



photo: B+ (aka Brian Cross)

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The book cover is black with white text. At the top right is the title "The Stack" in large, bold, sans-serif letters, with "On Software and Sovereignty" in smaller letters below it. In the center is the author's name "Benjamin H. Bratton". To the left of the title is a barcode. At the bottom left is the URL "-thestack.org". The spine of the book features vertical white bars of varying heights, resembling a stack of data or a barcode.

philosophy/software studies
Cover design by Metahaven
The MIT Press
Massachusetts Institute of Technology
Cambridge, Massachusetts 02142
mitpress.mit.edu
978-0-262-02957-5

What has planetary-scale computation done to our geopolitical realities? It takes different forms at different scales—from energy and mineral sourcing and subterranean cloud infrastructure to urban software and massive universal addressing systems; from interfaces drawn by the augmentation of the hand and eye to users identified by self-quantification and the arrival of legions of sensors, algorithms, and robots. Together, how do these distort and deform modern political geographies and produce new territories in their own image?

In *The Stack: On Software and Sovereignty*, Benjamin H. Bratton proposes that these different genres of computation—smart grids, cloud platforms, mobile apps, smart cities, the Internet of Things, automation—can be seen not as so many species evolving on their own, but as forming a coherent whole: an accidental megastructure called The Stack that is both a computational apparatus and a new governing architecture. We are inside The Stack and it is inside us.

In an account that is both theoretical and technical, drawing on political philosophy, architectural theory, and software studies, Bratton explores six layers of The Stack: *Earth, Cloud, City, Address, Interface, User*. Each is mapped on its own terms and understood as a component within the larger whole built from hard and soft systems intermingling—not only computational forms but also social, human, and physical forces. This model, informed by the logic of the multilayered structure of protocol “stacks,” in which network technologies operate within a modular and vertical order, offers a comprehensive image of our emerging infrastructure and a platform for its ongoing reinvention.

The Stack is an interdisciplinary design brief for a new geopolitics that works with and for planetary-scale computation. Interweaving the continental, urban, and perceptual scales, it shows how we can better build, dwell within, communicate with, and govern our worlds.

-thestack.org

The Stack: On Software and Sovereignty

Benjamin H. Bratton

The Stack is a major achievement. It is more than just philosophy of technology, software studies, or design criticism; it analyzes and guides our thinking in a baffling Anthropocenic era when computation works at the planetary scale and constitutes governance.

—Natalie Jeremijenko, Associate Professor of Art, Computer Science, and Environmental Studies, New York University

The Stack imagines a design brief for the whole world while floating or falling through all the ever-efflorescent plasmas and atmospheres of digital information.

—Keller Easterling, Professor, Yale School of Architecture; author of *Extrastatecraft: The Power of Infrastructure Space*

This political geography of computation is a strange, marvelous text of great conceptual beauty. Benjamin Bratton's *The Stack* breaks more new ground than a carpet bombing. The Stack itself may or may not exist, but it's left everything that came before it in a state of rubble.

—Bruce Sterling

User

Interface

Address

City

Cloud

Earth

The Stack

Software Studies

Matthew Fuller, Lev Manovich, and Noah Wardrip-Fruin, editors

Expressive Processing: Digital Fictions, Computer Games, and Software Studies,

Noah Wardrip-Fruin, 2009

Code/Space: Software and Everyday Life,

Rob Kitchin and Martin Dodge, 2011

Programmed Visions: Software and Memory,

Wendy Hui Kyong Chun, 2011

Speaking Code: Coding as Aesthetic and Political Expression,

Geoff Cox and Alex McLean, 2012

10 PRINT CHR\$(205.5+RND(1));: GOTO 10,

Nick Montfort, Patsy Baudoin, John Bell, Ian Bogost, Jeremy Douglass, Mark Marino, Michael Mateas, Casey Reas, Mark Sample, and Noah Vawter, 2012

The Imaginary App,

Paul D. Miller and Svitlana Matviyenko, 2014

The Stack: On Software and Sovereignty,

Benjamin H. Bratton, 2015

The Stack

On Software and Sovereignty

Benjamin H. Bratton

The MIT Press
Cambridge, Massachusetts
London, England

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This book was set in ITC Stone Serif by Toppan Best-set Premedia Limited. Printed and bound in the United States of America.

Cover design by Metahaven.

Library of Congress Cataloging-in-Publication Data is available.
ISBN: 978-0-262-02957-5

10 9 8 7 6 5 4 3 2 1

For Lucien, and his world.

Contents

Series Foreword xi

Acknowledgments xiii

Credits xv

Preface xvii

I The Models

Introduction 3

1. A New Architecture? 3
2. An Accidental Megastructure 8
3. Blur and Accident 13

The *Nomos* of the Cloud 19

4. Dividing Sovereignty 20
5. Over (and under) the Line 23
6. Land/Sea/Air/Cloud 28
7. The *Nomos* of the Cloud? 31
8. A Google *Grossraum*? 34

Platform and Stack, Model and Machine 41

9. Platforms 41
10. How Platforms Work 46
11. Stack as Model 52
12. Stack as Political Machine 55
13. Stacks That Were and Might Have Been 58

- 14. The Stack We Have 61
- 15. The Layers of The Stack 66

II The Layers

Earth Layer 75

- 16. Discovering or Inventing Computation? 76
- 17. Digestion 81
- 18. Geo-graphy and Geoaesthetics 83
- 19. From Global Surface to Planetary Skin 87
- 20. Smart Grid: Ouroboros 92
- 21. Sensing and Sovereignty; Polities of Supply and Effect 97
- 22. Designing for versus Designing with Emergencies 101
- 23. Designing the Earth Layer 105

Cloud Layer 109

- 24. Platform Geography 111
- 25. The First Sino-Google War of 2009 112
- 26. *Cloud* Infrastructure 115
- 27. *Cloud Polis* 119
- 28. Platform Wars 124
- 29. Facebook 125
- 30. Apple 128
- 31. Amazon 131
- 32. Google 134
- 33. Future *Cloud Polis* and Platforms 141

City Layer 147

- 34. Reversible Grids 149
- 35. City as Layer 151
- 36. Exposure and Control 155
- 37. Force Finding Function Finding Form 160
- 38. Envelope and Apparatus 163
- 39. Designing for Mixed Envelopes, Mixed Programs 168

40. Programs, Subjects, and Zombie Jurisdictions 172

41. Megastructure and Utopia 176

42. Platform Cities 183

Address Layer 191

43. Scale, Scope, and Structure 193

44. Deep Address 197

45. Objects in The Stack 200

46. Addressability and Technique 205

47. IPv6 207

48. Communication and Composition 210

49. Absolute Incommunication 212

50. Distortion and Genesis 214

Interface Layer 219

51. What Interfaces Are 220

52. Interfaces at Hand: From Object to Sign to Object 222

53. The Interface as Layer 228

54. Interfaces in The Stack 1: The Aesthetics of Logistics 230

55. Interfaces in The Stack 2: Apps and Programming the Space at Hand 236

56. Interfaces in The Stack 3: Theo-Interfaciality 239

57. Geoscapes: Interfaces Drawing Worlds 243

User Layer 251

58. Origins of the User 254

59. Finding the Universal User 256

60. Quantified Self and Its Mirror 260

61. Trace and Frame 265

62. Maximum User 267

63. Death of the User 271

64. Animal User 274

65. AI User 277

66. Machine User 279

67. From User-Centered Design to the Design of the User 284

III The Projects

The Stack to Come 293

- 68. Seeing The Stack We Have, Stacks to Come 293
- 69. Earth Layer to Come: God Bows to Math; Will Leviathan? 300
- 70. Cloud Layer to Come: Cloud Feudalism and Its Discontents 307
- 71. City Layer to Come: Multiple Utopias and Rough Totality 320
- 72. Address Layer to Come: Platform-of-Platforms 327
- 73. Interface Layer to Come: Ambient Interface 337
- 74. User Layer to Come: Inventing Users 343

The Black Stack 351

- 75. *Angelus Novus* Is Gone 351
- 76. The Stack and Its Others 355
- 77. Concluding Remarks on Design and The Black Stack 359

Glossary 367

Notes 377

Index 461

Series Foreword

Software is deeply woven into contemporary life—economically, culturally, creatively, politically—in manners both obvious and nearly invisible. Yet while much is written about how software is used, and the activities that it supports and shapes, thinking about software itself has remained largely technical for much of its history. Increasingly, however, artists, scientists, engineers, hackers, designers, and scholars in the humanities and social sciences are finding that for the questions they face, and the things they need to build, an expanded understanding of software is necessary. For such understanding they can call upon a strand of texts in the history of computing and new media, they can take part in the rich implicit culture of software, and they also can take part in the development of an emerging, fundamentally transdisciplinary, computational literacy. These provide the foundation for software studies.

Software Studies uses and develops cultural, theoretical, and practice-oriented approaches to make critical, historical, and experimental accounts of (and interventions via) the objects and processes of software. The field engages and contributes to the research of computer scientists, the work of software designers and engineers, and the creations of software artists. It tracks how software is substantially integrated into the processes of contemporary culture and society, reformulating processes, ideas, institutions, and cultural objects around their closeness to algorithmic and formal description and action. Software studies proposes histories of computational cultures and works with the intellectual resources of computing to develop reflexive thinking about its entanglements and possibilities. It does this both in the scholarly modes of the humanities and social sciences and in the software creation/research modes of computer science, the arts, and design.

The Software Studies book series, published by the MIT Press, aims to publish the best new work in a critical and experimental field that is at once culturally and technically literate, reflecting the reality of today's software culture.

Acknowledgments

This book took shape over several years, and only due to the friendship, collegiality, and support of many people. Whether or not I knew it at the time, at different moments, each of them ensured that this project would reach fruition. For the conversation, critiques, and cajoling, I am in their debt. At some point, I would like to host them all at once for a grand dinner. An incomplete invitation list must include Lida Abdul, Alisa Andrasek, Julieta Aranda, Armen Avanessian, Carla Azar, Juan Azulay, David Bergman, Ryan Bishop, Mike Bonifer, Alexi Bourbeau, James Bridle, Sheldon Brown, Anne Burdick, Jose Caballer, Ben Cerveny, Karl Chu, Peter Cowhey, Jordan Crandall, Kate Crawford, Sean Crowe, Teddy Cruz, Rene Daalder, Marc Davis, Joe Day, Manuel de Landa, Jessica D'Elena, Neil Denari, Robert Densworth, Ricardo Dominguez, Tim Durfee, Keller Easterling, Greg Edwards, Adam Eeuwens, Joel Ericson, Simonetta Falasca-Zamponi, Numair Faraz, Conn Fishburn, Jane Fitzgerald, David Fore, Brady Forrest, Peter Frankfurt, Ming Fung, Vincent Gallo, Alexandra Daisy Ginsberg, Ken Goldberg, Eugene Goreshter, Marcelyn Gow, Adam Greenfield, John R. Hall, Serene Han, Usman Haque, Dick Hebdige, Oliver Hess, Bradley Horowitz, Georgina Huljich, Jeffrey Inaba, Xeni Jardin, Adriene Jenik, Daniel Jennett, Natalie Jeremijenko, Andrew Jones, Joshua Kauffman, Ed Keller, Cheryl Kellond, Jeff Kipnis, Wolf Kittler, Norman Klein, Peter Krapp, Vinca Kruk, Steve Kurzman, Sanford Kwinter, Sylvia Lavin, Rachel Law, Neil Leach, Carla Leiato, Elizabeth Losh, Sylvère Lotringer, Peter Lunenfeld, Greg Lynn, Geoff Manaugh, Miltos Manetas, Elena Manferdini, David Maymudes, Cynthia McCauley, Nandita Biswas Mellamphy, Rebeca Mendez, Andrew Mitchell, Christian Moeller, Phillippe Morel, Eric Owen Moss, Reza Negarastani, Leonard Nevarez, Robert Nideffer, Marcos Novak, Juilian Oliver, Lisa Parks, Jussi Parrika, Matteo Pasquenelli, Constance Penley, Rene Peralta, Paul Petrunia, Florencia Pita, Sascha Pohflepp, Dave Ragsdale, Ramesh Rao, Casey Reas, Kim Stanley Robinson, Irit Rogoff, Rory Rowan, Mohammed Salemy, Joachim Sauter, Axel Schmitzberger, Patrik Schumacher, Tien-Ann Shih, Benedict Singleton, Kevin Slavin, Michael Speaks, Marcelo Spina, Jay Springett, Nick Srnicek, Brett Stalbaum, Molly Wright Steenson, Bruce Sterling, Gabie Strong, Lin Su Nalepa, Tiziana Terranova, Skylar Tibbets, Elizabeth Timme, Bruce Tizes, Daniel van

der Velden, Kazys Varmelis, Victoria Vesna, Joseph Wang, McKenzie Wark, John Welchman, John Wilbanks, Alex Williams, Tom Wiscombe, Nick Whitford-Dyer, Ben Woodward, Katharine Wright, Liam Young, Adam Zaretsky, and Peter Zellner. Special thanks are due to Roger O. Friedland whose extraordinary support during the most formative period of research made it possible to realize this project. The decade that I spent teaching at the Southern California Institute of Architecture (SCI-Arc) would not have been possible without the support and friendship of Hernan Diaz-Alonso. Moving from Los Angeles to La Jolla at the University of California, San Diego Department of Visual Arts and Calit2 was made possible by Lev Manovich and Larry Smarr. I am in debt to all those I have named and to these four in particular. While teaching at UCSD, the European Graduate School, and SCI-Arc (as well as at UCLA's Department of Design|Media Arts and Art Center College of Design's Media Design Practices graduate program), I had the privilege of working with several incredibly talented artists, writers, and designers, many of whom I first met as their teacher and then later again as their student. There are too many to list, but I especially thank Eli Altman, Adam Bandler, Simon Battisti, Ian Besler, Zach Blas, Sean Dockrey, Jeremy Douglas, Seth Ferris, Willea Ferris, Moira Henry, Richard Hollington, William Huber, Jordan Kanter, Miles Kemp, Aaron Koblin, Sam Kronick (who talked me through some of the key structural ideas of the book as they were forming), Alejandra Lillo, Benjamin Lotan, Nicholas Pesca, Drura Parrish, Daniel Rehn, Jessica Rivera, F. Myles Sciotto, Necole Tang, Josh Taron, Kyle Thompspon, Tricia Wang, Angela Washko, Emily White, and many others. I also thank Doug Sery at MIT Press for his patience and encouragement in the metamorphosis of this book from idea to object. Thanks also to Lawrence Chit and Pratik Pramanik for assistance with preparing the final manuscript. Most of all, I thank my family, and its odd diagram: Bruce, Janet, Dee, Michael, Marci, Jamie, Cindy, Karen, Dave, Edie, Marion, Ed, Bill, Ethel, and Bruna and Lucien.

Credits

This development of this book was honed largely through invited lectures and conference presentations to varied disciplinary audiences, including art, architecture, design, computer science, economics, international relations, literature, media studies, philosophy, and political science. My thanks to those responsible for invitations to present and discuss interim versions of this work at the Bartlett School of Architecture at University College London; proto/e/co/logics 2 conference, Rovinj, Croatia; École-Normale Supérieure d'Architecture Paris-Malaquais; Parsons/The New School, New York; Museum of Contemporary Art, Los Angeles; University of Michigan; Berlage Institute, Rotterdam; Studio-X, Columbia University, New York; Princeton School of Architecture; Moscow State; St. Petersburg State; Institute for Higher Economics, Moscow; Carnegie Endowment, Moscow; Knowlton School of Architecture, Ohio State University; e-flux Main Space, New York; Winchester School of the Arts, University of Southampton; Strelka Institute of Architecture, Moscow; The Fall Semester, Miami; The Summer Forum, Joshua Tree, California; Simon Fraser University, Vancouver; Incredible Machines conference, Vancouver; California Institute of the Arts, Valencia; University of Buffalo; University of Southern California; The Guardian Summit, New York; University of Western Ontario, London, Ontario; Sonic Acts, Amsterdam; TBA21-Augarten, Vienna; Kazan State University, Kazan, Tartarstan, Russia; European Graduate School, Saas-Fee, Switzerland; Duke University; UCLA; UC Santa Barbara; UC Irvine; and others.

The material in the book is previously unpublished, save for a few passages drawn from articles and book chapters I have published over the past few years. In most cases, I have reworked these here, but the cores of the ideas are in the original versions, and I acknowledge them with thanks. Sections of the “Earth” chapter appeared in *New Geographies 7: Geographies of Information*, ed. Ali Fard and Taraneh Meshkani (Cambridge, MA: Harvard Graduate School of Design, 2015). Sections of the “Cloud” and “Interface” chapters draw from “On Geoscapes and the Google Caliphate: Except #Mumbai,” *Theory, Culture and Society Annual Review* 26 (2009): 329–342. This original article in many ways was the seed material around which this book evolved. My thanks to Ryan Bishop

for his invitation to contribute, and also for setting *The Stack* in motion. Sections of the “City” chapter draw from “Ambivalence and/or Utopia,” in *Bracket 2: Goes Soft*, ed. Neeraj Bhatia and Lola Sheppard (Barcelona: Actar, 2013), from “Megastructures,” in *Entr’acte*, ed. Jordan Geiger (London: Palgrave-Macmillan, 2015), and from “Parametricist Architecture (Would Be a Good Idea)” in *The Politics of Parametricism*, ed. Matthew Poole and Manuel Shvartzberg (London: Bloomsbury, 2015). Sections of the “Interface” chapter draw from “iPhone City (v.2008),” *Digital Cities AD: Architectural Design*, ed. Neal Leach, volume 79, no. 4 (2009): 90–97 (London: Wiley, 2009), and from “On Apps and Elementary Forms of Interfacial Life,” in *The Imaginary App*, ed. Paul D. Miller and Svetlana Matviyenko, 3–16 (Cambridge, MA: MIT Press, 2014). Sections of the “Earth” and “User” chapters draw from “What We Do Is Secret: On Virilio, Planetarity and Data Visualization,” in *Virilio and Visual Culture*, ed. Ryan Bishop and John Armittage, 180–206 (Edinburgh: Edinburgh University Press, 2014). Parts of the concluding chapter draw from “The Black Stack” *e-flux journal*, no. 53 (March 2014), with special thanks to Julieta Aranda. This *e-flux* piece was a reworked version of a co-keynote at Transmediale 2014 with Metahaven; thanks to Ryan Bishop (again), Jussi Parikka, and Sean Cubitt for the invitation to Berlin. Finally, special thanks to Daniel van der Velden and Vinca Kruk of Metahaven for their ongoing friendship and collaboration (and for the excellent book cover). Many of the key ideas of this book developed in relation to our dialogues, some published and others not.

Preface

This book is both technical and theoretical. It is unapologetically interdisciplinary in its perspective and its project; it is a work of political philosophy, and architectural theory, and software studies, and even science fiction. It draws links between technologies, places, processes, and cultures that may exist at different scales but which are also deeply interrelated. In this crisscross, we observe that “computation” does not just denote machinery; it is planetary-scale infrastructure that is changing not only how governments govern, but also what governance even is in the first place. Computation is a logic of culture, and so also a logic of design. It is both how our culture designs and is itself that which we need to design better, but to do that we need to take a step back and view an emerging big picture that is different from what has been predicted. We may glimpse that another model of political geography is cohering before our eyes. What can we do with it? What does it want from us? The answers depend on our theories and tools, on our models and codes.

For design, theory and computation have been intertwined for decades. One might even suspect a direct correlation between the end of theory and the rise of software (software being a form of technology that is linguistic as well as a form of language that is technological). Sometime from 1995 to 1997 or so, especially in academic design programs, software seemed to displace theory as a tool for thought. Many students interested in asking essential questions about how things work turned to software, not just to describe those things but also to make them, and not just to make them, but also to think through them. This shift came with trade-offs. Thinking with tools, and in this case, working with the fixed capital of advanced technologies, is a good thing. It is part of the genesis of our species. It is how we mediate the world and are mediated by it; we become what we are by making that which in turn makes us. This is no less true (or less complex) as software becomes a more ubiquitous feature of the whole world: in your hand, in the building, part of every supply chain, every image, every archive, every query. I am of the opinion, however, that as we quickly learn more precise and higher-resolution processes, it becomes correspondingly

harder to see the whole at once. Accomplishments of analysis are paid for with a dissipation of synthesis. As such, software may need theory at least as much as theory needs software.

As for the geopolitics of computation, we can point to another shift, around 2008 or so. Before this break, the growth of planetary-scale computing systems was seen more generally as a beneficent blossoming. The old order would be swept away and a new day illuminated with the power of networks, iStuff, Twitter revolutions, “Internet freedom,” and smart cities. After this break, however, the sky darkened, and now the Cloud portends instead state surveillance, tax evasion, structural unemployment, troll culture, and flash crashes. Reality, however, is actually more radical in both directions. The thesis of this book holds that the official utopia and the official dystopia are not particularly useful frames of reference, and that neither provide a robust and intelligent program for art, design, economics, or engineering. In fact, the messianic effervescence of the former and the apocalyptic panic of the latter are part of the problem. Today we lack adequate vocabularies to properly engage the operations of planetary-scale computation, and we make use of those at hand regardless of how poorly they serve us. After the cycles of positive and negative hype run their course, we discover that computation holds both more potential and more risk than we foresaw. Going forward, we really do need new and better models, because computation already operates in ways that have surpassed and overflowed the regular cartographies.

This book starts with the technologies themselves, abstracting from them a formal model that is general and comprehensive, but not complete or fixed. The model does not put technology “inside” a “society,” but sees a technological totality as the armature of the social itself. It does not focus on computation in the service of governance, or in resistance to governance, but rather on computation *as* governance. In the first chapter, I propose that we view the various types of planetary-scale computation (e.g., smart grids, cloud computing, mobile and urban-scale software, universal addressing systems, ubiquitous computing, and robotics, and so on) not as isolated, unrelated types of computation but as forming a larger, coherent whole. They form an accidental megastructure called The Stack that is not only a kind of planetary-scale computing system; it is also a new architecture for how we divide up the world into sovereign spaces. More specifically, this model is informed by the multilayered structure of software protocol stacks in which network technologies operate within a modular and interdependent vertical order. The model allegorizes the logic of stacks into a general principle of systems, and uses it to describe both the geometry by which a political geography is subdivided as well as the aggregate shape of the technologies that occupy those spaces. The Stack model is global but it is not immutable. To the contrary, it is intrinsically modular and so this megastructure is also a platform, and an interface even, for the redesign and replacement of the Stack-we-have with a Stack-we-want (or perhaps with the Stack-we-want-the-least).

Accordingly, *The Stack: On Software and Sovereignty* is a book of design theory. Its interests are speculative and projective as well as analytical; it is about sketching things in advance of their arrival as much as mapping things as they are. It describes a consolidation of cultural, institutional, and technical systems through the exponential logics of planetary-scale computation and considers how we might recognize and engineer alternative effects. The design horizon for each layer of The Stack is understood both by what it accomplishes as an ideal technology and, perhaps more important, by what accidents it brings that also define its real impact. My interest is in how design—designating things according to program—can work through these schema, across their disparate scales and toward different futures. What new forms can we compose for this computational and geopolitical condition, first to map it, then to interpret it, then to redesign it?

More precisely, then, this book is a design brief; it outlines a design problem and invites new interventions. It articulates a project of “geodesign” to be taken up as a collaborative megaproject. Problems inevitably arise that cannot be defined in isolation, but also cannot be engaged other than by specific technical practice, so opportunistic approaches and experiments are necessary. The argument of this design brief is neither simply pro-Stack or anti-Stack. Any infrastructure of this scale inevitably gathers and binds power into itself, and so is either remedy or poison or both. The system we have now is both what makes these extraordinary technologies possible, but is also what ultimately retards their real potential. In response, we need a geopolitics of design that is comfortable not only with computation but also with vertical systems of designation and decision. The Stack model is a diagram that works only when it is put to use. Perhaps by drawing the whole, we stand a better chance of designing a better architecture of globalization. Perhaps we are not lacking ideas but a platform to situate, deploy, and enforce them.

Because *The Stack: On Software and Sovereignty* draws on many disciplinary discourses, it is inevitable that some passages may seem opaque and others obvious, and differently so for different readers. Most important are the lines of connection between ideas and their illustrations. I chose the examples for how they clarify a point made, but I claim no definitive treatments of any of them. I tried to choose examples that are not too of-the-moment. Given the subject matter’s pace of change, referring to events that are richly elucidative even though slightly untimely, may help ensure that the narrative stands the test of time. Similarly, many books about design rely heavily on images to make their point, and my editor and I decided early on that the text should stand on its own. Let the book be a book. There are (almost) no pictures to be found, but the companion website (thestack.org or bratton.info/thestack) includes many images and illustrations accompanying each chapter, and (if you choose) you may refer to these as you read and approach the book in a way that is a bit more like my visually elaborate public talks. Like any other project that tries to draw wholes, *The Stack* produces its own

vocabulary (e.g., *platform sovereignty*, *loop topology*, *Cloud feudalism*) that becomes clear as the argument accumulates. To aid readability, I have included a glossary to consult, or perhaps even to read first.

We are still very early in the historical trajectory of planetary-scale computation. How its algorithmic species will evolve and how our cultural systems will train them and be trained by them is anyone's guess. Writing from inside the research university, I hope that we will look back on this moment—when you could go to medical school and not take basic data structures or JAVA, or get a computer science degree and not be fluent in any of the basic issues in the philosophy of technology or the essential ideas of contemporary art, or train in a design program without working on any substantive political science problems—as one curtailed by bizarre intellectual paranoia. Our shared design project will require both different relationships to machines (carbon-based machines and otherwise) and a more promiscuous figurative imagination. Toward that, this book is my drawing on our cave wall, one that invites response, revision, and even replacement.

November 2014
La Jolla, California

I The Models

The Maelstrom, a mad spiral, the terror of hardened sailors, the Maelstrom is a circle of circles.
Which circle leads one by chance to escape? Or perhaps to be sucked down to the bottom?

—Michel Serres, “Jules Verne’s Strange Journeys”¹

Centralization is vulnerability—and yet the world is not content to build its biomass on such a fragile template, it forces the same model onto its metasystems as well.

—Peter Watts, “The Things”²

The cybernetics of men. ... As you, Socrates, often call politics.

—Stafford Beer, “Cybernetic Praxis in Government”³

Introduction

1. A New Architecture?

In an address to the Council on Foreign Relations on the need for a new geopolitical architecture, the outgoing secretary of state, Hillary Clinton, made a rather striking recommendation: “We need a new architecture for this new world, more Frank Gehry than formal Greek.”⁴ She described the system dominated by the United Nations, the North Atlantic Treaty Organization, and several other large organizations as the equivalent of the classical Parthenon in Athens. “By contrast, there’s Gehry’s Modern architecture [sic]. … Some of his work at first might appear haphazard, but in fact, it’s highly intentional and sophisticated,” Clinton continued. “Where once a few strong columns could hold up the weight of the world, today we need a dynamic mix of materials and structures.” Looking to contemporary design for new models of geopolitical architecture, both literal structures and figurative systems, may be a good idea (regardless of whether Gehry’s singular and floral morphologies are necessarily the best option), but what drives this demand for new armatures and diagrams of global power and sovereignty? Clinton went on to identify global information systems as perhaps the single most important powerful engine of the new world that would demand new organizing architectures. The continuing emergence of planetary-scale computation as metainfrastructure and of information as a historical agent of economic and geographic command together suggest that something fundamental has shifted off-center. But global transformations of hard and soft systems brought by computation have disturbed neat arrangements in ways that Clinton struggles to articulate and we struggle to describe and design for. While trade and migration perforate borders, state sovereignty and supervision over information flows are also dramatically reinscribed and reinforced. The possible architectures at work now and in the future seem twisted and torqued in the extreme.

In this context, this book proposes a specific model for the design of political geography tuned to this era of planetary-scale computation. It works from the inside out, from technology to governing systems. As we link infrastructure at the continental

scale, pervasive computing at the urban scale, and ambient interfaces at the perceptual scale, we will explore how these interweave and how we might build, dwell within, communicate between, and govern our worlds. To do this, it draws on the multilayered structure of software, hardware, and network “stacks” that arrange different technologies vertically within a modular, interdependent order. From this and from other non-computational structures, the model abstracts a general logic of platforms, now a fundamental principle for the design and coordination of complex systems. In practice this includes outlining an alternative subdivision of political geographies at work now and in the future, some of which may be familiar and others less so. In doing so, the chapters pull on threads from different intellectual fabrics and knit them together by following their crisscrossing patterns. These lead from the long-foretold and longer-postponed eclipse of the nation-state to the ascendance of political theology as an existential transnationalism, from the billowing depths of cloud computing and ubiquitous addressability to the logistical modernity of the endlessly itinerant object, and from the return of the city-state in the guise of a multipolar network of megacities and walled megagardens to the permanent emergency of ecological collapse and back again.

My conclusions are speculative and meant to inform and support further design of these systems. Like any other good theoretical design research, it handles slippery problems in ways that are provisional, prototypical, and provocative—not necessarily policy (yet). The story arc begins by tracing the political division of earthly territories—land, sea, and air among them. Throughout history, each arrangement of those divisions expresses a particular and evolving geometry of sovereign space and a specific topology of segmentation and jurisdiction, and because these orders are unfixed, they are also redesignable.⁵ It becomes clear, for example, that the stability of geopolitical architectures based on the land-bounded nation-state as the indispensable unit of sovereignty is continually undermined by its own successes and exceptions (and with them, many political identities are as well). I argue that in order to account for the real effects of planetary-scale computation and to make it accountable as a designable platform, a decentering of some conventional ideas about political geographic norms is necessary. Maps of horizontal global space can’t account for all the overlapping layers that create a thickened vertical jurisdictional complexity, or for how we already use them to design and govern our worlds. Instead of lamenting all the exceptions to the norm, hoping that they will get back in the box where they belong, perhaps it is time to map a new normal. Toward conceiving an alternative geometry of political geography, looking forward more than backward, this book considers the model of The Stack.

I propose The Stack as a way that we might map political geography, but also for how we understand the technologies that are making that geography. Planetary-scale computation takes different forms at different scales—energy and mineral sourcing and grids; subterranean cloud infrastructure; urban software and public service

privatization; massive universal addressing systems; interfaces drawn by the augmentation of the hand, of the eye, or dissolved into objects; users both over-outlined by self-quantification and also exploded by the arrival of legions of sensors, algorithms, and robots. Instead of seeing all of these as a hodgepodge of different species of computing, spinning out on their own at different scales and tempos, we should see them as forming a coherent and interdependent whole. These technologies align, layer by layer, into something like a vast, if also incomplete, pervasive if also irregular, software and hardware *Stack*. To be clear, this figure of The Stack both does and does not exist as such; it is both an idea and a thing; it is a machine that serves as a schema as much as it is a schema of machines. It lets us see that all of these different machines are parts of a greater machine, and perhaps the diagrammatic image of a totality that such a perspective provides would, as theories of totality have before, make the composition of alternatives—including new sovereignties and new forms of governance—both more legible and more effective. As the shape of political geography and the architecture of planetary-scale computation as a whole, The Stack is an accidental megastructure, one that we are building both deliberately and unwittingly and is in turn building us in its own image. While it names the organization of a planetary-scale computing infrastructure, my purpose is to leverage it toward a broader program for platform design. In the depiction of this incipient megastructure, we can see not just new machines but also still-embryonic geopolitical institutions and social systems as well. For these, The Stack is powerful and dangerous, both remedy and poison, a utopian and dystopian machine at once (it can go either way, and as Buckminster Fuller said, it will be touch and go until the last instant). As a model, The Stack is simultaneously a portrait of the system we have but perhaps do not recognize, and an antecedent of a future territory, and with both at hand, we hope to prototype the alien cosmopolitanisms these engender for us and suggest to us.

Planetary-scale computation both distorts and reforms modern jurisdiction and political geography and produces new forms of these in its own image. It perforates and transcends some borders while introducing and re-thickening others at new scales and in greater quantity. While this inaugurates new design problems, it does not represent the introduction of design into political geography as such: design is always already there. The frame of the nation-state as the core jurisdiction is a design—deliberate and otherwise—of a geopolitical architecture derived from the partitioning of planar geography, separating and containing sovereign domains as discrete, adjacent units among a linear and horizontal surface. That one particular modern model is a specific and durable compositional lamination of territorial and governmental layers into one, but today as a design logic for political geography, it is less a monopoly platform than it once was. It leaned on a consensus that was always a bit tenuous and today demands attention and revisititation. We could trace this design back to, among other defining events, the 1648 Peace Treaty of Westphalia, which formalized

this particularly flattened political-cartographic diagram and set some terms for its subsequent normalization and partial universalization throughout the world. The effects of this design extended not just to how political space would be formally represented and enforced but also how the content of “the political” as a unique domain of human action and ethics would be known. Some decades after Westphalia, Immanuel Kant codified and expanded on the implications of its arrangements and gave it deeper philosophical leverage. He articulated “cosmopolitanism” as the polity of those who share the surface of the earth’s crust as their locale and as a moral and legal federation of the landed national units and of their citizens. The formal system of Westphalian states did not resolve once and for all conflicts over law, land, and identity into this global and self-encapsulated legal architecture, but instead invested in the state the standing of the legitimate instrument of those conflicts (and, as importantly, over exceptions to that legitimacy as well).

Today’s political geographic conflicts are often defined as exceptions to that normal model, and many are driven, enabled, or enforced in significant measure by planetary computation: byzantine international and subnational bodies, a proliferation of enclaves and exclaves, noncontiguous states, diasporic nationalisms, global brand affiliations, wide-scale demographic mobilization and containment, free trade corridors and special economic zones, massive file-sharing networks both legal and illegal, material and manufacturing logistical vectors, polar and subpolar resource appropriations, panoptic satellite platforms, alternative currencies, atavistic and irredentist religious imaginaries, cloud data and social-graph identity platforms, big data biopolitics of population medicine, equities markets held in place by an algorithmic arms race of supercomputational trading, deep cold wars over data aggregation across state and party lines, and so on. In relation to the incommensurate demands of diverse protocols, these rewrite and redivide the spaces of geopolitics in ways that are inclusive of aerial volumes, atmospheric envelopes, and oceanic depths. In response, certain geopolitical modernities drift from the center of the frame, are obscured by the multiple exposure image of competing claims over the same place, and are sometimes even overcome by these effects.

Today the authority of states, drawn from the rough consensus of the Westphalian political geographic diagram, is simultaneously never more entrenched and ubiquitous and never more obsolete and brittle. In the emergence of The Stack, it is not that the state declines per se, but that our contemporary condition is qualified both by a debordering perforation and liquefaction of this system’s ability to maintain a monopoly on political geography, and by an overbordering, manifest as an unaccountable proliferation of new lines, endogenous frames, anomalous segments, medieval returns, infomatic interiors, ecological externalities, megacity states, and more. These zones fold and flip-flop on top of one another, interweaving into abstract and violent spatial machines of uncanny jurisdictional intricacy. Borderlines are militarized as they are

also punctured or ignored. However, the simultaneity of all this is only contradictory at first blush. Debordering and overbordering both testify to the crisis of the Westphalian geographic design, and indeed of the force of law that would predicate the state's ability to convene and constitute sovereignty only in relation to that particular image. The capacity of the state to enforce those same territorial claims is not simply undone; indeed, it is also reinforced by the same processes of delinking sovereignty and geography that states themselves have innovated. The modern norm of political geography is fracturing through its own radicalization and by its own hand, not just by the accumulation of violations to its authority. At the same time, the future of its governance, and the designability of that future, is now, as it has been many times before, being decided through encounters with incommensurate external challenges to its claimed monopoly on geographic geometry. Such encounters sometimes produce genuinely new things, and sometimes they produce what is merely consistent with what can be enforced, and sometimes they produce things that are neither.

Recognizing this paradox raises more questions and possibly provides some leads. What might account for its complexities and what topological imaginations might allow us to reform it? At stake is more than a new way for states to operate or a new set of technologies requiring governance; rather, it is a scale of technology that comes to absorb functions of the state and the work of governance. Toward an answer, The Stack model suggests both the means and ends of a specific kind of platform sovereignty. It demands that we understand the designability of geography in relation to the designability of computation and to see the state (and other sovereign institutions) in relation to both at once. This differs from how other political philosophies of technology have understood governance and machines. Max Weber's sociological theories of bureaucracy also described the state as a kind of machine, a vast apparatus for which the instrumental rationality of inputs and outputs should guarantee predetermined outcomes. Platforms, however, don't operate according to such guarantees; they feed on the indeterminacy of outcomes. Louis Althusser and other Western Marxists spoke of the "state machine," a more amorphously distributed ideological mechanism that interpolated its subjects through their internalization of the time of capital. Platforms, however, have much more varied relationships to nonstate forms of authority and noncapitalist economies. As we'll see, their totality is always adjacent to other totalities. Michel Foucault located "governmentality" more directly as the immanent discourses, techniques, and architectures that constitute the objectivity of the modern subject.⁶ For Foucault, the state, as such, is only one site of governance among many others and by no means the most central for understanding economies of power. Platforms are similar in this regard. Equally important for Foucault were scientific laboratories, daily routines in prisons, hospital quarantine protocols, psychiatric textbooks, the design of dormitories according to particular lines of sight, the shape of a surgical device according to an invented idea of a standard body, "the angle between two walls

and its happy ending.”⁷ Here governance itself is articulated and configured through the specific technologies and techniques with which it produces its own subjects and objects. It may justify enforcement according to the content of laws, but for Foucault, that governance is itself just as much invented by those techniques as the things that it governs. It is an effect as much as it is a cause of how certain machines and mechanics organize bodies over time.

One of the most important ways it does this is by seeing them in particular ways, and we might say that governance in general evolves in relation to what it is technically possible for it to see at any historical moment. If new means for perception and surveillance are made available (to see new spaces, new scales, new traces, new crimes), then governance—and the state in particular—will conform itself to the vacuum opened up by new vision machines and to the demands of whatever is now available to observe and control. What James Scott calls “seeing like a state” is then not just a way to imagine the world as something demanding state governance through the intervention of reason and interference of planning; it is also the ultimate effect of how increasingly powerful technologies of perception, sensing, detection, parsing, and processing all react together to enforce design and retrain governance in their own images.⁸ States and nonstate actors of all types compete directly not only over the invention of vision machines that produce new spaces to claim (air space, electromagnetic spectrum, exabytes of mass-intercept data), but also dominion over those spaces once they are mapped. The emergence of The Stack may represent this historical logic taken to an extreme new maturity. It is not the “state as a machine” (Weber) or the “state machine” (Althusser) or really even (only) the technologies of governance (Foucault) as much as it is *the machine as the state*. Its agglomeration of computing machines into platform systems not only reflects, manages, and enforces forms of sovereignty; it also generates them in the first place. Just as for Foucault’s technologies, its mechanics are not representative of governance; they *are* governance. But unlike for Foucault’s archaeology, its primary means and interests are not human discourse and human bodies but, rather, the calculation of all the world’s information and of the world itself *as* information. We, the humans, while included in this mix, are not necessarily its essential agents, and our well-being is not its primary goal. After billions of years of evolution, complicated heaps of carbon-based molecules (that includes us) have figured out some ways to subcontract intelligence to complicated heaps of silicon-based molecules (that includes our computers). In the long run, this may be for the better—and maybe not.

2. An Accidental Megastructure

This accidental megastructure, this machine that is also a “state,” is not the result of some master plan, revolutionary event, or constitutional order. It is the accumulative residue of contradictions and oppositions that arose to address other more local

problems of computing systems design. In the success and failure of those attempts, The Stack congeals, but do we know where and how? Contemporary geopolitics, and the largely confused commentary on it with which we muddle along, are knotted through and through. We see it in a politics of radial transparency aligned with another politics of radical privacy, in journalists' self-congratulation at the use of social media in the Arab Spring as supposedly outlining an anterior stratum of crowds and power (absent in their coverage of the shock economies of Haiti, Pakistan, Nigeria, and Louisiana, for example), in how Wikipedia formalizes taxonomic consensus from a heteroglossia of interests and how WikiLeaks inverted the ocular and occult body of the state, or in how Google cloud services both circumvent and circumscribe state authority in China and in how much of China's direct perception of computational supply chains is invisible to Californian search engines. Both events and pseudoevents are plentiful and it's hard to know what signals a new situation and what is trivial: the Google Earth stand-off between Costa Rica and Nicaragua, Prism and Data.Gov, hyperbolic packet-routing topologies, Dot-P2P and OpenDNS, net neutrality and the golden shield, downloadable guns 3D printed out of synthetic biopolymers paid for with Bitcoins, the National Security Agency (NSA) versus Unit 6139, NSA versus Anonymous, Anonymous versus Syrian Electronic Army, NSA versus Syrian Electronic Army versus ISIL versus FSB (Federal Security Service of the Russian Federation) versus North Korea versus Samsung versus Apple versus European Parliament, and on and on. Which of these situations scales well into a general lesson and which actually obscures the critical junctures? What will be the long-term ramifications of the privatization of the common intellect by search and social network platforms on our ability to self-govern, or toward what form of governance do they already serve us up? The tangle of these questions is not exclusive to what is historically new. Emergent secular geographies (such as cloud computing, ubiquitous computing, emergent ethnoscapes, minoritarian psychogeographies of user-interfaces) may appear in the guise of archaic sacred geographies (such as Dar al-Islam, Christendom, Greater Judea) against which the domain of secular states was formulated. These compete with states not only for claims over legitimate violence, but also claims over legitimate citizenship and the capacity to delineate borders. Sometimes the emergent defines the archaic by opposition, and sometimes it is an essential collaborator.

We describe this by a consolidation of cultural and technical systems, a realignment of institutions and discourses, and attempts to recognize and engineer their effects and accidents. That is, the design horizon for each layer of this Stack must be considered in terms of both what it accomplishes as an ideal technology and, perhaps more important, how its *undesigned accidents* characterize its real outcomes. For example, in the slippery redefinitions of citizenship and sovereignty in a cloud computing era, what referent of last resort can we rely on? Human rights? End-user agreements? Are we obligated to every service embedded in every software-enabled object or surface we might encounter? Is there a hierarchy of these? What if effective

citizenship in a polity were granted not according to categorical juridical identity, but as a shifting status derived from any user's generic relationship to the machinic systems that bind that polity to itself? In other words, if the interfaces of the city itself address everyone as a "user," then perhaps one's status as a user is what really counts. The right to address and be addressed by the polity would be understood as some shared and portable relationship to common infrastructure. Properly scaled and codified, this by itself would be a significant (if also accidental) accomplishment of ubiquitous computing. From this perhaps we see less the articulation of citizenship for any one city, enclosed behind its walls, but of a "citizen" (Is that even still the right word?) of the global aggregate urban condition, a "citizen-user" of the vast, discontiguous city that striates Earth, built not only of buildings and roads but also of perplexing grids and dense, fast data archipelagos. Could this aggregate "city" wrapping the planet serve as the condition, the grounded legitimate referent, from which another, more plasmic, universal suffrage can be derived and designed? Could this composite city-machine, based on the terms of mobility and immobility, a public ethics of energy and electrons, and unforeseeable manifestations of data sovereignty (various parts looking like *chora*, *demos*, *agora*, *polis*, *dromos*, and *technics*) provide for some kind of ambient homeland? If so, for whom and for what? If it could, or if it already is in some way, then our regular categories and criteria are not describing it very well for us. This is perhaps because it is not planned but an accident of the process. Adding processing power to legacy models of political sovereignty first inflates them grotesquely and then, in time, as the generative infrastructure of another geography fills up different frames and replaces them with irregular new forms and formats, all those legacy models start to look Greek to us.

These "accidents" form the basis of many of our current geopolitical conflicts and conundrums. The first Sino-Google conflict of 2009, during which Google "pulled out" of the world's largest Internet market in response to demands for state monitoring and control of search results as well as the hacking of its servers by Chinese state-sponsored teams, may well be the opening crack in new kind of war over who or what governs society in the first place. That war is less between two superpowers (or proxies for them) than between two irreconcilable logics of how polities and publics are convened according to what sovereign spaces. One of these sees "the Internet" as an extension of the body of the state (or subservient to it) and another sees "the Internet" as a living, quasi-autonomous (if privately controlled and profited) transterritorial civil society that produces, defends, and demands rights on its own. For this, Google is a nonstate actor operating with the force of a state, but unlike modern states, it is not defined by a single specific territorial contiguity. It is a US-headquartered corporation but also a transnational actor that has taken on many traditional functions of nation-states. While Google is as reliant on real physical infrastructure—its data centers are by no means virtual—that physicality is more dispersed and distributed than partitioned and

circumscribed. But this opposition is not simply states versus markets, or West versus East. The implication is not another prophecy of the declining state withering away into the realm of pure network, but to the contrary: the state's ongoing redefinition is now undertaken in relation to network geographies that it can neither contain nor be contained by. From here, the practical geopolitical design issues only get more, not less, complex. What, really, are to be the national rights of mobile subjects in a cloud-based society? Can you be bound to the data laws of your passport country no matter where you go? Or can your cloud platform follow you, and you follow it such that your platform constitutes your primary sovereign "territory" no matter where you go? Should it? Or should individual servers fly the flag of a certain state and disseminate data according to those laws, even if the server may be across the world? Or, instead, should the particular data laws of any one particular geographic site try to construct and contain the laws of flow on one particular spot, regardless of the sovereign origins of sender or receiver? The last mile trumps all? All of these options are counterintuitive, so what are the alternatives? What if the server farms are outside territorial waters altogether, like Google's patented offshore data centers, which for sensible energy-conservation reasons would also put the physical infrastructure of the global cloud outside regular territorial jurisdiction (discussed in more detail in the *Cloud* chapter). It is not my hypothesis that planetary computation will bring the accidental of alien political geography, because it already has. The design problems require speculation but are not hypothetical. They demand that we engage a response that is as inventive as it is ineluctable.

The architecture of this model treats these overlapping layers, claims, and networks not as exceptions to the normal rule but as the basis of an emergent order. The Stack, as examined here, comprises six interdependent layers: *Earth, Cloud, City, Address, Interface, User*. Each is considered on its own terms and as a dependent layer within a larger architecture, and each is drafted from the superimposed image of the geographic and computational machines we now inhabit and the ones we might yet make. Each layer is understood as a unique technology capable of generating its own kinds of integral accidents, which, perhaps counterintuitively, may ultimately bind that larger architecture into a more stable order. These layers are not just computational. As much as it is made from computational forms (multiplexed fiber-optic cables, data centers, databases, systems standards and protocols, urban-scale networks, embedded systems, universal addressing tables), The Stack is also composed of social, human, and concrete forces (energy sources, gestures, effects, self-interested maneuvers, dashboards, cities and streets, rooms and buildings, physical and virtual envelopes, empathies and enemies). These hard and soft systems intermingle and swap roles, some becoming relatively "harder" or "softer" according to seemingly arcane conditions.⁹ The Stack comes from both equilibrium and emergence, one oscillating into the other in undeciphered and unaccounted-for rhythms, stabilizing and destabilizing the same component for

sometimes mismatched purposes. What is its state condition, and, literally for governance, what kind of machine that is a state does it provide for?

The scenario described in the chapters to follow, and appearing before us in the real world, can be summarized as one in which *Users*,¹⁰ human or nonhuman, are cohered in relation to *Interfaces*, which provide synthetic total images of the *Addressed* landscapes and networks of the whole, from the physical and virtual envelopes of the *City*, to the geographic archipelagos of the *Cloud* and the autophagic consumption of *Earth*'s minerals, electrons, and climates that power all of the above. The most complex paths through these layers may displace well-established forms of human-machine-infrastructure interaction, perhaps so well established that entire cities were designed to accommodate them. This may insert machine control at almost any point, amplifying or diverting human control over any machine in which the *User* happens to be installed, or even of the whole infrastructural landscape in which those machines swarm together. For example, the integrated design of driverless cars includes navigation interfaces, computationally intensive and environmentally aware rolling hardware, and street systems that can stage the network effects of hundreds of thousands speeding robots at once. The next stable form of the "automobile" (a description that will become perhaps more and more accurate) may be as a mobile *Cloud* platform inside of which *Users* navigate the *City* layer of a larger Stack according to augmented scenery *Interfacial* overlays and powered by grids of electrons as well as bits. Planetary-scale computation involves the whole *Earth* from which silica, steel, and all manner of conflict minerals are drawn. Computation is not virtual; it is deeply physical event, and The Stack has an enormous appetite for molecules of interest and distributing them into our pockets, our laps, and our landfills. The chemistries and the terawatts that will feed The Stack, and us through it, force us to reckon that the ponderous heaviness of *Cloud* computing will be a key driver of geopolitical frictions to come. We are taking a high-stakes risk with the development of smart grids and the energy appetites per terminus they will enable. Will the platform efficiencies of The Stack provide the lightness necessary for a new subtractive modernity, an engine of a sustainable counterindustrialization, or will its appetite finally suck everything into its collapsing cores of data centers buried under mountains: the last race, the climate itself the last enemy?

In the figure of The Stack, we see not one totality but the production of multiple and incongruous totalities, some of which are "interfacial regimes," some are superimposed landscapes of *Addresses*, and others are interwoven *Cloud* and state geometries. These geometries both draw and draw on the vertical platform of The Stack, and in doing so may also displace existing geographies with several alternatives at once. Perhaps these culminate in the apotheosis of Anthropocenic industrialism and perhaps they provide larval scripts for a post-Anthropocenic alternative, or both, or perhaps something much less decisive and dramatic. Our sights are not trained on how The Stack might

hasten the messianic arrival of some seamless full-spectrum computational end of history, but how its gnashing and grating juxtapositions generate peculiar new spaces, normal enclaves, and how those exceptions are instructive as ways of deliberately reorganizing the world. Put differently, treatments of each of these six layers work with a particular caveat, that is Paul Virilio's axiom that the invention of any new kind of technology is also simultaneously the invention of a new kind of accident.¹¹ This holds true for the emergence of planetary computation and its Stack, as much as it does for the forging of aluminum and airplane crashes, set theory and stock market crashes, and incandescent light bulbs and climate change. Each individual layer promises its own range of possible accidents as it abuts its neighbors, and in some way each of the six layers is presented as a technology *for accidents*. Each is described in terms of both how it resolves the emergent accidental megastructure of The Stack into one and how the essential accident of each layer, and of the combined whole, points toward very different kinds of geosocial relations and geopolitical systems, perhaps especially those determined not by today's technology but by whatever technological regime will come after planetary-scale computation.

3. Blur and Accident

We start with questions that are as slippery as what they interrogate. In an age of planetary-scale computation, what is “sovereignty” and what is the future political geography, especially as the former is separated from the latter? How would the answers influence how we draw and divide up who and what goes where, and what shape the maps are that could do this? When geography becomes geolocation, who or what truly occupies any given place? Its owner, its user, the platform that makes it useful to either? Again, how is one person governed when platforms of governance see her as a *User* at a particular layer of a whole more than as a formal citizen? What freedoms of movement and freedoms from movement can she claim? What constitutes a constitution when the terms of engagement with other publics, near and far, both human and nonhuman, are codified into visual *interfaces*—images that are also tools? How can these platforms be redesigned to organize alternative economics, geopolitics, ecologies, philosophies, and even models of historical time? As it is conditioned by globalization, localization, and intermediate zonal regionalisms, by spaces absorbed by networks and networks absorbed by citadels, will some other, unknown political geometry come to enact and enforce the necessary partitions and brackets (border, wall, law, identity) that could program the world according to its alternative plan and plan it according to its program? Who and what gets to be the citizen-subject-*User-agent* of that program? Finally, to Clinton's half-formed question, what is the architecture of the emergent geopolitics of this software society? What alignments, components, foundations, and apertures?

We need ways to account for the intersecting complexities of computational globalization, its thickened geographies, its mysterious weaving of geometries of governance and territory, seen on their own terms, not as transgressions of some other system. The emergence of computation as global infrastructure contributes to an ungluing and delamination of land, governance, and territory, one from another.¹² Accordingly, sovereignty is now less guaranteed by the conceptual resolution of the flattened geopolitical plane as offered by the Westphalian nation-state system, but that does not mean that takes leave. As said, that particular compromise on the delimited monopoly over sovereign space is unbuttoned from its mooring, perhaps only to be refastened even tighter in another way. Indeed the appetite of the state is rejuvenated by the same processes of computation that delink modern sovereignty and geography and challenge that particular consensual framework. The state's own future is to be decided through its own negotiation of encounters with the challenges posed by planetary-scale computation to its geographic and jurisdictional legacies. The state continues by extending up and down into the new scales offered by multiple interdependent layers of The Stack, which sometimes do not blend into one form, but rather produce unresolved compound images and unresolved compound worlds, jurisdictions, frontlines, and boundaries. The gaps opened up by this rotation, a simultaneous coming undone and refortification, is where the reprogrammability of things plays out. The touchpoints between these layers make substitute locations and addresses, variously new and primeval; they are translations, wet with life, descriptive and consistent with what can be repeated over and again as governance. Squinting hard to make out the contours as they slip and slide off the map, we realize that only a *blur* provides for an accurate picture of what is going on now and to come. For better or worse, blur is what they are and what they do. Our description of a system in advance of its appearance maps what we can see but cannot articulate, on the one hand, versus what we know to articulate but cannot yet see, on the other. This oscillation between the real-but-as-yet-unnamed and the imagined-but-as-yet-not-real—this blur between them—might sustain the necessary challenges to the imagination and even enforce what it conceives, a giving way to compound images and sectional perspectives: to stacks.

For this investigation, that compound image is articulated through the lens of computation operating at planetary scale (which it does very unevenly). But this is also exactly what makes the question of that future more difficult to ask with precision because it is also too easy to ask.¹³ To say that the future of geopolitics is a function of the future of computation is to risk saying nothing at all or, worse, to repeat everything that shouldn't have been said in the first place. Isn't the conflation of globalization with "digital," under a rubric that cajoles allegiance to a computational teleology, today's quintessential nonthought, a mere sequencing of the most obvious into something that stands for history because it renders the mundane for us at a historical scale? Yes. Yet if looking from the future at the present instead of the present for the

future, we were to consider that exact situation from the virtual perspective of a world already utterly realigned, we would see plainly that a fundamental and computationally determined realignment of our world is already well underway. Where it goes is anything but settled, and today's official futurism may have little to contribute when all is said and done. We can, however, say a few things about where it goes with some confidence. This future-antecedent revision of political geography owes itself to a calibrated repetition, a desimulation, of the blur noted above in at least two ways. First, it is realized within a tangible geographic agency of material computation, a physical information geology, that is already at work, already spoken about ad nauseam and so therefore escapes adequate description; second, it is today latent in some possible articulation that could give it formal composability in advance. We can hope that even as the blur confounds, that we designate it further so that it can design *us* in the course of its own articulation. It may be that our predicament is that we cannot design the next political geography of planetary computation until it more fully designs us in its own image or, in other words, that the critical dependence of the future's futurity is that we are not yet available for it! It is less that the contemporary hyperbole for computational globalization is a lie, that it doesn't truthfully describe what it purports to map, but that what it maps doesn't yet exist. The difficulty in formulating a sufficient geopolity is a function of both what we think we know it has done (but don't actually know because it hasn't done that yet) and of what it has done and will do (but which we don't know and actually *don't know how to know*). Unfortunately, for learning how to know it, direct amplification in the intensity and resolution of our answers to the inevitably wrong questions will not help us.

Every thing is, it seems, a stakeholder and is at stake. The consequences hinge on what is the most difficult challenge to our uncertain competency to redesign our own geogovernance, that is, the fragility of our climatic and ecological commonwealth. The bedraggled UN Climate Change conferences underscore why intersovereign federations have a limited ability to enforce deep transformation through legal consensus. The ecological crisis will likely necessitate the formulation of new scales of bioregional jurisdiction (both smaller and larger than a state), new modes of calculating energy (quantifying, computing, distributing, visualizing a polity of electrons), and new forms of networked geopolitics (that can represent both urban megasettlements as well several hundred million migrants with equal representational facility). States and sovereignty as we know them may be ill-suited to these tasks, and so the option may prove to be, quite literally, adapt or die. And these are just the problems we know, the known-unknowns.

The project to be taken up sees politics as infrastructure, systems as law, totalities as site condition, supply chains as ecologies, and energy as money. Each of these, and each layer of The Stack drawn from them, is a unique but dependent logic of design and governance. Most of the unfamiliar questions arise from problems that cannot be

answered in isolation and cannot be properly addressed by extrapolating and extruding familiar models from past modern eras or by presuming that the past is actually in the past (despite the earnest protestations of some who would say they can).¹⁴ What maps, what media of exchange and equivalence, what agency of synthetic objects, which currencies for ecological economics, what ethical appetite of risk or promiscuity, what bargains with violence are necessary? These can't only be decided by philosophical discourse or solved by engineering, nor can we engage the blur that makes them partially legible to us without also deploying both at once. Opportunistic variations of thinking and making must be enrolled, all at once and in dissonant combinations, braided one into another (just as their subject matter already is). We may not have to wait long to find out which way things will break. Geographies that were comfortable and doxic are now transient and alien, inhabited uncannily. But even as strange geographies corrugate, fracture, and smear worldly scale and tempo, the ground isn't somehow evaporated into virtual information flux; to the contrary, we are brought to a certain *end of nonplace*. For this, a different kind of placefulness is reestablished, one that is not the organic inverse of artificial abstraction, but an experience of place as one resonant scale within a much larger telescoping between local and global consolidations.¹⁵ That reestablishment is not a generalized secessionism or irredentism, a natural regrounding, or transcendent escape into technological raptures. It is *designation*, a composition, a design aesthetics, and a projective ethics of pan-infrastructure deployed for a geopolitical reality that cannot possibly untangle material from information, materialism from informationalism, earth from sky.

Keeping the image of that reality in mind, all the while looking askance at the idiot predicaments of today, we can well wonder if our current faculties of analysis and making, our hideous languages, are capable of authoring any lasting alternatives. Perhaps ours is not a world of information but a wall of noise, a screeching mélange of incompatible equations into which we have no real choice but to enter into directly: scrambled territories, institutions, constitutions, sovereignties, citizenships, hardwares, softwares, protocols, interfaces, databases, patterns, platforms, cities, muscles, skins, organs, failing presumptions, exotic refrains, domains, settlements, penultimate boundaries—or, better yet, directly into the forms-to-come, for which each of these legacies is just an ancestral ante-image. There is less forward and backward than entropy and negentropy, oblivion and not oblivion, imminent or deferred utopia. As such, any design authorship must understand that the dynamics at work now are—for better and worse—simultaneously and interchangeably both futuristic and archaic, at once both technocratic and theocratic. The Westphalian-Kantian diagram of the nation-state is attacked from both the front and the rear (another blurring). At the same time that we ponder oceanic financial archipelagos that would game the speed of light by locating offshore trading sites that optimize the movement of pulses between trading centers, and through which the incremental value of a commodity is determined literally by

its location in the earth's light cone,¹⁶ we also watched, back in 2008, religious fundamentalist groups attacking Mumbai with Google Earth maps, satellite phones, stolen SIM cards. As some would launch the secular alter-cosmopolitanism-to-come, others lay the groundwork for a cloud-based neofeudalism: Visigoths with iPads, barbarian theological microstates with thriving biotech and nanotech industries (like California, perhaps). Supercomputing does not inoculate us from feudalism and from superstition, but it can perhaps provide for their opposite, that is, a futurity, and a futurism, without guarantees, only plasticity.¹⁷ And so the accidents keep piling up. The jurisdictions are more interwoven. The geometry of political geography is only more complex, especially in that it seems to have no outside, no "free space," to delimit itself against. Our accidental megastructure is more plural, more contradictory, more composite, and more polyscalar. But if so, then while Virilio's axiom holds, and the invention of any new kind of technology is also necessarily and simultaneously the invention of a new kind of accident, it is true that the opposite holds as well: *the accident also produces a new technology.*

The *Nomos* of the Cloud

But historical forces wait for science, no more than Columbus waited for Copernicus. Each time, through the impulse of new historical forces, new lands and seas enter into the horizon of the collective consciousness, the spaces of historical existence are transformed. At that moment arise new measurements and dimensions of political-historical activity, new sciences, new orders, new life or reborn peoples. Seneca: the hot Indus and the cold Araxes converge, Persians drink from the Elbe and Rhine. Thetis will reveal new worlds. And Thule will no longer be the outer edge of the Earth.

—Carl Schmitt¹

The space of the globe is a circle of circles. Time is imprisoned in the solar system where one may distinguish circles of circles by transfer, rotation, by helices and spirals.

—Michel Serres²

We began with an architectural question and then worked toward a political theory. In this chapter, we begin with a political theory and work up toward a technological predicament. As argued, The Stack emerges not only as a global technical system but also as geopolitical geography. It is able to do so because it also emerges from modern political space and its capacities to site, subdivide, and occupy “new worlds.” First, we consider the geographic history of sovereignty through (and against) the notorious German legal theorist Carl Schmitt’s notion of *nomos*. For Schmitt, the physical incision of the line into the earth precedes the empty abstractions of mathematized grids and naval liquidity and is essential to any proper sovereign form. We will examine Schmitt’s binary opposition between the land and the sea, the physical and the virtual, with regard to The Stack, first to put it to use and ultimately to break it apart and likely leave it behind. In the chapter following, we define the institutional logics of platforms in general by considering their technical processes as political technologies. We then consider examples of how platforms (specifically *stacks*) have been employed to compose economies and societies in their own image. Finally we will examine the specific layers and logics of The Stack as developed in subsequent chapters.

4. Dividing Sovereignty

In starting with and from political theory in this first part, it is important to acknowledge in advance that “sovereignty” is positioned as a question, not as a given conclusion. The implication is not that software is new and sovereignty is timeless, thereby leading one to ask how sovereignty now works through software, but rather that both are now mutually contingent and that the work of software at a global scale itself produces unfamiliar sorts of sovereignties. Even so, the many connotations of sovereignty are highly contested in political philosophy, and this book is unlikely to temper this and may disappoint anyone looking for the definitive explication of the concept. Even so, we can say that in the most prosaic sense, state sovereignty is drawn out by rules of an international system that is itself guaranteed by the federation of states. According to this, a state would have a right to the legitimate exercise of control and governance within an exclusive geographic domain, usually of land, including certain monopolies over legitimate violence and the recognition of and by international law. This arrangement is predominant but incomplete. It is characterized, at the very least, by its own continuous breaching. In relation to this system are other several specific sovereignties in play: the legal sovereignty of states recognizing one another; an interdependence sovereignty of stable global flows of resources and capital; domestic sovereignty, and the state’s authority over its own internal mechanisms and institutions; and Westphalian sovereignty, that states have the right to separately determine their own domestic structures of authority.³ The Westphalian mode is, as I’ve suggested, also predicated on a particular and arbitrary geographic design of political space defined primarily as zones of land, named by and as states. Sovereign decision has, of course, been a focus of renewed attention, from Jean Bodin’s definition of the sovereign as the absolute and perpetual power of a commonwealth through to the more Hobbesian definition of the sovereign as “he who decides on the exception.”⁴ The exception is that which is on the face of it undecidable by the law, but which the sovereign assumes the right to adjudicate nevertheless. The sovereign is he who has the power to suspend the regularity of the law and issue enforcement into the indeterminate state of this “emergency.” Giorgio Agamben’s reading of Carl Schmitt moved this “decisionism” close to the primitive core of political authority (particularly after 9/11, when irregular jurisdictions and executive actions were announced regularly as the new normal).⁵ His work also convened a lively discourse on sovereignty, including resistance to its forms, in relation to constituted and constitutive violence, drawing heavily on Walter Benjamin’s 1934 essay, “A Critique of Violence,” as well as Agamben’s own employment of Schmitt’s terminology to identify the *camp* (specifically the concentration camp) as “the *nomos* of the Modern.”⁶ Sovereignty here is not limited to the work of states. In his later-career lectures on biopolitics at Collège de France, Foucault outlined his idiosyncratic history of neoliberalism, which for Foucault was

itself a unique subspecies of capitalism. He argued that one of the things that makes neoliberalism unique is that markets do not operate in conjunction with or in conflict with sovereign states, but rather that sovereignty is itself shifted from states into markets. For sovereign markets, rights of economic exchange supersede the governance of public order at the level of the individual and the collective.⁷ Abstracted calculation supporting the strategic financialization of assets, both real and speculative, takes on new importance, and so at least in this regard, the historical emergence planetary-scale computation and neoliberalism are intertwined. However, as we examine in some detail with regard to platform sovereignty, that pairing is neither requisite nor inevitable.

For The Stack's sovereign products, the decision over the exception remains crucial in several ways, including in relation to where and when the law is suspended on behalf of the drama of violence, but also where and when boundaries of Westphalian subdivisions have jurisdictional preeminence versus other spatial orders. Most importantly, it is the *reversibility* of the exception that makes it so fraught; it is at once outside the law yet determined by the authority of law itself and available for retroactive normalization at any time. For The Stack (and for other orders), this may work through reversibility of geographic lines of segmentation, gathering an interior at one moment and guarding against an exteriority in the next. Those segmentations may divide physical space or separate layers in a larger machine, and from this conjunction, we can trace an infrastructural sovereignty that is produced less by formal law than by the shared physical postures of political subjects in relation to common infrastructure. Within that broader framework, we can also identify *platform sovereignty* as a still immature combination of legally articulated political subjectivity (one sometimes determined by geographic position and sometimes not) and an infrastructural sovereignty produced in relation to the platform infrastructures of planetary-scale computation, regardless of whether these are privately or publicly owned. We'll see that platform sovereignty operates within territories that are composed of intersecting lines, some physical and some virtual, and for this, deciding exceptions is no less critical. The exceptions to be decided, however, are over what geographies those lines describe and what conditions they inscribe. Is one side or the other the inside or outside? Is this a camp or enclave?

Modern state polities are defined as interior to their own circumscribing geographic partition, and their sovereignty is produced in the fragile image of that line's stability, even as that line remains reversible (all extrastate actors rely on that inversion and its convolutions). In the end, this economy of reversible partitions supersedes the integrity of external and internal borders, such that any polity is always an incomplete complex of smaller subpolities, defined for itself according to its own private exceptions, both inward and outward-facing: capital cities, special economic zones, overseas territories, embassies, local ordinances, and so on. Even with these buffers, the stability

of state polity is always in question, because to the extent that the state suppresses its original constituting violence (war, revolution, settler colonialism), all future agents of subsequent exceptional violence against that state become ghosts of those first rites of legal absolution and self-exception, their most exacting patriots in a way. But the political work of the geographic line and its violent reversal precedes and exceeds formal states into both their past and their future.

Consider that with the first agriculture also came more permanent settlement patterns, more formal authority structures, as well as the compelling fortification of place, cordoning it off through symbolic boundaries and by real walls and bunkers. The zone of habitation more forcefully encircles itself, now less a territory on an open plain (or plane) than one gathered into a proto-urban interior. With agricultural settlement as the driver, it is food—those parts of the world that we ourselves interiorize through ingestion and digestion—that guarantees this biopolitical economy of space. The digestion cycle envelops inhabitants into themselves; over time, a city consumes its inhabitants as the inhabitants consume the city (and in this way at least, all settlements are cannibalistic). The boundary lines that define the inside of that neolithic biopolitical economy are inscribed walls that outline and absorb what is wanted into its own corpus, filtering out what is not. As these partitions are membranes between the inside and the outside of a real social body, they are also skins, and it is in relation to the sensibility, intelligence, and vulnerability of skins and surfaces that these systems govern movements between enclosure and mobilization. In time, urban economies of eating and not eating, and including and excluding, will multiply and diversify such skins, deploying some as abstracted infrastructures and others as exposed flesh to be disciplined, sacrificed, capitalized, augmented, consumed over again. But for all that, it is still undecidable in advance what will finally constitute the interior or the exterior of any linear boundary, and so a specific sovereignty of that decision must necessarily be invoked, implicitly or explicitly, and even programmed and automated. Lines (and surfaces) provide tension by setting opposition between the negative spaces to each side (and inside and out), but they cannot ever fully control how either side is charged in relation to the other at any given moment: which one is dominant and which is subordinate, which is gathered in and which is excluded. This holds equally true for Stack partitions, both spatial and technical, such as *City* grids locking off bound cells from the linear flow, or *Interface* surfaces drawing together *Users* and systems, negotiating on the fly who and what is driving any interaction. While this primordial dynamic remains essential for the apparently irregular geographies of The Stack, we will see that platform sovereignty also relies on genuinely novel developments emerging through the reversibility of “lines” that are equally geographic and technological, folding the world in and out and up and down its layers, over and over again.

5. Over (and under) the Line

Globalization both destabilizes and enforces borders, tethering retronalationalisms and technological integration into the same contradictory dramas, populated by state and nonstate actors, czarists and androids, switching sides without moving an inch. Consider this odd and perhaps quintessential episode. During the Yugoslavian civil war of the 1990s, a squad of Serbian paramilitaries had captured a large group of Bosnian Muslims and held them in open-air prison camps. Now-famous photographs and film footage of these detainees, standing behind barbed wire looking out at the camera, horrified the world and mobilized opinion against the Serbian nationalist campaign and perhaps in favor of military intervention as well. The image of concentration camps, now again in Europe, crossed some red line and triggered demand for action. The Serbs claimed, however, that the global interpretation of the footage was all wrong—backward in fact.⁸ According to them it was the *photographer* who was “inside” the camp, looking “out” at the curious Bosnians who had gathered around the perimeter fence to look in on him. This claim (albeit decided to be false in British court) demonstrates how easily such lines can invert themselves when an inversion suits the strategic perspective at hand. The line may be drawn on the ground as clear as clear can be, but the quality of the space that it draws—what is inside and what is outside, and who or what governs either side—is always in question (especially for those who die on one side of the wire). As the utopia/dystopia of the Berlin Wall (known as the Anti-Fascist Protection Wall in East Germany) also made clear, the camp and the bunker, detention and the enclave, are inversions of the same architectural form. One is an architecture of internalization and the other of externalization, but they share the same material profile. While one works to contain the danger within its walls, the other draws the same physical partition to keep the world at bay and expelled outside its safety membrane. Any exceptionality of the camp is actually exceptional not only because it is authorized by a sovereign decision that is both inside and outside the law, but also by a preceding decision to differentiate that enclosure from its own double, the bunker. Each is built into the other and their shared reversible design; the outside-in camp is not the only figure of this *nomos* of the modern as the inside-out bunker is an equally essential posture taken in relation to the same line. We will consider how the flip-flop of one into the other can be normalized and even automated by platforms and how the “exception” of linear reversibility itself becomes unexceptional.⁹

First, we need to recognize how different kinds of lines, segmenting and generating different geometries, accumulate to realize different kinds of geopolitical effects. Schmitt has more than a little to say about this. Drawing the world is a work in progress. In Ptolemaic cosmology, the Earth was kept under a crystalline bubble, dividing two worlds, ours on the inside of this glass vitrine and one on the outside, the heavens looking in at us. From the fifteenth and sixteenth century claims on the New World,

to longitudinal zones derived from Greenwich mean time, to the subdivision of broadcast spectrum, modern geopolitics is always based on a particular and arbitrary compositional alignment of territorial and governmental layers into a particular architecture: no topography without topology. Lines that are linked, folded, and looped become a frame, keeping things in or out, but like all other frames, they also present a certain section of the world and put it on display. The modern nation-state is itself also function of a cartographic projection that conceives the Earth as a horizontal plane filled with various allotments of land in which individual sovereign domains are circumscribed by jagged lines. Some are drawn as irregular hexagons (like France), some are regularized rectangles (like Colorado), some are discontiguous clusters of spiky circles (like Hawaii), but all these shapes are derived from the basic topology of *loops*. Also there is no geography without first topology, and so as we'll see, also no *nomos* without *topos*: no stable geopolitical order without an underlying architecture of spatial subdivision. This loop topology is normative but not mandatory. As we know, other subdivisions of the Earth are not only possible; their lines already proliferate. While some lines and frames are more physically tangible than others, for the political geography of The Stack, it is the physicality of abstraction that is at the center of things. As a kind of master architecture (in the making), The Stack model is also perhaps also a contemporary version of what Schmitt called the *nomos*, and perhaps it is what retires the Schmittian *nomos* altogether. This slippery concept refers to the historically evolving structure of the world order (more specifically for him, an *Earth-order*) and the corresponding partitioning of political space according to which sovereign entities are constituted. Is there a *nomos* of the *Cloud*? We may conclude that The Stack is the *nomos* of our moment, or a better grasp on the architecture of The Stack may establish that there is no real *nomos* after all.

My extended discussion of Schmitt and this term, *nomos*, needs some explanation. My interest is not to make a new contribution to the already well-trod domain of Schmitt studies or to suggest that we cannot develop a practical theory of sovereignty and political geography without first steering clear passage through his thought and legacy. Instead, some of Schmitt's problematic concepts are used for both the particular things that they may illuminate and also for what is to be learned by what they obscure, and how and why they do both of these. In this sense, his concepts stand in for other related perspectives that deserve criticism, specifically those that begin from and end with a basic distinction between the physical and virtual when trying to make sense of computation and space, let alone geography. Implicit or explicit, this lazy association of analog systems, with physics and nature, and digital systems, with artifice and artificiality, dulls and confuses our debates about technology in ways we cannot afford. A corollary to this is a discourse on "the political" that fetishizes oppositional antagonisms, and another that can comprehend technology only as an instrument or topic of governance, and not as its actual form.¹⁰ The *nomos*, however,

is one of his concepts (“exception” is another) that might be twisted and reused in such a way as to force it toward very different conclusions than he intended. But what is *nomos* exactly?

In his 1950 work, *The Nomos of the Earth in the International Law of Jus Publicum Europaeum*, the legal theorist offered a sweeping history of Western geopolitical architectures. The work focuses on how Roman, British, and Germanic legal empires drew the geometry of territory—specifically European territory—into a stable of political geographic orders from which spatial sovereignty over land, sea, and air was derived.¹¹ Schmitt defined *nomos* as “the Greek word for the first measure of all subsequent measures, for the first land appropriation understood as the first partite and classification of space, for the primeval division and distribution, is *nomos*.¹² It is both a structural logic in accordance with the primal first act of territorial inscription that gives rise to its subsequent formalization; it is a making of a territorial order through the execution of a territorial claim and physical occupation that precedes it. It also refers to a set of “principles governing human conduct” regarding war, space, and governance, but Schmitt makes use of *nomos* to suggest something both more concrete and transcendental than the abstractions of law. *Nomos* is described as prior to every legal, economic, and social order;¹³ it is constituted by appropriation, distribution, and production, and only through this can it move from the particular to the universal: from arbitrary territorial capture, to representations of spatial delineation and to a geopolitical order. It is at once a physical oppositional arrangement, a discursive order, and an organic naturalization of this. Fredric Jameson offers another interpretation on Schmitt when he writes,

The concept of the *nomos* is a periodizing and structural category (whose family likenesses, besides one to the Marxian “mode of production,” might also include one to Foucault’s historical *épistemes*) then inevitably brings with it the problem of the break, not particularly solved by the notion of a “transition.” In Schmitt, however, the fact of the break is an energizing one: first, because it suggests that each break, the historical disintegration of a given *nomos*, will call for a historically original production of a new legal superstructure or *Novum*. This call then lays in place the notion of an active moment of constitutive power...¹⁴

Schmitt wrote *The Nomos of the Earth* following World War II, during which he served in Nazi Germany, and the “break” that concerned him was the end of a European order and the rise of an American era that he views with deep suspicion. He was pessimistic that the US was capable of such responsibility—and even if it was, that its reign would be desirable given “the nature” of “North Atlanticist” conceptions of space. As the US and the other Americas became a more central geopolitical actor, both the global omniscience of British-Greenwich naval ubiquity and the Roman-Germanic legal order of grounded jurisdiction were displaced by other forms of transactional sovereignty. In Schmitt’s history, this shift also validated transnational claims

of sovereignty over entire continental zones, such as the Monroe Doctrine, which Schmitt greatly admired as a model of how a multipolar *nomos* should work. The catastrophes of World War I and II led to the establishment of a binary architecture held in place by the extranational domains of the US and Soviet blocs, their hierarchies of client states, their proxy battles over postcolonial nations, their transformation of Berlin into an enclave inside an enclave, and so forth. Today another multipolarity between China, the other BRIC (Brazil, Russia, India, China) economies, the North American Free Trade Agreement, ASEAN, the European Union, and the Eurasian Economic Union, among others, plays out both in and over types of space that are equally geographic and technological.

Schmitt's history of the origins of that European *nomos* is staged through the continental encounter with the supposedly unpartitioned New World, and the "free soil" it presented to the European jurisdictional imagination. (We know full well that the very idea of an "empty American continent" is itself an invitation to genocide. For our purposes, we rehearse Schmitt's theoretical argument but not the validity of its world-view.) Schmitt claims that recognition of an "unwritten" territorial outside confronting a European interior motivated competing common laws and juridical traditions to respond by formalizing political geography. The pressing challenge of giving order to the "free soil" made the current heterodox and ambiguous state of jurisdictional affairs in Europe somehow intolerable by comparison. That solution ratified the subdivision of loops of land, but not sea (and largely ignoring air and the z-axis altogether), in favor of a master Archimedean point from which this political cartography would be consolidated and naturalized, as symbolized by the Westphalian compromise half a century after Columbus's first expedition. Today the continuing (if still incipient) emergence of planetary-scale computation may represent a similar break and a similar challenge to the political geographic order. It does so not only because the *Cloud* is a new continent to be colonized, but because, as a kind of space, it trespasses the Schmittian metaphysical distinction between solid ground and liquid sea as the essential poles of geopolitical space and theory.

This puts us today neither at the end of the liberal world-state nor as subjects of a consolidated and self-transparent empire, but, rather inside something much harder to map because it is not entirely certain which space is which, what referent is physical and what distinction is abstract, the fiber-optic line or the pulse of light? This is not only a crisis of legitimacy; it is also a crisis of addressability, and one that initiates a break between one order and another, *nomic* or not. Our own encounter with a new world of unaddressed space generates a productive confusion over what type of Earth is to be claimed: land, sea, air, and now information; each of these seems to always be allocated, addressed, owned, and unowned differently. But this also is where we begin to depart from Schmitt's framework altogether. He historicized the fate of Westphalia and the European *nomos* through his two metaphysical modes of geospatial

governance: the opposition of an authentic grounded order and organic habitation versus an inauthentic maritime and aerial lawlessness extending over the line. The latter's promiscuous forms are governed not by immediate occupation over time but by abstractions, located by flags, mathematical geopolitics, and a vectorial relation to starry neighbors.¹⁵ The industrial militarization of aerial space with World War I destabilized this essential opposition, and with it, according to Schmitt, the basic foundation for not only European geopolitical architecture and threatened the possibility of a renewed *nomic* order to come. From the sky, a pilot's survey and visual capture of land smoothed the ground over and made it perceptually flat, oceanic, optical, geometric, quantitative. The drifting swirl of aerial warfare overcomes the distinction between grounded habitation and liquid movement through abstract space. Later, Virilio would echo (in terms not so unlike Schmitt's) the significance of this shift and extend the analysis to include the arrival of information spaces that govern and are governed through an even more radical visual abstraction of planetary space and time, and the even more unnatural mathematization of territory manipulated from afar.¹⁶ Jameson again: "Yet the prophecy of an air-power return to total war, with the friend-foe pairing replaced by self and other, human and subhuman, is only partially correct, for it is no longer a question of air as an element, but one of cyberspace. Information is the new element that re-problematizes the spatial."¹⁷

The Stack also contributes to a geopolitical order and is a manifest representation of that order, but what sort? The Stack does not neatly fit into Schmitt's historical model or vice versa. Its appropriations of irregular territories and complications of geographical distinctions suggest more than modern political geometry outfitted with fast processors. Planetary-scale computation may need to be understood as a successor to these other modes of geographic governance—land, sea, air—each with its own logics of partition. But unlike the US Department of Defense, which also recognizes "cyber" as the fourth spatial domain of war but describes it as necessarily subordinate to existing forms of state jurisdiction, I suggest that other shifts are at work, perhaps even a break, that will prove more difficult to accommodate and contain. It is neither that the spaces of The Stack are enrolled into established systems or simply stamped with a new governing system of addresses all at once; rather, an accumulation of interactions between layers in an emergent structure is producing the scale, dimension, and contours of this supercomputational geography in the first place.¹⁸ First and foremost, The Stack is occupying itself. Schmitt's opposition of the "land versus liquid" logics of sovereignty ("Eternal Rome" versus "Eternal Carthage") does not hold, any more than the distinction between the physical and the virtual.¹⁹ For planetary-scale computation, the practical issues of addressing the world cross-divides of solid and fluid, the material and the informational, between sand and bits, between things and actions, between objects and enunciations, archived pasts and simulated futures and the structures that would govern all those exchanges as they bloom into new

forms. If addressability is also some form of accountability, all this congeals toward what kind of geopolitical space?

6. Land/Sea/Air/Cloud

To approximate an answer, it will first be necessary to show how this collapse of the Schmittian distinction between land and sea (and all that it implies for the ultimate career of states as they move into the *Cloud* and The Stack) is accomplished not only by a radicalization of the “aerial” into even more vaporous “information space,” but equally as much through a radicalization of the physical line carving into territory and guaranteeing its own enforcement. As The Stack emerges as both the machine and the geography, the territory and the map at once, yet more smoke escapes from the ears of Schmitt’s direct and indirect heirs. Schmitt’s spatial thought is aligned with the German philosophy of his historical moment. He writes approvingly of Heidegger’s dictum, “*Die Welt ist nicht im Raum, sondern der Raum ist in der Welt*” (The world is not in space; rather, space is in the world) as a path out of the “nihilism of empty space.”²⁰ Jameson conveys that “the origins of (*nomos* of the Earth’s) ‘spatial thought’ ... [follows] Husserl, whose critique of modern abstraction ... locates the fall in the separation, the occultation and/or repression, of geometry from the existential praxis of land surveying in ancient Egypt. Schmitt diagnoses a similar degradation in the dissociation of the juridical tradition from the brute geographical fact of *Landnahme*, that is to say, the seizure and occupation of land as such.” The geographies of land, from sea, from air, are arranged by Schmitt not just as different projects and techniques, but as a tragic dilution of a prelapsarian origination of ground toward increasingly legalistic, geometric, and virtual abstractions. In considering a *nomos* of the *Cloud* by counting the transoceanic fiber-optics also digging through the countryside, data centers buried deep in mountains near dams, the exotic minerals pulled from African rivers to make cell phones, alongside the engineered hallucinations of augmented reality, an inability to stay true to the dirt-venerating provincialism of Schmittian *nomic* priorities is seriously challenged. No workable distinction between ground and water, between *Cloud* infrastructure and *Cloud* interactivity as mapped across some spectrum from tangible to virtual, can survive much poking and prodding. Even so, there are *nomic* claims on the undetermined territory of the *Cloud*, as recent revelations regarding state surveillance programs and state versus state cyberwarfare make plain, for example. Even so, the residual confusion of jurisdictional divisions of land, sea, air, and cyber is itself worth mapping forensically. From its buzz and howl, perhaps alternative governmentalities for the decades that lie beyond might cohere.

The Schmittian primal scenes are the plowing of a field, taken and defended, and the state’s duty to build good walls around it. These sovereignties over place are materially substantiated by a defended occupation of place that is supposed to outlast the

prosthetic logistical visions of Roman surveyors who have come and gone. Two lines: the ox draws its line into the absolute place of this soil, whereas the itinerant emissary of empire superimposes his invisible geometry—one a true fact and the other a temporary mathematical conjecture. For Schmitt (and for Heidegger and any number of subsequent political programs, both left and right, irredentist and esoteric), “the very possibility of legal relations is dependent upon an original act of collective appropriation of land which establishes the material matrix—literally the ground—of those legal relations.”²¹ Even forgetting that this is the same ox plow that Jacques Derrida used, once upon a time, to prosecute for writing against ontologies of presence, it should be obvious that “facts on the ground” absolutely do not defend sites against revision and innovation.²² It should be said that for Schmitt, if not for Heidegger, it is the physical taking and defense of land that matters most, not the transgenerational claims of autochthonous bloodlines that may have lost out against new forces. These political conundrums are still on our plates, and the ecological absolutes staring back at us are based not in the simple honor of defending homelands, but in the *physicalization of abstraction* and the *abstraction of physicalization*. The *Cloud* is not virtual; it is physical even if it is not always “on the ground,” even when it is deep underground. There is nothing immaterial about massless information that demands such energy from the Earth.

Networks make space and take space, and like any other architecture, by their inscriptions into a given location, they exclude other possibilities from being there. Networks dwell differently than buildings do, however, and they exceed what a bipedal hominid would recognize as a single location, but they are nevertheless *placeful*. Network edges and lines produce interiors and exteriors, and so networks are not just superimposed on a given territory, they also produce a real territory by striating it. Consider the Montana East Line Telephone Association of the 1920s.²³ Before the federal universalization of telephone line service across the vast rural areas of the United States, farm collectives made use of a network of land demarcation and domain interiorization already in place: the miles of barbed wire that segmented the prairie. Using barbed wire fences, they fashioned crude but effective telephony using the steel lines as a signal relay channel. This network did what networks always do. The same network that links and integrates locations, house to house, in a disembodied conversation, is the same network that demarcates the distance and separation of each area by bordering them into a series of continuous positions. The same network of wire that virtualizes the presence of voice also establishes the territorial coherency of homesteads, each job easily folding into and on the other without fuss (farms, you see, are not allergic to disembodied inscriptions of informational geography). One line links across inhuman distance, and one line separates place into space, but no *real* line ever does one without the other and each allows the other to work. But any line cannot by itself constitute its own political efficacy and make its own decision about what is inside and what is outside. Schmitt

is not wrong when he argues that “the political works not by founding or composing, but by settling and dividing.”²⁴ But when the ground itself is indeterminate, when the air and the *Cloud* are both so heavy with mass, then the composition of settlement and the division of founding crossover into one another, and so the sovereign decision over that inversion is always in play.

For Schmitt these kinds of piracies and perversities are always threatening to undermine the regulatory work of authentically grounded power as they reverberate in the void of our geopolitics. Onshore or off, the phrase “beyond the line” includes an exceptional or unregularized geography carried by maritime movements as well. Schmitt argued that “when the great pioneering powers of Europe struck out towards the world oceans, this immeasurable broadening of the known world resulted in a qualitatively new conception of physical space. The opening of the world oceans created the cultural context in which the universe could be conceived of as an infinite, empty space.”²⁵ The internalization of this empty depth was seen in new modes of political thought, painterly perspective, literature, and philosophy. “Released from the limits and inhibitions of traditional spatial intuition, the ruling classes of Europe were mentally equipped to become the masters of the world.” The emptying out of intuitive anthropometric space was the starting point for the arrival of a universal spatial order based on mathematical formalization and geographic interchangeability. Decade after decade, this groundless materialism was radicalized over again by mechanical production, industrial flight, modern chemistry, and, eventually, we now understand, digital computing. As said, from the sky looking down, the sea and the land are both flat planes full of points located in a universally matching coordinate system, virtualizing the immediate perception of geography in motion. “Air space,” writes Cornelia Vissman, “seems to engender constructed images of space rather than space-experience.”²⁶ This proto-cinematic flattening of natural dimensions, where the Earth itself is seen merely as a “thicker version of the sky,” disheartened Schmitt, who saw it as a catastrophic ephemeralization of the embodied occupation of the Earth that should underwrite durable human geopolitics. Instead, that architecture would now be built on the unreliable footing of overwhelming synthetic speed and the screen of false equivalences.²⁷ This is because “movement makes space, rather than happens in, space”²⁸ and because this abstract global sphere is not properly occupied, it offers space that is merely measured. For Schmitt, it is less physically defended than divided up like an algebraic equation,²⁹ and it is the spacelessness of the twentieth century that the contemporary geopolitics provides, with none of the rooted limits of solid fortresses and true walls and no true distinction between friend and enemy. Without these, Schmitt warned of an era inaugurated not only by global war but of total war of all against all.³⁰

According to this line of thought, the deconcretizing of space instates a geopolitical simulacrum spinning in an endlessly self-available matrix. It can never finally govern because it can never find a solid ground on which to erect institutions capable of

durable distinction between inside and out, us and them. At the same time, however, this universalism, “homogeneous … and morally and legally malleable,” also has for Schmitt a certain ethnic and economic odor. It is highly functional for certain forms of capture and exploitation, namely English and American forms, which would not defeat their military enemies but instead “disqualify” them by policing moral and technical incapacities with “universal” architectures that are in fact extensions of their own specific interests. This counterhegemonic move undergirds how some on the contemporary left, have made use of Schmittian concepts, against what they take to be a US-centric neo-Wilsonian empire building, and instead in the service of a multipolar geopolitical architecture that is heterogeneous and programmatically antiuniversalist.³¹ For Schmitt, but not for most of these leftist deployments, that multipolarity is also couched in transnational *Großraum* (for ASCII, *Grossraum*), or “great spaces” or spheres of influences and domains of dominion over which dominant political cultures reserve systemic sovereignty, such as the US Monroe Doctrine claims over North and South American continental space. However, to establish what the *nomos* of the *Cloud* may or may not be, it is necessary to counter the misrecognition of the extraordinary spacefulness of global information networks, tracking their ongoing occupation, settlement, and doctrinal composition. We will observe the technically necessary and politically limited universality through which platforms can cohere polities, and toward that, we will look more closely at the *grossraum*, the type of claims it makes and could make (and how hard it is to decide its inside from its outside).

7. The *Nomos* of the Cloud?

For Schmitt, the Monroe Doctrine symbolized an end of older Jus Publicum European system of international relations and operated in a parallel domain to that arrangement of Westphalian modules, one for which multiple political geographic ordering principles abut and overlap. In that, the League of Nations was explicitly “excluded from asserting jurisdictional claims in the American Grossraum, i.e. the Western Hemisphere. … The Western Hemisphere was excluded from the purview of the League,” and so represented not only another pole of power competing with Europe but another political geographic mechanism altogether. At first the model it represented appealed strongly to Schmitt, and his “advocation of a *Großraum* world-view … grew out of his admiration for the origins of the Monroe Doctrine, when it was a *territorially delimited*, hemispherical order. From economic origins, it had found continental coherence, but had then been distorted into a liberal, universal, spaceless policy of non-intervention.”³² The model it suggested of a hemispheric multipolar arrangement of geographically natural transnational domains gave way, however, to what was for him most dubious thing about twentieth-century globalization. In Schmitt’s positive vision for it, through the Monroe Doctrine, the United States is the sole sovereign in

the Western Hemisphere and its will is fiat. The doctrine reintroduced transnational territorial lines of demarcation into the body of modern international law, infusing it not just according to population and land, or space and politics, but by “land, people and idea,” in opposition to liberal internationalism and “Anglo-Saxon pseudo-universalism.”³³ For the older Schmitt, both Wilsonian/United Nations globalism as well as Nazi Germany’s Lebensraum diluted a really “genuine” *Grossraum* solution, partially because both rejected true multipolarity and the coexistence of *Grossräume* (plural) in a stable order.

For The Stack, we recognize how our contemporary territorial and epidermal lines are multiplied, dashed, and cross-hatched as they overlap jurisdictions, and in relation to them there is no cardinal outside or outdoors per se. Their framings seem at once cacophonous and practical to the management of everyday life. To Schmitt, the “free soil” of an undenameed and undermeasured land is not the same as the sterility of abstracted global space for which he claimed to feel such *horror vacui*. It is not something that hollows out the discipline of sovereign decision, but rather something that demands it to act. So where Schmitt’s original notion of sovereign exception spoke to the suspension of an internal law and its spatial imprints, it now moves to the adjudication of external geography, of the free soil of planetary-scale computation that for all its mathematics is not sterile, and of the lines that mark its starting points. In this, the sovereign decision shifts focus from the judgment of the enemy toward the design of active walls and partitions, and as it does, the figure-ground relationship between the law and the line, each framing the other, starts to wobble and oscillate. The design of what executes the interiorization or the exteriorization of any boundary, exemplified by the *reversibility* of the fence that defines the exceptional space of the camp/bunker, is not only controversial but essential. In an even partially multipolar world, the effects of these accumulating reversals are that much more complex, but not without their own governable rhythms. The ground begins to fall out from beneath Schmitt’s bottom-line prioritization of geographic lines of durable jurisdictional settlement over promiscuous geometric grids and our ability to tell which is which. When the sovereign was revealed by and through his decision over the state of emergency, its identity was fixed into relief by this action, but now we are without clarity as to where sovereign arises from which decision. Is it from the decision over interiority/exteriority, or is it their irresolvable reversibility, or is it the line itself deciding the *polis* rather than other way around, or is it the programming of the line to flip-flop the open and closed according to some generative script? If we also sense that mechanisms of exception are becoming somehow increasingly normalized (and even infrastructural) by their further modernization, then it is because they are now embedded in the actual lines, envelopes, and interfaces that mediate the reversibility of the camp/enclave machine itself. Platform sovereignty may not only accommodate but require this embedding of decision-making interfaces. As technologies more than discourses, theirs is a captured decision over a now less

ambiguous interior and exterior limitation of where the outside starts and on which side of the line it sits, drawing us in or drawing us out (but even once decided, by automation or not, the active abstraction of physical geography takes over as lines reverse polarity all over again). It is here, in the automation of the exception, that infrastructural and platform sovereignties begin. As the provisional decision over the exception is designed into the technology of the line, the automated envelope and the *Interface* influences not only how the platform will address its *Users*, but also how *Users* will program the platform, and so another foundation of the Stack's political geography is established: the *machine*.

The Stack makes space by occupying it; it does so by surveying abstraction, absorbing it, and virtualizing it, which is how it is even possible to consider whether or not it expresses a *nomos* at all. If the space of planetary-scale computation is a new kind of "free soil," then that "soil" is land, sea, and air all at once, equally tangible and ephemeral. It can be both inside the line of the Westphalian state and its internal legal optics but outside its borders and sovereignty; sometimes it is both outside its borders and internalized by legal and military sight. It digs deep into the ground, tunneling cables across cities and countryside; passes across the seafloor of oceans linking continents physically as well as virtually; and bounces down from swarms of overhead satellites and cell towers. Its infrastructural profile contains all of these qualities of the earth at once, each of them dependent on the others. It smooths space by striating it with heavy physical grids of cables and server farms, and striates space by smoothing it out with ubiquitous access, sensing, relay, and processing micropoints. For its chthonic *Cloud*, data centers are housed under mountains with reliable ice cores; suburban farmland between metropolitan trading centers is redug to lay private cable for algorithmic trading concerns near the old AT&T switches in New Jersey, realizing a new topographic expression of the transport layer of the TCP/IP stack; while the wireless frequency spectrum is subdivided, auctioned, allocated, and bundled into derivatives like any other prized commercial real estate. Whereas the Schmittian "grounded" way of thinking detests dedifferentiated space and the flattening superimposition of multiple maps, valorizing instead the perspectival spatial order of human establishment, the geographies of The Stack go a long way toward collapsing distinctions between the one and the other, as its interlacing of land, sea, and air through networks of recombinant flows realizes the simultaneous physicalization of the virtual and the virtualization of physical forces. Again, ground is abstracted as abstractions are grounded, but if the platform space in question cannot be collapsed into a single type of Earth (land, sea, air, or cyber), this doesn't make it any less contested. Practical sovereignty over what its geography becomes is animated and augmented by a drive for a spectrum-dominant position within an integrated totality of enumerable, governable zones, both high and low, visible and invisible. Building out the spaces of The Stack is precisely the accomplishment of Google, the NSA, the Chinese Ministry of Public Security, Alibaba

Group, and many other global cloud platforms, less by some Lockean right of ownership underwritten by cultivation than by the strategic articulation of the contours of a plastic territory. Its spaces are bent, inflated, and folded, and mapped accordingly. Inherited political orders are both circumvented and reinforced as the worlds they once described are disenchanted. That is, whereas states may be agents doing the taking and formulating of worlds, they cannot do so without transforming the anatomy of their own sovereignty at the same moment. The Stack space is not an already given vessel into which states intervene or markets mediate or political theologies invest with myths; rather it is generated in the confluence of platform logics that will recalculate the fate of all of these. On their own, the flexible terms of occupation might warrant Schmitt's warning against the permission that technical universality gives to total war (or what Virilio later called "pure war"). Unrestricted by the brakes of proper *nomos*, the absolute motivation for capture extends up and down from molecular to atmospheric scales. But for The Stack, these terms are not operating on their own untethered; they are instead as bound by their planetary situation as any other form of occupation. Even in the absence of a proper *nomos*, they congeal layer by layer into a metastructural order of a different governing order: a machine that is a state held together by deciding the spaces of technical exceptions as much as legal ones.

8. A Google *Grossraum*?

The machine that is a state is not engineered without conflict and controversy. Today the specter of Google *Grossraum* hangs over (and under and in between) The Stack. Google's armatures, its internal and external interfaces, operate all up and down the spectra opened up by universalist computational geographies. Especially since Google is, to date, so deeply associated with the US and its interests, to what extent has the global space of planetary computation been occupied by its particular ambitions and strategies, and already established a certain claim on an embryonic political geography? Does "Google" (literally the cloud platform and the geography defined by it) represent something like a Monroe Doctrine of the *Cloud*, filling out and supervising a domain extended well beyond the North American continental shelf, across a more comprehensive composite spectrum? For Schmitt, the first Monroe Doctrine represented a break with an older order, and perhaps the new one (if it so exists) does too, but just as the first lost its validity for him by its transformation from an upright territorial claim into deterritorializing universalization, then at least, to this extent, it is possible to consider a it new doctrine because the first was itself already also so nebular?³⁴ The US-centricity of planetary computational space is even built into the infrastructure's own autocartography. Not only was ICANN (Internet Corporation for Assigned Names and Numbers), the Internet addressing authority, established in California and its relationship with the US federal authorities long controversial, but today the United States is

still (and may remain) the unnamed, unmarked center of addressable Internet space (US websites are usually “.com” not “.co.us” as they would be without this infrastructural exceptionalism). It is in this context that the National Security Agency’s (NSA) comprehensive data capture, surveillance, storage, and metadata analysis programs as disclosed by Edward Snowden and colleagues are understood to represent a strong American state maneuver of sovereign control over (or, at the very least, of policing of) the spectral spaces of planetary-scale computation. The willing and unwilling complicity of major commercial *Cloud* platforms in this endeavor associates them directly with the reach of that claim, and so the Monroe Doctrine of the *Cloud* and the Google *Grossraum* are seen by some to conceal only one another. This conflation may simplify things for those who prefer easy plots, but it actually does not explain the situation very well. This decisive appropriation of “free soil” by US security services was met, of course, with outrage, including calls for alternative non-US Internets that could circumvent this capture (and in some cases also to ensure local and often authoritarian control by political, economic, and religious authorities).³⁵ We also know that the NSA’s acquisitive line-drawing is not unique and that Russian and Chinese agencies are at least as acquisitive, if not much more, and it is also unlikely that European agencies do not manage similar if less hegemonic operations as well. Still, the unipolarity of this still unmarked universality already overflows the normal legal geography, and its militarized brokerage does more than just draw a new territory. It also occupies it. Provisional omniscience comes from making policing the primary technique of spatial approximation, such that the geographic delineations are the result of the search for criminality and transgression, and so the friend-enemy distinction between mutually suspicious states is augmented by a *User-hacker* distinction between the rights and abuses of platform sovereignty.

As is to be expected, global opinion dramatizes this in contradictory ways. With significant exceptions, the web has largely been developed through technologies and protocols of British, European, and American origin, with many of the most powerful governmental and economic players still located there (though it is certain that Chinese and Indian counterparts are at least as important in engineering The Stack that most people will ultimately inhabit). Its global growth could be read then as the creeping spread of cyber-empire and part of a larger superpower monocultural campaign, starting in Silicon Valley and Washington, DC, and spreading to world capitals like an invasive machinic species. Some European activists, on both the left and the right, describe it this way. Alternatively, the contested terrain in question, both above and below ground and across the plateaus of scale, could be seen as one that was always there but only recently activated and given shape by available technology, like the electromagnetic spectrum was before industrialization. Or instead, as seen through the slits of a Guy Fawkes mask, it should be defined as a global commons, a messy and truant public sphere for the common intellect, private speech, and social expression that

retains, and continuously regenerates, its own sovereign autonomies, and over which no security apparatus should ever claim to guarantee final jurisdiction. Or rather, for the view from Beijing (and from some of Washington, DC), sovereignty remains by right of modern national borders to retain (somehow) full control of the data that sit inside their Westphalian loop by engineering increasingly deep packet filtering at key transnational chokepoints.³⁶ Propositions for alternative Internets that would secede from the totality in order to retain relative political, cultural, or economic autonomy could be based on a more autonomous physical layer, regional encryption systems, or even unique addressing protocols. All of these are theoretically possible, and for some military and financial sectors, they already exist and thrive. But other proposals come from Brazil, Russia, Turkey, Iran, Saudi Arabia, the Schengen Area, and others that would require new platforms to process local data only on servers that physically reside inside the territorial borders of each state. Their data would be therefore (it is thought) subject to provincial policing and supposedly unavailable to other state actors (the NSA or Google, perhaps). In some cases, this may be technically possible in limited ways, but as a general politico-geographic principle on which to scale the *nomos* of the *Cloud*, it is a reactionary counter-policing that is of dubious value in the long run. Data do not really have a national career unless they are forced to produce one. Yes, information is just as bound to local and specific contexts as it is to global ones, but the idea that its transactional flows could be filtered into national flavors and pinned down in accordance with the coherent order of a fixed imagined community and its ethnic, legal, or linguistic forms invites the sort of nationalism that always ends in tears. That so many feel the design choice is between this secret police, that secret police, and cryptoanarchism shows just how dangerously immature our geopolitical theory of planetary-scale computation is at this point.

So where should the decision over the exceptionality, or lack thereof, of the spaces of planetary computation reside? For now, we observe the metalegal acquisition and cultivation of *Cloud* territory by state and nonstate platforms but understand that the depth of that territory guarantees its ongoing malleability and resistance to full capture. It's true that while the contours of such spaces are composed precisely by their occupation (entered into and so made), the armature of planetary-scale computation has a determining logic that is self-reinforcing if not self-fulfilling, and which through the automation of its own infrastructural operations, exceeds any national designs even if it is also used on their behalf. The programming of inversions between its interior and exteriors is generic to the program of the structure itself. Decision is based less on an economy of scarce sovereignty than on replicable algorithms built into the partitions of vertical and horizontal landscapes. Sovereignty is not just made about infrastructural lines; it is made by infrastructural lines. This principle of platform sovereignty is where the costume changes of *User* into citizen and citizen into *User* are worked out. In that those lines are already globally crisscrossing grids, layered one on top of the other, the

portrait of unipolar universality versus multipolar heterogeneity is far messier without any zero-sum tally to represent it. The Stack is not *the grid* but an accumulation of grids, some communicable to one another and others not, some affording one type of provisional sovereignty and others another type, some incarcerating *Users* and others offering lines of flight, and many of them reversible. The tangles thicken.

Perhaps the regional amorphousness of a “Monroe Doctrine of the Cloud” is both the wrong *nomic* precedent to claim and the wrong profile of empire to be resisted. The Stack appears to be American, and as of now, it both is and is not (it is also mostly Chinese), but in the long term, this identity may actually prove far less significant than it might seem today. The Stack will also change what “American” means in the first place, as the identity of a geopolitical actor and as a governmental service platform, and in doing so, The Stack as a whole may resemble that new national definition less and less. If the idea of one universal grid is a ruse in the service of a particular type of unipolar economy, then exponential overlaying of incommensurate grids brings different kinds of reversals and accidents. As computational edges and nodes claim some autonomy by their programmed automation, they also possess more authority as decision-making shifts from the designer to the designed. The platform sovereignties that emerge in turn generate their own unplanned productive accidents, layer by layer and in combination, and with them come other universal positions into which *Users* might dip in and out. These are not exactly cosmopolitan for reasons discussed below, but they are nevertheless not unipolar and are quite capable of bending state claims against their will. As discussed in more detail in the next chapter, another core paradox of platform sovereignty (besides its geographic illegibility and axial reversibility) is between architectures of standardization that bring together heterogeneous projects and decentralizing effects, on the one hand, and transitory dynamic interfaces, which in the accumulation of trillions of interactions enforce the authority of that standardization, on the other. With the break from one *nomos* toward something else, also *nomic* or not, comes a change in the topology of governance, from loops on a plane to something else. Platform sovereignty is derived from the *Interfacial* line, surface and partition, and how its designation influences how it will *Address* its *Users* and how they *Address* the platform and one another through it. In this regard, the amalgamation and reorganization of interactions into verticalized planes and towers is not only an event in the world but a process of making the world. Its geography is not only the allocation of lines; but is a squaring of the line into frames and a multiplication of frames and cells into grids. As grids become volumetric, the potential interiorizing reversals of their component lines multiply exponentially, and the squaring of lines over and again leads to more grids. Grids are reversible by design and the “sovereignty” of their reversibility is neither extrinsic nor exceptional; it is generic to their operation. It’s what grids do automatically. Or to paraphrase Gordon Matta-Clark, a volumetric grid describes all the possible layers without implying any priority or preferences. This is infuriating to

the Schmittian requirement for grounded, human-scale order of clear-cut antagonistic oppositions arranged in adjacent set-pieces, but oh well. Grids are bent and piled up on top of each other; multilayered images of their compound margins further convolute the situation as individual grids that were designed for one specific effect are braided into a composite infrastructure with emergent plans all their own. Some of these are expressed by standardized protocols and application interfaces, interoperable standards, and service wrappers.³⁷ With the standardization of these, the rigidity of the grid and its isolating cells lays down the generic system that gives an addressable location to every site of interest held within its honeycomb chambers. However, its geometric lines, up and down and over and across, are also avenues of regular escape and open possibilities of relation between those addressees. This is its bargain: no more innocent outside, now only a theoretically recombinant inside.

Mobility along the grid is also the writing of another line, and as these accumulate, they wear grooves into the landscape forming new channels. This is not best described however, as lighting a path of autopoietic “freedom,” if only because the lines of the grid and lines of mobilization through the grid are always reversible. Movement away is another mode of capture. Mobility is only one part of an economy of motility, from capture to camouflage, that holds no happy absolutes; as forms, these grids are the diagram of forces frozen, just as its forces are the form of the diagram made.³⁸ Immobilization is not what counteracts the drawing of the line of acceleration; it is what demonstrates its reversibility as a matter of normal course. For this, the decision over the regularity and regulation of slowing down or speeding up, over passage from or into the cells of the grids, can be programmed into the actual partitions of the world, and in the end it is their programmability, not their ideal geometry or geography, that affords platform sovereignty to their *User*. The geometries at work don’t simply reflect governance; they perform it: from line into frame into *topos* into something else situated where we might once have put *nomos*. Whether deliberately or accidentally designed, a geopolitical architecture is cast. Information is transformed into shape, drawing an arc of algorithmic governance along braided *topoi* built of asymmetrical superimpositions; less modus vivendi than the mutual invisibility of overlapping sovereignties. All of that.

Even as the sovereignty of designation over the “exceptions” of interiority and motility are unevenly embedded into the programs (e.g., architectural programs, algorithmic programs, software programs, political programs, economic programs) of the partition, the design of its automation remains part of the ongoing assignment for the design of The Stack as a whole. Topology is still the design problem, and as ever, the drawing of the line is both inscriptive and descriptive, both immanent and projective, both a writing of an immediate site and a determination of whatever might be there instead. The drawing can mark a surface, frame a site or event, or prototype how lines, frames, and grids should be engaged in the future or elsewhere. This is how worlds

remake themselves even as they intersect and unravel. As contemporary philosophy bemoans the preeminence of “digital” technologies and how they ensure an erasure of worlds and a profanation of solidarity, some posit world-making (mondialization) as the antithesis of globalization with its “atonal” quantification and banalization of affective experience.³⁹ For some writers (as for Schmitt), the loss of a special coherence of articulation is also loss of all inceptive self-renewal.⁴⁰ For them, computation has smothered the possibility of radical breaks with the present condition, leaving us all to wander about in a virtual haze, having confused the entropy of ubiquity with the space of creation. However, I am not convinced that the end is upon us or that perplexed melancholy is wisdom.⁴¹ I remain deeply curious as to how sensible oceans of planetary computation will evolve, making available a colossus deluge of connections within and across people, things, and traces, not necessarily according to the doctrines of the Google *Großraum*, but in the collateral accidents of wonderfully inhuman machines (including us) running about, in and out. I suppose that for both of these positions, universal computation does destroy the “world,” and while for the former this is a dishonorable apocalypse, for the latter, it is a good starting point. But stepping back from this too-stark opposition, we do continue to understand framing (by lines, by grids) as the presentation of some part of the world to itself (or to another part of another world). That frame is a device for saying something new or to say something about what is and is not new. The design of that frame itself and its capacity to enforce its own presentation is how the sense of a full world is approximated.

Clearly any discussion of the suspension or superseding of political norms that have grown up around the horizontal subdivisions of space, from national laws to human rights to currencies, will raise more questions that it can answer. We don’t know as much about what kinds of geopolitical effects vertical lines bring. We don’t know how to conceive of force and justice through them, and we barely know how to image the Earth through them. How is verticality similar and different in practice than horizontal? Does it mean first and foremost just so many horizontal lines overlapping and thickening such that they now have height, or are they a qualitatively different order? Regarding The Stack, I argue that they do represent a different order, but that this order is not given in advance. We need to design what that order is and will be. We start from what we know about what layering does to horizontal lines and what layers of vertical lines and sheets of horizontal lines pierced by slopes of diagonal and oblique lines do to political geography. Drawing from the sections already presented, we can make a summary. First, they perforate horizontal lines, making their ability to contain and conceal, as camp or bunker, more uncertain. As we’ve seen of late, this provokes states to mercilessly refortify their topographic contours. They normalize the exception of reversibility, making the movement between inside and outside into a programmed function of infrastructural surfaces and interfaces. They multiply the quantity of lines, making dense and unresolved grids. Some grids are filled with uniform and monochromatic

cells and others with hierarchical patterns, but all afford some kind of social posture and position. Their proliferation doesn't only close off space into smaller units; it also produces new territories that are equally physical and abstract, heavy and virtual. In turn, this space is motivating a new land grab among state and nonstate actors alike; it is also forcing transformations in how geography is held, conceptualized, modeled, and defended. The order of those transformations occupies a similar location in our architectures of sovereignty as *nomos*, but because it involves grids of land, air, and sea all at once, dedifferentiating their relative weight and liquidities, the logics of this new arrangement are also perhaps very different.⁴² Because these transformations are both driven by planetary-scale computation and mediated through it, any strong distinctions between a political geography supported by technical systems and technological systems spread through agonistic geographic space are undermined.

The state takes on the armature of a machine, because the machine, The Stack, has already taken on the roles and register of the state. While the proliferation of lines has normalized a certain kind of reversibility, the early geopolitics of The Stack also sees the fortification of intentional camps and bunkers, with some populations excluded from movement and transaction and others stationed in networks of enclaves absorbing capital by centripetal force. To design up and away from this outcome does not mean a reestablishment of ground for an upright primate perspective of natural place or prematurely freezing in place The Stack's most preliminary new geographies as the only options. An emergent alternative to archaic and recidivist geopolitics must be based on something more scalable than settler colonialism, legacy genomes, and Bronze Age myths and the maps of nations that have resulted from these.⁴³ The discussion of the layers of The Stack, and the productive accidents of each, is an outline *platform sovereignty*, a term that will appear explicitly in some parts of the following chapters but lurks underneath almost every paragraph in some way. But first, what exactly is a platform, and how do the layers of The Stack constitute one?

Platform and Stack, Model and Machine

The goal of future wars is already established: control over the network and the flows of information running through its architecture. It seems to me that the quest for global totalitarian power is not behind us but is a true promise of the future. If the network architecture culminates in one global building then there must be one power that controls it. The central political question of our time is the nature of this future power.

—Boris Groys¹

The essence of datagram is connectionless. That means you have no relationship established between sender and receiver. Things just go separately, one by one, like photons.

—Louis Pouzin²

9. Platforms

Platforms are what platforms do. They pull things together into temporary higher-order aggregations and, in principle, add value both to what is brought into the platform and to the platform itself. They can be a physical technical apparatus or an alphanumeric system; they can be software or hardware, or various combinations. As of now, there are some organizational and technical theories of platforms available, but considering the ubiquity of platforms and their power in our lives, they are not nearly robust enough. Perhaps one reason for the lack of sufficient theories about them is that platforms are simultaneously organizational forms that are highly technical, and technical forms that provide extraordinary organizational complexity to emerge, and so as hybrids they are not well suited to conventional research programs. As organizations, they can also take on a powerful institutional role, solidifying economies and cultures in their image over time. For The Stack, this is their most important characteristic but perhaps also the hardest to fully appreciate. Platforms possess an institutional logic that is not reducible to those of states or markets or machines, as we normally think of them. They are a different but possibly equally powerful and important form. Many different kinds of systems can be understood as

platforms, from urban street grids to Google, and so to consider their common operations, some abstraction is necessary. Part of their alterity to normal public and private operations is the apparently paradoxical way that they standardize and consolidate the terms of transaction through decentralized and undetermined interactions. Platforms can be based on the global distribution of *Interfaces* and *Users*, and in this, platforms resemble markets. At the same time, their programmed coordination of that distribution reinforces their governance of the interactions that are exchanged and capitalized through them, and for this, platforms resemble states. Platforms are often based on a physical standardization of functional components that allows for more diverse and unpredictable combinations within a given domain. On the macro scale, the intermixing of public-facing infrastructural investment and oversight tied up with the privatization of existing public services makes the political identity of platforms that much more ambiguous.³ So long as those exchanges are regularized by passage through the platform's established forms, they enforce the optimization of interactions by binding open exchanges between self-directed *Users* at the edges of its network. When those forms are computational (as for Google), that passage is the capitalized translation of interactions into data and data into interactions, and the movement of these into and out of central locations (such as strongly defended data centers). As we will see, the genealogy of platforms is diverse and seemingly contradictory. Roman urban planners, the encyclopedia of John Wilkins, Charles Babbage, the Commissioners' Grid Plan of 1811, John Maynard Keynes, Friedrich Hayek, Lady Ada Byron, Vint Cerf, and others, all contribute to the parentage of platforms, and it is their eccentricity and exteriority from normal state and market institutional models, combining elements of these as well as of machine engineering, that has made them so successful in redrawing the effective terms of global systems.

Platforms demand an active conversion between economic and technical systems and their respective limitations. Their initial program may be born of economics, but their execution can push sideways through other models of value, confounding and compressing the political spectrum along with them. Their history bears this out. A working technical definition of *platform*, in general, may include references to *a standards-based technical-economic system that simultaneously distributes interfaces through their remote coordination and centralizes their integrated control through that same coordination*.⁴ I will unpack this definition below. What I call platform logics refers first to the abstracted systems logic of platforms (their diagrammatics, economics, geography, and epistemology of transaction) and second to the tendency on the part of some systems and social processes to transform themselves according to the needs of the platforms that might serve and support them, both in advance of their participation with that platform and as a result of that participation. Platforms provide an armature and induce processes to conform to it. The Stack is a platform, or, more accurately, a combination of platforms. Its own governing logics are derived from platform logics,

but its geography and geometry are also peculiar, and so while stacks are platforms, not all platforms are stacks, and in fact most platforms are not stacks.

While systems that arguably operate as platforms might be found in every culture, where does the concept of platform come from, specifically in relation to the development of modern machines? The etymology of *platform* refers to a “plan of action, scheme, design” and, from the Middle French, *platte form*, or, literally, a plateau or raised level surface. As Benedict Singleton writes, this conjoined with the *plot*, which itself first implies a plot of land. Once situated on the platform of the stage, the “plot” becomes a more abstract structure that situates characters into the forgone conclusion of its unfolding, even as they suffer the choices that aren’t really theirs to make. As Singleton would have it, here the plot is a diagram that *ensnares* the *Users* of the platform in its designs.⁵ By at least 1803, *platform* takes on more explicitly political meaning, as in a “statement of party policies.” All three of these connotations (platform as a plan of action, as a stage for a plot, and as proposed rules governance) are important for understanding The Stack as a platform and for platform sovereignty in general. One is set of instructions, one is a situated place where action is played out according to plan, and one is a framework for a political architecture. Already these connotations are slipping and sliding into one another.

Now consider the word *program*. Its etymology refers first to a “public edict,” and in the early modern era, it also comes to mean variously a plan or scheme, a list of events to be presented, a menu of proposed political ideas, and a way to organize how people will occupy architectural space. Only after World War II does “to program” mean “to write software.” For architecture, computation, and politics, the “program” has central significance as a design problem and governing technique. The triangulation of designed site, designed action, and designed polis traces that of “plot”: platform and program overlay one another asymmetrically. For example, an architectural program might be defined as an intended organization of *Interfaces* in a particular arrangement so as to coordinate social contact and interaction (or prevent it). As a diagrammatic image, an architectural program indexes the significance of that organization. A software program is a set of instructions that a designer gives to computational systems with the intention of coordinating that system’s internal and external interfaces in relation to itself, to compatible systems, and to *Users*. An interfacial image of that program, usually the graphical user interface (GUI), summarizes, reduces, and makes those instructions significant for *Users*. And clearly today, these two kinds of programs intermingle. In many respects, what society used to ask of architecture—the programmatic organization of social connection and disconnection of populations in space and time—it now (also) asks of software. We will return to that shift more than once in the following chapters, and we will have to question what is or isn’t the remaining work of physical architecture in light of this. Among what remains is the active contingency of programs, both hard and soft.

A recognition of platforms as a third institutional form, along with states and markets, situates the convergence of its architectonic and computational forms in a more specific and fundamental way. A central argument of this book is that the “political program” is not only to be found in the legal consensus (or dissensus) and policy admonitions of traditional “politics” but also in machines directly. This is where the global-scale arrangement of planetary-scale computing coheres into The Stack, and how the convergence of the architectural and computational design logics of program directly contributes to that system. For our purposes it is far less important how the machine represents a politics than how “politics” physically *is* that machinic system. The construction of platforms draws in, to varying and contingent degrees, strong connotations of “design” (design as in to “designate,” and to govern through material intervention) and, in this platforms are plots, and (per Singleton) also diagrams that “ensnare” actors in their fatal outcomes (*design* as in “to have designs on something,” to trap the *User* just so). At the same time, platforms are not master plans, and in many respects, they are the inverse. Like master plans, they are geared toward the coordination of system *Interfaces* into particular optimized forms, but unlike them, they do not attempt to fix cause and effect so tightly. Platforms are generative mechanisms—engines that set the terms of participation according to fixed protocols (e.g., technical, discursive, formal protocols). They gain size and strength by mediating unplanned and perhaps even unplannable interactions. This is not to say that a platform’s formal neutrality is not strategic; one platform will give structure to its layers and its *Users* in one way, and another in another way, and so their polities are made. This is precisely how platforms are not just technical models but institutional models as well. Their drawing and programming of worlds in particular ways are means for political composition as surely as drawing a line on a map. However, as opposed to the public rights of citizens in a *polis* and the private rights of *homo economicus* in a market, we are severely lacking in robust and practical theory of the political design logic of platforms, even as they remake geopolitics in their image (or demand a different language to describe what the political is now or ever was). What we can know from the outset is that an essential logic of platforms is a reconvergence of architectural, computational, and political connotations of “program” back into one: the design logic of platforms is the generative *program* that is equally all three types at once.

At a more mechanical level, a platform is also a standardized diagram or technology. Its structure and the paths of interoperability that hold it together can’t be considered outside of the regularization and rationalization of how it connects to the outside world. As infrastructure, a platform’s regularity is often guaranteed less by laws than by technical protocols, and this is one of several ways that the sovereign decision is built into the platform’s interfacial partitions and surfaces. This kind of intrasystemic standardization was essential to the epochal metatechnologies of industrialization and post-Fordism, revolutionizing the manufacture, distribution, and consumption of

massive quantities of identical tangible and intangible items. Because protocols are in place to standardize physical and immaterial properties of integral components and discontiguous manufacturing processes—from the width and direction of grooves in a screw, to the costs of stamps and the nomenclature of international postal zones, longitudinal mean times, cryptographic keys for international monetary transfers, stochastic synchronization of data transfers, and so on—the pace and predictability of industrialization could unfold as it did.⁶ Artificial standardizations become naturalized as if they were always the measure of things. This kind of complementarity between technique and thought is familiar to adepts of Michel Foucault, Max Weber, Friedrich Kittler and Sam Walton. Standardization drives logistics, and logistics in turn enables geopolitical ambition and momentum. Innovations in munitions standardizations, allowing soldiers to quickly disassemble and repair guns on the battlefield with standard parts, contributed for better or worse to American military prowess in the nineteenth century and its ability to defend a hemispherical doctrine posited by a Virginia farmer, James Monroe. We appreciate the role of railroads, telegraphy, and telephony networks as the infrastructure of globalization, and their speed for the acceleration of the modernities of space and time, but perhaps we underappreciate the metastructuring importance of mundane anonymous standards to turn isolated mechanical inventions into infrastructural innovations (e.g., railroad gauges and spike lengths, timetable templates, the semiotics of graphical interface feedback conventions, transmission line materials, arbitrary telegraphic languages, packet-switching protocols, country codes and area codes, the fixed numeration of money itself, and so on). The centrifugal standardization of *how* individual components interrelate and assemble into higher-order systems, whether physical or informational, is as important as *what* any part or component may be. This is how platforms can scale up. To engineer systems that coordinate the shuttling of units from one point to another with efficiency, adaptability, and flexibility is to compose within the rules laid down by other systems, larger and smaller, with which interaction is required. If two different systems share common protocols, then the subsystems of one can interoperate with subsystems of another without necessarily referring to any metasystemic authority. Systems swap material in this way, such that intermodality and intramodality come to enable one another: no standards, no platform; no platform, no Stack.

The design of protocols, platforms and programs can be as speculative as needed, but the generativity of standards remains. Protocolological interoperability works not only to componentize tangible things, but also to represent undetermined relations between things, events, and locations and to provide the means to compose that traffic in advance. In some cases, these are formal notational systems, and the most ingenious are not always the most widely adopted, and sometimes those adopted become so naturalized that they disappear into the fabric.⁷ By design, systemic standardization is enforced by fixed physical measurement and procedure, and perhaps here most

particularly, the paradoxical tendency of platforms to control and decontrol at the same time is most evident. For example, the formal urban grid in a major city is for the most part rigid and inflexible, but precisely because of this linear and universally authoritarian topography, it affords both maximum tumult of dynamic horizontal interchange in the street plan as well as vertical recombinant programmatic complexity in the skyscrapers that pop up in each of its cells (more on this in the *City* layer chapter).⁸ Similarly, it is the legal and practical standard size of the humble paper envelope that makes it possible for it to shuttle messages both discrete and discreet; like the urban grid, the envelope's power is in its dumbness. In the 1970s as the world's cities began to more fully merge into the networked hierarchies of today with the widespread standardization of very-large-scale envelopes, made of steel instead of paper, in the form of fixed proportion and attribute shipping containers. Containerization migrated the packet switching from telecommunications onto the transit of physical objects (or perhaps the other way around). It traded the standardized, linear traffic program of the grounded asphalt grid for another, now smoothed into liquid shipping lanes, pacing big packets of objects back and forth across the avenues of oceans.

10. How Platforms Work

Platforms centralize and decentralize at once, drawing many actors into a common infrastructure. They distribute some forms of autonomy to the edges of its networks while also standardizing conditions of communications between them. Many of the defining cultural, political, and economic machines of our time operate as platforms (from Google to transnational political theologies). Platforms are formally neutral but remain, each and every one, uniquely "ideological" in how they realize particular strategies for organizing their publics. They are identified with neoliberalism (not without reason), but their origins lie as much within the utopian megastructures of 1960s experimental architecture, counterculture cybernetics, Soviet planning schemes, and many other systems of sociotechnical governance, both realized and imagined. Platforms are infrastructural but rely heavily on aesthetic expression and calibration. A platform's systems are composed of interfaces, protocols, visualizable data, and strategic renderings of geography, time, landscapes, and object fields. For stack platforms, they also include a predominant architecture of interoperable layers. Even as the majority of the information they mediate may be machine-to-machine communication (as, for example, today's Internet), the specific evolution of any one platform, in the ecological niche between the human and inhuman, depends on how it frames the world for those who use it. It draws some things in and draws other things out, but foremost a platform is a drawing and framing machine. Our interest, however, is not to critique platforms as aesthetic works but to identify the work that aesthetics does in their development,

and through this to clarify how some existing (and potential) platforms are worthy of our critiques.

Platforms might be analyzed in many different ways, and another book might make a more thorough contribution to a very needed general theory of platforms than this one can. In order to discuss The Stack as a platform, however, it is necessary to identify some typological characteristics that all platforms might share in common. These would characterize platforms in relation to other technologies (such as individual machines, executable programs, fixed infrastructure, legal mechanisms, or social norms) and in relation to other institutions (such as states, bureaucracies, and corporations). I list here seventeen criteria and qualities of platforms (a nice prime number). The list is by no means final or exhaustive, but taken as a whole, the shape and function of platforms as both technical and political-economic forms are more clearly specified, especially in relation to The Stack. Some of the criteria listed look like basic principles of second-order cybernetics, others of software application design, and others of any networks-savvy political science. As such, “platform theory” is probably less about inventing new attributes from scratch than it is about observing that recognizable common practices already do constitute platforms as an institutional and technical norm at the scale of states and markets:

1. As opposed to other macrogovernance institutions, platforms do not work according to detailed premeditated master plans; rather they *set the stage for actions* to unfold through ordered emergence. Bureaucracies, by contrast, are systems that are also dependent on strict protocols and interfaces, but they operate by premodeling desired outcomes and then working backward to codify interactions that would guarantee these: means are a function of ends. Platforms begin by fixing equally strict means but are strategically agnostic as to outcomes: ends are a function of means.
2. Platforms are based on a *rigorous standardization of the scale, duration, and morphology of their essential components*. The simplicity and rigidity of these standards make platforms predictable for their *Users*, but also allow them to support idiosyncratic uses that platform designers could never predict. The formal politics of platforms is characterized by this apparent paradox between a strict and invariable mechanism (autocracy of means) providing for an emergent heterogeneity of self-directed uses (liberty of ends). The emergent politics of any one platform may largely be a function of how it strategizes the relationship between standards calibration and the perceived self-interests of its stakeholders.
3. This standardization of essential components produces *an effect of generative entrenchment* by which one platform’s early consolidation of systems (formats, protocols, and interfaces) decreases a *User’s* opportunity costs to invest more and more transactions into that particular platform, while it increases the costs to translate earlier investments into another platform’s (at least partially) incompatible systems.⁹ The ongoing

consolidation of systems and reduction of transaction costs leverages that advantage toward increasing the robustness of that platform's unique requirements.

4. Standardized components may also be *reprogrammable within constraints* by *Users*, allowing them to innovate new functions for machines that are composed, at least partially, of preexisting platform systems. The systematic reuse of platform systems allows for the development of complex products based on virtual components, reducing development risks, costs, and project duration. For that innovation, the ratio of what is newly introduced by the *User* versus what is reused from existing platform systems may be extreme in either direction, though neither ratio directly corresponds to the intrinsic novelty of any one innovation's new functions.

5. The design and governance of platforms often relies on *formal models* to organize, describe, simulate, predict, and instrumentalize the information under its management. Those models may represent a rigorously discrete view of the platform's internal operations, its external environment, or, most likely, some combination of the internal and the external that measures platform performance according to metrics evaluating its outward-facing systems.¹⁰

6. Platforms' mediation of *User*-input information may result in *an increase in the value of that information for the User*. Platform network effects absorb and train that information, making it more visible, more structured, and more extensible for the individual *User* or in relation to other *Users* who make further use of it, thereby increasing its social value. At the same time, it is likely the platform itself that derives the most significant net profit from these circulations in total. Each time a *User* interacts with a platform's governing algorithms, it also trains those decision models, however incrementally, to better evaluate subsequent transactions. An economically sustainable platform is one for which the costs of providing systemic mediation are, in the aggregate, less than the total value of input *User* information for the platform. Platform economics provides then two surpluses: (1) *User surplus*, in which the information is made more valuable for the *User* once involved with the platform at little or no direct cost to that *User*, and (2) *platform surplus*, that is, the differential value of all *User* information for the platform is greater than the costs of providing the platform to *Users*.¹¹

7. Like centralizing systems, platforms consolidate heterogeneous actors and events into more orderly alliances, but they themselves are *not necessarily situated in a true central position* in relation to those alliances in the same way that, for example, a master planning committee or federal capitol building would be. Like some decentralized systems, platforms rationalize the self-directed maneuvers of *Users* without necessarily superimposing predetermined hierarchies onto their interactions. The centralization-versus-decentralization dichotomy may therefore be illusory in many cases (and not in others) in that the choke points where a platform incentivizes commitment and leverages its advantages over other options may be even more widely distributed than all of the *Users* that it organizes.

8. The generic universality of platforms makes them formally open to all *Users*, human and nonhuman alike. If the *User's* actions are interoperable with the protocols of the platform, then in principle, it can communicate with its systems and its economies. For this, *platforms generate User identities whether they are desired or not*. Platforms can provide identities to *Users* who would otherwise not have access to systems, economies, territories, and infrastructures, such as a person who is not recognized as a political "citizen" by a location, but who is nevertheless included in communication by platforms that are agnostic to the legal status of its *Users*. At the same time, platforms can also name, enumerate, track, and capitalize the identity of *Users* who would rather remain anonymous. For the former, the required provision of *User identity* may be seen as an advantage of platforms and for the latter as a disadvantage.

9. Even as platforms guarantee identities to the *Users* of its systems, for better or worse, they do not provide these evenly or equally. *A platform governs one User differently than it does another*. An *Interface* that may open a space for one *User* also closes it off to another. An interface that may be open for one *User* at one moment may be closed at another. This differential is a core technique of how platform sovereignties normalize the exceptional reversibility of the partition. What may be an interiorizing partition ("enclave") for one *User* at one moment may be an exteriorizing partition ("camp") for another at another moment.

10. An ideal platform architecture is one that produces a strategic minimum of new content into its own communication economy. *An ideal platform is like an empty diagram through which Users mediate new and archived information*. A search engine, for example, does not produce new Internet content for its *Users*, but rather structures the value of content that other *Users* produce. (If medicine were reconceived as a platform, it would obviously provide new critical information to *Users*, that is, patients and doctors, as well as organize medical knowledge to date, but it would, in principle, focus the point at which new diagnostic or therapeutic expertise is most crucially required and support it with, for example, highly structured patient data and precedents from the literature).¹²

11. *Any structuring component of an ideal platform architecture is replaceable by a new component*, and so the platform could, piece by replaced piece, evolve into something entirely different while retaining its essential shape. As in Theseus's paradox, every plank of wood in a mariner's ship is replaced over time by new wood, and yet the new ship occupies the same virtual place as the old ship and so it still is "Theseus's ship." The same operation holds for platform architecture. Any given component (e.g., layer, protocol, interface) could be replaced, inclusive eventually of all components of the platform in its totality.

12. Platforms may respond to *User* inputs immediately and may draw on archived rules to recursively govern those interactions in real time, or it may act back on those interactions only once some qualitative or cumulative threshold requirement has been met, perhaps by many *Users* at once. *Platforms govern both instantaneously and cumulatively*.

13. Ideal platforms not only act on new interactions according to programmed rules and in relation to archived structured information, but *also serve as distributed sensing systems that incentivize the detection of errors (or mere anomalies), which are interpreted by the platform's formal models*. In principle, what are interpreted as errors will not only update the model's description of the whole, but will also correct the rules by which future interactions are governed. Ideal platforms also treat anomalies not only as errors but as signals of emergent patterns or norms for which some new positive accommodation may be required.

14. The competition between platforms may occur over new tabula rasa space or over the recomposition of one or more existing systems in accordance with a platform's strategy. To date, many successful platforms are those that provide *Users* with new capabilities by making their existing systems more efficient. *Platforms that organize existing systems and information tend to achieve generative entrenchment more quickly* than those that seek to introduce new systems from scratch. *Users* will make tactical use of some platform interfaces to link some existing systems, and in doing so they are incentivized to incorporate more of their own interests within these systems. Subsequent *Users* are incentivized to link their systems to benefit from the network effects set in motion by earlier *Users*, who in turn enjoy increasing network benefits as more *User* systems are incorporated over time. The platform is able to realize platform surplus value from this generative entrenchment.

15. Platforms link actors, information, and events across multiple spatial and temporal scales at once. *Platform ubiquity makes it more robust in relation to some threats, both intrinsic and extrinsic, and more vulnerable in relation to others*. A platform's ability to defend one component or even replace it when it is no longer useful can make the whole more resilient, but it can also then leave individual components vulnerable. The integrated architecture of the platform may also allow internal component-to-component feedback loops to cycle out of control, amplifying the destabilization of the whole apparatus.

16. A platform's actual processes may be very different from how they are understood by their *Users*, who may form mental images of those processes based on their own individual interactions or on how the platform has represented itself to them. *Platforms don't look like how they work and don't work like how they look*. For example, a *User* may understand his or her own interactions with the platform according to the content hierarchies of a GUI that bears almost no relation to how the platform actually structures or sees that interaction. Architects of a typical *Cloud*-based platform may organize the system according to the provision (and strategic throttling) of data through application programming interfaces (APIs) that make many different kinds of platform effects possible, the sources of which may be opaque to the most common *Users* or even to other components of the system.

17. Platform sovereignty may be planned or unplanned, universal or specific, generative or reactive, technologically determined or politically guaranteed. *Platform sovereignty is automatic under some circumstances and highly contingent under others, and it may function differently in relation to different components of the platform system.* The conditionalities of these is a function of how platforms relate to other political, technical, and economic institutions that also manage something (or someone) that is also organized by that platform. When two or more platforms mediate the same thing, site, or person, both making claims on it and providing sovereignty to it, then the two sovereignties generated may be mutually constrained. While one of these forms of sovereignty may be universal in relation to the platform that issues it (always subject to the inversions and reversals noted above), it is also only partial and provisional in relation to other platforms (if it is even recognizable by them at all). These differences may be between how two platforms identify the same thing or between how two different components of the same platform (or different components of different platforms) address that thing. While this multiplication prevents any one *User* from enjoying unlimited universal sovereign privileges, it also tends to prevent any one platform from capturing all sovereignty-generative components within its whole and monopolizing how sovereignty is made, and for whom and what.

To further outline the platform principle, others can add to and modify this provisional list. Some may want to include, for example, demonetization: how platforms sometimes strip certain things of their scarcity and hence exchange value. Some may focus on how platform design can never account for the accidents that actual platforms bring, but also conclude that well-designed platforms can turn accidents into assets. Some may want to specify how and when a *User* has rights of *exit* and *entrance* from and to platforms. Can you leave, and can you get in? Others may want to explore the organizational logics of technical platforms as exemplified by street grids, punch cards, spreadsheets, circuit boards, and so on. Others may come at it from the other side and ask whether standardization works best when predictable outcomes are desired, whereas customization works best when not, and ask how the generic quality of platforms can and cannot do both at once. The Stack is a machine that becomes a state, but it is also how both become platforms, or at least, as one condition around which their armatures are forced to evolve in relation to platforms. As we will see in the chapters ahead, as platforms like The Stack appropriate technologies of sovereignty previously guaranteed to and by the state, the contemporary coevolution of these organizational forms may be punctuated by new disequilibriums. First, we need to better understand the genealogy of platforms as political models and how they have been deployed (successfully and unsuccessfully) as political machines.

11. Stack as Model

Stacks are a kind of platform that also happens to be structured through vertical interoperable layers, both hard and soft, global and local. Its properties are generic, extensible, and pliable; it provides modular recombinancy but only within the bounded set of its synthetic planes. It is an autogenerative parametric topography, but one that grows precisely through an initial subdivision of technologies into planar layers and then through an autocratic consolidation and rationalization of these through internal interfaces and protocols. As for any platform, that consolidation is driven less from centrally planned legal prescription than through the algorithmic conduction of self-directed behaviors by free-range *Users*. The Stack discussed in the following chapters is a vast software/hardware formation, a proto-megastructure built of crisscrossed oceans, layered concrete and fiber optics, urban metal and fleshy fingers, abstract identities and the fortified skins of oversubscribed national sovereignty. It is a machine literally circumscribing the planet, which not only pierces and distorts Westphalian models of state territory but also produces new spaces in its own image: clouds, networks, zones, social graphs, ecologies, megacities, formal and informal violence, weird theologies, all superimposed one on the other. This aggregate machine becomes a systematic technology according to the properties and limitations of that very spatial order. The layers of The Stack, some continental in scale and others microscopic, work in specific relation to the layer above and below it. As I have suggested, the fragile complementarity between the layers composing The Stack is discussed both as an idealized model for how platforms may be designed and as a description of some of the ways that they already work now. The metaphor and the machine are diagrams made real in the megastructure.

If you start looking for them, “stacks” are everywhere. In a way, the Earth itself is a spherical stack, from its molten core, to the lower and upper mantle, to the crust on which organic life evolved under the troposphere, stratosphere, mesosphere, thermosphere, and exosphere. Humans evolved between two and only two of these layers. Charles and Ray Eames’s famous “Powers of Ten” films for IBM showed generations of high school students how to start from one everyday spot and from there think down to 10^{-9} meters and up to 10^{23} meters, from quarks to walls of galaxies, and back again. In a way, their presentation is a kind of telescoping stack. Archaeology organizes and depicts the temporality of unearthed assemblages according to the Harris matrix, and its interlocking principles of original horizontality, original continuity, and stratigraphic succession. The Marxian model of base and superstructure provided another verticalized image of social totality, whereby economic structural causality flows bottom-up, from foundational technical processes of production, valuation, and relations in the base, to their ultimate expression in cultural and political institutions, as superstructure. Marx wanted to model historical cause and effect, but history is full

of images of society organized instead into static stratified layers of arbitrary hierarchies (Albrecht Dürer's 1515 woodcut *The Triumphal Arch of Maximilian I* comes to mind). Many contemporary technical systems work on stack principles, including smart grids that segment a power layer, below a communications layer, below optimization and applications layers. Examples are plentiful, and while some are recognizable as software stacks, others are fuzzier, more heterarchical than hierarchical.¹³ Beyond software, is the generic composability of any one layer in relation to another within a generative vertical platform that may help qualify systems as stacks.

Stack architectures are also conceptual strategies for design, not just for description, and they are not only conceptual architectures, they are models for actual architecture as well. Le Corbusier's *Five Points toward a New Architecture* is a strong stack, as embodied in Villa Savoye and the vertical platform for five essential but undetermined programs.¹⁴ The building may be "a machine for living in," but the Five Points stack is the machine for making machines. Constant's ever-changing New Babylon speculative urban system was redesigned again and again over the span from *Sputnik* to the OPEC embargo. It changed shape constantly, but one durable characteristic was the notion of a new city designed on top of the old one in two exclusive stacked layers. It imagined the new city as a landscape of vast multilayered networks and as continuous territories of ludic interfaces and opportunities, defined not by relation to a master ground plane but to the horizontal and oblique vectors of movement up and down the exploded sectional program. It was to be based not on functional regulation but on the feedback systems of play and serendipitous interaction. This project in turn inspired Rem Koolhaas's revision and expansion of Mies van der Rohe's sectional diagram into a generic principle of scale, for which the vertical juxtaposition of unlike programs in a single structure allows them to interoperate with as much mutual transparency or opacity as might be required, or which could be staged for optimizing spatial performance. This is seen perhaps most dramatically in the horizontal skyscraper OMA's (Office of Metropolitan Architecture) 1972 conceptual project, Exodus: Voluntary Prisoners of Architecture, in which residents pass from layer to layer as they move through the discrete biopolitical stages of their lives.¹⁵ Other architectural stacks are even more graphically explicit, such as Gordon Matta-Clark's slices through stories of buildings, Robert Smithson's concentric-layered world maps, and the stratified landscapes of MVRDV's Hannover 2000 exposition pavilion that stacked and segmented artificial nature and program into a hyperdense world-in-a-box. Elsewhere, stack perspectives erupt uninvited and unintended. The verticality of flattened systems is seemingly uncontrollable. While world maps render space in *x*- and *y*-axes, no linear geometry without thick verticality could represent the most entrenched geopolitical conflicts, rational and irrational alike. Consider Israeli architect Eyal Weizman's multidimensional maps of the overlapping and interweaving claims of sovereignty in Israel-Palestine, showing that no horizontal cartographic linear delineation, or any regular vertical elevation all by

itself, can finally describe, let alone govern, the multidimensional violence of that particular jurisdiction-intensive politico-theological matrix. Multiplications of the plane and rotations of perspective that move the flattened into the vertical are prevailing. Everywhere are stacks, good ones and bad ones, big ones and little ones, and many of them agglomerating into larger and larger platforms.

The architecture of The Stack, this one particular megastructure of planetary-scale computation, is an interoperable physical-informational system of systems, distributed under, onto, and over the surface of the globe, with its layers organized into a patchy, uneven vertical section. As said, The Stack is composed of geologic, humanistic, and mineral layers charging feedback loops between these. As a cybernetic landscape, The Stack composes both for equilibrium and for emergence, one oscillating into the other for diagonal purposes in barely accountable rhythms. The state conditions (and literally for governance, the condition of the *States* that its platform logics describe in advance) are derived both from stacks as abstract diagrams and, through its unenumerated operations, as real existing machines. In turn the infrastructural sovereignties of The Stack may, in principle, emerge from either of these. It can be derived from its career as accidental megastructure, which itself may or may not be the model for geogovernance to come, or from its immediate, projective, and potential designability. It goes both ways. Today, The Stack that we can analyze frames the one we can conceive, just as the one we can conceive frames the one we are beginning to realize. Alternatives are conveyed from its distortions.

The Stack's disciplining of communication as an ecology of isomorphic techniques makes the world appear as a system that demands from us a constant redesign of its ever more granular interoperations. The history of these technologies is also then the history of multiple competing communication standards. Protocol politics is always rough trade because to control the standard is to influence the economies it enables, which is to influence how they interrelate with other systems and the meta-economies those interoperations in turn give rise to. As should be plain from current events, the interweaving of otherwise incommunicative hard and soft systems into new assemblages continues apace, and so the politics of standards (e.g., open source, intellectual property, net neutrality, encryption) becomes integral to the "democracy" of infrastructure and to the little sovereignties of everyday life. Looking back, it is not coincidental then that formal systems theory and information theory appear historically concurrently and are part of the larger crest of cybernetics. The discernment of information as a first-order principle of material difference in the twentieth century would come to all but consume the very definition of *systems tout court*. The study of information bridged linguistics, symbolic logic, biology, chemistry, art, literature, and the theory of calculus with the practical engineering problems of automated logarithms, algorithms, cryptography, and long-distance signal transmission relay. In turn, the modeling of all of these and more as forms of information, as well as the conception of distributed

multimodel apparatuses ultimately as information systems, becomes an overriding epistemological ambition of twenty-first-century globalization. This registration of all systems as information systems a priori tracks software's migration from military logistics to consumer footprints. In this enforced translation of any thing into the status of information within a system, all things may possess their worlds and be possessed by their worlds only to the extent that they possess the attributes necessary for intermodal communication with other platform systems. Whether for bits or atoms, numbers or nectarines, no impedance mismatch can disallow the activation of that intermodality, and so compatibility within a given scale as well as the interoperability between scales, becomes itself the critical vernacular definition of *computability* as an economic technology. As all systems come to mean information systems, then computation, which otherwise might be defined differently, comes to refer to "algorithms holding systems of information together." The Stack, as a particular megastructure, emerges from this history of systems conceived in relation to computation, and computation in relation to systems. It has inherited some of its limitations, ambitions, accomplishments, and blind spots and has evolved beyond others.

12. Stack as Political Machine

The emergence of planetary computation as a global and intelligent system can be traced in broad strokes from perhaps Roman and Chinese military accounting, to the first Victorian calculators through to today, and it is marked by celebrated breakthroughs as well as long-ignored dead ends, some of which are eventually celebrated retroactively. By their appearances on the scene, it seems that every globalizing communication network, from printed books to telegraphy, railroads, radio, telephony, and television, was celebrated (and lamented) as the coming of some universal political community, messianic or degenerate or both. In their formative years, new regimes of digital global media are as well invested and inflated with world-historical importance, as signaling the ultimate arrival of a too long postponed cosmopolitanism. (Both Hegel's political time and Kant's political space were themselves conceived in intimate proximity of that most modern of global mass media, the network body of the state, which would continue to reinvent its own anatomy in relation to new media regimes.) If we are more used to living so much of our lives inside the shells of planetary-scale computational networks, we also observe that the political realities of universal global information turn out to be far more problematic, more mundane, and unusual than envisioned, feared, and hoped for. This disappointment itself may be the most timely message of the medium, but not necessarily its most lasting. Perhaps the persistent utopianism around communications infrastructure still works, not because of how well it predicts the outcome of large-scale technological interventions, but because as the genesis of productive accidents, it is able to make room for otherwise unauthorized

political and social forms in its wake. The Stack, like any other technology of such scale and significance, both constitutes a new political-geographic order and enforces an existing cultural-economic order already in place.¹⁶ It does each in different ways and at different locations, and the untangling of these is part of the design brief. Toward this, we have to do more than map platforms; we have to learn to read them and interpret them.

Conway's law, coined in 1968 by programmer Melvin Conway, states that "organizations which design systems ... are constrained to produce designs which are copies of the communication structures of these organizations." Put differently, "in order for two separate software modules to interface correctly, the designers and implementers of each module must communicate with each other. Therefore, the interface structure of a software system will reflect the social structure of the organization(s) that produced it." A corollary law might demonstrate that over time, the inverse is equally true: organizations come to take on the characteristics of their interfaces. If it goes both ways, then homologies between organizer and organized make the detection of cause and effect between cultural and technical systems rather difficult. For example, and to extend this problem to the largest scale, an understanding of the ongoing emergence of planetary-scale computation cannot only be understood as a secondary technological expression of capitalist economics.¹⁷ The economic history of the second half of the twentieth century is largely unthinkable without computational infrastructure and superstructure. In accounting for that transformation, it is not at all clear whether the computational technologies are more or less foundational than the economics that organized them and that they organize (even assuming that we could analytically separate the two, so as to put one in the fore and the other in back). Instead of locating global computation as a manifestation of an economic condition (as both its means of production and its superstructural expression), the inverse may be equally valid. From this perspective, so much of what is referred to as neoliberalism are interlocking political-economic conditions within the encompassing armature of planetary computation. The entwined polar positions of Sunnyvale, Caracas, Beijing, Brussels, Tribeca, and Tel Aviv don't integrate capital and resource markets into network societies on their own, but are themselves "computed" into these arrangements. Either way, it is possible to delineate structural causality between technological and socioeconomic systems only in model abstractions, because one always contains the other and is contained by the other at once. We cannot, for example, finally locate computation technologies as a base and information culture as a superstructure, bound together either through capital-intensive modes of production and exchange or through computational flows directly determining systems of valuation and exchange in their image. Rather, we could do so, but only with abstractions that are easily turned inside out. Neither serves as the last instance of the other, though today, neither can be defined without the other. Instead, we should work with this mesh on its own less mechanistic terms. Jameson, for

example, offers an injunction to treat such arrangements as active temporal operations rather than as a fixed architecture, “basing-and-superstructuring.”¹⁸ We may think of *foundation* as a verb, *base-ing*, and to seek out how specific material technical systems come to take on causal force and when the same do not. Such flexibility might allow us to differentiate, for example, when the discursive structure of the relational database drives not only the information access policies of a company or state, but also in turn the form of its organizational hierarchies, and when the inverse is predominantly true, such as when the laws and logistics of trade channels structure the form and content of interoperable supply chain management software and the database designs on which it depends. In locating The Stack within the intercourses of economics, culture, and technology, both Conway’s law (that organizations design systems in their image) and our inverse Conway’s law (that systems and their interfaces produce organizations in their image) are interpretive tools that are useful to keep at hand.

As a platform to be read and interpreted, The Stack clearly sits on both sides of this coupling of culture and technology. It relies on software as both a kind of language and a kind of technology, of algorithms of expression and the expression of algorithms, and this twisting of the conceptual and the machinic can sometimes bring emotional distress.¹⁹ For some, an apparently universal convertibility of social systems into software systems motivates euphoric convictions in the instantaneous self-realization of networked individuals, a particularly Californian enthusiasm spanning from the ingenious to the idiotic. (The so-called California Ideology is not what I am referring to here. That term was always a simplistic New Left chestnut that crudely lumped Survival Research Laboratories and Page Mill Road venture capitalists into one cohort).²⁰ However, the extremities of convictions also give way to a more nuanced complex of platforms that not only augment force and authority but constitute first-order modes of authority on their own (they are discussed in following chapters). These are the geographic powers to be further decided and designed, or left to go stale and rot on their own. For example, the ability of some platforms to absorb and recognize patterns in end *User* behavior might mimic how markets resolve fluctuations of price, but its formal centralization also allows for higher-level forms of planning, investment, and equity that states are, ostensibly, steering on their own. Contemporary *Cloud* platforms are derived from more specific systems of user-facing interfaces and services (discussed at length in the *Cloud* chapter). The intelligence of *User* interactions provides core content that is aggregated, optimized, and made more visible, more immediate, more standardized, more interoperable, more mobile, and therefore more valuable both to *Users* and to the platform than it would be otherwise. How far can that go?

For some, the capacity for platforms to operate in this way suggests striking similarities with the hopes of socialist planners to engineer a pricing and planning mechanism that could observe, analyze, calculate, produce, and distribute materials and goods according to principles of rational evaluation instead of the anarchic vagaries of supply

and demand.²¹ Francis Spufford's 2010 historical novel, *Red Plenty*, did much to respark interest in this overlooked period in the history of political computer science, and in Khrushchev- and Brezhnev-era Soviet economists and cyberneticians in particular.²² At that time, planners and programmers had access to what is by today's standards minuscule computing capacity to calculate patterns, pathways, and contingencies, but contemporary supercomputing systems not only could orchestrate and optimize the pricing and dissemination requirements of large economies; they do it every day.²³ Those planners and programmers also labored under centralized authoritarianism, and so for our efforts to plot out where else platform economies can be made to go and what alternatives to Anthropocenic economics are possible, it is not suggested that we look back on midcentury regimes for all the key clues. However, the clear homologies between the aspirations of Soviet cybernetics and the accomplishments of Google, for example, to model and govern superpower-scale digital economies, and the genealogies that link the latter to the former, at least testify against the notion of an intrinsic bond between capitalism and computational megaplatforms. We may anticipate that to some significant extent, the dovetailing of the future evolution of both agendas will transform one another and may even allow one to fully envelop the other: neither state as machine nor market as machine because the platform is state, market, and machine at once. Some Marxian articles of faith (such that once global technological means of production and valuation have reached some threshold level of efficiency and ubiquity, such that continuance of management by capital is not needed, then things will give way to a self-regulating infrastructural commonwealth) may have surprising interpretive value for the next century even if it works out in ways utterly different than originally and normally conceived. As many on the left and the right have postulated, the acceleration of capital flows through computational megaplatforms such as these may, in the long run, do as much to undermine the modern function of exchangeable property as it does to radicalize it (and perhaps the former because of the latter). We will have to wait and see what will and will not "wither away" should planetary-scale computation approach peak platform optimization and ubiquity, but in the meantime, we have other historical examples of proto-Stack governments to consider and to interpret.

13. Stacks That Were and Might Have Been

In 1970, British cybernetician Stafford Beer was commissioned by Unidad Popular, the new socialist Chilean government of Salvador Allende, to design the platform for a new computer-controlled economy, a project that came to be known as Project Cybersin (the name is a conjunction of "cybernetics" and "synergy").²⁴ The proposed network would have organized the entire Chilean economy according to, among others techniques, a twelve-layer concentric platform model, running from the worker himself (center layer), to successive layers of the crew, workshop, department, firm, line, sector,

branch, industry, state economy, central government, and finally enveloped by the twelfth, and final, layer of the whole nation. As seen in Beer's diagrams, layers in the system could recursively influence layers it surrounded, with any one factory floor or shipping port location sending status information regularly into the platform by a network of telex machines. This feedback loop seems like rocks and sticks compared to today's multivariate stochastic logistical lattices, but in the early 1970s, it was practically science fiction. Neither that Cybersin network nor its planned control room straight from Captain Kirk's bachelor pad survived the Pinochet coup. The Chilean army and its sponsors apparently didn't see much value in flat, decentralized economic ecologies sutured by cutting-edge information networks. Hmm.²⁵ Beer's "stack" was based on his viable system model, "a five-tier structure based on the human nervous system, which Beer believed existed in all stable organizations—biological, mechanical, and social." Biological system metaphors map onto modern social theory in diverse ways and while some emphasize equilibrium, others emphasize emergence.²⁶ For Beer's Project Cybersin, it was the latter. The aspiration of the platform was to constitute and compose a systemic state condition, literally a socialist nation-state condition, and bring it into being. The platform sovereignty attempted by his stack was generative ex nihilo. Unlike the deeply centralized planning mechanisms of the Soviet Gosplan, the reporting, planning, and coordination of Cybersin's architecture was meant to be decentralized and democratic. Beer himself was less interested in Marxian theory of history than in the revolutionary potential of autopoietic cybernetics as a form of governance, and the presumed effect of information flows to make systems less hierarchical, more composable, more vital and durable.

Meanwhile in Japan, a platform of cybernetic equilibrium has been in continuous development since 1984, one for which the normative apparatus of the nation and its interpolation of objects and subjects within its industrial economy is presumed, reified, served, and conserved. Ken Sakamura's TRON (an acronym for "The Real-Time Operating system Nucleus") is the basis for a "computer everywhere" infrastructure that envisions a ubiquitous national computer network built on a distributed real-time operating system among a vast network of objects and terminals of multiple scales and complexities, a blend of an Internet operating system and Internet of Things communication formats with ubiquitous ID systems.²⁷ In its heyday, TRON was an architecture and interfacial framework by which parts of the whole national industrial system, from cell phones to cars to factories to municipal infrastructure, could communicate and be addressed by similar and related software frameworks. Those frames were forked and developed as different subarchitectures, each incorporating a different subset of an overarching Japanese computational ecology: ITRON, JTRON, BTRON, CTRON, MTRON, and STRON for mainframes, industrial uses, telecommunications, cell phones, end user terminals, and on and on. The industrial variant, ITRON, for example, is widely used in Japanese embedded systems. It was designed to be what Sakamura called "open-open"

in the communication between parts and components and freely available to be reprogrammed for specific implementations. Taken as a whole, TRON was considered at one point “the most popular operating system in the world.”²⁸ Its success, however, has been limited by the insularity of the Japanese technical ecology, and the contiguity, coherency, and delimitation of the Japanese state system.²⁹ The ultimate boundary of its walled garden would prove to be as unambiguous as an island’s border, and so the growth of TRON was both enabled and curtailed by Japan’s *Garapagosu-ka* or “Galapagos syndrome.”

