Introduction

ETHER/ORE

There aren't too many places on this congested island where a developer can build a single high-rise, let alone a cluster of them, tabula rasa. But over on the West Side, where a wide gully of railroad tracks had long undergirded a veritable barrens, we now find perched a herd of cranes hoisting I-beams into the sky. Engineers have plunged hundreds of caissons into Manhattan schist to construct two gargantuan platforms that straddle thirty active rail lines and several transit tunnels. The city's old railways have served as conduits to some of its most lucrative developments in recent years. The nearby High Line Park, for instance, which germinated atop an abandoned elevated railway, transformed far west Chelsea—already the city's prime gallery district—into a residential and commercial hot-spot, despite its distance from the subway. Over the next decade or so, the 28-acre Hudson Yards development is expected to bring to New York 17 million square feet of new commercial, retail, and residential space, a cultural venue, parks, a new school, and a hotel—all in signature architecture by high-profile firms.[1] The impending influx incited an extension of the 7 train line, which now connects wildly diverse, solidly middle-class Flushing, Queens, about ten miles away, to this new floating island of oligarchs. A partnership between Related Companies and Oxford Properties Group, the project rivals Rockefeller Center as one of the largest private real estate projects *ever* in New York, and in the United States at large.[2]

Building Hudson Yards

Here, as elsewhere, infrastructure begets infrastructure. Track beds carve a foundation for further development. All those new steel and concrete

FIGURE 1. View east of 10 Hudson Yards from the High Line, across the West Side Yard, 2016, Manhattan. Photograph by the author.

structures serve as scaffolding for the installation of wired, wireless, and satellite technologies, providing commercial tenants with super-fast, dead-zone-free connectivity. And those massive platforms and building facades provide seemingly boundless surface area for all the embedded technology needed to transform this entire development into the country's first-ever "Quantified Community." New York University's Center for Urban Science and Progress (CUSP) is partnering with the developers to install sensors, implement tracking apps, embed Internet-of-Things linked

devices, and apply modeling software to capture data on pedestrian flow and traffic, air quality, energy production and consumption, waste flows, and residents' health and activity levels. This datafication of the city is also, simultaneously, the mediation of the city: those data are harvested, cleaned, filtered, analyzed, rendered visible and intelligible and *actionable* via an assemblage of media, from sensors to screens, smartphone apps to building management systems.

All that data will then inform the operation of other infrastructural systems—pneumatic tubes for waste-removal, an on-site power-generating plant, transit systems, and perhaps even social infrastructures focusing on public health—thus generating a "more productive, livable, equitable, . . . resilient . . . [and] efficient" city.[3] Data drive the placement and operation of pipes and cables; ether tempers ore, figuratively speaking. According to Constantine Kontokosta, director of the initiative at CUSP, "The 'Quantified Community' will create a unique experimental environment," a "testing ground for new physical and informatics technologies and analytics capabilities." Such "test-bed urbanism" promises to advance the fields of urban engineering and urban systems operation and planning, as well as the social sciences.[4]

Related Companies' project head Jay Cross boasts that Hudson Yards will be the "most connected, measured, and technologically advanced digital district in the nation." There are lots of other U.S. cities—Austin, San Francisco, and Chicago among them—that are integrating "smart" technologies into their existing architectures in order to improve efficiency and sustainability. And there are myriad sites around the world—from Songdo in South Korea to Masdar in the United Arab Emirates to Lavasa in India—that, like Hudson Yards, are building "intelligently" from scratch. Cities the world over, old and new, are clamoring to "get smart." There are lucrative corporate contracts to be brokered and much federal money to be made in such efforts. Yet this global urban "enlightenment" has a wide variety of potential applications: its open-data initiatives and urban informatics projects might aim to improve residents' quality of life—by aiding in wayfinding and tracking the location of hazardous cracks in the sidewalk—or perhaps even to empower citizens to effect changes in their cities. At the political extreme, those same technologies might be employed to monitor citizens' behavior and impose sanctions or restrict movement, and even to transform entire cities into proprietary operating systems. Or, they could do both simultaneously: "empower" and surveil, optimize and oppress. Given the services and conveniences

that "residents in cities are demanding," Kontokosta told *Fast Company*, they should expect greater surveillance and instrumentalization.[5] Such initiatives of course raise a host of questions and concerns—perhaps most obviously about the politics of data and the methodologies and ideologies of data-collection: how data are harvested, who owns them, and how they are applied. Some critics, including me, also wonder about the epistemologies of data-driven urban "intelligence," and the ontological significance of that intel—that is, how the quantifiable, measureable aspects of urbanity come to delimit our conception of what an "ideal" (productive? livable? resilient?) city can be.

There are indeed countless developers, engineers, designers, financiers, and city officials around the globe who are fervently pursuing these data-driven urban efficiencies, and all the profit that is to be made from them, at the possible expense of other civic values. But we also have lots of healthily skeptical designers, scholars, and critics posing questions about the wisdom of such "smart" initiatives.[6] I've been exploring these concerns in a series of long-form articles I've written for *Places* journal since 2013, and in a number of other events and discussions.[7] There's a rich, if restricted, contemporary debate about the mediated cities we're building for today and tomorrow.

Our focus here, however, will be on the foundations—not only the concrete caissons and steel tracks, but also the historical, intellectual, material, and political contexts—for our current-day obsession with urban intelligence. Were our cities dumb before we had building information modeling (BIM) software, before machines could count the number of cars passing through their intersections? Are we dependent on the proprietary knowledges of IBM, Cisco, Alphabet, and SAP—partners in many smart city projects around the world—to build responsive, resilient, equitable cities? Is New York unique in its efforts, as Kontokosta claims, to systematically measure "how the design of physical space influences activity, public health, and social interaction"?[8] Are we to believe that urban designers, administrators, and advocates were *not* attending to such communicative and quality-of-life concerns before they had the quantitative means to do so—and that such data-driven formalist or behaviorist approaches are better than old-fashioned formalism and behaviorism? Are we to presume that Big Data and the "science" of urbanism make everything better, that citizens are better served when their agency is tethered in part to their functions as data points?

As we head into a future offering ever more potential for mediated

control of the urban landscape, and, at the same time, a pervasive sense of our *loss* of control over the proliferation and sometimes uncritical application of networked technologies and data-driven methodologies, we would do well to enlighten *ourselves* about what kind of "smartness" or "sentience" we want our cities to embody and to encourage in its leaders and inhabitants.[9] And doing so, I argue, requires that we also recognize that today's smart cities don't have a monopoly on urban intelligence. In fact, we can trace that "smart" genome all the way back to ancient Rome, Uruk, and Çatalhöyük. Cities, including many far afield from our contemporary data hubs and R and D labs, embodied networked smarts and forms of "ambient" intelligence well before we implanted sensors in the streets. Yesterday's cities—even our earliest settlements—were just as smart, although theirs was an intelligence less computational and more material and environmental. For millennia, our cities have been designed to foster "broadcast"; they've been "wired" for transmission; they've hosted architectures for the production and distribution of various forms of intelligence and served as hubs for records-management; they've rendered themselves "readable" to humans and machines; they've even written their "source code," their operating instructions, on their facades and into the urban form itself. They've coded themselves both for the administrative technologies, or proto-algorithms, that oversee their operation and for the people who have built and inhabit and maintain them.

FIGURE 2A. Amazon Web Services data center, 2016. Photograph by Ingrid Burrigton.

FIGURE 2B. Göbekli Tepe archaeological site, 2011, in Şanlıurfa, Turkey. Photograph by Teomancimit / CC-BY-SA-3.0.

Malcolm McCullough, who has written widely about urban computing, agrees that historians and managers of information need to reconceive the urban "environment" as more than a *site* of information access, but also as a medium itself.[10] Our physical landscapes inscribe, transmit, and even embody information—about their histories, their state of repair, their potential uses, and so forth. As McCullough advocates, we need to "expand the role of environment beyond the sites of reading, to reexamine the distributed application of information to the innate and built world." In other words, cities aren't just where we "read" information; they're made of information themselves. And as we expand our urban site of exploration, we need to expand our historical scope, too. Calculation, coding, and "embedded" technologies have long been integral to urban infrastructures.[11] As we'll see in the following pages, our cities have been smart and mediated, and they've been providing spaces *for* intelligent mediation, for millennia. That intelligence is simultaneously epistemological, technological, and physical; it's codified in our cities' laws and civic knowledges and institutions, hard-wired into their cables and protocols, framed in their streets and architectures and patterns of development. The city mediates between these various materialities of intelligence, between the ether and the iron ore. Clay and code, dirt and data intermingle here, and they always have.

