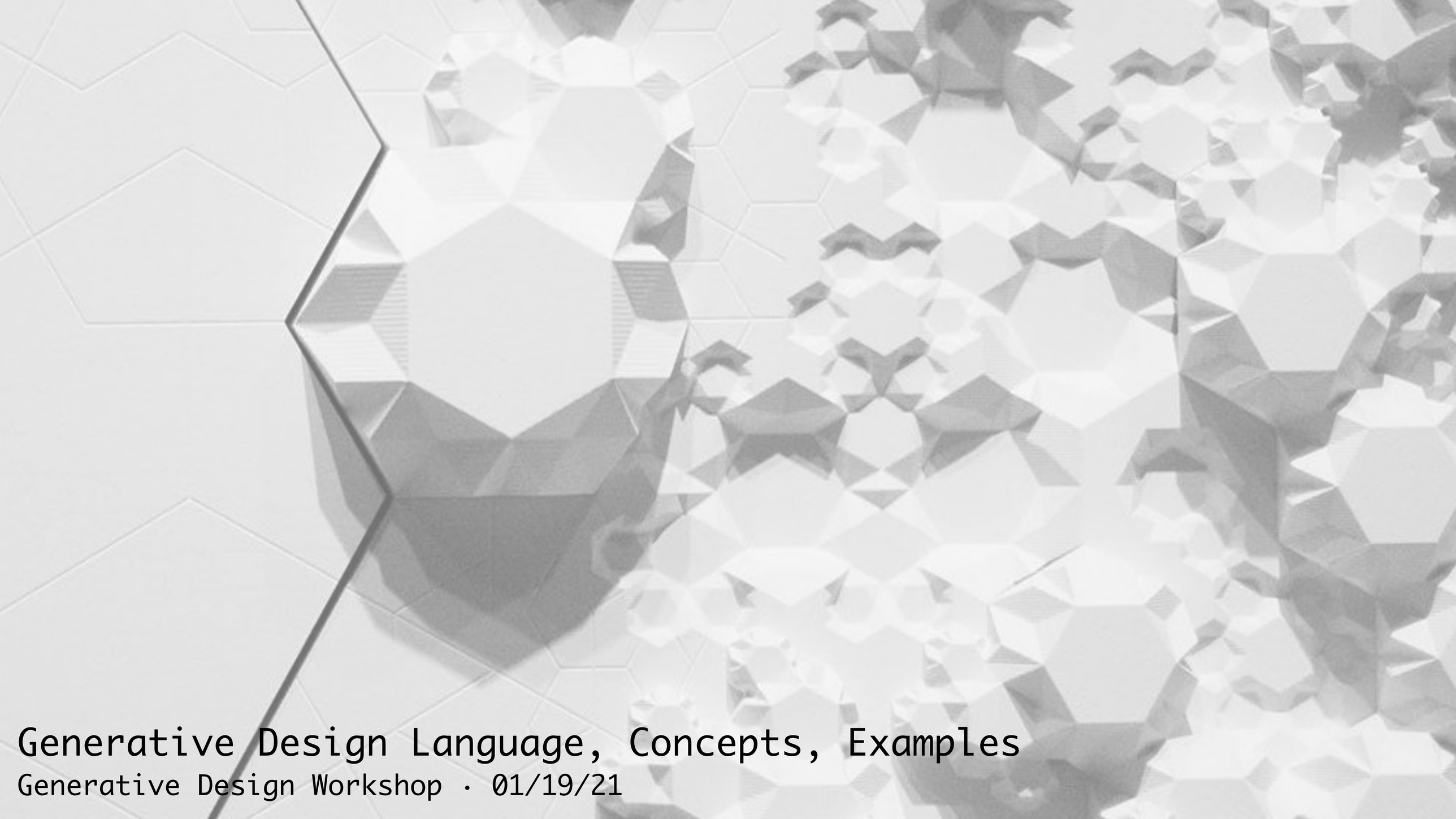


Generative Design Language, Concepts, Examples

Generative Design Workshop · 01/19/21

generative design workshop

product/service design

digital fabrication

iterative experimentation

All of the works and ideas in this deck are *experimental*, and many were never intended to solve a problem, be sold in stores, or address a social or global issue.

Please look at these works as examples of a new way of thinking and making before ignoring them as *science fiction* or *art and therefore not design*, and do your best to identify the statements *about the future of design* that are embedded within each piece.

generative design

data-driven design

parametric design

algorithmic design

generative design -> designed generativity

data-driven design -> design-driven data science

parametric design -> designed parameterization

algorithmic design -> designed algorithms

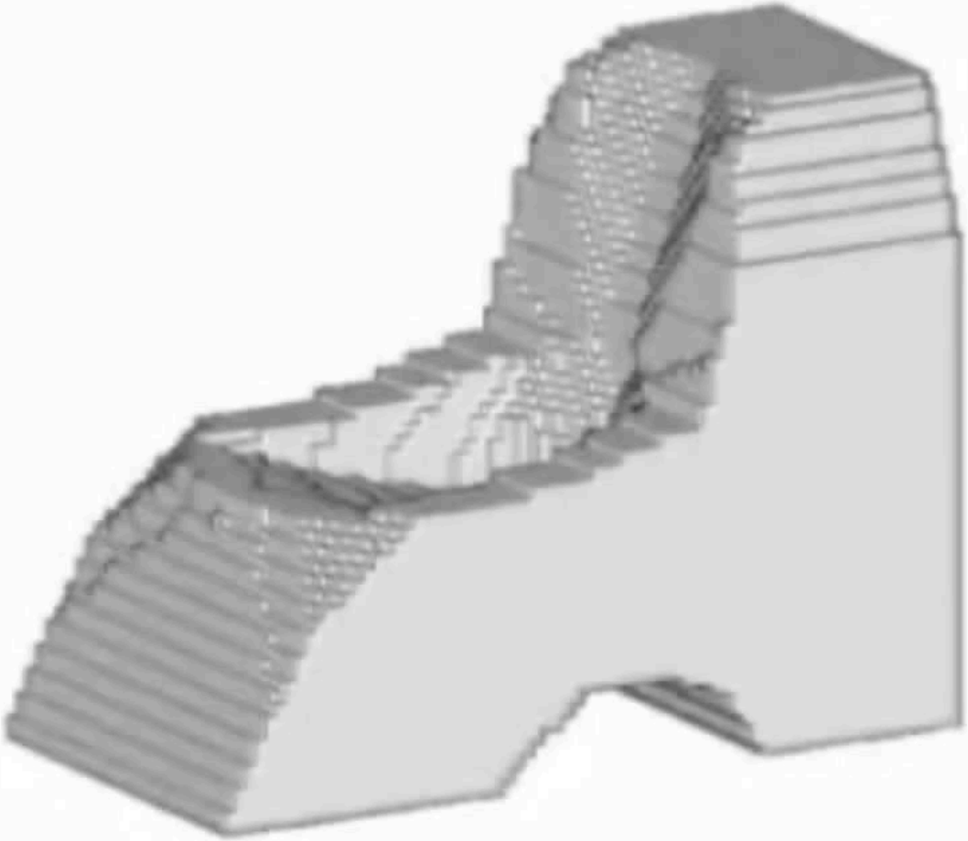
what the world thinks generative design is…