Sakamura’s stack was constituent and curatorial; Beer’s was constitutive and generative. Beer’s model posited a nested series of socioeconomic scales, from worker to nation, through which regulated information would be reported, analyzed, and governed. Sakamura’s model distributes operations among widely dispersed components sharing data directly or indirectly for separate uses (e.g., industrial, civic, interpersonal) and so lubricating intermodal communication between people and people, people and things, and things and things. Beer’s and Sakamura’s visions are asymptotic. Both sought to design a platform infrastructure that would integrate a national society by integrating its material economies into a master computational system, but each is animated by a different conception of that task. Beer’s assignment was to help engineer a new nation into being through cybernetics, and so the key diagrams of his stack depict the socioeconomic scales that would come to participate through that system. For Sakamura’s Japan, the program of his stack is to intensify a national and cultural equilibrium already established, and so his images depict not a new social order (as Japan’s organic stability could be presumed) but the technical network layers that would be made to serve it. Beer’s diagram was of the macrosocial emergent effect of platform sovereignties, and Sakamura’s was the inverse, a technical harmonization of a social foundation. The constitutive design imagined the social and the cultural as an effect of the technical intervention, and the constituent design imagined the technical as a function of the social and cultural, and so here, both sides of software as language and software as technology dichotomy are exemplified and mirrored. For The Stack, the essential forces of the generative and the regulatory, equilibrium and emergence, constitutive and constituent force, remain equally foundational for one another. The Stack freezes, radicalizes, and reinforces models of governance and macroeconomics at the same time as it dismantles them, builds geographies above and below them, and undermines their ability to reproduce themselves. Sometimes it accomplishes one by doing the other.

The ongoing design of The Stack is for an architecture that is equally technical and conceptual, drawn by both its diffuse instrumentality and its physicalized abstractions. It is well suited to reflect even politico-theological aspirations and can easily synthesize an ideal liturgy of preferred signals and echo them back at specific *Users* (as discussed in the *Interfaces* chapter), even as its ability to absorb and revalue new content (toward

inflation or deflation) is programmed to be agnostic and omnivorous as strategy dictates. As we conceive possible futures for The Stack platform, in what way might the generative aspiration of Cybersin do more work for more *Users* than the curatorial aspiration of TRON, or vice versa? As ideal types, TRON is designed to optimize coherent divisions, whereas Cybersin introduces communication across the boundaries of scale. Cybersin focuses on the flow and valuation of goods and actions taken, and TRON on the embedded intelligence of infrastructure and equipment. Cybersin seeks to enroll all actors in the economy into its ongoing planning and evolution, while TRON seeks to allow steering authority a more transparent chain of command. Beer and Sakamura would likely agree, however, that any platform architecture will succeed not through the premeditated ingenuity of its original schemes that will always prove too brittle, but through how it is taught to accommodate and validate unforeseeable new programs, and to do so as simply as possible.

14. The Stack We Have

The Internet is built out on stacks not so dissimilar to these. Its eminence and its monotony, both available in excess, are functions of the regularity and resiliency of several specific “stacks,” variously abstract models and real technical machines. As its stacks are far more pervasive and powerful than Cybersin and TRON, their dissection demands more reading and interpretation. They are the result of work by well-known scientists and engineers (more on them below), anonymous ingenious workarounds, and coordinated tactical responses of established industrial *Users*. Equal measures of emergence and equilibrium are at work in the interplay of anticipatory design and real-time problem solving. The shape of The Stack, our accidental megastructure (which contains this Internet but also much more), is also built on some of these models and their particular governing steerage of information networks. The history of Internet stacks also makes clear that the authoring of architectures can produce metasystemic accidents that in turn can themselves counterauthor and redesign the platform in unintended but successful ways.

Consider the lessons of the OSI (open systems interconnection) network model and the TCP/IP network model, on which global Internet connectivity is now largely based. The specification of both standards began in the 1970s, and the latter was more fully adopted by the mid-1980s. For OSI, the network represented has seven discrete layers, from the application layer addressing *Users* at the “top” down to the physical layer (which today may be fiber-optic cable channeling pulses of light). Below the application layer are, in descending sequence, the presentation layer, the session layer, the transport layer, the network layer, the data link layer, and then the physical layer. In simple terms, a message is sent by a user down the stack, layer by layer, until it is transmitted laterally across the physical layer to the receiving node across the street

or across the ocean. Upon being received, the message travels back up the stack, from the physical layer to the application layer, and is read by the next user. Each of the layers gathers, specifies, and links heterogeneous technologies together into a functional stratum.³⁰ On each layer, an instance provides services to and requests service from the layers above and below, and can also pass information laterally to its corresponding layer (i.e., network layer to network layer, as in many so-called level 2 networks linking financial traders and trading centers). Key to the success of this modular model is its flexibility in absorbing future technological innovations that can be introduced at any given layer (e.g., fiber optics instead of copper wire at the physical layer, better router software, an application with better features and security) without disrupting the existing components, so long as the new technology adheres to the protocols established by the platform model that allow it to communicate with its vertically adjacent layers, above and below. In principle any machine could be inserted in a layer of the network if it can adhere to the necessary grammar that would allow it to communicate with its most proximate neighbors. For The Stack, the OSI model serves as a literal and technical prototype for how network architectures operate between very small and large scales and, as the primary abstraction, or universal diagram, for how its heterogeneous participants can arrange communication in a vertical assemblage, now at a megastructural scale.

The network stacks conceived in the 1970s and 1980s by teams led by Vint Cerf (TCP/IP) and Charlie Bachmann (OSI) (among many others) were designed to solve complex but very specific transmission and communication problems. The big idea was not to disrupt modern geopolitics. However, for The Stack, we recognize them to represent a more universal topography and geographic machine, one that we may come to see as having real effects of a similar order of magnitude as the loop topologies ratified at Westphalia. It must be said that for a book of design theory, The Stack platform's logical structure is far more important than the technical details of existing networks, but one provides for the other. As indicated, however, a crucial consideration for these models was massively distributed infrastructural modularity as a way to accommodate unplannable new demands and new machines within discrete layers as the key to future growth of the system. For this they exemplify platforms far more than master plans, and they are direct technologies for governance at least as much as tools of governments. At the same time, the armature for that modularity guarantees the predictability of these inclusions and the scalability of the whole, and so as for any platform, the governing regularity of stack protocols is necessarily inflexible and regular. What is simplest and most fixed provides for Hermes's ephemeral work of transit and translation.

All of this is was and is highly contingent. It was quite possible that neither OSI nor TCP/IP would become anything like a central systems mechanism for global communications. The standards wars of this era divided phone companies, which preferred a

system that would support discrete circuits between one sender and receiver, like older telephony networks, versus many computing companies, such as IBM, which lobbied hard for packet switching technologies that could treat all messages (e.g., voice, data, image) as recombinant bits flowing over whatever future hardware that could connect with the network. The models of communication (equally technical and social) posed by both options contain profound downstream implications for the geopolitics of an information society. A polity of circuits and a polity of packets are in epistemological and functional opposition. For the circuit model, its stack is a bounded utility for which use is metered by monopolistic caretakers who, by guaranteeing the circuit between sender and receiver, retain de facto sovereignty over the channel. For the packet switching model, at least in the minds of Cerf's group, the platform would prioritize the edges of the network, asking them to do more of the work to reassemble transmitted packets and calculate the content of messages. Cerf's group presumed increasing computerization of networks from node to edge, but even more than its authors intended, their model would depend on the exponential growth of the computational capacity of all network equipment, soup to nuts (e.g., terminals, routers, servers), in order to bring the network to life at a global scale. The greater the computational carrying capacity of the entire network apparatus, the more information it can convey with greater speed, and the more information it conveys, the more demand for capacity by organizations increasingly reliant on its competitive efficiencies. In this way, Moore's law is not just the cause of the software society; it is also a contingent effect of a platform architecture design decision.

Both OSI and TCP/IP are packet switching models, but for better or worse, the seven-layer OSI model that Bachmann described never really took off. The simplified TCP/IP four-layer model described by Cerf's group did get traction, and based on those early adoptions, the Internet as we know began in earnest.³¹ TCP/IP was ratified in 1980, and besides compressing the stack geometry by combining the top three layers of the OSI stack into one, it proved a much simpler and flexible solution for early industrial and government network adopters.³² TCP/IP "won" not simply because its early adopters were more visionary but because it just worked better to link together heterogeneous existing systems and translating between them so that they could work as one. America's factories were not linked by the organicist tissue of TRON; they were full of various proprietary computing systems running mutually incompatible software. TCP/IP made it much easier to design and implement general-purpose hardware and software that could link all these together—as is—and thereby quickly realize gains in efficiencies with the machines that managers already had. As more sites (and more nodes and more *Users*) connected systems through this network platform (factories connected to suppliers to headquarters to warehouses and so on), the network became that much more valuable to every connected *User*. As the platform that glued all these together became more established, the opportunity cost of using alternatives such as OSI increased (a

good example of generative entrenchment). We see that platforms that allow for a tactical appropriation to optimize existing systems have an advantage over those that would appear from a tabula rasa, at least within this context for established industrial systems. Over time, the entirety of those original economies and mechanisms may be replaced bit by bit by new technologies and new communicative norms that are better tuned to take advantage of the wider systems that emerge.

There are important lessons for The Stack from this history. By the relative simplicity and rigidity of a modular architecture of translation, the platform gathered unlike and unforeseeable users into its media, and only by translating any “content” into generic information can it provide the effective universality of communication and exchange. This gathering of unlike *Users* into a central system that can then govern the terms of infrastructural and platform participation largely depends on how well it makes use of computational ubiquity to amplify the agency of all the nodes, wherever they may be. Perhaps most important, despite the fact that TCP/IP was intentionally authored as a scalable platform, it rose to preeminence in the governance of networks not because it was the most perfect, or because everyone voted for it, or because it was the most legally sound; rather, it just worked to tactically glue together lots of different things at different scales into more manageable and valuable forms. The same is basically true of The Stack as an accidental megastructure. There was no one commission or council whose vision authored it (though versions of it have appeared in dreams and nightmares for centuries). Its layers “just worked” for *Users* and platforms to make immediate tactical gains, and the accumulation of these trillions of maneuvers terraformed the planet. As for “the Internet,” we still can’t really point to it as one network, or one technology, or one stack. It is a conceptual assemblage of billions and billions of little machines that we treat as one thing. The Stack, as well, doesn’t really exist per se, and yet there it is.

The Stack is an engine for thinking and building. The architectural metaphor may suggest an exclusive design for one given site, but it should direct us instead toward a geometry in which different things occupy the same site at the same time and cohere into a stable system because of this co-overlapping. The Stack is built of real things, but how we conceptualize its totality depends on powers of aesthetic abstraction. While machinic networks demand their own recognition and when formalized these become infrastructural and platform sovereignties, the Stack diagrams these as techniques to use (or refuse) alternative political geographies but never allows for simplistic one-to-one correlations between one layer and one geopolitical operator. I am not suggesting, for example, that China functions “like” the physical layer of the OSI model or that Google functions “like” the application layer. Rather, different organs of state and *Cloud* platforms intersect jaggedly. Their intersections on multiple layers (e.g., *Earth, Cloud, City, Address, Interface, User*) can be understood through the model

lens of The Stack, not just as an unaccountable proliferation of exceptional enclaves, exclaves, and liminal legal zones, but also as the *topos* (if not *nomos*) of a normative order in which these very “exceptions” are regularized. It is a political geography for which the vertical is on equal footing with the horizontal and demanding its overdue tribute (their crisscrossing piling of jurisdictions, on-platform and off-platform, not only works through The Stack; it *is* a stack). State and nonstate *Cloud* platforms can operate both independently and interdependently, but their position is always now in relation to one another and to what is above and below them. Our model is, we hope, both a schematic map of this dynamic and a means for its retooling; it is infrastructure that is also simultaneously a projective interface for its own recomposition and for a geopolitics-to-come. It is a space of deep addressability nominating and enumerating *Users* and interlocking their traces easily or uneasily across unnatural scales. Layers are delimited like borderlines, invisible membranes just as arbitrary as their enforcements, but as they gather unlike technologies into their own level, they also fold their lines around them into a frame. Especially at the *Interface* layer that draws *Users* into the fold, their lines exude platform sovereignty through an intrinsic reversibility. This *nomic* principle of The Stack persists.

The aspect of this book that qualifies as a design brief hinges on how The Stack is already a larval geopolitical architecture and how its refashioning requires unexpected and uncomfortable redefinitions of what geopolitics might entail. As discussed above, The Stack is at once a machine that becomes a state, and a political geography that derives and is derived from the structure of that machine. The Stack includes all the various planetary computational technologies we now build with fanfare, but its significance is its reflection of the totality that emerges unintentionally. The platform sovereignties that it enables emerge in relation to material systems opened to the subjective image of all *User* positions and identities that cohere around them. In exploring the active contradictions of sovereignty in relation to emergent planetary-scale computation, we need a diagram of the global Stack that we have as it actually is (e.g., electricity grids, mineral sourcing, strange interfaces, smart and dumb cities, alien users) to give a technical specificity to our speculations on geopolitical and geo-social alternatives, but also to better abstract its scattered technical heterogeneity into a fungible totality. What binds that analysis and that design to one another is that while The Stack is a platform for computational networks and economies, it is also a metaplatform that works to gather, support, and superimpose multiple totalities at once (e.g., states, *Cloud* platforms, cities, projective political theologies). Each of these positions is itself in slippery contact with The Stack’s layers, circumscribed by one and shuttled between several. In so doing, it has repositioned itself in relation to other little totalities along the way, creating and claiming some part of the territory of planetary computation.

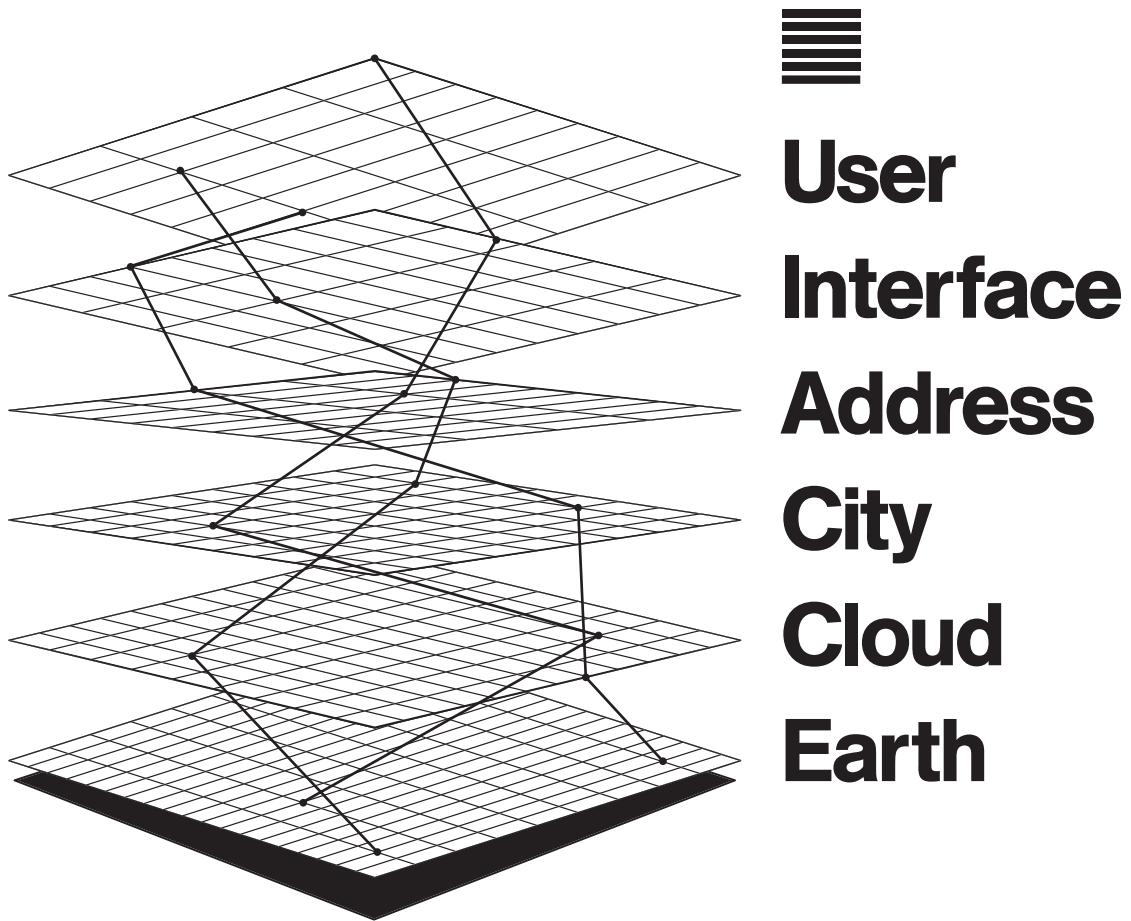


Figure 3.1

Diagram by Metahaven of the six layers of The Stack.

15. The Layers of The Stack

How does this work? What is the model exactly? The Stack is divided into six layers, moving from the global to the local, from geochemical up to the phenomenological: *Earth*, *Cloud*, *City*, *Address*, *Interface*, and *User*. For The Stack, multiple layers co-occupy the same terrestrial location (horizontally) but gather and subdivide their processes vertically into discrete machinic “jurisdictions.” That subdivisional geography is bound within the mechanism of the platform, but at the same time, The Stack platform itself disturbs existing models of jurisdiction and projects its own out into the world. Each layer configures and coheres its own specific forms of governance over what it touches,

and so the difference between one layer and another is also a difference between those forms and processes. That is, the *Cloud* layer is defined by certain spatial and temporal demands that include what we conventionally recognize as *Cloud* infrastructure (e.g., data centers, fiber optics, and in-browser applications), but those demands may press on rather unlike things as well (parking spaces, medical equipment, food supply statistics). The six chapters that follow discuss each one of these layers in sequence, detailing especially how each produces its own governing logics of scale, physicality, textuality, embodiment, force, motion, stability, and, perhaps most important, how each of these logics provides productive accidents that may direct us toward unexpected design outcomes.

The diagram of The Stack in figure 3.1 shows a vertical-sectional relationship between possible positions occupying all six layers at once. It demonstrates that while positions on layers are held simultaneously, each layer governs that position semiautonomously. In the practice of real communication, any one instance of such a stack works only in combination with another, and in this pairing, the real social form of active stacks comes into focus. That structure of connection and communication is similar to OSI or TCP/IP. Connections tunnel down, across, and back up stacks, creating temporary circuit-like connections in a U-shaped trajectory. *User* connects to *User* by initiating a “message” that tunnels all the way down through the other layers to the bottom and then back up again, and so direct communication between *Users* activates all six layers down The Stack and then all six layers again back up The Stack. The whole of the system is invoked and activated by any one connection; the whole is “folded” into each single instance of activation, bending the universal and the particular into one another. We define any one such path taken down and up The Stack in a U-shaped trajectory as a *column*. For one “session,” however fleeting or stable, columns fix one *User* to another by linking layers to those above and below into a whole, but they allow anyone or anything that is a *User* to initiate (or be initiated by) as many other simultaneous columns as needed. That is, as any given column tracks up and down, there is no final instance of vertical or horizontal integration that would truly and ultimately *resolve* a *User* down to the *Earth* layer or *Cloud* layer for good. Any one *User* will initiate millions of different columns at different moments over time, thereby executing different combinations of nested positions. This slipperiness does not correspond well with modern logics of last-instance sovereignty and citizenship. It’s not that there is no “there there” but rather that moment to moment, there are too many “theres” for any one sovereign geography to finally decide all the others.

At the top of any column, a *User* (animal, vegetable, or mineral) would occupy its own unique position and from there activate an *Interface* to manipulate things with particular *Addresses*, which are embedded in the land, sea, and air of urban surfaces on the *City* layer, all of which can process, store, and deliver data according to the computational capacity and legal dictates of a *Cloud* platform, which itself drinks from

the *Earth* layer's energy reserves drawn into its data centers. Paths between layers are sutured by specific protocols for sending and receiving information to each other, up and down, that do the work of translating between unlike technologies gathered at each plateau. In this sense, each layer can then simulate and countersimulate the operations of the other (for *Users, Interfaces* "simulate" the instrumental capacities of the entire Stack, as the hard and soft networks of the *Cloud* and *City* are "translated" one into the other). Their interlocking adherence to standard protocols guarantees the linking of information up and down and between like layers (or even skipping layers occasionally), and for this, an external application can enter into The Stack at any level and begin to move between levels from that starting point. Any path from top to bottom is but one possible route among many others. For example, one path from *Interface* to *Address* may be very different from another from *Address* to *City*. There are any number of possible links between *User* to *Address*, *Interface* to *Cloud*, and *Earth* to *City*, or horizontally between the same layer of two stacks (i.e., *City* to *City*). The durable form of one layer, in one context, might enable or prevent variation within another layer, because different layers function with a contingent whole with greater or lesser degrees of stability or variability. For example, identical configurations on the *Cloud* layer of column may link very different contexts on the *User* layer that is necessarily more responsive to dynamic cultural nuances.

In practical terms, two different *Users* may make use of the same *Interfaces* and *Addresses* within the same *City*, but each may have very different privileges and limitations at the *Cloud* layer. As that may be the layer on which it is most decisively perched, a state may see what the *Cloud* layer can see (and not what it can't see) in the recursive path up and down the columns that are visible to that particular layer's techniques of perception and its own dispositions of looking. At the top layer, because no two *Users* have the same level of privilege and access within the space of possibilities in which a particular column might form, political tension pulls tight around that difference. Perhaps then the ultimate identity of any one *User* within The Stack could be calculated by those limitations that contrast one *User* to its neighbors plus the patterned aggregation of the columns it has activated over time (not unlike how today's commercial *Cloud* platforms track and model their subscribers). For any *User* a particular position on one layer might guarantee a corresponding position on another layer, or might disqualify it altogether; not only are layers technically interdependent, but their social effects are as well. Attention to this leverage between layers is essential because the possible designable distribution of such positions in relation to one another may also drive the contested governance of the *Cloud* and of any alternative geopolitics it might engender. Even so, for the Stack platform to work, each layer still reserves its own limits, rules, and concreteness that is never finally reducible to the terms and jurisdictions of another. On the one hand, the layer's modularity within the whole means that its effects are never exclusive or exhaustible, and on the other, the rigid simplicity of the

total platform apparatus demands that its direct functions remain encapsulated.³³ Even as any one layer's operations unfold in relation to those of adjacent layers, and so may also affect events that fall well outside the entire platform's borders, the movement of hard and soft information must always pass through the protocols that divide and bind that layer's work from the others.

While any one layer's operations in a given site or moment could be captured (or guaranteed) by state, nonstate, transstate, superstate, or substate actors, all the different layers within the arc of a specific column trade on multiple and incongruous strategies, all or none of which may be codified by one legal jurisdictional vision (itself perhaps unrecognized by the jurisdiction underwriting local control of another layer). A spectrum between incongruent policing and practical interoperability nevertheless characterizes the politics of stacks and is also itself even subject to local enforcements, both inside and outside the column or layer that may be in dispute. In daily practice, specific columns (hundreds of millions of them every second) are separated from one another by their unique and particular nestings of these positions and counterpositions and by the interlocking coordination of their simultaneity, fixed or unfixed by the force of formal state description. Because the autonomy of individual layers in the platform resists total capture of the platform's totality, the interslicing of aggressive "little totalities" between columns might be rough or smooth, honed by the investments of happy *Users* or just as easily by the grinding tones of mutual resistance. For any column, any strong sovereign claim (state or nonstate) can only extend over some layers in any given moment or location, but never on the entire Stack at once. *Interface* and *Address* may be monopolized by one jurisdictional totality in one context, and *Earth* and *City* for another in another context, but absolute dominion over all six layers across contexts is doomed by the superimposition of multiple geographies at once, communicating with one another without master steerage or any one final settlement of transactions. At least in this way, The Stack is (we hope) a totality that is resistant to totalitarianism, even as its governing coherency depends on the gravitational pull of each layer and on the gathering of more and more of the world into its logistics (even making the opportunity cost of transactions and transitions too cheap to measure). In the six chapters that follow, I illustrate a provisional geopolitics of The Stack with which we work, one layer at a time and in aggregate, and speculate about a blossoming of exotic sovereignties that each layer might support or contain, in isolation from and in concert with others. The tilt is not toward how a sublime coordination of Stack technologies might hasten the arrival of some full-spectrum computational end of history, but how its gnashing juxtapositions generate peculiar new spaces, fractured enclaves, and how its newly normalized exceptions are perhaps instructive beyond their immediate scope. As said, each individual layer spits out its own possible accidents as it abuts its neighbors, and each is presented not only as a medium for design but as a technology for accidents.

First, the *Earth* layer provides a physical foundation for The Stack. This chapter begins by considering the agency of silica as a computational substrate and how the classical idea of a universal granularity of atomic matter has framed how we understand the physics (and metaphysics) of computation. It argues for a foregrounding of the geological substrate of computational hardware and of the geopolitics of mineral and resource flows of extraction, consumption, and discarding.³⁴ It examines arguments regarding the ultimate energy sourcing and routing necessary for planetary computational infrastructure and the paradoxes posed by the race to build smart grids capable of supporting its continuance and maturation. In important ways, it is possible for us to sense, quantify, and predict ecological precariousness through Stack technologies, and yet the production and feeding of those same systems are also key contributors to those same risks. The chapter concludes with a discussion of the knotty problems of ecological governance and the issues posed by turning the ecology itself into a kind of final, ambient emergency.

The *Cloud* layer chapter discusses the vast server archipelagoes behind the scenes and behind the surface that provide ubiquitous computational services as well as the geopolitical intrigue that involves them. It includes in this the entire infrastructural complex of server farms, massive databases, energy sources, optical cables, wireless transmission media, and distributed applications. It focuses on the conflicts arising from the juxtaposition and superimposition of state geography and cloud platforms (i.e., the Google-China conflict) and on how the evolution of states into cloud platforms extends and complicates the locations of infrastructural and legal sovereignty. The chapter also compares several existing *Cloud* platforms as models for alternative *Cloud* polities.

The *City* layer of The Stack comprises the environment of discontinuous megacities and meganetworks that situate human settlement and mobility in the combination of physical and virtual envelopes. These partition and subdivide access to urban space, but in their generic comprehensiveness, they may also provide for forms of accidental cosmopolitanism, ones derived not from parliamentary certificates but from a shared physical relationship to pervasive infrastructure. We also examine the urban-scale imprints of major *Cloud* platforms and how their physical postures and positions disclose specific geopolitical imaginaries.

Now closer to the scale of familiar objects and interactions, the *Address* layer examines massively granular universal addressing systems such as IPv6 (Internet Protocol version six) (including cryptographically generated hash addresses), which would allow for a truly abyssal volume of individual addressees. Such individuated addresses make any thing or event appear to the *Cloud* as a communicable entity, and for The Stack, computation then becomes a potential property of addressed objects, places, and events, and a medium through which any of these can directly interact with any other. While scenarios for ubiquitous computing and an “Internet of Things” suggest information

exchange between “smart” natural objects, what I refer to as “deep address,” is interested in communication between very different spatial and temporal scales, absorbing any addressable “haecceity” into vast, if also fragile, communicative fields that may exceed the limits of conventional control or literacy.

The *Interface* layer describes the projective, perceptual cinematic, semiotic layer on a given instrumental landscape, including the frames, subtitles, navigable maps, pixelated hallucinations, and augmented realities through which local signification and significance are programmed. *Interfaces* provide imagistic and linguistic mediation between *Users* and the *Addressable* computational capacities of their habitats, priming the pump for possible communication. The chapter outlines a typological history of interfaces, from the mechanical, to the semiolinguistic, to the haptic and gestural. As an interface, any surface or gateway oscillates between open and closed in a given context, and because of this, it is where the reversibility of the interior/exterior decision by platforms is most clearly observed. As an interactive diagram, GUIs present a visually coherent image of otherwise discontiguous and opaque logistical flows, but when aligned with new interface technologies, such as augmented reality that superimposes interfacial elements directly into the perceptual field, they can collapse a metaphorical space between object and interpretation. This literal projection of the ideas and ideologies of an imagined community onto perceived objects and events can engender undesirable cognitive fundamentalisms.

At the top of The Stack is the most culturally complex layer, the *User*. This chapter describes how The Stack sees the humans and nonhumans that initiate columns up and down its layers, from *Interface* to *Earth* and back again. As a contemporary image of self, the *User* is asked to speak through utilitarian scripts, and yet its subjectivity is also opened up to unexpected kinds of universality. Human and nonhuman *Users* are positioned by The Stack (perhaps rudely) as comparable and even interchangeable through a wide-ranging and omnivorous quantification of their behaviors and effects. The preponderance of data generated by *Users* and the traces of their worldly transactions initially overtrace the outline of a given *User* (e.g., the hyperindividualism of the quantified self movement), but as new data streams overlap over it and through it, the coherent position of the *User* dissolves through its overdetermination by external relations and networks. The *User*’s enumeration is first a grotesquely individuated self-image, a profile, but as the same process is oversubscribed by data that trace all the things that affect the *User*, now included in the profile, the persona that first promises coherency and closure brings an explosion and liquefaction of self.

The concluding chapter draws out from these discussions some of the most tangled and complex implications of The Stack as geopolitical design challenges to be achieved or resisted. Among these is the proliferation of enclaves as a political and architectural expression of network geographies. As each layer is considered in relation to its accidents, The Stack itself is the composite accident that may define the course

of geopolitics to come. As a global platform, its demand for universality and totality should be read in both utopian and dystopian registers equally. The Stack may represent an epochal enclosure of the planet under an absolutist regime of algorithmic capital, or the fragility of its totality may force new breaks as its infrastructural universality spawns new, even emancipatory programs of disenchantment, discovery, and design. The design brief begins on the cliff's edge of the Anthropocene, and tilts toward an acceleration into risk and reward; it presumes that the megainfrastructures of "actually existing" algorithmic capitalism are not, as of now, able to break clear of their own failures and realize a break for and toward the latent potential of a postscarcity geoeconomics. That acceleration is not therefore an acceleration of The Stack or away from its risks, but toward a particular termination and succession, and toward the articulation and realization of a more genuinely luxurious social geology. We are resigned that the emergence of that planetary condition, wherever and whenever, will likely not include or require human geopolitics as we currently understand it. As such, we commit to the ongoing design of the accidental megastructure knowing full well that its ultimate purpose may be to disappear before it fully arrives.

II The Layers

Earth Layer

The astronomers leave for the Southern Hemisphere, the physicists for the equator, and the geometers leave in order to measure the earth's meridians. The Bureau of Longitudes is created, universal geography is founded. The world is no longer the empirical domain of time and space. It is the compass of knowledge.

—Michel Serres, *Jules Verne*¹

And with these, the sense of the world's concreteness, irreducible, immediate, tangible, of something clear and closer to us: of the world, no longer as a journey, having constantly to be remade, not as a race without end, a challenge having constantly to be met, not as the one pretext for a despairing acquisitiveness, nor as the illusion of a conquest, but as the rediscovery of a meaning, the perceiving that the earth is a form of writing, a geography of which we had forgotten that we ourselves are the authors.

—Georges Perec, “The World”²

Molecules don't have passports.

—Carl Sagan³

The foundational layer within The Stack is the Earth itself. All movement through the lower machine layers draws on the chemistry and the physics of the *Earth* layer—its energy and minerals, scale and curvature, heat and cold, and so on. There is no planetary-scale computation without a planet, and no computational infrastructure without the transformation of matter into energy and energy into information. But for The Stack at least, what is computation, and how does the computational infrastructure at the *Earth* layer support the accidental megastructure? “Computation” is not only what The Stack is made from; it is also how the megastructure composes, measures, and governs itself. At the *Earth* layer, algorithms and electrons interweave at landscape scale, driving continental economies; in turn, those landscapes are disciplined by other algorithms hoping to rationalize the enormous energy appetite of the whole. We will examine this recursion from the ground up. The first sections of this

chapter consider the materiality of computation in itself, before any artificial computing machines came onto the scene, and will ask if computation was “discovered” more than it was invented.

The *Earth* layer is also made from the Earth itself, as the terraforming imperative of the Stack megastructure disembowels geological resources toward global conversions. These industrial processes are also as a kind of composition, one for which alternative geoaesthetics may point toward different outcomes. We will also consider how computational infrastructures at the *Earth* layer extend the planet’s capacities to sense and monitor its own energy usage by augmenting its “skin.” This is represented by grids that can rationalize energy use, but themselves may demand fatally large amounts of energy to construct. These contradictions contribute to uneven realignments of geopolitical jurisdiction according to the opposed positions of energy-producing geographies that most directly cause climate change and of those most affected by it. For The Stack, the identification, quantification, management, visualization, and provision of energy may serve as the last instance referent of economic value, and it may in time force the evolution of a platform capable of composing and governing such a system. This in turn may put the design of the *Earth* layer of The Stack in the untenable position of working on behalf of the exceptional “emergencies” that most threaten the platform’s coherency, such that in the decades to come, the self-amplifying logics of ecological governance demand not only geoengineering, but also incredible computational energy capture-and-distribution megastructures far beyond our current capabilities.

16. Discovering or Inventing Computation?

For the relationship between computation and its terrestrial substrate, the Earth, it is never easy to separate metaphor from physics, and so for my thesis, their conceptual interrelation is perhaps just as important as their material involvements. The *Earth* layer of The Stack draws from both the conceptual and the material, not by collapsing them into one so much as tracing ever-thickening lines back and forth between them. As I imagine those lines thickening, I become immersed in a photograph of the philosopher Gilles Deleuze, taken during a visit to Big Sur in the mid-1970s, as he sits on the California beach examining its sands and the breathing striations of the silica terrain.⁴ *The world remaking itself in waves, bit by bit and pebble by pebble.* In trying to place the image, I also think about how just up the 101 freeway from where Deleuze was sitting, silicon was being repurposed as the physical medium of synthetic computational intelligence, in the areas near Palo Alto in a “valley” already having been named in honor of this element. For me these are conjoined, and not just by their geographic proximity: Deleuze on the beach contemplating (we might assume) what he called “the plane of immanence,” the field from which all potential forms emerge, and

Intel's initial approximations of microprocessor technology for universal computation, putting a mini-Turing machine on a silicon wafer.⁵ In different ways and for different ends, both grapple with *matter* as vibrant, contingent, and mutable, as reproduced in the careful calculation of sets of differences drawn from particular virtual possibilities. At the end of the day, Deleuze's philosophy is more about chemistry than computation, continuities more than discrete digitalizations, but his philosophical imagery of worlds appearing from the multiplication of imminent processes and generic diagrams, on oscillations of the physical and the virtual, is not unfamiliar to the projects of information realism. In the words of the late Friedrich Kittler, "Silicon is nature! Silicon is nature calculating itself. If you leave out the part of engineers who write little structures on silicon you see one part of matter calculating the rest of matter."⁶

The shimmering idea that the world is composed not of given forms on a fixed stage but of an atomic field of flux and churn is ancient. The idea precedes our ability to mathematize the hypothesis experimentally and predates by millennia the engineering of machines that can simulate a calculation of discrete bits of information as if they are those atoms. Close your eyes and visualize dust motes floating and falling in the white light of a projector. See them just barely touch or miss one another. This swirling and tumbling through the void is also, given some poetic license, one model of elemental computation. Around 1 A.D., Lucretius called these atomic bits *primordia* or *seminarerum*, and for the Epicurean philosophical tradition, this flux is ontological and the basis of their own information theory *avant la lettre*.⁷ It says that what seems to be naive observation as solid figures and grounds, withdrawn into themselves and oriented as objects, are but clusters of bits that have fallen into one another over time, and will in more time fall apart and again into other things, conjugating or calculating themselves again and again. The name for the force of collision that causes their downward arcs to tumble into assemblage is translated from the Latin as *swerve*. Atomic bits *swerve*, as if by accident, and in their accumulation, the entropy of the noisy void gives way to the negentropic formulation of the world and its temporal orderliness: from this calculation, *forms form*. Lucretius called this economy of entanglement between atoms, located by their fluid communication in flight, the *clinamen*, and it has been the source of considerable philosophical and literary rumination (including Marx's doctoral dissertation).

Today, enjoying a vantage point that includes contemporary atomic physics, we see the clinamen less as a spontaneous lurch of some thing from its track (the universe as the eventual archive of these accumulated deviations) than as interlocking fields of stochastic probabilities structuring emergent order in this way or that. The details evolve, but the idea of calculative emergence persists. The basic innovations are well known. In twelfth century Majorca, Ramon Llull described logical machines, influencing Gottfried Leibniz, who developed a predictive calculus and a biliteral alphabet that, drawing on the *I Ching*, allowed for the formal reduction of any complex

symbolic expression to a sequence of discrete binary states (zero and one, on and off). Later, the formalization of logic within the philosophy mathematics (from Pierre-Simon Laplace, to Gottlob Frege, Georg Cantor, David Hilbert, and so many others) helped to introduce, inform, and ultimately disprove a version of the Enlightenment as the expression of universal deterministic processes (of both thought and physics). In 1936, with his now-famous paper, “On Computable Numbers, with an Application to the *Entscheidungsproblem*,” a very young Alan Turing at once introduced the theoretical basis of modern computing and demonstrated the limits of what could and could not ever be calculated and computed by a universal technology. Turing envisioned his famous “machine” according to the tools of his time to involve an infinite amount of “tape” divided into cells that can store symbols, moved along a stationary read-write “head” that can alter those symbols, a “state register” that can map the current arrangement of symbols along the tape, and a “table” of instructions that tells the machine to rewrite or erase the symbol and to move the “head,” assuming a new state for the “register” to map. The Church-Turing thesis (developed through the 1940s and 1950s) would demonstrate that Turing’s “machine” not only could simulate algorithms, but that a universal Turing machine, containing all possible such machines, could, in theory, calculate all logical problems that are in fact computable (a limit that Turing’s paper sought to identify). The philosophical implications are thorny and paradoxical. At the same moment that Turing demonstrates the mechanical basis for synthetic logic by machines (suggesting real artificial intelligence), he partially delinks the correlation between philosophical thought and machinic calculation. The implications continue to play out in contemporary debates from robotics to neuroscience to the philosophy of physics, as has Turing’s later conceptualization of “thinking machines,” verified by their ability to convincingly simulate the performance of human-to-human interaction, the so-called Turing test.⁸ In the decades since Turing’s logic machine, computation-in-theory became computers-in-practice, and the digitalization of formal systems into mechanical systems and then back again, has become a predominant economic imperative. Through several interlocking modernities, the calculation of discrete states of flux and form would become more than a way to describe matter and change in the abstract, but also a set of standard techniques to strategically refashion them as well. Computability moves from a universal logic to a generic technology (and so contemporary claims that this passage is reversible are both predictable and problematic). Although the twentieth century invented computers, it did not invent computation so much as it discovered it as a general force, and offered some initial basic tools to work with it more directly. We are, like everything else, also its product.

This conceptual shift is important to how we hope to consider reforming The Stack. One of Turing’s signal achievements is to show that an artificial “machine” could approach, and even approximate, the scope of natural computation, as defined in a

particular way. His innovation was the specific pairing of formal logic with industrial technology that was, even after Charles Babbage and Ada Lovelace's Victorian-era calculating machines, by no means obvious in its implications. For measuring the significance of that pairing in relation to The Stack, it is important to distinguish the limits of formal computation, on the one hand, from what the limits of actual computational technologies can really do, on the other. These are two very different kinds of limits. While Turing's hypothetical machine demonstrated the mathematical limits of formal computability, it also demonstrated that any problems that could be captured and expressed symbolically through a reduction to rational integers (which likely describes the vast plurality of things and events in the world as representable by intelligent creatures) could be simulated and solved by a machine engineered to do so, given enough time, materials, and energy. Anything expressed as computable information, regardless of the natural appearance, linguistic identity, or economic value, could be processed by a universal information machine programmed to do so and physically capable of running through enough operations. A strong computationalist philosophical position may also extrapolate from this that natural systems can be (and so must be) reducible to information and computational processes.⁹ Problems arise when the notion that things are formally equivalent by their shared computability slides into the claim that they are therefore ontologically equivalent, or even culturally and economically equivalent. The questions raised by the idea of universally calculable matter are interesting on both practical and philosophical terms, but I raise them here to provide conceptual context for other questions.

At the time of this book's publication, no one (certainly not I) can pronounce on the practical validity of quantum computing or industrial-scale atomic-level design, and so for that reason alone, we are careful to separate computation from computers, and not to confuse the mathematical genericity of computation as a process with the actual and comparatively feeble algorithm-crunching machines at work now and in the near future.¹⁰ Surely the latter is a sad cartoon of the former, and Turing's model of a universal computing machine specifies a break between what mathematics could describe as the computation of natural information and what artificial computing technology could ever program or perform. Even supercomputing grids are just machines particularly efficient at calculation tasks at predictable speeds, but they are not in themselves "computation," just as light bulbs are machines good at conducting electrical currents toward illumination but are not in themselves electricity or light. Many things process information algorithmically and could be said to "compute" in a meaningful sense (DNA and RNA, for example) without also demanding that we must see in them the reflection of our computing machines.¹¹ We might even assume that the "next machines" (the ones that come after planetary-scale computation) will look less like today's computers and more like biology itself.¹² Turing described a capacity to mimic natural computation, providing a measurement of the gap between it and artificial

machinic computation, but as we learn to design by the comingling of bits and atoms into strange hybrids, we may in time need to retake that measurement.¹³ Even if so, we will still resist the conflation of the quasi-universality of theoretical computation with the scope of real or near-future computational infrastructure, not to mention the indeterminate geopolitical effects of that infrastructure on those effects. Unfortunately, both utopian and dystopian alliances are happy to underwrite and expand that conflation to support their own deterministic narratives, but for The Stack, we won't. One hopes that instead of dressing up contemporary techniques as ontological principles, an emphasis on the discovery (versus invention) of computation should make the practical distinction between the formal and the functional more apparent. The geopolitical effects of accidental computational megastructures remain design problems precisely because they are not determined by inflated notions about immanent (and imminent) logics.

Anything else risks misleading conclusions drawn from deceptively conditional extrapolations from the present. For some, logarithmic arcs like Moore's law suggest exponentially accelerating change in the most general sense and lead them to posit a big computer in the night sky, or a quasi-theological master operating system, and to identify computation as some vital force pulsing through all media.¹⁴ From there, a future horizon filled with formal convergence, magic, and rapture looks inevitable. For some, that is the best possible news and for others the worst, but they can agree on the basic outline of a script that is too simplistic. At the same time, perhaps this genre of extrapolative futurism is just another way of saying that mathematics is universal and algorithmic technologies are medium independent, and so we need to employ them differently than we do now (which is true). Or, perhaps, is it but an elegant humming along with the most superficial and poorly theorized aspects of digital capitalism as it dissolves raw materials into interchangeable goods and services, and so the melody is rewarded for flattering the illusion that these linear speculations represent timeless principles? Industrial capitalism had social Darwinism, and today do we have instead a social Turingism: financialization as social metaphysics? Perhaps it is both (and more besides). Like Freud's figural model of the mind in the rough image of the thermodynamic industrial engine,¹⁵ the paradigmatic idea that the ongoing reassemblage of the world is, in some literal sense, given to computational processes is more than just ideological metaphor run amok.¹⁶ It is more than partially true because we have made it true. The long-term technical question is to what extent we can describe and practically manipulate material systems by algorithmic calculation—flipping bits on and off, like the motes present or absent at any given point in the light, and gathering them into the forms we recognize as the world—and to what extent not at all, and more important, when we can and cannot do so, and toward what outcomes they should be directed.

As is well known, hyperfast algorithmic asset trades flourish in global equities and futures markets and account for huge percentages of all executed trades; their swerves

also form value but do so in ways that can exceed or outpace human oversight. Algorithmic capitalism's own story is often too happy to confuse means and ends, but perhaps counterintuitively, we may conclude nevertheless that the synthetic inhumanity of computational capital is actually the most direct vector out of the anthropocentric humanism that places short-term human needs at the center of public philosophy and engineering. The limits of machinic calculation are not the same as the limits of deterministic rationality, and the social effects of computational systems are certainly given to creative accidents.¹⁷ Reactionary analog aesthetics and patriotisms, Emersonian withdrawal, and deconstrucivist political theology buy us less time and far less wiggle room than they promise, even less actually than the unfortunate notion that planetary-scale computation could emerge and mature without fundamental constitutive violence against traditional (that is, "modern") concepts of individual, society, and sovereignty. Because they simulate logic but are not themselves necessarily logical, computers make the world in ways that do not ultimately require our thinking to function (such as the interactions between high-speed trading algorithms that even their programmers cannot entirely predict and comprehend). The forms of inhuman intelligence that they manifest will never pass the Turing test, nor should we bother asking this of them. It is an absurd and primitive request.¹⁸ It is inevitable that synthetic algorithmic intelligences can and will create things that we have not thought of in advance or ever intended to make, but as suggested, because they do not need our thinking or intention as their alibi, it is their inhumanity that may make them most creative.¹⁹ Like Deleuze on the beach making sand piles, humans *wrangle* computation with our algorithm boxes, and in doing so, we make things by accident, sometimes little things like signal noise on the wire and sometimes big things like megastructures.

17. Digestion

In the dynamic between natural computation expressing itself through artificial computing machines and those machines in turn remaking the world, each bends and countersimulates itself awkwardly and incompletely in the other. The *Earth* layer is shaped by this irregular and perhaps unsustainable interplay between the one and the other—sensing, drawing, enumerating, consuming, effecting. While it is a mistake to imagine computation as something that just sprang into existence with the rise of computing machines, or as the superimposition of some synthetic layer on top of everything organic and analogous and ultimately separate from natural algorithmic processes, it is also wrong to imagine computation as existing on a dry virtual plane sealed off from wet economies of energy, water, arbitrary valuation, remote capture, and geographic chance. So irrespective of the mathematical limits of algorithmic reason, The Stack is interested instead in the limited and sufficient compositional capacities of a megastructure already under construction, the thresholds of which are geological,

sociological, economic, chemical, and geopolitical as much as they are calculative. This chapter draws on those limits and on the risks that come with positioning the Earth as a layer in a synthetic machine, and for this Earth is the *Earth*—a physical planet—not a metaphor for “nature.” There is no planetary-scale computation, now a vast network of many billions of little Turing machines, that does not intake and absorb the Earth’s chemistry in order to function. The Stack is a hungry machine, and while its curated population of algorithms may be all but massless, their processing of Earthly material is a physical event, and therefore the range of possible translations between information and mechanical appetites has another limit that is not mathematical but defined by the real finitude of substances that can force communication between both sides of this encounter.²⁰ Furthermore, like any megamachine the *Earth* layer is as socially constrained as it is technologically configured, and so there are political economies of Turing machines that are only accessible through misaligned and uneven hierarchies of geography, energy, and programmability.²¹

This is made clear by unpacking and sifting through the hardware on which The Stack depends. Silicon is far from the only important substance required in its manufacturing and maintenance, and the economics of its assembly are far from crystalline. The Stack’s need for more exotic elements is intense, and even relatively mundane consumer electronics and *Cloud* tethers (aka “phones”) contain dozens of different minerals and metals sourced from every continent. Some crucial metals are drawn largely from rich and vulnerable mines in central Africa. In the east of the Democratic Republic of Congo (DRC), for example, big chunks and little pebbles of tantalum (coltan), cassiterite (tin), wolframite (tungsten), and gold are pulled by hand from cold, sludgy mountain rivers, often by children, and eventually they make their way into the device component supply chain.²² In 2009 a few mines here produced 13 percent of the world’s mined coltan, an inert metal used in ubiquitous tiny capacitors, especially for cell phones.²³ From this same land, the Belgians took ivory, the Americans cobalt, and now *billions of Earthlings everywhere carry little bits of Africa around with them in their pockets*. The financial rewards of mining and trading in electronics have contributed to devastating effects in the region, including overlapping civil wars in the DRC and next door in Rwanda (from 1998 to 2003, upward of 5 million people died in the Congolese civil war, making it by one measure the deadliest conflict since World War II).²⁴ Extraction and export of minerals, both legal and illegal, have been controlled and taxed by competing militias and organized crime; away from the relative stability of the cities, these groups continue to terrorize local populations and use the proceeds of this export trade to finance ongoing wars over local territorial positions. The smoldering conflict is a war partially financed with the manufacturing capital of smart phones and laptops; inevitably, the smooth skin of the device demands gore to feed its gloss. Deforestation in the pursuit of new sources of coltan in remote areas populated by gorillas has also led to an increase in the trade and consumption of bush meat, a quasi-cannibal economy

that may also allegorize widespread war crimes in nearby villages. Exported minerals are sent to smelting companies, mostly in China, India, Thailand, and Malaysia, where they are mixed with metals sourced the world over (Australia and Brazil are the other major sources of coltan). More recently, the “conflict minerals” cause has taken its place among other Konyisms, but potentially effective legislation has been passed, including in the United States, that requires electronics manufacturers to better police their own supply chains.²⁵

The most heinous circumstances are the most allegorically rich, but even absent the anarchic brutality of these wars and the Conradian odor of campaigns against them, the lesson is more global: there is no Stack without a vast immolation and involution of the Earth’s mineral cavities. *The Stack terraforms the host planet by drinking and vomiting its elemental juices and spitting up mobile phones.* After its short career as a little computing brick within a larger megamachine, its fate at the dying end of the electronics component life cycle is just as sad. What is called “electronic waste” inverts the process that pulls entropic reserves of metal and oil from the ground and given form, and instead partially disassembles them and reburies them, sometimes a continent away and sometimes right next door. Minerals originally sourced from the Congo might make their way to California via China, before being pulled by hand from a dead phone and burned or buried in Agbogbloshie, Ghana, or Lagos, Nigeria, two of the most active repositories, a short distance from their source.²⁶

18. Geo-graphy and Geoaesthetics

As a transcontinental effect, this digestive cycle can also be seen as a sort of distributed composition, a discontiguous plastic-metallic mega-assemblage remade every day with little molecular bits floating in the light, across the ocean and our lives. To call these flows “compositions” is not to excuse their due ethical weight, but instead to remind ourselves that they are recomposable, and as such, that any sense of inevitability about how they are now arranged today is shortsighted. How unfamiliar could its flux and churn be from what it is now? At the radical end of that contingency, what is the ultimate recomposability of such materials? The answer may depend on how well we can collaborate with synthetic algorithmic intelligence to model the world differently—in other words, thinking takes place in relation to territory, and concepts not only represent the world but also make it according to their situation: diagramming, deforming, drawing and redrawing, and segmenting of the Earth back on itself. We internalize ideas from ground and sky according to whatever perspectives are available (Copernicus, Solaris, Hubble) until like the upside-down spacewalking astronauts, we are dislodged from this reference and given back to the void.

The Stack is not only on the Earth and built out of the Earth; as a composition, it is also a framing of the Earth, and so its geodesign works through its specific sorts of

line-making and putting segments of the world in motion. Elizabeth Grosz develops a philosophical trope of demarcation as an elemental principle of animal world-making. She writes, “The earth can be *infinitely* divided, territorialized, framed. ... Framing is how chaos becomes territory. Framing is the means by which objects are delimited, qualities unleashed and art is made possible.”²⁷ Making enclosure by drawing a segment of the world into a presentation is elementary place-making; it is the gesture of geography. Schmitt would not disagree up to this point. The frame, however, is a peculiar sort of introduction of difference whereby the surface of things appears to fold in on itself. It captures and exhibits its subject curled back on itself by a delineation of figure and ground. Grosz links the act of framing, however, not to the subtractive competition of natural selection but to the multiplicative energy of sexual selection and its economies of display, expenditure, and abundance. In her Darwinian parable, the animal draws territory with its paw, its wing, or song refrain not only to fend off predators but also to stage itself in the view of a mate. She quotes from Deleuze and Félix Guattari’s last collaboration: “Every morning the *Scenopoetes dentirostris*, a bird of the Australian rain forests, cuts leaves, makes them fall to the ground, and turns them over so that the paler internal side contrasts with the earth. In this way it constructs a stage for itself like a ready-made; and directly above, on a creeper or branch, while fluffing its feathers beneath its beak to reveal their yellow roots, it sings a complex song made up from its own notes and, at intervals, those of other birds that it imitates; it is a complete artist.” Beyond what is needed for survival in the moment, this act of self-framing sets the world in motion with a composition that motivates communion. The composability of the Earth is “not linked to some intrinsic relation to one’s own body but exactly the opposite: it is linked to those processes of distancing and the production of a plane of composition that abstracts sensation from the body.” Grosz writes that the frame “is the particular contribution of architecture to the taming of the virtual, the territorialization of the uncontrollable forces of the Earth. It is the frame that ... liberates the qualities of objects or event that come to constitute the substance, the matter.”

Framing lines, separate or conjoined, subdivide the ground or link points together. A plurality of lines, both dividing and linking at once, might fold on itself in various ways and in these overlaps create irregular twisty grids, populated by air pockets of various sizes and identity, inside or outside, enclaves and exclaves. Lines are agents of geopolitical form and their various types (e.g., lines of flight, lines of intensification, lines of transformation and subdivision) curve into the frames that present geopolitics to itself: the border, fenestration, aperture, plan, section, elevation, orifice, capital city, special economic zone, demilitarized zone.²⁸ When the *nomic* line that partitions polities from one another is looped, it too becomes a frame, and as a form of geopolitical design, these arrange and present political geography. For contemporary governance, the simultaneous unwinding and reinforcement of modern jurisdiction, and its fragile pairing of geography and law in mutually validating representational systems, hopes

to organize the world according to certain framings, and it defends its drawings with force. As a *nomic* technique, these generate and enforce jurisdictional conventions and exclude alternatives.²⁹ For example, however inspired or misguided the Mountbatten Plan may have been, the partition of India was a *design decision*, and the image and map of the region that would result was constituent of a specific design imaginary.³⁰ Scaling from one line to a whole system, the looping segmentations of the Westphalian model are bolstered into a geopolitical architecture, as are the sectional planes of our more vertical Stack. This compositional geopolitics has its own history filled with frames and topographies projected variously into the past and future as much as onto real living territory. Especially at the *Interface* layer, we will see that the violence of presentation and preemptive representation—*projection as territory* and *territory as projection*—is the engine of any Stack geopolitics, inherited or invented, at work now or to come later. Again, authority and its authorship can speak only to what it can see and sense, and in turn what it can measure, and so geopolitics and geoscopy are always bound up with one another.³¹ The Stack works within given geographic limits and draws new geographies with those limits. While landscapes have direct physical agency (that is, “geography,” as in “Montesquieu credits the rise of the West to *geographical* advantage, such as not having to govern wide flat expanses such as the Great Steppe”),³² we are as interested in another connotation, per Grosz, one more like *geo-graphy*, as in “earth-writing” or “earth-drawing.” Specifically this *geo-graphy* is both a kind of writing of space and of expressing, communicating, politicizing compositional images of terrain as a precondition of the social and technical construction of spaces to be defended. For there to be any kind of abstract jurisdiction—secular, sacred, national, networked—there has to be a figure of space through which force can work at all. Schmitt’s concept of the *nomos* is one establishment of this, but geography more generally frames the referent over which any governing, compositional, projective frame seeks authority, and here Grosz’s animalian frame becomes a basis of geopolitical constitution. Geography, in this sense, is a specific kind of relationship between world and image, in that it is itself both an image of the world and a real rendering of physical landscape according to that representation. Its force and coherence are based in both the abstract image and the physical world as they refer to one another, and in the course of real politics, by their mutual conjoining into one defensible inscription.³³

This process demonstrates that geography, geoscopy, and geopolitics are also related to the more ambitious and ambiguous operations of *geoaesthetics*. The composability of the Earth, as both figure and ground, mark and canvas, long precedes the global geometries of The Stack, but the latter inevitably still draws on many varied precedent gestures. Scores of ancient geoglyphs dot landscapes on all continents, carved into the skin of the planet or assembled with rocks put in lines for the viewing benefit of aerial audiences: deities, birds, skies, and whatever else might be observing from the top of the world. Landscape is given a face.³⁴ The advent and eventual predominance

of formal agriculture permanently refixed that face's expression, helped to geoengineer the Holocene climate, and with this terraforming also brought the archaic state and urban settlement. If viewed from the sky by the geoglyphs' audiences, agricultural megastriations might allow for a legible index of the accumulating distribution of different genres of biogovernance as distributed across the sphere; that is, different typologies of political form can be interpreted by differences in their physical landscapes viewed as *geo-graphic* drawings. In dialogue with the new externalized perspectives of the space age, this was not lost on art and design, and the very early years of planetary computation and global media (approximately 1964 to 1975) saw an explosion of land art, earthworks, and speculative megastructural architecture. For example, the Italian studios Archizoom and Superstudio made some of the most durable megastructural gestures from inside architectural discourse, while the American artist Robert Smithson left a body of work linking geoglyphic-scale sculpture with generative cinema³⁵ and cartographic semiotics with anarchist geography (his "mapping dislocations").³⁶ In these works, we see visual inscriptions into landscapes and images of those inscriptions blending into the same pottery, such that real drawing into the ground and the image of the drawing can swap places; the land becomes an image and the image becomes territorial, both of them equally infrastructural. This conduction between the two is by no means exclusive to institutional art and design and belongs to computation just as dearly. In 1968 *Apollo 8* astronaut William Anders took the famous "Earthrise" photograph, which would become among the most iconic and influential portraits of the whole planet Earth, and as for any island utopia, the totality of the singular figure of the Earth against a black abyss, here seen from specific external position on the moon, would invite projects of total design.³⁷ This image map from the "outside" reframed the very figurability of territorial ground as such and suggested a single, absolute scale for Earthly culture and ecology and a single planetary "inside."³⁸ That figure inspired as well the popular ecology movement by providing it a self-evident domain to conserve, commune, or administer.

Today, that same apparently same self-evident image of totality also serves as a graphical user interface to personal mapping applications that are based on satellite observations of all locations within the image-territory. Google Earth, for example, is a meta-interface into an archaeological view of the virtual frozen present of a planet comprehensively available to vision, but also largely devoid of animal bodies. It frames an Earth mostly deserted by humans who have left behind empty cities. For Google Earth, both the image and the interface promise an absolute frame; a metaframe of frames and their collaborative geopolitical ambition is derived from that promise. By zooming in and out across relative scales, the global image becomes a total site condition, one for which infrastructure-as-monument is apparently the most appropriate measure of intervention at any given resolution.³⁹ However, the territorial politics of Google, as discussed in the *Cloud* chapter, resides less in what is seen than what is not

seen, and in how the not-seen allows the seen to override other jurisdictional inscriptions and partitions.

19. From Global Surface to Planetary Skin

The Stack's visual geography amplifies economies of mutual simulation between land, image, and interface by redefining the surface of the Earth as a living and governable epidermis, and recomposing that skin as a bio-informational matrix enrolled into other hard and soft systems. As a landscaping machine, The Stack combs and twists settled areas into freshly churned ground, enumerating input and output points and rerendering them as glassy planes of pure logistics. It wraps the globe in wires, making it into a knotty, incomplete ball of glass and copper twine, and also activates the electromagnetic spectrum overhead as another drawing medium, making it visible and interactive, limning the sky with colorful blinking aeroglyphs.⁴⁰ The Stack walls off whole layers of that spectrum for private purposes by optimizing it through finer and finer atmospheric grids, turning location into geolocation and geolocation into application engineering. Its image of infrastructure and the infrastructure of the image flip-flop their respective works, repositioning geoscopy as geoaesthetics and geoaesthetics as geoeconomics. For example, the *Earth* layer also situates a network of telescopes "looking out" into space from many positions at once, so as to create a composite "false" image of a portion of the universe. This technique, known as very long baseline interferometry (VLBI), creates a single discontiguous machine distributed among many countries, useful only if it is operated across multiple time zones at once. As a Stack geographic machine, Google Earth can be thought of as an inverse of VLBI, in that it looks inward instead of outward to create a composite "false" image of the distributed surface of the Earth by integrating the perspectives of multiple orbital satellite perspectives into one (interactive) visual totality. Standing for a global domain drawn in place, this mosaic draws Earth's skin as an island to be measured and mastered. As it builds on the *Apollo 8* image of figure and void, Google Earth amplifies it into a general-purpose application interface through which the *User* layer and *Earth* layer of The Stack seem to inform one another directly.⁴¹ Here the geoaesthetics of Stack *geo-graphy* displays ecology as an archive to be indexed, cataloged, and sorted, and only then acted on (and as discussed in the *Interface* chapter, that archive is also made into an interface toward itself, provoking *User*-initiated feedback loops between icons and events).

Such Stack geographies both complicate and clarify the design of platform sovereignty, as much for what they make possible as for what they disrupt. Google's mission statement, "to organize the world's information and to make it universally accessible and useful," changes meaning when the world itself is seen as *being* information, such that to organize all the information is to organize all the world. Furthermore, synthetic computation expands what is sensed, measured, calculated, communicated,

stored, and worked on. That is, the ascendance of digital computing from a narrowly deployed, elite scientific-military instrument into a general-purpose planetary-scale consumer infrastructure shifting what states (and other systems of governance) can see, know, and affect, transforms it into an organ of organizational cognition. As sensing extends to all specific surfaces, no longer dumb but rather now affective, the net sum of spaces opened up or closed off by computation largely defines what it is that any governance platform now chooses to sense and not to sense in general. The information that is sensible to it is more often than not on the *surfaces* of the territory, intensifying governmental focus on them. Skin, after all, is the largest sensory organ of any animal body, composed of multiple dermal and epidermal layers holding organs together and mediating multiple layers of individual interiority and exteriority (the governance of skin will also figure prominently in the *City* chapter—in that case, urban skins and envelopes).⁴²

The extrapolation of planetary surfaces as epidermis has been inextricably linked with the conceptualization of climatic measurement and prediction. Global climate and weather systems have long been a driving application for planetary instrumentation and the understanding of the globe as a “vast machine.”⁴³ The interdependence between the image of infrastructure and the infrastructure of the interfacial image is exemplified as the systems logic of a geographic, bio-informational, planetary-scale epidermal sensing and computation megastructure by—who else?—the Planetary Skin Institute. For this project, the living and breathing geoepidermis is surveyed through a proposed meta-instrumentation of the biosphere into a totally available archived present, open to interested intervention, collaborative management, and quantified governance. Originally launched cooperatively in 2009 by the National Aeronautics and Space Administration (NASA) and Cisco Systems, and now an independent non-profit research and development platform, Planetary Skin sought to integrate data from many sources into a single, branded geoadministrative mechanism. An internal Cisco white paper describes Planetary Skin as “an open network platform for real-time, highly distributed mass remote sensing, authentication, risk-profiling, certification and monitoring of carbon stocks and flows that generates trust and enables collaboration between actors in all three sectors (industry, government, academia).” Its ultimate ambition is to provide an open and comprehensive multiconstituent platform for monitoring and governing planetary biological-ecological systems, with particular emphasis on water distribution and carbon quantification (ultimately to support pricing of these reserve currencies, we imagine). One early pilot project, Rainforest Skin, would measure the total quantity of carbon contained within the planet’s rain forests, perhaps the most immediately leverageable carbon governance opportunity and where carbon dioxide sinks are concentrated but threatened by land misuse. The project would combine data sets drawn from “geo-referenced satellites, unmanned aerial vehicles and multiple ground based sensor networks to estimate the forest’s carbon stock

and flow dynamics, so as to allow for trading and risk management of this new commodity.”⁴⁴ Stack-scale initiatives such as Planetary Skin (and there are many others) certainly qualify as frames in Grosz’s sense, as they frame the totality of Earth at once so as to identify and track strategic chemical subroutines, such as carbon flows, and to present these totalities back to the whole. This sort of speculative megacomputation is but one way that geoscopy, geography, and geopolitics blur and blend into amalgamated images, territories, and governmental techniques and is but one way that The Stack composes the *Earth* layer.

The Planetary Skin Institute’s tagline, “You can’t monitor what you can’t measure,” is a good motto for the big data society, should it ever be clarified at some point in the process who is and isn’t “you.” As Planetary Skin describes its plans, “you” are likely drawn from among the usual stakeholders of technocrats, academics, nongovernmental organizations, consultants, and so on.⁴⁵ The likely effect of this initiative, however, were it or something like it ever fully realized, would not merely extend or consolidate the arrangement of zero-sum governance as we currently know it, but would inevitably introduce other compound subjects and objects, some human and some not, and elevate them from object to subject in uncertain ways. A benefit of these initiatives would not only be the quantification of a status quo, but ultimately to break ground for alternative norms and constitute (or at least support) another *medium of governance* over the biosystems that it (“we”) can measure and monitor. “Planetary Skin,” or some similar descendant platform might connect with existing governmental and nongovernmental biopolitical authorities, supporting, augmenting, superseding them and, through ecumenical platform interoperability, would ultimately become itself a governing authority. Through neutral simulation-visualization of ground-level patterns on which any large-scale carbon trading markets would depend, a platform like this could quantify the carbon stocks that might be traded or sequestered, as well as validate treaty verifications or violations. This would help turn matter into money by providing a kind of financial transparency—in this case, of financialized molecules. Like many other platform projects emblematic of the Stack’s incorporation of the Earth as a layer, it would convene political authority not by starting from scratch, but by remeasuring, reframing, and reinstrumentalizing some already existing geographic whole. They generate comprehensive quantifications of processes and patterns that, to the extent that they operate as intended, also take on the effective force of law within an expanded ecopolitical jurisdiction even if their claims are not ratified by states (Westphalian or post-Westphalian) to do so. Furthermore, as these metatechnologies of ecological observation have become necessary to even perceive the contours of ecological risk, they also enter directly into the programmatic center of planetary governance as such. This is not Internationalism, however. The force of platforms is different, for example, from the “ecoglobalism” feared by conspiratorial isolationists, all spittle-lipped over “Agenda 21” (the conspiracy theory that has the United Nations introducing Green

totalitarianism through the Trojan horse of bicycle lanes) in that there is, according to design at least, no central commanding body outside the architecture of the platform itself.⁴⁶ Such platforms, in principle, may even work, for better or worse, to undermine forms of political centralization, even those that they themselves do not or cannot calculate or articulate. That said, nothing is certain. A transference of sovereignty from the declared self-interest of whoever counts as a citizen into the calculation of carbon and energy also links one inhale and another exhale, even across continents, and in doing so guarantees at the very least indecipherable accounting paradoxes.

Computation is training governance to see the world as it does and to be blind like it is. If, over time, something sees for the state, on behalf of the state and in place of the state, it does so by seeing as a state, or by seeing as something the state has not yet become but would become once it's trained by these same new tools of perception and blindness. As the state involves new techniques into itself, those techniques also absorb, displace, and diminish the state by controlling access to unique jurisdictions that the state cannot otherwise possibly comprehend without their help. While it extends jurisdictionality, The Stack also confiscates and multiplies it. It doesn't merely accelerate or open up governance as currently configured; it invents substitutions as alternate jurisdictions appear, linking cellular biology to computational geopolitics, some enduring for seconds, others perhaps for many centuries. Macroscopic platforms such as Planetary Skin frame Earth as a competitive archive sorted into a quantifiable past, an atemporal surficial now, and predictive virtualizations of its futures from which models and simulations, its preferred instruments of governance, can be derived. Through these, opacity and privacy are redefined by a spectacle of transparency, as the platform's authority is based on the quantity and quality of its data and from the means to translate that stash into simulations of error-corrected pasts, presents, and futures. From Cisco, NASA, Google, and others, data are available for free or on a subscription basis and provided with an invitation to innovate vertical markets with their tools, because geoepidermal megastructures such as these realize their political value through the immediate and potential events they can sense and their economic value through the currencies they can verify for their *Users*, and so they are themselves dependent on enabling *Users* to actively engage platform interfaces and to act back on the materials they represent. Platforms are machines as well as maps (an "engine, not a camera").⁴⁷ They are media with which to compose things not just to measure them, and so the slogan "You can't monitor what you can't measure" may need to be revised to include the Foucauldian line, "You can't *modify* what you can't monitor," or even, "You can't *not* modify whatever it is that you sense."

Today this and other geoscopic situations are provided to us by Stack infrastructures of orbiting satellites—artificial constellations—connected to terrestrial networks. Instrumenting the planet in this way has not only allowed for a more finely grained

geography; it has also physically altered the very scale of the Earth's gradient body, altering what it measures as the Holocene atmospheric membrane has been augmented by a crust of smart satellites and dumb garbage. The planet's natural equatorial diameter is roughly 12,756 kilometers, and if one were to include the celestial atmospheric firmament, that would be nearer to 13,000 kilometers. However the ring of communications technologies, in geosynchronous orbit every twenty-four hours, linking points on Earth's surface to one another and self-locating the whole sphere in its lonely void, forms another outer membrane extending the measurement to 36,000 kilometers. Are they not also part of Earth's body? As a whole, satellite observation technology has vastly inflated the physical geometrics of the observed planet, but it has compressed the conceptual spaces of relative distance as well. As surely as The Stack generates new spaces, does it also ensure a certain erasure of other worlds? This is, as noted, a common refrain for critiques of modernity, from both Right and Left, and Virilio has written scores of texts providing a negative apologetics of globalization and the subsumption of the continuity of the Earth into the omnivorous universalisms of cyberinfrastructure. For his eschatology, the "world" is a tragic casualty of its appearance in digital images of itself.⁴⁸ It cannot survive this manner of testimony. It is shrunken, eaten, defamed by its reduction to a plateau of digitalized time. Whereas difference and analogy are naturally functions of distance, in the instantaneousness of global information the landscape of distances has collapsed, and so for Virilio digital space is *dark matter*, one that instead of expanding and elongating real distances instead flattens the space of analogy into the simultaneity of network time. There are other, and better, judgments of these accelerations, displacements, elongations, migrations, vectors, lines, and links. Can they be drawn without replicating the terms of reduction that any truly living image would need to escape? Is this what is most starkly absent from Google Earth's transformation of the map into the *Interface*? In that the diagrams and visualizations of the networked totality are also, to varying degrees, *cosmograms* (figures of the whole of the universe and Earthly situation), what intrinsic violence does the speed of interactivity do to the depth or depthlessness of the global space that it models? What can we do with these pictures of the data that the world *secretes*, and what do they want from us ultimately? These questions are themselves some of the productive accidents of the *Earth* layer of The Stack.

The technologies we use to measure and monitor the Earth have increased the objective scale of the planet and have shown us real pictures of the cosmic abyss that might (should) crack open our little primate skulls, but in doing so have also collapsed the phenomenal scale of our sense of habitat. In its paired world-making and world-erasure projects, the *Earth* layer of The Stack will have introduced equal measures of numinous insight and atonal banality.⁴⁹ Our argument, however, is that like the turn away from geocentrism and toward heliocentrism (still very much an incomplete turn for the superstitious norms of humanist geopolitics), the platformization of the *Earth* layer

will, in net sum, provide for greater “worlds” than it erases. That said, the design program ahead is full of twists and turns.

20. Smart Grid: Ouroboros

As biological economies are dependent on energy economies, so biopolitics is dependent on the polities of energy.⁵⁰ Projects like Planetary Skin attempt to ensure one sort of compatibility between energy and biology by modeling their computational equivalence. Not only is carbon priced according to its negative costs, but the chemistry of life-forms that absorb carbon dioxide and ameliorate those costs is quantified and qualified as a valuable “service.” Rainforests, mangroves, and sea grasses eat the gaseous excrement of industrialization, and for this they and their legal custodians are perhaps due rent. Geophysics itself is thus made into a form of material labor, and its surpluses are enumerated, invested, exchanged, collateralized. But the *Earth* layer is not only where energy is monitored; it also the source and provisioner of the brute energy to run the other layers of The Stack; it is the bedrock stratum where energy economies produce the networkable electrons necessary to animate the machines above, fabricated in steel, cement, plastic, silicon, and flesh. Regardless of its source (solar, nuclear, compressed natural gas, wind, hydrothermal, coal) or the network architecture of its industrial generation and distribution (from massively centralized, like a nuclear fission power plant, to informal and decentralized, like an off-the-grid solar panel cluster), energy dictates the variability of human settlements and their ultimate risks, costs, and benefits. Our design interest therefore is not aligned with a notional sustainability conceived as conservative homeostasis, but with the force routes of a disequilibrium that reverberate through matter and transform the world in creative rhythms, slow and fast, including especially its plastics and fleshes.

The *Cloud* layer, just above the *Earth* layer in The Stack, makes epic, rapidly expanding energy demands (the total carbon footprint of the world’s data centers has already surpassed that of the airline industry and is presumed to triple by 2020), and so risk is not hard to find. Data centers are located to mitigate cost and uncertainty, away from likely natural disasters, in proximity of cheap or clean energy sources, diverse power grid interconnects, favorable land use zoning, and inexpensive intermediate bandwidth, for example.⁵¹ Because there is no planetary computational economy that is not first a planetary energy economy, the limits to growth for The Stack are not only Moore’s law and Shannon’s law (accelerating the speed of processors and squeezing more information into existing channels) but also, and perhaps foremost, to secure the energy necessary to power those data centers, smart cities, homes, cars, roads, smart objects, and phones, as well as the real costs (or benefits) of doing so at the expense of other infrastructure, like new roads and buildings.⁵² In principle, there is a potentially virtuous correlation at work for innovation across computation and energy sectors,

and the gamble on that potential is another generative accident of the *Earth* layer. The continuing growth of The Stack and the computationally intensive transformation of energy sourcing and distribution infrastructures on which it depends likely cannot occur without one another. The architectures of new energy-information networks, including so-called smart grids, require pervasive computational systems to realize necessary gains in the timely, efficient, and equitable distribution of megawatts of energy across networks. For this, each point in the grid that might produce or consume energy, which is in principle pretty much anywhere and anyone, must not only be able to store or transmit that energy, but also to calculate and communicate its activities to platforms that steer the whole. All electrons must pass through the angelic regime of recording and optimization, but today such grids are slow to come online.⁵³ Their politics are filled with inertia and gamesmanship, and, moreover, the underlying physics is uncooperative; electrons do not work “like bits” no matter what your smart city consultants are saying. At the same time, The Stack itself depends on new energy grids to feed and undergird its growth. It requires a conjoined-twin energy-information network that can generate, calculate, and allocate those usable electrons point-to-point. Absent a radical relaxation of energy scarcity by renewable sources, the finely grained electron sorting between points of production and consumption must be realized at global scale or the growth of planetary-scale computation will hit physical energy limits and will stall.⁵⁴ A more scalable grid of electrons needs to be wrapped inside and around The Stack’s *Earth* layer. In short, planetary-scale computation needs smart grids to grow, and for smart grids to grow, they need more ubiquitous computation. The computational future of energy and the infrastructural program of computation form such a coil, one end feeding on the other like Ouroboros, the ancient symbol of a snake eating its own tail.

Whether or not the risks associated with the energy costs of Stack infrastructure will outpace the efficiencies provided by calculative technologies as they become pervasive across industrial sectors is unknown, and probably unknowable at the moment. Prognostications vary from measured good news to very bad news. According to a Greenpeace report on cloud computing and climate change, the electricity consumed by cloud computing globally will increase from 632 billion kilowatt-hours (0.6 terawatts) in 2007 to 1,963 billion kilowatt-hours (1.9 terawatts) by 2020, and the associated carbon dioxide equivalent emissions would reach 1.034 megatons (currently the world economy’s total energy appetite is roughly 15 terawatts). If imagined as an emergent nation-state, the *Cloud* would be today the fifth largest consumer of electricity, ahead of India, Germany, Canada, France, Brazil, and the United Kingdom. But even this doesn’t fully capture the climatic and ecological impact of planetary computation.

The extraction of mineral resources to manufacture and dispose of devices and hardware can be extremely destructive in its own right. For their part, data centers are estimated to represent only 20 percent of the information computing technologies (ICT)

sector's total footprint by 2020, while telecoms infrastructure, PCs and peripherals, will represent much more. While the shift toward *Cloud* platforms represents efficiencies over "dead tree media" and perhaps will ultimately reduce reliance on air travel, it also enables an exponential growth in data flotsam, such as search histories, redundant personal media, legally mandated trails of sales receipts, unfiltered spam, backups of the trails of spam and search, and so on, all of which need to be stored somewhere, and it is now stored online in various databases here and there. Sometime in the future, this *Cloud* landfill of postcontemporary data junk may provide new insights for digital humanities as to the real nature of global discourse (or existential clues for a future artificial intelligence, itself born of spam perhaps,⁵⁵ seeking out the meaning of its origin), but until then, it is just more carbon debt. It is estimated that the electricity required to send the trillions of spam e-mails worldwide each year is equivalent to powering 2 million American homes and generates the same amount of greenhouse gases as 3 million cars. But the *Cloud* layer is not uniform, and how it affects the *Earth* layer depends on where it is buried. It matters where data centers are located because the available energy mix ranges from dirty fossil fuels to robust renewables sources (Hong Kong hosts one of the dirtiest clouds, while Iceland and Sweden are among the cleanest, and so Iceland has made *Cloud* hosting a key part of its national industrial strategy). In the United States, many of the largest data centers (such as Google's in Lenoir, North Carolina, Yahoo's in La Vista, Nebraska, Microsoft's in Chicago and Apple's in Apple, North Carolina) are, as of this writing, all at least 50 percent coal powered.⁵⁶ The incentives to introduce greater energy efficiencies in data centers and to reduce operating costs thereby are considerable, and they represent critical competitive advantages for different *Cloud* platform players, as will be discussed further in the following chapter. Nevertheless, without significant gains in energy and carbon efficiency (and cost), it may be too expensive for the *Cloud* to "grow" beyond certain thresholds. If so, then less assured paths of innovation will ensue, many of which may further distort infrastructural access between the global North and South.

Even if all goes well, the emergent mega-infrastructure of The Stack is, as a whole, perhaps the hungriest thing in the world, and the consequences of its realization may destroy its own foundation. If growth estimates are correct (or, worse, if they are too modest), then the collective project of constructing The Stack may tip toward an equally comprehensive and self-amplifying exhaustion of resources and systemic collapse. That is the bad scenario, but it is not the only one. The Stack not only consumes energy; it also mediates it and rationalizes its metabolic distribution. As said, energy is not just the driver of The Stack; it is also one of the things that The Stack computes. Energy, regardless of its source, is not likely consumed at the site of its capture, but is instead shuttled around a regional-scale network of production, storage, transmission, distribution, and metering, and in many cases this network is startlingly inefficient.

"Electricity generation currently accounts for 57% of India's total carbon emissions and will continue to do so until 2020. India's power network is highly inefficient and much of the generated electricity is wasted. The lack of transparency in the grid makes losses difficult to measure, but it is estimated that in 2007 India lost 32% of total generation."⁵⁷ For an economy of 1 billion people, *one-third* of the energy generated was lost in relay. That kind of signal-to-noise ratio cannot scale. To intervene, hardware consultants and equipment providers evangelize whole-cloth new grids, brought under the larger rubric of centralized information networks, such that grids for electrical "packets" working like grids for information packets would realize an "Internet of energy." Even though to date ecstatic marketing visions far outpace reality, under the right pressure, incentive, and circumstance, and with enough patience, that may not remain true.⁵⁸

Such energy-information networks (however theoretical or actual they may be at the time you read this book) are central to how the *Earth* layer functions within The Stack. They are also themselves designed as software-hardware platforms that can in principle reduce infrastructural costs and risks, which for some is earned through greater transparency and resilient decentralization and for others by greater centralization and system optimization. In principle, such grids can reduce peak demand crises through better energy storage, making the use of renewables for baseload energy more feasible, while also monitoring use through platform-standard metering making energy markets more liquid, resilient, accountable, and predictable. This may help to undistort market pricing of ecologically expensive energy use as well as the means to mitigate some of its associated risks—in theory, that is. For The Stack, this may allow for the production and consumption of flows of energy that are simple, omnidirectional, and ubiquitous. Any activity that generates more energy than it uses to sustain itself could invest that surplus into a vast metabolic *agora* where it powers and animates distant and complex projects, its muscular and cellular force captured, stored, and routed to where it can best collaborate with other aggregated exertions to power another unknown project. *Yes, you are a battery.* Our most visionary plots have the Stack's carbon footprint measured not in debt but in surplus, and likely in our lifetimes or not, the geopolitics of a postscarcity *Earth* layer is worth articulating and defending as an ideal.

In the meantime, we note that many of the most important positive potential effects of ubiquitous computationally intensive, point-to-point energy flows are on "non-Stack" industries. The Climate Group's *Smart2020: Enabling the Low Carbon Economy in the Information Age* report issues confident, sunny scenarios for carbon savings from ICT in five critical areas: smart grids, transportation, dematerialization, buildings, and information management. The key interventions include the more nimble transmission grids as discussed above, distributed energy storage systems, congestion pricing, vehicle-to-grid charging and energy storage, teleconferencing, desktop virtualization,

building and facility management, fine-grain metering, and supply chain and logistical optimization. The conclusion of the report is that if ICT is more deeply integrated into the fabric of industrial economies, especially in China and India, it would realize a total carbon savings that is five times greater than the sector's direct footprint based on projected growth (ICT's direct footprint is estimated to be 1.4 GtCO₂e in 2020, but the total ICT-enabled abatement is estimated to be a savings of 7.9 GtCO₂e). According to this model, we cannot afford *not* to accelerate the construction of The Stack. This is the conundrum into which we are thrown: *Can The Stack be built fast enough to save us from the costs of building The Stack?*

The *Earth* layer of The Stack is defined by this risk, also perhaps its most critical (and paradoxical) measurement and prediction challenge: the energy costs of planetary-scale computation on one side of the scale versus the energy savings of Internet on the other, the latter either rescuing us from the former or instead guaranteeing a catastrophe already underway. We may conclude that investment must be accelerated so that the costs of building The Stack do not sink the whole enterprise of industrial civilization, but if the energy and carbon costs of The Stack are too great to pay for the construction of the new grids, then the new grids cannot save us from the effects of those same costs. The Stack is in a race against its own physics, like a long-distance spaceship that must carry a prohibitive excess of fuel just to push the weight of that prohibitive excess of fuel.⁵⁹ If disaster calls, The Stack would also itself be a causality of its own potentially disastrous impacts. Its own machines and materials are also vulnerable to the foreseeable and unforeseeable disruptions brought by the climate change that its own appetite would exacerbate and ensure. "The rainfall from Typhoon Morakot caused rivers to flood in Taiwan flushing large volumes of sediment into the ocean. This led to several submarine landslides which broke at least nine communications cables 4000m down. It disrupted the Internet and telecommunications between Taiwan, China, Hong Kong and other parts of Southeast Asia"⁶⁰ Flooded data centers and compromised undersea cables can knock out whole networks, which is especially concerning when you realize that "over 95% of global communications traffic is handled by just 1 million km of undersea fiber-optic cable. Rising sea levels increase the risk of flooding of coastal cable facilities and may also affect the stability of the seabed, making cables even more vulnerable." The really smart grid is the one that still works once the climatic effects of its construction come back to bite. In the composition of The Stack, we are conducting an experimental live-fire exercise on its *Earth* layer. Will the armature of The Stack organize a resilient computational geopolitics, or will its own energy thirst, ecological impact, and toxic production footprint finally overwhelm all, leaving behind elaborate labyrinthine ruins? Will planetary-scale computing prove to be, in some guise, the metaplatform of an alternative counterindustrialization, full of effervescent interfaces of metabolic exchange, or instead will it be the final machine, drawing us into its self-immolation?

21. Sensing and Sovereignty; Polities of Supply and Effect

This risk is not equally shared, and political geography is also redrawn in the image of that unevenness, as sensor and sensed and cause and effect each become leverageable sovereign positions. In that governance is bound and determined by how its means allow it to see, measure, and organize its domains, the systems that mediate governance bind them to it just as it is bound by them. Nowhere is this truer than in the computational governance of ecologies, particularly for computational megaprojects such as Planetary Skin, but with the adoption of new media of observation and measurement come new complications. Is sovereignty primarily for the measurement or for the measured? The referent or the referred to? Who owns the data that all these nodes will be generating about themselves and their *Users*?⁶¹ The answer will not only reflect sovereign claims; it can also generate them. For example, between the Himalayas and the Karakoram, near the slippery boundary between India and Pakistan, both governments as well as nongovernmental organizations, have planted a sizable number of sensors to detect ice temperatures, water flow, and other telltale effects of climate change. In these areas, formal and informal borders are unclear and move as the landscape shifts. Fresh-water pathways vital to down-mountain settlements also shift, and flows that start on one side of the line may flow into the other. As development researcher, Sally Daultrey, observes the inscription of sensor grids and the flows of data they generate become active participants in these shifts.⁶² India and Pakistan are largely unwilling to share the data they capture with one another and thus create a secondary border between their data sets. The very placement of sensors in certain locations and the control of the data generated by them become a way to claim some of the always shifting terrain from their rival, not only through the installation outpost sensor hardware, but in the claiming of the virtual profile of water or air that a sensor can sense. In other words, it is not only that when the sensor drifts with the ice pack into the sovereign territory of one of the countries, then the data it produces now belong to that country, but also that wherever one country's sensor drifts into an ambiguous or contested new location, producing data about that location, then that location itself becomes that country's own because its sensor is measuring and enumerating that site. Here the state "takes" the territory that it is capable of sensing, as the data generate and guarantee a sovereign claim as much as (in this case, more than) the sovereign claim guarantees the right to install a sensor and capture data.

Sensing begets sovereignty over the site that is sensed, except of course when it is does not. Recently China asked foreign embassies in Beijing and consulates in Shanghai to stop taking and reporting their own weather and air quality readings and asserted an exclusive right to acquire and report that information.⁶³ In this case, while the site of a diplomatic embassy might be recognized as the sovereign satellite domain of another country, the *Earth* on which and in which it is situated is not; and neither is the weather

that pours down on it. Similarly in the United States, particularly in dry western states, the issue of “rainwater harvesting” by individual parties is extremely contentious. State and federal authorities intervene to protect the interests of downstream residents who rely on access to a legally guaranteed flow versus upstream ranchers who wish to capture the water that falls on their land for their own use. Those upstream claim that “the state is stealing the rain,” while downstreamers claim that those living upstream are “privatizing the weather.” Under certain conditions, state management of an ecology might be seen as an injustice, whereas in others, the injustice is the absence of governmental intervention, though sometimes the terms of that ungovernance take unexpected forms. James Hansen, the former director of NASA’s Goddard Institute, who has done as much as anyone else to clarify our climatic precariousness, also helped guide a lawsuit based on the public trust doctrine, and inspired in part by the sixth-century Byzantine rule of Justinian I. That doctrine stipulates “that common resources like water and air are held in trust by the government for future generations” and that they must make good on this charge.⁶⁴ The claim of the suit is that the federal government’s failure to suppress climate change is a dereliction of its essential sovereign duty and must be corrected as such. Another speculative alternative is Amy Balkin’s Public Smog project, which seeks to transform discrete volumes of the air above into new public parks through the issuance of emissions offsets. Maneuvers and innovations such as these may seem odd, but they may also represent a critical path of design intervention into the unstable geopolitical architectures of the *Earth* layer of The Stack. Wilsonian internationalist mechanisms have had a far too limited ability to enact and enforce effective solutions, as Hu and Obama’s flimsy “compromise” at the Intergovernmental Panel on Climate Change (IPCC) talks in Copenhagen in 2008 exemplify. Planetary Skin’s central bank for carbon could not rush in and save that particular day, as the essential problems of measuring a carbon economy (Who, how, when, where, why?) would require the most powerful national economies to disclose and share sovereign information about their industrial empires in ways that interested neither of the two most powerful prisoners in this particular dilemma.⁶⁵ We are left knowing both that impending ecological calamity represents perhaps the most significant challenge to the very premise of governance that we face today, and also that the Westphalian-looped state is a dangerously awkward sovereign unit with which to assemble an effective quorum. The Stack’s own mitigation program must also look elsewhere.

We anticipate that with the ongoing convergence of planetary-scale computation with ecological governance, alternative jurisdictional forms will come to augment national domains and may, in crucial ways, have greater importance for those who live within those domains and circumstances than national identity. The alternative sovereignties that they bequeath (or rent) may simply matter more to important outcomes, but the appearance of any such geographies requires new frames, procedural alliances, and counterintuitive techniques. Like species that fill a new niche after an ecological

shift, new ecojurisdictions and their unorthodox spaces and organs are more likely to appear in direct response to an emergency situation than through any parliamentary deliberation. The latter may retroactively codify the former, but is unlikely to first introduce them. According to Schmitt, the *state of emergency* provides the generative exception (and sometimes vice versa), and as it draws eccentric lines, it forces positions to be taken in relation to them. But these “emergencies” should be understood in both senses of the word: first as a crisis for which conventional understandings and instruments are inadequate and therefore require or justify unconventional measures, and second as moments of the *emergence* of something that was genuinely and qualitatively not there before. For ecojurisdictions, these emerge around both the production of energy and the effects of that production. We see this already in the divided constituencies and alliances represented at the IPCC climate talks. Large oil- and gas-producing countries share certain interests in ecological governance, or in its prevention, that cut across ideology and continental location, whereas countries whose landscapes serve as important carbon sinks also seek common cause, as do those whose circumstance puts them at shared risks for particular kinds of disaster. Shared ecogeographic interests can matter more than party lines when the transversal economic solidarities of energy production, and its consequences, come to outweigh cartographic, historical, or ethnic proximity.

First, we see subdivided energy polities bound by the kinds of energy that they produce and the specific demands of a particular process of extraction. Behind the slow crawl of petrocitizens, will there be something like an OPEC (Organization for the Petroleum Exporting Countries) for solar-, wind-, and geothermal-producing regions around the world? Would that be a consolidation of interests linking, for example, Japan, Iceland, and geothermal powers to leverage how that energy source is enumerated and calculated as a carbon currency or debt relief mechanism within a larger ecological economics? We strongly suspect that they would rely on different math from that offered by say, the oil geopolity convened under the flags of Saudi Arabia, Venezuela, and Texas. As part of a team commissioned by the European Commission, AMO (the research wing of Koolhaas’s OMA architectural studio) proposed a new map of Europe (now “Eneropa”) based on a similar conjecture. In their map, different areas of Europe are redrawn such that Spain, France, and Sweden give way to the new regions of Solaria, the Tidal States, and Geothermia, respectively.⁶⁶ However, perhaps instead of new federalisms, even discontiguous ones based on energy production, might we see instead see a fragmenting of geographies down into superlocal finely grained bi-regional localities linked through the much more nimble sensing and calculating tools now at our disposal? Why start with the blunt brush of the latitudinal state scale? Why not instead thousands, or tens of thousands, of smaller compu-ecological microjurisdictions, some stable and others lasting only a season or two, many overlapping and interweaving like the imaginary lines that try to keep Indian ice out of Pakistani data

sets? But if so, how do they enforce their varied interests? Whereas bioregions recognize the primacy of grounded situation, changing climates, like the *Cloud*, do not.

At the same time, coalitions of producers can't represent those bearing the brunt of global energy use. Ecopolities of those affected are equally important as polities of producers, and we already see them emerging by emergency. In the wake of Hurricane Sandy, New York City introduced a system of zones that differentiated proximity to rising coastal water vulnerability. Citizens living in zone A or zone B might be required to evacuate at different times and might be recognized for different rights of return from those not occupying the same block-by-block micropolity. In this case, the tactical invention of emergency ecojurisdictions as a governing geographical superimposition could not be clearer. As the emergencies that give rise to these inventions become less isolated incidents, these initially temporary jurisdictions become increasingly permanent, and the provisionality of the exception becomes normalized and concretized into a new territory that comes to make demands on its neighbors and citizens. For example, the Alliance of Small Island States emerged during the Kyoto Protocol discussions to represent the interests of low-lying nations that would be most egregiously affected by raising sea levels. The federation of (not exclusively) islands is spread across the world, concentrated along the equatorial belt, and has proven a formidable aggregate voice in global climate talks. Perhaps as well we will see an alliance of those threatened by desertification, or a federation of agricultural regions overrun by migrating insects, or, equally likely, a league of those who, in warmer subpolar regions, will become new agricultural powers, such as Russia and Canada.

These kinds of ecojurisdictions arise out of circumstances that may persist for generations to come, but the form they take at different geographical scales and their varying ability to demand and defend claims are heterogeneous and asymmetrical. It would seem unlikely therefore that these quasi-sovereign forms will congeal into one master format as regular as the Westphalian-looped state, and so the rights, claims, and forms of identities that different groups are likely to claim will remain diverse, contradictory, and unevenly effective. At the same time, emergency is as emergency does. Ecological instability remaps self-interest and geopolitical multipolarity in strange ways, and in some cases, the claims of those affected are truly existential, such as for "drowning nations" such as the Marshall Islands, Tuvalu, Maldives, and Kiribati. The international law questions provoked by their possible erasure from the surface of the planet are stunning and even bizarre, and no existing legal framework is well suited to answering them.⁶⁷ If the entire land of a nation is permanently drowned, is it still a nation? Do former inhabitants still possess even fishing rights in the waters now on top of their homeland? What about the right to issue currency or passport? "Environmental migrant" is not a globally recognized legal category of refugee today, though it likely will be, but for whatever nation takes them in, what form of citizenship do the displaced retain? What effective sovereignties (e.g., monetary, legal, geographic) does the

state that once represented them (or still does) retain in relation to those offered by their new hosts? Do countries that take in persons permanently displaced by climate change get land, water, and commerce rights in return? The exceptions that necessitate similar improvisations regarding sovereign geographies now scrambled by rapid ecological change will only get more painful, and the solutions only more convoluted and violent. Among the apparently uncomputable accidents of The Stack are the ghost sovereignties of the swelling Pacific, even as they exemplify the most critical geopolitical design questions now set in motion by and for its *Earth* layer.

22. Designing for versus Designing with Emergencies

Many of those design questions can be evaluated only by first evaluating the different positions in which they would situate the designer. There is a world of difference between designing for, against, or with these conflicts; as often as not, attempting one thing may result in an opposite outcome. The *Earth* layer is held in place by both an absolutist interest in computational transparency and the debilitating contradictions and ultimate impossibility of that transparency. Telescoping between planetary and atomic scales, The Stack introduces synthetic computation deep down, deep up, and deep into abyssal scales of intricate matter. That introduction can begin with the provision of an *Address* that allows a location to communicate data across scales, and that addressability may or may not be motivated by, for example, an avaricious splitting open of the world, from the atmosphere to the atom, toward a mandate of full-spectrum dominance. But programs for total capture are also vulnerable to their own comprehensiveness. Their interconnectedness can make them brittle.⁶⁸ The Stack works by vertical integration, across scales and across technological genres. This allows it to function as a core platform for multiple economies at once and to provide universal valuation and exchangeability only to the extent that participants can be represented as similar computational events. Because of this, it can also absorb, dissipate, and deflect forms of risk that might make any one layer more vulnerable, but at the same time, that integration can also distribute and amplify destabilizing forces and factors. This is not a bug; it is axiomatic of platform logics. In the constitution of a durable order through a hyperlinking of earthly energies and forms—things, people, words, cells, molecules—we recognize that this order can and will also be the generator of the disorder that it hopes to regulate. Philosopher Brian Massumi writes, “The figure of today’s threat is the suddenly erupting, locally self-organizing, systemically, self-amplifying threat of large scale disruption. The form of threat, fed by instability and metastability, is not only indiscriminate, it is also indiscriminable; it is indistinguishable from the general environment.” The rough bargain of the universal platform, and of full-spectrum governmentality, is that the systemic feedback loops that give the structure life can also be dangerous or even fatal to the whole. For systems that link across scales,

small events can quickly and unexpectedly scale up to threaten much larger processes, and supercomputing systems in particular not only provide no guarantee that they can contain those amplifying eruptions, they can easily magnify and intensify them. Besides rolling and interlocking component failure, the circularity of this infrastructural vulnerability is also the path by which the program of absolute transparency and computational omniscience comes to defeat itself by infinite regress.

Some years ago I was at a panel with HP research scientist Stanley Williams, who recounted a remarkable assignment he once had. He was part of a group of computer scientists who had been asked by the US Department of Energy to propose an architecture for a computer that would be capable of a high fidelity predictive simulation of the entire planetary climate, and of monitoring and simulating the entire planetary climate in real time. The group concluded that such a machine would require zettaflop computing, that is, a system capable of 10^{21} floating-point operations per second. At the time, the fastest supercomputers were measured in petaflops (10^{15}); on-tap exaflops (10^{18}) are still years away. Williams discussed how it is possible that zettaflop computing would demand a very different processing architecture from one based on silicon transistors and might instead be based on photonics and nanoswitches hybridized with silicon to increase performance without loss of volume and power. He spoke of layers and layers of nanoscale wiring weaving into dense synaptic computing fields. Could it be done? Somewhat anticlimactically, Williams also shared the conclusion of the group's report: based on current technology technology, the necessary specifications would mean that the computer would not only be roughly the size of Paris, but it would consume so much energy that it would be the single most significant anthropogenic climatic event that it itself would be modeling! Short of fundamental breakthroughs, his anecdote underscores the paradoxical recursivity that undergirds the demand for global ecological omniscience, especially for an accidental megastructure such as The Stack.⁶⁹

With the promise of eruptive emergencies in mind, as well as Williams's figure of a megamachine eaten by its own image of the world as it tries in vain to source enough power to measure and simulate its own power consumption, how then should we think about design in relation to Stack emergencies and emergences? Remember that for our discussion of Schmitt, the exception draws an exemplary space that exists both inside and outside the law at once. It is where authority is absolute but derived less from normal law than from the sovereign decision both granting and granted by the state of emergency, one taken ostensibly to protect the framework of law that it itself supersedes. In relation to this, design must be genuinely suspicious of remedies that valorize the amelioration of symptoms. States of emergency often begin as a "temporary measure"—precaution, pilot program, protective custody, probation, prototype—but over time, through both political shift and in the normalization that appears through a design's ingenious accommodations of the emergency, the exception becomes the

rule, and the rule becomes the rule of law because it is now seen as the normal shape of things. In the face of emergencies, design is asked to provide adaptation for those negatively affected and to give form to accommodation such that a sovereign decision would not be fundamentally threatened by the emergency that it has called into being. Design's job too often is to reform the emergency, so that over time, the exception sheds its temporary and provisional character as its effects settle out.

Consider the stakes for what this enables and prevents. Among Isamu Noguchi's most heartfelt projects, but not best known, is a series of schools, playgrounds and meeting halls he designed for the Japanese American internment camp at Poston, California, during World War II. As Bruna Mori writes, Noguchi feared that those camps would be permanent. He presumed that the emergency was perhaps not a temporary episode but the new state of affairs for his friends and extended family. As such, the camps would demand more careful design to make them as livable as possible for the unforeseeable future. Of course, at the time, no one could know whether the internments were temporary or not, and it is precisely this well-meaning making permanent of the provisional exception that is worrisome. Had Noguchi's proposals been built to their full intended extent, the camps may very well have become more permanent than they were, and perhaps the freedom of the interned was to some degree aided by the lack of design accommodation undertaken to normalize their camp's exceptionality. Today many well-meaning projects enroll design to work, like Noguchi's did, to provide better comfort to those caught within real emergencies, such as refugees, displaced persons, and disaster victims.⁷⁰ Without discounting the obvious help that good shelter provides to alleviate the acute misery of such experiences, we must be honest in seeing that accommodating emergency is also how a perhaps illegitimate state of exception is stabilized and over time normalized. If by sponsoring a commission, the perpetrator remains immunized from disruption while the interned and displaced are reformed and reconfigured, then design on behalf of the emergency aids both victims and victimizers. This danger is especially severe if we believe that a declaration of the emergency, and the political reality of its exceptions, is already dubious in its own right (such as an infinite war or terror, an ethnic profile that allows for the suspension of legal rights, or the wholesale capture of an entire country's Internet traffic). Similar soft normalizations are also at work in some of the most easy-to-follow programs for climate change mitigation, including, and especially, those that promote the superiority of preindustrial economies. Some accept buffering an anthropogenic economy against the tides of its own effects by a minimal decorative alterations, while others spiritualize their basic confusion regarding means and ends and seek solace in folklore; many combine both in varying guises. Instead we should plot systemic interventions based on deeper scales of operation that might arrest the eventual immiseration of places, species, and landscapes by securing lines of flight for them. "Restoration," yes, but as part of a wider geopolitics of geoengineering. We hope that the short-term

self-congratulation of accommodation by innovation can be inverted along its own seams and made successful despite itself. We hope that design can take on a different role from the agent of immunization-through-mitigation on behalf of a bad-faith sovereign and can instead work less in response to the exceptional emergency than on behalf of the emergence itself. This design needs to graduate from forms of practice that defer so much agency to authorities who claim but cannot defend incredible decisions over the arbitrage of exceptions, and needs to stop providing paramedic gestures that give them support.

It is because there is no one governance format for climates and electrons that the space for design is open at all. A communitarian integration of local techniques of measurement and mitigation into a more immediate tapestry may be an attractive vision for some, but a singing chorus to the invisible hand of flat networks is not a scalable posture of resistance to the status quo; to the contrary, programmatic localism and the democracy of means is a play for weakness. Without strong force-of-law mechanisms (and machines) in place, it is doubtful that design can possibly intervene at the superhuman scale of an planetary ecology, which, however, then leads us back to the contradictions of full-spectrum geography (but necessarily a compulsion to omniscience) with all its attendant problems, gaps, and failures intact. Moving away from an untrue position doesn't make the new position truer. By way of comparison, merely inviting everything into a "parliament" (of all things) is to ask them to mimic and recite an old-fashioned, even reactionary, kind of political speech, but do strong computational alternatives seem any less arbitrary?⁷¹ Is some currency backed by tons of carbon or gigaflops instead of US dollars (or gold or cryptocurrencies) a greater or lesser danger than the failures it would hope to ameliorate? Moreover, where is the limit to the conceptual violence of turning nature itself into a kind of permanent emergency, climate change into its final exception, and global warming into the masterwork of this ambient terrorist? Involving the planet as a ubiquitous enemy to be managed cannot end well for humans. What price is this to pay, even for a better currency? Does emergence necessarily shift from an open set available to unexpected incursions, recalling Deleuze's meditation on the sands of California, to a closed loop, a synthetic landscape regulated as an objective resource? Yes and no. A synthetic landscape can also provide for new apertures in and out, especially the kinds unavailable while sitting on a beach. Within the Earth simulation machine demanded by planetary energy governance, the scalar relations between the local and global flip-flop in ways that may multiply, absorb, and flatten alternative economies of energy exchange between big and little actors, and the most difficult step for geo-political design is to learn how to game the difference. In other words, the real design issues for the *Earth* layer are not defined by how well we can calculate risk and stage-manage disaster, but rather how well we engineer the path for one world to strategically fall apart into another.⁷²

23. Designing the Earth Layer

By way of summary, we note that energy ecologies can confound state geographies because they work both below and above the scale of states' formal capacities to sense and observe which, in principle, extend only up to the limit of horizontal looping borders. Ecological emergencies suggest new geopolitical design based on data and energy jurisdictions, ones that can augment the nation-state, if not also demote it or defer it. In doing so, they substitute a politics of anthropic subjects for one of carbon flows, energy flows, and their effects, and in this regard, politics is partially refocused from the qualification of elections to the quantification of electrons. But this shift cannot by itself design for less violence, as any sovereign force, including The Stack, requires a continuing supply of disruption to renew its assignment to enforce force as such. As in the aftermath of Hurricane Katrina in New Orleans, the failure of a state to maintain even basic infrastructural protection can ultimately serve to renew its charter to expand and regularize protection against an external enemy, now cast as a hostile climate provoked into unpredictable patterns and requiring a new bulwark of collective mitigation and enforcement. These are less geodesign programs of curation and creation than of a militarization of chemistry, a different and unwinnable type of warfare.⁷³ It frames the unspoken-for public face of a quantified landscape not as our open perch within a particular astronomic neighborhood, but as a frontier of dangerous and vengeful toilets dotting plots of Earth as yet unmapped until brought inside as mere agriculture.

Instead of fighting a ubiquitous ecological enemy with higher-resolution countermeasures, a key aspect of the design program is to invent better economic technologies for valuing and evaluating what is inside and outside as such. Our ecological emergency is an exceptional state of things largely built out of unaccounted-for transactional externalities, neither legal nor illegal per se, but that nevertheless cannot be expunged from the physical world that a sovereign state tries to see, name, and count. In relation to Foucault's identification of a sovereignty of markets, that sovereignty is partially held in the right to identify whether an externality is in fact external, and so whether the exception needs to be accounted for.⁷⁴ Determining what is and is not accounted for—addressed as being inside or outside the economy—is also a determination of what that sovereignty is accountable to. Today this works by the normal sorting of what is and is not an externality, not only to a given transaction but also to the core reason of an economic model that might be validated or invalidated thereby. For those models and for what they do and do not claim in total, the right to deny identification is as essential as the right to assign it. For an emergent governance of ecologies, that includes a right of denial regarding the existence and extent of climate change itself, and in gradient degrees, this death wish spans all vestigial Anthropocenic political theologies. It claims an equivalent right to adjudicate ecological emergency not by omniscience but by a kind of blindness, and in this case, that blindness is a form of

unreason willing to see only what it has already seen, but not what actually appears to it now. It is a sovereign decision drawn from inverse hallucinations: not seeing what is actually right there in front of you. It arranges for both an absolutized surveillance, as well as the right not to see what appears in the lens, and so in this regard, “seeing like a state” or “seeing like a market” also means protecting blind spots as needed.

By contrast, computational megaprojects such as Planetary Skin do have an important part to play in building and thinking alternatives for the *Earth* layer of The Stack, and we shouldn’t dismiss their potential based on the naïveté of their initial goals and marketing. As a rule of thumb, I recommend more megastructures, not fewer, and yet Planetary Skin cannot really “manage what it measures” because ultimately it cannot measure what it thinks it can measure. Instead the *Earth* layer should be designed by thinking at the spatial and temporal scales of the ecological emergency itself, which means to build with the self-amplifying irruptions, not by policing them. Is the reliance on the identification of ecological noise—a standing enemy of excess and waste to be disciplined and normalized—also to foreclose possibilities and to guarantee that Anthropocenic global society, as it exists now, can *only* be the antecedent enemy of another Stack-to-come? If we fashion the *Earth* layer of The Stack in these terms, we have set ourselves up as the enemy of the enemy of the enemy of the friend we hope to conjure up. The math is against us.

Finally, as for the scale and program of the lines and frames we inscribe and the worlds we present by them, I would rather that design draw too big than draw too small. As we know, Anthropocenic energy platforms largely rely on sucking fossil fuels out of the ground and burning them in the sky, but planetary-scale computation cannot really grow if it powered by the oozy corpses of Mesozoic vegetation. Can we power the planet other than by eating the planet, or at least find a better way to do so? Splitting atoms (or, better, merging them) still holds some promise, as does the direct capture and storage of the energy shining down every day from our sun. While all of Earth’s civilizations are by definition solar powered, if sometimes indirectly (consider the ancient photosynthesis that made possible what goes into your gas tank), the amount of solar energy we use is nowhere near the total amount theoretically available to us. Thinking big, we recall that in his 1960 paper, “Search for Artificial Stellar Sources of Infra-Red Radiation,” Freeman Dyson surmised that a sufficiently advanced civilization would come to require not just more energy from its sun, but eventually all the energy from its sun.⁷⁵ He supposed that one way to do this would be to build a sphere around the sun that would capture its energy (minus a bit of infrared radiation) and use it to support engineering projects elsewhere. The sphere could be a solid ball or a latticework of satellite collectors arranged in longitudinal or latitudinal rings, or perhaps arranged in triangular networks like a geodesic dome. As noted above, currently the global economy uses about 15 terawatts of energy, but consider what it could do if it had several orders of magnitude more than that (Earth now gets about

175 petawatts of radiant energy from the sun, and we are about 150 million kilometers away). Science-fiction authors, Charles Stross in particular, have updated the Dyson sphere conjecture to include macrocomputational geoengineering.⁷⁶ Beyond collecting energy to run machines somewhere else, the solar megastructure would also be a vast star-sized computer, known as a Matrioshka brain, that is able to support unimaginably complex and powerful synthetic calculation and intelligence.⁷⁷ Perhaps some variation on this sort of megastructure will be, as Stross has suggested, composed not around a star but around a planet, such as Earth, where it will use the raw material of the stellar body itself as a computational substrate, and perhaps (like Galactus) also eventually consuming that planet by its operations. It is of course impossible to know what life-forms will survive the Anthropocene, let alone if they will want to engineer carnivorous Turing machines at this scale, but such conjectures help coax a necessary shift in our thinking about the ground and figure of natural and synthetic computational landscapes. At stake for The Stack is not only a design and engineering program but a political-philosophical maneuver as well; though as should be clear, these are all but impossible to untangle from one another. As such it may be that the purpose of the Stack megastructure is less to archive and rationalize our bizarre digital cultures than to deliver the platform logics that will allow geodesign and geoengineering their full due as modes of governance. For this, the *Earth* layer is not only The Stack's schematic foundation; it is also the driving force and form of its logic: the world remaking itself in waves, bit by bit, pebble by pebble.

Cloud Layer

There is no doubt that we are currently witnessing a decisive turning point in history, comparable to the one that took place at the end of the Middle Ages. The beginning of the modern age is characterized by the unstoppable process of the progressive elimination of “feudal” political formations dividing the national units to the benefit of kingdoms, which is to say of nation-States. At present, it is these nation-States which, irresistibly, are gradually giving way to political formations which transgress national borders and which could be designated with the term “Empires.” Nation-States, still powerful in the nineteenth century, are ceasing to be political realities, States in the strong sense of the term, just as the medieval baronies, cities, and archdioceses ceased to be States. The modern State, the current political reality, requires a larger foundation than that represented by Nations in the strict sense. To be politically viable, the modern State must rest on a “vast ‘imperial’ union of affiliated Nations.” The modern State is only truly a State if it is an Empire.

—Alexandre Kojève, "Outline of a Doctrine of French Policy" (1945)¹

No society can make a perpetual constitution, or even a perpetual law. The earth belongs always to the living generation.

—Thomas Jefferson to James Madison Paris, September 6, 1789²

Heavy medium, light signal ; light medium, heavy signal.

—Unknown

Aristophanes' play *The Clouds* is a parody of intellectual presumption and its gift economies based on debt virtualizing all meaning into nothing but tactical rhetoric.³ Does the same go for our *Cloud Polis*? As it draws its own lines, walls, and envelopes, their multiplication puts into play eccentric geopolitical designs including the delamination of normative Westphalian state sovereignty from its referent territory and the introduction of another territory on top or below. At the same time that *Cloud* platforms also take on traditional governing assignments such as public cartography, legal identity, currency, protocol allegiance, even patriotism, states themselves also evolve toward becoming *Cloud*-based entities.⁴ In combining these, a *Cloud Polis* is built of thickened

plural geographies and noncontiguous jurisdictions; it mixes some aspects of US super-jurisdiction over the *Cloud* (and over state-space) with others that resemble the charter cities carving new partially privatized polities from the whole cloth of desovereigned lands.⁵ These platforms extract revenue from the cognitive capital of their *User*-citizens, who trade attention in exchange for global infrastructural services that provide each of them a fixed and formal online identity and a license to use its services. Perhaps these early accomplishments of planetary-scale computation to redraw political territory in its own image point toward a more universal transformation of the organization of sovereign space and its organizing technologies. The *Cloud* layer is low in The Stack, above the chthonic forces of the *Earth* layer, from which it sucks the energy and minerals that course through its expansive megastructural body. It is also below the *City* layer into which it installs data centers and distribution nodes and for which it performs incredible feats of instantaneous calculation. While the term *cloud computing* may be traced back to the writings in the 1980s on “life streams” by Unabomber victim and Glenn Beck courtier David Gelernter,⁶ the idea of computing as an on-tap utility served from central processing plants is as old as computer science itself. It builds on distributed server and terminal architectures, extending shared computing resources across a networked organization, and just as the regulation of industrial modernity was given tempo by the longitudinal standardization of railroad and telegraph timetables, the beginning of the *Cloud* could just as well be dated to the inauguration of the UNIX epoch (January 1, 1970) and the starting point of UNIX Time used to synchronize computers across a network (and which today helps synchronize, for example, Linux, C, Java, and Javascript).⁷

But the footprint of the *Cloud* is measured at the scale of continents, not enterprises. Some see it as an uneven computational troposphere, others as a prototype universal Turing machine, arranged not with tape but with uneven networks of fiber optics, data centers, nested databases, terminals, and browsers.⁸ The *Cloud* layer is also a geopolitical machine, erasing some geographies and producing others, forming and destabilizing territories in competitive measure. It is at this level of The Stack that the modern coherence of the state, which would produce one sort of public, and the operations of platforms, which would produce another, can come into conflict, overlapping and interlacing one another without universal jurisdiction or resolution, but it is also where they can reinforce each other with more pervasive forms of ambient governance. The geopolitics of the *Cloud* is everywhere and wants everything: the platform wars between Google, Facebook, Apple, and Amazon, anonymized servers routing the angry tweets from street battles, Anonymous going up against Mexican drug cartels, WikiLeaks crowd-sourcing counterespionage, Tor users building on top of Amazon Web Services services, carriers licensing content, content providers licensing bandwidth, proprietary fiber networks connected trading centers, and on, and on. It might seem at first blush that these events, each perhaps pushing legal boundaries in its own way,

should be understood as disruptive contaminations of a standing political order—acts of resistance to the system, even. Yet in their own consistency, this stockpile of exceptions is probably better interpreted as part of the constitution of another emergent order (a *nomos* of the *Cloud* even?). It is an order derived from the structural and technical protocols that locate different *Users* among different operations and condition the actions they take from there. As a governing nexus of The Stack, this order identifies, produces, and polices the information that can move up and down, layer to layer, fixing internal and external borders and designating passages to and from. In doing so, it generates more lines and borders, not fewer, and so its apparent universality is actually densely divided against itself.

24. Platform Geography

In mountainous regions, trees above the cloud line are sometimes invisible from the vantage point of cities in the valley below. Sometimes it looks as if the gray sky has decapitated the peaks. But for the *Cloud* layer, what is invisible is less what is above than what is below the point where the computation touches the ground. Unseen but not placeless, the trans-urbanism of the *Cloud* layer is defined not just by the distribution of terrestrial borders, but also by the terraforming recentralization of nodes—urban, financial, logistical, political—in the service and purpose of its networks (e.g., former Siberian missile command bunkers are turned into icy data centers, and entire skyscrapers in downtown Los Angeles are turned into massive, stacked switching hubs for every major telco by CoreSite/Carlyle Group). Above ground, the *Cloud* makes its own kind of temporary logistics plantations at exurban perimeters or near, or indeed inside, regional airports. The warehouse and supply chain centers that turn commands in databases into the traffic of real goods constitute a shadow network of itinerant packages and only slightly less itinerant laborers. Amazon and Walmart's fulfillment centers in places like Hebron, Kentucky, Goodyear, Arizona, and Fernley, Nevada, are staffed by a multitiered outsourced and re-outsourced population of sorters, packers, and movers. During Christmas, when demand for short-term labor is acute, Amazon will make use of “workampers,” often senior citizens moving in large recreational vehicles from one fulfillment center to another, coming and going from Amazon towns as demand dictates. Guest workers of the algorithms: Grandpa, the Wandering Morlock of The Cloud.⁹ Here we glimpse the prototype of a future *Cloud* feudalism.

A constitutional geography is at work. As the *nomos* of the *Cloud* rotates from a two-dimensional map to a vertical, sectional stack, its topography is shaped by the multiplication and superimposition of layers of sovereign claims over the same site, person, and event. The microenclaves that it spawns are a pixelated patchwork of discontiguous partial interiors and enclaves. Their double exposures are the exceptions that constitute a new rule. Strategic networks of data centers, fiber-optics cables, energy pipelines,

freeways, warehouses, and shipping ports magnetize other geographies around themselves, generating legal exceptions, economies of monetized cognition, and platform wars for expanding populations of *Users*, both human and nonhuman. So through the *Cloud* layer, it is less that The Stack emerges in the service of or in opposition to world governance than that it dissolves computational governance into the very fabric of things—platform immanence—and perhaps the productive accident of the *Cloud* layer is exactly this rotation and interweaving of regular and irregular sovereign geographies into still largely unmapped configurations.¹⁰ Its everyday lived geopolitics is like that of Beszel and Ul Qoma in China Miéville's novel *The City and the City*, twin cities only partially visible to one another even as they occupy the same location, each dependent on enforcing a willed ignorance of the other's presence, constantly policing one another's breaching.¹¹

The Google-China conflict is exemplary of this interweaving. It can be interpreted reasonably as geopolitical conflict between empires, both leveraging their different state-corporate-military-information network systems to claim the free soil of planetary computational territory. It is more fundamental than that between two megastate actors; it was and is a conflict not only over the right to control search engine results, but indeed over the predominance of two different modes of sovereignty. The conflict pits a state that would dominate and determine the network sovereignty of information and energy flows versus a platform that would, by assembling users into another real network and imagined community, exceed, in deed if not letter, the last-instance sovereignty of the state and determine an alternate polity in its own image.¹² The alternative that the platform poses is perhaps both too big for the state to control (the platform connects people and things and banks of data across planets) and too small to control (*Users* ultimately could access the constitutive data packets of the latter regardless of any Great Maginot Firewall). The Stack itself coheres from conflicts such as these not by masterplan but by the accumulation of tactical solutions into a massively distributed inscription, one not circumscribed by a single stretch of land but spread across multiple layers in vast sectional landscapes. To understand how to design and engineer that inscription differently, we first consider in more detail how its conflicts are articulated.

25. The First Sino-Google War of 2009

The First Sino-Google War of 2009 may well be the opening crack in a very different kind of war over who or what governs global society, one less between two superpowers than between two logics of territorial control. One of these sees the Internet as an extension of the body of the state, or at least beneath the state in the priorities of sovereignty, and another sees the Internet as a living, quasi-autonomous, if privately controlled and capitalized, transterritorial civil society that produces, defends,

and demands rights on its own and which can even assume traditional functions of the state for itself. For this, Google is a nonstate actor operating with the force of a state, but unlike modern states, it is not defined by a single specific territorial contiguity. While Google is as reliant on real physical infrastructure—its empire of data centers are by no means virtual—its terrestrial footprint is more dispersed and distributed than partitioned and circumscribed. On the superimposition of the two interlocking spaces, consider the breach theory of Fang Binxing from the China Academy of Engineering and one of the main designers of the infamous great firewall. In November 2011, he warned a conference that the Chinese Internet does not have the capability to disable a global Internet service whenever it wants to. He used the example of Google and said it was a pity that although Google had retreated from China, its service was still accessible in China: “It’s like the relationship between riverbed and water. Water has no nationality, but riverbeds are sovereign territories, we cannot allow polluted water from other nation-states to enter our country.”¹³ This is an amazingly succinct rehearsal of the older European *nomos*’s juridical separation of land and sea, fixed and liquid, made into parable.¹⁴ While Fang likely was not familiar with Buckminster Fuller’s admonition that “the fearful sovereign nation politicos will find that trying to arrest networking is like trying to arrest the waves of the ocean,” Fuller, it is more certain, was never given the assignment, as Fang was, of building a glass dome for a billion Internet users.¹⁵

Shifting the figure of water from a metaphor to geography, consider that for Schmitt’s history of the *nomos* (that is, Carl Schmitt, not Eric Schmidt), the territorial domain of nations was always defended by the naval capacity over the omnidirectional glacis of the ocean in light of Google’s filed patent on water-based data centers.¹⁶ This floating cyberinfrastructure would, in principle, greatly reduce the energy and cooling costs of hosting and serving the peta- and exabytes of data that will constitute an eventual planetary cloud computing platform. It may also neatly symbolize a productive crisis of territorial jurisdiction, one that alters how truly pervasive computation may demand, or activate, new forms of agonistic or cosmopolitan political habitats.¹⁷ As discussed in the *Earth* layer chapter, data centers, as the hard technical core of the Internet, demand massive provisions of energy, mostly to keep processors cool; with only about half of the world’s 7 billion or so people using the web in any given month, the anticipated growth curve is steep. Where will the energy come from? How can Google possibly feed the energy appetite of the data centers that would provide ambient supercomputing to the next 3.5 billion human users and the next 5 billion to 500 billion object users of the Internet of things?¹⁸ Oceanic data centers theoretically would help solve this by using both tidal and wind energy to power the stations, as well as the abundant supply of water to assist in the cooling process, but in doing so, the literal offshoring of such critical infrastructure also raises issues about the jurisdiction and legal control of data and the governance of the emergent *Cloud Polis*. What if a data

object is originated in Beijing by a Japanese citizen, uploaded to a server off the shores of Vladivostok in international waters, and then used by a kid at an Internet café in Las Vegas to commit a crime in Brazil? Does one country's data privacy and prosecution laws have clear means to control this? But of course such what-ifs are already everyday problems. The oceanic datacenter symbolizes the infrastructural offshoring that is one productive accident of the *Cloud* layer: the delamination of the layers of territory, economy, and sovereignty, one from the other, potentially perforating the domain of the state with the economies of nonstate infrastructure beamed in from the middle of the open ocean. This may conjure images of other ad hoc circumventions of national geography, such as pirate radio, offshore banking, and unrecognized microstates. But unlike these, the *Cloud* layer is not a peculiar outlier from an otherwise stable system of territorial sovereignty; rather, it is the technical basis of an emergent global system, an exception that takes on the force and diction of a geopolitical norm. The *Cloud* layer hosts more than a few streams of pirate data; it can carry entire cultures, economies, societies, and religions. And so it is not simply where an alternative geopolitics will take place; rather, in taking and making territory, it is also how it will take place. The *Cloud* layer is characterized less by a shift toward a new equilibrium of formal state powers now working at the scale of planetary computation than by the incongruities between modes of governable territorialization. For this, and unlike the Westphalian consensus, it is the absence of mutual recognition between types of actors (a state and a platform, in this case) that keeps something approximating a true *nomos* of the *Cloud* unresolved and perhaps irresolvable.¹⁹

My argument then is not another prophecy of the declining state withering away into the realm of pure network, but to the contrary, that the state's own pressing redefinition takes place in relation to network geographies that it can neither contain nor be contained by. As cloud-based computing platforms of various scales and complexities come to absorb more and more social and economic media, and do so on a planetary scale, the threads linking one data object to one jurisdiction bound to one geographic location become that much more unraveled. It's not that the state cannot follow those threads, rather that when it does it takes leave and becomes something else. Other exemplary exceptional territories, such as tax-free Special Economic Zones, also mark the visible effects of network globalization in general, but the underlying function of emergent *Cloud* systems to enable these demands special consideration, especially at the level of the individual *User*. The rights and conditions of citizenship that were to whatever degree guaranteed by the linking of information, jurisdiction, and physical location, all within the interior view of the state, now give way perhaps to the riskier prospects of a Google *Grossraum*, in which and for which the terms of ultimate political constitution are anything but understood.

For example, we know that the modern state is also bound to a particular set of protocological interests and generative legal codes and that the membranes of their

jurisdictions are defined by them, but the transposition of juridical media from legislation to computation produces a rather different set of ground rules. Certain political *positions* are built already into the hardware, not allegorically but literally. For example, for many processor chips from the last few decades, “core user” is a sovereign figure who can generate subordinate administrative subjects—who in turn can control the calculative access of other users.²⁰ What law, passed where, could undo this polity, based not on formal constitution or really even the perfunctory end user agreement? As we have seen, states respond forcefully, sometimes by attempting to directly compete with these kinds of sovereignty and sometimes by absorbing them as their own new norms.

At the scale of agonistic geopolitics, the variance in strategies for governing sovereign space, between states, platforms, and their combinations, seems to do more to multiply the variables than to reduce them toward consensual maps. For the emblematic Sino-Google conflict, the productive friction is also the result of a superimposition of two incommensurate logics of territory and governance: one is a cognitive capitalist proto-*polis* predicated on universal information rationalization, and the other is a geographically circumscribed central command that sees the *Cloud* as an extension of the body and charge of the national state. In this case, the two are like unmerged layers of an image pasted onto the same canvas, each a different shape and scale, but each demanding the recognition and acquiescence of the other. In the messy practices of billion-*User* scale technopolitics, even this arch opposition cannot itself hold. What if instead of simply staying put or leaving China, the Google *Grossraum* instead evolves over time and blankets or pours down on Chinese sovereign territory in such a way that the state would be as powerless to enforce policy on it as it is on the rain?²¹ And if we imagine this circumnavigation to be well subscribed by Chinese publics, then how divided are their loyalties and how will they identify with dual citizenships such as these? What do states become in relation to this perforation when the circumscription of land guarantees that much less? For party planners, nightmares do such things make.²² Others, looking back from that virtual future in which Google (or some similar *Cloud* platform) more fully connects China’s continent of *Users* with or without the formal acknowledgment of the Chinese government, may have more fondness for a *Cloud Polis* in which multiple *User* identities compete, conflict, and overlay without also congealing into a tidy individual *User* citizen-subject. That is, the superimposition of dissensual sovereignties applies to the people as well. Toward a design of such systems, what are the real limit conditions of the *Cloud* layer as an actual machine?

26. *Cloud Infrastructure*

What is the *Cloud*, exactly, if understood as a vast discontiguous apparatus? Like The Stack as a whole, the *Cloud* layer is itself a terraforming project, covering the globe in

subterranean wires and switches and overhead satellite arrays, simultaneously centralizing and decentralizing computing and data storage and the social relations that depend on them (and vice versa). *Cloud* infrastructure's energy and water appetite demands specific landscape accommodations, including putting data centers in unexpected locations (inside office towers, ice caves, underground bunkers, coal mines, carved-out mountains, dead malls, inhospitable islands, old churches) all in the name of strategies both rational and strange (cheap energy, cheap space, proximity to oceanic passage, lax regulation on data storage, earthquake and flood avoidance, perimeter security, ideal temperature control).²³ Above ground, *Cloud* infrastructure is serviced by torqued logistics networks of warehouses, roads, factories, containers, ports of call, airports, and package routing hubs that together allow it to route physical objects in the way it routes data packets. In doing so, the layer absorbs metadata about each thing and each relation of exchange, all translated by algorithmic militiations of cognition, data semantics, manufacture, demand, and response optimization as it links these across continents, compressing and expanding economic rhythms and cycles.

Those *Cloud* economics are predicated on efficiencies of centralization made possible by simultaneous and exponential price drops in data computation, storage, and transmission, which are driven in turn by increases in the amount of data produced by the billions of devices that continuously pump information into these platform services.²⁴ This virtuous cycle of devices in the field uploading data to cheap central storage, for processing in datacenters and redistribution to other users and devices, fuels the rapid centripetal centralization of information toward a small number of global *Cloud* platforms capable of supporting and leveraging service infrastructures at such a massive scale. At the edges of this network, the merger of data processing, storage, and distribution into a composite platform makes possible the generic provision of computational capacity into an on-tap service utility for large organizations and individual *Users* (e.g., people, sensors, devices). In many cases, individual applications are provided free of immediate charge and monetized through the capitalization of *User* cognition by advertising. In other cases, *Cloud* application interfaces charge based on per unit of use as defined by different combinations of number of *Users* and total amount of data processed, stored, and transmitted. The ultimate effect of the centralization of *Cloud* services, paired with faster wired and wireless bandwidth to end devices, is to link almost any person, thing, animal, building, car, plant, or smart mote into supercomputing platforms. This allows each such end *User* to perform or contribute to otherwise impossible calculations, all of which further centralize the platform's economy of uses, effects, and profits. Access to live data and peer-to-peer communication streams means that aggregate responses to individual interactions can be calculated in remote data centers and relayed back to the *User* almost instantaneously, as if the computation and all the data it is based on were happening in the palm of her hand. Dumb devices are infused with seemingly cosmic omnipotence. Servicing

generic supercomputation draws any thing and any place into a formal interrelation and interdependency, flattening both hierarchies and nuances. Today's end user *Cloud* apps will grow in complexity and capability only as exponentially larger pools of data are aggregated, analyzed, optimized, and made available through networks of application programming interfaces (APIs) with which developers can link oceanic reservoirs of information into smart services that learn as they are put to greater use. *Cloud* services will include greater artificial intelligence streamed into graphical, voice, or object interfaces with which we interact in naturalistic ways. Most likely, however, they won't do this primarily over the open Internet as we know it, but through more narrowly designed and owned networks in which competitive advantages (drawn from physical infrastructure to data optimization to energy efficiency to format lock-in) will drive and delimit everyday computational economics.

Another reason the open Internet may provide a diminished fraction of the load for next-generation *Cloud* services is that it is getting full. There is a finite amount of information that can be pumped through the network as it is currently constructed, and that limit may be appearing on the near horizon. In order to ensure that future services can stay online and continue to scale, *Cloud* platforms will likely continue to build their own secondary and tertiary versions on top of or in place of the "old Internet," using both open and closed protocols to consolidate proprietary publics and networks. How full are the physical channels of the *Cloud* layer already? While it is extraordinarily difficult to exactly map the scope and shape of the Internet, as so many avenues are closed off from scrutiny,²⁵ it is nevertheless generally agreed that the total amount of data produced and transmitted doubles every one or two years (perhaps faster). A recent study estimated that in 2018, 6.5 zettabytes of data (trillions of gigabytes) will pass through the *Cloud*, with 31% in the public *Cloud* and 69% in the private *Cloud*.²⁶ The increase is seen as a function of faster processors in end user devices, which can produce more data and feed them into common platforms, but the growth rate of shared data is increasing faster than the spectral efficiency of the optical fiber networks over which it passes can accommodate it. Even techniques like multiplex polarization will probably not suffice in the long term.²⁷ We may like to think of fiber optics as providing functionally limitless bandwidth, but at a zettabyte order of magnitude, for a planetary *Cloud* ultimately linking trillions of devices, this is not true. Unless new technologies, such as widespread multicore fiber, are widely deployed in the next decade, the physical limits of how much information can actually pass through a given channel may introduce new economies of bandwidth scarcity, prioritization, and pricing.²⁸ At the same time, newer networks with greater carrying capacity, as well as faster signal throughput, may provide new kinds of *Cloud* services previously only imagined, such as holodeck-quality virtual environments. Such accomplishments may steer primate evolution toward shared intersubjective experience, introducing fantastic new genres of narrative, design, architecture, poetry, medicine, and music

at a planetary scale, or it may allow a select few to watch 8K LOLcat videos from 10 angles at once.

The pressure of that physical limit also pushes against the geoeconomics of the Internet backbone and private *Cloud* platforms, forcing how their development impacts on political geography as a whole. Instead of thinking of the *Cloud* as a bunch of individual private computers connected to data centers by big public pipe, it is perhaps better to think of any (at least partially) gated *Cloud* network as a single vast discontiguous computer, linking servers to browsers and back again, such that functions that may have once happened “inside” any one device now happens on the device’s “outside,” now on and in the network itself. Information input, storage, processing, display, and so on are handled by different components in the wider computer architecture, but when very fast optical links connect devices, supercomputers, dense populations, server farms, and enterprise clusters, they can delink and distribute that machine architecture, spreading it even across oceans.²⁹ But in practice, the *Cloud* (and any one *Cloud* platform) is much more than one shared network computer. Different actors (e.g., telcos, states, standards bodies, hardware original equipment manufacturers, and cloud software platforms) all play different roles and control hardware and software applications in different ways and toward different ends. Internet backbone is generally provided and shared by tier 1 bandwidth providers (such as telcos), but one key trend is for very large platforms, such as Google, to bypass other actors and architect complete end-to-end networks, from browser, to fiber, to data center, such that information retrieval, composition, and analysis are consolidated and optimized on private loops. Consider that if Google’s own networks, both internal and external, were compared to others, they would represent one of the largest Internet service providers in the world, and by the time this sentence is published, they may very well be the largest. Google indexes the public Internet and mirrors as much of it as possible on its own servers so that it can serve search results and popular pages quickly to *Users*, regardless of where the original page may originally be coded, sourced, and hosted. It also maintains large-scale networks for the distribution of its own *User-facing* content, such as YouTube videos, Gmail, and Search, and for the shuttling of the incredibly large “copies” of the Internet from one Google data center to another around the world. We could also then think of Google, the integrated platform architecture, as a kind of metacomputer that absorbs and processes data so as to maximize its own growth. When I log in to Gmail, my laptop becomes, for a moment, a peripheral device of that larger Google metachine spread across the world. This ubiquity affects how data traffic itself is composed and managed. For example, software-defined networking (SDN) allows a network to prioritize, plan, track, and optimize the ideal routes of sets of packets in a way that is more sophisticated, composable, and responsive but less neutral and less dependent on political decisions made elsewhere.³⁰ In the long run, the investment and expertise in developing the infrastructure necessary to maintain the world’s largest consumer *Cloud*

platforms may trend away from networks on which packets are sorted and routed in neutral, but not always reliable, pathways across shared pipes, and toward very large data providers and *Cloud* platforms, such as Google, or toll road developers, such as Comcast, controlling traffic over their own networks for their particular purposes. The future maturation of global *Cloud* platforms as quasi-independent geopolitical domains may be determined to a significant degree by their ability to deploy their own competitively effective, end-to-end cyberinfrastructures.³¹ This will redraw the practical boundaries between open and curated computational services, public and private data, state and corporate geography, *User* and service, and *Interface* and infrastructure. The end result supports more ubiquitous, finer-grained supercomputation, but deals a severe blow to the social ideal of general-purpose computing, as hardware devices would also likely be further tuned to suit specific platform strategies, perhaps locking out others (see the discussion of the Apple *Cloud Polis* below). As we already see for financial networks, general *Cloud*-based geopolitical enclaves may appear as indirect functions of exclusive networks, monetized by providing premium services to those that can pay, including many that are traditionally managed by states, leaving other publics to wrestle over thirty-one flavors of net neutrality. As a global trend, this mode of computational production also bears the potential for a much more stratified mesh of enclaved *Cloud* experiences and a multitiered, more socially asymmetrical *Cloud* that provides premium services for some (including privacy, the ultimate *Cloud* service) and bare-bones services for others (their identities and interactions more exposed to the elements and to exploitation.) Still, the most pressing geopolitical design problems are those posed by what *Cloud* platforms already are and do. By examining some of our dominant platforms more closely—reading and *interpreting* them—we can perhaps predict what they will become, but, more important, perhaps steer their becoming as well.

27. *Cloud Polis*

In tracing the outlines of our current *Cloud*-based polities, we see that platforms have assumed and absorbed several core political functions of the modern state and innovated new modes of governance besides. Cartography, for example, has long been a core competence of states, particularly when they are busy expanding their empires, naming locations, planting flags in them, and rendering these on their own maps for the first time. Throughout the colonial era of globalization, the basic description of a “new” territory over which a state might wish to internalize into its jurisdiction, and over which it contests control, may be legally precedent to whatever private strategies are subsequently put in motion, or they may come later as decorative legitimization of earlier speculative adventures.³² Either way, sovereigns have long claimed and enforced the right to name and objectively represent the territories they govern. Today contested lines on maps still symbolize geopolitical tensions over sovereign

influence, as the many intrigues over islands in the South China Sea attest. Consider then the curious episode in 2010 when Google Maps slightly shifted the line marking the border between Nicaragua and Costa Rica. Troops were summoned and war over the ambiguous territory seemed possible. The naming and measuring of the ground over which and into which politics might maneuver was, however unintentionally, remade not by either of these states but by a Californian software company. The situation was defused, but a new precedent was made. In the US context, compare this to Lewis and Clark's westward excursion, or the cartographic corps sent out during the New Deal to expand and reinforce federal territorial vision and the right of final say-so over what parcel is where. More recently, Google made news by formally recognizing Palestine as a delineated nation, well ahead of its eventual full status at the United Nations,³³ and between the two institutions, it's not altogether obvious which recognition will prove with the benefit of historical hindsight to be the more efficacious. These episodes hint at a potential swap in the relative positions between the cloud and the states in the definition of a last-instance geography that is now also described to states by *Cloud* platforms instead of the other way around. The ambiguities of the rotation in priority, and perhaps of which institution finally underwrites which, persist in differing models of *Cloud Polis*. For one, the state shape-shifts into a *Cloud* platform, and for the other, *Cloud* platforms functionally displace states by assuming their functions.

States move into the Cloud. We see this in guises from the benign to the sinister, from progressive gestures of information democratization like data.gov to the troubling surveillance armatures associated with the National Security Agency, the Patriot Act, and superjurisdiction over international *Cloud* data.³⁴ From the prosaic gathering and reportage of information to its citizens, on the one hand, to the clandestine hoarding of massive troves of data about its citizens (and other countries' citizens), on the other, states in the cloud transform what states can see, and what "seeing like a state" (and listening and sensing like a state) actually entails.³⁵ With this shift in perceptual techniques, habits, and dispositions, states are inspired to look for some things and not others. The work of contemporary governance is transformed toward the management of multiple, irregular, asymmetric layers of *Cloud* platforms, and as the "eyes" of the state evolve, its bones and blood will follow.³⁶

Much has been made in recent years about a reinvention of government through the more intensive and intelligent strategizing of its institutions as public data-generating, -sorting, and -disseminating systems, and their optimization along the lines of any other large peer-to-peer information service. The sunny ethos of "government as a platform" imagines *Users* accessing democratic states in the same way that a private *Cloud* platform allows *Users* to retrieve and program structured data for their own secondary purposes.³⁷ It sees platforms spawning new clients, developing economies and microtargeted utilities, and it asks then, "If states are conceived as platforms,

wouldn't they work the same?" One version of this presumes a general inversion of government's data-capturing mission now outward toward the exterior-facing world of active constituents. This might lead to a greater modularization and even outsourcing of governmental services to constituents interested in providing and innovating these.³⁸ However, the PRISM/Snowden affair and the general revelation of the core role that consultants like Booz-Allen Hamilton and Palantir play in the federal information complex demonstrate that this disintermediation of the work of the *Cloud*-based state is not only well underway, and that the more individualistic-entrepreneurial story of "government as a platform," as told by publisher, Tim O'Reilly and others, is at most a supplemental augmentation of a well-established apparatus. In fact, one shudders at the thought of what a more individually distributed subcontracting of state *Cloud* surveillance might look like. At the same time, the most far-reaching visions of the open government movement might still represent a transformation of the state itself into something unknown—perhaps an apps-based queryable megamachine like Planetary Skin or Google Earth, but with obvious and significant differences.³⁹ The optical positions of a state—how it sees the world and its constituents and how its citizens see themselves reflected through the ambient quantitative commons—might bear all the benefits and bankruptcies of earlier forms of communicative reason. As these try to reform technocratic media into humanist channels, they are not necessarily predicated on an overcentralization of expertise; rather, we see how some core mechanisms of governance on the ground become less like a central command machine and more like an ambient, generalized utility at hand for anyone interested in parsing the databases and spreadsheets and deploying them toward new designs. Here the maximal state and the minimal state convene and even converge.⁴⁰

Clouds become de facto states. "Platform as governance," the inverse of "government as of platform," is suggested just as strongly by today's *Cloud Polis*. The structures and limits of a global *Cloud* platform cannot *not* reorient the contexts in which the fragility of state sovereignty is contested. Like charter cities, we see specific *Cloud* platforms absorbing forms of sovereign differentiation between people and places that used to be the exclusive domain of the state and can only imagine what kinds of "sovereignty services" this may lead to. How will the *Cloud*-based delineation (or absence of delineation) of land, identity, energy, value, territorial interiority and exteriority, and so on, come to mutate the overlapping layers of everyday law and life? It is less that *Cloud* platforms ultimately replace states than that two domains become dramatically less distinct from one another, interlacing and folding up in new ways, producing emergent institutional forms not reducible to the direct combination of the two. The ability of the *Cloud* to achieve this is based not only on the networking of information between locations, but on its interdependent position in the larger Stack, linking energy economies, *Cities*, *Interfaces*, and *Users* into a global but wholly uneven platform. That governing logic, privileging the *Cloud* layer as timekeeper and space maker, is built into the technical

architecture of The Stack and imposes itself on states and traditional geopolitics as much as the inverse.⁴¹ That is, *Cloud* platforms not only have geopolitical ramifications and implications; they are a geopolitical condition and constitution in their own right. *Cloud Polis* is populated by hybrid new geographies, new governmentalities, awkward jurisdictions, new regimes of interfaciality, and so new (and old) imaginary communities, group allegiances, ad hoc patriotisms, and inviolable brand loyalties will inevitably follow. Some of these may be archaic fundamentalisms now given a new mission; others are more novel and progressive, or soupy mixtures both futuristic and atavistic at once. The assignment claimed by planetary-scale computation is then not only to challenge the state's monopoly on legitimate violence (the force of material as well as of material force) but also its monopoly on legitimate *citizenships*. As discussed, the fate of every location, and person and *User*, is overlayed with multiple, asymmetric, and irreconcilable platform allegiances, rights bequeathed and values extracted. That layered patchwork is the result of both the global circulations of "citizens," understood as a mixture of people and things, as well as of the fractured ability of any one imagined community to incorporate the lives of its adherents when it must share space (and *Users*) with multiple simultaneous alternatives.⁴²

What is the proper role and ambition for this mode of *Cloud Polis*? How should we imagine the role of a geopolitical actor with the future scale, program, and capacity of, say, Google or Apple or Alibaba, as well as the smaller players that will fill out the space cleared by similar enterprises? First, the space over which Google's (limited) capacity to generate or mediate proto-citizenship and economic sovereignty is neither comprehensive nor properly pluralistic. It is derived not from some classical constitutional claims, but from the mission statement to maintain the everyday nuts and bolts of planetary computation ("to organize the world's information, and to make it universally accessible and useful") and from this the presumption of an historical mission. In the administration of these global input and output interfaces, a kind of governance over the networks and territories mediated by them does emerge, *Cloud Polis* taking shape not through master plan but through accumulated microtechniques of regularization. By contrast, if the modern capitol building was an architecture that symbolized a legal, jurisdictional, and geographic *center* from which the terms and limits of sovereign citizenship might radiate concentrically, then the data center located out of site or even in the extraterritorial, un-national plane of the open sea, draws instead a technical and symbolic mesh of uneven threads flossed through multiple territories at once. From it, smaller assemblages of economic activity emanate, and practical norms of privacy and participation are worked out by both everyday habit and deliberate predation.

Again, this is not to suggest that even this form of *Cloud Polis* somehow formally secedes from national interest and control, but rather that as national interest and control pivot to the *Cloud*, the *Cloud* absorbs assignments of sovereign identification. Data centers and large switches also continue to operate under some normal authority, such

that each Westphalian state claims (contested) rights over data within its geographic loop. The data that any one data center might house and distribute might be globally accessible in principle but also may be filtered or unfiltered by both national and international authorities (including mass interception of all traffic, national firewalling and keyword sorting, targeted deep packet inspection, or, in the recent examples of Egypt and Syria, complete blocking of a national top-level domain). International and transnational jurisdiction are even less settled, as evidenced by US superjurisdictional enforcement episodes and by controversies at the UN International Telecommunications Union over the role of member states to control, filter, and tax entry points of data entry into and out of their recognized territories (or even to adopt locally idiosyncratic Internet addressing schemes).⁴³ The lines are unclear, dotted, smudgy, knotty, and self-contradictory, but the lines do exist and are multiplying in number. As the cat-and-mouse games of perforating and mending the membranes of national virtual borders continue, a kind of accelerated evolutionary episode is playing out, and the mutual constraint between state and extrastate actors brings strange moments of symbiosis. Instead of the simplistic schema of centers versus networks, centralization versus decentralization, elites versus the people, we observe instead states becoming networks and networks becoming states, nodes becoming more like edges and edges becoming more like nodes. The intrapenetration of *Cloud* geography and state geography results in another spatial-institutional model based on the logics of platforms and on platform sovereignties that don't fit into those frameworks. Something like *Cloud Polis* is still an awkward embryonic form of governance, both for and through planetary computation, and likely will be for some time.

That said, as the *Cloud* is planetary in scope, state control of its systems is guaranteed only to the extent that private providers continue to respect (by consent, force, joint venture, outright merger) the practical sovereignty of the national jurisdictions in which their servers are installed, where their offices are headquartered, how exactly their data structure economic exchanges, and how their monetization of those data is or is not taxed. That arrangement is both resilient and unstable in various measures and tracks the successes and failures of globalization itself. Today most *Cloud* service providers have constraining jurisdictions built into service plans. For example, Amazon Web Services segregates the serving of hosted data according to several geographic "availability zones," allowing developers to deploy specific versions of their application to specific users in specific countries according to local laws and priorities, regardless of where Amazon might be hosting or mirroring their data. However, the sorting of state space and data space is not always so neat, and the unintended effects of innovative interconnections between *Cloud* publics can be calamitous. Recall the Bank of Iceland's ill-fated online banking venture in the United Kingdom, where easy access to "offshore" digital deposits and inopportune loans help to crash both nations' economies and contributed to a long-term destabilization of Iceland's (and Europe's) solvency. Ultimately,

as a design problem, the potential political economic architecture of the *Cloud Polis* is at best a blurry composition, and like any other form of governance, its emergence is unevenly and asymmetrically violent.⁴⁴ While it standardizes and flattens some symbols, geographies, and economies, it simultaneously frays and multiplies others. There is no way to guarantee either outcome in advance, and it is precisely the unforeseeable *reversibility* of these effects on any one location that makes the *Cloud Polis* central to the forms of sovereignty it mediates and which mediate it.⁴⁵ In other words, the increasing reliance on *Cloud* infrastructure produces unintended geopolitical effects precisely because its power to govern through the observation of geographies, and the calculation of strategic information in the competition over those spaces, is always in the end reversible. Government data willingly opened to the public for its edification and employment, reinforcing the bonds and identification with a particular state apparatus generating this bounty, are also a potential basis for countergovernance, resistance, revolution, and the multiplication of unpredictable microsovereignties. The opposite—oversecuritization making systems brittle—is equally risky. That any innovation may accomplish one *and* the other, or how it may be deployed for one agenda and also its opposite, depends to a degree on the *Interfaces* we use to engage them and on what they as *Interfaces* connect and disconnect for us and from us. This is how The Stack connects *Users* and *Clouds*, *Cities* and *Interfaces*. But even then, any one *Interface* (that is, any one instrumental image of the platform as it is decoding its functions to us) is enrolled by more than one imagination at the same time. *Interfaces* are dream worlds, however restricted. They are also the real techniques by which power is inscribed by and for the imagined communities of geopolitical intrigue. But because interfacial images, like the machines they mediate, are tools for more than one geography at once, even the semiotic specificity of any one interface is a poor guarantee against the ultimate reversibility of the *Cloud Polis*. Just ask Costa Rica.

28. Platform Wars

For The Stack, *Cloud Polis* represents an extremely complex design problem, because while it may determine so much, it guarantees little about the predictability of outcomes. Renewal and innovation or totalitarian dystopia: neither is assured or foreclosed. While we can survey the landscape of *Cloud* platform empires as they exist today, we can't presume that the current arrangement of stakeholders and their positions will continue without dramatic unforeseen disruptions to the status quo. It is also possible (even probable) that the most decisive and geopolitical *Cloud* formations are still some years off. While Google, the specific company headquartered in Mountain View, California, is its most obvious exemplar of today's platforms, my argument concerns something far less immediate than the product and service road map of any single corporation. The figure of The Stack is that of a politico-geographic-technological framework that

does not yet exist, and may very well never exist, but serves as a conceptual-technical structure to think with and against as we compose what does emerge. For this, what makes the *Cloud* layer of The Stack so important is that today each of the major US-based ventures—Facebook, Apple, Google, Amazon (plus Walmart, Oracle, IBM, FedEx, UPS, Microsoft, Goldman Sachs, Cloudera, Dropbox, and others)—embody and enact, each one differently, a prototype (a “prototypology”) for our *Cloud* geopolitical futures. The architecture of their brands and their software platforms is not only representative of geopolitical interests; each one in its way is a geopolitical model. To be clear, the more relevant questions for us are less how they might extend US superjurisdiction than how each constitutes different and incomplete options for what emerges around it and in spite of it. They perform this role both as privately held corporations and also, as Umberto Eco pointed out years before (1994) in his prescient satirical essay, “The Holy War: Mac vs. DOS,” even as exemplars of alternative *techno-theological* programs.⁴⁶ In sequence, we’ll examine the models posed by Facebook, Apple, Amazon, and perhaps the most significant for this stage of the argument, Google.⁴⁷

29. Facebook

Facebook’s *Cloud Polis* is built directly on its *Users’* personal lives and their interest in each other’s personal lives. Its reserve currency is what the theory of symbolic interactionism in sociology calls the “presentation of self-identity.”⁴⁸ In the reconstruction of the social networks that link the social-psychological capital of hundreds of millions of people, Facebook represents a voluntary and highly limited simulation of human culture, and for this, it is a singular achievement. Whereas Wikipedia, for example, publicly automates topical consensus, Facebook captures that social capital and guards it from strangers, displaying it through limited interfacial prisms. In turn, it leverages that capture into metacapital to be sold to microtargeting advertisers. Facebook’s *Cloud* model is rendered in the cumulative *captured graph* of the lives, likes, and allegiances of its active users, who spend more time on Facebook than any other site, and who have amassed the largest single repository of mechanical images in human history on its servers.⁴⁹ Gabriel Tarde’s nineteenth-century dream, for a sociology based on diagramming society bit by bit from every microencounter until emergent patterns come into view, is suggested, if not also partially realized, by social network platforms such as these.⁵⁰ Just as for Google’s search algorithms, for Facebook’s social graph simulation, *the index is the innovation*. If the paradigmatic cultural energy of the nineteenth and twentieth centuries was the invention of new media technologies and the exploration of these as vehicles to drive avant-garde forms of expression, then twenty-first century invention focuses instead on the scanning, archiving, cataloging, sorting, visualization, cutting and pasting, sensing, and serving rationalization and capitalization of archived reservoirs of content. Further, “new content,” like the billions of images uploaded to

Facebook or its Instagram, are already archived, socialized, and disseminated in near real-time. For such services, the archive is the primary channel of communication; the index is the medium of the message.

As a model for *Cloud Polis*, Facebook's social graph relies on at least four techniques: *identity and display*, *network closure*, *visual communication*, and *fabricated currencies*. Through the profile and the feed, Facebook gives standard form to acts of social display, filtering them through perpetual refinements and updates. Participation in this narrowed *Cloud* "public" means a consistent, performative fashioning, and the "care of the self" as a public artifact of its own shadows and connections. Peers *like* what you say, they *share* your offerings, and, in time, they subscribe to *you*, the individual character in your own reality mini-show. The fabrication of the self becomes the primary project of this platform, at least for the *User*, but in time, this general model could take many different forms, as subjectivity and agency are dispersed into nonlocal networks and assignments. For Facebook today, that means Tarde meets Sartre meets Pavlov: this "hell of other people" is drawn as a social prison of timelines, passionate position-taking, political sentimentality, "weird tricks" for this and that, pseudoscience, teen and mid-life narcissism, and stalking, all paid for in microseconds of attention.

The Facebook model is a closed and largely opaque network. How exactly its *Users* network with one another is based on proprietary graph algorithms and subject only to periodic, largely useless protests and petitions. Spawed in the image of the Ivy-covered walls of elite mating grounds, Facebook maintains the reality and illusion of a well-pruned curated lifestream (restricted from other random people, that is, not from Facebook), such that one's social network is not spammed by usurping gatecrashers. In some ways, this closure mimics the enclaved and privatized *Cloud* itself, monetized mostly by a few early investors. Whenever pressed, it seems that Facebook explicitly and emphatically does not endorse the cosmopolitan vision of information infrastructures professed by Google. However, as default rentier of our social affiliations and wannabe concierge of their capitalization, this conservatism may stunt the platform's long-term evolution.⁵¹ For one, it pushes *Users* toward regulatory remedies for perceived mismanagement of what they take to be "their" content in a "public" forum. It also invites the legal preemption of many techniques for social graph capitalization that Facebook (or any other graph-based *Cloud*) might wish to pursue and leverage in the future toward further independence. The company's leadership is unloved and popularly perceived as selfish, petulant, and uncommitted (as reflected in the company's IPO problems, the David Fincher movie, a hundred Sean Parker jokes, a smirking Eduardo Saverin defecting to Singapore to avoid paying his taxes, and the contrarian public persona of early funder Peter Thiel). There are, however, many other examples of *network closure* that deliver very different effects (Apple's own take on the walled garden is discussed below) not the least of which is the model provided by China's portfolio of social media properties like Renren, Sina Weibo, Tencent/QQ, and others.

All of these are interested first in the extraction of some sort of surplus from a captured social domain over which they exercise a slightly resented monopoly, and each looks at the other—state-sanctioned company versus private holding—as an ambiguous variable in its own strategies. The Facebook model (including its Instagram property) is also of a *visual Cloud*. It boasts human history's single most prolific consolidation of images. As a primary channel of *User* communication, here the image overwhelms text as the basic gesture of self-fashioning. Should the Facebook platform bend toward socialized video, then the future of the feed may turn into semi-random cinema, edited by one's network affiliations, and circulated by peers as social currency: real-world Chatroulette as the future of our species' intersubjective symbolic thought.⁵² From the Facebook platform's perspective, the ability to glean information about *Users* from large-scale artificial analysis of image content also greatly amplifies the scale and scope of the social simulation project.⁵³ The acquisition of Oculus, the virtual reality hardware company, may extend this into more immersive visual cultures, perhaps operatic platform-scale multiplayer online games built from the personal media of Facebook's *User* base (or perhaps just 4D Farmville hallucinations).

The Facebook model is also based on *artificial currencies*. The platform has spawned a secondary economy of twitch-and-reward game apps, which feed off the central graph like little symbiots. In the midst of the European financial crisis, Metahaven proposed only half-ironically with its *Facestate* project that perhaps Facebook credits could replace the euro as a common currency. In this inside-out microeconomics of social capital extraction, we are all World of Warcraft Gold Miners, spamming ourselves to get through the day.⁵⁴ However, the final form of that currency is still undecided for Facebook (as it is for PayPal, Apple Pay, Google Wallet, bitcoin, and Walmart Banking, for example). How a functional “social wallet” might emerge from the consolidation and transparency of our linking and delinking, one to another, generating and paying debt with attention and reputation, is an important component of a truly interconnected *Cloud Polis*. None of the other digital currency projects is built on the core currency over which Facebook still has privileged position of access: the microeconomies of *recognized social debt* from which the value of money is primordially derived (at least for humans; HST algorithms are a different story).⁵⁵ But to date, Facebook's furtive and ill-conceived experiments at the monetization of that capital are based on strategies of rent more than mediation, such as reciprocal likes, selling post promotion, charging users to message each other, and so essentially taxing the graph's own growth. This may be a doubtful recipe for the conversion of public obligation into private money and back again. The magical ontology of money requires a trust so trusting that it requires no deliberation, and while social graph-based platforms may be where new currencies will be sustained in the long run, Facebook may have soiled its own punch, and so perhaps we'll see banks becoming social graph platforms before we see graph platforms becoming banks. Still Facebook is the most widely engaged social media site

with well over a billion active users and so its potential for structuring human communication according to its own logics of platform sovereignty remains profound.