Histories of the Mediated City

This project itself has quite a long and undisciplined history. It began almost two decades ago, when I was in graduate school, piecing together a curriculum that combined media and urban studies with architectural and urban history. I was studying in New York during the first dot-com boom, a period characterized by widespread conviction that our new mobile, geolocative technologies and e-commerce ventures would render material shops and schools, bodies and buildings—perhaps even cities themselves—obsolete. Sages predicted that we would collapse geographic distances, even-out spatial disparities, extend opportunity, build universities and workplaces and global communities in the ether.

But we'd heard it all before. History shows us that time and again, whenever a new "game-changing" technology—television, radio, the car, the steam engine, the printing press, even writing—emerges, latter-day "futurists" have offered up breathless predictions regarding its capacity to radically reshape our brains, families, homes, neighborhoods, cities, na-

tions, and world; to offer new forms of convenience and enlightenment; to promote world peace and liberation. And we're hearing it again in the latest Silicon Valley boom, whose start-ups seem obligated to practice willful historical inattention in order to make their claims of innovation and "disruption."

Back amidst the hubris of the first boom, I sought to use my teaching as a small historical corrective. Inspired in part by Marshall McLuhan's recognition of roads, paper routes, and houses as media, and by his mentor Harold Innis's recognition of media as critical political-economic forces, I designed a course that examined the long-standing links between media and architecture.[12] In the class's inaugural run, in 2003, we looked at the histories of architectural rendering and spaces of writing, like the scriptoria where medieval monks copied manuscripts; at the public stage and public sphere as sites of public address; at the history of the architectural treatise and the metaphor of "legible" cities and building facades; at the telephone's arrival in the home and office, and telecom's impact on urban form; at the rise of nineteenth-century architectural plans books and contemporary shelter magazines; at architectural photography and the use of the photograph as a design tool; at cinematic cities and movie palaces; at television screens in mid-century homes and the architectural facade-as-screen; and, finally, at the fold, the "blob," and other digital morphologies. And we topped it all off with a field trip to the Diller + Scofidio exhibition at the Whitney Museum, where the designers put on display new data-driven architectural forms and tools of computational fabrication. Our survey progressed more or less chronologically. As the semester advanced, my freshman students found themselves on ever more solid footing. Each week brought them closer to the present—closer to the material technologies and material landscapes they lived with. It was only at the end, when we retraced our steps, that those early topics, which at first seemed like so much distant history, revealed themselves as foundations for, foreshadowings of, the built world of today and tomorrow. We wrapped the semester recognizing that our cities have *always* been mediated, and that the exceptional advances of our current age maybe aren't so exceptional after all. Perhaps a bummer of an epiphany, but also an empowering one for budding art historians and designers who would soon begin grappling with the anxiety of influence and the generative powers of precedent.

In subsequent iterations of the class, I flipped the script. We started with the present day—with what the students lived and knew intimately—then defamiliarized it, contextualized it, by digging farther and farther

backward in time. We started with urban informatics, data centers, and digital architecture and ended with clay tablets and bricks in Çatalhöyük. And with each new-old layer unearthed, we heard preambles and observed prefigurations of contemporary tropes and promises: of distance collapsed and time saved, of technological solutions to persistent urban problems.

Research from my own field, media studies, sustained us for only the first few weeks of the semester. For our deeper-historical discussions, and for our cross-format studies of diverse media, I had to piece together resources from other fields: architectural and urban history, book history, musicology, archaeology, paleography, and classics. At the time (and, frankly, still today, to some degree), most existing scholarship within media and design studies suggested that the mediated city is a *modern* development. We enjoy a plethora of research on architecture and cities in relation to mechanically reproduced still and moving images—in other words, photography, film, animation, motion graphics, and the like. For instance, many photographic, architectural, and cultural historians (many greatly inspired by Walter Benjamin) have examined the city as a photographic subject; photography's early role in the documentation of urban transformation and as an instigator of social change; and photography's influence on particular modern architectural and urban designers.[13] There's also a tremendous amount of work on the city and film as contemporaneous developments; on the representation of the city *in* film; and on film's influence upon architects and planners, and vice versa.[14] In more recent decades, scholars like Lynn Spigel, Anna McCarthy, and Nanna Verhoeff have begun to address the synchronous rise of television and postwar suburbs and the politics of screens in public places. We've also observed an explosion of recent works—from media studies, urban studies, geography, architecture, and elsewhere—exploring the impact of networked digital media on urban design and urban experience.[15] And thanks to the rise of sound studies, we've enjoyed some excellent research on radio and modern sound technologies' impact on architecture, zoning, and city life.[16]

The sheer number of books and conferences and exhibitions on the city in photographs, the cinematic city, and the digital/networked/cyber/smart/sentient city indicates that most of our attention—at least within the fields of media and design theory and practice—has focused on these modern media technologies' relationships to the city, and particularly on the *representation* of the city *in* these modern media. Furthermore, the emphasis on imaging technologies has historically reinforced an ocular-centric approach, to use historian Martin Jay's term. There has been in

many cases an assumption that the mediation of the city began with these modern media. For instance, media scholar Eric Gordon, in *The Urban Spectator,* argues that, "from the hand-held camera at the end of the 19th century to the mobile phone at the end of the 20th, the city has *always* been a mediated construct."[17] Yet that "always," I'd say, begins well before the late nineteenth century. As Scott McQuire argues in his *Media City,* the mediation of urban experience "has been underway at least since the development of technological images in the context of urban 'modernization' in the mid-19th century."[18] At least. The "always" of urban mediation, which extends all the way back to the days of Eridu and Uruk, is a story that's been parceled out across the research agendas and literatures of multiple fields, many of which all-too-rarely talk to one another.

An Archaeology of Media

It wasn't until the late-aughts that I discovered the field of media archaeology (which has been around, particularly in film studies, for a few decades) and found a fitting retroactive justification for my surveying-and-excavating-across-multiple-sites pedagogical methodology. Work in this gallantly named field offered a set of conceptual and methodological tools—notably, its focus on the materiality of media, and its embrace of nonlinear histories and forking paths—that were pertinent to my interest the *longue durée* of urban mediation. Media archaeology's unofficial slogan—"challenging the newness of the 'new' "—was something I could totally get behind.

But we'd heard this before, too. Historians have long been engaged in the search for precedents and have challenged the notion of linear progress. Within media studies, Carolyn Marvin and Lisa Gitelman had already demonstrated that, at one time or another, all "old technologies were new," that media are "always already new," that emerging technologies typically follow the "scripts [and] grooves" carved out by their predecessors.[19] Marvin's and Gitelman's were among the few female voices that resonated within the predominantly male—and, according to video game historian Laine Nooney, often masculinist—media-archaeological terrain.[20]

As one who often bristles at the absurdities of the capital-T Theory economy, I tend to approach fashionable theoretical movements with a measure of skepticism.[21] Yet media archaeology's spokesmen present it as a humble "traveling discipline" characterized more by "mobile concepts and shifting institutional affiliations" than by a comprehensive, inclusive

statement of purpose.[22] This lack of a defining method and unifying objective (what is the problem to which media archaeology is the solution?) has been both a prime target for the field's critics and a cause for celebration—an opportunity for topical and methodological diversity—among its proponents. Some of the field's most prominent actors have put forward their own intellectual histories and surveys of the field.[23] And in the wake of those synthesizing texts, Nooney and film historian Thomas Elsaesser have both offered analyses of media archaeology as a "symptom," a "socio-historical academic phenomenon" that is the product of its time and culture. Defining its context are the "disruptions" of the digital, expanding global circuits of e-waste, the rediscovery of old media artifacts and archival material, the widespread embrace of data-driven methodologies, as well as new varieties of the various "crises" that always seem to plague academia (crises of the archive, of the image, of the humanities, of higher education, of crisis itself, and so forth).[24] This is the world into which media archaeology emerged.