optimization paradigm

simulation paradigm

APWORKS
by Airbus Group
ROCK SHOX
BOXER
400

Bone Chairs
Joris Laarman · 2006-2008



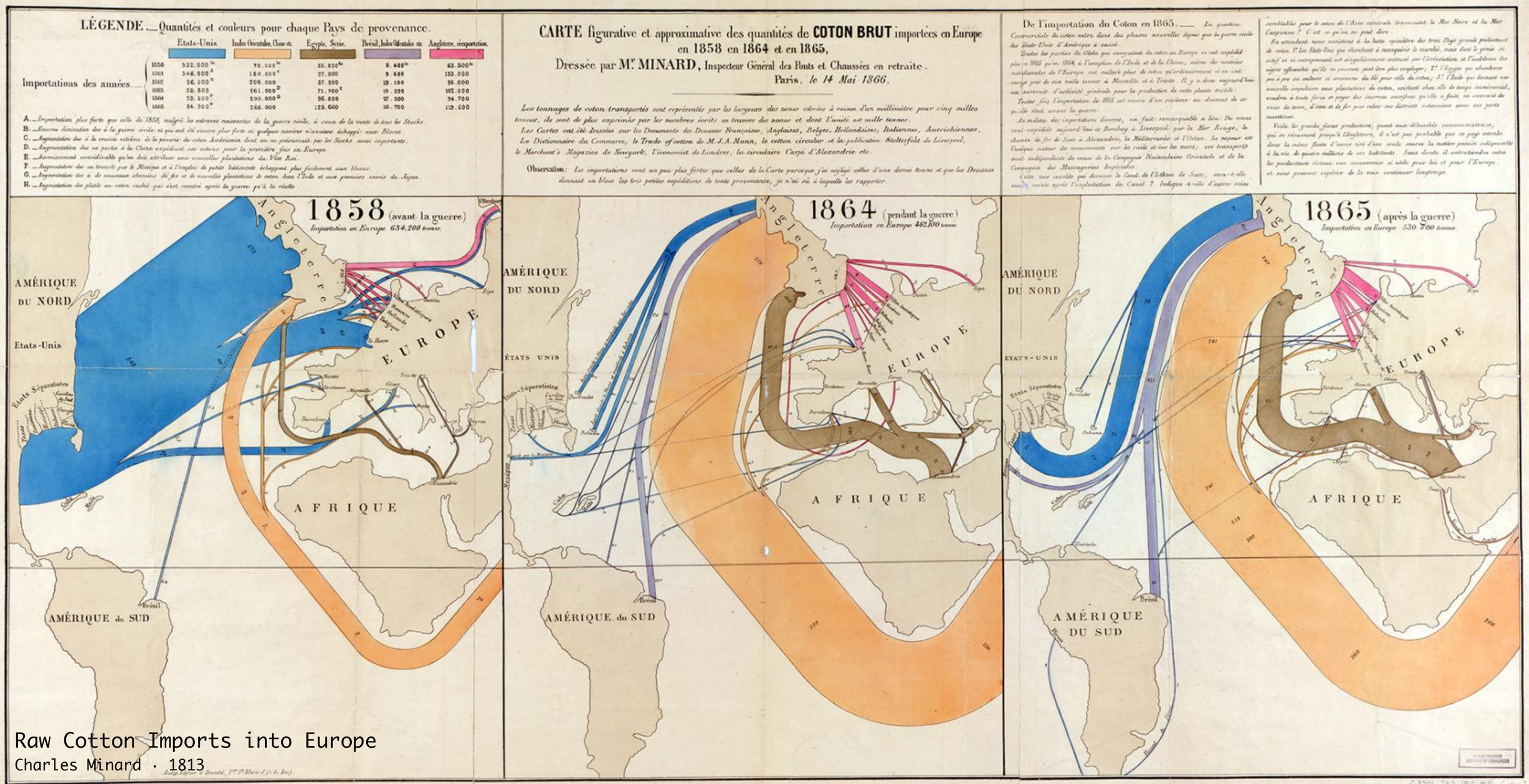
Ingo Table

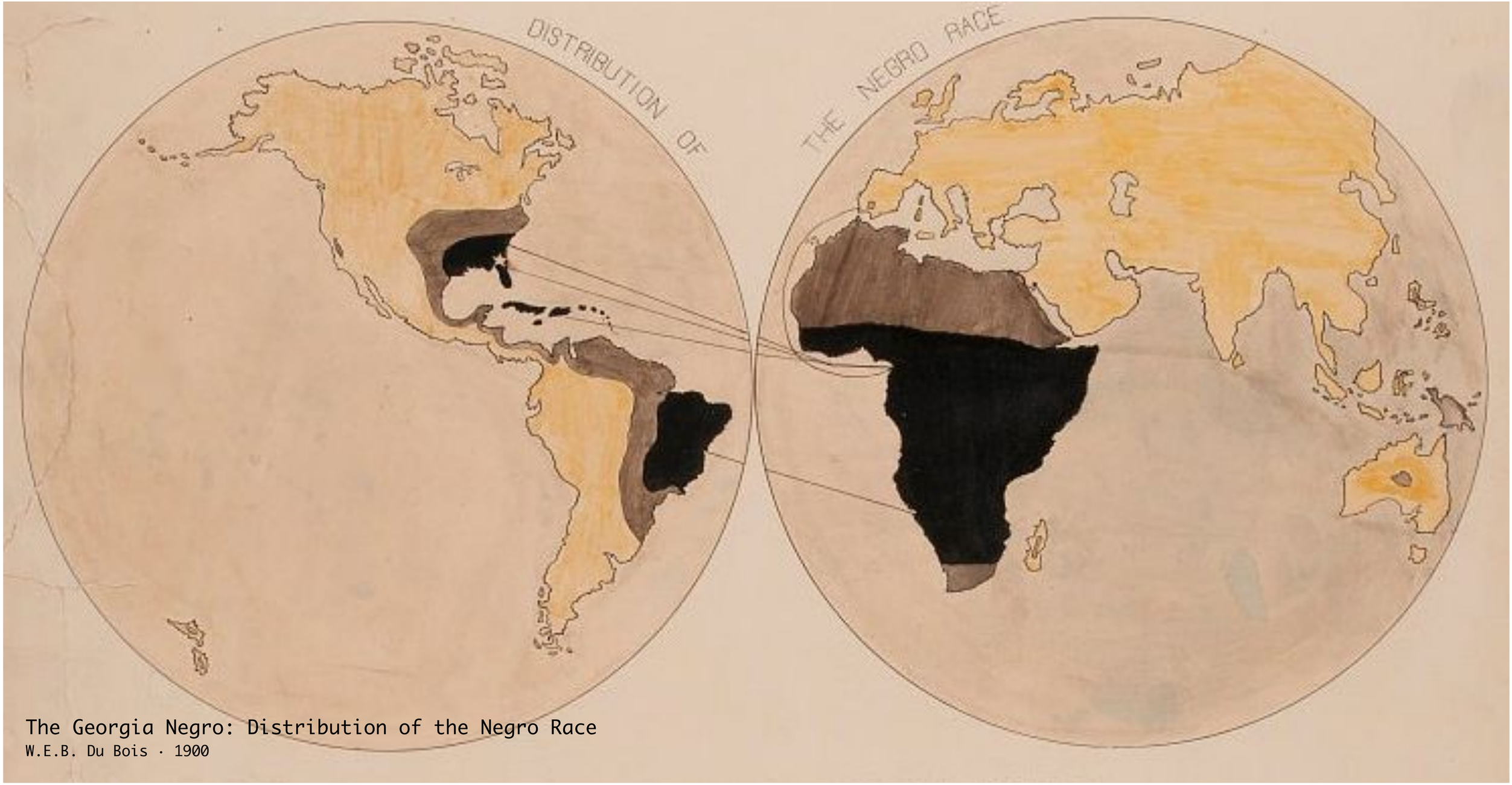
Ikea Design Team · 2016 –

~~optimization paradigm~~

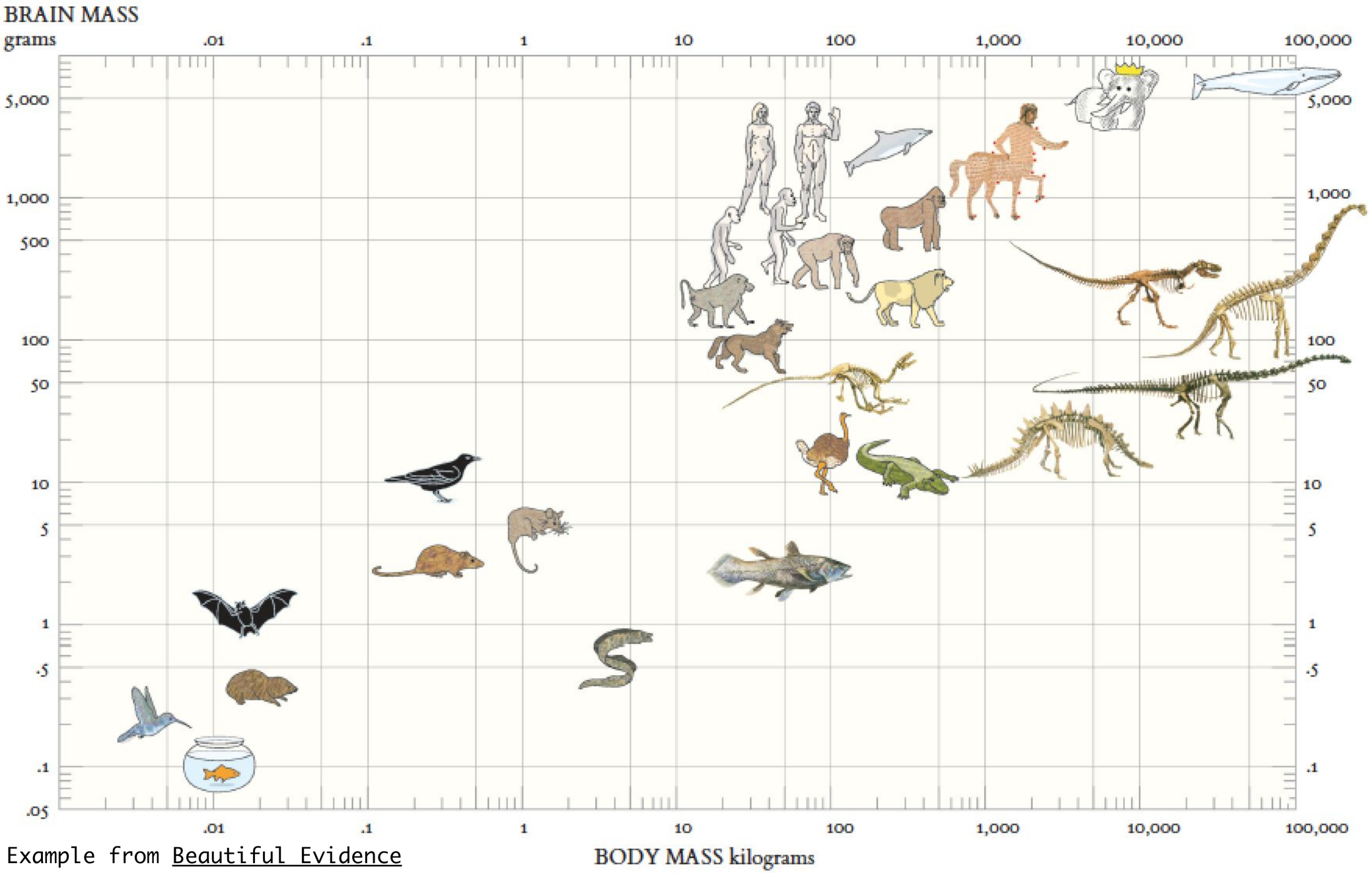
~~simulation paradigm~~

data visualization paradigm


LÉGENDE. — Quantités et couleurs pour chaque Pays de provenance.
Etats-Unis
Indes Orientales, Chine etc.
Egypte, Syrie.
Brésil, Indes Occidentales etc.
Angleterre, réexportation.
Importations des années.
1858 532.000 balles 70.000 balles 23.850 balles 8.400 balles 63.500 balles
1861 546.000 balles 180.000 balles 27.000 balles 9.600 balles 133.000 balles
1862 26.000 balles 209.000 balles 37.200 balles 19.100 balles 96.000 balles
1863 28.500 balles 261.000 balles 71.700 balles 19.200 balles 102.000 balles
1864 39.600 balles 299.000 balles 96.000 balles 27.500 balles 94.700 balles
1865 84.900 balles 266.000 balles 129.600 balles 30.700 balles 129.600 balles
A. — Importation plus forte que celle de 1858, malgré les entraves naissantes de la guerre civile, à cause de la vente de tous les Stocks.
B. — Énorme diminution due à la guerre civile et qui eut été encore plus forte si quelques navires n'avaient échappé aux Blocus.
C. — Augmentation due à la crainte extrême de la pénurie du coton Américain dont on ne prévoyait pas les Stocks aussi importants.
D. — Augmentation due en partie à la Chine expédiant ses cotons pour la première fois en Europe.
E. — Accroissement considérable qu'on doit attribuer aux nouvelles plantations du Vice Roi.
F. — Augmentation due au trouvé par le Mexique et à l'emploi de petits bâtiments échappant plus facilement aux blocus.
G. — Augmentation due à de nouveaux chemins de fer et à de nouvelles plantations de coton dans l'Inde et aux premiers envois du Japon.
H. — Augmentation du plaité au coton, enfin qui s'est montré après la guerre qu'à la récolte.
CARTE figurative et approximative des quantités de COTON BRUT importées en Europe en 1858 en 1864 et en 1865,
Dressée par Mr. MINARD, Inspecteur Général des Ponts et Chaussées en retraite.
Paris, le 14 Mai 1866.
Les tonnages de coton transportés sont représentés par les largeurs des zones coloriées à raison d'un millimètre pour cinq milles tonnes, ils sont de plus exprimés par les nombres écrits en travers des zones et dont l'unité est mille tonnes.
Les Cartes ont été dressées sur les Documents des Douanes Françaises, Anglaises, Belges, Hollandaises, Italiennes, Autrichiennes, Le Dictionnaire du Commerce, le Trade of cotton de M. J. A. Mann, le cotton circular et la publication Stotterfoht de Liverpool, le Marchant's Magazine de Newyork, l'Economist de Londres, la circulaire Carpi d'Alexandrie etc.
Observation: Les importations sont un peu plus fortes que celles de la Carte parceque j'ai négligé celles d'une demie tonne et que les Douanes donnant en bloc les très petites expéditions de toute provenance, je n'ai rien à laquelle les rapporter.
De l'importation du Coton en 1865. — La question Commerciale du coton entre dans des phases nouvelles depuis que la guerre civile des Etats-Unis d'Amérique a cessé.
Toutes les parties du Globe qui envoyaient du coton en Europe en ont expédié plus en 1865 qu'en 1864, à l'exception de l'Inde et de la Chine, même des contrées méridionales de l'Europe ont cultivé plus de coton qu'ordinairement et en ont envoyé près de six mille tonnes à Marseille et à Trieste. Il y a donc aujourd'hui un surcroît d'activité générale pour la production de cette plante textile.
Toutes fois l'importation de 1865 est encore d'un sixième au-dessous de ce qu'elle était avant la guerre.
Au milieu des importations diverses, un fait remarquable a lieu. Des cotons sont expédiés aujourd'hui de Bombay à Liverpool par la Mer Rouge, le chemin de fer de Suez à Alexandrie, la Méditerranée et l'Océan. La vapeur est l'unique moteur des mouvements sur les rails et sur les mers; ces transports sont indépendants de ceux de la Compagnie Péninsulaire Orientale et de la Compagnie des Messageries Impériales.
Cette voie inédite qui devance le Canal de l'Isthme de Suez, sera-t-elle suivie après l'exploitation du Canal? Indique-t-elle d'autres voies semblables pour le coton de l'Asie centrale traversant la Mer Noire et la Mer Caspienne? C'est ce qu'on ne peut dire.
En attendant nous assistons à la lutte opiniâtre des trois Pays grands producteurs de coton. 1° Les Etats-Unis qui cherchent à reconquérir le marché, mais dont le génie si actif et si entreprenant est singulièrement entravé par l'irrésolution et l'indécence des esprit affranchis qu'ils ne pourront peut être plus employer; 2° l'Egypte qui abandonne peu à peu sa culture si ancienne du blé pour celle du coton; 3° l'Inde qui donnant une nouvelle impulsion aux plantations de coton, existant chez elle de temps immémorial, voudra, à toute force et payer des énormes sacrifices qu'elle a faits en ouvrant des voies de terre, d'eau et de fer pour relier ses districts cotonniers avec ses ports maritimes.
Voilà les grandes forces productrices, quant aux débouchés consommateurs, qui se résument presque à l'Angleterre, il n'est pas probable que ce pays retombe dans la même faute d'avoir tiré d'une seule source la matière première indispensable à la vie de quatre millions de ses habitants. Sans doute il entretiendra entre les productrices rivales une concurrence si utile pour lui et pour l'Europe, et nous pouvons espérer de la voir continuer longtemps.
1858 (avant la guerre)
Importation en Europe 634.200 tonnes.
1864 (pendant la guerre)
Importation en Europe 462.100 tonnes
1865 (après la guerre)
Importation en Europe 530.700 tonnes.
AMÉRIQUE DU NORD
Etats-Unis
ÉTATS UNIS
ETATS-UNIS
Etats Séparatistes
Angleterre
EUROPE
AFRIQUE
AMÉRIQUE du SUD
AMÉRIQUE DU SUD
Brésil
Mexique
Cuba
Malte
Bordeaux
Marseille
Trieste
Gênes
Livourne
Alexandrie
Suez
Barcelone
Le Havre
Anvers
Hambourg
Hollande
Belgique
Stettin
Riga
Cadix
Gibraltar
Bahamas
Bermudes
Cap de Bonne Espérance
Madère
Canaries
Cap Vert
Fernando Po
Ile Maurice
Ile Bourbon
Ile Réunion
Ile Maldives
Ceylon
Calcutta
Bombay
Madras
Pondichéry
Chine
Singapore
Java
Batavia
Manille
Japon
Yokohama
Nagasaki
Hong Kong
Canton
Shanghaï