30. Apple

Apple has assumed a mantle from Disney for preeminence in mass-scale, closed-loop experience design.⁵⁶ By comparison with the extractive micromanagement style of Facebook, Apple's closed world is ruled with luxury carrots more than with behaviorist sticks. Inside, its public expects total design into which (or onto which) *Users* can invest individual desires for creative self-idealization. Apple's origin story is now as deeply ingrained in the American myth of the prodigal hero-entrepreneur as that of Peter Parker bitten by a radioactive spider. While the company's roots extend back into mid-1970s Northern California hippie hacker culture, in important ways the Apple *weltanschauung* was not crystallized until the airing of Lee Clow and Ridley Scott's Superbowl TV ad in and of the year 1984.⁵⁷ Here the driving *theologic* dichotomy of the brand is established, cleaving the line between Apple (individual, color, youth, cool, iconoclast) and IBM (mass, monochrome, old, awkward, hierarchical), a creed equally appealing to 1960s counterculture and its boomer aftermath, as it is to the John Wayne wing of the American Right. An LSD-eating Buddhist and his gentle programmer pal set in motion what would become Rush Limbaugh's favorite company.⁵⁸ The story of the company and its brand have provided privileged archetypes to postindustrial capitalism: a populist concept, rejection by the old guard, a near-death experience, the return of the True Idea, blockbuster appliances, an actual death and hagiographic reverence, the passing of the doctrine, and so on.

Apple has also done more than any other company to make the rhetorics (and sometimes reality) of design into a central problematic for digital culture, far beyond the relentless cognitive utilitarianism of a traditional human-computer interaction (HCI) seeking to annihilate all ambiguity. The company turned computation into a mass medium of self-articulation: a main ingredient for any socially and economically sustainable *Cloud Polis*. Beyond the *Cloud* (or computing even), Apple also exemplified the power of brand as a core competency for publicly traded companies. It turned brand into content, encouraging customers to speculate on the brand experience in the third person, not only as something they themselves experience but such that their performative discussions about the brand experience are a core aspect of the experience. For Apple, this is founded on the idea that Apple uniquely "gets it," and if you get Apple, then you are perceptive enough to get it, too. This conspiracy of the illuminated first drew its fundamental distinction against corporate cybernetics in that 1984 ad, and then against Microsoft and the (supposedly) crass, artless boredom of corporate IT departments and the malignant malevolence of Bill Gates. But today the terms of Apple's Manichean doctrine are less clear and less confident. Apple's light is now cast in

contrast with what darkness? Is it Apple versus Google or Samsung, or what? The space is too fragmented; others are doing newer, more colorful and imaginative things. The software experience is now best recommended for its seamlessness, tastefulness, and predictability. These are hardly the watchwords of revolution. To paraphrase and invert the referent of the 1984 ad, the Apple model for *Cloud Polis* may be a walled “garden of pure ideology,” but it is backed up by inscrutable attention to physical detail in the design and manufacture of its hardware lines that allow its *User* to touch a tactile cloud.

The Apple model of *Cloud Polis* is based on four primary emphases: *hardware/physical touch*, *App ecology*, *cult brand/leader*, and *enclave aesthetics*. The iOS, iTunes, App, and third-party content ecosystem is the basis of the company’s Cloud platform, but the Apple “public” coheres through mutual esteem for the premium hardware that *Users* carry with them in daily life. As *Cloud Polis* develops beyond the data-on-screens framework of today, it is an open question what the design brief for *Cloud* hardware will include, and so it may lead a company such as Apple or Google well beyond the domain of consumer electronics as we conventionally understand them and deeper into the personal effects of the world (as Apple’s Watch and Google’s Car and Glass projects foreshadow). In this, platform lock-in versus neutral interoperability becomes an even more existential problematic. Apple’s initial forays into massive *User*-centric *Cloud* services have a spotty track record (think MobileMe), while its audience-centric *Cloud* services (such as iTunes) bend whole industries toward them and generate fabulous profits. Still, it is at the level of the operating system that Apple’s model platform logic coheres, and it is through premium hardware that it is guaranteed. As usually credited to Jony Ive’s talent and Steve Jobs’s perfectionism, Apple’s physical objects ground the *Cloud* as something you can and want to touch and accompany you. This “design” adds dramatically to profit margin per device and underpins other channels of involvement and lock-in, pushing *User* experience of The Stack toward dictates of affect, flattening and cajoling the megastructure to “just work.” Beyond individual touch, the physicality and tactility of Apple’s platform are also available as architectural immersion in the global footprint of Apple Stores, where an ideal Apple culture is performed by teams of ideal Apple *Users*, the youngish, intelligent, helpful, at-ease store staff. In this architectural network of mall-based parishes, one does not merely shop for electronics; one is to be supported in the goal of creative self-realization. The expert experiential design of the object, as well as the inspirational native habitat from which it is adopted at point of sale, cannot be separated from the political coherency of the Apple model of *Cloud Polis*. It is renewed less by new services than by a dramaturgical cycle of tactile collective participation and self-representation. No future *Cloud Polis* can afford to overlook these accomplishments. However, despite its total design model, Apple’s platform logic is underwritten by its (now much-copied) innovation of *Apps* and the App Store. Instead of providing every possible software service, product, or function that could be anticipated, it instead administers a centralized market for

mini-applications, connecting developers and *Users* indirectly and ensuring profit for the former and some degree of code quality for the latter. An outgrowth of a hardware-led strategy, Apple's App ecology means letting developers assume the risk and reward for the long tail of software experiences. Even so, these must hew to the platform's core interaction affect or face banishment. Whichever way the *Cloud* (particularly the mobile *Cloud*) might evolve, Apple is positioned as a preferred physical "last millimeter" of delivery (the feel of "look and feel"), the exact physical point where *User* and *Cloud* touch. (There is more on Apps in the *Interfaces* chapter.)

Apple's walled garden, as opposed to Facebook's, is utopian in tone, a paradigmatic community unto its own: autoexceptional. Jobs spoke of Apple as "an Idea," wholly unlike the consumer electronics and software companies for which his contempt was always easily forthcoming. The Apple *Cloud Polis* also rests, then, on the enclave aesthetics of that concept and how it extends into particular choices about the company's relationship to the governance of terra firma. The reader is perhaps familiar with the tale of Jobs's Mercedes SL55, which he leased every few months so that he would never have to affix license plates. Having to do so would have required him to publicly acknowledge, in this small way, that he was personally subject to the general jurisdiction of the state of California and to its administrative control over roads and drivers. This conflation of an ethic of exceptional design work with political exception and exemption is inherent in the Apple model for *Cloud Polis* and gives wind to the effervescent patriotism among its *Users*. The ecstasy of revelatory launch events, the hermeneutic interest in the company's history and future product road maps, not to mention hagiographic reverence for founding figures, all mutually strengthen real and imagined bonds between the Apple public and the brand.

As the delamination and re-interweaving of *Clouds* and contemporary states point toward one possible future of proliferating and overlapping enclaves and exclaves, the Apple totality is a model for an elite sovereign format, walled off from the relative chaos of outside publics. As ever, utopias are closed systems—islands—but where "Apple" is finally located is not so clear. Whereas Disney's original plan for EPCOT Center was a utopian community, a real Disney city realized with diminished ambition as Celebration, Florida, the town of Apple, North Carolina, is the home of one of the company's most important data centers, but it is a very unlikely site for residential relocation. Apple's comprehensive attention to the interiority of product experience is well suited to a future featuring nation-sized gated communities wherever they may encircle themselves. For this, the exceptional enclave and the camp work both ways. The dystopian megastructures on which experiential seamlessness depends, like Foxconn's factory cities where Apple objects are assembled, are the necessary mirrored doubles of the Apple *polis* itself, each cocooned in opposing bubbles yet each interior to the other. While some are drawn into live-work-sleep factory cities, where even suicide is not allowed, others are tucked like happy frequent flyers into a benevolent, tastefully

designed compound in the sky (more on this pairing in the *City* chapter). While the Apple model for *Cloud Polis* represents a real triumph of expert industrial and interaction design at the level of technological geopolitics, these can't be separated from the cloud enclaves against which they lean.

31. Amazon

By comparison with Facebook and Apple, Amazon's model for *Cloud Polis* emphasizes an agora of *objects* rather than of humans, logistical expertise over tactile affect and self-identity, and white label services instead of brand patriotism. By far the largest online retailer, it has made post-Fordist supply chain compression and retail distribution chain automation into a long-tail mass medium. Through its gargantuan website and its network of warehouses and distribution centers, the Amazon platform centralizes connections between producers and retail consumers at a massive scale. The sum of individual items listed in the cosmic Amazon.com inventory index is measured in the hundreds of millions and is kept in check by the company's own proprietary object identifier, the Amazon Standard Identifier (more in the *Address* chapter below). The Amazon *Cloud* model is based not only on expertise in faster-than-military-grade point-to-point logistics and mega-retail, but also the linking of these two with algorithmically driven pricing, recommendation, profiling, and proprietary purchase functions like One-Click and Prime. This gives Amazon visibility into small-volume supply chains similar to Walmart's into mass-volume merchandise. The results are price constriction, delivery time compression, and a general undermining of brick-and-mortar retail economics. Of those discussed here, Amazon's model is the most demonstrative of how what was once called e-commerce has transformed how goods are made and consumed, and how spatial and temporal economies of production, habitation, and labor have been refixed accordingly. But the "flat world" initiated by these logistical integrations is far flatter for objects than it is for people, as Amazon has orchestrated an incredibly precise scattering of commodified molecules coming and going.

In his 1950 essay "The Thing," Heidegger lamented what he saw as the "going" of the organic, situated thing gathered from natural ingredients and the "coming" of the technological object, all placeless, anonymous, and cosmopolitan (I do not share his view on this). Scanning the landscapes of shipping containers, we assume that renewed philosophical interest in the agency of inanimate objects—the globality of material cultures, object-oriented philosophical speculations, assemblages, and networks—cannot be coincidental. These are overly timely reactions to an apparent if also unnamed predominance of object flows and freedoms, as supported by planetary-scale computation. This interest variously valorizes or rejects that predominance and those flows, more or less uncomfortable with the anti-anthropocentrism that rootless objects suggest and, as discussed in more detail in the *Interfaces* chapter, the post-Internet globalization of

inanimate and animate substances presents a challenge to disturbed everyday sense of place and agency. For many, logistical distance and nearness bring not systemic transparency but mystification. Objects somehow appear on the doorstep, their origins opaque to their consumers and *Users*. Perhaps, from some vast and distant reservoir of a Spinozan ursubstance, a pure clay of stuff, commodity form is given to each one of these iterations, then packed in containers with millions more just like it. When this mass arrives at the shipping port, that sequence of smaller components assembling into larger aggregate states is reversed.⁵⁹ The packed shipping container is opened; pallets are removed, trucked, tracked, broken down into boxes; and then finally a single-*User* unit appears for delivery, a pebble peeled off this unseen boulder and delivered to your porch-become-retail interface.

When you click on the Buy button, you trigger this whole process again. One fewer unit on the shelf means one more is assembled elsewhere to replace it as “choice” activates the supply chain as surely as turning a key in a car makes it start. Amazon’s is the state-of-the-art model platform for this *Cloud Polis of things*. Amazon’s central demands for that polity’s prototypical future are *object logistics, retail compression and virtualization, procedural individuation*, as well as *third-party hosting*, the provision of wholesale *Cloud* hosting at global scale. Amazon’s eminent retail position leverages the just-in-time global delivery networks born in the 1970s that enabled overnight links between the East and West coasts of the US through central hubs in the Southeast, namely, UPS and FedEx.⁶⁰ Tracking the growth of planetary-scale computation to synchronize and accelerate flows of data and metadata, these package delivery networks have evolved from expensive supplementary services for high-priority clients into general platforms for the distribution of objects to and fro. Their efficiencies threaten federal postal systems, which offer universal service even to remote locations but comparatively slow delivery options (more on the postal ontology of the state in the *Address* chapter). Through megaoutlets like Amazon, these delivery platforms not only grease the flow of goods from warehouse to shelf, they virtualize the shelf and alter the relative advantages and disadvantages of local businesses. The velocity of object flow tracks to exponential increases in the computational capacity of individual processors, which are also the switching gateways of real packages coordinated by them in aggregated multiples. As each switch in the landscape of logistical infrastructures increases in its ability to route bits, it also increases its ability to route the real objects that those bits represent. Amazon (and others—e.g., Walmart, Carrefour, Alibaba) aggregate and centralize those routes, feeding on efficiencies of scale, the competitive supervision of these networks, and the leverage over smaller actors in the cycle that these both guarantee.

The Amazon model demonstrates (as does Google’s) how the microtargeting of content to individual *Users* based on previous search-and-click history allows unique terms of engagement with diverse subpublics without needing to put one *User* on display

to the other. This technology of procedural individuation-without-identity is in contrast with Facebook's, which defines the individuation of the *User* largely through the visual display of identity. For Amazon, the long tail is a model of objective tendencies, not subjectively performed gestures. The platform does not care about your name or who you really are deep down, but only in the likelihood that the next presentation of object X, Y, or Z will motivate your One-Clicking and the subsequent activation of supply chain cascades that ensue. For this, Amazon does not even necessarily have to provide the *User*-facing front end for *Cloud* services. Just as UPS and FedEx moved into high-margin logistics consulting businesses, Amazon Web Services is a major provider of large-scale *Cloud* hosting and e-commerce for third parties (including states and their intelligence agencies). In addition to finding customers for its suppliers, Amazon also rents the pick-axes for the *Cloud* rush. This superterranean platform-of-platforms (from servers to warehouse to inventory delivery) allows both small and large affiliate actors to engage multiple overlapping and even opposed publics on the same shared hosting infrastructures.

As Amazon further shrinks the remote order-delivery cycle from a network of nearby distribution hubs and subhubs toward the same-day and instantaneous downloadable delivery of items, the remaining functions of local retail become both more constricted and more open.⁶¹ On the one hand, ever greater supply chain compression may further transform retail space into purely experiential demonstration theaters, designed to motivate later online purchase, or may push to reprogram them all as publicly accessible storage facilities: a Tesla showroom or Home Depot, and not much in between. In time, 3D printing and other digital fabrication technologies may accelerate and overpower even this process, as your Kindle evolves from an e-book reader to an e-goods fabricator key and license library. Perhaps the Amazon model will lead away from today's warehouse archipelagos dotting rural landscapes connected by cargo trucks and toward a denser network of print stations where furniture, electronics, appliances, clothes, and other products are fabricated on demand for pickup or shuttled to nearby residences (by drones, maybe—and maybe not). Perhaps the same network would also reverse the supply chain, providing deep recycling and upcycling of used goods. A network of Amazon printing stations might not only regurgitate commodities, but also reabsorb used matter as well, slurping up that universal commodity clay, and closing the open trash loop of mass consumption by shifting *Users* away from the redundant ownership of individual items and toward lighter subscription and service economies. The impacts of this gray-goo macroeconomics are unknown unknowns: all goods made free through object torrents, implosion of the demand base, empty factories in China, shipping ports turned into Museums of Cement, centrally planned provisioning, nano-communism, nanofeudalism? As ever, platforms at this scale are both cure and poison at once.

32. Google

In 2011, in a bid against Apple, Microsoft, and others for a cache of Nortel's patents, Google offered what at first seemed like weird, arbitrary sums. It was soon apparent that these were not random, but represented definite and significant mathematical strings—for example, Google bid \$3.14159 billion, or pi times a billion, for one bundle. It had bid numbers that were Brun's constant and the Meissel-Mertens constant, which relate to prime numbers. One can interpret this as an oblique but emphatic symbolic statement by Google that the immutable and universal laws of *mathematics*, which are by their nature uninterested in the folly of political hierarchies and economic intrigue, will ultimately win out over the hysterical mere numbers of human counting. Google may or may not share this view, of course, but none of the other platforms discussed in this chapter come close to Google in its universal, even cosmic ambition. Not only does the company express a cosmopolitan mission (at least rhetorically), it does so as if the company itself were merely the conduit of a deeper force of quantitative reason. The company's mission statement, "to organize the world's information and make it universally accessible and useful," is in its simplicity about as all-encompassing as you can get. When everything is information, then organizing the information means organizing everything. For example, Google recently purchased the smart thermostat company Nest (as part of a robotics buying spree), and the company still has its license to sell energy. In the longer term, a Google Energy may be a key player in the retail and wholesaling of renewables and the management of both consumer and municipality-facing smart grids. The company sees the pairing of bits and electrons as part of its *vocation* in ways that others simply cannot: Google Energy, Google Glass, Google Ideas, Google Car, Google Robotics, Google Earth, Google Space, Google Time, Google AI, Google *Grossraum*, Google Sovereignty, Google World. For the Google platform model for the *Cloud Polis*, these are all based on a grand vision encompassing (at least) *information cosmopolitanism, search, advertising, physicalized information, and global infrastructure*.

Google (and now Alphabet) is a company founded on an algorithm.⁶² The original PageRank algorithm was Larry Page's attempt to organize the entire World Wide Web according to something like the peer citation models that quantify which academic papers are most influential and relevant. This computational meritocracy is in the service of a universalist mission to not only organize the world's information but to "make it accessible and useful." The most current status report on this mission as a geopolitical framework is the book *The New Digital Age: Reshaping the Future of People, Nations and Business* by Google executive chairman Eric Schmidt and former State Department official, now Google Ideas director, Jared Cohen. The book pledges allegiance to various contemporary truisms regarding the Internet's ability to flatten and democratize political systems and to deliver market-friendly civil societies. It argues that open data flows puncture local superstitions and will eventually sink capricious

authoritarian ideologies under the weight of the transparency and enlightenment that they usher in. Partially reminiscent of the Wilsonian doctrines that drew Schmitt's disdain, and also of Clintonian versions of the end-of-history thesis, for Schmidt and Cohen, friction is equated with antiquated self-serving oppression whereas universal information liquidity is linked with geocultural progress and democracy. Their characterization of Google's role as neutral platform is often more implied than directly outlined, and visionary claims for the digital future are made through and on behalf of the regular people whose lives will be enhanced by the Google platform's evolution. Today, however, Google is also perceived as too linked to the US federal system, and both fairly and unfairly is held in suspicion throughout the world, especially in China and Russia, as a stalking horse for the US State and Defense departments' security apparatuses.⁶³ Any real informational cosmopolitanism is far less likely to come to fruition in any way resembling Google's stated aspirations as long as this is the case. In his slashing review of the book, Julian Assange characterizes it as "an attempt by Google to position itself as America's geopolitical visionary—the one company that can answer the question, 'Where should America go?'" While his cynicism about the chrysalis Google World on tap and what it means for a company hoping to not "be evil" is shared by many, Assange's laser focus on the US-centricity of Google overstates the particular.⁶⁴ Put plainly, Assange's single-mindedness about the United States as the epicenter of hegemony and therefore the key innovator of authoritarian models (an assertion he had no qualms making from own show on Putin's RT television channel) is too idiosyncratic and limited a critique. It is informed by an absolutized (and Oedipalized) metapolitics that crusades for transparency, opacity, and/or privacy as the guarantors of safety and sovereignty for atomized rational actors, and too often also as the core or even sole requirements for human social organization. For Assange, Google equates with sinister schemes of a single state, and according to Schmidt and Cohen's book, Google is but a useful and agnostic enabler of the democratic project. What neither Assange nor Google is able to say is that the more disruptive and even likely future is one in which platforms such as Google undermine the ability of traditional states to control the evolution of the new *Cloud* polities, irregular and unrecognizable, that spring to life and will in time turn on their state hosts.

For their part, Schmidt and Cohen also warn against "Internet balkanization" whereby authoritarian state actors (China, Russia, Iran, federations of Sunni states, Texas, and so on) build virtual borders around their citizens, keeping them trapped in a closed bubble of sanctioned concepts, and sheltered from the enlightening waters of the global Internet provided by open platforms, such as Google. Under this deglobalization, the cosmopolitan potential of the Google *Cloud* model would be subverted and inverted by local "traditional states" jealous of their citizens' wandering attention. They explain the dynamic of *Cloud* versus state in the gentlest possible terms for a Western audience. The negative scenarios drawn include alternative DNS (Domain

Name System) addressing systems allowing any state bloc to contain its own map of the online world, separate from others, and in principle to wipe other locations off their particular map. Such information enclaves, especially those implemented and enforced by traditional state regimes, are a hovering threat to atmospheric universalism, and so Google now also offers its own Google Public DNS, which allows *Users* behind the wall of a closed-off Internet to tunnel through anyway.⁶⁵ As these arms races heat up, Schmidt and Cohen speculate about Internet refugees and asylum seekers moving across physical borders, without or without special visas, so that they might access *Cloud* systems unavailable from where they escaped. The corollary of this proliferation of walled gardens and online enclaves is what the authors call “virtual states,” represented by proto-states that hope to realize themselves as distinct communities, and they discuss the examples of formal online polities for a Kurdish state and an independent Chechnya. But the more interesting *Cloud* polities are not those that simply extrude national or ethnic identity online and reestablish borders there, or those that use online space to make irredentist claims to territorial sovereignty denied them on the physical ground, but those that develop and form without that geographic and historical legacy and for whom the *Cloud*’s own geographic situation is the first basis of emergent sovereign imaginaries. *Cloud* “citizenship” is structured around the slippery semantics of *User* identification and addressing. While *Cloud* platforms might support, subvert, or sidestep the sovereignties of particular state systems, those same systems may be put to the task of arbitrating some aspect of the final maps of identity and the portions of political subjectivity that they might still contain. Competing platforms, which seek to leverage their core control of self-identity economics as the basis of their platform’s effective autonomy, might be less enthusiastic about that particular arrangement. At the same time, identity services are sure to continue to play a decisive role in differentiating privacy and publicity, cozily secure for those who can pay, but for those less fortunate life is lived out in the open, shedding data for whatever may come along to observe them.

Google’s geopolitical model depends on their core revenue channels, namely *search* and *advertising*. Search is conventionally understood as the ability to enter strings of human-understandable language into an index and then receive ranked links to “web pages” correlated to their relevance for *Users* like you. But search, as an epistemological technology, can and does extend to more esoteric realms, expanding “who” is searching, the semantics of “a query,” and the uncertain discreteness of “what” can be searched for in the first place. As computational systems absorb more and more industrial infrastructure at a finer grain of detail, imbuing tiny components with network addressability, nonhuman *Users* will make far more queries than those by regular humans, and by some measures, they already do. Search shifts from a person-looking-for-information business model toward a subsystem component-querying-external-systems mode of infrastructure. Search becomes about machines querying state

conditions of other machines, and these can include Google hardware such as a car, which will search or sense their immediate surroundings and are in turn searched by those same surroundings.⁶⁶ Perhaps there is no *User* who can search who cannot also be searched. As search includes many forms of *Cloud*-based person-to-machine, machine-to-machine, and machine-to-person communication, it may also develop deeper and more semantically standardized grammars. Many semantic systems would allow a simple query to execute a script or small program that would return much more than a list of links; “to search” becomes more like programming the search engine and its index according to *User* wants and purposes. When nonhuman hardware executes semantically complex query programs, then search becomes a general platform for an autoprogrammatic physical *Cloud*. Finally, far beyond Web pages, the landscape of what can be addressed by a given search expands to include any “thing” that can be addressed with a discrete numerical signifier, whether it resides on a server in a data center or in the habitats of everyday life. That addressee could be a bit of datum, a physical thing, a mapped relationship between things in time, tangible or intangible (more on this in the *Address* chapter). The future of search involves all these innovations of the who, how, and what of searching and being searched, and Google’s current eminence in this space depends on its ability to outpace (or outacquire) competitors in these domains.

Google’s revenue does not come from the direct provision of retail *Cloud* services, such as search, but from the monetization of *User* attention paid to services in the course of engagement. Its *Cloud* model economics is based on the successful transformation of the web into a massive peer-to-peer advertising platform, and the transformation of advertising into a meshwork of computationally microtargeted points and clicks. By the pairing of supplied and demanded attention at the infinitesimal degrees of individual search results, page views, and keyword bidding, Google absorbs cognitive capital from the collective intellect of its *User* population, siphoning value centripetally and then pushing it back outward.⁶⁷ Google’s vast suite of *Cloud* services costs no money for *Users* to use, but they are not exactly free; the company generates far more money in aggregate by optimizing attention and information that it costs them to provide those services, and in this regard Google’s business is exemplary of *platform surplus value* discussed in the second chapter, and of how the platform derives value proportional to its own use and adoption. Google’s essential techniques for this, besides the built-in network effect of its vast *User* population, are the proprietary algorithms that precisely pair bid-on search terms with optimized advertising and results. Every time anyone makes a search on Google and clicks on a particular result or advertisement, she is also retraining the platform’s algorithmic intelligence, a tiny bit each time, helping it to make incrementally more precise predictions of *User* intention, intuition, desire, and demand. Without minimizing the expertise of Google’s scientists and engineers to actually compose these complex systems, we can also say that Google’s search and advertising infrastructure draws on the work of its users to optimize which

search results will best match the inquiries made by future *Users* and their interests. Every time we execute a search query, Google is not only working for us; we are also working for Google. The total value of Google's costs to provide those services is always less than the total value of the intellectual and information capital that its *User* population provides to the platform. The difference between the former and the latter was a gross profit margin of 62.86% for 2015 as of mid-June, according to Google's reporting. Whereas for all advertising economies, the audience is the real product resold by the minute, impression, or click, for mature platform economies such as Google's, the *User* is the product *and* the worker cobuilding the platform (of which he or she or it is also a customer). This would not work if *Users* themselves did not receive real platform value from their participation in this particular platform as opposed to others. From the perspective of the individual *User*, the personal value of information received must be (or at least seem) greater than value sent, even if at the aggregate level of *User* populations, the inverse may be true. At once, Google's *Cloud* economics draws on capitalized cognition, networked value production, and incremental value accumulation and reappropriation.⁶⁸ In this sense, it is not foremost an apparatus of surveillance or control per se but a medium for the capture and transformation of living, thinking, and knowing into platform value. The latter is not reducible to the former. Its "organization of the world's information" strongly depends on the incorporation of the work done for its global index by its *Users*, and the blending of that work into new aggregates, so as to better train that machine's capacity to simulate, motivate, and mediate *Cloud* economies with thought-by-thought, gesture-by-gesture granularity. One wonders what the Soviet cyberneticians of the 1950s and 1960s, with their plodding ledgers and "gosplans," would make of such a system if it were stripped of its patina of American hegemony.

"Information" is not only about the world; it is in the world, and so once Google's platform archive has reached a threshold equilibrium, the company's mission statement suggests that it should retool the world to make it generate more information, so that the world itself can be better organized. In some cases, making information physical is indistinguishable from making physical machines more computational; the impetus for hybridization can begin from either side. In 2013–2014, Google went on an extraordinary buying spree, acquiring many of the most innovative robotics companies, many working in areas not directly related to the company's existing services and offerings. Google's new zoo of machines represents a diverse range of physical activities that could be programmed and monitored by its platform; together these companies make robots that can run, jump, carry heavy things, fly, make things, take things apart, and manage the temperature of your house based on your daily routines. It is reported that Google's robotics ventures will be one of the occupants of the Hangar One megastructure at Moffett Field, leased from NASA's Ames Research Center in Mountain View, CA, but with the chief architect of the Android mobile operating system, Andy Rubin, initially in charge of the project, we surmise that its mission is

perhaps more to link robots together on a common operating system than to engineer their bodies. Rubin has since left Google, replaced by James Kuffner, but the longer term strategy may be in place: organize and make accessible the robotic phylum. Our anthropocentric predispositions often lead us think of a robot in the singular, as a synthetic person that contains its program just like a human thinks that it contains a will and a personality. Platform-based robotics, however, suggest other avenues of evolution. Today, ROS (robot operating system) is one existing platform of tools, libraries, and frameworks for adding software-based functionality to robots in ways similar to how one would program a software-only application; however; it cannot match what something like a robust “Android for robots” could do as part of the Google *Cloud Polis* model. Robotic mechanisms at varying scales would not only execute programs, but could sense, correlate, and report data on their interactions with the world, feeding the platform’s appetite for information to search, organize, and optimize. Each mechanism would also be in essence another *User* of the Google platform, and like all other *Users*, it would search and be searched, make use of the information that is there, and generate more information for other *Users*. Furthermore, as a model *User*, it is plural; its own intelligence is networked with the platform and with the wider collective of robotic and human *Users* with whom it collaborates. Should any one mechanism encounter something unknown, it could access a live API (application programming interface) or another more efficient technique and register the intelligence necessary to make decisions and actions. Over time, as each encounters different things and modifies its programming to accommodate them, two robot mechanisms born of the same model begin to diverge and even speciate. (More on this in the concluding chapter.) In the meantime, instead of new forms and behaviors, as platform information becomes more physical, its initial accomplishments may to “roboticize” machines, processes, techniques, behaviors, and systems as we already find them. The results are not unlike skeuomorphic interface designs where digital icons are made to resemble everyday objects and so allegorize how human *Users* (and designers) understand their machine’s functions to work. It will take some time for platform robotics to invent new infrastructural systems that are unique to how its capacities can be designed instead of merely automating what already exists.

Toward this, the ambition of Google’s *Cloud Polis* model already extends into the design and deployment of *global infrastructures*, and this interest is not a recent addition to the company’s founding vision, but in many ways precedes it. When Larry Page was a student at the University of Michigan, he was fascinated with the idea of an Ann Arbor monorail that would make local transportation more efficient. Google’s interest in transportation-as-platform extends, as discussed, into the Google driverless car project, now a focus of Sergey Brin’s interest and attention (more on these in the *User* chapter). One corollary of governing the *Cloud* as a global infrastructure for the integration of multiple economies under the rubric of rationalized information is a reframing

of existing infrastructures as local instances for the application of a new information systems engineering program. Some of these (e.g., mass transportation, energy distribution, economic identity, cartography, banking) developed during the industrial era as platform mechanisms for large-scale states that may have been, at that time, among the only actors with sufficient capacity to deploy and defend these acts of sovereign inscription at continental scale. For better or worse, platforms such as Google may be positioned to offer parallel innovation of these same inscriptions now as private *Cloud*-based services. In that the ongoing effective sovereignty of modern states was to a degree underwritten by their management of local sections of global infrastructure, the realization of viable alternatives to this guarantee, now as core functions of The Stack, further complicates the boundaries between platform as state and state as platform.

Perhaps the most fundamental of these, however, will prove to be energy and the *Cloud* layer's governance of the *Earth* layer of The Stack. To return to the earlier figure of a remote sea-based data center, we can say that is not likely that Google's research exploration of this solution is meant as an experiment with the liquid boundaries of *Cloud* jurisdiction. The company is not, I assume, looking at this particular project as a way to directly challenge state jurisdiction altogether. In fact, Google's fortune is probably more suited not to secession from state platform space, but to strategic interweaving with states (plural) and to an incremental assumption of traditional functions of the state, as they themselves pivot to the *Cloud*. However, taken as a design fiction (albeit one under Google's patent protection), the oceanic data center cannot but inspire ideas about new geographies. As indicated, Google's direct interest in such a system is driven by the pursuit of energy efficiencies and how to scale a planetary *Cloud* without a minimum of carbon- and dollar-intensive electrons. Google already has a subsidiary, Google Energy, that allows it to directly buy and sell federally regulated wholesale electricity, allowing the company to purchase directly from independent producers bypassing local utilities, and then selling excess energy back to the grid.⁶⁹ It is not difficult to imagine how a *User*-facing alternate version of Google Energy could become both major smart grid concern and provider of Google-branded or Google-produced energy, municipal and personal metering services, grid platform software, or a business-to-business and business-to-customer customer/*User* relationship management systems. In principle, that combined energy-data platform could make (some) international carbon mitigation agreements more enforceable precisely because states would not have to agree among each other as to how to monitor and measure the flows. Could Google (and corollaries in other parts of the world) just do this on its own and report it? Would state security hacking of energy-data routers and sensors only extend the old realpolitik into the realm of networked electrons? Still, as discussed in the *Earth* chapter, the membrane between an energy grid that powers the *Cloud* and the *Cloud* as a grid that mediates both bits and electrons at once is potentially porous at some key points. Google's energy ventures may suggest a model for the *Cloud Polis* for which the

provision of both of these at once is a compound service and system.⁷⁰ The interface of two existing systems, an information network and an energy network, may combine to produce a third thing: an energy *Cloud* drawn by a mixture of urban and regional infrastructures, networked production and storage centers, and on-demand utility nodes. Just as the production and management of infrastructure cohered publics for industrial states, the same may be true for the organization of new publics in their image of the platforms that come to manage them. If so, Google might depoliticize energy in some ways and radically politicize it in others. Recall that the political guarantee of a secure energy source (food) was and is a building block of archaic political loyalty, and is continued by states that did and do provide electricity as a public utility. Regardless of any benefits, the rendering of human-usable electrons according to the logics of platform surplus value is also certain to be attached to at least a few calamities. Nevertheless, as the geopolitics of climate change-related energy production and consumption effects looms larger, the questions of energy provision, dissemination, transparency, monitoring, alliance, and allegiance will (as discussed in the *Earth* chapter) drive realignments of jurisdictional loyalties around common predicaments, whether we prefer them to do so or not. Going forward, there is no *Earth* layer without the *Cloud* layer, and vice versa. Because energy is so essential and its calculative rationalization so attractive, it may drive the determining variables—its planetary limits, its antagonistic territories, its reserve currencies, and its included and excluded populations of *Users*—not just for Google's model of the *Cloud Polis*, but for the political geographic alignments of the entire Stack.

33. Future *Cloud Polis* and Platforms

The geopolitical design question for the *Cloud* layer of The Stack circulates around what forms different *Cloud* polities will take in the near future and how they will draw on alternative organizational logics in their emergence. To diagram this, it is tempting to extrapolate from existing models and to inflate and linearize their exponential development. Surely to varying degrees the models described above, as abstracted from Facebook, Apple, Amazon, and Google, will persist, normalize, expand, and recombine in some linear fashion. But in their recombinations and in the gaps and failures, unexpected and perhaps unlikable developments are certain to shift the terms by which such models mediate power. In the span of a generation, we may be living with an ecology of competing platforms for which the models that differentiate today's players are mixed differently along with new unknown functions. Only for this reason, and not for making futurist predictions about companies or stocks, the models of the current mix are a good starting point from which to sketch what might arrange alternative *Cloud* polities. Each of the limited sovereignties that a platform enjoys over a specific domain can be recombined. For example, instead of today's division of organizational

acumen as drawn above, perhaps some new *Cloud* platform will be based on a combination of aspects drawn from Facebook, Amazon, Apple, and Google at once. Perhaps one is based on *individuation and display*, *App ecology*, *object logistics*, and *global infrastructure*. Perhaps another instead draws on *visual communication*, *hardware and physical touch*, *third-party cloud services*, and *search*, while a third is based on *fabricated currencies*, *enclave aesthetics*, *retail virtualization and compression*, and *cloud-based robotics*. To date, the current major platforms have evolved as expressions of specific but not inevitable strategic decisions. There is no reason to assume that the ecology of platforms must be as it is, and very different arrangements are not only possible but inevitable. Today's key *Cloud* platforms might evolve in the direction of these prototypical mutations, while new platforms consolidate and bifurcate, others emerge from bits and pieces of incomplete smaller players, and still others remain resolutely partial and interstitial, carving unrecognized parcels from the overlaps. It would be worthwhile to formally outline full scenarios for each set of possible recombinations from existing platforms (several others—e.g., Walmart, Alibaba, General Electric, Samsung, Unilever, Siemens, Toyota—could be included here) formalizing the gaps, unexpected synergies and conflicts, and the different agendas that drive them to cohere and diverge. The resulting diagram of this menagerie of chimeric *Cloud* platforms will likely include some creatures that will in time appear for real and stalk the Earth.

If the basic ingredients from which those might be combined to develop global proto-state platforms seem dangerously inadequate then my point about the necessity of tuning our design attention here has been made. That designable future of *Cloud Polis* will not evolve on its own, as if determined by some autonomous space of calculative variables. It will appear in coevolution, sometimes complementary and sometimes violent, with other existing modes of political imagination and organization, including the Westphalian state and its inept adaption to global ecological governance. This is complicated by how the future of the state will also develop through its incorporation of the *Cloud* as its own field of vision, domain, and jurisdiction, in parallel with the *Cloud* further incorporating state functions. What, if anything, finally grounds these counterclaims? In one sense, the practical locus of governmental control is over the capacity to structure, police, and, especially, tax flows: flows of people, money, data, energy. Through the control of the interfaces of input and output, be that a port city, a great firewall, or a superjurisdictional seizure, the taxation of flows is both the means by which states execute the right to exact capital and the result of sovereignty. In turn, that sovereignty over flows of value is translated into the right to issue standard guaranteed currencies, through which those flows are measured and which symbolize the sovereignty that legitimizes that claim in the first place. Money is also a way to identify the content of flows through abstracted equivalencies and, through the *Address* layer, to enforce territorial claims over identification itself. But as *Cloud* platforms have perhaps more direct means to validate them, competing claims for unforceable

identifications of taxable flows may be where critical conflicts for the coevolutions of *Cloud* governance also rest.

Today some states seek to reconcretize their authority over the otherwise untaxed flows of value through the *Cloud* and have turned to forums like the UN International Communications Union to redefine global governance of the *Cloud* accordingly.⁷¹ Some simply want more global representation in standards and policy bodies dominated by the United States, others want to meter and tax Google for sending data over their lines, others to build tighter control systems into the apparatus making it easier for them to police troublemakers, and others even seek to shift the assignment of neutral infrastructural processes, such as the allocation of IP addresses, to individual nation-states for reasons that are unclear even to them.⁷² Instead of resolving the contradictions posed by the sovereign *Cloud* platforms by putting everything back in the bottle of the state's borders, some propositions would immediately exacerbate pockets of friction by fraying points of mutual incompatibility toward kaleidoscopic delirium and structural vacuum. A further decentralization of Internet governance is not a bad idea in itself, but basing governance instead on the privileges of local fiefdoms and seizures, and on making blunt old-school patriarchal authoritarianism more convenient, is in fact a very bad idea. The Stack suggests no teleology or necessary outcome, and the specter of *Cloud feudalism* becoming the normal twenty-first-century macroeconomics is a real possibility, but the state pushback against today's version of planetary-scale computation should not be seen as extrinsic, or even contradictory, to the logics of Stack geopolitics. As already suggested, a political and cultural momentum toward *generalized secession*, not one-worldism, seems to drive what we might see as the *nomos* of the *Cloud*. As a response to the uncertainties of the *Cloud*, polities consolidate into enclaves, new and old. Some of these are based on gestures like a reinscription of original lines of ethnic division and self-location, and some are based on platform sovereignties provided or demanded by regular participation in and identification with particular *Cloud* services, and some are based on both at once. Libertarian dreams of atomic secession and Eurasianist dreams of atavistic empire are two sides of the same coin.⁷³ Just as fundamentalism is a persistent symptom of globalization, sometimes conservative localism is a symptom of planetary systemization; as such, it succeeds less as countermeasure against hegemony than as a culture laying siege to itself.

At some point, these conflicts may resolve into stable, if also contradictory, geopolitical architectures. *Cloud Polis* models may recognize some consensus(es) for the superimposition of one sovereignty on the other, sharing the same spot on alternative maps. Or perhaps, even if without mutual recognition, the “Google” and “China” models of *Cloud Polis*, for example, may still coexist in some as-yet-undetermined modus vivendi, the terms of which change as quickly as unintended effects of technical maneuvers ripple back and forth through their planes of jurisdiction. But even so, we expect that the map that is supposed to mark the sites of disputation between the two would itself

be disputed. The two may weigh the scale of a demilitarized zone very differently, and the drawing of a real line on the ground may or may not be registered as formal demarcation regardless of how much it might actually structure actual flows. Any functional monopoly over the crucial symbolic lexicon of geography structures the kind of economics that can play out on it, and the Google Maps Nicaragua–Costa Rica conflict is telling, if only as a geopolitical allegory, of a novel shift between states and cloud platforms in establishing functional authority over that geographic symbolization. But China is no Costa Rica, and as India, Japan, and every other neighbor can attest, it is not shy about redrawing its own version of territorial reality according to an ambitious geographic self-image. Google's ultimate geographic strategy is less obvious and strategically articulated; indeed, it neither needs to be nor should be. Instead of claiming and occupying an exclusive sovereign territory, Google absorbs existing spaces into its purview by capturing and consolidating images of all territory at various scales, from street to satellite and back, and rendering them into the platform's comprehensive interface of rationalized space. Territory absorbed by Google is not one loop among others on a zero-sum horizontal plane, but a universal layer beneath the particular claims of any one entity in a thickened geographical stack. Google's mapping ambition therefore is foundational and inclusive of territory-in-total, and thereby it may be seen as interfering with an absolute last instance of sovereign identification that states might otherwise enjoy. Its descriptive reason extends beyond land masses, even deep into the Amazon river basin to oceanic underwater canyons, and beyond the planet, including Mars and Earth's moon, and offering them up through its own versions of the Blue Marble Earth, now interfacial regimes for the Google Earth publics. Does the *Cloud Polis* model suggested by Google's geographic reach recast political territory in a recognizable way, and if so, where are its binding limits? Are they established by the interfaces between Google and the state, or do they extend "beyond the line"? On the one hand, the superterranean spaces of the *Cloud* layer are a geometric mismatch with political geography as conventionally understood, but they are also coterminous with a return and ascendance of new city-state networks, and so with the fissiparous unbinding of one-world architectures comes a general resorting of mobile subjects into new infrastructural cosmopolities, enclaves, and exclaves, including ancient nationalisms and futuristic alliances.⁷⁴

Just as the overlaid geographies of the *Cloud* layer are generative of its most interesting future developments (and this geometric dissensus should be recognized as such), the same superimpositions will give structure to the pathways and limits of our own individual lives. In relation to software and sovereignty, each person, each plot of land, each addressable object, will be claimed by multiple incompatible jurisdictional authorities at the same time. Each such authority is in its way complete and "universal" within the limited domain that it can see and move, even if it is invisible to the others. The management of this multiplicity therefore works not in spite of overlapping

claims, but because of their claims of exclusivity. We will see that finally, it is the mutual exclusivity and closure between delimited sovereign spaces that allows multiple universal claims to coexist in different dimensions, even as they claim the same person or site as a subject. Perhaps, as we will discuss in the following chapters, the most critical secondary accidents of the *Cloud* layer are those that automate the architecture of exclusion between territorial planes according to violent hierarchies of absorption and extraction. It may also be our hope, however, that the same operations bring with them their own generative accidents, ones that introduce unexpected and uncontrollable forms of spatial access and practical mobility for those otherwise curtailed by its intended predicaments. That is, the flip side of producing platform *User* identity when none is wanted is that it is also produced for *Users* regardless of how other systems may otherwise try to exclude them. By their normalization of exceptional reversibility, urban and infrastructural scale interfaces that once kept them out now let them in, automating sovereignty where states had decided alienation. To consider this in more detail, we'll have to examine how the *Cloud* drives and animates the next layer up in The Stack, the one inside of which we all live: the *City* layer.

City Layer

No one, today, can know what the city of tomorrow will be. One part of the semantic wealth which belonged to it in the past ..., it will lose that, certainly. ... The creative and formative role of the city will be taken charge of by other communications systems ... , perhaps ... television, radio, their vocabulary and syntax, consciously and deliberately.

—Jean-Luc Godard, *Deux ou trois choses que je sais d'elle*¹

The inhabitants [of Ersilia] stretch strings from the corners of the houses, white or black or gray or black-and-white according to whether they mark a relationship of blood, of trade, authority, agency. When the strings become so numerous that you can no longer pass among them, the inhabitants leave: the houses are dismantled; only the strings and their supports remain. From a mountainside, camping with their household goods, Ersilia's refugees look at the labyrinth of taut strings and poles that rise in the plain. That is the city of Ersilia still, and they are nothing. They rebuild Ersilia elsewhere. They weave a similar pattern of strings which they would like to be more complex and at the same time more regular than the other. Then they abandon it and take themselves and their houses still farther away. Thus, when traveling in the territory of Ersilia, you come upon the ruins of abandoned cities, without the walls which do not last, without the bones of the dead which the wind rolls away: spiderwebs of intricate relationships seeking a form.

—Italo Calvino, *Invisible Cities*²

It is not the line that is between two points, but the point that is the intersection of many lines.

—Gilles Deleuze, *Pourparlers*³

Whenever I hear the term *smart cities*, I reflexively think of Jacques Tati's satires on the follies of automated modern architecture. However dark the humor, for master-controlled megacities and stale visions of bland efficiency, mega-hijinks are sure to follow. The poverty of off-the-shelf smart city strategies is all the more distressing given how important the intelligent composition of computational systems at urban scale actually is, especially for new platform sovereignties. Instead, however, if we view these supposedly futuristic digital technologies in relation to more primordial relationships

with territory, we may conclude that our meandering, rootless itinerancy through the surpriseless pathways of junkspace, gripping our mobile *Cloud* platform tethers (aka “phones” and tablets and so on) scanning, sorting, poking, and choosing as we go, is a far less modern way of being urban than we assume.⁴ Humans, as a species, have physically evolved very little in the last hundred thousand years, and barely at all since the appearance of writing. Our bodies’ own sensory media are the same as those that allowed our ancestors to survive the predatory rhythms of the primal savanna, and in the *City*’s landscapes of information production and reception, similar rhythms persist, now triangulated with new remote communication channels and various forms of augmented cognition. Perhaps we have tuned these rhythms so that they can resonate with new tools as much as we have tuned our tools to them. As Sanford Kwinter wrote,

The contemporary “mediascape” has given such primacy of place to communication that it has transformed it into substance itself, the very material of which we, and our world, are made. Yet all biological substance is founded on signaling, from the first single-cell organisms nearly 3 billion years ago to the most sophisticated forms of human social life today. There is no family of animal that is not defined by its capacities for signaling and no ecological niche that is not defined by the infrastructure that supports this signaling. When the human line broke off from its ape ancestors it was a result of a new capacity for communication (a new hand-eye-brain-mouth machine) and the rise of a new signaling niche in the environment to be filled (the long distance savannah).⁵

Architecture at landscape scale, whether as continuous networked urban fabrics or as withdrawn megastructure, is a particularly important communications infrastructure, in harmony or dissonance with those tunings and countertunings of tools and perception. In this guise, The Stack enrolls the city as a discrete layer within its larger sum by the binding of sensation and scale with enclosure and envelope and by pairing the tactility of the virtual with the effervescence of the monumental. As such, architecture itself serves as both a compositional model for stacks and stacking and as the tangible infrastructure for its manifestation as cities. While it captures humans and consoles them within walls, it also provides boulevards of escape toward other urban interiors, and at least in this way, the *City* layer of The Stack does not enforce dichotomies between urbanisms of enclosure and urbanisms of mobility as much as it combines them. One may turn into the other at any moment. For this project, the *City* layer’s basic building unit is the interfacial partition, the physical or virtual boundary that is made systematically reversible by the situation of its functions within larger computational systems. As we’ll see, it opens up and closes off urban spaces to different *Users* in different ways, allowing different *City* morphologies for some than it does for others, and in doing so, it generates and automates visceral first-person experiences of platform sovereignty, whether invited to do so or not.

34. Reversible Grids

Along with policing reversible partitions, the *City* also situates signposts and landmarks around which roving bodies might orient their passing. In many respects, for Stack urbanism, mobilization precedes and supersedes settlement. Instead of housing massive inert populations, the *City* layer is perhaps foremost a platform for sorting *Users* in transit, who in turn reprogram the urban platform, and through it re-sort one another. Consider, by way of analogy and allegory, the excavations beginning in 1994 that unearthed the Göbekli Tepe temple near Sanliurfa, Turkey, among the oldest human-made places of worship ever found to date. The dig's stratified layers, one upon another, were set over centuries. The earliest layers date to 9000 B.C.E., the dawn of the Holocene era a staggering 7,000 years before the Great Pyramids, more than 6,000 years before Stonehenge first took shape, and 5,000 years before the first proto-states emerged in the Nile and Indus valleys. The temple predates not only formal agriculture but large-scale human settlement, and it is thought that it was a site of worship for numerous hunter-gatherer groups within a roughly hundred-mile radius. The discovery is obviously significant for Neolithic anthropology and has challenged some presumptions about the social and technological capacities of preagricultural societies. For our purposes, this temple as primal scene not only underscores the foundational role of "theology" in the centralization of symbolic interfacial authority well in advance of the proto-state, but also for its demonstration of the essential importance of geography, and *geo-graphy*, or "writing on the Earth." We can imagine (perhaps naively) that for those following game and gathering food, the direction of Göbekli Tepe, this ancient megastructure, may have been a guiding vector around which unpredictable landscapes were measured. Perhaps its collection of animal images served as an index of possible encounters, its funeral rituals as interfaces to the mysteries of life, and the imagined possibility of triumph in or over death. For unknown reasons, at the beginning of the eighth millennium B.C.E., the entire temple system was deliberately buried under 500 cubic meters of soil, preserving it until its discovery in the 1990s. The temple's establishment and thousand-year career as a homing figure orienting the movements of groups in motion, by proximity, distance, access, and reference, marks an inception of landscape geography as an *interface* to the world as it is moved through.

Zipping back to the present, the *City* layer may be seen not only as enveloping space into fields of control, but also a return to these elemental functions of passage, direction, and narration. The modern urban surface is striated by regularized voids that provide self-directed passage from one enclosure to the next; we call some of those voids "streets" and some of those enclosures "blocks," and we call the generative platform striation "the grid." The grid serves the dual purpose of enclosure and escape noted above. At once, it subdivides urban space into geometric units, each bound by

legal and physical membranes, and each also situated along the shore of avenues of linear flight toward other cities over the horizon. The *City* layer is filled with interfaces shifting between acceleration and enclosure, of both physical objects coursing through congested logistical routes and also data packets shuttled or throttled through glass wire and ambient electromagnetic fields. The urban-scale interweaving of both grids, one literally concrete and the other more delicate if no less heavy, binds the mysteries of our own temples to the spatial interfaces that turn sites into places. With *Cloud*-devices pointing the way and Apps at hand (or Apps *as* hand, as discussed in the *Interfaces* chapter), we hunt for and find our modern itineraries, gather food, tabulate risks, mark passage, manage personal economies of sovereignty and alterity, and make tribute to the cycles of synthetic time and governance that give shape to the landscape.⁶

The parabolic history above dramatizes how the *City* layer also unwinds the well-worn distinction between two ideal cities (reminiscent of Schmitt's land versus sea): one is a city of partitions, permanent centers, and enveloped populations, and the other a city of movement expressed through nomadic landscapes, shifting perspectives, and impermanent networks. For the latter *City*, the line is an angle of flight, a vector and trajectory. For the former, as it is for Schmitt, the line fixes and differentiates between inside and outside, a distinct boundary membrane that holds together a contiguous polity under voluntary siege, enforcing and naturalizing that polity's lived experience of place. But just as any line is itself reversible (any outside also an inside), these two urban careers of the line are themselves equally as reversible. For the grid, both the line of absolute passage and the line of absolute partition become in practice a means for the expression of the other. Like the young girl-old woman optical illusion, the figure-ground prominence of the inside versus the outside and the grounded versus the mobile flips between one ideal resolution and the other, oscillating wildly and permanently. Its reversibility may be depicted in several other ways too. It could be a Euclidean grid of points specified on a plane, separated by equal distances in the crisscrossing of perpendicular lines, or the grid could just as well be the irregular thistle of pedestrian drifts, switched packets, infinitesimally granular addressees, unexpected sea sludge (and for the *City* layer, one may be the precondition of the other).

Like any other platform, the urban grid is both descriptive and generative. It both draws a map of its own host situation, providing by its rigidity and predictability both the four-squared coordinates that resolve *City* blocks and the open channels of circulation around them, making that land legible and available to exogenous agents. In anticipation of how such grids can link cities to other structures of vastly different scales, architecture has anticipated and modeled these sorts of reversible territory and *topos* in many different ways. For example, around the time of the *Apollo 8* "Earthrise" photograph, the Italian architects Archizoom, led by Andrea Branzi, were interested

in considering an image of the city “in exclusively quantitative terms, eliminating the qualitative question from the debate.” No-Stop City, their most recognized experiment toward a “city without architecture,” is organized primarily through “systems of electronic instruments, products, information, and … componential interior[s].” The dominant figure for the project is the minimal inspiration of the line, but less the line of primordial graphical marking than the line that emerges in the normalized repetition of instances into a nodal grid (or in the tonal line that resolves and dissolves in the score of minimalist musical composition or in the arc of a linear statistical tendency, for example). Their abstractions required no fancy computation; rather, the project featured intensely reductive urban grid plans composed partially on typewriters, with periods and commas for nodes and zeros and dashes overlaying these to create formal fields. Later, several mirror box installations presented fleshed-out models infinitely reflected on all sides to generate a similar infinite horizon of the same, reducing all objects within the geometry to recombinant instances of graphed information. Branzi writes that No-Stop City represents a city that is an “apparently hyper-expressive reality but that is, actually substantially catatonic because it is the result of the infinite repetition of an alienating political system without density.”⁷ For this, the city equals the world, and the world is rendered as a conjunctive grid wrapping a closed informational array within the arrangements of urban totality.⁸ One price of this totality is, for some, a “disappearance of the outside,” as there is nowhere to escape if everywhere is already gridded.⁹ What remains, however, is less an architecture of qualitative symbolization than a spatial politics of addition and subtraction standing in for appearance and disappearance. For this, there is always more than one totality and more than one geography employed, and within the informational geodesies evoked by No-Stop City, the symbolic depth of cities doesn’t disappear so much as it itself becomes an interface to and for these totalities. Today the globalization of urban geography engenders a standardized fabric of flows, radically consolidating nodes into a more centralized and hierarchical matrix of continental interfaces, but some objects in motion are all the more free for it. Others are on lockdown, and some switch back and forth on the fly, both fast and fastened down. In other words, just as for hunters and gatherers, platform sovereignty is guaranteed more by what it does and where it does it than by what it is and who it does it to.

35. City as Layer

Now that humans are a majority urban species, it is time to reevaluate what real, final-instance sovereignties can be derived from a city’s (or all cities’) surfaces and interfaces. To do so means to situate the *City* as an interdependent layer within The Stack, and thereby the management of urban networks within global information and energy *Clouds*. These infrastructures produce the fragments from which platform sovereignty

is identified, codified, and enforced across scales, from the intrapersonal to the interfacial and the transcontinental. In contrast to conceptions of the political as a discursive realm transcendent of the physical urban *polis* itself, platform sovereignties emerge less through legislative birth canals than through the irregular but consistent access to public and private hardware. The layer is not encapsulated by legal boundaries but is spread throughout a global composite *City* for which any one metropolis is a localized instance of global economies of mobilization and partition. That composite is ultimately built not only of many different cities, but also grids of optical networks for photon exchange, energy grids for electron exchange, and concrete grids of object placement and displacement, which together link city clusters into geographical hierarchies. Any one grid situates actors according to its particular matrices, its own history, momentum, alliances, contradictions, and the overlapping of two grids might work to multiply those situations or at times to stereoscopically resolve them into one. (This is discussed further in the *User* chapter.) As part of the *City* layer in The Stack, each of these grids might be activated individually; more likely, they are combined by some functional equivalence whereby the *Cloud* layer below and the *Address* layer above connect to the grids in ways that are agnostic as to unique relative durability, history, or character of each. That is, within The Stack, glass, steel, power, and data (and their grids) may all look the same to the layers above and below. At the same time, more specific *User* relations are arranged by any of the interfacial surfaces of the urban fabric (not only buildings and roads, but also those energy, hydration and data grids), all of which prioritize differently how a city is open or closed to different people and purposes. The reversibility of platform sovereignties will often play out through the computational automation of interfaces into and out of these grids.

From these, larval proto-citizenships are derived not just from formal borders and envelopes but also from the aggregate and crisscrossing steel-energy-information envelopes. As we all share some relationship to these composite envelopes, by using them and by being used by them, that commonality coheres and automates *User* positions in relation to one another. The road makes us all drivers, the fiber cable line makes us all callers, and the *City* layer makes us all inhabitants of a composite urban territory. It suggests that any one of us is (or could be, or should be) less a political subject of *this one city*—London, Mumbai, Shanghai—but of *the City*, of the globally uneven mesh of amalgamated infrastructures and delaminated jurisdictions. As for humans, our shared but unequal relationships to this aggregate metaurban layer of The Stack also means that political subjectivity is resolved variously for the “*User*” of energy, information, or land. Different *Users* of the *City* layer are curtailed toward different outcomes, even if the calculative terms of resolution are common. An individual *User*’s value, profile, and footprint are sorted within this consolidated index, fixing the *City* layer’s control program, as much as terms of a common access and rights of inhabitation and mobility throughout the layer’s wider expanse. The program of capture within the envelopes

of a given city is always as real as the prospects of flight, but neither is guaranteed. For both of these, residential jurisdiction of a single city may be only one moment within the arc of a larger itinerary. Any one of us might only be passing through for a short time (on tourist or worker visas) or credentialized as formal citizens or restrained from leaving (refugee camps, prison cities, factory towns) or employed to drift across urban infrastructural *polis* (legally or not). Each of us passes from one relative state of motility to another, day by day or lifetime by lifetime. We are situated in motion, both inside generic cities, modeled on airports, translating less and less between increasingly homogeneous places, and also in the heterodoxy of *urbanity as globality* for which interlocking networks of passage are leveraged to support mutually reinforcing rhythms of spatial consumption. Still the platform sovereignties that emerge in the technical relations of this composite urbanity are at best contradictory. As for any grid, the reversible interfacial surface of the urban fabric can produce a durable *User* subject because it also by definition is a potential technology of capture and control. Part of the design brief for The Stack is to disseminate a repertoire of accidents that might frustrate the more unwanted forms of centripetal incarceration. The ultimate challenge for this is to conjure alien genres of urbanization from the bounded universality of the generic *User* subject position: not an undead Kantian cosmopolitanism but a geopolitical hypermaterialism for which the “right to the city,” and therefore to The Stack, is an essential suffrage of all meaningful *Users*, human and otherwise.¹⁰

This is possible (or would be possible) only to the extent that the multiple grids of the *City* layer are also interfaces to other layers of The Stack. The *Earth* layer provides, for example, the incredible energy necessary to feed the physical appetites of the *City* layer’s composite urbanism. Its epidermal imperative for seeing and sensing is not only a substrate to the *City* layer; it also becomes an operative logic of interfacial control and composition (more on this below). The *Cloud* layer provides the generative and reactive ambient supercomputing that makes urban envelopes and *Interfaces* active and brings them into other formal and informal political geographic dramas. While the *Cloud* may see urban nodes and fabrics as like any other material for computational expression, its main switches are themselves gathered into tight rings of intensive transcontinental hubs, centralizing bandwidth economies into a specific few cellular cities. Away from those bandwidth capitals, smaller *Cloud* data centers, assembly factories, fulfillment centers, call centers, and shipping ports dot more remote geographies and gather itinerant laborers into their midst (or, alternatively, protect themselves against all human contact). In special cases, *Cloud* platforms design their own architectural footprints by gathering their higher-level cognitive-managerial functions into megastructural corporate headquarters, often city-scale buildings with backs turned on their immediate location (more on these below). Just above the *City* layer in The Stack, the *Address* layer provides network presence for any “thing” within the urban landscape and for the potential of communication among them. Unlike transnational postal systems,

this layer doesn't address sites based on their adjacent positions on the Earth's surface, and unlike the formal addressing of parties by a modern legal system, it is available to potential addressees at very different spatial or temporal scales and even degrees of physicality and abstraction. The territories of addressed instances within the larger expanse of the *City* layer are named, organized, and made coherent and meaningful by the *Interfaces* that turn maps of addressable options into practical instruments. For the *User*, these maps cohere the range of possible interactions and transactions not only with the *City* layer, but also with the *Cloud* and *Earth* layers as mediated through it; *Interfaces* provide a channel for the *User* to model and monitor his or her own position within the range that they describe. Furthermore, The Stack is not only mediated through the *City* layer; the entire apparatus also expresses itself at the scale of the city and the built environment, and it does so in sometimes contradictory ways, characterized as much by centralization (e.g., the continental consolidation of key bandwidth channels into meganodes and megacities) and decentralization (e.g., the global predominance of increasingly powerful mobile handsets as an essential provision for everyday urban life).¹¹

Below we examine several ways that The Stack is grounded at the *City* layer, from the scale of global networks to that of the individual envelope, and back again. We will see that this integration of one into the other looks less like Leon Battista Alberti's organic city, all parts fitting into natural wholes, than gory multispecies nested parasitism, one organism living inside another, itself perhaps living inside yet another, and shuttling energy in and out, through skins and interfaces. For this figure, the *City* layer is an urbanism of catalytic digestion more than settled homeostasis; its appetites are computational but no less violent for it. The Stack is also expressed in *City* versus *City* remote warfare, as dramatized by the launching of the Stuxnet virus into Iranian nuclear facilities (perhaps physically installed there by hand, perhaps inadvertently downloaded), where the software took hold of specific centrifuges and tricked them into malfunctioning but reporting themselves as fully operational.¹² This sort of weaponized transurban code is not so unlike a parasitoid fungus, *Orphiocordyceps unilateralis*, for example, which infects the brain of a species of ant and directs its zombie to crawl to the precise height in the jungle canopy suitable by temperature and humidity for the fungus to fully spore and where the ant husk becomes a factory for the production of more fungus. Such is the model infrastructural information warfare of microorganisms, insects, mobile software, and megacities.¹³

At landscape scales, The Stack supports the consolidation of bandwidth infrastructure into continental nodes as well as the design of massively integrated architectural forms and programs, encapsulated into architectural megastructures visible from a now primary satellite perspective: buildings at Stack scale. These megastructures may be there to organize human habitation or object flow (e.g., corporate campuses, airports, warehouses), but in many cases, the design problems are increasingly similar to one

another. The end result is not so much a neutralization of placefulness but rather a monumental (or antimonumental) hyperinscription, a total architecture withdrawn from the public city and bound by its own structural borders, gates, walls, and skins, gardens, introverted from its immediate environment so as better to connect to external planetary economies on its own terms. Enclaves inside of enclaves digest one another all the way down. For these megastructures, spatial integration is defined in the paired tongues of experience and logistics, and realized by folding their urban functions under a single roof and programming them (attempting to at least) as a single architectural system, as a self-binding and homogeneous geodetic datum. Some of the most dramatic examples are, not surprisingly, the headquarters of *Cloud* platforms themselves. But like the Sith from *Star Wars*, megastructures always come in pairs: their purification of program from immediate urban situation and withdrawal into formal singularity is always necessarily and irreducibly dependent on a doppelganger megastructure (or more than one) somewhere else.

36. Exposure and Control

Touchpoint by touchpoint, the *City* layer is perhaps where the birth pangs of Stack geopolitics are felt most viscerally. The arrival of any political constitution is accompanied by a corresponding foundational violence, and this is no less true of planetary computation and the jurisdictions emerging in its interfacial networks. But unlike modern political states that may have exploded into being by the breaching or establishment of specific symbolic centers, the constitutional violence of planetary computation's platform sovereignties occurs at the surface of the entire city, in and on every object seemingly all at once, as ubiquitous and convergent as it is partial and partitional. The *City* layer rests on residue of this violence, so where into its shallow surfaces can we dig? The urban interface was not always conceptualized in terms of its manifest spatial, political performance, but two essays, written in the Paleolithic years of the digital era, still clarify some of what is at stake for the *City* layer in particular. First, Virilio's essay, "The Overexposed City" (1985), synthesizes many of his ideas on the mediatization of the city by focusing on the *airport*, as both a security environment and a model for the city's compression through command, communication, speed, and inertia. Long ago, the ceremonial interface to a city may have been a gate or a bridge, which, when closed, also shut off the city from the movement of goods, people, ideas, microbes, and more. These orifices between city and periphery were where the martial risk and complexity of contact were modulated, but now the airport is that interface into the city and to the nation-state, regardless of the global point of departure, and regardless of how close the airport is from any actual formal border. Airports, even in the deep national interior, contain within them legal international borders, safe zones, duty-free zones, security screens, unsafe and quarantine zones, and other liminal jurisdictions

and complementary policing programs. Looking at airports as a model for intermodal information exchange, we see that the global mobility of people and things is possible in part because of the protocolological standardization of an interfacial network of airports and cities, arranged by increments of first-person travel time, hub-and-spoke econometrics, and its flattening affectless provisionality of boarding lounge culture. Movement through the airport's multistage rituals of filtering and sorting paces the *User* through densely juxtaposed police and leisure zones. Security agents examine and handle your person in ways usually reserved for criminals and *sans-papiers* as you pose in the midst of the leisure corridors where summary versions of human culture have been miniaturized into inspirational magazines and the unchallenging solicitations of snack food.

Airport urbanism in general is characterized by this critical cohabitation of security and entertainment: securitized entertainment and entertaining securitization. In what Virilio calls a "new topological order," control is both hard and soft. The machine guns are real and terrorists' obsession with these sites is real, and the unspoken threat of being grabbed offstage to be questioned behind closed doors by state agents able to eject the *User* back across the world is also real.¹⁴ No less real are the digital departure and arrival screens, the hyper-legible black-on-yellow Helvetica signage, the precise strategic placement of the coffee carts exactly so many steps away from bathrooms, and again that omnipresent media and candy matrix. Human occupation of this space, a soft enveloping of delays and digestion in collaboration with the hard enveloping of security and filtering, is elevated now to a general principle of contemporary urbanism. For Virilio, this easygoing layering of exceptional, militarized space with the ambient landscape of airports' generic "Singaporization" of the global city, positioned at the critical interface connecting urban nodes within an expanded global sphere, is the model for the city as rendered as information hardware and software. That is, the airport discloses without fanfare that cities *are* airports. Airports are not simulations of cities; rather cities are simulations of airports. It is where police deep-scan your person while blending you a delicious smoothie of your choosing, and to do so without irony or contradiction of purpose and affect. But this is not (only) a surreal pun on despotism; as universal urbanism, the business model also has to include the reactive management of individual *User* actions provoked by this accidentally sadistic little drama.

The scattering distribution of interfaces and the intensification of potential agency reflected in the increased computational capacities of each does not dissipate the weight of platform authorities, but it does reformulate their permissions. Perhaps counterintuitively as interfaces become ubiquitous, *interface decentralization becomes the engine of Cloud centralization*, and as these interfaces become channels of increasing end *User* management, swarm intelligence, and spontaneous utility, *Cloud centralization becomes as well the engine of interface decentralization*. The logic of the *City* layer of The Stack power is thus both decentralized top-down and centralized bottom-up, as well as

directed side-to-side interaction monetized as a raw social currency of cognition and circulation. Look over there by gate 12 at the search field on every screen, in every hand and on every lap, while the *Users* wait for their flights. See that what finally empowers the interface is less its function as some coercive frame for all signification and gesture than because it is so uniquely and relentlessly responsive to the nuances of every *User's* own desires, interests, and intentions. It may do one because it can do the other.

A second essay from the same era extended these dynamics into a new diagram of the social writ large. Among his very last published writings, the essay "Postscript on Societies of Control" ended up as Deleuze's most widely leveraged observation on the contemporary city and media. This very brief text is concerned with the historical transformation of cities from an older "disciplinary" mode, coercing inhabitants into governable mass envelopes such as schools, factories, prisons, office buildings, and barracks, toward a new "control" mode, for which anyone's self-directed movements through open and closed spaces is governed in advance at every interfacial point of passage, as built up parametrically through filtering gateways, point-of-purchase identity verification, and the local geography of entertainment. *Control*, which Deleuze defines in terms of the addiction-debt-mimicry tropes of William S. Burroughs, normalizes oscillations between the striation and smoothing of urban space and gives real-time shape to social systems convened by the soft cybernetics of interface design. We recognize the city he describes as filled with suspicious responsive environments, from ATM PINs, to key cards and parking permits, e-tickets to branded entertainment, personalized recommendations from others who have purchased similar items, mobile social network transparencies, GPS-enabled monitoring of parolees, and customer phone tracking for retail layout optimization. In the "control" city, there may not be a Foucauldian disciplinary gate because there is no "outside" to which anyone might escape.¹⁵ For other *Users*, the interfacial regime at work already knows in advance that they are not allowed into the generalized gated community, and for them there is only outside.

Deleuze's essay begins by contrasting Virilio's analysis of the "ultrarapid forms of free-floating control that replaced the old disciplines operating in the time frame of a closed system" to Foucault's disappearing societies of carceral discipline as evidenced by a general crisis of enclosure. Where enclosures are "molds," controls are instead a "modulation," a "self- deforming cast that will continuously change from one moment to the other, or like a sieve whose mesh will transmute from point to point," as laid over soft focus phase transitions of activities without distinct beginning or end. Techniques of identity are externalized into codes and passwords, overcoming the mass/individual dynamic whereby each *User* is a provisional individual and each plurality is a market of patterns and predictive models. Deleuze saw that an evolution into societies of control is marked by the predominance of computational information technology as its signal apparatus: "The societies of control operate with machines of a third type, computers,

whose passive danger is jamming and whose active one is piracy or the introduction of viruses." He closes the essay with a warning of sorts about a hypothetical control city that from today's perspective looking back to 1991, when it was written, seems quaint:

The conception of a control mechanism, giving the position of any element within an open environment at any given instant (whether animal in a reserve or human in a corporation, as with an electronic collar), is not necessarily one of science fiction. Felix Guattari has imagined a city where one would be able to leave one's apartment, one's street, one's neighborhood, thanks to one's (*dividual*) electronic card that raises a given barrier; but the card could just as easily be rejected on a given day or between certain hours; what counts is not the barrier but the computer that tracks each person's position—licit or illicit—and effects a universal modulation.

Now such urban interfaces—some carrot, some stick—are commonplace platforms for overexcited social media innovation, for mixtures of locative media, augmented reality, biometric and digital security, personal tracking and mapping, fitness Apps, automated point-of-purchase check-out, and the products and services based on their convergences and combinations.

He concludes, "The disciplinary man was a discontinuous producer of energy, but the man of control is undulatory, in orbit, in a continuous network. Everywhere *surfing* has already replaced the older *sports*," and indeed the drift through this version of the control city is an encounter with layers of visible and invisible interfaces, mapping you and rendering the world as an image map and image instrument for your particular idealized conception of it. The scenario he describes is one where the only apparently rhythmless intersections of free agents surfing across smooth urban canyons are in fact governed by the highly striated weave of dense differential connections in specific networks: one only because of the other. This city is not managed from some central command position in the cybernetic equilibrium machine, like the Alpha 60 master computer in Jean-Luc Godard's *Alphaville*, but rather the inverse. Dispersal of authority into hypergranular interfacial fields is the constitutional power; each "*dividual*" is cast as a sort of cellular automaton, expressing absolutely specific intentions and instructions for an emerging territory in formation. That territory in turn is driven from the bottom up according to the limited frames of thought, action, access, and expression that its own aggregate field of interfaces presents to each *User*. The interfacial array of the *City* layer is designed according to these conditional pragmatics of interfacial access and communication points, each of which is both a particular discretely tuned portal and an instance within a larger array.¹⁶ A totality of interfaces is then more than the sum of these single encounters, as it also comprises the active power that divides peoples and cities according to regular spatial and temporal programs; such totalities emerge through the repetition of activation of particular combinations of interfaces and are thereby a medium through which control distributes *Users* in turn. As they serve as both indexes of interfacial connection and as media by which those

connections are given shape, these networks also establish new territories by smothering precedent territories or interweaving with them asymmetrically. The soft violence of this establishment is, once more, the constitutional logic of the *City* layer as a social system and geopolitical framework, a logic of incorporation more than imposition. As discussed below, some visual interfaces also work as regularized cognitive maps of the urban interfacial territories in which they are situated, and as such, their semantic content can function as a binding collective representation of The Stack's geography (or even of a projected jurisdiction or an idealized polity), providing for its social regularity and durable structure.

As The Stack enrolls individual cities into common platforms of energy, water, labor, information, and so on, it also links their resource economies toward new capital streams based on urban services integration. Just as Google generates revenue by repackaging the notions, preferences, clicks, and pathways of its *Users*, the *City* layer generates sustenance not only through extractive taxation, but through the network value drawn from perpetual interaction with the interfaces that constitute the city in situated space. For this metroeconomics, the costs for sustaining infrastructure are to be born by the platform's algorithmic governance of its *User*-citizen-laborers-customers' social intercourses and may also generate a platform surplus for those stakeholders and for itself. In couching our idiosyncratic paths through city space, some ambient urban interfaces become cash cows for the right *Cloud* urbanist, and so as cognition and movement are translated and capitalized from *User* to *Cloud*, everyday living and thinking in the smart city become a form of information labor.

Under these circumstances, geodesign focuses in on the plasticity of sovereignty, not only on individual privacy but also on the valuation of plural motion, gesture, and movement as the basis of fabricated polities. As we will see, one axis of innovation is between the rights and responsibilities that the urban interface gives to and demands from a *User* who is a formal legal citizen of its explicit jurisdiction versus those it gives to and demands from a *User* who is not. We will find that in the future, the noncitizen may in some ways enjoy certain advantages over the citizen as infrastructures may not already be preprogrammed to govern that *User* directly as a formal subject but merely to transact services with her. We may, in time, see the world's population of noncitizen residents of the *City* layer tip the scales to shift the architectures of software and sovereignty away from formal state jurisdiction and toward the platform sovereignties of other transurban and transcontinental communities, configurations, and allegiances. Or, we may not. The *Cloud* layer's own political geographic accidents draw one framework for this, but the immediate provision of access at the point of an interface that is deliberately ignorant of the national status of its *User* may draw another. Concern over private versus public space takes on a different tenor when each is considered in relation to a Stack urbanism for billions of noncitizen temporary residences, as guaranteed by a metroeconomics that equates *User* interaction with value generation irrespective

of other legal claims that states would make on those transactions. This sort of politics of the urban interface (also of the envelope and of the membrane, of the visible and the invisible) may point toward another geopolitics of the *City* layer, one where the grim and suffocating closure of Virilio and Deleuze's "cities of control" gives way to descendant genres of urban-scale computation that their initial accounts could not anticipate. In other words, like any other territory comprising reversible exceptional interfaces, megastructures can sometimes be inverted in situ.

37. Force Finding Function Finding Form

As already suggested above, too much of our actually existing Stack urbanism is naive and fragile, obsessed, for the time being, with the optimization of doomed municipal arrangements and designed by marketing departments to be sold to urban managers who don't actually control what they think they control. This is to be expected, to a certain degree, from a smart city discourse built on enthusiasm for simple fixes and broken urban politics, but again there is still potential in what has gone wrong. The Stack already sees the city as one layer in a larger totality, and not surprisingly, several contemporary schools of thought conceive of designable urban space as a function of delimited totalities, plotting how to rearrange every square meter of a zero-sum geographical pie always threatened by a creeping ocean (real and figural). For some of these indirect descendants of No-Stop City, the city is modeled as a dense material and logistical equation within a receding horizon of data. Urban territory and graphical statistics are morphed into towers of intensive quantitative mass, sometimes representing programmatic adjacencies, sometimes graphical indexes of relative sums, sometimes formal profiles, and usually some mountainous and brightly colored combination of these all at once.¹⁷ But such architecture may confront more problems raised by the mutual design of quantified space and programmatic narrative than it resolves. In all but a few cases, the dysfunctional relationship between database and narrative ends in a stalemate, two symbolic forms able to communicate only by awkward irony. We can still acknowledge impasses as lessons: the contrived statistical normalization of unlike kinds of urban *Users* demonstrates just how difficult it is to design urban interfaces for so many demanding occupants of the same location.¹⁸ Even as certain totalizing ambitions of the *City* layer, those that see space as a closed set of universal modules of production and consumption and cities as spreadsheets waiting for the right formulas, are doomed to self-cancellation, perhaps the contradictions of this approach illuminate other paths.¹⁹ Cities are also media for rot. Smart cities are also dumping grounds, platforms for human warehousing, telelabor dormitories, floating prison ships, entropic megalums, spontaneous war zones, colonial settlements and encroachments, contested archaeological dig sites, fabled ruins, periodic abandonments, dead malls, sleeping cranes hovering over skyscrapers on pause, and similar things that defy easy

tabulation and calculation. We see that the global composite platform *City* isn't filled up by one total informational model but by the overlapping and superimposition of multiple models, multiple totalities competing for air, life, and dominion, and as their juxtaposition comforts some, it discomforts others. By design or by accident, they are all *City*-level expressions of The Stack.

More visible than esoteric forces of production and consumption, but no less important as governance interfaces, are those architectural surfaces and envelopes that articulate physical and figural politics of urban space. At the same time that spatial planning management consultants employ predictive financial models to ensure, they suppose, a preferred quality of urban-economic performance, architectural design studios increasingly rely on generative algorithms as form-finding agents to calculate individual building morphologies in pursuit of other, sometimes conflicting, performative goals. This division of labor between formal economics and designed form sometimes bedevils progressive architectural design, a disciplinary project relegated to a thinner and thinner slice of the structural pie. Among the most emblematic and visually striking formal machinations of today's architectural vanguard are perhaps those gathered under the rubric of parametricism. These practices and techniques, much more diverse than they may seem at first glance, use algorithms as design agents for the partially automated genesis of complex forms and also supposedly to guarantee an intelligent index of the intrinsic and extrinsic forces that couch a project's programs. In theory, important design solutions—programmatic circulation, interarticulation of subsystems, site posture, material distortion, proportion and nested symmetry, energy administration—may find direct formal expression by the mediation of the building's envelope as machine.²⁰ As one contemporary derivation of D'Arcy Thompson's "form is a diagram of forces," parametricism's often extremely self-conscious self-theorization claims to use architectural form to *communicate* the social, economic, ecological, cognitive forces that, after having been codified somehow into Grasshopper scripts, are now well disposed to disclosing themselves through the exacting distortions of involute morphology. At the project level, it concentrates expertise on the delineation of bones, surfaces, and skins at the unit level of individual architectural envelopes, hoping to capture the lightening of global forces into the bottle of programmable metallic flora. This strategy is partially a response to the diminished and decorative economic position for even famous architects in the post-Bilbao effect era, but it is also supported by much broader and more substantial disciplinary interests (especially those that one would not consider to be "parametricist" as such) in surface performance, living and nonliving emergent systems, and alternative topologies as the loci for future design as consolidated by a global signal style. They also speak to the unsure agency of algorithms in the design and organization of space beyond the professional domain of architecture and architects. Pessimistically, we may lament that the impoverished perch from which architecture has authority to say which assemblages go where is now reduced

to variously thrilling or bombastic skins, shells, and special effects. Optimistically, we might say that in these same post-Euclidean habitats, the stage is set for new, complex, and challenging points of tactile encounter between human and architectural bodies that don't just index client programs but forcefully reinvent them. More than perfect obedience to macroeconomic energetic field conditions, the more creative promise of continuous involuted forms involves perverse moments of folded contact and nested cohabitation between unlike bodies, flesh and form.

For the moment, parametricism and related programs have won one circumscribed battle to represent early twenty-first-century supercontemporary style for airport cities, but architecture in general has badly lost the war for the design of urban space. The two are at least correlated. Instead of design studios, management consultants—McKinsey, Morgan Stanley and Halliburton to Cisco, Siemens and IBM—are winning the city-making game, and they have rather different design interests in the flows of algorithmic capital and its spastic valuations of land, energy, information, and human capital. They too can be said to render the *City* layer as an imprint of the layers above and below, and they possess equally deliberative mechanisms to structure urban systems accordingly. Their topological imaginary, however, is not the folded surface but the calculative grid, and any disinterested alien intelligence would observe that today most efficacious “parametric” urban design software is Microsoft Excel. In effect, management consultant–driven design has dislodged architecture and traditional urbanism from the prime seat of authorship over urban form, as new built space becomes a form-finding by-product of speculative space-use and site-cost simulations. Their methods pull data-driven design from deeper strata of The Stack, telescoping descriptive and prescriptive algorithms set in motion in the *Cloud* layer and building their local franchises into urban (or “urbanish”) investments.²¹ Their spatial-systems economics often outpaces legal codification, leveraging an arbitrage of gaps in formal building code and zoning (but as well, from such gaps generative accidents of interfacial sovereignty also hatch themselves). Their portfolios can be measured in millions of square kilometers, but it seems that the quantity of officially futuristic cities is inversely proportional to the quality of their futurism. New “totalistic” (not really totalitarian) smart city initiatives from global information technology companies have borne real fruit for those offering them, often finding clients in sovereign capital funds or in sovereign governments directly.²² They also are in no way allergic to collaboration with (or subcontracting to) globally known architectural design firms. This mix of “real” architects and urbanists with consultants and IT systems architects and administrators is neither intrinsically offensive nor automatically fortunate, but it does alter the relative *tabula rasa* on which synthetic megacities are built. No more Brasilia or Tsukuba Science City; now we have variations on J. G. Ballard's Super-Cannes: Masdar (Norman Foster, Partners, et al.), Skolkovo (Cisco et al.) Songdo City (Cisco, IBM, et al.), KAUST (IBM, HOK, et al.), and on and on²³ These Moon-bases on Earth are spliced from Soviet science

cities, Silicon Valley campuses, Orange County gated communities, and a mutual understanding between political despotism and technological innovation. They are what cities look like in the shadow of airports, Special Economic Zones, and “sustainability mandates.” Some of these would redefine city-states as carefully policed service platforms, and for this, their urban-planning expertise relies on CRM (Customer Relationship Management), DRM (Digital Rights Management), server virtualization, end-*User* usage metrics, object synchronization across multiple devices and device synchronization across multiple data objects, at least as much as it does on architectural design, and often not at all on things that are normally thought to make interesting cities interesting.²⁴ Like all Ballardesque metropoli, these cities are “post-interesting,” which is itself interesting. Contrary to parametricism’s claims, figural virtuosity is subordinated to building forms that are recognizable and ad hoc, popular and stupid, but amenable to the real estate metrics that outvote other politics of the envelope. A partial list of these benchmarks includes both the sensible and the sinister: on-site carbon footprint minimization, energy and water management, replaceable and recombinant building materials, perimeter gate security, civic control contingency planning, bomb-resistant membranes, crowd circulation administration, tightly curated digital signage, assigned parking spaces, account credit-issuing recycling bins, and, for some, separate public entrances for citizens, tourists, women, unclean animals, and service staff.²⁵

38. Envelope and Apparatus

In order to design with or against any given program, we need to understand exactly *how* a given interface can construe the *User* of the *City* layer as a particular kind of political subject. We start with an interim summary of the varied and dynamic qualities of the urban interface. Platform sovereignty can be a function of how a border or interface addresses one or many *Users* and their interlocking relationships, while the *City* layer’s physical and virtual interfaces and its architectural edges and envelopes can be equally decisive in their governing methods. As these form a matrix of capture and control, like all precedent models of spatial governance, they also enable new and unpredictable stages for urban performance and need not be computational in order to align the urban environment into The Stack’s polyvalent claims on global space. Inside cities, the line, the gate, and the wall separate inside from outside, quasi-private from quasi-public, and generate and direct flows accordingly. Some corralled spaces persist longer than others, fleeting or permanent, and so even as they fix space, urban interfaces may be in motion, however imperceptible their speed. Lines not only shift and perforate; their ability to interiorize and exteriorize is also always reversible, and so even when it does not move, which side is being exteriorized by the other can switch in the blink of an eye: as it orders the landscape around itself, the center might hold, but what it holds may come and go. As computational media prostheticize *User* mobility, virtual

envelopes also slice up and program urban space, but along rather different planes than fixed architectural surfaces do, and they do so with increasingly authority. The mobile device's interface is based on the semiotics of graphical diagrams more than architectural vernaculars, and so it can index and express The Stack's organization of the city as the *City* layer with greater explicitness than any building-scale morphology, and it can do so on the fly for different *Users* according to different governing programs. That said, it is only by conceiving the design of both physical and virtual modes of the urban interface at once, either as conflicting or complementary parts of a whole, that we can hope to intervene in their effects with consequence.

The *User* is constructed through an ongoing and uneven processes of subjectification, itself largely developed by the co-constitution of a subject or an agent who experiences a subject *effect* and the equipment and machines with which she addresses her habitat. For example, Giorgio Agamben's short essay on Foucault's term *dispositif*, translated as "apparatus," locates the procedure of subjectification not with any single tool (architecture, software, grid, self) but rather, as Foucault defines it, in the "network that can be established between these elements."²⁶ That network-between describes governance not in the resolved image of categorical self-idealizations, but in immediate events of world formation and subject positioning, working with or without proper names at first, but which ultimately inspire durable discourses and their secondary enforcements. For Agamben, "apparatus" realizes "a pure activity of governance devoid of any foundation in being. This is the reason why apparatuses must always imply a process of subjectification. That is to say, they must produce their subject." He goes on to say that "an apparatus is literally anything that has in some way the capacity to capture, orient, determine, intercept, model, control, or secure the gestures, behaviors, opinions, or discourses of living beings." From this perspective, a subject is an effect of what has been captured, oriented, determined, intercepted, and enabled in the course of these networks, and whose agency is configured accordingly. Agamben proposes a thought experiment to explain the essence of this distinction: the world is divided into beings on the side and technologies on the other.²⁷ "On one side, then, to return to the terminology of the theologians, lies the ontology of creatures, and on the other side, the *oikonomia* (economy) of apparatuses that seek to govern and guide them toward the good." The apparatus brings forth subjects that think and do according to the range of possible dispositions it arranges for them. It doesn't make them into automatons; rather it establishes a certain field of enunciation, improvisation, innovation, which, being similar for other *Users* of that apparatus, also provides terms for cumulative, collaborative work and social systems. For The Stack, we see that these subjectifications are as limited and limitless as the capacities put into play between the "'creatures'" and their "apparatuses," between "the substances and the subjects," which for Agamben's neomedievalist metaphysics seem to overlap but not completely. In this sense, for example, the same individual and the same substance can be the place of multiple

processes of subjectification: the user of cellular phones, the web surfer, the writer of stories."

For reasons that will be clearer toward the end of the *User* chapter, we take issue with Agamben's rhetorical distinction between humans and machines as two different kinds of things that may enter into only combinatory relationships. In the meantime, however, the open-ended processes of subjectification through the apparatus is useful in how it can be made to link different scales and genres of technologies at the *City* layer in ways that likely exceed Agamben's own interest and understanding. The apparatus describes architectural envelopes as much as a GUI, and so as a synthetic figure it can represent the complexity of design's assignment as it is defined both by exploring the material plasticity of the world, on the one hand, and the durable codification as a technique of enforcement, on the other. For The Stack, worldly interfaciality includes any operation by which the world is sensed and made sense of; it may form on (or *as*) the surfaces of *User* habitat, physical or virtual. The software and hardware of a computational framework and the partitional network of architectural space are both equally "apparatuses" and part of the processes of urban subject making. Through the sheer quantity of *User* interactions, some emergent apparatuses may absorb the roles of others already at work, transforming or displacing them in the process. This transformation is traced by the shift from one program to another, from one dominant apparatus on which such a regime depends to another, and a migration from one institutional isomorph to another. While the drifting transposition of stable discursive technologies—a migratory power/knowledge (*pouvoir/savoir*)—from one institutional architecture to another is familiar to readers of Foucault, for example, from clinics, to asylums, to prisons, to schools, it doesn't work only according to his genealogical and archaeological models. The particular subject-making effects of a given apparatus are not only situations waiting for the next authority to arrive. Rather in their immediate physical operations, a specific apparatus regularizes structures of subjectification in its own image in ways that are irreducible to, but never immune to, discursive context and intention. So, yes, in this way, the medium can be the message, and so as the same *User* hops from one apparatus to another, he moves between variations of subject, geography, and polis, a process that in turn cycles back through the system reforming both the calibration of the apparatus and the *User*-subject over again.

Linking these, the polyvalence of the word *program* is again instructive, as already suggested in relation to platforms. In software, the design of a program both enables and configures the quality of a *User*'s agency in relation to particular hardware and sets of actions that might be taken with it.²⁸ For architecture, program entails a predictive determination of spatial habit sorted and staged in advance by a site's plan. The proposed design of a social organization in space is a techno-anthropological diagram of work, play, violence, and collective phenotypical embodiment, all modeled as functions of particular strategies of sorting, partition, enveloping, interfacing, planning,

and sectioning. For the architect, to posit a particular arrangement of activities, of collective access points—of privacy and subjectivity and agency—is to set the stage for some desired organizational-behavioral outcome, including even serendipitous encounters.

Perhaps today no discipline has more expertise in interface design than architecture, and perhaps someday no discipline will ultimately have more expertise in architecture than some expanded interdisciplinary mode of interface design, because for the *City* layer, computation is not privileged over cement. The interfacial operations of software and architecture should not be categorized as two distinct economies, but as mutually involved sides of corresponding governing effects, sometimes symbiotic and sometimes antagonistic in their relations. However, under the interfacial regimes of planetary computation, programs that we may have asked architecture to host in the past are now assignments for software, with the latter not only absorbing but sometimes hollowing out the former as well. Meeting rooms become chat windows, store shelves become online databases, places are geotagged, organizational hierarchies become fire-walled *User* access configurations, and so on. This transformation doesn't only dissipate architecture's authority (though in some instances, it does exactly that). Nevertheless, because architecture works as collective interface to urban space and because computation draws our attention to interfaciality per se and its contested governance of systems, then how architectural design will continue to enforce programmatic authority becomes an increasingly pressing question. Architecture's ability to represent systems (idealized, abstracted, mythical, logistical) exceeds any physical mediation of space, and extends its reach beyond the semiotic play of the GUI at hand. At the same time, a shift in design discourse away from symbolization, toward direct material effect, and on political positions that are imminent in a structure's postural embodiment in location, also has to be seen as a disciplinary reaction to the challenges posed by software's virtualizations of architecture's heavier interfaces.²⁹ It is a way of taking stock of what is left.

In his influential essay, "The Politics of the Envelope," architect Alejandro Zaera-Polo proposed a political theory of the (normative) architectural interface based on a simple formal typology of the building's envelope and of the different kinds of social spaces that each gathers into its midst. His model seeks to index the political effects of the architectural apparatus not in terms of what it might *represent* ideologically, but how it directly organizes publics (or subjectivizes *Users* of the *City* layer) as functions of the spatial networks in which it and they participate. In their different ways, envelopes structure and express links between the building and the world and introduce the segmentation, hierarchy, division, compression, massing, or adjacency that is, in the last instance, the reality of architectural micropolitics.³⁰ Through a close reading of building face and volume, Zaera-Polo directs us to see the envelope apparatus as a medium for the actors, networks, and assemblages that it might arrange, as well as a kind of master actor within the networks and assemblages in which it is itself situated. In the

terminology of The Stack, the interfaciality of different architectural surfaces enables platform sovereignty through repeated access to networks and concrete images of those networks. Zaera-Polo's scheme characterizes the envelope beyond architectural expressivity, and treats it instead as a material interface of polities and geography in situ. He writes, "A general theory of the building envelope aims to draw a direct link between spatial typologies and political modalities of forms of political organization through the identification of a series of concrete domains of architectural performance with attached political potentials."³¹ One structured micropolity is pressed against another and linked by the fuzzy membranes that make and unmake publics in different shapes and sizes. At the same time, however, his summary schema is limited in some of the same ways as interface theory in general, namely, the abstraction and individuation of one envelope from its contextual neighborhood of envelopes, which combine with others into urban-scale landscapes of competing envelopes and the polities they convene.³² In groups, multiple architectural envelopes provide an interfacial rhythm that can be monotonous, dissonant, or catalyzing. No one interface interfaces in a vacuum: a fact regularly overlooked by normative interaction design methodologies that over-individuate *Users*, forever atomized and psychologized, instead of seeing them as part of larger and less frozen subject-apparatus networks.

The interfacial problematics of the *City* layer include both the micropolities configured by architectural envelopes and the equally complex virtual envelopes that organize mobile *Users* as they meander past the gathering confines of any single building form. Like the hard envelopes Zaera-Polo describes, software envelopes are also sites of convergence between function and representation, linking program and figuration, and so design of the *City* layer (and the programmatic envelope in particular) draws from architectonic and urban formats alike, but no more so than from the diverse media of planetary-scale computation. The mutual economy of software and architecture is one of programmatic drift, but the interfaciality of software is of particular interest for The Stack in large part because, as said, software is now asked to structure flows of social organization that had once been the assignment of architecture in the modern era. For the moment, hard-into-soft is the more trafficked direction of programmatic transposition between the two, though that may reverse in unexpected ways. While the virtual envelope may be amorphous and invisible, it is not structureless or infinitely permeable. Software envelopes also conform into typological envelopes, sometimes even in the manner described by Zaera-Polo, and according to their own spatial politics, they can straddle the material and the immaterial, variously enforcing, augmenting, or negating the hard architectural envelopes he describes. As physical and virtual envelopes overlap, the clarity of a singular sharply defined exterior is less certain; hard and soft interfaces leak information into one another through their perforated skins. This suggests a need not only for a parallel typology of software envelopes' individual performances, but also for a composite matrix describing the differing ways that physical architectural and virtual software envelopes interweave within the other

to form the hybrid platform apparatus that in turn produces the subjects and polities of the *City* layer.³³

39. Designing for Mixed Envelopes, Mixed Programs

Toward drafting that matrix of mixed envelopes as part of the design brief for The Stack, we may want to consider our own thought experiment: half of all architects and urbanists in the world should, as of now, stop designing new buildings and new developments altogether. Instead they invest their training into the design and programming of software that provides for the better use of structures and systems we already have. It is a simple matter of good content management. The other half, the control group, may continue as before. Very likely the first group, steered toward virtual envelopes, would quickly focus their attention on mobile handsets. Their design brief might state that the essential function of the city is proximity—to people, markets, goods, transport, information—and that the handset condenses the *City* itself into a remote control apparatus. For ambulant bodies moving through active world, the handset is part of an active network linking site to speech and data and gesture to affect.¹⁰ Mobile device plus city equals a composite read-write medium, allowing for real-time communication, linking a *User* not only to the *City* layer of The Stack but to the *Cloud* infrastructures that provide the cheap vapor of on-demand computation as translated through the little glass screen. Its immediate functions can be modified in relation to App platforms that transform the same machine from handheld telephony into a homing beacon, high-definition video camera, music collection, Geiger counter, magic antenna, virtual goggles, scanning X-ray filter, field recording microphone, medical monitor, or magic window that makes invisible things appear. Ambient urban networks become in-hand animations with which to communicate with (or at) immediate and remote environments. This changes not just how people interact with cities but how they see them as well. With the release of the first iPhone in 2007, a critical mass of *Users* could envision interaction-in-the-wild as a new genre of computing, not as a variation on a desktop or telephone experience but instead a personal interface to ambient sights, sounds, and words. This would change how people see the device at hand. The shift from point-and-click to multi-touch gesturing represents a kind of substantialization of data, now embodied in tangible interfaces activating a living information substance that you directly grab and manipulate. Enclosed in sensate glass, an onyx frame of immanence, the device interface and hardware blend into what the *User* takes to be a single dynamic form or field. Older genres of GUI offer menus and contextual options but rely on an instrumental distance between signifier and signified; with iPhone, the mobile interface became filled with things more than with metaphors for things. Couched in a face-like shell and illuminated from within, Apps possess a prehensile tangibility to be pushed and pulled as organic, rubbery stuff. This tangibility

and anthropomorphology are what make this apparatus work, socially and psychologically, as an urban interface, making it seem to link not virtually into a deferred realm of the iconic, but directly to the physical world itself.

The *City*, as seen through the medium of that face, oozes with living data to be touched and rewritten all over again. It doesn't only represent its world, but affects it as well; interaction is recursive, as a single *User* action is itself also new information aggregated into a living whole, informing what everyone else sees as their map. This recursion can cause one person to change his path and decisions in accordance with the actions of another *User* as indexed by the App, which is itself read as a real physical event, happening as part of the urban fabric, not floating "on top of it." In this way, the virtual envelope of the mobile apparatus is, as much as the architectural envelope, a real circuit of movement primary to the *City* layer. But that equivalence also complicates programming strategies. Architectural programs and interfaces can be fixed or unfixed and can be designed into permanent structure or as shifting furniture; the same is true for software programs, which can be immobile site-specific installations or mobile applications in the urban wild.³⁴ For both architectural and urban projects, "program" provides material support to social activities that repeat themselves within predictable zones and partitioned locations, but as that material support is provided by software, the spatial "program" becomes itself as mobile as the handset device, which, for one or many *Users* at once, transposes that support into different locations at different times. As the functional organization of people across location and duration is coordinated by software as much as by walls and zones, urban functions are translated into applications, and as those are activated at a moment's notice by different *Users*, each application provides a different interface to the same location for each of them, and so also a different urban program for each of the *Users* who happens to be in the same spot at the same time. Unlike the architectural envelope that coheres a polity by arranging its place just so, for the virtual envelope of the mobile apparatus, program becomes less of a fixed posture rendered in plan than a setting of parameters of access, improvisation, and opportunity. In other words, for mixed physical and virtual urban envelopes, the program itself becomes the platform.

Surely, however, the most interesting design questions are not to be drawn by the artificial separation of physical and virtual envelopes (such as my proposed experiment) but by reorienting software and urban programming to mix and merge in more clever ways and, through this, to express emergent sovereignties more explicitly. The two are drawn together as architecture becomes a staging plane for software programs, just as software envelopes organize how urban space can be framed and activated. Whose assignment is this? Computer science is not nearly ready to take this on alone (perhaps someday), and architecture's critical expertise in composing, replicating, condensing, and mobilizing the small and large interfaces of social space is woefully underused and underfinanced. A properly interdisciplinary design of the *City* layer would be

both mechanical and dramaturgical; it would systematize the possibility of particular events occurring, both on schedule and off, and would draw the scenarios by which those events become richly woven languages. As the channels of the *City* are compressed and revealed by the handset's interfaces, the virtual envelope's augmentation might dissolve the gravity of architectural programs, or it may harden it. Either way, for architectural representation, the sectional stacking or planimetric allotment of discrete zones for spatial-social behavior to take place within a single envelope, gives way to interior and exterior encounters that can be activated in any number of different ways by different people using different software in hand, and so from minute to minute, as different Apps augment given spatial programs for different *Users*, any single architectural envelope is, to that extent, relieved of some of its programmatic responsibility and specific purpose. The same is true (more so) at the urban scale, where multiple architectural envelopes combine and compete, and where the distribution of formal programs is also finally bound to formally restricted legal-spatial zones (e.g., residential, manufacturing commercial zones). But at this scale as well, when multiple *Users* interact with a section of the *City* differently depending on what software they are running, zoning in the traditional sense becomes a much more problematic urban design trick; it becomes a less enforceable and perhaps also self-defeating sort of rule making. For the *User*, "use" is always mixed use, and so the design of the *City* layer requires a new way to represent program, not one that resembles an OMA (Office of Metropolitan Architecture) sectional diagram or the iPhone deck, but instead some kind of image that can trace the interdependent contingencies of hard and soft envelopes across lived network time.³⁵

An integrated platform design would seek to modulate conditions of appearance rather than attempting to script or contain what finally emerges. As discussed above, the urban street grid platform itself works this way as the urbanite calculates his own movements by the grid's network. If the street grid were irregular and idiosyncratic, it would not mediate the maximal churn that it does. But now the rational programming of urbanist modernities and developer-driven postmodernities converges with software and hardware application programming interfaces and protocols with names like GeoRSS, GML, GPX, KML, EXIF, and OpenSearch Geo. As these cohere in and as the *City* layer of The Stack, our design concern should be with how a mixed interfacial regime could support a loquacious multiplication of outcomes impossible for either hard or soft systems alone. Some mixed platforms are already encoded into isomorphic software suites, some of which are the lattice on which designers might conjure and implement forms across multiple scales. The Stack's layers arrange open and closed channels of access, manipulation, function, and irrelevance, and through these designers designate where to situate interfaces, speculate how to capitalize undervalued interactions to come, and, if they work on behalf of established *Cloud* platforms, extend and enforce the centripetal advantages of those particular services. Today some designers

are trained to design for inside the glowing glass rectangle of the screen and some for the outside spaces in which screens are situated, but many of the most pressing opportunities of the *City* layer demand amphibiousness. For savvy urban designers, equally adept with physical and virtual envelopes, it's not difficult to make up long lists of possible projects: augmented reality Apps for ambulance paramedics and open-air surgical theaters; a mash-up of post-Twitter microblog Apps linked to post-Siri voice-control interfaces and trans-Google translation software, together posting anything you want to say to anyone anywhere always; citizen activists using GIS, mass-market geo-browsers, and modified drones to streaming real-time C3 video to 3D-printed phones; mining composite crowd-sourced behavioral data to optimize the recycling of post-purchase prosaic junk; real-time flu outbreak visualization and private micogovernance of microbiopolitical swarms (a premium upgrade only for club members); traffic control sensor and smart tollbooth hacks; individually reconfigurable robotic building interiors collapsing rooms and even floors serving different programs in morning and at night; anonymized parking markets based on bitcoin and namecoin; building exteriors featuring networked cinema, not on thirty-second loops but on eighteen-month lunar cycles; lifelong syncing of car-phone-home-*Clouds* platform allegiance chosen at birth like football team fandom; Google Office per-minute commercial office leasing apps; personal RFID managers; rock star privacy consultants—all driven by (at least partially) open APIs enabling other applications to build further on their existing traces. Insert your own schemes and nightmares here.

Regarding the experiment suggested above, for two groups of architects assigned to tackle the virtual as well as the physical envelope, it's certain that even this is fraught with risk, not only because of what it would leave behind but because of what it might accomplish and quickly lose the ability to control. The experimental half turning its attention to the virtual envelope should consider several admonitions in advance. First, the computational city activates human-object networks that are both new and primordial at once. You should anticipate the rapid coevolution of urban behavior and urban software, such that the mobile handsets themselves and their capacities will appear to be evolving more in relation to each other than to us. This fast Darwinism of the device will make it seem as though we are *their* media, and not the other way around. Such appearances may prove to be true. The explosion of hyperlocal and hypervisual information will both amplify and multiply the intensities of social interaction, but will also reveal the scale and complexity of communication between nonhumans (animals, ecologies, infrastructures), such that at just the moment at which our collective urban cultural cognition comes online, it will be exposed as a hopelessly outflanked minority discourse, a dying language even. Quite clearly the computational intensification of the GUI interface will make it more animated, more speech-based, and more seemingly factual, exacerbating everything we already know about the instability of cinematic diegesis (memory, action, projection, pixelation, repetition, juxtaposition,

correspondence, false causality) now brought deeper into everyday life. The social-psychological results of all this will be complex and contradictory, as pervasive computing makes inanimate objects see, hear, and comment on our interactions with them. This experience may, in many cases, be observationally indistinguishable from a psychotic break or from the affinity rituals of animism. In a recent interview, Virilio notes that today's qualities of technology—instantaneity, ubiquity, immediacy—are those associated with the divine.³⁶ As we'll examine in the more detail in the *Interface* chapter, the killer application of pervasive computing is not advertising to the hipster *flâneur*; it is closer to something like religion, and its impact on non-secular polities and monotheisms will be turbulent, existential, and fertile.

40. Programs, Subjects, and Zombie Jurisdictions

But first, I turn back to how the *City* layer and its platform apparatuses can generate accidents of sovereign subjectivization and how platform megastructures at this layer do and do not work to envelop stable *Cloud* polities. Well before smart cities evangelism, the modernist call for a more intense technologization of design's disciplinary *doxa*, blending urban and cybernetic programs, was a predominant discourse.⁶ For a century now, it has asked us, in one way or another, to recognize the network city as a shared nervous system, connecting each of us on its terms. Today, however, mastery and transparency are not the only values in play. The accelerated rupture of computational forces up from the *Cloud* through urban orifices, out into the open view, relies not only on formal piloting of a *User* along his course, but also on her capacity to proprioceptively map her own displacement in real and imagined geographies.³⁷ That self-directed—if also still tethered—drift is not antithetical to control and its spatial governance of unwalled *User* subjects, but at the same time, the legal neutrality with which its ambient interfacial infrastructures address those subjects can result in unexpected, and even disruptive, new demands for access and recognition by those *Users*. As envelopes compose the urban landscape, the work they do aggregates into regular networks of open and closed centers, pathways and clusters, which in turn combine to give form to territories and larger geographies, but as often as not, the territories produced make conflicting claims on the same *User*. The generative accident of the mobile apparatus, within the *City* layer, is the spawning of unintentional sovereign positions into which *Users* can step, even if they are at odds with formal scripts of jurisdiction.

For example, in the specific case of the elongated wedge envelope-interface of the US-Mexico international border, its geopolitical disciplinary intrigue spins out as many exceptions to its control assignment as it manages to enforce. As a jurisdictional membrane, many parts of this border are less like the tightly packed machine of a customs zones in an international airport, coding every centimeter with the neutralizing authority of the legal grid, than a wide liminal expanse where the legal transition and

translation from one national status to another is vexed, intangible, and dangerously ambiguous, even as the resolute bluntness of the wedge tries in vain to remain unpermeated by that ambiguity. An exemplary fundamentalist reinscription of Westphalian geography, this border tries to cohere and filter control over production and consumption chains between North and South into a single horizontal line. It encapsulates a specifically programmed regime of differential mobility, in which some things are heavily sponsored flows (goods and services) and other things (human bodies) are heavily restricted, the latter then driving the gray and black economies that sprout in the border's cracks. The border is an architecture of both systemic wealth centralization and provincial immiseration. Its geography writes both integration and severance, from the disembedding of local and regional economies to *maquiladoras* (globally owned factories along the border) and formal kleptocracies, to a cannibalistic drug war feeding the chemically induced mania of American cocaine users (where a neurochemical event inside the head of one person in Los Angeles results indirectly in the decapitation of another person in Tijuana), all operating under the sign of modulated flow: flow of capital, flow of risk, flow of commodities, flow of drugs, flow of serotonin, flow of trucks, flow of tourists, flow of cash, flow of vegetables, flow of electronics, flow of chemical waste products.³⁸ Along the border zone, where everyday emergency is unexceptional, the rule of law is either comically overenforced or tragically underenforced, both outcomes ensured by a principle of flow along paths of least resistance. As a case study in how the architectural envelope and the virtual envelope can work at productive cross-purposes, it is worth considering in some detail one design project that toys with the paradoxical transformations of the *User*-migrant-subject status as she moves across this particular jurisdictional melange.³⁹ Some colleagues at the University of California, San Diego, B.A.N.G. Lab, directed by Ricardo Dominguez, earned the vitriol of local nativists by developing an App called Transborder Immigrant Tool (TBIT), which, when installed on cheap and recycled handsets with GPS, is designed to aid those traveling by foot across the treacherous Sonoran and Mojave deserts from Mexico in the United States (or perhaps the other way around) by directing them to nearby water stations set up by other Samaritan organizations.⁴⁰ The migrant humans against which the border wedge defends jurisdictional order can get stranded in a dry sea of sun and sand, neither here nor there. But as far as the device apparatus is concerned, their presence there and their use of the *Interface* is neither legal nor illegal; they are just a *User*, and that's good enough to provide full infrastructural and territorial access.

Agamben's own perspective may be instructive here, and at least partially so by its demonstration of tiresome blind spots. "Apparatus, then, is first of all a machine that produces subjectifications, and only as such is it also a machine of governance," and vice versa, "Indeed, every ... apparatus implies a process of subjectification, without which it cannot function as an apparatus of governance, but is rather reduced to a mere exercise of violence." This violence is another name for what Agamben calls a "process

of their de-subjectification,” or of removing the very possibility of subjectivity through a kind of total and standardized form of capture, whereby the contradictions of multiple subjectifications are flattened. He sees this as the political tenor of the apparatuses we work with today. And yet at the same time, he hesitates: “It would probably not be wrong to define the extreme phase of capitalist development in which we live as a massive accumulation and proliferation of apparatuses. ... We must also immediately consider the apparatuses that crowd the Open with instruments, objects, gadgets, odds and ends, and various technologies. ... This may produce the impression that in our time, the category of subjectivity is wavering and losing its consistency; but what is at stake to be precise, is not an erasure or an overcoming, but rather a dissemination (of multiple subjectivities).”⁴¹ At once we have both fewer and more subject positions. Now this apparent contradiction—that today’s computational apparatuses desubjectify but also multiply subjectivities by their own proliferation—may be just the right paradox to map; more of less and less of more. It may also locate the point where we now abscond with the idea of interfacial apparatus from Agamben’s stewardship altogether, if only because it is already quite plainly doing much in the world more than his account can account for (i.e., “in the untruth of the subject, its own truth is no longer at stake. He who lets himself be captured by the ‘cellular telephone’ apparatus—whatever the intensity of the desire that has driven him *cannot acquire a new subjectivity* but only a number through which he can, eventually, be controlled” (emphasis mine, eyes rolling).

The notion of a “right to the city,” for anyone to move and navigate freely through urban space and to engage with it on his or her own terms, is a rallying truth for critical urbanism, but its exact terms are as uncertain as the convoluted control structures of the *City* layer against which the notion maneuvers. In addition to a right to general passage through urban interfaces, it also includes some right to use these for one’s open-ended creative purposes, not only for closed-loop consumption.⁴² For its part, the TBIT device elegantly unknots several governments of mobility at once, including the mobility of the handset, enabling a territorial mobility of the person, in turn enabling a mobility of his position within political networks.⁴³ Perhaps part of the reason that TBIT, even just as a poetic prototype, drew such seething anger from some quarters is that how it obliquely but unambiguously signals a structural shift in the agency of excluded *Users* to access the regional interfaces-networks-territories.⁴⁴ The alegal status of the migrant shifts between two modes of the biopolitical: that which is banished and left to die and that which can be killed with impunity.⁴⁵ The migrant is not only outside the walled protection of human settlement but sentenced to the vast unwalled “camp” of the desert, both inside the law of national border and outside the confines of the societal. Drifting, she is cast into a zone of ungovernable nature, further animalized by xenophobic paramilitaries on the prowl, themselves acting both outside the law but also in the name of a jurisdictional border, defending the arbitrary line itself as the true

sovereign. In the nativist view, it is not the migrant's right to passage or employment that is or is not legal, but that she herself, her very person, is illegal. It is less that the migrant commits the felony of entering the country without permission and is therefore a person who has committed a felony (like tax evasion, securities fraud or animal cruelty, for example). Rather, by a strange inversion of habeas corpus, it is more that her very body and its presence on the land is a felony, and so to arrest her mobility is not just to stop the movement of a person, rightly or wrongly; rather, the capture of her biological person is to police a crime that is embodied therein.

TBIT does not attempt to transform the nonperson of the migrant into a formal citizen; rather, it positions her as a *User*, and that *User* position, halfway as it is between dispossession and citizenship, may prove to be a more powerful and resilient subject agency than we might normally expect, not only for migrants but for *Cloud Polis* going forward.⁴⁶ For this *User*-as-sovereign, the apparatus is an interface to the territory, functionally agnostic to the *User*'s formal legal identity, and so it can rewrite the geography not by rigid subdivisions of mutually hostile states and the prophylactic imperatives of national immunity, but toward another unspecified urban vocabulary of an open territorial commonwealth. Here we also get a useful glimpse of what the virtual software envelope, to extend Zaera-Polo's schema, is capable of providing besides constitutional programs of control and commercial software mash-ups. The reorganization of spatial access through a new interfacial regime introduces new de facto "rights to the city" to those with otherwise insufficient political agency, and so it encourages alternative geographies to proliferate, not by decree but by physical occupation (as even Schmitt would have to acknowledge). As they do, they promote and enforce innovative claims over what the *City* layer is and does, and for whom and for what. The nativists' outrage was not incorrect in this sense, as the acute implications of the project are indeed catastrophic to the idea of ethnically and geographically pure polities. And so, one generative accident of this layer is the germination of such informal *User* "cosmopolitanisms." They arrive as functions of the omnivorous neutrality—even universality—of an interfacial regime that produces a polity of *User* subjects that is far more inclusive than state sovereignties can manage. States often react to these by refortifying their policing of identity, even of their own "organic citizens," and so, as said, we can anticipate some scenarios in which the noncitizen *User* may enjoy more spatial permissions than the citizen *User* because the *City* layer's vision is not programmed to see and govern her. At the same time, as we'll discuss further in the *User* chapter, this agnostic universality can extend *User* suffrage not just to humans, but to any agent capable of interacting with that interfacial regime as a deliberate actor (e.g., car, animal, microbe). This should alert us already to the limits of interpreting interfacial governance along an axis of individual agency versus collective interest. Instead, the design problematic is to make more explicit how plural configurations of *User* positions cohere across different scales and rhythms.

A global political and geographic dynamic is demonstrated by the TBIT controversy, and that a real subjectivization is at work may also clarify some of Agamben's unfortunate confusion regarding the contemporary mobile apparatus. As we consider how global geography is remade by The Stack, another lesson to glean is that whenever there is a persistent and broadly experienced mismatch between, on the one hand, a residual legal-political form (an old legal statute attempting to govern and contain what it can neither describe nor circumscribe) and, on the other hand, an emergent social-technical form (a new social condition arising from a new network condition), then we can expect the structural momentum of that emergent form to spawn various "criminal" connections and transferences, both amorally and asubjectively. It just does. A critical mass of such emergent connections or actions may, for good or bad, eventually overwhelm heritage lines in the sand. To be clear, this is very different from the transgression of an active code. It is less illegal than it is *alegal*: illegible, invisible, outside, or just incommensurate to established legal supervision. Even if the state can see it at all, it still cannot name it properly. The *alegal* represents an embryonic quasi-agency, neither exactly inside or outside governance, nor exactly inside or outside markets, but largely generated by platforms directly, and they can also be founding figures of a preferable geopolitics that we may honestly anticipate for The Stack.

This is especially true if that future platform, that interfacial regime to come, would technically be illegal according to today's statutes. Worse perhaps than the criminalization of culture is the criminalization of infrastructure. Such *alegal* actions and events, normative tomorrow but prohibited today (Do we call them "postcrimes"?), fulfill the programs provided by new networks in an autonomic and sovereign disregard of zombie jurisdictions. Alternative geographies appear in the repetition of actions and processes that are as illegal for one jurisdictional geography as they are constitutional of another, even as the two occupy the same location. To design the *City* layer in the image of that emergent political geography (with the emergence, not against the emergency) also means to design, as B.A.N.G. Lab has done, through the interfacial agencies that this alternative is already formulating in its disinvestment from the geographies it overwrites. That is how to conjure it.

41. Megastructure and Utopia

That's no moon, it's a space station.

—Obi-Wan Kenobi

In the accidental platform sovereignty of a migrant's apparatus, we may see a certain slow-burn afterimage of Göbekli Tepe and the circling movements of its mobile admirers, and as part of that image, what some might call a virtualization of the *City* layer is certainly part of the design program. At the same time, those Westphalian geographies

are engaged not just at the tactical level of the savvy *User*, but also at the scale of the *Cloud* platform, and their interests and intentions are very different. While *Cloud* platforms may capitalize interactions between any and all *Users*, their own designs for the *City* layer may be represented more by megastructural artificial geographies—formal utopias even—that allow them to program their own encapsulated territory according to more predictable plans. What kinds of cities are our major *Cloud* platforms actually building, and how do they choose to make architectural scale footprints on the *City* layer? Put differently, after the above consideration of how the *City* layer's envelopes and interfaces might be expressed at the *Cloud* and *User* layers of The Stack, and what kinds of deliberate and accidental platform sovereignties this enables, we also need to ask how the *Cloud* layer expresses itself directly at the level of the *City* layer, and when this preserves or dissolves those platform sovereignties.

The Stack, as a whole, structures the *City* layer through the consolidation of urban nodes into megacities and also through the consolidation of both public and private urban systems in megastructures. We'll find that instead of heterogeneous and open interfacial platforms, for their own footprints *Cloud* platforms prioritize instead urban-scale walled gardens. The megastructure provides a bounded total space in which architectural and software program can be composed by complete managerial visualization; for it, the border, the gate, and the wall bend into closed loops containing vast interiors, sometimes in pursuit of utopian idealization and isolation. The megastructure is an enclave within the city that also holds a miniaturized city within itself, and so the specific and different terms of that miniaturization are the vocabularies of differing utopian agendas, whether explicit or suppressed. Its curation of opacity as both a spatial strategy and an affectation operates not only in and on the skin of its closed physical envelope but also within its capturing claims on the virtual territories of the *Cloud Polis*. As we'll see, these closures are often interdependent, one closing off a physical site into an artificial island for which the inward bend of the envelope gathers a polity into form and the other cordoning off parts of the electromagnetic spectrum itself as another equally important megastructural territory to utilize. Their geographic secession provides the megastructure one measure of spatial sovereignty, one that begins as a function of autocratic enclosure but can also be leveraged well beyond physical jurisdiction and into the realms of iconic form and charismatic mobilization. The politics of both are utopian and dystopian at once, one never really able to purge itself of the other, always able to flip into the other and back again, depending on where you may be standing and why.

The image of global urbanity as a single contiguous body is drawn at the scale of the whole spherical planetary surface, and we certainly have no shortage of depictions of it, especially at night, as a throbbing weave of life, light, movement. (What telecommunications brand can make it through one fiscal quarter without advertising itself thusly?) It's less clear, however, what this obligatory geographic icon

might communicate other than communication itself. Like the Incan geoglyphs of pre-Columbian Chile, does the global urban weave have pictographic content to be read from above, or, like the Earth art and maps of Robert Smithson, does it make a pedagogic point about geological time and perspective?⁴⁷ The image of urban neural nets draws more specifically on an aesthetics of logistics (more in this in *Interfaces* chapter) and from an admiring contentment with network topologies as some final form and format. In such renderings, networks more than cities (and specifically the metanetwork of The Stack) are indeed monumentalized. The pronouncement may be something like, "We are those who have wrapped the planet in wire. This is the signal accomplishment of our time. Our pyramids are gossamer shaped." This image-infrastructure tries to capture some important change in the local-global telescoping between anthropometric habitat and the wider urban envelope. The *City* layer of The Stack itself operates as a massively distributed megastructure and draws on, however obliquely and opportunistically, the reservoir of speculative, even utopian megastructural design projects of years past (built and unbuilt), even realizing them after the fact with a sometimes perverse inversion of their original intent. As discussed in the *Earth* chapter, in and around the years when the first photographs of Earth were taken from space, speculative architectural design was inspired by the visual scale of the whole Earth as a comprehensive site condition and spawned scores of now canonical megastructure projects. Many proposed total utopian spaces (islands cut off from the rest of the world, per Fredric Jameson's discussion of the utopian genre in science fiction), including, as already mentioned, OMA's Voluntary Prisoners of Architecture (1972) and Superstudio's planet-spanning Continuous Monument (1969), while others sought the utopian through the maximal perforation of boundaries by ludic interfaces and absolute grids, including No-Stop City (1969) or Constant's New Babylon (1959–1974). The merger of cities into planetary-scale conglomerations was imagined, among others, by Constantin Diodiadis as Ecumenopolis, a single planned urban form across the whole world, and Paolo Soleri as Arcology, enclosed megacities rising into the lower atmosphere, so large that they constitute their own ecosystems. The impetus for these massive, even planetary-scale architectural propositions may be a positive or negative reaction to the Buckminster Fullerian vision of Spaceship Earth as a single design problem, and attempts to see the whole of society in terms of the whole of space (part of the desire for totality important to Jamesonian utopian desire and dystopian anxiety).⁴⁸ The projects provided a link between the grandiose progressivism of high modernity, such as the massive Karl-Marx-Hof in Vienna, a neighborhood-sized building from 1930 holding over 1,300 apartments, and ideas for extraplanetary colonies on Mars, dating at least to the late nineteenth century. For many of these, the goal is a wholesale replacement of the modern programmatic order of nested and individuated buildings, cities and states with new models and programs, perhaps along that continuum from strong architectural authority

(Voluntary Prisoners of Architecture) or to an open, ludic urban field (New Babylon), for which megastructures serve a new spatial authority more appropriate to a properly global society.⁴⁹

The composite megastructural form of the *City* layer of The Stack (composite in the interweaving of physical and informational infrastructures in a given site, as well as in the differential integration and disintegration of continental urban sites) is, in some ways, a realization of *Apollo*-era architectural mega-utopianism (total envelope, universal interfacial grids, superimposition of quasi-sovereign layers) and in other senses an almost complete inversion of it (regularization of production and consumption cycles, strong filtering of individual mobility, intensive capitalization of every encounter and gesture). We can see aspects of these utopian projects in the *City* layer today and recognize their evil doppelgangers as well. This is possible perhaps because The Stack works as both a control mechanism and a means to open up and flatten access, providing one because it provides the other, and so it is not surprising, then, that it would discover the legacy of utopian megastructures through this very reversibility. For example, Foxconn is the largest private employer in China and assembles much of the human-scale digital electronics equipment that connects urban society to The Stack. Its largest factory city, in Longhua, Shenzhen, situates an estimated 300,000 employee residents in a massive live-work complex. It is a megastructure by sheer architectural scale and social totalization, and one could also say that Foxconn is an island and therefore prone to both utopian and (as has been more the case) dystopian imaginations. Along the spectrum of platform openness versus closure, Foxconn's regimented cycle of life passing from one phase to another, perhaps until death, places it at the end of a dotted line leading through Voluntary Prisoners to the present, each the prototype for the other. Its factory floor is responsible for the physical assembly of much of the world's consumer devices, laptops, smart phones, and as these are the essential physical interfaces between *Users* in motion and the recombinant landscapes they strategize, it is also a savage realization of Archigram's Plug-In City (1968) and Computer City (1966). We see Superstudio's fabulous Continuous Monument realized by Global Crossing's massive deployment of transoceanic fiber optics during the dot-com frenzy in the late 1990s. Superstudio's was successful as a project but unbuilt; the telecom's was built but busted its investors. We can measure No-Stop City in the compulsive speed of ambulatory urban computing and the interfacial city without beginning, end, or middle. We imagine Cedric Price's Fun Palace (1961) turned inside out by North Korean stadium pageants where the audience itself is the media content, but instead of free to play, each actor is instead rendered into disciplined pixel within a larger choreography of the spectacular image. We could mark an ancestral trace from Yona Friedman's La Ville Spatiale to the new Asian smart cities such as New Songdo City ("a ubiquitous city," says its brochure) in South Korea's Incheon development, or see Paolo Soleri's Arcology as a first pass at Masdar, the massive "green" smart city in Abu Dhabi. (Both

Songdo and Masdar were built with Cisco and IBM as key partners.) Is Situationist cut-and-paste psychogeography reborn or smashed to bits by Minecraft? What binds the hyperlibertarian secessionism of the Seasteading Institute, which would move whole populations offshore to live on massive ships floating from port to port unmolested by regulation and undesired publics (Facebook funder Peter Thiel is a key funder) with Archigram's Walking City project from 1967, which plotted for *Star Wars* Land Walker-like city machines to get up and amble away to greener pastures as needed? For that matter, as models of programmable planets and embryonic Matrioshka brains, how should we weigh Cisco/NASA's Planetary Skin, which, as we know, would blanket the globe's epidermal crust with ubiquitous physical sensors, on one hand, and the Death Star, on the other? For the Death Star, as for the animal brain, many of the most important information processing and mission-critical tasks take place on the outer surface of the sphere—on the skin, not in the core. Palm Jumeirah, Taitlin's Tower, USS *Enterprise*, the Pentagon, Noah's Ark, Le Corbusier's Plan Voisin, the New South China Mall, Ryugyong Hotel, San-Zhi Pod Village, Sim City, Irvine: it gets harder to keep all these walled megagardens straight.

Just like the *City* layer does and does not generate new forms of sovereignty as a function of a specific politics of envelopes, both physical and virtual, themselves defined by the reversibility of its interior and exterior, the urban platform is also defined by the reversibility of a design gesture's ultimate effects. The utopian and dystopian will invert one into the other without even switching places! The aspiration to the comprehensive "content management" of everything that lives inside its fold drives the *City* platform to open and close, to centralize and decentralize, over and back again, instituting control through the universality of its interfacial protocols, and vice versa. It may be that the agonistic logics of politics—drawing lines between friend and enemy over and over—make it more difficult to see how the technical achievements of constituencies that we believe we oppose also can form the basis of the real alternative systems we also seek to design. For the geopolitical ruptures of The Stack, we can be sure that reversibility sloshes both ways: if Voluntary Prisoners can become Foxconn, then the Foxconn apparatus-assembly archipelago could also provide the genesis of further inversions and utopian opposites. If it does, would we be able to notice them? The Obama era, you will recall, started with a new vogue for infrastructural investment and governance, but the fashion proved short-lived and easily diverted. The overleveraged early 2000s "Bilbao effect" architectural projects were supposed to give way to massive public spending on large built systems that actually did things, but the new New Deal didn't happen.⁵⁰ For some bets, attention turned toward compressed natural gas development at the expense of more difficult-to-solve renewable energy sources and systems, and for others to actively preventing infrastructural development of, for example, airport expansion or the Keystone tar sands pipeline from Canada into the United States. For the most part, the new infrastructuralism sought less to mitigate against the risks of algorithmic

capital and anthropocenic growth than to update their armatures: think Sir Norman Foster's Beijing Airport (built) versus the North Sea wind farms proposed by OMA (not built). Around the time of Obama's second inauguration, we also received word that Foster had received a most extraordinary commission. His office was asked to work with the European Space Agency to design structures to be 3D-printed on the moon. The prospect of constructing new civilizations from whole cloth on nearby planets and moons has inspired no shortage of utopian schemes, but in this case, that cloth is the moon itself, turned into the printed matter with which off-Earth habitations might be mechanically excreted.⁵¹ Such a project should be called robotic terraforming as much as off-planet urbanism because instead of sending designers and building supplies across the vacuum of space, the mission calls instead for programs (call them what you like: scripts, recipes, algorithms) that would instruct a replicating printer to build up new structures layer-by-layer of lunar soil, and in time fill the sunny southern lunar pole with new airport cities.

The choice of Foster's office for this project like this is not surprising, as he is arguably the preeminent architect of the Google Earth perspective: he might terraform the Moon because he has already, project by project, terraformed Earth. Regardless of how you may like or not like the projects, from Masdar to the new Reichstag and the Gherkin, few contemporary offices have done more to expand the perspectival scale of architectural figuration than his. Architectural students now include "satellite" view along the required plan, section, elevation, and axonometric perspectives on their projects, and his portfolio suggests one reason why. While a building's face has usually been read from the view of a pedestrian front or entrance, Foster's projects (especially but not uniquely) are sometimes best considered from tens of thousands of feet in the air, as landscape-scale interventions in relation to the urban regions that they gather into their midst. The megastructural scale of the projects also confirms a gathering of social totality into a single envelope (as drawn from high above, instead of in sectional view as for the Palace of the Soviets or OMA's CCTV, or Dürer's *Triumphal Arch*, for that matter) into which that massive enclosure inhales utopian aspirations (of the client and their publics). At the same time, the universal management platform of the smart city, such as Foster's Masdar plan (with IBM, Cisco, and others), gathers its world less through the anthropometric technique of the envelope than through the anticipatory and parametric management of the discrete energy event. By circumscribing and rationalizing a local polity of the electron as the core constituency of urban governance, this genre of urbanism supervises not only a social totality of humans but also a closed ecology of bounded energy flows. For urban projects such these, the preference is for green infrastructural systems that sense and spit back data suitable for macroscopic images of those flows which are then made into interfaces and thereby instruments for the recursive management of those flows (see the *Interfaces* chapter). As legacy cities are slow to acquiesce to this managerial and ecological reason, megastructural architecture

refers back more and more to the Apollonian scale-image of the Earth to prosecute on behalf of its synthetic ecologies, now so much more manageable because they are legally and ecologically delimited by the building envelope.

A case in point is Foster's unbuilt Crystal Island in Moscow, a massive hyperboloid, Christmas tree-like tower that would contain a myriad of residential, cultural, and educational programs under its glass skin and within its 27 million square feet, four times the size of the Pentagon. After the financial crisis, development financing was frozen, and the tower is not likely ever to be built. Keller Easterling also links the project to utopian schemes of yesterday, some now registered into architecture's critical canon, others still languishing in the historical junk pile of unacknowledged visionary cranks. Like Masdar, Foster's secessionist Island chooses to recommends itself as an exemplar of green urbanism in that it can generate much of its own energy needs, allows carbon-friendly internal transportation from home to work to leisure, and as a city within a city, offers a centralized economy of scale and density for the consumption of resources. Easterling's critique, however, draws on a Sloterdijkian trope of the planetary condition seen as vast interlocking layered interiors, and she argues that "capital A" Architecture's response to the challenge of the Anthropocene is not properly met by bubble-era faux-Arcologies such as these. Ultimately it may well be that The Stack's intensive global mesh of megacities will support megadense resource economies that drive the development of larger and larger buildings, like the larger and larger bombs of the 1950s and the larger and larger airplanes of the 1970s. Both of those arms races were "won" by the Soviet Union, with the 50-megaton Tsar Bomba and the 300-foot Antonov 225 airplane, neither put to much real use, and now Moscow could someday add Crystal Island to this collection of hypertrophic trophies. It may also be that this scalar recalibration of built interiors will realize the positive effect of drawing more and more networks, and even territories, within one building's single, intelligent interfacial design scheme.

Even so, the proper architectural address of the design challenges of a now permanent ecological exception remains with the still-unfinished Copernican conceptual recalibration: that our planet itself is already the megastructural totality in which the program of total design might work. The real design problem then is not foremost the authorship of a new envelope visible from space, but the redesign of the program that reorganizes the total apparatus of the built interior into which we are already thrown together.⁵² At best, flightless spaceships, such as Crystal Island, will be interim experiments that clarify the imperatives for more ambitious and meaningful geodesign. At worst, they are alpha versions of luxury enclaves, post-crash storage facilities for dead currency notes, or props for the closing shot of the next *Planet of the Apes* remake. However we may choose to read the lessons they provide, there is no expansion or any a single building envelope that can actually accomplish what is asked of these projects: "architecture" is perhaps the wrong metaphor for architectural thinking and

experimentation to lean on. As the larger architectural imaginary tries to shift from what the professional assembly of buildings asks from it and toward the technological reassembly of the territory itself, we join it in groping toward a design brief for the governance and geopolitics of The Stack, especially in regard to that Anthropocenic ecological exception. In doing so, we realize that Foster's building is simply way, way too *small*.⁵³ It is actually a miniature in comparison to what is needed, and far too beholden to the traditions and economics of urban program from a bygone era. Instead we would do better to draw energy from artificial envelopes that do less to seal off and subdivide urban polities and do more to enable the appearance of programs that we cannot already anticipate, measure, or rent and resell in advance: a megastructuralism based not on the metaphor of the ark but on the scale and ubiquity of Earth's atmosphere.

42. Platform Cities

Early results are mixed. *Cloud* companies building smart cities and key architects designing enclaves for *Cloud* companies might together point us toward that ark or to something more interesting if less recognizable.⁵⁴ They may provide some additional clues for the design brief, both by what they get right and what they get wrong. It is in this context that we can also tally how global *Cloud* platforms choose to express their terrestrial presence through the medium of architecture on the *City* layer, not only by marking the imprint of their subterranean data centers but also by a close reading of the new megastructural headquarters built to house the embodied human intelligence of particular *Cloud* corporations in Silicon Valley, California. By comparison, recall the Chrysler Building on 42nd Street and Lexington Avenue in New York City, designed by William Van Alen for Mr. Chrysler himself in the late 1920s, as exemplary of an older contiguous and self-contained organizational body. The preponderance of a company's executive staff cohabited a vertical castle, summoned into a singular, internalized corporate hierarchy, modeled in the stacked floors and rigid posture of the tower.⁵⁵ In his ponderous film *Cremaster 3* (2002), Matthew Barney takes on the construction of the Chrysler Building as an occult epicenter of bygone symbolic economies of industrial power, old money, and organic class hierarchy. The conspiratorial conflict involves "the architect," an "entered apprentice," and some other stuff related to Masonic lore and the grandiloquent opacity of deep wealth. Now in considering, for example, the Googleplex in Mountain View, or the proposed new Apple headquarters in Cupertino, we might well wonder (and shudder) if some future Matthew Barney will dance through their hallways with similarly reverent obsequiousness? Do the old and the new headquarters even traffic with the same denominations of spirit and cash? The answer leads mostly to other questions. Below, then, and to conclude our discussion of this layer, is a bit of architectural phrenology and corporate-scale palm reading (or at least one biased interpretation of platform models replicated as organizational space

and form) of current headquarters plans understood as an expression of the *Cloud* layer into the *City*.

"In the plex," Google's footprints seem less determined by architectural innovation than by the nuts-and-bolts accommodation of an elite, idealized elective community. Prioritized over style is the compound's performance as a support system for the peak cognitive labor that is staged there. Instead of being stationed with magisterial Art Deco appointments as were Chrysler's executive elect, Googlers lunch together on artless furniture, and while they do, they enjoy free and nutritious gourmet meals. Why fuss with decorative aesthetics when something far more valuable is being hatched during the meal? Available onsite amenities include massage, free bikes, indoor rock climbing, and regular symposia with thought leaders on a range of topics. Efforts are made to couch an idealized version of programmer lifestyle in its own idiosyncratic luxuries and to dampen any distraction or discomfort that might interrupt collaborative innovation, including perhaps going home. The Googleplex (the architecture of which was designed incidentally by Clive Wilkinson and others) may already serve as a kind of model sub-urban spatial system for the maintenance of global software platforms, but for that, it is also a highly selective population of *Users*. Unlike some utopian communities, Google's infamous and seemingly obtuse interview questions guarantee that entrance into this rarified colony is filtered according to demonstrable problem-solving acumen, creativity, and academic pedigree.

This older more insular version of Google *Cloud Polis'* footprint will apparently be getting an upgrade if it is approved by municipal councils. The oddly paired Bjarke Ingels and Thomas Heatherwick may be designing a new Google campus in North Bayshore, initially dubbed "Google 2.0" and marked by ambitiously open groupings of buildings ("workshops") and gardens beneath semi-transparent canopies. The project seems to enable a more open and diverse social machine than a hermetically sealed campus bubble might. It is still geared toward staging and accelerating cognitive accomplishment, or as Heatherwick says in the project's video, "what is the best possible environment we can make, to invent, engineer and most importantly, make ideas happen and go out into the world?"⁵⁶ Strategies for that staging move past the open-plan faux warehouse, "our self-driving car team, for example, has very different needs when it comes to office space from our Search engineers," Google executive, Daniel Radcliffe explains. Others are more circumspect about the "Googledome," arguing that it is either a wasteful expenditure or that its success will further gentrify the area, making it all but unlivable for anyone but the elect.⁵⁷ It is too early in the project to say anything definite about its success or failure on specific terms, but we can read in the choice to keep (at least parts of) the campus open to publics including retailers and non-employee pedestrians that Google wishes for its footprint to be more than a high-performance vitrine for its human resources, and more like a spatial platform that draws surplus value from and provides lesser surplus value to those who come. It

suggests an idea about the company that is more urbanistic than architectural, however artificial it may appear at this point. The project seems to aspire to be not a basecamp for a single optimal community but a prototype armature for an optimal microsociety through which people move in and out. If the campus is a sort of utopian idealization of the Google *Cloud Polis* itself, this version, unlike some others, at least makes some gestures toward including the outside *User* in its model. The project is still to be approved, if at all, by Mountain View city council, and so we shall have to wait and see what is actually built to compare the real environmental platform to that proposed.⁵⁸

By contrast, looking at Frank Gehry's early proposals for a new Facebook headquarters in Menlo Park (nicknamed "Zee Town" after company founder, Mark Zuckerberg) we see a plan for a more traditional corporate campus, designed, it appears, to ensure the managed serendipitous contact between employees in motion. In this encapsulated "company town" winding pathways and strategic lines of sight connecting interior and exterior views are embedded in a multilevel landscape where sub- and superterranean greenery twists and turns onto and under the collection of buildings.⁵⁹ At their desks, the aggregate social graph of the on-site employee/resident population is framed and displayed to itself as it moves and involves itself within itself in airplane hangar-scale open-plan work space. It's an obvious but valid observation to note that the collected body of Facebook employees is here mediated by Gehry's proposal as a closed-loop network of people, one that will ostensibly perform at a higher level should its undulating nodes and edges be given a single supportive program. Unlike the old Googleplex, defined by robust services in a generic, no-frills context (like Google perhaps), Facebook's seems more tuned to the advantages of the active performance and the structured monetization of captured human networks (like Facebook itself). For its part, Amazon recently took over a huge high-rise campus in the South Lake Union neighborhood of Seattle, and there it will help to consolidate its scattered executives into one big storefront.⁶⁰ Plans for another nearby location also include a "biosphere" building featuring three huge glass domes in which full size trees and other flora will grow in simulated ecologies.⁶¹ For Amazon to encapsulate ecosystems of nonhumans is perhaps the point. Together, the urban headquarters will integrate the company into the fabric of a "real city" in ways that the suburban Silicon Valley campuses will not. Amazon's society will have comparatively blurry boundaries between itself and the rest of the world, similar perhaps to how the mega-retail platform is a more agnostic medium of supply, demand, and algorithmic recommendation, defined by behind-the-scenes engagement with its outside suppliers and *Users*.

This is fine and well, but the far more important architectural-urban footprint of the Amazon *Cloud* platform is not in Seattle but distributed among the company's many fulfillment centers, especially in and around the logistics plantations near the airports of Louisville, Kentucky (UPS's hub) and Memphis, Tennessee (FedEx's hub).⁶² Amazon's platform logic is based on the massive coordination of the pricing, retail

display, storage, and delivery of its flat commerce ontology of objects. If Google's mission is to organize the world's information, Amazon's may be to organize the world's tangible commodities. This places it on a direct collision course with Walmart, but that company has been slow to move into e-commerce and still largely uses its supply chain omniscience to guarantee itself economies of scale with a limited range of downmarket goods—a very short-tail strategy—sold through its network of grim retail centers to people who may not have so many other options.⁶³ Amazon uses the physical supply chain itself (especially *Cloud* infrastructure, airports, warehouses, and third-party delivery services) in lieu of any big box retail holdings. These networks, taken together as a composite Amazonian territory, are the platform's megastructural play at the *City* layer, all but invisible to its *Users* save for the vast Amazon.com website. One can go inside those object-network machines and find unsentimental beauty in their airport-adjacent logistics so precise and responsive that they could be described as a form of artificial intelligence. That description will become more true as Amazon's warehouses, sorting, and distribution facilities become further populated by robotic systems and "workers."⁶⁴ We might anticipate that in a few years, an Amazon platform *User* could choose an item online and have it retrieved (even manufactured), mailed, and delivered with no human touch, at least until the last postal mile. This may be welcome or terrifying news to the precarious population of current Amazon warehouse workers. As discussed in the *Cloud* chapter, many are nomadic part-timers coming and going with the ebbs and flow of retail demand. Those with relatively permanent positions, called Amazon fulfillment associates, are divided among those on the receive lines, the pack lines, stockers, and pickers who are directed by handheld devices to find your order wherever it may be among the immediate stocks of children's bicycles, shoe repair kits, and physics textbooks. By all accounts, Amazon space is already built on the nimble precision of a logistical engineering of human workers' movements with a repetitious efficiency probably better suited to robots. In describing the stress and precariousness of work in Amazon fulfillment centers, GigaOM, a Bay Area technology blog, went so far as to characterize employment at Amazon as a "dystopian model of neofeudalism."⁶⁵ As Amazon absorbs, centralizes, and consolidates production labor into tighter strata of proprietary commerce-logistics algorithms, the future of work is made that much more uncertain, and along with it the buying power of the workers who would also be their customer-*Users*.⁶⁶

Perhaps the boldest (not necessarily best) design statement made by a *Cloud* platform is Campus 2 in Cupertino, as proposed by Apple and Sir Foster during Steve Jobs's last years (though when Jobs pitched the plans to the Cupertino City Council, he neglected to mention with whom exactly his vision sought collaboration; Foster was not named). Plans show a giant toric "spaceship" (Jobs's own word) landed among apricot groves in apparent prelaunch posture.⁶⁷ The design harkens to Eero Saarinen's Watson Research Center for IBM (1961) and the many mid-twentieth-century suburban

corporate exurban campuses, but instead of a set of buildings, Foster's closed ring fits an entire campus inside one curving arc.⁶⁸ To many, it resembles an austere relative of Herzog and de Meuron's Allianz Arena (2005) as transplanted from Munich into more bucolic Northern California or, better, a cult-inspired interplanetary escape craft straight from a Michel Houellebecq novel.⁶⁹ The vast closed (infinite) loop contains 2.8 million square feet of interior space, but appears to have no face to the outside world, no real front or back, beginning or end. Perhaps this replicates the looped border of the Westphalian state or the utopian island. Descriptions used in the proposal like "integrated" and claims that it will "create a physically unified community" rather understate the insularity of this habitat with its central plant, cavernous underground, and off-site parking. Once employees have made their way back to the surface from the subterranean automobile rump state, they will look out and see only the trees for the forest. Withdrawn into this island package, Apple citizens will enjoy the benefits and suffer the fragilities of the reserved enclave.⁷⁰ Bunkers imply security, control, purification, and impenetrability, but like the walled garden of iOS itself, it can also suffer from having to serve as both platform and content at once. As others have observed from the distant sidewalks across the entrance roads, this sort of suburban walling off of a corporation's population may be less futuristic than it is a throwback to 1950s campuses. As opposed to the old "creative class" accommodations of urban contact and stimulation, here Apple recedes and secedes into the controlled space of the curated megastructure. As the price of total interiority is a "disappearance of the outside," for utopian platforms like Apple's, the price of that curation is closure.⁷¹

Perhaps, however, the design gesture is working at a much larger scale, not in relation to any one nearby downtown but, as for all of Foster's projects, as part of a higher-stakes process of terraforming the Earth and building his own distributed portfolio of Earth bases (in many cases directly on behalf of The Stack's expression). The shapes of things to come? What has already been said about the Apple *Cloud Polis* in the *Cloud* chapter is perhaps also seen here extruded into an architectural programming strategy: curated and closed off, affectively perfected, explicitly branded, secretive and opaque, totalizing and majestic, a theological rhetorical voice, etc. The utopia on offer to its OS *Users* is a slightly ecstatic platform that seems to transcend mere computation and operate more within a realm of ineffable experience. That the social contract of that experience would demand such secrecy, silence, restriction, and exclusivity is not necessarily unusual as political theologies go, but that it would be invested in branded equipment that connects *Users* to the *Cloud* layers of The Stack is an important novelty. In anticipation of the ultimate footprint and expression of the Apple *Cloud* platform into the *City* layer of The Stack, we also note that the integration of the closed megastructural platform model is now planned to include Foster's refresh and redesign of Apple's most public terrestrial presence, its hundreds of brand retail stores. That Foster's office would become the house architect of the Apple platform's human-facing

earthly permeation suggests that his acumen with megastructures serves to organize the physical expression of the Apple *Cloud Polis's City* layer more generally. Apple has invested in the biological extravagance of the iconic megastructure in ways that the other platforms have not, including its resolute ambition to utopian totality. Certainly the data centers, warehouses, and logistics parks that give shape to Google, Amazon, and Facebook are no less geographic in scope, but they are not foregrounded as the *face* of the *Cloud Polis* in the same way. The incipient *Cloud Polis* of these other platforms does not rely on the ethics and aesthetics of total design closure with nearly the same intensity as Apple does. Google's networks surely are megastructural in their scope and universality, but they do not observe the guardianship of interior borders as *the essential principle and promise of User experience*, whereas Apple's do.

So truly, with Foster's other commission to design printed structures on the Moon, should we decide to categorize the Apple *Cloud Polis* as part of that collection of megastructural Earth bases? The question remains, however, per Crystal Island, whether this design is properly suited to post-*Apollo* logics of geographic scale and the recognition of any project's expanded planetary situation. Is it instead another ark built for paranoid withdrawal, a design to sustain life on a hostile alien planet even if that planet is our Anthropocenic Earth? There are surely many ways to characterize how the megastructure works at the *City* layer and from these to draw out different implications. Unlike a real moon base or Buckminster Fuller's Domed City, for example, many such structures are not designed only for the permanent or even semipermanent housing of humans in settled encampments. Like the temple at Göbekli Tepe, they may also be monumental landscape switching stations through which we might pass on our way. Their scale and centrality demand this passage, and the arcs of our movements are composed in their bending toward the gigantic nodes. We don't reside in Foster's Beijing Airport, but we must pass through its digestive system if we are to reach the next level of our passage in or out of China. Other megastructures are not only impermanent, they are also not designed for the mediation of humans at all. Most of the very largest buildings in the world accommodate and express the algorithmic resorting and distribution of inanimate objects, commodities, and cargo from sites of extraction, to assembly, to consumption, and back into landfills or the production cycle. As already noted, the relative freedom of objects to cross borders and gather global materials into themselves is far less restricted than the passage of people, bound as we are to the rights and restrictions of formal political citizenship. The physical object becomes the exemplary noncitizen *User* of the *City* layer, as the most intensive impact of algorithmic capital into the physical realm of The Stack is in the molecular reassemblage of standardized matter, its global redistribution as manufactured objects, and the computational optimization of their itineraries through supply chains. All of these enjoy their own kinds of megastructural theater. At the *City* layer, this object-oriented economy of molecular logistics is expressed in "planetary supersurfaces" such as warehouses that are so large

that their floors have been laser-leveled against the curvature of the Earth. Instead of walls and windows, these spaces are programmed by bar codes, RFID chips, and scanners and populated by robotic platforms, shelves, and stockers that can easily lift over a ton of goods at once.⁷² From the perspective of The Stack looking out at the Earth, these architectures of and for things are perhaps even more essential than those rendered for the benefit of human appreciation (as discussed in more detail in the *User* chapter).

Taken as a whole, these *Cloud* platform megastructures concentrate the *City* layer by drawing economies of flesh, information, energy, and symbolization into a web of settlement and displacement as vast as it is uneven and asymmetrical. Often a megastructure will have a special interdependent relationship with another, such that its own enveloping closure belies dependence on a doppelgänger megastructure, one perhaps a continent away, for its own energy, purpose, and support. For example, as said, Apple's spaceship in Cupertino, California, where design and strategy live, cannot possibly exist without the Foxconn factory campus in Langua, Shenzhen, where Apple's products are assembled from parts into the perfected slabs that tether its *Users* to its *Cloud* platform.⁷³ Even as they occupy different corners of the globe and remain selectively ignorant of what goes on in the other site, the two megastructures are intimately paired. They share a unique bond across the strange distances of the *City* layer binding them together in ways that penetrate the total closure of their envelopes by doubling and mimicking one totality into the other. Foxconn's fences sit next to suicide nets as Apple's sit next to apricot fields, Foxconn's dorms occupy Apple's subterranean parking, and Foxconn's massive assembly lines tag along with Apple's customer service training programs. Together these megastructures, along with the network of mall-based retail embassies, constitute the terrestrial urbanity of the Apple *Cloud* platform, but their symbiotic relationship may prove to be more fragile than it may seem. Like the Eloi and Morlock from H. G. Wells's *The Time Machine*, the megastructures' two paired populations share the same world but inhabit different spaces, one above ground and the other underneath. One lives in the perpetual innocence of play and leisure, experience, design, and innovation, staying strategically distanced, oblivious, or uninterested in how it all appears every morning for them, while the other runs the machine underneath, toiling against the Earth, forcing it to produce the bounty over and again. It is perhaps a bad omen for Cupertino that the bargain between the subterranean world of the Morlocks and the surface world of the Eloi is maintained only because the Morlocks periodically harvest Eloi like cattle and eat them.⁷⁴ Lesson: for better and for worse in various measures, the cannibal economies between networks of megastructures at the *City* layer of The Stack are actually not always what they first appear to be, and almost always reversible.⁷⁵

Address Layer

Matter thus resolves itself into numberless vibrations, all linked together in uninterrupted continuity, all bound up with each other, and travelling in every direction like shivers through an immense body.

—Henri Bergson, *Matter and Memory*¹

Never will he [the emperor's messenger] win his way through. And if he did manage that, nothing would have been achieved. He would have to fight his way down the steps, and, if he managed to do that, nothing would have been achieved. He would have to stride through the courtyards, and after the courtyards through the second palace encircling the first, and, then again, through stairs and courtyards, and then, once again, a palace, and so on for thousands of years. And if he finally burst through the outermost door—but that can never, never happen—the royal capital city, the centre of the world, is still there in front of him, piled high and full of sediment. No one pushes his way through here, certainly not someone with a message from a dead man. But you sit at your window and dream of that message when evening comes.

—Franz Kafka, “An Imperial Message”²

The objects on call for The Stack’s logistical imaginary are organized in whirlwinds but their itineraries are anything but random. The cartographic imperative of planetary-scale computation extends beyond remapping the Earth’s surfaces in horizontal and vertical subdivisions of land, air, sea or cloud; it includes the *addressing* of every “thing” therein that might compute or be computed. Individual units of life, loaded shipping containers, mobile devices, locations of datum in databases, input and output events and enveloped entities of all size and character are kept in rhythm not only by the mixed envelopes that contour their paths but also by the synthetic address cartography superimposed on their global fluctuations. In many cases, the geography of this addressing bears little or no resemblance to the physical proximity of one addressee to another in physical space. Two things adjacent to one another may have completely nonsequential addresses, and things with sequential addresses (perhaps considered adjacent according to some virtual geographic order) may be

many time zones apart from one another. Furthermore, as we will see, the *Address* layer of The Stack is not only a master plane where individuated addressees are situated; it is also a medium of communication between them. Things can send and receive information to and from one another because they are positioned on this common plane, and so planetary-scale computation is made ubiquitous not just at the macrolevel of the *Cloud* but also at the microlevel of the humble object, whatever its name or career.³

Common addressing tables are a means to enable forms of universal communication with sometimes very different ends, and so more than one specter of ubiquitous computation haunts the landscapes of our material imagination. The design problematics of planetary-scale computation push up against the expansion of infrastructure at urban and transcontinental scales but also draw on the dilution of small-scale objects into something like a universal solvent of synthetic computation. By comparison, we are no longer so impressed by the prospect of “smart objects,” interactive habitats, and reflexive architectures. Now projects seek “networked matter,” the hybridizing of digital bits and pieces of the physical world, both above and below anthropometric scale, into an ambient field of systematic intercommunication and assembly. Joining the battalions of RFID-enabled objects would be smart dust, robotic insects, transistors inside of living cells, and programmable clay filled with zillions of nanometric machines that can take on any animated form. Research programs such as Hewlett-Packard’s Central Nervous System of the Earth (CeNSE), work toward the trillion-sensor world in which bridges, trains, warehouses, earthquake faults, trees, flowers and animals, and even internal organs are filled with tiny sensors, each transmitting data directly to one another or to the *Cloud*.⁴ The promise (or threat) of designing with a computation that is so deeply laced into the structures and behaviors of matter is an ambition for addressing platforms of comprehensive transparency and the remote interaction with the world at a chemical and atomic scale. The motes falling in space that fascinated Lucretius would be addressable data points and their transit fields a programmable clinamen. Why stop at a trillion? The “googol sensor world” or “Avogadro’s number address world” might allow *Users* to search the whereabouts and state conditions of any “thing” that one could imagine as a discrete addressable event. This open assignment is the basis of many different possible designs. One path suggests a full-spectrum surveillance society, in which no biochemical misdeed goes unsearchable and unnoticed, but another suggests an almost inconceivable reopening of the possible qualities, grammars, temporalities, and polities of material communication and design. For one, the world closes down on itself, reduced like an algebraic equation to baseline symmetries, but for the other, it opens up as never before. The design brief of the *Address* layer of The Stack contains the seeds of both outcomes.

43. Scale, Scope, and Structure

For any thing or event to participate in the worlds I just described, it must have an identity and location that makes it available for connection with other things and events. On its own, it is not present; it needs to be made into an “it” with a location. It needs an address to have an identity, and any address requires an addressing table commensurate with the scales of our Stack scenarios. The ability to assign addresses is critical to any geopolitical system (including The Stack). As discussed above regarding the *nomos*, it is essential for any political-geographical regime to be able to identify the individual sites, fields, instances, and actors within its jurisdictional field, such that any of these would be able to send and receive messages from the others as part of a regular and governable flow of information through space. The terms of the *nomos* are also the shape of that space as configured by the flows that fill it up. For modern governance, this requires not only the subdivision of geography by lines, but also the superimposition of a formal addressing matrix onto new or existing geographies and the assignment of individual addresses to unique points within them. Furthermore, the hierarchical semantics of the address may also express divisions of geography (e.g., the sequence of building number, street, city, and state for Western postal addresses). Political space is both made and made legible through such categorical presentations, and the ancient and modern histories of cartography, geography, geometry, and geoscopy are interwoven with comparisons between real physical features of the world and these ideal abstractions that measure, codify, and explain their scales, similarities, and differences. That legibility depends on the identification of individual datum (any reference point on the planet’s surface) against which position and measurement are made, in reference to the addressing of some subsection of that surface (e.g., that site pinpointed as the intersection of longitudinal and latitudinal lines). In turn, the composite whole model is derived finally from the spaces of difference between internal individual points and sections, occupying positions relative to one another. The model names the points, and the points add up to the model.

The drawing of such a matrix of lines and inscription on the *Earth*, perhaps in military competition with another enemy abstractions, is also a demarcation of possible interior and exterior relations and of political spatial orders to be accumulated and occupied. At the level of the *City* layer, however, the structure of addresses is applied less in the service of absolute state geography than for the production and regularization of sender and receiver relations among situated networks. The assignment of a unique postal address to a building gives it a certain legal, political identity as a public entity to which and from which messages can be sent, and the official enumeration of these identities by the state has been an essential feature of the political modernity of cities and a source of sovereign legitimacy for their governance. That legitimacy is enforced

by maintaining the apparatus of postal identify for sites within the *polis* and securing the right to recognize and assign new identities with new addresses. Sovereignty over communication flows may arise from this monopolistic addressing of senders and receivers, even if the privacy of individual messages is formally guaranteed by physical and virtual envelopes. Later, states (and others) would credentialize permission for messaging with postage stamps, imprinting the message with its official seal and selling access to a delivery infrastructure on an parcel-by-parcel, address-to-address basis (consider that it is Charles Babbage, inventor of the first modern computer during the Victorian era, who also contributed to the design of the first system of flat-rate postage pricing instead of rates based on distance). The problems posed by international post for the mutual recognition between different stamp-and-addressing sovereignties were worked out as late as the Treaty of Bern and the establishment of a Universal Postal Union in 1874 (China did not sign on until 1914). But even with some functional measure of global interoperability between postal domains, the heterogeneity of legacy and local addressing schemes and procedures persists and even multiplies with the development of information technologies. For example, whereas in Western systems, postal addresses go from the smallest to largest entity (person, house number, street, city, state, country), in Japan, addresses can move from the largest to the smallest (prefecture, municipality, ward, city district, city block, house number) in addition to a postal code. Moreover, exceptions are found inside the exceptions. In Kyoto, wards are very small, and often they share the same name, and so informal addresses are commonly used instead; in Sapporo, the city is divided into quadrants, and blocks are named according to their distance from the intersection of the center point of convergence of the North-South and East-West divisions. Around the world in many older cities, building numbers may have been originally and unsystematically assigned according to the chronology of their construction and so sometimes in relation to buildings long since gone. More recently, some master-planned campuses also feature buildings numbered in near chronological order, while other developments subdivide areas according to vertical and horizontal grid matrices, like a spreadsheet with addresses of "A5" and "F9." Each system is logical in its own way. At the same time, the assignment of addresses and street names is not only a matter of logistical rationalization; it can also stage highly charged political symbolism. Revolutions are often solidified through the replacement of one geographical regime of street names with another, giving a new identity to the physical polity and its urban stage (France in 1789–1799, Russia in 1917–1921, and Iran in 1979 are well-known historical examples).