We now have some new crises and epistemic ruptures to add to the list: climate change and global conflict have incited concern about their potential impact on the world's vulnerable populations and our shared material cultural heritage; the spread of automated labor has pressed us to reconsider our collective investment in and obligations to our fellow human beings; and reorientations of global power have necessitated that we redraw our geopolitical maps. And alongside the real-time, fraction-of-a-second temporality of our data-driven technologies and markets, we've witnessed the rise of a "long-term" Anthropocenic scope of vision. That's a fraught terrain for a theory to traverse, yet it's within this context of seeming contradictions that I humbly situate my own intervention. Before I get to that, however, I'll offer an abstracted sketch of media archaeology, emphasizing what it does and doesn't offer to help us make sense of these new "disruptions." Rather than trying to pin down this traveling discipline (one whose road map doesn't always match my own), I'll focus instead on the media-archaeological themes that are especially pertinent to our interests in the material, the environmental, the temporal, and, relatedly, the archival.

To begin, media archaeology turns our attention away from traditional hermeneutics—i.e., textual interpretations of what's on the page or the screen—and toward the page and the screen themselves: toward the hardware of media. Some practitioners take that hardware-focus to the extreme of post- or even anti-humanism. Friedrich Kittler, among the fore-

fathers of media archaeology, heeded the call of *his* forefather, Foucault, in seeking out a "method of historical analysis purged of all anthropologism."[25] Kittler's offering: a theory of technical media—gramophones, typewriters, film, other optical technologies—as prime historical actors and shapers of human perception and subjectivity. In Kittler's world, media are data processors, engendered and diffused largely by war. As John Durham Peters explains, Kittler "gives us a media studies without people. In a sense, Kittler is Mr. Anti-Cultural Studies."[26] Wolfgang Ernst, in turn building on Kittler's work, likewise prioritizes signal processing over semiotics, focusing on the "non-discursive," operative processes—the codes and software, the "techno-epistemological configurations"—powering our media.[27]

In focusing on machines and signals, media archaeologists often bracket out not only the people with which, but also the environments *within* which, those media interact. Yet Kittler offers one notable exception. In a 1996 essay, he examined the hardware of the city, portraying the urban environment as an information-processing, -storing, and -transmitting machine complete with support systems—like postal offices and addresses, logistical systems, currency, and so forth—that serve to format and address the information surging through it.[28] While such an approach does help us to appreciate computation and information management writ large, at the scale of the urban, and it calls out the role of the material landscape in that computational work, Kittler's analysis still leaves little room for affect, for meaningful experiences, for *humans*.[29] Kittler's city is a means of efficient information management, much like Hudson Yards. But Hudson Yards' developers, unlike Kittler, at least acknowledge the important roles that architecture and art and human experience play in urban design.

Erkki Huhtamo, meanwhile, does attend to human experience in mediated spaces. Through his work on alternative histories of cinema, Huhtamo examines panoramas and other early cinematic environments, drawing attention to media within their urban contexts.[30] Yet Huhtamo's work, like that of most media archaeologists, doesn't follow the historical trail back much farther than the late eighteenth century. As I noted earlier, most historians of the mediated city likewise present it as a *modern* spatial phenomenon: a product of photography and film and mass-produced periodicals. Siegfried Zielinski has dug a bit deeper than the rest, back into the "deep time" of media.[31] The term "deep time" references eighteenth-century geologist James Hutton's proposal that the earth has evolved

through a cyclical process of accumulation and erosion—of oceans flooding lands and continents emerging from seas—that has unfolded, and continues to unfold, over a timespan that far exceeds the notions of "Biblical time" that dominated in Hutton's own lifetime.[32] Transforming Hutton's concept into a media-archaeological framework, Zielinski studies historical variations in the technics of seeing and hearing, highlighting several "qualitative turning points," "attractive foci, where possible directions for development were tried out and paradigm shifts took place."[33] His "variantology" focuses on a rowdy band of visionaries: among them, Greek philosopher Empedocles, Jesuit polymath Athanasius Kircher (who offers several reverberant examples of acoustic spaces that are tangentially pertinent to our study), and Russian avant-gardist Aleksej Kapitanovich Gastev.[34] Zielinski refers to his own work as *an*archaeology, because of its brazen disinterest in origins and "firsts." For all its self-professed radicalism, however, this is still a story of curious Great Men.

Nevertheless, Zielinski's project demonstrates that digging back into "deep time"—well past the nineteenth century, where many modern media histories begin—often yields evidence that "everything has always been around, only in a less elaborate form."[35] Jussi Parikka's work on the geology of media takes this statement literally, and simultaneously reinserts the geologic into the concept of "deep time." Parikka examines the elemental, earthly components of our media objects—the unelaborate natural materials that "have always been around," embedded in the earth, as well as the material traces they leave in the environment throughout their lifecycles, as they're mined, assembled, distributed, used, discarded, or recycled.[36]

Those impacts, those traces, represent another of media archaeology's traditional interests: the archive, which has served as both a research resource and a research topic, a subject for theorization. Media archaeologists typically rely on archival materials—the papers of defunct manufacturing companies or eccentric inventors, old technical manuals, personal collections of antique video game packages—or assemblages of preserved technologies: warehouses full of copy machines, drawers stuffed with old joysticks, or closets full of wax cylinders. The field's key theorist of the archive is Ernst. His interest in signal processing attuned him to the distinctive temporalities—the inscription and processing speeds, for instance—of different media. Those temporalities then impact how media record their own existence and operation: how they "archive" their own pasts, in their own codes, at their own speeds, on their own disks or membranes (or, in our urban case, on their own facades or in city form).[37]

FIGURE 3. Atari cases and cartridges unearthed during 2013 excavation of landfill in Alamogordo, New Mexico. Photograph by taylorhatmaker, via Wikimedia Commons / CC-BY-2.0.

Ernst's archive "refers to what is actually there: what has remained from the past in the present like archaeological layers, operatively embedded in technologies."[38] And "what is actually there," he claims, isn't always humanly empirical. Technical media's signals and operations often exceed human sensation and comprehension. Thus, one doesn't *read* that media archive; one reverse-engineers it. And one doesn't use it to "write history" with narrative coherence, a pursuit that Ernst regards as a distinctively human means of understanding media's pasts; one "processes" the data in the archive to find a temporal logic and to appreciate the poetics in "discrete, serial strings of information."[39]

Yet not all media archaeology brackets out human discourse. In his "topoi studies," which borrow from classical rhetoric, Huhtamo studies the archive to identify discursive patterns, conceptual "molds" that recur in slightly different forms in different contexts across time, to help us imagine media and their place in the world.[40] The figures of the cyborg, the cloud, the "hand of God," for example, have repeatedly appeared in fiction and film, advertising, and even religious and economic discourse.

The panorama is another formal and phenomenological topos that has been variously imagined and materialized across millennia. As we'll see in the following pages, our cities have hosted countless communicative topoi—modular material sites for mediation—and they've engendered countless commonplace, perhaps clichéd, ways of talking about those urban media: as portals, podiums, substrates, screens, as collapsers of distance and even as obsolescers of cities themselves. Evangelists of our always-already-new media have long promised that new technologies would alternatively allow cities to sprawl luxuriously into disparate wire-linked nodes, or concentrate intensively into clusters of crystalline towers or close-knit communities united by the audible voice. Those media technologies would either render cities obsolete or, alternatively, drive them to their utopian apotheoses. Such a variety of topoi—urban and mediated fantasies, recited across the ages and manifested in diverse forms across the globe—demonstrate that our urban media histories are cyclical, entangled, a messy mix of discourses and dirt, imaginaries and I-beams, sketches and sensors.

Trowel-wielding archaeologists—along with scholars and practitioners in allied fields concerned with the human-made material environment: architectural and urban historians, anthropologists, geographers, material culture scholars, and so forth—have long been gathering concrete evidence of urban and media evolution. And they, like Ernst, have also had to look beyond the historical record to reconstruct the past. Yet the "archaeology" in media archaeology has been mostly metaphorical, a figurative "digging back" into history. Or it has signaled a Foucauldian methodology: a search for historical ruptures and the underlying conditions and conventions that make particular knowledges or discourses, in particular historical contexts, possible. While Foucault's archaeological "artifacts" consist of statements, or enunciations, the media archaeologist focuses on media artifacts—"dead" media, forgotten ancestors to contemporary gadgets, legacy software, old memes, and so on—and "digs" all around the artifact in order to figure out what conditions made it possible. That digging, as we noted above, typically takes place in archives and collections of preserved technologies.