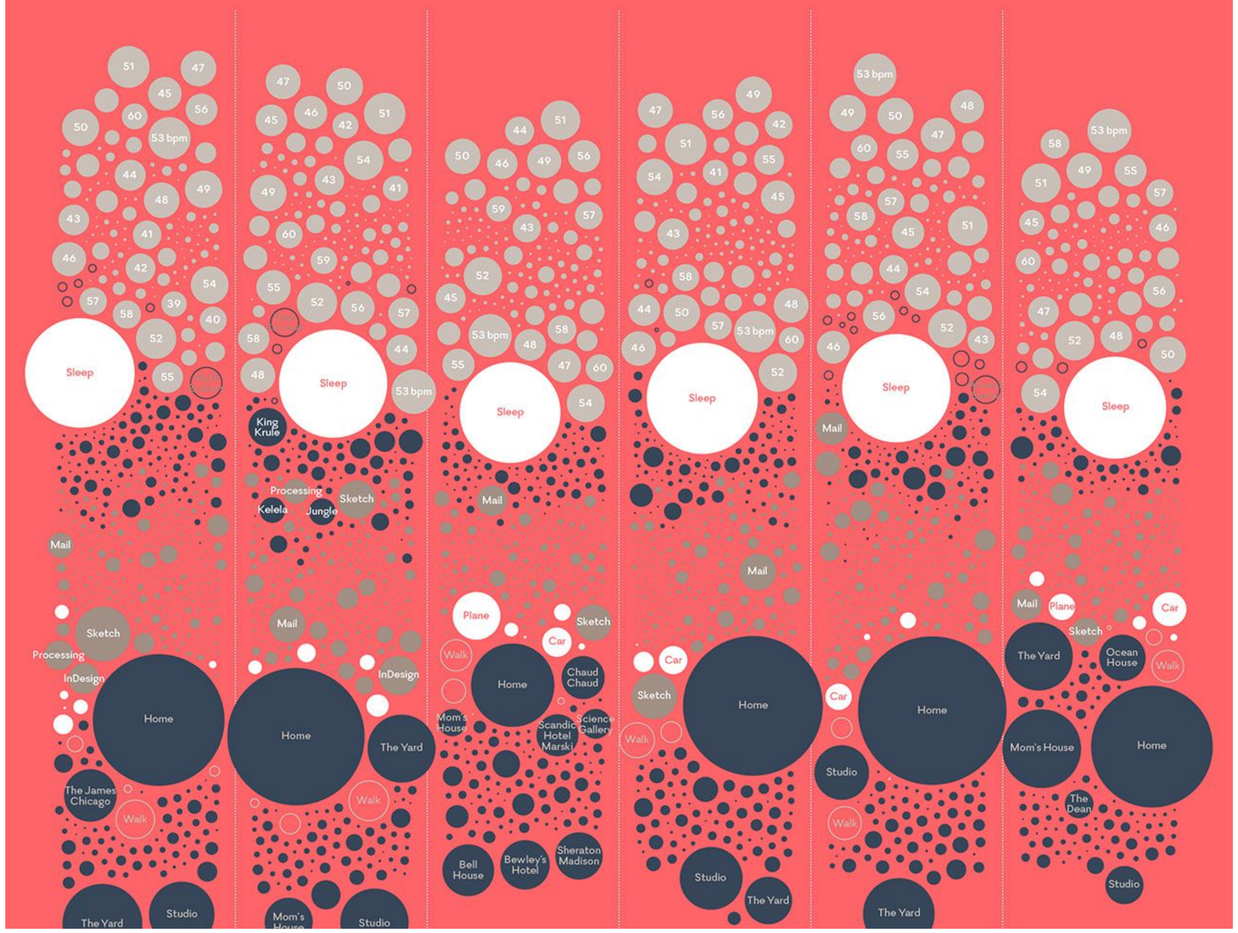
The Georgia Negro: Distribution of the Negro Race
W.E.B. Du Bois · 1900



Scatterplot Example from Beautiful Evidence

Edward Tufte · 2006

2014



NYC

Nicholas Felton
Feltron Report 2014 · 2014

1st Quarter

TIME IN NEW YORK
67d 4h
75% of first quarter

UNIQUE LOCATIONS
Sixty
Including 12 restaurants

PHOTOS TAKEN
186
7 Instagram posts

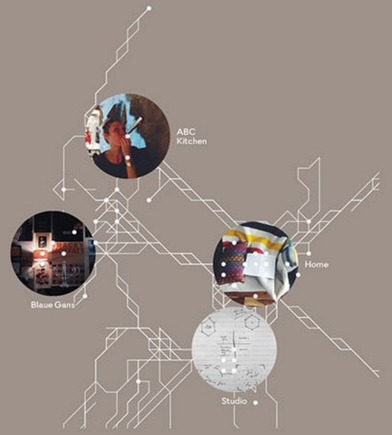
TOTAL DISTANCE
701 mi
Avg 10.4 miles/day

ACTIVE DISTANCE
98 mi
Avg 1.5 miles/day

PUBLIC TRANSPORT
45 trips
33 subway and 12 bus

AVERAGE TEMP
34°F
Range: 4°–65°F

TIME OUTSIDE
1d 12h
Avg 32 mins/day



2nd Quarter

TIME IN NEW YORK
70d 20h
78% of second quarter

UNIQUE LOCATIONS
101
Including 19 restaurants

PHOTOS TAKEN
364
13 Instagram posts

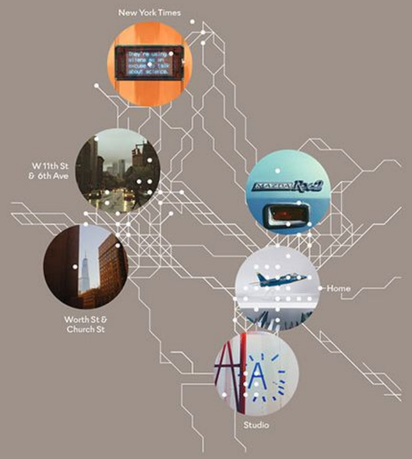
TOTAL DISTANCE
780 mi
Avg 11 miles/day

ACTIVE DISTANCE
172 mi
Avg 2.4 miles/day

PUBLIC TRANSPORT
70 trips
57 subway and 13 bus

AVERAGE TEMP
62°F
Range: 32°–88°F

TIME OUTSIDE
3d 8h
Avg 1h 8m/day



3rd Quarter

TIME IN NEW YORK
67d 2h
73% of third quarter

UNIQUE LOCATIONS
Ninety-nine
Including 22 restaurants

PHOTOS TAKEN
337
7 Instagram posts

TOTAL DISTANCE
601 mi
Avg 9 miles/day

ACTIVE DISTANCE
172 mi
Avg 2.6 miles/day

PUBLIC TRANSPORT
55 trips
38 subway and 17 bus

AVERAGE TEMP
74°F
Range: 61°–90°F

4th Quarter

TIME IN NEW YORK
81d 1h
88% of fourth quarter

UNIQUE LOCATIONS
128
Including 26 restaurants

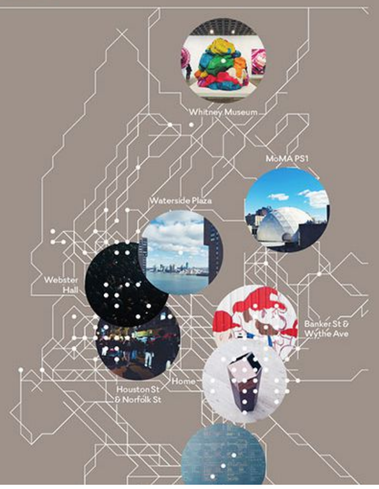
PHOTOS TAKEN
445
13 Instagram posts

TOTAL DISTANCE
940 mi
Avg 11.6 miles/day

ACTIVE DISTANCE
184 mi
Avg 2.3 miles/day

PUBLIC TRANSPORT
85 trips
73 subway and 12 bus

AVERAGE TEMP
49°F
Range: 22°–77°F

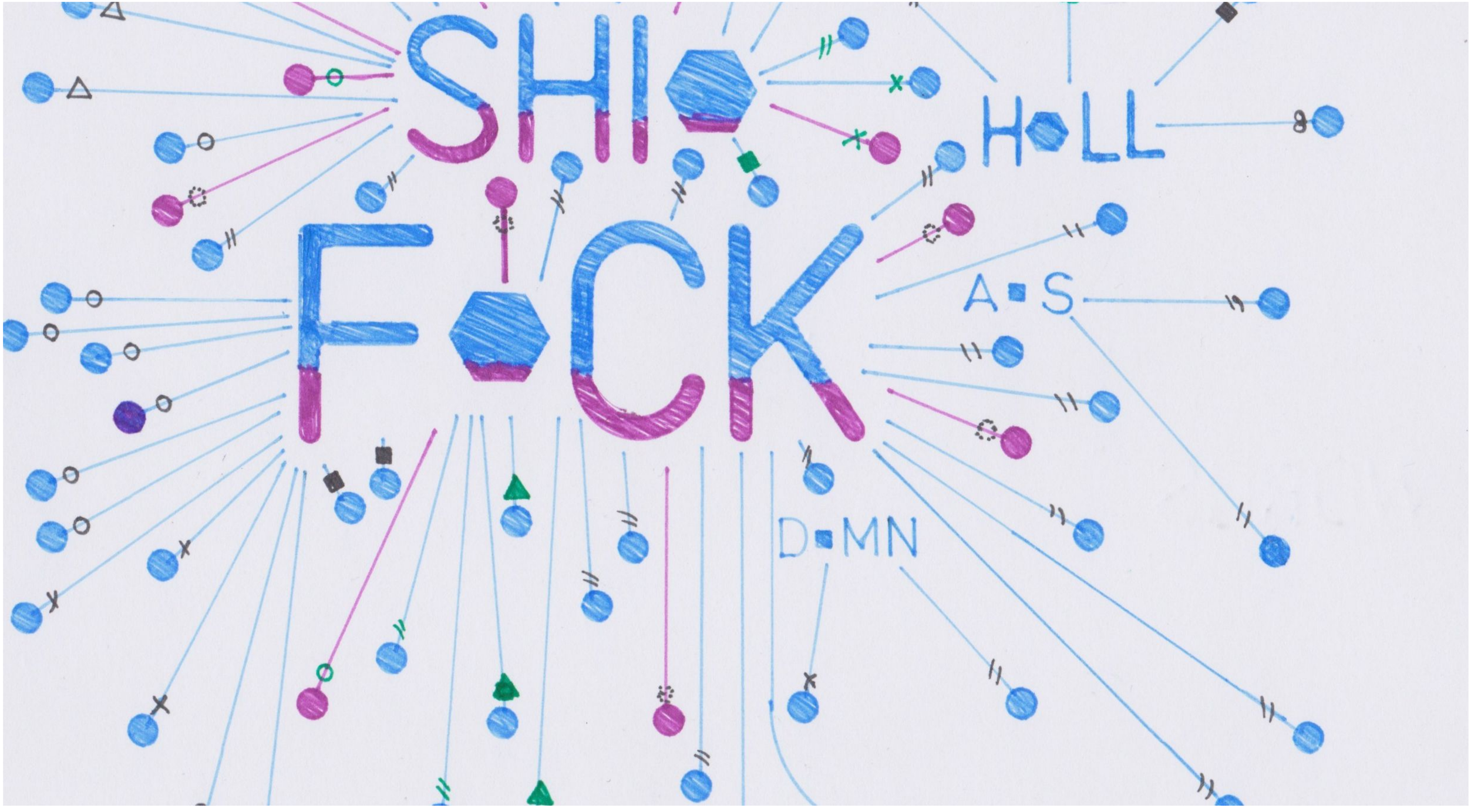


After spending more than six hours drawing this hyper-detailed card, Giorgia texted Stefanie as she posted it:
"You need to know that if this one doesn't get to you I won't redraw it. You'll see what I mean."

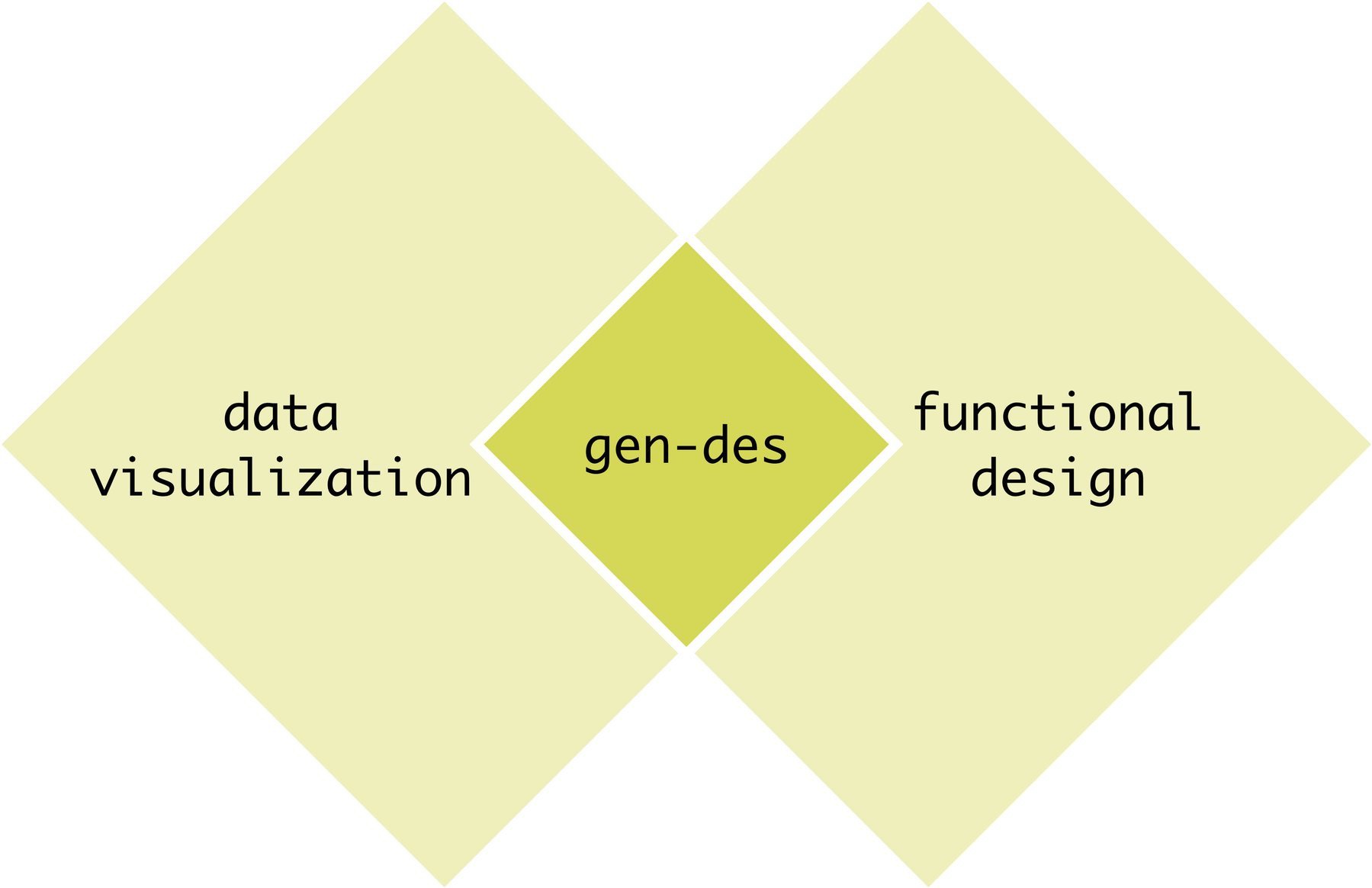
Unfortunately, while Giorgia's postcard arrived, Stefanie's postcard didn't, so she had to draw hers again
(luckily it wasn't as detailed, but it was still supremely annoying).