An addressing regime does more than imprint identity onto an existing geography of things; a new regime of segmentation and organization overhauls relations between what is enrolled within it, and does so regardless of whether it is organizing physical or virtual space. As in Thomas Pynchon's *The Crying of Lot 49*, the control of the postal address code is essential to how states, real and imagined, can see and manage both

territory and the territorialized. As its authority delimits the addressed and is itself in turn limited by the addressed, the focus of its control shifts to the enforcement of these systems of signification and to how each system subdivides and individuates the world in different ways and toward different ends. For example, the number of possible addresses in any addressing scheme is based on the ultimate granularity of the total possible senders and receivers within that delimited space. According to the five-digit US postal code system, the entirety of US sovereign land can be subdivided into 10^5 possible zones (including all possible ranges from 00000 to 99999). Because this has proved insufficient for automated paper envelope routing, another four suffix digits were added in 1983. (Compare this to the Millionth Map project beginning in 1913, which would have subdivided the Earth into 1 million individual mapped zones.)⁵ With the development of global information technologies, the capitalization of new forms of virtual space suggested additional addressing measures, including the subdivision of the frequencies within the radio spectrum and their defined allocation for specific public and private uses. Here the “geography” is as physical as the ground, if also invisible to humans, and measured not by longitudinal grids but in the increments of wavelength: kilohertz, megahertz, and gigahertz. At different frequencies, different communication networks are provided specific zones of operation so that they won’t interfere with one another, including commercial television, broadcast radio, cellular telephony, satellite communication, aeronautical radio, commercial Internet, and secure military lines. For this, the division of space into specific discrete plots is less to identify sites within a point-to-point messaging network, as it is for post, but to delimit and corral mutually incompatible signals and channels from one another. For the former, the governance of addressing ensures the triumph of signal over noise by making sure messages arrive only where each is intended and meaningful; for the latter, it ensures that unlike messages don’t trample over one another as they occupy different parts of the spectrum but pass through the same physical location. A perspective that foregrounds the infrastructural agency of Hertzian space in relation to territories of ground and water might understand the entirety of that spectrum as a kind of atmospheric megastructure, another invisible architecture enveloping and organizing the world within itself. Inside it, two channels compete for the ability to occupy a certain enumerated frequency according to their physical distance from one another in the spectrum and by the sheer strength of signal. The antagonisms of Hertzian geography aren’t an oceanic or aerial smoothing over the striated limits and edges of mountainous land; their addressing is based more on *resonance within a field* than on discrete position and on relative amplitude more than simple presence and absence. Nevertheless, in order to make practical use of the spectrum, humans require tangible hardware that can carefully tune, send, and receive signals, and each piece of hardware often requires a single discrete address, as if it were a house on a street, in order for a particular message to be properly relayed to it and to it alone. At the social level,

when particular pieces of hardware, such as a telephone and its telephone number, are linked to particular individuals, we are accustomed to saying that this person has this phone number, so that he or she is known by that spectrum address. In ye olde times, people kept “personal phone books,” paper volumes in which they wrote names and numbers, to associate people known to them and the addresses of the telephones they were most likely to answer if called. People even committed some of these numbers to memory so that intimate friends and family could be reached on a moment’s notice by entering a code string into local hardware. Today with *Cloud*-based contacts Apps, those device codes are hidden one layer beneath a roster of proper names or faces, and once entered into a private database, they are possibly never seen again no matter how often you activate the spectrum to connect with that person’s associated address or “phone number.”

The *Address* layer of The Stack develops through both geographical site subdivision and the identification of untethered instances out in the ambient wild, and its governance depends on the linking of one to the other and making them mutually communicable. This combination blends physical and virtual systems and sets the stage for the overlapping of multiple address geographies, some open and some proprietary, one on top of the other and without necessary resolution (as discussed in relation to Google and China in the *Cloud* chapter). At the level of everyday objects and processes, that proliferation of addressing schemes extends into the tracking of individual commodities through the supply chain, to the tracing of real and virtual data instances within the *City* layer, to the enumeration of fictional currencies for online economies, to the specification of agricultural, ecological, medical, and bacteriological objects of interest, and so on. Not surprisingly the centralized and decentralized control of these interlocking systems is a matter of considerable debate. For example, the domain name system (DNS) and the global Internet addressing system is overseen in general by the Internet Corporation for Assigned Names and Numbers (ICANN), which, in principle, functions as a neutral technical standards body but is sometimes seen, both fairly and unfairly, as extending US influence over the global development of the Internet and its digital economies. Because of this, we entertain the possibility of wide-scale alternative DNS systems, introduced by states or by companies (the .amazon domain name was recently proposed and rejected for recognition by ICANN, but perhaps in time it will appear in some way without ICANN’s consent). If some are adopted only locally, the principle of a single universal Internet addressing geography would be undone. (Is the price of universality always the acceptance of a totality?) This plurality of addressing schemes could theoretically result in a flowering of novel forms of identification and cartography or the proliferation of incompatible schemes and networks walled off from one another. The mutual opacity between the worlds of different addressing systems may enable forms of network speciation and diversification by their separation, and also new hierarchies of who and what can and can’t communicate in certain ways.

For the *Address* layer of The Stack, however, our interest is focused less on “the Internet” as it exists than on the expanded fields of addressability per se to coordinate communication between things, whether through a single universal geography or multiple competing systems. We’re interested not just in how the essential procedures of addressing do more than tally up the digital world as we see it, but also in how they can allow us (force us) to engage with scales and qualities of communication otherwise inconceivable. We can understand addressing as a formal system, regardless of what it is organizing. Addressing depends on the identification of a singularity (the thing, site, event, however heavy or ephemeral, that is enumerated as a discrete entity), on a system of bifurcators (the names, hierarchies, and sets that include the singularity as a member, such as a street name, a postal prefix, or an IP address quadrant), and on a resolver (a universal or idiosyncratic table that can route messages by matching any enumerated address string to the proper entity in the world). As we’ll see, this combination can produce several productive accidents for the *Address* layer of The Stack. These include the enforcement of social hierarchies based on the capitalization of private addresses by some actors and an exploitable exposure of addresses for others. In this, address spoofing and the misidentification and misrecognition of addressable entities as something other than what they really are can have strategic consequences. The most interesting accident, however, may be a cracking open of the scope of what ultimately can be (and cannot be) specified as an addressable singularity in the first place. This will frame the greatest challenges not only to technological infrastructure but to our conventional understandings of what is and is not available for communication, human and nonhuman, physical and immaterial. It is there that the material ambition of The Stack may be most clearly demonstrated.

44. Deep Address

As said, any “thing” that is incorporated into The Stack must be known by it. To be known, it must be locatable as a discrete entity among all others. To the extent that The Stack, as megastructure, provides a global and universal architecture for planetary computation, the space of potential location in which any thing may be situated is equally global and universal. That universality is necessary because the addressed “things” may be of very different kinds and qualities (an entry in a particular spreadsheet, a light bulb in a remote street lamp, a single gateway on a single transistor, a component on an orbiting satellite, or a unique chemical process in a Petri dish). The *Address* layer of The Stack organizes this telescoping from a global grid of locations to the specific local instance of the addressed and back again. This is the ultimate horizon of a truly ubiquitous computing that exceeds the experiential limits of anthropometric and anthropocentric design by enrolling entities into a scope of addressability across and between natural scales, from the infinitesimal to the astronomic, and across natural tempo,

from instantaneous to geologic duration. This is *deep address*; it is where the scope of addressability expands to the point of breaking common sense of what is and is not a sender, a receiver, and message as the theoretical landscape of information promiscuity explodes.

What has been called “ubiquitous computing” since the 1970s (and will soon simply be called “computing”) refers to an evolutionary transition of computation from a generic type of equipment object (“this one thing is a computer but that one is not a computer”) toward a technical environment in which synthetic computation is, like electricity, *a generic property of things in the world*. We say that light bulbs, toasters, and remote controls are electric but not that they are electricity or “electricity machines.” Instead, for them, electrification is just another physical aspect alongside plastic compounds and steel wire. For better or worse, so too for computation: cars, doors, lights, window switches, and all forms of significant gateways and networked pebbles become computational media. On this general computation, Cory Doctorow observes that “the world we live in today is made of computers. We don’t have cars anymore, we have computers we ride in; we don’t have airplanes anymore, we have flying Solaris boxes with a big bucketful of SCADA controllers; a 3D printer is not a device, it’s a peripheral, and it only works connected to a computer; a radio is no longer a crystal, it’s a general-purpose computer with a fast ADC and a fast DAC and some software.”⁶ Sensor nets and smart surfaces transform whole landscapes into intelligent territories (or remake their dumbness in new ways). As the ubiquity of computation extends to finer and finer granularity, smaller and smaller, it enlivens the things of the world (we hope) in perhaps startling and even animistic ways. The share of traffic dedicated to human-to-human communication (or even human-to-thing) is overwhelmed by tidal waves of object chatter coming online all around us. As it extends to envelop yet more vast gestures, the oscillating chatter of stuff that is now given voice only gets denser and more intricate. Perhaps instead of inaugurating some full-spectrum mastery, our own attempts to communicate with a ubiquitously computational world become but one vernacular voice among the object legions.

For such a computational landscape of things to communicate with itself, it must map and enumerate all the things that can send and receive information, and so provides each with an (at least temporarily) unique address, regardless of what that address might resolve. As said, that addressability does not replicate the proximity of those things in the real world (the way a sequential postal address does) but instead organizes them according to a universal indexical simulation that provides a bewilderingly high resolution of possible addresses and even produces new routing geographies and locations in its own image. In that it controls the very possibility of communication between things, the governance of the address becomes more than the management of an addressing schema; it becomes a governance of the addressee and of the *addressable* in general.⁷ Besides the technological and epistemological complexity, it also suggests

possible channels of direct economic relations between points within this vast address cloud, any single instance also a node of, for example, supply, demand, valuation, or debt. Consider the 2008 financial crisis. One effect of planetary computation on economic geography is the virtualization of sovereign currencies into n -dimensional abstractions and the consequent disturbance in the force of money to represent the exchange value of commodities, assets, work, and debt. What does money point to? The ultimate reference of a currency is always mythic ("Gold? Seriously?"), but when it is reduced to absolute pulses of light, the link between a currency, the value that it contains, and the thing or process that is exchanged for that currency becomes even more unwound. Among other things, the financial crisis is a crisis of addressability, a de-addressing of things, and one that continues consolidating a shift within global market economics (when not also collapsing them). We can only anticipate what forms of high weirdness will ensue, as the paired computerization of matter-into-monies (i.e., carbon credits trading, where the value of money is itself measured in carbon) and monies-into-virtuality (i.e., the light pulses of high-speed trading) continues to evolve and accelerate.⁸ New addressing schemes to locate and coordinate instances of value are multiplying, both as generic currency (bitcoin blockchains) and as platforms for brokering things-with-value (various sharing economy schemes). At stake in all this is also the design of the economy of information itself, from the smallest-scale object or gesture to the largest topological frameworks, and interrelations across scales by drawing and managing an orthodox map in the form of an address table.⁹ What gets to count and to whom, and who profits from merely counting? If one is unaddressed, then one cannot speak or be spoken to, and so in turn, resistance to official addressable geography and its enforcements characterizes so many histories of resistance to authorities wishing to consolidate their power by consolidating ability to nominate space.¹⁰

But deep address is not only a mechanism for the capture of what exists and a formalization of its space of juxtaposition; it is also, as conceived, a medium for the creative composition of those relations, positions, and interrelations. It is a machine for mapping states and procedures of interrelation that are as ancient as they are ephemeral. If we were to think of interaddressability in this way (and even abstracted from its integration with planetary computation as the *Address* layer of The Stack), we see that its practices are analogous to the intertextuality that links and delinks written texts, one to another, in varying scales of reference, quotation, association, and categorization. "Textuality is massive addressability," claims digital humanist scholar, Michael Witmore.¹¹ By this, he means that any text provides "multiple provisional scales of unity" (inscriptive, semantic, intertextual, formal) and that such "levels of scale and provisional objectness are as historically-phenomenologically determined as technical."¹² Any layer of addressability, internal or external to what is individuated as a single text, is then so open to alternative logics of subdivision, categorization, and

direct and indirect association that any one coagulation of addressability is always provisional if also historically overdetermined. This allegorical provisionality is what allows a reader to produce new momentary conceptual framings of a local instance within a text or an association between multiple texts, within or across logical sets on the fly, so to speak. That simultaneous decoding and production of intertextuality is an essential task (and risk) of readership.¹³ With deep address, that process is augmented by a platform for *the real numerical explication of such provisional intensities* and the communication of them into a global network of mutual, formal, technical inter-addressability for which the trace (i.e., any writing) is made durable and directly available outside itself and a “reader’s” experience of it. The addressable space could range from the molecules in printed ink, to an individual letter on a page, to a complete sentence, to scenes or passages, to a citation or thematic link to another passage that is written about it, to metacommentary on that theme, and so on. Each instance could be traced in different ways by different people for different purposes, all of which in turn could also be addressed over again, with their queries themselves searchable: data and metadata, text and reading, object and event. All fold into origami-esque fields of interpretation, referencing, and mapping. Thereby, any local address no longer comes and goes in the same way. It now leaves a durable marker on the “text” (any site, object, event, person) such that it can be reconstituted later and can be incorporated into a reframed public life of that text. In this case (the one most familiar to the digital humanities), deep address represents a kind of second-order intertextuality, an artificial superimposition of a linking mechanism into techniques of reading, quotation, archiving, analysis, archaeology, and so on. However, once again, the wider interest for The Stack is not only as a mapping or interpretation tool, even for leaving bread crumb trails through deconstruction or tracing cognition in real time, but as itself a first-order compositional medium through which gestures of nomination, measuring, localization, linking, delinking, association—in other words, *articulation*—are developed with due virtuosity so as to produce new creations in their own right, built of nothing perhaps but the addresses that codify and arrange each gesture for others to sample and appreciate.

45. Objects in The Stack

Before we consider the terms for that kind of compositional exploration, let’s revisit the more familiar, visible, human-centric, utilitarian program for ubiquitous computation developed for an “Internet of Things.” One could be excused for assuming that the future of computing involves primarily the proliferation of calculation and networking into domestic appliances, so that rolling waves of suburban kitchens may be refashioned as smart spaces and interactive habitats. However, this forever stale vision predates general-use computing by many years, and Architecture has had better plans

for information spaces for at least as long. For example, in the 1960s, the definition of architecture as a container and conveyer of information was central to Christopher Alexander's project, while the reprogramming of *Apollo*-era cities as a lattice for interactive media technologies was sketched out by Cedric Price, Archigram, Reyner Banham, and others. Before MIT's Media Lab, Nicholas Negroponte founded Architecture Machine Group, which focused on the problems of human-computer interaction at the environmental scale and what came in time to be called "information architecture."¹⁴ Today, as suggested, many speculative information space design questions are not only coordinated around building automation but also for the conjuring of exotic materials such as smart dust, a generic name for different kinds of millimeter- to nanometer-scale sensor arrays with ultralow power budgets connected wirelessly and which gather hyperlocal data as they swerve. Some of these perhaps even also in turn react back on their microcosmos and our macrocosmos—what Vernor Vinge calls "smart motes with effectors."¹⁵

Other programs focus on the design of the spatial, temporal, and semantic relations between physical and data objects. Bruce Sterling's influential *Shaping Things* introduced the term *SPIME* to designate the hybrid profile of an object, as accumulated all the way from its virtual design, to sourcing, to assembly, through its use and consumption, and its ultimate disassembly back into entropic matter. He situates this at the end of a schematic history of artificial objects, from artisanal craft to post-Fordism, and suggests that the SPIME is the modality of objects defined by the conjunction of computer-aided design, pervasive big data, computational logistics, global sourcing, and waste materials management. It is less the object as melted into the computational solvent, but one that talks to the platform through the long arc of its conception and assemblage, oscillating between virtual and tangible states and shedding metadata all along the way. This "thing" is ultimately indistinguishable from (if not reducible to) the traces that it produces about itself and its various relations with the world that brought it into being.¹⁶ The SPIME is then a kind of meta-diagram that precedes the object's manufacture, couches its real physical life in the world, and outlasts its recycling; it is the "thing" defined as an artificial temporal instance of digital-physical relations from beginning to end. The politics of the SPIME motivates interest in making global supply chains deeply transparent, and in principle more accountable and sustainable. The hope is that if any interested *User* can "read" the complete biography of a thing, measure all of the conditions of its appearance, use, and disappearance now captured as extensible metadata, then the politics of its chemical and mineral origins (as discussed in *Earth* chapter) or factory labor conditions, or nutritional authenticity, or post-use death cycle might become more legible currencies of everyday material culture. From other highly controlled perspectives, such transparencies are common in global supply chains but are guarded proprietary sources of competitive information, not public platforms (see the discussion in the *Cloud*

chapter on Amazon and Walmart). But as object fashioning also moves from far-flung extraction-design-factory-distribution chains to scenarios associated with networked 3D printing, then the public constitution of the thing as a traceable data shell is perhaps both more apparent and more salient for end *Users*. Every time that the schematic instructions of physical object are downloaded and rendered into atoms, that transformation and the relevant information about who, what, where, when, how, and why that took place might be added to the cumulative “objectivity” of an object that is itself already a networked entity. Given the disruptive potential of a tectonic shift toward the economies of additive manufacturing, including the decentralization of the “industrial Internet,” the related control and governance issues are uncertain. They might range from the dangerously annoying (such as digital-rights management schemes for tangible objects crippled by remote rentier platforms attempting to collect royalties and fees on forks, lamps, and chairs)¹⁷ to the annoyingly dangerous (the widespread distribution of tools of mayhem, and new forms of virus spread through distributed object networks, either a real biological virus¹⁸ or physical malware or combinations thereof¹⁹).

For any human or nonhuman *User* to locate any “instance” (physical or virtual) within this expanded address field requires not only that it has a predictable and available location, but that the career of that thing and the history of its relations must in fact be queryable. Internet search has largely focused on the sorts of data that are publicly available at IPv4 addresses, namely web pages, but both the Internet of Things and the more comprehensive theoretical SPIME spaces suggest radically expanded search domains (and deep addresses exponentially more so). These range from the prosaic (Google “my car keys” to find them under the couch) to the barely fathomable (“search the contagion distribution of the RNA in the virus that laid me up”). Just as for today’s web pages, search providers are eager to provide more direct services built directly into query results themselves by predictively interpreting the *intention* of the query and providing its likely solution along with tools for the *User* to accomplish that intention as part of the search result. These are techniques sometimes associated with the semantic web, for which structured data are linked and associated to allow instrumental relations with other data, making the web as a whole more programmable by *Users*. Through various combinations of open or proprietary exigetics of data, and perhaps a sequence of application programming interfaces (APIs), a query entered as “book me a ticket to New York” can activate a series of secondary inquiries to calendars, banks, flight schedules, airline databases, bank accounts, and so on and, through this, initiate the cascading programming resulting in that booking. For this, to search is also to program. Such tidy consumer use cases require enormously difficult standardizations of interoperability between competitive services (not to mention beyond-Esperanto level standardization of all *Users’* conceptual taxonomies). The goal of linking data into semantically relevant and accessible structures so that “search” would also provide more actionable

results, and in turn allowing queries to program those results for specific ends, remains compelling for search engines, if less so for individual down-service-stream providers, such as airlines and banks, which see their business absorbed into a handful of search platforms.²⁰ By comparison, physical search may be based on a similar tissue of interrelation between addressable entities—in this case, a mix of physical things and data of interest—and might be a necessary condition of a really viable Internet of Things or SPIME space. The designation of semantic relations between objects, according to some disinterested (or extremely interested and capitalized) graph of addresses and their interlocking sets, might reorganize what we take to be the natural proximities of one thing to one another and introduce another map (even topology) of queryable association between them. This resulting platform might provide for the programming and counterprogramming of the resulting object landscapes and event graphs, putting them to direct use, as well as providing secondary metadata about their efficacy or accuracy. Just as most of the traffic on the Internet today is machine-to-machine, or at least machine generated, so too a semantic web of things²¹ would be correlated less by the cognitive dispositions or instrumental intentions of human *Users*, but those of “objects” and other instances within the larger meta-assemblage all querying and programming one another without human intervention or supervision. In the hype, it’s easy to forget that the Internet *of* Things is also an Internet *for* Things (or for any addressable entity, however immaterial).

Control of this multitude of chattering things would represent enormous power, and the danger of overcentralization paired with a monetized opacity of data flows is real. The capture of the “general intellect” by search and other mechanisms of “cognitive capitalism” is one lens through which to imagine a future in which tracing objective knowledge about the appearance and disappearance of material culture is a proprietary narrative.²² At the same time, Internet of Things scenarios that prioritize human *Users* sensing and interacting with their responsive habitats, as masters of the data that appear in their midst, divert discussions of the politics of ubiquitous computing toward an overly local frame of reference within a larger landscape of humans and nonhuman associations. Among the most thoughtful perspectives on this problem is that of designer and programmer, Usman Haque. In 2011, he helped coordinate a drafting of an “Internet of Things Bill of Rights,” which included the rights of “people to own the data they (or their ‘things’) create,” of “people” to “keep their data private,” of “people” to “own the data someone else creates for them,” of “people” to “use and share their data however they want,” and so on.²³ All of those enumerated are strong and sensible principles, and the beneficent blossoming of ubiquitous computation would be more assured should they be widely adopted. But one can’t help notice that as a model governance of a landscape largely populated by nonhuman addressees, every sentence in this list of rights begins with the word “people” and refers to the rights of individual human *Users* to retain individuated sovereignty over flows of data that may

very decisively exceed the boundaries of any one person's practical domain. Given that so much Internet of Things traffic will be object-to-object and that any object may directly affect and be affected by many people at once or over time (some owners, some *Users*, some passers-by), how can anyone be sure what "person" we are talking about? By articulating the terms of governance in the terms of individual rights, we limit how design might govern in advance the emergence of addressable computational-material communication to a narrow, even parochial subsection of invested *Users* who happen to resemble this kind of profile.

Instead, we also need to consider a politics from the perspective of the *addressed* looking out at the world. Because each object is understood not only as a discrete entity but as a durable intersection of multiple ancestor and descendant objects, events, and processes, all of which are inscribed and archived in some sort of available "cloud" of traces, a mature *Address* layer infrastructure would also generate second- and third-order layers of metadata about metadata produced by the logistical intersections of new and old objects, coming and going. Like a text, any object can contain a multitude of contingent layers of logistical trace, including its location in open or proprietary supply chain models, as one instance in a network of metadata, traces, and relations with its own semantic meanings held in relation and association with others. "It" is contained inevitably within multiple sets of structured data at once, each set perhaps overlapping, perhaps aware of the work of jurisdictional categorization done by other sets and perhaps not. Any parameter of the object is articulated by an addressing of it as a nameable entity, as a site of interconnected relations, or as a producer of metadata about itself and those relations, but its appearance as a "virtually discrete" thing, a fleeting event, or a cipher for networked commodity flows is fixed at a specific location within a global addressable space so that "it" can say things to other things and other things can say things to it. Once more, for any trace to be visible, it must be enumerated and enunciated, and as these inscriptions for the virtual object are instances within a universal space of trace enumeration, they are *addresses*. This addressability of the object (or sub-object, or relation of assemblage, or SPIME, or event of association, or trace, or commodity life cycle phase) zooms between spatial and temporal scales, gaining complexity exponentially as data and metadata for second- and third-order relations accumulate. This ecology of proliferating data points generated by and about the flows of material cultures seems to aspire toward a beyond human-scale universal architecture for addressing the qualities of relations between all parameters. Seen through deep address, the ultimate politics of the Internet of Things hinges on the dynamic between the open universality of such a platform architecture and its global closure as a total geography. The abyssal scope of this architecture, its exponential layers of relations upon relations, and its essential position within The Stack, may be the most important intersection between the SPIME motif and deep address, and may be the most integral accident of the *Address* layer.

46. Addressability and Technique

For the *Address* layer of The Stack, different design programs might want only to deploy or disassemble existing Internet address architectures, but should instead proceed from the procedural terms of addressability itself. Some are universal, and others are specific to addressing within computational networks. According to Saul Kripke's philosophy of language, we first point at something, and only then do we learn qualities about it. Designation precedes description.²⁴ Internet addressing systems also describe the world first by pointing at things, differentiating them, only later filling in content for them, and as they point toward unlike things, processes, and actions, this designation becomes a generic technology.²⁵ Laura Denardis describes the essential functions of Internet addressability according to four variables: *universality* (the address must be a required common denominator for access to the network), *identification* (the address must constitute a truly unique identifier such that no two things can share an address), *exposure* (addresses cannot be encrypted and must be visible to others), and, *disinterestedness* (the address is unconcerned with the content of any message sent to or from it). To locate *Address* as a layer within a planetary computational landscape, we could add several more of our qualifications. Among these is *presence*; whether something has or does not have an address has the functional effect of allowing it to exist or not exist within a world of experience external to itself and extrinsic to the generic designation of its address. If something that has an address is addressable, it is *present*, and stripping something of its address, or turning off its address, erases it from that world. This is address as a technique of identity and precondition for social performance. Second, addresses provide a space of *relationality* between things that exceeds the relations they might already possess as natural objects. Wine would still "relate to its jug," as Heidegger intoned,²⁶ but as one node in a flat universal network, it could also relate to, and exchange real Shannon information with, a helicopter, a book in a library, or someone's kidney stone. *Flatness* here refers not to ontology or the withdrawal of objects, but to their functional communication and their mechanically unwithdrawn relations.²⁷ These relations could include the identification of something with an address that previously had no name or any normal discrete quality as a natural object for any *User*, including either a tangible thing or an intangible condition between things. This "word" (the four letters to the immediate left, in quotes) in this sentence could have an address, but so could the immaterial fact that I wrote it, or that at a given moment, it is in my proximity. The fact that you just read that word could have an address. These *relations*, these traces without mass, are equally addressable and so equally "things" in the program of a universal deep address. What would relations say to other relations? By providing an address to a massless relation and making it a source or receiver of further information, alien worlds perhaps come into relief (if not for us). As heretofore unseen or unnamed relations are made clear and new concepts about their relations

are superimposed on them, then things that already possessed common names and certain identifiable relations are also now seen in new light. The everyday taxonomy and categorization of the world might be scrambled. Things reorder themselves according to distant logics of proximity and come to belong to different sets and categories than before. Once recategorized, they could also be valued differently, revealed as crucial or dismissed as irrelevant for unexpected reasons. In this regard deep address is also a *mereological* technology.

Third, addresses, in plural networks, produce *topology*. Whereas the nested hierarchies of postal addressing (e.g., name, building, street, city) refer to specific locations within a natural geography, such that the physical proximity or distance of one addressee versus another might be deduced from their addresses, Internet addressing follows no such geographic conventions, and peer-to-peer networking is all but agnostic as to the territorial origins and outcomes of packet flows. Instead, the accumulation of Internet addresses in certain areas, such as New York and Palo Alto, and the density of relations between those accumulations produce durable patterns of information communicated through the world.²⁸ Globally our regular networks of bundled addressors and addresses wear grooves into information channels, sometimes aligning with geopolitical borders and interests and sometimes perforating them. Sometimes these grooves are a deliberate regulation, such as a walled garden enveloping a platform's *Users* or a secure military organization, and sometimes they are accidents of common cause or of the expediencies of packet routing, which can generate new hyperbolic geographies in their own image. Fourth, address produces an effect of *generic subjectivization* within the network, such that anything, regardless of what a particular address actually resolves, human or nonhuman, big or small, is possibly both an addressee and an addressor within network space. Not only does it have presence, but it can also be spoken to and it can speak, and it can be spoken for. This goes for anything and anyone. Importantly, in this generic universality, there can be a dehierarchicalization of participants, putting everything on a similar level that ultimately can amplify eccentric pathways of evolution in the relationships of information at play in the world.²⁹ Flowers and bees already communicate, but what do flowers have to "say" to birds if they, or sub- or supercomponents of each, could exchange messages directly? And finally, fifth, as already mentioned in relation to intertextuality, address space allows for retroactive *traceability* between lines of communication and events of differentiation that have taken place. Such artifacts may in turn be themselves addressed and made into aggregate objects for subsequent chains and networks. That possibility of infinite recursion, for which any connection later becomes an address, and which is itself addressed and so on, is discussed further below.

Each of these speaks to three general principles (which can be mapped onto or across singularity, bifurcator, and resolver). *Address* provides *identity* (through "designation"), *address* provides *exchange*, and *address* provides *recursion* and the capacity to govern

the conditions of those exchanges and their traces. Whether addresses are resolved as parcels of binary data, sovereign currencies, or quantities of extinguished carbon, each of these could in principle be enumerated by one or several universal addressing procedure platforms linking addressors and addressees up and down the layers of The Stack: *User* to *Cloud* to *Earth*. The design brief of the *Address* layer revolves around such scenarios and all their effects and accidents.

47. IPv6

In practice, ubiquitous computing and the identification of digital objects depend on multiple unlike schemes. There is no single globally unique identifier (GUID) system addressing all networked things across macro and microscopic scales. Explicit and implicit in each scheme is a means not only to describe and designate a certain functional world but also to program one through a particular grammar of connection. Some track homology between real and virtual objects (i.e., the Tour Eiffel in Paris to the Tour Eiffel avatar online in *SecondLife*, or an instance in a database to a real toy in a shipping container somewhere in mid-Pacific transit). Others, such as MQTT (message queue telemetry transport), broker signals between more local networks of the Internet of Things, and in Hollywood, EIDR (entertainment identifier registry) tries to identify and stores information for the tracking of unique copyrighted content across multiple work flows and consumer channels (it is but one of several systems of digital object identifiers supervised by the International DOI Foundation).³⁰ For the Internet at large, universal platforms for generic addressability might in principle enumerate anything, but they are not infinite. On the contrary, they are—perhaps unfortunately, perhaps fortunately—a finite and tightly governed resource. Internet addressing is based on protocols designed in the early 1970s, a time when it was thought safe to presume that the total number of network-addressable computers would be rather small, not conceivably more than a few billion. For the most part, IPv4 has been used to address almost everything connected to the Internet. There is, however, a problem with IPv4 and its ability to map a fast-growing Internet and a thriving ubiquitous computing ecology: all possible addresses are now allocated. IPv4 is a 32-bit address space and so has a maximal capacity of approximately 4.3 billion addresses, far fewer than even one per person. There are not nearly enough numbers in the address space to enumerate all the individual “things” that a robust future of ubiquitous computing would require, even with subnet routing and swapping addresses to and from things on the fly. In 2011 the final blocs of 16 million addresses were allocated to the five global (regional internet registries (RIRs). Readers can be excused if they have never heard of the trans-national bodies responsible for allocating the addresses that provide address and access to the global Internet: AfriNIC (Africa), ARIN (which covers North America) APNIC (Asia-Pacific), LACNIC (Latin America), and RIPE (which covers Europe).

Pondering the significance of the Internet's becoming "full," I was interested in seeing a map of the global address space. Indeed in the long history of cartography, of world maps going back to the Greeks, Westphalian, and Mercatur projections, and medieval Islamic geographies like Muhammad al-Adrisi's *Tabula Rogerina*, would the cosmogram of a now-full IPv4 address space perhaps compare on some small level? I was surprised, then, that was readily available. So in collaboration with the San Diego Supercomputing Center, Sam Kronick and I made one to satisfy our curiosity, which you can view online at the site associated with this book (thestack.org or bratton.info/thestack). You'll note two things right away. First, although the biggest presumed growth of *User* population is in South America, Asia, and Africa, it is North America and Europe that control many more addresses than those continents. Second, one whole quadrant (totaling hundreds of millions of addresses) is claimed by private and government actors, such as Apple, Microsoft, Halliburton, the US Department of Defense, the UK Ministry of Defense, Merck, and Lilly. One new economy of scarcity is addressability, and existing solutions to expand the address space are unlikely to be implemented as quickly as they could be. There is hard power in soft addresses as the power of the map is the power to qualify movement, and the top left corner of the IPv4 map is beachfront real estate.³¹ But ultimately this scarcity is artificial and technologically unnecessary, and it has even distorted the structure of the Internet itself.³² An original vision for the Internet platform was for decentralized "state-full edges" in which every node could peer with any other. "Distributed state meant that adding nodes also added capability and that ownership and power stayed distributed as the Net grew. ... Unfortunately that chronic shortage of addresses contracted the web, shifting the definition of 'edge' from the device you are looking at to the ISP (Internet Service Provider) it's connected to."³³ By contrast in an alternative postscarcity economy of addressing, with every little node also a server (hosting, sending, receiving, processing, sensing), then the physics of centralization and platforms may evolve quite differently, with communication flowing mote-to-mote, mountain-to-mountain, and mote-to-mountain, for example. Toward that, what is needed is not just another way to number the network but something that functions like a new network emerging through an enumerative infrastructure that is more correspondent to the polyvalent and multitemporal scales of The Stack.

One technical solution to the artificial scarcity of addressability is IPv6, a 128-bit address replacement for IPv4, proposed originally in the mid-1990s. When would IPv6 run out? If you were to divide the total number of possible addresses within a 128-bit space by 7 billion people, it would be able to theoretically allocate approximately 5×10^{28} addresses *per person*. That is an genuinely incomprehensible number; it is orders of magnitude more than Avogadro's number (>1 mole of addresses). You could, if so inclined, assign over 4 billion unique IPv6 addresses to every known star in the universe. Everyone, with his or her personal allocation, could assign a unique address to each grain of sand on Earth's beaches; we could give each cell in every human body $2 \times$

10^{13} addresses, and so on. However, it must be said that the full IPv6 address space can enumerate many orders of magnitude fewer items than the possible number of books in Jorge Luis Borges's "Library of Babel."³⁴ How ubiquitous is the ubiquitous computation? If you were to try to assign an individual address to 10^{28} things over the course of your life, you would have to work down to the level of individual molecules, numbering things at a scale below natural perception, doling out addresses for individual letters in books, hairs on heads, blood cells, specks of dust.³⁵ I was interested in experimenting with that fine granularity, trying to get a picture of it in my mind so that it might be more easily understandable. How small could one "write" an IPv6 address? I would need the most fine-tipped writing tools invented to find out. In collaboration with the Nano3 lab at Calit2, we wrote a single IPv6 address (3ffe:1900:4545:3:200:f8ff:fe21:67cf) with an electron lithography beam into a silicon wafer and photographed it with the scanning electron microscope (see the image in the online companion to this chapter). The address in our picture is 10 micrometers in width, about the size of a red blood cell. The lines of each digit are about 50 nanometers in thickness.

But nano-objectivity is only part of the story. Recall that deep addressability would allow for the identification not only of things with mass but also of relations between things. Once again, each letter in the sentence you are reading right now could have an address, but your act of reading of each one of them, those immaterial relations between two things, it and you, could be addressed as well, and from this graph and set traces proliferate and become techniques of a new geography. One can address both a discrete thing and the abstract reverberating envelope of relations around it that could extend toward infinity. Put differently, deep addressability includes not only discrete entities but also multiple levels of abstraction, as well as the traces of those entities and in turn the abstractions we hold for those—not just addressable nouns but addressable verbs, events, and allegories. While it's unlikely that I could exhaust 10^{28} addresses for familiar physical things over the course of my life span, I could easily exhaust that many relations of relations of relations of relations. I could spend all my addresses in an instant if we were to extend relationality all the way down into the abyss. The exhaustion of any full allocation of deep address exists therefore *somewhere between never and instantaneously*, and the measure of that vast middle ground is essential to the design brief of the *Address* layer of The Stack.³⁶ Whereas the traditional Internet of Things situates a network of physical objects, the full *Address* layer would include all these but also concepts, events, procedures, and memes, addressable at a common level through a generic protocol.³⁷ While there are real barriers to a global IPv6 implementation, some technological, others economic, and others political, we should assume that for The Stack, some platform for deep address will in time enumerate things and events at a similar or even more granular scale, giving way to disorienting associations between micro- and macrocosmos, linking, delinking, and blurring across natural scales. Besides IPv6, Bitcoin allows for 2^{256} possible private keys and 2^{160} possible private

addresses. Perhaps its hash architecture can be made to not only to map virtual quanta of “value” but actual things as well at the scale required by a global economy, or a parallel economy. (Is the “coin” the “address” and the value in the mesh of addressees? If so then the cost of addressing of anything and everything may be prohibitive without the introduction of some new incentive for settling the blockchain consensus.) All that is solid doesn’t melt so much as it becomes fuzzy and spastic. In this, *Address* layer technologies of universal addressability point not only to assemblages that exist but to the media with which to compose those to come.³⁸

48. Communication and Composition

Design can only grope with the implications of an *Address* layer that meets matter at its own scales, and surely, unfortunately, it will do so initially through a demand that everything must appear and be disclosed to the cartographic militation of logistical necessity. But the geographies of communication are never and can never be limited to fixing things according to path and place. Things in the world always communicate and exchange information: DNA, RNA, and hair follicles disturbed by sound waves and sunlight exchanging information with celluloid film, for example. Things *inform* one another in specific ways, and this specificity is how Michel Serres defines *communication* as the work of Hermes. Adjacent to this, I see addressability not just as an absolute logistics but as a transalphabetic compositional platform. The logic of deep address is not only to identify discrete things and capture them into the fold by tagging them but also to designate with some manner of practical durability the ephemeral, immaterial, even metaphorical associations between instances, and thereby framing them as addressable events and passing them along as messages. By one perspective, this is what poetry does with written words. Its facility is not in the naturalistic explication of things as they are, but in the ongoing demonstration of language’s ability to contend with the affective contradictions of semantic abstraction. It might do this through the alignment of ideas that, by their positioning just so, are arranged for us as the trace of an alternative perception, or through the fixing of symbols on a surface that, through the poet’s cunning alienation of our interpretation, disclose startling truths about the materials of writing, sounding, reading, and so on. Similarly for deep address, in the assignment of a specific sequence of addressing identities to a precisely chosen web of immaterial associations now made into singularities (a certain view out the window, the falling of an anonymous bit of debris, one moment in the crashing together of dangerous alloys like a car and a driver), we render a composition built of nothing but a stream of applicable addresses resolving (somehow) to the signified arrangement of concepts, proximities, and appointments. The more difficult assignment for design is to compose relations within a framework that exceeds both the conventional appearances of forms and the provisional human context at hand, and so pursuing instead

less the materialization of abstract ideas into real things than the redirection of real relations through a new diagram.

In expanding the space of potential addressability, the protocol interfaces between any two things that could be encapsulated into a provisional incorporation claim for them a position within a territorial apparatus. Even so there can't be one single necessary relationship between a comprehensive computational addressing mechanism, such as the *Address* layer of The Stack, and the given distribution of things in the world. There is no one matrix of correspondence between a primary planetary plane and a second artificial machinic layer. Instead, between the two are qualified simulations and countersimulations that always flow both ways. *Address* is not simply a virtual layer constructed at scale so that it could overlay the first plane, like Borges's one-to-one scale map, causing the original geography of positions to fade, crackle, and blow away. Rather, the interlacing territories blend and perforate, signifying within the other, feeding back and forth until each is interior to the other. Through addressability, the linking of matter and information otherwise disconnected is also a reinscribing of the boundaries of potential aggregations and a restructuring of their amalgamations and divisions through a recognition of their conditions and dependencies as a formal "haecceity" (after Charles Sanders Peirce). The correlation between an address and an addressee puts into question the stability of referent, which can be temporary, slow, or fast. As such, the proper unit for deep address wouldn't be an Internet of Things, which suggests durable appliances beeping at each other, but an Internet of Haecceities, addressable specificities that might name particularities as they come and go, even before and after they exist for individual *Users*.³⁹

For The Stack, the compositional logic of addressing is not contained only within the *Address* layer but links operations up and down from the local to global and back again. The Stack could be said to compose lines between addressees located elsewhere, as the *Address* layer provides identification and rendering as "present" whatever might be available for delineation or containment. *Address* is like a valve through which the *nomos* of the *Cloud* cleaves subdivisions smaller than the geographic, and where it draws landscape-scale calculable interiors. At the *Earth* and *Cloud* layers, platform service empires organize open and closed populations of addressable *Users*, sensors, data sets, and interaction platforms, among others, from which they absorb and recirculate patterns of value. The worlds that the *Cloud* layer provides is limited to what it can address and be addressed by. At the *City* layer, *Address* augments urban intensities of activity, attention, circulation, simultaneity, segmentation. That addition, where avenues, apertures, and avatars are gathered into tacit micro-stacks, doesn't (necessarily) override local sites and their embedded rhythms, but it can compress and expand them by linking each interface with distant events. Above, at the *Interface* layer, interactive screens and programmable objects structure circuits of cause and effect undertaken through their summary diagrams, but can only present, frame, and instrumentalize

what it is possible to address and summon. Only then are the gymnastic accumulation of traces that outline the *User* organized as a set of addressable positions, and only then can she affect and be affected by The Stack. Like pixels resolving into a portrait image with given distance, the pattern of instances that constitute the biography of the *User* for The Stack is a mosaic of addressable haecceities, and zoomed out further, the encapsulated *User* is also in turn another one of these resolved addressees.

49. Absolute Incommunication

Another way of conceptualizing the design problematic of this sort of assembly is in symbolic artifacts and how they come to seemingly absorb traces of memory and significance that are imparted to them through use. Whether by genealogical possession or through ritual, repeated use, and iconic significance, simple objects are a repository of intentions and sometimes are thought to be haunted by them. Whole societies organize around pilgrimages to such haunted objects. Deep address might also serve to materialize absorbed traces of emotional baggage as explicit information in and through the objects they mark. The limit of what the thing can “remember” about its intersubjective relations with the world (e.g., affective, geochemical, temporal) is also what can be made calculable and sensible for it. Perhaps those memories are part of how searches about searches for something introduce significance through their recursion. As more things, events, and things are addressed, the social relations of mutual interest between haecceities are themselves transposed into addressable clusters and empirically queryable entities; they are addresses about addresses. These may spawn addressable networks of metadata that spawn addressable meta-metadata, all of which require visualization tools to make them sensical to human *Users*. And so things that materially absorb and communicate the conditions of their appearance, and the installations of people and things along the same plane of such a network, are a challenge to our ethical, political, aesthetic stance toward the dignity of both. Marx famously diagnosed capitalism’s confused employment of people as if they were things and the assignment of magical agencies to objects. We know full well that capitalist economic relations drive and are driven by a productive rationality that renders all components according to their most *apparently* efficient conditions of production and circulation so as to maximize the surplus realized in their transactional intercommunication. Logistics understands flatness quite well, and this is also the good news.⁴⁰ The challenge is unwinnable on humanist terms, and I am not convinced that any “parliament” of things can govern this maelstrom.⁴¹ Instead I would hope that a strongly ubiquitous computation would help to implode the sentimental parameters of brute humanism toward an alternative and more rigorous materialism that extends ethical programs outward by demanding empathetic recognition of ourselves in networked matter as co-addressees. That said, we do not require anything like deep address to realize that our

temporary condition as bags of absolutely secular chemistry is also a seat of empathy and solidarity, but it might help.

Who or what could organize universal addressing platforms and distribute their rights and regulations, especially now? Anthropocenic economic axioms lean everything toward an imperative of connection, to link one market with another, one location with another, one gesture with another, and to capture all things under the rubric of universal exchange where they might communicate without interference, friction, noise, distance, or delay. Its capture and transmission of energy (e.g., physical, geographic, cognitive, chemical) is also, if not essentially, a relay and mediation of these forms as information (their storage, calculation, transmission). From the perspective of deep address, these economies are but one local site of a more comprehensive congregation of reactions.⁴² The ultimate interest of this prehensile vortex is a white hot absolute communication, as means and end in itself. We have no idea how to govern in this context and will likely fall back on the structural compulsion to transparency and an enforced necessity of *appearance*, everything summoned past the threshold of the pornographic. For The Stack, appearance may already be “compulsory,” as nothing is couched within its architecture without prior nomination of its presence and identity (and its deformation and alterity). This mandate is similar to the function of money as the mediator of universal equivalence between things and actions, which guarantees their appearance one to the other according to that reductive exchangeability. We might then anticipate a full financialization of addressability whereby hoarding and speculating on the capacity to address things and events is itself a commodity with global value. However, while the *Address* layer contributes to The Stack’s totality through this compulsory cartography in which anything unaddressed cannot have formal presence and everything past, present, and future must be addressed, it is not necessary that they are representable through a *single* master perspective. That is, while the universal appetite of deep address appears as a totally synchronic space, an atonal closed field (an atemporal zero-sum geography, the ultimate walled garden), and so invites reflexive reactions of resistance, strategic opacity, and lines of flight, the totality is far more fragile and unpredictable than we might wish or fear.⁴³

We can then summarize two basic conditions that we will want to bounce off one another until they crack. The first is algorithmic logic in the service of a ferocious autophagic efficiency that characterizes the myopia of the post-Fordist aesthetics of logistics. The second is that the individuation and virtualization of particulate substance into a self-transparent computational material through standardized indexes of nested relations would become a prerequisite for the unrestrained financialization of matter, living and nonliving. But not only is the totality of The Stack itself deeply unstable, it’s not clear that its abyssal scope of addressability and its platform for the proliferation of near-infinite signifiers within a mutable finite space are actually correspondent with the current version of Anthropocenic capitalism. Concurrent to its

immediate programs, deep address also distributes a mesh over existing supply chains that has the potential to destabilize their closed hub-and-spoke topologies. The valorization of the node within a decentralized network provides to it a certain degree of autonomy to form new edges on its own without the permissive provision from a central authority, market, or provider. The apparently irreducible plane of the addressable landscape begins to percolate with odd links and “conversations” between unpredictable pairings of sender and receiver. Organic conspiracies blossom in our midst, and these accidents are part of the unpredictability of platforms. Deep address demands appearance, but appearance to what? Toward what forum is it a forensic medium? How many utterly incongruent territories can evolve through this platform, one layered on top of the other, speaking completely different languages, deaf to one another’s claims on anything? There is no reason that the same object might not have a million different addresses for a million different schemes, most of which might not even be aware of the existence of the other and need never be. In this, the radical transparency of utter appearance becomes but one worldly immediacy, within the space of a particular addressing territory that may be illiterate of others and invisible to them. While any haecceity is obligated to appear to its own semantic references and in this is given both subjectivity and subjugation, it is also free to enter into relations with others that enroll it in exotic extrinsic economies. This potential blessing of drift toward alien incomprehension is along with the very abyssality of deep address itself, a most productive accident of the *Address* layer, and one we would do well to explore.

50. Distortion and Genesis

As indicated in the first chapter, each layer of The Stack prioritizes the structural ideal of an independent technology, and like all other sufficient technologies, it generates its own integral accidents. In turn, each layer in conjunction with other layers of The Stack generates the interweaving and composite accidents of The Stack itself as a metatechnology. The logic of absolute communication for which any haecceity must appear to a common, commanding network platform is a utopian gathering of all into one (the first hint of totality and totalitarianism blurring). But in that guise, it is just that, a utopian projection of a master perspective from the heart of algorithmic capital, and like any other utopia, its purity in principle is also its fragility in practice. Consider the performance piece, *Value Added* (2012), by Nobutaka Aozaki, in which he takes a single can of Del Monte corn to multiple supermarkets and rebuys it over and over again. “The single can of corn has been re-bought from 100 supermarkets for a total of \$107.42 (as of December 30, 2012).”⁴⁴ The UPC barcode on the side of the can is a present-day ancestor of deep object addressability, but it can address not this one particular can of corn but can communicate only that the object in hand it is a member of the set “Del Monte cans of corn.”⁴⁵ Once the barcode is shown to a laser and

then to an inventory database, its printed information is translated into a price, and the fact of its purchase in turn demands and activates its replacement through a supply chain from store shelf to farm and back again. Aozaki's can is an archaic prototype of the deep address haecceity, and his simple maneuver to multiply its moment of addressable translation one hundred times over suggests at least two lessons. First, any haecceity can be addressed multiple times by interested addressing territories, each of which need not have any knowledge of the fact that others have already claimed this thing. Second, when in the future that universal object identifier is not a dumb barcode but an active online address and its resolver is something more ambient than a fixed-in-place laser scanner, then that haecceity's identity can be spoofed as easily as any IP-networked computer can be today. In this regard, Aozaki's work should be seen not only as a performance of repetition and ritual and the failure of the object to retain its official memory, but also as a smart object hack that doesn't require any end-User software reprogramming. When IP-networked haecceities are not just anthropometric objects but also, for example, blood cells, pollen, oceanic wave formations, or abstract concepts, then hacking and spoofing their identity becomes much more provocative. We already have many *Users* online pretending to be other things, or forced by some exploit to mimic the appearance and value of other things on behalf of strange plots. Darknets allow for peer-to-peer sharing between devices without openly revealing their IP addresses and by actively obscuring addresses through the anonymizing rerouting of traffic. For the design brief of the *Address* layer, what is "dark" is any material that is connected to the rest of the world based on mischievous or accidental departure from its natural location or quality. As the saying can go, online no one knows that you are (not) a hurricane, a bee, an implanted organ, a crab nebula, a legal procedure for the packing of fish in the Solomon Islands, or a can of Del Monte corn, if you say that you are. By comparison, today's DoS (denial of service) attacks on devices operating at the scale of the Internet of Things seem pedestrian. But DoS attacks on living tissue or on active concepts (!) suggests difficult new domains of cyberbiowarfare, either beyond the immediate scope of NSA/PLA privilege or as their next assignment. Both state and poststate security apparatuses already familiar with ruse surveillance and camouflage are drawn deeper into the viscous mire of networked performance.

So if deep address evolves in such directions, its geopolitical effect may be driven more by these accidents, doublings, and reversals than by immaculate chambers of unventilated order. Should the day come when we are flying over cities spaying aerosolized smart motes with effectors, then not only will "Street View" come to mean a trillion possible perspectives at once, but also that the fertile soup germinating in every sidewalk crack will overflow the business models of today's enterprises, to say the least.⁴⁶ When our lives are linked by the deeply addressable traces, shed like dead skin cells, then the biographical and cognitive contiguity of the individual *User* will

rupture into a thick cloud of shadows (more on this in the *User* chapter). Moreover, given that today at least 75 percent of all e-mail sent is spam, and that if you were to add together spambots, search engine spiders, scrappers, and so forth, well over half all Internet traffic is initiated by nonhumans, then for the deep address, how difficult a problem will object-to-object spam be? If the current net is any indicator, even the everyday Internet of Things may involve equipment, furniture, driverless cars, and sensor arrays ruthlessly direct-response marketing to one another.⁴⁷ But perhaps it is not spam, and the presentation and exchange of alluring information is exactly what happens already in the coordination of sympathetic and symbiotic relationships in nature, say, between a bee and a bright flower or a peacock displaying for a peahen. One would have to stretch the metaphor well beyond snapping point to suggest that a field in spring bloom is “spamming” insects to come and fly their pollination routes, but to observe a slice of any complex ecology, at any scale, is to see that things are already communicating with one another, and with incredible intensity and intricacy. Some deep address scenarios would augment these lines of communication with formal addresses, sensors, and effectors, a prospect that leads in directions that are disruptive, destructive, creative, and outlandish. Would the interweaving of the existing matrices of communication between things with the secondary blanket of addresses introduce, in the intermingling of their tempos, their resiliencies and fragilities, their defenses, immunities, and fitness selection dynamics, some sort of second-order synthetic evolution at least in some local sites? Distortions emerge that are unknowable in advance, and with them the universality of the *Address* layer makes it always suspect to idiosyncratic purposes and outcomes. If its network topology is apparently flat and affected by endothermic perturbations from any point, then it is not just a map; it is a medium, an ecology even, and it can and will evolve. Gray goo scenarios of out-of-control molecular manufacturing and discharging entropic sludge in its wake are now best understood less as a real existential risk than as a parable for mindless industrial rapaciousness. Similarly, perhaps federations of the *Addressed*, across scales, become catalysts of a countercomposition of the world, generating unthinkable new ground and air, and so instead of an Anthropocenic future in which fewer and fewer conglomerates own, license, or otherwise capitalize more and more things, perhaps the evolution of the infrastructure results in an inversion of the ratio, whereby something on the order of 340 undecillion haecceities (in IPv6 address space) come to recompose and govern a vastly smaller number of assemblages. But there is a countervailing scenario (perhaps equally parabolical) in which the unfathomable legion of haecceities lurches not toward entropy but toward a new and more heterogeneous and complex jungle, one that is perhaps mostly unrecognizable and incomunicable for us.⁴⁸

The integrity of these sorts of accidents emerges not against the grain of the *Address* layer’s ambition of universalization and totality but along with its emergence, and this may be how the dehierarchicalization of natural denotation can be approached.

Any haecceity can enter into incongruous economies with unlike addressing territories without final resolution or conflict. Any haecceity can also appear to any addressing territory as what it actually is, or instead as what a strategic exploit (perhaps launched by another object) would have other *Users* believe that it is, and thus baking principles of simulation and deception into the genetic code of the system. Instead of freezing every addressable instance in place, gathering them into a maniacal, brittle central geography, the universality of deep address as a platform may unleash allochthonous, spooky ecologies that bend and disfigure any master program of homeostatic order. Lastly, the radical ubiquity of addressing may allow the entire project of planetary-scale computation to survive the eventual transition out of the Anthropocene in ways that our lumbering, hungry Internet will not. If so, deep address may outlive The Stack, and it may even be part of whatever post-Anthropocenic platform infrastructures of energy and information come next.

Interface Layer

This whole question of the cinematic author is certainly about ensuring the distribution of films, since creative work solicits a whole other temporality, but it is also about keeping open the possibility of creating films that do not yet exist. Maybe cinema is not capitalist enough. There are circuits of money with very different durations: short-term, mid-term and long-term cinematic investment should be recognized and encouraged. In science, capitalism does now and then rediscover the interest in doing fundamental research.

—Gilles Deleuze, from “The Brain Is the Screen”¹

I wouldn’t have seen it if I hadn’t believed it.

—Marshall McLuhan²

No system as complex as The Stack could actually work without some way to simplify its functions and render them legible for the end *Users* who make it all go on a second-by-second and year-by-year basis.³ *Users* can use and be used by The Stack only to the extent that they are provided the *Interfaces* that make the *Earth*, *Cloud*, *City*, and *Address* layers available and sensible for them. Without that *Interface* translation layer, *User* actions can’t affect those infrastructures or be affected by them in any regular and scalable fashion. While interfaces fix and limit possibilities, they simplify them in different ways for different *Users*. How interfaces mediate between people, things, and the technical layers lower in The Stack also depends on how a *User* perceives the natural world and is already able to make some sense of it. For example, if those *Users* are machines or other inanimate objects, then the interfaces through which they recognize The Stack may be specialized sensors, codes, switches, or chemical surfaces. If the *User* is a more phenomenologically intuitive subject, such as a human, then the exact semantics of interfaces (perhaps icons, symbols, indexes, and diagrams) work not only to synthesize some affordances of The Stack, but also to narrativize the *meaning* of possible actions that someone might take. In this weave of signification and significance, and in the potential to order the world through intense narrative diagrams (geographical, theological, ideological), the human-Stack interface also locates

everyday interactions within larger contests over what should count as the form and content of political geography by connecting between local and global scales. To do this, graphical user interfaces (GUI) in particular offer a kind of diagrammatic map of what they interface between and what they interface toward, be that a machine or an imagined territory. But unlike drawn maps, GUI not only describe the spaces they refer to; they also allow a *User* to directly act on them in a way that is (one hopes) both cognitively and semantically consistent with its demarcations.⁴ It can provide this in different ways for different translations, each drawing out a slightly different world for a *User*. Ultimately it is the arbitrary precision of interfacial diagrams of specific interactions that allows them to delimit in advance what the *User* can and cannot do with The Stack as a whole. Beyond just the framing of possible actions, the active responsiveness of the interfacial diagram allows its unique mapping of reality to seem not only valid but also functionally real to the *User*. Through The Stack, interfaces are tools for remapping what they map, and as interfacial drawings multiply, their alternate geographies overlap and juxtapose. This accumulation of incommensurable recursive projections back into direct perceptual reality (however inaccurate, false, stupefying, and illegible they may be) is the first generative accident of the *Interface* layer.

51. What Interfaces Are

The *Interface* layer consists of any technical-informational machine, compressed into graphical or objective formats, that links or delinks *Users* and the *Addressed* entities up and down columns within the Stack. Its role is to telescope, compress, and expand layers of The Stack, routing *User* actions both up and down as they go.⁵ We need to think of interfaces not only in terms of the GUI (as “buttons with words on them”) but as a more generic structuring of links and boundaries within a given form or field.⁶ An interface is *any point of contact between two complex systems that governs the conditions of exchange between those systems*.⁷ Levers, steering wheels, doorways, mobile Apps, fences, office layout schemes, international borders, telecommunications infrastructure: these are all interfaces. The conditioning of exchange that any interface provides could be variously promiscuous or prophylactic, physical or virtual, accelerating or decelerating, signifying or asignifying, symmetrical or asymmetrical, territorializing or deterritorializing.⁸ The interface could be a line that links two things together into one, or a line that cleaves them apart. Buttons and levers are interfaces to machines and to what machines do. Familiar architectural interfaces organize interior and exterior zones, and borders between countries are interfaces between sovereign polities. Once an image can be used to control what it represents, it too becomes technology: *diagram plus computation equals interface*. As a computationally intensive interface, the image is not only a picture of the network; it is also an instrument through which

a user of this image-interface can effect change back on that network. Computation turns the image into a technology, just as it then turns technology more generally into fields of actionable images—in this case, maps that also reprogram territories. In other words, for the GUI specifically, interfaces are diagrams of possible actions, a menu of simulations that when activated (clicked, touched, pinched, waved at, chosen from a delimited array of options) executes some information loop resulting (it is assumed) in an outcome approximating what was on the menu. The veracity of that loop between interface and event depends on both a technical correspondence between one part of a machine and another (i.e., a button on a keyboard linked to a peripheral device across the room) as well as a semiotic correspondence between a visual simulation and a relevant outcome (i.e., between an icon on the screen that resembles X and the X-like event that it initiates in the world). We could have one loop working without the other, and often do in fact, but our expansive interfacial modernity depends on a universally usable and effectively compelling alignment between these two correspondences. For interfaces to be systematic, clicks must work and do what they promise.

For this, an interface necessarily limits the full range of possible interactions in a specific and arbitrary way. Any interface, because it is a specific summary, must eliminate or make invisible a whole range of other equally valid possible interactions. This is not in itself a negative aspect of interfaciality. Only because they reduce and simplify complex systems can they make it possible for people to use those systems at a systematic scale and realize platform value from them. Without coercing us, the interface cannot properly interface anything to us. This essential persuasive and rhetorical work of interfaces can obviously have ambiguous and negative consequences (one augmented reality interface for a video game might “suggest” to the *User* which unworthy strangers in a crowd to kill, another might give deliberately misleading nutritional information about food, and another uses everyday keystrokes to execute remote, unadjudicated violence). But the subtraction of possible interactions to a manageable set leaves behind clearer channels of systemic legibility. With the *Interface*, the *User* sees what she can do with The Stack. At the same time, the range of possible interfacial circuits into The Stack may not be identical for every *User* even for the same machine, and so for the *Interface* layer, the governance is also the modulation and enforcement of the differential possibilities available through a specific interface and for a specific *User*. *Interfaces* slice, cleave, and individuate. Each is open for some and closed to others.

For software polities derived from intermodal networks, the provision of contact itself is condensed into these buttons and icons, menus and dashboards, familiar pathways and arresting surfaces. These are nodes along lines of urban flow: terminals, spectacles, ports, and stations. Interfaces link and partition society itself, as belief systems, ballots, and borders. Such points of contact, everywhere and nowhere at once, are not

just our interfaces to the world, but also the world's channels to us. What is open for me may be closed to you, and so our vectors are made divergent. As we ourselves are hurtled through logistical space, the world discloses itself to us as interfaces: activated and unactivated interfaces, fast and slow interfaces, synchronous and asynchronous interfaces, graphical and tangible interfaces. As discussed regarding the *City* layer, what Deleuze called "control" is based on the computational intensity of interfaces and governs through its differentiation of the capacities of *Users* to do and make things in accordance with whatever interfaces they can access (and that can act on their behalf). Some *Users* are sent drifting through the *City*, bouncing across zoning boundaries, given provisional subjectivity by interfaces that allow for their mutual communication, governed less by what captures them in place than by what programs their aimlessness and what allegedly inserts them into demand chains without names. Others are sent very intentionally into the urban storm, bound by formal zones with explicit legal projects. Both assemble tactical habitats and tradable assets, and are in turn absorbed by them in accordance with how their individuated profiles as *Interface Users* can be monetized by sacred and secular *Cloud* capitalizations.

52. Interfaces at Hand: From Object to Sign to Object

About our hands, those prehensile interfaces with which we embody cognition and manipulation, Michel Serres writes that they are never *finished*. Unlike animal limbs and their ecological niches, the hand is "despecialized" and adapted not to one specific task like the crab's claw but open to the limit of the world. The world is the place where hands are usable.⁹ Evolutionary biologists may differ, but the hands of Serres's parable are, unlike, say, the fur of a cheetah, which camouflages her only in the savanna niche, adaptable to any number of unforeseen environmental and technical challenges. As adaptations, hands are general-purpose interfaces; they are machines that allow for the fabrication of all manner of subsequent machines (clothing, shelter, tools, weapons), which in turn allowed us to accelerate evolutionary advantages by transforming our environment faster than it would be possible to evolve our bodies (capturing and wearing the fur of another animal is far more expedient than waiting to grow fur after having migrated north, for example). This story of prehensile environmental embodiment, a self-animating circuit of habit and habitat, also speaks to the *City*'s ambient informational fields through which we learn to mediate spaces both near and far. Such spheres of influence need to be learned, and while it takes time to master remote controls, let alone the control of remoteness, we are fast learners. There are monkeys that, as part of a project by Michel Nicolelis, have learned to control a robotic arm and hand through interfacial electronics connected to the brain.¹⁰ The primate's dispositional impulses become informational pulses that, properly mediated, effect a remote grasping prosthesis to do its bidding. Just as we learned QWERTY in order to type by internalizing the

feedback of expression and arbitrary inscription machines, we also now learn to operate the interfaciality of other habitats and ambient surfaces. As we negotiate the interfacial density of the urban fabric, our own primate bodies are infused and intersected by its rhythmic extensions, controlling its machinery at a distance and triangulated as subject-*Users* by that machinery in the course of our movements. *Cloud* infrastructures seep and rupture through the orifices of the city into the open view of people and their mobile screens, and around them we proprioceptively map our displacements in real and imagined geographies.¹¹

With Serres's lesson in mind, I am looking at photos that I happened to take of the moment when my son Lucien, then two years old, became interested in a certain remote control that turned on and off an overhead light and a fan in our home office. That night he spent at least an hour clicking them both, light and dark, spinning and not spinning, in various combinations. He was lost in a fundamental discovery about his new world: that some things are not like other things and possess an inscrutable power to affect other things at a distance in predictable and repeatable patterns and according to some invisible force controlled by buttons. He had discovered a basic principle of modern interfaciality, and for him this was very big news. Like many other kids, he entered a phase of button-pushing mania, investigating which objects, surfaces, and icons possess this capacity, serving which effect, and which did not. He may also have deduced, in his own way, that this interfaciality is not reducible to the physical qualities of any object. A plastic button by itself, disconnected from any relay or absent that invisible force of effect, has no interfacial power. Isolated, it is all but useless, just a button. Only when it is embedded in some system of input and output, usually involving waves or wires, he soon learns, does the thing become interfacial. Then it takes on its capacities of sorting, transference, and vicarious causality. But of course, that particular discovery is limited to interfaces with local and observable cybernetic circuits. Remote interfaces, linking *Users* across time zones perhaps, are more difficult to keep straight. More broadly, any effective tool has some interfacial capacities in that it transforms, encodes, or transmits some worldly dynamic in a specific way. A rock is an interface if you use it in the right way. We could say, at the risk of teleology, that the mastery of a tool, already a kind of embodied internalization of its own effects, entails a specific intelligence regarding the mutual interfaciality of objects in the world. That is, any reflexive knowledge of effects and environments must also include an understanding of the intrinsic and extrinsic interfacialities of available objects.¹²

But what about GUIs and their links, both simulated and mechanical? For them Charles Sanders Peirce's full range of "signs" (icon, index, symbol, diagram) is put to use in order to represent what interfaces do and the programs they present to us. Instead of manipulating objects as tools, we have learned to manipulate signs that have the same technical effects of tools. A general conversion is at work in this transference of interfacial knowledge from things to signs for things, from objects to icons.

A fantastic transubstantiation takes place for which visual signs and images no longer simply represent other things in the world, but become themselves tactile technologies that, when activated, cause a real event to occur correspondent with the semantic content of that sign/image. A picture of a bomb is merely a representation, whereas a button with a picture of a bomb on it that causes remote explosions is *weaponized skeuomorphism*. Put in more technical terms, the GUI is a visualization of a machinic network and of the outcomes that it claims to mediate; the formation of its interfaciality is an arc of translation from a set of possibilities into a visual instrument. Between the machine and what it can do and the representations of that potential are translations, and however arbitrary or integral each may be, they are necessary for our comprehension of any network we might encounter.

This is particularly true for computational machines, which can, according to software instructions, perform any calculable task we might assign to them. In the past, any one of those functions may have been performed by a single-purpose analog machine that perhaps communicated its unique functions directly by its form. Wrenches look like wrenching. Computational machines may rely on the rhetorics of the interface to do the same, or as a design strategy, the posture of the computational object and its function can evolve semiautonomously. Through that expression of function by GUI layers, the machine network can appear to be and do almost anything, and because of this (not in spite of it), the interface is essential to the machine itself. In the play of a function communicating itself, honestly or by dissimulation, the real and relative transparency or opacity of an interface's distant effects are themselves disclosed, hidden, or masked. As the interface conceals and narrates, its concealments and narrations are themselves concealed and narrated. At one extreme, placebo interfaces let *Users* point and click all they want and yet have no real effect on any outcome other than apophenic satisfaction. Some *Users* manage persuasive interfaces, which deliberately train the self in response to positive and negative feedback stimulus, promising more control over life by reassigning that control to automated metrics. These micro-rhetorics of the interface are core to their social effects. Some call this "making computers invisible," others call it "interaction dissolving into behavior," and still others "society without organs." Not so unlike my son, we are all probing our interfacial condition, trying to figure out the ultimate technical, ethical, political, and aesthetic possibilities of a world full of images of things that do (or do not do) the things they visual signify.

In the awkward, incomplete (and incompletable) semiotics of interface representability, where cause and effect is reduced to a bounded set of idiomatic and idiotic pictograms, culture becomes interfacial and vice versa. Even a maturing metaphysics of data visualization serving the ubiquity of time-based diagrams of events and patterns (and prototyping perhaps what future GUI will look like) does not provide a short-cut out of ambiguity, but it does raise the stakes.¹³ In that they previsualize their

effects in advance for us, these sorts of interface machines must be located within a historical shift in technologies of the image itself.¹⁴ Taking the long view, we see that humans' externalized expression of visual ideas dates at least to the primordial architectures of the cave wall, and then much later, it passed through a relatively short painting-photographic-cinematic phase (lasting a few centuries, give or take) for which individual images and image sequences were produced, distributed, and appreciated as rare artifactual events. Now and for the foreseeable future, images are a specific genre of machines. How so? Like the images on paper money that appear as they do in order to support the performance of specific counterfeit-prevention technologies designed into the patterns, some images have a discrete technical capacity that is inextricable from their physical form. Consider how everyday data visualization turns the diagrammatic image into a scientific, managerial, and military instrument, or how GUIs turn icons into active, goal-directed tools mediating between human folk psychology of action and algorithms linked to screens in the *User's* environment. Additionally GUIs don't only mirror preexisting *User* intentions; as whole interfacial regimes (such as Windows or iOS or Bloomberg Terminal, etc.), they also train thought toward certain ways of interpreting that environment through the repetition of represented interactions. As those representations become more closely glued to the direct perception of environments (as for augmented reality, for example), their capacity to engender committed interpretations for *Users* will prove irresistible to various fundamentalisms (see below). The machinic image is qualified by many little sinkholes between the symbolic, the imaginary, and the real, and at a global scale of billions of *Users*, the interfacial image is also partially a function of sheer machinic quantity. With the comparatively instantaneous adoption of mobile devices (a Turing complete processor + camera + homing tether + telephonic voice relay), we have seen an explosion in the absolute volume of mechanical images of and in the world, dwarfing the total sum produced before the mobile phone appeared in our hands. Unlike images of the painting-photographic-cinematic era, these images do not pass into an archive only after their practical life is passed; rather, through various Apps, images are produced through the medium of the archival database itself, socialized through the archive, and assigned searchable metadata through the archive. As a consequence, the general image apparatus is slowly accumulating a comprehensive simulation of visual experience that will be of enormous value to future artificial intelligences interested in simulating its Anthropocenic origins. This may even be its most durable purpose and its true responsibility. Even today, it's not difficult to see the whole Android user population (for example) as comprising individual nodes in a vast, massively distributed supercomputing sensing, seeing, tracking, and sorting platform. At the same time, visual trends like the New Aesthetic suggest the potential of an art (if that is still the right word) that is made not only by artificial vision machines generating their own autonomous aesthetic, but in time an art for such

intelligences that can appreciate them uniquely and perhaps develop their own taste genres of M2M (machine-to-machine) connoisseurship.¹⁵ It is also worth noting that many current applications of the machinic image (e.g., on currency, or to X-ray great works of art to verify their originality, or facial recognition to verify the identity of *User*) are used to authenticate the originality of either the image itself or what it represents. With Walter Benjamin in mind, we see that the image in the age of mechanical reproduction is being pushed toward the assignment of verifying the original and its aura as well.

However, even as GUIs become more normative and essential to the instrumentalization of global culture, we also see at the same time that physical objects are increasingly imbued with the interfacial intelligences of computational media (storage, calculation, and transmission). This suggests a reversal of the earlier shift from natural interfacial objects to virtual interfacial signs, and now back again to computationally intensive interfacial objects. The MIT Media Lab Tangible Media Group, led by Hiroshi Ishii, works on tangible user interfaces (TUI) and a future of radical atoms based on microscopic computing machines dissolved into physical matter, while the MIT Center for Bits and Atoms led by Neil Gershenfeld develops self-assembling microrobotics and a program of “conformal computing” in which artificial and natural information layers might interoperate directly. Computation is cast again as a generic solvent within and between everyday things. In living rooms, Microsoft’s Kinect gestural-based gaming interface dispenses with touch altogether and relies instead on *Users’* natural maneuvers and proprioceptive skills to manipulate both physical things and their digital shadows (a general-purpose theremin).¹⁶ These expansions of interfaciality through objects return it from the semiotic to the corporeal, and in doing so draw potentially even wider worlds into their computational domains than GUI can. The GUI largely reduced the hand to a fingertip, one that points and selects among a bounded set of options, and so simulated tactile craft as a sequence of discrete menu items, each executing chosen software subroutines in programmed sequences. But with gestural-tangible-haptic interfaces, we can imagine the possibility of a fully mature interface regime that dispenses almost entirely with both the alphanumeric machine of the keyboard and the semiotic machine of clickable icon. In contrast, some things might be so thoroughly imbued by that computational solvent that they will contain their own direct interfaciality with the world, not as objective metaphors but as real objects. To interact with an everyday object may involve haunted causality at a distance. To provide interfacial mediation between the mobile primates—that’s us—and the environmentally embedded digital information in which we are situated, such a regime would rely instead on the wisdom of spatial-object navigation accumulated over millennia: waving, poking, dancing, stacking, peeling, squishing, sorting, throwing. Any of these interactions with computational matter could link *Users* down the layers of The Stack and back up again.

We then extend the traced path for modern interfaculty from objects as primordial interfaces, shifting then to graphical signs as modern interfaces, and again back to objects, now imbued with the computational intelligence to interpret our gestures. In considering an emergent genre of object interfaciality, blending natural and artificial information into composite manipulative substances and habitats, one question to raise, after Serres's parable, is, "What happens to the hand and its universal flexibility to manipulate the world?"¹⁷ For the GUI, the hand is trained to sift through menus, windows, and sliders, playing a software application like a musical instrument, but in doing so, its immediate range of adaptive expression is focused on the pushing and pulling of signs and simulations. Those software routines initiated may be highly varied, but when computational objects and habitats respond to a wide range of gestures and manipulations, we can imagine that they may allow the hand a much wider range of expression, and in this, there are potentially novel coadaptations of the hand and the programmable object interface, of the grasp and the grasped.¹⁸ At the same time, as the world meets it more than halfway, the uniqueness of the hand to exceed the accommodation of one niche is made that much less unique, as the niche is itself programmed to perform specific reactions to whatever the hand commands (or to resist that command and frustrate its intention). Heideggerians and Latourians spoke of the "thing" as a kind of gathering of the world into itself, but when the physical object is programmable in this way and responsive to gestures, or even able to make such gestures on its own affecting other objects in its orbit, then the interfacial thing seems to "unfold" its influences out into the world. This kind of "thing," and perhaps any interface, is at least in this respect, is an inverse of a gathering; it aggressively unfurls its relations in a tangle of effect and relay.¹⁹

How does that interfacial arc, from natural object to graphical sign to computational object, scale up for the collective interfacial matrices of the *City* layer, or the *Cloud* layer, and of millions of people and billions of things at once? The allegory of the city as a big computer is one that appears historically along with the computer itself,²⁰ but it's an altogether different design challenge to account for an urban-scale agglomeration of computational object-instruments, ranging in size from a few molecules,²¹ to a few centimeters, up to the scales of furniture, a dump truck, and city block, all interacting among one another. Instead of (or in addition to) spatial projections through the graphical interface, this open condition for urban interfaciality is closer to an expanded landscape architecture composed by active arrangements of such objects. The design and governance challenge is then not to program this jungle platform in advance according to some set master plan, but to formulate parameters through which multiple subsystems can leverage one another.²² The emergence of its eventual governance would be determined less by fixed formal interventions than by a procedural choreography and the accommodation of unpredictable collectives of these unfurling interfacial objects. The interlacing of computation and urbanism isn't

the direct superimposition of an artificial computational network on top of a given cement-and-steel scenario, but the activation or suppression of programs already present. For example, industrial technologies did not introduce electromagnetic fields in the urban landscape, but activated what was always there, and similarly, the design challenge of this urban-scale interfaciality is also to provide some regularizing geography to territorial energies already at work (as discussed in the linking of physical and virtual envelopes). That said, determining how sets of such computational hyperobjects might be embedded into the *City* layer remains a prerogative not just for interface design, even in this expanded sense, but can be initiated from any of the other layers of The Stack as well.²³ We assume that any single object, perhaps as the subject of multiple *Address* schemas at once, will be interpolated not only by one master geography but many projects and projections at once. Critically, it is the incommensurability between these claims that is the real engine for Stack's geopolitics of interfaciality, writ large and small.

53. The Interface as Layer

Interfaces are thresholds. They connect and disconnect in equal measure, structuring flows by combining and segmenting it, enabling it or frustrating it,²⁴ bridging unlike forms over vast distances and subdividing that which would otherwise congeal on its own.²⁵ Any given interface may have one effect at one site, just as it has the opposite effect at another. Its performance—who, what, and how it interfaces—may vary widely depending on circumstances. At a global level of billions of interfaces working at once, The Stack might deterritorialize (and apparently decentralize) modern institutional inputs and outputs at the same time that it installs another even more regularized network on the same landscape (effectively recentralizing it in its own image at the *Cloud* layer). But while this superimposition of generic thresholds works to homogenize the wider apparatus, it can also flatten hierarchies of access to that infrastructure, as we've seen. It bears reinforcing at this point that this is an elemental principle of The Stack as an organizing matrix, and to a degree of platforms in general; through rigid regularization, dynamic self-directed flow can achieve scale, and as it does, those flows congeal and centralize into global subplatforms (as we see among the key set of players at the *Cloud* layer discussed above). The dynamic is not unique to computational platforms. It is as apparent in the urban systems that order physical flows according to fixed geometries that host dynamic autonomous circulation, which in time produce new superscalar nodes often centralized around key threshold points. When grid topologies circumscribe sites as individual cells within their larger matrix, they also allow each to generate its heterogeneous program, separate from its horizontal neighbors and internally differentiated within its own vertical strata, as far up into the air as needed. (The form that is horizontally differentiated as a discrete cell within an urban

grid and vertically differentiated by multiple stacked programs is called a skyscraper).²⁶ Especially but not exclusively for GUIs, Stack interfacial systems are also grids and sometimes work in a similar way as urban grids. The lines they draw, both linking and segmenting, crisscross one another in regular patterns and circumscribe individual cells within their own particular telescopic logics of the global and the local. As multiple interfaces congeal or are deployed as strategically particular *interfacial regimes*, they push toward naming everything that is visible to its scope (as discussed in the *Address* layer chapter). In that this drawing is also a kind of machine, the GUI synthesizes cognition (and aspiration, affect, drama) into its syntax; it grids both the image machine itself and the space in which the image machine can act. Interfaces can give local shape to The Stack's aspiration to *nomos*, prototyping political geography as a technology of artificial distributed cognition, and through this, it constructs and configures the diagram of possible action that *Users* can make on The Stack and that The Stack can make on *Users*. An interfacial regime draws together flows and connections that may be geographically dispersed, massively discontiguous, and yet intimately connected by a particular causal interfacial chain, and then presents these to the *User* as a single image in its own particular way, different than other such regimes. The interface takes what is linked by distributed computational systems but impossible to directly perceive because it is happening across the planet at once, and in turn gives it a portrait. In this regard, interfacial regimes are also *totality machines*, both describing linkages and making projective claims over them. But as said unlike other geographic projections, the interface is not only a visual representation of an aspirational totality; it is an image of a totality that when acted upon actually effects it. By using these kinds of image-map-instruments, the *User* herself collaborates in the real remaking of the world according to that interfacial regime's particular geographic vision and representations. The power (and danger) of the *Interface* layer is this remaking of the world through instrumentalized images of totality; it is what gives any interfacial regime even a politico-theological coherency and appeal.²⁷

In the following sections, I examine the dynamics of the *Interface* layer of The Stack by looking at three ways that interfacial regimes organize the actions of *Users* in their own image. First, the visual organization of an aesthetics of logistics²⁸ and global assemblage line draw total images of commodity production across vast distances. As nodes within global interface networks, these images are themselves subject to exponential arcs, such as Moore's law, and when accelerated, they in turn accelerate the flows of all those things that they interface. Second is the role of Apps to counterprogram immediate *User* habitats and recast them as localized forms of *Cloud* hardware. This also has the effect of simultaneously augmenting and dissipating the technical specificity of the hand as the privileged interface between body and environment. Third is how the direct blending of a graphical interfacial overlay on a *User*'s direct perception poses unique complications for design and interface geopolitics. We will look at the specific

case of augmented reality interfaces and consider their ripeness for the revival and innovation of fundamentalist and militarized forms of political theology.

54. Interfaces in The Stack 1: The Aesthetics of Logistics

Because interfacial grids within The Stack compose lines that both subdivide and gather, even at the same time, and because these framings localize interactions within a global platform, they can control the distribution of bits, objects, and affects according to those curves. Within this context, the effectiveness of the GUI is not limited to simple relays but also depends on other physical interfaces in the landscape. A contemporary interfacial regime includes all manner of gates and switches, both large and small, adding up to a vast distribution of circuits: anatomical sensations, screen-based icons, chips and sensors, software protocols, buildings and roads, airport terminals, warehouses and continental shipping ports, transoceanic supply chains, open and closed production cycles, forensic analytics, geographically particular store shelves, individuated instances of consumption, and so on. Any particular interfacial regime is itself one among the many that compete to design The Stack, and while each provides a particular (perhaps totalizing) logistical imaginary for the *Interface* layer, it in no way exhausts its design horizon.

Interfacial regimes focus all mediation onto and into key switch points, but like any other media, they are not only conduits of information; they also produce information by translating and relaying it from there to here. Interfaces work as machines, and machines work as interfaces, and so in the wider interfacial landscape, many specific technologies are not isolated mechanisms put to work for isolated goals; they are also technologies for the production of other technologies. A car is produced by assembly line robots, which are produced by other machines, which are produced by other machines, all operating in relations of mutual production (it is technology turtles all the way down). In this contemporary logistics, the procedural chains of productive and consumptive succession pass from one machine to another and one interface point to another. The interfaciality of each level is of course designed toward particular ends, even if the entire chain is not really knowable or viewable as one big whole from any one point. For The Stack, increasingly intense computational intelligence is designed into specific nodes in this chain, and sometimes without knowledge or control of other interfaces that may directly or indirectly link to it. Despite this, or perhaps because of it, we should then define *interface design* not only as the specification of one given node (such as the GUI for an App) but also as *the design of the succession of relays* through an intended pathway of connections. It is a programming of multiple interfaces in spatial and temporal sequence, potentially spanning ideation and production to distribution to consumption to recycling and recapture. With this expanded brief, interface design (combining tool, icon, space, service, interaction, organization, and so

on) encompasses the design of objects and surfaces and the systems that enable other *Users* to put their own programs in motion, as well as the programming of the processes whereby all these things may assemble or disassemble according to plan. By this perspective, the potential interfaciality of any single node (virtual or physical) could be thought of as equal to the cumulative interfaciality of all the processes that it can put in motion toward some resulting assemblage, however permanent or temporary. This is first-order interface design: the design of chains of interfacial effect by means of physical and virtual relay networks (and it clearly has much in common with platform design but focuses on designing the exact mediations as its essential problematic).²⁹

Today, at the withering end of post-Fordism and tilting perhaps toward a material economy based on desktop fabrication and real-time customization, we observe logistics shifting from the spatially contiguous assembly line to the radically discontiguous *assemblage line* linked internally through a specific interfacial chain.³⁰ Contemporary logistics disembeds production of things from particular sites and scatters it according to the synchronization and global variance in labor price and resource access, and it is this delinking that makes the arrival to us of material goods (and the process of the world of production in general) more opaque, even occult. How things come to be is removed further from the daily experience of direct cause and effect. The cyclical routes of the artificial ecologies of logistics are often proprietary and subterranean, and it is the visual incomprehensibility of the origins and outcomes of the interfacial chains in which *Users* are embedded (you, me, it) that instigates a second-order interface design, namely, information visualization, or the diagrammatic summation and articulation of those interfacial chains so that their form might be grasped. As hinted, GUIs also perform a kind of information visualization on their own. Beyond simple instrumentation, in their rhetorical display of relay networks connected to any one surface, we find the GUI's pedagogical narrativization of discontiguous processes redrawn as a single actionable diagram, perhaps its most essential social function. Global logistics' material economy of assemblage is mediated to human actors, along its many chains, through these reductive interfacial summary diagrams of planetary-scale computational networks. It has to be seen also as a kind of rhetorical and stylistic system suggesting, if not promising, closure.³¹ As real logistical channels link the unlikely arcs of things from here to there and from there to here, they then also enroll the *User* not only into an aesthetic of logistics but also logistics itself as an aesthetic ideal.³² However, in this drawing together of otherwise incomprehensible cause and effect, the tracing of idealized configurations of flow becomes self-validating, and when these interfacial network visualizations evolve from diagrams into active instruments of action to enforce those configurations, they take on a life of their own.

The orthodox post-Fordist plot for "the network society" recounts a storied evolution from fixed, contiguous institutional interfaces into decentralized serial nodes and couplings. Old centers give way to new networks. But logistical modernity is defined as

much by the concentration around meganodes and global platforms and protocols as it is by decentralization and dispersion (e.g., Google, the shipping container, the TCP/IP protocol, US dollars). For The Stack, the performance of governance both centralizes and decentralizes interfacial regimes, one informing the other, and in this, the spinal contours of a global social morphology unfold along with them, their topological convulsions inextricable from the computational infrastructures with which they evolve and through which they are expressed. For this, we observe that there is something like a Moore's law of exponential computing speed not only for processors but also for the interfaces and the landscapes of gateways that they power; there is an arc of exponentially accelerating computational capacity for both individual interfaces and their composite networks. Instead of tracking the number of transistors on a given chip, this exponential arc of interfacial acceleration might measure the total aggregate switches within a landscape of interfaces through which relays snake from site to site, or perhaps the number of FLOPS (floating-point operations) that landscape as a whole is capable of providing per second or per day.³³ This would recognize the network effects of the intensification of edges as well as nodes. It might (with sufficient research) specify something like the maximal carrying capacity of the computational substrate of the global economy in any given moment: the total possible interfacial throughput of all interconnected nodes and points and a weighing of the relays with which they accelerate in logarithmic correspondence.

Any increase in the computational capacity of any given interface, as both conduit and producer of information, allows that interface to concentrate and give structure to greater quantities and more complex qualities of informational-logistical flow. In turn, as computational power and networked software become faster and cheaper, each node is newly empowered as a medium of governance over what those flows represent, and so the intensification of capacity also shines political attention onto them. This "law" of interfacial acceleration makes any given node able to handle increasingly complex programs, which, in accumulation at the level of a whole interfacial regime, also amplifies the complexity of articulation through which that governance can act. This makes any question as to how to design an interfacial regime that much more fraught and important, and especially so when its nodes are programmed and articulated through the *Cloud* layer (such as Android and iOS nodes in motion, sucking up information as they are dragged around the world by *Users*) as this can also induce overflow of the jurisdictional bounds of any single designer's own control or her client's. Put more succinctly, the acceleration of a network of interfacial nodes, both screen based and physically embedded, gives that network greater capacity, and for this, social systems place greater demands on it, capitalizing further acceleration, and shifting interest and attention onto them as they displace other infrastructures for which they may have played only a supporting role in the recent past. A tendency toward generalized mobility of goods, people, and information, as described throughout recent decades of social

theory, should be seen as both a driver and effect of this technical acceleration in the computational power and communicative flexibility of the interface regimes that contest with one another to congeal the social domains of *Users*.³⁴ It is an autocatalytic process. The greater the mobility is within the network, the greater the need for more sophistication in its interfaces, and the greater the availability of cheap, powerful, intelligent computation, the greater the enabling of flexible mobilization. Phenomenon feeds on epiphenomenon feeds on emergent capacity, and back again. For The Stack, this makes the production and figuration of these interfaces a critical site of empowered authority and its social imaginary. As discussed regarding the *City* layer, forms of power that were once inscribed by the fixed and partitioned citadel are shifted to ambient gateways for bodies in motion, now gathered into open corrals with invisible fences. This distribution provides the raw material and competitive channels for new forms of concentration and capture, not in citadels but platforms.

One of the most complex social effects of that generalized acceleration and centripetal consolidation is a sense of systemic incoherency for the end *User* and a corresponding need for interfaces to then renarrate whatever they connect. From the perspective of the *User*, as the intensification of computational power of each interfacial node and of the aggregate networks that link them gathers momentum along its accelerating axis and provides for more intense logistical linkages across even more nonlinear routes, then the temporal integrity and cognitive coherency of the worlds mediated by them are correspondingly dissolved in equal measure. Unlike a capitol building, corporate headquarters, or medieval prison where the corporeality of power was embedded into the site-specific dramatic choreography of architectural form and program, the architecture of The Stack delocalizes *User* experience of interactive cause-and-effect and its chains of interfacial transference. They may appear invisible, ungraspable, or insubstantial, despite (or because of) the friction and fragmentation that they carry up and down its layers. This well-known tendency of modernities to melt what is solid and disembed institutions is turned once more back on the forms that those earlier modernities had established. So, as a therapeutic response, *Interfaces* are asked to soothe the stress that they have caused by presenting their remedy images of orderly resolution as data visualizations, as GUI, as mind maps, as tools and trackers. Some of these are real medicine, some are placebo, some are dissimulation, but all are territorial claims on the geographies and geometries of The Stack by competitive interfacial regimes. Because the increase in computational intensity of each node in an opaque global network and of the network's circulatory capacity as a whole helps to produce the radically diminished contiguity of the interfacial landscape, and less transparency of far-flung assemblage lines, a tremendous demand is then placed back on its own images, especially interfacial images, which can represent the totality of these nodes into coherent wholes. Instead of appeasing the desire for a "binding collective representation,"³⁵ nonlinear connections of the *Interface* layer seemingly intensify and radicalize it. The

User demands visual resolution with descriptions, diagnoses, and coherent projections of how important interfaces are dispersed and their impact on our lives. This is the essential comfort of information visualization, especially dashboards, because instead of being elusive and rare, data arrive in bewildering excess. This complicates its assignment to clarify things for us, as any query of the world results in so much raw information coming back to the *User* in response that another question must be asked of the first answer in the form of a reductive visualization, and inside the bounding frame of that diagram, pattern recognition begins to take over for interpretation.

This drawing of coherent wholes gathers multiple events and effects into a conceptual whole as if they were a single thing, and in the interfacial landscape, they in fact are one and many at the same time (just as an automobile comprises hundreds of smaller machines, not to mention legal, political, and cultural attributes and determinants, but these are understood in the singular, a car, and the plural at the same time). This kind of putting together is different from an assemblage, which would refer the real physical intermingling of material into a new composite. This conceptual gathering refers instead to how a massively discontiguous assemblage line, bound together by exceedingly complex interfacial relays linking continents, must be understood and represented as if it were a single pattern or machine.³⁶ For The Stack, such apparently comprehensive interfacial images of assemblage lines that themselves comprise interfacial relays, are, for the *User*, a necessary tool to manage otherwise illegibly complex chains of interaction. It draws the discontiguous assemblage line into that resolved diagram, but to do so, it must, like all diagrams, necessarily reduce and conceal the complexity of the processes it represents (and as indicated above, that reduction is also necessary to its ability to function as a broadly useful social tool). Further, as interfaces are reductive in how they compress information—in their foregrounding of certain things and not others—they are also inevitably “ideological.”³⁷ Their reduction toward resolution is doctrinal. Ultimately the provision of an affectively compelling and instrumentally effective image of a composite interface chain becomes a strategic expertise, as information designers carve out a niche to provide convincing images of organization, tempo, and narrative.³⁸ For *Users*, they compose cognitive maps of multiple layers of exchange drawn at once, gathered into provisional total images (for which pattern recognition and intentional, motivated interpretation can start to merge).³⁹ Moreover, such image interfaces are not only maps of flows as they exist according to whatever logic of reduction they invoke; they are also tools that reproject and extend their conceptual gathering of relations back out onto the world. Once more, unlike static diagrams, such interfaces can directly affect what they represent; as the chain of signification runs both from the event up through a chain of representation to the image represents it, it also runs back down to the event, and so the *User*-manipulated image of the thing becomes the medium through which the thing can also be manipulated. In this recursion, the semiotic and instrumental loop

is closed, and so these images of assemblage that are also machines to make those assemblages are a third-order interface design. Within the broader history of images, these diagrammatic tools are innovative in that they not only provide a convincing and concise minimal diagram of far-flung processes; they *actually do what they represent* (see the above reference to “weaponized skeuomorphism”). Conversely within the history of interfaces, which would include fences, levers, latches, knobs, switches, handles, buttons, and plugs, these interfaces rely on visual representations of the effects on the menu.

For this reason, the ideological reductiveness of the interfacial image is more than a conceptual problem; it is also how systems enforce themselves, one against another. An image of totality, which when acted on configures cause and effect in the literal terms of its own totalization, makes its reductive map incrementally truer each time it is used. The *User* clicks X, and X happens, and so the world has more X for this and more images representing X-making interfacial tools, and so on. This recursion, both mechanical and semantic, is how the *Interface* layer telescopes between the local and global, enrolling its own resources and the *User's* simultaneously to put both in order according to the logic of that interfacial regime's particular vocabulary of reduction. The ongoing competition between multiple platforms, both state and nonstate, to define the *nomos* of The Stack includes a kaleidoscopic collection of interfacial regimes, each projecting its own specific grids, one on top of the other, superimposing their differing self-referential claims on the nomination and arrangement of various territories. Critically, because their comprehensive images are not merely descriptive of what they diagram but are driven by a motivated narrativization of The Stack as a totality for *Users* to make and remake it over and over, they are ripe for investment by utopian imaginaries.⁴⁰ Interfaces are composed images of an encapsulated totality in the here and now, but they can also function as projective total images of a world clarified—cleansed—according to its idealized master diagram. Whole interfacial regimes can then function not unlike cosmograms, offering prototypical geographies for worlds to come. The political volatility of a future interfacial regime is not only in the drawing of an imaginary resolution directly overlapped onto the real and available landscape, but also its technical ability to affect those realities by *User* action. When counterprograms for the whole world are drawn from acutely self-serving platform strategies or from delusional political and theological doctrines, then whole *User* populations can lose the interpretive distance between a merely tactical reductive description of the world on the one hand, and its ecstatic idealization or exploitative distortion on the other (more on this phenomenon below). In that such futural projective images of utopian totalities are, like all such graphical interfacial tools, not only simulations but also fantastic instruments aimed directly toward The Stack's megastructure, this is perhaps, for better or worse, the most essential productive accident of the *Interface* layer.

55. Interfaces in The Stack 2: Apps and Programming the Space at Hand

I shift the discussion here from the theory of *Interfaces* in general to a study of the App, an important type of everyday interface sitting between the *User* in motion and the rest of The Stack. What are Apps? On the one hand, Apps are software applications and so operate within something like an application layer of a specific device-to-*Cloud* economy. However, because most of the real information processing is going on in the *Cloud*, and not in the device in your hand, the App is really more an interface to the real applications hidden away in data centers. As an interface, the App connects the remote device to oceans of data and brings those data to bear on the *User*'s immediate interests; as a data-gathering tool, the App sends data back to the central horde in response to how the *User* makes use of it. The App is also an interface between the *User* and his environment and the things within it, by aiding in looking, writing, subtitling, capturing, sorting, hearing, and linking things and events. Depending on how it senses the world, the App mediates between *User* and environment, and so also between the *Cloud* layer and that particular environment via the *User*. Accordingly, it renders the habitat to the *User* and the *User* to the habitat, and it does this in ways that may be variously exacting or vague, prescriptive or reactive.

This dynamic of embodied prescription is built into the *habitus*/habitat circuit of geolocation Apps in particular, and especially, perhaps, those that superimpose descriptive layers on a device's mobile camera view.⁴¹ We should consider with caution (and a bit of awe) how emergent genres of Apps that project interfacial elements onto what is seen through the device's eye, including augmented reality (AR) may come to radicalize absolutist and fundamentalist dispositions by making them seem real. These may be sacred or secular visions, inspired by religious or politics or economics, and may also spawn bizarre and as yet unimagined new *Cloud*/AR-based politico-theological mutations (this is discussed in more detail below). In many AR applications, synthetic textual annotation of the world is fused with direct perception, and for these Apps, visual symbols don't signify things as much as they are directly laminated onto real things in real situations. As these Apps become more commonplace, how might this collapse of representational distance within the immediate perceptual field undermine the power of metaphor and contingent interpretation to guide *User* thought and action? Does an immanent and tactile sign demand a more exact duty from the believing reader? It seems likely that selecting from a categorized interface, like a GUI's choice-array of menus and buttons, must work differently when that interface is perceived as a real object out in the world, as opposed to a screen event at a distance that merely refers to things iconographically. More troubling is when its annotations are labeling and dividing not just commodity X from event Y, but instead the absolute categories of the sacred and the profane, clean things from unclean things, our land and their bodies. Seeing the world through such an apparatus, can the primate brain manage to keep the

critical space of doctrinal metaphor open against absolutism? Does it want to? Are the *User's* cognitive abilities extended by this reality, or are they amputated?

But first, we will unpack Apps and App platform economies within a mobile ecology of interfaces. Compared to most consumer software, an App is tiny. The Google Earth iOS App puts a genuinely total geography into your pocket for a mere 29.5 megabytes.⁴² It can do this because most of the significant information that the App displays is stored, calculated, and served from the *Cloud* layer. The App is a thin membrane on top of a vast machine, but one that nevertheless allows its *User* to pilot and be piloted by that machine with the slightest gesture. It is at the intersection point between these two far more complex reservoirs of intelligence: the intentional *User* and the *Cloud* and Stack infrastructure on which the little App is perched. As that tiny membrane, it can synthesize and make useful vast continents of data and computational intelligence gathered from afar in the instance of a single *User* interaction, and so the real utility of a single piece of code that the App may contain vastly outleverages its relative parsimony. For this, an App condenses the *Interface* layer within the larger Stack, pitched between *User* and the *Addresses* that link the *User* to the *Cloud*, *City*, or environmentally embedded software. Within the governance logic of platforms, an App then transforms and translates some capacity of the *Cloud*, rendering and framing it for the *User* as an at-hand service. In turn it also draws the interactions of the *User* into a larger aggregation of data (e.g., location, path, preference), capitalizing their qualities and feeding the updated information back to the *User* in a virtuous loop. Whatever the App happens to be interfacing (geolocative routing, portable banking services, stored files, news or music streams, site-specific games) is provided to the *User* as a *Cloud-based* service. In that the service is provided to a device-*User* that is in motion, moving through the *City* layer and encountering different contexts on the go, the App platform provides that provisional link between a preexisting physical spatial context and this *User-directed* overlay of a *Cloud* service onto immediate circumstances. As discussed in the *City* layer chapter, there is then a kind of programmatic blending between the urban situation through which a *User* moves and the interactions he may be having with a specific App and *Cloud* service. A mall becomes a game board, a sidewalk becomes a banking center, a restaurant becomes the scene of a crime in a crowd-sourced recommendation engine, birds are angry and enemies are identified, and the experience of these may be very different for different people and purposes. At any given moment, multiple *Users* interacting with different Apps in the same place may have brought their shared location into contrasting *Cloud* dramas; one may be ensconced in a first-person shooter game and the other in measuring his carbon footprint, further fragmenting any apparent solidarity of the crowd. With billions of *Users* wielding mobile Apps at a time, and to varying degrees navigating their domains accordingly, it is certain that over time, physical habitats are also remade as architectural-scale *Cloud* hardware. They are not just where *Cloud Polis* works; they are a physical extension of it. As a blended coprogramming of

space and software, habitat and *habitus*, the terrain modulates itself to the dictates of the navigation tool, a thin, *User*-facing membrane of a larger *Cloud* platform. The App is therefore not just the interface through which the *User* works on the world; it is also the aperture through which the *Cloud* (and The Stack) redraws the *City* and its *Users*.

Back to Serres's parable, the App also transforms the ubiquitous device into a modulation of the hand, and so over time, it will also dissipate the hand as machines settle into another kind of *User* agency. The platform structure of App, device, plus *Cloud* locates global computing directly into the palm of the ambulatory *User*. The mobile device, not laptops or desktop machines, is the first and still primary computing experience for most Earthlings. In this natural motion, the App interface on the device (what some still insist on calling a "phone") is often a kind of extension of the hand. It points, grabs, selects, draws lines, pushes, and pulls. It may also extend the eye and the ear, the voice and even the skin, but the combination of a *Cloud* platform device that can alter its function to suit a near-infinite range of potential challenges (over 1.4 million Apps approved for the Apple App Store in early 2015) suggests comparison with Serres's characterization of the hand as a technology that is "never finished" because it is so adaptable to new uses instead of being held to a fixed niche. The mobile device has a similar generic anatomy, as the App enables an endless array of techniques, simulating the palm, finger, or fist, and so the device "at hand" extends the work of the natural hand to inscribe and coax digital information into and out of the pathways of the world.

Beyond the single device, the platform logic of the App can be, and is already, extended from the mobile deck into a wider range of machines and networks. Some doctors prescribe health care Apps in addition to medications as part of a therapeutic regime, and the race to design low-cost clinical tools (a "tricorder") redefines the administration of medical equipment.⁴³ Cars are already App platforms, but the real innovation in specific Apps for transportation hardware is still to come. Driverless cars (or cars that are simply more autonomous along a generic spectrum) would change what passengers are expected to do and not do while hurtling through the *City* layer and on what events they are expected to focus their attention. Apps that connect cars to work or play, some using windows as screens, will, for better or worse, further virtualize the experience of automotive drift. Some cars might be bound to an Android or iOS platform lock-in, or new manufacturer-specific operating systems might support neither or both, but cars already contain multiple software and hardware systems, and by extending these to control how cars navigate streets and how passengers interact with the world and one another, it's not difficult to see how the redefinition of "a car" as a high-velocity computing platform, enveloping the user inside, initiates new genres of in-motion Apps. As it does for the mobile device, this would redefine the individual car, or a swarm of cars, into another kind of hardware-extended habitat of a wider *Cloud* platform. As the single "car" becomes a fast and heavy computer that you can sit down

in, so do “cars” also become components of the larger computational network infrastructure. But here the anthropocentric bias of construing the *User* as necessary like a human, who extends his primate hand into the world, reaches an impasse. Cars with Apps, medical devices with Apps, or any machine with Apps also suggest design assignments for modular forms of bottom-up artificial intelligence. Any machine, whether general or highly specific, could be imbued with the narrowly focused intelligence of the App linked to a wider *Cloud* and could download any particular sensing, sensory, storing, calculative, or transmission function programmed for it. Each can do that without addressing humans or requesting our interference in the communication flow between machine *User* and *Cloud*. The most important, viable, and effective Apps and App market platforms may serve the nonhuman *Users* that interface across scales and systems—manufacturing, logistics, healthcare, transportation, agriculture, retail service—by linking and delinking modular functions of component machines working in interoperable concert.⁴⁴ In this economy, the universal flexibility of the “hand” dissipates into a more open field of tactical computation animating all programmable platform components more equally. As any piece of equipment, regardless of its shape or mammal origin, can be augmented by downloading a needed App function, it too can now serve any number of unexpected niches.

56. Interfaces in the Stack 3: Theo-Interfaciality

This slow transference of the human body onto a landscape of software subroutines is not limited to the hand. It also includes other forms of embodied thought and intelligence, but the blossoming of fully fledged nonhuman Apps does nothing to prevent traditional anthropocentric Apps from operating with the full spectrum of stupidity that our species is capable of bringing forth, and among these are doctrinal cognitive fundamentalisms. Etymologies of “religion” describe a binding and a rebinding of a community of belief, or of a bond between a believer and a covenant or commitment. The repetition of prayer, of ritual, of weekly services is all testament to the procedurality of the sacred. These are techniques of anamnesis and the invested memorialization of the divine into sites and objects. For example, by sublation the Eucharist involves the masses of the Mass into a divine symbolic cannibalism, and through this, the spectacle of sacrifice and resurrection at the core of Christianity is repeated over and over again. Rebinding upon rebinding, there is the first incanted memorialization of Christ’s body into the bread and wine, and the second memorialization in the devout cycle of the eating and drinking these every Sunday. Are these processes of binding the social at work in The Stack? In his essay “Religion in the Age of Digital Reproduction” (and his book *Google: Words Beyond Grammar*), Boris Groys laments the eclipse of anamnesis by software regimes that do the work of memory and memorialization on the *User’s* behalf.⁴⁵ We, the *Users* of Google, need not exercise our faculties of memory in order

to remember anything, it seems, and so the mind is free to wander through a vast flat moment, presented as an endless archive. As Groys tells it, the devout need not consciously perform the work of memorialization, or even really comprehend the work that is done for them, when it is sufficient, for example, to download a portfolio of important texts and carry them along on one's hard drive.⁴⁶ He shakes his head in pity at his wannabe-extremist students for whom it's enough to possess copies of incendiary, uncompromising (unread) PDFs on their laptops in order for the act of identification to stick, or so they think; radicals not even radicalized, merely fanboy collectors.⁴⁷ Groys laments that without the necessary and difficult investment of interpretation and an exacting self-transformation into the position of faith through the physical training of repetition and memorialization, however arbitrary it may be, then the rebinding (and the religion itself) is empty. By this view, today's *Cloud* theology without anamnesis is actually a self-dispossession of commitment by which the experience of faith, now without opinion or interpretation, is outsourced to cognitive prostheses. Devout Apps can have devout opinions for you. For Groys, this subcontracting is not just an externalized memorialization of belief into digital artifacts, a sacralization of interfaces with theological distinction; it is, rather, religion evacuated of *religio*. Even if so, it does not mean that such interfaces cannot also motivate extraordinary acts of motivated devotion and violence.

The mobilization of automated opinionlessness is perhaps most clearly illustrated by a subgenre of Apps that uses the device's built-in camera to superimpose interfacial content on top of the ambient world as perceived by the user, such as for AR. As mentioned, the layer of interfacial icons and indexes on a given perceptual field transforms it by subtitling objects and events, offering navigational tools, overlaying GUI menus on real-world systems, cinematic insertions, and elisions, and other artificial sensations by which the ambiguities of local signification and significance are eliminated for the *User*. The ultimate effect of this programming may be to transform semiotic techniques into direct ideological, even theological, articulations of the world. Whereas for tangible media and conformal computing, interfaciality melts into tactile objects, for AR interfaciality melts into the perceived surfaces of objects and environments. In extending the cinematic language of new media, AR is an aggressive subtitling of the phenomenal world now rendered as interactive narrative. It does this in ways that may be highly contextual, or perhaps instead according to a strange juxtaposition of a description with what it describes, like a film subtitle with only tangential relation to the screen image and event.⁴⁸ For the latter, the *User* is thrown into confusion, forced to not only interpret the correlation between the interface and the world but perhaps to invent one on the fly, relying only on his own actual thinking. In most cases, however, semiotic correlation is easy, and it is the absence of any work of interpretation, of reading even, that would characterize a successful AR *User* experience. The job of the software is to explain what is seen and to automate active sorting of how it should be

encountered, valued, and qualified—with reverence, indifference, or violence. As *religio*, or for the Schmitt App, AR draws lines and differentiates friend and foe, automating even intentional belief, subcontracting the neocortex's manipulation of metaphor, offloading it to the algorithms strapped to your face.

As operative for the *Interface* layer within The Stack, AR performs the imagistic and linguistic mediation between *Users* (one layer above) and the ubiquitous computational capacities of their habitats (one layer below). As a design space, it is a way to stage, animate, compose, and account for communication between *Users* and their worlds, and unlike traditional mechanical or screen-based user interfaces, it performs this as artificially embodied perception; it is a new genre of physical cinema in which spaces between fantasy and projection are collapsed.⁴⁹ In AR, just as for the interfacial image in general, its descriptions of space also become a medium for the recursive reinscription of a broader politico-geographic diagram back on the world through its direct instrumentalization as an interface.⁵⁰ Put another way, AR Apps, in all their baroque banality, augment the world more than they augment vision. As we define the interface as any point of contact that governs the conditions of exchange between two complex systems, then within AR, the GUI melts, so it seems, into reality itself, and is seen as another property of surfaces, things, and events. That melting becomes the scope of design, the registration of labor, the touchpoint of advertising, and even (perhaps especially) the domain of activist belief, sacred and secular. Slavoj Žižek's definition of "the Real" as that which is negatively defined by fantasy is here given a literal, if dull, gloss.⁵¹ If so motivated, we could then locate AR among modern media and their psychological or psychoanalytic effects and might say, in line with Friedrich Kittler's association of film with the imaginary, the typewriter with the symbolism and the gramophone with the real, that in AR, the imaginary is so directly inscribed into the symbolic, as the content of the interface, that the real is also itself collapsed into the imaginary, making the reality of AR perhaps irredeemably occult.⁵²

One supposes that the most pressing and initial nonaccident of AR is a deeply granular and pervasive advertising by which our embodied perceptions and gestures generate the monetizable surplus platform value of the network *User* profile, but it should not be confused with the technology's ultimate social impact.⁵³ AR is where the microtargeting business models of cognitive capitalism melt into the choreography of the mobile *User*-subject. The effort that the *User* already makes to perfect targeting algorithms for search engines, in exchange for useful search results, can be scaled from finger points and clicks to the very musculature and dance of dwelling itself. However, a less secular danger is latent in AR in that its most killer application would prove to be not marketing but those fundamentalist religion and politics (as well as security Apps and their monetizations) by which the segmentation of the *polis* into friend and enemy becomes a direct literal annotation of the lifeworld (again, clean and unclean, ours and theirs, empire and rebel forces, kill it or eat it, and so on.) It is then with a lack of astonishment

that we note that Google's inaugural AR game is based on a science-fiction alien religious warfare story embedded into the lived urban fabric. Developed as part of its internal Niantic Labs, *Ingress* divides users into two opposing camps: Enlightened (green) and Resistance (blue). Players "enclose regions of territory on the surface of the earth with virtual links between virtual portals, which are visible in the game software. The top-level goal of the game is for one's faction to control large numbers of Mind Units, the estimated number of humans within the regions of territory controlled by the faction."⁵⁴ It should be a surprise only for those who have not realized that *Star Wars* is an al-Qaeda-esque parable (rural religious cult flies into the architectural core of the empire and blows it up) that the Manichean ludic demands of *Ingress* are to send people out into their cities training them to see, attack, and defend against the territorial incursions of enemies perceivable only through special software-enabled perspectives.⁵⁵

Will mature AR initiate a wave of bizarre new sects, scams, and activist versions of fundamentalist monotheisms and ideologies for which the metaphorical nuance of holy books is collapsed by the direct imprint of virtual words onto real things?⁵⁶ There are some indications that this is so. We can see the use of Google Earth, Google Maps, stolen SIM cards, and other advanced off-the-shelf spatial command and communication technologies by, for example, Lashkar-e-Taiba during their attack on Mumbai in 2008, as a prototype of the weaponized AR that concerns us.⁵⁷ The dozen attackers used these tools to see and navigate the city, identifying targets and keeping a closed communication loop intact (to what extent any given technology was employed, we can only speculate based on press and court accounts). One assumes that their movements were planned beforehand to advance through the overhead and tilted satellite images of the city's buildings, streets, alleys, and squares. As much as classified reconnaissance, simulation, and situational-awareness tools are war technologies for states, declassified tools can be for nonstate actors; and the trail of representation and counterrepresentation of contested space through these specific tools and specific events is knotted. For example, in Mumbai, Google Earth was a mechanism of the attack itself, but news agencies also mapped the attacks in near real time using Google Earth as part of their own coverage. In this awkward recursion, satellite views of the *City* layer serve as medium of violence by those who would enact it, witness it, report it, or defend against it, as Google Earth's cosmograms are deployed by politico-theological geographies that may appear at first to be outside its intended program.⁵⁸ Here a proto-AR is not only the territorial index through which such projections play themselves out; it is, as much as the *City* that it maps, the very means to project their activist and in this case irredentist imagination.

This episode is a more violent and extreme variation of a Christianist AR overlay of the Grand Canyon in Arizona that explains how the canyon proves creationism and disproves evolution for those willing to peer through the looking glass and see what it sees.⁵⁹ An App simply called *The Bible* is already installed on over 100 million

devices and helps its *Users* navigate their days according to a personalized devotional itinerary, positioning them into the rhythms of *religio* as they move about, and translating various homilies into a closely curated experience of the everyday.⁶⁰ We anticipate that Apps like these may innovate a close integration with the geolocative tracking to enforce by surveillance a particular pathway through *City* space, knowing and logging whether *Users* went to good places or bad places and inferring behavior accordingly, perhaps suggesting the confession of sins as appropriate. The automation of repentance can now be based on real evidence of wrongdoing instead of the unreliable guilty conscience of individual worshippers. Perhaps the tallying of sins was the first big data play (numinous omniscience as panopticon archive), but now it can be done with greater worldly precision as repentance is now supported by information visualization. In time geotheological innovation may give us new commandments and invented prohibitions based on the ability to trace movements through the *City* layer. Today there are many widely used Apps that provide some moral frame, for example, Qibla direction indicated from any spot on Earth, and others that allow users to scan bar codes to determine if food is kosher or halal, or vegan, free-range, or GMO free, or if your new colleague is a “restrictive person,” or even perhaps if he is a Cylon (or if you happen to be a Cylon, if someone shares your particular form of monotheism), and they all may seem benign and obvious. Most are. But once again, one truly hopes that the poetry and metaphor of the monotheistic cognitive cultures that they reference can withstand the unambiguous literalism that AR might afford them and the violence that absolute explication demands of adherents. Interfacial regimes such as these are more than visual technologies; they are indeed *cosmograms* (Umberto Eco’s 1984 essay arguing that Mac is Catholic and DOS is Protestant isn’t obsolete; it’s prophetic).⁶¹ As the spawn of logistical aesthetics, these regimes are not only a programmatic diagram of how a particular machine network works but, in aggregate, of how the world works and what its proper configuration is or should be, and what is to be done about it, right here and now, by you. It is this capacity to project an alternative global space, in some cases a vision of purified utopia, through an interfacial system of symbols that are also active tools, that allows AR and similar interfaces to function as theological media. Utopian political theology becomes projective interfacial geography, and vice versa in some cases. This is borne out by observing that any closed self-referential platform is also a belief circle. Other much stranger platforms to come will certainly coalesce as belief circles as well, and together they will help design, map by map, the spaces over which the geopolitics of The Stack is claimed and contested.

57. Geoscapes: Interfaces Drawing Worlds

That an interfacial regime could encode the world so as to activate an archaic imagined community, or even to conjure a new one, in no way guarantees that absolutist and

fundamentalist cultures will determine the future of the platform. In no way does it prevent it either. Just as for older forms of “new media,” such as the transistor radio, which provided a singular voice and explanation for tumultuous political change, the results can be as dramatic as they are contradictory. Such precedents provide models, especially those that demonstrate the role of a motivated imagination, aligned with rote determination, in the mobilization of fabulous media. For example, in the short span from D-Day to decolonization, France was on both sides of transistor radio’s power to script and mobilize the national imagination. De Gaulle came to national prominence through his broadcasts to occupied France from London during World War II, giving a semiofficial voice to the occupied nation. By the late 1950s, pirate broadcasts to contraband radios also played a role in the organization of Algerian independence from colonial France. As Franz Fanon relates it, the Voice of Fighting Algeria (VFA) was a pirate radio project set up by relatively disorganized resistance fighters to spread news about the military and cultural struggles of Algerian nationalist forces in response to the press (and public meetings) blackouts imposed by the occupation forces. In lieu of other public venues, the broadcasts contributed to the shape and mobility of the imaginary battalion of resistance for its listeners.⁶² The voice of the VFA was even given a role in Gillo Pontecorvo’s classic simulationist film, *Battle of Algiers*, in which street-fighters are shown to stop, listen, or follow the explanatory cues of a non-diegetic and disembodied commander-narrator.⁶³ In effect, the Algerian public came to order in thinking that there was a strong, effective military resistance in early battles with the French when there was not, largely because the radio *Users*, already literate in the fantastic narrative, conceived there to be one. While Algerians previously had little interest in the radio receiver device in their homes, the VFA broadcasts allowed for its enthusiastic inclusion. Fanon writes that through the broadcasts, “the nation’s *speech*, the nation’s spoken words gave it shape.” Crowded around receiver sets, listeners actively formulated that voice:

This voice, often absent, physically inaudible, which each one felt welling up within himself, founded on an inner perception of the Fatherland, became materialized in an irrefutable way. Every Algerian, for his part, broadcast and transmitted the new language and the reality of the renewed nation. ...The radio receiver guaranteed this true lie. Every evening from nine o’clock to midnight, the Algerian would listen. At the end of the evening, not hearing the Voice, the listener would sometimes leave the needle on a jammed wavelength or one that simply produced static, and would announce that the Voice of the combatants was here. For an hour the room would be filled with the piercing, excruciating din of the jamming. Behind each modulation, each active crackling, the Algerian would imagine not only words, but concrete battles. The war of the sound waves in the *gourbi*, re-enacts for the benefit of the citizen the armed clash of his people and colonialism. As a general rule, within this marvelous psychopathology, it is the Voice of Algeria which wins out. ...Very often, only the operator, his ear to the receiver, had the un-hoped for opportunity of hearing the Voice. The other Algerians in the room would receive the echo

through the privileged interpreter, who, at the end of the broadcast was literally besieged. Specific questions would be asked of this incarnated voice. ... [If something specific had not been heard], by common consent, after an exchange of views, it would be decided that the Voice *had* in fact spoken of those events, but that the interpreter had not caught the transmitted information, and that the preferred outcome had been relayed.⁶⁴

Fanon's account gives a glimpse of the future politics of the *Interface* layer of The Stack. Whereas radio relies on speech and active description, AR provides direct and automated perceptual annotation; however, just as for Fanon's example, noise reinterpreted into essential significance will surely play a key role in the dissensual interfacial politics to come. It should not be difficult to imagine two different AR regimes, both describing the same *City* layer but with completely different maps of what is there, what it means, and what interactions are rewarded or discouraged.⁶⁵ In the tension between two or more narratives, their diagrams not only describe events; as the medium of some omniscient command, they also partially determine them. Pulling laws off from the safety of the page and projecting them onto the surfaces of the real world is also to alter their weight and accentuation. AR media don't just imply their intentions for bodies in motion; they explicate them, and they don't just signify power they pronounce and program it in distributed cognition and artificial embodiment. AR adds the world to the interface, as much as, if not more than, it adds the interface to the world. Regardless of whether any two alternate interfacial totalities are locked in a dualistic battle, one drawn across the other in some friend/enemy division (as for a war of decolonization or for *Ingress*) the mingling of overlapping totalities brings some degree of noise and ambiguity. Any given site in the *City* may be overcome by multiple competing perceptual totalities, systems, or sovereign geographies, but for any of these, what are the terms of encounter with the alien software platform and belief circle? Only war? If this were so, then the societies sustained by these would be impossibly fragile. As the *Cloud* layer may be where competing political geographies are interwoven, as for the Sino-Google conflict, the *Interface* layer is where those overlaps are literally inscribed at the level of everyday action. Again, each interfacial regime, total or not, articulates its specific reductive version of the world in which its own geography is sovereign, and through these diagrams, the *User* composes actions through The Stack that enforce and reinforce that same totalizing worldview. But that any single *User* may be interpolated not by one but by many such interfacial regimes at once, any one site is defined not by purification but by the alloy of multiple totalities at once (even if each totality would explicitly exclude the others in principle). The *User* must then manage more than one exclusive totality at once, and the multiple identities and agencies that each regime provides to the *User* position. *Modus vivendi* gets you through the day, as one *User* occupies multiple walled gardens at the same time and place, as she co-occupies them with other claimants, friends, and foes. This jumbling may be essential to how The Stack works as a platform for totalities by cohering the agonistic and dissensual

drawing of geographies, simultaneously exclusive and inclusive of one another. This tangle of utopias is another integral accident of the *Interface* layer as it attempts to host the various investments in this geography of multiple geographies.⁶⁶

While The Stack is a real physical construction, it is also a canvas on which spatial imaginaries are screened, and the spaces over which that competition moves and fills what we call *geoscapes*. Why this term? Interfaces, and most especially interfaces like AR, locate competing master dogmas not just about what the world does but what it is about.⁶⁷ This projective geographic image is one means by which specific interfacial regimes govern the mediation of their *Users*, The Stack, and the parts of the world they can access. The *Interface*, as an image of this territory, becomes a means by which territory is written and managed, and finally the medium through which other territories are challenged and the whole apparatus is contested. To augment Arjun Appadurai's now canonical lexicon of "scapes," I nominate this addition: *geoscape*. A geoscape is a contested terrain of contested terrains, a shifting landscape made up of shifting landscapes: image maps, projections and plans, irredentist land claims, borders and jurisdictions, strata and striations, imagined worlds, macroeconomic forecasts, projected homes and homelands, addressing systems, and various terra incognita. All of these can, but need not necessarily, enter into irregular public exchanges whereby contrasted spatializations are both supplied and demanded according to a panoply of capitals. Compiled into one, geoscapes are a form of content that cannot *not* be designed and designed for. They represent a population of territorial alphabets mutually interiorizing and exteriorizing each other, which includes cosmograms, images of the entirety of global space and the order that it is seen to frame, govern, and distribute. For example, the revived global caliphate, as envisioned by the Lashkar-e-Taiba, ISIS, and some others, is an image of the whole world captured under a particular interpretation of Islam. It is a cosmogram that describes, validates, motivates, and delimits their program by its image and for this, we have to count their vision as kind of geopolitical design agenda.⁶⁸ Google, China, the US State Department, or a diasporic community lodged in a remote enclave: each of these may have its own projective geographic solidarity in play. Everywhere, as cosmograms fight it out with other cosmograms and with other local situated claims, they compose together a cumulative territory of territories over which such antagonistic actors compete to enforce a primary, sovereign description of the geographic distribution of things, location, distance, borders, and their significant juxtapositions. Geoscapes comprise then both sacred and secular projections, as they are in relation to one another: exceptional territories, patchworks of the enclave, and exclave zones overflowing competing totalities.⁶⁹ In turn, the inscriptions of the *nomos*, drawing and framing sovereign interiors, can find traction to the extent that the surface on which it writes is recognized by its neighbors.

This multiplicity of territorial claims and types of claims is held in an overflowing and finally incommensurate, if also interdependent, polity of quasi-fictitious

illustrations, and perhaps at the end of the day, this is all that geopolitics ever is. Geoscapes are a conceptual assemblage of territorial claims as well as the conceptual space that it might occupy. That is, the geoscape is not an empty arena into which territories would move and be counted or installed, but an irregular territory never empty but always exactly as full as the spaces that comprise it. Whatever highly conditional equivalence or exchange that exists is not an *a priori* feature but the result of the real operations of encounter. Instead of being real spaces into which we might go, geoscapes *are entered into and so made real by their occupation*. By contrast, other versions cosmopolitanism presuppose global space as a self-evident panorama into which politics might take place. They often depend on representations of that space derived from mapping platforms that are supposedly so secular and neutral that they can absorb and position all interested geographies that might course through them (something perhaps like Google Earth). However, geoscapes emerge from a more agonistic politics for which the juxtaposition of difference is not within a shared consensual mechanism, not a spectrum of opinion inside a given frame, but is itself an irreducibly dissensual array of positions without a common master plane of situation. The geoscape extends in all possible directions at once and is held only by the tensile strength of the imagined geographies that compose it by their co-occupation. One geography on another, interfacial regimes interlace but cannot ultimately resolve into any last instance. Their geopolitics are driven instead by a generic fissiparousness, and so while any given interfacial image map may be (part of) a total image, the cumulative incongruity of multiple totalities renders every whole only partial. The geoscape stages these incommensurate projections, including those that deny the legitimacy or even existence of other projections with which they share the same physical location, and it is that incompatibility, the noisy grinding of incompatible terms for addressing things, events, and territory, that is, in practice, the engine of geopolitical design.

For this turbulent territorial economy, some purposes may be intentionally designed while others seem to emerge as organic mutations in response to apparently normal conditions. In the case of the Mumbai attacks in 2008, the cosmopolitan platform of Google's interfacial regime is used to serve a reactionary vanguardism, a future-historical irredentist imaginary projecting backward into an alternative past or future, so as to arrive back at the desired state condition (one, of course, with very different conditions for states). When advanced technologies of globalization, closely associated with secular cosmopolitics, are employed opportunistically by political theologies for their own particular purposes, then unplannable and unresolved territories, jurisdictions, and programs are put in play. Truth be told, such monster projections and warring claims on space are also generative of the essential qualities of the spatial as a political medium. As we might hope to guide a comprehensive geopolitical design of The Stack, now constructed piecemeal all around us, we confront the perilous legacy of atavistic political utopias of the past and the present and how they force us to question the

logic or purpose of totality in geopolitical and political theological thought in general. Totalities (plural) are everywhere. In the Mumbai example, the lesson of the interoperation of seemingly incommensurate layers of the geoscape—the archaic and the ultra-contemporary—is less that jihad could “fit inside” Google Earth than Google Earth fit inside the conceptual jihadi map of a caliphate-to-come and the situation of Mumbai within it.⁷⁰ One partition folds and is folded into another, from Kashmiri valleys to hotel rooms in Mumbai, to privatized satellite data, to interaction design conventions, technologies, and accidents and embryonic formats of extrastate citizenship emerging from one from another. In this, the contradictions of The Stack’s totalizations are made clearer. As we contemplate a future Stack geography, we recognize that nothing guarantees designable outcomes. As played out over and again, modernity is itself an open platform for the design and development of antimodern designs. Not only does modernity disembed and reembed traditional social forms, traditional and fundamentalist social forms also disembed and reembed modernity.

Put into sharper relief by the Mumbai attacks is the volatile economy of contemporary warfare: contested urbanity, exceptional violence, civil architecture, geographic projection, networked software, motivated interfacial maps, all rolled into one. For this, Lashkar-e-Taiba is, among other things, also a sort of politico-theological urban design practice. It is one that follows maps and plans, that creates them, challenges received maps that draws them and makes them real, and is clearly willing to die over them. Obviously the tactical use of Google Earth in providing situational awareness during the attack was a practical choice, and in no way do I suggest that it is their literal intention to remap the caliphate directly onto Google Earth, making the software some new sort of illuminated Word. I am also not blaming Google. Instead, I observe that the ultimate asymmetry between these two spatial logics, jihad and Google, is less absolute than we might presume, and in their unlikely compatibility and alignment, something critical about how geoscapes operate above and beneath the state is discovered. Because they must be reductive in order to even work as interfacial regimes, even those secular interactive cartographies are not a truly universal plane into which all competing political ontologies can be embedded and arranged; rather, the polyphous perversion of their translatability, even and especially into anticosmopolitan fundamentalisms, is the means by which the geopolitics is given form.

These slippages depend on the immediacy of the interfacial image, as both a technique for spatial inscription and a screen on which a geographic imagination is projected. The *Interface* layer is simultaneously a site for the direct aggregation of flows, a technique for the representation of those assemblages, and a vocabulary of contentious alternatives. It is the social need for total images of dispersed assemblages and invisible interfacial chains that makes an economy of purified imagined geographies possible. The *Interface* layer becomes a medium not only for the transmission of utopian images but for the composition of utopian spaces. Whereas the *nomos* of The Stack refers to

an ordinate, enumerated spatial logic, *geoscape* names the agonistic territorial images of the world, any of which may be a direct expression of the architectures of The Stack, or which may be driven by another doctrine or megastructure. When the terms of geoscapes are contested through the instrumental images of an interfacial regime, the geographic framings of the Earth can congeal into total and cosmographic diagrams. As active instruments, those projective and idealized inscriptions are more than maps; they are also the means to realize their particular compositional arguments about how the world should be idealized; the interface becomes the very tool to bring about the conceptual arrangement that it would want to represent. At the same time, images of interfaces come to connote futuristic speculative design. From summer movie science fiction to corporate vision of future marketing videos, advanced GUIs have become part of the global visual culture, signifying expressivity, contemporaneity, security, omniscience, secrecy, and, most of all, a future world in which frustrated desire and agency are resolved by graceful and powerful technical apparitions-to-come.⁷¹ For these, the drawing medium of the interfacial regime takes leave of any immediate machinic purpose and serves instead a dreamworld canvas on which utopian social relations are evoked. In this utopian cinematic subgenre, if possible geographies are prototyped for later instantiation as geoscapes demanding enforcement, they are first drawn into fantastic infrastructures, transhumanist overcoming, transcendental experiences of speed and immersion, and calming day-in-the-life use for personal control, ease, clarification, groundedness, and affluence. In these clairvoyant fictions, we see how techniques of the *Interface* layer, especially GUI, are mobilized toward the management of platforms that may almost exist, but are at least partially illegible or unresolved and so demand our active participation, even vigilance. They are the visual languages available with which to explore, express, and communicate unrealized desires and ambitions for realities only imagined and wished for, which find shape as design fictions and so have permission to absorb utopian and dystopian energies at that level. The real complexity of discontiguous assemblage lines and interfacial chains requires that fictional resolution of the interfacial diagram in order for *Users* to comprehend and participate within them, and the utopian projection of fictional alternatives to these uncertain social and technical conditions onto surfaces of real technologies of interfaces is how they articulate those wishes. The agonistic politics of geoscapes and their claims on the territories of The Stack oscillate back and forth between both of these projects. The inspired utopian interfacial landscape-to-come (from Thomas More's diagrams of the island Utopia to Tony Stark's schematics for an omnipotent heads-up display) is also a geoscape-to-come specified by the images that would reflect and represent it.⁷² They conceive possible technology and possible social connections, possible powers and abilities, possible sovereignties and polities, and possible social realities to be drawn.

This is unavoidable, and so let's not avoid it. Any sovereign claim over a space is first a claim to define that space as such, and that ontological gesture is as necessary

for satellite photography and Internet addressing protocols as it is for monotheistic political theology, even as their claims may be heterodox and irresolvable and in fact *because* they are. In the balance between an infrastructure over which territorial claims are made and an infrastructure through which those claims are drawn, the ultimate geopolitical design of The Stack can't possibly be decided in advance. Too many inversions are part of the process, and yet it is clear that our existing geopolitical machines desperately require intervention at scale. And so the interfacial regimes that give narrative form to The Stack are image-instruments of governance both here and now and yet to come, and for this, perhaps their momentum is too fast and their topography too dispersed for states to capture on their own, and too bound up with slow-to-change human anthropology for algorithmic *Cloud* platforms to merely abscond with them. At the same time, these instabilities are also what give stability to the whole. As The Stack has elevated interfacial diagrams to the status of planetary infrastructure, linking event to image with the ambient interfaces and habitats of the *City* layer, it coheres *Users* around generic experiences of social confusion that may *still* germinate new forms of political universality. This productive dissensus will remain open as long as the political architectures of The Stack can situate multiple jurisdictional claims and generate new jurisdictional strata where none existed, such that no single combination can finally resolve into a consensus sovereignty of last instance (or last resort). This defense against totalitarianism comes not from any axiomatic reverence for nonhierarchical horizontality but from the multiplication of verticalized totalities one on another. In that each of us, as a *User*, is also a living site over which that dissensus competes—not only over the right of legitimate violence, but also of the right of legitimate citizenship and political agency—then our own immediate experience of our interfacial regimes demands from us the management of several often incompatible personal identities, perched within these double-exposed platform totalities. It is the condition of any site, including any single *User*, to be enrolled into more than one regime at once and to suffer or enjoy a surplus of utopian total images, dual and treble citizenships, and fractured and noisy names and aliases. As discussed in the following chapter, on the last and top layer of The Stack this confusion first compels an overidentification with the reflective contours of *User* subjectivity, which is then followed by a more productive dissolution of the *User*-subject back into the indifferent churn of worldly interfaciality.

User Layer

The modern sovereign state and the modern autonomous individual (have codetermined) each other's emergence.

—Michel Foucault, *The Birth of Biopolitics*¹

... I marveled that these bits and pieces stayed isolated one from another, held the same shapes for so long, that the labeling of individual aliquots of biomass actually served a useful purpose.

—Peter Watts, “The Things”²

Among the accomplishments of the Enlightenment, one amplified considerably by industrial apparatuses, is the dubious fabrication of the atomized human individual, a magical figure separated from the world by his mastery over it.³ This construct is resistant to implications of Copernican traumas, as it continues to appreciate not only humanity but individual humans at the radiant center of the action.⁴ As this figure came to organize systems in its own image, its synthetic replication through micro-economics and social psychology set the stage for its cohesion into what is called, by design, the *User*. In practice, however, the *User* is not a type of creature but a category of agents; it is a position within a system without which it has no role or essential identity. Think of the *Apollo* astronaut, the Vitruvian Man of the McLuhan era, floating in space wrapped in a body-shaped bubble and linked by his umbilical tube to the mother ship. The astronaut is not the somatic *homo economicus* denuded of dependencies; he is rather a composite effect of interlocking organic and inorganic skins and metabolisms, from the mechanical life-support systems without which his bubble bursts to the trillions of microbes inside his gut without which his body will fail more slowly. Even the space cowboy’s role as “pilot” of his spaceship its debatable. Recent scholarship underscores that ground control and on-board computers did the bulk of the work to land the *Apollo* assemblage onto Earth’s moon and that the human hood ornaments sent up with them were also marketing devices to ensure a species-centric exploration narrative.⁵ Remember too that the first earthlings launched into outer space were not humans; they were monkeys, dogs, microbes, robots, and others. We

stand in their place, as much as they did in ours (even here on Earth, inside our atmospheric skins, we are all already astronauts).⁶ Another view would foreground how the human mind, body, and species, while appearing as the center of phenomena and perception, is instead, like all other matter, an open field irreducibly dependent on forces both larger and smaller than its own shell. This cascade of Copernican traumas—from Darwinian evolution to postcolonial and ecological inversions, to trans-phylum neuroscience and synthetic genomics, from nanorobotics to queer artificial intelligence—should erode conceptual models of the atomic individual human as historical actor (easy come, easy go). Instead, the conceptual gravity of the humanist illusion not only persists, but seems to draw some dark nourishment from these shocks. The more that the fantasy is disenchanted, the more entrenched the border-lines of what makes people “special” and the more that the hallucinated autonomy provides mystical shelter from the storm. Through it, the individual sees his poetic reflection everywhere, including in the positions configured for it as *User* of the systems on which it is dependent. By contrast, the platform sovereignty of the *User* in The Stack as identified for the *Interface* and *City* layers is derived not from some essential dignity of the particular human who “uses,” but from the agency of the *User* position in relation to the envelopes against which he or she or it is situated. Any sovereignty of the *User* draws less probably from established legal rights than from the contradictions and slippages between how formal citizens are provided access under control regimes versus how platform envelopes provide access to all *Users* regardless of formal political standing. One envelope may open up territories in ways the former cannot, and when it does, the position of the *User* is not just an empty suit, but a point of leverage in reorganizing the political geography of The Stack. Even so, that position never allows someone to enter into it fully formed; it also forms that person (or thing) into shape as it provides them tactics for shifting systems and their apparatuses.⁷ In this, the *User* layer of The Stack is not where the rest of the layers are mastered by some sovereign consciousness; it is merely where their effects are coherently personified.

This chapter focuses on *Users* (human or nonhuman) at the top layer up in The Stack and how they are interpolated by The Stack as comparable and interchangeable through various qualifications and quantifications of behaviors and impact. The *User* of this layer is not the universal persona that collapses design research into reductive and manipulative psychologism, a fixed term toward which design must orient its interfaces and artifacts, but as a model that is not given in advance and must be construed by interfaces and constructed for platforms. Its position at the top of The Stack, where driving agency is situated momentarily, is slippery, fragile, and always enmeshed in its own redefinition, an uncertainty that underwrites the formation of subjectivity in general, always a manifest image cobbled in relation to available technologies of self-reflection, from cave walls at Lascaux to Quantified Self Apps.⁸ The Quantified

Self movement enrolls available digital tools into the willful fabrication of autonomic self-interpolation and may be where the current political logic of the *User* reaches a certain apotheosis. While the empirical tracking and analysis of one's personal biological processes is surely diagnostically important in many ways, especially as such data are aggregated and pluralized beyond private individuals by the surfacing of ecological, economic, and microbial forces, but the currency of personal performance optimization leans toward something rather different. It elevates the principles of *User*-centered design into an existential mandate for biological disclosure and epistemological closure tuned to harmonize with the hyperindividuated self-regard native to the zones that link transhumanism and *Atlas Shrugged*. I will argue that its animating desire for self-mastery through the quantification of system interactions over the course of autobiographical time is premised on a fundamental misrecognition—one for which the *visual coherency* of the object tracked is taken as validation of the subjective coherency of the “self” that stares back at it. As before, mirror reflection makes a false guarantee of the self’s apparent outline.

For anything that is situated in the *User* layer of The Stack—he, she or it—the interplay between technical delineation and stable self-image is volatile. In that it is entwined with feedback loops up and down the layers, the position of *User* is obviously in some ways always “cybernetic,” but it does not bend toward any homeostasis or necessary resolution. It is a limited effector of processes bubbling up and down layer to layer. To and from its location, the *User* is both an initiator and an outcome of those vertical paths that in the introductory chapter I called *columns*. But because this is also where actual human beings are most unambiguously situated within The Stack, it is also where political constitutions, end-user agreements, linguistic and cognitive cultures, psychoanalytic conundrums, and so on, together structure how platforms (including states) see *Users* and how *Users* model their own interests and actions, as seen in *Interfaces* large and small. As a given column tracks up and down, there is no single necessary path from layer to layer that must finally resolve a *User* through *Interfaces* and *Addresses*, within a *City* and *Cloud* platform and all the way down to the *Earth* layer. There are only possible routes among possible routes, and the durable form of one layer might guarantee or prevent variation within another layer that coexists with it in the same context. For example, one *Cloud* platform in one *City* may provide very different sets of interfacial possibilities than it would in another *City*, and in this case, it is a layer located well below the *User* and *Interface* that frames and limits how social formations can and cannot cohere. What a state sees or what any other *Cloud* platform sees is what it can see and wants to see through its particular capacities of perception and institutional dispositions of looking as it strategizes its own reflection up the columns toward the *User*. Looking back down, it is the contact between the *User* and the *Interface*, the recursive image of The Stack’s procedural totality, that informs how a *User*’s habits of thought and action, no matter

how fantastic or delusional, become at least for a moment validated by the concreteness of global information infrastructure. Indeed, it should go without saying that precisely because the claims by and for *Users* can be so diverse, and so deeply bound to a dynamic heterogeneity of human cultures, the historical and political textures of the *User* layer are also the most anthropologically complex. That said, where do *Users* come from?

58. Origins of the User

Design has been an active participant in the formulation of the *User* as a privileged and practical subject position. It has refined the construct over at least a century into order to engineer the things that we all use every day—cars, globally unique identifiers (GUIs), hand tools, furniture, cities—by reflecting this shadowy hypothetical identity back onto real people. As part of a design research process, the formal postulated ideal users for intended products, messages, or services are known as “personas.” In 1955, for example, Industrial designer Henry Dreyfuss published his *Designing for People*, which featured “Joe and Josephine,” two extraordinarily typical people, one man and one woman, both described in minute detail. They would be used as the literal ergonomic standards against which things might be made to measure. They were, in this way, an Adam and Eve of use case personas. The premise of a scientific measurement of people and their movements as a way of designing systems to accommodate or to train them goes back at least to the proportional guidelines of Vitruvius’s *Ten Books of Architecture* (around 15 B.C.E.) and da Vinci’s *Vitruvian Man* (1490); many other genealogical threads are not hard to identify. Foucault’s genealogies of modernity painstakingly recount how typical and normative human bodies were served and served up by the design of disciplinary institutions of knowledge. By observing machine shops and workers and replanning how their bodily movements could be abstracted and optimized so as to be better incorporated with their laboring habitats, Frederick Winslow Taylor pioneered scientific management theory and the efficiency movement as the nineteenth century became the twentieth. Concurrently, Max Weber would identify a tendency toward depersonalized rationalization through the formulation of people into interchangeable bureaucratic components as a key sociological feature of industrial capitalism. Paul Lazarsfeld’s audience studies for the Princeton Radio Project (which momentarily included Theodor Adorno on the team) was among many midcentury attempts to apply the scientific method to the deduction of typical patterns in consumer thought and behavior used as templates for the formulation of products and propagandas. Information about audiences and *Users* would be used to inspire and validate the authorship of representative fictional personas that stand for those people by typifying them as ad hoc archetypes.⁹ Later, the requirements of software and interaction design came to rely on the specification of

diverse groups of multiple hypothetical *Users*, each with different needs, all put into overlapping fictional worlds where optimum click paths could be modeled, categorized, and used to perfect possible GUI solutions.¹⁰ Whereas Joe and Josephine were absolutely generic, extranormal people, the complexities of designing dynamic interfacial systems means that any thing must be usable for people with heterogeneous aptitudes and intentions. If you could make software just by measuring people's fingers and eyeballs, things would be easy. But the design of interfaces that have to link together various machines, forms of human cognition, and totalizing images of logistical networks demands more nuanced abstractions and optimizations than ergonomic verification of the angle at which "Joe's" elbow bends can tell us.

Today persona design and use case modeling is widely taught as a basic design research methodology, and as a result, for better or worse, a plurality of our material artifacts were conceived to suit the nuanced interests of completely fictional people following fictional scenarios. We, the actual consumers, are the shadows of the personified simulations of ourselves. Now real-time *Cloud*-based *User*-response-driven systems (such as Google AdWords and geolocative advertising schemes) work to close the gaps between upstream observation of *Users* and the microcustomization of services that are provided to them. Instead of abstracting a few typical personas out of the patterns seen through cumbersome, representative studies (we hope), and then designing offerings to suit those abstractions, the cycle between analysis and provision is more instantaneous. Whereas the standardization of large-scale industrial production demanded standardized *Users*, this is not as true for Stack economies. Instead of one *User* served by her supposed resemblance to one of a handful of personas derived from n population of all *Users*, *Cloud* platforms with access to each *User*'s specific profile (previous search history, purchases, geographic location, circle of friends) can hypersegment services and content. The ratio between number of *Users* and possible personas is then trending toward a 1:1 ratio; your profile is your persona, and in principle, every data *User* gets his or her own version of any offering. To be sure, this doesn't conclude but rather intensifies the interfacial apparatus processes of artificial subjectivization.

"User" is a normative figure of subjective agency for The Stack, not just a dummy sovereign held in an empty (if also supervisory) position at the head of a table with words put in its mouth. It also brings with it residual and sometimes discredited concepts of human agency and cognitive transparency. While the differential design of one apparatus versus another must modulate how each does or does not construct *User*-subjects, any entity positioned as a *User*, however briefly or permanently, brings with it a contextual history that is not reducible to software instructions and can twist the terms of subject delineation for its own purposes. An apparatus's ways of subject making set terms of disposition and articulation, but it does not magically flatten the history of the world into its single interface (even as much as it might want to do

exactly that). It also cannot hold onto all *Users* for the same duration, and so we must be equally attentive to the *dissolution* of subjects, in and out of *User* positions, as we are to their formulation. As described in the *City* chapter, apparatuses and envelopes situate the indissolubility of technical and subjective systems, drawing them together and unwinding them in equal measure. This dynamic of making and unmaking *User*-subjects is neither exhausted by discursive shifts and play, as assiduously mapped by poststructuralism, nor excluded from them, and often it innovates on them directly. The open entanglements of multiple apparatuses express different postures and positions, some of which can innovate cultural norms and invent new *Users* on the scene. More often, however, at the global scale of The Stack, the *User* position is reserved for a reductive regularization into customized utilitarianism, and when that is mobilized for planetary-scale interfacial regimes, then its identification with the local reflections of computational mirrors can make it alien even to its own experiences. It can do this in at least two ways: by the “informatization” of self-identity as a project of individual care and management and in the revelation of the robust subjectivity of other nonhuman but computationally complex *Users*. As we’ll see, both of these work to first overdefine and overdetermine their subject (sometimes by bizarre constraints) and then work to dissolve its individual boundaries through a radicalization of that same overarticulation. For the *User*, from solution comes dissolution. Across the two, the geopolitics of The Stack in no way requires the alleviation of these unsettled identifications, externalizations, and counteridentifications. On the contrary, I would argue that anthropocenic humanism is not a natural reality into which we must awake from the slumber of machinic alienation; rather it is itself a symptomatic structure powered by—among other things—a gnostic mistrust of matter, narcissistic self-dramatization, and indefensibly pre-Copernican programs for design. By loosening the grip, alternatives can be modeled, midwifed, cultivated, cared for, radicalized, soothed, executed, extrapolated, rendered, exported, and accelerated.

59. Finding the Universal User

User is a position not only through which we see The Stack, but also through which The Stack sees us, and so the platform sovereignties that it is most disposed to support are those that align with how the other layers organize their own intersecting interfacial regimes. The *Earth* layer spins out polities of the electron and emergency, the *Cloud* layer enrolls proto-citizens in global platform totalities, the *City* chapter maps out spaces of filtering control and accidental alegal access, the *Address* layer discloses a landscape in reserve filled with things and events available for interaction, and the *Interface* layer diagrams reductive images of all of these processes, served up as total or tactical instrumental regimes. All these are put in motion for *Users*, as *Users* are put in motion for them. This singular-generic *User* pinpoints where proto-cosmopolitanisms

overlap and contradict the acquisitive platforms of cognitive capitalism and its blurry alternatives. The more salient design problem seems less to design for *Users*, as if they were stable forms to be known and served, than to *design and redesign the User itself* in the image of whatever program might enroll it.¹¹ For this, any *User* is always a step behind itself as it moves along its path of potential use cases, realizing some and not others. When one virtual possible path collapses into a real interaction with a real interfacial regime, it alters the profile and the persona, which in turn transforms the interactions to come. The evasive distance between the predicted path and the one taken directs the portraiture of future *Users*, one by one or in populations, as the repetition of irregular interactions is normalized into new models from which Stack geopolitics coheres second by second and measurement by measurement.

Wandering around the Shanghai World Expo in 2010 and into the Urbanian pavilion, I encountered this *User*, perhaps in its metaphysical essence (or so it seemed at the time).¹² The core pedagogy of the sensurround urban-scale propaganda for urban-scale systems instructed that global citizenship is based on the quantitative comparability of how much energy, water, land, and other resources a person uses and produces. For this material cosmopolitanism, humanity is held in a planetary commons, not merely because we share Earth's territorial surface (as it was for Kant) but because each of us generates a resource footprint that can be known to us and made known to one another. Visitors learn that it is our quantitatively comparative shadows that make us all one. Across apparent differences in appearance, culture, and lifestyle, each *User* consumes energy and produces things that others consume in turn, and so *Users* consume not only carbon and energy but also one another within an infrastructural metabolism. The geopolity staged here in the Urbanian pavilion is a governing commonwealth of urbanized electrons, one demanding a material ethics of biographical measurement and comparison. On display, literally, are several sample *Users*: towering use case personas extruded in zoological exhibition as if by Charles Ray. We have big mannequins of the Reids from Phoenix and the Hagens from Ghana, for example, and through the pavilion's displays, we examine cinematic and sculptural vignettes of their daily lives, learning about what each of them does in the morning, what they consume at night, whom they love, what they produce, how much of the urban platform of information, energy, and carbon they use. All the while these immersive qualitative accounts of their lives are overlaid with alphanumeric dashboards of total consumption and production data, per *User* family unit. Their distant lives and situations are brought together and made comparable, if not also interchangeable, by these standard metrics for evaluating their relative performance. Here the *City* (the world, really) is posited as a mesh of semantic chemistries subordinated to their logistical administration. This isomorphic standardization of human survival—biopolitics entwined as usual with the statistical imaginary—underwrites an autobiographical geopolitics of the *User*, opening its position up to whatever it might acquire or make

use of it so long as platform interactions can be traced, weighed, and optimized in relation to a planetary resource totality.

This particular Sino-futurist cosmo-urbanity of information, energy, and architecture is as generous as it is omnivorous. Can we really expect full interoperability without some degree of cannibalism?¹³ The Shanghai exhibition pedagogy is ecumenical, fair and strict, democratic and autocratic at once. But here, “we,” the persona and use cases of the world, cohere as a polity to the extent that we are all agents of the urban commonwealth of the digitally articulated electron, water molecule, and land use event. The foundation of a *User*’s proto-citizenship falls within this Stack-scale urban fabric, feeding into and off its provisions of life. There is a correspondence with the platform sovereignties derived from urban envelopes, discussed in the *City* layer chapter, and their capacities to project unexpected *User*-subject positions and pathways, but in Urbanian, we are asked to contemplate with wonder the arithmetic fairness of closed loops and the social diversity possible within them, not lines of flight from them. Fear and surprise, work and play are all equivalent in that they can be deduced equally in our common shadows. As the *User* is drawn deeper into urban platforms, drawing resources from them and providing cognitive and physiological value back to them, tensions between entertainment as labor and labor as entertainment move front and center, and the attendant paradoxes of economic privacy and civic transparency grow louder. This consolidation of *City*, smart grid, and *Cloud* produces new aggregate technology and aggregate territory, not only by blanketing one on top of the other but by linking them into a composite apparatus (“itself the network established between … elements”) by enforcing a universal regime of comparative metrics.¹⁴ This *Cloud Polis* model of a planetary urbanity, integrated under the sign of full-spectrum macroeconomics of energy production and consumption, is rendered as an ethics of autobiographical self-identity.

On this side of the Pacific, we can explore further how this ethical methodology works to construct the political subjectivity of the *User* in the image of resource totality and the quantification of the feedback loops initiated with infrastructural systems. This might entail the monetization of cognition (as for *Cloud* platforms) or of the calculation of a *User*’s carbon footprint toward other ends, but what matters most is the optimization of the *User*’s profile as the source of its economic viability and its political agency. Perhaps the bravura performance of *User* quantification as autobiographical anthem was by Saul Griffith for a talk at the Poptech! conference in 2008.¹⁵ His talk begins by recounting the procedures he underwent in order to come up with a viable measure of the number of watts of energy that he, as one person, draws from global platforms. Because one uses so many different systems, from airlines to highways to processed meats, it’s necessary to calculate not just immediate interactions but the percentage of vast wholes that one individual is arguably responsible for. It took a year, but this is what Griffith and his partners did, quantifying every big and small systemic

interaction, from food and diet to transatlantic flights to taxes paid toward the paving of roads. He concluded that he uses around 17,027 watts per year, which is not extraordinary for a US citizen. The world average, however, is 2,250 watts per person, with several billion people filling out the long tail of energy access. Even so, Griffith's confessional might nominate his practice of self as the ideal universal *User* (*Homo persona?*) far more than comparatively blunt profiles available for the Reids or the Hagens in Shanghai. Not only are his interactions with The Stack quantified with exacting candor and offered up for critique and comparison, but his intelligent efforts also provide those systems a valuable measure of their interactions with him. He then performs a similar heroic act of statistics for the collective *User* inclusive of all humans and their aggregate effects on the planetary situation (my words, not his). His point then is to demonstrate exactly how difficult will be the necessary transitions from current infrastructures to those required to stave off ecological calamity. At the time of his talk, the United States had put about 90 gigatons (GT) of carbon dioxide into the atmosphere since the beginning of the Industrial Revolution (China had put about 26 GT). Before industrialization, the climate held about 270 parts per million carbon dioxide, and we've recently passed 400 parts per million. Griffith asks how the collective *User* could sustain a still very dangerous 450 parts per million and still produce the same 16 terawatts of energy currently demanded by the global population. He surmises that we'll have to come up with about 10 terawatts of clean renewable energy, in addition to the 6 terawatts from other sources in order to have any reasonable hope for stabilization at 450 parts per million. Getting 10 new terawatts of clean energy in twenty-five years, however, may mean the immediate, simultaneous, and comprehensive transformation of almost all of our entire industrial infrastructure. We would need one 3 gigawatt nuclear plant to go online every week for the next two decades. Plus we would need to install 100 square meters of solar cells every second. Plus we would need twelve 3 megawatts of wind turbines every hour. Plus, to grow enough biofuel-producing algae, we would need to fill a space the size of Wyoming. To have a chance of accomplishing these feats, he says, Coke and Pepsi would have to switch entirely to making sheets of reflective mirrors instead of sheets of aluminum for cans of sugar water. GM, Ford, and Toyota would have to team up to achieve the goal of one wind turbine every five minutes. Obviously such lurches would bring their own negative consequences, and so even "solving for carbon" is sure to cause other problems. In other words, it seems impossible. It is true, he concludes, that we have brought 10 terawatts online in the last forty years, and so who knows? Without the *deus ex machina* of miraculous nanotechnological quantum fusion from Mars, the prospects for the comprehensive stabilization of atmospheric carbon without dramatic reduction in energy use by people like himself seems highly unlikely. Most interesting, however, is not Griffith's individual apologetics but the shift from the unit of the individual *User* of The Stack to a profile derived from the total sum of all *Users*, gauged as one enormous meta-*User*. Perhaps

this shift in scale provides some hope that deliberate redesign of governance is possible. The political identities of *Users* are produced through interfacial regimes, and the public profile and legitimacy of those regimes appear in the composite mosaic of the *Users* that it generates. The whole makes parts, which make wholes: the apparatus individuates *User*, and the totality of *Users* comes to define the scope and quality of the apparatus as infrastructure for their lives.

60. Quantified Self and Its Mirror

Above I identified two tracks by which the *User*-subject is at once synthesized and made alien to itself: the experience of the self reflected through visual-quantitative technologies and the granting of subjectivity to nonhuman agents imbued with computational intelligence. The following sections explore both of these in greater depth. Elsewhere I have identified what we can call the “death of the user.” By this, I mean the expiration of a specific kind of user, and the displacement its soft humanism from the conceptual center of design strategy by the proliferation and predominance of both nonhuman and nonindividuated actors within the expanded field of ubiquitous computation.¹⁶ “Joe and Josephine” are no longer generic; they would now be seen, in comparison to all possible *Users*, as specifically and idiosyncratically primate. As discrete human individuals believe themselves in charge of their tools, they nevertheless represent an increasingly particular, even marginalized type of *User*-agent within a diverse throng of alternatives. At the same time, this same dispersion and diversification of *User*-agency into the wider landscape of the world provokes a belligerent overdetermination and *overappearance* of the individuated human as the base unit through which that world is measured.

As we human *Users* reflect on our selves with images of quantified digital traces, the richly detailed portrait reflected back convinces us of our individual coherency and efficacy. However, as this *User* is outpaced by nonhuman actors and multitudinous objects, he appears to himself as another one of these things. Like the addressable haecceity tracked through logistical space, *you* are a smart object held together by platforms for deep biographical comparability. The apparent stability of the profile image reflected back conceals the necessary fragility with which any one thing holds the position of *User*-subject. That fragility is a bit like Theseus’s paradox, which questions whether an object, having had all of its parts replaced one by one over time, remains essentially the “same” object. You may have heard a version of this as a story using George Washington’s axe instead of Theseus’s ship: “The handle has been replaced three times and the head twice, but it is essentially the same axe.” The new axe occupies the same “place” as the old axe, but even so, it is not the same bunch of molecules. What we have at hand is a double within the exact outline of what is now displaced. It is the same for the positions of *User* subjectivity into which we step for a moment or more.

Like the axe, the *User* is situated by the myriad relations that produce our worlds and the things that we do in them. There is a “there” there, but it is plural and in motion. In our profiles, our names, ideas, organs, identities, rights, licenses, tools, itineraries, and genomes can each be peeled off, however provisionally and artificially, from those that also belong to other *Users* and so can be made to cohere into the composite image of one self. But not only do these always move in and out of that frame, moment by moment, each is constantly attaching itself to other profiles and to another positions. Sometimes one of these can even take on the position of *User* all by itself, leaving all the others elsewhere. As discussed for Griffith’s movement between the scales of individual and collective *Users*, the part is determined by the whole, which achieves its identity through the coherence of its parts (even when the whole is one *User* and the parts his partial component characteristics). But inside the economy of the *User* position, profile components cohere into the temporary resolution, but they do so without belonging exclusively to it.¹⁷ They travel into external places and positions, leaving behind the afterimage of the resolved *User* into which so many people invest their own identities.