An Urban Media Archaeology

In the introduction to their 2011 anthology, Jussi Parikka and Erkki Huhtamo clarify that "media archaeology should not be confused with ar-

chaeology as a discipline. When media archaeologists claim that they are 'excavating' media-cultural phenomena, the word should be understood in a specific way."[41] But what if we took media archaeology literally, and borrowed a few tricks from archaeologists of the stones-and-bones variety?[42] What if we picked up their trowels and surveying tools? There's much to be gained in a study of media-networked sites, like any city, by considering how archaeologists-proper understand fieldwork and assessment—how they dig both metaphorically and literally into physical terrain—and by productively "confusing" media archaeology and archaeology-proper.[43]

In recent years we've witnessed the rise of more productively messy disciplinary "confusion," including Parikka's own work in the "geology" of media, Lisa Parks's and Janet Vertesi's "cosmology" or "astronomy" of extraterrestrial media, John Durham Peters's "meteorology," "cetology," and "cosmology" of "elemental" media, and Nicole Starosielski's "oceanography" of submarine Internet infrastructure.[44] The past two decades have also brought us books offering archaeologies of materiality, memory, colonialism, vision, trade, conflict, attachment, the future, and so on and so forth. "Real" archaeologists, occasionally perplexed by these other-archaeologists' seeming disregard for their own field, have wondered about possible exchanges between media archaeology and "archaeology-as-such."[45] *Code and Clay, Data and Dirt* is meant to offer one such exchange. In advocating for an urban media archaeology, I certainly don't intend to exacerbate the archaeological proliferation or to offer yet another theoretical neologism. Instead, I'm using "urban media archaeology" as shorthand for a generalizable approach: a *literal* archaeology of the mediated city, a materialist, multisensory survey and excavation of the deep material history—that is, a cultural materialist history that acknowledges the physicality, the "stuff," of history and culture—composing our mediated cities and urban intelligences.

Amidst these multiplying metaphorical archaeologies, even the "real" archaeologists would admit that their own field—the *ur*-archaeology, we might say—contains multiplicity. There is no essentialized, naturalized, neutralized "archaeology-as-such," no single archaeological lineage. The field has been consistently committed to studying the material record of the human past (even the relatively shallow past of *yesterday*). But over the last century, its conception of that "study," those "records," and that "past" (and whether it is exclusively "human") has evolved considerably.[46] Archaeologists have questioned their own agency, the agency of their human subjects, and the agency of nonhuman creatures and objects in the

archaeological terrain. They've debated who owns the past, and who does, and should, have the right to shape cultural memory. They've deliberated over how that past is told: does the archaeologist *describe* artifacts, does she attempt to explain the cultural processes that give them context, or is her mission something else? Are archaeological practice and its prevailing epistemology gendered?[47] Many archaeologists have grappled with the field's own colonialist, imperialist, and patriarchal history (and present?) and with the ways in which their work can lend itself to commercialization by the "heritage industry," to romanticization in the creation of local identity, or to politicization in nationalist agendas.[48] They've wondered if their theoretical models have served them well: what is left out when one "reads" material culture as a "text," for example? Is archaeology a science, a social science, an art? Is it more closely allied with anthropology, which also studies humans past and present but not exclusively through their material remains; or with history, which studies humans primarily through their written records? Does the archaeological record exist "out there" to be excavated, or do archaeologists create those "records" by deciding where to sink the shovel, so to speak? Is archaeological practice inherently political?

While they might have particular leanings and allegiances, archaeologists themselves don't have definitive answers to these questions. These are not the kinds of questions that lend themselves to definitive answers. Yet the fact that archaeologists are *inquiring,* and that they've been engaged in lively debate over these issues for decades, demonstrates a degree of self-reflexivity and political consciousness that, some claim, media archaeology—with its occasional techno-fetishism, cabinet-of-curiosities historiography, and martial "masculinism"—is sometimes lacking. Granted, Kittler's work is rooted in the history of war, and Parikka's recent work speaks to ecological issues: two undoubtedly political concerns. And media archaeology (as well as archaeology-proper) has drawn inspiration from the various "new materialisms," from Bruno Latour's actor-network theory, and (for better or worse) from the multiplying object-oriented and "thing"-based philosophies—all of which propose a redistribution of agency and a model of nonanthropocentric politics.[49] Yet archaeology-proper's willingness to confront the ideologies and geopolitical imbalances underlying its entire enterprise, the cultural politics of its practice, and the exploitative ends toward which its work is sometimes put—nationalist land claims, heritage theme parks, global antiquities markets—could set an example for media archaeology. Archaeology's *self*-analysis, its Fou-

cauldian "archaeologizing" of its own discipline, could potentially compel media archaeology to rethink its own prevailing Western orientation, its occasional "orientalist" treatment of curious devices from other cultures and times, its mostly male bibliographies, and its other biases and limitations. My hope is that our inquiry throughout the book will also prove useful to archaeologists and practitioners in allied material culture fields as they press forward in their ongoing, critical self-reflection.

We can even draw instructive, perhaps cautionary, parallels between archaeology's own disciplinary evolution and media archaeology's current fascinations. Consider the "scientism" of what were called the "processual" archaeological approaches that emerged in the 1960s, and the romanticism of some of the phenomenological approaches that emerged later, as an intended corrective.[50] Media archaeology has its own processualist "science"—particularly Ernst's techno-mechanical focus on signal processing and operating procedures, and the various critical practitioners inspired by his work. It's got its Romantic elements, too: its fetishizing of the old, the curious, the misfit (not to mention the wider cultural lionization of khaki-clad men in pith helmets, and their contemporary T-shirted hacker descendants).[51]

Equally significantly, archaeology promotes a more global view than has been customary within media archaeology and media studies at large. The "media city," for example, has frequently been conflated with the "global city," which is global primarily in that it is a privileged central hub in overlapping international networks.[52] Consequently, much work on the media city focuses on global capitals like New York, Paris, Berlin, London, and Tokyo. While there is still much insight about urban mediation to be surveyed and excavated at these sites, and while some scholars have explored areas of the Global South (aka the developing world) and other under-studied regions of the world, we can do more to look beyond the heavily networked cities that dominate the existing research.[53] By expanding the geographic focus of our study of urban mediation—in part by drawing on the work of archaeologists and anthropologists—we can show that nodes in our mediated networks exist in parts of the globe that are rarely on our radar, and that the network manifests itself differently in different cities. Highlighting this variation can help us to better appreciate the politics of the media city, too. We can be more attuned to the uneven spread of networks and access to infrastructurally distributed resources, uneven rates of technological development and commitment to maintenance, and diverse systems of ownership and control.

This focus on different cultural contexts also has the potential to expand media studies' understanding of what constitutes media, of what materials and systems serve communicative functions. Archaeologists have found communicative potential in brick walls, stone structural elements, dirt mounds, bone tools, and even cities writ large. By examining how cities themselves have served as media (and how they've *been* mediated) across time, we'll see how media materialize in and through urban practices and processes—how they're the products of their urban environments and their human creators and users—and how those urban processes themselves are agglomerations of various media: stones and bones, streets and circuits, plazas and people. Archaeologists know well that artifacts don't exist apart from their material environments and human agents; that "what is actually there" in the archaeological field is not so easily extracted from its context and then reduced to data through clinical analysis. While archaeologists-as-such might rely on scientific tools, like those Ernst employs in his study of technical media, to locate buried remains, date artifacts, or test the reverberance of an ancient room or instrument, those tools aren't meant to offer some form of "pure data navigation" unencumbered by "hermeneutic empathy" or historical narratives, as Ernst would prefer.[54] To the contrary, archaeologists' scanning, measuring, and modeling are almost always meant to help us better understand the connections between humans, their things, and their environments.