Dear Data

Giorgia Lupi and Stefanie Posavec · 2014


SHI
HELL
F CK
AS
DMN

~~data visualization paradigm~~


data visualization
gen-des
functional design

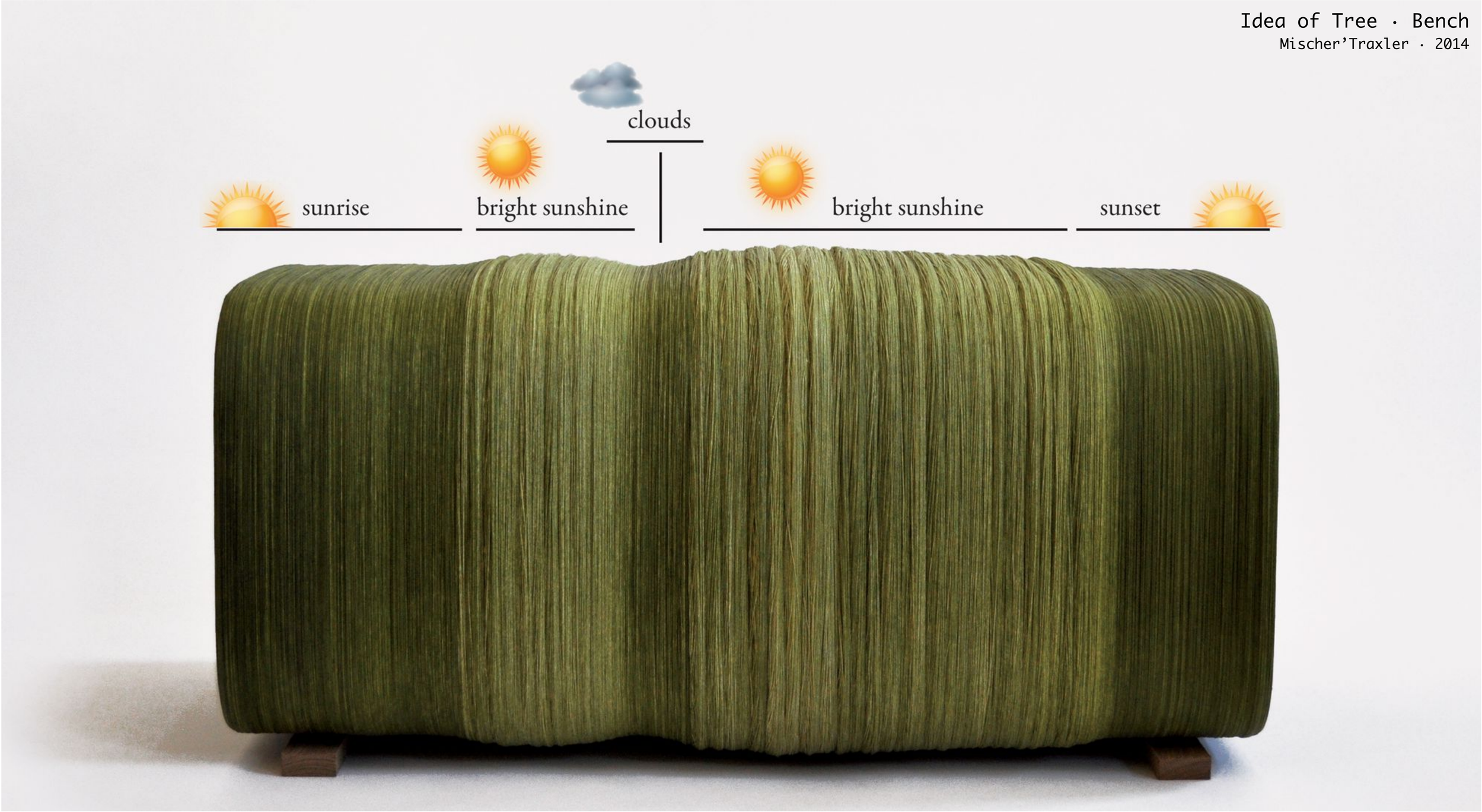
customization + contextuality paradigm

EGP

Idea of Tree : Recorder One
Mischer'Traxler · 2014

Idea of Tree · Bench

Mischer’Traxler · 2014



data input

transformation algorithm

physicalized/visualized output

hyper-customization

markets-of-one

customization

Audience/Designer Relationship

Audience Spectrum

customization

Audience/Designer Relationship

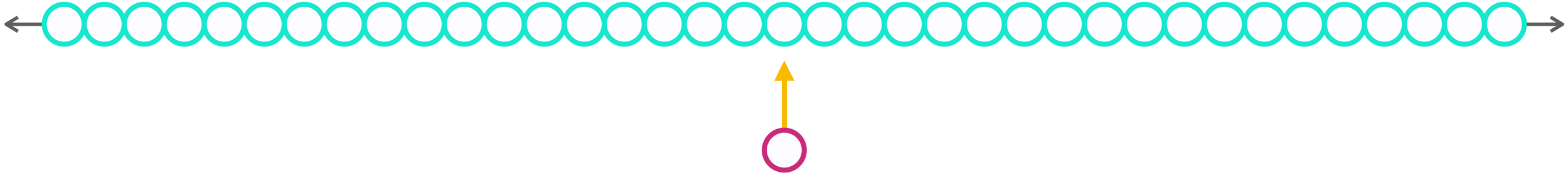
Audience Spectra

Audience/Designer Relationship

Potential Users

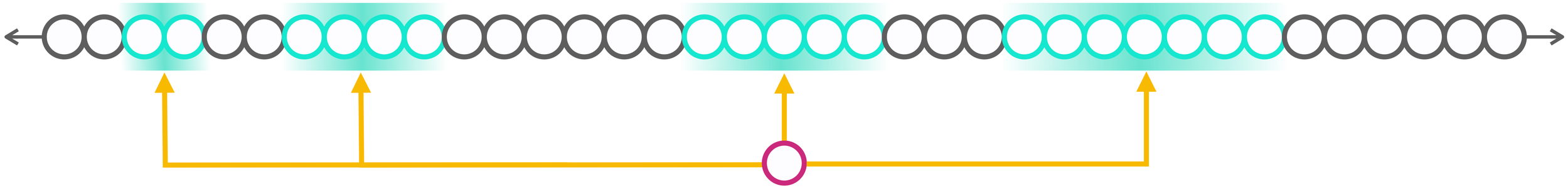
Audience/Designer Relationship

Craft Approach · Designer, Design, User



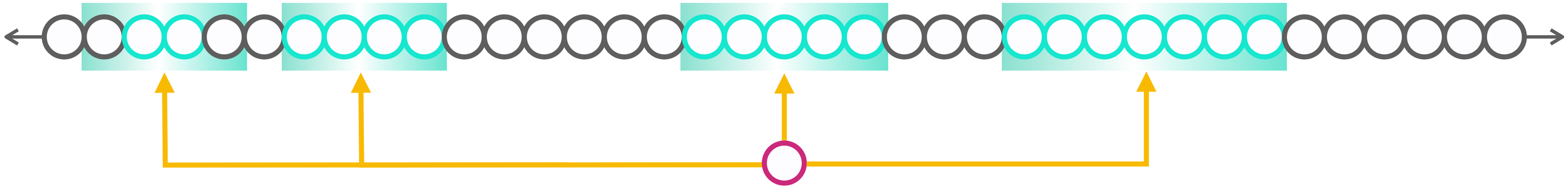
Audience/Designer Relationship

Modernist Approach · Designer, Design, User



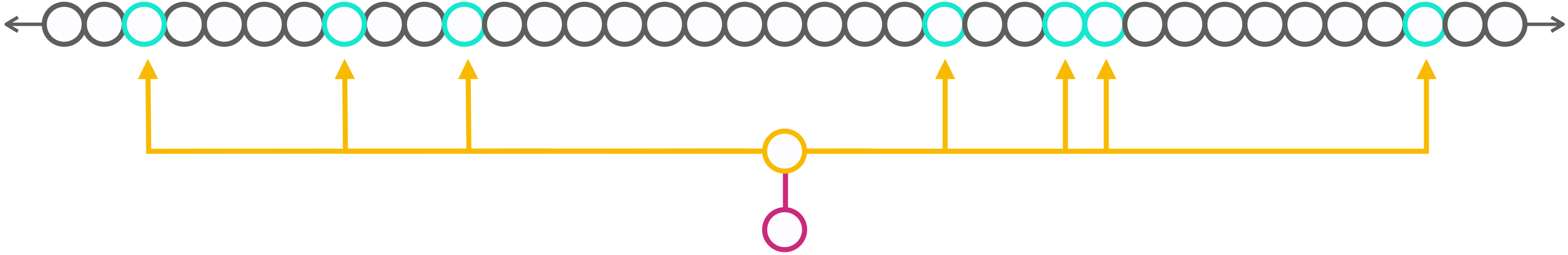
Audience/Designer Relationship

Post-Modernist / User-Centered Approach · Designer, Design, User



Audience/Designer Relationship

Universalist Approach · Designer, Design, User



Audience/Designer Relationship

Hyper-Customization Approach · Designer, Design, User

indirect design

audience segmentation

personas

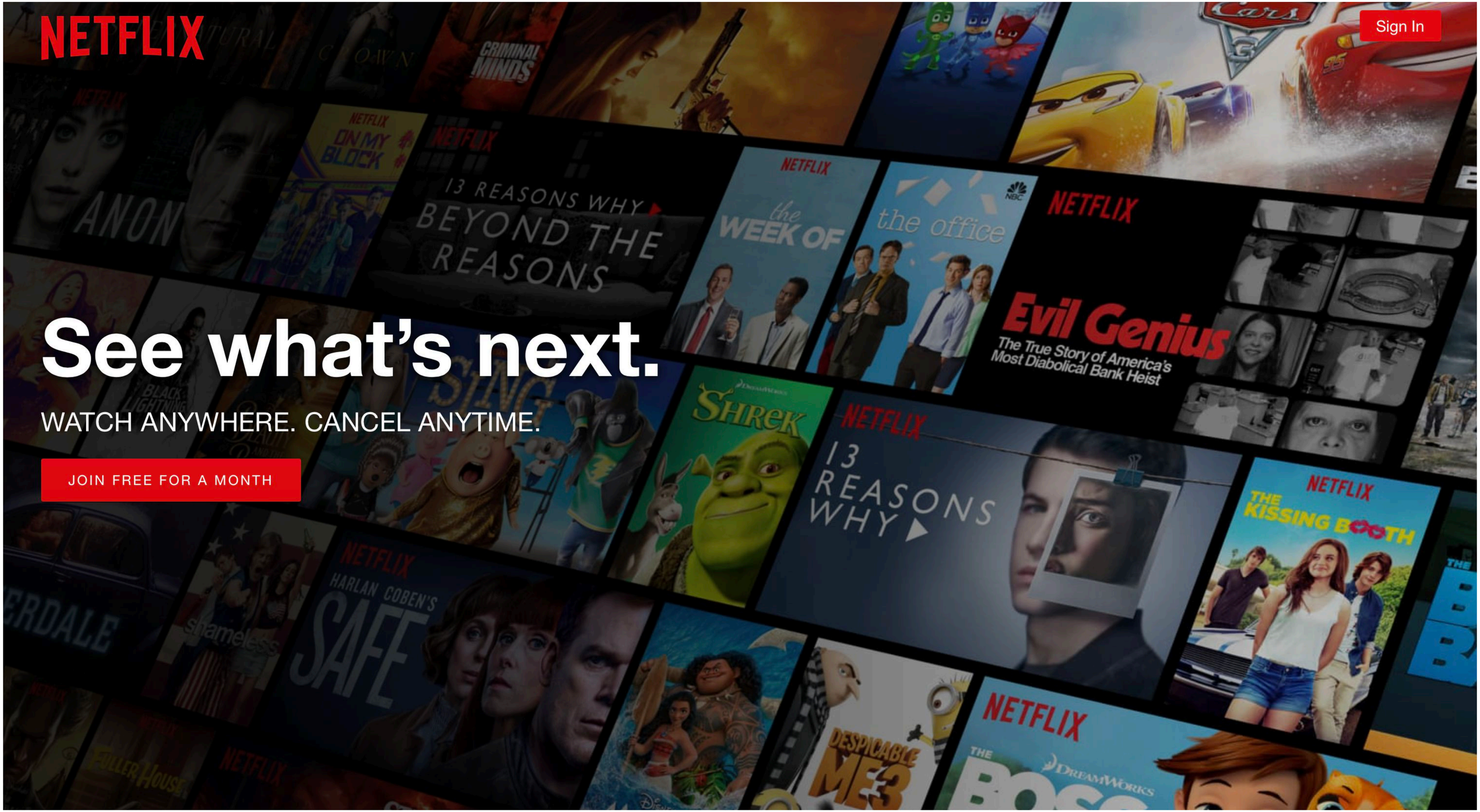
'heavy' vs 'light' users

~~audience segmentation~~

~~personas~~

~~'heavy' vs 'light' users~~

1 user : 1 design


NETFLIX
Sign In
See what's next.
WATCH ANYWHERE. CANCEL ANYTIME.
JOIN FREE FOR A MONTH
CRIMINAL MINDS
ANON
ON MY BLOCK
13 REASONS WHY
BEYOND THE REASONS
the WEEK OF
the office
Evil Genius
The True Story of America's Most Diabolical Bank Heist
SHREK
13 REASONS WHY
THE KISSING BOOTH
HARLAN COBEN'S SAFE
DESPICABLE ME 3
THE BOSS BABY
DREAMWORKS