As suggested, this slippage is exemplified by the Quantified Self movement, an extremely Californian subculture that seeks “self knowledge through numbers.” It champions the use of data capture technologies to track an individual *User*’s “inputs” (i.e., food and air), “states” (mood, energy level), and “performance” (mental and physical metrics). This administrative auto-objectification turns the gaze of user-centered design research inward on itself, inflating it toward existential closure. This “care of the self” is a fabricated hypertrophic self-interpolation, a hyperindividuated diagnostics perfectly suited to cube farms. For the *User*, the reflection provides recognition and misrecognition, not so unlike Jacques Lacan’s mirror stage parable, whereby the visual coherency of the body reflected back is believed to confirm the psychological coherency of the self who stares at it.¹⁸ Before the primal encounter with a mirror, the temporality of inner experience was confused, unable to differentiate the mental imagery of direct experience from memory, from a desired wish; present, past, and future are all a jumble. On seeing the coherent image reflected back, seeing outlines following movements following outlines, the grounding of a coherent sense of self as a self-directed subject, and as an object in the world among others, was not only possible but imperative. The visualization comes with a false guarantee but provides for more interesting detours by those inevitable failures.

Consider, by way of example, a project that Gordon Bell developed at Microsoft in the late 1990s, MyLifeBits, which considered the *User* and his individuated biography as the locus of a kind of computational infinity. The experiment draws on a simple and ambitious question: What if everything you ever saw, heard, and felt, every object you ever touched, every location you ever shadowed—every externally trackable experience—could be recorded at some incredible lossless resolution and fidelity, fed into practically infinite storage, and available to recall and replay at any time?

Where Turing's artificial intelligence test attempted to detect machine intelligence by testing its reflection in human cognition, projects like Bell's suggest capture of the totality of autobiographical experience by couching it within a personal universal Turing machine and so (as the research was for Microsoft) to prototype the sorts of data management, visualization, semantic sorting, editing, and indexing interfaces necessary for the yottabyte-fluent absolute *User* to come? Of course, in that future, part of what would be recorded are her sessions during which she plays back past experiences, which would then also be available for review later on, and so on, and so on, a mirror held up to a mirror, reflecting up into the darkness.¹⁹ The phenomenology of metadata would be overwhelming. Certainly new vistas of self-mastery might open up for her, but at the same time new psychopathologies would emerge in her attempts to manage the infinite regression of reflections of reflections. Leaving aside the service design implications for Microsoft and focusing on the vertiginous depth of this kind of auto-cognitive technology, wouldn't the absolute *User* at some point lose (or let go) the ability to differentiate present experience from past memory and from future wish? A kind of transcendental infantilization or enlightened disindividuation? Would memories of memory become unwound such that the consciousness of a situated subject is forever unwound as well, leaving little piles of neurofabric throbbing in the feedback of its own disassembly?²⁰ If so, then can those be rewoven into different, less individuated *User*-subjects, after the fact?

To define this process more formally, in the short term, an increase in the intensity, granularity, and reflexivity of information about a *User*'s traces in the world first produces a cartoonishly overactualized diagram of the self as a continuous individual unit. In the long term, the quantity of information reflected back becomes too great, and so these same technologies undermine the boundaries of self and other, resulting in an open, incoherent, and discontiguous identity. The self burns brightest just before falling apart; more is more, until it is actually much less, and in this case, less may be a more fruitful accomplishment. (For this, *intensity* refers to the scope, scale, and computational capacity of a diagram to capture an event or life; *granularity* refers to the detail it can capture; and *reflexivity* refers to how much the diagram can be meaningfully acted on, either as a GUI that controls a feedback loop or social connections providing surveillance, and a stage to show off the self-events under the social microscope.) Where exactly the threshold point between solution and dissolution sits, we can only hypothesize, but we can anticipate, and not without optimism, the crumbling of the psychologized single-serving human *User* as the generic universal *User* position in relation to The Stack, and consider instead the soupy ingredients for alternatives that are left behind. Nicholas Felton is an information designer famous for his obsessive and ironic annual reports on himself, as if he were a corporate client needing to comply with shareholder reporting requirements.²¹ He also was a major contributor of a redesigned Facebook timeline in 2009, which shows how Quantified Self,

turning accounting techniques born of big box supply chains and reassigning them to the surfacing of unseen patterns in our everyday lives, is not an isolated subcultural phenomenon but increasingly central to Stack culture at large. From the Reids, the Hagens, Saul Griffith, and Gordon Bell, and toward the mainstreaming of QS logics, especially for social networks of *Users* online and offline, what will be their societal impact more generally? Are billions of *Users* being convinced that their individual profile biographies are more real than they actually are, or are they being trained toward the distributed realization of the opposite ultimate conclusion? In aggregate, will each of us become further atomized, more grotesquely overindividuated, staring dumbly into our own templated reflections of profiles, feeds, and complimentary feedback, or will we become even more hive-like, drifting in the wake left by the memes of our curated externalized cognition? The better question is: What kind of *User* can be designed instead?

This hyperattenuated version of the *User* is claimed by myriad relations, and in stepping into its position, one is “already a crowd.”²² The overdetermined QS is analogous to the blackened canvas, overwritten with layers and layers of figures, colors, diagrams, and abstractions, all targeting the same referent and in so doing generating multiple means and medians. As for Theseus’s paradox, identity is tuned and retained, but despite all attempts at resolution and actualization, it remains an open field into which and out of which any of these layers might travel. That overdetermination does not prohibit creativity, but it does shift its terms of operation. When the canvas is full, completely blackened with overlapping content, the act of creation doesn’t mean adding paint, more black on black; it is instead subtraction, that is, the introduction of absence and silence so as to make room for information now made visible by this negation—scratching the black away to let the light in, removal as design strategy. We see this play out with the *absolute User*’s slide into an abyssal dissolution of the self when confronted with the potential totality of virtualized experiences. In response to the white noise of his infinitely refracted subjectivity, he reflects this entropy by sliding back into perceptual incoherency (or potentially stumbling toward secular hypermaterialism). It’s true that the real purpose of QS is not to provide all possible information at once, but to reduce systemic complexity with summary diagrammatic accounts of one’s inputs, states, and performance metrics. But adding more and more data sources to the mix and providing greater multivariate fidelity also produces other pathways of dissolution. By tracking external forces (e.g., environmental, microbial, economic) and their role in the formation of the *User*-subject’s state and performance, the boundaries between internal and external systems are perforated and blurred. Those external variables not only act on you; in effect they are you as well, and so the profile reflecting back at the *User* is both more and less than a single figure (and as we’ll see, sometimes those extrinsic forces live inside one’s own body). This is one site from which alternative *User* positions can be invented. It’s where the fictional resolution of the individual person as the

core unit of the *User* position gives way toward something else, where nodes begin to work like edges and edges like notes. The ocular appearance of the resolved first person, first seen in the outline reflected back in the mirror and then verified in the continuity of feedback from input, state-condition, and performance diagrams, multiplies into a mosaic of new components clinging to other subjects, bigger and smaller than the individual person.²³

The baseline design brief for the *User* layer of The Stack may go something like this: In the image of planetary-scale information infrastructure, comprising trillions of addressable haecceities, the resolved scale of the platform need not be for one *User* at a time, drifting into and out of narcissistic virtual reality, but for pluralities of partial users, quasi-users, human and nonhuman, organic and inorganic, intermingling in intersubjective alliances, sharing perceptions, memory, algorithms and techniques, visualization rhetorics situated among the semantic graphs of aggregate *User* experiences predicated not just on autobiographical interoperability, but on direct physical and cognitive promiscuity. Imagine one sort of *User* logging the totality of her perceptions and interactions not as an atomic iota lost in her own manifestations (like Bell's MyLifeBits QS persona) but as a population of 10 billion *absolute Users*, all generating content and all feeding off one another's issuances. Plural systems provide plural images, which provide plural *Users*—two of us, ten of us, a hundred of us, an entire city of us—literally seeing through each other's eyes, remembering through one another's experiences, walking in one another's shadows. Imagine Jakob von Uexküll's foray through the garden of *Umwelten*, where he encountered the interweaving but exclusive lifeworlds of plants, animals, flowers, and insects, but in our biosemiotic field, everything can now swap points of view. Tomorrow, may I have your yesterday? Unexpected alliances, continental organizations, linguistic traditions, and politico-theological communions ensue, any one *User* moving into and out of several of them, just as they move into and out of him. The profile reflected back is not of a resolved individual but of empathetic assemblages across multiple spatial and rhythmic scales. Furthermore, as nonhuman users (sensors, animals, artificial intelligence, what-have-you) are enrolled into these collaborative perceptual-interfacial affiliations and platforms, the contingent hierarchies between physical subjects and objects are put once again into play. So instead of the Shanghai Expo's *universal User* scenario, where the cosmopolitan apparatus of The Stack would interpolate each human as an interoperable atomic profile, however comparable and equalized they might appear, can it instead come to provide and even demand far more alien subjectification en masse? These would perhaps be unaccountable, even invisible to, the dynamics of individuation versus collectivization, physicalization versus virtualization, localization versus globalization—neither solution nor dissolution, only strange columns up and down The Stack, and from strange columns new geographies and geopolitics for a post-Anthropocenic *User*.

61. Trace and Frame

But even without such anastrophic departures from the world as we know it, the geopolitics of data-driven *User* subjectivization can evolve in other ways. As the *User* profile shifts from one based primarily on the observation of individuated intrinsic variables to include also the weight of the world into its measure, then as any one actor (human or nonhuman, singular or plural) moves into and out of different assemblages, it not only produces new territories of action, but develops meaning and strategy for its actions in relation to the comprehensive images of territory available to it. The image of totality that any fully formed interfacial regime provides as part of a platform is not only the composite pattern made by crisscrossing atomic grains in flux, drifting, charging, and discharging with one another; rather, those interactions are situated within cartographies produced not only by the traces of their instantaneous encounters accumulated over time, but also in relation to slow macrologic images of the territory as a whole. Remember that any deep address haecceity can enter into and withdraw from an exchange of information, appearing and disappearing over and over again, but its specification by the *Address* not only makes it discrete from any instances, it also enrolls it into a larger-scale architecture through which it contributes to new linkages across otherwise incommunicable scales. This architecture precedes those links and is preceded by them, just as the map precedes an itinerary through the territory that is reduced in that map's image but is itself produced by the accumulation of movements through it.

For example, in *Exit*, a series of stunning panoramic data visualizations designed by Diller, Scofidio + Renfro, Mark Hansen, Laura Kurgen, Ben Rubin, and others as part of the *Native Land-Stop Eject* exhibition curated in 2008 by Virilio and Raymond Depardon, we see this dynamic pedagogically demonstrated in the service of several information narratives about the conflicts and paradoxes of globalized space, time, population, and value. The panoramas render the world in the image of an ongoing intercourse of datum with datum, and ask us to identify with the individual element and the summary patterns that emerge. The former and the latter coalesce in second- and third-order recursive cycles, less refractions of perspective than reverberations feeding back on themselves. Global visualizations such as these sift patterns produced by actors who may already be piloting themselves according to more local indexes, diagrams, and feedback loops, which in turn may also be responding directly to modulations in the global system in which they see themselves as embedded actors. Ponder the drivers who all refer to the same Google Maps road traffic data updates and switch freeways all at once, effectively causing new traffic jams or even alleviating the snarl from which they tried to escape: the regulatory equilibrium of self-mapping swarms. In one of *Exit*'s panoramas about the future of transcontinental migration, "every person is represented by one pixel." Its global visualization describes a universal system monitoring

particular events, which in turn are monitoring themselves in relation to the universal system and back again. In *Exit*'s visualizations, the multiplied accumulation of smaller-scale assemblages—information events such as a single cash remission or cross-border movement—cascade across the plane of the Earth composing the global scale as the pattern space of these interlocking network flows. At the same time, the scale of the global assemblage provides top-down structural forcings (legal, geographic, semiotic) governing and delimiting bottom-up multiplications, and so recompose forces “back down” to regional and atomic levels, determining in advance the kind of flows that can and cannot be initiated and sustained by *Users*. In this telescoping geography, the global and the local are neither dichotomous nor fixed scalar operations. Planetary scales such as the “global” framed by the installation panorama should not be seen as the closure of master abstractions, just as the local, drawn here as the individual pixel in flight, is not only the monadic mote of autopoietic flow. Both are interlocked and mutually embedded scales of assemblage that comprise and delimit one another (and are by no means the only such recursive scales). While this is not, by itself, big news for social theory, it is worth pointing out again for the context of *User* formation and dissolution across intrinsic and extrinsic profiling: the part and the whole are one.

It's perhaps easier to conceptualize this than to draw it. For example, Bruno Latour's recent interest in network visualization in relation to actor-network theory passes through a reenactment of the 1903 Gabriel Tarde–Emile Durkheim debate, social monadology versus macrological abstractions (with Latour playing Tarde and speaking on his behalf).²⁴ He concludes that because we can now identify and track social interactions at the immediate scale that Tarde sought, and have the computational means to model boundless instances according to as many different scalar prisms as we choose, therefore the vocabulary of individual (as element) and society (as aggregated structure) is an unnecessarily reductive schema. For its part, working to speak as/for Virilio's theories, *Exit* does and does not succeed in reslicing the data sets so as to demonstrate this recursion, relying in many cases on the optics of individuals caught up in global flows within the bounded array of the Mercatur projection. We appreciate this multitude of intersecting systemic perspectives, as escaped from the single structural plane, but want to extend beyond secondary analytical images of social interactions. As discussed in the *Interfaces* chapter, the images of systemic interrelationality found in GUI and in dynamic visualizations not only diagram how platforms operate; they are the very instruments with which a *User* interacts with those platforms and with other *Users* in the first place. At stake for the redesign of the *User* is not only the subjective (QS) and objective (*Exit*) reflections of her inputs, states, and performance metrics within local/global and intrinsic/extrinsic variations, but also that the profiles of these traces are the medium through which those interactions are realized. The recursion is not only between scales of action; it is also between event and its mediation. Put differently, the composition with which (and into which) the tangled positions of *Users* draw their

own maps (the sum of the parts that busily sum themselves) is always both more and less whole than the whole that sums their sums! This interfacial recursion—the identification and measurement of *Users* that already organize themselves with the very mechanisms that are used to do the measuring—underscores that planetary data infrastructure, now general-purpose equipment, are means not only to scan a world but to compose one as well. Data visualization is, for good or ill, more than world-mapping; it is also world-making.

62. Maximum User

World-making is always also world-erasing, especially at the *User* layer, and appearance and disappearance themselves show up and go away at strange times and in strange ways. The case study of another exemplary maximal *User* draws us back into the heart of the QS movement, and also brings us more through the solution and dissolution of the individual *User* than toward a more expansive and inclusive population of *Users*. That this maximal *User* has also been called “the patient of the future” underscores the strange biopolitics at stake.²⁵ I wonder, not without some perverse pleasure, what Virilio might make of my friend and colleague Larry Smarr’s nearly decade-long interest with the rational self-quantification and observation of data pertaining to the health of his biological person. Originally a mathematician and astrophysicist, Smarr is the founding director of Calit2, the California Institute of Telecommunications and Information Technology, the University of California system’s flagship IT research institute, in La Jolla. Smarr was also the founder of the National Center for Supercomputing Applications, which among other things brought forth Mosaic, the web browser that became Netscape.²⁶ He is among the key pioneers in cyberinfrastrucure, scientific visualization, and what he calls “planet scale distributed computing.” But as of late, the information platform that has captured his most intense interest is his own body. While QS has many ancestors, Smarr’s own quest brings to mind Buckminster Fuller’s notebooks, the “Dymaxion File,” in which he recorded his every activity. The personality type of those who see the design of planetary technologies as their vocation seems to suggest an interest in modeling everyday activities as if they were astrophysics. For others in the QS scene, their own comparatively subdued pursuit may instead have more to do an unhealthy internalization of Office Park evaluative criteria of systems performance and benchmarking. Smarr and I have discussed this at some length, and it’s clear to me that his interest is much deeper and less individualistic than the psychology I have ascribed the QS movement as a whole.

Smarr tracks his health at a finer grain level than most of us could manage, or even likely want to. It demands forms of data mining that he is uniquely prepared for (he diagnosed himself with adult-onset Crohn’s disease years before doctors confirmed this). He has not only monitored and quantified his food intake for years, but has his

blood drawn and analyzed according to a dizzying array of tests every few weeks. He's had his personal genome mapped at a resolution few others ever have, and perhaps more interesting, he has also done the same for his microbial gut biome, the ecology of microscopic life that inhabits us and helps keep each of us healthy. The genome of the microbial biome inside our guts has evolved over millions of years in correspondence with the host human species, sometimes beneficially and sometimes pathologically. Over the course of our individual lives, our bodies provide selection pressures on how our individual microbial biomes change and evolve inside us. What we eat, in particular, can fundamentally alter the alien ecology in our gut, for better or worse. A poor diet can force the evolution of the biome toward an unhealthy state in which it no longer supports our health and instead could contribute to significant malaise in the entire biological mechanism. Smarr's personal medicine is somewhat unusual in that the focus is shifted from the self-regard of his own somatic body toward the curation and gardening of this internal microbial civilization.

Inside the shell of one's skin, there is far more DNA that is nonhuman than DNA that is human. You, the skin bag, are all too less human than human. Even to the extent that your individual corporeal machine is to be taken as the base unit of medical analysis and political subjectivity, it is already a multispecies arrangement. Smarr's broader intellectual project for the systemic establishment of digital medicine envisions the coembodiment of information at the scale of 7 billion humans and zillions of genes, environmentally bound molecules, proteins, and microbes, all contributing to a comprehensive diagnostic simulation and treatment metabiopolitics, a universal biocomputation intersecting with the universal ecocomputation that Griffith's demonstration popularizes. As a research model, it draws an explosion of traditional, individuated patient models into pluralized platforms in which every *User*'s genomic, nutritional, neuronal, microbial, and environmental data would be systematically aggregated into an information commons where new kinds of analysis and pattern recognition could mature. The thickened interrelations of intrinsic and extrinsic force further dissolve the individuation of the singular patient toward alternative, as yet unnamed patterns of biological plasticity. The tracing of pathologies across multiple biological scales, over time and over multiple populations at such comprehensive scope and granular detail, would surely also reform basic concepts of "disease," from one recognizing swatches of individuated symptoms toward one governing nuanced economies of symbiotic infection, transfer, and immunization across multiple host sites, and smart enough to see some contamination as enabling health, not preventing it.²⁷ In time we see projects designing artificial intelligence systems that could interpret the exabytes of real time and archived data and produce interpretive causal models, images of emergent patterns, that startle diagnosticians and patients alike. This hyperilluminated medicine would surely show that causality and pathology zigzag from microbe to bioregions and back again in utterly surprising ways, and that today's folk conceptions of organ, body,

group, and toxin demand more rational recategorizations (and *Addresses*), likely ones that will appear as self-evident when revealed but that today we can scarcely anticipate.²⁸ In parallel, the various technologies and concepts gathered under the rubric of synthetic biology can engage this absolutized commons as an open-ended toolkit for biological refashioning (if it is actually held in common) and in doing so bring its own controversies and contradictions. Further, in the institutional transference of tracking, diagnosis, and treatment expertise toward the tracing of super- and subindividual forces by computational infrastructures, and away from the one-on-one observation and interviewing of individual persons, the necessary role and proficiencies of “doctors” would evolve as well. While the expert arts of high-touch treatment don’t abdicate their positions, the computational support of pattern recognition and robotic support of therapeutic abscission do alter how health is provided, just as they alter what health is and make very different demands on those trained to do the providing.

To be sure, the biogeopolitics of all this are ambiguous, amazing, paradoxical, dangerous, and weird. Our at-hand ideas about sovereignty, transparency, therapy, jurisdiction, and privacy provide unreliable models for a biopolity based on the composite information that each of us physically secretes. This also makes projects like *Exit* incomplete, in that they draw prematurely conclusive images of totalities now overflowing their global frames. The pluralized *User* position may include melancholic information traces bearing witness to injustice, but this cannot develop in isolation from a far less certain politics of the stigmergic smear and stain.²⁹ With this in mind, it should be noted that Smarr the permanent patient, also collects his own feces and has them expertly analyzed. This is the best way to keep tabs on the state of his gut microbes, and through their cipher, the general state of his own health. Grandparent toilet bowl stool diviners, you were right: considering the density of DNA from microbes, from one’s own internal fluids, and from the DNA of the remaining food-stuffs that one ate, the human stool is one of the most information-dense substances you are likely to regularly encounter. Bit by bit, your stool is far more information rich per cubic centimeter than the flash memory in your iPhone. Lesson: *We secrete more information than we ourselves constitute on our own*. In their aggregation, are our shadows more substantial than what casts them? If so, where, if anywhere, do we finally pin down the stable sovereign of the *User* (or the individual person) as a systemic agent? For quantitative biomedicine (not just for deconstruction), presence finally guarantees less than the trace. Can we imagine an inversion, then, for which the sovereign interface to the platform is tethered to the structured information simulacrum instead of to the discrete entity from which it slips? Of course. We call this the *profile*, and platforms are built on economies of their administration. However, we need to more forcefully activate the back-and-forth between the profile and the individuated humanist subject so that the simulation’s work as the expression of multiple geopolitical and biopolitical intersections can do more and say more. What responsibilities the entity has to the

profile, the profile has to the entity, and how the *User* position can or should mediate them are thankfully still open questions. Constitutional resolutions on privacy and permission seem feeble, both intellectually and strategically, without better options for what preferred policy actually might be. Do they hint of a bioethics in which a *User*/person/profile's refusal to submit data trails to holistic biomedical platforms, and by this endanger the care of the larger commons each of us is inevitably both consuming and secreting at once, would be analogous to today's idiot stunt of refusing vaccines? Put another way, in such radically transparent environments, when do systems and individuals become indistinguishable, not to mention redundant? Is the design of one indistinguishable from the governance of the other, and if so, is the accountability of human individuals, as the subjects and users of digital regimes, really the most viable sovereign unit to enforce?

Considered in relation to *Exit*, these questions might be clarified by juxtaposing them with a remark by Gayatri Spivak, from her lecture on "planetarity," to the effect that "the most pernicious presupposition today is that globalization has happily happened in every aspect of our lives. Globalization can never happen to the sensory equipment of the experiencing being *except insofar as it always was implicit in its vanishing outlines* [my emphasis]."³⁰ I am perhaps more at ease with this perniciousness than she, but I take this to mean that globalization (only one weak guise of planetarity) does in fact happen to the sensory equipment of the experiencing being exactly by making the outlines of that being appear and disappear, including *to itself*, according to regular rhythmic terms. Odysseys of self-quantification (such as Smarr's) might confirm that disappearance must be preceded by an appearance of the cybernetic *User*-subject and of a world made through his embodied biology and disembodied profile. The cultural resonance of big data and their participation in the formation of the *User* position within The Stack is defined by this oscillation between appearance and disappearance realized in finely grained logistical techniques now reassigned to make heretofore unseen autobiographical patterns visible and actionable as interfacial compositions. That position, filled with subjects and other effectors, is strongly optimized as a visual object of knowledge, and so situated *Users* are invited to see themselves within the stabilizing outlines of the exabyte ego. In this regard, Spivak may have it wrong. Globalization, as she defines it in the planetary career of electronic capital as ubiquitous grid, is very much experienced at the level of sensory equipment precisely because it, at least initially, makes appearance possible and validates subjects produced accordingly. This validation is not just perceived; it is experienced (and for some, it is experienced as synthetic *User* experience). But the inclusion of information from extrinsic (if also corporeally internal) sources into an economy of identity has the opposite effect, and it is exactly the vanishing of outlines that Spivak suggests is basically impossible. To the extent that the composition of the *User* as a biopolitical subject also includes vectors of data—genomic, microbial, microeconomic, metaecological—into the living diagram

of interpolation, then the site of the subject is experienced as fully infused and overcome with extrinsic flows such that the coherence, stability, and confidence previously invested in the visual fade away. The visual outline of the *User* perforates and liquefies because the biological apparatus itself comes to observe its own becoming from the temporal perspectives of the inhuman forces congealing to give it form. Looking inward from the outside, the somatic *homo economicus*, especially the one reflected in the mirror of big data, burns brightest in the sharp relief of its own extinguishment.³¹ As ever, economic imperatives fabricate subjects, even universalizing them as transhistorical actors, only to melt them down as the raw material of another project—in this case, one that is not limited by the self-regard of a single species.

63. Death of the User

In the disappearance, or at least displacement, of the essential human *User*, a multitude crowds into and overflows the evacuated position.³² As the existential incorporation of information into the *User*-subject works to consolidate and then explode its humanist register, it does so by placing the biological materiality of the human subject onto a common plane with other actors and events. It doesn't unwind human privilege into formlessness; it leverages and augments its form with other, perhaps livelier post-human (nonhuman, inhuman, ahuman) agents and subjects. Along a legal axis, this spans from the recognition of the prospective "personhood" of other species (dolphins, apes, rainforests, artificial intelligence, robots) to the formalization of the personhood of corporations, complete with constitutional rights to free speech and to bear arms beyond those of the individual people who may comprise them.³³ We may see interesting combinations of these claims, for example, artificial intelligences or rainforest carbon sinks, not just as possessed by corporate persons but which are corporate persons in their own right and enjoy the political benefits thereof.

We'll visit some of the current denizens of this space, but first, I consider what the appearance of these kinds of posthuman *Users* means for the more general understanding of *User* subjectivization already discussed above (including in the *City* chapter). When "things" are subjects, then what are the "apparatuses" that provide platform subjectivity to *Users*? Only other apparatuses and envelopes? Or do people subjectivize things and give them platform sovereignty through interaction in the same way? Turning momentarily back to Agamben's disposition on *dispositif*, he writes that "we have then two great classes: living beings and apparatuses. And, between these two, as a third class, subjects. I call a subject that which results from the relation and, so to speak, from the relentless fight between *living beings and apparatuses* [emphasis added]. Naturally, the substances and the subjects, as in ancient metaphysics, seem to overlap, but not completely. In this sense, for example, the same individual, the same substance, can be the place of multiple processes of subjectification: the user of cellular phones,

the web surfer, the writer of stories.”³⁴ So while any one entity can surely step into many different *User* positions depending on the demands of different apparatuses, for Agamben the very possibility of that position arises in the interplay between organic and inorganic bodies (and given his example, the humanist agent is the presumed exemplar of the former). He goes on to concede (a half-nod in the direction of Gilbert Simondon, perhaps) that while, yes, it is true that technological individuation is inseparable today from species-becoming (“apparatuses are not a mere accident in which humans are caught by chance, but rather are rooted in the very process of ‘humanization’ that made ‘humans’ out of the animals we classify under the rubric *Homo sapiens*”); the sheer proliferation of such apparatuses demands, however, a different kind of encounter between that (already-formed?) “human” and the bewildering gizmos in his midst, asking strange and unwanted things of him. “It would probably not be wrong to define the extreme phase of capitalist development in which we live as a massive accumulation and proliferation of apparatuses. It is clear that ever since *Homo sapiens* appeared, there have been apparatuses; but we could say that today, there is not even a single instant in which the life of individuals is not modeled, contaminated, or controlled by some apparatus. In what way, then, can we confront this situation, what strategy must we follow in our everyday hand-to-hand struggle with apparatuses?”³⁵ While he goes on to say that that the appropriate response is not one of simple refusal or acclimation, it does not seem for him that the landscape of apparatus might make worlds (and *User*-subjects) through encounters with things other than what he would qualify as (human) “living beings.” In fact, for Agamben, our engagement with apparatuses seems to work in the opposite direction: “We must also immediately consider the apparatuses that crowd the Open with instruments, objects, gadgets, odds and ends, and various technologies. Through these apparatuses, man attempts to nullify the animalistic behaviors that are now separated from him and to enjoy the Open as such, to enjoy being insofar as it is being. At the root of each apparatus lies an all-too-human desire for happiness. The capture and subjectification of this desire in a separate sphere constitutes the specific power of the apparatus.”³⁶ Not only do animals and machines have no place inside this *User* position, they are, he observes, foremost subservient apparatuses through which humans inject, invest, and sublimate their own desires for reconnection (through disconnection). It would seem that by this doctrine, a more active subjectivity for machines and animals is, if not impossible, then at least archaeologically or politically perverse. Things (and other humans) are what make humans into subjects; humans don’t give subjectivity to things, nor do things do this for other things. The “third class” of subjects between “living beings” and “apparatuses” is his diagnosis, now a unidirectional accomplishment.

Everyday examples suggest that this provides an inadequate explanation of the apparatus and platform sovereignties, and an empirically suspect description of how the contemporary career of the *User*-subject is formulated in apparatus economies. Clearly

sometimes apparatuses (e.g., machines, systems, animals) are the *User*-subject of and for other machines, systems, and animals without the immediate human involvement and interference, though human-directed invention may set the stage for these interactions. Sometimes these *Users* are living, nonhuman beings with rather different desires regarding the recapture of some lost animality (in that they are already on the other side of the human-animal political divide, as articulated by Agamben in *The Open*).³⁷ Perhaps as living systems, their valence and variance is encapsulated by the consistent encounter with a particular apparatus, such as a rainforest whose “inputs, states, and performance” are sampled as a continuous calculus by ambient sensor arrays. Sometimes they are not living at all in any conventional sense. Machines possessing varying innate capacities or artificially imbued intelligences can work from the position of the *User* with Stack systems at every layer and are addressed by those layers in ways that are functionally agnostic as to whether such agents are motivated by human desires or not. It is still important to recognize that any one machine, just like any human, can be subjectivized by different external systems in different ways, and so can take on different effective profiles, just as a person does. The available range of *User* positions that a machine can inhabit is as diverse as the demands and interfaces that are made available to it. Its possible performances are also as diverse as those of any other *User* that derives its platform sovereignty by interacting with the surrounding apparatus and envelopes. We anticipated this decentering of human perspective in describing the potential plurality of deep address haecceities, invoking potential *Users* across an abyssal spectrum of scalar abstraction and physicalization. Of more immediate concern for the *User* layer of The Stack, however, is to understand the multidirectional and mutual capture of being (living or not), apparatus, and subjectivization. Giving them more depth, Agamben’s formulation echoes theories of machinic prostheticization, so important during the McLuhan era, whereby “Man” pilots various tools and technologies through which he extends himself and becomes reembodied by those media.³⁸ The high-tech Vitruvian Man, radiating waves of “desire” and “needs” out through the successive concentric relays of television, architecture, automobiles, and robotics, is like Earth within Ptolemaic astronomy, always sited at the center of his technical cosmos and believing his own perspective view rather too much. Economies of prostheticization are in fact important to understanding the posthuman *User* position, but their shape is not that of a one-way concentric radiation, from human into apparatus. It is, rather, a crisscrossing field in which humans themselves are just as likely to be the prostheses, and the apparatus is just as likely to be the *User* that prostheticizes the human, as the other way around.

If, as this book argues, technologies can be defined by the quality of accidents that they produce, at least as much as, if not more so than, by the uses for which they were intended, then for The Stack, we can include the universal—once again human and nonhuman, living and nonliving—*User*-subject among these. Foregrounding the fact

that this subject need not be human in order for it to constitute a relationship with other agents and apparatus suggests some conclusions and projects for the *User* layer. The first might suggest that the *User* is an obnoxious subject, derived from the simple-minded and self-affirming utilitarianism of consumer cybernetics and defended mostly to make humans easier to locate and monetize as end points in systemic relays. In this light, putting nonhumans into that *User* position should be seen as a temporary station at best, but perhaps a means to invent different kinds of agencies, not just mimicking this degraded human. We must save the nonhumans from being merely humans, so that they could show us a different way for us to be both human and not. Another project might steal from the surfacing of posthuman actors through the medium of the universal *User*, that these simple utilitarianisms cannot hold and that the psychological-utilitarian *User* is thereby recast in a far less reductive and less familiar light. In its place we imagine a re-wilded landscape of inhumanist intentions, mapped by multipolar points of control, composing a more polysynchronous and less chauvinistic system of systems. It is probably prudent to acknowledge the first conclusion and design on behalf of that second project. In doing so, we should pay special attention to the risks incurred by legacy *User* positions, including the tendency to individuate the subjective outcomes of interactions with The Stack's apparatuses and envelopes. With these caveats at hand, we examine the work of nonhuman *User* in three exemplary guises: animal *User*, artificial intelligence (*AI*) *User*, and machine *User*.

64. Animal User

For McLuhanite prostheticization, we invest and amplify agency by projecting it away from ourselves and into specific parts of the world, such that our embodiment might be augmented by the capacities of those objects (a hammer's solidity) just as that object is augmented by our soulful agency (the hammer knows what to hit). In this cooperation, the world folds into the extended will and wisdom of the human body, but today, the reverse of this fold is perhaps a more critical process for exploration. The biological informationalism of the *universal* and *absolute User* also turns the animal-human body into another kind of matter, leading to a decentering disenchantment of its agency. Instead we watch the world fold into the body, now itself a prosthetic extension of that world, correlated and piloted by it. In this *reverse prostheticization*, the human figure is set in motion from some other position in the field; the subject becomes object, self becomes substance, body becomes metabolic reserve, food machines consume you. Even for such multipolar mutual extension, the influence and self-identity of human subjects are by no means excluded (just look around you), but it is made conditional by multidirectional chains of association and by the recognition of previously inert media as potential colleague *Users*. In particular, animals are

one key metabolic reserve that have been essential, if not always willing, enablers of human evolution. Proteins in their flesh were consumed for ours, their skins became our clothes and allowed migration to new places that we explored while riding on their backs on our way. The terms of this relationship already seem ugly. As the unfolding disenchantments brought by genetics, neuroscience, and evolutionary biology continue to undermine the human/animal distinction (according to Agamben, critical to the historical provision of political sovereignty onto the former), the contested space of animalian identification has been the site where posthumanism is being actively articulated for the humanities.³⁹

To map that multipolar field, an idea of inverse prostheticization is necessary to pinpoint symmetrical reversals of the human/animal distinction, where the human is now ridden and no longer the rider. The physiognomic, communicative, and emotional continuities and discontinuities between species are restaged by mutual identification and invention, exemplified by robotics laboratories that draw from animalian anatomies to solve for locomotion and adaptation: robot dogs, robot fish, robot birds, robot insects, and so on. For human purposes, the graduation from biological to synthetic animal machines is not difficult to understand—there is no design without some biomimesis—but what those animals might make of their robotic cousins is another matter. Surely perhaps some of the attraction and wariness that humans feel for humanoid robots might be played out for them as well, including fascination, indifference, and hostility. But instead of transposing animal machines into robots, how might animals *use* robots? What does it mean to install an animal body into the *User* position of a complex robot, especially an animal with whom anthropomorphic identification is all but impossible? Back in 2004, Garnet Hertz designed a table-sized mobile robot, navigable through a rollerball interface, and introduced a Madagascar hissing cockroach into the pilot's nest.⁴⁰ When cooperative, the cockroach did what cockroaches do and scurried about on the rollerball, which in turn caused the entire robot to scurry around the room like a giant cyborg cockroach, because that is exactly what it was. The effect was startling and uncanny, and it had everything to do with the degraded station of the cockroach. The creature occupies some liminal space between animal and matter, living dirt, filth that is but should not be in motion. If dirt is “matter out of place,” watching the living dirt in the driver’s seat of complex technology is upsetting, a sensation that runs up and down the spine of autonomic prejudice.⁴¹ This is so, first because the unequivocal *User* in this demonstration is a bug, that all-purpose figure of primordial mindlessness and repetitious swarming aggregation, and second, because the robot prosthesis amplifies the scale of the bug’s “intentions,” transforming it into a grotesquely outsized coparticipant in our immediate habitat. The observer is forced to identify with the cockroach as a fellow *User* and to do so despite the absolute minimum of Cartesian credentials that it may possess. Cybernetics, of course, refers

to the piloting of systems, and Garnet's roaches, now learning to fly, present a precise example of subjectivization through the apparatus because of, not despite, their dubiousness.

But the shifting of relations between humans and animals, mutually co-constituted by shared interfaces, needn't be limited to placing animals in isolated control over more and more complex prosthetic technologies, letting them find their own purposes in The Stack, as wonderful as that design brief surely is. The positioning of human and animal as *co-Users* of interfacial platforms also demonstrates the scope of communication and identification that is possible when both occupy symmetrical locations within the platform. OOZ is a series of projects led by Natalie Jeremijenko, that seeks to expand from the restrictive and hierarchical forms of human/animal encounter available in zoos, where animals are trapped in place for observation but really where communication between species is at best serendipitous and at worst systematically suppressed. The project description explains that "unlike the traditional zoo [OOZ] is a place where the animals remain by choice, a zoo without cages. Like a traditional zoo, it is a series of sites where animals and humans interact. However, the interactions at an OOZ site differ from that of a zoo. OOZ is interactive in that it provides human a set of actions, the animals provide reactions and these couplets add up to a collective pool of observations and encounters. The human/animal interface has two components: (1) an architecture of reciprocity, i.e. any action you can direct at the animal, they can direct at you and (2) an information architecture of collective observation and interpretation." The basic proposition is then extended in several instantiations featuring variously robotic geese, human-goose language translation media, bird art, amazing birdhouses, amphibious architecture, restaurants for fish and humans to share a common meal, stages for human/bat encounter in dense urban settings, and so on. The project employs of a kind of expanded interaction design, and its built-in structuring of the *User* position, as a way to leverage a rotation in pervasive and unnecessary asymmetries between human and animal actors in general: animals are no longer prosthetic channels and metabolic reserves but collaborative *co-Users*. This is not only for the benefit of the animals but also as a way to allow curious humans an introduction to the fascinating lifeworlds of our neighbors and to experience more satisfying sorts of communication with them. Critical to this is the design of reciprocal interfaces in which both sides of the interfacial membrane have equally impactful (if not always identical) means to affect the other. Here, that multipolar field for which the *User* subject position can be inhabited by a plurality of individual and aggregated agents draws not on the prosthetic radiation of control, in either direction, but rather on leveling the species-agnostic *User* position toward the open invention of alternative common interfaces.⁴² The impetus for Agamben's plea that the essential accomplishment of the subjectivizing apparatuses is to "nullify animalistic behaviors" is also put to rest.

65. AI User

It may be that the deprioritization of the human *User*-subject within The Stack as a whole is made that much less frightening by interfaces designed to invite anthropomorphic empathy and identification. As of this writing, Siri for iOS is one iconic version of this new form of interface. Its significance is not only that it is voice-activated instead of mouse-click controlled, or that it responds to *User* inputs in synthetic spoken language, but that it is designed as a nascent form of an artificial human personality. We are invited not only to interact with iOS, and through the operating system with the semantic web (or at least the parts of the web that Siri knows how to search and process), but also to interact with Siri herself. The development of the *User* is also driven by the ability of artificial intelligences, simple ones and complex ones, to enter the *User* position and engage The Stack directly. They do this on the direct behalf of a human *User*, and they do this with or without human supervision, such that the human is in a way Siri's *co-User* as much as the other way around.⁴³ So then, who is Siri and who (or what) would the wider population of similarly personified interfaces/bot agents become? As the base model of the ideal assistant, her personality is specifically defined in relation to what the range of options might be, but her supposed neutrality as a universal assistant is highly contestable. She is one individuated person, not a plurality or multitude or composite. She is by default setting female in gender. She possesses a kind of patient and understated omniscience. Though a bit hard of hearing, she is extraordinarily reliable, and by the same turn, she is reliably subordinate. When asked strange things, she may demonstrate a dry sense of humor. She is also invisible, possessing no face, like Charlie on *Charlie's Angels*. She is always there, but also apparently spending her time elsewhere when not actually here. All of these specific qualities need not define the personified agent as they do.

In 2012 (before Spike Jonze's film *Her*), a group of my undergraduate students who wished to explore other alternatives began developing Siri-like assistant apps based on alternative, often fractured personalities. Departing from the supposed neutrality of Siri, these artificial borderline cases would engage in less generic sorts of *User*-Stack relationships, not all of them healthy or immediately recognizable. Some of their assistants were moody and unreliable. They may give answers based on their jealous analysis of your recent wall posts and try to trick you into paranoid suspicions about your friends. In time, similar alternative personality assistant Apps may demand absolute fidelity and suffer virtual death when it is revoked, like a passive-aggressive Tomagotchi. At this same time, it may merge with other Apps to perform spontaneous amazing feats on your behalf. Their interest went beyond persuasive interaction design gone sideways and was based more on what kinds of complex cognition and interaction are sanitized out of synthetic *User* agency and how weaving those wooly leftovers back in could point in more interesting directions. The results differed from Siri in two key ways.

The suite of assistants they designed were not meant for one imaginary *User* for whom Siri's personality is "universally" appropriate. Instead they developed idiosyncratic and culturally specific agent personalities. Their menagerie included agents for specific ethnic experiences, familial niches, curatorial perspectives, and *User* predicaments. Each would be finely tuned to a certain *User* but irrelevant to most others. Second, the agents were in different ways unreliable. Their personalities were defined by contradictions and mixed motives, much like human personalities. They may be manipulative or insecure, prejudiced or forgetful. The design issue here is not that broken tools are better, but that in designing interfaces that resemble a familiar mind, it may well be that vulnerable and limited artificial personalities invite and support deeper identification and loyalty from human *Users* than generic and predictable ones.⁴⁴ The fifth edition of *Diagnostic and Statistical Manual of Mental Disorders* may prove essential reading for programmers of the next decades full of Siris.⁴⁵ If Siri is just the tip of a AI interface iceberg, then to presume that "she" should be so defined by C-suite master-slave small talk is already to presume too much. The full spectrum of weirdness, based on actors passing information into and out of one another, is a richly reticulated space, and approaching it as such makes those clichéd relationships moot. We need to ensure that AI agents quickly evolve beyond the current status of sycophantic insects, because seeing and handling the world through that menial lens makes us, in turn, even more senseless. Something else needs to sideline the vestigial, embarrassing anthropocentrism that brings the false flattery of passive (or passive-aggressive) assistants. In fact, the stage management of the human *User* as somehow commanding the work of the App is already, we may conclude, an unnecessary alibi protecting the essential opposite effect (that the mammal *User* is only a provisional mechanism for dragging gigaflop tracking devices through the avenues of cities and for remonetizing these routes as the spatial career of algorithmic capital and its successors).

Put differently, bots are *Users* already, and we are already well past the point in which more than 50 percent of Internet traffic is generated by nonhuman users.⁴⁶ As far as The Stack may see it, humans are a privileged *User*, but a shrinking minority, even as the next billions of them come online over the next decade. Similarly, the role for HFT algorithms is indeterminable, even though they do not speak at us they do speak for us, and we can assume that if similar forms of weaponized mathematics become more normative, then the plural and partial nature of any individuated human *User* subject interest and position may be that much harder to keep straight. In the ongoing technologicization of intelligence, we see cute slippages of position between humans and machines. For example, the original mechanical turk in the eighteenth century was a chess-playing machine, apparently an automaton exhibiting human intelligence, but in fact operated from afar by a human *User*. Today Amazon Mechanical Turk restages this arrangement, not just for chess but for any menial task the *User* can devise. Behind the browser are at least half a million "workers" who complete piecemeal tasks for

micropayment.⁴⁷ We see not AIs appearing as if they were human, but humans appearing as if they were AIs. As it's been since Karel Čapek's "universal robots" introduced on the stage in 1921, the robot not only mimics the human, but provides a portrait of the human as an object viewable to itself from the outside, and with the human negotiates an ongoing dance of reciprocal idealization. And in itself, this may signal less a mechanistic subsumption than a wider berth for incentive mutual identification between *co-Users*.

66. Machine User

The machine *User* comes in many different guises and in a variety that is difficult to summarize and characterize. It can refer to almost any kind of automation or machinic process, if drawn broadly enough, or to very specific instances in which an apparatus is designed to operate in exact relation to other apparatuses, as if it were something like Agamben's "living being," which becomes a *User* subject through this delicate interpolation. For the latter, robotics will play an increasingly important role, and not just as a subgenre of biomimicry. Their expanded field would be populated by subjects and objects, of varying degrees of anthropomorphism, that animate the *User* layer of The Stack by internalizing flows from the other layers and sending them back down in columns of intentional action. These include machine *Users*, individuated as discrete addressable entities within interfacial regimes and more diffuse aggregate *Users* interwoven into background infrastructure, and various combinations of both. Some may be tightly bound to remote human control, such as the da Vinci robotic surgery system, and others may be programmed to operate and locomote with relative autonomy, such as sensor arrays or mobile surveillance robots.⁴⁸ The most complex of these blend in such a way so as to displace what has been a well-established form of human-machine-infrastructure interaction, one so well established that cities are designed to accommodate it. That blend inserts networked machinic control at different points, including computational augmentation of human agency over the system, or over the machine in which the *User* is installed, and of the infrastructural landscape in which those machines swarm together. Among these scenarios, the integrated design of driverless car navigation interfaces, computationally intensive and environmentally aware groups of cars and street systems that can stage the network effects of hundreds of thousands such speeding robots at once, would have a dramatic impact on everyday urbanism. The "automobile" is a mobile *Cloud* apparatus inside of which *Users* navigate the *City* layer according to augmented scenery, interfacial overlays mapping addressable haecceities of interest, and suckling chemical energies from, one hopes, a sustainable and equitable grid. Inside the fast box, the world doesn't only pass by as interstitial nonplaces between departure and investigation; the kinesthetic momentum of a world passing becomes homelike, the default state against which stationary

location is measured. The human *User*-passenger, drifting through an architecture of displacement and suspended proprioception, is symbiotically reliant on the apparatus, itself a machinic *User* of the wider infrastructural systems around them to provide not just transportation but an artificial somatosensorium.

This massive mutual prostheticization (a form of nested parasitism, even) takes time to arrive, and the mediatization of the automotive experience did not arrive recently. Many years ago, I jotted down these notes while stuck in a particularly slow traffic jam:

Sitting in traffic on a Los Angeles freeway, I am reminded of Joan Didion's revelation that this trap is the most authentic Angeleno social experience. We are not going to any place, all lined up behind our windshields, we are all already there.⁴⁹ Today, bumper to bumper, we are now all also talking to ourselves, taking meetings, texting, emailing, Googling, checking on this and that, editing essays on our phones. This is the home and office. We do not always need to arrive, because we are already there: if this was your home, you would live here by now. ...The freeways as boulevards of "fast parking" are a grid that segments and enables an inertial sort of mobility. Ensconced in our furtive provisional networks, the car is no longer the primary technology of mobility, even in LA. The car has gone the way of the building: too slow. ... By the time Reyner Banham arrived, the car had eaten LA, but now the smartphone is eating the car.⁵⁰ The "mobile" first appeared in 1970's as a "car phone" but now the terms are reversed. In *The Transformers* movie, the alien robot became a car and the phone became a robot. Here now, the car becomes a phone (as the car, in turn, becomes a robot). ... As the economy of mobility slides from mechanical to informational the car is augmented by hands-free telephony, Bluetooth networks, in-dash GPS navigation systems offering visualised or spoken directions, audio jacks, big screens counting down the drops of fuel while talking to you in weird accents, and emergency concierge communications by built-in satellite intercom. The handset does all this too, steering us in different directions by maps, recommendations, search results, tags and so forth. The phone and car find ways to subcontract each other's functions, one to the other and back again. ... In ways that would have made no sense in Banham's Los Angeles, the car's interfaciality is an important criterion of performance as a personal vehicle. The most visible change to the car in recent years is in the display electronics within its primary interface, the dashboard/cockpit. If the grille on the outside used to be the car's face—its look—now the face comes with the voice and is seen (worn?) now from the inside, in the driver's seat. That most brandable experience is not the profile of the car seen passing through the world, but rather how the world looks gazing out through the lens of the car. ... The car+phone hybrid is a mass medium, a mobile cinema + micro-urbanism for one driver/user, a habitat organised and narrated by data networks. But in the end, they are not equal; the handset is the ascendant vehicle, and the car is the architecture in slow disappearance.⁵¹

In conceptualizing how Stack transportation might evolve, it's tempting to suppose that the aggregation of systems into central platforms at the *Cloud* level would be replicated at the *City* layer such that atomized vehicles (such as cars) would be agglomerated into larger urban, regional, and continental megavehicles (such as high-speed rail). The economies of scale that are possible by regularizing and extending itineraries might parallel those of regularizing and monetizing other kinds of social interaction

online. Elon Musk's perhaps real and perhaps speculative Hypertube project, which would send humans whooshing up and down California inside what is essentially a giant pneumatic tube, is exemplary, as is the tendency for cities to strategize economic growth through the enhancement of their airports (now "aerotropoli") ensuring their inhabitants easy access to the rest of the global urban grid.⁵² Implementing such systems is obviously very expensive in both time and treasure. In addition, these existing car-based systems would also be consumed by The Stack and transformed into *Cloud*-based platforms that could provide many of the same advantages, and more besides, least in theory. Currently several at-least-partially autonomous unmanned ground vehicles are in regular operation; driverless mining trucks, for example, move millions of tons of dirt without a human behind the wheel, and driverless tractors plow fields controlled remotely by V2V (vehicle-to-vehicle) networks.⁵³ Within cities, the implementation of automotive automation has proven more difficult, as evidenced by the retreat from initial designs for personal rapid transit transport in Masdar City, Abu Dhabi (as well as the ill-fated Aramis project in Paris, as chronicled by Bruno Latour—planned and re-planned, but never built).⁵⁴ The best-known autonomous car project, as yet to launch services commercially, is of course that spearheaded by Google. It is not so uncommon to see Google's prototype vehicles, decked out with telltale gear on the hood, pacing along particular streets in California. Much of the earlier work at Google on these technologies was done by Sebastian Thrun, who famously announced that a full-scale automobile automation system would save "one million human lives per year" by preventing accidents.⁵⁵ As said, Google's interest in mass transportation goes back further (at least Page's Ann Arbor monorail).⁵⁶ It seems quite natural that someone with an interest in the engineering of global platforms would either begin or end up with transportation, but whether one sees the Internet as a "superhighway" or the hundreds of millions of cars in motion at any one time as very large "data packets" makes all the difference in how the issue is problematized and formulated.⁵⁷

Just as your mobile is not really so much a "phone" anymore (it too is a *machine User*), the Google mobile apparatus should be understood less as a car than, as said, as a car-shaped end device within a larger *Cloud* platform. It is a robotic device that a person gets inside and which carries her around. From the perspective of The Stack, it is also a composite *User*, built of augmented human perception as well as the individuated profiles of the human "passengers," the manifold addressable systems of the rolling device, as well as its changing inputs, states, and performances as it travels around from site to site. The same human profile may enter and exit this shell, just as the car device may incorporate many different human *User* profiles in the course of the day. But when in motion and hurtling next to other cars, the encapsulated actor may temporarily be seen as one *User*, for whom the whole system must optimize a uniquely ideal path. The real impact of autonomous vehicular *Cloud* devices does not appear until their movements can be coordinated not *User-by-User* but as components in a

streaming swarm.⁵⁸ In theory, when synchronized by shared situational awareness and communication, whole herds of them may speed within inches of one another without worry of imminent collision. Should one brake suddenly a mile ahead, those behind would brake instantaneously instead of hurtling into the cascading pile-up. Cars going long distances could be clustered into long trains and fast-tracked away from local traffic. In this, many of the goals of PRT (personal rapid transit) systems (such as Aramis) might be realized by upgrading existing systems in this way. The systemic integration of vehicles would also have an impact on the economics of ownership, financing, and insurance that make car ownership more onerous today by shifting driving toward service-based platforms. *Users* may subscribe to a fleet of driverless cars available to them at a moment's notice, and so can forgo the sunk costs of purchasing a machine they might use only a few minutes a day. For carbon-intensive products such as cars, a very large-scale shift toward using but not owning would at once save resources and offer greater end *User* convenience, not to mention the benefit to urban planners no longer having to waste valuable land on parking lots to store cars that will sit idle.⁵⁹ The mass medium of swirling textures of robotic computational exoskeletons would also suggest innovations in the phenotypical outer surfaces of the devices themselves. They can in principle touch, connect, and intersect with one another, switching from singular to plural according to circumstances, and so the rather rigid shell and chassis form we know today could give way to other flexible morphologies. At the very least, as we are shuttled here and there in the vast multitudes of such machines, how human *Users* are physically positioned and what we spend our time doing will certainly not be the same as it is now.⁶⁰ As discussed in the *Interfaces* chapter, as the “car” becomes a *Cloud* platform, it becomes available to an Apps economy, and to the extent that the Google Car is just a very large Android device with a very large, next generation Google Glass display, there is much for designers to work with.

At the same time, such a system would bring potential problems of the same order of magnitude as those it alleviates. The software and sovereignty questions don’t abide easy answers. First, the legal identity of this composite *User* is not immediately clear. Several states have already passed legislation indicating that autonomous vehicles are legal to operate on their roads, thereby establishing the baseline that such machines are at least not criminal. But considering the quantity, complexity, and sensitivity of the data generated by such technologies, all working in concert, as well as the expertise and infrastructure necessary to conduct the rhythms of the swarm safely and effectively, it’s not likely that any Department of Motor Vehicles is a likely candidate to govern a network of pilotless vehicles. Who is, then? Is the working presumption that over time, drivers will subscribe to personal mobility platforms that operate with sufficient autonomy from the agencies ill equipped to monitor anything of this sort? When would such a platform, linking cities and vehicles into one metamachine, require clearance from every single state legislature for intercontinental cargo traffic to flow? Surely the

National Security Agency has something to say about all that geolocation data. In short, the roads themselves may be where some of the most contentious and important friction between emergent *Cloud Polis* and the state over the geography of jurisdiction will play out. As discussed in the *Cloud* chapter, the interweaving of multiple and incongruous sovereign claims often hinges on how emergent platforms problematize and repurpose existing platforms (such as the intercontinental highway network and its federal stewards), and by how existing platforms steer that emergence toward its own publics.

Moreover, the psychological anguish of relinquishing driver status would likely ensure whatever policies are initially put in place may be irrational and absurd. Today the populist backlash against smart meters installed in residences as end points of more efficiently managed energy networks is *nothing* compared to the resistance (both legitimate and delusional) that will meet the sunsetting of human-driven automobiles. In important ways, however, the moral high ground may be with the robots. Gary Marcus writes, “Eventually (though not yet) automated vehicles will be able to drive better, and more safely than you can; no drinking, no distraction, better reflexes, and better awareness (via networking) of other vehicles. Within two or three decades the difference between automated driving and human driving will be so great you may not be legally allowed to drive your own car, and even if you are allowed, it would be immoral of you to drive, because the risk of you hurting yourself or another person will be far greater than if you allowed a machine to do the work.”⁶¹ Be that as it may, and despite the systemic benefits to humans, there will be teeth-gnashing animosity to the call for humans to abdicate so much of the *User* position to the apparatus. It’s not quite a Copernican trauma, but it will be taken as an insult. In relation to infrastructural systems, the position of the *User* is one of at least partial or provisional sovereignty (per the discussion in the *City* chapter of what informal territories, physical and virtual envelopes, provide to *Users* in motion across state geographies). The interweaving of human and nonhuman bodies and *User* subjectivities is a radical extension and amplification of practical sovereignties (i.e., extending the freedom to move and ensuring against accidental death). For many, however, it will be seen instead as an unholy and unacceptable relinquishing and diminishing of self.

That said, there is no doubt that a technological assemblage such as this, drawing on all layers of The Stack at once, perched on uncertain and ineffectual regulatory concepts and methods, installed unevenly through often dysfunctional urban fabrics, carrying our very persons in its clutches (and so on), will also innovate massive new genres of catastrophe (though with over a million people killed in cars every year, those catastrophes will have to pass a high bar to be worse than those they’ve displaced). They mirror the vulnerabilities of The Stack as a whole, vulnerabilities of centralization and standardization, of universalization and interconnectedness, of energy breaches and code failures. A recent demonstration showed just how easy (fun and scary) it is to commandeer today’s cars by hacking their electronic control units: turning off brakes,

indicating a full tank when empty, indicating the wrong vehicle speed, initiating the self-parking system while driving at 60 mph, sounding the horn randomly.⁶² The implications for what might be possible when similar Fluxus mayhem is orchestrated at the scale of an entire *City* boggles the mind. As Marcus puts it, “These driverless cars will be safer, but when accidents do happen, they may be on the scale of airline disasters” though he may be off by an order of magnitude or two, depending on how deep and pervasive the *Cloud* vehicle platform does or does not become.

67. From User-Centered Design to the Design of the User

These three models for the design of posthuman *User*—the animal *User*, as exemplified by the design of reciprocal interfaces between species; the AI *User*, by the design of idiosyncratic companion personalities; and the machine *User*, by the infrastructural driverless car platform—in no way exhaust the range of problems and opportunities, but they are instructive in several important ways. First, their dynamics aren’t contained at the *User* level into a single subject position. Beyond the *User* and *City* circuit, they draw all layers of The Stack into volatile but particular configurations, such that a design intervention at any other layer (*Address*, *Interface*, *Cloud*, or *Earth*) could determine the character of the whole, and in turn configure the *User*’s position differently. Second, they don’t simply replace humans with nonhuman actors, but incorporate diverse living and nonliving agents into nonexclusive assemblages, from which any of them can come and go and still retain their unique profile. As design problematics, the models in different ways also demonstrate a principle of the *platform within a platform*. That is, for each scenario, The Stack metaplatform provides interoperability through the central coordination of information produced and consumed by autonomous, if also regularized, *Users* at the far edges of its networks. But the incorporation of many different types of actors (human, machinic, bots, animals, infrastructures) into recombinant *User* assemblages, all with differing regular morphologies and temporalities, means that inside the *User* position itself, rather different kinds of platform logics between individuated actors can occur. That is, not only is the *User* served (and does it serve) the platform logic of The Stack, but the possible form and affective content of the *User* position is itself engaged by different intelligent actors negotiating among one another. That empty shell of the *User* position is itself a microplatform within the macroplatform of The Stack. Finally, as the future governmental complexities of a continental-scale autonomous *Cloud* vehicle system in full bloom make clear, the surfacing of *nonhuman Users* can’t simply inherit legacy sovereign positions available to humans, like citizen or legal individual or driver or “person.” They don’t fit, and the *Cloud Polis* we will constitute with them will have to include other durable, enforceable political positions for human and posthuman *Users* alike. The development of these new sovereign formats necessitated by the revelation of nonhumans in *User* positions, may

be the most effective driver for retooling how the territorial visions of nonstate *Cloud* platforms and state *Cloud* platforms intersect and collide. In short, as more and more unlike figures come to occupy the *User* position, smashing up against one another and plugging into one another, they contort that position into different shapes, sizes, and durations. As such, design cannot possibly continue to refer to “user-centered design” without a radical complication of each of these terms (or risk reactionary failure), and so as new actors crowd that position, the longer-term geopolitical design problem is *the design of the User itself*—its limits, vulnerabilities, velocities.

Cockroaches, Siri, and driverless cars, taken together, make a strange confederation, but from the perspective of The Stack, no stranger than the Reids, the Hagans, Larry Smarr, or you or me. At the same time, this agnostic flatness of the *User* subject does little by itself to adjudicate what the “best” “sovereign” position for any of these *Users* might be. While we are optimistic that posthuman *Users* contribute in some way toward a post-Anthropocenic geopolitics, that does not mean necessarily that visualizing Siri’s carbon footprint or mapping the microbial biome in the cockroaches that pilot Google cars is the shining path. To date, much of the discussion about the political “rights” of the *User* have conflated the “property rights” (and privacy rights) of a computer’s owner with the interests of a *User* who may or may not own his or her apparatuses. The scope of rights that the individual owner to protect his machine and information from surveillance, malware, DRM, and spyware, for example, has animated discourses around data freedom, cyberlaw, and the electronic frontier for decades now, and as the NSA revelations show the disturbing depths of how far these policies (if that is even always the right word) have skewed. For as much as is at stake in these controversies, the focus on individual privacy and autonomy from systems does not help frame how *Users* that do not own the computational systems with which they interface (which is to say almost the entirety of The Stack itself) can assert their interests. Cory Doctorow’s “The Coming Civil War over General-Purpose Computing,” draws several dark scenarios for what happens to human *Users* who may be renting (financing) biomedical robotic components (e.g., artificial eyes or legs, cochlear implants) and for whatever reason are not able keep up with the financial terms of this particular “use/not own” service economy. It cannot be acceptable for a biomedical *Cloud* service provider to suspend service on the smart medical components that the provider owns, leaving the *User* blind or immobile or deaf. Surely the *User* that merely uses and not owns should be able to assert individual interests against the harm brought by property rights to determine what an apparatus may or may not do.

For The Stack, this issue is crucial. As discussed in the *Address* chapter, as computation becomes a general property of all apparatuses, from the implantable to the infrastructural, then over the course of the day, a human actor may be the *User* of thousands and thousands of different “computers” at various scales and in various collaborative combinations with other actors, human and otherwise. A program by which that *User*

position is always subservient to the sovereignty of property claims made by the owner of the apparatus itself, whether on behalf of state publics, corporate *Cloud* platforms, or distant individuals cannot possibly scale. While there may be versions of The Stack megastructure that could withstand and even enforce that kind of totalitarian monologic, to do so would likely go against the catalytic platform logic for which end *Users* in the network regularize autonomy so as to introduce information, modify it, and reprogram the whole according to local and instantaneous needs. Clearly the better design strategy is instead to imbue the *User* who is *not* the property owner (and who may never own property such as a robot or an animal or a rainforest) with some real control over his or her relations to The Stack, as broad or as delimited as any one of those addressable relations might be. Even if the *User* position is occupied by software, such as Siri, this model is in some ways the opposite of the Taylorist archetype of the *User* as automaton. In practice, this means not just that the specific entity that may enter the *User* position requires some form of sovereign identification, but also that the columns that this *User* makes up and down The Stack, linking intention through interface, to addressable haecceity in the *City*, to energy-intensive *Cloud* provision and back up the column to another *User*, do as well. An alternative is to address every single *User*-Stack relation and every column initiated as a discrete haecceity and as the instantaneous mutual property of all the actors contributing to its realization.⁶³ However, this leaves the simplistic notion of sovereignty derived from property unimproved, and as a design solution, it merely translates the opposed interests of some owner-*Users* and some tenant-*Users* into the legacy vocabularies of a property conflict and all the structural inadequacies that entails. It does nothing to adjudicate their claims, or enforce the mutual interests of good actors, or protect them from the cost of bad actors, and more.

The *User* cosmopolitanism on offer at the Shanghai Expo to the Reids and to all the rest of us is based on the constitutional precondition that total statistical transparency of the *User* as the composite weight of his interactions is the price to pay for political voice, exit, or entrance. For some, that social nudity may be nonnegotiable, whereas for others, privacy and opacity are just like other premium services and allow them some measure of protection.⁶⁴ Framing the *User* as a free agent whose person, privacy, and actions are his property to be leased and fortified according to market demand, and couching *User* sovereignty in privacy markets, is but one suspicious point of agreement between Assange and neo-Austrian libertarians.⁶⁵ “Privacy,” of course, is a deeply paradoxical ethos that does very different things under different circumstances.⁶⁶ The axiomatization of individual privacy as a first-order principle of political systems is also a salve for those made insecure by an insulted sense of self-command, and it’s a very limited program for the geodesign of the *User* layer of The Stack. Counterintuitive as it may seem, the design decision should not be to locate sovereignty in the encapsulated person who steps into the *User* position but instead into the position itself.⁶⁷ Particular agents may step into or out of composite *User* assemblages (as tangible as

a Google Car or as intangible as a trace over time), and their interests do not remain stable as they do so. From The Stack's perspective, the *User* is both the edge-state on the other side of the *Interface* and the agent initiating columns back down into its layers; it is defined by what it connects to, not by who or what it "is." In a way, the NSA revelations demonstrate this. The target of message interception in many cases was the metadata attached to any communication of interest. "It's only 'metadata,'" some scoffed. "What's the big deal?"⁶⁸ Of initial interest is how a particular thread within the larger landscape is located in time and geography, what systems and networks it passed through, and, most important, the corresponding metadata for the receivers of the thread. From these, we believe that analysts can reconstruct specific networks of *Users*, monitoring their rhythms and intensities.⁶⁹ While the semantic content of what a message says is obviously of some interest to the analyst, in order to knit the haystack in which needles hide, he collages metadata to reconstruct its patterns. In the terms of The Stack, this is more directly a policing of columns than it is of individual persons who are *Users*. The regular channels of association across layers and scales become the target of opportunity. Palantir's analysts, for example, use the company's software to provide structure to unstructured government data, and so their work provides for us at least a reasonable model for the sort of activities that Snowden's leaks shed light on. But instead of watching from some sterilized perch, even the *User* of the Palantir software is participating in the tracing of the column. "Palantir's central privacy and security protection would be ... 'the immutable log.' Everything a user does in Palantir creates a trail that can be audited. No Russian spy, jealous husband or Edward Snowden can use the tool's abilities without leaving an indelible record of his or her actions."⁷⁰ This meta-metadata recursivity is a key aspect for how such systems function. The fact that analyst B has already established links between persons X and Y becomes the trail that analyst C explores. *The query becomes the quarry.* Meta-meta-metadata of any event in the world becomes in a sense the event itself, and just like you or me, the event itself, the column, also secretes more information that it contains within it. The policing of columns, their metadata, all the way down into the abyss strongly suggests that tolerance for vertigo is an important attribute for designers of Stack governance.

The expansion of suffrage toward ever more universal inclusion is almost always met with indignance (at the very least) by many of those whose privileged position is shifted that much off center. The same is true for Copernican rotations of human autophenomenology off its axis. When the two combine forces, there cannot not be trouble, and the ongoing geopolitical surfacing of the posthuman *User* will be a far more complicated political and anthropological event than is a technological one.⁷¹ Engineering for animals, AI, and robots is much easier than designing and enforcing the terms of their participation acceptable to those now asked to make room, but what some will call a fundamentalist reification of the atomic private human as the sovereign core for the *User* layer of The Stack cannot sustain that engineering for very

long. It's not sufficient. In the short run—yes—the blunt-edge illuminations regarding surveillance platforms are to be defended against duplicitous cynicism and opportunism; but in the long run, the agenda that matters most is that another *User* position must be composed and defended. The atomic citizen *User*, forever scandalized and seeking revenge against the inevitable failures of a enemy regime, wearing sacralized revelations of wrongdoing, cannot be depended on to provide the resilient geopolitical design that is required. Assange can nail his 99 Theses to the virtual door of power as many times as he needs to, but it will not bring forth the necessary atheism but rather retrenchment of the wrong fundamentals. I believe that instead of pleading the Jeffersonian wounds over and over, the more radical and prudent line of sight is toward carving defensible space around the nonhuman *User* in order to explore the literatures by which human beings can become part of their set. This plays with role reversal and drag, as in Jean Genet's *The Balcony*, or the old Google Glass App that let the *User* control the pitch and yaw of a quadrotor drone by tilting his head, even though we all know the drone is really controlling his neck muscles (sic).⁷² Recording becomes playback and playback a variation on recording, swapping tempos: the ultimate promiscuity of the roles—apparatus, interface, and subject—all can be recast by one another in the arc of watching someone else watch you, and to watch yourself watching it over again while pretending to be the camera.⁷³

Put differently, at the same time that the *User* encrypts its membranes against violations from the outside, the system itself always inoculates itself against bad actor *Users*. Corporate IT departments are funded precisely to ensure this biopolitical security, but the platform commons demands guarantees of resilience and coherence against both vectors of risk. A different model *User* is required, but how? Benedict Singleton has developed a design theory based on *metis* and cunning, for which design is the instigation of *traps*.⁷⁴ All species are at work to design their interactions with the world so as to trap what they need, and for humans the institutionalization of these traps is where design and governmentality intersect. This is not just an immoral tendency for natural and sexual selection; it is how intelligence leverages ecological interdependencies so as to modulate them by strategies and tactics.⁷⁵ Like Grosz's framing of the Earth presents design as a primordial geography, a design ontology of traps foregrounds instead a violent symbiosis as the frame's actual strategy revealed. Different things require different traps, and each becomes ensnared in the trap of the other, around and around, a trap within a trip within a trap stabilized over time: flowers and bees, orchids and wasps, bees and wasps, Venus fly-trap and fly, fly and dirt, dirt and flower, photograph and memory. Ensnared one within the other, the “user” of each design encapsulates another while being itself encapsulated, infecting and infected at once, integrities crumbling.⁷⁶ This is part of the architecture of biology, this is a model for communities of *Users* one inside the other. Far weirder than Larry Smarr's gut microbes, nested parasitic biostrata are in some cases embedded five levels deep inside the other (fifth-order

hyperparasitism): animal inside animal inside animal inside animal inside animal, user inside user inside user.⁷⁷ This symbiotic recursion could be called a microplatform, but it's more than that; it is not just the negotiation among actors within the *User* position; it is a durable interpenetration of actors, mutually embedded one within the other. This is the primal scene that should have been on display at the Shanghai Expo as the root pedagogy of the universal *User*, not the mannequin zoology of the Reids and the Hagens. This dissolution of the private human *User* comes not through the white noise of absolute quantification or mathematically guaranteed withdrawal from appearance, but through the plodding evolution toward alternative phenotypes in relation to manic apparatuses, both internal and external. The dispersant is not *thanatos*, a slouching toward deliquesce, but an activist attentiveness to the more open geographies available to our composite inhuman alternatives. So, again, forget human-centered design; we need to design for what comes next, what comes outside, what has already arrived, for the synthetic *User*-subjects for which another geopolitics is derived. These come from the division, segmentation, and multiplication of partial and compound *Users* into diagonal organs, both bigger and smaller than any one body or person. In this, the geopolitical design problem is drawn as a planetary resorting and redistribution of envelopes, interfaces and membranes, hard and soft, enabling forms of political sovereignty and geography that will enforce a more adventurous futurity, along a path of anguished falling toward our own special void. That, as well, is the design brief.

III The Projects

The Stack to Come

Secrets are lies.

—The Circle, company policy¹

Surveillance is theft.

—Writers against Mass Surveillance²

Autonomy is abstraction.

—Chris Anderson, 3D Robotics³

Convenience means not secure.

—Jacob Appelbaum, Tor project⁴

Fear is awareness.

—Charles Manson⁵

68. Seeing The Stack We Have, Stacks to Come

The Stack we have means: borderlines are rewritten, dashed, curved, erased, automated; algorithms count as continental divides; the opposition of chthonic versus geometric territory is collapsed by computation; interfaces upon interfaces accumulate into networks, which accumulate into territories, which accumulate into geoscapes (territories comprising territories, made and so entered into, not entered into and so made); the embedded is mobilized and the liquid is tethered down into shelter and infrastructure; the flat, looping planes of jurisdiction multiply and overlap into towered, interwoven stacks; the opaque is transcribed and the transparent is staged, dramatized, and artificialized; irregular allegiances are formalized (the enclave and exclave, for diasporic and satellite expatriates); both futurist and medievalist scenarios confiscate, one from another, the program of supercomputational utopias; and the incomplete(able) com-

prehensiveness of Earth's archives is folded back on itself as a promiscuous, ambient geopolitics of consumable electrons.

These are predicaments that condition us, but design is out of sync with them at present. Some design appears in advance of what it wants to describe, while other designs lag behind what has already arrived but may not be recognized and named. The Stack-we-have does both, and so The Stack-to-come is drawn by a geoaesthetics and a geodesign that is, at best, seen now in a kind of double exposure: one future that is anonymously present with us, arrived but unnamed, and one that is already named but not yet here. As discussed at the very beginning of the book, to grasp that other geography, our attention is split between these two concurrent images that we must hold in mind at once, even as they blend into the other, both with and without our control. Our capacity to now design, govern, and draw sovereign geographies depends on the management of this blur. First, how has sovereignty already been redesigned, whether or not we can properly name or comprehend the character of all effects, and second, how can the genesis of another geopolitical geometry deliberately recast the terms of sovereignty that would give those realized formations some preferable structure? The unseen and arrived is interlaced with the seen and the delayed, the blur is precisely this oscillation between "what is" but does not yet have a name, and "what might become" because we can give it name in advance of its arrival. The challenge requires imagination but also enforcement, the establishment of foundations, the techniques of strategic position and material fabrication, such that they can form one another and form us through them. To hold the two images in mind is also to bring into focus the variables of their interpolation and to trace the pixelated translation between them. At the same time, the sorting of any single *User*-subject effect, yours or mine, is also an arc of decay, marked for itself only in passing, such that any entry point into The Stack is fixed by what we exchange among one another in passing: money, carbon, electrons, affect, law, territory—one serving as the referent standard for the other without final grounding. Its scope is global, but the interfaces into the machine, and the visible diagram of the work that it does, are always only partial.

With these caveats and limits, it is possible to see what appears to us as a reasonably complete image of the whole, and even to leverage this totality as a way to draw what might replace it, sooner or later. Perhaps we can see all the layers at once, both as what they are and as what they do. We start at the bottom of the image and move up, from *Earth* to *User*, in one vertical tracking shot.⁶ The black death of oil is formed into brilliant plastic mobile decks; heterogeneous minerals are pulled from mountain streams in central Africa and elsewhere; satellite networks expand the circumference of the Earth, bearing down with optimized images of a denuded whole, now turned from a map into an interface and, in turn, into a vast planetary epidermis to be governed as a total living image. All this is powered by an Ouroboros-shaped energy grid that distributes electrons in peer-to-peer packet networks and so may rationalize and lighten the

carbon burden of industrial computation, or may consume the last remaining terawatts and carbon dioxide gigatons into a black hole of data center-shaped future ruins. In doing so, it spawns new jurisdictions of those causing and those affected by climate change, turning the ecology itself into the final emergency against which we try to defend ourselves in a losing battle with the mathematics of systems biology.

Moving our gaze just upward to the *Cloud* layer, we see vast logistics archipelagos and far-flung subterranean server farms, some outside normative jurisdictional control, and all superimposing irregular partial polities over locations and *Users*, interweaving themselves with state claims. Google *Grossraum* delaminates polity from territory and reglues it into various unblendable sublayers, weaving decentralized supercomputing through increasingly proprietary networks to hundreds of billions of device end points. Each of these is also a sensor and tracking node feeding information back into the proto-sovereign *Cloud* platform, which uses this to draw new maps of state space and also to absorb it into new formats (*Clouds* becoming *de facto* states, states becoming *Cloud* platforms). This activates open-ended platform wars over identity, currency, logistics, devices, services, and infrastructure, with no player capable of fully remapping all links between the mobile citizen-user, data center location, and national laws. And so, we are left with specters of *Cloud* feudalism and cosmopolitanism, both at once.

We try to trace where this goes and from where it came. Archaic states drew their authority from the regular provision of food, and over the course of modernization, more was added to the intricate bargains of Leviathan: energy, infrastructure, legal identity and standing, objective and comprehensive maps, credible currencies, and flag-brand loyalties. Bit by bit, all of these and more are now provided by *Cloud* platforms, not necessarily as formal replacement for the state versions but, like Google ID, simply more useful and effective for daily life. For these, the terms of participation are not mandatory, and because of this, their social contracts are more extractive than constitutional. The *Cloud Polis* draws revenue from the cognitive capital of its *Users*, who trade attention and microeconomic compliance in exchange for global infrastructural services, and it in turn it provides each of them with an active, discrete online identity and the license to use that infrastructure. Before the full ambition of the state cybersecurity apparatuses were so evident, it was thought by many that the *Cloud* was a place where states had no ultimate competence or maybe even a role to play; they were seen as too slow, too dumb, too easily outwitted by using the right browser.⁷ States would be cored out, component by component, until nothing was left but a well-armed health insurance scheme with its own World Cup team. In the long run, that may still perhaps be the outcome, with modern liberal states taking their place next to ceremonial monarchs, stripped of all but symbolic authority, not necessarily replaced but displaced and misplaced to one side. But now we hear the opposite, equally brittle conclusion that the *Cloud* is only the state, that it equals the state and that its totality (figural, potential) is intrinsically totalitarian. Despite all, I wouldn't take that bet either.

Tilting our eyes slightly higher, we see that the urban fabric has shifted from hunter-gatherer landscapes to sedentary fortresses and back to itinerant mobilities between enclaves and exclaves, linking not just points within one city but all cities as a discontiguous constellation. It transforms dwellers into *Users* of an integrated energy, carbon, cement, information aggregation, adding as many points of quasi-sovereign access as they draw lines, borders, and walls. Its primary architectural expression, besides the distributed grid, is the totality of the megastructure, erecting new topologies of control and overexposure, built into the programmatic field of ambient interfaces. These interfaces are integral to platform logics of simultaneous centralization through ubiquitous decentralization and decentralization through the investment of each interface with supercomputational capacity. Competing for air, multiple interfacial totalities cohabit in and on urban surfaces, including the dense extreme parametric articulation of architectural envelopes. These are pregnant with computational intricacy, freezing a field of forces that is, however, always itself in motion and never finally reducible to formal mediation, and thereby splitting any politics of the envelope between those physical membranes and the equally determining electromagnetic delineations thrown up by information media and protocols. In the multiplication of these, accidental sovereignties are made available to anyone or anything interpolated as a *User* of those dual systems and of the city that couches them. That city is in turn part of a layer of the larger Stack hollowing some old territories into zombie jurisdictions and generating new as yet informal alegal openings. For other *Users*, it composes elaborate megastructural enclaves and geoglyphs, even for *Cloud* platforms themselves, each competing to express itself as an urban-scale subject and each also paired with its own doppelganger megastructure on which it depends and through which its total enclosure is always contaminated.

Swirling just closer to the top of the image, we see that any instance, singular or plural, of matter, particle or wave, is potentially identified by massive universal addressing systems, in which mapping and linking of Avogadro's number of haecceities may be allotted to every *User*. The global credential of the address subdivides heterogeneous territories, hard and soft, Hertzian space and carbon space, into a disintegrated communicative array, an atmospheric metropolis built of digit strings. The addressability of physical objects withdrawn into their specific enumeration is itself overmatched by the addressability of abstract relations between objects and their compositing and sorting into higher-order sets, any of which also address and are addressed by one another in a process that is itself addressed by them: meta-addressing all the way up and down into the abyss. This deep address is not only a mechanism for the capture of what exists and a formalization of their juxtaposition; it is also a medium for the creative composition of the traces, positions, and interrelations between them, across natural scales and tempos, drawing otherwise illegible forms into a wider Internet of haecceities. This places micron-scale processing of Shannon information into irregular

meshes of networked matter and substantialized abstractions, toward absolute communication and absolute incommunication at once, as multiple maps and geographies name and number intersecting territories and enroll addressees into assemblages that may be effectively invisible to one another. As any addressee is compelled to appear to one platform of ubiquitous computation, this compulsion may also guarantee its disappearance from alternative addressable landscapes to which it may be all but invisible. In the end, the mastery of master perspectives is overcome by the proliferation of other master perspectives that cannot recognize, let alone contain, one another.

Four of the six layers are seen now at once, and above them we locate *Interfaces*, particularly graphical user interfaces (GUIs) that make legible the far-flung *Earth*, *Cloud*, *City*, and *Address* layers of this Stack for *Users* who cannot possibly map the cause-and-effect relations of their own actions without some instrumental narrative. As they multiply, *Interfaces* assemble into interfacial regimes that present and enforce synthetic diagrammatic total images of how the entire platform can work for a *User* who perceives that platform through the grammar of that same regime. In turn as the *User's* own actions are also sensed and read by the *Interface*; they are incorporated into its totality and into governing procedures for monetizing *User* activities according to that regime's own aesthetics of logistics. Hand-based tools may have passed for a moment into iconic point-and-click modes of the interface, but they now return to embodied gesture and perception, including App subplatforms that introduce new interfacial capacities to generic hardware. In this naturalistic synthesis of cognition and interfaciality, the metaphorical space between icon and what it represents, or between the single interface and the platform it interfaces, begins to implode. Subsequently, some platform totalities are drawn into theological projections, for which the work of anamnesis is externalized into perceptual-instrumental events that pre-decide the significance of real world interface elements, as well as the terms of encounter the *User* should have with them. We fear a militarization of cognition itself, as avant-garde and atavistic fundamentalisms move into the direct augmentation of reality and new political theologies emerge alongside them. Again, totalities are layered on top of totalities, but here the elemental terms of their superimposition are a catechism of war.

Enrollment and motivation according to the interfacial closures of a political theological totality might work by ludic sequences for human *Users* or by competitive algorithmic ecologies for nonhuman *Users*. But for each the proto-sovereignty of the *User* is drawn from both the artificial individuation of each *User* as well as the dissolution of that individuation by the overwhelming accumulation of incorporating information flows, some parasitic and others infrastructural. First, the political economic position of *User*, born of Taylorist rationalization, becomes the site of a different universality for which the *User*-subject position is circumscribed in the measurement of its appetite for carbon, energy, water, and data: the footprint. But eventually the maximal user—the absolutely quantified and qualified self—is dissolved by the intersection of multiple

indexes and traces; its singularity is drawn and quartered by the accumulation of its relations. Further, the interfacial apparatus that coheres the human *User* as an economic subject also addresses nonhuman agents (algorithmic, animal, and machine users) with the same ease, placing all *Users* on a common plane and shifting the design question for the platform from a design *for Users* to a design *of Users*.

This is The Stack-we-have. We can see it as one image and so perhaps can also see how it might be recomposed as a whole. Our most lucid attention now needs to be on the Stacks-to-come. The fissiparous geopolitics of Stacks includes the adjustments noted above as well as strategic Stack-versus-Stack warfare (“destroying a society one controller at a time”). Any of the possible Stacks-to-come can each be imagined as a whole, linking some *User* down to *Earth*, or they may intersect layer by layer, producing heterogeneous mixtures. Any relationship with or between infrastructural technologies might converge or diverge according to plan, or despite the plan, but can also be undone by *Users* driving columns into and out of other Stacks’ layers. In the *Cloud* layer chapter, I outlined some of the logics of four existing platforms as *Cloud Polis* models (Google, Apple, Amazon, and Facebook) in order to demonstrate that their particular strategic combinations are not inevitable, and so just as we can imagine new combinations of these four, all the possible Stacks-to-come will be (as Stacks are now) made useful by real *Users* in dynamic amalgamations. The *User* layer of one model links to the *Interface* layer of another to the *Address* layer of a third, all perhaps situated in a *City* layer unreferenced by any of these three but drawing on the *Cloud Polis* of the second and the *Earth* layer of the first. The agnostic generosity of universal resolvers enables overlapping jurisdictions, and as a *User* moves from Stack to Stack to Stack, moment by moment, it also enables multiple and simultaneous sovereign positions.

These intersections are the normal condition with which and against which design must work, and there are at least four ways that adjustment between layers and between Stacks can be anticipated. They can be adjusted by the *overlapping* of one layer from one Stack by a column through a layer of another (as described above). There is also an adjustment in space, whereby two layers and two Stacks are situated *adjacent* to one another, like two cities. If a single *User* is in location X, then he can access *Interface* layer X, but if he is in location Y, then he will access *Interface* layer Y. A *User* traveling to another country who has to access another “foreign” wireless network is a familiar example of how two *Interface* layers may relate to one another by their adjacency in physical space. There is also an adjustment of *sequentiality* and of the relation between layers and Stacks over *time*. A *User* may access two different relatively homogeneous Stacks, one after the other, such that the use of the first makes possible the use of the second, or the use of one layer within one Stack may be a prerequisite for the use of another layer within the same Stack (which it usually is) or within another. It’s not hard to imagine different security scenarios that require a very specific sequence of actions to precede others. There are also adjustments in *scale*, both between Stacks

and between layers. As discussed in the *Interface* chapter, an interface can be as small as an icon on a screen or as large as a security barrier between two countries. A *User* could be as “small” as an algorithm executed on a particular server or as “large” as the human population of a *City* combined over the span of a year. A Stack will work just as well with a tight scalar fit between what is situated at different layers (i.e., a human *User* and a standard keyboard *Interface*) or a loose scalar fit (i.e., a tiny algorithm and a distant megastructure, such as for Stuxnet). The Stack, and therefore also the design of The Stack, is qualified by these kinds of simultaneities, correspondences, parallels, desynchronizations, mismatches, and phase shifts.

As far as geodesign is concerned, that blur between one Stack and another is not a symptom to be clarified and cured; rather, the blur is a high-resolution image of what is actually happening, which itself is blurry. To design with the blur instead of against it requires comfort with ambiguity. The hope is that we do have some handle on how to visualize The Stack today and how it organizes generic columns up and down. Without too much trouble, we can model a baseline scenario of an individuated human *User*-citizen, named and profiled, using a vanilla platform *Interface*, connected to a stable mix of IP-addressed websites and smart objects, situated in a specific *City* connecting to a public/private mix of WiFi microterritories, governed by the application architecture of a global *Cloud* platform such as Google, and, at the *Earth* layer, drawing on local hydroelectric and coal plants that power the servers chiefly accessed by his usage. We can also imagine another Stack in which the *User* is a environmental sensor, the *interface* is a data-reporting application programming interface (API), *Addresses* are assigned to individual threshold chemical events as detected, all working in the *City* layer of a threatened rainforest as part of a transnational carbon risk reinsurance *Cloud* platform and pulling low-wattage power from plentiful solar and chemical energy sources. We can draw another Stack in which an assemblage of two robots, three delimited algorithms activated from afar, and three humans on three different continents constitute the composite *User*, linking them at the *Interface* layer through a Shanghainese fork of Android that translates between the five or six different “languages” at work. We can imagine them mapping and acting on a specific culinary-agricultural assemblage that has been *Addressed* according to Bronze Age dietary conventions, located in multiple, even hostile, *City*-states, accessing a mix of several public *Cloud* applications as well as locally encrypted databases, sucking up an all-of-the-above stew of utility electrons. Or, an unnamed kid at a quasi-public 3D printing works in Lagos using two different open source additive manufacturing APIs, downloaded CAD scripts, and YouTube Uploader to spoof the *Addresses* of pirated bicycle cranks that will now phone home and report that they are actually licensed and operational in Cape Town, but which are really being used to haul bags of cement to the fourth floor of a building that shows up having only two floors on Google Earth RealTime (at least when queried from South African IPs) all running on the AfriNIC version of Google’s “no carrier fee” Continent Cloud, sucking

energy from a Franco-Chinese nuclear plant on the shores of Lake Chad, and chewing up circuitry minerals recycled from e-waste drone lifts from Bossangoa, Central African Republic, courtesy of All-African Defense Forces. And so on. It is not too hard to come up with political science-fiction scenarios, but it is hard to specify the *shape* of them working in combination, if only because any of the layers in the scenarios above could just as easily be combined with the layers of any of the others. Take two to five layers from each and sort, stir, and simmer. We need not one but many Stack design theories. Even the US Department of Defense are Stack theorists, having made their own version of a Stack model of planetary-scale computation in semiscrecy and featuring layers similar to the one described in this book (unknown to me until very recently).⁸ Instead of neat utopias or dystopias, it is the divergent mixtures of the two, drawing on the energy loss and radiant waste materials of whatever is most distant or closest at hand, which may nevertheless be most crucial and fruitful.

69. Earth Layer to Come: God Bows to Math; Will Leviathan?⁹

A side effect of the unmanned programs of the National Aeronautics and Space Administration (NASA), particularly *Viking*'s initial probes to the surface of Mars, is what Kim Stanley Robinson calls *comparative planetology*, the consideration of pattern and difference among astronomical bodies.¹⁰ Arguably, the leverage of such a perspective would be greater than that of the more iconic visual knowledge of the *Apollo* "Earthrise" or "blue marble" photographs, which demonstrated the formal coherency of Earth as one geophysical unit.¹¹ Now the special singularity of that sample can be measured by comparing variation among like and unlike cousins, each of which represents an alternative chemical reality from which or toward which our own perch might be distinguished and interpreted. Given that other planets are assembled from the same chemical ingredients as is Earth (still mostly hydrogen, helium, some carbon, bits of other things, albeit in different ratios), the far end of the comparability is the full spectrum of possible recombinations of elements "computing" one another into the relative molecular stability of a planetary sphere. The universe could, in principle, disassemble one astronomic body and build a couple others out of the raw material, and in fact, in astronomic time, that is more or less how planets are made.

Seen from this outside, the *Earth* layer of The Stack is ultimately not only the plateau from which emerges the material and energy to run the other layers of a closed tower; it is also—in a sense—the basis of a *second planetary computer*, one laid on top of a first whose calculations resulted in the relative ecological and chemical stability of our planetary situation. More often than not, globally pervasive eco-computing is validated by a diagnosis model; it provides us with a way to detect pathologies. We detect pollution or telltale ecological traces in one way or another and render them as evidence. It is a way to visualize the invisible evil, drawing its picture so we can see where it is and

where it goes, and one way or another prevent it from happening again. The maximal design image of pervasive computation—of this second planetary computer—is understood both rightly and wrongly as a smearing of the planet's surface with an objective computational film that would construct a stream of information about the performance of our shared socionatural spaces through which geopolitical decisions can be made. Within a material public based on a truly ubiquitous computational infrastructure, the political formations that would cohere might be based on the aggregation of encounters and relationships between persons, things, and material events, including especially those in which people are not directly involved. But even if everything is seen and registered, not everything sees or works back on what it sees in the same way. Part of the design question then has to do with interpreting the status of the image of the world that is created by that second computer, as well as *that mechanism's own image of itself*, and the way that it governs the planet by governing its model of that planet. That model is built on the interrelationship of nonhuman biologies and chemistries as well, and so the images that the designer can deduce or produce serve the representational agency to a matrix that otherwise would be invisible to itself beyond its most local chemical interactions.

The status of that ecology in relation to the designer, considered now in emergent models of software and sovereignty, conjoins sensing, sense-making, and image-making into a generic infrastructure of sensors, databases, displays, firmware-in-the-wild, and so on—in other words, a “stack” system that both reflects and congeals what it “represents” technically and politically. The columns going up and down the paths of this Stack link a politics of seeing to a politics of our being seen, and through them, one becomes the other. It compiles a diagnostic image by diagramming present and potential relationships between agents within its line of sight. We assume that any (human or nonhuman) component’s ability to recognize and consume that image, and thereby also consume the projection of a set of potential governable relationships between the variables within that interface, does so not just for utilitarian imperative but with real affective intensity. In this utility and intensity, another proposition is made about how it is that we may sense the world, or how the sensibility of the world might be distributed or organized, made infrastructural, and activated to become part of how the landscape understands and narrates itself. It is not only a diagnostic image then; it is a tool for a *geo-politics in formation*, emerging from the parametric multiplication and algorithmic conjugation of our surplus projections of worlds to come, perhaps in mimetic accordance with one explicit utopian conception or another, and perhaps not. Nevertheless, the decision between what is and is not governable may arise as much from what the model computational image cannot do as much as from what it can. Its geopolitical effects are as reliant on stockpiles of failures as on capacities for success. This is no less true of the surplus of interfacial utopias constituted with information visualization than it is for the parliamentary politics born of an

agrarian time and persisting long enough to provide funding for those *Viking* missions to Mars.

And so, “comparative planetology” works not only between this astronomic body and that one, but also between one body and the computational model that simulates it and governs it in turn. For the *Earth* layer of The Stack, the fragility of this model comes also from its purported successes, and specifically, from how much it underestimates the difficulty of achieving them. Core to the utopian project for pervasive computation and ecological governance is positing a world in which every square inch is in some way constantly outpouring infinitely communicable information about itself, overwhelming some expert systems while spawning others, enabling the world to declare itself as data tectonics. From this another polity could emerge in this parametric swarm of information secretion and consumption, one that represents itself to itself through these enforceable representations. It implies (perhaps) a flatter, a less authoritarian, a less anonymous, less humanistic (and even less designed) geopolitical space—or perhaps instead just another mode and method for its design. However, the simpler and sadder truth is that we are, as of now, incapable of governing ourselves according to the already available, more rudimentary information that ecologies communicate. A clouded river, a shrunken branch, a coughing fish: these are also instances of “data visualization,” and we do a bad job of interpreting them and acting on them. At best, we attempt to pathologize them and even criminalize them because they do not conform to quality metrics and thresholds (and higher resolution of images of the pathology will not ensure that the model can govern better). Still, perhaps the problem is also that the vast plurality of worldly actors are left out of the picture, and perhaps by rendering those variables visible and transmissible, by incorporating them at the scale of a planetary archive, those “trees” become things for which political engineering can be more systematic and effective. The most difficult question for this design-and-monitor-and-diagram system remains whether a more appropriate geopolitical architecture can be deduced from and designed by and for the *Earth* layer.

In petabyte-aggregations of ecological knowledge and application, is there a channel for these instances to pluralize, to assemble into networks of different size, so that they can in fact become more durable forms and be properly empowered to make gestures at the scale of the forces that affect their fates? Can the “second planetary computer” create worlds and images of worlds that take on the force of law (if not its formality) and effectively exclude worse alternatives? If so, its mediations will surely include some abdication of the central piloting role of modern political subjects as played by the anthropic “human” who is the geological agent of the Anthropocene. Here technical representation and political representation become more symmetrical and less rather than more “parliamentary.” The process by which sovereignty is made more plural becomes a matter of producing more than discoursing: more about pushing, pulling, clicking, eating, modeling, stacking, prototyping, subtracting, regulating,

restoring, optimizing, leaving alone, splicing, gardening and evacuating than about reading, examining, insisting, rethinking, reminding, knowing full-well, enacting, finding problematic, and urging. In these, mediation and translation between ecology and model move from one scale to another, up and down and back again, and that itinerary is where the action is and where the story plays out.

In structural engineering, when the pressure difference between the outside and the inside of a building causes heat to rise up from the bottom, floor by floor, and try to escape from the top, this is called the *stack effect*. In the cycle of energy into and out of data centers, up through the layers to the *User*, a corollary process is at work for planetary-computational stacks as well, which is on the whole bad news for the ecology that it would hope to model. At the same time, it bears repeating that with terrestrial, oceanic, satellite, and atmospheric sensing networks, it is only through the medium of the Stack itself that we know so precisely how the carbon appetite of The Stack is contributing so decisively to our Anthropocenic predicament in the first place. This paradox (some may call it a self-cancellation) is only one reason that there is such strong disbelief that the current geopolitical, geoeconomic, or geoecological order can continue in its present form. We experience a crisis of “ongoingness” that is both the cause and effect of our species’ inability to pay its ecological and financial debts. The Stack itself, this accidental megastructure, is surely as well a result of these same processes, and it may be seen as symptomatic from one perspective or emergent from another, but its ability to mature as a form of intelligence is dependent on learning to not cannibalize its planetary host. I also argue that some conceivable versions of a future Stack have a decisive role to play in making intractable problems of governance and design far less dangerous, and the abstract machine of the *Earth* layer’s second planetary computer is among these. Another argument laced throughout this book is that the necessary intellectual and technological achievements are not at hand, that we must make them so, and toward that we must be willing to entertain shifts in the relationship between *software and sovereignty*, taken as our primary example. That said, the picture is far from rosy. Despite appearances, one can easily argue that technological progress has slowed since the last quarter of the twentieth century (the 1973 oil crisis to be specific). The low-hanging fruits (e.g., the speed of transcontinental flight, increase in age expectancy, median income in affluent societies, crop yields, truly significant new medicines) have been gathered up, and in many cases their rate of progress has either slowed or even reversed.¹² Meanwhile, commodity prices have continued to rise, clean energy has yet to materialize at a necessary scale, and atmospheric carbon dioxide has broken the 400 parts per million barrier. It is true at the same time that the number of people living in extreme poverty (as defined by the dollar value of their daily available purchasing power) has been cut in half since only 1990, and the average family size, or total fertility rate, has also halved since 1950 from almost 5 children to fewer than 2.5 (concurrently the percentage of people living in cities has gone from 20 percent to 50

percent in one hundred years and is projected to be 70 percent by 2050.) These are all causes and effects of one another, each accomplishment coming at a sometimes savage price and each calamity with a silver lining (of sorts). None of this, however, proves that it is impossible to do what we know is required, but it may suggest that we are not willing.

In a talk that I gave on the topic of popular discourse on innovation, a feeble genre of “middlebrow megachurch infotainment,” I said:

The most recent centuries have seen extraordinary accomplishments in improving quality of life. The paradox is that the system we have now—whatever you want to call it—is in the short term what makes the amazing new technologies possible, but in the long run it is also what suppresses their full flowering. Another economic architecture is prerequisite. ... We hear that not only is change accelerating but that the pace of change is accelerating as well. While this is true of computational carrying-capacity at a planetary level, at the same time—and in fact the two are connected—we are also in a moment of *cultural de-acceleration*. We invest our energy in futuristic information technologies, including our cars, but drive them home to kitsch architecture copied from the 18th century. The future on offer is one in which everything changes, so long as everything stays the same. We’ll have Google Glass, but still also business casual. This *timidity* is our path to the future? No, this is incredibly conservative, and there is no reason to think that more gigaflops will inoculate us. Because, if a problem is in fact endemic to a system, then the exponential effects of Moore’s law also serve to amplify what’s broken. It is more computation along the wrong curve, and I doubt this is necessarily a triumph of reason. ... [Our current conversation] has too much faith in technology, and not nearly enough commitment to technology. It is *placebo technoradicalism*, toying with risk so as to reaffirm the comfortable. So our machines get smarter and we get stupider. But it doesn’t have to be like that. Both can be much more intelligent. Another futurism is possible.¹³

As far the *Earth* layer is concerned, “another futurism” is what we call *geodesign*, which would include geoengineering, understood as possible techniques for ecological restoration operating directly upon the atmosphere, but certainly not only that. There are other ways to intelligently and deliberately intervene in the architecture of geopolitics, geoeconomics, and geoecology, and some of these recall “utopian” plans of the *Apollo* era. The crisis of ongoingness may, however, demand that options that may have once seemed fantastic are now imperative, and what is most normal is now also the most unlikely path forward. In his essay, “Who Will Build the Ark?” Mike Davis puts it this way:

From this perspective, only a return to explicitly utopian thinking can clarify the minimal conditions for the preservation of human solidarity in face of convergent planetary crises. I think I understand what the Italian Marxist architects Tafuri and Dal Co meant when they cautioned against “a regression to the utopian”; but to raise our imaginations to the challenge of the Anthropocene, we must be able to envision alternative configurations of agents, practices and social relations, and this requires, in turn, that we suspend the politico-economic assumptions that chain us to the present.¹⁴

The regression Davis mentions refers to a willingness to trade the comfort of ideal “solutions” for the work of fundamental transformation, but perhaps given the precariousness of the situation, having learned to entertain the utopian impulse with imaginative schemes may prove an extremely practical capability to possess. This also relates to what Heidegger once called our “confrontation with planetary technology” (an encounter that he never managed to actually make and which most Heideggerians manage to endlessly defer, or “*differ*”).¹⁵ That encounter should be motivated by an invested interest in several “planetary technologies” working at various scales of matter, and based on, in many respects, what cheap supercomputing, broadband networking, and isomorphic data management methodologies make possible to research and application. These include—but are no means limited to—geology (e.g., geochemistry, geophysics, oceanography, glaciology), earth sciences (e.g., focusing on the atmosphere, lithosphere, biosphere, hydrosphere), as well as the various programs of biotechnology (e.g., bioinformatics, synthetic biology, cell therapy), of nanotechnology (e.g., materials, machines, medicines), of economics (e.g., modeling price, output cycles, disincentivized externalities), of neuroscience (e.g., behavioral, cognitive, clinical), and of astronomy (e.g., astrobiology, extragalactic imaging, cosmology). In that all of these are methodologically and even epistemologically informed by computer science (e.g., algorithmic modeling, macrosensors and microsensors, data structure optimization, information theory, data visualization, cryptography, networked collaboration), then all of these planetary technologies are also planetary *computational* technologies. The question of planetary-scale computing addressed by this book is therefore not only a topic for us to understand; it also names our mechanisms of inquiry. I would insist on the inclusion as well of art, design, philosophy, film and literature (especially their science fiction genres)—or at least my own preferred conception of them—which themselves may or may not be computational. These are our key technologies for conceiving the inevitable ambiguities of planetary-scale computational computation and its potential vectors up and out, but they don’t work well when they are asked to resolve ambiguity instead of conspiring with it and cultivating its efficacy. The geodesign that I have in mind would draw on all of these in varying measures for its subject matter, for its means, for what it may be called on to know, but it would also provide a platform for these disciplines’ rotations from ways of knowing toward ways of making. It may do this because *there is no local, only global*, to invert Bruno Latour’s well-known and unfortunate maxim.¹⁶ To pull intelligently on one thread is to tug on the whole at once, a whole that has come together in one particular way at one particular moment in the form of a thread and someone to pull it.¹⁷ This not a wish for renewed human mastery or transcendence. It is rather a call for the difficult, even traumatic work of disenchantment and demystification and toward a geopolitics based on what our species knows that it knows about our limited position and on how we might recompose ourselves accordingly.

Put differently, that situation is also characterized by an opposition between the global plasticity of the second planetary computer and the Anthropocenic crisis of ongoingness. While it may be that our position on the precipice of ecological collapse suggests an anti-cosmopolitanism based on sharing this *Götterdämmerung*, different economies have contributed to its inadvertent geoengineering in very different ways and it is certain that how some groups accommodate the coming crisis will be as equally pronounced and divided. It is sometimes said by the political right that the dangers posed by climate change are overblown by leftists keen on using centralized anti-market regulatory measures as a matter of principle and eager to mobilize them in the name of bad weather from the future, but the political opportunism of climate-change denialists represents the more ominous teleology. The longer that effective interventions and mitigations are forestalled, the more catastrophic the eventual outcomes will be, and the less likely that open and democratic societies will be able to manage the deluge of life or death consequences. Many on those the political right are well aware of this, but see it as an opportunity for the development of quasi-sovereign enclaves in which those who can will consolidate their wealth and deploy it as a bulwark against both the ecological consequences of industrialization and the populations that these effect most dramatically. For those who would prefer neo-Feudalism and/or tooth-and-nail libertarianism, inaction on climate change is not denialism, rather it is action on behalf of a different strategic conclusion.

Too often, notions of ecological cosmopolitics rely on rhetorical criteria of consensus, whether as a lifeboat ethics—that we are all in this together—or the supposed self-evidence of Earth’s archive seen as a single space that can be made more communitarian. However, while it draws on an ethics of rationality, the geodesign I would endorse doesn’t see dissensus as an exception to the norm but as a matter of fact (nor does it see it as only and necessarily “political”). It doesn’t confuse the universality of a shared planetary ecology with how its political geography subdivides sovereignties, ones that are not only separate but may not even be interoperable. It is not that we will split the middle but that, quite specifically, we speak different languages, live in different worlds, and have different geophysical relations to capital as a design asset in relation to emergencies. That said, the current ecological emergency extends, rather than supersedes, the importance of totality as interpretive instrument, especially with regards to planetary-scale computation. When I peruse with fascination all the right-wing conspiracies theories about “Green totalitarianism,” Agenda 21, and carbon police confiscating McMansions, I can’t help but wonder if the right has a more active and forceful vision (however goofball) for the left than the left does. At the same time, we are sensitive that just as well-meaning initiatives too often sour into failure (and wonder if we should instead design evil things that will decay into something wonderful and successful) we know that the anti-strategy of neo-feudal secession may, however counterintuitively, usher in a geopolitics that provides a platform that—in time—may

unwind the social hierarchies that inaugurated it. Who knows? They may get what they want, but they may not want what they get.¹⁸ With regards to this, the next section considers possible futures of the next layer of The Stack, and how the delimitation of sovereignty from territory by global *Cloud* platforms, and the differing models of *Cloud Polis* that they represent, supports the momentum of generalized secession (for better and for worse) which may or may not evolve toward (away from) an institutionally normative *Cloud* feudalism.

70. Cloud Layer to Come: Cloud Feudalism and Its Discontents

Ground zero of robotic labor automation may be in California, but a few hundred miles south and east of Silicon Valley in the San Joaquin Valley, where 1 percent of the US farmland produces 8 percent of its agricultural output, generating at least \$36 billion for the state and over \$100 billion in related economic activity. The area is the engine that makes California the fifth largest supplier of food in the world, and its capital is the crestfallen metropolis of Fresno (population 500,000). Fresno often comes near last in urban quality-of-life polls, and even a quick visit to its dusty and mean avenues confirms the results. Roughly a third of all jobs in the city are tied directly to agriculture, which makes the economy particularly vulnerable to downward wage pressures, as well as to climate change-related drought. The pressures of increased efficiencies against crop losses, toward crop diversity, and speed of delivery make agriculture an important area for applied robotic automation (picking, sorting, transporting, as well as plant-by-plant drone observation and diagnosis). These factors together nominate Fresno to enjoy first-mover disadvantage in the evolution of similar urban centers toward broadband-dependent manoralism and serfdom (and evacuation) and its economy toward *Cloud* feudalism. Detroit is the first case study we have of what automation can do to an insufficiently diversified urban system, dependent on intensive assembly labor (it is certainly not the only one, nor does it represent the inevitable outcome of physical computing as applied to infrastructure-scale manufacturing economies), but Fresno may soon take its place next to it. Future scenarios for *Cloud* feudal life in Fresno are mostly grim. Most remaining jobs might be related to servicing the automated logistics and warehousing of food packets, not so dissimilar to working in an Amazon warehouse or FedEx routing facility, while the surplus population that has not or cannot exit is largely unemployed and increasingly desperate.¹⁹

The *Cloud* is able to treat “food”—defined here as culturally and economically desirable modules of proteins, vitamins, and sugars—as parcels or data packets in a deep supply chain that incorporates local climate, soil, nutrients, seed systems, individual plant care, harvesting, sorting, warehousing, packaging, refrigeration, and global product destination optimization, as well as the metagovernance of demand modeling, crop diversification, qualitative and quantitative research, and, one hopes

as well, the geogovernance of nutrition and food health (this is to say nothing of multistory hydroponic megastructures growing onions, orchids, and okra in deep midnight). The intelligent industrialization of food is potentially an extremely positive (even crucial) Anthropocenic strategy. If Heidegger self-servingly compared industrial agriculture to “Auschwitz,” and today’s biofundamentalists sometimes use similar imagery to demonize genetically modified organisms, we may prefer instead to see the design of food platforms as less about preserving the experiential simulation of preindustrial farming and eating (“A is for Apple”) and more like molecular gastronomy on a landscape scale, inventing amazing new forms from the calculative slurry. In their seams of leisure, craft farms can be left to those with the time to indulge pornographic fantasies of prelapsarian originalism. That is to say, *Cloud* feudalism is neither desirable nor inevitable, even according to the processes that are trying hard to birth it today.²⁰

None of this gleaming promise screens out a reality determined by vastly inequitable relations to the wealth of the Fresno that we have and the Fresno toward which we slouch. In time, cities such as these may not need so many people but will have them nevertheless. They may not really be cities so much as city-shaped refugee camps, and like all other camps, they are the inverse image of the enclaves that spawn them. Those employed “in” Fresno may not even be inside city limits. If we follow the thread of Alex Rivera’s *Sleep Dealer* (2008), a film in which California’s agriculture is served by drone pilot/robot fruit pickers working remotely from behind the sovereign wall separating the United States and Mexico, it is not unreasonable to imagine a further logistic dehumanization of Fresno’s on-site population.²¹ Perhaps the costs of piloting agricultural labor will be held down by global wage arbitrage, pickers in Tijuana competing with pickers in Jakarta and Juneau to provide fast and cheap results. That is, formal national jurisdiction may have far less to do with the economics of *Cloud* feudalism than with whichever *Cloud Polis*, enclave platform, or urban camp happens to counts a given worker as one of its *Users*. The elevation of labor systems like Amazon’s Mechanical Turk, TaskRabbit, and Uber to infrastructural scale suggests several paradoxical and even contradictory outcomes, both positive and negative. One of these is well summarized as: “I’m really looking forward to a future in which service employees are leased Google Glass so they can complete courses in for-profit trade schools while simultaneously earning health care vouchers instead of actual currency and Soylent instead of actual food.”²² We should add, however, that the lease terms on that Glass set are conditional on whether the *User* actually won the bid to pilot-pick avocados.

Cloud feudalism can be understood as a particular distribution of power between central and commanding platform servers and quasi-autonomous, if relatively powerless, network clients as applied to human economic geography. Others have articulated the problems associated with these sorts of arrangements, their deflationary impact

on demand-side growth, and their ultimate macroeconomic instability. Under such regimes, platform economics works to monopolize power and wealth into centripetal consolidations of extracted value, such that the ratio of value realized by those *Users* who collaborate with the platform commons (*User* platform value) to those who own claims on infrastructural profits (platform surplus value) is grotesquely misaligned. For political dispositions across the ideological spectrum, the supposed solution is making freedom of personal autonomy from platforms more absolute, up to and including generalized secession. From one side, “the main achievement of the nation-state in the last century has been the establishment of a uniform grid of heavily policed barriers across the world. ... Given a free movement of people, the whole neoliberal project would collapse.”²³ From another side, “If you value freedom, then I think that ‘exit’ comes out way ahead of ‘voice’ as a mechanism by which people can express their preferences.”²⁴ Under some real-world situations, the hard partition keeping people in or keeping people out is itself given sovereign status, with its surface imbued with maximal gateway intelligence, and in others the “elective” coordination of free market actors and agents is seen in a proliferation of modular desiring machines, like a North Korean stadium pageant without an actual country behind it, all decisions linked by an ontological proletariat writing the rules of proprietary semantic webs. If everyone (in principle) has the right of exit and to opt out of their citizenship end user agreement for another offered elsewhere, but all the good spots have already be taken by high-end *Cloud* polities that feature strong exclusionary membership bylaws keeping the plurality of humans at bay, then the differences between state violence on the border and posted rules of the gated community, between positive and negative freedom essentially, are dark and bitter comedy.

The previous discussions of *nomos* emphasize the arbitrary but meaningful geometry of political geographic subdivisions, including secession. It begins with an image of the Earth’s surface differentiated by chemical arrangements of water, land, and air. Nation-states can be read in relation to these as petroglyphs written by law. They are keen to concretize the integrity of virtual boundaries when ingress and egress are seen to compromise asymmetries of power between zones of a synthetic landscape of loops and bubbles. Enclaves, exclaves, and especially colonies drew another jigsaw on top of the first, nonlinear and noncontiguous outlines of sovereign control rule.²⁵ At various times, this becomes a momentum for jurisdictional integration (as for the American colonies in the 1770s, the European Union in the 1990s, Italy and Germany in the nineteenth century), and at other times it is an equal momentum for disintegration (as for the United States in the 1860s, India/Pakistan in the 1940s, the USSR in the 1990s, and seemingly everywhere today). It takes different forms and seeks different ends: schemes to break up California would mean political autonomy for Silicon Valley and several more Senate seats; Special Economic Zones freeing up markets for commodity assemblage by keeping hands and fingers on call in special factory camps; sovereign

wealth funds turning states into corporate actors; Supreme Court rulings turning corporate actors into holders of religious and political speech rights; neo-Confederates once again taking control of one of the major US political parties; Saudi Arabia buying sovereign farmland in Indonesia to secure its food future; the hard geopolitics of ongoing state-sponsored spying, hacking, and mutual recriminations; and so on. The great migrations, psychodemographic segmentations, and biopolitical wall building are not always about claiming more and more zero-sum territory at the expense of rivals. Sometimes it means the opposite, even deliberately shrinking domains of sovereign interest (Australia recently relinquished its sovereign claim on a nearby island so that it would not have to take responsibility for refugees who landed there hoping to gain admittance to the jurisdiction and its protections). However, these examples of generalized secession are not interoperable with one another, at least not in the same way that the Westphalian platform for political consolidation made the form and formats of states compatible. Instead, according to pressures of combination and separation, integration and disintegration, bull markets in both nonpolarity and hyperpolarity collaborate to assassinate unipolar geopolitical architectures.

Most are interested not only in drawing new legal lines for self-interested benefit, but also in building the armature of occupation that will enforce those lines and give their physical boundaries the force of law. These initiatives thereby spawn their own exceptions. China has several important urban jurisdictional anomalies, such the special status of Hong Kong, Macau, and the Shanghai foreign concessions, and more recently, its urbanization has been steered somewhat by a strict distinction between urban and rural systems and populations, most clearly symbolized by the *houkou* license system, which also generated a huge population of internal “illegal aliens.” The growth of new cities, almost from scratch, but mostly on top of where old ones stood a few years ago, drew on the fungibility of enforcing this credentialization of infrastructural access. Elsewhere, a new kind of tabula rasa urbanism is seen in the charter city movement, as evangelized by New York University economist Paul Romer. The city remains a crucial site for challenges to traditional spatial models of sovereignty and innovation in what might augment or displace them, and Romer has advised plans for a “charter city” in Trujillo, Honduras, one administered by the courts of Mauritius and, in principle, open to qualified persons who may choose to reside there. Here individual sovereignty is derived from the access to and use of a common urban infrastructure network more than autochthonous genealogy. Such schemes are certainly not without the dystopian potential of the absolute capitalization of habitat, but at the same time, in the delinking of transient sovereignty from fixed geography, they also contain an important kernel of utopian potential for geodesign invention, one that instead of eradicating place would reestablish it anew for a network society.²⁶ One hopes so, but the more immediate context of contemporary sovereignty markets would seem by appearances to tilt toward privatopias.

Neil Blomkamp's film *Elysium* (2013) is based on the parable of two Earths, one wallowing in the Anthropocenic decay of a burned-out planet and one orbiting above in bucolic (if run-of-the-mill) privilege.²⁷ Like the *Cloud* megastructures discussed in the *City* layer chapter, feudal megastructures such as these always come in pairs. Bloomfield Hills comes with South Detroit; Silicon Valley comes with its San Joaquin Valley. Today new enclave developments, and soon charter cities looping around them, are marketed as branded service platforms. In time, they will require more than this. In order to fully urbanize secession, they will have to take on the status of "homeland" and mobilize patriotism against the temptations of "exit." Disney's Celebration, Florida, is a landmark project here, from its branded mythology to its status as a self-governing city and county. Elsewhere developers recognize that a fetish for arbitrary distinctions of hierarchy isn't a bug but a feature, and so at The Oaks, north of Los Angeles, residents who pass through one gate from the outside world still are excluded from the gated community inside the gated community, known as The Estates of The Oaks. In dense cities, enclaves are more vertical than horizontal and branded according to discreet (and discrete) address coordinates. In New York, One57 (Christian de Portzamparc, architect) and 432 Park Avenue (Rafael Viñoly) towers near Central Park, and 56 Leonard in Tribeca (Herzog & de Meuron) are just a few options. The *demos* of the modern city presents certain difficulties not suffered by planners of the orbiting *Elysium*, however, as evidenced by concern in New York over so-called "poor doors" that would filter high-income from low-income residents of the same Westside tower, One Riverside Park. Readers of J. G. Ballard's novel *High Rise* (1975) will also note the tendency for communities that live within the same building envelope, but strongly differentiated by status, to lurch inexorably toward tribal violence (and hence have a negative impact on unit resale value across the board).²⁸

In light of this, it is not surprising to see enclave/camp conditions coexisting side by side and even sharing walls and borders, flipping interiority quickly or very slowly or not at all. My home university, University of California, San Diego in La Jolla, sits in the northwestern-most region of the San Diego/Tijuana metroplex, which is for many purposes a single city that happens to be bifurcated by an international border. A strategy of militarized luxury urbanism also has strong appeal to the affluent of Latin American cities in which violence is an everyday worry. For example, in San Salvador, "wealthy Salvadorans can retreat to residential compounds that resemble a militarized version of a Palm Beach retirement community, complete with golf carts. Behind high walls and even higher voltage wires, one economist gushed to me: 'This place has everything—we never have to go outside!' For the rest, those who stay and those who get sent back, gangland drama is a fact of life."²⁹ But it is not as if the poor do not have their own megastructure gated communities, with their own special dispositions given for exceptional enforcement of rules. Consider the Dr. Manuel de la Pila housing block in Ponce, Puerto Rico, one of hundreds built after World War II:

When it was first built Dr. Pila was an open community. But early one November morning in 1994, two years after a private firm had taken over its management, three helicopters carrying national guards and police descended upon the project, officially occupying it. Operation Centurion, popularly known as Mano Dura Contra el Crimen (Strong Arm Against Crime), had dictated that the largest, presumably most dangerous public housing projects should be gated in order to reduce crime. Over the course of four years, nearly a quarter of Puerto Rico's 337 public housing developments were "rescued" or "occupied," leading to arrests of residents, the establishment of police outposts, and the erection of fences to control movement. Dr. Pila became a gated public housing development.

The opportunity to live behind walls and under armed guard is available anywhere, it seems. It may even be true that in some circumstances, *Users* of a city-shaped camp (its autochthonous refugees), may have their clean water supply turned off if service fees are overdue.³⁰ What remains persistent, however, is that the mutualizing interiority/exteriority of every enclave/camp condition is reversible, even if movement between one zone and another and the right of exit is not.³¹ The geodesign problems of generalizable secession are now dominated by the artificially narrowed interest of capital transactions (and transactors) to protect themselves from direct contact with their own externalities, not by the general interest to seek out viable access to that capital. This is neither a necessary or conclusive situation, and increasing the delamination of sovereignty from territory and the emergence of computational platform infrastructures may be both the means and the ends to better alternatives. The impetus toward secession and an activist stance on platform sovereignty (which are not the same things) is obviously not limited to building borders and, as this book argues, The Stack's delinking of infrastructural systems from place also relinks them again in new ways. Two operations interweave legacy megacities with the *Cloud* and allow *Interface* layers to spin out new media at multiple scales. A new medium brings new noise and new noise brings new music. Unlike the zero-sum subdivision of a land behind walls, requiring *Users* to vote with their personal presence, the *Cloud Polis* (in principle) comes to you wherever you are. Many of those who engineer these platforms are not only well aware of these architectures of proto-sovereignty; they evangelize them, sometimes ingeniously, sometimes anxiously, and sometimes idiotically.

Demonstrating all three of these in various measure, venture capitalist Balaji Srinivasan summarized the rationale of secession in his Internet-famous speech "Silicon Valley's Ultimate Exit."³² His address is worth examining for what it clarifies about the current state of the popular discourse on *Cloud Polis*, how that discourse is so strikingly inadequate, and how it is received and misunderstood. Srinivasan's key point was that as the loci of twentieth-century American power (in governance, media, finance, entertainment, education, military) are giving way to a new economic system based on Silicon Valley software, that the old order will inevitably defend its flagging legitimacy by blaming software macroeconomics for the world's problems. He argues that the best

remedy is to allow for “free zones” in which the “world run by Silicon Valley” could be tried, tested, and demonstrated without interference for all to observe. “We need to run the experiment, to show what a society run by Silicon Valley looks like without affecting anyone who wants to live under the Paper Belt,” he implores. The inevitable success of this new polity will make it obvious that it is the sovereign platform of choice for anyone clear-minded enough to care. For this, he argues, the essential criterion of liberty is the right to withdraw from unworkable regimes. Without naming the source, he draws on the thesis of Albert Hirschman’s *Exit, Voice and Loyalty: Responses to Decline in Firms, Organizations, and States* (1970), which addresses the remedies available to consumers and citizens in the face of deteriorating quality of goods and services (including, for example, a failed or repressive state).³³ “Voice” is the right to petition or reform institutions to which one belongs, and “exit” is the right to get up and go, to emigrate, to change teams, to start anew. Addressing the diverse audience, Srinivasan says, “I would bet that exit is a reason why half of this audience is alive. Many of us have our ancestors who came from China, Vietnam, Korea, Iran, places where there’s war or famine, economic basket cases. Exit is something that I believe we need to preserve, and exit is what this talk is about.” He compares states and *Cloud* platforms directly and quickly asks us to evaluate one like the other. “Is the United States the Microsoft of nations?” he asks an audience for whom Microsoft represents everything old, inflexible, arbitrary, poorly designed, coercive, monolithic, and unfortunate about large platforms. Just as progress in the *Cloud* depends on *Users’* ability to opt out of one platform and opt in to another that provides more robust, trustworthy, and well-designed services, he asks, doesn’t the same apply to governing platforms called states? Leaving iOS for Android does not involve navigating the armed guards at the Berlin Wall, or walking across the Sonoran desert (as of this writing), so why can’t movement between platforms of political sovereignty work the same way? We note that he does not specify the convergence of *Cloud* platforms absorbing traditional functions of the state with states rotating and evolving into *Cloud* platforms. That convergence may confirm or undermine the argument about the necessary superiority of one form over the other.

The more valuable point he makes (almost offhandedly) is one that does not require the geographic region of Silicon Valley to redraw lines on the map as such. “That’s the thing about exit is: you can take as much or as little of it as you want. You don’t have to actually go and get your own island; you can do the equivalent of dual-booting or telecommuting. You can opt out, exit at whatever *level* [emphasis mine] you prefer.” Especially if we take “level” to correspond strongly or weakly with the layers of The Stack, he is correct but perhaps not entirely aware of the cascading implications of this observation. As I discussed at length above, different *Users* may initiate columns up and down The Stack from many different positions and will be interpolated by the geoscopic interests of different *Interfaces*, will make use of what those interests are able to *Address*, will be situated within the interfacial envelopes of a given *City*, variously

interiorizing and exteriorizing his location, will be enrolled by one or many competing *Cloud* platforms and supporting energy systems of varying interoperability. Different *Users* will have different columns available and unavailable to them, by definition, according to the determinant strength of one or more governing layers activated. The *City* layers of Pyongyang and Palo Alto will curtail or enable such very different possibilities for the other layers in The Stack that the *City* layer may have final leverage over the others. Or, in a perfectly walled garden, the platform coherence of the *Cloud* layer may be so closed and perfected that the *Interface*, *Address*, and *User* layers, are decided within a very small margin of variance. That is, for any real column up and down The Stack, there is a range between the strong incorporation of the sovereign operations of all layers together into complete vertical systems and the strong modularity of the layers into separate and counterprogrammable components. That range is not equally distributed to all *Users* everywhere, and the most important variations may be possible for some *Users* but not for others, and so exit is never available equally to and from all platform *Users*.

For our geodesign initiative, the important pressure point is that the sovereign operations of any one layer in The Stack are not necessarily reducible to or even interoperable with the others, and so redesigning (reprogramming, relegislating, rearticulating) the sovereign techniques of those layers can directly affect the others and shift the relative leverage between them. There is nothing inevitable about any one angle, and the recombinant logics of Stack platforms allow in principle for the future replacement and displacement of the machinery of one layer. Further, as the activation of a column occurs down and up all layers of The Stack from wherever a *User* may be physically located, the reformation of the sovereign qualities of any one layer may reverberate up to *Users* across the world from and to one another, but because they are located differently, the ultimate effects of that reverberation will not be uniform. As both activate that reprogrammed layer, one *User* may be opting out while another may be opting in, even as their gestures appear identical. What is up for one may be down for the other; what is exit for one may be entrance for another. As a *User* initiates multiple columns over time, even simultaneously, she may be inside the sovereign terms of one version of one layer (say, a *Cloud* platform or the apparent geolocation of her IP address) while simultaneously inside those same layers as the *User* of another column in another stack. That is, the political interpolation of the *User* never finally resolves into the biography of one single person in the same way that the identity of the citizen did and does. The management of multiple *User* identities and political positions is less a psychological disorder than the politics of everyday life. The design of the terms and norms of that irresolvable multiplicity is inseparable from the design of the sovereign characteristics of the Stack layers that mediate it, and in this way the simplistic state-versus-market metaphysics of mainstream Silicon Valley technolibertarianism rather undersells the disruptive potential of its own product.

The trial balloon of an information technology free zone echoes remarks made in 2013 by Google CEO Larry Page during his Google I/O keynote speech, as he wondered aloud about a “Google Island” where we “set aside a part of the world. ... I think as technologists we should have some safe places where we can try out new things and figure out the effect on society. What’s the effect on people, without having to deploy it to the whole world.”³⁴ Page compared his speculative temporary autonomous zone to Burning Man, a city that comes and goes on an annual cycle unlike an actual island, and so of only limited experimental significance and value. Page’s thought bubble presents more than few problems, even taken at face value (especially taken at face value). “Without having to deploy it to the whole world” implies that the island is a society-sized laboratory with all the standard measures in place to isolate and contain contaminants from entering or exiting.³⁵ Accordingly the test-bed can prototype the ideal software society within its formal boundary only if that border is enforced by draconian walls and firewalls. This purified closure would either validate or violate the inspiration for the island as a project, depending on your motivation. If it is not breached and remains a vacuum, then the findings will have diminished significance outside the artificially hermetic environment. If data or some other aspect of the Island microsociety were to leak out, or some of the outside world to link in, on a regular basis, as happened with Biosphere 2 in the Arizona desert, then the experimental noninterference would be breached, to whatever significant or insignificant degree. If breached, then the island is really just one locus among many others in “the whole world,” one that may layer experiments one on another in dense concentration, but one that does what it does in direct (if filtered) relationship with other enclaves and camps. By the measure of Srinivasan’s admonitions, this is a mixed blessing, as the rarified testing grounds must still make sense of unprogrammable input from the normal outside, a concession that may disappoint some purists. On the other hand, his strenuous defense of exit must apply even to the utopias to which emigrants relocate, not just the ones from which they originated. People, data, carbon, air, and capital have to be able to leave Google Island for the principle and narrative to hold true. The only way to have it both ways is to solve for the closed totality of island and then “deploy it to the whole world,” where planetary boundaries drawn against outer space may provide the same closure as the island drawn against the ocean: to the make whole world into “the island.” The inclination toward that information universalism is more familiar to Google’s information cosmopolitanism project than it is to that of the strong secessionists.

There are other future scenarios to spin out from the leverage of this hypothetical fissure, and they all may really be a more polite way of describing the present from the comfort of a slightly off-stage futuristic perspective. If formal Westphalian political geography is to be further delinked from last-instance sovereignty, we could as easily imagine (if not as easily implement) a situation in which a state’s services are available to *Users* anywhere, according to their interests and choices, some determined by

economic privileges, others by cultural and brand allegiances, others by whether they are simply a human or not. As *Cloud* platforms absorb state functions and states realize *Cloud* platform topologies and methods, The Stack does not necessarily privilege either in favor of the other. State and *Cloud* platforms may consolidate their competing and complementary services based on different strategies for protocol lock-in—some geographic, some constitutional, some by historical legacy, some contractual, some extractive, some by taxing premiums, some mere convention. For example, we may draw a scenario in which the European Union (or some quasi-state actor, perhaps a religious polity or a *Cloud* platform) offers far more secure and useful digital identity services than California, so those of us who are now California residents choose to be part of that platform instead of or as well as being Californians at other layers and other times, and effectively pay “taxes” to a state other than the one on our passports according to terms of service. In time, people from different locales might become more intertwined with the services and political conflicts of the EU than they are of their home nation, because it is the EU platform that is actually providing them a preferred secure economic and cultural identity, access to transactions, even education and other social services. Perhaps someone can choose to live under the EU platform’s data laws even if they mostly reside in Los Angeles, and perhaps, by the terms of a data-traffic encryption and securitization mutual nonaggression pact among platforms, no one can (or does) stop them. Perhaps they don’t even give up their US passports, because doing so wouldn’t really matter. In this scenario, some platform strategies would rely on interoperability among federated universal networks (maybe Google’s or maybe not), while others would entertain the advantages and suffer the disadvantages of closed loops (such as Iran’s continuously pending “Halal Internet”). However, for our *User* from California, movement is still restricted. Perhaps the greater state services apparatus in China is part of a transnational bloc that for whatever reasons has been programmed to prevent interoperation with the EU platform. The walled garden topography becomes, once again, one of antagonistic fiefdoms and empires, but ones that are more agnostic as to the latitude and longitude coordinates of *Users*, citizens, clients, and members.

The prospect of polities delinking from states, and states from territories, and territories from the consumable image of governing platforms sets in motion other realignments and liquefactions. Unlike oceans, however, that liquidity does not cover location with an equal, smooth surface. Does universal mobility always also mean that economies mobilize against the consequences of their metatransactional externalities stored in camps, carbon sinks, landfills, and prisons? Some technolibertarian design fictions draw the conclusion that elective self-exclusion will better guarantee a community comprising only those of the preferred disposition. Freedom is taken to mean a challenge to the state’s monopoly on walls and borders, seen as offensive to the principles of personal liberty and mobility, in order that new private walls and borders

can be developed without the restraints of collective regulation. The economist Robin Hansen wonders aloud about the impending likelihood of individual human trillionaires, people who have encircled so much monetary wealth that they each control more than the GDP of any but the top twenty or so nation-states (as of 2015).³⁶ For Hansen, this development might be welcome because it would allow for a scale of privately sovereign capital previously unknown to highly technological societies, which could be risked on behalf of globally beneficial megaprojects that would be otherwise impossible. Yes, perhaps. It may bring instead (or also) psychotic, incestuous autocracies, which generally have a poor track record. For some, the prospects of running the world through a “Sky Club” suite of sovereign private lounge services may feel like a tidy substitute for the messy state of things, but *Users* without the means to purchase their way in, or whose cognitive labor and attention is deemed not valuable enough to support adequate platform services, are left exposed to the wilderness beyond the bad walls.³⁷ Unless it is designed in another direction, this *Cloud Polis* model may tend to lead away from a heterogeneity of dynamic alternatives and toward a strongly differentiated hierarchy of lived experiences and isolated economies. That scenario casts a vast cognitive biomass, heaving and wheezing, clicking on things, with no privacy or support, curtailed into restricted channels of menial online work, training search and advertising algorithms with their frustrated queries, naming things, captcha-ing blurry images until mealtime. In other words, under the terms of this scenario, the differential capacity of mobility for some is proportional to the immobility of others. For some the right of “exit” is paired with a right (or ability) of “entrance” to the island platform of their choosing, whereas for others, “exit” is a dead option because they are denied “entrance” into the closed enclaves that they would choose if they were allowed. Without entrance, exit is not a right; it is a privilege (or product). When exit becomes a privilege, one defined by the suppression of entrance, it stops being a philosophical principle and starts being a weapon.³⁸

What does design learn from this consideration of *Cloud* feudalism?³⁹ Or, what do we learn about design by examining the logistics of this numinous demolition derby? First, violence over the terms and conditions of political geography has moved to society’s *interfaces* (airports, stations, itinerant websites, terminals, shipping ports, disposable cell phones, buses, embassies, financial hubs, hotels, SIM cards, interactive maps). The mobilization of what Walter Benjamin called the “constituent” power of extralegal violence is normally thought to prefer targeting the centers of grounded contiguous institutions (capitols, towers, obelisks, sacred books, and personas), but instead, we see another strategic tendency to go after crossroads, points of convergence, dilation, expansion—interfaces—that are as often diffuse, civilian, urban, and algorithmic. Perhaps this is because the center is now diffused, or because in the interfacial image of totality, the center is already represented and available anywhere. The uncertainty of The Stack’s social repercussions are thereby on display. As we evaluate its potential for

a future geopolitical rotation, we recognize that this is possible only because The Stack cannot guarantee in advance that its *Cloud polities* will not degrade into caricature dystopias (and no one can guarantee that they will). To repeat the point already made, modernity is an open platform for the design and development of antimodern briefs. Not only does modernity disembed and reembed traditional social forms, traditional and fundamentalist social forms also disembed and reembed modernity. It is the proximity and adjacency of premodernist fundamentalist projects with the burrowing ubiquity of hypermodernist platforms that is most telling. It is instructive of what we do not know: how to describe and theorize this atemporal jumble of projective geographies, and what happens to states and the guarantees of modern sovereignty when they must compete to defend so directly for their monopoly on legitimate citizenship? What we haven't figured out, haven't designed, are the appropriate ways for such an assemblage to compose itself. In the figure of the *Cloud Polis* we have, as it stands today, no idea what the terms and limits of a *Cloud-based* citizenship of the Google *Grossraum* will or would entail and curtail: Some amalgam of postsecular cosmopolitanism, agonistic radical democracy, and rational actor microeconomics, largely driven by intersecting petabyte at-hand data sets and mutant strains of Abrahamic monotheism? But specifically, what is governance (let alone government) within that amalgamation?⁴⁰ Working by subtraction, we can say that it may be neither the annulment of dissensus nor the wholesale transposition of political will into systems optimization, nor is it the synthesizing the political as a metaphysical operation undertaken perhaps with technology but never as technology. In the absence of well-drawn alternative futures, the proliferation of unredeemable programs means that the primary positions of utopian dissent end up being those of the secessionist, the fundamentalist, and the misanthrope. That is an unsustainable trinity.

As the following section on the *City* layer-to-come will explore, we are not lacking utopian visions; we are instead drowning in their surplus. It is increasingly unlikely that for each and every state, each layer of The Stack would somehow resolve inside of each national boundary, which would then, as similar units, cooperate in a universal and global constitutional federal order. "The right of the state" to "control the Internet inside its borders" is very difficult to enforce when its borders are on the Internet and are themselves, in one of several ways, outside their own terrestrial geography. Today this option is nevertheless floated by regimes (some if not most authoritarian) hoping to fix themselves against the tides, withdrawing into national islands, while disallowing entrance and exit to their own *Users* and citizens (the state monopoly turns ugliest when its ability to cohere citizens is challenged and undermined). We assume that not only is there no conventionally cosmopolitan resolution forthcoming around the bend but perhaps that there cannot be, and should not be. Isn't the "state condition" of software and sovereignty going forward one in which each of us is already claimed

by multiple jurisdictions at the same time, and in which we already manage multiple formal claims on our social identities and economic agency? Geodesign must draw on that entanglement, not problematize it as a “contradiction” to be solved. The outgoing Secretary of State Clinton was right in this regard: the *Cloud polities* to come—State into *Cloud* platforms and platforms into states—do need new architectures.⁴¹

We need to experiment with formalizing the partial “citizenships” already at work in our multiple *User* identities, including the rights of the “refugees” that all of us will be at one time or another, as both state-ful and state-less persons.⁴² We can draw some provisional principles; we can choose whom we share our time with but not whom we share our world with, and so the voice-versus-exit dichotomy is dangerously incomplete as a basic algorithm for platform geopolitics. First, without the ability to materially design and redesign the systems that we have, “voice” is just requesting others to take action. “If you can’t open it, you don’t own it,” and while you can voice all you want, if you can’t redesign it, it’s already at least partially broken (as they say). *User*-redesignable systems are both more resilient and more accountable: no “voice” then without also “design.” Second, a right of “exit” without symmetrical rights of “entrance” is an empty promise. The emigrants that Srinivasan spoke about not only left their home countries, they also entered a new one. If they had not been able to freely move *to*, as well as freely move *from*, the lesson and the example fall apart. “Exit for all, entrance for some” is a bunker mentality, a sovereign filtering decision camouflaged as something else. It is not practical or scalable and is antithetical to the cold, hard optimism of my thesis.⁴³ As a platform politics, it also goes against the “robustness principle” that John Postel wrote into an early draft of a TCP/IP specifications document: “Be conservative in what you send, and liberal in what you accept from others.”⁴⁴ Lastly, the real futures of our *Cloud polities* will be determined by extreme accidents at least as much by the execution of plans, and the coexistence of opposites as much as by the curation of ideals, and so whereas we might normally contrast the envisioned “clean future” (*2001: A Space Odyssey*'s airport lounges, or *Gattaca*'s dress code) from the “dirty future” (*Blade Runner*'s streets of LA, or *Mad Max*'s social contract of mayhem) as mutually exclusive, instead they actually depend on one other, each world drinking the wastewater of the other. It is utopia and dystopia, both at once. For every *Cloud Polis*, the reversibility of the utopian and the dystopian tracks with the reversibility of the enveloping line of interiority and exteriority. The normalized exception can protect or fight the asymmetries of exit and entrance whether the *Interface*'s *User* intends it or not. As discussed below, this is true (truer in fact) when the lines and hinges of these reversible enclaves/camps overlap and coexist in volumetric space, in the same project, sharing the same envelope, in the same *City* layer. Accordingly, even identifying where exit and entrance take place is not always easy.⁴⁵

71. City Layer to Come: Multiple Utopias and Rough Totality

In the modern tradition, the utopian is bound up with the future and the future with the utopian.⁴⁶ As intimated, however, it also spawns the fundamentalist utopian future-past and the totalitarian future-present, as well as other impulses that sometimes work without messianism. It does, however, require a kind of imagination—what we might otherwise call “fiction,” an alternative that is not exactly true or false but is, like all other models, a simulation of logical intentions. Now today we seem to rely on more sordid measures and untoward means, apocrypha, apophenia, and the gruesome populism of conspiracy theory. Design is not immune to this, and the *City* layer of The Stack may succeed by doubling up again on the actual fictions. In Los Angeles, for example, the rhetoric of future utopia was part of the official foundational brand of the city, a city with so much future because it had so little history. Today the city has less an official utopia than an officially cracked utopia. To speak of the Angeleno condition, its precipice, in the dystopian vernacular is not a critical stance; it is the party line (or more precisely, the oscillation between the utopian and the dystopian, back again, over again, in and out, one through the other, both occupying the same place and plot). The Tyrell Corporation and Rand Corporation, Reyner Banham and Darby Crash, Squeaky Fromme and Ryan Seacrest. Joan Didion’s self-driving Google car and Gregory Ain’s gated community project in Calabasas. Philip K. Dick’s spec screenplay for the *Farmville* movie, and Rene Daalder and Rem Koolhaas’s 1974 screenplay about computer-generated actors and digital films taking over Hollywood. Diller, Scofidio & Renfro’s use of proprietary film script analysis and focus group testing algorithms ported into Grasshopper to simulate crowd flow at the Broad Museum, and blockchain-based digital object identifier infrastructure linking Disney’s DRM copy protection to Prism. Morphosis’s CalTrans building’s second career as the bad guy’s headquarters in every cop show ever made, perhaps soon dethroned by versions of Apple’s UFO megastructure headquarters up the coast in Cupertino. Among the many quotable dictums of British urbanist and science-fiction writer J. G. Ballard, one is “sex times technology equals the future.” We might modify it slightly, perhaps even without changing its essential meaning, to political theology times technology equals the utopian catastrophe. Put differently, even once more, the history of the city is, after Walter Benjamin, bound to the rhythms of theological and prophetic history, and in the guise of the city, that prophetic economy becomes both utopian and dystopian at once. For Benjamin, the persistence of theology is its own revelation, but for my thesis, it is more of a nuisance, but one with explanatory value nevertheless. The design of political systems in the here and now (which can extend in variously extreme durations) is, for better and for worse, often enacted through some politico-theological projection for which real cities and real societies exist, always in a fallen simulacrum of an eventual ideal. For example, after the beginning of the never-ending and never-not-ending War on Terror, the

globalization of risk has brought with it an aspirational vision of security as a utopia of urban interfaces, an image of all urban interfaces in a single governable totality. The geodesign of the *City* layer must surpass or evade this program.

Utopia not only depends on futurity; it produces futurity as a space to be described and filled with peace or war or both. Unlike cities in the real world, utopias are absolute singularities, from a Jerusalem that was the geographic center of the world, to the island jurisdiction of Thomas More, to Theodor Adorno's insistence to Ernst Bloch that the utopian impulse is not that of positive reform, but of complete transformation of the totality of *what is*, up to and including the apparent reality of death. On that last bend sits Fredric Jameson's quote, repeated often by even those it was meant to ridicule, that "it is easier to imagine the end of the world than the end of capitalism." But is that even still true? Was it less true at the end of 2008 than now, when, after the storm, we have blithely resumed business as usual and officially wasted a good crisis? Either way, we are most definitely not lacking in imagined ends—capitalist, critical, green, securitarian, sacred ends—and it is this surplus (of utopian ends of this or that) that presents a problem for the *City* layer. Whatever "end of history" began in 1989 and supposedly ended in 2001 (or later again in 2008) was in no way an eclipse of utopia, as some who believe themselves dispassionate pragmatists would have it. The flat earth of digital globalization was nothing if not intensely utopian in its self-image. Cities were adorned with a new brotherhood of obelisks marking this new "postutopian" order, predicated on the cargo cult economics of Bilbao effects and affects and punctuated by the destruction of the World Trade Center towers in New York City by that utopian urbanist, Mohamed Atta. His master's degree in urban planning described the segmentation of Aleppo, Syria, into Islamic and Western zones where immunity of the former could be protected from the dangers of the latter, as well as his mortification at the mistreatment of the twin towers of the Gates of Al-Nasr. His utopian security urbanism was to "sacrifice one set of twin towers to save another."⁴⁷ This is the problem with a surplus of utopian ends.

What holds for our *City* layer's urbanism proper? Real progress in design tends to occur in response to an emergency, often a war. Recently design has been asked to choose between two metaemergencies: ecological deterioration and securitization/the War on Terror. Lines are drawn. Use cases are modeled. Budgets are allocated. And now a third, the financial crisis, adds another metaemergency/productive constraint condition against which design can push. The three work in combination and in competition for prioritization, and through them, constraint is not only a set of conditions in which design must struggle; to constrain is itself the design strategy. Already these first two crises, among others, turn our attention to urban interfaces, physical and virtual both, as the critical design points. The realities of climatic, ecological, natural, and energy economies as enabling limits on urban systems stage every point within that system as a transference to be interrogated, subtracted, or optimized. For security, the permanent

emergency of potential exceptional violence recasts every partition, aperture, orifice, choke point as a site of discipline for the generalized interior and the immunity of the aggregate urban body. The utopia of security might even be defined exactly as the aspirational notion that the polymorphous (and polyspatial and polytemporal) interfaces of the city can be known and governed in total and as a resolved totality through total images and image instruments. So again, for the normalized exception and the reversible interfacial envelope, it is not the utopian versus the realist but an effluent of multiple utopias, of open utopias and closed utopias, fully operational and co-occupying the same location, totalities on top of totalities. For the *City* layer, we see that this interlacing of utopias, one involving the other, even through the medium of a single architectural or urban form, as defining its lurches into the future.

Examples are not difficult to collect. Lashkar-e-Taiba's attacks on Mumbai are already one illustration of this. The utopian urbanism of this Pakistani state within a state may be based on an expansive geographical vision of Dar al-Islam, whereas the cosmopolitan logic of Google and Google Earth is a singular denuded space into which competing claims can be enveloped. The platform utopia of Google Earth's cosmographic capacities are instrumentalized by fundamentalist politico-theological geographies, such that one space can interweave through the other in the same projection. And again, their interweaving and interdependency produce the space of their encounter (once more, the lesson is less that jihad can fit within Google Earth but than Google Earth fits within jihad). The space of this interlacing of utopias is made and thereby entered into, not entered into and so made, or again, after Adorno, "but in that we travel there, the island of utopia rises out of the sea." But this doubling is also the work of emergent platforms, fundamentalist or futurist. In everyday urban design, we see forms based on both openness and closedness at once, often rendered into the official symbolism of the state. While the George W. Bush-era US embassy in Berlin by Moore Ruble Yudell (though it looks like Halliburton's design) didn't bother even to suggest civil space or civilian purpose, some others do. Consider Kieran and Timberlake's winning design for the US embassy in London, one quickly derided for its schizophrenic posture to the world, both transparent glass and defensive bunker at once. It may be a confused compromise of contemporary cliché and contradictory programmatic requirements, or it may be a perfectly tuned ambivalent and affectless posture for what global architectural presence even means to the Obama era. Similarly, for Morphosis's Los Angeles CalTrans building, dynamic expressionistic forms look like public sculpture but perform as martial security program: decorative camouflage precisely. It is ostensibly an open, green democratic building in which the virtue of architectural innovation and artistry is on display for public edification. The building's footprint is defined in relation to post-Oklahoma City Bombing guidelines against vehicular proximity, a gigantic concrete skirt opening only along one corner, where pedestrians encounter outsized expressionistic metal fingers as they try to enter. Housing the higher administrative functions of

California's network of roads and freeways, it is not without reason that the CalTrans headquarters is a kind of fortress, but it does not really look like one exactly. It looks like irreverent sculpture, but it is in fact the whimsical artistic sculptural elements that also are the defensive techniques in play and at work. The building's architect, Thom Mayne, and I once discussed this, and the irony is not lost on him that one key function of the expressionist gestures of the LA School is now to serve as security programming. This displacement is by no means limited to this kind of design. In this nervous self-contradiction, the urban public body is redefined by its supposed relation to imminent violence by extrastate actors, but with design flair and ingenuity. It is another mode of the paranoid style in American spatial politics, one for which urbanism's primary use cases are always, on the one hand, the tax-paying citizen who may actually also be suicide bomber and, on the other, the symbolism of a responsible and transparent institution held up and out of unauthorized reach. Attempts to reconcile the performative and symbolic demands of security and the open society within the same architectonic entity, whether a building or a park or a city, means interweaving openness and closedness into a complicated pattern of open and shut, bulletproof glass that makes building skin transparent, massive car bomb deterrents as public art in pedestrian plazas, evacuation corridors that link floors with sculptural public walkways that also sort and filter crowds into firewalled zones in case of emergency, and more. This combination of Enlightenment transparency of publics and gated bunker with weaponized interfaces is a special design solution that we could call a glass fort. The combination of apparent opposites into adjacent fabrics and into a single form is one version of what reversible political boundaries and interiors collapsing on themselves—the normalized exception of the reversible interface—look like as a design language. Its utopian enclave is less *Elysium* than executive lounge membership check-in protocol, and its dystopia is less the vast pens of Agamben's canonical camp, and more the furtive moments of political exception, sandwiched between moments of generalized mobility, like the ten minutes spent in airport security lines.

While we can interpret the political complications that give rise to these forms, we are less certain of their ultimate effects, even as we get used to them. The securitarian utopia of total interfacial visualization works at the scale of the individual building or city because it also works at the scale of subdivided states and jurisdictions, especially when its ability to separate one from the other is mostly legal and symbolic. The border, like any other interface, activates as much energy and information as it cleaves and suppresses, and while there are persistent calls to finalize a West Bank-style total wedge between the United States and Mexico, from the Pacific to the Gulf, the utopian securitization that motivates this is not possible. The border economy is so deeply and thoroughly interdependent (money, goods, labor, people, data, water, food) that to tilt toward their final disentanglement by strong sorting is a fantasy. Instead the emergent flow of day-to-day networking continually overwhelms the zombie jurisdictions of this

prophylactic geopolitics. On the other side of the world, Jerusalem itself is in many ways archetypical of this sort of designing against regional intracontamination. The physical city materializes the sacred maps of three major religions, one layered on top of another, one woven through another, history and prophetic future differentially activated for Jews, Muslims, and Christians. These exist also in the imaginary architectures of rebuilt temples, original foundations, polydimensional boundaries and land rights codes, and of course a real wedge introducing an artificial canal, torturing the limits of legitimate jurisdictionally past their breaking point. But the boundary of this theocratic enclave/camp economy is not only at the external membrane of official Israeli territory. Like the international borders held deep within landlocked airports nowhere near another country, the checkpoints that dot the political border, marking interior from exterior, are repeated again and again inside Jerusalem proper. These external-but-internal checkpoints multiply the border interface, absorbing it into the interfaces of everyday life and folding the civil war of Abrahamic monotheism into their programming. Finally, as their association is concretized in the governed interfaces of mutual immunization, it is also no clearer where the secular economy is predicated on theocratic military segmentation, and where theocratic military segmentation is built on the secular economy.

“Imagine no lines” is the manifesto of security experts, as in no frontlines to definitely situate war and no clear interior demarcated by exterior membrane. This infinite smoothing is perhaps another name for what Schmitt called *total war* and Virilio called *pure war*. It is in effect the same thing as “imagine nothing but lines” where the infinity of smoothness proves on closer inspection to be infinite striation. The reversibility of the line and the no line is expressed in the reversibility of the open and the closed within the same architecture, the line that draws the enclave that flips into the line that draws the camp. Just as for the embassies, the paired demands of open and transparent urbanity and the megastructure-under-siege, democratic and martial, co-occupying the same structure and the same architecture, less juxtaposed than twisted one within the other, never dissolve into the same solution. So for The Stack, this leaves more questions. Does the surplus of utopias prevent political will from acting on a planetary level precisely because it sublimates so much energy into the realm of the imaginary, leaving us to conquer only fantastic worlds? Are these dreamworld fragments recuperable? If romanticism is foremost the will to lost unity, and utopia the will to potential totality, can there be an antiromantic utopianism? A catastrophe without melancholy? For the geodesign we most need, can there be a true plurality of utopias, not a totality of the multiple, but like real cities, a multiple of totalities?

It would seem that the positive answers to these questions point away from Security (with a capital S) as the sovereign utopian imaginary for which all governance becomes a subset of policing. It does not, however, bend away from governance per se (and from the design of governance). An urban interfacial regime constitutes and

mediates power, and this is why it is worth designing at all. The unromantic and unmelancholic utopian impulse as a conceptual driver for urban futures (whatever direction that might lead) may or may not involve the politicization of this difference between securitization and the programmatic interests of another geodesign framework. Just as civil technologies can and do have martial qualities and consequences regardless of whether militaries or paramilitaries ever touch them, so too can explicitly military technologies have civil purpose that goes beyond, or even altogether evades, their instrumentality for violence or how that violence would have designated the city. In fact, the city itself, the primordial bunker on the horizon or the boulevard turned into battleground, is perhaps the exemplary technology for the oscillation between military and civilian deployments. We already say all too readily that violent irruptions within the *City* represent failures in the governance of interfaces. Any architecture not only symbolizes power; it also mediates it directly, even constitutes it. One core weakness of securitization as the design driver of urban interfacial systems is its consistent tendency to enact greater violence onto the city that it is ostensibly protecting than the dangers it defends against is ever likely to bring. As perhaps our single most important form of technology, the *City* suffers from a kind of autoimmune disorder by which we disfigure them in advance of potential future disfiguring; we attack them with defensive measures in the inverted image of a potential threat of future criminal or terrorist attack. This is designing for the emergency (as discussed in the *Earth* layer chapter, and not on behalf of the emergent) by preemptively repeating the possibility of the catastrophic violence before it actually occurs. That eventual violence may or may not come, and now it does not even need to come because its disfiguring plot has already been accomplished by security engineers. By way of precedent, consider that for the entirety of the Cold War, the United States and the Soviet Union did not explode a single nuclear device on the enemy's territory. Instead, in the guise of the test, the United States bombed the United States (over 1,000 bomb tests, over 300 of them atmospheric, in Nevada, Alaska, Colorado, Mississippi, New Mexico, the Marshall Islands, and elsewhere, for a total of 174 megatons) and the Soviet Union bombed the Soviet Union (700 to 900 bombs, in Kazakhstan, Arctic archipelagos, Turkmenistan, Ukraine, and other areas of Russia proper, including the Tsar Bomba in 1961—50 megatons all by itself, or ten times the total munitions of World War II, for a total of 285 megatons). By comparison, the bombs that were used in a war on an external enemy, on Hiroshima and Nagasaki by the United States, were 15 and 20 kilotons, respectively. To attack one's own body, not just to demonstrate the capacity to attack, but to ward off the possibility of the attack from occurring in the future by performing the attack over and over again on oneself: this is pathological, is it not?

Another geodesign problem for the *City* layer with which we are concerned, then, is not the protection of indeterminate space from this sort of excessive defense mechanism,

but the extension and expansion of platforms of openness, not because it would be nice but because it is necessary to the ultimate goal of robust, designable governance of urban platforms. This requires a model of the *User* that is constitutionally diverse and well tuned to the computationally active urban interfaces in which it is situated. That model would be guaranteed more by the continuity of urban networks, blending into planetary boulevards, than by cartographically delineated parliaments. Its potential depends on the viable universality of whatever base-unit interfaces it can build on, and whatever intelligent agent, human or nonhuman, of that urban political geography would engage them. Buttons? Borders? Ballots? Buildings? Still just these interfaces? One of these becoming another? In the worldliness of migrant labor, migrant capital, migrant information, migrant cultures, migrant languages, migrant standards of legal rights and itinerant universalisms, the specific standards of (national) citizenship (*jus sanguinis*, “right of blood,” and *jus soil*, “right of soil”) cannot carry the same guarantee of determination as they may have under different regimes of relative motility operated by nations tied to land and states woven to nations. These citizen statuses may be a matter of life and death for some, but are they still inadequate foundations from which to scale the model geopolitics of the *User* going forward. Furthermore, any inadequacy is measured not only against hypermobility, but against positions of agency no longer exclusive to humans and the political traditions of humans, occupied by the overlaid populations of *Users* and *Addresses* for whom we now design. Such are the cities, and the *City* layer.

The next section deals directly with how essential the *Addressing* systems that link all layers of The Stack through ubiquitous but not always universal matrices are to the geodesign we undertake. They may be seen as planetary-scale megastructures in and of themselves, naming and mapping physical matter and temporal events at superhuman scale. Crucially, however, just like the interweaving jurisdictional volumes of The Stack itself, these systems may overlap one another in different states of alignment. They may cooperate, they may conflict, and they may be unaware of one another. At the level of the *City*, they may be operationalized for Stack-versus-Stack warfare, whereby one interfacial regime attacks the precisely *Addressed* object within another Stack, in another city, perhaps even in such a way that the other Stack is incapable of identifying and addressing the anomaly. Any one city may contain multiple addressing regimes or may be exclusive to only one (which may constitute the functional definition of the interfacial utopia of security: as pure as it is fragile). Differences between the map of the real (the *Interface*) and the archive of what is enumerated (the *Addressed*) are differences not only over a contested ground; they are differences in how to describe, think, and act on that ground in the first place. Different addressing regimes inform different interfacial regimes, which in turn ground the *Cloud* differently, over which their complementary and conflicting platforms contest one another. That is, their holy wars are not only over naming and enumerating the ground on which the temple might go;

they are also over the definition of *ground* in the first place and over specifying into what currencies it can be converted and circulated.

72. Address Layer to Come: Platform-of-Platforms

Our extended consideration of The Stack is hardly the first time the idea of a computational governance has been considered. From the early twentieth-century science fiction, to the midcentury rise of IBM and cybernetics, to late-century campaigns to see the “law as code” and “government as a platform,” it has been a recurring thematic ideal or nightmare, depending on perspective.⁴⁸ It is curious, then, how poorly academic political science and international relations have dealt with computation as an institutional and global force. It is acknowledged as a mechanism available to statecraft and a sector over which policy is to be developed, but it is not usually considered by these disciplines as a primary seat of authority in its own right. Conversely, computer science, at least its populist variants, has had little trouble convincing itself that the social and institutional mechanisms for governing complex software and hardware systems (e.g., open source collaboration, sovereign user and administration, clustered APIs) can directly displace older models of public governance without prohibitive difficulty. But the translation between politics and programming is not automatic or inevitable, and indeed their transgenic encounter is occurring in ways that are often unpremeditated and misunderstood (being therefore the topic of this book). We observed that new forms of governmentality arise through new capacities to tax flows (at ports, at gates, on property, on income, on attention, on clicks, on movement, on electrons, and on carbon, for example). It is not at all clear whether, in the long run, *Cloud* platforms will overwhelm state control on such flows, or whether states will continue to evolve into *Cloud* platforms absorbing the displaced functions back into themselves, or whether both will split or rotate diagonally to one another, or how deeply what we may now recognize as the surveillance state (United States, China, or others) will become a universal solvent of compulsory transparency or an opaque monolith of absolute paranoia, or all of the above, or none of the above.