Those very same connections also determine "what is actually there" (or not there) to be discovered in the first place. Ernst seems to "naturalize" the media archive, the "*arché* of [media's] source codes," and assumes its presence to be an objective fact of engineering.[55] Yet archaeologists and archivists have long acknowledged that both the archaeological and historical records are political constructs, as much *human* creations as technical or environmental ones. As Nooney explains,

> Not all archives are created equal, not all media are valued and saved, not all information leaves an inscription, and sometimes the "things" that we search for can't be studied except in their ghostly residue—and there can be political, social, gendered, and racial dimensions to how these ex- and inclusions come to be.[56]

The same is true of the archaeological record. The gaps and exclusions in the record—what is *not* actually there, the artifacts weathered or demolished, the lives excluded—can also reveal, even through absence, their

own operative logics: about natural and cultural processes of erosion, destruction, and erasure, and also, importantly, about cultural politics and epistemologies.

Integrating media archaeology and archaeology-proper has the potential to shape the epistemologies and politics of *other* fields, including urban and architectural history, as well as urban and architectural design practice. Recognizing the "deep time" of urban mediation, urban historians will ideally be incentivized to reevaluate their prevailing theories about the birth of cities, which tend to privilege economic explanations for urbanization, and to pay greater attention to the central role played by media and communication in urban history. Various anthropologists, archaeologists, and urban historians, like Clifford Geertz, Peter Hall, and Paul Wheatley, have posited that the birth of cities is rooted not (or not only) in economics, but in the need for ceremony and communication.[57] Lewis Mumford, author of two grand histories of urbanity, likewise suggests that "what transform[ed] the passive agricultural regimes of the village into the active institutions of the city" was not merely a growth in size or population density or economy, but an extension of "the area of local intercourse, that engenders the need for combination and co-operation, communication and communion."[58] That "area of local intercourse" is an infrastructure, a structure that undergirds communication and communion. One of our goals, then, will be to account for the critical roles that communication and mediation have played, since the early days of civilization, in giving rise to and sustaining our settlements and cities. Furthermore, we can reinforce the role of communication in giving *form* to our cities. Prevailing theories suggest that urban form is shaped mainly by topography, transportation, defense, or even cosmological or philosophical views. We can assert that the means of communication—whether the voice, the printed page, or cellular networks—have also shaped cities throughout history, and that those cities have in turn given form and vitality to their media. Cities and media have historically served as one another's "infrastructures."

Over the past several years the term *infrastructure*, like *archaeology*, has proliferated across scholarly, artistic, and design fields—almost to the point that the term has become infinitely elastic. Still, I believe that, if used in moderation, it can be a useful concept for us here. Thinking about media through infrastructures, as I've done in some of my own work on cities and knowledge institutions over the past decade or so, enables us to appreciate media as potentially embodied on an urban or even global

scale, as a force whose modes, ideologies, and aesthetics of operation can be spatialized, and materialized, in the landscape.[59] Aspects of these infrastructural systems constitute a layered landscape that lends itself to digging; they leave asphalt, copper, and plastic residues that we can dig up. Historical communication infrastructures offer artifacts like pneumatic tubes, gutta-percha-coated telegraph cables, old postal roads, technologies for the production and dissemination of early print forms, palimpsests of writing on city walls, ruins of ancient amphitheaters and old libraries. For the archaeologists of tomorrow, today's wireless technologies will leave behind fiber-optic cables, massive data centers, and piles of e-waste. But it's when we're dealing with more "ethereal" media—those, like radio or public address, that seem to have limited material apparatus, little "actually there"—that the city-as-media-infrastructure model proves particularly useful. By studying these seemingly bodiless media's urban contexts, we can better understand how the material environment supports them: how the city provides broadcast sites and acoustic venues; how urban surfaces, volumes, and voids have functioned as sounding boards, resonance chambers, and transmission media. We'll listen to such sonic infrastructures in chapters 1 and 4. What we'll ultimately find, in examining the city as a media infrastructure, is that our media histories are deeply networked with our urban and architectural histories, and that, in most cases, these cultural and technological forms are mutually constructed.

This historical and critical sensibility about media infrastructures could then inform the practice of those who are designing and engineering our contemporary built environments. Both Zielinski and Parikka emphasize the generative possibilities of media archaeology: its potential to inform, and be informed by, creative practice. As they retrofit our existing cities and build our networked cities of tomorrow, urban and architectural designers and engineers of all stripes can consider how they might honor and integrate the "deep time" of urban mediation, the legacy networks and customary communicative practices that have shaped communities and local identities, into their work. One of their responsibilities, as they strive to create sustainable, responsive urban environments, is thus to make provisions for a layering of communicative infrastructures old and new, informal and formal, made of both ether and ore, data and dirt.

There is much more at stake here than methodology and historiography. The "productive confusion," or aggregation, of archaeologies should compel us to reassess the politics and purpose of both disciplines. A more global and more deeply historical framing for media archaeology, for

instance, reveals that media history, particularly when conceived at the scale of the city, is in part about human cultural heritage: the very resource that Kittler's model of urban-scale computation brackets out. And that heritage encompasses human rights and freedoms and responsibilities. Media and urban history, entwined, have long given form—material, legal, technical—to these critical, timeless concerns. Scholars and practitioners in both fields thus have the capacity to advocate for protocols and practices that will promote more ethical and enriching future developments: urban neighborhoods and amenities, gadgets and platforms, infrastructures and institutions that reflect both critical progress and historical sensibility, that embody a "newness" that knows and learns from its own pasts, and makes room for those pasts to be present *in* the present and future.

Temporal Entanglements

Given the simultaneous *timelessness* and *timeliness* of archaeology's most profound concerns, we need to pay particular attention to questions of temporality. An archaeological sensibility prompts us to shift our focus from "real-time" data-streams and various speculative "futures"—the obsessions of so many contemporary tech developers, content managers, design consultants, urban planners, and administrators—toward the *longue durée* within which those presents and futures take shape. In order to promote this temporal shift, perhaps we need to reconcile the temporalities of our two archaeologies, or at least be aware of their consistencies and incongruities.

While media archaeology seeks to offer alternatives to canonized historical media narratives and the "idea of inexorable, quasi-natural, technical progress," the familiar notion of archaeological "stratification" seems to make manifest the very idea of layered epochs of "progress."[60] Yet many archaeologists have challenged the classical stratification model, arguing that it "wraps blocks of linear temporality up into periods placed into neatly stacked boxes," separated by "arbitrary divisions."[61] Archaeologist Christopher Witmore suggests that the metaphor of the palimpsest presents similar conceptual problems: historical layers aren't simply "written, erased, and rewritten"; instead, there are plenty of "points of connection, proximity, and action between various pasts."[62] Many archaeologists (some drawing inspiration from theorists like Henri Bergson, Gilles Deleuze, Michel Serres, and Karen Barad) have embraced the notion

of temporal entanglement. If we reject the idea that there are stratified epochs of "revolution"-based history, with new developments eradicating old systems, we need to rethink how the archaeological object—whether an ancient urn, a cuneiform tablet, or a network of fiber-optic cable—is conceived. Seemingly "modern" things, Witmore says, are "really [just] gatherings of achievements from various times and numerous places."[63]

These theoretical models of entanglement and assemblage actually take shape and become physical in our urban infrastructural landscapes. In many cases our older media networks have laid the foundation for our modern-day systems (as per the technological and economic principle of "path dependence"), but the "old" systems—those we might regard as buried on the "lower strata"—are also very much alive in, and continuing to shape, the contemporary city. These historical media are, like Raymond Williams' category of the "residual," "formed in the past, but . . . still active in the cultural process, not only and *often* not at *all* as an element of the past, but as an effective element of the present."[64] This is why our cities today are not solely virtual, but are simultaneously aural, graphic, textual, sonic, visual, and digital. "Old" media are still very much alive in them. We tend in media studies to write format-specific histories, and to suggest that new technologies supplant the old. But when we look at our media histories through our cities, we observe a layering or resounding, a productive "confusion," of media epochs. Such realizations open up new methodological opportunities for studying media, and, for me, they necessitate an alternative means of writing history—one that looks beyond revolutions, Great Men's accomplishments, origin stories, and reductive distinctions between "old" and "new."