NETFLIX Home **TV Shows** Movies Originals Recently Added My List

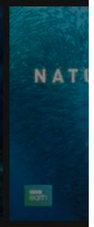
DVD 9+

TV Shows

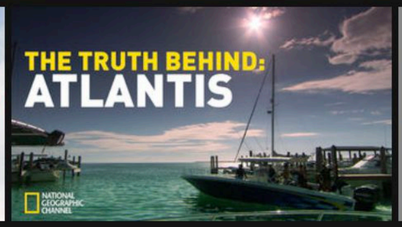
GENRES

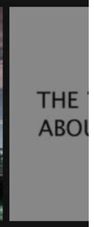
SUGGESTIONS FOR YOU

Top Picks for Zachary

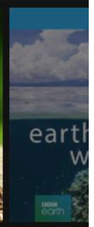


Casual Viewing





Because you liked The Blue Planet: A Natural History of the Oceans

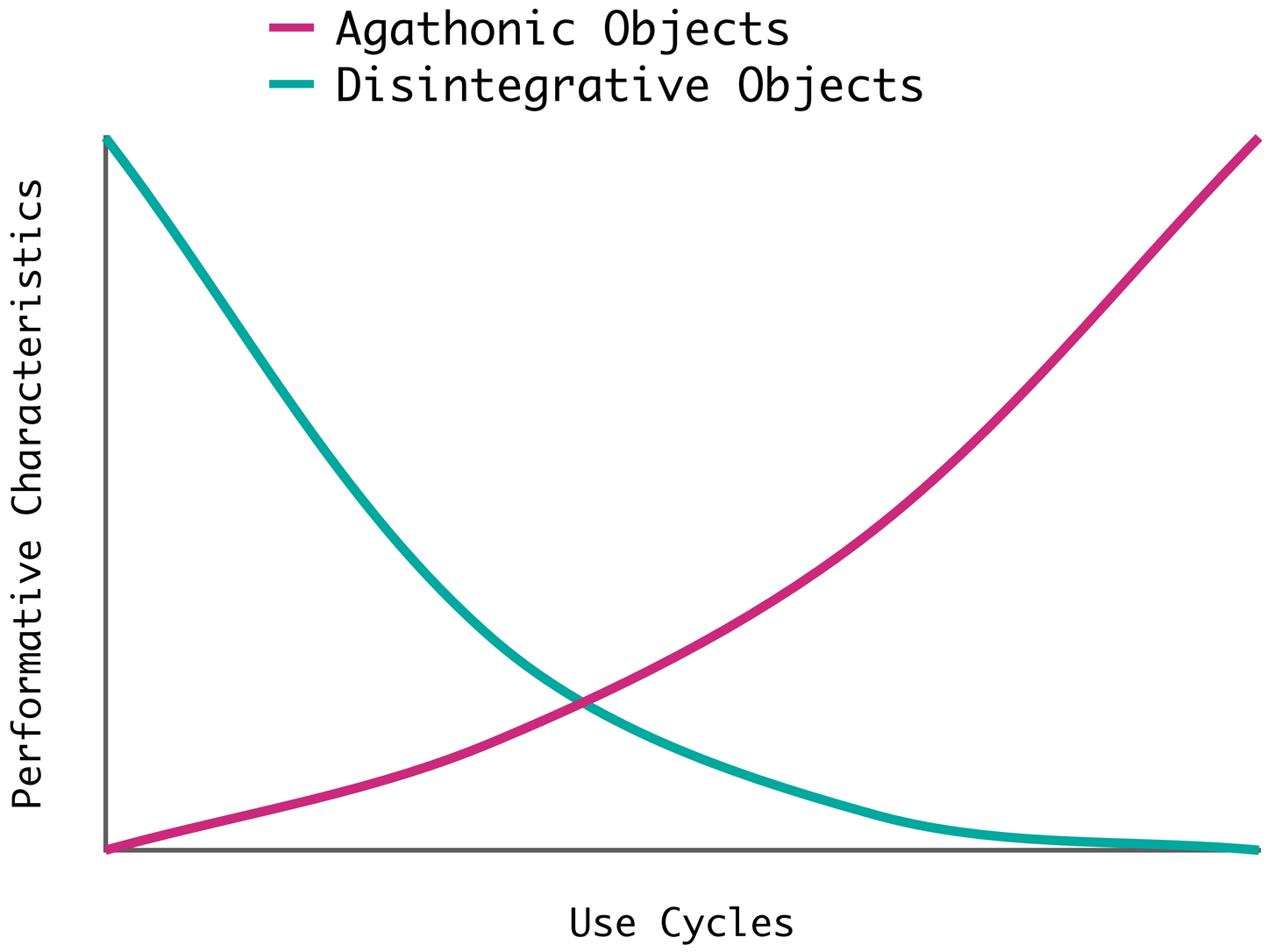


Science & Nature TV

behavioral data embedded deeply in design outcomes

agathonic design

designs which improve with wear, age, and use

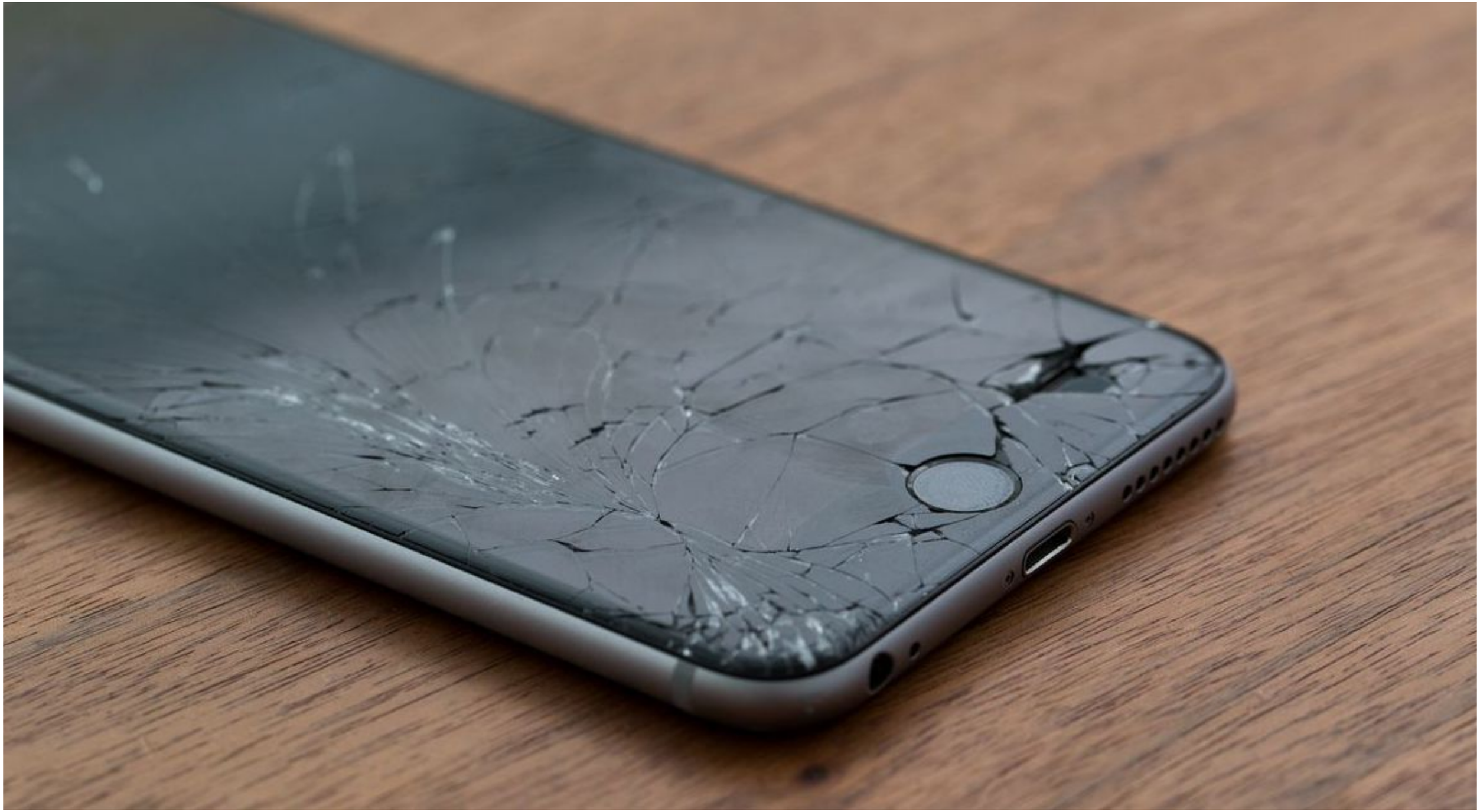

Agathonic Objects
Disintegrative Objects
Performative Characteristics
Use Cycles

Kintsugi
Edo Era

Mugs

Hasami (right) and Heath Ceramics (left)

agathonic objects are *unintentional* data storage



every object is a data visualization of its own fabrication process and *lived* experience

LIGHT YEAR

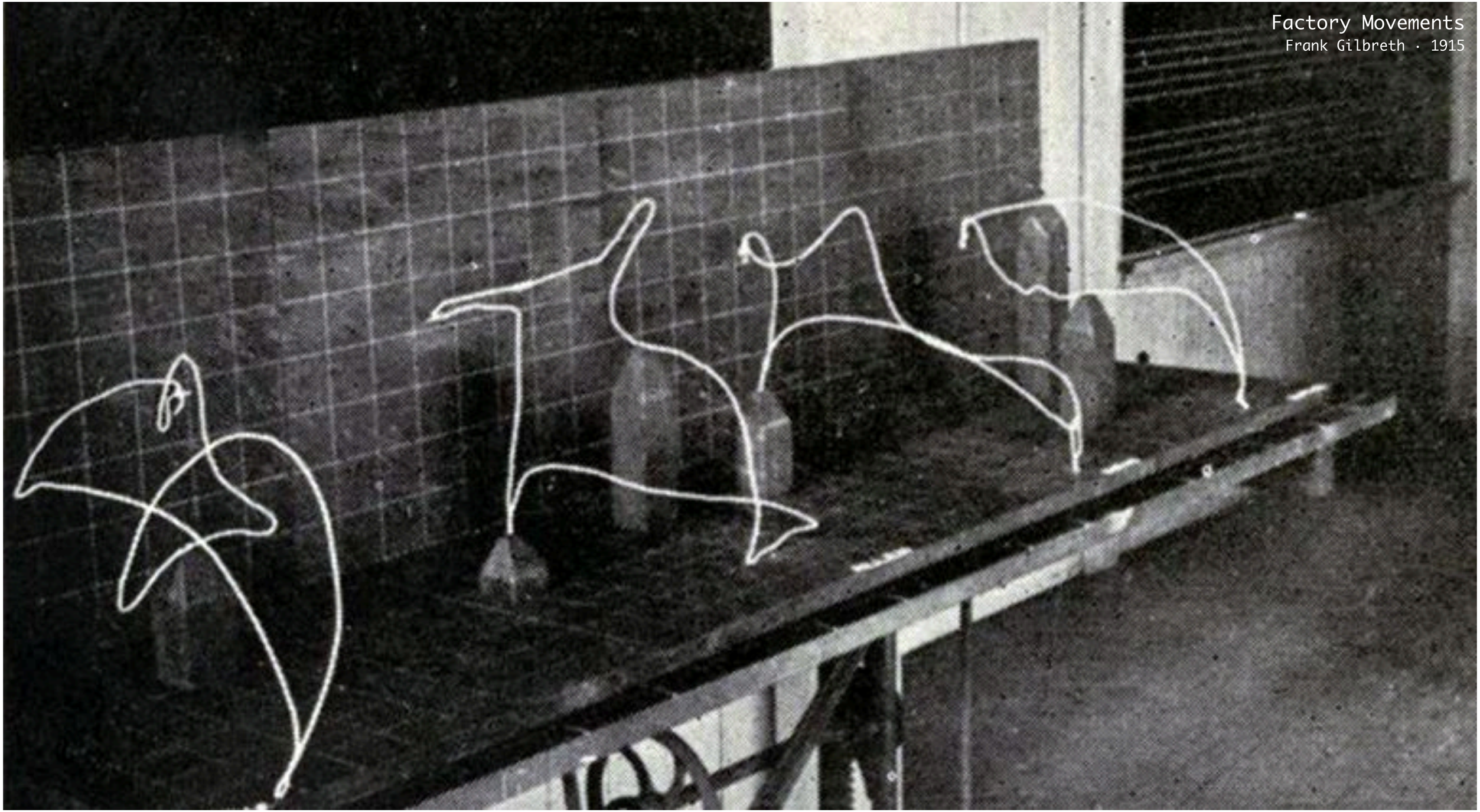
IMMIGRATION
PHUKET AIRPORT THAILAND
VISACLASS
21 SEP 2009
ADMITTED
20 OCT
15 JAN 2010
16 JAN 2010
VISACLASS
30 DEC 2009
ADMITTED
UNTIL
28 JAN 2010
SIGNED
15 JAN 2010
- 2 JAN 2015
ADMITTED
UNTIL
14/APR/
2009-0024
SRI LANKA IMMIGRATION
16 JAN 2010
29 JAN 2010
EMBARKED
SRI LANKA IMMIGRATION

physicalized data

data forms

Incan Quipu
15th Century

Inuit Hand Maps
18th Century



Factory Movements
Frank Gilbreth · 1915

Form Follows Data
Iohanna Pani Nicenboim · 2009

Form Follows Data
Iohanna Pani · 2009

Trends in Water Use

Adrien Segal · 2000

Mollalla Meander
Adrien Segal · 2009

DNA Glass

Suntory · 2016

01

Alcohol Tolerance

↓

Capacity

Glass capacity is adjusted based on the level of tolerance to alcohol.