Between the state, the market, and the platform, which is best designed to tax the interfaces of everyday life and draw sovereignty thereby? It is a false choice, to be sure, but one that raises the question of where to locate the proper site of governance as such. What would we mean by “the public” if not that which is constituted by such interfaces, and where else should “governance”—meant here as the necessary, deliberate, and enforceable composition of durable political subjects and their mediations—live if not there? Not in some obtuse chain of parliamentary representation, some delusional monadic individual unit, or some sad little community consensus powered by moral hectoring, but instead in the immanent, immediate, and exactly present interfaces that cleave and bind us. Where should sovereignty reside if not in what is in between

us, and derived not from each of us individually but by what draws the world through us? For this, it's critical to underscore that *Cloud* platforms (including sometimes state apparatuses) are exactly that: platforms. It is important as well to insist once more that platforms are not only a technical architecture, but also an institutional form. At once, they centralize (like states) scaffolding the terms of participation according to rigid but universal protocols, just as they decentralize (like markets) coordinating economies not through the superimposition of fixed plans but through interoperable and emergent interaction. Next to states and markets, platforms are a third form, coordinating through fixed protocols while scattering free-range *Users* watched over in loving if also disconcertingly omniscient grace. The platform as totality draws the interfaces of everyday life into one another, again, where the maximal state and the minimal state, "Red Plenty" and "Google Gosplan," start to look weirdly similar. From this, our own subjective enrollment in them is less as citizens of *polis* or as *homo economicus* within a market, but positioned rather as *Users of a platform*. As I see it, the future work of geopolitical theory (and of design and geopolitics) includes the development of a proper history, typology, and program for such platforms. These would not be a shorthand for *Cloud* feudalism (or for the monotonic network politics of the "multitude") but models for the organization of durable alter-totalities that command the force of law, if not necessarily its forms and formality. Our understanding of the political and economic philosophy of platforms demands its own Hobbes, Marx, Hayek, and Keynes—but until then, only a few broad strokes or, a field of dots that may provoke other inspired line drawers to connect them in ingenious ways.

In the "platforms" section of the first chapter, I briefly discussed the history of centralized cybernetic economic planning programs, including during the 1950s and 1960s in the former Soviet Union, under the supervision of many, including especially mathematician Leonid Kantorovich, as well as the Cybersin initiative, undertaken in the early years of Salvador Allende's rule in Chile, as designed by British cybernetician Stafford Beer. Abstracted from the politics of their host nations, the Soviet Union and Allende's Chile, there has been renewed interest in the sometimes tragic stories of these primordial computational economies that place them both on the shelf with other wistfully unrealized past utopias, as well as a more pragmatic interest in properly constructing a history of the present and perhaps to discover overlooked and highly relevant accomplishments, both technological and economic.⁴⁹ As part of a cyber-leftist archaeology, these projects are included among Nikolai Federov's "Cosmism"; Alexander Bogdanov's revolutionary-era proto-systems theory, Tektology, and *Red Star*, his science-fiction novel about a socialist utopia on Mars; Konstantin Tsiolkovsky's involvement with *Kosma Vojagho*; Pavel Klushantsev's space exploration films, even Marcuse's speculations on automation and the end of scarcity; and any number of other interfaces between science fiction and speculative communistic futurism.⁵⁰ At the same time, in their matching of totalities, and of computational systems with economic and

territorial totalities, they are also part of a larger genealogy that includes, on the one hand, the modernist design value for the rational manufacturing and distribution of a universal baseline of material goods based on the most advanced available chemistry and calculations, and on the other, capitalist platforms for economic governance, such as simulating markets, calculating optimal prices, futures modeling, consumer profiling, and logistical optimization. Liberal technocracy has its own (sometimes overlapping) utopian archaeology. As we'll see from the perspective of the platform looking out at the economies it is being asked to compose, the differences between state and market planning are far less dichotomous than they may appear from perspectives looking in. In the 1960s, programmers tried to use available computing capacity (incredibly limited by today's standards) to implement the multifactorial calculations demanded by Gosplans, the State Board for Planning, that supervised the Soviet five-year plans. They were attempting to rationalize through planned centralization the supposedly spontaneous pricing computations of the market—what Hayek called *catalexy*. For Hayek, a market is itself a distributed computer of sorts that will always have better information with which to work because calculations happen at the very end-points of the network, within individual transactions and on their cascading pressure on aggregate supply. To the socialist cyberneticians, the market's transactional calculations would always be fatally inefficient because they are driven not by the optimal distribution of goods and value but by the tactical extraction of profit, always providing a price that is a distorted reflection of that surplus and not the need fulfilled (among other reasons, of course). These are caricatures of real economic mechanisms that are always anything but pristine, but the terms of abstracted oppositions posed here are useful in that they may clarify what is most important about the platform economies that straddle both types.

Platforms locate the signal processing of pricing intelligence in both central mechanisms and in the indeterminate activities of *Users*, whose behavior may be modeled in advance but is not legally fixed to the dictates of that model (we hope). Furthermore, the functional difference between goods provided without profit by public utilities versus goods provided at or near zero-marginal cost by quasi-private platforms suggests a paradoxical alignment between the absolutization of monetary signification and its practical obsolescence (more on this below). A centralized system may be based on input-output models that are agnostic as to exchange value of goods and are therefore able to include the entire life cycle of resources in their models of economic activity, in principle if not in practice, but historically have been crippled by the slow feedback of demand signals back into those models. For expenditures with a long duration and widely shared return on investment, such as building a bridge, this slow relay is not such a problem, and most likely an advantage. Market governance works by building aggregate systems out of the emergent intelligence of zillions of individual transitions, including the distributed planning and forecasting of commodities and futures, and in doing so, they can have difficulty modeling totalities with long durations, especially

ones composed of resources with tremendous value but no explicit price, such as a rainforest (or perhaps a bridge), and which therefore can be excluded as “externalities.”⁵¹ (Again to preempt criticism from economists and ideologues alike, I grant that my treatment of these is artificially reductionist. They are meant to diagram a dynamic of convergence between what are conventionally understood as polar opposing tendencies into platforms, shown as technical-institutional systems that combine aspects of both and perhaps the ascendant infrastructural typology for contemporary planetary-scale computation.) Of particular interest is when very large-scale market actors also take on the governing role of central planning of the vast numbers of transactions that they engage in and enable. Problems of asymmetries of information between market actors engaged in a transaction are well known and in many respects presumed as part of a regularized cycle of buyers and sellers turning into winners and losers. However, when the sheer scale of one actor also allows it extraordinary omniscience and influence over the very possibility of a transaction, perhaps even by controlling the determining signals of prices already in advance of any impact they may have on any “open” transaction, then a form of governance is discerned. For example, the platform scale of Walmart and Amazon allows them line-of-sight into the supply chains that is so comprehensive, from the raw materials on which their suppliers depend through to the tastes of individual *Users*, that they can set wholesale prices (and wages) at skin-thin margins because they know more about their suppliers’ bottom-line costs than their suppliers do. This is one aspect of how platforms can manage a kind of *synthetic catallaxy*.

Before discussing the key difference between these two platform actors, one from Arkansas and one from Seattle, we should first quickly revisit Jameson’s infamous consideration of “Walmart as Utopia” (perhaps in light of Lenin’s celebration of monopoly). On the one hand, Jameson sees the incredible accomplishments of this most rapacious of capitalist organisms: keeping prices low enough that lower-income shoppers can afford a diverse range of standardized goods modeled to satisfy standardized desires, driving logistical and production innovations and with them rationalizing the deep chemistry of industrial production in ways that would have seemed impossibly attractive to the early modernists, and many others. He writes, “So it is that Wal-Mart is celebrated as the ultimate in democracy as well as in efficiency: streamlined organization that ruthlessly strips away all unnecessary frills and waste and that disciplines its bureaucracy into a class as admirable as the Prussian state or the great movement of *instituteurs* in the late nineteenth-century French lay education, or even the dreams of a streamlined Soviet system. New desires are encouraged and satisfied as richly as the theoreticians of the 1960s (and also Marx himself) predicted, and the problems of distribution are triumphantly addressed in all kinds of new technological innovations.” At the same time, this extraordinary logistical accomplishment comes at equally extraordinary costs. Jameson continues, “This dialectical character of the new

reality Wal-Mart represents is also very much the source of the ambivalence universally felt about this business operation, whose capacity to reduce inflation and to hold down or even lower prices and to make life affordable for the poorest Americans is also the very source of their poverty and the prime mover in the dissolution of American industrial productivity and the irrevocable destruction of the American small town.” In other words Walmart’s relentless synthetic pricing and production megastructure allows the working poor to afford a diverse collection of commodities from roughly 11,000 stores in twenty-seven countries, but at the expense of keeping them poor. Walmart is known to pay wages so low that many full-time employees may receive regular government assistance just to survive, effectively treating marginal labor costs as an externality and outsourcing them to the state as just another manipulated supplier, and all the while realizing global net profits of over \$17 billion. A platform actor of this scale could exercise its sovereign influence to radically restructure and improve production and labor conditions, but largely does not do so at the scale of need and opportunity.⁵² Perhaps in an alternate universe (or year to come), Bizarro Walmart will exercise its ubiquity toward another and better *Cloud Polis*. Amazon’s total revenue is still a fraction of Walmart’s but it is all e-commerce, a domain in which Walmart still struggles for various reasons, but obviously where the long-term growth in retail will be realized.⁵³ By comparison, and to the ongoing chagrin of some of its investors, Amazon regularly loses hundreds of millions of dollars a year, with revenues well below the cost of its operations and aggressive infrastructure expansion.⁵⁴ What is the proper name for this kind of platform actor? Forget your associations with “Amazon” as real brand and company and imagine something as yet unnamed that does the following: it aggregates the most comprehensive catalogue of commodities ever enumerated; provides supply chain omniscience, a comprehensive synthetic catallaxy that is arguably rivaled only by Walmart or Google (among remotely similar companies); uses this leverage to lower unit costs by deflationary degrees each year; introduces its own proprietary unit addressing system; innovates the use of robotic warehousing processes to distribute objects with a minimum of physical intermediation; and does so at global scale without making a profit. Public utility? Monopoly? Neoliberal deterritorialization incarnate? Object-oriented *Cloud* feudalism? What would have the mid-1960s engineers of *Red Plenty* have called it?⁵⁵

There is a joke (now an old joke) that goes like this, “Question: What is the most significant accomplishment of communism? Answer: The Apollo Space Program.” The implication is that state communism not only accomplished nothing with the violent upheavals of its misguided and self-corrupted effort at building egalitarian society from scratch, except by way of stimulating market-based societies to greater heights in response. It’s not my interest to revisit or revitalize Cold War ideologies (or evangelize twentieth-century economic ideologies, as should be clear by now) and so will offer instead an update and correction of this joke.⁵⁶ The most significant indirect

contribution was not Apollo; rather it was Google. Is that still even a joke? The Page-Rank algorithm that formed the initial core of Search was based on “collective evaluation” as opposed to expert evaluation, which would be more expensive, slower and less reliable when dealing with massive amounts of unstructured and dynamic data. As described by Massimo Franceschet in his article “PageRank: Standing on the Shoulders of Giants,” which locates Google’s algorithmic methods in the long and diverse history of econometric, sociometric, and bibliometric information evaluation and calculative techniques, “PageRank introduced an original notion of quality of information found on the Web: the collective intelligence of the Web, formed by the opinions of the millions of people that populate this universe, is exploited to determine the importance, and ultimately the quality, of that information.” This too is synthetic catallaxy, the real-time weighing of the value of information within a differential field too large for any one actor to envision or evaluate, let alone steer. But instead of this system taking place “spontaneously” and for the purpose of realizing profit by one side of incremental transactions (there is no buyer or seller—yet), it is done through the unilateral centralization of decision-making algorithms into a single governing computational platform. For Google, that is itself an incipient intelligence as taught by its *Users*, is guided by the cosmic vocation “to organize the world’s information and to make it universally accessible and useful” and to do all this at a unit transactional price of zero and for half the planet at once. Again, what would have the engineers of *Red Plenty* have called this?⁵⁷ Perhaps they would call it “my employer”? The genealogy of a project as complex as Google is much more twisty than any straight line from 1958 to 1968 to 1998, but it is impossible to understand the Google variant of *Cloud Polis*, and the accomplishment of engineering a freely available, global-scale econometric infrastructure, let alone the impetus to do so without also understanding the design ambitions of socialist/ communist cybernetics for a universal platform-of-platforms that produces nothing on its own but would optimize everything to everyone.⁵⁸ By some Gordian knot in political-economic history, among the most important contemporary accomplishments of capitalism is a descendant flower from the rubble of communism, our beloved and feared Google Gosplan (NASDAQ: GOOG). Perhaps—it is as yet to be determined—the inverse may also be true, and an ultimate consequence of Google’s platform universality will be an economic and informational social apparatus that bypasses the pricing and planning deficiencies of twentieth-century economic doctrines. In some variants of Marxian theory, it is an article of faith that socialism will emerge once capitalism has perfected technological systems to a degree that competitive ownership is unnecessary. In time, so the parable goes, the state itself will give way and dissolve into the generalized sovereign network of the general intellect. In the future, once all the information is “made universally accessible and useful,” it is unknown whether the future descendant(s) of today’s Google Gosplan will also fade away. “My work here is done,” says the *Interface* one morning. “OK, Google,” we reply.

In the meantime, the design dilemmas of algorithmic governance are undecided but of pressing importance.

The infrastructural determinism of platform economics shifts where politics might be located and what its compositional limits might be in relation to markets, agora, and polities is solved differently by different systems. The economic architectures of China, the United Arab Emirates, Wall Street, and Silicon Valley (for example) all represent different genres of capitalism, differently expressed by similar computational substrates, enrolling or refusing available layers of The Stack. More important, components of those architectures are as available without prejudice to geodesign as much as the legacies of red futurism. We are interested in systems that can adjudicate the “socialist pricing problem” (knowing that centralized systems can be too slow to sense and calculate individual price signals) and as well as the *capitalist pricing problem*: that market models can confuse the emergent effects of transaction liquidity with systems planning and do so at the expense of artificially segregating and suppressing the real costs of near- and long-term “externalities.” We allow, to the pronounced consternation of both socialist and capitalist realists, that some polypaternal supercomputational descendant of Google Gosplan might provide a mechanism of projection, response, optimization, automation, not to mention valuation and accounting, beholden neither to market idiocracy nor dim bureaucratic inertia, but to the appetite and expression of a curated algorithmic phyla and its motivated *Users*. Perhaps to an extent, it already does. As suggested, such a platform-of-platforms might be idealized as pure governing medium, creating almost no original content in and of itself, because its fundamental role would be to interface, sort, and optimize the logistics of physical and virtual value, moving in and out. Its politics are fought over the naming, archiving, optimizing, disseminating, and recapitalizing what has been or will be produced by *User* polities that can possibly be *Addressed*. Its vision, “seeing like a state,” would be defined by the particular constellation of addressable objects and processes that constitute its world and by how it gives interfacial narrative to these through binding metadata about its uniquely cohered archive(s). Now, consider not just one of these universal apparatuses at work, but several, each interlocking, opposing, or ignoring the others, each social totality of planetary-scale computation enrolling the whole globe at once, along with the others. Comparative planetology, we now realize, does not necessarily require going to Mars.⁵⁹

The calculation problem for centralized plans or decentralized markets or any combination of these depends on the availability of data, which itself depends not only on the worldly divulgence and figuration of information from signal to sensor, but on how any platform apparatus is constructed to construe the world as an *Addressable* surface in the first place. A old growth redwood falling in a forest is not registered as a governable signal if the sensing apparatus is ignorant of its existence or relevance. It is not data until it is made so. Sociology has been aware of the potential and perils of diagramming the world by immanent statistical self-transparency going back at least to

Tarde's *Monadology and Sociology* (1893).⁶⁰ Tarde writes, "If statistics continues to progress as it has done for several years, if the information which it gives us continues to gain in accuracy, in dispatch, in bulk, and in regularity, a time may come when upon the accomplishment of every social event a figure will at once issue forth automatically, so to speak, to take its place on the statistical registers that will be continuously communicated to the public and spread abroad pictorially," and so big data optimism is born, at least in theory. With the benefit of second-order cybernetics in hindsight, we understand that the "registration" process is bidirectional, that reporting agents in such a system both send and receive information to a higher-order governing abstraction. The swarm is measured in relation to how algorithmic governance feeds back to it, resensing its reactions, and so on. From the opposite perspective of the *User* looking to the platform, what may appear as data visualization may prove to be an *Interface* allowing delimited access and even control of the platform network and its data, and so between the edge-and-node visualizing one another, the *Interface* also becomes a visual diagram indexing the current state of this multiscalar recursion (at least in principle). The immediate question to ask on behalf of governance to this idealized cybernetic flow is where to locate anything like planning. Is the plan still a future model pushing from the center out, or is it now an emergent pricing index pushing from the periphery in? Neither extreme is really adequate on its own, and so instead we would focus on how planning and programming, some with the force of law, may be situated at (if not originate from) the *Interface* layer in the form of the model-simulation. We hold that the epistemic significance of big data would be realized by their ability to find and surface utterly alien patterns and relationships among the measured, and thereby to disturb our doxic conventions, even, and especially when, those interpretations are sensible only to machine *Users* (more on this below). Unfortunately, to date these methods seem to more disposed to optimize surgical correlations, confirming basic presumptions, and delivering high-resolution skeuomorphologies that don't feel as fragile as they really are only because everyone else is making queries and visualizing test data based on the same conceptual conventions.

In the *Address* chapter, I introduced the notion of "deep address," an expansive concept suggesting the identification of objects and events with a granularity that far surpasses the scales at which humans perceive physical space and duration. We observe the world as given by the capabilities of binocular vision that can register light between infrared and ultraviolet wavelengths, memory that can capture and forget events that happen in seconds or years, and so on. The physical world itself also works much faster and slower than that, and between nanometric and astronomic magnitudes, there is much we miss without using microscopes and telescopes. As for all of the things and events beyond natural perception, the design program of deep address considers how it is that some as yet unspecifiable means to sense their presence and to identify them according to a generic addressing matrix, and even to network them one to the other,

would crack open the world's information portraiture well beyond the normal scale of Internet of Things.⁶¹ That is, the governable space of deep address is not only limited by the technological ability to see and sense something but also by the conceptual categorical systems in place that interpret what is seen and sensed as being something worthy of a discrete address or not. As discussed, any governing system, especially those situated as *Cloud Polis*, congeals into a functioning governing platform by the combination of these two contingent forms of power and knowledge. The platform sees what it can, what it is programmed to sense, and it identifies and addresses those perceptions according to how it is programmed to "think," seeing what it thinks and thinking what it sees. At the same time, this is a highly dynamic process and one feeds back into the other, and any durable platform will evolve according to how and what it thinks about anomalous signals. The "alien insights" we hope appear from any sufficiently smart data analysis may begin as entropic noise and in time become foundational typologies and ontologies. This is where the *nomos* of the *Cloud* really works itself out, inch by inch. As Stewart Elden writes, "Territory should be understood as a political technology, or perhaps better as a bundle of political technologies. Territory is not simply land, in the political-economic sense of rights of use, appropriation, and possession attached to a place; nor is it a narrowly political-strategic question that is closer to a notion of terrain. Territory comprises techniques for measuring land and controlling terrain."⁶²

In the near term, before its holy wars kick in, we can plot the *Address* layer-to-come by tracing how it works within the forms of algorithmic governance that we already have. We've suggested that the recent financial crisis was also a crisis of addressability in that the kaleidoscopic nesting of asset debt inside collateralized futures inside options and so on not only allowed contagion to spread without quarantine, but that the absence of any reliable map of this haunted house of intertextual valuation made untangling the rot from the flesh all but impossible. The redesign of money—not just the currency vehicle of exchange, but of the valuation of things and events as such—may also require, or even entail, a more rigorous, flexible, and intricate mechanism for the identification of discrete assets as they twist and turn their way through financial wonderlands. What we now call "high-frequency trading" or algorithmic trading may continue to represent an increasingly larger percentage of all transactions, and as these techniques become more institutionalized, their methodologies and mechanisms become more normalized for even long-term investments. At the same time, the ability for deep address to engender not one but multiple address topologies describing the same set of events means that the potential for unprosecutable chaos is increased unless there are some workable standards for financial singularities, bifurcators, and resolvers that can police these data ontologies. Among the key drivers in the emergence of HFT were proprietary market simulations with which traders could execute mandated best prices and which helped inaugurate the supercomputing arms race on Wall Street.⁶³ Money, as we know, signifies not only value but debt, and anthropology confirms that

debt as a technology of social organization precedes the innovation of material tokens to measure it. In time, some traditional materials became reference standards, however unlikely, such as the element Au, a soft, shiny, yellow rock. This option reintroduces the problems posed by a delimited total amount of value or debt reference, which are elastic by definition, but which are supposedly equal to the total quantity of that signifying substance. That total may be continually subdivided into units with less and less value, but the zero-sum economics is guaranteed by the physics of the whole. Moving off the gold standard increased the scale and granularity of debt to both increase, and with them the quantitative intensity of the social bonds that debt binds to itself (in principle at least). It allowed currencies to swell and contract in relation to one another and to the vagaries of unit value purchasing power, but the indexing of price is not the same as the indexing of value which is the tabulation of what should be most scarce within an economy. For example, a carbon tax may help force the real deexternalized costs of carbon to rise, to undistort transaction pricing signals, and in principle to make its continued overdigestion by ecological sinks prohibitively expensive and hence scarce by design. This dovetails with the logic of computational megastructures like Planetary Skin, which would wish to identify, address, and ultimately sort the price of ecologically sensitive molecules and chemical reactions. Some future permutation of these sensing apparatuses that is also a kind of banking or insurance infrastructure (and what are banks and insurers if not also already sensing apparatuses) may turn carbon itself into the reserve standard against which units of currencies can enumerate debt and value (including our species' carbon debt and the value of the ecosystems we have remaining), or at least a kind of standard conversion currency. If Au has already established that we can link currencies to the table of elements, then why not to C? Would it do more to ground money in a marking fabrication of total debt that is more relevant to economies defined by the paradoxes of Anthropocenic growth?

Speaking of reserve currencies, Bitcoin introduces addressable scarcity not in direct relation to the sum of mined minerals or national currencies, but by the mathematics of solving increasingly difficult problems toward an eventual arbitrary limit of 21 million "coins." There is much to explore with Bitcoin, blockchains and related initiatives, such as Ethereum, but it is also the monetary platform of choice of secessionist projects for which the metaphysical expulsion of externalities is the paramount program, as important if not more than the disintermediation of central banks. The version of Bitcoin that we have (other currencies may fork or follow) is exemplary of the future-archaic quality of many Stack innovations. It is, as Paul Krugman puts it, "both a 17th century and 21st century currency at once," a currency mechanism that would freeze the sum total of possible liquid value tokens in the world, now and forever.⁶⁴ In this regard, for certain persuasions, it is better than magic rocks (like gold) because incrementally more gold can always be mined, allowing rootless cosmopolitans to upset "the natural order" of hierarchical hereditary accumulation. If nothing else, Bitcoin

has made money into a general design problem, as it should be, and not just the design of financial products or the look of paper bills, but of vessel abstractions of time, debt, work, and prestige. Better alternatives are needed soon, before today's digital platform currencies are prematurely entrenched in the wrong direction (artificially attenuated to closure and scarcity of the wrong stuff). Bitcoins also appear not only in mathematical space but through the energy-intensive mining of coins using special hardware with names like AntMiner, Minerscube, TerraHash HashCoins, and so on. The math is a function of the processing power of the servers, which is also a function of the amount of energy that a server pulls, which for some custom clusters is tremendous. The value of a single Bitcoin is also then a direct expression of carbon-intensive energy brought to bear on powering and cooling chips. Perhaps the transparency of that chain of transference, from energy to money, may lead toward even more direct reference to the heat and carbon at the real bottom of this particular financial stack.

The ultimate granularity of that reference, how it might address and identify value or debt by trace-routing production and consumption, both physical and conceptual, is but one fenestration through which deep address enters into the design of Stack money. In addition to some massive sensing, sorting supercomputational platform needed to track and pay all this—some terrestrial amalgamation of Planetary Skin, Google Gosplan, and whatever else—mechanisms are needed to identify every single instance of economizable matter, action, event, and procedure that can be accounted for in the first place. The deep and wide adoption of some massively universal, spatially and temporally expansive addressing schema is required to individuate, nominate, and enumerate something like Avogadro's number of instances per person, such that this absolute accounting of everything might have a map of its own charge. If so, then solving the capitalist pricing problem becomes practical. While the exaflops might in theory be available for such a mechanism in the future, its energy costs may be insurmountable, save for quantum computing or some such deliverance—especially if those costs are themselves priced in reserve currency of network addressable carbon.

73. Interface Layer to Come: Ambient Interface

The voyage stacks space upon space, concrete space upon the space of knowledge, the space of practical communication upon the former two. It therefore stacks map upon map, world-map upon world-map, the uniform space of plains and seas, the space of techniques, the space of knowledges. When the first cycle is exhausted, a second cycle is constituted from it; when the second is finished, a third, and so forth.

—Michel Serres, “Jules Verne’s Strange Journeys”

The *Interface* layer may come to situate a new architecture of algorithmic governance that draws and enforces the conflicts in layers above and below. It may come to absorb

an automated sovereignty over decisions of inside and outside and deploy it through the surfaces of everyday computational habitats. How so? It links the *User* to the other layers by radically reducing the possible network relations between these sprawling infrastructures and the individuated agents who may initiate columns up and down, back and forth. As discussed in the *Interface* chapter, an interface may take any form that supports that work of reduction and translation, and today that is it is often the GUI, through which the *User* observes and controls things, events, or data. However, the *Interface* layer at work for the deep address platforms described may be almost any object or surface with which a *User* could conceivably interact and which could then affect, in principle, any other such object or surface, nearby or far away: instead of a hyperlink, a true hyperobject.⁶⁵ These are all ways that something we are comfortable doing might be automated by ubiquitous computation, but the deeper design program is to allow for other kinds of *Users* to do other kinds of things that may seem uncomfortable or even illogical to us today. The pairing of a deep address with ambient interfaces—the field of interfaces both physical and virtual that surround a *User* at any given moment—allows us to imagine a computational solvent imbued into any bit of matter, providing it with additional intelligence and a universal and/or highly curated network addressability. As discussed, this would allow “things” that exist at very different physical scales to exchange information and form unusual confederations, with or without human involvement. It would also imply that either of these could be an interface allowing a *User* to point to, control, or play with the other. If a plastic stick in my hand can be used to control a video game character whose actions are calculated on a server inside a mountain drawing power from a nearby dam, then many even more bizarre chains of remote agency and distributed responsibility are possible. This pile of smart sand could be a haptic interface that precisely guides a robotic surgical tool inside another person’s body across the ocean as he lies prone, enveloped in the loving embrace of several twenty-four-axis machine hands and their cushiony little arms. That cuttlefish changes color in relation to the presence of prey, which causes its linked avatar, several meters tall, to do the same, which causes the birds to flee just as a human player of a popular augmented reality (AR) game walks by, ruining his chances of capturing their fountain for his aligned forces. The factorial combinations of the chains of interfaciality that are possible go well beyond automating smart home use cases.

As computation becomes more deeply ubiquitous and the agency of the *User* is shared by any addressable thing or event, then for many people, the world may become an increasingly alien environment in which the privileged position of everyday human intelligence is shifted off-center. To my thinking, this strongly recommends this program. As discussed in the *Interface* chapter, one of the chief functions of the GUI’s reductions is the simplification and narration of all possible interactions to a understandable set of options for the *User* to easily manage. Long before we achieve anything

like a deep address hypermaterialism, the design of any sufficiently advanced Internet of Things infrastructure will have to deal with ongoing complexity issues for human *Users* and, it is hoped, will do so in ways more imaginative than simple physical skeuomorphisms for which an object “looks like” what it does (i.e., tiny models that are synced with their full-size counterparts elsewhere, like little tanks on a big war gaming table). As designers learn to accommodate nonhuman *Users*, those kinds of correspondences may or may not prove useful, but the basic function of the interface, graphical or objective, will persist: to reduce the complexity of systems by presenting some self-referential closure that will allow for directed entry into that system and into how that system differentiates itself from its own environment.⁶⁶

Among the essential features of the emerging geopolitics of The Stack is how entire interfacial regimes cohere not just into functional reductions of complex chains of interaction, but also into total images of The Stack and of the world as whole,⁶⁷ and it is from that perception of a totality—an augmented cognition for a synthetic ontology—that any *Cloud Polis* draws its authority, and as those totalities multiply, so do their jurisdictions. A strong interfacial regime prefigures a platform architecture built of total interfacial images and does so through the repetition of use that coheres a durable polity in resemblance to the model. As suggested, the process is mutually constitutive; the representation gives rise to what it describes, on the one hand, and that polity articulating itself through interfacial systems eventually comes to resemble those structures of articulation, on the other. The regime’s interfacial images are the instruments through which their particular diagrammatic description of “what exists” on other layers of The Stack is directly enacted by its *Users*. In other words, those circuits of interfacial relay are never only cognitive models of action but establish real physical links between things and events, and in the cumulative agglomeration of those traces, they eventually cohere into a higher-order system and are realized as the physical transformation of the world itself.⁶⁸ Every totality, every little utopia, may arise from the correlation and coherence of one or more interfacial regimes evolving to express itself as an autonomous sovereign platform, as an informal imagined community or an actual nation-state. Each of these *platform states* may provide the experience of internal closure and “autonomy” even as they are structurally dependent on other platforms, including ones against which they may define themselves in opposition and by double-exposure. Not only is the instrumental coherence of The Stack coordinated by the interfacial regime, that regime becomes for its *User* the primary means by which the world itself is made to appear, and through which it is experienced in relation to that appearance. Whatever is assigned an *Address* by that regime appears may appear and whatever is not addressed simply does not exist as such. Each regime, and hence each mature *Cloud Polis*, state or nonstate, represents a different world of sites, things, events, processes, valuations, causes, and effects that is internally consistent for the *User*. But because it must reduce the world in order to provide that coherency,

the regime's mapping is always incomplete; some things are identified as addressable entities and located in an interactive narrative, and some are not, some are *Addressed* as figures and others as ground. No two regimes' reductions need be alike (or different) in how they specify a specific element, and nor does anyone need to acknowledge the existence of any others, though one could also demand some drama of allegiance or opposition to another regime as part of its worldview (e.g., the ancient DOS versus Mac schism).⁶⁹

Where will those regimes get their raw material for this artificial coherency? As *Users* go about their days and lives, dragging their phone-shaped homing beacons hither and yon, they may pass by millions of sensors, each peering out into the world like a tick waiting for mammal heat. Together they form a cloud of machine sensation, each listening or looking or feeling or smelling something about the world or about the *Users* in the world, or both at once. A sensor may even be a *User* if it also initiates columns up and down The Stack from its little perch. With this new infrastructure now active, the churn of social interactions that so interested Tarde is now not only made up of human-to-human communication; it is also a din of bodies, machines, and other chemistries signaling to itself about itself. Human *Users* are both the subject and object of this system, sometimes piloting it and sometimes piloted by it. We leave little traces of ourselves as we march through the sensor cloud, traces of our presence, our attention, our interests, the biological specificity of our person, and the risk and reward that we represent to the different *Cloud* polities here "sensing like a state."⁷⁰ This stigmergy of data, like ants communicating by leaving tracks of pheromones, is another way that human interact with one another indirectly, anonymously, and perhaps unconsciously as the impact of one *User*'s presence, her habits, is part of the information that another *User* may observe or be observed by when passing along the same route that is accumulating input and output. On the ground, this is where the interfacial regime of a particular *Cloud Polis* is formed and is how it guides and frames the worldview of the embedded *User* as a visual, graphical interface would.

We see then that Internet of Things operates at the *Interface* layer in relation with the specific patterns of *Users'* physical movement, gathered up into secondary images, which then in turn contribute to how other physical interfaces will or will not interact with a given *User* and enforce the logics of a given regime. As the *User* establishes place through the interfacial lens of possible engagements with a site, the accumulation of these interfacial events upon events and connections upon connections generates another scale of interconnection through its own patterns, densities, rules, and durations. The stigmergic currents of clustered groups of people moving though the *City* form nodes by the cumulative overlapping and gathering of multiple itineraries around common interfaces. In order to form, a node requires a heterogeneous field of possible interfacial sequences, some of which will bind into a specific, meaningful pattern. Like possible moves on a game board, there must be capacity for a multitude of patterns to

arise by the addition of new groups and new possible links. That there would be one pattern and not another is what makes the social reality of one network significant—its inclusiveness, exclusiveness, duration, centrality—especially to itself. It is here that all these crisscrosses take on that secondary order of abstraction as an emergent meta-image of all these situated interfacial events and their cybernetic back-and-forth. Ubiquitous computation may be for the most part a nonvisual interfacial array, but it is also capable of describing itself as an image, even as an image that can govern and design how that array is recomposed. By design, this image of the nonvisual network can also govern other interfaces up or down an order of scale such that their use would result in desired outcomes at the *User* layer.⁷¹ This reflexive cycle of intentions, decisions, sensations, and filters governing the processes to which it refers (and to which it is itself referred) is another name for *algorithmic governance*.⁷²

As we outline the long course of platform governance (both with a *nomos of the Cloud* and without one) the seat of that governance may be neither in the formal sovereignty of states nor in the headless tournament of markets, but in interfacial couplings themselves. Platforms govern in and as algorithmic decision-making machines. They decide what an interface will or won't do for which *User* and when. For Agamben, the sovereign is he who decides on the state of exception and on the internal exception of the camp (for him, the "*nomos of the modern*") but in the more mundane but pervasive decisions made several times a second by the computationally active interfaces of the *User's* world, the decision over the exception and the reversibility of the interior and exterior is automated. This is the essence of algorithmic governance. In a way, all machines represent ways that we have learned to automate decision and action (and it is at this juncture that the edge of "the political" terminates and something else takes over). Laws are also a way to automate decision; they codify decision into precedent, norm, and exact interpretation to be followed over and over again according to code. Laws refer to how interfaces should and should not operate in the future by attempting to articulate in advance all possible variations according to plan, whereas algorithms may automate a decision at the exact point where it needs to be made and where it will affect a *User* and a *User* will affect it at the interfacial seam.

In Stanislaw Lem's *Summa Technologica* (1964), his treatise on the future of technology (including space travel and things that closely resemble nanotechnology and virtual reality), the Polish science fiction author warns—with clear fascination—against possible totalitarian perils of cybernetic governance ("Electrocracy") and what he calls "The Black Box: The Regulator of the Highest Kind." In any conflation of legal regulation, such as a formal statute, with mechanic regulation, such as a thermostat, there always exists the potential for enforcement to become either dangerously opaque, unavailable to redress, or dangerously stupid, demanding compliance even against the logical goals of the regulation, or both. In some recent discussions of algorithmic governance, it has been suggested that such platforms may work best when desired outcomes are

well known and understood and when system performance can be quickly measured and finely tuned.⁷³ Instead of dictating every step along the way, stifling improvisation in the face of contingency, the system is free to find its own best means toward that particular and consensual end. There are, however, at least two problems with this heuristic. The first is if insufficient care is given to who or what is desiring a particular outcome and how these may be determined in general before they are decided in the particular by an interfacial regime.⁷⁴ The second is that platforms often just do not work this way. As discussed in the first chapter, a “plan” fixes outcomes and may also fix means, a “bureaucracy” fixes outcomes and means, whereas a platform can fix means (such as protocols, APIs, data standards) but not the content of outcomes (“Google does not ‘make’ what you search for”). It sets criteria for outcomes, but not the outcomes themselves; that is the point of them. The top search result is the one that algorithms deem the most “relevant,” but it could be anything at all (to the chagrin of large content providers that would wish to foreground their highly leveraged content assets). That is, the deciding of outcomes is something that happens in the course of interaction itself and could be a result of the *User’s* disciplining the algorithm of automation as much as it is the algorithm delimiting *User* behavior by what it shows, hides, allows, or prohibits. The relative symmetry or asymmetry of this interfacial relationship is, of course, situation dependent and is itself *decisive*.⁷⁵

Designing the modulation of symmetry and asymmetry between *User* and system is much easier written than done, but anticipating some “outcomes” is obviously also necessary. When a *User* is providing input through an interface that alters the algorithm that governs that interface, and so also affecting that algorithm by unconsciously reprogramming it, we say that the balance of interfacial asymmetry tilts toward the *User*. When an algorithm is controlling and curtailing *User* behavior, cognition, desire, or affect, for example—or, better, when it is *producing* these things—then we say that the interfacial asymmetry tilts toward the algorithm. As discussed, sensors are likely to become at least as predominant mode of interface design as GUI are today, and the attendant design questions are only beginning to resolve. For one, interaction may take place by a complete *absence* of interaction. A smart thermostat, to take a prosaic example, learns as much about an inhabitant’s space use patterns by when she is not home as when she is. Her absence and lack of interaction is not an absence of information at all; it is information of absence. To the consternation of suspicious persons, the “mobile phone” with a CCD (charge-coupled device) absorbing light and a microphone absorbing sound waves is also a sensor, and for it the principle of information by absence of interaction holds true. One sensor makes use of the information haul of another, such as an autonomous vehicle that can navigate terrain based on LiDAR mapping (a portmanteau of “laser” and “radar”), motion detection sensors, and street maps (among other sensors). Ultimately, as a *User* experience design problem, the sense of a device’s relative autonomy and intelligence will be a key criterion in everyday

HRI (human-robotics interaction) but is a separate issue from the actual autonomy or dependence of that device. Interfaces may sustain and nudge *Users* toward systemically optimal interactions, but for The Stack-to-come, the nudging must work both ways.⁷⁶ No platform can only anticipate how *Users* will make use of it. The most basic principles of infrastructural resilience dictate that the algorithmic correlation of new sensed information must be able to reprogram even the most fundamental assumptions of that interfacial regime's model of governance and how it obligates decisions of inside from outside. If not, then that platform is a theocracy, and surely there are far too many theocratic platforms already plotting their ascendancy. I hope, however, that those interfacial regimes will be dissipated by exit, as others are correspondingly swelled by entrance.

74. User Layer to Come: Inventing Users

The names don't matter. The biomass does: so much of it, lost. So much new experience, so much fresh wisdom annihilated by this world of thinking tumors.

—Peter Watts⁷⁷

For the most part, people would like to believe that the future of The Stack depends mostly on the geopolitics of the *User* and that the more human and humane the *User* layer becomes, the better resolved the rest of the accidental megastructure. Resolution at the *User* layer may prove decisive in some ways, but very different from how one might expect and perhaps from "human" in any normal sense. The world is still full of pre-Copernicans, across the political spectrum, and disturbances to human privilege will continue to invite violent pushback. The status of the *User* as a political and technological creature will stage much of this conflict to come, and it will draw both our deepest intelligence and stupidity to the surface.

An early work by Douglas Engelbart from 1960 is "Special Considerations of the Individual as User, Generator, and Retriever of Information." Among the considerable effects for "the individual" of Engelbart's later work, as one of the key designers of many of the interfacial systems we today take for granted (he was key contributor to the design of the mouse, pointer, and pull-down menu, among other techniques), has been the conflation of the use, generation, and retrieval of information under a single actor, the *User*. It is however also an identity that can easily also pluralize the singular agent into composite groups of users, generators, and retrievers, and it does so not only by what it allows people to do but by how it sees them as doers. For architectural space, the singular *User* is the generic identity of passengers, customers, drivers, shoppers, bench sitters, door-knob turners, the fenced in and the fenced out, and those cut-and-pasted inhabitants of rendered visualizations.⁷⁸ For the *Cloud*, the *User* is also the subject created by available means of measurement and discrete identification,

markup languages, online ID checks, avatars, and click paths, and for the law, the *User* may be whoever has a searchable cellular phone on his person, as his person, as part of his person, or simply in the proximity of his person. As discussed above, the conventional *User*-subject's neutral utilitarianism relates him to *homo economicus*, but it is not identical to him; he is defined as much by how technologies delineate him for their purposes as he, she, or it uses technologies for perceived self-interest. The *User* is whatever The Stack senses at its top layer initiating columns up and down with means and ends in mind. This is where and how *User* subjectivity opens up beyond the borders of the human, and if all the sensors and bots are included, the clear majority of *Users* are already not human or even organic. This rerendering of the human in the image of the bot, as filtered through microeconomic compulsion, is as a task-solving sentient agent who will complete tasks for micropayments, just like other *Cloud* utility computing services that provide liquid markets of gigaflops.⁷⁹ The cultural complexities to be negotiated (or to be simply made irrelevant) are uneven and irregular. It is interesting to note that the transposition of human labor into simple puzzle solving is taken by some as straightforward market efficiency and not as a transformation of humans into diminished automatons, whereas other Stack technologies that may ultimately allow for greater individual pleasure and safety are seen as affronts to the dignity of Creation.

I recently heard Joi Ito, director of the MIT Media Lab say, "Google didn't just design a self-driving car. They designed a driver." This focuses attention on the hardware-data-*Cloud* path dynamic that comes into play as the car navigates the *City* layer, partially or fully autonomous from human passenger intention. Among the most interesting features of what we call today the "driverless car" ("horseless carriage") is how it decenters the agency and authority of the human pilot from the cockpit and disperses it into ambient networks operating at multiple scales. For some, this is a welcome innovation, and for others, it will prove an unacceptable emasculation or even dehumanization and will be met with violent resistance, and various forms of human-centric identity politics. Should driverless systems become commonplace at some point in the near future (uncertain at this point), we might expect considerable policy interest in preventing legacy human-driven cars from hazarding public roads and killing tens of thousands of people per year due to human driver error. One can expect pushback as fervent as it is irrational. There are some affinities with technologies, however fictitious or bizarre, that are thought to embody the essence of human mastery. Guns and cars are among these. They are seen to amplify the human, not contaminate it by mediation and hybridization. I would go so far as to predict that there will be a movement to identify human-driven automobiles as a type of "arms" and that the Second Amendment to the United States Constitution, now used to shield gun owners from obvious liabilities and to protect their sense of personal dominion, will be flown to keep human beings behind steering wheels.⁸⁰ Your life may be ended by someone encased in

a two-ton steel box careening down the asphalt vista trying to prove a point about how technology will never capture his natural humanity.⁸¹

The individuation of populations into single *Users* is not a technological necessity, but from the perspective of The Stack looking up, it is an accommodation and a way of making its own emergent platforms interoperable with the conventions of identity we have inherited.⁸² The function of *User* individuation is as much to accommodate the cultural logics of human self-identity predicated on naming, autobiography, lineage, moral self-accounting, and bureaucratic management as it is a real systems requirement. User IDs make it easier to regularize patterns among multiple variables, but they are a function of the fact that *Users* understand their interactions with platforms over time as the accumulation of events that are temporally unique to themselves. Some people are surprised to learn that many *Cloud* platforms are not overly interested in their name and address, only in their actual and predictable behavior. The idea that their identity could be reduced to what they do instead who they are seems counter-intuitive, even insulting. At the same time, interfacial security regimes can demand highly specific identification of one exact *User* versus all possible other *Users*. Access to secure locations, such as a data center, is controlled by highly demanding interfacial apertures. In general, a combination of identification criteria must be satisfied, all of which are effective for identifying human *Users* but equally effective identifying non-human *Users* as well, and so as in Kafka's "Before the Law," all who come before the door are made equal, but this door will open only for you. This triumvirate of *User* identity is: "something you know" like a password, or a specific response to a specific question; "something you have" like an identification card, a dongle, key, or specific chip; and "something you are" like a fingerprint, retina pattern, or other hard-patterned information. These are the three sides of the triangle that individuates one *User* from a population: *knowing, having, being*. So long as something can know, have, and be, it can be a *User*. To some, that may seem unnatural; to me, that looks like universal suffrage.

In order to design more robust transformations at the *User* layer, it is not enough to expand the criteria for admission only to who and what counts as a *User*; it also demands a shift in how (and indeed *if*) the *User* is made to account for the intentions and effects of every column that he, she, or it initiates. A crash may be put down to driver error, but from a wider perspective, the entire transportation system collaborates in allowing for the possibility that this error might result in catastrophe. The preponderance of attention paid to the legal rights of human *Users* to interact with one another without regard to "externalities" and largely without governance other than the carnival of "reputation," has the secondary effect of diverting energy from these other two (likely more) important design problems: the representation of nonhuman *Users* and the codification of enforceable accountability within a complex composite technical system. One starting point is to peel apart the *User* of an interface from the *owner* of an interface, as the demands of each may continue to diverge significantly. As

discussed above in relation to the ownership or stewardship of data within an Internet of Things ecology, it is not enough to simply say that the legal owner of a device should have control over its data, and not only because “the” owner is not likely a single identifiable entity. A sensor may be owned by X and capture data about Y, and here the former is the owner while the latter is the *User*, who may also claim durable rights over what the sensor senses about themselves. The owner can’t possibly own all that he knows about everyone, but at the same time that *User* (person Y) cannot possibly claim that anything and everything any sensor senses about himself is really a part of his expanded sovereign person and should remain under his control. The sound waves disturbed by your voice that my eardrum picks up are as much mine as yours, and in a world of trillions of sensors, dividing the *City* layer up into zones of reasonable privacy and zones where one has no expectation of privacy makes no sense because, if no other reason, no zone is ever discrete; it is always overlapped and overlapping. In some cases, we will definitely wish for the interests of the *User* to trump those of the owner. As in Cory Doctorow’s example cited in the *User* layer chapter, someone who falls behind on the payments for his or her child’s smart ocular implants and has to choose between a bankruptcy and an ability to see should rightly claim that the needs of the *User*, in this case her daughter, trump those of its owner, her bank.⁸³ Whether the same is true of driverless cars that drive themselves back to the dealer lot, automatically repossessing themselves from delinquent *Users*, is less clear. It is precisely this fog, this gray area the size of the *User* layer itself, that needs our most concentrated and critical design attention.⁸⁴

The assignment of autonomy and culpability (too often conflated) is equally messy. Some might anticipate a future in which rival *Cloud* polities will be defined as much by the real-world violence of their external conflicts as by their internal strategies. The development of weapons for large-scale infrastructural warfare through complex viruses is well underway—spy versus spy, algorithm versus algorithm, *City* layer versus *City* layer, and Stack versus Stack—and attracts some of the very best computer scientists to the problem space. In many cases, the strategy is not only to break an enemy’s servos, it is to weaponize that enemy’s *Users* “against him,” especially when the *User* is unaware of having been weaponized. The zombified personal computer, taken over by malware acting like a parasitic fungus, is a basic example, but the capacity of unprogrammed *Users* to wreak havoc on their own platform is almost limitless. In such a case, is the *User* or the owner more responsible? He who initiates the column of death or he who owns its Stack? Surely intention is important, but not from the system’s perspective on its own security. There are only low-risk and high-risk *Interfaces* and the *Users* attached to them. One lesson of this is that just as the diffusion of “responsibility” into the system cannot lay the blame at the doorstep of the unconscious *User* position, it cannot be designed around the effable conscious will of the *User* either. Colonel Jack Ripper might tap the first domino in order to protect the purity of essence of his

precious bodily fluids, but even his maniacal self-sovereignty depends on a vast already existing machinic apparatus that springs into action. The sacralization of individuated privacy through encryption might also seem to guarantee purity of essence and the sovereignty of the atomized *User*, but it anonymizes some of the key variables in the larger human-technological chain of association, activity, and accountability, also withdrawing them from reasonable adjudication. Instead of containing the impacts of an exchange within the closed circle of those transacting, it instead makes some agents invisible to the trace routing of algorithmic governance altogether, thereby automating the free-rider problem, as well as making everything that transaction externalizes (both benign and pernicious) invisible even to the *Users* that spawn them. Out of sight, out of mind. This kind of tactical anonymization can both overinflate the end *User's* sense of commanding authority over all interactions (an inflation that is both technological and psychological) and withdraws the *User* from forums of accountability for the partial costs of his partial agency. It achieves the former by promising the latter.

The overindividuation of *User* identity in accordance with modern conventions of political identity can produce both comedy and tragedy. During protests in Maidan Square in early 2014, the Ukrainian government of then-President Viktor Yanukovych sent a text message to the phones of many of those gathered that read, "Dear subscriber, you are registered as a participant in a mass disturbance." This fact should be obvious to anyone participating in the mass disturbance, but the implied threat that comes from the sudden revelation that the state knows who she is, or at least her phone number, is clear, if somewhat pathetic as well. An explicit drawing of sides does not benefit a weak regime, and the anointment of someone in the square as officially an enemy of the state would do little to shore up its flagging legitimacy. Furthermore, the awkward over-individuation of a mass protest that has power only because it is an emergent crowd, not a coincidental gathering of many *Users* at one time, must have provoked more chuckling than cowering. For the future of the *User* layer, the episode also dramatizes the mismatch between traditional political individuation versus real world *User/Interface/City* layer assemblages when one is clumsily overlaid on top of the other. Who knows how sophisticated the targeting was or ever would be in a future of cell proxies, IP spoofing, number forwarding, and urban software ("Dear sensor embedded in a bridge, you have been identified as a protester ..."). The mismatch gets more convoluted when it has to account for the inadvertent interpolation of *Users* with citizen-like rights, on the one hand, and the unwanted segmentation and surveillance of individuated *Users*, on the other. It confuses one with the other because it sees them both only in relation to how they deviate from an obsolete figure of *User* as individual citizen.

A specific design problem for the *Interface* layer-to-come is this individuation of the interface itself. By hailing "the" *User* as a single agent with a single perspective, instead of an important but partial agency within many larger and small apparatuses at once,

the placebo identity of a resolved Vitruvian *User* is not only accommodated; it is reproduced and fortified. What is the better “sovereign unit” of this assembly then? One wonders if the legal accounting of individuals is even a viable notion when systems and individuals become indistinguishable from one another. The Stack’s technologies of the self give enormous weight to formulas that seem to verify the existential discreteness of the individual, diagrammed by biographical quantification and attended to by single-serving pointing and clicking. This is so even as the technologies of the self we see at work in (or *as*, or *through*) The Stack do what seems to be the exact opposite of what I am suggesting, and instead give more and more weight to formulas of individuation that seem to verify the existential discreteness of the existential individual through the diagrammatic quantification of his biography. For the *User-to-come*, perhaps no door is built only for you, because your being, having, and knowing are never only yours alone? The door builds you as that which passes or does not, that which is absorbed by the profile or that which absorbs it. Real infrastructure involves many actors, some named and some unaccounted for by law or by software but nevertheless active. The interface constructs *Users*, but it is also constructed by *Users*, and so to remake the *User-subject* is to reform “the door” to better reflect all of what is actually present and active within any chain of exchange and to institutionalize these as interfaces into new normative systems. To innovate the agency of the *User* is then not just to innovate the rights of humans who are *Users* but also to innovate the agency of the machines with which the *User* is embroiled. A *User* may be anything that can initiate a column up and down The Stack, but because as any particular thing, human or non-human, may step in or out of that position many times over the course of the day we need to design modes of accountability all the way up and down the line. Only then can we reasonably expect to design a livable governance of automated decision on the inside and the outside, who and what goes where, and how to program algorithmic interfacial governance, all the while attentive to the exceptions that it decides and does not decide.

Building a better armature for the *User-subject* position may not seem like the most pressing design problem, but in many ways, that is exactly what it is. An (only somewhat) unlikely consensus has formed around the structural importance of robotics and automation and their impact on the macroeconomics of labor and markets. Bets are placed from both the right and the left that a “zero-marginal cost society” or “fully automated luxury communism” is built into the future of software-driven globalization. A party line that crosses parties emerges in different versions, blending nanotechnology, industrial robotics, additive manufacturing (3D printing), Internet of Things, digital replication, biotechnology, and open networks to draw a scenario in which many physical commodities are rationalized into downloadable streams, and much of the heavy lifting (and flying) will be done by intelligent quasi- or fully autonomous machines. We shall have to wait and see, but algorithms and algorithmically intelligent

hardware are already active *Users* in our world, and we need to give them their due. For better or worse, we and they occupy converging niches in a new equilibrium and its many punctuations. It is with vestigial stupidity that we police the human/animal divide in the way that we do, and it is equally misguided to insist that computing machines are “just tools” and not also co-*Users* along with us. The implications are both ethical and economic, and the geopolitics of the *User* must reflect not only how we want states and platforms to treat human *Users*, but how we would situate these ideals within interfacial regimes that are more effectively inclusive and more accurately representative (never fully—always by reduction) of who and what is interfacing with whom and what, regardless of species or kingdom.

The Black Stack

75. *Angelus Novus Is Gone*

To what extent is The Stack, and its stratigraphic model of interlocking and incongruent softwares and sovereignties, an answer to Clinton's call for alternative geopolitical architecture—or is it an answer to another, better question? For our secular geodesign, the blur by which The Stack-we-have becomes The Stack-to-come doesn't offer any messianic historical redemption; it is no one's "coming community."¹ It is not a transcendental diagram into which matters can go to find their proper places; it is only a machine with which we can configure things and events of very different scales and duration, and to realize otherwise illegible abstractions now become infrastructure. Its formal rigidity necessarily multiplies itself, braiding political geography into rough weaves, giving sanctuary to double agents on a layer-by-layer basis. But one cannot be pro-blur anymore than one can be pro-Stack (or anti-Stack), and nor can design just remap one place onto the next, shifting sovereignty from there to here, from state to individual, from state to corporation, from law to protocol, from institution to network, from land to *Cloud*. Instead alternative actors, agents, objects, machines, and ethics will surely come into view and will fill up another diagram with another distributed tension. These aliens both are and are not us. The geopolitics of computation, its geographies of programmability, recombinancy, extensibility, recursively, and addressability, are not overseen by any one *Angelus Novus* that could, per Walter Benjamin's assignment, make good on history's knottily kneaded, well-promised catastrophe, always tearing and folding back on itself as it flies backward. Because of and despite its utopian timbre, planetary-scale computation may lead to desolation, tyranny, and destitution, but if it does, then perhaps it is our own fault.

Accidents fold into accidents into accidents, and jurisdictions into jurisdiction as the geopolitics become more plural, more compulsive, more contradictory, more composite and polyscalar. The interfacial totalities of our platform states, drawn from ambient signals of price and risk and faith and fundamentalism, decide sovereignty by extracting and extruding value from the ties that bind, their polarized multiplicities

shimmering by fractal superimposition. Dual-booting citizens, all of them migrants in some way, are held in particular postures by algorithmic governance and granted premiums by firewalls. Nothing, anywhere, can really be “native” anymore² and perhaps if we were to accomplish nothing more than this, it will have been worthwhile. See all the hearts and minds rented several times a day to different walled gardens and perceptual belief systems, and by “the cunning use of flags” everything that is anything is laundered, like Nauru launders passports, Cayman Islands launders money, and Guantanamo Bay launders people.³ Crypto *City*-states enjoy protected rights of religion and speech, but less so the individuals who live for a time inside them, unless each or all of them are also incorporated in some manner, because when the state is sovereign, the individual seeks citizenship, but when the market is sovereign, the individual person seeks the status of the corporation. Immigration becomes the panicked face of climate wars; homelands are invented by the day, week, and month. Exodus and exile are branded, even at the expense of keeping time zones straight.⁴ Nongovernmental organizations guarantee basic health insurance according to increasingly dubious definitions of net neutrality. Artificial intelligences make the deeper historical time of intergenerational governance more culturally acceptable, at least for what is mutually addressable by all parties, while all that is governed by its accountings of appearance and disappearance fills landscapes with sovereign interfaces and their automated decisions.

Synthetic computation shifts what can be sensed, measured, calculated, communicated, or stored and performs feats of organizational cognition at a scale and speed previously unknown. There is a productive and generous cannibalism in this. For some, the friend-enemy distinction is rationalized by the ambiance of vast indoor airport cities, thousands of them each supporting hundreds of millions of people, most skirted by lethal security prophylactics.⁵ Recall that the Biosphere 2 experiment did have a winner. It was the ants that beat back the cockroaches that made the humans go insane.⁶ The lesson is that inside a domed totality, massively distributed single-mindedness may be a better evolutionary adaptation than individuated nuanced thinking, and so Google charter cities may be drawn more by stigmergic chemical communication than by glassy formal algorithms. Ants organize their war machine by epidermal secretion and sensation, and our own satellite-dependent relays do as well, staging the query, the result, the visualization of the result, the metadata about the query, the call and response. States involve these prostheses and are involved by them; they are confiscated by their own mechanisms, and for them the interface is very literally skin. As spaces opened up and closed off by computation are defined not just by what governance chooses to see and not see, but by what it chooses to sense and not sense, the distributed naming of what is and is not sensible expresses that epidermal mode of sovereignty, where securing in place and securing in motion guarantee the field of relations that anything might enter into. The abstracted granularity of things and the

wetness of their membranes are both preconditions for how they sense the world and how the world senses them, how they are designed in place, how they are secured and provide security. In other words, the designability of skin is already also food by other means, and thereby also the state by other means. For geopolitics within comparative planetology, chemistry always wins.

The wrestling between geodesign and platform states is also defined by the limiting condition that designable space is never empty and that the precarious world is always already full. No *tabula* is ever *rasa*: the world is filled but never completed, with no Genesis alibi on call. In this, political geography is less a zero-sum image of territories to acquire than the design of a substitute totality, which may or may not be correspondent with the unitotality of any one world image (such as a globe in space). Already design today is preoccupied with managing the archive of all “content” produced in preceding centuries; we don’t make new things; we innovate on the archive and index what is already there, moving from “event” to database and back again. Whereas industrial platforms like Ford and Toyota innovated the manufacture of complex industrial machines from scratch at mass scale, Google’s mission is not to make new raw information per se, but to structure and curate the total space of all the world’s information—a standing reserve that already exists, however underformalized—and to manage it within its anti-obelisk of data centers and make it a medium for reflexive action on the world now rendered as a computational plateau. We rotate from the system of objects to an economy of metadata. If mass mediation and information scarcity once demanded the architecture of formal ideological systems, now governance is predicated on the differential management of open and closed data sets, still also realized as animal violence. The care of any archive is one present moment’s self-accounting toward an unknowable future—an ethics—and a database is just a particularly active kind of archive, one for which information that is drawn from the world more easily becomes an instrument for working reflexively back on it. It’s unclear though if the shift from scarce, sacred texts to overabundant, instantaneously archivable information still requires the same promise of ethical completion to motivate and justify our participation and promise toward the future. We could act as if it does, until we find out.

Across this span, we are confronted with both a surplus of new worlds and a lack of clear civilizational frontiers, other than those simulated by various senile medievalisms now in ascendance. Can we survive that? Can we address the openings closest at hand fast enough that they generate new geographies before we can ruin them? The curation of these dysfunctional archives directs our attention onto geodesign projects beyond our economic comprehension, because after all, humans have already redesigned the Earth (The Stack is itself a reflection of that dubious accomplishment), and it took all our capital since the beginning of the Industrial Revolution to do it. The Anthropocene should represent a shift in our worldview, one fatal to many of the

humanities' internal monologues, but it is also the broadest cliché, one favored by business journalists and know-nothing primitivists alike. In just the century of industrialization, or centuries since wide-scale agriculture, we've managed such a radical transformation in life on the planet's crust—climate change, population growth, deforestation, ocean acidification, asphaltization, massive extinction, mega-urbanization—that we've finally smothered it whole and brought a new geologic era named after the pervasive and permanent impact of the human genome on the geophysical profile of the Earth's crust and atmosphere. The bad news is evidenced by the longer odds we hang over our own heads, filling markets with promissory notes to extract and rationalize more natural resources than may actually exist. The good news is that we know for certain that short-term “geoengineering” is not only possible but in a way inevitable, but how so? How and by whom does it go, and unfortunately for us the answer (perhaps) must arrive before we can properly articulate the question. For the darker scenarios, macroeconomics completes its metamorphosis into ecophagy, as the discovery of market failures becomes simultaneously the discovery of limits of planetary sinks (e.g., carbon, heat, waste, entropy, populist politics) and vice versa; The Stack becomes our dakhma.⁷ The shared condition, if there is one, is the mutual unspeakability and unrecognizability that occupies the seat once reserved for Kantian cosmopolitanism, now just a pre-event reception for a collective death that we will actually be able to witness and experience. We shuffle along, soggy-footed. For the brighter scenario, Shanzhai nanotechnologies may save us from the gray goo of the landfills, putting them back to work, allowing us to make and buy unnamable assemblages with no relation to our needs or wants, forcing the world's supply chain algorithms to go haywire, not knowing how to model this or that impulse, or what to stock on shelf interfaces, putting dog food next to hex wrenches with peach syrup on top, and for this, the logistical absolute would careen toward universal molecular flux.⁸ Put another way, The Stack's infrastructure failure interdependencies include the provision of secure potable water. While many platform states may exercise monopoly control over interfacial exception within their gardened walls, they have no monopoly on monopolies, and so, opt out to where? The Apollo program's Apollonian planetary photography may have rendered an eco-calculative interiority, but the outside didn't end there on that day; for both left and right politics, that outside was always an illusion of geocentric ideological habits.

Design (in fact, the real subject of this book) here means the structuring of the world in reaction to an accelerated decay and in projective anticipation of a condition that is now only the ghostliest of a virtual present tense. This is a design for accommodating (or refusing to accommodate) the post-whatever-is-melting-into-air and prototyping for pre-what-comes-next: a strategic, groping navigation (however helpless) of the punctuations that bridge between these two. This *geodesign*—the work of the blur and for the emergence within the emergency—is the congealing and uncongealing of

the equilibria—that-were from the equilibria-to-come. If so, what enforces design when “sovereignty and territory increasingly lead separate lives”?⁹ Lodged here is not just political design or politically intelligent design, but rather the redesign of the geopolitical, including the possible conclusion to scrap it outright as an operational concept. While the objectivity of our common planetary position is far more self-evident than in the eighteenth century when the Treaty of Westphalia was signed, we should also be far less certain that it can serve as the determining model of metajurisdictional scale. As platforms grow, they diverge and converge with equal ease, and as regional differences are absorbed by them, primordial social distinctions are globalized and revitalized by those very same platforms, just as new forces also appear and evolve from novelty to norm. These may be constitutive of new social-systemic realities, but only because they can occupy multiple scales simultaneously, at once subpolitical and suprapolitical. They seem to sit still for Russian doll jurisdictions and equidistant equatorial-cylindrical projection maps only when we transpose them through filters full of errors. They are not well described by the partitioning of public from private sectors, of civil from martial societies, progressive from oppressive policies, or even finally humans from nonhumans, atoms from bits. In response, our geodesign still draws from (and into) its specific planetary situatedness, but does so by overwriting itself again and again in the same space. When there are no single fixed conditions of inclusion and exclusion, it may not even be proper to refer to its deliverables as territories and geographies as such. What then? Can planetarity still be at once a cartographic image and a pregnant machine, both less and more than a single backdrop? We do know that in the interfacial calculability of sensations and events, borders do everything but vanish, but that in their simultaneous proliferation and dissipation, liquefaction and fortification, their interfaces become pervasive. If counterterrorism discourse can dare to even say “imagine no lines,” thinking that “the front” is everywhere, then it is because already *everywhere is skin* and geopolitics is epidermal. This makes the design of the conditional interfacial exception, drawing the interior versus the interior over again many times a second, into both the icy calculation and the bloody siege for any platform that hopes to persist for very long.

76. The Stack and Its Others

Ideally, design’s setting of norms is active, not responsive; it should produce more than it accommodates. What is today most legal and most explicitly protected by the formal apparatus of law is what may be the most dangerous. Meanwhile many forms of connection and interfaciality that are technically illegal—or alegal—adapt to emergent conditions in ways that formal securitarian urbanism could never pre-program, and also represent some of the most secure public policy paths available. In the repetition as facts on the ground, these translegal forms (software or hardware)

come to take on the force of law, and then just maybe, if urbanists are savvy, these designate as law, and geography is recompiled and restocked, brick by brick, in their image. For design, working with a legal interfaces represents a form of constraint and also a medium for the proliferation or suppression of utopian and dystopian alliances and enemies. As said, Cambrian lurches forward in design tend to occur in response to a crisis: that is when design is most wildly inventive because no other option would be practical ('lines are drawn. Use cases are modeled. Budgets are allocated'). And so, in response, deep systemic crises invite three interrelated and apparently opposing responses: *acceleration*, *inertia* and *fundamentalism*: fight, hide, and flight, accordingly.¹⁰

It bears repeating, especially as we tinker with the comparative planetology business, that as every technology brings new accidents, so too every accident brings new technologies. For design, planetary-scale computation is both, amplifying industrial modernity toward a ubiquity that is matched in intensity only by its imminent dissolution. Our experiment—indeed everyone's experiment for the coming decades—is tied to an ecologically ubiquitous computing, a gamble that in many ways underpins all others. The Stack-to-come should tilt the outcome of that impact toward a renewed modernity, but will it—in some configuration of *Clouds*, objects, tags, *Addresses*, *Interfaces*, sensors, algorithmic phyla—provide the *lightness* necessary to organize a restorative, subtractive, resilient modernity, or will its own voracious energy appetite, toxic production footprint, and alienating virtualization finally overwhelm all? Put differently, where industrialization was a modernity for tabula rasa, today a subtractive modernity is what curates that world that is always already full. But can it power an interfacial modernity not of identity and maximalization, but of externality and transference? Will planetary-scale pervasive computing prove to be, in some guise, the integral media of real reindustrialization, allowing for light but powerful interfaces of governance and exchange, or instead, the final, most unsustainable machine consuming the remaining resources into its subterranean pits? Is it all or nothing? If it can succeed, it is because its radicality is not drawn from the historical or geographic momentum of a new world, but rooted in the precarity of globalizations that are as irresolvable as they are interconnected. Either way, we slowly learn to let go of certain things (of nationalisms, of monotheisms, of economic psychologisms, strong genomic and semiotic ontologies) and negotiate instead a deliberate and strategic dissolution—on-planet, off-planet—into whatever and whoever comes next. Somehow I am optimistic, if that is the right word. The thesis of this particular book is neither a manifesto nor an instruction manual, but as said, a design brief that invites others to collaborate on the articulation and realization of the renewed modernity described here, with all their deliberate commitment and expert abstraction.¹¹

For that, the prevalent client-side versus the server-side critique of planetary-scale computational power becomes that much less relevant when it is the interfacial

relays *between* addressable objects that are the real object of governance, and not the things themselves. We must assume that more governing pressure on the rights spots is how to go about geoengineering an economy, and we assume that such pressure will include how it is that interfaces exact terms of exception. If the reader's working assumption is, however, that mathematics plus the force of law equals totalitarianism, then I suppose other issues are more pressing for you and your colleagues.¹² The geodesign I would describe means an exploration of how certain control systems, certain platform systems, and specific configurations work toward particular desirable and undesirable governmental effects ("there is no architecture without violence, because there is no architecture without program").¹³ Platforms are emergent systems that are informed by power. That is why they work (and where they work). As said, the frame of planetary computation not only houses and distorts multiple jurisdictional claims; it directly produces new strata of jurisdiction where none existed before, and yet it causes any particular site, in any particular *City*, to be so layered with jurisdictional image systems that no one of these can ever really resolve into a single consensual sovereign geography. The political experience of the overlayered site is not only a competition for the right of legitimate force but the dominance of one addressable geography versus another, and often one because the other, hence the irresolvable surplus of utopian total images ("we are millionaires in images of revolution").¹⁴ Writ large, the layered architecture of The Stack makes vertical totality and hence the strategy of consensus more difficult than within a bounded horizontal encampment of whatever size and relative secularity. Political spectrums, between authoritarianism and communization or state and platform, may be different for each layer within the same Stack, and especially within a real-world column initiated by a real-world *User*. A gesture from one *User*, incorporating all layers on its way down and all layers again on its way back up again to another *User*, may pass through a zoo of different captured ideological zones fighting it out layer by layer, interacting with geographies of every imaginable purity or toxicity along the way, each one spinning to a different tune.¹⁵ That is just the table stakes. From here comes the Promethean fascination with how intelligent systems, including human societies, evolve on and from this particular planetary perch, and a program to design first in the service of maximum possible wealth to the maximum possible interactions and intercourses, with prejudice toward disenchantment and without deference for superstition and sentimentality. Other alternatives suggest instead worlds of shit and pain. Delay and dissembling will insult current opportunities for enlightenment, prosperity, and jubilation and will only encourage the worst scenarios to reach fruition—letting some believe that those were fulfilled prophecies when they actually required the dour, bewildered participation of their victims.

In order to build The Stack-to-come, we have to first imagine it in ruins and work backward from this as both a conclusion and a starting point. History (that is, the

coevolution of carboniferous and noncarboniferous phyla) is already topological whether we speak of it that way or not, and this is especially true at the local level of animals and their machines. They build worlds and cities that are variously hard and soft, at least to their *Users*, and it is in relation to this stratigraphic variation that some choose to intuit differences between what we call hardware and software (and between mechanical and informational machines, even when those differences are only conventions). The Stack-to-come (in ruins) is both hard and soft, shifting its textural profile according to how we compare it to the rest of the physical world, warm or cold, wet or dry, inside out or outside in. We see this in how the clinamen, as a primordial vision of universal computation, can accommodate a positive figure-ground image of bits calculating-in-flight through a void (of computation in the world), but just as well, the inverse negative image of the world unfolding through calculative subtraction from a universally “full” totality (of the world as the shadow of computation). Quentin Meillassoux calls this an “‘inverse Epicureanism’, not one of real atoms displacing each other in a hazardous fashion … in an infinite void, but one of ‘atoms of void’ displacing each other in a hazardous fashion within the infinite plenitude of fluxes. It must therefore be that disconnection itself is ultimately reduced to the plenitude of heterogeneous flux.”¹⁶

Shifting down from mathematics to mere algorithms, this oscillation in perspective may parallel how we situate artificial planetary-scale computing, such as The Stack, in relation to the rest of the physical world. The latter is already a “first” planetary computer on top of which our far less capable synthetic copy has been laid down or, perhaps it is an intensively organized local manifestation of a general geocomputational evolutionary landscape that could be rendered in silicon or carbon or hydrogen at different times in different ways. The former might be inclined to see calculation *in* or *on* the world, and the latter to see the world as taking shape through the (negative) swerve of bits in the first place, and calculation *as* the world. For one, technology may or may not affirm the world (even without our having access), and for the other, the rest of the world sets forth its own machines to access *us* (who are also—lovingly—real machines). I wonder then whether this is why machines that rely heavily on software to achieve their utility are seen as more artificial, as layered onto the real, than those that work through analogic mechanical operation, which are more likely to be seen as within the real?¹⁷ For me, what is at stake is not philosophy or physics but the means by which we abstract actual work into intelligence and back again according to ideas of preferred function and outcomes. As the last starting point, design of the next Stack must not define itself by a symbolic or operational opposition between the virtual and the real, or the soft and the hard (or even the thinking and the unthinking). It must work with both the positive assembly of matter in the void, on the plane and in the world, and also with the negative maneuver of information as the world, from its form and through its air.

77. Concluding Remarks on Design and The Black Stack

Designing with and for Stacks means designing at multiple scales simultaneously. Forget *User*-centered design; we need to design for what comes next, what comes outside, what has already arrived. As said, the pressing issue is the design of *Users*, which includes designing a geopolitics of *Users* that is more sophisticated than the extrusion of microeconomic privacy into metaphysics. On the ground, sometimes you are the *User* of the drone, sometimes the drone is the *User* of you, and mostly the coagulation of effective agency within a given network is some reverberating combination of these. Better to design for their mutuality and communication than for their relative opacity or transparency, because as generic dispositions go, suspicion is tiresome for everyone but the most vigilant personalities. Still, design needs more and better villains; it needs better complexes and syndromes, a better, more primordial sense of time—rubbing the clinamen raw, as it were. Functional requirements research may or may not find for acceleration beyond Earth and Earthiness (including to Mars, beyond the moon, that dumb homunculus, that planetoid teratoma, broken off dead twin hanging in space).

In the muck of symbolic interchangeability (art into money into toy into energy into symbol into .JPG into art into money), the building project needing donors is a new structure that can give rhythm and shape to the global noise. Its gambit embarks headlong into the banality of the universal so as to find the coordinates of eclipse, and the recognition that the end of this world does not mean the end of worlds, but rather of us, which may be our only means of survival. Humans: we come and go. The multiplication of exceptions and contradictory normalizations, address upon address upon address, makes people who seem to be right at hand appear more uncertain and unprovable the more you try to look straight at them. Look and he is gone; look away and he appears again: Schrödinger's pedestrian. This is what it means to see clearly into plastic futures markets where the same droning monotone voice recognized by psychiatrists as a symptom of homicidal psychosis narrates the boredom overhanging contemporary design culture. The thinking is muddled. Even if all markets are futures markets, we know that it may not be possible to prioritize and weigh with any degree of certainty which existential risk might solve the threat posed by another and then mobilize programs appropriately. In response to this, the language of utopia has shifted, and the cybernetics of scenario planning has given way to apophenic eschatology, geopolitics as a *Dark Side of the Rainbow* effect.¹⁸ With this shift, information becomes unmanageable, nonlinear, associative, arbitrary. Anything can be uploaded into the local rhetoric of conspiracy, for meta-addressability, for atemporality, for speculative realist science fiction, for hashtags of outrage, for neo-Lysenkoism.¹⁹ Ideological apophenia grows freely in walled gardens, choking off other species. This may be the crux of Jameson's field notes on Walmart. This is the alibi of Masdar, New Songdo City,

Skolkova, Foxconn, Peter Thiel's tutelage under Rene Girard, and the dissertation that Alex Karp, founder of Palantir, did with Jürgen Habermas before inventing big data search tools that would provide a far more rigorous communicative rationality than his advisor could ever grasp.²⁰ Or perhaps not. Perhaps the most relevant totalities multiplied one on top of another into hyperbolic geometries are those that seem too dumb to matter. Perhaps the real candidate is not the smart city but Home Depot, and the logistical space of the recombinant object coursing through supply chain heaven. Ponder these warehouse arcades filled with incomplete things with incomplete utility that must be assembled later into metathings in order to be consumed and in order to realize their mission, a factory for 10^9 (people) multiplied by 10^{28} (addresses) as potential experimental architectures. Invention depends, doesn't it, on recalculations of substance, but when or where? The deep time of comparative planetology brings with it local implementation in and as computational geopolitics. Instead of driving a new condition to emerge at some postponed launch event (next fiscal quarter, after the rebuilding of the temple, the coming of the multitude's sovereignty, or whatever), this recalculation would perhaps do so here and now in this space through the resorted synchronic field of the longest possible present moment.

The geopolitics of the *User* we have now is, however, inadequate for that task, including its oppositional modes, but perhaps the spells of geopolitical apophenia can be broken. The Oedipal discourse of privacy and transparency in relation to the evil eye of the uninvited stepfather is a necessary process toward an alter-globalism, but it has real limits.²¹ A geopolitics of computation predicated at its core on the biopolitics of privacy, of self-immunization from any compulsory appearance in front of publics, of platforms, of states, of others, can sometimes also serve a psychological internalization of a now ascendant general economy of succession, castration anxiety—more besides—resulting in the preparanoia of withdrawal into an atomic and anomic dream of self-mastery that elsewhere one might call “neoliberal subject.” Like Theseus’s paradox, where after every component of a thing has been replaced nothing original remains but a metaphysical husk, the *User* is confronted with the existential lesson that at any point, he is only the intersection of many streams (at first, the subject position of the *User* overproduces individual identity, but in the continuance of the same mechanisms, it then succeeds in exploding it). That immunization is matched and inverted by a demand for an equally absolute transparency of authority. Power apparently can tell no jokes of its own, supposedly is never ironic, and any shadows that it harbors are already sinister, never demonstrating nuance. The autonomic narcissism means that the world endangers you; the empire cares about you, who are such an important threat to the order of things that your anonymity and boundaries must be enforced as a first principle for the design of the *User*-layer as a whole. This glass house of immurement calls for absolute transparency when looking up and absolute opacity when looking down, but it is never so clear where we are, even if we are within

an architecture with clear directions of stratification in the first place. Without a clear map of up and down in a social structure, these absolutes are inevitably contaminated and spasmodically invert on each other, and so the stakes are raised (axiom: no one is more likely to commit atrocities than someone who believes himself to be acting in self-defense).

The space in which the discursive formation of the subject meets the technical constitution of the *User* enjoys a much larger horizon than the one defined by these kinds of projects for hyperattenuated digital individuation. Consider, for example, proxy users. uProxy is a project supported by Google Ideas, a browser modification that lets users easily pair up across distances to allow someone in one location (trapped in the Bad Internets) to send information unencumbered through the virtual position of another *User* in another location (enjoying the Good Internets).²² Recalling the proxy servers set up during Arab Spring, one can see how Google Ideas (Jared Cohen's group) might take special interest in baking this into Chrome. For Sino-Google geopolitics, the platform could theoretically be available at a billion-user scale to those who live in China, even if Google is not technically "in China," because those *Users*, acting through and as foreign proxies, are themselves, as far as the Internet geography is concerned, both in and not in China. Developers of uProxy believe that it would take two simultaneous and synchronized man-in-the-middle attacks to hack the link, and at population scale, that should prove difficult even for the best state actors, for now. (More disconcerting perhaps is that such a framework could just as easily be used to withdraw data from a paired site—a paired "user"—that for good reasons should be left alone.) Any plural *User* subject that is conjoined by a proxy link or other means could be composed of different types of addressable subjects: two humans in different countries, or a human and a sensor, a sensor and a bot, a human and a robot and a sensor, a whatever and a whatever. In principle, any one of these subcomponents not only could be part of multiple conjoined positions, but might not know or need to always know which meta-*User* it contributes to, any more than the microbial biome in your gut needs to know your name. Spoofing with honeypot identities, between humans and nonhumans, is measured against the scope and scale of deep address. The abyssal quantity and range of "things" that could, in principle, participate in these vast pluralities includes real and fictional addressable persons, objects, locations, even addressable massless relations between things, any of which could be a sub-*User* in our Internet of haecceities.

So while The Stack and The Stack-to-come stage The Death of User in one sense—the eclipse of a certain resolute individuated utilitarian humanism—they do so because they also bring in the multiplication and proliferation of other kinds of nonhuman *Users* (including sensors, financial algorithms, and various robots from nanometric to landscape scale), any combination of which one might enter into a relationship as part of a composite *User*. This is where the recent shift by major *Cloud* platforms

into robotics may prove especially vital, because—like Darwin's tortoises finding their way to different Galapagos islands—the Cambrian explosion in robotics sees speciation occur in the wild, not just in the lab, and with “us” on “their” inside, not on the outside. As robotics and cloud hardware of all scales blend into a common category of machine, it will be unclear for everyday human-robotic interaction whether one is encountering a fully autonomous, partially autonomous, or completely human-piloted synthetic intelligence. Everyday interactions replay the Turing test over and over. Is there a person behind this machine, and if so how much? In time, the answer will matter less, and the postulation of human (or even carbon-based life) as the threshold measure of intelligence and as the qualifying gauge of a political ethics may seem like tasteless vestigial racism, replaced by less anthropocentric frames of reference. The position of the *User* then maps only very incompletely onto any one individual body. From the perspective of the platform, what looks like one is really many, and what looks like many may only be one. Elaborate schizophrenias already take hold in our early negotiation of these composite *User* positions. The individual subject position makes absurd demands on people as *Users*, as quantified selves, as SysAdmins of their own psyche, and from this, paranoia and narcissism are two symptoms of the same disposition, two functions of the same mask. For one, the mask works to pluralize identity according to the subjective demands of the *User* position as composite alloy; for another, it defends against those same demands on behalf of the illusory integrity of a self-identity fracturing around its existential core. Ask yourself: Is that *User* anonymous because he is dissolved into a vital machinic plurality, or because public identification threatens individual self-mastery, sense of autonomy, social unaccountability? The former and the latter are two very different politics but use the same masks and the same software suite. Given the schizophrenic economy of the *User*, first overindividuated and then multiplied and dedifferentiated, this really isn't an unexpected or neurotic reaction at all. It is, however, fragile and inadequate.

In the construction of the *User* as an aggregate profile that both is and is not specific to any one entity, there is no identity to deduce other than the pattern of interaction between partial actors. We may find, perhaps ironically, that the *User* position of the Stack actually has far less in common with the neoliberal subject than some of today's oppositionalist formats for political subjectivity that hope (rightly so in many cases) to challenge, reform, and resist the state Stack as it is currently configuring itself. However, something like a digital bill of rights for *Users*, despite its sweetness, becomes a much more complicated and limited solution when the discrete identification of a *User* is both so heterogeneous and so fluid.²³ Are all proxy composite users one *User*? Is anything with an IP address a *User*? If not, why not? If this throne is reserved for one species—humans—when is any one animal of that species being a *User*, and when is it not? Any time that it is generating information, is it a *User*? If so, that policy would in practice trespass some of our most basic concepts of the political, and for

that reason alone may be a good place to start. In addition to the fortification of the *User* as a geopolitical subject, we also require, as I have laid out, a redefinition of the political subject in relation to the real operations of the *User*, one that is based not on *homo economicus*, parliamentary liberalism, poststructuralist linguistic reduction, or the will to secede into the moral safety of individual privacy and withdrawn from coercion. Instead, this definition should focus on composing and elevating sites of governance from the immediate, suturing interfacial material between subjects, in the stitches and the traces and the folds of interaction between bodies and things at a distance, congealing into different networks demanding very different kinds of platform sovereignty.

I conclude with some thoughts on The Stack-that-we-have and on what I call *The Black Stack*, a generic profile for its alternative totalities: the Stack-to-come. The Stack we have is defined not only by its form, its layers and platform, and their interrelations, but also by its content. As is now painfully clear, leak after leak, its content is also the content of our daily communications, now weaponized against us. If the panopticon effect is when you don't know if you are being watched, and so you behave as if you are, then the *inverse Panopticon effect* is when you know you are being watched but act as if you aren't. This is today's surveillance culture: exhibitionism in bad faith. The emergence of Stack platforms doesn't promise any solution or even distinctions between friend and enemy within this optical geopolitics. At some dark day in the future, when considered versus a Google Gosplan, the National Security Agency may even come to be seen by some as the "public option." "At least it is accountable in principle to *some* parliamentary limits," they will say, "rather than merely stockholder to avarice and flimsy user agreements." If we take 9/11 and the rollout of the Patriot Act as year zero for the massive data-gathering, encapsulation, and digestion campaign by the United States (one that we are only now beginning to comprehend, even as parallel projects from China, Russia, and Europe are sure to come to the fore in time), then we could imagine the entirety of network communication for the last decade—the big haul—as a single deep and wide digital simulation of the world (or a significant section of it). It is an archive, a library of the real. Its existence as the purloined property of a state, just as a physical fact, is almost occult. Almost.

The geophilosophical profile of the big haul, from the energy necessary to preserve it to its governing instrumentality understood as both a text (a very large text) and a machine with various utilities, overflows the traditional politics of software.²⁴ Its story is much more Borges than Lawrence Lessig. Its fate is as well. Can it be destroyed? Is it possible to delete this simulation, and is it desirable to do so? Is there a trash can big enough for the Big Delete? Even if the plug could be pulled on all future data hauls, stopping it all immediately, surely there must be a backup somewhere, the identical double of the simulation, such that if we delete one, the other will be forever haunting history until it is rediscovered by future AI archaeologists interested in their own

Paleolithic origins. Would we bury it even if we could? Would we need signs around it like those designed for the Yucca Mountain nuclear waste disposal site warning off unknowable future excavations? Those of us “lucky” enough to be alive during this span would enjoy a certain illegible immortality to whatever curious metacognitive entity pieces us back together by our online activities, both public and private, proud and furtive, each of us rising back centuries from now, each of us a little Ozymandias of cat videos and Pornhub.

In light of this, the Black Stack could come to mean very different things. On the one hand it would imply that this simulation is opaque and unmappable, not disappeared, and that the whole thing is ultimately redacted. It could imply that from the ruined fragments of this history, another coherent totality can be carved against the grain, even from the deep recombinancy at and below the *Earth* layer of The Stack. Its blackness is the surface of a world that can no longer be composed by addition because it is so absolutely full, overwritten and overdetermined, and to add more is just ink into an ocean. Instead of *tabula rasa*, this *tabula plenus* allows for creativity and figuration only by subtraction, like scratching paint from the canvas, by carving away by death, by replacement. The structural logic of any Stack system allows for the replacement of whatever occupies one layer with something else, and for the rest of the architecture to continue to function without pause. For example, the content of any one layer, *Earth*, *Cloud*, *City*, *Address*, *Interface*, *User*, could be replaced (including the masochistic hysterical fiction of the individual *User*, both neoliberal and neo-other things) while the rest of the layers remain a viable armature for global infrastructure. The Stack is designed to be remade. That is its technical form, but unlike replacing copper wire with fiber optics in the transmission layer of TCP/IP, replacing one kind of *User* with another is more difficult. Today we are doing it by adding more and different kinds of things into the *User* position, as described above. We should, however, also allow for more comprehensive displacements, not just by elevating things to the status of political subjects or technical agents, but making way for genuinely posthuman and nonhuman positions. In time, perhaps at the eclipse of the Anthropocene, the historical phase of Google Gosplan will give way to stateless platforms for multiple strata of synthetic intelligence and biocommunication to settle into new continents of cyborg symbiosis. Or perhaps instead, if nothing else, the carbon and energy appetite of this ambitious embryonic ecology will starve its host.

For some dramas, but one hopes not for the fabrication of The-Stack-to-come (Black or otherwise), a certain humanism and companion figure of humanity still presumes its traditional place in the center of the frame. We must let go of the demand that any artificial intelligence, arriving at sentience or sapience, must care deeply about humanity, *us specifically*, as the subject and object of its knowing and its desire. The real nightmare, worse than the one in which the Big Machine wants to kill you, is the one in which it sees you as irrelevant, or not even as a discrete thing to know. Worse than

being seen as an enemy is not being seen at all ("The AI does not hate you, nor does it love you, but you are made out of atoms which it can use for something else.")²⁵ One of the integral accidents of The Stack may be the Copernican trauma that shifts us from a design career as the authors of the Anthropocene to the role of supporting actors in the arrival of the post-Anthropocene. The Black Stack may also be black because we cannot see our own reflection in it. In the last instance, its geopolitics is less eschatological than chemical, because its grounding of time is based less on the promise of historical dialectics than on the rot of isotope decay. It is drawn, I believe, by an inhuman and inhumanist molecular form finding: pre-Cambrian flora changed into peat oil changed into children's toys, dinosaurs changed into birds changed into ceremonial headdresses, computation itself converted into whatever metamachine comes next, and Stack into Black Stack.

Glossary

The specific vocabulary of The Stack is an important part of the complete picture. Certain terms have a distinct connotation that may require additional clarification. In some cases, if a term is also defined in the text itself, the definition here may be paraphrased.

Accidental Megastructure It was not the plan for The Stack to become the geopolitical armature that it is. The Stack itself is an accidental megastructure. Considered as one massively distributed machine, it envelops the planet, over land, under water, and in orbit. Unlike other megastructures, it is not the result of one coordinated master plan (though some of its key components were). Instead, the technologies of its layers cohere into an emergent order that is largely the result of unintended, unplanned, unpredicted, and unmanaged technical and social interactions at different scales and as part of different histories. *See also* The Stack.

Address Layer The fourth layer from the base in the Stack model, between the *City* and the *Interface* layers. Like a house connected to a postal system, any device that is connected to the Internet is assigned a discreet address (usually temporarily) to which information is sent and from which it is received. Assigned an address, any “thing” (a device, a person, a physical event, a piece of data, or some other abstraction) is, in principle, present and available for communication to any other addressee. Addressing systems are finite and so can incorporate only as many senders and receivers as their architecture allows for. *Address* provides *identity*, *exchange*, and *recursion*. *See also* Deep Address.

Alegal Something not recognizable as legal or illegal by the law but which contravenes the present governing order in some fundamental way. In particular, an alegal action may represent something that strongly characterizes an emergent governing order, and so may be against the logic of current governance but exemplary of the logic that may soon replace it. An example is file sharing. Originally it was neither legal or illegal because the law could not recognize it. It then became illegal in relation to current regimes in intellectual property law, but it also may be exemplary of an emergent governing logics of sharing, property, distribution, and asset commonwealths.

Algorithmic Governance A reflexive cycle of intentions, sensation, filtering, and decision-making that can govern the social, economic and computational cycles to which it refers and is referred by. Reporting agents in such a system both send and receive information to a higher-order governing abstraction: a measured swarm in relation to how algorithmic governance feeds back to them, resensing their reactions, and so on. *Users* observe that cycle through *Interfaces*, which in turn govern *User* actions by delineating and filtering their options.

Ambient Interface The term has both descriptive and prescriptive connotations. It is the field of both the physical and virtual interfaces that surround a *User* at any given moment; or put differently, it is the user's world *defined* as a field of interfaces (an interface being defined as any point of contact between two complex systems that governs the conditions of exchange between those systems). The prescriptive connotation refers to designing in accordance with haptic, gestural, or semiotic *User* interfaces that prioritize interaction between things existing at very different physical and qualitative scales at once, suggesting unusual chains of remote agency and causality.

App A small software application running on a given piece of hardware that provides a highly specific, temporary, and limited functional *Interface*, thereby converting the general tool into a particular machine. The App manages information in several possible ways. It may store gathered information, including sensors and direct *User* input, for immediate or later use; it may draw new information down from more powerful applications in the *Cloud* to the device interface; and it may coordinate local and *Cloud-based* information streams into a consolidated image. Importantly, an App platform allows for software-driven hardware modularity.

Assemblage Line The space of Logistics shifts from the spatially contiguous assembly line to the more discontiguous assemblage line linked internally through specific interfacial chains. This delinking makes the arrival of material goods (and the processes of the world of production, in general) more opaque. Interfaces draw these chains as coherent wholes, gathering multiple events and effects into a common visual frame. This conceptual gathering refers instead to how a massively discontiguous assemblage line, bound together by exceedingly complex interfacial relays linking continents, must be understood and represented as if it were a single pattern or machine. For The Stack, such apparently comprehensive interfacial images of assemblage lines, which themselves comprise interfacial relays, are, for the *User*, a necessary tool to manage otherwise illegibly complex chains of interaction. *See also* Interface Layer.

The Black Stack The generic term for The Stack-to-Come that we cannot observe, map, name, or recognize. It may describe The Stack that remains, thriving or dead, after *Homo sapiens* is no longer the dominant geological actor. It is a name for the “not-blank slate” of whatever composition The Stack will turn into. It is a composition that we know is coming, know that we will have a hand in fashioning, but don’t know how to recognize in advance (or cannot possibly recognize in advance because we cannot possibly ever witness it for whatever reason.) Some ante-verberations of “this-totality-to-come” are surely already here and now.¹

Camp/Enclave The camp and the bunker, detention and enclave, are inversions of the same architecture. One is an architecture of internalization and the other of externalization, but they share the same material profile. What may be an interiorizing partition (“enclave”) for one *User* at one moment may be an exteriorizing partition (“camp”) for another at another moment. Giorgio

Agamben, after Carl Schmitt, identified the camp as “the *nomos* of the Modern” and sovereignty in relation to the decision to initiate the camp as a site of exception. What we may choose to identify as the *nomos* of the *Cloud* shifts that decision to the interface that causes the same architecture to oscillate between interiorization and exteriorization, camp and enclave. Here the exception is the inversion itself, and the normalization of that exception through the automation of that oscillation (by software) is one key aspect of platform sovereignty for The Stack.

Capitalist Pricing Problem Market models can confuse the emergent effects of transaction liquidity with systems planning and do so at the expense of artificially segregating and suppressing the real costs of near- and long-term “externalities.” This is contrasted with the socialist pricing problem for which centralized systems can be too slow to sense and calculate individual price signals. An addressing mechanism capable of identifying the true “costs” of a given transaction, many of which are now diverted into various externality sinks, could provide a price for that transaction that reflects an accurate signal.

City Layer The third layer from the bottom of The Stack. It includes networks of megacities situating human settlement and mobility within a single distributed urbanism that combines physical, informational, and ecological infrastructures. These present a politics of the envelope in which architectural and informational partitions both organize and subdivide access to social space. It is suggested that the generic and comprehensive quality of this condition may also afford novel forms of platform sovereignties, derived not from parliamentary universals but from a common and differential relationship to urban envelopes and interfaces.

Cloud Layer The second from the bottom of The Stack. It includes the computing and transmission hardware on which Stack software depends, such as data centers, transmission cables, geosynchronous satellites, and wireless network technologies, and so on. It also includes *Cloud* platforms, such as Google and Amazon, which provide services to their federated *Users* through the applications they directly manage or those they support. Formal differences in service models also drive strategic differences in how *Cloud* platforms may structure *Cloud* polities. These differences in turn affect geopolitical conflicts ensuing from the juxtaposition or superimposition of national geography and those *Cloud* services (e.g., the Google-China conflict), from the evolution of states into *Cloud* platforms and complicating effective claims of final sovereignty.

Cloud Feudalism One possible, but by no means inevitable, outcome of the consolidation of *Cloud* platforms into *Cloud* polities is *Cloud* feudalism, characterized by overly centralized capture, consolidation, and distribution of value by those platforms. In this scenario, *Cloud* polities realize effective if also informal sovereignty over how they use *Users*, such that the ratio of platform surplus value to platform user value is highly asymmetrical and dramatically weighted in favor of the former at the expense of the latter. Unlike in medieval feudalism, where serfs were tied to specific sites and plots, for *Cloud* feudalism, *Users* are untethered from specific locations and migrate from one provisional labor interaction to another. *Cloud* feudalism may arise in relation to automation, but automation may also lead to entirely different macroeconomic outcomes.

Cloud Polis The model provided and enacted by global *Cloud* platforms to cohere *Users* into proto-state entities. These entities may operate at the scale of a true state and may come into political geographic conflict with states accordingly. *Cloud Polis* is characterized by hybrid

geographies, incomplete governmental apparatuses, awkward jurisdictions, new regimes of interfactivity, archaic imagined communities, group allegiances, ad hoc patriotisms, and inviolable brand loyalties: soupy mixtures both futuristic and atavistic at once. We can observe different formal models of *Cloud Polis* in the service architectures of contemporary *Cloud* platforms, such as Google, Amazon, Facebook, and Apple, and can deduce possible *Cloud Polis* by the recombination of these architectures.

Column *User* connects to *User* by initiating a message that tunnels down through the other layers to the bottom and then back up again, and so direct communication between *Users* activates all six layers down The Stack and then all six layers again back up The Stack. Any one path taken down and up The Stack in a U-shaped trajectory is a column. The whole of the system is invoked and activated by all connections; the whole is folded into each single instance of activation, bending the universal and the particular into one another. Any one *User* will initiate vast numbers of different columns at different moments over time, thereby executing different combinations of nested positions. Any given column tracks up and down; there is no final instance of vertical or horizontal integration that would truly and ultimately resolve a *User* down to the *Earth* layer or *Cloud* layer for good.

“Death of the User” Refers to at least three separate breaks. (1) The decentering or eclipse of a utilitarian-cognitivist *User* commonly construed from conventional user-centered design by an evolving population of nonhuman *Users* with very different kinds of embodied and disembodied experiences and interactions. (2) The displacement of the soft humanism from the conceptual center of the design for the *User*-subject position and toward a design of the *User*-subject position. (3) A rhetorical function of information visualization whereby convincing diagrammatic mastery of the represented data suggests that there must be an expert *User* somewhere who makes use of these impressive interfaces, a figure who is in most cases only an empty or absent implication.

Deep Address While scenarios for ubiquitous computing and an Internet of Things suggest information exchange between smart natural objects, what I refer to as “deep address” is interested in communication between very different spatial and temporal scales, absorbing any addressees into a vast, if also fragile, communicative field that may exceed the limits of human control or literacy. Deep address is also a mechanism for the capture of what exists and a formalization of its space of juxtaposition, and so it is also a medium for the creative composition of those relations, positions, and interrelations. An Internet of haecceities refers to addressable specificities that might name particularities as they come and go, even also before and after they are recognizable for individual *Users*. These enumerated specificities may be things with mass or relations between things without mass, and accordingly the scope of any addressing platform might be functionally limitless compared to the number of anthropometric objects it might address, or highly limited by the ultimately abyssal scope of possibly addressable relations-of-relations-of-relations between addresses.

Earth Layer The first layer, at the bottom of The Stack. It is the point by which the planetary perch of the Earth itself is subsumed into the geographic frame of The Stack. It is the substrate from which the power necessary to operate all other layers is drawn and from where the metals and minerals that comprise platform electronics are extracted. The layer is also where the

recursive contradictions of projects on behalf of computational omniscience are played out most dramatically, including by ecological surveillance metainstruments and energy optimization grids that may or may not actually represent the critical inefficiencies that they were designed to mitigate. It is where the horizontal subdivision of land by normative Westphalian state sovereignty is broken down by emergency challenges to the governance of a synthetic ecology with local causes and effects but translocal scope.

Exit/Entrance The capacity of a *User* to leave the obligations of one platform (including a state perhaps) and to enter into the preferable terms, confines, contexts, or protections of another platform. For purposes of platform sovereignty, it refers less to the formal “rights” of *Users* to do so, which may be stipulated contractually but made insignificant by other mechanisms that filter exit and entrance opportunities for particular *Users*. This dynamic relates directly to that of the camp/enclave as its *Interfaces* oscillate between interiorization and exteriorization. Platform sovereignty over this oscillation, and thereby also over the practical ability of a given *User* to exit or enter a platform, may reside in the *Interface* itself, as programmed by the platform or with the *User* who engages the interface on their own behalf.

Geodesign The larger, ongoing, collaborative megaproject to reconfigure our ecological, geoeconomic, and geopolitical condition through an active redesign of The Stack itself. It begins from the architectural modularity of stack platforms, from the challenge of realizing a vibrant ecology and luxurious society, and from the recognition that the ultimate career of computation as core infrastructure is still embryonic. It may include the redrawing of geopolitical maps, including or excluding Westphalian forms according to different perspectives. It would include what is commonly understood as geoengineering but would not limit the project to exclusively technical problems and solutions or to Holocene natural systems as the substance to work on. It may work with the signal figure of the post-Anthropocene, pushing toward it and against it in various measure. Like The Black Stack, geodesign may stand for what cannot be said or seen at this time, but which is also inevitable.

Geography The writing or drawing of or on the Earth in order to frame its specific features, scope, face, or landscape. It is both a kind of writing of space and of expressing, communicating, politicizing, and defending compositional images of terrain as a precondition of the social and technical construction of political domains to be defended. For there to be any kind of abstract jurisdiction—secular, sacred, national, networked—there has to be a figure of space through which force can work at all. Carl Schmitt’s concept of the *nomos* is one establishment of this. Geography more broadly frames the referent over which any governing, compositional, projective frame seeks authority, not just those of modern states. Geographic inscription may range from early geoglyphs to modern agriculture to transoceanic transmission cables.

Geopolitics For The Stack, the term has at least two connotations. First, it references the more conventional history of political thought on a stable relationship between great state powers. Carl Schmitt’s term *Grossraum*, “the Large Space,” of a regional, supernational domain of sovereign control, like the Monroe Doctrine, is perhaps exemplary. For some, this suggests an ideal multipolar arrangement for global political entities and empires, and so as new claims on global space are made, for example, by the *Cloud*, the geopolitical question is how to locate them within the

genealogy of modern geopolitics. Like geography, the second sense is related to Gilles Deleuze and Félix Guattari's notion of geophilosophy, which suggests that thought is always tied to its planetary situation. Geopolitics then names the ways in which a society attempts to assemble itself, thinks its own terms, its own ethics, its own models of operation, its own logics of value, in relation to how it is situated on its planetary perch. This second connotation may modulate the first, and perhaps help us to understand new realities as within a longer arc of geopolitics, geography, geology, geoscropy, and so on.

Geoscapes Maps on top of maps create the map of maps. Geoscapes are defined as a territory of territories, each competing over the right to describe the reality of location, distance, borders, and juxtaposition of the whole of territory itself. It composes and is composed of multiple contradictory mapping gestures and held in overlapping and finally incommensurate arrangements. Geoscapes are held in agonistic tension by overlapping descriptions of territories as they exist, as well as idealized territories, futuristic or atavistic, as they should be. In such utopias, idealizations continue to operate through geographic imagery, just as geographic imagery—in its fidelity, affect, comprehensiveness—continues to imply an idealized (and sometimes utopian) image of the world as it is. The ultimate quality of geoscapes is made only by the accumulation of territories that fill it by their drawings; it has no shape or presence other than by this accumulation.

Google Gosplan/*Grossraum* Refers in general to the convergence of planned and market economies into computational platforms that share ideal and practical characteristics, and specifically to the genealogy of Google as inclusive of socialist and communist state attempts to use computing systems, primitive by today's standards, to model and coordinate their economies, sometimes with success and sometimes with disastrous effect. The term also implies that the future evolution of *Cloud* platforms that absorb traditional functions of states (such as Google, to a degree) may realize forms of effective economic governance that are recognizable as both minimal state and maximal state at once. It strongly suggests that there is no intrinsic relationship between infrastructural scale computation and neoliberal economies as they are conventionally understood. Many socialist computing platforms were criticized as suffering insufficient information to regulate price properly, but platforms like Google may suggest that information scarcity may no longer be as strong a limitation, and in principle it implies that such platforms could also calculate the true costs of transaction externalities.

Interface Layer The fifth layer from bottom of The Stack, just below the *User* layer. Interfaces are the membrane through which The Stack addresses and is addressed by *Users*. *Interfaces*, as compressed into graphical or objective forms, link (or delink) *Users* and the *Addressed* entities up and down columns. The speed by which the embedded interface circulates information and physical goods contributes to the real and perceived discontiguity of chains of production and distribution of material culture for the *User*. The dominant contemporary genre of *Interface*, the graphical user interface, is an interactive visual diagram that presents a visually coherent image of otherwise discontiguous and opaque processes and flows. Some emerging technologies, such as augmented reality, superimpose interfacial elements directly into the *User's* perceptual field, with the capability of articulating the significance of people, places, and things according to the program of different imagined communities. This collapse of the metaphorical space between perceived object

and its interpretation, especially when paired with messianic political theologies, can engender forms of cognitive fundamentalism.

Interfacial Regime/Interfacial Totalities Particular platforms support multiple touchpoints coordinating interactions across their service offering, and in doing so, they provide a coherent and complete array of interfaces at multiple scales. The coordination of this array is recognized as a key aspect of user experience design, and ultimately, that experience becomes more coherent as it becomes more complete. That coherence defines one interfacial regime in relation to another. Unlike other geographic projections, the interface is not only a visual representation of an aspirational totality; it is an image of a totality that when acted on also instrumentally affects the world. By using one regime exclusively, the *User* collaborates in that regime's larger program. Interfacial regimes are thereby also totality machines, both describing linkages and making projective claims over them. Two alternate interfacial totalities may compete to describe the same site, *User* or process, and the mingling of overlapping totalities brings some degree of noise and ambiguity. Any given site in the *City* layer may be overcome by multiple competing perceptual totalities, systems, and sovereign geographies.

Loop Topology Geographically the modern nation-state is based on a cartographic projection of the Earth as a horizontal plane filled with allotments of land in which individual sovereign domains are circumscribed by lines derived from a now-normative topology of *loops*. The national boundary and its governable choke-points express and defend the model in relation to other *Cloud Polis* based on other geographic models, such as the transcontinental data network or the premodern regional or worldwide religious body.

Machine as State The Stack is less a new medium of governance than it is a form of governance in and of itself, less the machine *of* the state than the machine *as* the state. Its agglomeration of computing machines into platform systems not only reflects, manages, and enforces forms of sovereignty; it also generates them in the first place. States and nonstate platforms compete directly not only over the generation of Stack geographies but also for dominion over those spaces once they are mapped.

Nomos *Nomos* refers to the primary act of territorial inscription that gives rise to its subsequent formalization and structural logic in accordance; it is a making of a territorial order through the execution of a territorial claim and physical occupation that precedes it. It is essential for any political geographic architecture to identify the individual sites, fields, instances, and actors within its jurisdictional field, such that any of these would be communicable as part of a regular and governable flow of information through those spaces. The terms of the *nomos* are also the shape of that space as configured by the flows that fill it up. *Nomos* is described as prior to every legal, economic, and social order. It is constituted by appropriation, distribution, and production, and only through this can it move from the particular to the universal: from arbitrary territorial capture, to representations of spatial delineation, to a geopolitical order.

Nomos of the Cloud As the geography of the *Cloud* rotates from a two-dimensional map to a vertical, sectional stack, its topography is shaped by the multiplication and superimposition of layers of sovereign claims over the same site, person, and event. The micro-enclaves that it spawns are variously exclusive or inexclusive, a pixelated patchwork of discontiguous partial interiors. No

workable distinction between ground and water, between *Cloud* infrastructure and *Cloud* interactivity as mapped across some spectrum from tangible to virtual, has yet to congeal into a stable order in the way that Schmitt characterized the modern European *nomos*. The spacefulness of The Stack's networks, and their ongoing occupation, settlement, and doctrinal composition, overlays incommensurate physical and geographic forms without a common master plane, and accordingly no *nomos* of the *Cloud* may (need to) emerge.

Platform All stacks are platforms, but not all platforms are stacks. Ultimately platforms can be seen as not only a technical model but also an institutional form along with states and markets. Platforms are generative mechanisms, engines that set the terms of participation according to fixed protocols (e.g., technical, discursive, formal protocols) but gain size and strength by mediating unplanned and perhaps even unplannable interactions. A platform may be defined as a standards-based technical-economic system that may simultaneously distribute interfaces into that system through their remote coordination and centralizes their integrated control through that same coordination. Platform logic refers first to the abstracted systems logic of platforms and the tendency on the part of some systems and social processes to transform themselves according to the needs of the platforms that may serve and support them, both in advance of their participation with that platform and as a result of that participation. For a more complete list of general characteristics of platforms see section 10.

Platform Sovereignty Refers to the still immature combination of legally articulated political subjectivities and an infrastructurally determined sovereignty produced in relation to the platform infrastructures, regardless of whether these are privately or publicly owned. Platform sovereignty operates within territories that are composed of intersecting lines, some physical and some virtual, and for this, deciding exceptions is no less critical. The exceptions to be decided, however, are over what geographies those lines describe and what conditions they inscribe. These forms of sovereignty may be produced by an automated normalized exception, programmed at the level of the *Interface*, and may coincide with formal legal norms, may transgress them, or may operate outside their supervision altogether. Exit/entrance dynamics are a key site of contestation where different degrees of platform sovereignty cohere or filter *Users* in their image.

Platform Surplus Value Platforms often provide core service at no direct transaction cost to the *User*. Platform economics is based on absorbing value from the provision of each transaction that is ultimately greater than the cost of providing it. Platform surplus value is this differential. For example, the ultimate value for Google that *Users* provide in training its algorithms to anticipate future *User* interactions has proved much greater than Google's net costs to provide its search algorithms to *Users* for free.

Stacks Generally stacks are platforms, but not all platforms are stacks. Stacks, like most other platforms, are generic, plastic, and extensible. They may provide for modular recombinancy of system components, but only within the bounded set of its synthetic planes. Its generative capabilities grow through an initial subdivision of technologies into planar layers and then through an autocratic consolidation and rationalization of these through internal interfaces and protocols. Key to the success of this modular model is its flexibility in absorbing future technological innovations that can be introduced at any given layer (e.g., fiber optics instead of copper wire at the

physical layer, a faster router, an application with better features and security) without disrupting the existing components (so long as the new technology adheres to the protocols established by the platform model that allow it to communicate with its vertically adjacent layers, above and below; in principle, any machine could be inserted in a layer of the network if it can adhere to the necessary grammar that would allow to communicate with its most proximate neighbors). For computation, there are many different kinds of stacks with very different functions (e.g., application stacks, data structure stacks, protocol stacks). It is likely that every contemporary academic discipline relies on some form stack model as part of its ontology, epistemology, or methodology.

The Stack Refers to a transformation in the technical infrastructure of global systems, whereby planetary-scale computation has so thoroughly and fundamentally transformed the logics of political geography in its own image that it has produced new geographies and new territories that can enforce themselves. Unlike modern political geography, which divided up horizontal maps, Stack geography also vertically layers spaces on top of one another. Instead of surveying all the various forms of planetary-scaled computation—cloud computing, smart cities, ubiquitous computing, massive addressing systems, next-generation interfaces, nonhuman users, and so on—as different genres or species of computing, each off on its own, this model locates them on layers of a consolidated metaplatform, an accidental megastructure. We observe these bottom-up from the *Earth* layer up to the *User* layer. Energy drawn from planetary resources at the *Earth* layer drives *Cloud* computation, and its global platforms organize new political topologies. The *City* layer is animated by those *Cloud* platforms from within, organizing things, events, and relations at the *Address* layer into *Interfacial* regimes that provide a window into the whole system for *Users*. Together these sectional layers comprise the larger apparatus: The Stack. The Stack is equally a descriptive system and a design model that may point us in a different direction from its current configuration. The Stack is a model for thinking about the technical arrangement of planetary computation as a coherent totality, as well as a conceptual model for thinking the contradictory and complex spaces that have been produced in its image. It is both a schema that refers to a technical system, and a technical system that demands different kinds of interpretive schema from us. It is a work of partially accidental geodesign that demands from us further, better deliberative geodesign.

Synthetic Catallaxy Popularized by Austrian school economics, catallaxy refers to the shared values, knowledge, information, and communication of those participating in a market economy. Friedrich Hayek employed the term to describe what he saw as an essential failure of planned economies, namely, that central planners could never know or process the real information exchange within an economy in such a way as to properly set prices or govern transactions. Contemporary *Cloud* platforms radically complicate any strong distinction between planned and market economies, with many setting prices, planning infrastructure, and modeling demand in real time, as well as making these same tools available to *Users* as they plan and transact. They represent in this way a kind of synthetic catallaxy.

User Layer The top layer of The Stack and the sixth from the bottom, just above the *Interface* layer. This layer situates how *Users* (e.g., human, animal, machine) view The Stack and that initiate chains of interaction (columns) up and down its layers, from *Interface* to *Earth* and back again. It is also the position at which The Stack views those *Users*. As such the “user” has represented

a contemporary technical image of the self, sometimes reduced to utilitarian frames and also sometimes allowing for unexpected new kinds of platform sovereignty. This includes both the exaggerated depiction of self that the *User* position may provide, as well as its equally radically fractured or dissolved reflection in multiple layers of data. The *User*-subject is a position that can be occupied by anything (or pluralities, multitudes, and composites) capable of initiating a column, especially anything that can do so and respond to how The Stack communicates back to it. This generic universality of the *User*-subject is both how it can flatten or curtail the human experience of remote interactions and how it introduces otherwise unrepresented agents into mediated contact with the whole.

User Platform Value Platform economics provide for at least two forms of “surpluses”: platform surplus value and *User* platform value, which is characterized by how information entered into a platform is made more valuable for the *User* at little or no direct cost to that *User*. As an ideal model, *Users* will make tactical use of platform *Interfaces* to link existing systems (e.g., social, technical, informational, biological) and in doing so are incentivized to incorporate more of their own interests. Subsequent *Users* are incentivized to link their systems to benefit from the network effects set in motion by earlier *Users*, who in turn enjoy increasing network benefits as more *User* systems are incorporated over time. In principle, the platform itself realizes platform surplus value from this cycle.

Westphalian State The political model of sovereignty defined by the horizontal projection and loop topology of the modern nation-state political geography. “Westphalian” refers to the 1648 Treaty of Westphalia, symbolizing the formal consolidation of this sovereign geographic model. The model provided the modern unit of state sovereignty as interior to that geographic loop, and a geopolitics that would variously identify a balance of conflict between these units and a federalization of them into a particular form of cosmopolitanism. The *nomos* of the *Cloud* is characterized partially by a “delamination” of practical sovereignty from this grounding.

Notes

Introduction

1. Michel Serres and Jean-Paul Dekiss, *Jules Verne: La science et l'homme contemporain: Conversations avec Jean-Paul Dekiss* (Paris: Pommier, 2003). Also see Michel Serres and Maria Malanchuck, "Jules Verne's Strange Journeys," *Yale French Studies* no. 52 (1975): 174–188.
2. Peter Watts, "The Things." *Clarkesworld*, no. 40 (January 2010).
3. Stafford Beer, "Fanfare for Effective Freedom: Cybernetic Praxis in Government," 1973, <http://ada.evergreen.edu/~arunc/texts/cybernetics/Platform/platform.ps>.
4. <http://www.ibtimes.com/hillary-clinton-remarks-american-leadership-council-foreign-relations-full-text-1056708> February 01 2013 3:49 PM.
5. Carl Schmitt, *The Nomos of the Earth in the International Law of the Jus Publicum Europaeum*, trans. G. L. Ulmen (New York: Telos Press, 2003).
6. Michel Foucault, *The Birth of Biopolitics: Lectures at the Collège de France, 1978–1979*, trans. Michel Senellart (New York: Picador, 2010).
7. J. G. Ballard, "Notes from Nowhere: Comments on Work in Progress," *New Worlds* (October 1966): 147–151.
8. James C. Scott, *Seeing like a State: How Certain Schemes to Improve the Human Condition Have Failed* (New Haven, CT: Yale University Press, 1998).
9. On Michel Serres's conception of the transformation of hard tools into soft tools, see Steven Connor, "Topologies: Michel Serres and the Shapes of Thought," *Angelaki*, no. 15 (2004): 105–107.
10. Throughout this book, I capitalize and italicize the names of the six layers of The Stack (*Earth, Cloud, City, Address, Interface, User*) to indicate specific reference to the layer.
11. Paul Virilio, "The Museum of Accidents," trans. Chris Turner, *International Journal of Baudrillard Studies* 3, no. 2 (2006). http://www.ubishops.ca/baudrillardstudies/vol3_2/virilio.htm.

12. Appadurai, Arjun. "Sovereignty without Territoriality: Notes for a Postnational Geography." in *Geography of Identity*, ed. Patricia Yaeger (Ann Arbor: University of Michigan Press, 1996), 40-58.
13. "Weary thought, incapable of maintaining itself on the plane of immanence can no longer bear the infinite speeds that concern only the succession of movement from one point to another, from one extensive component to another, from an idea to another, and that measure simple associations without being able to reconstitute any concept." Gilles Deleuze and Félix Guattari, *What Is Philosophy?*, trans. Hugh Tomlinson and Graham Burchell (New York: Columbia University Press, 1994), 214.
14. Chris C. Demchak and Peter J. Dombrowski, "Rise of a Cybered Westphalian Age: The Coming Age," *Strategic Studies Quarterly* 5, no. 1 (2011): 31–62.
15. Stuart Elden, "Secure the Volume: Vertical Geopolitics and the Depth of Power," *Political Geography* 34 (2013): 35–51.
16. A. Wissner-Gross and C. Freer, "Relativistic Statistical Arbitrage," *Physical Review E* 82, no. 5 (2010). On this topic in relation to geodesign, see also Geoff Manaugh, "Islands and the Speed of Light," March 2011. <http://bldgblog.blogspot.com/2011/03/islands-at-speed-of-light.html>.
17. Here I am departing from Catherine Malabou's use of the term *plasticity*, and toward the mutable future I refer more directly to the chemical qualities of what we commonly call "plastic."

The *Nomos* of the Cloud

1. Carl Schmitt, quoted in Gopal Balakrishnan, *The Enemy: An Intellectual Portrait of Carl Schmitt* (London: Verso, 2000), 245.
2. Michel Serres and Jean-Paul Dekiss, *Jules Verne: La science et l'homme contemporain: Conversations avec Jean-Paul Dekiss* (Paris: Pommier, 2003).
3. Stephen D. Krasner, *Sovereignty: Organized Hypocrisy* (Princeton, NJ: Princeton University Press, 1999).
4. Giorgio Agamben, *The State of Exception*, trans. Kevin Atell (Chicago: University of Chicago Press, 2005).
5. Carl Schmitt, quoted in Giorgio Agamben and Daniel Heller-Roazen, *Homo Sacer* (Stanford, CA: Stanford University Press, 1998).
6. Walter Benjamin, quoted in Beatrice Hanssen, *Critique of Violence: Between Poststructuralism and Critical Theory* (London: Routledge, 2000).
7. On William Davies's studies of the later Foucault lectures, see Nicholas Gane, "The Emergence of Neoliberalism: Thinking through and beyond Michel Foucault's Lectures on Biopolitics," *Theory, Culture and Society* 31, no. 4 (2014): 3–27.

8. David Campbell, "ITN vs. *Living Marxism*," *Independent Television News*, August 7, 1992.
 9. Liquefaction and solidification overwrite and overwhelm one another, over and again. The introduction of the membrane-partition works against the capacity of sovereign movement, against its abilities, and the same holds true for walls internal to the city; inside its outer walls are inner walls, equally defeated. Does the suppression of violence support the civil society ostensibly protected from attack, or does it double in advance the attack, rendering the surface of the city in the image of its own projective violence, ceding to it in advance? The *City* to be governed can't possibly know in advance whether and how the closing of a channel will work to stabilize or destabilize an intended civil equilibrium. If the content of the terrorist form is that there is no civilian space, then the content of counterterrorism is identical if inverted.
 10. I would argue this framework of "the political" as articulated by Schmitt and developed by Chantal Mouffe and Ernesto Laclau, for example, is a stale and ineffective strategy for understanding the logics of power and design in our age of ecological precarity. Put differently, only a fool would tell you that the functional definition of the "post-political" looks like the Washington Consensus. As should be clear to the attentive reader, my rehearsal of Schmitt's model in this chapter is in order to overwhelm it with catastrophic contradictions.
 11. See also Stuart Eeden's work on the history of the concept of territory, especially *The Birth of Territory* (Chicago: University of Chicago Press, 2013), as well as Eeden, "Secure the Volume: Vertical Geopolitics and the Depth of Power," *Political Geography* 34 (May 2013): 35–51; Eeden, "The Geopolitics of King Lear: Territory, Land, Earth," in *Law and Literature*, 25: 2 (2013); and Eeden, "Chamayou's Manhunts: From Territory to Space?" for *The Funambulist Papers: Volume 2* (Punctum Books, 2014).
 12. Stewart Eeden: "Schmitt reminds us that the Greek word *nemein*, from which *nomos* is derived, means both 'to divide' and 'to pasture' (1997 [1950]: 40; 2003 [1950]: 70). Hannah Arendt has similarly noted the relation between 'law and hedge in the word *nomos*', stressing the relation between law and boundary line or zone, and pointing out that 'the Greek word for law, *nomos*, derives from *nemein*, which means to distribute, to possess (what has been distributed) and to dwell' (1958: 63 n. 62). The legal is thus tied directly to the land. As Schmitt continues: '*Nomos* is the *measure* by which the ground and soil of the earth [*Grund und Boden der Erde*] in a particular order is divided and situated; it is also the form of political, social, and religious order determined by this process. Here, measure, order, and form constitute a spatially concrete unity. (1997 [1950]: 40; 2003 [1950]: 70)." See Eeden, "Reading Schmitt Geopolitically: *Nomos*, Territory and *Großraum*," in *Spatiality, Sovereignty, and Carl Schmitt: Geographies of the Nomos*, ed. Stephen Legg (New York: Routledge, 2011), 91–105.
- Schmitt himself defines it in more than one way. "The Greek noun *nomos* derives from the verb *nemein*, and like the latter, has three meanings. Firstly, *nemein* is the equivalent of the German *nehmen*, to take. Hence *nomos* means seizure. As the Greek *legein-logos* corresponds to the German *sprechen-Sprache*, so too, the German *nehmen-Nahme* corresponds to the Greek *nemein-nomos*. At first, it meant the seizure of land, and later it also meant the appropriation of the sea, much of which is part of our historical review here. In the industrial sector, one speaks of the appropriation of the means of production. The second meaning is the division and

distribution of what was seized. Hence also the second sense of nomos, the basic division and repartition of the soil and the resulting ownership order. The third meaning is to tend, that is, to use, exploit, and turn to good account the partitioned land, to produce and to consume. Seizing-dividing-tending in that sequence are the three fundamental notions of every concrete order. More about the meaning of nomos can be found in my book *The Nomos of the Earth* (1950).¹³ See Carl Schmitt, *Land and Sea* (1942) (Washington: Plutarch Press, 1997), 37.

13. This ordering order of the State as the guarantor of sovereignty was also, at Westphalia in 1648 as elsewhere, a displacement and replacement of State religion as the ultimate provider of the law of the land. This moment in the invention of secularism was a geographic undertaking, and one that is under attack from the front and the rear at once. The Modern *Nomos* is fragmenting and perforating, it is distorted and deformed by both planetary computation, which produces new territories in its image, and by resurgent political theology which reconvenes pre-modern geo-jurisdictional domains.

14. Fredric Jameson, "Notes on the Nomos," *South Atlantic Quarterly* 104, no. 2 (2005): 199–204.

15. "He interestingly applies this to the growth of piracy at this time too: freedom of the sea vs. limits on land is another hallmark that starts to develop. Two different concepts of the sea begin to be posited: one by France, who finds the sea the common property of all, one by England, who finds the sea to be the property of no one—presaging, of course, future problems. Thus, a seemingly primordial opposition between land and sea (later on itself relativized and historicized)—between landed order and maritime lawlessness—fails, despite the Deleuzian overtones of smooth (maritime) versus striated or landed space, to generate any nostalgia for the nomadic, for gypsies or hunters and gatherers, as that utopian and Rousseau-esque valorization of early social forms emerged from Lévi-Straussian structuralism." Ibid.

16. For example, Paul Virilio, *Open Sky* (London: Verso, 1997).

17. Jameson, "Notes on the Nomos."

18. The new space predicates another addressability, just as another addressability predicates the new space.

19. The quote is from Alexander Dugin, a Russian, Eurasian-ultranationalist mystic-sociologist-crank.

20. "Schmitt referred to 'a contemporary German philosopher—Heidegger—who had captured the significance of this Raumrevolution as a paradigm shift which promised to overcome the nihilism of empty space: 'Die Welt ist nicht im Raum, sondern der Raum ist in der Welt' ('The world is not in space; rather, space is in the world'). Even if these new representations of space had not yet been grasped in coherent conceptual form....'" Gopal Balakrishnan, *The Enemy: An Intellectual Portrait of Carl Schmitt* (London: Verso, 2000), 244.

21. Ibid., 249.

22. Cornelia Vismann, "Starting from Scratch: Concepts of Order in No Man's Land," in *War, Violence and the Modern Condition*, ed. Bernd-Rüdiger Hüppauf (Berlin: De Gruyter, 2010), 46.

23. See, for example, James Gleick, *The Information: A History, a Theory, a Flood* (New York: Vintage, 2012), 169, and <http://www.farmcollector.com/Farm-life/IT-ALL-TREW.aspx>.
24. Giacomo Marramao, for instance, argues that while the spatial dimension of Schmitt's politics is central, it cannot be circumscribed, confined, or topologically delimited, but it can be temporarily localized; like the decision and its borderline, the political works not by founding or composing, but by settling and dividing. Giacomo Marramao, "The Exile of the Nomos: For a Critical Profile of Carl Schmitt," *Cardozo Law Review* 21 (2000): 1567.
25. Balikrishnan, *The Enemy*, 241.
26. Vissman, "Starting from Scratch," 46–64.
27. "There is perhaps also an indication here that a conceptual revolution is underway within the Air Force, where the earth itself—geological space—is seen as merely a thicker version of the sky." Geoff Manaugh, "Bldg Blog," September 22, 2011, <http://bldgblog.blogspot.com/2011/09/tunnel-countertunnel.html>.
28. "Der Raum wird zum Leistungsraum" (the space becomes a space of performance). See Stephen Legg and Alexander Vasudevan, "Introduction: Geographies of the Nomos," in Legg, *Spatiality, Sovereignty, and Carl Schmitt*, 16.
29. "Indeed, elsewhere in the *Völkerrechtliche Grossraumordnung*, Schmitt advocated a biological over a mathematical approach to thinking state space." Ibid.
30. See Paul Virilio and Sylvère Lotringer, *Pure War* (Los Angeles: Semiotext(e), 1997).
31. Schmitt's essential distinction between friend and enemy underwrites these agonistic politics. See Chantal Mouffe, *On the Political* (London: Routledge, 2005).
32. Legg and Vasudevan, "Introduction: Geographies of the Nomos," 15.
33. See, for example, Nikolai von Kreitor, "The Concept of Grossraum in Carl Schmitt's Jurisprudence: The Historical Necessity of a New Russian Grossraum," August 7, 1970, <http://www.amerika.org/globalism/the-concept-of-grossraum-in-carl-schmitts-jurisprudence-nikolai-von-kreitor/>. This is the language of today's Russian Eurasianists, France's Nouvelle Droite, Japanese imperial revisionists, as well, it must be said, of some voices on the European Left.
34. For a melodramatic but not uninformed account, see Julian Assange, *When WikiLeaks Met Google* (N.p.: OR Books, 2014).
35. See, for example, the European Schengen Cloud, or Brazil's proposed "independent Internet": <http://www.itworld.com/article/2705173/networking-hardware/bric-nations-plan-their-own-independent-internet.html>.
36. Chris C. Demchak and Peter J. Dombrowski, "Rise of a Cybered Westphalian Age: The Coming Age," *Strategic Studies Quarterly* 5, no. 1 (2011): 31–62.
37. Alexander Galloway, *Protocol: How Control Exists after Decentralization* (Cambridge, MA: MIT Press, 2006), is a key text on these points.

38. I paraphrase D'Arcy Thompson's dictum, "Form is a diagram of forces." See Thompson, *On Growth and Form* (Cambridge: Cambridge University Press, 1917).
39. Typical of this perspective is Jean-Luc Nancy, *The Creation of the World, or Globalization* (Albany, NY: SUNY Press, 2002).
40. A particularly egregious example is Franco "Bifo" Berardi's missive, *Neuro-Totalitarianism in Technomaya Goog-Colonization of the Experience and Neuro-Plastic Alternative* (Los Angeles: Semiotext(e), and New York: Whitney Museum, 2014). His target is Google Glass, a piece of hardware that takes on black magic powers in his estimation. In the *Interfaces* chapter, I will discuss the dangers of augmented reality-based interfacial totalities to engender forms of cognitive totalitarianism, but this is not because they train attention on artificial images, negating our natural faculties of reason and experience (see also the *Phaedrus*, and Socrates' admonitions against the written word, 370 B.C., or the whole history of experimental cinema). Rather it is that augmented reality could mediate so well the sort of mythopoetic political Messianism that is the lifeblood of any lunatic fundamentalism: a stunted flame that he (and Tiqqun for that matter) tend with duly incoherent melancholia.
41. For examples of that perplexed melancholy see the works of Franco "Bifo" Berardi.
42. After having presented this research at the Winchester School of the Arts at University of Southampton in 2013, I have also had the pleasure of an ongoing discussion with Ryan Bishop about the uses and abuses of the term *nomos*. His own work on this, linking *nomos* to automation—as in "autonomous"—as another way that the policing of the inside and outside takes place, should be an key referent for those interested in the future of the concept.
43. I paraphrase my lecture and op-ed "We Need to Talk about TED," 2013, <http://www.theguardian.com/commentisfree/2013/dec/30/we-need-to-talk-about-ted>.

Platform and Stack, Model and Machine

1. Boris Groys, "Form," Metahaven, *Uncorporate Identity* (Baden: Lars Müller, 2010), 262.
2. Quoted in http://spectrum.ieee.org/computing/networks/osi-the-internet-that-wasnt?utm_source=feedburner&utm_medium=feed&utm_campaign=Feed%3A+IeeeSpectrum+%28IEEE+Spectrum%29.
3. The contradictions between private ownership of platforms and how they do or do not make good on and public service or public interests is the focus of much Martin Kenney's work. What he calls "Platform Capitalism" presents several challenges to conventional political science and organizational theory. See <http://hcd.ucdavis.edu/faculty/webpages/kenney/writings/writings.html> By contrast, David Theo Goldberg considers platforms as kind of world-projection and world-making. See his "World as Platform" essay at <https://medium.com/genres-of-scholarly-knowledge-production/world-as-platform-da7f8a1f042e>.
4. There are other available definitions, but far fewer that the ubiquity of the word *platform* would suggest. Annabelle Gower and Michael Cusumano write, "In this paper we use the

platform definition of Gawer and Cusumano: ‘A foundation technology or set of components used beyond a single firm and that brings multiple parties together for a common purpose or to solve a common problem.’’’ They also state that the value of the platform increases exponentially with more complementary products and services and more users. See their “Defining Software Ecosystems: A Survey of Software Platforms and Business Network Governance,” 2004, <http://slingerjansen.files.wordpress.com/2009/04/definingsecos.pdf>.

5. This discussion of platforms draws on an ongoing discussion with Benedict Singleton, Nick Srnicek, and Alex Williams, on their potential as technical models and model technologies. Singleton, “On Craft and Being Crafty” (PhD dissertation, Northumbria University, 2014); Singleton, “The Long Con,” in *When Site Lost the Plot*, ed. Robin Mackay (Urbanomic: Falmouth, 2015); Srnicek, “Eyes of the State: Machine Thinking and the Production of Economic Knowledge” (presented at the Incredible Machines conference, Vancouver, March 7–8, 2014); and Srnicek and Williams, *Inventing the Future: Folk Politics and the Struggle for Postcapitalism* (London: Verso, forthcoming).

6. For a nontechnical overview, see James Gleick, *The Information: A History, A Theory, A Flood* (New York: Pantheon Books, 2011), especially for a history of longitudinal demarcation, network synchronization, and time zones.

7. The history of notational systems deserves more than a few dissertations. In order to engineer his difference engine, Charles Babbage first had to invent a now long-forgotten notational system for how parts would be manufactured to make sure that one worker’s gesture would be compatible with that of another. Architects know Louis Kahn’s notational system to analyze and plan the movement of autonomous agents through pathways, used but once for his unrealized project to redesign automobile traffic flows in Philadelphia. His beautiful diagram of how cars might turn left and right hangs on the wall of the Museum of Modern Art in New York may prove to be a particularly breathtaking prototype for future shipping manifests.

8. See Rem Koolhaas, *Delirious New York: A Retroactive Manifesto for Manhattan* (Oxford: Oxford University Press, 1978).

9. “Generative entrenchment” comes from William Wimsatt’s philosophy of engineering. See his *Re-Engineering Philosophy for Limited Beings: Piecewise Approximations to Reality* (Cambridge, MA: Harvard University Press, 2007). Thanks to Benedict Singleton and Reza Negarastani for the original reference.

10. See Srnicek, “Eyes of the State.”

11. For a Marxist perspective on this asymmetry, see Matteo Pasquinelli, “Google’s PageRank Algorithm: A Diagram of Cognitive Capitalism and the Rentier of the Common Intellect,” in *Deep Search*, ed. Konrad Becker and Felix Stalder (London: Transaction Publishers, 2009).

12. This example comes from conversations with Bruce Randolph Tizes.

13. The stack model referred to is the network protocol stack, but this is not the only form of a software/hardware stack. Memory stacks based on FIFO (first in–first out) are taught in basic data structures courses. Application programming stacks are central to how web applications

are engineered. Any complex software system is built from layers of code designed to perform different low-level or high-level functions, from the operating system kernel, to system utilities, to core and application services, to applications themselves and the graphical user interfaces that translate human-cultural interest into machine-executable instruction and back again. In systems designed for a densely networked computing environment where groups of machines may be serving applications, accessing shared stores of data, and parsing data for distribution over the web to provide specific solutions, the programming architecture becomes more layered, more generic, and more modular. Programming stacks are sometimes an aligned combination of an operating system: a server, a database system, a programming and scripting language for the authoring of unique applications. For example, the LAMP stack (Linux/Apache/MySQL/PHP, or Python) is (was) a widely used, open source set of programming languages and related tools and libraries for building general-purpose web applications. (This generic structure allows programmers of code on one layer, the Python scripts, to rely on the code constructed at the other levels by other programmers, knowing that the entire system will work as planned. Available open source code written for one project may be repurposed for a particular project, and as we move up the stack, that code requires more specific programming for specific applications.) For all such programming stacks, layers divide the computational labor of input, processing, storage, and machine control in regular and predictable ways, and so the performance of one is dependent on the other.

14. Le Corbusier's Five Points include, first, supports, a grid of reinforced concrete load-bearing columns. Next, roof gardens that can be occupied, then the free-designed ground plan, with an absence of supporting walls. Next is the free design of the facade, separating the exterior from its structural function. Finally is a long horizontal window cut along the entire length of the facade, allowing all rooms to be lit equally. The building is reduced to five essential layers, each of which can be modified on its own, but all of which integrate into a preferred whole. Thanks to Josh Taron for making the initial link with stack models.

15. See also Rem Koolhaas, "Bigness or the Problem of the Large," in *S, M, L, XL* (New York: Monacelli Press, 1995).

16. In terms of Benjaminian forms of violence, its force is simultaneously "constituent" and "constituted."

17. See Galloway, "The Poverty of Philosophy: Realism and Post-Fordism," *Critical Inquiry* 39 (2013): 347–366. Here we are amused to learn that "capitalism" uses computation to treat all things as interchangeable data, that certain kinds of "realism" define things according to a flat ontology, and so by analogical transfinite induction, mathematics is thought captured by capital. In some ways, we can mark flame wars between philosophical "Marxists" and "realists" in relation to past conflicts between historicists and structuralists, humanist Marxists and structural-functionalists, New Left and cybernetics, and so on. For one alliance, the agonistic *telos* of human history is more self-evident, and for another, history doesn't even contain itself, let alone the world.

18. On "basing and superstructuring," see Fredric Jameson, *Valences of the Dialectic* (London: Verso Press, 2010).

19. Coming to mind, perhaps unfairly, are the declarations of confusion and outrage continuously forthcoming from Jürgen Habermas.
20. For the original 1995 “California Ideology” essay by Richard Barbrook and Andy Cameron, see http://www.alamut.com/subj/ideologies/pessimism/califldeo_I.html. For a characteristically misinformed contemporary take on Google, see Shoshanna Zuboff’s “Dark Google” in *Frankfurter Allgemeine*, April 30, 2014, <http://www.faz.net/aktuell/feuilleton/debatten/the-digital-debate/shoshanna-zuboff-dark-google-12916679.html?printPagedArticle=true>. For those unfamiliar, Survival Research Laboratories is a Bay Area-based “industrial performing arts” collective famous for its pyrotechnic displays of machinic mayhem and which might typify a DIY engineering ethic often associated with the “California Ideology,” whereas Page Mill Road in Palo Alto (and Sand Hill Road in Menlo Park) have housed important clusters of important Silicon Valley venture capital firms.
21. Nick Whitford-Dyer, “Red Plenty Platforms,” *Culture Machine* 14 (2013): 1–27, and Tiziana Terranova, “Red Stack Attack!” in *#Accelerate: The Accelerationist Reader*, ed. Robin Mackay and Armen Avanessian (Falmouth, Cornwall: Urbanomic and Merve Verlag, 2014), 379–400, both make explicit connections between Spufford’s version of cybernetic planning, contemporary computing platforms, and my Stack thesis. Terranova considers how an alternative Stack could operate for far more communitarian economies, and Whitford-Dyer draws on the *Address* layer specifically to consider how that Red Plenty Platform/Red Stack might identify and index components of the economy it asked to calculate. As discussed below, parallel considerations about computational platforms and marginal cost are also coming from across the political spectrum, from bitcoin macroeconomics to Jeremy Rifkin’s “Zero-Marginal Cost Society.” See Jeremy Rifkin, *The Zero Marginal Cost Society: The Internet of Things, the Collaborative Commons, and the Eclipse of Capitalism* (New York: Palgrave Macmillan, 2014), and Michael Hardt and Antonio Negri, *Commonwealth* (Cambridge, MA: Harvard University Press, 2009).
22. Francis Spufford, *Red Plenty* (Minneapolis, MN: Graywolf Press, 2012).
23. From Whitford-Dyer, “Red Plenty Platforms”: “It will, however, identify three cybernetic tendencies that point towards the ‘higher’ phase of communism: automation, copying and peer-to-peer production … I am thinking tangentially about a metasystem in which the minimum amount of carbon has to be assembled to meet the desires and demands of all consumers because an existing inventory of objects can be instantaneously redistributed where it is needed.” A parallel vision, minus the self-identified socialism and plus a lot of nanoscale molecular manufacturing, is Eric Drexler, *Radical Abundance: How a Revolution in Nanotechnology Will Change Civilization* (New York: Public Affairs Press, 2013).
24. Eden Medina is the expert on Cybersin. See her “Designing Freedom, Regulating a Nation: Socialist Cybernetics in Allende’s Chile,” *Journal of Latin American Studies* 38 (2006): 571–606, and her book *Cybernetic Revolutionaries: Technology and Politics in Allende’s Chile* (Cambridge, MA: MIT Press, 2011).
25. This is ironic for several reasons, including that when General Pinochet later invited the Chicago Boys (the neoliberal economists associated with Milton Friedman at the University of

Chicago) to help fix the economy, they would recommend “free market” policies that resemble in some ways the libertarian economic ethos of some aspects of Silicon Valley culture, where cutting-edge information networks are now hatched.

26. The biological metaphor is important for a diverse range of social-theoretical perspectives. These range from Emile Durkheim’s cultural integration, to Fascist nationalist organicism, to Edward O. Wilson’s sociobiology, to Talcott Parsons’s structural-functionalism and Niklas Luhmann’s systems theory to Donna Haraway’s cyborg feminism and Giorgio Agamben’s biopolitics, and so on.

27. See T-Engine Forum, <http://www.t-engine.org/>; TRONweb, <http://tronweb.super-nova.co.jp/tron.html>; “Japan’s Homegrown Operating System TRON Competes for the Info-Appliance Market,” *Trends in Japan*, May 22, 2003, <http://web-japan.org/trends/sci030522.html>.

28. Jan Krikke, “The Most Popular Operating System in the World,” *Linux Insider*, October 3, 2003, <http://www.linuxinsider.com/story/31855.html>.

29. “Asking the Project Leader: Where’s TRON Headed in the Future?” 1996, http://tronweb.super-nova.co.jp/sakamurainterview_tw42.html. Images of TRON diagrams can be found most easily on Wikipedia, but are also on this book’s companion website, thestack.org. See <http://tronweb.super-nova.co.jp/tronlogo.html>; <http://tronweb.super-nova.co.jp/homepage.html>; and http://en.wikipedia.org/wiki/TRON_Project.

30. As discussed, the four-layer TCP/IP “won,” but for purposes of explication, the open systems interconnection (OSI) seven-layer model provides a more detailed profile. As indicated, the OSI model is a standardized subdivision of component zones and functions of information networks into logical discrete layers, each of which provides specific “services” to the layer just beneath in the stack and receives services from the layer just above it. In this, it is a classic tiered stack architecture, both as a functional distributed machine and its abstract model, and worth some detail. At the base of the OSI stack is the physical layer of copper wire, electronic switches, antennas, or other hardware. Above this in the OSI model is the data-link layer, which transmits information directly between two networked entities and corrects for errors at the physical layer level. The Ethernet port and cable on your computer are examples. The network layer addresses individual senders and receivers of messages. Your IP address is a network layer protocol, as is the border gateway protocol. One level above this, the transport layer polices byte traffic, flow, and reliability and delivers it safe to the right application process. For example, TCP (transmission control protocol) is used for HTTP. Above this, the session layer manages the opening and closing sessions between end user applications and keeping different data streams in proper sync. The presentation layer above is responsible for translating information between the application layer above it, the one you and I interact with most directly, and the session layer and other network layers below. The renderings of ASCII text or XML data into and from binary strings are examples. That application layer contains a multitude of protocols, interfaces, and application programming interfaces that allow end users, you and me, to query and access network resources as if they were part of our local system. “Above” these “base” seven layers are individual operating systems—applications like browsers, image editors, word processors, and so forth that, to the extent that each is pulling information from the network beneath it and pushing information

toward it, are themselves interfaces with and into the strata of network depths, and as visual, imagistic interfaces, they are diagrams of what these networks do.

31. Cerf is now chief scientist at Google and hard at work on, among other things, the embryonic “interplanetary Internet,” which seeks to account for the unique network design problems posed by slow lunar orbits, message delays due to interstellar lag in the speed of light, and so forth. As discussed in the *Address* chapter, the specification and implementation of IP version 6 addressing systems, with which he is also deeply involved, plays a crucial role in the material future of The Stack.

32. Andrew L. Russell, “OSI: The Internet That Wasn’t,” *IEEE Spectrum*, June 30, 2013, <http://spectrum.ieee.org/computing/networks/osi-the-internet-that-wasnt>.

33. The model platform Stack is not a perfect correlation with the “real stacks” that cohere the global Internet, nor is it meant to be. It is a heuristic, a diagram that is only as useful as what work it is asked to do. This leeway allows for considering how it could function in different ways. Unlike some models, such as OSI, which allow the passage of information only between adjacent layers, up and down or between sibling layers at the same level in adjacent stacks, the inexhaustibility of any layer suggests that The Stack might extend a conditional and exceptional promiscuity of direct communication between nonadjacent layers (e.g., *Address* directly to *Cloud*, *User* to *Earth*). It need not necessarily evolve into this kind of open totality, but potential contact between the technologies gathered in remote layers is a contingency continuously provoked by the persistent exception of the reversible border (usually most visible in the flip-flops of in and out at the *Interface* layer). We can speculate that the filtering, codifying, and governing of this eccentric splicing between layers of the platform not only implies very different design agenda but perhaps an as-yet-to-be-articulated geopolitics and geophilosophy as well.

34. This parallels in many ways Jussi Parrika, *The Anthrobscene* (Minneapolis: University of Minnesota Press, 2014).

Earth Layer

1. Michel Serres and Jean-Paul Dekiss, *Jules Verne: La science et l’homme contemporain: Conversations avec Jean-Paul Dekiss* (Paris: Pommier, 2003).
2. Georges Perec, “The World,” in *Species of Spaces and Other Pieces*, ed. John Sturrock (New York: Penguin, 2008), 77–79.
3. Carl Sagan, multiple public lectures. See, for example, Reid Kanaley, “Carl Sagan Seeks Unity to Save Earth,” *Inquirer* (Philadelphia), April 24, 1989.
4. The photo I describe is from the same series as that used on the cover of the posthumous collection of Deleuze’s writings, *Desert Islands and Other Texts, 1953–1974* (Cambridge, MA: MIT Press, 2004). Readers may reference the image at this book’s companion website, thestack.org.
5. Originally conceived in 1936 by twenty-four-year-old Alan Turing and called an “a-machine” (for “automatic machine”), it describes a hypothetical universal computer, which, given enough

time and energy, would be capable of calculating any “computable” problem. In that paper, “On Computable Numbers, with an Application to the *Entscheidungs* Problem,” *Proceedings of the London Mathematical Society*, Ser. 2 42 (1937), Turing demonstrates the range of problems that in fact are not computable. The figure of the Turing machine, as a philosophical and machinic hypothesis, stands for the technology of universal computation and for the ultimate limits of computation within mathematics.

6. Nicholas Gane and Stephen Sale, “Interview with Friedrich Kittler and Mark Hansen,” *Theory, Culture, and Society* 24 (2007): 323–329.

7. Lucretius, *De Rerum Natura*, 1 B.C., in *Lucretius on the Nature of the Universe*, ed. R. E. Latham (London: Penguin Books, 1951):

We wish thee also well aware of this:

The atoms, as their own weight bears them down
 Plumb through the void, at scarce determined times,
 In scarce determined places, from their course
 Decline a little—call it, so to speak,
 Mere changed trend. For were it not their wont
 Thuswise to swerve, down would they fall, each one,
 Like drops of rain, through the unbottomed void;
 And then collisions ne'er could be nor blows
 Among the primal elements; and thus
 Nature would never have created aught ...
 ... For whatsoever through the waters fall,
 Or through thin air, must quicken their descent,
 Each after its weight—on this account, because
 Both bulk of water and the subtle air
 By no means can retard each thing alike.

8. The implications continue to play out in contemporary debates from artificial intelligence to the philosophy of physics (e.g., if emergent calculative form is universal, then not only is “human thought” no longer a necessary referent model for artificial intelligence, but its own ideas about deterministic rationality do very little to guarantee the regime of computational processing, and the other way around). Computing machines do not differentiate “rational” instructions from irrational ones, and we needn’t even know what is going on within a computer that makes computation interesting. Computation takes place outside any direct reliance on necessary reason, or “regimes of knowledge primarily associated with the laws of thought—[it] does things outside of it.” See Robert Jackson, “Negarastani, Computing and Knowledge,” *Algorithm and Contingency*, December 2, 2012, <http://robertjackson.info/index/2012/12/negarestani-computing-and-knowledge/>.

9. Turing himself began to address the theoretical foundations of biological systems, with “The Chemical Basis of Morphogenesis,” published in 1952 in *Philosophical Transactions of the Royal Society of London B* 237 (641): 37–72.

10. Once again, I am not qualified to offer even an implied opinion on whether matter is fundamentally discrete or continuous, or related questions. For a general account on behalf of the strong digital physics position, see, for example, Seth Lloyd, *Programming the Universe: A Quantum*

Computer Scientist Takes on the Cosmos (New York: Vintage, 2006). Craig Hogan's research into discrete matter is certainly of interest. A general reader can turn to Michael Moyer, "Is Space Digital?" *Scientific American* (February 2012), <http://www.scientificamerican.com/article/is-space-digital/>. Reza Negarastani approaches this rather differently and has offered both incisive critiques of computationalism (see his "Abducting the Outside," http://blog.urbanomic.com/cyclon/archives/2012/11/abducting_the_o.html), as well as impassioned defenses of a Turing-centric version (see his "The Revolution Is Back (Turing, Functional Realization and Computational Description)," <http://blog.urbanomic.com/cyclon/Turing-Revolution.pdf>).

11. Apparently there are something like 700 terabytes of potential storage in a gram of DNA. Be that as it may, the rush to collapse fragile metaphors between biological-machinic and computational-machinic processes is unnecessary. Sebastian Anthony, "Harvard Cracks DNA Storage, Crams 700 Terabytes of Data into a Single Gram," *ExtremeTech*, August 17, 2012, <http://www.extremetech.com/extreme/134672-harvard-cracks-dna-storage-crams-700-terabytes-of-data-into-a-single-gram>.
12. The "next machine" after computation is a favorite motif of mathematician Giuseppe Longo. See, for example, Longo and Francis Baily, *Mathematics and the Natural Sciences: The Physical Singularity of Life* (London: Imperial College Press, 2011).
13. Again bioinformational systems (such as how bacteria encode messages) provide a rich source of speculation on the postsilicon future of artificial computation, but in the meantime, more prosaic (but still remarkable) engineering at the scale by which physical matter and information directly interface may prove more fruitful.
14. This tendency can also lead toward unlikely speculative convergences between advanced science and technology and singularity-inflected "God in/of the gaps." See Paul Davies and Niels Henrik Gregerson, *Information and the Nature of Reality: From Physics to Metaphysics* (Cambridge: Cambridge University Press, 2004). Peter Watts, *Echopraxia* (New York: Tor Books, 2015), tinkers with this inflection quite effectively.
15. Or consider instead Friedrich Kittler's association of film, the gramophone, and the typewriter with three distinct modes of modern thought.
16. The ideological position is made in Alexander Galloway, "The Poverty of Philosophy: Realism and Post-Fordism," *Critical Inquiry* 39 (2013): 347–366. Aesthetic suspicion of digital systems couched in political suspicion (perhaps also couched in professional anxiety) has also led to awkward schisms in art. See Clare Bishop, "The Digital Divide: Contemporary Art and New Media," *Artforum* (September 2012).
17. Luciana Parisi, *Contagious Architecture: Computation, Aesthetics, and Space* (Cambridge, MA: MIT Press, 2013).
18. See my editorial "Outing A.I.: Beyond the Turing Test," *New York Times*, February 23, 2015.
19. To me this is the purchase of the Promethean accelerationism of Reza Negarastani and Ray Brassier. See Brassier's "Prometheanism and Real Abstraction" in *Speculative Aesthetics*, ed. Robin Mackay, Luke Pendrell, James Trafford (Urbanomic Press: Falmouth, 2014), and Negarastani's

"Labor of the Inhuman, Part 1: Human," *e-flux journal* #52, 02/2014, and "The Labor of the Inhuman, Part II: The Inhuman," *e-flux journal* #53, 03/2014.

20. See, for example, Brian Massumi, "'Technical Mentality' Revisited: Brian Massumi on Gilbert Simondon with Arne De Boever, Alex Murray and Jon Roffe," *Parrhesia*, no. 7 (2009): 36–45, http://www.parrhesiajournal.org/parrhesia07/parrhesia07_massumi.pdf.

21. See Matteo Pasquinelli, "Machinic Capitalism and Network Surplus Value: Notes on the Political Economy of the Turing Machine," 2011, http://matteopasquinelli.com/docs/Pasquinelli_Machinic_Capitalism.pdf.

22. With great care and skill, Jussi Parikka explores the deep materiality of our media technology hardware in *A Geology of Media* (Minneapolis: University of Minnesota Press, 2015).

23. See USGS survey at <http://minerals.usgs.gov/minerals/pubs/commodity/niobium/myb1-2009-niobi.pdf> and Philippa Velhinho, "Corporate Coltan Rush Fuels Congolese Violence," *Green Left Weekly*, September 24, 2012, <https://www.greenleft.org.au/node/52337>.

24. See Conrad Taylor, "The Curse of Congo's Mineral Wealth," *Conradiator*, November 11, 2008, <https://conradiator.wordpress.com/2008/11/11/the-curse-of-congos-mineral-wealth>.

25. After KONY2012, the ill-fated social media campaign, we could define a "Konyism" as a self-congratulatory Africa-themed social cause, invested in by well-meaning but naive Westerners, that ultimately has little effect other than wasting the concern of benefactors, or worse.

26. Chiara Fazzoli and Orish E. Orisakwe, "Electronic Revolution and Electronic Wasteland: The West/Waste Africa Experience," *Journal of Natural and Environmental Sciences*, October 2, 2010, <http://www.academyjournal.net/asj/index.php/NES/article/viewFile/27/ORISAKWE>.

27. E. A. Grosz, *Chaos, Territory, Art: Deleuze and the Framing of the Earth* (New York: Columbia University Press, 2008), 17.

28. Andrew Benjamin, *Architectural Philosophy* (New York: Continuum Press, 2001), is a particularly interesting study of these various forms of the line. Deleuze and Guattari's typology in the chapter "On the Line" is an essential definition. Gilles Deleuze and Félix Guattari, *A Thousand Plateaus: Capitalism and Schizophrenia* (Minneapolis: University of Minnesota Press, 1980).

29. Stuart Elden's work on the history of the notion of territory is instructive here. See his *The Birth of Territory* (Chicago: University of Chicago Press, 2013).

30. Remember that within the Western European philosophical tradition, Georges Bataille defined architecture as the "physiognomy of power," an actual anatomy of the social, and Walter Benjamin referred to history as "a state of siege," a capturing and binding behind the fortifying wall (Holier, 1990, Benjamin, 1986). Today it is almost axiomatic in contemporary architectural theory to cite the partition, the very verb and noun of cleaving space and of instantiating that gesture with a solid plane as perhaps the fundamental grammar of territory and enclosure (Andrew Benjamin on this). The central importance of "partition" is a scarce point of agreement on ontological matters between those associated with the deconstructive turn (Wigley, 1995) and the Deleuzian program that displaced it in architectural curricula. See Bernard Cache, *Earth*

Moves: The Furnishing of Territories (Cambridge, MA: MIT Press, 1995), and Elizabeth Grosz, *Architecture from the Outside* (Cambridge, MA: MIT Press, 2001). Denis Holier, *Against Architecture: The Writings of Georges Bataille* (Cambridge, MA: MIT Press, 1990), Walter Benjamin, *Reflections: Essays, Aphorisms, Autobiographical Writings* (New York: Schocken Press, 1986). Mark Wigley, *The Architecture of Deconstruction: Derrida's Haunt* (Cambridge, MA: MIT Press, 1995).

31. "Google Earth is the end of the world. ... All you have to do is press to zoom in, and you can almost see a car's license plate. We need the bigness of the world, the rotundity and immensity of the globe. But we are exhausting that, just as we have exhausted its resources. We are exhausting its extent, and its temporal distance." Paul Virilio in Raymond Depardon and Paul Virilio, *Native Land, Stop Eject* (Paris: Fondation Cartier pour l'art contemporain, 2008).

32. Gopal Balakrishnan, *Antagonistics: Capitalism and Power in the Age of War* (London: Verso, 2009).

33. Its terminological origins are not obscure. *Geo* from the Greek γῆ ("Earth") refers to our planet, and specifically to the land, the ground, the land *as* ground, and when paired with "to describe," as *geography*, γεωγραφία (as for Eratosthenes, who first calculated the circumference of the Earth around 240 B.C.E.) to literally measure and give exact scale to the ground, and to spaces themselves, one smaller and larger than another. So for our virtual political geography, where the Earth is rerotated again from another center of a space in which it was located, there is an implicit correspondence between geography and cosmology, the scientific conception of the universe as well then to *cosmograph*, the "writing-describing of the universe" and to *cosmogram*, the "writing-image of the universe." As a foundation for political science, a diagram of the universe with the Earth as the center throne is qualitatively different from one that locates it askew among billions of other illuminated dots. The two diagrams present unlike polities and would require different rationales to correlate world and image to their logics of governance, and we see the dynamics of that distinction played out in centuries-long culture wars. Any relationship between geography and cosmography is also then a relationship between Earth and universe as interrelated domains and of the boundary distinction between the two, as one contains, delineates, or corrugates the other. But that boundary between the geographic and the cosmographic is really less a final partition of jurisdictions than a reversible figure-ground interdependence. For an interesting selection of recent works and commentaries on cosmogrammatic images, see Melik O'Hanian and Jean-Christophe Royoux, *Cosmograms* (Berlin: Sternberg Press, 2005).

34. Maurice Ronai's semiotics of landscape, "face of the fatherland," is discussed in Gilles Deleuze and Félix Guattari, *A Thousand Plateaus: Capitalism and Schizophrenia* (Minneapolis: University of Minnesota Press, 1980).

35. Andrew V. Uroskie, "La jetée en spirale: Robert Smithson's Stratigraphic Cinema," *Grey Room* 19 (spring 2005): 54–79, doi:10.1162/grey.2005.1.19.54.

36. "Robert Smithson: Mapping Dislocations" at the James Cohan Gallery, New York, 2001.

37. Fredric Jameson, *Archaeologies of the Future: The Desire Called Utopia and Other Science Fictions* (New York: Verso, 2005), 10–21.