What's more, these entangled systems have distinctive temporalities and evolutionary paths; they don't all "progress" at a standard rate. Local variations in media and urban history have implications for how archaeology demarcates its terrain: the abstract line between prehistory and history, which ostensibly marks the disciplinary territories of archaeology and history, varies in different cultures depending upon when people began creating written historical records. The presumption here is that most societies "progress" toward ever more complex literacies. Yet archaeology offers us plenty of evidence of nonlinear, non-"successive" evolution. Through archaeological investigation we can assess the lifespans of media objects and networks, and ascertain when "old" infrastructures leak into new-media landscapes, when some areas "leapfrog" particular stages in normative patterns of progress (as much of Africa has done with land-

line phones, for example), when media of different epochs are layered palimpsestically, or when new urban media remediate their predecessors.[65] Richard John, who's written histories of American telecommunications and the postal system, has found that the infrastructures he's studied were "complementary rather than mutually exclusive. Telegraphy supplemented mail delivery, and telephony supplemented telegraphy, without rendering either mail delivery or telegraphy obsolete."[66] While the electronic and digital ages have dealt serious blows to both the post and telegraphy, new media need not necessarily obsolesce the old; we'll likely still listen to the radio and scratch out handwritten notes (on paper or screens) in our "sentient cities" of tomorrow, for instance. Various networks also provide material support for one another. Geographers Stephen Graham and Simon Marvin write, "Because of the costs of developing new telecommunications networks," for instance, "all efforts are made to string optic fibers through water, gas, and sewage ducts; [and] *between* cities, existing railway, road, and waterway routes are often used."[67]

The notion of temporal entanglement has gained purchase within both media studies and archaeology. And media and network archaeologists have managed to question the notion of "inexorable progress" by excavating our new media technologies' diverse roots in the nineteenth, and occasionally the eighteenth, century. Yet, as I noted earlier, most existing media history and media archaeology work doesn't dig much deeper than the 1700s; it doesn't offer a terribly deep historical perspective. Among the few exceptions are Zielinski's choice of a Greek philosopher among his "variants"; Parikka's work with geologic time; and Grant Wythoff's investigation of mobile media "gadgets" through paleoanthropological tool studies.[68] Thus, another benefit of infusing media archaeology with archaeology-proper is that, once equipped with theoretical trowels, we can dig much deeper.

My hope is that *Code and Clay, Data and Dirt* models a different kind of temporal orientation for media studies: one rooted in the recognition that, in cities across time and across the globe, both "ethereal" and resolutely material media have always coexisted; that the "old" and "new" have always overlapped. What I offer here is something messier—productively muddier and more discordant, I hope—than conventional approaches to genealogy, archaeology, and geology.[69] What I'm proposing is a historiographical and methodological alteration to the way we do media and urban history. I want us to reassess archaeology's and history's implications for contemporary practice in a whole host of fields: urban and architectural

FIGURE 4. "Marten," by Morehshin Allahyari, from *Material Speculation: ISIS,* a series of 3D-printed reconstructions of ancient artifacts destroyed by ISIS in 2015. Courtesy Morehshin Allahyari.

design, media design and tech development, administration and policy (even among the archives, libraries, and museums who preserve and present cultural heritage for contemporary publics). We in media and design studies need to recognize our objects of study as situated, embedded in particular material contexts, and activated by their interactions with people and nonhuman actants—other media, other infrastructures, other creatures and things—in those environments. We need to appreciate the temporalities of those objects as entangled and overlapping, following various paths of development and knotted up with both their "pasts" and "futures." There is no universal, normative evolutionary trail. To misquote L. P. Hartley, our urban and media pasts are *not* foreign countries; they're here, now, and tomorrow.

These seemingly abstruse theoretical propositions actually become "facts on the ground" in our built environments. We could easily find evidence of temporal and spatial entanglements at myriad scales: in particular neighborhoods, within larger geographic regions, even at the planetary scale. While our focus here in *Code and Clay, Data and Dirt* is on the urban scale, it is important to note that the urban is a constellation of blocks and neighborhoods, and that it's a product of regional flows and

planetary dynamics. Our scales of investigation and operation are entangled, too. Yet I choose to home in on the city because cities make manifest, they conveniently concretize, their entanglements: they're full of networked infrastructures, layered histories, and multiple media forms. And given that cities are a common area of investigation for many scholars, and a common site of practice for many spatial practitioners, cities provide a pragmatic meeting point for interdisciplinary investigation, for scholars and practitioners to integrate their various disciplinary knowledges and critical sensibilities. Here, media and culture scholars, borrowing tools and techniques from archaeologists, can learn to look to the material landscape for evidence of temporal and spatial entanglements. Researchers and designers can learn from archaeologists' own history of self-reflexivity regarding the sensitive cultural politics of "rescuing" objects from the past, of sinking shovels into the dirt and isolating particular artifacts or sites for analysis. Our acts of excavation, whether metaphorical or literal, have ethical and political implications for those who occupy or have some investment in those sites—as well as for those who administer and design their futures. Those envisioned futures, informed by an archaeological sensibility, will ideally be something more richly layered than the tabula rasa techno-solutionism of sites like Songdo or Hudson Yards. A city that recognizes its dependence on both ether *and* ore—and appreciates their potentially complimentary logics of mediation—is better equipped to accommodate temporal entanglement, to acknowledge and amplify the immediate, and timeless, resonances and relevance of its pasts.

A Note on Multisensory Methods

I'd like to offer a final note on those resonances and how we can listen for them. "Cities are a product of time," Mumford writes.

> They are the molds in which men's lifetimes have cooled and congealed, giving lasting shape, by way of art, to moments that would otherwise vanish with the living and leave no means of renewal or wider participation behind them. In the city, time becomes visible: buildings and monuments and public ways, more open than the written record, more subject to the gaze of many men than the scattered artifacts of the countryside, leave an imprint upon the minds even of the ignorant or the indifferent.[70]

If we think of our cities themselves as historical media, or archaeological artifacts embodying their entangled temporalities of evolution, we have to acknowledge that they're not just historical texts to be read or artifacts to be gazed upon. They can also serve as resonance chambers in which we hear echoes of past conversations, oratory, radio static, clanging printing presses, and pens scratching on parchment. Our cities are textural environments in which we feel traces of architectural inscriptions and centuries' worth of public notices affixed to building facades, and where we shake with the vibrations of loud sonic media—today, a booming subwoofer in a passing car, centuries ago, the village bells. And that static we sometimes feel in the air on cold, dry days is the same electromagnetic activity that convinced early experimenters that the "ether" might support wireless communication.[71] We can even detect olfactory clues of the city's mediation; walking past a paper recycling plant in the Dumbo neighborhood of Brooklyn, or through a printing district in Seoul, reminds us that our historical publishing centers also smelled of ink and paper.

While there has been, over the past two decades, some excellent work in sensory history, particularly on the sounds of historical sites, much ex-

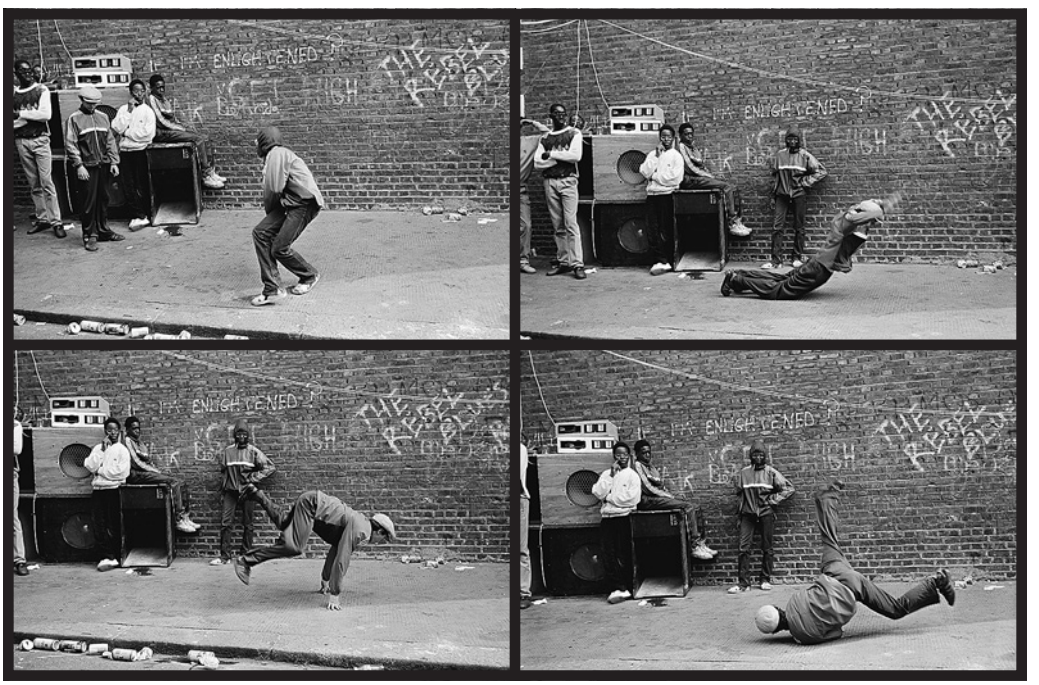

FIGURE 5. Young men breakdancing in front of a sound system, 1996, London. Photograph by Adrian Boot, 1996.