*Glass capacity is not an indication of a recommended amount of alcoholic consumption.

02

Sensitivity to hops bitterness

↓

Glass rim thickness

Create a thicker rim for those inherently sensitive to bitterness, allowing them to enjoy the natural flavor of beer. Design a thinner rim for those less in tune to bitterness,

03

Sensitivity to malt aroma

↓

Top diameter

Create a wider opening for those with a heightened sense of smell, allowing them to enjoy beer's natural aroma. Design a narrower opening for those with a less re-

04

Stimulation preference

↓

Glass design sharpness

A straightforward and angular design for thrill seekers.
A smooth, curvy shape for easy-going folk.

05

Sociability

↓

Design complexity

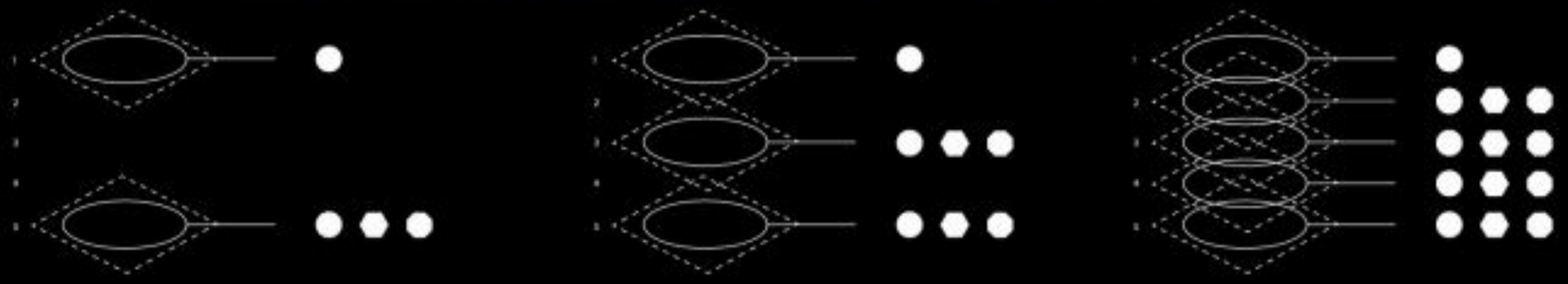
A fun, slightly complicated design for those who enjoy the company of others.
A simpler, rather stanch shape for those who prefer a solitary atmosphere.

4

5

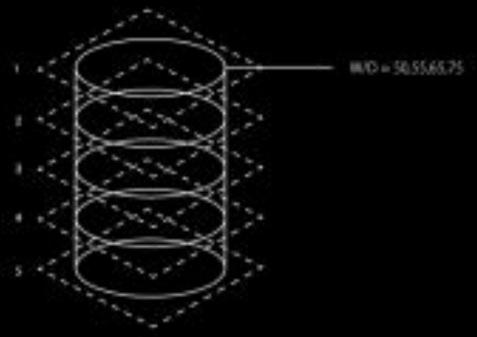
Cross-sectional shape

Dopamine - 11P15.5/636784 | Tenacity - 17P12/14007232 | Resilience to adversity - 6P12/47344162



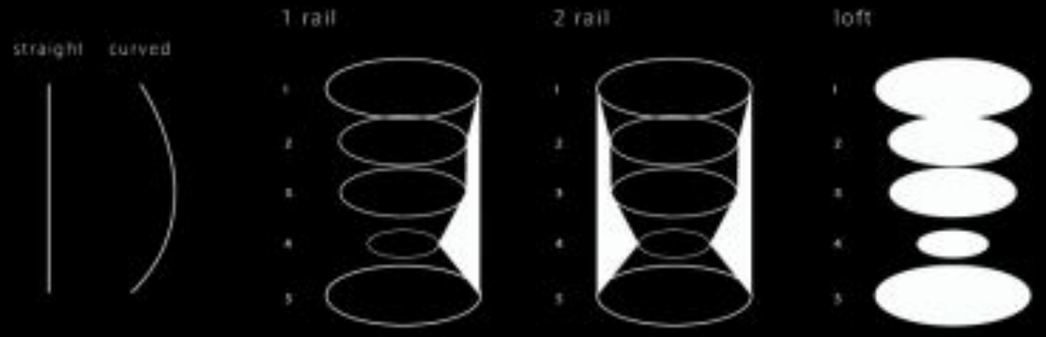
Top diameter

Sensitivity to malt aroma - 2Q37.3/239960704



Sharpness

Stimulation preference - 2P12/80484464



Central axis

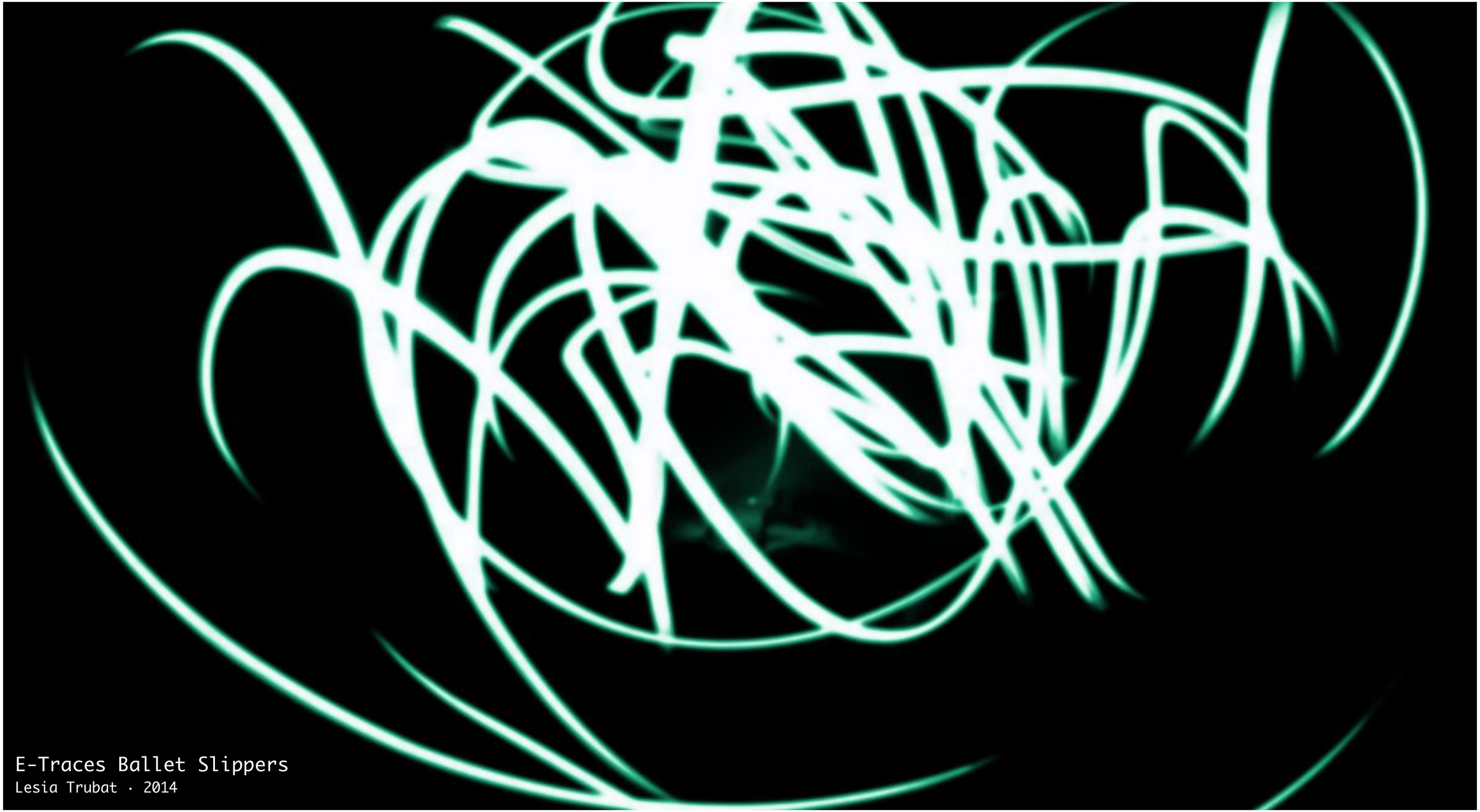
Honesty - 18Q21.1/47059049

Rotation

Exercise habits - 10Q23.3/87683553

E-Traces Ballet Slippers

Lesia Trubat · 2014



E-Traces Ballet Slippers

Lesia Trubat · 2014

Go · Data-Driven Wheelchair

Layer Design · 2016

Aspire

YOUR SHAPE

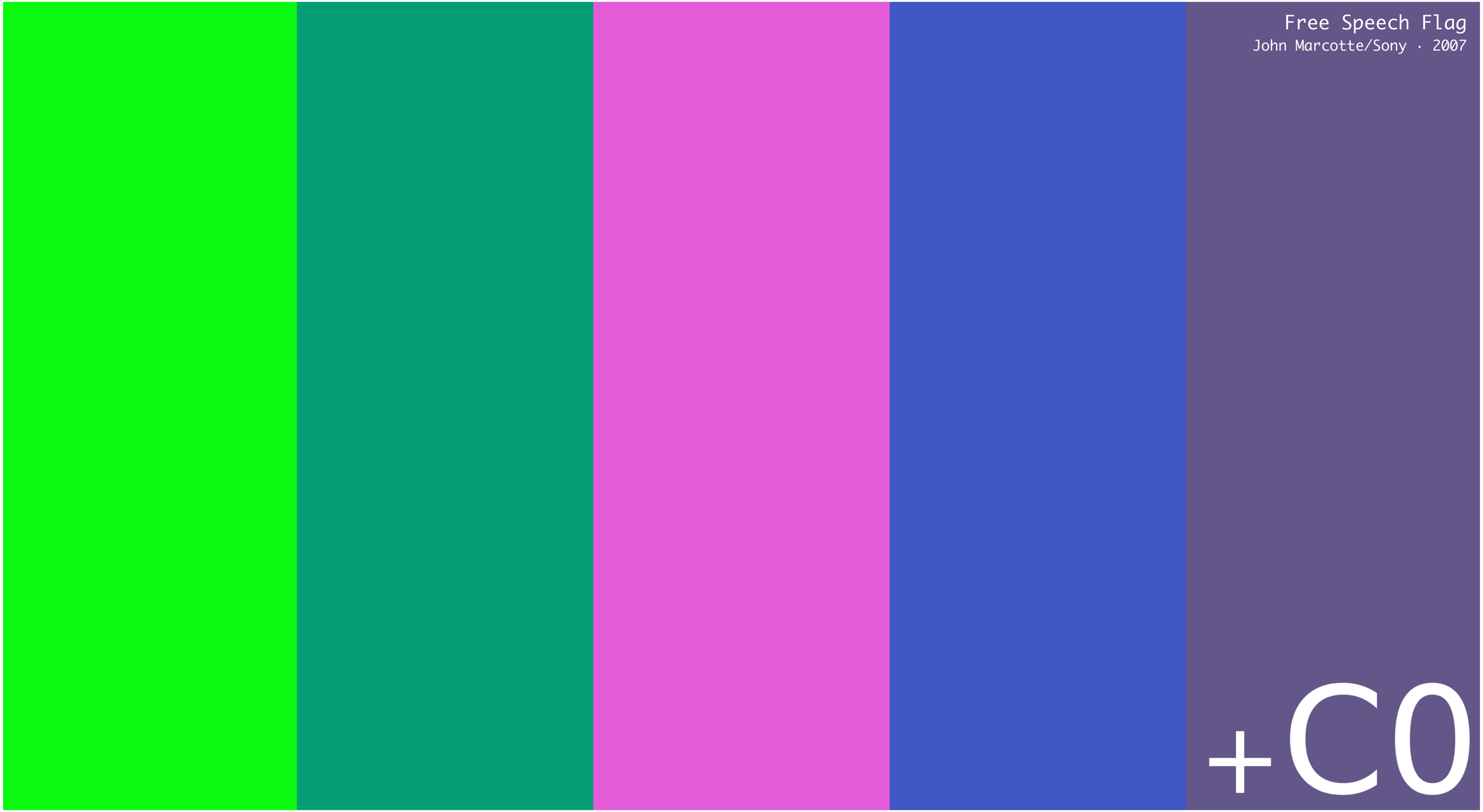
1. BACKREST HEIGHT
2. BACKREST ANGLE
3. SEAT LENGTH
4. SEAT ANGLE
5. SEAT WIDTH
6. SEAT CURVATURE
7. CENTRE OF MASS
8. FOOTREST HEIGHT
9. FOOTREST LENGTH
10. FOOTREST ANGLE