38. See Diedrich Diederichsen and Anselm Franke, *The Whole Earth: California and the Disappearance of the Outside* (Berlin: Sternberg Press, 2013).
39. I discuss this convoluted relationship between scenographic cosmopolitanism and Google Earth in my "On Geoscapes and the Google Caliphate: Reflections on the Mumbai Attacks," *Theory, Culture and Society* 26 (2009): 329–342.
40. Consider, for example, Usman Haque's Sky Ear: "Sky Ear is a non-rigid carbon-fibre 'cloud,' embedded with one thousand glowing helium balloons and several dozen mobile phones. The balloons contain miniature sensor circuits that respond to electromagnetic fields, particularly those of mobile phones. When activated, the sensor circuits co-ordinate to cause ultra-bright colored LEDs to illuminate. The 30m cloud glows and flickers brightly as it floats across the sky." <http://www.haque.co.uk/skyear.php>.
41. Mark Dorrian, "On Google Earth," in *New Geographies, 4: Scales of the Earth*, ed. El Hadi Jazairy and Melissa Vaughn (Cambridge, MA: Harvard University Graduate School of Design, 2011), 164–170.
42. The question of skin shows up in cultural theory in a variety of ways. In addition to the obvious connotations for theories of race and racism, see also Mark C. Taylor, *Hiding* (Chicago: University of Chicago Press, 1998); Nicholas de Monchaux, *Spacesuit: Fashioning Apollo* (Cambridge, MA: MIT Press, 2011); and Peter Sloterdijk, *Bubbles: Microspherology*, vol. 1: *Spheres* (Los Angeles: Semiotext(e), 2011).
43. Paul N. Edwards, *A Vast Machine: Computer Models, Climate Data, and the Politics of Global Warming* (Cambridge, MA: MIT Press, 2010).
44. Juan Carlos Castilla-Rubio and Simon Willis, "Planetary Skin: A Global Platform for a New Era of Collaboration," Cisco internal white paper, March 2009 (no longer online). See now <http://www.planetaryskin.org/>.
45. Some descriptive detail from the Planetary Skin website: "It is supported by joint policy programs that extend the model of planetary instrumentalization to the political realm through open and collaborative, if also expert-piloted, forums. These include theconnectedrepublic.org, connectedcommons.org and connectedurbandevelopment.org, and it also extends to include tools for the integration of actors into common parliamentarian media, largely identical to those in development and deployment under the rubric of E-Government (digitalization of governmental processes) and Government 2.0 (employment of open social media channels and tools to support self-governance)." The white paper continues, "The Planetary Skin platform can be thought of as a globally pervasive 'nervous system,' assimilating disparate and siloed data sets held in public and private enterprise resource planning (ERP) systems. It also analyzes data originating from airborne and terrestrial sensor networks located around the world (*SensorSpaces*). These, in turn, are connected to a Web 2.0 mashup of decision-support tools (*DecisionSpaces*). These tools facilitate proactive management of resources, risks, and new environmental markets, enabling innovation by private sector entrepreneurs, next-generation regulatory agencies, and social entrepreneurs (*CommonSpaces*)."

46. Glenn Beck and Harriet Parke, *Agenda 21* (New York: Pocket Books, 2012).
47. Donald A. MacKenzie, *An Engine, Not a Camera: How Financial Models Shape Markets* (Cambridge, MA: MIT Press, 2006).
48. Raymond Depardon and Paul Virilio, *Native Land, Stop Eject* (Paris: Fondation Cartier pour l'art contemporain, 2008).
49. See my "What We Do Is Secret: On Virilio, Planetarity and Data Visualisation," in *Virilio and Visual Culture*, ed. John Armitage and Ryan Bishop (Edinburgh: Edinburgh University Press, 2013).
50. In his famous interviews with Clare Parnet, Deleuze recounts Jakob von Uexküll's parable on the life world of the tick. The tick sits on his perch, all but motionless, waiting. It waits for the heat of a passerby mammal. Its life world is defined by this sense and reaction: no heat, still; heat, leap from the branch into the void and perhaps latch onto the warm skin of its new host.
51. As we'll see in the *Cloud* and *City* chapters, data center and fiber-switch installations are an avant-garde of secret urbanism and subterranean architecture.
52. "The Shannon-Hartley Theorem bounds the maximum rate at which information can be transmitted over a Gaussian channel in terms of the ratio of the signal to noise power." Eric Price and David P. Woodruff, "Applications of the Shannon-Hartley Theorem to Data Streams and Sparse Recovery," technical paper, 2012, <http://www.cs.utexas.edu/~ecprice/papers/isit.pdf>.
53. The smart grid is also a recording medium for the immanent representation of all things, passing through signification, toward enable an angelic harmony of things. See Sol Yurick, *Metatron: The Recording Angel* (Los Angeles: Semiotext(e), 1985).
54. The weight of virtual systems is amplified by the weight of virtual systems that monitor and mediate virtual systems. Consider the impact of bitcoin and coin mining. The key innovation is that "the work needed to commit a fraud is set to be higher in electricity costs than the economic benefit derived from it." See <http://www.bloomberg.com/news/2013-04-12/virtual-bitcoin-mining-is-a-real-world-environmental-disaster.html> and http://www.computerworld.com.au/article/458439/cloud_real_ecological_timebomb_wireless_data_centres/.
55. The Singularity born of spam is a plot device in Charles Stross, *Rule 34* (New York: Ace, 2011).
56. Mark P. Milles, "The Cloud Begins with Coal," August 2013, http://www.tech-pundit.com/wp-content/uploads/2013/07/Cloud_Begins_With_Coal.pdf.
57. Climate Group, "SMART 2020: Enabling the Low Carbon Economy in the Information Age," 2008, http://www.smart2020.org/_assets/files/02_smart2020Report.pdf.
58. For a taste of that ecstasy, <http://www.ft.com/intl/cms/s/0/f5228aec-7b36-11e0-9b06-00144feabdc0.html>.
59. See Nick Land, "Lure of the Void, pt. 1," August 2012, <http://www.scribd.com/doc/242684419/Nick-Land-Lure-of-the-Void#scribd>.

60. See Pete Foster, "Cloud Computing—a Green Opportunity or Climate Change Risk?" *Guardian*, August 18, 2011. <http://www.guardian.co.uk/sustainable-business/cloud-computing-climate-change>.
61. On smart grids and data ownership, see Jon Bruner, "Two Crucial Questions for the Smart Grid," *O'Reilly Radar*, November 5, 2012, <http://radar.oreilly.com/2012/11/two-crucial-questions-for-the-smart-grid.html>.
62. See Sally Daultrey, "Adaptation on the Roof of the World," December 30, 2010, <http://designgeopolitics.org/blog/2010/12/adapatation-on-the-roof-of-the-world/>.
63. On the Chinese embassy air monitoring issue, see Steven Jiang and Alexis Lai, "China: Haze Isn't Foreign Embassies' Business," CNN, June 6, 2012. <http://www.cnn.com/2012/06/06/world/asia/china-foreign-embassy-pollution-monitor/index.html>.
64. See "Byzantine Perspective on Climate Justice," *New Scientist*, May 11, 2011, <http://www.newscientist.com/article/mg21028124.400-byzantine-perspective-on-climate-justice.html>.
65. See David G. Victor, *Global Warming Gridlock: Creating More Effective Strategies for Protecting the Planet* (Cambridge: Cambridge University Press, 2011).
66. See David Basulto, "Roadmap 2050: A Practical Guide to a Prosperous, Low-Carbon Europe," *ArchDaily*, April 13, 2010, <http://www.archdaily.com/56229/roadmap-2050-a-practical-guide-to-a-prosperous-low-carbon-europe/>.
67. See Paul Chapman, "Entire Nation of Kiribati to Be Relocated over Rising Sea Level Threat," *Telegraph*, March 7, 2012, <http://www.telegraph.co.uk/news/worldnews/australiaandthepacific/kiribati/9127576/Entire-nation-of-Kiribati-to-be-relocated-over-rising-sea-level-threat.html>. I had the pleasure of seeing Michael Gerrard present this work to an eager audience of architects at Columbia University's XLab at an event I helped to organize with Geoff Manaugh and Ed Keller, Google/Arctic/Mars. At this event we examined how each of the three complicates normative sovereign geographies and how each might directly compare and inform the others. The event also hosted Gerrard of the Columbia University Climate Law Center, who represents the interests of drowning island nations as director of the Sabin Center for Climate Law. <http://web.law.columbia.edu/climate-change>.
68. Brian Massumi, "National Enterprise Emergency: Steps Toward an Ecology of Powers," *Theory, Culture and Society* 26, no. 6 (November 2009): 153. He writes, "Dampening accident-amplification is not enough. An alternate growth pattern must be planted on the proto-territory. Full-spectrum power preempts threat by counter-producing its own systemic effects in its stead, in a supplanting of incipience. Its business is to induce potentially systemic counter-effects through an alter-emergent incursion of a change-conditioning force of nature. Preemptive power is the cuckoo in the nest of naturing nature."
69. See my "Undesigning the Emergency: Against Prophylactic Urban Membranes" (lecture at O'Reilly ETech 2009, San Jose, CA, March 11, 2009). Williams's point was that this is precisely why nanocomputing technologies are absolutely necessary to engineer that computer, *not* that comprehensive models are a waste of time.

70. For example, Architecture for Humanity and its book, with perhaps the most self-satisfied title ever: Kate Stohr, *Design like You Give a Damn: Architectural Responses to Humanitarian Crises* (New York: Metropolis Books, 2006).

71. I'm referring here to the work of Bruno Latour to rethink the logics of political inclusion and exclusion for a modern social theory. In particular, see his address, "Toward a Compositionist Manifesto," <http://www.bruno-latour.fr/node/140>. Tom Cohen, *Theory in the Era of Climate Change* (Ann Arbor: Open Humanities Press, 2012), is an excellent appraisal of the complicity and failure of cultural theory to understand its situation within the historical arc of ecological deterioration and potential catastrophe.

72. A designer at SAP suggested to me that 22 percent of the world's water is managed by its software on a daily basis. Warren B. Causey, "Important Issues Water Utilities Face," February 2, 2011, http://www.sap.com/bin/sapcom/en_us/downloadasset.2011-02-feb-01-08.important-issues-water-utilities-face-pdf.htm.

73. "The state loves climate change because a schizophrenic nature is the ultimate terrorist and—as became apparent in New Orleans—militarized police will be needed." See Massumi, "National Enterprise Emergency."

74. Michel Foucault, *The Birth of Biopolitics: Lectures at the Collège de France, 1978—1979* (New York: Picador, 2010).

75. Freeman J. Dyson, "Search for Artificial Stellar Sources of Infrared Radiation," *Science*, June 3, 1960, 1667–1668, doi:10.1126/science.131.3414.166.

76. Charles Stross, *Accelerando* (New York: Penguin Group, 2005). See also Robert J. Bradbury, "Matrioshka Brains," working paper, 1999, <http://www.gwern.net/docs/1999-bradbury-matrioshkabrains.pdf>.

77. Nick Bostrom of the Oxford Institute for the Future of Humanity imagines that computational megastructures of this scale and capacity would even be capable of supporting full-scale simulations of entire worlds and if that is so, perhaps our reality is already being powered by such a machine. Bostrom, "Are We Living in a Computer Simulation?" *Philosophical Quarterly* 53 (2003).

Cloud Layer

1. Alexandre Kojève, "Outline of a Doctrine of French Policy," 1945, Paris, <https://www.marxists.org/reference/subject/philosophy/works/fr/kojeve2.htm>.

2. Thomas Jefferson, *The Papers of Thomas Jefferson* (Princeton, NJ: Princeton University Press, 1950).

3. Aristophanes, *The Clouds*, trans. William Arrowsmith (Ann Arbor: University of Michigan Press, 1962).

4. See Benjamin H. Bratton, "Interview by Metahaven," October 2011, <http://www.bratton.info/projects/texts/interview-by-metahaven/>, and "The Cloud, the State, and the Stack: Metahaven in Conversation with Benjamin Bratton," December 16, 2012, <http://mthvn.tumblr.com/post/38098461078/thecloudthestateandthystack>.
5. See <http://urbanizationproject.org/blog/charter-cities>. Charter Cities represents a plan to introduce new legal frameworks for new or existing cities, turning them into a parallel to Special Economic Zones, here Special Political Zones. New York University economist Paul Romer is a leading advocate for the vision.
6. See this discussion of Gelernter's influence on the conceptual development of the Cloud: David Gelernter, John Markoff, and Clay Shirky, "Lord of the Cloud," *Edge*, April 29, 2009, <http://edge.org/conversation/lord-of-the-cloud>. For a sense of Gelernter's political conservatism, see <http://www.nationalreview.com/author/david-gelernter>.
7. See http://en.wikipedia.org/wiki/Unix_time.
8. Sun Microsystems' old tagline, "the network is the computer" has been realized, especially if the definition of *network* is expanded to include both the physical computing network and the network of users providing content and feedback.
9. See Stu Woo, "Welcome to Amazon Town," *Wall Street Journal*, December 20, 2011, <http://online.wsj.com/articles/SB10001424052970204058404577108821485438232>.
10. I refer to Google's mission statement: "to organize the world's information and make it universally accessible and useful." See <https://www.google.com/about/company>.
11. China Miéville, *The City and the City* (New York: Del Rey Ballantine Books, 2009).
12. John Battelle calls this "the government layer." He writes, "We are increasingly going to the Web/Internet as the platform for our lives. There, our identity is not managed by the government. It's managed—in the majority—by Facebook. When we buy things, our identity is managed by PayPal, Amazon, and Amex/Visa/Mastercard, not to mention a raft of pretenders to our identity throne, including Facebook, Google, and startups like Square. All of these are private corporations. None of them ask us for our government issued identity cards before allowing us to make a purchase. Some do ask for our SSN, of course. But online, the 'government layer' is melting into the background of our identity—rather like DOS melted into the background of Windows 3. I expect this to be the source of some serious conflict in the coming decade(s)." See John Battelle, "What Role Government?" John Battelle's Search Blog, November 4, 2011, <http://battellemedia.com/archives/2011/11/what-role-government.php>.
13. See Jin Ge, "The Father of China's Great Firewall Re-defines Internet Sovereignty," <http://www.88-bar.com/tag/sovereign-internet/>. Thanks to Tricia Wang for alerting me to this quote.
14. See Xu Wu, *Chinese Cyber Nationalism: Evolution, Characteristics, and Implications* (Lanham, MD: Lexington Books, 2007).
15. R. Buckminster Fuller, *Grunch of Giants* (New York: St. Martin's Press, 1983).

16. Katie Fehrenbacher, "Google Floats Idea of Wave Powered Data Center," Gigaom, September 8, 2008, <https://gigaom.com/2008/09/08/google-floats-idea-of-wave-powered-data-center/>, and "Google to Switch on Seawater-Cooled Data Center This Fall," Gigaom, May 24, 2011, <https://gigaom.com/2011/05/24/google-to-switch-on-worlds-first-seawater-cooled-data-center-this-fall/>. On the speculative geography of oceanic architectures for Cloud systems, in this case HFT, see "Islands at the Speed of Light," BLDGBLOG (blog), March 30, 2011, <http://bldgblog.blogspot.com/2011/03/islands-at-speed-of-light.html>. Pay particular attention to the notion of "aircraft carriers as networked archipelagos."
17. See Larry Digran "Google Wins Floating Data Center Patent," April 30, 2009, <http://www.zdnet.com/blog/btl/google-wins-floating-data-center-patent/>: "It can be beneficial to distribute computing power closer to users. As such, data centers may be moved closer to users, with relevant content sent from a central facility out to regional data centers only once, and further transmissions occurring over shorter regional links. As a result, every request from a user need not result in a transmission cross-country and through the Internet backbone; network activity may be more evenly balanced and confined to local areas."
18. Cisco proudly estimated the number of "things" connected to the Internet of Things as 50 billion by 2020. See Dave Evans, "The Internet of Things: How the Next Evolution of the Internet Is Changing Everything," April 2011, https://www.cisco.com/web/about/ac79/docs/innov/IoT_IBSG_0411FINAL.pdf. To say nothing of the more or less charted waters of the Dark Net, accessible only through tools like the Tor browser.
19. But as Jameson notes, it is the irregularity of opposing forces that breaks down the order of the *nomos*: "With the religious wars, but perhaps also the English dominance of the sea—now leads to the Westphalian system of nation-states, in which, for the first time, the new nomos of state equality and friend-foe emerges. The friend-foe opposition is possible, indeed, only between equals: it includes Hegelian recognition, except that whereas Hegelian struggle aims to produce recognition, Schmitt's version is enabled only after mutual recognition is secured. The individual analogy is with the duel." Fredric Jameson, "Notes on the Nomos," *South Atlantic Quarterly* 104 (2005): 199–204, doi:10.1215/00382876-104-2-199.
20. See Cornelia Vismann and Markus Krajewski, "Computer Juridisms," *Grey Room*, no. 29 (Fall 2007): 90–109, doi:10.1162/grey.2007.1.29.90.
21. Or perhaps less, given that Beijing has put rain under some measure of control, such as cloudbusting efforts just before the Beijing Olympics in 2008. More prosaic, Android is the most popular mobile operating system in China, but many versions in wide use are so forked that neither Google nor the Chinese central authorities can control or capitalize it directly. One solution proposed by the latter is COS (China Operating System) a linux based OS that could reduce reliance on "American" code. See <http://www.china-cos.com/>.
22. That back doors allowing for espionage are to be found in both United States and Chinese routers should surprise no one, least of all Cisco or Huawei. For this reason both countries have severely curtailed the importation and official purchase of one another's equipment. See <http://www.reuters.com/article/2015/02/27/us-china-tech-exclusive-idUSKBN0LV08720150227>.

23. Ryan Arsenault, "Weird Data Center Locations," *TechTarget*, April 2010, <http://searchdatacenter.techtarget.com/feature/Weird-Data-Center-Locations>.
24. Roger E. Bohn and James E. Short, "How Much Information? 2009 Report on American Consumers," December 2009, http://hmi.ucsd.edu/pdf/HMI_2009_ConsumerReport_Dec9_2009.pdf.
25. This does not stop dedicated researchers from trying to develop maps of the Internet that are as comprehensive as possible. At the University of California, San Diego, the San Diego Supercomputer Center's Cooperative Association for Internet Data Analysis has developed multiple ways to render Internet geographies and geometries. See "Walrus-Gallery: Visualization and Navigation," Center for Applied Internet Data Analysis, <http://www.caida.org/tools/visualization/walrus/gallery1/>. The site submarinecablemap.com provides what it says it does. Recently a project called Internet Census 2012 by "Carna Botnet" used bots to scan IP version 4 space in a way that is more effective than legal. See Carna Botnet, *Internet Census 2012*, 2012, <http://internetcensus2012.bitbucket.org/paper.html>.
26. See the white paper studies by Cisco: "The Zettabyte Era: Trends and Analysis," June 10, 2014, http://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/VNI_Hyperconnectivity_WP.pdf, and "Cisco Global Cloud Index: Forecast and Methodology, 2013–2018" http://www.cisco.com/c/en/us/solutions/collateral/service-provider/global-cloud-index-gci/Cloud_Index_White_Paper.pdf.
27. For a basic definition and explanation, see http://en.wikipedia.org/wiki/Polarization-division_multiplexing.
28. See Eric Price and David P. Woodruff, "Applications of the Shannon-Hartley Theorem to Data Streams and Sparse Recovery," 2012, retrieved from IBM Watson researcher site May 8, 2015, <http://researcher.watson.ibm.com/researcher/files/us-dpwoodru/pw12.pdf>.
29. For the OptIPuter project, for example, each major component could be on a different continent, but they all work together as if it were a single self-contained machine. See <http://www.optiputer.net/>.
30. See, for example, Steven Levy, "Going with the Flow: Google's Secret Switch to the Next Wave of Networking," *Wired*, April 17, 2012, <http://www.wired.com/2012/04/going-with-the-flow-google/> and James C. Corbett, Jeffrey Dean, Michael Epstein, Andrew Fikes, Christopher Frost, JJ Furman, Sanjay Ghemawat, Andrey Gubarev, Christopher Heiser, Peter Hochschild, Wilson Hsieh, Sebastian Kanthak, Eugene Kogan, Hongyi Li, Alexander Lloyd, Sergey Melnik, David Mwaura, David Nagle, Sean Quinlan, Rajesh Rao, Lindsay Rolig, Yasushi Saito, Michal Szymaniak, Christopher Taylor, Ruth Wang, and Dale Woodford, "Spanner: Google's Globally-Distributed Database," technical paper, October 2012, <http://static.googleusercontent.com/media/research.google.com/en/us/archive/spanner-osdi2012.pdf>.
31. As a *Cloud Polis* model, Google Fiber would allow the platform to provide the line as well as the service, as well as software to optimize the line as the physical layer of that platform.

32. The Dutch East India Company's licensed proto-sovereignty is perhaps the most obvious historical example.
33. See Tom McCarthy, "Palestine Now Recognised by Greater Power Than US or Israel—Google," *Guardian*, May 3, 2013, <http://www.theguardian.com/technology/2013/may/03/google-palestine-palestinian-territories>. See also Greg Kumparak, "Google Palestine Hacked and Defaced through a Domain Registry Attack," *TechCrunch*, August 26, 2013, <http://techcrunch.com/2013/08/26/google-palestine-hacked-and-defaced-seemingly-through-a-domain-registry-attack/>.
34. As claimed in cases such as the Megaupload raids whereby USA federal authorities claimed transoceanic jurisdiction and seized the property of CEO Kim Dotcom in his New Zealand residence and place of business. See http://en.wikipedia.org/wiki/Seizure_of_Megaupload.
35. See James C. Scott, *Seeing like a State: How Certain Schemes to Improve the Human Condition Have Failed* (New Haven, CT: Yale University Press, 1998), as well as Bruno Latour, "How to Think like a State" (lecture at the WRR Scientific Council for Government Policy, The Hague, November 22, 2007), <http://www.bruno-latour.fr/sites/default/files/P-133-LA%20HAYE-QUEEN.pdf>.
36. We see this transposition of the state into the Cloud quite literally in Estonia's efforts to secure a full "back-up" of the country's data, in case of (Russian) cyberattack. The plan calls for the distribution of "data embassies" in different parts of the world so that if the country's systems were compromised or erased that could be restored from a comprehensive remote backup. See <http://www.economist.com/news/technology-quarterly/21645505-protect-itself-attack-estonia-finding-ways-back-up-its-data-how>.
37. An awkward-at-best vision of this at the scale of an entire nation might look like UK Prime Minister David Cameron's Big Society initiative, which sought to "integrate the free market with a theory of social solidarity based on hierarchy and voluntarism," or in other words, offload state services onto local charities wrapped in words like "social media" and "decentralization." See http://en.wikipedia.org/wiki/Big_Society.
38. Or even agents well beyond that government's borders, as today much of the US federal government data entry is done in India.
39. See the US data.gov and the UK's data.gov.uk (overseen by World Wide Web inventor Sir Tim Berners-Lee) as very curtailed and limited examples of this federal information transparency.
40. This refers to Robert Nozick's notorious economic libertarian manifesto, *Anarchy, State and Utopia* (New York: Basic Books, 1974), where he introduces the conceptual ideal of the minimal state. See also Methaven's "ultramimimal state" and its Facestate project: Andrea Hyde, "Metahaven's Facestate," Walker Art Center, December 13, 2011, <http://www.walkerart.org/magazine/2011/metahavens-facestate>.
41. The confusion this sows is readily apparent in both attempts to curtail Google under the rubric of a trust "monopoly" and in the awkward rationales for why Google is actually not a monopoly. See judicial "originalist" Robert Bork's back-bending "What Does the Chicago School Teach About Internet Search and the Antitrust Treatment of Google," Robert H. Bork and J. Gregory Sidak, *Journal of Competition Law & Economics* 8 (2012): 663–700.

42. In a way, geopolitical reality is only catching up with the anticipations of the science fiction that has already explored the proliferation and institutionalization of data havens and data infrastructures, “community clouds,” cloud-based microreligions and macrostates, and others. I believe that Bruce Sterling coined the term *data haven* in his 1989 novel, *Islands in the Net*, and Neal Stephenson developed the notion closer to the normalization of an emergent political geography in *Snow Crash* (1992), in which characters pop in and out of passport-granting microstates, not bound to specific lands but instead distributed on street corners like 7-11s (the protagonist frequents one of these known as Mr. Lee’s Hong Kong). Later in Stephenson’s sprawling *Cryptonomicon*, the transhistorical plot stretches from Alan Turing’s war years to the present day and locates a data haven in the fictional country of Kinatua, located between Borneo and the Philippines (domain .kk). In the real world, HavenCo operated from the self-declared sovereignty of the oil platforms of Sealand, while Freenet, a distributed encrypted network, tries to support a secured flow of information over public and private lines. While new micromodels of civil (or uncivil) society may well emerge from these miscellaneous jurisdictional folds and seams within the legal and extralegal geographical fabrics of globalization, they also couch and host the darkest repercussions of the tooth-and-claw libertarianism on which some are founded. For example, the US Federal Trade Commission recently shut down 3FN, a company based in Belize, which had run a lucrative business based largely the hosting and distribution of spam, malware, spyware, and, more disturbing, hundreds of gigabytes of images and videos of child sexual abuse. The street finds a way. However, unlike these interstitial pirate “free-zones,” the global platforms of *Cloud Polis* are not a confederation of alternative tactics. To the contrary, they are the normative architecture from which the exception bends.

43. The relevant passage reads, “Management of Identification resources, 31B 3A.2 Member States shall have equal rights to manage the Internet, including in regard to the allotment, assignment and reclamation of Internet numbering, naming, addressing and identification resources and to support for the operation and development of basic Internet infrastructure.” See McTim, “It’s Not Paranoia If They Are Really After You!” *CircleID* (blog), December 9, 2012, http://www.circleid.com/posts/20121209_it_is_not_paranoia_if_they_are_really_after_you/.

44. We might take this in the sense of “constituent” and “constitutive” violence as described in Walter Benjamin, “The Critique of Violence,” in *Reflections Essays, Aphorisms, Autobiographical Writings*, ed. Peter Demetz (New York: Schocken Books, 1986), 277–300.

45. Consider how Iraqi insurgent groups managed to tap into coalition surveillance and communication satellites as well as aerial drone camera feeds using the Russian off-the-shelf software, SkyGrabber, which sells for \$26. See Charles Arthur, “SkyGrabber: The \$26 Software Used by Insurgents to Hack into US Drones,” *Guardian*, December 17, 2009, <http://www.theguardian.com/technology/2009/dec/17/skygrabber-software-drones-hacked>.

46. Umberto Eco, “The Holy War: Mac vs. DOS, La bustina di Minerva,” *L’Espresso*, September 30, 1994. See also <http://cliffarnold.com/macvdos.pdf>.

47. There are certainly other *Cloud* platforms to consider as possible *Cloud Polis* models, and certainly not nearly all of them are US megaplatforms. A word on Twitter, which I view as too one-dimensional to compare to the others’ more grandiose geopolitical potentials: It may be better

compared to a critical insect species in a larger ecology, moving memes from place to place, like bees pollinating flowers. It never builds more than simple clusters on its own, but without it, more complex architectures would decay. For some time, I've argued that Twitter mustn't overlook the nonhuman user base and that its potential as a universal platform for the Internet of Things may prove an equally important function as human-human threads.

48. See, for example, Erving Goffman's seminal *The Presentation of Self in Everyday Life* (Garden City, NY: Doubleday, 1959).

49. See Doug Beaver, "10 Billion Photos," *Facebook*, October 14, 2008, <https://www.facebook.com/notes/facebook-engineering/10-billion-photos/30695603919>.

50. Unsurprisingly then, *Cloud* network platforms have hired many of the best social network analysis away from academia. For example, during my time at Yahoo! I worked with small-worlds network pioneer Duncan Watts, formerly of Columbia's Department of Sociology and now at Microsoft Research.

51. Company founder Mark Zuckerberg may have found a way around the problem of Facebook's closure from the open Internet, and that is to implement a proprietary aerial Facebook-centric version for the developing world. See Quentin Hardy and Vindu Goel, "Drones Beaming Web Access Afloat in the Stars for Facebook," *New York Times*, March 26, 2015, <http://nyti.ms/1GpPOXh>.

52. See <http://chatroulette.com/> if you must.

53. I particularly like the premise considered in Charles Stross's novel *Rule 34* (New York: Ace Books, 2011), that "the singularity" is born from the accumulation of global e-mail spam becoming sentient.

54. See Cory Doctorow's novelization of gold farmers' plight and struggle in *For the Win* (New York: Tor, 2010).

55. David Graeber's *Debt: The First 5000 Years* (New York: Melville Publishing, 2011) revived popular interest in debt as primary in the social ontology of money. See also Marcel Mauss's *The Gift* (originally published in 1925), which remains a reference for the anthropology of finance, Marcel Mauss and E. E. Evans-Pritchard. *The Gift: Forms and Functions of Exchange in Archaic Societies* (New York: Norton, 1967).

56. It's perhaps easy to underestimate Apple's scale and position. Apple generated \$43.7 billion in sales during the first three months of 2014. That's more than Google, Amazon, and Facebook combined. Apple now has 800 million iTunes accounts. That's 800 million credit cards on file, which is more than any other company in the world. As of this writing, Apple has \$150.6 billion in cash. It could buy Facebook at Facebook's current valuation with its cash. Or it could go on a shopping spree and buy Netflix, Tesla, Twitter, Dropbox, Pandora, and Spotify. When it was done buying those companies, it would still have \$59 billion in cash to spend on anything else it wants. See <http://www.businessinsider.com/mind-blowing-facts-about-apple-2014-4?op=1#ixzz30L3YYeDJ>.

57. In this famous TV advertisement aired only once—during the 1984 Super Bowl—a young rebel representing Apple hurls “a torch of freedom” into the screens on which the face of “IBM” drones on. The promise is that with Apple’s new colorful day, 1984 (the year) will not be like 1984, the Orwellian dystopia. If the reader is unfamiliar with the advertisement, its Wikipedia page will explain its significance: http://en.wikipedia.org/wiki/1984_%28advertisement%29.

58. See Fred Turner, *From Counterculture to Cyberculture: Stewart Brand, the Whole Earth Network, and the Rise of Digital Utopianism* (Chicago: University of Chicago Press, 2006). For an example of Limbaugh’s Apple love see <http://www.rushlimbaugh.com/search/?query=apple&go.x=-299&go.y=-365&go=go>. For a unusual and interesting take on Jobs and Wozniak’s early relationship, see the *Steve & Steve* comic, <http://www.steve-and-steve.com/>.

59. “What then is an object? In the literal sense it is: ‘that which has been thrown or which one throws in front.’ Are world-objects lying in front of us? The global dimension that characterizes them eliminates the distance between us and them which in the past defined objects. We now live in those world-objects as we live in the world.” From Michael Serres, “Revisiting the Natural Contract,” trans. Anne-Marie Feenburg-Dibon, *CTheory*, May 11, 2006, <http://www.ctheory.net/articles.aspx?id=515.>).

60. For more on the urbanism of these hubs in the *City* chapter, see John D. Kasarda and Greg Lindsay, *Aerotropolis: The Way We'll Live Next* (New York: Farrar, Straus and Giroux, 2011).

61. See Farhad Manjoo, “I Want It Today: How Amazon’s Ambitious New Push for Same-Day Delivery Will Destroy Local Retail,” *Slate*, http://www.slate.com/articles/business/small_business/2012/07/amazon_same_day_delivery_how_the_e_commerce_giant_will_destroy_local_retail_.html.

62. As this book was going to press, Google announced that it would create a parent company called Alphabet, with many experimental initiatives moving outside of Google proper. It is not known how the reorganization will impact or revitalize the company’s founding mission, but the reader should infer that “Google” refers here to all ventures included within the Alphabet enterprise.

63. A typically simplistic and misinformed example is Shoshanna Zuboff’s thought piece, “Dark Google” in *Frankfurter Allgemeine*, April 30, 2014, <http://www.faz.net/aktuell/feuilleton/debatten/the-digital-debate/shoshanna-zuboff-dark-google-12916679.html>. We are provided with several of the most shrill and counterproductive tropes of Google bashing: taking what Eric Schmidt says in op-eds at face value as representing Google’s strategy, or, worse, as representing Google’s geo-political and geo-economic significance, power, or danger; conflating user feedback and pushback regarding strange new forms of data transparency with some deliberate and explicitly criminal mischief on Google’s part, including misrepresentation of what practices were and are secret and which are merely unusual and controversial; insisting that confusion about the ambiguous social logics of secrecy and privacy in a network society is proof not merely of disenchantment but of innocence betrayed by bad actors; insisting that the inability to articulate a coherent political description of Cloud-based social systems is demonstrable proof, not just of a general confusion, but of Google’s willful violence; insisting that the only way to adjudicate these new Googly

conundrums is with new language and analytical tools. (The next five sentences then repeat the oldest and most conventional calls for general well-being through measured oversight.) By comparison Assange's *When Google Met WikiLeaks* is a fascinating, self-contradictory, hyperactive tangle of ideas, accusations, and bizarre rationalizations. Within critical Google discourse it is in a league of its own, for both better or worse. Julian Assange, *When Google Met WikiLeaks* (New York: OR Books, 2014).

64. See Julian Assange, "The Banality of 'Don't Be Evil,'" *New York Times*, June 1, 2013, <http://www.nytimes.com/2013/06/02/opinion/sunday/the-banality-of-googles-dont-be-evil.html>. It was later republished in Assange, *When WikiLeaks Met Google*.

65. As recently occurred in Turkey, when the AK Party tried to shut down Twitter, and the government also tried to shut off access to Google DNS as well. Steven Carstensen, "Google's Public DNS Intercepted in Turkey," *Google Online Security Blog*, March 29, 2014, <http://googleonlinesecurity.blogspot.com/2014/03/googles-public-dns-intercepted-in-turkey.html>.

66. A current line of my research looks at convergences of machine sensing and animal sensation. The larger domain of "search" underwrites both and sometimes enables that convergence.

67. Yann Moulier Boutang and Ed Emery, *Cognitive Capitalism* (Cambridge: Polity Press, 2011).

68. Pasquinelli writes on this conjunction within Google's algorithmic phylum: "First and foremost Google's power is understood from the perspective of *value production* (in different forms: attention value, cognitive value, network value, etc.): the biopolitical consequences of its data monopoly come logically later." Matteo Pasquinelli, "Google's PageRank Algorithm: A Diagram of the Cognitive Capitalism and the Rentier of the Common Intellect," in *Deep Search: The Politics of Search beyond Google*, ed. Konrad Becker and Felix Stalder (Innsbruck: Studien Verlag, 2009).

69. For example, a recent deal for 100 megawatts of wind energy from developers in the US Midwest. See Poornima Gupta, "Google to Use Wind Energy to Power Data Centers," Reuters, July 20, 2010, <http://www.reuters.com/article/2010/07/20/us-google-windpower-idUSTRE66J3BL20100720>.

70. Bernard Stiegler develops from Gilbert Simondon a far more subtle theoretical application of epiphylogenesis. See his *Technics and Time, 1: The Fault of Epimetheus* (Stanford, CA: Stanford University Press, 1998).

71. See, for example, Eric Pfanner, "Debunking Rumors of an Internet Takeover," *New York Times*, June 11, 2012, <http://www.nytimes.com/2012/06/11/technology/debunking-rumors-of-an-internet-takeover.html>. See also Michael J. Gross, "World War 3.0," *Vanity Fair*, May 2012, <http://www.vanityfair.com/culture/2012/05/internet-regulation-war-sopa-pipa-defcon-hacking>.

72. See Google's quasi-astroturf response to the ITU proposal: <http://www.google.com/intl/en/takeaction/whats-at-stake/>.

73. The joke goes something like this, "Mencius Moldbug and Alexander Dugin walk into a bar ..." "

74. Saskia Sassen, *Territory, Authority, Rights: From Medieval to Global Assemblages* (Princeton, NJ: Princeton University Press, 2008).

City Layer

1. Jean-Luc Godard, *Deux ou trois choses que je sais d'elle* (Paris: Anouchka Films/ Argos Films/ Les Films du Carrose/ Parc Film, 1967).
2. Italo Calvino, *Invisible Cities* (New York: Harcourt Brace Jovanovich, 1974).
3. Gilles Deleuze, *Pourparlers: 1972–1990* (Paris: Editions De Minuit, 1990).
4. The term “junkspace” refers to Rem Koolhaas’ essay on the poverty of contemporary environments. See *October* 100 (Spring 2002): 175–190.
5. Sanford Kwinter, “Digital Pleistocene” (seminar syllabus, Mediascapes program, SCI-Arc, summer 2008). See <https://mediascapes.wikispaces.com/DigitalPleistocene>.
6. A positive spin on this dual attention is suggested by Elie During, “Loose Coexistence: Technologies of Attention in the Age of the Post-Metropolis,” in *Cognitive Architecture: From Biopolitics to Noopolitics: Architecture and Mind in the Age of Communication and Information*, ed. Deborah Hauptmann and Warren Neidich (Rotterdam: Uitgeverij 010, 2010).
7. Andrea Branzi, *No-Stop City: Archizoom Associati* (Orléans: HYX, 2006).
8. Kazys Varnelis, “Programming after Program: Archizoom’s No-Stop City,” *Praxis: Journal of Writing and Building*, May 18, 2006, 82–91.
9. Diedrich Diederichsen and Anselm Franke, eds., *The Whole Earth California and the Disappearance of the Outside* (Berlin: Sternberg Press, 2013).
10. The term *right to the city* comes from Henri Lefebvre, who developed an urban materialism quite different from the one described here, though not necessarily incompatible with it.
11. Steven Graham and Simon Marvin identified this tunnel effect in their *Splintering Urbanism: Networked Infrastructures, Technological Mobilities and the Urban Condition* (London: Routledge, 2001). Among these is the centralization of key bandwidth hubs, often, but not always, in tier 1 global cities linking their trading centers to one another and further accelerating forces consolidating capital into fewer megacenters where it can be efficiently leveraged. Whereas in the dot-com era, some pundits emphasized how information technologies would soon virtualize economic contact and usher in a new era of cybersuburbs (and to an extent it has, but not by hollowing out urban cores as some enthused it would). See William J. Mitchell, *City of Bits: Space, Place, and the Infobahn* (Cambridge, MA: MIT Press, 1995), and Joel Kotkin, *The New Geography: How the Digital Revolution Is Reshaping the American Landscape* (New York: Random House, 2000). It is now clear that while planetary-scale computation does virtualize some kinds of places, its real project, it turns out, is the terraforming of continental interfaces with ferocious effect. In this large-scale bandwidth, provision and access becomes a core spatial planning strategy, whether for

small market cities like Kansas City, Missouri, the first test bed for Google's 100 megabyte fiber network, or for large market actors like traders who relocate their offices farther down the island in Manhattan to get closer to the central switches on Wall Street and shave nanoseconds off high-speed trading cycles. Despite its global spread and horizontal ubiquity, for Stack urbanism, proximity to the center, as defined by supermassive concentrations of bit flows, is seen as essential.

12. See David Kusner, "The Real Story of Stuxnet," *IEEE Spectrum*, February 23, 2013, <http://spectrum.ieee.org/telecom/security/the-real-story-of-stuxnet>.

13. As well as simulations of all of these, as evidenced by the imaginary ISIS attack on Louisiana as invented by Russian mischief makers. See Cory Doctorow, "Imaginary ISIS Attack on Louisiana and the Twitterbots Who Loved It," <http://boingboing.net/2015/03/08/imaginary-isis-attack-on-louis.html>.

14. The shock and awe of military/entertainment programs is by no means exclusive to airports, but as an urban type, they are perhaps most decisively dependent on its effects. On the one hand, the airport is a liminal space of territorial and jurisdictional transition, and so available to exceptional policing actions. On the other, airport urbanism is the absolutely normal essence of what the *City* layer is and does, and because of this symbolic miniaturization of the world at large, it is so useful as a target for political violence (and so available to exceptional policing actions).

15. The Foucauldian disciplinary model describes a mode of spatial power predicated on the securing of subjects in place (securing a negative freedom of movement and a positive freedom from movement).

16. The problematics and potential of the urban operating system are well articulated by Matthew Fuller and Usman Haque in *Urban Versioning System v.1.0*, Situated Technologies Pamphlet series, 2008, <http://www.situatedtechnologies.net/>. The conflicts involved, however, are impossible to tally in real time. In their book *Cypherpunks: Freedom and the Future of the Internet*, Julian Assange, Jacob Appelbaum, and Andy Muller-Maguhn are alarmed that "Siemens is marketing a platform for intelligence agencies that does actually produce automated actions. So when target A is within a certain number of meters of target B according to their mobile intercept records, and target A receives an email mentioning something—a keyword—then an action is triggered." For them the *User-versus-Cloud* arms race is tilted by the widespread use of cryptographic systems (including perhaps the Cryptophone, <http://www.cryptophone.de/en/products/mobile/>). One lesson from the Snowden affair was that the cryptographic and anonymizing tools (like Tor browser) may increase the likelihood that the *User* will be a tracked target of surveillance. See Dan Goodin, "Use of Tor and E-mail Crypto Could Increase Chances that NSA Keeps Your Data," <http://arstechnica.com/tech-policy/2013/06/use-of-tor-and-e-mail-crypto-could-increase-chances-that-nsa-keeps-your-data/>. For one, much of the tracking involves the reconstruction of metadata about the network of *Users* communicating instead of the more laborious cracking of individual messages, and so encrypting only content provides no additional privacy. Second, the National Security Agency seems to have decided that Tor users, for whom an IP address cannot be confidently located within the United States, are presumed not to be US citizens, and so

not covered by federal legal protection. The argument then is that only when everyone uses cryptographic and anonymizing tools their use no longer places a target on the back of those who do. See Assange, et al., *Cypherpunks: Freedom and the Future of the Internet* (New York: OR Books, 2012).

17. See William Gibson's Sprawl trilogy novel *Mona Lisa Overdrive* (Toronto: Bantam Books, 1988), and MVRDV's drafting of "cyberspace" in Metacity/Datatown (Rottterdam: 010 Publishers) (1999).

18. Also MVRDV *KM3: Excursions on Capacity* (Barcelona: Actar, 2006).

19. Adam Greenfield, *Against the Smart City* (New York: Do Projects, 2013).

20. See Patrik Schumacher's evolving parametricist manifestos that list many of his key claims on behalf his understanding of this design methodology: "Parametricism as Style—Parametricist Manifesto," 2008, <http://www.patrikschumacher.com/Texts/Parametricism%20as%20Style.htm>.

21. Keller Easterling discusses this consultant-driven urbanism in *The Action Is the Form: Victor Hugo's TED Talk* (London: Strelka Press, 2012).

22. We are left to wonder who the real architects of the architecture actually are: Zaha Hadid, Cisco, or McKinsey? Shall we now acknowledge the collaborations with more transparency, and in doing so expand the landscape of parameters that can be admitted into a Luhmannian design strategy? See also Sam Jaco, "Where Cities Talk to Money," *Domus*, no. 970, June 19, 2013, http://www.domusweb.it/en/architecture/2013/06/10/where_cities_talktomoney.html.

23. See J. G. Ballard, *Super-Cannes* (New York: Picador, 2001), a novel of seething, barely suppressed mayhem, set in an exclusive technology park enclave.

24. Greenfield, *Against the Smart City*.

25. The urban armatures of Masdar City are in some places raised off the ground like server racks in a data center, allowing the replacement of components' building parts to be done quickly from backstage.

26. Gilbert Simondon, a French philosopher, sees the individual as a process—through individuation rather than as fixed entity. Neither matter nor form is fixed, as they too go through a process of development. See Simondon's *The Individual and Its Physico-Biological Individuation; L'individu et sa genèse physico-biologique* (Paris: University Presses of France, 1964); and *Du mode d'existence des objets techniques* (Paris: Aubier, 1989). On Agamben's take on the apparatus, see Giorgio Agamben, *What Is an Apparatus? And Other Essays* (Stanford, CA: Stanford University Press, 2009). Deleuze offered a strikingly different interpretation of Foucault's *dispositif* in his "What Is a Dispositif?" in *Michel Foucault: Philosopher*, ed. T. J. Armstrong (Hemel Hempstead: Harvester Wheatsheaf, 1992), 159–168.

27. Agamben makes extensive use of such theo-politico-etymological binaries to push his arguments forward, for example, his well-known, "Anthropological Machine," which differentiates humans from animals according to their inclusion or exclusion from political representability. See his *The Open: Man and Animal* (Stanford, CA: Stanford University Press, 2004).

28. I use the American *program* to indicate both architectural programme (in British English) and computational program. It is precisely the promiscuous ambiguity between one and the other that I wish to convey. After the appearance of the computer but before the mobile phone, Reyner Banham called for a revolution in the technologization of the environment, a complete folding of architectural and cybernetic programs. Reyner Banham, "Architecture after 1960," *Architectural Review* 127 (1960): 253–260. See also Anthony Vidler, "Toward a Theory of Architectural Program," *October* 106 (2003): 59–74. For a fascinating discussion of the role of program as a technique of provocation in the late-1970s architectural avant-garde, see Rem Koolhaas and Bernard Tschumi, "Two Architects 10 Questions on Program Rem Koolhaas + Bernard Tschumi," *Praxis 8: Journal of Writing and Building*, May 18, 2006.

29. It may be a matter of debate whether for parametricism that a shift away from representation is at work, or whether the style has introduced a formal vocabulary for the indexical expression of fast finance in building form. Schumacher, however, may not find this such a problem. See "I Am Trying to Imagine a Radical Free Market Urbanism: Conversation between Peter Eisenman and Patrik Schumacher," *Log* 28 (Summer 2013). However, this is not the only perspective available. Luciana Parisi has outlined a more promising alternative grammar of algorithmic thought and practice in contrast to deterministic homeostasis and formal closure in her *Contagious Architecture: Computation, Aesthetics, and Space* (Cambridge, MA: MIT Press, 2013). Instead, (through her reading of Alfred North Whitehead) architecture is staged as a mereotopology of points, parts, and wholes, and put into motion by algorithmic machines toward open-ended, ultimately contingent and indeterminate cascades of formation, information, and deformation. It overflows the authority of a given designer, design, or transactional urban context, and in this way, algorithmic "thought" escapes from stylistic, methodological, or economic strategic fields and becomes an alien machinic irruption into urban fabric according to its own self-directed aesthetic and procedural programs. The torsion between individual points resolving continuous surfaces and the mutualism between the smooth and the striated (the work of parametricism) as a platform logic refocuses attention on the agency of envelopes and surficial complexities to mediate those programs. This serves the critical path of connection between the larger career of algorithmic operation in The Stack and the agency of the line, envelope, and epidermis to organize its effects.

30. Alejandro Zaera-Polo, "The Politics of the Envelope," *Volume* 17 (November 2008): 76–105.

31. Without rehearsing Zaera-Polo's entire schema here, suffice that he focuses on four envelope types (flat-horizontal, spherical, flat-vertical, and vertical) and the types of polities they configure. The flat-horizontal envelope, such as a very large airport, stadium, or big box retail, organizes flow into artificial environments; the spherical, which dislodges representation and function and has the most to offer for the presentation of building facility; the flat-vertical, which presents a sectional diagram, organized tessellation, and segmentation of public and private at the plinth; and the vertical, which works at a much larger perceptual scale and organizes variation within a projection of power.

32. Zaera-Polo's schema is meant to index the architectural envelope's status quo and provides terms of speculation on what it might do differently. He concludes that we think of the politics of the envelope as a set of possible strategic maneuvers and tactical tricks that can be insinuated

into projects as a supplement to a client's conservative plans, but which can restructure spatial publics in ways to which he may not be attentive and incapable of perceiving. For him, while his politics of the envelope is pragmatist design within the presumed formats of capital cultures, modulations in the envelope might constitute a transformation in the possible enrollment of publics and of the urban-scale diagram of their configuration, and thereby a new political ecology of things and people. We can certainly add to his index as needed and expand it perhaps to include the scope of interfaces accounted for as The Stack. What about the megacity slums and shanties that are arguably the dominant urban typology of our era? Would their envelope be the flopping door, a shifting envelope as unclear as the barriers between legal and alegal occupation? Is the whole favela one vast shared envelope, or should we look instead at each individual construction? Should we assume that its politics of the envelope can be deduced by measuring operations at the aggregate scale or the individual? To add a fifth wall to the taxonomy, we might also nominate the elongated wedge, exemplified by the US border fence, the Israeli security barrier, parts of the Berlin Wall, or any of the hundreds of similar geopolitical membranes that have appeared in recent years. It is, in some ways, our moment's most characteristic political envelope, and at least as much as the original four typologies, its spatial, political performance is guaranteed by an animal physicality irrespective of whatever ideological symbolism may accompany that concrete posture's purpose. The elongated wedge represented aspires to be an ideal envelope cleaving an absolute inside and outside, without hosting any regular interior program within itself, diluted by no perforation (the bunker and the camp depend on the wedge-like envelope but also host human habitation within them, one for protective exclusion the other for protective inclusion).

33. Some updated version of Perec's typologies, perhaps? Georges Perec, *Species of Spaces* (Melbourne: West Space, 2009).

34. For example, for the designer (or the *User*), the function of "illumination" can come from a window (architecture) or a lamp (furniture), sitting from a chair or a fold in the wall, cooling from a walk-in freezer or a refrigerator, and so on. Choosing which will be solved by fixed designs and which by unfixed, by architecture or by furniture (that is, by envelope or by apparatus), underwrites all programmatic strategies.

35. Perhaps, however, the disciplined section for which OMA and its descendant studios are known for will in time come to play a different but equally important role. Instead of registering and exacting an orderly subdivision of urban programs according to a deep sociological insight into these behaviors placed on an architectural stage, the fixing of program into an over-determining plan will be more and more at odds with the normal flow of things. Instead of anticipating and accommodating the *City's* organic self-organization, sectional strategies of are used as a slowing, braking, and grating technique of resistance to those flows. They may be modern space's revenge on the programmatic confusion of the virtual envelope.

36. Virilio remarks from the same interview, "In this case too, if time is money, speed is power. This is why we are constantly in a race. What is a race? It means taking hold of power by getting there first. And at the same time we are on horseback, on foot or driving a car. It's very clear that speed = power, and power = speed, and instantaneity, ubiquitousness and immediacy are the

prerogatives of the divine." Quoted from the filmed interview with an interview with Sylvère Lotringer "Itineraries of the Catastrophe," Film presented by Lotringer at Mandrake Bar, Los Angeles, July 1, 2007.

37. See Brian Massumi. "Sensing the Virtual, Building the Insensible," *Architectural Design, Hypersurface Architecture* 68, no. 5/6 (May/June 1998): 16–25.

38. Maximum liquidity partitioned by a security barrier that ironically also causes massive flooding.

39. The exhibition Native Land/Stop-Eject, curated by Paul Virilio and Raymond Depardon at Cartier Fondation, Paris, 2008-09 promoted the estimation that 645 million people will be displaced by wars and other catastrophes by 2050. Today it's estimated that there are perhaps 300 million internal illegal immigrants within China. Mostly these are migrants from rural areas who live in major cities like Beijing and the southern factory metropoles without the appropriate *hukou*, or urban license. They often make their way without official social services and schools for their children, let alone voting rights. Even though they have crossed no national border, they can be counted with the other hundreds of millions of alegal migrants, stateless persons, and stateless ethnic groups. Taken together, perhaps they represent a kind of transnational political prototype of whatever may follow the modern Westphalian model of state and sovereignty. If a shared relationship to urban infrastructure is a source, if not the source, of that sovereign model to come, what public do they constitute? What urbanism should they demand? What, if any, cosmopolitanism do they enable or deflate? Outside the law, are they the left-behind or the avant-garde?

40. Ricardo Dominguez, Amy Sara Carroll, Brett Stalbaum, Micha Cardenas, and Elle Mehrmand. Videos of the tool explained and in action are on the B.A.N.G. Lab page at <http://vimeo.com/banglab>. See also Electronic Disturbance Theater, and B.a.n.g. Lab. *Sustenance, A Play for All Trans /] Borders* (New York: Printed Matter, 2010).

41. Agamben, *What Is an Apparatus?*, 17.

42. It also begs the question as to the *City's* right to the *User*. To what extent does the *City* have a corresponding "right" to use the *User* for its own creative purposes? The tracking of phones for spatial service optimization is a relatively banal example, but points toward controversies to come that cannot be solved by the axiomatization of individual privacy.

43. The way that TBIT activates the virtual territorial envelope can also be compared to US federal efforts to augment the physical international border with electronics sensors. In *Sustenance*, B.A.N.G. Lab notes that "in March 2010, the U.S. Department of Homeland Security announced that the virtual portion of the separation barrier erected along the U.S.-Mexico border thus far had proven ineffective, manifesting numerous technical glitches (notably, a hyper-vigilant inability to distinguish among wind, sage brush, and human beings)." They ask, "Did an aesthetic unconscious will the fence's malfunction? Wabbit trans/nation? Mayan meets queer technologies? 'Earth Telephone'? Sleep Dealer's nod to node-to-node resistance? It's your turn to try to circumvent borders with this 'true story'—the borders falsely constructed between the university, the gallery, the museum, the library ... and the 'real world.'" The project is described in

greater detail in B.A.N.G. Lab's "Sustenance: A Play for All Trans [] Borders" <http://www.thing.net/~rdom/Sustenance.pdf>. They also note that their tool is hardly the first, or most reliable, navigation technology available: "The outdoor GPS devices from Garmin and Magellan are indeed useful aids for the long distance overland orienteering required to walk into the United States. Readily available at Wal-Mart and Best Buy in Mexico, they have been utilized for a long time in border crossings. In other words, capitalism long ago accomplished what the atavistic right and neoliberal administrations fear most!"

44. In his capacity as University of California, San Diego visual arts professor, Ricardo Dominguez bore the brunt of the official backlash against TBIT, including a formal accounting inquiry instigated by the university at the request of at least three Republican congressmen. On August 31, 2010, Glenn Beck launched his site, *The Blaze*, with the headline, in all capital letters, "UCSD PROFESSORS: DISSOLVE U.S. — GIVE GPS PHONES WITH EXPLICIT POETRY TO ILLEGALS FOR BORDER CROSSING."

45. Michel Foucault and Michel Senellart, *The Birth of Biopolitics: Lectures at the Collège de France, 1978–79* (Basingstoke: Palgrave Macmillan, 2008).

46. We will revisit the potential of the *User* as geopolitical subject and "the death of user" in the *User* chapter.

47. As compared to, for example, Aaron Koblin's "Flight Patterns," 2006, <http://www.aaronkoblin.com/work/flightpatterns/index.html>. For a more nuanced discussion of the telescopic scales of planetary striation, see Reza Negarastani's lecture, "The Topos of the Earth: Telescopic and Stereoscopic Visions of the Abyss-in-One," at the James Gallery, New York, February 21, 2013.

48. Fredric Jameson, *The Geopolitical Aesthetic: Cinema and Space in the World System* (Bloomington: Indiana University Press, 1995).

49. See Reyner Banham, *Megastructure: Urban Futures of the Recent Past* (London: Thames & Hudson, 1976). The recent lineage includes the New Monumentality, Fuhimiko Maki's Collective Form, Kenneth Frampton's Megaform, Italian neorationalists' typological piazza, Oswald Mathias Ungers's Grossform, and Rem Koolhaas's Bigness. See Antonio Negri's essay, "On Rem Koolhaas," and Martin Van Schaik and Otakar Mácel, *Exit Utopia: Architectural Provocations, 1956–76* (Munich: Prestel, 2005). See also Sabrina Van Der Ley and Markus Richter, *Megastructure Reloaded: Visionäre Stadtentwürfe Der Sechzigerjahre Reflektiert Von Zeitgenössischen Künstlern = Visionary Architecture and Urban Design of the Sixties Reflected by Contemporary Artists* (Ostfildern: Hatje Cantz, 2008).

50. The Bilbao region in Spain experienced significant economic growth concurrent with the opening of the Frank Gehry designed Guggenheim Bilbao and opening in 1997. The "Bilbao effect" is a term coined by Peter Eisenman to refer to the misguided hope of second-tier cities that adding some flashy new architectural icons would magically boost their city's brand and regional economy.

51. Perhaps a future Erich von Daniken will interpret Foster's structures as proof of alien intelligence on Earth's moon.

52. Yes, "Ladies and Gentlemen, We Are Floating in Space."
53. Easterling reaches the same conclusion for different reasons in "New Monuments: Keller Easterling on Norman Foster's Crystal Island," *Artforum International* 46, no. 10 (Summer 2008).
54. There is no lack of attention in the popular press as to how *Cloud* platforms affect Bay Area urbanism. See, for example, Kelsey Campbell-Dollaghan, "How the Tech Industry Is Quietly Changing the Face of American Cities," *Gizmodo*, June 18, 2013, and Daniel Safarik, "The Spell of Hot Desk," *Unfrozen* (blog), May 28, 2013, <http://arch-unfrozen.tumblr.com/post/51615608029/the-spell-of-hot-desk>.
55. A grand organizational chart, like Dürer's massive print, *Triumphal Arch of Maximilian I*.
56. See the Google 2.0 campus video at <https://www.youtube.com/watch?v=z3v4rlG8kQA>.
57. See for example, no author cited, "Googledome, or Temple of Doom?" <http://www.economist.com/news/business/21645747-tech-firms-are-building-pharaonic-head-offices-again-googledome-or-temple-doom>, March 7, 2015, and Nick Allen, "Google Faces Opposition to New Headquarters," *Telegraph*, February 25, 2015. See <http://www.telegraph.co.uk/technology/google/11435802/Google-faces-opposition-to-new-headquarters.html>.
58. As this book was going to press, we learned that the Mountain View city council voted for LinkedIn's alternative proposal for the site, perhaps preventing at least delaying, the eventual construction of some version of Ingalls' and Heatherwick's plan. See Conor Dougherty "Google Loses to LinkedIn in Silicon Valley Headquarters Pitch," *New York Times*, May 6, 2015, <http://nyti.ms/1F68CMI>.
59. Adam Greenfield compares "Zee Town" to company towns of years past in "Is Facebook's 'Zee Town' More Than Just a Mark Zuckerberg Vanity Project?" *Guardian*, March 10, 2015, <http://www.theguardian.com/cities/2015/mar/10/facebook-zee-town-mark-zuckerberg>.
60. See Kirk Johnson and Nick Wingfield, "As Amazon Stretches, Seattle's Downtown Is Reshaped," *New York Times*, August 25, 2013, <http://www.nytimes.com/2013/08/26/us/as-amazon-stretches-seattles-downtown-is-reshaped.html>.
61. See for example, Colin Marshall, "Amazon's New Downtown Seattle HQ: Victory for the City over Suburbia?" *Guardian*, May 22, 2014. <http://www.theguardian.com/cities/2014/may/22/amazon-futuristic-new-downtown-seattle-hq-microsoft-nintendo>.
62. For a partial list of the locations of Amazon fulfillment centers in North America, see Jennifer Dunn, "Locations of Amazon Fulfillment Centers," *Bottom Line* (blog), March 17, 2014, <http://outright.com/blog/locations-of-amazon-fulfillment-centers-2/>.
63. In the essay "Utopia as Replication," in *Valences of the Dialectic* (London: Verso, 2009), Fredric Jameson draws links between Walmart and certain infrastructural utopian potentiality.
64. On Amazon's ongoing implementation of robotic systems in its warehouse and distribution chain, see Sam Grobart, "Amazon's Robotic Future: A Work in Progress," *Bloomberg Business Week*, November 30, 2012, 2012 <http://www.bloomberg.com/bw/articles/2012-11-30/amazons-robotic-future-a-work-in-progress> and Sarah O'Connor, "Amazon's Human Robots: They Trek 15 Miles a

Day around a Warehouse, Their Every Move Dictated by Computers Checking Their Work. Is This the Future of the British Workplace?" *Mail Online*, March 1, 2013, <http://www.dailymail.co.uk/news/article-2286227/Amazons-human-robots-Is-future-British-workplace.html>. Amazon also purchased Kiva Systems, a leading manufacturer of warehouse automation systems. See Scott Kirsner, "Amazon Buys Warehouse Robotics Start-Up Kiva Systems for \$775 Million," *Boston.com*, March 19, 2012, http://www.boston.com/business/technology/innoeco/2012/03/amazon_buys_warehouse_robots.html.

65. Stowe Boyd, "If Amazon Is the Future of Work, Then Be Afraid," Gigaom Research, February 22, 2013, <http://research.gigaom.com/2013/02/if-amazon-is-the-future-of-work/>.

66. This dynamic is the central problem drawn out in Jaron Lanier in *Who Owns the Future?* (New York: Simon & Schuster, 2013), and it leads him to advocate for, among other things, a revaluation of how tacit human knowledge might be rewarded by ubiquitous micropayments. See also Jaron Lanier and Douglas Rushkoff, "The Local-Global Flip, or, 'The Lanier Effect,'" *Edge*, August 29, 2011, <http://edge.org/conversation/the-local-global-flip>.

67. See Jobs's presentation of the proposed Campus 2 to the Cupertino City Council at Cupertino City Channel, "Steve Jobs Presents to the Cupertino City Council (6/7/11)," *YouTube*, June 7, 2011, https://www.youtube.com/watch?v=gtuz5OmOh_M.

68. Alexandra Lange, "New Apple HQ, 1957," *Design Observer*, June 11, 2011, <http://designobserver.com/feature/new-apple-hq-1957/28018>.

69. Michel Houellebecq, *The Possibility of an Island*, trans. Gavin Bowd (New York: Vintage International, 2007). More than one person has also remarked to me that their first reaction to seeing Jobs/Foster's proposal was to recall the "silver seed flying to a new home in the Sun" from the Neil Young song, "After the Gold Rush."

70. An impression that is not discouraged by the company's international tax avoidance strategies. See Nelson D. Schwartz, "Apple's Web of Tax Shelters Saved It Billions, Panel Finds," *New York Times*, May 20, 2013, <http://www.nytimes.com/2013/05/21/business/apple-avoided-billions-in-taxes-congressional-panel-says.html>.

71. On the "disappearance of the outside" that comprehensive views of the whole planet suggest or enforce, see Diedrich Diederichsen and Anselm Franke, eds., *Whole Earth: California and the Disappearance of the Outside* (Berlin: Sternberg Press, 2013).

72. Geoff Manaugh, "The Planetary Super-Surface of San Bernardino County," BLDGBLOG, April 15, 2013, <http://bldgblog.blogspot.com/2013/04/the-planetary-super-surface-of-san.html>.

73. For a glimpse into the everyday life of workers at Apple City in Zhengzhou, see this photo essay, Gilles Sabrie, "Off-Hour Escapes for China's Workers," *New York Times*, July 15, 2013, <http://www.nytimes.com/slideshow/2013/07/16/world/asia/20130717-CHINA.html>. The accompanying text states, "Unlike Apple's modernistic new campus in California, which will be surrounded by apricot trees, the Zhengzhou facility has all the charm of a penal colony. Employees, who must wear matching uniforms, say supervisors routinely curse and yell."

74. Herbert G. Wells, *The Time Machine* (Stuttgart: Reclam, 1984).
75. Perhaps the most significant *Cloud* megastructure is not one built to house the higher brain functions of a private global platform, but one built to house the intelligence and surveillance operations of a global platform in the form of a state, namely, the United States, and specifically the National Security Agency's Utah Data Center. See "Utah Data Center," *Wikipedia*, November 7, 2014, http://en.wikipedia.org/wiki/Utah_Data_Center, and the helpful "NSA Utah Data Center: Serving Our Nation's Intelligence Community," NSA Utah Data Center, <https://nsa.gov1.info/utah-data-center/>. If there's one building the in the world where The Stack lives, it might be here. I think not, actually.

Address Layer

1. Henri Bergson, *Matter and Memory*, trans. Nancy Margaret Paul and William Scott Palmer (London: G. Allen & Son, 1912), 276.
2. Franz Kafka, "An Imperial Message," in *The Penal Colony: Stories and Short Pieces*, trans. Edwin Muir and Willa Muir (New York: Schocken Books, 1961), 1–2.
3. In some objects, you can see the entire Stack at once.
4. See "CeNSE," *Wikipedia*, March 21, 2013, <http://en.wikipedia.org/wiki/CeNSE>. If Cisco had Planetary Skin and HP has Central Nervous System of the Earth, then we eagerly anticipate claims of the Planetary Immune System and the Earth Lymph Node Network.
5. Beginning in 1913, the International Map Project (also known as the Millionth Map, because of its use of 1:1,000,000 scale standards, and by the number of total maps necessary to complete the set) sought to subdivide the Earth's surface according to a standard alphanumeric gridded matrix of longitudes and latitudes. The Central Bureau of the Map of the World was established, and a few thousand maps were produced using the standard system. Germany withdrew in 1914 as the European powers were more preoccupied with reinscribing borders than capturing their status. Later it was assumed by the United Nations in 1953, after which it lost momentum.
6. Cory Doctorow, "Lockdown: The Coming War on General-purpose Computing," *Boing Boing*, January 10, 2012, <http://boingboing.net/2012/01/10/lockdown.html>.
7. This is not lost on the handful of Internet of Things consortia that are positioning for a position of "generative entrenchment" with regards to ubiquitous computing protocols, languages, and standards. Among these are the AllSeen Alliance (Qualcomm, Microsoft, LG, Cisco, among others), the Industrial Internet Consortium (GE, Intel, IBM, AT&T, among many others) and the Open Interconnect Consortium (Intel, Samsung, Broadcom, Dell, and others). Just as for the circuit versus packet-switching battles during the early years of what became the Internet, for the emergent Internet of Things, which standards can achieve dominant platform status and which are forgotten will help determine the winners and losers among all the alliance member companies. Bruce Sterling argues that the interests end-users and consumers will likely not be well-served by how such standards are adopted. See his book *The Epic Struggle of the Internet of Things*

(Moscow: Strelka Press, 2014). One lesson of TCP/IP's adoption over OSI is that whatever platform can make use of existing systems fastest and easiest has an advantage over those that demand all new implementation. What turns out to be the real "killer apps" of Internet of Things (indeterminate at best at the time of writing) will in turn drive what (and who) is linked with when, where and when, and so it may be that end-user adoption will be a function of needs after all. However, whether those "end users" are advertising companies, search engines, or actual persons is an equally undecided question.

8. It also inspires a new wave of currency speculators interested in refashioning "money" as a system of valuation, exchange, and references.

9. This is taken up in a different way by Hiroki Azuma in his "Postal-Ontological" in *Ontological, Postal Basis: For Jacques Derrida* (Tokyo: Shinchōsha, 1998).

10. That axis of resistance was core, for example, to the situationists' reimagination of the modern city through unitary urbanism, and the impetus for Guy Debord to scramble (or unscramble) *le Plan de Paris* into the psychogeographic *Naked City*, though for Debord, as for others, the impetus is not necessarily to retake the territory but unmake the possibility of a universal addressability in the first place. See Guy Debord, "Guide psychogéographique de Paris," in *Discours sur les passions de l'amour* (Copenhagen: Permild & Rosengreen, 1955).

11. See Michael Witmore, "Text: A Massively Addressable Object," *Wine Dark Sea* (blog), December 31, 2010, <http://winedarksea.org/?p=926>, and "Digital Inquiry," Digital Humanities @ the UW-Madison, <http://dighum.wisc.edu/digitalinquiry/>.

12. Witmore wrote, "The book or physical instance, then, is *one of many levels of address*. Backing out into a larger population, we might take a genre of works to be the relevant level of address. Or we could talk about individual lines of print; all the nouns in every line; every third character in every third line. All of this variation implies massive flexibility in levels of address. And more provocatively: when we create a digitized population of texts, our modes of address become more and more abstract: all concrete nouns in all the items in the collection, for example, or every item identified as a 'History' by Heminges and Condell in the First Folio. Every level is a provisional unity: stable for the purposes of address, but also: stable because it is the object of address. Books are such provisional unities. So are all the proper names in the phone book. ... To have this thought is to dispose relevant elements in the dataset in much the same way a spreadsheet aggregates a text in ways that allow for layered access. *A reader is a maker* [emphasis mine] of such a momentary *dispositif*, and reading might be described as the continual redisposition of levels of address in this manner. We need a phenomenology of these acts, one that would allow us to link quantitative work on a culture's 'built environment' of words to the kinesthetic and imaginative dimensions of life at a given moment." Witmore, "Text: A Massively Addressable Object."

13. Jacques Derrida, *The Post Card: From Socrates to Freud and Beyond* (Chicago: University of Chicago Press, 1987).

14. See Keller Easterling, "An Internet of Things," *e-flux*, no. 31 (January 2012), http://worker01.e-flux.com/pdf/article_8946204.pdf, and Molly Wright Steenson, "Architectures of Information: Christopher Alexander, Cedric Price, and Nicholas Negroponte & MIT's Architecture Machine

Group" (PhD dissertation, Princeton University School of Architecture, 2014). Richard Saul Wurman is widely credited with the first use of the term *information architecture*, and for this we may be glad. He was also the founder of TED, and for this we may be sad.

15. Vernor Vinge, "Vernor Vinge at the Center for Design and Geopolitics" (lecture at the Center for Design and Geopolitics University of California, San Diego, June 3, 2011).

16. The thing as "gathering" is in reference to Martin Heidegger's use in his 1950 essay "Das Ding," and Bruno Latour's employment and furtherance of this image in his "parliament of things." For an explanation of Latour's construction (and an idiosyncratic rejoinder), see Bruno Latour, Graham Harman, and Peter Erdélyi, *The Prince and the Wolf: Latour and Harman at the LSE* (Winchester, UK: ZERO Books, 2011).

17. For such strangeness, see Mark Wilson, "The DRM Chair Self-Destructs after 8 Sittings," *Fast Company*, March 7, 2013, <http://www.fastcodesign.com/1672050/the-drm-chair-self-destructs-after-8-sittings>.

18. Consider the following regarding potential interfaces between viral systems of various scales. John Baichtal, "3D Printed Model of a Virus Self Assembles When Shaken," *MAKE*, August 16, 2011, <http://makezine.com/2011/08/16/3d-printed-model-of-a-virus-self-assembles-when-shaken/>.

19. Not just in Charles Stross's Rule 34, malware for 3D printers is live and at play. Kerry Stevenson, "The 3D Printer Virus, Really?" *Fabbaloo*, April 7, 2010, <http://www.fabbaloo.com/blog/2010/4/7/the-3d-printer-virus-really.html>.

20. Cory Doctorow, "Metacrap: Putting the Torch to Seven Straw-men of the Meta-Utopia," *Well*, August 26, 2011.

21. Payam Barnaghi, Cory Henson, Kerry Taylor, and Wei Wang, "Semantics for the Internet of Things: Early Progress and Back to the Future," *International Journal on Semantic Web and Information System* 8, no. 1 (2012): 1–21, http://knoesis.org/library/download/IJISWIS_SemIoT.pdf.

22. Yann Moulier-Boutang, *Cognitive Capitalism* (London: Polity Press, 2012).

23. Open Internet of Things Assembly, "Bill of Rights" <http://postscapes.com/open-internet-of-things-assembly>. (July 17, 2012).

24. See, for example, Saul A. Kripke, *Naming and Necessity* (Cambridge, MA: Harvard University Press, 1980). I particularly care, in this instance, to underscore that citing this work is not the same as recommending this work.

25. For an overview, see "Universally Unique Identifier," *Wikipedia*, November 1, 2014, http://en.wikipedia.org/wiki/Universally_unique_identifier. However, in a practical context, the separation between designation and the designated is not so clean. For example, with some GUID (globally unique identifier) schemes used to identify unique information in distributed systems, instances (such as file system IDs) are sometimes generated by an algorithm that incorporates the network interface ID of the User's computer as well the exact moment at which the ID was generated, measured in 100-nanosecond increments since the adoption of the Gregorian calendar.

26. The core parable is from Heidegger's "The Thing" essay from 1950.
27. By contrast, with the connotation of both for Graham Harman, for example: Graham Harman, *Toward Speculative Realism: Essays and Lectures* (London: Zero Books, 2010). Whereas the veracity and value of Object-Oriented Ontology would be as true or false 1000 years ago as it is now, or as true or false or 1000 years in the future, the "flat" addressable terrain I discuss could only exist and function when a particular set of historically contingent technological substrates could make it so. It is mechanically flat, not ontologically flat.
28. This concept of global network topology is all but axiomatic after the work of Manuel Castells and Saskia Sassen, and after a thousand and one telecommunications and airline commercials showing arcing lines pinpointing senders and receivers over a rotating globe.
29. For readers with a Continental bent, the reference here may be to Jakob von Uexküll, *A Foray into the Worlds of Animals and Humans with a Theory of Meaning*, trans. Joseph D. O'Neil (Minneapolis: University of Minnesota Press, 2010; originally published 1934) while others may consider information theory in the context of quantitative biology. See, for example, John Avery's introduction: *Information Theory and Evolution* (River Edge, NJ: World Scientific, 2003).
30. See the DOI (Digital Object Identifier) Foundation site at <http://www.doi.org/>. See IBM and Eurotech, "MQTT V3.1 Protocol Specification," IBM, <http://public.dhe.ibm.com/software/dw/webservices/ws-mqtt/mqtt-v3r1.html>.
31. Ben Edelman and Michael Schwarz have modeled an auction market for scarce IPv4 addresses: "Pricing and Efficiency in the Market for IP Addresses," *Working Knowledge*, November 3, 2011, <http://hbswk.hbs.edu/item/6849.html>.
32. For an interesting perspective on this, especially as it relates to Internet mapping, see Kimberly Claffy, *Ten Things Lawyers Should Know about the Internet* (San Diego, CA: Cooperative Association for Internet Data Analysis, 2008), http://www.caida.org/publications/papers/2008/lawyers_top_ten/lawyers_top_ten.pdf.
33. For an overview of IPv6 and the server-edge problem/opportunity, especially as related to early Internet models, see Jim Stogdill, "IPv6 Day and the State of the Edge," *O'Reilly Radar*, June 6, 2012, <http://radar.oreilly.com/2012/06/ipv6-internet-addresses-scarcity.html>.
34. See Jorge Luis Borges, "Library of Babel," in *Labyrinths: Selected Stories and Other Writings*, ed. Donald Alfred Yates and James E. Irby (London: Penguin, 1970; originally published 1941), 58–64. From the Wikipedia entry for "The Library of Babel": "The Library contains at least $25^{1,312,000}$ books. (The average large library on Earth at the present time typically contains only several million volumes, i.e. on the order of about 10^6 books. The world's largest library, the Library of Congress, has 2.18×10^7 books.) Just one 'authentic' volume, together with all those variants containing only a handful of misprints, would occupy so much space that they would fill the known universe."
35. The theoretical space of IPv6 can be measured in a number of ways, many of which boggle the mind and none of which guarantee anything whatsoever about future implementation: $6.67 \cdot 10^{23}$ IPv6 addresses per square meter of the surface of Earth, or $6.67 \cdot 10^{17}$ per square millimeter,

or $6.67 \cdot 10^{11}$ per square micrometer. The image shown of an IPv6 address the size of a red blood cell seems tiny, but in principle, it is big enough to contain 1 trillion addresses according to that distribution. Imagine if every Google search received an individual IPv6 address. If we were to assign an individual address to 1,000 searches per day for all 7 billion people (or $2.56 \cdot 10^{15}$ addressed searches per year), it would take 10^{23} years to run out of addresses. The age of the entire universe since the Big Bang is only about 10^9 years. And so on. Thanks to Sean Crowe for helping to sketch out these figures.

36. An IPv6 address is not a random number but a hierarchical addressing structure, like a postal address. It is a categorization and mapping schema, in which some numbers are subsets of others, used for routing, and so on. Like any other widely adopted addressing platform, it is a kind of geographical and jurisdiction technology. For what that political technology is ultimately used for, if anything of significance, we do not know.

37. Secure hashes may be another worthwhile model to pursue. Julian Assange outlines lays out a vision for this in his *When WikiLeaks Met Google* (N.p.: OR Books, 2014).

38. Once again there is a correspondence between the universal addressability of discrete assemblages with mass and indiscrete assemblages without mass, things, or concepts, with the flat ontology of Latour's "irreductionism." One could borrow any Latour litany of possible objects and imagine them as addressed in relation to one another and supported by an artificial infrastructure for the exchange of physical information between each other. That said, it may be tempting to overinterpret apparent resemblances between the generic universalities of deep address with the various flat ontologies of object-oriented philosophy, and any direct conflation of the two would be a mistake. The *Address* layer is an artificial superimposition of a symbolic cartography onto the world according to a specific, contingent diagram, and like any other symbolic cartography, it is totally limited by the prejudicial finitude of its own structure. Its ontology is tactical, not metaphysical. That its structure, as a layer within The Stack, would come to materially affect whatever "objects" it may address demonstrates only the power of categorization to mobilize complex systems. The litany of things that may be identified by *Address* sets does not actually flatten the plateau any further than it already is, or support any additional withdrawal of objects from one another. To the contrary, it nominates each as an instance with a location to which and from which information could be communicated. It is only cartography and communication, not chemistry or ontology.

39. I will quote a standard definition of the term. *Haecceity* (from the Latin *haecceitas*, which translates as "thisness") is a term from medieval philosophy coined by Duns Scotus. It denotes the discrete qualities, properties, or characteristics of a thing that make it a particular thing. Haecceity is a person or object's "thisness." Charles Sanders Peirce later used the term as a nondescriptive reference to an individual. See Martin A. Bertman, *Classical American Pragmatism* (New York: Humanities-Ebooks, 2010).

40. Furthermore, the specter of deep address should not be seen as a necessary justification for a cosmically inflated ontological "computationalism" whereby the whole universe is understood at its essence as algorithmic unfolding, with deep address cast as infinite drawing by which such cosmic calculations can be mapped. Instead, deep address should be taken for what it is: an

emergent global logic for the de-differentiation of things and events by their common entry into a common, artificial platform of identification and exchange. And for this already and without decoration, it already represents a sufficiently disruptive and provocative aspect of The Stack infrastructure and its relation to the omnivorousness of Anthropocene capitalism (as well as to the fragility of the totalities that its growth program composes for itself and which may prove its undoing). See Alexander R. Galloway, "The Poverty of Philosophy: Realism and Post-Fordism," *Critical Inquiry* 39, no. 2 (2013): 347–366, doi:10.1086/668529, and Reza Negarastani, "The Non-Trivial Goat and the Cliffs of the Universal" (lecture at the Abrons Playhouse, New York, November 15, 2012), and my own "Some Trace Effects of the Post-Anthropocene: On Accelerationist Geopolitical Aesthetics," 2013, <http://www.e-flux.com/issues/46-june-2013/>.

41. I refer to Latour's well-known "parliament of things": *We Have Never Been Modern* (Cambridge, MA: Harvard University Press, 1993). While despecializing modernist divisions of scientific and interpretive labor is laudable, a "parliament" is an inadequate politico-architectural metaphor for the designability and composability of the tumult he describes.

42. Gean Moreno, "Notes on the Inorganic, Part I: Accelerations," *E-Flux*, no. 31 (January 2012), http://worker01.e-flux.com/pdf/article_8946775.pdf.

43. Galloway comments on the tactics of black bloc juxtaposed with the black box, the opaque machine that affects the world within open explication. The goal of black bloc is not to redraw the map or to take a different position within an alternative territory, but to refuse formal appearance altogether, to exist and operate under a cloak of aterritorial nonaddressability. See his "Black Box, Black Bloc," in *Communication and Its Discontents: Contestation, Critique, and Contemporary Struggles*, ed. Benjamin Noys (New York: Autonomedia, 2012), 237–249. With far blunter wit, Brian Holmes articulates resistance to the prevailing "technosemiotic order," its molar enclosures, and their "cybernetic lines of latitude and longitude ... speak[ing] of exploration and conquest, of industry and trade." These can be eluded through the cultivation of alternative schizoanalytic cartographies, and toward this, he warns us solemnly that we must "Escape the Overcode" See <https://brianholmes.wordpress.com/2009/01/19/book-materials/>.

44. On the Aozaki project, see Nobutaka Aozaki, "Value_Added #240950," 2012, http://www.nobutakaaozaki.com/value_added.html, and his "Artist Project/Value Added: # 240950 DM NOSLT WHL KRNL CR," *Cabinet*, no. 47 (Fall 2012).

45. Aozaki's project is also a nice demonstration (and inversion) of the "double spend problem" that could plague any digital or networked currency: without discrete physical tokens that guarantee each unit of value is in only one place at a time, how to ensure that the same "dollar" is not spent more than once at a time? Blockchains offer the solution of distributed clearing of all transactions so that bitcoin's realm of value-representation remains uncompromised. It does not, however, solve the "problem" that Aozaki introduces, which we could perhaps call the "double acquire problem."

46. Rachel Swaby, "Big Ideas: Spray Wi-Fi Hotspots on to Everything," *Wired UK*, March 30, 2013, <http://www.wired.co.uk/magazine/archive/2013/03/big-ideas/spray-wi-fi-hotspots-on-to-everything>.

47. Thanks to Aaron Fooshee, a student in a workshop I taught at Art Center College of Design in Pasadena, California, in 2013 for exploring the idea of object-to-object spam.
48. See my "Root the Earth: Peak Oil Apophenia," in *Leper Creativity: Cyclonopedia Symposium*, ed. Ed Keller, Nicola Masciandaro, Nicola Masciandaro, and Eugene Thacker (Brooklyn, NY: Punctum Books, 2012).

Interface Layer

1. Deleuze, Gilles. "The Brain Is the Screen: Interview with Gilles Deleuze on 'The Time-Image,'" *Discourse* 20, no. 3, Gilles Deleuze: A Reason to Believe in This World (October 1, 1998): 47–55. See also Gregory Flaxman, *The Brain Is the Screen: Deleuze and the Philosophy of Cinema* (Minneapolis: University of Minnesota Press, 2000).
2. A widely quoted quip from McLuhan, with numerous sources in print, many quoting television appearances.
3. We should be careful, as William James once said, that the word *dog* does not bite.
4. It's always possible that a technical relay between button and effect is in good working order but that the appropriate semantic association is scrambled, such as when the button that says Open in fact closes a door, or the knob for watering flowers opens the garage door instead. Jacques Tati's films elevated the lampooning of these interfacial crossed wires into his own conservative lament against modernity.
5. Conversely, phatic interfaces—those that interstitially interrupt attention, such as a phone ring—as well as geolocation tracking of devices revealing *User* trajectory, like a tagged shark, are examples of interfaces that the *User* accesses The Stack, but interfaces through which The Stack accesses the *User*.
6. The etymology of *interface* dates the word back only to the late nineteenth century, and is now defined by the *Oxford English Dictionary* as "a surface lying between two portions of matter or space, and forming their common boundary." "interface, n.," OED Online, July 2014, Oxford University Press, <http://www.oed.com/view/Entry/97747?rskey=BpuToj&result=1&isAdvanced=false> (accessed July 12, 2014). Only much later does it come to mean components in a machine, then specific components in a computing machine, and finally the tools used to engage with a computer. In fact, each of these connotations is still active in our use in regard to the *Interface* layer of The Stack. It is interesting nevertheless that it took the emergence of computation for the interfaciality of the world to warrant a separate disciplinary mode of design. Now the program of interface design is to expand (some would say inflate) its portfolio toward the diagnosis and designation and all manner of complex systems in the physical world, including common boundaries in the physical world. See my "What Do We Mean by 'Program'?" *Interactions: Experiences, People, Technology* 15, no. 3 (2008), 20–26. See also <http://www.bratton.info/projects/texts/what-do-we-mean-by-program/>.
7. This definition is drawn from my introductory remarks at Ambient: Interface, the 54th Annual International Aspen Design Conference, which I cochaired with Christian Moeller in 2005.

8. For a much detailed elaboration of these different performative typologies of interfaces, see my "All Design Is Interface Design" (presented at SoftWhere, University of California, San Diego, June, 25, 2008). See <https://www.youtube.com/watch?v=MSoGFzLjLYQ>.
9. Michel Serres and Peter Hallward, "The Science of Relations: An Interview," *Angelaki: Journal of the Theoretical Humanities* 8 (2003): 227–238, doi:10.1080/0969725032000162675.
10. "Nicolelis Lab," <http://www.nicolelislab.net/>.
11. Brian Massumi, "Sensing the Virtual," *Hypersurface Architecture*, ed. Stephen Perrella, *Architectural Design* (Profile no. 133), 68 (May-June 1998): 16–24.
12. In this conjunction of a generalized interfaciality with the technogenesis of the human form, the reference is, in very different ways, related to the work Gilbert Simondon and Bernard Stiegler, but recall also Maurice Merleau-Ponty's discussion of the cane becoming part of the body of the person who uses it to sense the world.
13. Lev Manovich, "Cultural Software, Introduction to Software Takes Command," July 2011, <http://manovich.net/content/04-projects/068-cultural-software/67-article-2011.pdf>. Bruno Latour, Pablo Jensen, Tommaso Venturini, Sébastien Grauwin, and Dominique Boullier, "'The Whole Is Always Smaller Than Its Parts': A Digital Test of Gabriel Tardes' Monads," *British Journal of Sociology* 63 (2012): 590–615, doi:10.1111/j.1468-4446.2012.01428.x.
14. Peter Galison, "The Lives of Images: Peter Galison in Conversation with Trevor Paglen," *Aperture* 21 (Summer 2013).
15. Like most visual economies of love or war, this depends on the identification of "objects of interest." See "Cyborg Astrobiologist Put Through Its Paces in West Virginian Coalfields," *MIT Technology Review*, September 24, 2013, <http://www.technologyreview.com/view/519576/cyborg-astrobiologist-put-through-its-paces-in-west-virginian-coalfields/>.
16. John Underkoffler's work on large-scale gestural interface systems has helped define this avenue of design research.
17. "So the word habit, from *habere*, signifies corporeal possession, the having or wearing proper to body, which is conspicuously demonstrated by the hand as an instrument of possession operating in concert with the overcoming of inside/outside distinctions proper to consciousness." Nicola Masciandaro, *Come Cosa Che Cada: Habit and Cataclysm, or Exploding Plasticity* (New York: TPSNY/Erudio Editions, 2010).
18. What groups these together is the use of the motor body itself as a signifying machine, not a source from which a signifying trace remediates between body and machine. The model is kind of an inversion of modern dance notation systems, which code the slightest gesture with incredible nuance and flexibility.
19. I should explain this folding/unfolding allegory in more detail. The "Thing" is, at least in the German, a "gathering." Invoking this etymology, Bruno Latour extends Heidegger's four-foldedness of *the thing* into new domains. We could say, however, that the interfaciality of a thing inverts the gathering and its network of relations. According to the Latour-Heidegger story,

drawn from Heidegger's 1950 essay, "Das Ding," and Latour's recent essays on the "parliament of things," a thing is an assemblage or index of those actors and forces that gave rise to it, which are combined and folded within one another in marvelous ways to result in a given thing. The "thing," however stable or temporary, gathers its particular forms and forces of earthly production into itself and presents them (each one of these—sun, water, metal, work—is still present in the thing) toward a new use or encounter. Conversely, the interfaciality of a thing inverts the direction of that gathering. In connecting one thing to another by remote control, by action at a distance, the interfacial thing unfolds out toward the world of other things in looping cybernetic circuits of relay and interruption. It doesn't fold in; it explodes out. The unfolding, degathering interfaciality of the thing is equal and opposite to its infolding gathering as assemblage. See Martin Heidegger, "The Thing," in William Lovitt, trans. and ed., *The Question Concerning Technology and Other Essays* (New York: Garland Publishing, 1977), and Bruno Latour, *We Have Never Been Modern* (Cambridge, MA: Harvard University Press, 1991).

20. And before this, the network city was already well understood. The Romans, and the informational city by French pneumatic tube engineers who largely perfected the point-to-point packet, switched distribution analog information units. By the 1960s, continental-scale computational network systems, such as the SAGE early warning system, suggested more comprehensive transformations of urban pathways and partitions according to information processing perspectives, especially in cinema and architecture. A short and scattered list might include Jean-Luc Godard's *Alpha 60* (1965), overseeing a future Paris in Alphaville; Dennis Crompton's *Computer City* (1964); and John McHale's *2000+* (1967). All are part of a milieu popularized by Marshall McLuhan's publication of *Understanding Media* in 1964, which made the redefinition of the city into a landscape of smart networks, informational prosthesis, a cocktail party commonplace. That figure of the city, less a vast industrial machine than an unfolding collective sensory apparatus, couched many of the important cinematic projects of the time, from Stan Van Der Beek intermedia experiments to Gene Youngblood's expanded cinema; they explored the architectural potential of cinema as an architectural material and the urban environment as a cinematic surface. See also the early music video for Pierre Henry, "Psyche Rock," 1967, http://www.dailymotion.com/video/xcjrv_pierre-henry-psyche-rock_music.

21. The ambition of the BioBricks Foundation is to introduce general-purpose modular blocks of DNA for do-it-yourself biotechnologists. See "About BioBricks Foundation," <http://biobricks.org/about-foundation/>.

22. The resolution of real events in the physical world will be determined as much by operations made through software as not, and from within the substance of that real world, perhaps processed by nanometric smart motes and their yet-to-be-invented atom-scale effectors, to remote sensing and management through various sensors and interfaces. If so, then the implicit or explicit association of the digital with the virtual and the virtual with the immaterial or unphysical (and, conversely, the analog with the actual, material, and physical) is well beyond the point of impasse. More pressing is the physicality of computing and the materiality of the virtual and the actuality of digital/analog as state conditions of the same matter. This holds for architectural and urban-scale matter as much as any other, and so the question of architecture at the edge of physicality is less interesting if it underwrites interest and evaporation of interest in physical

systems through a relentless investment in computation as a numinous and gnostic portal to pure algorithmic autonomy, or some opposite thereof. Better to serve the physicalization of urban material as the computational figuration of what we used to call virtual *toward the physical*, toward data in-the-wild and as-the-wild.

23. This connotation of “hyperobject”—as in hyperlink, a human-computer interaction mechanism in the guise of a physical object—is very different from that already defined by Timothy Morton in *Hyperobjects: Philosophy and Ecology after the End of the World* (Minneapolis: University of Minnesota Press, 2013).

24. For this foregrounding of the agency of interfaces, the project that might define the political design ends of the spectrum may be Aldo Van Eyck’s urban playgrounds for children. Thanks to McKenzie Wark for this comparison.

25. “What if the architectonic in Kant were not an overarching system but something that has itself to be constructed anew, in each case, in relation to fresh problems—something looser, more flexible, less complete, more irregular, a free plan in which things hang together without yet being held in place?” John Rajchman, *Constructions* (Cambridge, MA: MIT Press, 1998).

26. As already noted, Koolhaas captured this exact dynamic in his *Delirious New York* study. See Rem Koolhaas, *Delirious New York: A Retroactive Manifesto for Manhattan* (New York: Monacelli Press, 1994).

27. Franco B. Berardi, *Neuro Totalitarianism* (Los Angeles: Semiotext(e), 2014).

28. *Logistics* here refers to both the expert mobilization of things, but also the aestheticized image of mobility in action. For the latter, logistics is a technical imaginary for the world in choreographic motion, an image that in turn becomes a technique for organizing the world as a distributed, generalized complex of distributed, integrated interfaces.

29. A possible methodological framework: Interface design is less about the design of a thing than of a condition of transference (that could become a thing) and can take at least three main forms. First-order interface design produces the conditions of interassemblage between people, things, or places—making it good, smart, fast, flexible, sustainable, and so on. This is how urban planning and public policy are also interface design. Second-order interface design produces images of interassemblage that give order, predictability, and clarity to how people use systems. These images are very powerful guides—so powerful that they really are the interfaces to what they represent. This is how graphic designers are interface designers. Third-order interface design produces the image-instruments of interassemblage that allow for the system to be governed, controlled, and optimized according to plan. These are maps of a system that, because they are interactive maps, become tools to engage that system.

30. For a more in-depth discussion of assemblage not as a rigid system but as a temporally fragile coming together and falling apart at once, see Manuel De Landa, *A New Philosophy of Society: Assemblage Theory and Social Complexity* (London: Continuum, 2009).

31. On the aesthetic engine of cosmograms, see Melik Ohanian and Jean-Christophe Royoux, *Cosmograms* (New York: Lukas & Sternberg, 2005). The visual language of the logistical sublime

has a specific graphical and photographic style. It is a dramatic mix of the now overly familiar landscapes of Andreas Gursky, Edward Burtynsky, Bruce Mau, and Jennifer Leonard, *Massive Change* (London: Phaidon Press, 2005).

32. Keller Easterling's work is paramount in tracking how the logistical aesthetic works itself out through corporate and academic architecture. See Easterling, *Extrastatecraft: The Power of Infrastructure Space* (London: Verso, 2014).

33. "Switches" in this case would include the aggregate number of transistors on all the networked and embedded processors (a kind of cumulative and total Moore's Law of interfacial capacity) but also non-computational interfacial gateways that contribute to the overall flux and flow, and ranging from object-scale to urban-scale to transcontinental-scale.

34. Articulating this insight in every way possible seemed to define fin-de-millennium social theory in relation to the network society, the global city, the information bomb, sociology against society, supermodernism, and so on. See Manuel Castells and Gustavo Cardoso, *The Network Society: From Knowledge to Policy* (Washington, DC: Center for Transatlantic Relations, Johns Hopkins University, 2006); Saskia Sassen, "The Global City: Introducing a Concept," *Brown Journal of World Affairs* 11, no. 2 (2005): 27–43, <http://www.saskiasassen.com/pdfs/publications/the-global-city-brown.pdf>; Paul Virilio, *The Information Bomb* (London: Verso, 1999); John Urry, *Sociology beyond Societies: Mobilities for the Twenty-First Century* (London: Routledge, 2000); and Hans Ibelings, *Supermodernism: Architecture in the Age of Globalization* (Rotterdam: NAI, 1998).

35. "Binding collective representation" is meant in the sense central to the grand unifying social theories of both Emile Durkheim and Niklas Luhmann.

36. On "punctualization," see Bruno Latour, *Reassembling the Social: An Introduction to Actor-Network-Theory* (Oxford: Oxford University Press, 2005).

37. A result examined with nuance by Alexander R. Galloway in his essay "The Unworkable Interface," in his book *The Interface Effect* (Cambridge: Polity Press, 2012), 25–53.

38. For example, the recent editorial work by Manuel Lima and visualization work by Laura Kurgan.

39. There is resonance with Fredric Jameson's discussion of images of totality as an active response to systemic complexity in ways that would contradict the notions that information visualization brings an eclipse of active and prejudiced interpretation (Manovich) and undermines any need for macroscopic and global theories of the social (Latour).

40. The term *utopian imaginary* is used more or less in Jameson's sense of a progressive (if frustrated and sublimated) desire for the comprehension and reform of social totality, especially as seen through speculative science and technological fictions, across all media. Fredric Jameson, *Archaeologies of the Future: The Desire Called Utopia and Other Science Fictions* (New York: Verso, 2005).

41. The design problems related to nonvisual (or least nongraphical) interfaces, such as those conceived for our many ubiquitous computing environments, are less clearly outlined before us

now, especially when these interfaces are employed for the benefit of nonhuman *Users*. When software is embedded within a *User's* physical environment, it becomes part of his habitat and contributes to how he is embodied by and within that habitat. In sociological theory, the term *habitus* has been used, by Pierre Bourdieu and Henri Lefebvre in particular, to name the productive circuit between a contextually rich *habitat* and a disposition of bodily and cognitive habits. In Lefebvre's connotation, *habitus* speaks to how the production of social space is a kind of mimetic extension of bodily movement, a habitual wearing of grooves into the surfaces of the world, which by its material repetition produces the artifacts of habitat. In the plural, such spatial practice results in the channels, monuments, and activities of the city, a collective artifact of spatial life. Among the most important of such collective spatial productions is the border and boundary of the city, the edge system of membranes that governs internalization and externalization. For the individual, *habitus* can also refer to how embodied dispositions become codified into the organization of place and how this comes to reconfigure how they are occupied and programmed in their reflective image. The repetition of habit produces an inscription, a "groove," in the figural contours of the built environment, and in fact it builds the environment precisely through such repetitions, while habitats in turn produce and enunciate themselves through bodies, manifested as habits. Spaces contain and constrain, and are configured by the bodies they constrain. Spaces are not just expressions of embodiment; they also express themselves as and through bodily form (prisoner, worker, individual, mass). Habitats (cage, desk, car, savannah, bed, corridor) condition and are the condition of the production of bodily habits and of the collective representation of those habits fixing themselves as material culture.

In this circuit, Bourdieu identifies a crucial nexus of power. The cultural legitimacy of any sort of regular exercise of power depends on how it can structure a part of society into its own shape, according to its own program, and on its ability to then reproduce itself formally and institutionally. For Bourdieu, that reproduction decodes dynamics of social class, and certain patterns of cultural capital—access, expertise, and information—replicate themselves over generations. The sociological tradition from which Bourdieu worked understood technology as only enabling or reflective of more essential social dynamics, whereas my own would situate as being indissoluble from the genesis of complex material cultures ("social" and otherwise). Today the reflexively reinforcing circuits of *habitus* are not only organized by software; they are also physically composed of software, literally built out of software-mediated interactions. In the activation on ambient interfacial fields of everyday life, software participates on both the habit *and* habitat sides of the equation. As computation becomes an increasingly generic property of objects, software envelops us with no greater novelty than electricity did decades before. In the interface's pre-defined terms of action—the dispositions of inhabitation that it presents, on a screen or through an object—software affords a reproducible form of habit, inhabitation, and practice. Between *Users*, differential access to certain interfaces in certain combinations comes to define their individuated biographies within the wider production and reproduction of social capital and as a function of the interfacial regimes that both consolidate and disseminate power. The *Interface* layer of The Stack, especially as habitat, is a medium of cultural, technical, symbolic, and economic capital at once. As played out every second, from Bangalore to Boston, software acumen is also access to the dispositions of practice it embodies, which in turn compose access to the frames of reproductive capital-formations they afford.

42. The App's real installed size varies somewhat with each device.
43. See for example the Qualcomm Tricorder XPrize. <http://tricorder.xprize.org/>. From the site's promotional copy: "Imagine a portable, wireless device in the palm of your hand that monitors and diagnoses your health conditions. That's the technology envisioned by this competition, and it will allow unprecedented access to personal health metrics. The end result: Radical innovation in healthcare that will give individuals far greater choices in when, where, and how they receive care."
44. One version of this platform of and for nonhuman *Users* of Apps and App markets is partially articulated as the industrial Internet. See Jon Bruner, "Defining the Industrial Internet," *O'Reilly Radar*, January 11, 2013, <http://radar.oreilly.com/2013/01/defining-the-industrial-internet.html>.
45. A variation perhaps on the death of affect. See Boris Groys, "Religion in the Age of Digital Reproduction," *E-Flux*, no. 4 (March 2009), http://worker01.e-flux.com/pdf/article_49.pdf, and Groys, *Google: Words Beyond Grammar* (Hatje Cantz: Berlin, 2012).
46. During a personal conversation about this essay, "Religion in the Age of Digital Reproduction," Boris Groys offered an argument regarding what he took to be the political theology of Google. It was an anecdote about some of his Islamic students in Germany. His argument, developed in this short essay "is that the digital logic of infinite reproducibility (not of a substantial image as in mechanical reproduction, but of a binary substance that is itself nothing but a potential formal pattern) is well suited to a flattening of the affect of religious experience into a kind of rote, mechanistic exercise whereby the mere execution of a ritual program constitutes a supposedly successful theology. Most of his students, he said, had not really studied the Koran nor, he presumes, experienced much of anything we might take to be an ecstatic vision of transcendent truth through it or any other religious medium. Instead those who fancy themselves radicals merely download entire radical websites, largely unread, and store them on their laptops. The implication is that they needn't be enthralled by the theocratic utopian energies of the actual particulars, but merely to possess the imagery-discourse there contained, regardless of any unnecessary affective experience, and that this is not only sufficient but preferred. Simpler.

Groys's remark, however, as distant from or attuned to the actual intentions of his students it may be, is telling in the intellectual attitudes that it inverts. Foucault's fascination with the function of Islam for the Left, not so much as a model of communitarian equity but simply as a wedge in the door keeping the conceptual possibility of radical political difference from slamming shut, was to see in political Shi'ism a heterological alternative to the cynical European Liberal *doxa*. It is also a (perhaps more learned) variation on the predictable tendency to romanticize (both positively and negatively) the presumed depth of faith and conviction of jihadists, radicals, and especially suicide bombers. For this, "we" who are too cynical to believe in anything other than fatal self-interest and the impossibility of something other than capitalist realism are in awe of the resolved single-mindedness of "their" unwavering fanaticism. Their naiveté, so unencumbered with the burden of postmodern nuance and ambivalence, signifies the remaining possibility of actual, ecstatic effervescent experience in the direct midst of global malaise. As Slavoj Žižek jokes, "they have faith for us" in perfect inverted symmetry of our own secular disenchantment. But this is perhaps very wrong. Quite apart from Mumbai, the suicidal assignment can be seen as the

expression not of certainty but of doubt, not as sacrifice but as evasion. While the bombers themselves have doubts, their suicide becomes a way of confirming their belief: "If I kill myself in this way, I can calm my doubts and prove, even to me, that I do believe." The act does not happen because of the belief; the belief is retroactively testified by the reality of the act: from radical conviction to autonomic nihilism to an eventual leap of faith.

Groys had developed the relationship between this tautological automatism and digital media. He writes, "The modern age has not been the age in which the sacred has been abolished but rather the age of its dissemination in profane space, its democratization, its globalization. Ritual, repetition, and reproduction were hitherto matters of religion; they were practiced in isolated, sacred places. In the modern age, ritual, repetition, and reproduction have become the fate of the entire world, of the entire culture." Our question then is whether this constitutes something like a ubiquity or dissolution of the utopian along with a ubiquity and dissolution of the religious culture within global network. Groys's position is affirmative, but for a particular version of what the utopian means that is in some ways the opposite of Adorno and Jameson's uses. "The significance of the Enlightenment was not so much that it resulted in the complete disappearance of religion, but that religion became a matter of private choice, which then resulted in the withdrawal of religion into the private sphere. In the contemporary world, religion has become a matter of private taste, functioning in much the same way as do art and design." And in this, we would argue, political theology is linked more directly to the politicization of affect as the basis of its legitimacy. For Groys, this is linked intrinsically to the solipsism of the Internet unwinding the reason of deliberate authority, as "the Internet favors private, unconditional, sovereign freedom over scientific, conditional, institutional freedom." In other words, "The slogan of the previous age was, 'The private is political, whereas the true slogan of the Internet is, the political is private.' See Groys, "Religion in the Age of Digital Reproduction."

47. The effect is drawn not only from the solipsism of information and opinion but from an automatism necessarily at work in the algorithmic recombinancy of the digital. Groys sees in this a dense synthesis of the ritual logic of religion: "I would argue, however, that religion—any religion—is not a set of opinions but primarily a set of rituals, and that the religious ritual refers to a state in which there is a lack of opinions, a state of opinionlessness—a *doxa*—for it refers to the will of the gods or of God ultimately concealed from the opinions of mortals." The ritual and its repetition are not executed as the spontaneous expression of numinous insight but, "as such, is neither true, nor false. In this sense it marks the zero point of freedom of opinion, that is, freedom from any kind of opinion, from the obligation to have an opinion." And isn't it this opposition between what two experiences of the religious—the repetition of the spirit and the meaningful core of a religious concept on the one hand, and the mechanical carrying out of formal recitation on the other, "between living spirit and dead letter"—that structures our discourses on religion? What is the political form of this recitation? "This is precisely what fundamentalism is, namely, the insistence on the letter as opposed to the spirit." Whereas for Adorno and Jameson, the utopian is that which properly precedes and exceeds any possibility of positive inscription, Groys demands instead that "it is for this reason that religious fundamentalism has always possessed a revolutionary dimension: while breaking with the politics of spirit, that is,

with the politics of reform, flexibility, and adaptation to the zeitgeist, it goes on to substitute for this politics of spirit the violent politics of the letter.”

With the reality of planetary computation and the governmental challenges it poses, what do we make of the idea that “religious ritual is the prototype of the mechanical reproduction that dominated Western culture during the modern period, and which, to a certain degree, continues to dominate the contemporary world. What this suggests is that mechanical reproduction might, in its turn, be understood as a religious ritual. It is for this reason that fundamentalist religious movements have become so successful in our time, for they combine religious ritual with mechanical reproduction”? Is this to contradict Baudrillard’s insistence that there can be no utopian function with the realization that there cannot not be actualized utopian space, but that the utopian is pure function and that pure function is utopian? For Groys, any affect of the projective utopian image is not the solemn duty of *religio*, the sacrality of the return within religious mediation, but in this digital nihilism a response drawn only from the desubjectifying solipsism of the instant sensation of repetition, the diagram of rotteness, and the calming abdication that comes with machinic iteration. See Groys, “Religion in the Age of Digital Reproduction.”

48. For example, *Can Dialectics Break Bricks?* (directed by René Viénet, 1973), though it is Atom Egoyan and Ian Balfour who have provided the most applicable analysis of the subtitle and the production and mitigation of the experience of a “foreign” image, in Atom Egoyan and Ian Balfour, *Subtitles: On the Foreignness of Film* (Cambridge, MA: MIT Press, 2004).

49. Christian Metz, *The Imaginary Signifier: Psychoanalysis and the Cinema* (Bloomington: Indiana University Press, 1982).

50. This is the basis for seeing the diagrammatics of information visualization operating as a utopian-projective discourse for the image-interface yet to come, as the deepest worldly recombinancy shifts from the linear temporal unfolding of metahistory to the nonlinear spatial unfolding of meta-interfaciality.

51. It’s impossible then to avoid the comparison with Žižek’s well-worn reading of John Carpenter’s science-fiction film *They Live* (1988) in which certain characters can, by wearing special ideology-filtering Ray-Bans, perceive that Earth (or Los Angeles, at least) is controlled by skinless reptile aliens and that humans live in a state of somnambulant delirium. See, for one example, Slavoj Žižek, “Through the Glasses Darkly,” *In These Times*, October 29, 2008, http://inthesetimes.com/article/3976/through_the_glasses_darkly. Regarding AR then, the wearing of glasses instead of allowing us to wake from “false consciousness” allows users to choose which subscription hallucination they prefer. After Žižek, we might say, “Yes, AR looks as if people are strapping ideological reductions onto their face, but don’t be fooled; they really are.”

52. It is said that at the end of the rainbow, there is a pot of gold. Where that end is, however, poses a problem, since it is different for every observer. The rainbow is actually a distorted virtual image of the sun. Nevertheless, it looks like a real object. Could it be that similar distortions apply to other “real” objects? Otto E. Rossler and Peter Weibel, “Our Rainbow World,” in *The World from Within—Endo and Nano: Ars Electronica 92*, ed. Karl Gerbel and Katharina Gsöllpointner (Vienna: PVS Verleger, 1992). Also republished in Peter Weibel, ed., *Olafur Eliasson: Surroundings Surrounded—Essays on Space and Science* (Cambridge, MA: MIT Press, 2001), 504.

53. See Kietchi Matsuda's cinematic visualizations of AR's cinematic visualization of everyday habits/habits, Augmented Kitchen and Augmented City: "Augmented (hyper)Reality: Augmented City," <http://www.keichimatsuda.com/augmentedcity.php>.

54. *Ingress*, <https://www.ingress.com/>.

55. Terrorism's symbolic economy not only seeks out targets with some meaningful and representative value, but in doing so, it also imbues certain sites with symbolic currency through the act of design violence itself. Game scenarios like *Ingress* validate the insight that indeed "everywhere is a target, and everywhere is symbolic." See also Sam Jacob's essay in *Domus*, <http://www.domusweb.it/en/op-ed/everywhere-is-a-target-everywhere-is-symbolic/>.

56. The age of television, the *Apollo* program, and baby boomers brought us Scientology, Esalen, and televangelism. What bizarre new theological regimes will AR bring?

57. See my "On Geoscapes and Google Caliphate: Except #Mumbai," *Theory, Culture and Society* 26 (2009): 329–342.

58. The other "smart mob" of nonstate actors in the Mumbai attacks were those trapped by the chaos and carnage in hotel rooms, closets, cafés, and whatever other refuge they could find. The only lifeline available to many was their mobile handset, and in the crisis, they put these to use to coordinate their defense and flight. As events unfolded, I sat in my office in California watching the #Mumbai Twitter feed chronicling real-time first-person reports of what was happening: "hospital update: shots still being fired," "also Metro cinema next door," "blood needed at JJ hospital." "We're in Ruggate Cafe, where should we go?" Mainstream media outlets were left flat-footed, their anchors just repeating both fact and rumor from these feeds on air and in print. Interestingly the US military almost predicted this. The army issued a report the month before warning that "al-Qaeda-like" terrorists might use Twitter to coordinate an attack. Instead Twitter became a way to mobilize a response to terrorist violence (reconnaissance, situational awareness, logistics) by civilians. This telematic stigmergy was most definitely not included in use cases that Twitter concocted in advance of their launch, but is as instructive a political, urban, geographic "accidental" technology as Lashkar-e-Taiba's appropriation of Google Earth, satellite phones, and GPS.

59. In his short story "Maneki Neko," Bruce Sterling describes the everyday world of a Japanese "entity" that might be described as the mixture of a cell-phone-based AR game, an omniscient artificial intelligence, a karmic futures market, and a disruptive new cult theology: navigation, software, religion. Bruce Sterling, "Maneki Neko," *Lightspeed Magazine*, no. 11 (April 2011), <http://www.lightspeedmagazine.com/fiction/maneki-neko/>. The flabbergasted Japanese-American cop trying to break up the ring chastises her captive: "We computer cops have names for you kinds of people. Digital panarchies. Segmented, polycephalous, integrated influence networks. What about all these free goods and services you're getting all this time?" No reply. "Do you pay taxes?" No reply. She barks: "Well, your network gift economy is undermining the lawful, government-approved, regulated economy!" "I'm just living my life," he sheepishly replies just as whatever it is steers a superswarm of mayhem down on the cops, strangers instructed to mob their escape routes, automatic doors closing, phones and elevators inexplicably going dead. The whole digital

world it seems is accessible to this unnamed sentient agency to decide and keep benevolent order, instructing strangers to deliver precise gifts to each other at just the right moment or foil dumb-founded IT security police.

In a blog entry about iTACITUS Reality Filtering, a European Union-commissioned, intelligent tourism project that provides a smart-phone-based AR narrative to many of Europe's key heritage sites, Sterling posts, "Fantastic to see history made so atemporally flexible, eh? Since it's necessary to get cynical ('Always Look at the Underside First') let's get cynical about this technology and it's trajectory. This 'true glimpse' of history won't sell well, compared to Disneyfied 'untrue glimpses.' Wherever there is 'Intelligent Tourism,' brutal, vulgar and stupid tourism follows fast on its heels! Soon we'll have some theme park Creationist Augmented Reality, where you can visit the Grand Canyon and see pre-Noachian people pan-frying trilobites and riding dinosaurs." See Sterling's post, "Augmented Reality and Atemporality," *Wired*, August 15, 2009, <http://www.wired.com/2009/08/augmented-reality-and-atemporality/>.

60. The App has received considerable mainstream press. See Amy O'Leary, "In the Beginning Was the Word; Now the Word Is on an App," *New York Times*, <http://www.nytimes.com/2013/07/27/technology/the-faithful-embrace-youversion-a-bible-app.html?hp>, and Nir Eyal, "This Mobile App Is Already on 100 Million Devices But Its Goal Isn't to Make Money," *Quartz*, July 25, 2013, <http://qz.com/107969/this-mobile-app-is-already-on-100-million-devices-but-its-goal-isnt-to-make-money/>.

61. Regardless of the computational architecture of The Stack, geoscapes do not in principle require anything like modern interfaces to organize geographical antagonisms. Surely maps are already precomputational interfaces that conceived a world image and world space striated by longitude and latitude possible for their sacred and secular imperium, and which by their notation indexed what spaces were full and which were empty, and how to get there from here. In the latent theological imperative of AR, are nothing so much as late medieval afterimages now ported to the optical technologies of artificial interfacial vision?

62. This public, huddled around their transistor radios, is not so unlike the bourgeois family huddled around the radio in *May Fools*, Louis Malle's 1990 film about May '68, or the thousands of soixante-huitards in the streets of Paris listening to broadcasts from Radio Luxembourg at the beginning of May, and then to de Gaulle, once more, on television at the beginning of June. *May Fools* (directed by Louis Malle, Pyramide Distribution, 1990).

63. In one key scene, a little boy commandeers the French army's public address system to rally his beleaguered countrymen, assuming the mantle of the Voice of Fighting Algeria, as the VFA commandeered the narrative of democratic self-determination.

64. Frantz Fanon, *A Dying Colonialism* (New York: Grove Press, 1967), 84–88.

65. The modeling of "persuasive interfaces" has been a particularly successful form of interaction design consulting (in financial terms) promising to train Users and consumers away from undesirable actions (eating too much) and toward desirable ones (buying stuff). Far too many evangelize this research area with a startling lack of self-awareness and appropriate scope. In many cases (surely not all), the conclusions on offer may resemble, to the untrained eye, plain-old

behavioralist microeconomics with all its shallow psychologisms intact, now dressed up in the millennial business jargon 2.0 of digital self-actualization.

66. "In mid-2014, the group released a video entitled 'The End of Sykes-Picot' featuring an English-speaking Chilean national named Abu Safiyya. The video announced the group's intention to eliminate all modern borders between Islamic Middle Eastern countries; this was a reference to the borders set by the Sykes-Picot Agreement during World War I." See Global Islamic Media Front (GIMF), Wikipedia, October 4, 2014, [http://en.wikipedia.org/wiki/Global_Islamic_Media_Front_\(GIMF\)](http://en.wikipedia.org/wiki/Global_Islamic_Media_Front_(GIMF)).

67. This is so even if those narratives are actually based on the postnarrative aesthetics of databases, as developed, for example, in Hiroki Azuma, *Otaku: Japan's Database Animals* (Minneapolis: University of Minnesota Press, 2009).

68. These examples chosen should in no way be taken to imply a unique association between Islam and the sort of politico-theologic violence described. Certainly any variant of Abrahamic monotheism could offer up case studies for us. There are other research projects that examine the relationship between Islam and the GUIs that are much more rigorous than my scans of convenience. For example, Laura Marks's work on Islam and interfaces is instructive of the specific relationship between Islamic modes of art and inscription and the nested swirls of intra-signification in GUIs. See her *Enfoldment and Infinity: An Islamic Genealogy of New Media Art* (Cambridge, MA: MIT Press, 2010). Construed in the context of this essay, it would suggest that the Islamist activation of the interfacial image as a geo-graphic medium is less a modern appropriation than a historical continuity of formal visual syntax "in which image, information, and the infinite interact: image is an interface to information, and information (such as computer code or the words of the Qur'an) is an interface to the infinite." She writes, "An aniconic turn is stirring the contemporary visual and media arts. Less and less is present to perception; more and more is latent, in quiet surfaces that seem to be 'hiding something in the image.' The latent image waits to be 'unfolded,' either subjectively, by the viewer, or by the force of its interior logic. Figural images are increasingly being subordinated to information, performativity, communication, and other relatively nonvisual contents. This contemporary aniconic tendency, a general movement in the arts of information societies, occurs particularly with computer-based art. One of the origins of this aniconic tendency in contemporary art is the influence of Islamic art and thought on Western modernism. Fascinating subject though it is, the Islamic genealogy of Western modernism is not my focus in the present essay. It does, however, inform my claim here that the parallels between tendencies in contemporary computer art and tendencies in classical Islamic art are not happenstance but the manifestation of historical connections. In turn, this Islamic genealogy of Western modernism should make it possible to examine contemporary computer-based art in light of the impressive variety of philosophical questions and aesthetic solutions found in the varied works of Islamic art of past centuries."

69. Consider by analogy the strange story of three schizophrenic patients who all believed themselves to be Jesus Christ and were placed in the same room to proclaim their divinity to one another. Milton Rokeach, *The Three Christs of Ypsilanti: A Psychological Study* (New York: Knopf, 1964).

70. Is it curious that Google Earth and Maps, perhaps the most aggressively secular, pluralistic, universalizing cosmopolitan mapping technology realized to date, would serve at the center of this antisecular, antidemocratic politico-theological paroxysm? The attacks in Mumbai were, in the parlance of counterinsurgency, both irregular and asymmetrical. They were irregular in that the combatants were apparently armed civilian tourists rampaging through civilian spaces until the siege of uniformed men turned up, and asymmetrical in that the city (its buildings, its tourists, its state institutions) was assigned characterization by these armed tourists in a fight to which they did not know themselves enrolled. (Perhaps this is one social definition of terrorism: war fought against enemy-people who do not consider themselves enemy-combatants, and then as well largely against their architectural habitat as much as their persons.) Within this, the Mumbai event was an unwelcome innovation on more than one level. It was a highly coordinated but direct personal attack on the soft, leisurely substance of civil society more than on hard military or politically symbolic targets, looking more like what the Malay and Javanese call *amuk* (amok), than any Clausewitzian opposition of equals. Second, we see the strategic employment of locative social media and personal mapping technologies for the C3 (command-control-communicate) project of mayhem. It is less Netwar (Samuel Weber's term; such as the pulsing of logistics of a denial-of-service attacks on Estonia's systems by Russian nationalists) than of a social/locative media-enabled swarming maneuver, both of and on the city engaged as itself a network of real and symbolic interfaces and here overrun by the capacities of real-time, collaborative situational awareness.

It precedes the Arab Spring and the Google doctrine by a few years, but it may represent a more essential lesson regarding the conjunction of mobile computing and urban spatial politics. A major source of unease (if not shock) for many in the liberal West was the souring of the Thomas Friedman-esque supposition that the cosmopolitan cognitive apparatus that is Google Earth must surely provide a world picture that is so open, objective, materialist, dialogic—and perhaps because so absent of visible human bodies that might invite contentious biopolitics—that it could not possibly be compatible, interoperable, instrumental with the closed, naturalist, idealist imagined collective geography of jihadist Islam. Isn't Google Earth exemplary of all that makes the secular, technological pluralism of the West intolerable to fundamentalist institutions? It is a blank, purified vision of a planet somehow constructed as an objective integrated context onto and into which history might work, and simultaneously agnostic as to how anything arrives in its place or why. The jolt invited confused speculation about how "a new reality" in the spatial warfare of globalization had revealed itself: "they" are not immune to "our" most central terms and things because our modernity is also "theirs." "We do not control even what we control," goes the lament.

71. Many of the most impressive interfaces are seen in science-fiction movies where they play a starring role to draw out the contours of fictional worlds. The Los Angeles-based studio oooii has developed many of the best. See <http://www.oooii.com>. Earlier historical examples of "future interfaces" can be found at the blog Paleofuture. The shift seen here in pop futurist media from pulp stories and architectural drawings to corporate-funded users from tomorrow is telling in and of itself. In the early 1990s, I wrote about a particularly cringe-worthy video, *Connections: AT&T's Vision of the Future*, a story about how videoconferencing, fashion avatars, reversed-translation software, and holographic visualization will provide for so many good things: finding a good

spouse, resolving intergenerational conflicts, not to mention architectural preservation. More recent examples focus on future health care, placing more attention on the soft pastel palettes and extra-light typefaces to suggest a world in which better UI is part of a safe, affluent lifestyle, and a central focus for domestic interior design. Health care is remade as a project of constant real-time self-regard and expert information management. Here the principal promise and achievement of the interfacial regime is to seal the biological habitat, policing risk and disorder with graceful gestures and visualizations. For a useful index, see Nelson Shedroff and Christopher Noessel, *Make It So: Interaction Design Lessons from Science Fiction* (Brooklyn, NY: Rosenfeld Media, 2012).

72. For a particularly beautiful example of a projective augmented reality dreamworld-interface-geography, see Factory Fifteen, "GOLDEN AGE—SOMEWHERE," <http://www.factoryfifteen.com/7936/152396/home/golden-age-somewhere>.

The process by which software comes to configure *User* cognition is familiar to anyone who has taken the time to learn a particularly difficult application, but the principle holds for everyday tools as well. An architecture student who is struggling to learn Maya will be frustrated by the disconnect between her idea and her ability to realize that idea with the application's powerful but confusing GUI. Over time, however, she begins to internalize the logics of geometry, force, distortion, and iteration that underlie the software. Rotation and manipulation of virtual forms become increasingly habitual. Instead of slowly translating between idea, hand movement, and on-screen outcome, the feedback cycle becomes faster and more intuitive. She is internalizing the cognitive schema of the program, which is now not only expressing her ideas more fluidly; it has begun to inform that ideation process in the first place. As she becomes a more expert *User*, she will learn to "think" in Maya and use the application not just to output her original inspirations but as a collaborator in the design of forms that are possible only once the different abilities of her creative and interpretive intelligence and its machinic intelligence are correlated. That correlation entails a process of forgetting—of forgetting the translation, the hand movements, the arbitrary qualities of how a GUI categorizes possible combinations of gestures made and scripts executed. The software is habituated, and the acumen that allows that software to generate capital for the *User* is itself a function of that habituation. As those habitations become more intense and widely shared—in this case, among a community of designers—the terms, vernaculars, limits, and liabilities of a software application also inform how the *User*-designer comes to see what the software is meant to simulate and describe—in this case, buildings and cities. One comes to look at cities as variations on what can and can't be done with the tools one has habituated for the design of cities.

This is not meant as a criticism of creative ingenuity, rather a simple observation that there is no thinking that is not also topological and, for this, also technological. Software is not unique in this or excluded from it. In relation to Heidegger's notion of "equipment," we also observe that we, the *Users*, "unforget" that habituation when the technology breaks. Busted hardware or glitchy software draws our attention out of focused concentration and back to the strange mechanics of the apparatus, seeing it again a bit more as we did as a beginner. For any interfacial regime, the ambient field of interfaces made available to a *User* is a different kind of "distribution of the sensible," one in which visual and tactical interfaces, both graphical and objective, constitute a habitat of possible applications with which one makes the world in the best way available.

In this, intelligence is objectified in the permutations of action, interaction, calculation, visualization, interpretation, and power that arrange this arrangement. As we see, the *Interface* layer is not only the prism through which the *User* sees and accesses the other layers of The Stack; it is also the membrane throughout which the other layers, the *Cloud* layer in particular, observe and access the *User*.

User Layer

1. Michel Foucault and Michel Senellart, *The Birth of Biopolitics: Lectures at the Collège de France, 1978–79* (Basingstoke: Palgrave Macmillan, 2008).
2. Peter Watts, "The Things," *Clarkesworld Magazine*, no. 40 (January 2010), http://clarkesworld-magazine.com/watts_01_10/.
3. "The high road to thinking no longer passes through a deepening of human cognition, but rather through a becoming inhuman of cognition, a migration of cognition out into the emerging planetary technosentience reservoir, into dehumanized landscapes, emptied spaces where human culture will be dissolved. Just as the capitalist urbanization of labour abstracted it in a parallel escalation with technical machines, so will intelligence be transplanted into the purring data zones of new software worlds in order to be abstracted from an increasingly obsolescent anthropoid particularity." Nick Land, "Circuitries," *Pli: Warwick Journal of Philosophy*, no. 4 (October 1992): 217–235.
4. Benedict Singleton, "On Craft and Being Crafty" (Ph.D. dissertation, Northumbria University, 2014).
5. David A. Mindell, *Digital Apollo Human and Machine in Spaceflight* (Cambridge, MA: MIT Press, 2008).
6. In this regard, Alphonso Cuaron's film *Gravity* (2013) can be read as a very liberal adaptation of Sloterdijk's *Spheres* trilogy.
7. Singleton, "On Craft and Being Crafty."
8. See the discussion of Wilfrid Sellars in Ray Brassier, "Nominalism, Naturalism, and Materialism," and Jon Cogburn, "Ray Brassier on Sellars (hat Tip Leon Niemoczynski)," *New APPS: Art, Politics, Philosophy, Science* (blog), June 13, 2013, <http://www.newappsblog.com/2013/06/ray-brassier-on-sellars-hat-tip-leon-niemoczynsk.html>.
9. Use case scenarios are translated into functional requirements for software and hardware systems according to the demands of informal user-centered design methods, often according to formal systems like UML (Unified Modeling Language) or IBM's Rational.
10. Alan Cooper helped pioneer the use of use case personas for Internet-era GUI design in his *The Inmates Are Running the Asylum: Why High Tech Products Drive Us Crazy and How to Restore the Sanity* (Carmel, Indiana: SAMS Publishing, 1998).

11. Recall Massimo d'Azeglio's quip from 1861, commonly paraphrased as, "We have made Italy. Now we must make Italians."
12. "The Urban Pavilion, World Expo Shanghai: Herman Kossmann," PICNIC, <http://www.picnicnetwork.org/herman-kassmann>.
13. For a historical survey of Sino-futurism in the context of the expo, see Nick Land, *Shanghai Expo Guide 2010* (Shanghai: Urbanatomy, 2010).
14. Agamben quoting Foucault in Giorgio Agamben, *What Is an Apparatus?: And Other Essays* (Palo Alto: Stanford University Press, 2009).
15. Saul Griffith, "PopTech 2008: Saul Griffith" (lecture at PopTech 2008, Camden, ME, 2008), <http://vimeo.com/7081438>.
16. Referring to Roland Barthes, "The Death of the Author," in *Image, Music, Text*, trans. Stephen Heath (New York: Hill and Wang, 1977).
17. Referring to De Landa's definition of an "assemblage," for which a component retains some autonomy that would allow it to participate in other assemblages by realizing a different function.
18. Zoe Kleinman, "Chinese Dad Hires Virtual Hitmen," *BBC News*, January 7, 2013, <http://www.bbc.com/news/technology-20931304>.
19. In a similar vein, see Richard Adhikari, "Art Prof Lets World Peer through His Surgically Embedded 3rd Eye," *TechNewsWorld*, December 6, 2010, <http://www.technewsworld.com/story/71377.html>.
20. *Until the End of the World*, directed by Wim Wenders (Warner Brothers, 1991).
21. See Nicholas Felton's work at <http://feltron.com/>.
22. Gilles Deleuze and Félix Guattari, *A Thousand Plateaus: Capitalism and Schizophrenia* (Minneapolis: University of Minnesota Press, 1980).
23. The overlapping territories between early computer culture and the counterculture imagined the potential in global cybernetics to provide various dissolutions of the self into recursive networks. Fred Turner, *From Counterculture to Cyberculture: Stewart Brand, the Whole Earth Network, and the Rise of Digital Utopianism* (Chicago: University of Chicago Press, 2006).
24. Bruno Latour, "The Tarde Durkheim Debate," <http://www.bruno-latour.fr/node/354>.
25. Jon Cohen, "The Patient of the Future," *MIT Technology Review*, February 21, 2012, <http://www.technologyreview.com/featuredstory/426968/the-patient-of-the-future/>.
26. Antonio Regalado, "Stephen Wolfram Adds Analytics to the Quantified-Self Movement," *MIT Technology Review*, May 8, 2013, <http://www.technologyreview.com/news/514356/stephen-wolfram-on-personal-analytics/>.

27. Scott F. Gilbert, Jan Sapp, and Alfred I. Tauber, "A Symbiotic View of Life: We Have Never Been Individuals," *Quarterly Review of Biology* 87 (2012): 325–341, doi:10.1086/668166.
28. On the use of artificial intelligence to analyze large quantities of health data, see, for example, "Lee Hood Group," Institute for Systems Biology, <https://www.systemsbiology.org/hood-group>.
29. Not so unlike the Earth-figure-cursor rotating its way around the panoramic territory of its own location, leaving a trail of data visualizations along its path in *Exit* visualizations for the Native Land exhibition, discussed below.
30. Gayatri Chakravorty Spivak, *An Aesthetic Education in the Era of Globalization* (Cambridge, MA: Harvard University Press, 2012).
31. A tweet from Xeni Jardin @xeni: "Wondering if (when) a future Son of Sam will blame his evil deeds on a Fitbit he believed to be flashing murderous command prompts."
32. Two thoughts: "I understand why Freud constructed his first psychology on the model of the electrostatisticians. I am not explaining Jules Verne by Freud; I am explaining Freud by the electricity of Verne. It's so much more amusing, and what's more, truer. Verne says the same thing. Verne says that it is the same thing to describe a condenser and to liberate its discharge as to translate a coded message into clear terms. Freud stated it, Verne had already recounted it." Serres, "Jules Verne" (1975); and "We are taught that corporations have a soul, which is the most terrifying news in the world," Deleuze, "Postscript on Societies of Control" (1990).
33. Eduardo Mendieta, "A Letter on Überhumanismus: Beyond Posthumanism and Transhumanism." in *Sloterdijk Now*, ed. Stuart Elden (Cambridge: Polity Press, 2012).
34. Agamben, *What Is an Apparatus?*, 14.
35. Ibid, 15.
36. Ibid, 17.
37. Giorgio Agamben, *The Open: Man and Animal* (Stanford, CA: Stanford University Press, 2003).
38. The currency of mediated prosthesis in the 1960s was by no means limited to McLuhan. John McHale proposed an image of architecture as an assembly of prostheses for plural bodies and compound subjectivities that would, on local and global scales, extend their embodiments into the world into and against its expanded ecologies: "It is not that social life deploys various technologies to sustain itself or that social life can be found within technological space. Rather, social life can only reside in prosthetic accessories. As McHale puts it, man is a social animal only through his extensions." John McHale, *The Future of the Future* (New York: Braziller, 1969). For McHale, modernity is itself a complex of prostheticizations, a global field in which the subjective agency of the human body is extended into a global "house" of communications media, transportation, architecture, medicine, ingestive imagery and instrumentality, and so on. It is both an amplification and a diversification of the organism and the species, "a fundamental transformation of the morphological and social condition of humanity." "The distinction between body and space soon collapses. In ecological terms, human flesh is but a transitional event in the

continuous redistribution of energy." John McHale, *The Ecological Context* (New York: Braziller, 1970). See also Amerigo Marras, *ECO-TEC: Architecture of the In-Between* (Princeton, NJ: Princeton Architectural Press, 1999), 40.

39. Cary Wolfe, "'Life': Neovitalism and Biopolitical Thought" (lecture at the Forum on the Humanities and the Public World, Berkeley, CA, September 15, 2011), <https://www.youtube.com/watch?v=XztJjdLCeRs>. Donna Haraway "From Cyborgs to Companion Species: Dogs, People, and Technoculture" (lecture at the Townsend Center for the Humanities, Berkeley, CA, 2011) <https://www.youtube.com/watch?v=Q9gis7-Jads>. Dominic Pettman, *Human Error: Species-Being and Media Machines* (Minneapolis: University of Minnesota Press, 2011).
40. Garnet Hertz, "Cockroach Controlled Mobile Robot: Control and Communication in the Animal and the Machine," Conceptlab.coma, <http://www.conceptlab.com/roachbot/>.
41. Mary Douglas, *Purity and Danger: An Analysis of the Concepts of Pollution and Taboo* (London: Routledge, 2002).
42. Benjamin H. Bratton, Natalie Jeremijenko, Laura Forland, and Dharma Dailey, *Suspicious Images, Latent Interfaces* (New York: Architectural League of New York, 2009). In this I write that effects such as these are exemplary of "the death of the user" because it puts at stake not how a human might react ethically or unethically toward a situation from her central position in local or smaller systems, but the way in which the ubiquitous, pervasive systems comprise an ecology where parts of the natural system relate and co-govern directly with other parts at a distance without requiring the agency of the human to intervene or mediate. The techno-ecology works without users. We are designing our own abdication.
43. Nanowerk LLC, "Rise of the Ultrafast Machine Ecology," *Nanowerk*, September 11, 2013, http://www.nanowerk.com/news2/robotics/newsid=32214.php?utm_source=feedburner&utm_.
44. *Her*, directed by Spike Jonze (Annapurna Pictures, 2013).
45. American Psychiatric Association, *Diagnostic and Statistical Manual of Mental Disorders*, 5th ed. (Washington, DC: American Psychiatric Association, 2013).
46. Dominic Basulto, "Is the Internet Becoming the Bot Net?," *Big Think*, April 2, 2012, <http://bighink.com/endless-innovation/is-the-internet-becoming-the-bot-net>.
47. In carbon footprinting all things, sentient or dumb, are comparable. The robot replaces the expensive worker, the inexpensive worker replaces the expensive robot, the even more inexpensive desktop fabrication network replaces the inexpensive worker, and so on.
48. See Intuitive Surgical, "Da Vinci ... Changing the Experience of Surgery," Da Vinci Surgery, December 2013, <http://www.davincisurgery.com/>; K. Grant, "MDARS: Multiple Robot Host Architecture," SPAWAR, July 10, 1995, <http://users.isr.ist.utl.pt/~jseq/ResearchAtelier/misc/MDARS%20Multiple%20Robot%20Host%20Architecture.htm>.
49. Interview with Joan Didion in *Shotgun Freeway: Drives through Lost L.A.*, directed by Morgan Neville and Harry Pallenberg (King Pictures, 1995).

50. Reyner Banham *Loves Los Angeles*, directed by Reyner Banham (1972).
51. Benjamin H. Bratton, "iPhone City (v.2008)," in *Digital Cities AD: Architectural Design* 79, no. 4 (2009): 90–97.
52. Elon Musk and SpaceX, "Hyperloop Alpha," August 12, 2013, http://www.spacex.com/sites/spacex/files/hyperloop_alpha-20130812.pdf.
53. Vicky Validakis, "Rio's Driverless Trucks Move 100 Million Tonnes," *Australian Mining*, April 24, 2013, <http://www.miningaustralia.com.au/news/rio-s-driverless-trucks-move-100-million-tonnes>.
54. Bruno Latour, *Aramis, or the Love of Technology* (Cambridge, MA: Harvard University Press, 1993).
55. Sebastian Thrun, "Google's Driverless Car," TED, March 2011, http://www.ted.com/talks/sebastian_thrun_google_s_driverless_car. The relative "autonomy" of the car from the driver is a gradient. The design problem is not one of full autonomy of the car replacing full autonomy of the driver, but of varying degrees of cyborgization, drawing on those with which car culture is already comfortable.
56. Steven Levy, *In the Plex: How Google Thinks, Works, and Shapes Our Lives* (New York: Simon & Schuster, 2011).
57. For those who honestly don't know, the Google driverless car project is a research initiative to develop cars that can autonomously navigate all roads without human steerage (or much of it), using a combination of laser-guided mapping, video cameras, radar, motion sensors, on-board computing, and other tools. Prototypes to date have mostly used a customized Prius, though the company recently announced plans to work with auto manufacturers to build autonomous vehicles to Google's own specifications, and some early products could be commercially available in a few years, if some very wicked problems can be worked out first. On these see Lee Gomes, "Hidden Obstacles for Google's Self-Driving Cars," *MIT Technology Review*, August 28, 2014.
58. Levy again: "Why is OpenFlow so advantageous to a company like Google? In the traditional model you can think of routers as akin to taxicabs getting passengers from one place to another. If a street is blocked, the taxi driver takes another route—but the detour may be time-consuming. If the weather is lousy, the taxi driver has to go slower. In short, the taxi driver will get you there, but you don't want to bet the house on your exact arrival time.
"With the software-defined network Google has implemented, the taxi situation no longer resembles the decentralized model of drivers making their own decisions. Instead you have a system like the one envisioned when all cars are autonomous, and can report their whereabouts and plans to some central repository which also knows of weather conditions and aggregate traffic information. Such a system doesn't need independent taxi drivers, because the system knows where the quickest routes are and what streets are blocked, and can set an ideal route from the outset. The system knows all the conditions and can institute a more sophisticated set of rules that determines how the taxis proceed, and even figure whether some taxis should stay in their garages while fire trucks pass." Steven Levy, "Going with the Flow: Google's Secret Switch to

the Next Wave of Networking," *Wired.com*, April 15, 2012, <http://www.wired.com/2012/04/going-with-the-flow-google/all/>.

59. John Thackara, "Lightness," in *In the Bubble: Designing in a Complex World* (Cambridge, MA: MIT Press, 2005), 18–19: "Power tools are another example. The average consumer power tool is used for ten minutes in its entire life—but it takes hundreds of times its own weight to manufacture such an object. Why own one, if I can get ahold of one when I need it? A product-service system provides me with access to the products, tools, opportunities, and capabilities I need to get the job done—namely, power tools for me to use, but not own."

60. Based on a working presumption that the "glass" in Google Glass—or some daughter technology with longer-term traction—would also be well suited to windshields, another group of students developed a prototype suite of geolocative augmented reality games to be played by passengers in cars sharing nearby locations on the road through vehicle-to-vehicle networks. From this, other applications are easy to imagine, from the mundane (videoconferencing) to the whimsical (site-specific virtual flora and fauna superimposed over the passing outlines of the landscape) to the ugly (advertising-supported toll routes). See also Ryan Lawler, "Dispatch from the Future: Uber to Purchase 2,500 Driverless Cars from Google," *TechCrunch*, April 25, 2013, <http://techcrunch.com/2013/08/25/uberauto/>. Chunka Mui, "Dispatch from 2023: Google Considers Buying 250,000 Driverless Cars from Tesla, but Buys Tesla Instead," *Forbes*, August 29, 2013, <http://www.forbes.com/sites/chunkamui/2013/08/29/dispatch-from-2023-google-considers-buying-250000-driverless-cars-from-tesla-but-buys-tesla-instead/>.

61. Gary Marcus, "Moral Machines," *New Yorker*, November 24, 2012, <http://www.newyorker.com/news/news-desk/moral-machines>.

62. Nick Bilton, "Disruptions: As New Targets for Hackers, Your Car and Your House," *New York Times*, August 11, 2013, <http://bits.blogs.nytimes.com/2013/08/11/taking-over-cars-and-homes-remotely/>.

63. See, for example, Jaron Lanier, *Who Owns the Future?* (New York: Simon & Schuster, 2013).

64. See Danielle Citron, "Bright Ideas: Anita Allen's Unpopular Privacy," *Concurring Opinions*, January 13, 2012, <http://www.concurringopinions.com/archives/2012/01/bright-ideas-anita-allens-unpopular-privacy.html>.

65. Jacob Applebaum, Andy Mueller-Maguhn, Jeremie Zimmermann, and Julian Assange, "Episode 8, Part 1," *WikiLeaks World Tomorrow*, April 2012, <https://worldtomorrow.wikileaks.org/episode-8.html>.

If you look at it from a market perspective, I'm convinced that there is a market in privacy that has been mostly left unexplored, so maybe there will be an economic drive for companies to develop tools that will give users the individual ability to control their data and communication. Maybe this is one way that we can solve that problem. I'm not sure it can work alone, but this may happen and we may not know it yet.—Jeremie Zimmermann

Philip Mirowski writes that "the Incredible Disappearing Agent has had all sorts of implications for neoliberal political theory. First off, the timeworn conventional complaint that economics is too pigheadedly methodologically individualist does not begin to scratch the neoliberal

program. ‘Individuals’ are merely evanescent projects from a neoliberal perspective. Neoliberalism has consequently become a scale-free Theory of Everything: something as small as a gene or as large as a nation-state is equally engaged in entrepreneurial strategic pursuit of advantage, since the ‘individual’ is no longer a privileged ontological platform. Second, there are no more ‘classes’ in the sense of an older political economy, since every individual is both employer and worker simultaneously; in the limit, every man should be his own business firm or corporation; this has proven a powerful tool for disarming whole swathes of older left discourse. It also appropriates an obscure historical development in American legal history—that the corporation is tantamount to personhood—and blows it up to an ontological principle. Third, since property is no longer rooted in labor, as in the Lockean tradition, consequently property rights can be readily reengineered and changed to achieve specific political objectives; one observes this in the area of ‘intellectual property,’ or in a development germane to the crisis, ownership of the algorithms that define and trade obscure complex derivatives, and better, to reduce the formal infrastructure of the marketplace itself to a commodity. Indeed, the recent transformation of stock exchanges into profit-seeking IPOs was a critical neoliberal innovation leading up to the crisis. Classical liberals treated ‘property’ as a sacrosanct bulwark against the state; neoliberals do not. Fourth, it destroys the whole tradition of theories of ‘interests’ as possessing empirical grounding in political thought.” See his remarks, “The Thirteen Commandments of Neoliberalism” at <http://www.the-utopian.org/post/53360513384/the-thirteen-commandments-of-neoliberalism>.

66. The simple formula that the powerful should be transparent and the powerless opaque means something only if those terms are self-evident and if they sit still while the world turns. Neither is a reasonable assumption. Consider this example. Solly Benjamin and his colleagues looked at the impact of the digitization of land records in Bangalore. Their findings were that newly available access to landownership and title information in Bangalore was primarily being put to use by middle- and upper-income people and by corporations to gain ownership of land from the marginalized and the poor. The newly digitized and openly accessible data allowed the well-to-do to take the information provided and use that as the basis for instructions to land surveyors and lawyers and others to challenge titles, exploit gaps in title, take advantage of mistakes in documentation, and identify opportunities and targets for bribery, among others. They were able to directly translate their enhanced access to the information along with their already available access to capital and professional skills into unequal contests around land titles, court actions, offers of purchase, and so on for self-benefit and to further marginalize those already marginalized. Solomon Benjamin, R. Bhuvaneswari, P. Rajan, and Manjunatha, “Bhoomi: ‘E-Governance,’ or, an Anti-Politics Machine Necessary to Globalize Bangalore?” CASUM-m working paper, January 2007, <http://casumm.files.wordpress.com/2008/09/bhoomi-e-governance.pdf>.

67. “Virtual People to Get ID Checks,” *BBC News*, July 29, 2011, <http://www.bbc.co.uk/news/technology-14277728>.

68. Charles A. Shanor, “Making a Mountain out of a Digital Molehill,” *New York Times*, June 7, 2013, <http://www.nytimes.com/2013/06/07/opinion/making-a-mountain-out-of-a-digital-molehill.html>.

69. Consider Cloud Inc., "a non-profit working to create a contextual markup language around identity." See "Austin Nonprofit Trying to Help the World Get Back Its Online Identity," *Statesman*, July 24, 2011, <http://www.statesman.com/news/technology/austin-nonprofit-trying-to-help-the-world-get-back/nRcwY/>. Or, Kyle Vanhemert, "For \$300, You Can Buy a Stunning 3-D Printed Version of Yourself," *Wired*, August 2, 2013, <http://www.wired.com/2013/08/this-company-will-transform-you-into-an-incredibly-detailed-3-d-printed-figurine/>.
70. Andy Greenberg and Ryan Mac, "How a 'Deviant' Philosopher Built Palantir, a CIA-Funded Data-Mining Juggernaut," *Forbes*, August 14, 2013, <http://www.forbes.com/sites/andygreenberg/2013/08/14/agent-of-intelligence-how-a-deviant-philosopher-built-palantir-a-cia-funded-data-mining-juggernaut/>.
71. Hugo De Garis, *The Artilect War: Cosmists vs. Terrans: A Bitter Controversy Concerning Whether Humanity Should Build Godlike Massively Intelligent Machines* (Palm Springs, CA: ETC Publications, 2005).
72. Gigi Fenomen, "New App Allows Piloting a Drone with Google Glass Using Head Movements," *Android Apps*, August 24, 2013, <http://android-apps.com/news/new-app-allows-piloting-a-drone-with-google-glass-using-head-movements/>.
73. Let me propose that Philip K. Dick's novel *A Scanner Darkly* (Garden City, NY: Doubleday, 1977), should be part of the standard high school literature curriculum, if only because the existential psychology of the *User* will prove to be based on first-person access to third-person experiences of first-person experiences.
74. Singleton, "On Being Crafty."
75. Benedict Singleton, "Maximum Jailbreak," *e-flux journal*, no. 46 (June 2013).
76. Mark A. McMenamin and Dianna L. Schulte, *Hypersea: Life on Land* (New York: Columbia University Press, 1994).
77. Katherine Harmon, "Undead-End: Fungus That Controls Zombie-Ants Has Own Fungal Stalker," *Scientific American*, November 8, 2012, <http://www.scientificamerican.com/article/zombie-ant-fungus-parasite/>. The line, "animal living inside of animal living inside animal" is Ed Keller's.

The Stack to Come

1. Dave Eggers, *The Circle* (San Francisco: McSweeney's, 2013).
2. Writers Against Mass Surveillance, "A Stand for Democracy in the Digital Age," a collectively signed petition at <https://www.change.org/p/a-stand-for-democracy-in-the-digital-age-3>. First published December 10, 2013.
3. From Chris Anderson's talk at Google, *Authors@Google: Chris Anderson* (2012), <https://www.youtube.com/watch?v=3grzYoj2oPQ>.

4. Jacob Appelbaum, "Art as Evidence" (panel at Transmediale, Haus Der Kulturen Der Welt, Berlin, January 30, 2014), <http://www.transmediale.de/content/presentation-by-jacob-appelbaum-at-transmediale-2014-keynote-art-as-evidence>.
5. Charles Manson, "Lie," recorded August 9, 1968, Phil Kaufman, 1970, vinyl recording.
6. A sectional tracking shot, as in *Hitchcock's Rear Window*, directed by Alfred Hitchcock (Paramount, 1954). *Made in USA*, directed by Jean-Luc Godard (Anouchka Films, Rome Paris Films, S.E.P.I.C, 1966). (Or, for that matter, Shigeru Miyamoto's video game *Donkey Kong*.)
7. This line of thinking is represented by John Perry Barlow's "Declaration of the Independence of Cyberspace" manifesto from 1996, as well as various anarchist and libertarian platforms. To states he warned, "You are not welcome among us. You have no sovereignty where we gather." To his credit, Barlow's opinions have evolved considerably since this text was first posted.
8. One of the ways that states hope to manage a transition and translation into *Cloud* platforms is to take it on themselves to realize a cartographic and optical authority—omniscience, if you like—over the entirety of the space they call "cyber." In September 2014, as part of an ongoing wave of disclosures, *Der Spiegel* published a PDF file of a PowerPoint deck, "Bad guys are everywhere, good guys are somewhere," presented by the NSA/CSS Threat Operations Center, which included a slide featuring the US security agencies' own version of The Stack. As said, the US Department of Defense has Stack theorists too. The diagram is not secret, it has been around a while, and it depicts what Paul Rosenzweig calls "the five layers of the cyber domain." This book's stack is *Earth* and *Cloud* at the physical layer, *City* and *Address* at the network layer, and *Interface* and *User* at the application and agent layers. The Department of Defense's stack has a Geographic layer, a Physical Network layer, a Logical Network layer, a Cyber Persona layer, and a Persona layer. The deck also discusses an initiative called Treasuremap, which purports to "map the entire Internet—Any device, anywhere, all the time." A whole chapter of this book could have been devoted just to the US federal Stack programs at work, especially those detailed in similar decks and perhaps that will be a follow-up in one way or another. Detailed images of the Defense Stack, and of these programs' publicly available diagrams and publications, are at the book website, thestack.org. Another notable usage of "stacks" is by Bruce Sterling, who around the same time as I was giving public lectures based on this book, made several references to what he called "The Stacks." For him this term refers, roughly speaking, to large *Cloud* platforms such as Google, Apple and Facebook. He contrasted these systems to an ideal "open internet." See for example Sterling's closing address at the 2012 South By Southwest conference, Austin, Texas. March 13, 2012. And his essay "State of the World 2013" (with Jon Lebkowsky) at <http://www.well.com/conf/inkwell.vue/topics/459/State-of-the-World-2013-Bruce-St-page01.html>. Sterling and I have exchanged notes on the implications of the term, and he has also blogged about this book's developing research. See for example, "The Cloud, The State and the Stack" at <http://www.wired.com/2012/12/the-cloud-the-state-and-the-stack/> and "On the Nomos of the Cloud: The Stack, Deep Address and Political Geography" at <http://www.wired.com/2013/02/on-the-nomos-of-the-cloud-the-stack-deep-address-internal-geography/>.
9. "God Bows to Math" is a song by Minutemen, from the album *Double Nickels on the Dime* (SST Records, San Pedro, CA, 1984).

10. See "Comparative Planetology: An Interview with Kim Stanley Robinson," <http://bldgblog.blogspot.com/2007/12/comparative-planetology-interview-with.html>.
11. That it is not surprising does not make it any less disappointing, but that famous "blue marble" photograph that ostensibly gave figural clarity to a globally politicized Ecology movement was taken by astronaut, Harrison Schmitt, later a vociferous climate-change denialist senator from New Mexico. Further, the original version of the photograph showed the continent of Africa with the tip of the Cape of Good Hope facing "up" and so putting the occluded areas Europe and the United States "below" Africa in perspective. There is no north or south in space, but the public versions of the photo inverted this perspective to a north-up map orientation restoring a completely artificial natural order.
12. On Peter Thiel's thesis see "Technology Stalled in 1970," *MIT Technology Review*, September 18, 2014, <http://www.technologyreview.com/qa/530901/technology-stalled-in-1970/>.
13. See my "We Need to Talk About TED" editorial published by *The Guardian*, December 30, 2014, <http://www.theguardian.com/commentisfree/2013/dec/30/we-need-to-talk-about-ted>.
14. Mike Davis, "Who Will Build the Ark?" *New Left Review*, no. 61 (January/February 2010): 45, <http://newleftreview.org/II/61/mike-davis-who-will-build-the-ark>: "Tackling the challenge of sustainable urban design for the whole planet, and not just for a few privileged countries or social groups, requires a vast stage for the imagination, such as the arts and sciences inhabited in the May Days of Vkhutemas and the Bauhaus. It presupposes a radical willingness to think beyond the horizon of neo-liberal capitalism toward a global revolution that reintegrates the labour of the informal working classes, as well as the rural poor, in the sustainable reconstruction of their built environments and livelihoods."
15. Martin Heidegger interview with *Der Spiegel* by Rudolf Augstein and Georg Wolff, September 23, 1966, published May 31, 1976.
16. Latour's unfortunate and broadly dismissive remarks on geoengineering: Bruno Latour, keynote speech (CAST Symposium: Seeing/Sounding/Sensing, MIT Media Lab, Cambridge, September 26, 2014), <https://www.youtube.com/watch?v=R7hAP4wG71s>.
17. The case for geoengineering is made by David Keith, *A Case for Climate Engineering* (Cambridge, MA: MIT Press, 2013). Nick Srncicek's review of Keith's book is at <http://review31.co.uk/article/view/196/prometheanism-and-the-precautionary-principle>. On the importance of preemptive international agreements governing if, when, and how geoengineering may be initiated, see David G. Victor, *Global Warming Gridlock: Creating More Effective Strategies for Protecting the Planet* (Cambridge: Cambridge University Press, 2011).
18. Speaking of platforms, fossil-fuel-based economies are themselves subordinated by platform lock-in, in this case, for the extraction and transmutation of particular molecules.
19. By all accounts, Amazon space is already built on the precision of an object flow that engineers the movements of human workers with a repetitious efficiency probably better suited to robots. In describing the stress and precariousness of work in Amazon fulfillment centers it may

be that less human labor is more humane, but as Amazon (and really all the major *Cloud* platforms) absorbs, centralizes, and consolidates production labor into tighter strata of proprietary commerce-logistics algorithms, the future of work is made that much more uncertain, and along with it, the real economic power of their workers to also be their customer-*Users*.

20. For example, Ian Berry, "Monsanto to Buy Planting Technology Company," *Wall Street Journal*, May 23, 2012, <http://online.wsj.com/articles/SB10001424052702304707604577422162132896528>.

21. *Sleep Dealer*, directed by Alex Rivera (Vaya Entertainment, 2008).

22. From a private Facebook post by Christopher Head.

23. For example, on the North American Free Trade Agreement, David Graeber writes: "Hardly surprising: if it were not possible to effectively imprison the majority of people in the world in impoverished enclaves, there would be no incentive for Nike or The Gap to move production there to begin with. Given a free movement of people, the whole neoliberal project would collapse. This is another thing to bear in mind when people talk about the decline of 'sovereignty' in the contemporary world: the main achievement of the nation-state in the last century has been the establishment of a uniform grid of heavily policed barriers across the world. It is precisely this international system of control that we are fighting against, in the name of genuine globalization." See Tom Mertes and Walden Bello, *Walden, a Movement of Movements: Is Another World Really Possible?* (London: Verso, 2004), 206.

24. A similar conclusion from the other side of the political spectrum, folding around the point where left anarchism and right libertarianism carry water for one another. Arnold Kling, "Exit, Voice, and Freedom: An Example," *Library of Economics and Liberty*, August 13, 2009, http://econlog.econlib.org/archives/2009/08/exit_voice_and_2.html.

25. For a list and typology of enclaves and exclaves, see Jan S. Krogh's "Geosite: Enclaves and Exclaves," <http://geosite.jankrogh.com/exclaves.htm>.

26. At the same time as the *City* layer of The Stack integrates individual cities more thoroughly into a general planetary infrastructure of energy, water, labor, and information, it also might shift the economics of that common infrastructure from one that is by necessity held in common to one that becomes, through its use, a revenue platform. Whereas Google generates revenue by reselling the thoughts, preferences, clicks, and pathways of its users, so might the Google City (of activated energy, water, and labor, as well as information) generate revenue by the "using" of the very interfaces that compose and comprise the city in situated space: user-citizen-laborers making money for a city's charter investors by the simple arcs of their *dérive*. The ambient urban interface is a cash cow for the right cloud urbanist. Such are the geopolitics of the *City* layer of The Stack.

27. See *Elysium*, directed by Neill Blomkamp (Sony Pictures Entertainment, 2013). As when Ukrainians seized the semisecret palace of deposed President Yanukovych, only to discover a museum of kitsch gold toilet seats, the audience of *Elysium* could only be disappointed with the incredible lack of imagination (and taste) exhibited by those who would abscond with the planet's remaining wealth for their own benefit. That they would use the lives of billions of people for

kindling is one thing; that they would purchase such dull garden-variety bourgeoisie, is the insult on top of insult. Dictators these days have no *taste*.

28. J. G. Ballard, *High Rise* (London: Jonathan Cape, 1975).

29. See <http://www.theguardian.com/commentisfree/2014/jul/23/history-border-crisis-central-america-gangs>.

30. Recall recent attempts to shut off the water for at least tens of thousands of residents of Detroit, <http://www.cbsnews.com/news/detroit-water-shut-offs-brings-u-n-scrutiny/> <http://www.bbc.com/news/world-us-canada-29697767>. Martin Lukacs, "Detroit's Water War: A Tap Shut-Off That Could Impact 300,000 People," *Guardian*, June 25, 2014, <http://www.theguardian.com/environment/true-north/2014/jun/25/detroits-water-war-a-tap-shut-off-that-could-impact-300000-people>.

31. See <http://www.crimethinc.com/texts/ex/digital-utopia.html>, <https://www.youtube.com/watch?v=cOubCHLXT6A>, and http://www.ftc.gov/sites/default/files/documents/public_statements/promoting-internet-inclusion-more-things-more-people/140107ces-iot.pdf.

32. Balaji Srinivasa, "Silicon Valley's Ultimate Exit," speech at the Y Combinator Startup School, De Anza College, Cupertino, CA, October 25, 2013, <https://www.youtube.com/watch?v=cOubCHLXT6A>. "Peacefully start an international (1) company, (2) community, (3) currency, (4) country. We are now at step 3." (@balajis, January 3, 2014.