isting work on the media city presents it as a visual entity, and the urban dweller as first and foremost a spectator—a subject position that implies a particular, limited politics of engagement with the city.[72] In *Code and Clay, Data and Dirt*, and in a short volume that foreshadowed it, my *Deep Mapping the Media City*, I have hoped to redress both the limited historical and sensory scope of this existing work by demonstrating the copresence of media from myriad epochs, and by depicting cities past and present as spaces that are simultaneously aural, graphic, textual, electroacoustic, digital, and haptic. Clues in any one of these sensory modes might offer insights into other registers. Emily Thompson, in *The Soundscape of Modernity*, acknowledges that "everyday sounds" from the early twentieth century, her period of study, "are virtually always lost to the historian, who must necessarily turn to textual descriptions and silent photographs to elicit the lost reverberations of the past."[73] In his *The Acoustic World of Early Modern England*, Bruce R. Smith "assembled evidence from travelers' accounts, estate maps, letters, diaries, sermons, plays, poems, fictional narratives, ballads from oral tradition, and architectural remains, and interpreted that evidence in relation to sixteenth- and seventeenth-century ideas about sound and the human body, and in light of modern principles of acoustic ecology, psychoacoustics, architectural acoustics, and sociolinguistics."[74] We can't know precisely how the denizens of early modern England heard the cries of street barkers, or how the citizens of ancient Rome heard a public address in the forum; there's necessarily some speculation involved in piecing together the sensory dimensions of urban and media history. Architectural historian Diane Favro and classicist Christopher Johanson acknowledge that creating a model of an "entire urban space," and imaging its textures and colors and acoustic properties, "requires hypotheses and assumptions about many unknown aspects."[75] Such indeterminacy "is unpalatable to many scholars, but especially to archaeologists, who are trained to appreciate accuracy, not speculation"—particularly certain camps of archaeologists, like the processualists who value rigorous use of the scientific method.

But speculative methods do at least allow us to acknowledge our media cities as multisensory, and to appreciate that these myriad sensory registers are integral to mediation. Speculative models allow us to imagine, if not posit definitive claims regarding, what our historical media cities might've looked, sounded, and felt like—and how urban politics might have been exercised through these empirical and affective registers. Urban and architectural historians and archaeologists have much

methodological insight to offer in this endeavor, in large part because they already appreciate what a historical and material understanding of media and infrastructure can offer to studies of the past. In their *Archaeology: The Discipline of Things*, Bjørnar Olsen, Michael Shanks, Timothy Webmoor, and Christopher Witmore speak of

> making manifest the past (or, crucially . . . allow[ing] the past to manifest itself) in its traces through practices and performances (writing, corresponding, visiting, touring, mapping, pacing, debating), artifacts (letter, notebook, manuscript, printed book, pamphlet, map, plan, plaster cast, model), instruments (pen, paint brushes, rule, Claude Glass, camera lucida, surveying instruments, boots, wheeled transport, spades, shovels, buckets), systems and standards (taxonomy, itinerary, grid), authorized algorithms (the new philology, legal witnessing), dreams and design (. . . of a nation's identity, of personal achievement). Making manifest came through manifold articulations.[76]

Olsen and his colleagues see these various disciplinary infrastructures—technologies, instruments, protocols, and standards—as modes of engaging with and manifesting the past. Different tools for record-keeping and representation manifest different aspects of that past, including those ineffable qualities that don't readily lend themselves to "accurate," standardized formats of representation. Witmore argues that using a mixture of media can allow archaeologists to "translate something of the sensory, physical presence of the material past" into the present.[77]

There are myriad artists and media-makers and writers—Dziga Vertov, Walter Benjamin, Constant Nieuwenhuys and the Situationists, Alighiero Boetti, Lize Mogel and Alexis Bhagat, Rebecca Solnit, Joyce Kozloff, and Julie Mehretu among them—who discerned a similar need for new tools and strategies to represent modern spaces, and the modern city in particular. The "literary montage" form of Benjamin's *Arcades Project*, and the reader's experience in engaging with it, are regarded as "city-like"; its textual passages resemble, in their pace and structure, the passages of urban exhibition halls, arcades, and train stations.[78] Cartographers and geographers, too, have experimented with various critical, counter, and radical cartographic approaches, including indigenous mapping and sensory mapping.[79] These approaches aim to illuminate the unavoidably subjective and political aspects of mapping, and to pro-

vide alternatives to hegemonic, authoritative—and often naturalized and reified—approaches to cartography.

In my *Deep Mapping the Media City* I explored the use of "deep mapping" as a means of capturing the *longue durée* of urban mediation. The deep map, as archaeologists Mike Pearson and Michael Shanks explain, "attempts to record and represent the grain and patina of place through juxtapositions and interpenetrations of the historical and the contemporary, the political and the poetic, the discursive and the sensual; the conflation of oral testimony, anthology, memoir, biography, natural history, and everything you might ever want to say about a place."[80] While Pearson's and Shanks's list of ingredients is rather literary, we can also layer in GIS and empirical data and satellite images, thus juxtaposing qualitative and quantitative conceptions of space, or balancing out GIS's seeming precision with the relative fuzziness of humanistic data.[81] My own mapping studios at The New School have adopted such a multimodal approach. Fellow archaeologist Cliff McLucas adds that deep maps are characterized not only by their layering of different media or registers, but also by their "engagement of both the insider and outsider," "the official and the unofficial."[82] Deep maps don't claim to be authoritative or objective; to the contrary, they're intentionally "fragile and temporary"—always evolving and evading stable representation, just like our media and the cities they inhabit and shape.

Our Materials of Investigation

Our investigation here, in *Code and Clay, Data and Dirt*, is less cartographic and more thematically topographic. In other words, we'll explore patterns in how particular media made themselves materially present in cities around the world, at various points in history. And we'll consider how those cities took shape in order to accommodate mediation. My own methodology in piecing together these histories over the past fifteen years has been similarly diverse and distributed. I've studied the evolution of urban media and urban form in various archival collections—at the New York Public Library; the New-York Historical Society; the U.S. National Archives; the Lemelson Center at the National Museum of American History; the Hagley Museum and Library in Wilmington, Delaware; and the Canadian Centre for Architecture, to name just a few (I've relied, too, on the published and publicly presented research of international colleagues who've employed primary resources in their own languages and

regions of the world). And I've explored additional collections alongside my students, as they've mapped their own historical urban media infrastructures. I've organized and participated in walking tours of Internet and cell-phone infrastructures, and behind-the-scenes tours at knowledge institutions, sound labs, logistical centers, information hubs, and various media-cities-in-the-making.[83] I've studied artifacts ranging from cuneiform tablets to old pneumatic tubes to the history of record-keeping systems—both material and ethereal "things." I've welcomed architects, planners, acousticians, cartographers, anthropologists, sound artists, infrastructural stewards and scholars, and policy experts into my classes and into the many public events, speaker series, and exhibitions that I've helped to organize. I've also conducted interviews with those same folks, and visited their studios and examined the tools and techniques they use to design media for urban use, or to build cities to accommodate those media, or to understand how cities past have facilitated mediation. And all the while I've read as widely as possible across the disciplines, weaving together insights from classics, materials science, art history, geology, urban history, engineering, media studies, and elsewhere. I've attempted to teach myself a little something about everything from brick-making and ancient bookkeeping to cell-phone azimuths and acoustic modeling. Mine was not a systematic methodology; it was more of a dig across space and time, through ether and ore, that only after years of sifting and sorting has enabled me to recognize thematic, historical, and geographical patterns in urban intelligence and mediation.