YOUR FEATURES

A. PUSH BARS
B. TRANSFER BARS
C. SIDE GUARDS

YOUR STYLE

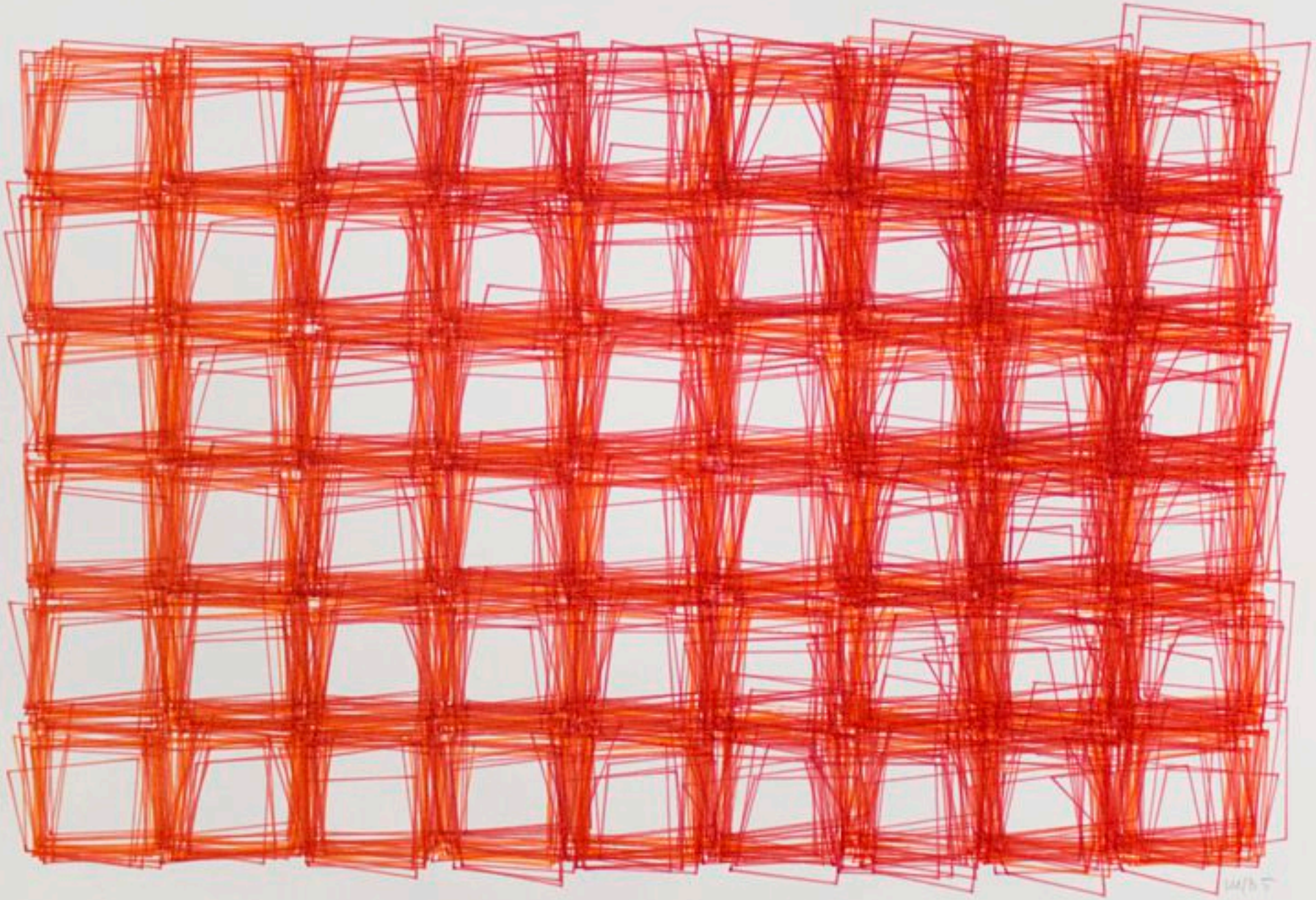
most data visualizations are *commemorative*…


Free Speech Flag
John Marcotte/Sony · 2007
+C0

but what about visualizing *predictive* or *reactive* data?