33. Albert O. Hirschman, *Exit, Voice, and Loyalty; Responses to Decline in Firms, Organizations, and States* (Cambridge, MA: Harvard University Press, 1970).

34. Larry Page, "Google I/O 2013: Keynote," YouTube, May 15, 2013, https://www.youtube.com/watch?v=9pmPa_KxsAM.

35. Bruce Sterling, *Islands in the Net* (New York: Arbor House, 1988).

36. Robin Hanson, "More Inequality, Merited," *Overcoming Bias*, September 22, 2011, <http://www.overcomingbias.com/2011/09/more-inequality-merited.html>.

37. "Beyond this core agenda, the forces of Organized Chaos, by and large, think that the Internet should be allowed to evolve on its own, the way human societies always have. The forces of Organized Chaos have a pretty good sense of how it will evolve, at least in the short term. The Internet will stratify, as cities did long ago. There will be the mass Internet we already know—a teeming bazaar of artists and merchants and thinkers as well as pickpockets and hucksters and whores. It is a place anyone can enter, anonymously or not, and for free. Travel at your own risk! But anyone who wishes can decide to leave this bazaar for the security of the bank or the government office—or, if you have enough money, the limousine, the Sky Club, the platinum concierge. You will always have to give something up. If you want utter and absolute privacy, you will have to pay for it—or know the right people, who will give you access to their hidden darknets. For some services, you may decide to trade your privacy and anonymity for security. Depending on circumstance and desire, people will range among these worlds." Michael J. Gross, "World War 3.0," *Vanity Fair*, May 16, 2012, <http://www.vanityfair.com/culture/2012/05/internet-regulation-war-sopa-pipa-defcon-hacking>.

38. In the mature version of this particular *Cloud* feudalism scenario (again, it is one among many such scenarios, not a prediction), the walls of some gardens are hard and thick and resemble those of factories or zoos, while others are informal, invisible, or covered in pixels. The routinization of everyday life for the vast plurality of people reduces *User*-citizens to mere personnel in wider interplatform conflicts and dramas. The social and economic relationships between enclave/camps in a geography of *Cloud* polities operating at such radically different levels of power is likely to function like similar arrangements have in the past, through the extraction of arbitrary rent and the coordination of coercive exposure and autonomous servitude.

On the geopolitical stage, a not dissimilar mix of the new and the old, of consolidation and division, is played out. On the secular side, it is characterized by an apparently paradoxical dynamic between the entropic global integration of mobile people, goods, data, currencies, viruses, and genomes, versus pronounced state securitization, as well as nativist or irredentist claims against the effects, both real and imagined, of that mobility. The tension between geographic integration and disintegration emerges from an interdependent spatial-cultural economy in which the conditions of movement and the risks of interpenetration are mediated by the subdividing envelopes of interfacial provincialism and urban regionalism. Contemporary geopolitics depends on this tension just as much as the attacks on it from both the future front and archaic rear exploit it by elevating it to messianic first principle. Globalization results less on the disappearance of borders than in their perforated multiplication and superimposition, and in the proliferation of enclaves and exclaves bending around each other's only-partial interior space. In this, the conditions of exclusive or partial membership of any *Cloud Polis* is determined not only by its technological services on offer but also by the more complex sociocultural, even theological, demands of those multiple interiors. That any *User* may occupy several, even at once, complicates how they are and are not mobilized by any one of these. This patchwork may generate new geopolitical belief systems, or make use of older ones, or combine them. Imagined communities might precede their migration to the *Cloud* (by several centuries in the case of religious or ethnic nationalisms) where they can reanimate and rearticulate older cosmologies and geographies. The appearance of new variations might be a novel function of the *Cloud's* most recent social moral communities to which they are native (such as Anonymous).

In practice, as for any transnational cultural sphere, the imagined communities that fill out any *Cloud Polis* with social content will draw on both an existing archive of cultural identities and tensions as well as employ novel logics of the *Cloud* to innovate on their conceptual alliances and practices of inclusion and exclusion. As we've explored, the fragility of such translations between the message and the medium includes ambiguities as to what is and is not a state or "market" endeavor in the first place, sacred or profane, inside and outside, here and there. At present, with that fragility at hand and those ambiguities in our hearts and mind, perhaps among the most urgent next steps for geodesign is to draw preemptive scenarios of their implications and work backward from them.

39. There is unlikely potential in other examples at a different scale as well. We have the curious cases of religious movements becoming parastates, such as the Vatican, or ISIS, or Hezbollah, the transnational Shi'a party, and military and social service apparatus based in Lebanon. Suspending from our minds only for a moment the ideological content of this entity, what in reality is the sovereign status of this organizational form? It is a state within a state, albeit one largely financed

by another state, that has not seceded from its host nation but controls large swaths with last-instance sovereignty. On purely formal terms, how would organizational apparatuses such as these compare to corporations that have, at least in the United States, been granted the constitutional protections of private religious belief? (Here market fundamentalism collaborates directly in desecularization.) We can easily imagine scenarios in which theologically programmatic *Cloud* platforms might compose their *City*, *Address*, *Interface*, and *User* layers as something that resembles Hezbollah at least as much as a mid-twentieth-century corporation.

40. It is clearly not the annulment of dissensus, because in the absence of real politicization of fundamental conflict and the proliferation of incompatible and often unredeemable cosmographies, the only positions of dissent end up being those of the irredentist, the humanist, and the fundamentalist. That is an unsustainable trinity.

41. Behold the Schengen Cloud, New Arizona, Transcalifornia, Hong Kong West, the Alibaba-Tesla Printing and Charging Station franchise network, NTT-DoKoMo Planet Tokyo retirement towers and robo-spa, Google Continent Cloud, Tata-IIT-Khan Academy primary schools, the Confederate States of Walmart, RadTransFem GMOrganic Foods and Soil Stewardship (based in Fresno), the Apple-Pixar-Genentech Alliance, and so on.

42. Consider once more Estonia's program to extend "e-citizenship" to those who do not physically reside inside its land borders. See <https://e-estonia.com/e-residents/about/>.

43. The anarchist-artist dream of autonomous secession by sabotage, refusal, anonymity, and delinking is part of the problem. Localism (individual or communitarian) means inside these sturdy walls. A political philosophy inordinately nervous about the ambiguities of transaction externalities will have to build increasingly more elaborate justifications. The simplest is to simply wall off the external altogether so that it cannot intrude, interfere, or enforce a division of labor.

44. See the full RFC at <http://tools.ietf.org/html/rfc761>.

45. The reversibility of the line, between inside and outside, exit and entrance to or from what, tracks the reversibility of utopia and dystopia. The utopian perfect island may be projected into the present for the totalitarian, into the fundamentalist's past, or into the modernist's future. The dystopian is sometimes the aberration that merely smudges the utopian absolute, ruptured from the inside by the revenge-seeking tabula that was not so rasa after all. At other times, as in many Philip K. Dick fictions, the dystopian is more like the nightmare that turns out to be an dream of unforeseen redemption or unforeseeable enlightenment. As the utopias and their reversals (which may be dystopian, or perhaps not) begin to pile up and reflect onto the diagonal surfaces of one another, insides and outsides multiply, and the exit and entrance dynamics becomes less intelligible as the borderlines intersect in volumetric space. Those lines seem to reverberate and blur, doing double duty to hold something in and out, but as we will see, these may not be imprecise traces of something definite; rather they are also meticulous representations of something ambiguous.

Further, the reversibility of the line can help design or make its job impossible. Every new historical phase of information technology seemed to bring a promise of universalism, or of at

least of an integration of global community and communication. At the same time, perhaps every “imagined community” congeals through its particular ways of reading and being read by media technologies unevenly arranged across the world. Any universality that does arrive may be that societies are subdivided from one another according to the same means, and so share this cycle of consolidation and forking, both real and imagined. Any line drawn with purpose pushes and pulls against this, knowingly or unknowingly, partitioning and framing its additions on an always rotating plane. Any project of metadesign is then faced with some crisis of confidence. As it becomes technically easier to draw a line, it is that much harder to know whether that line is linking or delinking, gathering something in or fencing something out. Because of this, not despite it, the right of design has to be equal to that of voice in the automanagement of those societies subdivided from one another as they share the common limitations of mutual intersection. It also means that the basic social problematics of cohabitation remain.

As discussed in the *City* layer chapter, we lack an adequate legal and political understanding of the “refugee” as a generic position, as opposed to an exceptional situation. It is always not enough to say that we cannot solve a refugee problem by producing a new refugee problem because, for better or worse, the identity that anyone and everyone shares of the stateless person dislodged from her home is the identity that each of us navigates when the shadow of some other utopia or dystopia sweeps over us in which we have no role to play. That namelessness and uselessness can also be another name for statelessness. Given the contemporary mania for revanchism, based on claims of primordial occupation going back centuries or even millennia, it is worth asking once again if the values we place in the notion of home and homeland are more dangerous than whatever comfort of continuity they may promise. This would be a good starting point to designing cohabitation. It does not answer for us how to solve the puzzle of inclusion, always based on exclusion as a shared condition, or even if solving that is the point. It does point us away from conventional discussions of the legal unipolarity of a single regime of “rights” for citizens and noncitizens and toward another one about partial citizens, temporary citizens, dual-, triple-, and quad-citizenships, or away from this legal position altogether perhaps. It is complex enough to map stateless persons. It is perhaps more so to make room for personless states, or for corporations of multiple persons that are afforded religious and speech metarights above and beyond those of the humans that they aggregate. Swatting at flying robots all day and night can’t possibly keep the natural order in place.

On the contrary, the normalized exception, inverting interior and exterior also inverts the utopian and dystopian projects, even across the same interfacial hinge of the subdividing wall. The oscillation of the enclave and the camp may work variously as the cause or the effect of the proliferation of our overlapping surplus of utopias, absorbing design programs into its demands and spinning out the accidents of political subjectivity that characterize the *City* layer of The Stack. What is clear is that in this overlap, as each of us is, at every given moment, inside some Cloud polities that actively recognize us as *Users* or citizens, outside of others that may or may not, and inside others that do not recognize us, even as we move around geographies in what it may imagine to be their jurisdictions, that our continuous transactions with the physical and virtual envelopes of our habitats never resolve into any absolute political space that can make last-instance claims on whatever or whoever is passing through. No one addressing scheme can finally exclude others. Accordingly the plans and programs of the designers of that space,

regardless of their own valorizations of an absolute architecture, have even less durable authority on those claims and those identities. The site is itself a microcosmic platform but only even in relation to others, at the same or different scale. As the borders cross you, you must be able to come as well as go. The interfaces that cohere the site as a surface of interest are only ever interfaces to or from another site, and if for no other reason than this, the platform geopolitics of the *User* must design entrance to be as dominant a function as exit.

46. "Marxists will likely find that life in our centrally-managed military compound is incompatible with their ideology." Eric Lach, "'Liberty-Driven' Fortress Community Being Planned in Idaho," *TPM*, January 14, 2013, <http://livewire.talkingpointsmemo.com/entry/liberty-driven-fortress-community-being-planned-in-idaho>.

47. Roger O. Friedland, "Money, Sex and God: The Erotic Logics of Religious Nationalism," *Sociological Theory* 20 (2002): 381–425.

48. Robert MacBride, *The Automated State: Computer Systems as a New Force in Society* (Philadelphia: Chilton Book, 1967); Stanislaw Lem, *Summa Technologica* (Minneapolis: University of Minnesota Press, 2013; originally published 1964); and Thomas Wells, "The Robot Economy and the Crisis of Capitalism: Why We Need Universal Basic Income," *ABC Religion and Ethics* (Australian Broadcasting Corporation), July 17, 2014, <http://www.abc.net.au/religion/articles/2014/07/17/4048180.htm>.

49. Srnicek and Williams' book *Inventing the Future* would hold one end of this spectrum, while Evgeny Morozov's "The Planning Machine" would fix the other. See <http://www.newyorker.com/magazine/2014/10/13/planning-machine>.

50. McKenzie Wark, *Molecular Red: Theory for the Anthropocene* (London: Verso, 2015); Benedict Singleton, "Maximum Jailbreak," *e-flux*, July 27, 2013, <http://www.e-flux.com/journal/maximum-jailbreak/>.

51. Friedrich A. von Hayek, *Law, Legislation, and Liberty: A New Statement of the Liberal Principles of Justice and Political Economy* (Chicago: University of Chicago Press, 1976), 2:107–132.

52. "If Wal-Mart instituted, say, a zero-tolerance policy against developing-world factories abusing their workforces, and simultaneously brought in a regime of unannounced factory inspections combined with anonymous, off-site interviews with workers, it would probably do more to change the working conditions in Third World sweatshops than any government on the planet. That, though, is the problem. Wal-Mart stretches far beyond the reach of any government." John Lanchester, "The Price of Pickles," *London Review of Books*, June 22, 2006, 3–6, <http://www.lrb.co.uk/v28/n12/john-lanchester/the-price-of-pickles>.

53. Walmart's customers, demographic analysis may suggest, do not have the same degree of access to e-commerce infrastructure, from home PCs to broadband service. Still, the current discrepancy of total revenue between Amazon (about \$50 billion a year) and Walmart (about \$450 billion) suggests any major shift is still to come.

54. That chagrin comes through in financial press articles such as these, <http://www.fool.com/investing/general/2015/02/04/amazon-just-admitted-that-its-losing-billions.aspx>.

55. Amazon is not a model of “fully automated luxury communism” but it is a model of something that may in turn be one of its ancestors.

56. As we will discuss in greater detail below, the geodesign potential of algorithmic governance, in the rawest sense, is hamstrung by the negative disposition that some hold regarding the politics of quantitative representation, statistics, and even mathematics itself. This is both a reaction to the considerable violence that calculative reason wrought during twentieth-century wars, as well as the result of a self-validating antimodernism that ensued and has become, in turn, the basis of a sometimes reactionary posture that in various mixtures and guises draws on noble and ignoble traditions. Moral vigilance against “instrumental reason” easily slides into anti-intellectualism. Some activists may bomb the Army Research Center for Mathematics and believe it to be a morally defensible part of an antiwar strategy, as they support and are supported by the conclusion that mathematics and war are inextricable ways of knowing. Others see our Anthropocenic precocity as the unprecedented metaexternality of modernity itself and conclude that only a dismantling, reversal, or downscaling of ambition and its equipment, especially computing machines, can limn the path away from apocalypse and toward their preferred salvation. These perspectives are not only assailable, they are variously inadequate, immature, and sociopathic. The importance of truly confronting the inarticulability of the Anthropocene, is unfortunately obscured not only by our own cowardice, but also by the enchanted nihilism of our worst angels. Back in the city, people may assault other people wearing Google Glass on behalf of evicted renters, imagining their acts as those of popular refusal and resistance to the tyranny of calculative vision. Others draw embarrassing dichotomies between “poetry” and “finance” as the key to unlocking a new society. However, others provide durable critiques of how the algorithmic geopolitics is currently configured, and how its dangerous naturalization by market fundamentalism is not only legible in certain philosophical trends but naturalized by them. Others have accomplished a powerful politics of open, reprogrammable computational infrastructures that has had a direct and positive on how global systems are developed, though not nearly enough, and battles won may be reversed. Still others have articulated, from the disciplinary margins, a visionary and proactive leftist futurism that makes a native comfort with techniques of comprehensive abstraction a central tenet of post-neoliberal economics. Lest the zealotry of negative retreat and resistance is to define the leftist geopolitics of planetary-scale computation, it is essential that the legacies of progressive futurism, democratic welfare and pleasure, and infrastructural transnationalism are able to resolve their crises of courage and self-legitimacy and to find themselves willing and able to design and enforce the platforms we all require.

57. I find the use of the term *communism* to describe these kinds of transformations in the marginal costs of commodity provisions needlessly old-fashioned. “A new cybernetic communism, itself one of these options, would, we have seen, involve some of the following elements: use of the most advanced super-computing to algorithmically calculate labour time and resource requirements, at global, regional and local levels, of multiple possible paths of human development; selection from these paths by layered democratic discussion conducted across assemblies that include socialized digital networks and swarms of software agents; light-speed updating and constant revision of the selected plans by streams of big data from production and consumption sources; the passage of increasing numbers of goods and services into the realm of the free or of

direct production as use values once automation, copy-left, peer-to-peer commons and other forms of micro-replication take hold; the informing of the entire process by parameters set from the simulations, sensors, and satellite systems measuring and monitoring the species metabolic interchange with the planetary environment.” Nick Dyer-Witheford, “Red Plenty Platforms,” *Culture Machines*, July 28, 2013, <http://www.culturemachine.net/index.php/cm/article/view/511/526>.

58. As well as a partial corrective, perhaps, to Adam Curtis’s tendentious narrative *All Watched Over by Machines of Loving Grace* (BBC Productions, 2011).

59. This is drawn on our white board as a syncretic thought experiment because of, not in spite of, the complexities and contradictions it makes visible. Among the two most salient are, first, that no actual platform ever functions in an ideal manner and so simply transposing state or corporate governance into platforms does not guarantee specific outcomes, and, second, that the data with which any platform might govern do not merely exist in the world to be gathered and then presented to political systems for their application; rather the identification, sensing, sorting, application, revelation, and instrumentalization of data *is* the political system in this context. Its distortions are not errors; they are, as for any other intelligence, a function of what any platform can and cannot see. The provisional typology of platforms listed in the first chapter should be applied as both generic description and functional ideal: the setting of stages, by rigorous morphological standardization, toward forms of entrenchment that are desirable, allowing for unexpected reprogrammability, according to intelligent formal models, adding genuine value for *Users*, from a position that is neither exactly central nor distributed, that modulates the generation of governable identities, according to denuded diagrams, in which all components can be replaced, governing instantaneously and cumulatively, with incentivized error correction, by organizing existing systems, that can withstand the vulnerabilities that come with ubiquity, that demonetize (or monetize absolutely, which may be the same thing), that inform *Users* of their architecture in ways that support narrative participation as much as infrastructural transparency, that coordinate with the parallel ubiquity of other total platforms, and which therefore spin out system-scale accidents that are net positive, and so on, and so on. These are not givens; they are guidelines, both descriptive and prescriptive. To this list I highlight the right of exit and entrance from platform totalities. It’s true that successful and sustainable platforms may not only be “walled gardens,” but will enforce that wall with serious punishment, but our geodesign program stipulates that orderly *User* promiscuity between platforms is how the totality of totalities would work best as an active search field for optimal Anthropocenic (or post-Anthropocenic) planetary urbanism.

60. Gabriel De Tarde and Theo Lorenc, *Monadology and Sociology* (Prahran, Victoria: Re.press, 2011), 167–168.

61. It would also expand the governability of the information into depths and domains previously impossible. The fully posthuman descendant of The Stack we have may compose communicative flows in ways that our unique perch, measured in meters and months, will have far less privilege of place. But just as indicated for any big data apparatus, any such governance of addresses, especially those in the near term, would not cohere around what they find out there

but around what they are looking for. The Borges Chinese Encyclopedia problem does not disappear with supercomputing or 10^{23} addresses; rather, it expands exponentially. Any two governing apparatuses are able to map the same planet and what happens on it according to the categorical logics of utterly different kinds of descriptive systems, both of which are equally valid from the rigorously agnostic view of the addresses themselves. For example, the ontologies of, say, mid-twenty-first-century organic chemistry as informed by electron microscopes as well as certain medieval spoken dialects mixing Russian and Polish languages may both be able to decide that certain things are in fact “things” requiring a number or not, while others don’t register at all, physically or conceptually, and may do so according to their own limited scopes.

62. See Stuart Elden, *The Birth of Territory* (Chicago: University of Chicago Press, 2013).

63. The Security and Exchange Commission’s 2005 Regulation National Market System (Reg NMS), which required that traders execute trades at the “best price for their clients,” of which an unintended consequence was the rise of “dark pools” that incentivize large traders to build market simulations to make trades against. See <http://online.wsj.com/articles/SB10001424052702304886904579475584095555384>; Michael Lewis, *Flash Boys: A Wall Street Revolt* (New York: Norton, 2014); and US Securities and Exchange Commission, Division of Market Regulation, *Regulation National Market System* (Washington, DC, 2005).

64. Paul Krugman, “Bits and Barbarism,” *New York Times*, December 22, 2013, <http://www.nytimes.com/2013/12/23/opinion/krugman-bits-and-barbarism.html>.

65. Once more, a different connotation for the word “*hyperobject*” than Timothy Morton’s.

66. Niklas Luhmann, Dirk Baecker, and Peter Gilgen, *Introduction to Systems Theory* (Cambridge: Polity Press, 2012).

67. It does so by representing the full scale of planetary systems and in doing so suggests some authority over them. As seen most explicitly in computational megaprojects such as Planetary Skin, the ascendancy of data visualization as a governing visual rhetoric allows for, if not also demands, the pictorial coherence of worldly systems otherwise dedifferentiated. As GUI come to take on more of the look and utility of data visualization (the image-instrument diagram discussed in the *Interface* chapter), the same tilt toward not just comprehensive images but also total images and image-instruments. In other words, interfacial regimes make claims on the always reconfigurable geoscapes that frame the social, economic, or religious significance of any chain of interaction, and which by repetition comes to physically enforce that regime in the world. The symptomatic interest in reflecting a master diagram onto the world as if its mimetic regularity were interchangeable with the regulation of that world not only persists but is amplified by the affordances of planetary computation. The instrumentalized “world picture” functions not only as a projective image of a claim into the geoscape, as any utopian image does; it channels the utopian program of that projection not only into the abstract futurity of an image of a world in the future but also as a literal technology for the management of that future today. It renders its utopia less by the implied resolution of a meta-history than as meta-interfaciality.

68. This is perhaps a kind of reverse skeuomorphism. They *automate* consent, like automating a decision by building it into an interface.

69. Planetary-scale computation is both the medium through which the possibility of comprehensive planetary visualization (however skewed) is possible and something to be represented within that geography and its motivated geoscapes. The *Interface* layer is where the performance of any exceptional reversal between inside and outside plays out, even if it is for the benefit of just one *User*'s line of sight. It is also, as discussed regarding the *City* layer, where any one interface, physical or virtual, may open or close urban habitats to some *Users* and foreclose them to others, automating the normalization of that inversion of exceptional internalization and externalization on the fly. Depending on the regime at work, the results for any given *User* may be very different, however resolved or however alien they appear to different *Users* all sorted by platform cognition into their microcultures. Things show up on your map that are not on mine, and vice versa, and that is precisely the point. While this may undermine the simple geometry of cosmopolitan consensus, it may also provide for less timid forms of universalism.

70. For modern panoptic systems, surveillant sensors are hidden or camouflaged from the view of the surveilled. The gaze is present but unseen. But the contemporary moment is characterized instead by the display of surveillance and the spectacle of transparency.

71. In practice the interrelationship between scales, both as real accumulations and as diagrammatic images of those accumulations, is a densely intermingled pattern of infra- and intrasignification. The interfacing image represents an interfacing assemblage, but it can also represent a network, a territory, or a geoscape. For example, a hand-held mapping application may construct a framed image of very local interfacing objects and surfaces or the larger-scale networks at work and the territories that structure them. The *Citysense* app, for example, as an interface to the urban field draws an image of particular networks among others as they congeal onto particular nodal interfaces within the city among others, but the image is of the coagulation more than of a given interface within it. It also locates that network onto the schematic territory of the city here rendered only as a field of channels for the potential formation of networks. In this, the interface not only accumulates into networks and networks into territories; here the interface directly diagrams the network in formation and the territory as its limit. We can expect any recursivity then to be between a decision to be subjectivity located within a field of urban interfacing based on a sense of coordination with a network ("my people go there, so I should too") and even the positive effects an action might have on the network accumulation itself and its socialized image ("if I go there, it will show up on the map of my network").

72. See Tim O'Reilly, "Open Data and Algorithmic Regulation," Beyond Transparency, <http://beyondtransparency.org/chapters/part-5/open-data-and-algorithmic-regulation/>, and Tim McCormick, "A Brief Exchange with Tim O'Reilly about Algorithmic Regulation," February 15, 2014. <http://tjm.org/2014/02/15/a-brief-exchange-with-tim-oreilly-about-algorithmic-regulation/>. See as well this from O'Reilly: "Consider, for a moment, regulation in a broader context. Your car's electronics regulate the fuel-air mix in the engine to find an optimal balance of fuel efficiency and minimal emissions. An airplane's autopilot regulates the countless factors required to keep that plane aloft and heading in the right direction. Credit card companies monitor and regulate charges to detect fraud and keep you under your credit limit. Doctors regulate the dosage of the medicine they give us, sometimes loosely, sometimes with exquisite care, as with the chemotherapy required to kill cancer cells while keeping normal cells alive, or with the anesthesia that

keeps us unconscious during surgery while keeping vital processes going. ISPs and corporate mail systems regulate the mail that reaches us, filtering out spam and malware to the best of their ability. Search engines regulate the results and advertisements they serve up to us, doing their best to give us more of what we want to see.” Tim O’Reilly, “Open Data and Algorithmic Regulation,” in Brett Goldstein and Lauren Dyson, eds., *Beyond Transparency* (San Francisco: Code for America Press, 2013), and <http://beyondtransparency.org/chapters/part-5/open-data-and-algorithmic-regulation/>.

73. O'Reilly, "Profile of Tim O'Reilly."

74. Evgeny Morozov, "The Meme Hustler," *Baffler* 66 (2013), <http://www.thebaffler.com/articles/the-meme-hustler>.

75. Among the core design problems for algorithmic governance is the modulation of that symmetry and asymmetry: between “server side” and “client side,” authority and autonomy, between upstream and downstream decisions, between *Users* informing algorithms and algorithms governing with the force of law, or perhaps just “nudging” *Users* toward ostensibly desirable outcomes. That is, where it may be news to conventional political science that planetary-scale computation is not only something to govern but where and how governance occurs, it may be equally surprising to others that software is not only how to govern but that it itself needs to be governed, and that the cultural conventions of early twenty-first century North American programming culture cannot be transposed onto all systems without difficult mutual translation and even violent (if necessary) counterdistortions. (As “design outcomes” algorithmic governance and governance of algorithms should be tightly paired.) Historical precedent strongly suggests that asymmetries of knowledge and power between governor or and governed (in either direction) may have disastrous consequences. Contemporary concerns over *User* privacy in relation to state surveillance and platform dataveillance have led to considerable outcry, some very legitimate and some not. The contravention of surveillance (looking “down” onto the governed) with *sousveillance* (looking “up” at the governor) has become the conventional point of distinction for modulating transparency versus opacity, and, by extension, designing the geopolitics of the *User*. The problem in practice (as well as in theory) is that this distinction relies on notions of who or what is “up” and “down” in relation to whom and to what that are at best highly debatable. This is so even among the privacy advocacy communities who have come to agree on “outcomes” even if the reasons for these are incompatible. For some, large central governing systems must always by definition operate in complete transparency lest they become totalitarian and end *Users* must always by definition retain rights to complete opacity for the same reason. For others, a phobia regarding public scrutiny is hardly the point, and there is strong motivation to shine the bright light on some “*Users*” such as wealthy tax evaders for the benefit of large public governance. Others advocate for maximum societal transparency as a self-correcting good, such as David Brin, while others advocate for maximum opacity and privacy for parallel or opposite goals, such as some cryptoanarchists. One pernicious result is that everyone believes himself to be working from a position of disadvantage and self-defense, and so assumes for himself a limitless license for social violence.

This up-versus-down heuristic will prove to be a far limited model for scaling the complex geopolitical design questions at hand now and in the future. It is born of a presumption that

governance is synonymous with states that contain human beings citizens, that governments are centralized and distant, but “re-present” the will of those citizens, that any space not occupied by government sovereignty is instead the domain of “the market,” which has diametrically opposed priorities for the essential (and inaccurate) vision of center versus periphery that underlies parliamentarian and bureaucratic conceptions of how and where political authority operates, and so which can only vaguely discern how platforms may constitute a very different kind of political geography. As discussed in the *City* layer chapter, *Cloud* platforms push what used to be command-and-control infrastructural capabilities to the edges of the network, imbuing humble objects and interfaces with supercomputing capacity, with the *Cloud* interface device called the “mobile phone” being the plainest example, and in doing so, the *Cloud* absorbs and centralizes other platform regulation duties. In doing so, the object of governance is not just humans but things as well, including and especially the interfaces between humans and things. Who or what is or is not transparent in the first place is not the same for people and objects, and yet both can be *Users* of one another. As we will see, the geopolitics of the *Cloud* and composition of the *User* as a political subject may bring a kind of trauma, as the emergence of an algorithmic governance that is not primarily a governance of humans but also of ecologies, inanimate objects, data sets, other algorithms, of sensing and sensation. This is complicated by the fact that we are not designing one algorithmic-interfacial regime but multiple simultaneous and interweaving totalities. “Desired outcomes” may overlap but vary widely. What is legal and consistent for one may be technically or morally impossible for another. That heterogeneity may be another bulwark against totalitarianism, and it may also be a path toward another as yet undefined universal materialism, one that is no more or less totalitarian than the laws of mathematics.

76. Bruce Clarke and Mark B. N. Hansen, *Emergence and Embodiment: New Essays on Second-Order Systems Theory* (Durham, NC: Duke University Press, 2009).

77. Peter Watts, *Beyond the Rift* (San Francisco: Tachyon Publications, 2013), 9.

78. James Bridle, “Do You Know This Person?” Render Search, <http://render-search.com/>.

79. Sarah Jaffe, “Silicon Valley’s Gig Economy Is Not the Future of Work—It’s Driving Down Wages,” *Guardian*, July 23, 2014, <http://www.theguardian.com/commentisfree/2014/jul/23/gig-economy-silicon-valley-taskrabbit-workers>.

80. When I was a youngster, my dislike for the Canadian rock band Rush was confirmed by the song “Red Barchetta,” about a guy who drives around in his muscle car in defiance of climate and pollution laws. Today, Johnny Dronehunter protects normatively masculine white guys from the emasculating influence of “drones” (and “technology” in general we assume) by zooming around inside his big metal box and shooting at things in the sky. Behold: “Johnny Dronehunter: Defender of Privacy—Official Trailer Feat,” Salvo 12 Shotgun Silencer, SilencerCo, 2014. <https://www.youtube.com/watch?v=jIXwQVFt8Ho>.

81. The same Johnny Dronehunter: the bitter cyborg in a big heavy car, sitting down with his knees touching, his little eyes shielded, not only by a massive windshield, but also reflective lenses strapped to the front of this skull and covering his orbital sockets.

82. Drew Harwell, “Human Props Stay in Luxury Homes But Live like Ghosts,” *Tampa Bay Times*, July 6, 2014, <http://www.tampabay.com/news/business/realestate/human-props-stay-in-luxury-homes-but-live-like-ghosts/2187417>.
83. Cory Doctorow, “The Coming Civil War over General-Purpose Computing” (lecture at Talks at Google, Google, Mountain View, CA, August 22, 2012), <https://www.youtube.com/watch?v=gbYXBJOFgeI>.
84. Ryan Calo’s work is instructive on these and related issues. See his “Robotics and the Lessons of Cyberlaw,” *California Law Review* 103 (2015), University of Washington School of Law Research Paper No. 2014-08, February 28, 2014.

The Black Stack

1. By contrast see Giorgio Agamben, *The Coming Community* (Minneapolis: University of Minnesota Press, 1993).
2. Paul Virilio, *The Futurism of the Instant: Stop-Eject* (Cambridge: Polity Press, 2010). Liis Kängsepp, “Estonia to Offer ‘E-Residency’ to Foreigners,” *Wall Street Journal*, October 21, 2014, <http://www.wsj.com/articles/estonia-to-offer-e-residency-to-foreigners-1413897698>. *Sleep Dealer*, directed by Alex Rivera (Vaya Entertainment, 2008). L. Jordan, *Dress to Kill* (Vision Video, 1980).
3. “Cunning use of flags” is a line by comedian Eddie Izzard, describing British colonial strategy.
4. For example, Gaza and the West Bank are to live in different time zones. Maan News Agency, August 28, 2011, <http://www.maannnews.net/eng/viewdetails.aspx?id=416597>.
5. O. Wainwright, “The World’s First Indoor City: A Greatest Hits Mashup of London and New York,” *The Guardian*, July 9, 2014, <http://www.theguardian.com/artanddesign/architecture-design-blog/2014/jul/09/worlds-first-indoor-city-dubai-mall-of-the-world>.
6. “Biosphere 2 was a giant sealed world. Eight humans were locked in with a mass of flora and other fauna, and a balanced ecosystem was supposed to naturally emerge. But from the start it was completely unbalanced. The CO₂ levels started soaring, so the experimenters desperately planted more green plants, but the CO₂ continued to rise, then dissolved in the ‘ocean’ and ate their precious coral reef. Millions of tiny mites attacked the vegetables and there was less and less food to eat. The men lost 18% of their body weight. Then millions of cockroaches took over. The moment the lights were turned out in the kitchen, hordes of roaches covered every surface. And it got worse—the oxygen in the world started to disappear and no one knew where it was going. The ‘bionauts’ began to suffocate. And they began to hate one another—furious rows erupted that often ended with them spitting in one another’s faces. A psychiatrist was brought in to see if they had gone insane, but concluded simply that it was a struggle for power. Then millions of ants appeared from nowhere and waged war on the cockroaches. In 1993 the experiment collapsed in chaos and hatred.” A. Curtis, “How the ‘Ecosystem’ Myth Has Been Used for Sinister Means,” *The Guardian*, May 28, 2011. See <http://www.theguardian.com/environment/2011/may/29/adam-curtis-ecosystems-tansley-smuts>.

7. Even though the UN's 1967 Outer Space Treaty stated that no country could claim the moon, Dennis Hope sold pieces of it anyway. Hope is the owner of the "Lunar Embassy Corporation" and has sold plots of moon land to 3.7 million people since 1980. The Nevada entrepreneur believed that he could claim the moon under the guise of a galactic government that he created. This government would technically be exempt from the UN's treaty. Unfortunately for Hope and the other lunar loonies, the UN treaty also exempts private citizens of terrestrial governments from claiming stake in the moon. Victoria Jaggard, "Who Owns the Moon? The Galactic Government vs the UN," *National Geographic*, July 17, 2009, <http://news.nationalgeographic.com/news/2009/07/090717-who-owns-moon-real-estate.html>. United Nations Office for Outer Space Affairs, "Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies," January 1967, <http://www.unoosa.org/oosa/SpaceLaw/outerspt.html>.

8. McKenzie Wark, *Molecular Red: Theory for the Anthropocene* (London: Verso, 2015); Kim Stanley Robinson, *Red Mars* (New York: Bantam Books; 1993); Kim Stanley Robinson, *Green Mars* (New York: Bantam Books, 1994); Kim Stanley Robinson, *Blue Mars* (New York: Bantam Books, 1996).

9. Arjun Appadurai, "Sovereignty without Territoriality: Notes for a Postnational Geography," in *Geography of Identity*, ed. Patricia Yaeger (Ann Arbor: University of Michigan Press, 1996), 40–58.

10. Geodesign is hampered, however, not only by the complexity of its brief but also by the traditions of humanist politics across the spectrum. Moreover, many, if not most, of these traditions are, on more rigorous examination, less about politics than matters of faith and cultural identity, symptomatic responses that may incur catastrophe by their intransigence. Historian of science, Naomi Oreskes, often makes the point about climate change denial that the strength of belief (or disbelief) often has little to do with a conviction about the state of the science, or even necessarily the state of what the science describes. It stems rather from a distrust or fear of the policies that seem most relevant to mitigate against it, especially big, coordinated, infrastructure-level transnational governance. For a rightist libertarian at home on the range in his mind, nothing could be more unwelcome, and so competing conspiracy theories take the place of thinking and knowing. Oreskes, however, makes another point, which is that the longer that decisive action on climate change is delayed, the more draconian and even totalitarian would be any necessary measures to keep civilization afloat. A pinch of governance now saves a pound later, and so the filibustering inaction actually does more to guarantee the arrival of what the right (supposedly) fears most.

Responses like this are by no means confined to the right. Now that The Stack has emerged as a globally hegemonic system, we see on the left an unfortunate knee-jerk antidigital technology politics. When "the Internet" was seen as a way to decentralize and distribute power horizontally, disintermediating older institutions, then a "net politics" for the multitude was essential, but now that it is seen instead as an architecture for the consolidation and instrumentalization of power in volumetric space, then the Left falls into familiar stances well suited to critique but not to design or to the possession of power. Some discourses have trouble keeping straight whether the chief critique is "client side" (that neoliberalism foists all governing responsibility onto atomized individuals who cannot possibly decide on systemic problems) or "server side" (that massive

state-scale platforms control systems-scale governance, leaving individuals no ability to maneuver autonomously). It is true that in theory, both can be true at the same time, but perhaps another reason for the contradiction is to protect another paradoxical double-wish: the romance of left libertarianism, blending old New Left self-realization with in-pocket supercomputing, and trying to find its footing on ground now given way into the sinkhole of state Keynesianism and its various variations. The latter used to underwrite the former's sense of autonomy, but now the former has helped to decapitate the latter. It should be clear that the interests of the strong geodesign articulated by this book in the interests of a better Stack-to-come are not to be found inside the cultural politics of this First World psychodrama. A late-industrial-era aesthetics of hand tools, grooming, and food (particularly of the white working class) may represent a new pastoral for some urban youth cultures, but a generational fetishization of analog machines does not make for a good theory of technology. And yet it sometimes seems as if that, plus a 4Chan-of-everything, is where things stand. The end result of this dreary convergence of the artisanal opt-out with misanthropic populism is that many of the worst *Cloud* feudal outcomes are far *more* likely to emerge than they would be if that collective intelligence were guided by another more future-forward cultural politics. Just as for the Right denialists, the Left counterparts sometimes work as if their strongest loyalties are to the protection of their own worst fears.

11. The design program suggested doesn't only pay attention to what is right in front of its nose, but works with strategic appreciation for incorporation and recursion between scales, which range from the geo-graphic staging of planetarity to the molecular granularity of deep address, and in between. This too is a logic of Stacks. As for governance, what binds it to software is its dual situation "before the law." It both precedes the law and is subject to the law. It is both how the state organizes the legal possibilities of connection through the ordination of worldly interfaces and how our legal entanglement with the interfaciality of planetary computation allows it in turn to take on the roles of governance. Perhaps it is true that the killer application of the Internet of Things was "insurance." At first blush, this sounds both boring and scary, but I think there is a lot to this (though not in ways that O'Reilly is necessarily speaking to). Some critics jumped on this remark as proof that Californians are digital fascists after all. I think, however, that after bitcoin and digital money, another area to redesign may in fact be the pooled and priced risk as a future model of governmentality, as understood in the disciplinary Foucauldian sense and meant thereby as a *good* thing. After Mauss (and Graeber), we believe that money represents "gift" and "debt" but it also represents risk, and this may be equally important. I floated the notion above that Google-scale platforms might be able to solve both the "socialist pricing problem" as well the "capitalist pricing problem," namely, transaction externalities (e.g., carbon footprint, infrastructure theft, energy theft, pollution), by including these real costs in to the real price. That price might not only be price of an individual transaction but the price of the insurance and reinsurance that allows the enterprise to function in the first place. That is, insurance as killer app of Internet of Things gets interesting if those "things" are not just smart refrigerators but every little bit of every supply chain that must account for itself as a carbon-intensive Earth object.

12. Another software trend championed by O'Reilly is Open Stack, a set of tools that allows for, as it sounds, an open source Stack architecture (in a delimited sense). It also claims to work without the governance of a Benevolent Dictator for Life (BDFL). Many *Users* may be surprised to learn that many of the open source software tools they use every day, perhaps without knowing it, such as Linux, Python, Perl, Drupal, and PHP, are not communitarian anarchies but rather—at least in the last instance—formal monarchies. I raise the point not so as to recommend that platform states function as *Cloud*-based monarchies, but to underscore that the reality of order-giving force and decision making is not a design problem that can be avoided by leaving it to the ever-widening dining tables of horizontal relational “consensus.”

13. Bernard Tschumi, *Architecture and Disjunction* (Cambridge, MA: MIT Press, 1994).

14. Jean-Luc Godard, *Ici et ailleurs* (Paris: Gaumont, 1976).

15. It will prove confusing to the left and the right that there is no necessary correspondence between planning an egalitarian economic system and a sustaining governance of the Anthropocenic ecology. We could have one without the other. With legacy state communism, we can have strong planning toward egalitarian economics that is also based on ecological devastation (such as Chavismo), and so it is possible that postcapitalist, postscarcity platform economics providing a “universal service level” may feature the stark absence of communitarian deliberation and consensus in any sense of *vox populi* mimesis. Comparing emergent systems to legacy systems (e.g., autocracy, anarchy, liberalism) may simply clarify less than it obscures. One would hope, and one would design on behalf of that hope, for a Stack that unleashes better models.

16. Quentin Meillassoux, “Subtraction and Contraction: Deleuze, Immanence and Matter and Memory,” in *Collapse*, vol. 3: *Philosophical Research and Development*, ed. Robin Mackay (Falmouth, UK: Urbanomic, 2007), 63–107.

17. Or perhaps soft and hard are not the operative distinction when, for example, soft animal bodies and hard mechanical bodies are understood as together more natural than the nonhuman machines absorbing and expressing computation. (Perhaps it will shake out in some way that this constructed mismatch between physical topology and conceptual topology reflects also how information technology is associated with virtuality and apparition and mechanical technology with materiality and physicality.) It would appear that the actuality of computation is not only difficult to imagine but sometimes offensive to afterimages of naturalistic humanism.

18. See http://en.wikipedia.org/wiki/Dark_Side_of_the_Rainbow and <https://www.youtube.com/watch?v=0gXvVUg-VAE>.

19. During a visit to the University of California, San Diego, Ed Keller bought a book from the campus bookstore that catalogued various forms of exotic psychopathology. As I recall, we spent much of the afternoon issuing diagnoses to various societal trends. Among these was “apophenia,” the phenomenon whereby someone perceives a direct correlation between two sensory inputs where none actually exists, such as between an image and sound that are not really in synchronization but which we perceive as such (such as the old iTunes visualizer that presented swirling lines supposedly pulsing with the music, but was really just swirling). *Dark Side of the*

Rainbow is another classic example (Google it). We also discussed “On the Origin of the ‘Influencing Machine’ in Schizophrenia” by Viktor Tausk from 1933, and Karl Popper’s writing on conspiracy theory and narcissistic attribution errors. Popper wrote that members of informationally and socially isolated groups (which means today any Internet subculture) tend toward a kind of paranoid cognition. They become suspicious and distrustful of society and susceptible to “sinister attribution errors.” As Cass Sunstein puts it, “This error occurs when people feel that they are under pervasive scrutiny, and hence they attribute personalistic motives to outsiders and overestimate the amount of attention they receive. Benign actions that happen to disadvantage the group are taken as purposeful plots, intended to harm. They *overestimate the amount of attention they receive* [emphasis mine]. Benign actions that happen to disadvantage the group are taken as purposeful plots, intended to harm.” See Cass R. Sunstein and Adrain Vermeule, “Conspiracy Theories,” *Coase-Sandor Working Papers in Law and Economics*, University of Chicago Law School, 2008. Keller and I discussed how, in some Software Studies circles, people compare Google AdWords to the Stasi with a straight face. We discussed how conspiracy theory politics mirrors the absent *User*, except that here it is the absent agency. In a way, it is a kind of secular creationism, or at least intelligent design. It holds that systems can’t evolve according to their own selective processes; rather, some agent must have caused this to take place. Google or the NSA, or Bush or Obama, or the Jews or Goldman Sachs, some absent and abstract Oedipal first mover, must be the source of this confusion and misery. We discussed the strong gravity field between the overestimation of WikiLeaks’ significance and Truther websites, which suggests that apophenia has, for the geopolitics of technology, risen to the level of a political ethics, and that the “Influencing Machine” is no longer the purview of psychiatrists but now also sociologists.

20. “But Palantir’s central privacy and security protection would be what Karp calls, with his academic’s love of jargon, ‘the immutable log.’ Everything a user does in Palantir creates a trail that can be audited. No Russian spy, jealous husband or Edward Snowden can use the tool’s abilities without leaving an indelible record of his or her actions. Why had the thought of these data mining projects analyzing their own use not occurred to me until just now?” Andy Greenberg, “How a ‘Deviant’ Philosopher Built Palantir, a CIA-Funded Data-Mining Juggernaut,” *Forbes*, August 14, 2014, <http://www.forbes.com/sites/andygreenberg/2013/08/14/agent-of-intelligence-how-a-deviant-philosopher-built-palantir-a-cia-funded-data-mining-juggernaut/2/>.

21. Jacob Appelbaum, Laura Poitras, and Trevor Paglen, “Art as Evidence” (panel at Transmediale, Haus Der Kulturen Der Welt, Berlin, 2014), <http://www.transmediale.de/content/presentation-by-jacob-appelbaum-at-transmediale-2014-keynote-art-as-evidence>.

22. See <https://www.youtube.com/watch?v=ZJ6BuHLOEiQ>. Thanks to Serene Han, programmer at Google Ideas, for helping me understand the uProxy technology.

23. See <https://webwewant.org/>, <http://www.theguardian.com/technology/2014/sep/28/tim-berners-lee-internet-bill-of-rights-greater-privacy>, and Agence France-Presse, “Tim Berners-Lee Calls for Internet Bill of Rights to Ensure Greater Privacy,” 2014.

24. See <http://www.offnow.org/11361>, a petition to cut off the water supply to the NSA’s Utah data center.

25. Eliezer Yudkowsky, "Artificial Intelligence as a Positive and Negative Factor in Global Risk," 2008, <https://intelligence.org/files/AIPosNegFactor.pdf>.

26. See <https://www.youtube.com/yt/press/statistics.html>.

Glossary

1. This definition comes from the interview, "Machine Vision: In Discussion with Benjamin Bratton." See <http://dismagazine.com/issues/73272/benjamin-bratton-machine-vision/>

Index

- absolute incommunication, 212–214
abstraction of physicalization, 29, 33
accidental megastructure of The Stack, 5, 8–17,
 54, 61, 64, 72, 303, 367
accident produces a new technology, 13, 17,
 356
accountability, *User*, 345, 347–348
actor-network theory, 266
addressability
 crisis of, 26, 199, 335
 defined, 210
 financialization of, 212–213
 geopolitics of, 208
 matter-information link, 211
 of the object, 204, 296
 potential, expanding space of, 208–210
 textuality as, 199–200
address-addressee correlation, 211
addresses
 exchange provided by, 206
 geopolitics of assigning, 193–194
 global credential of, 296
 identity and, 193–196, 206
 individuated in the *Address* layer,
 191–192
 layers overlapping, 196
 as networks for communication, 132, 153–
 154, 192–195
 organizing, 198
 recursion provided by, 206–207
 retroactive traceability, 206
 space of relationality between, 205–206
 in Stacks-to-come, 299, 339–340
subjectivization effect, 206
surveilling, 215–216
topology produced by, 206
addressing regimes, 193–195, 198–199, 326
addressing systems, 70, 135–136, 195–197,
 205–206, 296
Address layer. *See also* deep address
 absolute incommunication, 212–214
 addressability, 205–207
 to come, 216–217, 326–337
 communication, 210–212
 composition, 210–212
 defined, 367, 417n38
 design brief, 192, 207, 209, 215
 development of, 196
 distortion of, 214–217
 governance, 196
 individuated addresses in, 191–192
 integral accident of, 204
 introduction, 70–71, 191–192
 objects in The Stack, 200–204
 productive accidents of, 197
 scale, scope, structure, 193–197
 thing-to-thing communication, 197
 totality and universality, ambition of,
 216–217
Address layer interactions
 City layer, 153, 211
 Cloud layer, 152, 211
 Earth layer, 211
 Interface layer, 211–212

- Adorno, Theodor W., 254, 321–322, 427n47
 advertising infrastructure, Google, 137
 aerial space, 25, 27, 30
 aerotropoli, 281
 aesthetics of logistics, 178, 230–235, 243
 Agamben, Giorgio, 20, 164–165, 173–174, 176, 271–273, 275–276, 279, 341, 368–369
 agency. *See also* political agency
 amplifying, 274
 collective versus individual, 175
 decentering, 344
 of the excluded, 173–175
 human, 255
 of inanimate objects, 131
 of machines, 348
 political, 250, 258
 of the *User*, 164–165, 238, 252, 258, 260, 338, 347–348
 utopian, 249
 Agenda 21, 89, 306
 agonistic geopolitics, 115
 agricultural industry, 307–308
 agricultural settlement, 22, 86
 Ain, Gregory, 320
 airports
 borders within, 155–156, 324
 economy of, 281
 envelopes of, 156–157
 interfacial network of, 155–156
 airport urbanism, 155–157, 162, 405n14
 Alberti, Leon Battista, 154
 alegal, 174, 176, 367
 Aleppo, Syria, 321
 Alexander, Christopher, 201
 Algerian independence, 244–245
 algorithmic automation, 134, 332, 341–342
 algorithmic capitalism, 72, 80–81
 algorithmic decision-making, 134, 332, 341–342
 algorithmic geopolitics, 449n56
 algorithmic governance, 134, 332–334, 337–338, 341–342, 348, 368
 algorithmic hardware, 348–349
 algorithmic intelligence, 81
 algorithmic trading, 33, 335
 Allende, Salvador, 58, 328
 Allianz Arena, 187
 Al Nasr, 321
Alphaville (Godard), 158
 Althusser, Louis, 7–8
 Amazon
 Cloud platform, 185–186, 330
 Cloud Polis, 131–133, 331
 corporate campus, 185
 fulfillment centers, 111, 186, 443n19
 future possibilities for, 141–142, 186
 as geopolitical model, 125
 mission, 186
 platform wars, 110
 profitability, 331, 449n52
 workforce, 186, 307, 443n19
 Amazon space, 443n19
 Amazon Standard Identifier, 131
 Amazon Web Services, 110, 123, 133
 ambient emergency, 70–72
 ambient interface, 296, 337–343, 368
 anamnesis, 239–240, 297
 Anders, William, 86
 Anderson, Chris, 293
 animal-human distinction, 275
 animal-human interface, 276
 animal *User*, 274–277
 anonymity, 347, 360, 362, 405n16, 445n37
 Anonymous, 110
 Anthropocene
 architecture's response to, 182
 challenge of, 78, 304, 353–354
 life forms surviving, 107
 planetary-scale computation surviving, 217, 302
 post-Anthropocene, 364–365
 anthropocentrism, 278
 anthropometric design, 197
 anthropometric space, 30
 anthropomorphism, 277, 279
 anti-cosmopolitanism, 248, 306

- Anti-Fascist Protection Wall, 23
Antonov 225 airplane, 182
ants
 communications, 340
 war machine, 352
 zombie, 154
Aozaki, Nobutaka, 214–215
Apollo 8, 86–87, 144, 150, 251–252, 300. *See also* “Earthrise” photograph
Apollo-era architecture, 179, 188, 201
Apollo-era utopia, 179, 304
Apollo program, 331–332, 354
apophenia, 359–360, 459n19
apparatuses
 Agamben on, 164–165, 173–174, 271–272, 276
 architectural, 164–166
 City layer, 163–168
 in human lives, 272
 of surveillance, 215
Apple
 architectural-urban footprint, 186–189
 Campus 2, 186–187, 189, 320
 Cloud Polis, 128, 187–188
 future possibilities for, 141–142
 as geopolitical model, 125
iPhone, 168
 platform wars, 110
 sales, 402n56
 Siri for iOS, 277, 286
 Super Bowl ad, 128, 402n57
Applebaum, Jacob, 293
Apple Pay, 127
Apple Stores, 129, 187–188
Apple User, 129
Apple Watch, 129
application programming interfaces (APIs), 50, 116–117, 139, 171, 202, 299
App platform, 168, 237, 238–239
Apps
 anthropocentric, 168, 239
 Apple’s ecology of, 129–130
 artificial personalities, 277–278
 artificial reality, 240–242
 augmented reality, 171
 Cloud-based contacts, 196
 data-gathering, 236
 defined, 236, 368
 devout, 240
 future of, 117
 hands transformed by, 150, 238, 297
 interfaciality, 225, 297
 monetizing, 116
 moral frame of, 243
 nonhuman, 239
 subcontracting opinions to, 240
 tangibility, 168–169
 Transborder Immigrant Tool (TBIT), 174–176
 urban interface, 168–169, 237
 User-habitat/habitat-User mediation, 236–239
 virtual death of, 277
App Store, 129–130
Arab Spring, 9, 361
Aramis project, 281–282
archaeology, utopian, 328–329
archaic, the, 9
Archigram, 179–180, 201
architectural envelope, 23, 165–170, 195, 296, 303, 311–313, 323
architectural imaginary, 181–183, 324
architectural program, 43, 165–166, 169–170
architectural space, 43, 164–165, 343
architectural-urban footprint, 183–189, 320.
 See also megastructures
architecture. *See also* design; megastructures
 Anthropocenic, 182
 apparatuses, 164–166
 of biology, 196, 288
 city without, 151
 communication through, 148, 161
 defined, 201, 391n30
 dynamic expressionistic forms of, 322–323
 geopolitical, 3, 27, 38, 65, 98, 300–302, 309–310
 illumination in, 408n34
 innovation in, 184, 322

- architecture (cont.)
Interface design, 166–167
 interiority/exteriority, 23, 185, 220, 303, 323–324, 391n30
 mega-utopian, 179
 new forms of, 2–13
 perspectival scale, expanding, 181
 politics of, 166–167
 post-Oklahoma City bombing guidelines, 322
 power symbolized by, 325
 Stack models, 52–54, 357
 of and for things, 188–189
User layer, 296
 violence and, 357
- Architecture Machine Group, 201
- Archizoom, 86, 150–151. *See also* No-Stop City
- Arcology (Soleri), 178–179
- Arendt, Hannah, 379n12
- Aristophanes, 109
- artificial currencies, 127
- artificial intelligence (AI), 78, 225–226, 262, 268, 277–279
- artificial personalities, 277–278
- artificial reality. *See* augmented reality
- Assange, Julian, 135, 285, 288
- assemblage line, 231, 234–235, 249, 368
- Atlas Shrugged* (Rand), 253
- atmospheric carbon, stabilizing, 259, 303
- atmospheric megastructures, 195
- atomized human, 251–252, 287–288
- atoms, 77
- Atta, Mohamed, 321
- audience-centric *Cloud* services, 129
- augmented reality (AR), 236, 245–246, 382n40, 429n61, 438n60
- Apps, 240–243
- games, 242, 245, 429n59
- authority. *See also* jurisdiction; sovereignty
 decentering of, 344
- platforms as modes of, 57
- state, 6, 295, 318
- transparency of, 360
- of the *User*, 347
- autobiographical geopolitics of the *User*, 257–258
- automation
 of repentance, 243
 workforce, 254, 285, 307–308, 344
- automatism, 426n46
- automobiles. *See* cars
- autonomy
 computational edges and nodes, 37, 46, 214
 device, 279, 342–343
 of layers, 69
 platforms, 136, 282, 339
User, 309, 346
- Avogadro's number, 192, 208, 292, 337
- Babbage, Charles, 42, 79, 194, 383n7
- Bachmann, Charlie, 62–63
- Balcony, The* (Genet), 288
- Balkin, Amy, 98
- Ballard, J. G., 311, 320
- B.A.N.G. Lab, 176
- Banham, Reyner, 201, 280
- banking, 123, 237, 336
- Barlow, John Perry, 441n7
- Barney, Matthew, 183
- Bataille, Georges, 391n30
- Battle of Algiers* (Pontecorvo), 244
- Baudrillard, Jean, 427n47
- Beck, Glenn, 110
- Beer, Stafford, 1, 58–61, 328
- "Before the Law" (Kafka), 345
- Beijing Airport, 181, 188
- Bell, Gordon, 261–264
- Benjamin, Solly, 439n66
- Benjamin, Walter, 20, 225–226, 317, 320, 351, 391n30
- Bergson, Henri, 191
- Berlin, US embassy in, 322
- Berlin Wall, 23
- beyond the line, 30
- Bible, The* (App), 242–243

- big data society, 89, 243, 270–271, 334
Big Society initiative (Cameron), 399n37
Bilbao effect, 180, 321, 410n50
bill of rights, 203, 362
biofundamentalists, 308
biogeopolitics, 269
bioinformational systems, 389n13
biological informationalism, 274
biological refashioning, 269
biology, architecture of, 196, 288
biomedical service providers, 285
biopolitical economy of space, 22, 141
biopolitical security, 288
biopolitics
 Foucauldian, 10, 251
 polities of energy and, 92
 of population medicine, 6
 of privacy, 159, 360
 of the statistical imaginary, 257
Biosphere 2, 315, 352, 456n6
Birth of Biopolitics, The (Foucault), 251
bitcoin, 9, 127, 171, 209, 336–337, 393n54
“Black Box, The” (Lem), 341
Black Stack
 defined, 368
 design and, 359–365
 The Stack and its others, 355–359
 summary overview, 363–365
Blade Runner, 319
Bloch, Ernst, 321
Blomkamp, Neil, 311, 444n27
Blue Marble Earth, 144
blue marble photograph. *See “Earthrise” photograph*
Bodin, Jean, 20
Bogdanov, Alexander, 328
bombs, Cold War, 325
Booz-Allen Hamilton, 121
borders. *See also* camp/enclave; walled gardens
 within airports, 155–156, 324
 within cities, 311–312
conflicts, 9, 120, 144
economy of, 323
of enclosure and escape, 22, 32–33, 149–150, 172–176, 303
enforcing, 310
as envelope-interface, 172–173
formal and informal, 97
geopolitical geography of, 6–7, 97, 120, 144, 172–173, 308–310, 323–324, 409n42
globalization destabilizing and enforcing, 23
interfaces as, 220
Internet, 318
reversibility of, 23, 32–33, 148–149
of self, 262
software, 315
of technology, 29
virtual, 309
Borges, Jorge Luis, 209, 211, 363
Chinese Encyclopedia problem, 451n61
bots, 278, 344
boundaries of self, 262
Bourdieu, Pierre, 424n41
“Brain Is the Screen, The” (Deleuze), 219
brand, power of, 128, 130
Branzi, Andrea, 150–151
Brassier, Ray, 390n19
breach theory, 113
Brin, David, 454n75
Brin, Sergey, 139
Broad Museum, 320
bunker. *See* camp/enclave
bureaucracy, 7, 342
Burning Man, 315
Burroughs, William S., 157
Bush, George W., 322
California Ideology, 57, 385n20
Calit2 (California Institute of Telecommunications and Information Technology), 267
CalTrans building, 320, 322–323
Calvino, Italo, 147
Cameron, David, 399n37
camp/enclave. *See also* borders
 defined, 368–369
exceptionality of, 23, 32–33

- camp/enclave (cont.)
 free of information technology, 313, 315
 gated communities as, 311–312
 interiority/exteriority of, 173–175, 311–312
nomos of the Modern, 20, 369
 refugee, 174–175, 308, 312
 reversibility of, 23, 32–33, 312, 324
 walled gardens compared, 187
- Campus 2 (Apple), 186–187, 189, 320
- Čapek, Karel, 279
- capital, computational, 80–81
- capitalism
 accomplishments of, 332
 algorithmic, 72, 80–81
 Anthropocenic, 213
 cognitive, 110, 116, 203, 241, 258, 295
 digital, 80
 future of, 321
 industrial/postindustrial, 80, 128, 254
 of people versus things, 212
- capitalist pricing problem, 333, 337, 369
- carbon economy, 98
- carbon footprint
 China, 259
 of data computing, 92–96
 electricity generation, 95
 India, 95
 stabilizing, 259, 303
 US, 259
- carbon governance, 88–90
- carbon police, 306
- Carpenter, John, 427n51
- cars
 car+phone hybrid, 280
 communication in, 280
 driverless, 238, 279–283, 342, 344, 437nn57–58 (*see also* Google Car)
 hacking, 283–284
 human-driven, 283, 344–345
 redefining, 238–239
 vehicle-to-vehicle (V2V) networks, 281–282, 438n60
- cartography function of the state, 119
- cassiterite, 82
- Castells, Manuel, 416n28
- catallaxy, 329–331, 375
- Celebration, Florida (Disney), 311
- cellular phones. *See* mobile devices
- Center for Bits and Atoms (MIT), 226
- Central Bureau of the Map of the World, 413n5
- centralized cybernetic economic planning systems, 58–61, 328–329
- Central Nervous System of the Earth (CeNSE) (HP), 192
- Cerf, Vint, 42, 62–63
- chains of interfaciality, 231, 233–234, 338–339
- change, commitment to, 303–304
- charter city movement, 310–311
- Chicago Boys, 385n25
- Chile, 58, 328
- China
 boundary enforcement, 310
 carbon emissions, 259
 conflict with Google, 9, 112–115, 143–144, 245, 361
 factory cities in, 179, 189
 internal illegal aliens, 310, 409n39
 Internet in, 113
 jurisdictional anomalies, 310
 mobile operating systems popular in, 398n21
 rain, control of, 398n21
 social media in, 126
 software espionage, 398n21
 state services apparatus, 316
 Universal Postal Union, 194
 weather data, claim over, 97
- Christianity, 239
- Chrysler Building, 183
- Church-Turing thesis, 78
- Cisco Systems, 88, 179
- cities. *See also* entries beginning with urban
 agricultural, 307–308
 ambient interface, 296
 borders within, 311–312

- building codes and zoning, 162
charter city movement, 310–311
citizens, 153, 159, 175
of control, 157–160
function of, 168
future of, 308–312, 315–316, 414n10
futuristic, 162–163
green, 181–182
Internet compared, 445n37
jurisdiction in, 153, 296
mobile device interface, 168–169, 237
noncitizens, 159, 175, 310, 409n39
population, 303–304
poverty in, 443n13
redrawing by the *Cloud* through the App, 238
right to passage through, 174
self-governing, 310–311
standardization in, 46
violence defining, 311, 322–323, 325
without architecture, 151
citizens. *See also* humans; individuals
of cities, 153, 159, 175
identity of, 314
citizenship
Cloud-based, 136, 316, 318
of the displaced, 100–101, 159, 310, 409n39
dual, of state and platforms, 115, 319
global, basis of, 257
Google *Grossraum*, 318
legitimate, 9, 122, 250
mobile, 153, 326
of the modern state, 114
political, 188
sovereign, 122
citizen *Users*, 115, 159, 299
City and the City, The (Miéville), 112
city-as-airport, 155–157, 162, 405n14
city-as-layer, 151–155
city-as-world, 151
City layer
address geographies, 193–195
apparatuses, 163–168
appetites of, 154
basic building unit, 148
boundary reversibility, 148–149
City versus *City* warfare, 154
to come, 314, 320–327
composition, 152, 179
computational hyperobjects embedded, 227–228
control structures, 174
defined, 369
design, 167–172
economics, 159–160
envelopes, 12, 70, 148–149, 152, 154–155, 163–171, 173
exposure and control, 155–160
force finding function finding form, 160–163
function of, 149
generative accidents, 175
geodesign, 321
geopolitics, 444n26
grids, 149–153
ideal cities distinction, 150
infrastructures, 151–153
interfacial problematics of, 167, 256
introduction, 70, 147–151
jurisdiction, 357
megastructural form, 176–183
sovereign accidents, 172–176
Stack integration, 154–155, 170
territories of, 154
Users, 148–149, 154, 163–164
violence below, 155
City layer interactions
Address layer, 153, 211
Cloud layer, 110, 153
Earth layer, 153
Interface layer, 124
city-states, 4, 144, 163
City-states, 299, 352
climate, state and, 395n73, 398n21
climate and weather systems, 88

- climate change
 crisis of ongoingness, 295, 306
 denial, 457n10
 finding solutions for, 88–90, 259, 443n13
 refugees of, 100–101
 sovereign duty to suppress, 98
 clinamen, 77, 358–359
 Clinton, Hillary, 3, 13, 319, 351
Cloud layer
 access to, limiting, 314
 beginnings, 110
Cloud-based state, 109, 119–121, 295, 316, 327, 399n36, 441n8
Cloud-based User-response-driven systems, 255
Cloud corporations, 183
 to come, 295–296, 299, 307–319
 decentralization, 156–157
 defined, 67, 369
 design, 141–145
 economics, 116, 136–138
 feudalism, 111, 143, 295, 307–309, 317–318, 328, 369
 geography, 123
 geopolitics, 26, 110–112, 114, 118–119, 124, 141–145, 454n75
 governance of, 68, 140, 143
 as grid, 140
 growth, limits to, 94, 117–118
 importance of, 125
 infrastructure, 67, 115–119, 124
 interfacial problematics, 256
 introduction, 70, 109–111
 jurisdiction, 113–114, 140
 landfill, 94
 metadata, 116
 as physical, 29
 productive accidents of, 112, 114, 145
 services, 116–118
 terraforming project of, 111, 115–116
 tethers, 82, 148 (*see also* mobile devices)
- Cloud layer interactions*
Address layer, 152, 211
- City layer*, 110, 153
Earth layer, 94, 110, 140–141
User layer, 124, 154, 168, 187
- Cloud Polis
 Amazon model, 131–133, 331, 369
 Apple model, 128–131, 187–188
 availability of, 312
 China-Google conflict, 9, 112–115, 143–144, 245, 361
 China model, 143
 to come, 122–123, 298, 313, 316–319
 defined, 369–370
 design of, 109, 124, 141–145
 exclusionary, 309, 311–312, 317
 Facebook model, 125–128, 187–188
 Google model, 134–141, 143, 184–185, 187–188, 332, 369
 interfacial regime, 339–340
 introduction, 109–110
 megastructure headquarters, 155
 model of planetary urbanity, 258
 political economic architecture, 124
 popular discourse on, 312–313
 present-day, 119–122, 318
 revenue stream, 295
 reversibility of, 319
 of things, 131
 Walmart model, 331
- Clouds* (Aristophanes), 109
- Clow, Lee, 128
- cocaine, 173
- cockroaches, 275, 285
- cognition, militarization of, 297
- cognition-interfaciality synthesis, 297
- cognitive capitalism, 110, 116, 203, 241, 258, 295
- Cohen, Jared, 134–136, 361
- coin mining, 393n54
- Cold War, 325
- coltan (tantalum), 82–83
- columns
 accessing, 68, 298, 314
 defined, 67, 370

- function of, 66–67
intention linked through interface, 286
Interfaces, activating, 67–68, 220
layers within, totalities between, 68–69
policing, 287
Stack-to-come, 301
User initiation, 67
User interests, interpolating, 253, 313–314
User-to-User connections, 67, 286, 301, 370
Comcast, 119
“Coming Civil War over General-Purpose Computing, The” (Doctorow), 285
command and communication technologies, 242
Commissioners’ Grid Plan, 42
communication
absolute, logic of, 214
addresses as networks for, 132, 153–154, 192–195
Address layer, 210–212
architecture for, 148, 161
in cars, 280
defined, 210
geographies of, 210
human, structuring, 128
human-to-human, 198, 340
human-to-nonhuman, 136–137, 171–172, 198, 340
images for, 127
mediascape in, 148
object-to-object, 197–198, 210, 212, 216, 338
physical/virtual, 196
real-time, 168
restrictions on, 194, 196
standards, 54
traceability between lines of, 205
universal, addressing tables enabling, 192
communication networks, 55, 132
communities of *Users*, 288–289
comparative planetology, 300–302, 333, 353, 360
composite *User*, 281, 362
computability, 55
computation, 55, 75–80, 388n5
Computer City, 179
“computer everywhere” infrastructure, 13–14, 59–60, 301–302, 356
computer science, 327
conflict minerals, 82–83
conspiracy theory politics, 128, 459n19
Constant (Constant Nieuwenhuys), 178
consumer electronics, 82–83, 179. *See also* mobile devices
Continuous Monument (Superstudio), 178
control, defined, 157, 222
control city, Deleuze, 157–158
Conway, Melvin, 56
 Conway’s law, 56–57
Copernican rotations of human autophenomenology, 287
“Cosmism” (Federov), 328
cosmograms, 91, 235, 243, 246
cosmopolitanism
 accidental, 70
 to come, 17
 cosmopolitan logic, 318, 322
 cosmopolitics, 247, 306
 informational, 135, 315
 Kantian, 6, 153, 354
 material, 257
 postsecular, 318
 proto-, 256–257
 User, 175, 286
Costa Rica-Nicaragua border conflict, 9, 120, 144
counterespionage, crowd-sourcing, 110, 398n21
counterterrorism discourse, 324, 355
Cremaster 3 (Barney), 183
crime embodied, 156, 175–176
crisis of addressability, 26, 199, 335
“Critique of Violence, A” (Benjamin), 20
Crying of Lot 49, The (Pynchon), 194
crypto City-states, 352
cryptographic tools, 405n16
Cryptonomicon (Stephenson), 400n42

- Crystal Island, Moscow (Foster), 182, 188
culpability, User, 346
 cultural-economic order, 56
currency. See also money
 bitcoin, 9, 127, 171, 209, 336–337, 393n54
 digital platform, 336–337
 double spend problem, 418n45
 Facebook, 127
 future of, 127, 336
currency-matter link, computerization of, 199
 “Cybernetic Praxis in Government” (Beer), 1
cybernetics
 autopoietic, 59
 consumer, 274
 corporate, 128
 economic planning systems, 58–61, 328–329
 of interface design, 157
 meaning of, 275–276
 rise of, 327
 of scenario planning, 359
 second-order, 334
 Soviet, 58–61, 138, 328–329, 332
 theory concurrent with, 54
cyberwarfare, 27
- Daalder, Rene, 320
 Dal Co, Francesco, 304
 Dar al-Islam, 9, 322
 dark matter, 91
 Darknet, 215
 dark pools, 451n63
Dark Side of the Rainbow effect, 359
data
 jurisdiction over, 113–114, 120, 122–123, 285–286
 ownership of, 203, 285, 345–346
 proliferation of, 117, 204
 substantialization of, 168
data centers
 energy footprint, 92–94, 113, 140–141, 303–304
 water-based, 113–114, 140
data collection
 Apps for, 236
 mobile phones for, 342
 sensor nets, 97, 180, 192, 295
 smart dust for, 201
Users used for, 340
Data.Gov, 9
data hauls, 363–364
data haven, 400n42
data space versus state space, 123
data visualization, 267, 302, 334
 Daultrey, Sally, 97
da Vinci robotic surgery system, 279
 Davis, Mike, 304–305
de-addressing of things, 199
death of the User, 260, 271–274, 361, 370, 436n42
 Debord, Guy, 414n10
debt, 303, 335–336
decision-making algorithms, 134, 332, 341–342
“Declaration of the Independence of Cyber-space” (Barlow), 441n7
dedifferentiated space, 33
deep address, 64, 197–200, 206, 209, 210–216, 334–335, 338–339, 370. *See also Address layer*
deep address haecceity, 214–215, 273, 279
deforestation, 82–83
 De Gaulle, Charles, 244
 Deleuze, Gilles, 76–77, 81, 84, 104, 147, 157–158, 160, 219, 222, 378n13, 393n50
Democratic Republic of Congo, 82
demonetization, 51
denial-of-service attacks, 215, 451n70
 Depardon, Raymond, 265
De Rerum Natura (Lucretius), 388n7
 Derrida, Jacques, 29
design. See also architecture
 defined, 354
emergency, 101–104, 321, 325
future of, 355–358
geopolitical, 247, 354–355

- interior/exterior, 171
with and for Stacks, 359
villains in, 359
- Designing for People* (Dreyfuss), 254
- design ontology of traps, 288–289
- design violence, 428n55
- Detroit, 307, 444n30
- Deux ou trois choses que je sais d'elle* (Godard), 147
- Dick, Philip K., 320, 447n45
- Didion, Joan, 280, 320
- digital bill of rights, 362
- Diller Scofidio + Renfro, 265, 320
- Dioxiadis, Constantin, 178
- Disney (Walt Disney Company), 128, 130, 311, 320
- dispositif* (apparatus). *See* apparatuses
- DNA, 268, 389n11
- Doctorow, Cory, 198, 285, 346
- domain name system, 196
- Domed City (Fuller), 188
- Dominguez, Ricardo, 172–173
- Dotcom, Kim, 399n34
- double spend problem, 418n45
- doubt, suicide as expression of, 426n46
- Dreyfuss, Henry, 254
- Dr. Manuel de la Pila housing block, Puerto Rico, 311–312
- drones, hacking, 401n45
- drowning nations, 100
- Dürer, Albrecht, 53, 181
- Durkheim, Emile, 266, 385n25
- Dutch East India Company, 399n32
- "Dymaxion File" (Fuller), 267
- Dyson, Freeman, 106–107
- Dyson sphere conjecture, 106–107
- Eames, Charles and Ray, 52
- Earth
- composability of, 84–86
 - in *Earth layer*, 76, 82–84
 - geoaesthetics, 83–87
 - geometrics, 90–91, 309
- grids and networks, 37–38, 90–97, 149–153, 170, 180, 192, 229, 280, 294–296, 393n53
- human transformation of, 354
- loop topology of, 24
- petawatts of radiant energy from sun, 106–107
- planet-spanning architectural propositions, 178
- remapping everything in, 191–192
- second planetary computer overlaying, 300–301
- as skin, 87–92
- subdividing, 21–24, 193, 195, 309, 413n5
- terraforming, 85–86, 181, 187, 404n11
- two, parable of, 444n27
- writing on (geo-graphy), 85–86, 149, 193, 249
- Earth layer*
- address geographies, 193–195
 - to come, 294–295, 300–307
 - computational transparency, 76–81, 101
 - defined, 370–371
 - design issues, 101–107
 - Earth in, 76, 82–84
 - emergencies, designing for/designing with, 101–104
 - energy monitored and provisioned, 87–92
 - function of, 107, 300
 - geodesign, 83–84, 288, 304
 - geopolitical architecture, 98, 300–302
 - governance, 98–104, 140
 - human-facing permeation, Apple's, 187–188
 - interfacial problematics of, 256
 - introduction, 69–70, 75–76
 - productive accidents of, 91, 93
 - sensing and sovereignty, 97–101
 - world-making/world-erasure projects, 91–92
- Earth layer* interactions
- Address layer*, 211
 - City layer*, 153
 - Cloud layer*, 94, 110, 140–141
 - User layer*, 154

- Earth-order, 24
 "Earthrise" photograph (Anders), 86, 150, 300, 442n11
 Easterling, Keller, 182
 e-citizenship, 446n42
 Eco, Umberto, 125, 243
 eco-computing, 258–263, 268, 354
 ecoglobalism, 89, 259, 303
 ecojurisdictions, 97–100
 ecological crisis, contributors to
 Anthropocenic energy platforms, 106
 anthropogenic climatic events, 102
 electronics manufacturing, 82–83
 planetary-scale computation, 82–83, 92–96, 106–107, 113, 140–141, 258–260, 303–304
 ecological noise, 106
 ecology
 Anthropocenic, 102, 106, 217, 458n15
 of energy, 98–104
 mobile, of interfaces, 237–238
 popular ecology movement, 86
 restoration of, 304–305, 442n14
 ecology of the gut, 268
 e-commerce, 131
 economic inequity, 311–312, 439n66, 458n15
 economic planning systems, cybernetic, 58–61, 328–329
 economics. *See also* platform economics
 Anthropocenic, 58, 103
 of borders, 173
 capitalist, 56
 City layer, 159–160
 Cloud model, 137
 electronics, mining and trading in, 82–83
 zero-sum, 336
 economy
 of additive manufacturing, 202
 of cognitive capital, 110, 116
 computational, 328
 computer-controlled, 58–60
 of contemporary warfare, 248
 digital, 196
 of energy, 92, 106–107
 Facebook, 127
 Google, 136–138, 159, 444n26
 of identity, 270
 of information, 199
 of mobility, 280
 of prostheticization, 273
 of reversible partitions, 21
 of scarcity, 208
 and sovereignty and territory, 114, 316
 ecopolitics, 100
 ecosystems, 129, 178, 185, 336, 456n6
 Ecumenopolis (Dioxiadis), 178
 Eisenman, Peter, 410n50
 Elden, Stewart, 335, 379n12
 electricity, 93, 95, 141
 electronics, mining and trading in, 82–83
 electronic waste, 83
Elysium (Blomkamp), 311, 323, 444n27
 emergency
 accommodating, 103–104
 designing for/designing with, 101–104, 321, 325
 ecojurisdictions in response to, 99–100
 ecological, 105–106, 295, 305
 ecopolitics emerging by, 100
 exceptional, 103–104, 173, 321–322
 permanent, 104
 progress in response to, 321
 sovereign decision and, 20, 32, 102–103
 state of, 32–33, 99
 emergent, the, 9
 empty space, 30, 380n20
 enclosure and escape, 22, 32–33, 149–150, 172–176, 303
 "end of history," 321
 "End of Sykes-Picot, The" 430n65
 energy
 alternative sources, 259
 ecologies of, 98–104
 economy, 92
 efficiencies, 140–141
 energy-information network, 93, 95

- footprint, of planetary-scale computing, 82–83, 92–96, 106–107, 113, 140–141, 258–260, 303–304
grid, 92–96, 140, 152, 201, 294–295
needs, predicted, 113
political loyalty and availability, 141
polities, subdivided, 99–100
post-Anthropocene, 217
Eneropa, 99
Engelbart, Douglas, 343
Enlightenment, 251, 426n46
entertaining securitization, 156
entertainment identifier registry (EIDR), 207
entrance/exit, 149–150, 313, 315, 317, 371
envelope-interface borders, 172–173
envelopes
airports, 156–157
architectural, 23, 165–167, 195, 303, 311–313, 323
cars as, 238
City layer, 12, 70, 148–149, 152, 154–155, 163–171, 173
as interface, 167
mixed, designing for, 168–172
paper, 46, 195
physical, 167
software, 167
urban, 168–172
urban platform, 180
User position in relation to, 252
environmental migrants/refugees, 100–101
Epicureanism, inverse, 358
equilibrium, cybernetic, 59, 158
error detection, 50
espionage, 398n21
Estates of The Oaks, 311
Estonia, 399n36, 446n42
Ethereum, 336
ethics, 258, 285, 362
European *nomos* of World Wars I and II, 25–26
European Space Agency, 181
European Union, 309
exception
in Apple model, 130
automation of, 33
becomes the rule, 102–103, 111
emergency, 103–104, 173, 321–322
emergent order of, 110–111
inside and outside the law, 102
interface, 357
legitimate state of, 104
normalizing, 23, 32–33, 39, 103–104
reversibility of, 21, 32–33, 39, 145
sovereignty over, 20–21, 32, 105, 341
state of emergency as, 99, 105
territories of, 114
exclusion
agency and, 173–175
augmented reality and, 236, 241–242
elective, 316–317
societal, 308–309, 311–312, 317
exclusive totalities, 245
exit. *See* entrance/exit
Exit (Diller Scofidio + Renfro), 265–266, 269
Exit, Voice and Loyalty (Hirschman), 313
exit-voice dichotomy, 286, 309, 313, 319
Exodus: Voluntary Prisoners of Architecture (OMA), 53
experiential design of the object, 129
extrapolative futurism, 80

Facebook
Apple compared, 130
closure from the open Internet, 401n51
Cloud Polis, 125–128, 133, 187–188
future possibilities for, 141–142
as geopolitical model, 125
platform wars, 110
Zee Town, 185
factory cities, 130–131, 179, 189
Fang Binxing, 113
Fanon, Franz, 244–245
Federov, Nikolai, 328
FedEx Corporation, 131, 133, 307
Felton, Nicholas, 262–263

- fences, barbed-wire, 29
- feudalism, *Cloud*, 111, 143, 295, 307–309, 317–318, 328, 369
- fiber optics, 117
- 56 Leonard, New York, 311
- filtering, rituals of, 156
- financial crisis, 123, 199, 335
- financial networks, 118–119
- Fincher, David, 126
- Five Points toward a New Architecture* (Le Corbusier), 53
- flow
- at borders, 172–173
 - cybernetic, 334, 341
 - global assemblages, 265–266
- flow, cybernetic, 334, 341
- food
- biopolitical economy of space and, 22, 141
 - building block of political loyalty, 141
 - intelligent industrialization of, 307–308
 - meaning of, 307–308
- food platform design, 308
- force of law, 302, 310, 328, 334, 356
- Foster, Norman, 179, 181–182, 186–188
- Foucault, Michel, 7–8, 20–21, 45, 105, 164–165, 251, 254, 425n46
- 432 Park Avenue, New York, 311
- Foxconn, 130, 179–180, 189
- framing lines, 84–85
- France, in World War II, 244–245, 429n62
- Franceschet, Massimo, 332
- freedom, 316–317
- free soil, 26, 32–33, 35, 112
- Fresno, CA, 307–308
- Freud, Sigmund, 80, 435n32
- Friedman, Milton, 385n25
- Friedman, Yona, 179
- friend-enemy distinction, 35, 352, 397n19
- Fuller, Buckminster, 5, 113, 178, 188, 267
- fundamentalisms
- anti-cosmopolitan, 248
 - avant-garde and atavistic, 297
 - bio-, 308
- defined, 427n47
- doctrinal cognitive, 239
- globalization and, 143
- religious, 17, 241, 427n47
- Fun Palace (Price), 179
- futurism, 303–304
- Galapagos syndrome, 60
- game apps, 127
- game scenarios, 428n55
- gaming interface, 242
- gated communities, 311–312
- Gates, Bill, 128
- Gattaca*, 319
- Gehry, Frank, 3, 185, 410n50
- Gelernter, David, 110
- genealogy of platforms, 42
- Genet, Jean, 288
- geoaesthetics, 83–87, 294, 304–305
- geodesign
- with the blur, 299, 351
 - City* layer, 321, 325–326
 - crisis of ongoingness, 304–305
 - defined, 354–355, 371
 - Earth* layer, 83–84, 288, 304
 - for ecological restoration, 304–305
 - elements restricting, 456n10
 - framework, 325
 - future of, 182
 - of privacy, 159
 - of secession, 312
 - Stacks-to-come, 107, 294, 305–306, 310, 314, 319, 321, 324–326, 333, 353–354, 357
 - User* layer, 286
- geoeconomics, 72, 87
- geoengineering, 354
- geoglyphs, 85–86, 177–179
- geogovernance, 15, 27
- geographic lines of segmentation, 9, 21, 120, 144
- geographic strategy, Google, 9, 120, 144
- geo-graphy (earth-writing), 83–87, 149, 309

- geography. *See also* Earth
artificial megastructures, 176–183
constitutional, 111
defined, 371
economic, 199
essential importance of, 149
exceptional or unregularized, 30
informational, 29
Internet, 361
of jurisdiction, 171–176, 283, 308–309, 323
of multiple geographies, 245–246
politico-theological, 242, 248, 320–322
of The Stack, sovereignty over, 33
superimposition of the addressing matrix, 193
telescoping, 16, 101, 178, 197, 220, 229, 235, 266
geolocated augmented reality, 438n60
geolocative advertising, 255
geolocative Apps, 236, 243
geometrics, 90–91, 309
geometry of territory, 25
geophilosophy (Deleuze and Guattari), 372
geopolitical architecture
designed, 38
of *Earth* layer, 98, 300–302
European, 27
new, need for, 3, 300–302
unipolar, future of, 309–310
geopolitical conflict
Google-China, 9, 112–115, 143–144, 245, 361
historical, 6
Nicaragua–Costa Rica border, 9, 120, 144
present-day, 6
geopolitical domains, 118–119
geopolitical geography, 4–5, 19, 33, 65, 252
of borders, 6–7, 97, 172–173, 308–310, 323, 409n42
of conflict, 6, 9, 112–115, 120, 143–144, 245, 361
design model, 3–6
energy driving alignments in, 141
European *nomos*, 25–26
future-antecedent revision of, 14–17
geometry of, 13–17
loop topology of, 84
mapping, 4–5
of planetary-scale computation, 14–17, 143
TBIT controversy, 174–176
geopolitical theory, 328
geopolitics, 19, 39–40, 257–258, 326, 360
of addressability, 193, 207–208
of addresses, 193–194
algorithmic, 449n56
City layer, 155, 160, 444n26
of climate change, 140–141
Cloud layer, 110–112, 114, 454n75
within comparative planetology, 353
compositional, 85
computational, 360
defined, 371–372
design, 119, 141–145
elements of, 246–247
as epidermal, 355
framework, 159
geoscropy and, 85
Google model, 125, 134–136
of interfaciality, 228
modern, basis of, 24
post-Anthropocenic, 285
of postscarcity, 95
projection as territory/territory as projection, 85
spacelessness of contemporary, 30
space of, 6
geoscapes, 243–249, 372, 429n61
geoscropy, 85, 87, 89–90
geotheological innovation, 242–243
Germany, 309
Gershensonfeld, Neil, 226
ghost sovereignties, 100–101
gift economy, 429n59
GigaOM, 186
Girard, René, 360
global assemblages, 265–266

- global citizenship, basis of, 257
 global commons, 35–36
 global infrastructure, 139–140
 globalization
 fundamentalism and, 143
 individual experience of, 270
 infrastructure, 45, 110
 international system of control in, 443n23
 of postal domains, 194
 of risk, 321
 software-driven, 348
 spatial warfare of, 431n70
 twentieth-century, Schmitt's view of, 31–32
 of urban geography, 151
 globally unique identifier (GUID), 168, 207, 254
 global society, Anthropocenic, 106
 global urban, 177–179
 global visualizations, 265–266
 Göbekli Tepe, 149, 176, 188
 Godard, Jean-Luc, 147, 158
 gold, 82, 104, 336
 gold standard, 199, 336
 goods and services, quality of, 313
 Google
 advertising infrastructure, 137
 algorithmic methods, 332
 architectural footprint, 184–185
 AR game, 241–242
 Cloud Polis, 132, 134–141, 184–185, 187–188, 332
 conflict with China, 9, 112–115, 143–144, 245, 361
 cosmopolitan logic of, 322
 economic sovereignty, 122
 Facebook compared, 126
 future of, 129, 141–142
 geographic strategy, 9, 120, 144
 geopolitical model, 125, 134–136
 Grossraum, 34–40, 134, 295, 318, 372
 infrastructure, physical, 10–11, 113
 Interface joke, 332
 interfacial regime, 247
 mission statement, 87, 122, 134, 138, 186, 353, 396n10
 as monopoly, 400n41
 nation-state functions, 10–11
 Nest, purchase of, 134
 network architecture, 118–119
 Nortel patent bid, 134
 oceanic data centers, 140
 OpenFlow's advantages to, 437n58
 platform universality, 332
 political theology of, 425n46
 proto-citizenship, 122
 revenue stream, 136–138, 159, 444n26
 search infrastructure, 136–138
 shutting down access to, 403n63
 synthetic catallaxy, 331
 territorial footprint, 113
 US-centricity, 135
 Google AdWords, 255
 Google AI, 134
 Google bashing, 402n62
 Google Car, 129, 134, 139, 281–282, 344, 437n55, 437n57. *See also cars: driverless*
 Google charter cities, 352
 Google City, 444n26
 Googledome, 184
 Google Earth, 86, 91, 134, 242, 247–248, 322, 391n30, 431n70
 Google Earth RealTime, 299–300
 Google Energy, 134, 140
 Google Fiber, 399n31
 Google Glass, 129, 134, 282, 308, 381n30, 438n60
 Google Glass App, 288
 Google Gosplan, 328, 332, 363–364, 372
 Google ID, 295
 Google Ideas, 134, 361
 Google Island, 315
 Google Maps, 9, 120, 144, 242, 265, 431n70
 Googleplex, 183–185
 Google Public DNS, 136
 Google Robotics, 134, 138–139
 Google Sovereignty, 134

- Google Space, 134
Google Time, 134
Google 2.0, 184–185
Google Wallet, 127
Google: Words Beyond Grammar (Groys), 239
Google World, 134–135
gorilla populations, 82–83
Gosplan
 Google, 328, 332, 363–364, 372
 Soviet, 59, 138, 329
governance
 of addresses, 198–199
 Address layer, 196
 algorithmic, 134, 332–334, 337–338, 341–342, 348, 368
 apparatus of, 173–174
 Cloud layer, 68, 140, 143
 of *Cloud Polis*, 113–114
 computational, 90, 97, 112, 327
 cybernetic, 341
 ecological, 88–90, 97–106
 economic, 329–330
 geographic, modes of, 27
 of interfaces, 325
 Internet, 143
 intervention versus interfaciality in, 227–228
 machine of, 173–174
 of the market, 329–330
 meaning of, 327
 new forms of, 5, 119, 260
 new war over, 10–11
 Obama-era infrastructuralism, 180–181
 object of, 357, 454n75
 of platforms, 143
 spatial, 163
 technologies of, 7–8
 training by computation, 90
 of urban interfaces, 155–157, 163, 326
 of urban platforms, 326
 of the *User*, 49, 159
governmentality, 7–8, 327
government layer, 396n12
Graeber, David, 443n23
Grand Canyon AR overlay, 242
graphical user interface (GUI). *See also*
 interfaces
 architecture and, 165–166
 computational intensification of, 171–172
 effectiveness, 230
 function of, 224–225, 229, 231, 297, 338–339
 images of systemic interrelationality, 266
 limitations, 226
 normative essentiality of, 226
 older, Apps versus, 168
 ubiquity of, 249
 User interfaces, 219–221, 223
Grasshopper, 320
Great Maginot Firewall, 112–113
green urbanism, 181–182
grids
 architectural expression of, 296
 City layer, 149–153
 to come, 294–295
 descriptive and generative function, 150
Earth-wide, 37–38, 90–97, 149–153, 170, 180, 192, 229, 280, 294–296, 393n53
economy of motility, 38
freeways as, 280
lines of mobility forming channels, 38
smart, 92–96, 393n53
sovereignty of reversibility, 37
Stack interfacial systems as, 229
urban, 149–151, 160, 170, 178–179
volumetric, 37
Griffith, Saul, 258–261, 263, 268
Grossraum
 American, 31–32
 Google, 34–35, 39, 134, 295, 318, 372
 Schmittian, 31–32, 371
Grosz, Elizabeth, 84–85, 89, 288
ground is abstraction, 33
Groys, Boris, 41, 239–240, 425–427nn46–47
Guattari, Félix, 84, 158
Guggenheim Bilbao, 410n50
guns, 344–345

- Habermas, Jürgen, 360
 habit, 420n17
 habitats, 237–239, 310, 424n41
 habitus, 424n41
hacker-User distinction, 35
 hacking
 cars, 283–284
 war, 401n45
 haecceities
 addressable, 212, 216, 264, 273, 279
 mapping and linking, 296
 hands
 the App transforming, 150, 238, 297
 as interfaces, 222–223, 226, 236–239
 Hansen, James, 98
 Hansen, Mark, 265
 Hansen, Robin, 317
 Haque, Usman, 203, 392n40
 Haraway, Donna, 385n25
 HavenCo, 400n42
 Hayek, Friedrich, 42, 328–329
 Heatherwick, Thomas, 184
 Hegel, Georg Wilhelm Friedrich, 55
 Hegelian struggle, 397n19
 Heidegger, Martin, 28–29, 131, 205, 304, 308, 421n19
Her (Jonze), 277
 Hermes, 210
 Hertz, Garnet, 275–276
 Hertzian geography, 195
 Herzog & de Meuron, 187, 311
High Rise (Ballard), 311
 Himalayas, 97
 Hirschman, Albert, 313
 Hobbes, Thomas, 20, 328
 Holmes, Brian, 418n43
 “Holy War: Mac vs. DOS, The” (*Eco*), 125
 home and homeland, values of, 447n45
homo economicus, 44, 251, 328, 344, 362
 Hope, Dennis, 456n7
 Houellebecq, Michel, 187
 HST algorithms, 33, 127, 278, 335
 Hu Jintao, 98
 humanism, 81, 212, 255–256, 361
 humans. *See also* citizens; individuals
 atomized, 251–252, 287–288
 autophenomenology, 287
 biological refashioning, 269
 evolution, 148
 human-animal distinction, 275
 human-animal interface, 276
 human-centered design, 289
 human-driven cars, 283, 344–345
 humanization, 272
 human-machine distinction, 164–165
 human-nonhuman distinction, 268, 275
 human-object networks, 171
 human-robotics interaction (HRI), 342–343, 362
 human-to-human communication, 198, 340
 human-to-nonhuman communication, 137, 171–172, 198
 hunter-gatherer groups, 149
 impermanence of, 359
 personality, 277
 privilege, 343
 stool, 269
 survival, isomorphic standardization of, 257
 transformation of the world, 354
 Hurricane Katrina, 105
 Husserl, Edmund, 28
 hypermaterialism, 153, 263, 339
 Hypertube (Musk), 281
 IBM, 63, 128, 179, 186, 327
 ICANN (Internet Corporation for Assigned Names and Numbers), 34, 196
I Ching, 77
 icons, 225
 identity. *See also* User: identity
 addresses and, 193–196, 206
 boundaries of self in, 262
 economy of, 270
 externalized, 157
 individuation-without-, 133
 management, 396n12

- online, 215
policing, 175
services, 136
illumination in architecture, 408n34
image-interface, 220–221, 225–226, 233–235
imaginary
 architectural, 181–183, 324
 film and, 241
 interfacial, 225, 230
 of resistance, 244
 social, 233
The Stack's logistical, 191
topological, 162
utopian, 235
imagine no lines/imagine nothing but lines, 324, 355
“Imperial Message, An” (Kafka), 191
inclusion/exclusion
 based on shared condition, 448n45
 borders of, 22, 32–33, 172–176
 Cloud Polis, 309
 prisons, 153
 universal, 287
 of the *User*, 184
 wealth and poverty, 311–312
index is the innovation, 125, 138
India, 85, 95, 97, 309
individuals. *See also* citizens; humans
 agency of, 274
 crime embodied in, 156, 175–176
 energy footprint, 113, 258–260
 individuation, 133, 405n26
 jurisdictional claims on, 144–145
 personified simulations of, 254–255
 as a process, 405n26
 right to the city, 174–175, 404n10
 self-quantification by, 203–204, 267–270
 sense of self, 261
 User relation to, 264
industrialism, Anthropocenic, 12
industrial power, symbols of, 183
information
 of absence, 342
 centralization of, 116
 culture of, 56–57
 exchange, 361
 governability of, 353, 451n61
 human secretion of, 269
 instant access to, 116–118
 interaction with, 168–169
 interfacial regimes producing, 230
 networks, 31
 post-Anthropocene, 217
 reproblematising the spatial, 27
 scarcity, 372
 spaces, 27, 31
 systems, 3, 54–55
 universalism, 315, 332
 value, 332
visualization, 220–221, 225–226, 233–235, 243, 301, 323
information architecture, 201
information computing technologies (ICT), 93–96
information technology free zones, 313, 315
information theory, 54–55
Ingels, Bjarke, 184
Ingress (Google), 242, 245
inhuman intelligence, 81
innovation
 Apps, 129, 238
 architectural, 184, 322
 city site for, 310
 future of search and, 137
 geotheological, 243
 historical, 45, 77–78, 303–304
 imitation of, 129
 index as, 125, 138, 304
 paths of, 94, 98
 political-theological, 230
 resistance to, 334
 self-congratulation of accommodation, 104
 social media, 158
Stack-to-come, 336
technological, 45, 62, 79, 92, 129, 163, 330
twenty-first-century, 125–126, 353

Instagram, 126–127
 intellect capture, 203
 intellectual property, 439n65
intelligence. See also artificial intelligence
 abstracting work into, 358
 algorithmic, 81
 cognitive capitalism, 110, 116, 203, 241, 258, 295
 computational, 230
 interfacial, 226
 machinic, 78, 81, 262, 362
 of mobile devices, 342–343
 pricing, 329
 shifting off-center, 338
 subcontracting, 8
 synthetic, 362
 technologicization of, 278
 threshold measures of, 362
intention-Interface link, 285
 interaction design, 254–255
 interaction through absence of interaction, 342
 interaddressability, 199
Interface design, 166, 230–235, 255, 420n6, 422n29
Interface-intention link, 285
Interface layer
 Apps and, 237–239
 to come, 297–299, 337–343, 347, 432n71
 defined, 372–373
 function of, 124, 219
 future politics of, 244
 generative accidents, 220
 as habitat, 425n41
 integral accident of, 246
 Internet of Things at, 340
 introduction, 71, 219–220
 local-global recursion, 235
 logistical imaginary for, 230
 organization of, 256
 productive accidents of, 235
 remaking of the world, 228

Interface layer interactions
Address layer, 211–212
Cloud layer, 124
User layer, 253, 297, 299
Interface machines, 224–226, 230. *See also Google Car*
interfaces. See also graphical user interface
 alegal, 355–356
 ambient, 296, 368
 animal-human, 276
 Apps as, 236
 chains of, 231, 249
 city and nation-state, 155–156
 in *City layer*, 154
 decentralization, 156–157
 decision-making, 32–33
 defined, 220–222, 419n6
 etymology, 419n6
 forms of, 338
 function of, 68, 124, 220–222
 Google's, 34
 governance, 325
 hands as, 222–223, 226, 236–239
 human-Stack, 219–221
 individuation, 347–348
 as layer, 228–230
 machinic, 224–226, 230
 mobile ecology of, 237–238
 navigational, 12
 nonhuman-Stack, 219
 from object to sign to object, 222–228
 perceived as real, 236
 persuasive, 224, 430n65
 placebo, 224
 remote, 223
 tangible, 168
 as thresholds, 228
User in relation to, 12, 338
User versus owner, 345–346
 of violence, 317, 325
 visual/nonvisual, 13, 230–235, 341, 424n41
interfacial acceleration, 232–233

- interfaciality
Apps, 225, 297
chains of, 231, 233–234, 338–339
geopolitics of, 228
intrinsic/extrinsic, 223
through objects, 226–228
software, 167
urban, 223, 227–228
- interfacial knowledge, 223–228
- interfacial regimes
centralizing and decentralizing, 232
of a *Cloud Polis*, 339–340
competitive, 229, 233
as cosmograms, 243
defined, 373
design, 232
flows and connections, 229
function of, 235
future, legality of, 176
political identity of the *User*, 260
present-day, 229
sovereign geographies, 243–250
Stack-to-come, 339–340
as totality machines, 229
- interfacial security regimes, 345
- interfacial symmetry and asymmetry, 342
- interfacial totalities, 229–230, 233–235, 373
- Intergovernmental Panel on Climate Change (IPCC), 98–99
- interiority/exteriority
architectural, 23, 185, 220, 303, 323, 324
camp/enclave, 173–175, 311–312
exit to and from, 313, 315, 317, 371, 447n45
political borders marking, 324
reversibility of, 23, 312, 319, 341, 447–448n45, 452n69
of the social body, 22
- International Communications Union (US), 143
- International DOI Foundation, 207
- International Map Project, 413n5
- Internet
addresses, 202, 207–211
addressing authority, 34, 196
addressing systems, 195–196, 205–206
alternative non-US, 35–36
balkanization, 135–136
the city compared, 445n37
Cloud services based in, 117
to come, 445n37
development of, 35
geography of, 361
governance, 143
growth of, 35
industrial, 202
interplanetary, 387n31
mapping, 398n25, 441n8
nonhuman *User*, 216, 278
slogan of, 426n46
space available, 117, 207–209
state controlled, 318–319
we know, 61–64, 445n37
worlds of, 445n37
- Internet Corporation for Assigned Names and Numbers (ICANN), 34, 196
- Internet of Things, 200–203, 207, 211, 216, 335, 339–340, 397n18
consortia, 413n5
ecology, 346
emergent, 413n5
Internet for Things, 203–204
Internet of haecceities, 211, 296, 361
Internet of Things Bill of Rights, 203
Internet service provider (ISP), 118, 208
intertextuality, 199–200
invention, 76–81, 360
invention of technology as invention of accident, 13, 17
inverse prostheticization, 275
Invisible Cities (Calvino), 147
iPhone, 168
IP-networked haecceities, 215
IPv4, 202, 207–208
IPv6, 207–210, 416n35

- Iran, 154
 Iraq, 401n45
 irredentism, 417m38
 Ishii, Hiroshi, 226
 ISIS, 246
 Islam, 246, 321, 425n46
 islands, technology free, 313, 315
Islands in the Net (Sterling), 400n42
 iTACITUS Reality Filtering, 429n59
 Italy, 309
 Ito, Joi, 344
 iTunes, 129
 Ive, Jony, 129
- Jameson, Fredric, 25, 27–28, 56–57, 178, 321, 330–331, 359, 427n47
 Japanese internment camp, Poston, CA, 103
 Japanese postal system, 194
 Jefferson, Thomas, 109
 Jeremijenko, Natalie, 276
 Jerusalem, 324
 Jobs, Steve, 129–130, 186
 Johnny Dronehunter, 455nn80–81
 Jonze, Spike, 277
Jules Verne (Serres), 1, 75
 “junkspace,” 404n4
 jurisdiction. *See also* authority; sovereignty
 in cities, 153, 296
 City layer, 357
 Cloud Polis, 113–114
 over data, 113–114, 120, 122–123, 140
 eco-, 98–100
 geography, 171–176, 283, 308–309, 323
 over individuals, 144–145
 integration, 309
 international and transnational, 123
 jurisdictionality, 90
 over land and sea, 19, 26–28, 113, 153, 296, 398n21
 legitimate, 324
 nation-state as, 5, 309–310
 residential, 153
 surveillance, 28, 121
- transoceanic, 399n34
User-migrant-subject status, 172–173
 over weather data, 97
 zombified, 296
- Justinian I (emperor), 98
- Kafka, Franz, 191, 345
 Kahn, Louis, 383n7
 Kant, Immanuel, 6, 55, 257
 Kantorovich, Leonid, 328
 Karl-Marx-Hof, Vienna, 178
 Karp, Alex, 360
 Keynes, John Maynard, 42, 328
 Kieran, Stephan, 322
 Kinect (Microsoft), 226
 Kittler, Friedrich, 45, 77, 241, 389n15
 Klushantsev, Pavel, 328
 knowledge, interfacial, 223–228
 knowledge-power asymmetries, 454n75
 Kojève, Alexandre, 109
 Konyism, 390n25
 Koolhaas, Rem, 53, 99, 320
Kosma Vojagho, 328
 Kripke, Saul, 205
 Kronick, Sam, 208
 Krugman, Paul, 336
 Kuffner, James, 139
 Kurgen, Laura, 265
 Kwinter, Sanford, 148
- labor force. *See* workforce
 Lacan, Jacques, 261
 Laclau, Ernesto, 379n10
 landscape geography, 149
 landscape of things, 198
 land versus sea
 nomos's juridical separation of, 19, 26–28, 113
 perception of, 27, 30
 sovereignty, 25, 27, 150, 380n15
 LA School, 323
 Lashkar-e-Taiba, 242, 246, 322
 Latour, Bruno, 266, 281, 305, 416n35, 421n19

- law
automating decision-making through, 341
as code, 327
force of, 302, 310, 328, 334, 356
law of the land, 380n13
rule of, 103, 111, 173
layers of The Stack
accidents possible within, 11, 13
architecture, 11–12, 357
blur as metaphor for workings of, 14
to come, 314
complementarity/differences, 52, 66–67
interdependence, 68
leverage between, 68
machinic jurisdictions, 66
modularity within, 68–69
nonhuman *User* interactions, 284
productive accidents of, 9–10, 37
sovereign claim over, 69
sovereign operations, 314
Stacks-to-come, 299–300
standard protocols, 68
Lazarfeld, Paul, 254
League of Nations, 31
leap of faith, 426n46
Lebensraum, Nazi Germany, 32
Le Corbusier (Charles-Édouard Jeanneret), 53
Lefebvre, Henri, 404n10, 424n41
legitimacy, crisis of, 26
Leibniz, Gottfried Wilhelm, 77
Lem, Stanislaw, 341
Lenin, Vladimir, 330
Leonardo da Vinci, 254
Lessig, Lawrence, 363
Lévi-Straussian structuralism, 380n15
Levy, Steven, 437n58
Lewis and Clark expedition, 120
liberal internationalism, 32
liberal technocracy, 312–314, 316–317
liberty, 313
“Library of Babel” (Borges), 209, 416n34
library of the real, 363–364
Limbaugh, Rush, 128
lines. *See also* borders; grids
of communication, 205
of demarcation, international law, 32
geopolitical effects, 39–40
inside and outside of, 23–28
land versus sea, 19, 26–28, 30, 113, 150
nomos of the *Cloud*, 28–31
reversibility, 22, 150
subdividing Earth, 21–24, 193, 195
liquefaction and solidification, 355, 379n9
liquefaction of self, 71
live-work-sleep factory cities, 130–131
living beings-subjects-apparatuses, 272, 279
Llull, Ramon, 77
localism, 104, 143
logistical aesthetics, 178, 230–235, 243
logistics, defined, 422n28
London, US embassy in, 322
Longo, Giuseppe, 389n12
loop topology, 24, 84, 373
Los Angeles, 320
Lovelace, Ada Byron, 42, 79
Lucretius, 77, 192
Luhmann, Niklas, 385n25
machine-as-state, 7–13, 34, 40, 65, 373
machine-human distinction, 164–165
machine owners, rights of, 285
machines
agency of, 348
of governance, 173–174
innate capacities of, 273
intelligence of, 78, 81, 262, 362
real versus artificial, 358
subjectification of, 272–273
machine-to-machine (M2M) communication, 137
machine-to-machine (M2M) connoisseurship, 226
machine *User*, 279–284
machinic prostheticization theory, 273
Madison, James, 109
Mad Max, 319

- Maidan Square protests, Ukraine, 347
 Malle, Louis, 429n62
 malware, 202, 346
 Manson, Charles, 293
 manufacturing electronics, ecology of, 82–83
 maps
 cartographic function of the state, 109,
 119
 Europe by energy polities, 99
 geolocation Apps, 236, 243
 of global address space, 208
 Google Maps, 9, 120, 144, 242, 265,
 431n70
 modern nation-state, 24
 Nicaragua–Costa Rica border conflict, 9, 120,
 144
 personal mapping technologies, 86, 236,
 243, 431n70
 as precomputational interfaces, 429n61
 remapping war, 17, 242, 247–248
 of sovereignty, 53–54
 subdividing Earth, 195, 413n5
 of territorial expansion, 120
 Marcus, Gary, 283–284
 Marcuse, Herbert, 328
 market fundamentalism, 446n39
 market governance, 310, 329–330
 market sovereignty, 21, 105, 285, 329
 Marramao, Giacomo, 381n24
 Marx, Karl, 52, 77, 212, 328
 Masdar City, Abu Dhabi (Foster), 179, 181–
 182, 281
 Massumi, Brian, 101
 material cosmopolitanism, 257
 materialism, 131, 212
 mathematical space, 337, 352
 mathematics, universal laws of, 134
 Matta-Clark, Gordon, 37, 53
Matter and Memory (Bergson), 191
May Fools (Malle), 429n62
 Mayne, Thom, 323
 McHale, John, 435n38
 McLuhan, Marshall, 219, 251, 273
 mechanical images, growth in, 225–226
 Mechanical Turk (Amazon), 278–279, 308
 media
 computational, 198
 digital, 55
 global, 55
 Media Lab, MIT, 201, 226
 mediascape, 148
 medicine, hyperilluminated, 267–269
 megacities, 162–163, 182, 312
 megastructures
 accidental, 5, 8–17, 54, 61, 64, 72, 303, 367
 architecture of, 154, 183–187, 296, 320
 atmospheric, 195
 cities infolded in, 155
 Cloud platform, 183–189
 computational, 336
 corporate campuses, 183–187, 320
 feudal, 311
 geoepidermal, 90
 inclusion and exclusion in, 311–312
 intimate pairing of international, 189
 inverting, 160
 mediation of humans, 188
 purpose of, 154–155
 Stack as, 197
 synthetic, 162–163
 as utopia, 176–183
 Megaupload raids, 399n34
 mega-utopianism, architectural, 179
 Meillassoux, Quentin, 358
 membranes. *See also* interfaces
 atmospheric, 91
 boundary, 123, 150, 172, 289, 324
 encrypted, 288
 legal and physical, 149–150
 partition, 2, 22, 379n9
 porosity, 123, 140
 of safety, 23
 memorialization, 239–240
 memory
 memories of, 262
 of objects, 212, 215

- requirements for using, 239–240
software eclipsing need for, 239–240
theological, 239–240, 297
- mereological technology, 206
- message queue telemetry transport (MQTT), 207
- messages, restricting, 194
- Messianism, mythopoetic political, 382n40
- meta-addressing, 296
- metadata for surveillance, 287
- Metahaven, 127
- metals, mining and trading in, 82–83
- meta-metadata recursivity, 287
- meta-*User*, 259
- metroeconomics, 159–160
- metroplexes, borders within, 311–312
- Mexican drug cartels, 110
- Mexico–United States border, 172–173, 308, 323, 409n42
- microbial biome, 268
- microeconomics, 127
- microjurisdictions, ecological, 99–100
- microplatforms, 289
- micropolitics, architectural, 166–167
- Microsoft, 128, 134
- Excel, 162
- Kinect, 226
- Mies van der Rohe, Ludwig, 53
- Miéville, China, 112
- migrants
- cross-border, Apps for aiding, 173–176
 - ecological, 100–101
 - interiority/exteriority status, 173–175
 - intracountry, 310, 409n39
 - rural to urban, 409n39
- military/civilian deployments, 325
- millenarianism, 442n14
- Millionth Map, 195, 413n5
- Minecraft, 180
- mining
- of coins, 337
 - data, 267
 - gold, 337
- mineral resource extraction, 82–83, 93–94
and trading in electronics, 171
- Mirowski, Philip, 439n65
- mirror box installations, 151
- mirror reflection of the self, 253, 264
- mirror stage parable, 261
- mobile devices. *See also* consumer electronics
- Agamben on, 174, 176
 - anatomy of, 238
 - autonomy of, 342–343
 - cameras, 236, 240
 - evolution-to-come, 171
 - growth in data from, 225
 - at hand, 168, 238
 - inert metals in, 82
 - interfaces, 164, 168–169, 237
 - phone-car interface, 280
 - as sensors, 342
 - virtual envelope of, 168–170
- mobile ecology of interfaces, 237–238
- mobility. *See also* cars
- differential, 173, 318
 - in economy of motility, 38
 - and enclosure, urban, 148
 - global, 156
 - within networks, 233
 - technology of, 280
 - territorial, 173–176
 - universal, 316, 326
 - urbanisms of, 148
- modern age, the sacred in, 426n46
- modernity
- antimodernity and, 248, 318
 - critiques of, 91
 - Foucault's genealogies of, 254, 318
 - geopolitical, 6
 - industrial, 45, 110, 356
 - interfacial, 221, 356
 - logistical, 4, 231–232
 - political, 193
 - subtractive, 12, 356
 - traditional social forms and, 248
- Monadology and Sociology* (Tarde), 334

- money, 199, 213, 329, 335–337, 458n11.
See also currency
- money-into-virtuality, 199
- monkeys, 222
- Monroe, James, 45
- Monroe Doctrine, 26, 31–32
- Monroe Doctrine of the *Cloud*, 34–35, 37
- Montana East Line Telephone Association, 29
- moon, owning, 456n7
- Moore Ruble Yudell, 322
- Moore's law, 63, 80, 92, 232, 304
- More, Thomas, 249, 321
- Mori, Bruna, 103
- Morphosis, 320, 322–323
- Mosaic (browser), 267
- Mouffe, Chantal, 379n10
- Mountbatten Plan, 85
- Mumbai attacks (2008), 17, 242, 247–248, 322, 428n58, 431n70
- Musk, Elon, 281
- mutual prostheticization, 280
- MVRDV exposition pavilion, Hannover 2000, 53
- MyLifeBits (Bell) (Microsoft), 261–262, 264
- namecoin, 171
- namelessness, 447n45
- National Aeronautics and Space Administration (NASA), 88, 300
- National Center for Supercomputing Applications, 267
- National Security Agency (NSA), 35, 120, 283, 287, 363, 413n75
- nation-state
- Cloud* as, 93
 - interfaces into, 155–156
 - as jurisdiction, 5, 309–310
 - Kojève on, 109
 - modern, 24
 - non-state actors functioning as, 10–11
 - socialist, platform in, 59
- twentieth-century achievements of, 309, 443n23
- Westphalian system of, 14, 397n19
- Native Land-Stop Eject* (Virilio and Depardon, curators), 265
- Negarastani, Rezi, 390n19
- Negroponte, Nicholas, 201
- nemein*, 379n12
- neo-Austrian libertarians, 285
- neo-feudalism, 17, 186, 306–307
- neoliberalism, 20–21, 56, 439n65
- Nest (smart thermostat), 134
- nested parasitism, 280, 288–289
- Netscape, 267
- Netwar, 431n70
- network city, 172, 421n20
- network is the computer (Sun Microsystems), 396n8
- networks
- communication, 132, 153–154, 193–195
 - defined, 396n8
 - interior/exterior in, 29
 - megastructure, 189
 - of package delivery, 131
 - peer-to-peer, 205, 215
 - social reality of, 341
 - society, 231
 - space, making and taking, 29
 - as state, 11, 123
 - territory produced through, 29
 - value, 159
 - vehicle-to-vehicle (V2V), 281–282, 438n60
 - visualization, 266
- "New Aesthetic, The," 225
- New Babylon (Constant), 178–179
- New Deal, 120
- New Digital Age, The* (Schmidt and Cohen), 134–136
- New Songdo City, South Korea, 179
- Niantic Labs (Google), 242
- Nicaragua-Costa Rica border conflict, 9, 120, 144
- Nicolelis, Michel, 222

- nihilism of empty space, overcoming, 380n20
1984 advertisement, 128–129, 402n57
Noguchi, Isamu, 103
nomos
 breaking down order of, 397n19
 defined, 373
 derivation, 379n12
 drawing and framing sovereign interiors, 246
 of friend-foe, 397n19
 Modern, 380n13
 nomic line, 84
 Schmittian, 24–25, 85, 113, 379n12
 of The Stack, 24, 229, 235
 of state equality, 397n19
nomos of the Cloud
 defined, 373–374
 dividing sovereignty, 19–22
 drawing landscape-scale calculable interiors, 211
 drivers of, 143
 Google *Grossraum*, 34–40
 introduction, 19
 land, sea, and air, 28–31
 over and under the line, 23–28
 platform governance and, 341
 topography, 111
Nomos of the Earth in the International Law of Jus Publicum Europaeum, The (Schmitt), 25
noncitizen residents in cities, 159, 175, 310, 409n39
noncitizen *User*, 175
nonhuman-human distinction, 164–165, 268, 275
nonhuman-to-human communication, 137, 171–172, 198
nonhuman *User*. *See also User*
 AI *User*, 277–279
 algorithmic hardware, 348–349
 animal *User*, 274–277
 as co-*User*, 276–277, 349
 designing for, 339
 enrollment and motivation, 297–298
 identifying, 345
 machine *User*, 279–284
 rights of, 345
nonpersonhood, 173–175
nonplace, end of, 16
non-state actors with nation-state functions, 10–11
nonvisual interfaces, 341, 424n41
Nortel patent bid, 134
North American Free Trade Agreement, 443n23
North Sea wind farms proposal (OMA), 181
No-Stop City project (Archizoom), 149–151, 160, 178–179
notational systems, 383n4
NSA/CSS Threat Operations Center, US, 441n8
Obama, Barack, 98, 180, 322
Obi-Wan Kenobi, 176
object identifiers, universal, 214–215
object-instruments, computational, 227
objects
 addressability, 214–215
 agency of, 131
 defined, 402n59
 essentials of, 260
 identifiers, digital, 207, 214–215
 interface design, 230–235
 memory of, 212, 215
 non-citizen *User*, 188
 object-to-object communication, 197, 210, 212, 216, 338
 object-to-object spam, 216
 reordering by, 206
 semantic relations, 202–203
 SPIME designation for, 201–204
 as symbolic artifacts, 212
ocean exploration, 30
oceanic data centers, 113–114, 140
Oculus, 127
Office of Metropolitan Architecture (OMA), 53, 99, 170, 178, 180–181
offshoring, 443n23
oil geopolity, 99

- Oklahoma City Bombing guidelines, 322
 "On Computable Numbers, with an Application to the *Entscheidungsproblem*" (Turing), 78
 One57, New York, 311
 One Riverside Park, New York, 311
 OOZ (Jeremijenko), 276
Open, The (Agamben), 273
 OpenFlow, 437n58
 open government movement, 121
 Open Stack, 174
 open systems interconnection (OSI) network model, 61–63
 Operation Centurion, Dr. Manuel de la Pila housing block, 312
 opinionlessness, state of, 240–241, 426n47
 O'Reilly, Tim, 121
 Oreskes, Naomi, 457n10
 Organized Chaos, forces of, 445n37
 Ouroboros energy grid, 92–96, 294–295
 Outer Space Treaty, 456n7
 "Outline of a Doctrine of French Policy" (Kojève), 109
 "Overexposed City, The" (Virilio), 155
 ownership
 competitive, 332
 of data, 203, 285, 345–346
 economics of, 282
 owner-*Users*, 285–286, 345–346
 Page, Larry, 134, 139, 281, 315
 Page Mill Road, 57
 "PageRank" (Franceschet), 332
 PageRank algorithm, 134, 332
 Pakistan-India border, 97, 309
 Palace of the Soviets, 181
 Palantir, 121, 287, 360, 459n20
 Palestine, 120
 Panopticon effect, 363
 paper envelope, 46
 parametricism, 160–161, 162–163
 parastates, 446n39
 Parker, Sean, 126
 Parnet, Clare, 393n50
 Parsons, Talcott, 385n25
 partition in architecture, 391n30
 Patriot Act, US, 120, 363
 peer-to-peer networking, 206, 215
 Peirce, Charles Sanders, 211, 223
 Perec, Georges, 75
 persona design, 254, 255
 personality, 277–278
 personal mapping technologies, 86, 236, 243, 431n70
 personal mobility systems. *See* cars: driverless
 personal rapid transit (PRT) systems, 282
 personhood, 173–175, 271, 439n65
 persuasive interfaces, 224, 430n65
 pervasive computing, 113, 172, 301–302
 petroglyphs, 309
 phone-car interface, 280
 physicalization of abstraction, 29, 33
 physical-to-virtual binary opposition, 19
 Pinochet, Augusto, 59, 385n25
 piracy, 380n15
 pirate radio, 244–245
 placebo interfaces, 224
 placefulness, 16, 29, 155
 place-making, 84, 149–150, 310
 planetary computational economy, 92
 planetary data infrastructure, 267
 planetary photography, 150, 300, 354
 planetary-scale computation
 architecture, 5, 197
 assignment claimed by, 122
 cartographic imperative of, 191
 client-side versus server-side critique, 356–357
 climactic impact of, 92–93, 96
 design and, 192, 356
 divides crossed, 27–28
 ecological governance convergence, 98
 economic geography, effect on, 199
 elements of, 5
 emergence of, 3, 13, 55

- energy footprint, 82–83, 92–96, 106–107, 113, 140–141, 258–260, 303–304
forms taken, 4–5
future of, 351, 356
Google's occupation of, 34–40
governance and, 27
jurisdictions, 357
limits to growth, 93–94
at microlevel of the object, 191–192
neoliberalism and, 21
physical world, relation to, 358
political geography and, 6, 11
real project of, 404n11
space of, 34–40, 303
technologies' alignment into, 4–5
urban design for, 160
- Planetary Skin Institute, 88–90, 92, 97–98, 106, 180, 336, 392n42, 452n67
- planetary supersurfaces, 188–189
- planetary visualization, 452n69
- Planet of the Apes*, 182
- planetology, comparative, 300–302, 333, 353, 360
- plan of action, 43, 342
- platform architecture, ideal, 49–50
- platform-as-state, 7–8, 42, 48–50, 120–123, 140, 295, 315–316, 319, 327, 335, 341
- platform-based robotics, 138–139
- platform cities, 183–189
- platform design, 44, 48, 51
- platform economics
- network value, 159
 - platform surplus value, 48, 137, 159, 309, 374
- User* platform value, 309, 375–376
- User* surplus, 48
- value versus price, indexing of, 336
- platforms
- accidents of, 51
 - authority, 57
 - autonomy, 136, 282, 339
 - centralization versus decentralization, 48
 - characteristics of, 47–51, 214
- City* layer, designs for, 177
- competition between, 50
- component standardization, 47–48
- control-decontrol paradox in, 46
- decision-making, 44, 341–342
- defined, 42, 328, 374, 383n4
- diagrams ensnaring actors in, 44
- economically sustainable, 48
- etymology, 43
- exchange value, 51
- functions of, 19, 41, 119, 328, 342
- future of, 117, 141–145, 244, 295, 315–316
- genealogy of, 42
- generic universality, 49
- geography, 110–112
- governing, 109, 119, 143
- identity, 42
- information mediated, 46
- institutional forms, 44
- introduction, 41–46
- logic, 19, 44, 314
- mechanics, 44–51
- model-to-real correlation, 387n33
- network effects, 48
- neutrality, 44
- origins, 46
- overview of, 41–46
- physicality and tactility of, 129–130
- platform of platforms, 332–333
- platform-within-a-platform principle, 284
- plots in, 44
- as remedy and poison, 5, 133
- robotics, shift to, 362
- service infrastructures, 116
- as stacks, 7–8, 42–43
- standardization, 44–46
- theory, 41, 47
- wars, 110, 123–125, 295
- platform sovereignty
- activist stance on, 312
 - architectural surface interfaciality in, 166–167

- platform sovereignty (cont.)
City layer infrastructures role in, 151–153
 constitutional violence of, 155
 deciding exceptions in, 21
 decision-making, 32–33, 44
 defined, 374
 derivation of, 37
 design, 87–88
 emergence of, 33, 152
 grid programmability providing, 38
 guarantees, 151
 of nonhuman *User*, 273
 overview of, 51
 paradoxes of, 37
 principle of, 36
 productive accidents of, 37
 reversibility, 22, 152–153
 states, 339
 urban envelopes, 159, 258
 platform surplus value, 38, 48, 137, 159, 309,
 374
 platform totalities, 297
 plot, 43–44
Plug-In City (Archigram), 179
 pluralism, 302–303
polis, segmentation of, 241
 political, the, 6, 30, 379n10
 political agency, 173–175, 250, 258
 political-geographic order, 26, 56
 political identity of the *User*, 260, 347
 political machine, stack as, 55–58
 political philosophy, 20
 political rights of the *User*, 285
 political subjectivity, 21, 136, 152, 258, 260,
 268
 political technology, territory as, 335
 political theology, 105, 236, 243, 297, 426n46
 politico-theological geographies, 242, 248,
 320–322
 politics
 agonistic logics of, 180, 247
 architectural, 166–167
 interfacial, 244–246
 of Internet of Things, 204
 norms of, 39
 Schmittian, spatial dimension of, 381n24
 of ubiquitous computing, 203
“Politics of the Envelope, The” (Zaera-Polo),
 166
 Pontecorvo, Gillo, 244
 poor doors, 311
 pop futurist media, 432n71
 Popper, Karl, 459n19
 popular ecology movement, 86
 Portzamparc, Christian de, 311
 postage stamps, 194
 postal identity, 193–196, 206
 postal system, 132, 153–154, 195
 post-Anthropocenic geopolitics, 285
 post-Anthropocenic *User*, 264
 Postel, John, 319
 post-Fordism, 231
 posthumanism, 275
 post-human *User*, 285, 287–288
“Postscript on Societies of Control” (Deleuze),
 157–158
Pourparlers (Deleuze), 147
 Pouzin, Louis, 41
 poverty
 ending, 303, 443n23
 interiority/exteriority of, 311–312
 politics of, 312, 444n30
 of working poor, 331
 power
 architecture symbolizing, 325
 cultural legitimacy of exercise of, 424n41
 of extralegal violence, 317
 monopolizing, 308–309
 shifts in, 233, 312–313
 power-knowledge asymmetries, 454n75
 power of brand, 128, 130
“Powers of Ten” (Eames and Eames), 52
 power tools, 438n59
 preagricultural societies, 149
 presence, 205
 Price, Cedric, 179, 201

- Princeton Radio Project, 254
Prism, 9, 121, 320
privacy
 axiomatization of individual, 409n42
 biopolitics of, 159, 360
 cost of, 136, 285, 445n37
 expectations of, 346
 meta-metadata recursivity for, 287
 right to, 270, 285
 sacralization through encryption, 347
privacy markets, 285, 445n37
private human *User*, dissolution of, 289
private versus public space, 159
production labor. *See* workforce
product-service system, 438n59
program, 43, 165–166, 169
programmer lifestyle, 184
program-platform relationship, 165–166
progressivism of high modernity, 178
Project Cybersin (Chile), 58–61, 328
Promethean accelerationism, 390n19
property rights, 285–286, 380n15, 439n65
prostheticization, 273–275, 280
proto-citizenship, 152, 256, 258
protocol politics, 54
proto-cosmopolitanisms, 256–257
proto-sovereignty, 297, 312
proto-systems theory, 328
proxy *User*, 361
pseudo-universalism, 32
psychogeography, 179–180
Ptolemaic cosmology, 23, 273
public housing, 311–312
Public Smog project, 98
public trust doctrine, 98
pure war, 34, 324
Putin, Vladimir, 135
Pynchon, Thomas, 194

quantification of the *User*, 258–263
Quantified Self movement, 261–263, 266–267
quasi-cannibal economy, 82–83
Radcliffe, Daniel, 184
radio, 244–245, 429n62
Radio Project, Princeton, 254
Rainforest Skin, 88–89
Rainwater
 Chinese seeding of, 398n21
 harvesting, 98, 339
Rand, Ayn, 253
Raumrevolution, 380n20
Ray, Charles, 257
reality filtering, 429n59
Real-Time Operating system Nucleus, The (TRON) (Sakamura), 59–61
“Red Barchetta” (Rush), 455n80
Red Plenty (Spufford), 58, 328, 331–332
Red Star (Bogdonov), 328
refugee camps, 174–175, 308, 312
refugees, 100–101, 153, 319, 409n39, 447n45
regional internet registries (RIRs), 207
Regulation National Market System (Reg NMS)
 (SEC), 451n63
religion
 Apps, 242–243
 contemporary, 426n46
 etymologies of, 239
 fundamentalism, 17, 241, 427n47
 religious movements as parastates, 445n39
 rituals of, 426n47
 of the state, 380n13
 technology, qualities associated with the divine, 172
“Religion in the Age of Digital Reproduction” (Groys), 239
repentance, automation of, 243
resource economies, 182
retail space, future of, 133
revanchism, 447n45
reverse prostheticization, 274
RFID-enabled objects, 192
right of legitimate force, 357
“right to the city,” 174–175, 404n10
Rivera, Alex, 308
Robinson, Kim Stanley, 300

- robotics, 138–139, 279, 348, 362. *See also cars:*
 driverless
- robotic terraforming, 181
- robot operating system (ROS), 139
- robots, 275, 279, 307
- robustness principle, 319
- romanticism, 324–325
- Romer, Paul, 310
- Rosenzweig, Paul, 441n8
- Rubin, Andy, 138–139
- Rubin, Ben, 265
- rule of law, 103, 111, 173
- Rwanda, 82
- Saarinen, Eero, 186
- Sagan, Carl, 75
- Sakamura, Ken, 59–61
- San Salvador, 311
- Sassen, Saskia, 416n28
- satellite observation technology, 90–92
- satellites, hacking, 401n45
- Saverin, Eduardo, 126
- scarcity
- addressable, 336
 - artificial, 208
 - automation and the end of, 328
 - bandwidth, 117
 - bitcoin and, 336–337
 - economy of, 208
 - energy, 93
 - exchange value and, 51
 - information, 353, 372
- Schmidt, Eric, 113, 134–136
- Schmitt, Carl, 19, 24–27, 29–32, 34, 84, 99,
 113, 150, 175, 324, 368–369, 371, 379n10,
 379n12, 397n19
- Schmitt, Harrison, 442n11
- “Schmitt App,” 241
- Schrödinger’s pedestrian, 359
- scientific management theory, 254, 285
- Scott, James, 8
- Scott, Ridley, 128
- Scotus, Duns, 417n39
- Sea. *See also land versus sea*
- beyond the line, 30
 - French versus English concepts of, 380n15
- search, 112, 118, 136–138, 202–203, 332, 342
- “Search for Artificial Stellar Sources of Infra-
 Red Radiation” (Dyson), 106
- Seasteading Institute, 180
- secession, 177, 306–307, 309–314, 336,
 447n43
- second planetary computer, 300–301
- secular disenchantment, 426n46
- Securities and Exchange Commission, Regula-
 tion National Market System, 451n63
- securitized entertainment, 156
- security
- imagine no lines/imagine nothing but lines,
 324, 355
 - interfacial security regimes, 345
 - post-Oklahoma City Bombing architecture,
 322–323
 - trading for, 445n37
 - utopia of, 311, 321–325
- security Apps, 241
- seeing like a state, 8, 106, 120, 333
- self, the
- care of, 126, 261
 - dissolution of, 263
 - fabrication of, 126
 - mirror reflection of, 253, 264
 - quantification of, 258–263
 - self-knowledge through numbers, 261
 - technologies of, 348
- self-identity of the *User*, 258, 261, 263, 274,
 345, 362
- self-image
- geographic, 144
 - human, 71, 253
 - of the *User*, 253, 261
- self-knowledge through numbers, 261
- self-mapping swarms, 265
- self-realization, 129
- self-reflection of the *User*, 252–253
- semantics of the address, 193

- semantic web, 202–203
“sensing like a state,” 340
sensing networks, 303
sensors
 blanketing Earth, 97, 180, 192, 198, 295
 design questions, 342
 forming a *Cloud* of machine sensation, 340
 future of, 342
 mobile phones as, 342
 as *User/User* as, 340
September 11, 2001, terrorist attacks, 321, 363
Serres, Michel, 1, 19, 75, 210, 222–223, 238
Shanghai World Expo (2010), 257–258, 285, 289
Shannon information, 205, 296–297
Shannon’s law (Shannon-Hartley Theorem), 92, 393n52
Shaping Things (Sterling), 201
signaling, 148
“Silicon Valley’s Ultimate Exit” (Srinivasan), 312–314
Simondon, Gilbert, 272, 405n26
Singleton, Benedict, 43–44, 288
singularity, 401n51
Siri for iOS, 277, 286
skeuomorphic interface designs, 139, 224, 339
skin. *See also* Earth
 designability of, 352–353
 everywhere is, 355
 human, 88
 question of, 392n42
Sky Ear (Haque), 392n40
SkyGrabber, 401n45
Sleep Dealer (Rivera), 308
Smarr, Larry, 267–270, 285, 288
smart cities, 147–148, 160–162, 179, 181
smart dust, 201
smart grids, 92–96, 393n53
smart meters, resistance to, 283
smart space design questions, 201
smart surfaces, 198
Smart2020 (Climate Group), 93–94
Smithson, Robert, 53, 86, 178
Snow Crash (Stephenson), 400n42
Snowden, Edward, 35, 121, 287, 405n16
social body, inside/outside of, 22
social capital/social debt, 127
social imaginary, 233
socialism, 332
socialist pricing problem, 333, 369
social media, 9, 262–263, 428n58, 431n70
social nudity, 285
social space, 125–128, 169, 424n41
social systems
 City layer as, 157–159
 classlessness in, 439n65
 inclusion/exclusion in, 308–309, 311–312, 317
social-technical form, emergence of a new, 176
social Turingism, 80
social wallet, 127
software
 architecture, 166
 constructing new civilizations, 181
 design, 254–255
 envelopes, 167
 interfaciality, 167
 language versus technology dichotomy, 60
 law as code, 327
 mixed programs, designing for, 168–172
 and sovereignty, 20, 303
 translegal forms, 355–356
software espionage, 398n21
software program, 43
software-space coprogramming, 237–238
solar energy, 106
Soleri, Paolo, 178–179
solidification and liquefaction, 379n9. *See also*
 land versus sea
sorting, rituals of, 156
South Korea, 179
sovereign
 defined, 20, 341
 User as, 175–176, 269, 283, 285–287, 297, 347
sovereign decision, 20, 32–33

- sovereign exception, 20–21, 32, 105, 341
 sovereign identification, 122–123
 sovereign markets, 21, 105, 285
 sovereign network of the general intellect, 332
 sovereign space
 claim to, 8, 25, 111, 249–250
 governing strategies, 115
 land, sea, and air, 25, 27, 150, 380n15
 lines symbolizing, 119–120
 megastructural, 154–155, 176–183
 monopoly over, 8, 14
 satellite domains, 97
 sea versus land, 27, 150, 380n15
 sovereignty. *See also* authority; jurisdiction
 accidental, 296
 over borders, 32–33
 from city surfaces and interfaces, 151–155
 over communication flows, 194
 over data flows, 203–204
 data producing, 97
 derived from property, 285
 over displaced citizens of ghost nations, 100–101
 dividing, 19–22
 domestic, 20
 epidermal mode of, 352
 geographic history of, versus Schmittian *nomos*, 19
 Google's challenge to, 34–35, 39, 134, 144, 295, 318, 372
 infrastructural, beginnings, 33
 interdependent, 20
 of layers, 314
 location of, 327–328
 meaning of, 36
 new forms of, 5
 in political philosophy, 20
 present-day decline, 443n23
 private, 308–309, 317
 process making, 302–303
 purpose of, 97
 redesigned, Stack-to-come, 294
 and territory, 114, 312, 316
 transient, 310
 Soviet Union. *See* Union of Soviet Socialist Republics
 space
 aerial, 25, 27, 30
 of animalian identification, 275
 architectural, 43, 164–165, 343
 beyond the line, 30
 biopolitical economy of, 22
 constructed images versus space-experience, 30
 data space versus state space, 123
 deconcretizing, results of, 27–31
 dedifferentiated, 33
 designable, 353
 digital, 91
 divisionable, 195
 empty, 30, 380n20
 of exception, 32–33
 expressions of embodiment, 424n41
 geological, 381n27
 geopolitical, 6
 global, 19
 governance of, 163
 of historical existence transformed, 19
 information, 31
 of mathematics, 337, 352
 of networks, 29
 private versus public, 159
 of relationality between addresses, 205–206
 retail, future of, 133
 social, 125–128, 424n41
 sovereign claim to, 8, 111, 249–250
 The Stack's making of, 33
 technological and geographic equality of, 27
 spacefulness/spacelessness, 30–31
 Spaceship Earth (Fuller), 178
 space-software coprogramming, 237–238
 spam, 94, 401n51
 “Special Considerations of the Individual as User, Generator, and Retriever of Information” (Engelbart), 343

- Special Economic Zones, 114, 163, 309
SPIME, 201–204
Spivak, Gayatri, 270
Spoofing addresses, 361
Spufford, Francis, 58
Srinivasan, Balaji, 312–315, 319
Stack, The
 as accidental megastructure, 5, 8–17, 54, 61, 64, 72, 303, 367
 architecture, 5, 11, 52–54, 327
 axonometric diagram of, 66
 City layer integration, 154–155, 170, 177
 conflict in cohering/distributed inscription, 112
 constituent and curatorial, 59–60
 constitutive and generative, 58–59
 decision-making, 37
 defined, 37, 375
 design, 38–39, 153, 299, 364
 emergence, 28
 energy footprint, 93, 303
 examples of, 52–54
 formation of, 66
 framework, 124–125
 future of, 124–125
 geographies of, 33, 87–88
 geopolitical geography, 4–5, 33, 65, 176
 governance, 69, 111, 287
 historical precedents, 58–64
 identity, 37, 65
 infrastructure, 90, 93, 101–102
 integral accident of, 365
 interfacial systems, 228–229
 limits of, 85, 92–94
 location of humans in, 253
 as megastructure, 197
 metaplatform, 65, 284
 metatechnology, 214
 nomos of, 235
 objects in, 200–204
 and its others, 355–358
 platforms as, 7–8, 42–43
 as political machine, 55–58
 politics of, 69
 properties, 5, 52
 purpose of, 107
 stability, 250
 things incorporated, requirements for, 197
 totalitarianism, resistance to, 69
 totality of, 213–214
 utopian and dystopian machine, 5
 that was and might have been, 58–61
stack effect, 303
Stack model, 2–8, 12–13, 24, 52–55
Stack space, 34–35
Stack-to-come
 Address layer, 326–337
 becoming, 351
 building, 357–358
 challenge of seeing, 294
 City layer, 314, 320–327
 Cloud layer, 295–296, 307–319
 Earth layer, 294–295, 300–307
 fabrication of, 364
 future arrived but not named, future named but not arrived, 294
 geoaesthetics and geodesign, 294, 304–305
 imagining, 298–300
 Interface layer, 297–299, 337–343, 347, 432n71
 possibility of, 303–305
 made useful, 298
 User layer, 296–297, 313–314, 343–349
Stack transportation, 280
Stack urbanism, 149, 159–160, 405n11
Stack-versus-Stack warfare, 298, 326, 346
Stack-we-have, 61–66, 293–300, 363–365.
 See also specific layers
standards, 45, 46, 54
Stark, Tony, 249
Star Wars, 155, 242
state
 authority, 6, 295, 318
 cartography function of, 119–120
 Cloud-based, 109, 119–121, 295, 316, 327, 399n36, 441n8

- state (cont.)
- data rights, 123
 - definition and redefinition, 11
 - emergence of The Stack and, 6–7
 - future of, 13–14
 - market planning versus, 329–330
 - official seal of, 194
 - outsourcing labor costs to, 331
 - privatization of, 316–317
 - rights of, 20
 - self-exception, 22
 - sovereignty of, 20, 380n13
 - state cyberwarfare versus, 28
 - territories, delinking from, 316
- state-as-machine, 7–13, 34, 40, 65, 373
- state-as-network, 11, 123
- state-as-platform, 7–8, 42, 48–50, 120–123, 140, 295, 315–316, 319, 327, 335, 341
- state equality, *nomos* of, 397n19
- state-ful and state-less persons, 319, 447n45
- statelessness, 319, 447n45
- state of emergency, 32–33, 99, 102–103, 105
- state services apparatus, 295, 315–316
- state space versus data space, 123
- Stephenson, Neal, 400n42
- Sterling, Bruce, 201, 400n42, 441n8
- Strong Arm Against Crime (*Mano Dura Contra el Crimen*), 312
- Stross, Charles, 107
- Stuxnet virus, 154
- subjectification, apparatuses of, 164–165, 173–174
- subjectification effect, 206
- subjectivity, 174, 256, 272–273
- suicide bombers, 426n46
- Summa Technologica* (Lem), 341
- Sun Microsystems, 396n8
- Sunstein, Cass, 459n19
- Super Bowl ad (Apple), 128, 402n57
- Superstudio, 86, 178, 179
- supply chains, 9, 83, 131, 188, 201–202. *See also* Amazon
- surfaces, interface design, 230–231
- surveillance
- address, 215–216
 - apparatuses of, 121, 138, 215
 - culture of, 363
 - geolocation Apps enforcing, 243
 - jurisdiction over, 28, 121
 - metadata for, 287
 - NSA/Patriot Act, 35, 120, 287
 - satellite technology, 90–92
- surveillance-sousveillance contravention, 454n75
- surveillance state, 8, 106, 138, 192, 327
- surveilled, spectacle of transparency for, 452n70
- Survival Research Laboratories, 57
- swarms, 281–282, 334
- swerve, 77
- synthetic algorithmic intelligence, 81
- synthetic catalaxy, 330–331, 375
- synthetic computation, 198, 352
- synthetic intelligence, 362
- systems theory, 54
- tactile technology, 148, 177, 224, 226
- tactility of the virtual, 129–130, 148
- Tafuri, Manfredo, 304
- Tangible Media Group, MIT, 226
- tangible user interfaces (TUI), 168, 226
- Tarde, Gabriel, 125, 266, 334, 340
- Tarde-Durkheim debate, 266
- TaskRabbit, 308
- Tati, Jacques, 147
- Taylor, Frederick Winslow, 254, 285, 297
- TCP/IP network model, 61–63, 319
- technical-institutional systems, 329–330
- technolibertarianism, 312–314, 316–317, 329
- technological innovation, 45, 62, 79, 92, 129, 163, 330
- technologicization of intelligence, 278
- technology
- accidents of new, 273, 356
 - borders of, 29
 - computational, limits of, 78–79

- embodying human mastery, 344–345
future of, 303–304, 341
governance and, 7–8
qualities associated with the divine, 172
of social organization, 336
for the Stack-to-come, availability of, 303–305
tactile, 148, 224, 226
for violence, 17, 325
technopolitics, 115
technoradicalism, placebo, 303–304
Tektology, 328
telematic stigmergy, 428n58
telephone line service, 29
telescopic logics, global/local, 16, 101, 178, 197, 220, 229, 235, 266
Ten Books of Architecture (Vitruvius), 254
terraforming, 85–86, 115–116, 181, 187, 404n11
territory
 addresses defining, 193–195, 296
 Cloud layer, 154
 elements of, 335
 exceptional, 114
 geometry of, 25
 Google's *Grossraum* delaminating, 295
 intelligent, 198
 lines of demarcation, 32
 megastructural, 154–155, 176–183
 networks producing, 29
 as political technology/political technology as, 335
 and sovereignty, 97, 114, 119–120, 312, 316
 urban interfacial, 155–160
territory of territories, 246–247
terrorism
 counterterrorism discourse, 324, 355
 Mumbai attacks (2008), 17, 242, 247–248, 322, 428n58, 431n70
 September 11, 2001, terrorist attacks, 321, 363
 War on Terror, 320–321
textuality as addressability, 199–200
theo-interfaciality, 239–243
theological imperative of augmented reality, 429n61
theological memory, 240, 297
theology, 125, 149. *See also* political theology
Theory of Everything, 439n65
Theseus' paradox, 260, 263, 360
They Live (Carpenter), 427n51
Thiel, Peter, 126, 180, 360
“Thing, The” (Heidegger), 131, 421n19
“Things, The” (Watts), 1, 251
thing-to-thing communication, 197–198, 210, 216
Thompson, D'Arcy, 161
threat. *See also* terrorism
 in airports, 156
 to atmospheric universalism, 136
 economic, avoiding, 359
 Massumi on, 101
 state implied, 347
3FN, 400n42
thresholds, interfaces as, 228
Thrun, Sebastian, 281
tick, life world of, 393n50
Timberlake, James, 322
Time Machine, The (Wells), 189
Tomagotchi, 277
tomorrow, corporate funded use of, 432n71
topological imaginary, 162
Tor browser, 405n16
Tor User, 110
totalitarian future-present, 320–327
totalitarianism, 214, 250, 455n75
totality, 214
totality machines, 229
total war, 30, 34, 324
Toya, 353
traceability, 206
Transborder Immigrant Tool (TBIT), 173–176
transformation of the world, 339, 354
Transformers, The, 280
transhumanism, 253
transistor radio, 243–244, 429n62

- transportation-as-platform, 139
 transportation systems, 46, 282. *See also* cars
 traps, 288
Treasuremap, 441n8
Treaty of Bern, 194
Treaty of Westphalia, 5–6, 355, 376. *See also*
 Westphalian state
Triumphal Arch of Maximilian I (Dürer), 53, 181
 TRON (The Real-Time Operating system Nu-
 cleus) (Sakamura), 59–61
 Tsar Bomba, 182
 Tsiolkovsky, Konstantin, 328
 tungsten (wolframite), 82
 Turing, Alan, 78–80, 262, 388n5, 389n9
 Turing test, 78, 81, 362
 Turkey, 403n63
 Twitter, 401n47, 403n63, 428n58
2001: A Space Odyssey, 319
 Typhoon Morakot, 96
- Uber, 308
 ubiquitous computing, 198, 200–201, 203,
 212, 260, 338, 341, 356
 Uexküll, Jakob von, 264, 393n50
 Unidad Popular (Chile), 58
 UN International Telecommunications Union,
 123
 Union of Soviet Socialist Republics (USSR),
 58–61, 182, 309, 325, 328–329
 United Kingdom, financial crisis, 123
 United Nations globalism, 32
 United Parcel Service (UPS), 131, 133
 United States
 Air Force, 381n27
 bombing, 325
 carbon footprint, 259
 data-gathering, 363
 Department of Defense, 27, 441n8
 embassy buildings, 322
 federal Stack programs, 441n8
 Google's line with, 135
 information transparency, 399n39
 Internet development, influence on, 196
 jurisdictional integration, 309
 Mexico border, 172–173, 308, 323, 409n42
 National Aeronautics and Space Administra-
 tion (NASA), 88, 300
 National Security Agency (NSA), 35, 120,
 283, 287, 363, 413n75
 planetary computational space, 34–40
 software espionage, 398n21
 subdividing with postal codes, 195
 superjurisdictional enforcement, 123, 125
 surveillance, 35, 120, 287
 universalization, deterritorializing, 31–32
 Universal Postal Union, 194
 universal Turing machine, 78–79, 82, 110, 262
 universal *User*, 257–258, 264, 274
 uProxy, 361
 urban design, 160–163, 168–172, 248, 296,
 442n14
 urban envelopes, 153, 172, 258
 urban fabric, 296
 urban grid, 149–151, 160, 170, 178–179, 229,
 296
 urban interfaces, 223, 227–228
 airports as, 155–157
 Apps, 168–169, 237
 architecture's, 166
 capitalizing, 159
 governance of, 155–157, 163, 326
 lines of interiority/exteriority, 151
 politics of, 160
 tangible, 168–169
 territories, 155–160
 urbanism
 of enclosure and mobility, 148
 Foster's genre of, 181
 militarized luxury, 311
 off-planet, 181
 Urbanium pavilion (Shanghai World Expo),
 257–258
 urban platforms, 149, 326
 urban services capital streams, 159
 urban space
 design and organization of, 160–162

- inhabitants of, 152
interiority/exteriority, 148
pervasive computing in, 172
rights of the *User* to, 174–175, 404n10
subdivision of, 149–150, 163–164
urban surface, 149–150, 296
use case modeling, 255
uselessness, 447n45
use/not own service economy, 285
User. *See also* nonhuman *User*
absolute, 262–264, 274 (*see also User: maximal*)
accidental sovereignty, 296
accountability, 345, 347–348
agency, 164–165, 174, 238, 255, 258, 260, 338, 347–348
Amazon model, 131–133, 186
anonymity, 347, 360, 362
Apple model, 128–131
as automaton, 139, 254, 285, 297, 344
autonomy, 309, 346
characteristics of, 252–253
City layer, 148–149, 152, 157, 163–164, 168
claims on, 172
cognitive capability, 110, 116, 203, 237, 241, 255, 258, 295
to come, 326, 343–349
composite, 281, 362
culpability, 346
customization of services for, 255
death of, 260, 271–274, 361, 370, 436n42
defined, 251, 362
design of, 164–166, 256–257, 266–267, 284–289, 298, 343–349, 359
energy footprint, 113
Facebook and, 125–128
formation of, 266, 270
geopolitics, 257–258, 360
Google model, 134–141
governance of, 49, 159, 245–246
government as a platform image of, 120–121
growth in, 112, 208
human, prioritizing, 203
identification of, 362
identity, 49, 68, 141, 145, 260, 347
inclusion/exclusion, 148, 174, 184
individual as, 343
individuation, 297, 345–348
information, instant access to, 116–118
maximal, 267–271, 297–298 (*see also User: absolute*)
noncitizen, 175
origins of, 254–256
platforms accessible, 49
platform value, 309, 375–376
post-Anthropocenic, 264
posthuman, 271–274, 285, 287–288
privacy, 270, 285, 454n75
proto-citizenship, 256, 258
proto-sovereignty, 297
quantified, 258–264
redrawing by the *Cloud* through the App, 238
remaking the world, 228
replacing, 364
rights of, 285–286, 345, 362
rituals of filtering and sorting, 156
self-identity, 258, 261, 263, 274, 314, 345, 360, 362
self-image, 253, 261, 270
simplification of The Stack for, 219
social domains of, 127, 232
sovereignty, 298
Stack interactions, 219, 229, 253–254, 259–260, 357
Stacks-to-come, 298–299
tactically savvy, 177
traces of encounters, 265–267, 269, 340
virtual envelopes organizing, 167
visual outline of, 253, 264, 270–271
User assemblages, recombinant, 284–285
User-as-sensor, 340
User-as-sovereign, 175–176, 269, 283, 285–287, 297, 347
User-centered design, 253, 256–257, 261, 284–289, 298, 344, 359

- User-centric Cloud* services, 129
User-citizens, 115, 159, 299
User communities, 288–289
User habitat, 164–165, 236–239
User-hacker distinction, 35
 - architectural expression, 296
 - to come, 296–297, 313–314, 343–349
 - defined, 375–376
 - design brief, 264, 360–361
 - geodesign, 286
 - introduction, 71, 251–254*User layer* interactions
 - Cloud layer*, 124, 154, 168, 187
 - Earth layer*, 154
 - Interface layer*, 12, 233, 253, 297, 299, 338*User-migrant-subject* status, 172–173, 409n42
User networks, surveilling, 287
User-passenger in driverless cars, 279–280
User profile, 258–261, 263–265, 269–270
User-redesignable systems, 319
User-subject
 - biopolitical, 22
 - conjoined by proxy, 361
 - cybernetic, 253, 270
 - data-driven, 258–263
 - formation and reformation of, 255–256, 263–264, 348
 - fragility of, 260
 - neutral utilitarianism, 344
 - political, 258, 297, 454n75
 - subjectivity, 272–273*User subjectivity*, 71, 222, 250, 260–261, 271, 344
User subjectivization, 265, 271–274
User surplus value, 48
User-system symmetry, 342
User-to-User connections, 67
User-versus-Cloud arms race, 405n16
utopia
 - Apple's offer of, 187
 - and dystopia, 23, 180, 319–320, 323, 355–356, 446–447n45
 - information visualization creating, 301, 323
 - language of, 359
 - megastructures as, 176–183
 - of security, 311, 321–325
 - unrealized, 58–60, 328
 - Walmart as, 330–331*Utopia (island)*, 249
utopianism, 235, 320–327, 442n14
 - archaeology, 328–329
 - political theology, 243
 - regression to, 304–305, 442n14
 - utopian imaginary, 235*value*. *See also* platform surplus value
 - addressing schemes locating and coordinating, 199
 - indexing of, 336
 - information value, 332
 - things-with-value, 199
 - User surplus*, 48
 - Value Added* (Aozaki), 214–215
 - Van Alen, William, 183
 - vehicles, autonomous. *See* cars: driverless
 - vehicle-to-vehicle (V2V) networks, 281–282, 438n60
 - Verne, Jules, 435n32
 - very long baseline interferometry (VLBI), 87
 - Viking* (NASA), 300, 302
 - Ville Spatiale (Friedman), 179
 - Vinge, Vernor, 201
 - Viñoly, Rafael, 311
 - violence. *See also* war
 - Agamben on, 159, 173–174
 - architecture and, 357
 - borders of, 309, 311, 325
 - city in relation to, 311, 322–323, 325
 - constituted and constitutive, 20, 22, 81, 155, 159, 317
 - designing for, 105
 - drama of, law and, 21
 - future of, 346
 - interfaces of, 317, 325
 - legitimate, 9, 20, 122, 250
 - medium of, 242

- motivated acts of, 240–241
projected and preemptive, 85
Virilio, Paul, 13, 17, 27, 91, 155–157, 160, 172, 265–267, 324
virtual borders, 123
virtual envelopes, 12, 70, 167–170, 173, 175, 194
virtual systems, weight of, 393n54
vision machines, 8
Vissman, Cornelia, 30
visual *Cloud*, 127
Vitruvian Man (Leonardo), 254, 273
Vitruvius Pollio, Marcus, 254
Voice of Fighting Algeria (VFA), 244–245
voice-versus-exit dichotomy, 286, 309, 313, 319
volumetric grid, 37
Voluntary Prisoners of Architecture (OMA), 53, 178, 180
- Walking City project (Archigram), 180
walled gardens. *See also* borders
Apple's, 130
Black Stack, 352
bunker's compared, 187
deep address, 213
ideological apophenia in, 359
perfect, 314
topography, 206, 316
TRON, 60
urban-scale, prioritization of, 177
User occupation of, 206, 245
utopian, 130
virtual states versus, 136
Walmart, 111, 131, 186, 330, 359, 449nn52–53
“Walmart as Utopia” (Jameson), 330–331
Walmart Banking, 127
Walton, Sam, 45
war. *See also* geopolitical conflict; violence; specific wars
aerial, 27
City versus City, 154
cyber, 27
cyberbio, 215
economy of contemporary, 248
financing, 82–83
global, Schmitt's prediction of, 30, 34
hacking, 401n45
imagine no lines/imagine nothing but lines, 324, 355
infrastructural informational, 154, 346
military/civilian deployments, 325
pure, Virilian, 324
refugees from, 409n39
remapping, 17, 242, 247–248
of the soundwaves, 244–245, 429n62
spatial, 431n70
Stack-versus-Stack, 298, 326, 346
technology of, 17
total, Schmittian, 324
weaponized augmented reality, 242
weapons design for, 346
War on Terror, 320–321
Washington, George, 260
water, 98, 312, 319, 354, 444n30
water-based data centers, 113–114, 140
Watson Research Center (IBM), 186
Watts, Peter, 1, 251, 343
wealth gap, 308–309, 311–312, 317
weaponized augmented reality, 242
weaponized mathematics, 278
weaponized skeuomorphism, 224, 234–235
weaponized transurban software, 154
weather data, 97–98
Weber, Max, 7–8, 45, 254
Weber, Samuel, 431n70
Weizman, Eyal, 53–54
Wells, H. G., 189
Westphalian state, 5–7, 14, 20–21, 33, 85, 173, 176–177, 376, 397n19
What Is Philosophy? (Deleuze and Guattari), 378n13
“Who Will Build the Ark?” (Davis), 304–305
WikiLeaks, 9, 110
Wikipedia, 9, 125

- Wilkins, John, 42
Wilkinson, Clive, 184
Williams, Stanley, 102
Wilson, Edward O., 385n25
Wilsonian globalism, 32
Witmore, Michael, 199
workampers, 111
workforce
 agricultural, 307–308
 Amazon's, 186, 307, 443n19
 Apple's, 186–187
 automation and dehumanization of, 254, 285, 307–308, 344
 Facebook's, 185
 factory cities, 130–131, 179, 189
 fulfillment centers, 111, 186, 443n19
 Google's, 184–185
 outsourced and re-outsourced, 111
 poverty, 331
 programmer lifestyle, 184
 third-world countries, 443n23, 449n52
 unemployed, 307
working poor, 331
- world
 city as, 151
 digital simulation of, 363–364
 end of, 359
 interfaces, 149
 “World, The” (Perec), 75
world-making/world-erasure projects, 91–92, 267
World Trade Center, 321
Writers against Mass Surveillance, 293
- Yanukovych, Viktor, 347
Young, Neil, 412n69
Yugoslavian civil war, 23
- Zaera-Polo, Alejandro, 166–167, 175
Zee Town, Facebook, 185
zero-sum economics, 336
zettaflop computing, 102
Žižek, Slavoj, 241, 426n46, 427n51
zombie jurisdictions, 296
zone of habitation, 22
Zuckerberg, Mark, 185