Each chapter of the book moves progressively farther backward in time—from the radio city of the early twentieth century, to the early wired cities of the mid-nineteenth century, to typographic places of print that have spanned the past five centuries, to sites of urban inscription and record-keeping, to urban volumes of vocality from the ancient world through today. As Graeme Gilloch advises in his study of Walter Benjamin's writings on the city, "History itself is a construction of the present age and must always be read backward from the ruins which persist in the here and now."[84] Similarly, archaeologists Rodney Harrison and John Schofield state that doing archaeology on the "contemporary past"—on recent history, like our media cities of the telecommunications age—requires that we "approach the present as a surface layer, working 'backward' through time to explore the ways in which the past intervenes in the present."[85] While we are reading backward, we'll examine our old media infrastructures not as *ruins* but as "residual" media, as "effective

element(s) of the present."[86] Thus *Code and Clay, Data and Dirt* isn't organized in a simple reverse-chronological order; each chapter examines not only how these historical media have shaped urban space in the days when they were "new," but also how they continue to do so in our time, and will continue to do so tomorrow.

I offer an "anonymous history" of urban mediation—one that, much like Heinrich Wölfflin's "art history without names," pays little attention to great men or specific sites and times of origin and invention. While some folks—typically, those deemed sufficiently important to have had their thoughts recorded for posterity—might have interesting things to say about cities and media, and might aid in our historical and archaeological tasks, I don't regard these figures as the sole, or even primary, catalysts for historical change. Ether and ore, mud bricks and paper, sound waves and electricity are all critical actants here—just as critical as the named and nameless people who learned to harness them, mold them, and maintain them. In aggregate, these "humble objects . . . have shaken our mode of living to its very roots . . . for, in the anonymous life, the particles accumulate into an explosive force."[87] So proclaimed Siegfried Giedion, who presented his own *Mechanization Takes Command*—in which he examined the history of mechanization through the hand and the hearth, soil and sanitation—as an anonymous history. While my history of media cities is similarly anonymous, and while I have drawn inspiration from a theoretical tradition that is known for its occasional anti-humanism and technofetishism, the history I present here is certainly not a nonhuman one. Our story is one of how various topographies, climates, things (both immaterial and material), and people (both named and unnamed) have, across the millennia, shaped cities that, at their best, represent humankind's greatest feats of engineering, its greatest repositories of media and culture in their myriad forms, and its greatest embodiment of a culture's core values and critical knowledges—and at their worst can become, by design or through neglect, sites of decay, erasure, oppression, and injustice.

Each chapter of the book will be structured around the search for a particular archaeological-infrastructural "emblem," a material "topos" or artifact, that we tend to associate with specific epochs in media history, but which we'll trace forward and backward in time, through cities around the world. Archaeologists and historians have long acknowledged the ideological significance of different building materials. Concrete, in the form of expressways, for instance, is thought to embody various modernist political visions, ranging from self-directed mobility and emancipation

to the military-industrial "disciplining" of urban circulation. Likewise, many media archaeologists and historians, like Ernst and Gitelman, have addressed the importance of considering the specific material natures of our historical records and artifacts; our histories are shaped by the substrates they're etched into.

We'll start amidst the ether—that "mediating substance between technology, science, and spiritualism," "the source of all things," as Joe Milutis describes it.[88] Our first chapter, "Waves and Wires: Cities of Electric Sound," describes how, since the mid-nineteenth century, urban atmospheres have been charged with electric and electromagnetic telecommunications—telegraph and telephone wires and radio waves. We'll begin by looking and listening for the impact of radio on urban form and architecture, and how the medium made itself both seen and heard in the urban environment. We'll then study how radio's wired precursors, the telegraph and telephone, effected their own influence on urban form and built space, and how new fiber-optic and cellular technologies are doing the same. Ether and ore (or its metallurgic analogs) have long been intertwined in our radiophonic cities: then and now, these ethereal technologies have relied for their operation on a byzantine array of antennae, rivers of wires, and a constellation of transmitters and switches—all of which have remade the material urban landscape around themselves.

We then shift our scale of observation to focus on ore molded into much more modestly-sized forms—particularly the letterform. Chapter 2, "Steel and Ink: The Printed City," traces how, for over half a millennium, a humble assemblage of steel, ink, and paper has informed the way we've imagined, designed, constructed, inhabited, administered, and navigated our cities. We'll study how new printed urban and architectural treatises and documents transformed the way designers learned their craft and shaped the cities they created. We'll then map how those cities became centers of print production, distribution, and consumption; they generated literary cultures and public spheres of readers and writers, and their new print forms—maps, guidebooks, and publicly-accessible architectural texts and pattern books—shaped the way people interacted with their cities. We'll look then to newspapers' role in both rendering the modern city legible to its inhabitants and shaping the urban material landscape. The administration of modern cities was particularly printing-intensive: we'll study how urban governance necessitated the generation of mountains of printed forms and typewritten memos and punched cards, as well as the creation of homologous architectures—metal filing cabinets, municipal

archives, and the "enormous file" of the skyscraper itself—to circulate and contain all those standardized printed artifacts. And while our current age of more "ethereal" texts might spell the diminishment of the press, we'll close by examining how the printed page persists, even thrives, in some places as a still-popular mass-circulated medium, or as the fulcrum of niche urban print cultures.

In chapter 3, we dig into an even more humbly and messily elemental medium: mud. In "Of Mud, Media, and the Metropolis: Aggregating Histories of Writing and Urbanization," we'll consider how mud and its material analogs—clay, stone, brick, concrete—have supplied the foundations for our human settlements and forms of symbolic communication, and have bound together our media, urban, architectural, and environmental histories. Some of the first writing surfaces, clay and stone, were the same materials used to construct ancient city walls and buildings, whose facades also frequently served as substrates for written texts. The formal properties of those scripts—the shapes they took on their clay (or, eventually, parchment and paper) foundations—were also in some cases reflected in urban form: how the city molded itself from the materials of the landscape. And those written documents have always been central to our cities' operation: their trade, accountancy, governance, and culture.

In chapter 4, we attend to the sounds and textures of the voice, arguably among our oldest of "media." In "Speaking Stones: Voicing the City," we'll consider how the city itself functions as a sounding board, resonance chamber, and transmission medium for vocality—for public address, interpersonal communication, and vocal expressions of affect. Such considerations have, either intentionally or accidentally, informed the design, construction, and inhabitation of cities for millennia. We'll consider what we might learn from the field of archaeoacoustics, particularly regarding how urban spaces—the Greek agora and Pnyx, the Roman forum, the Byzantine church—have created the acoustic conditions necessary for democratic deliberation and other forms of assembly. We'll then discern how the resounding or containment of voices (particularly the voices belonging to particular classes of society) has demarcated urban boundaries and established territory. For instance, the Muslim call to prayer and the activist's voice, engaged in urban demonstration, have both exploited the material city as their resonance chamber, and supplemented the "live" performance with other mediations, including amplification and radio broadcast. We'll then close by considering new opportunities for scripting the urban voice and carefully engineering bounded spaces for

its resounding. While such sound design work can help us to build more acoustically efficient cities, those sanitized, rationalized spaces can also muffle the urban public voice by stripping away its resonant texture and muting the historical echoes that might mix with and amplify it, creating harmonies or productive discord.

And finally, in the Conclusion, we examine a recent archaeological project, the reconstruction of Palmyra's Arch of Triumph, that involved the use of a wide variety of media technologies as archaeological tools, and that ultimately transformed the archaeological object into a globally circulating media production. The project's entangled materialities, temporalities, and geographies will allow us to revisit many topoi we will have explored through each of the book's four chapters; to reassess the cultural politics of media archaeology and archaeology-proper; and to consider the potential implications of these past-oriented fields of exploration for our urban media futures.

These chapters don't reflect mutually exclusive archaeological periods. I'm not suggesting that the voice, writing, print, and electrified sound are the media equivalents of our bronze, iron, and stone ages. While our media technologies did rise to prominence at different times in different places, they don't reside in distinctive historical strata. Our urban media ages are productively mixed in their materialities. Our cities past and present have been simultaneously aural, graphic, textual, electroacoustic, digital, and haptic. They're made of electromagnetic waves and infrastructure formed from mud, metal, or silicon. They've *always* been both new and old, immaterial and material, wireless and wired. Our media cities have been, and still are, both ether *and* ore, code and clay.