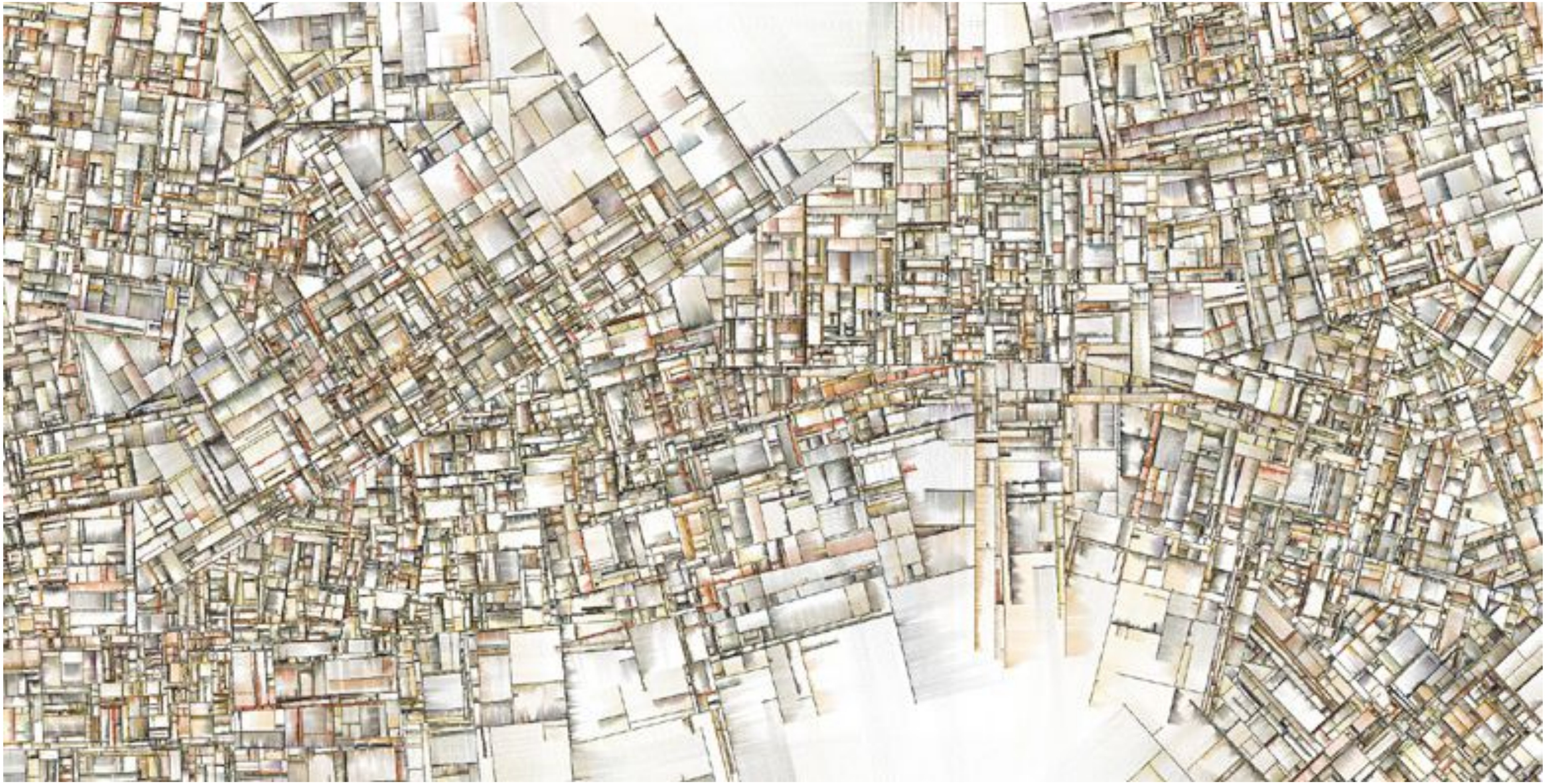
Stucture de Quadrilateral

Vera Molnar · 1986



Substrate

Jared Tarbell · 2011



Quasi Series

Aranda \ Lasch · 2014

Quasi Series

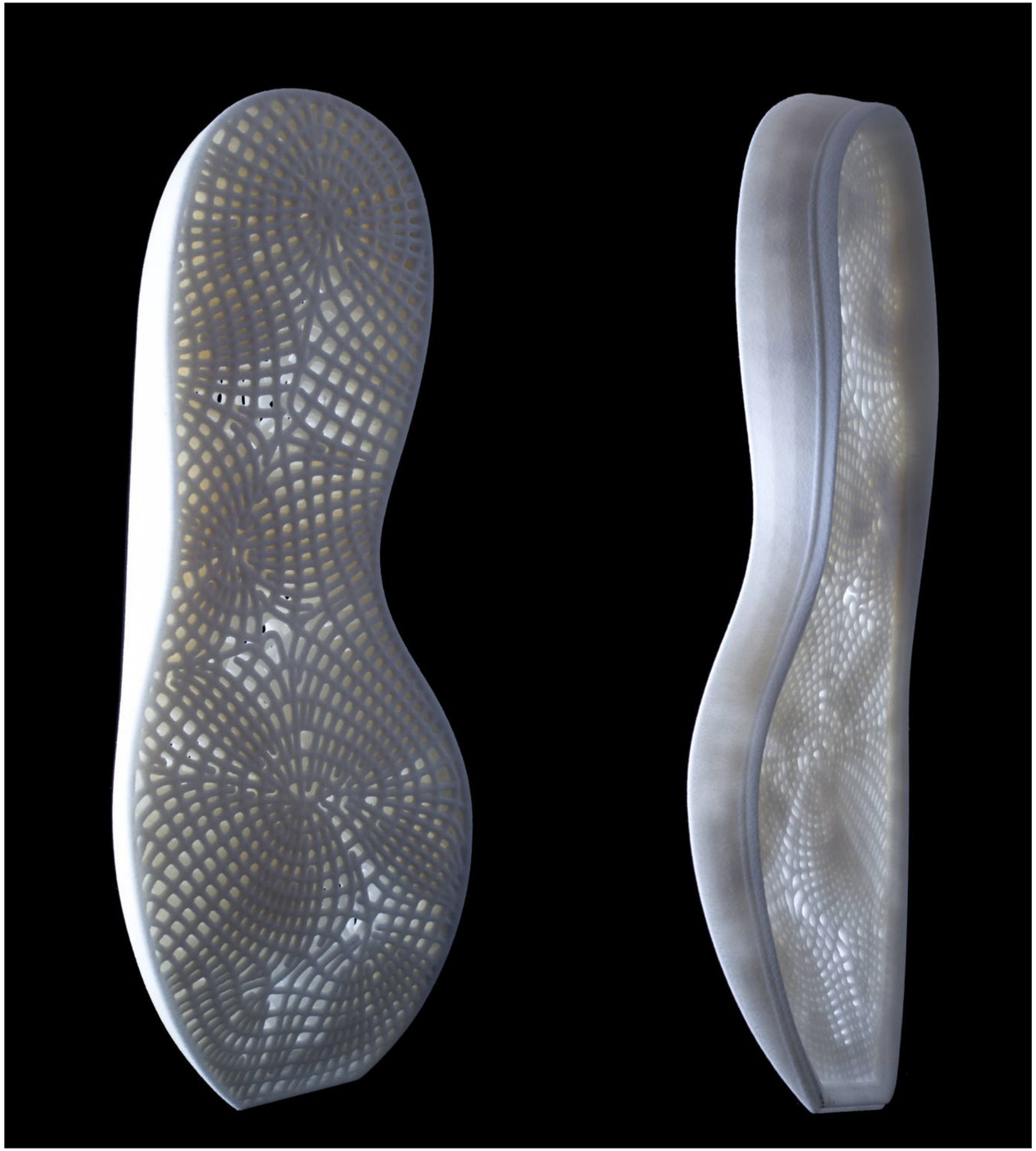
Aranda \ Lasch · 2015

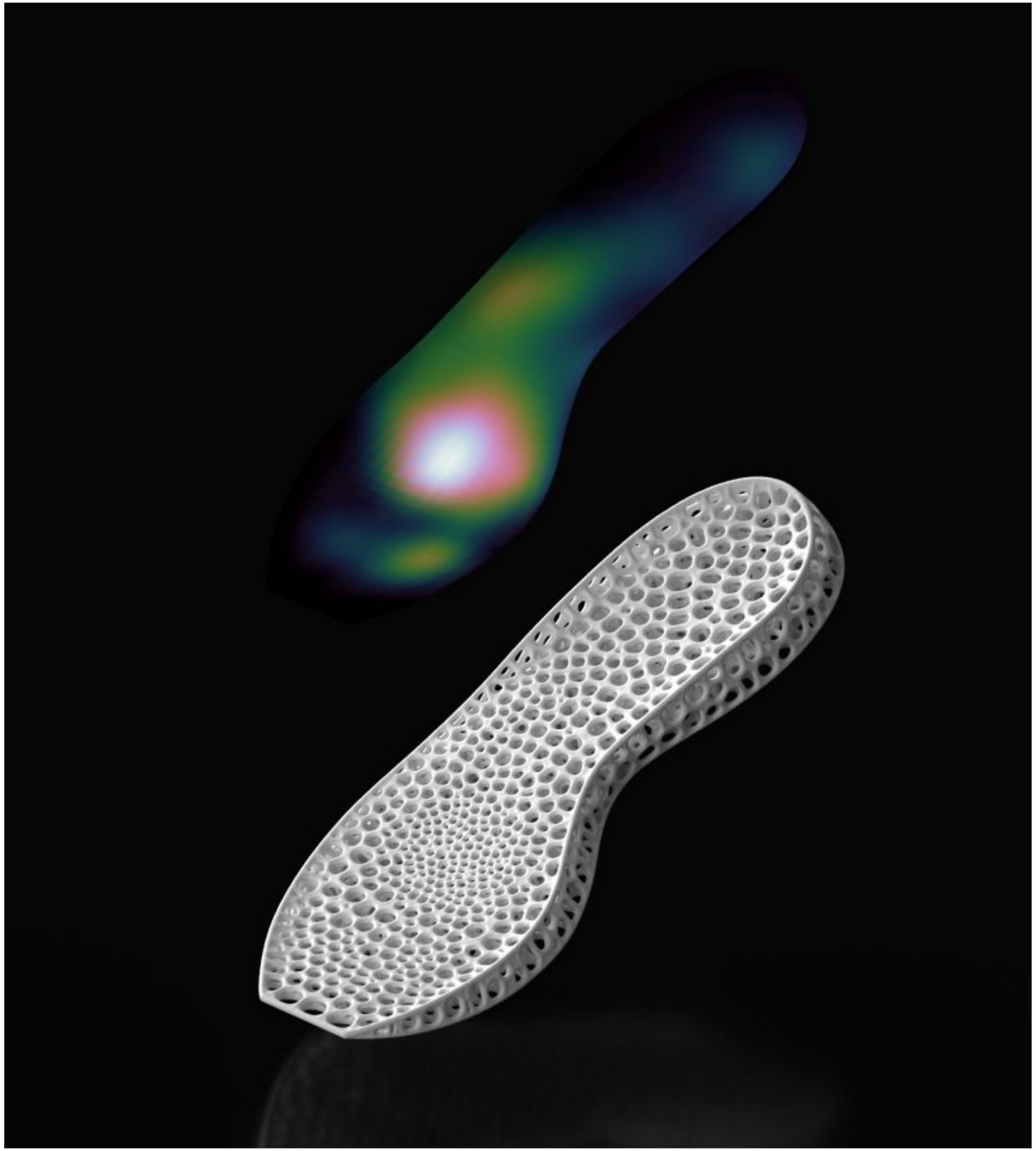
Hyphae Lamps

Nervous System · 2017

Data Midsoles

Nervous System for New Balance · 2016





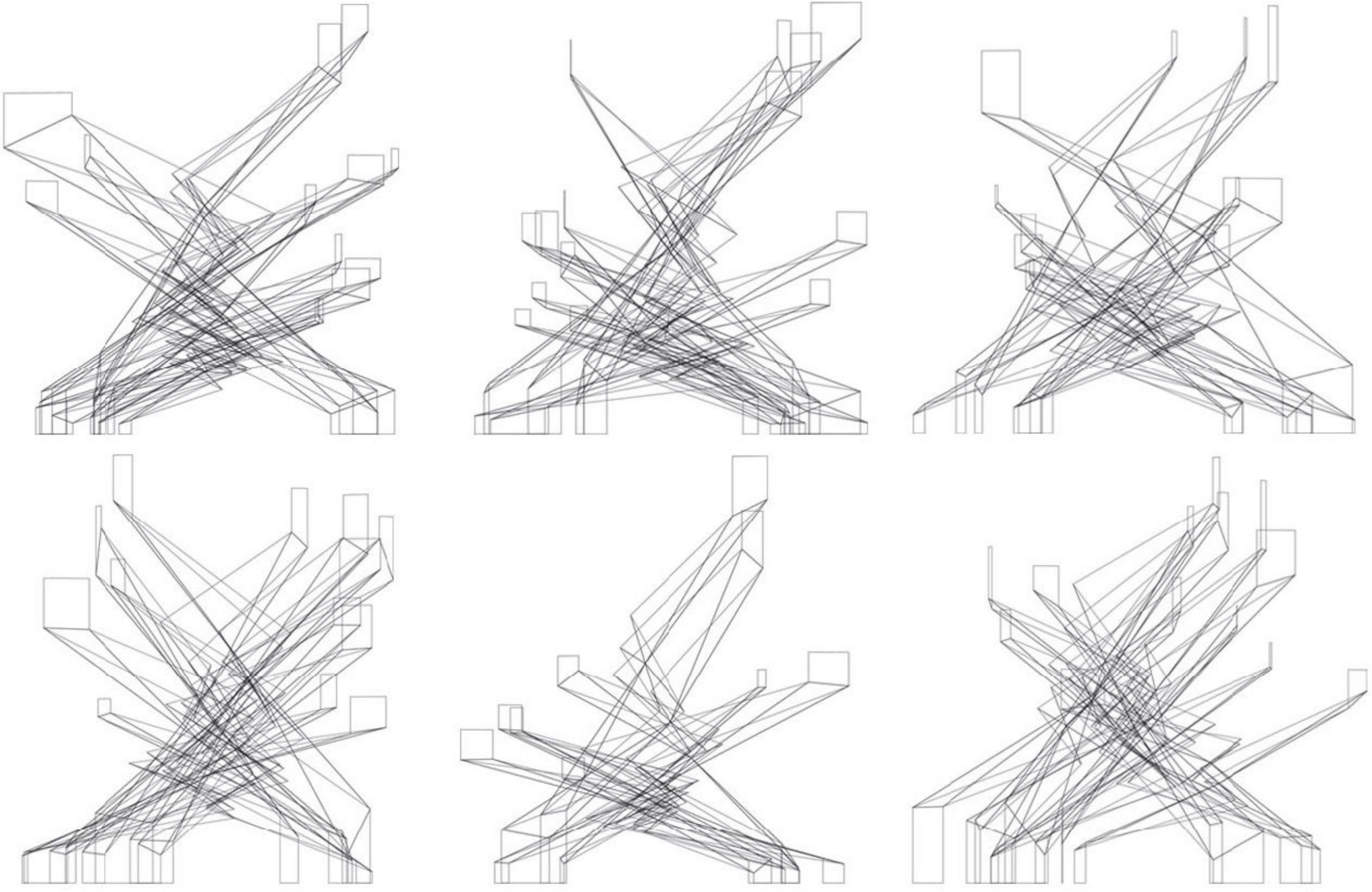
Kinematics

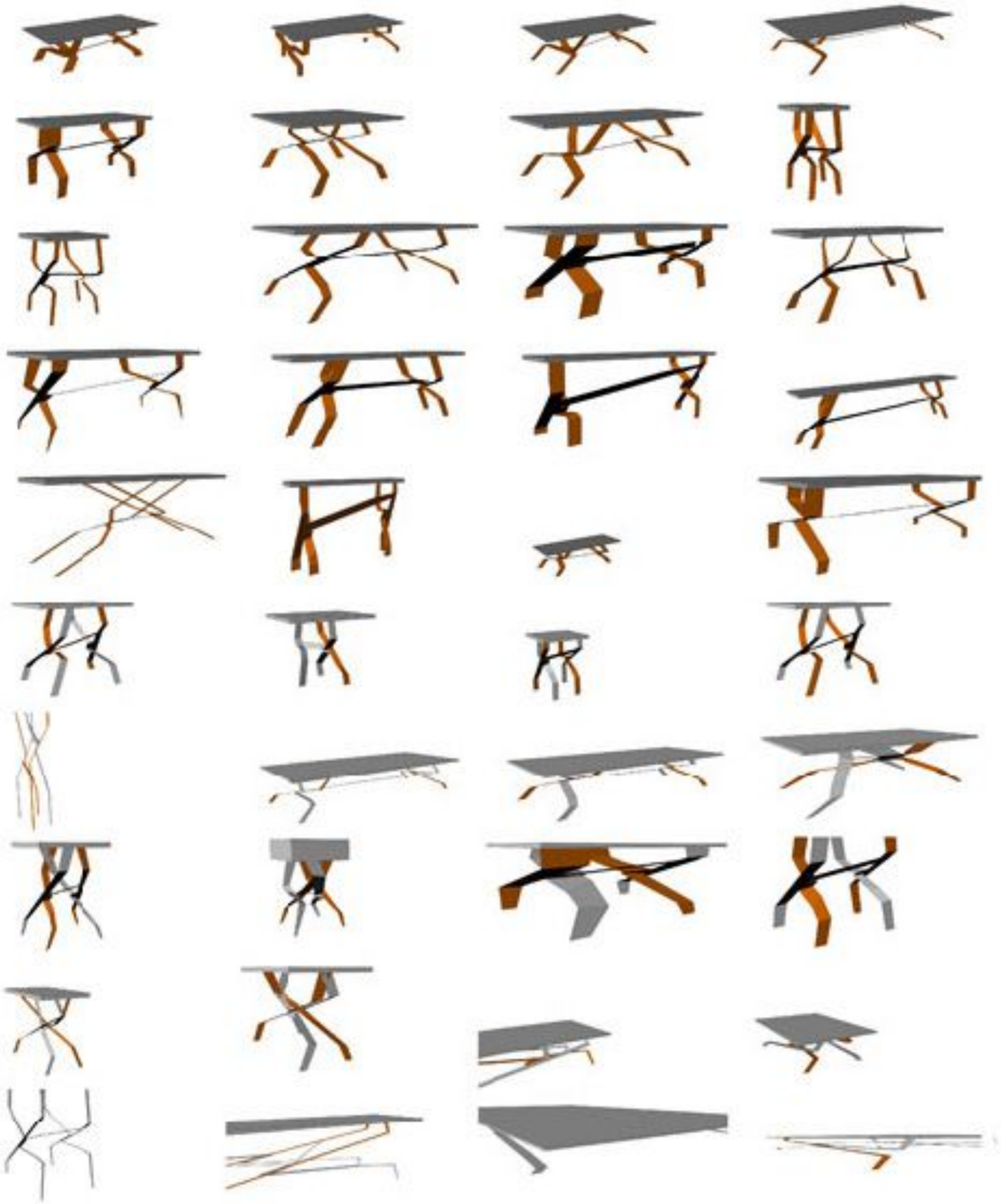
Nervous System · 2013 –

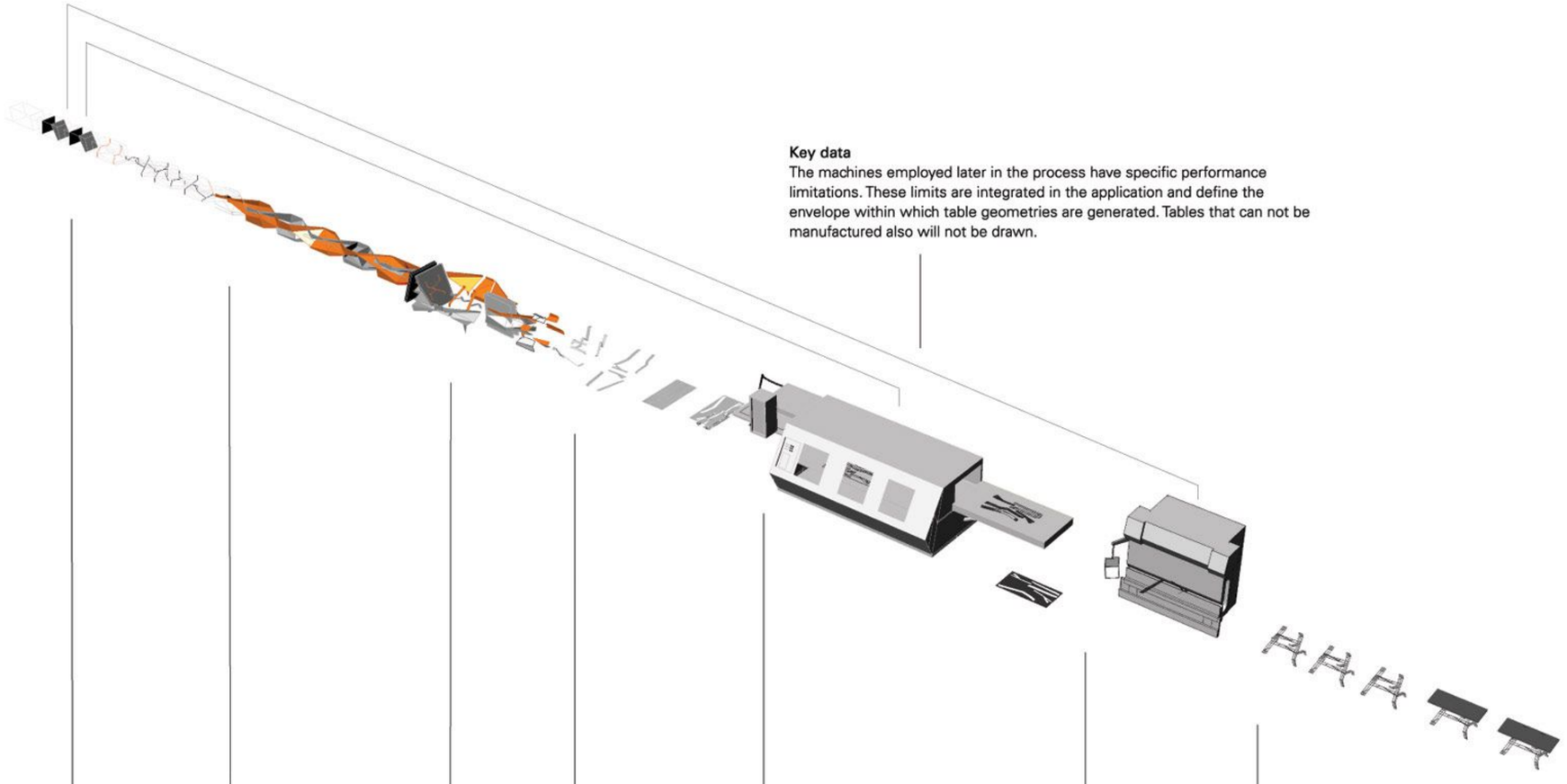
kinematics cloth

Breeding Tables

Kram / Weisshaar · 2010







Key data
The machines employed later in the process have specific performance limitations. These limits are integrated in the application and define the envelope within which table geometries are generated. Tables that can not be manufactured also will not be drawn.

Input
Basic data is input into the applica-tion by the user. Table width, Table height, Table length as well as a set of typology rules are defined.

Algorithm
Within the envelope established, the algorithm continuously generates a series of 2d base geometries each inheriting a set of properties from the mother table.

Construction Surfaces
The basic construction surfaces are generated by triangulating the base geometry created by the algorithm in the previous step.

Structure Extraction
The table structure is extracted using angled cutting planes. A 3-dimensional model of the table is now available

Unfolding
After computational testing, if the table is deemed suitable for production, the program unfolds the table legs flat. These flat geometries then make up the cutting pattern for a given table structure.

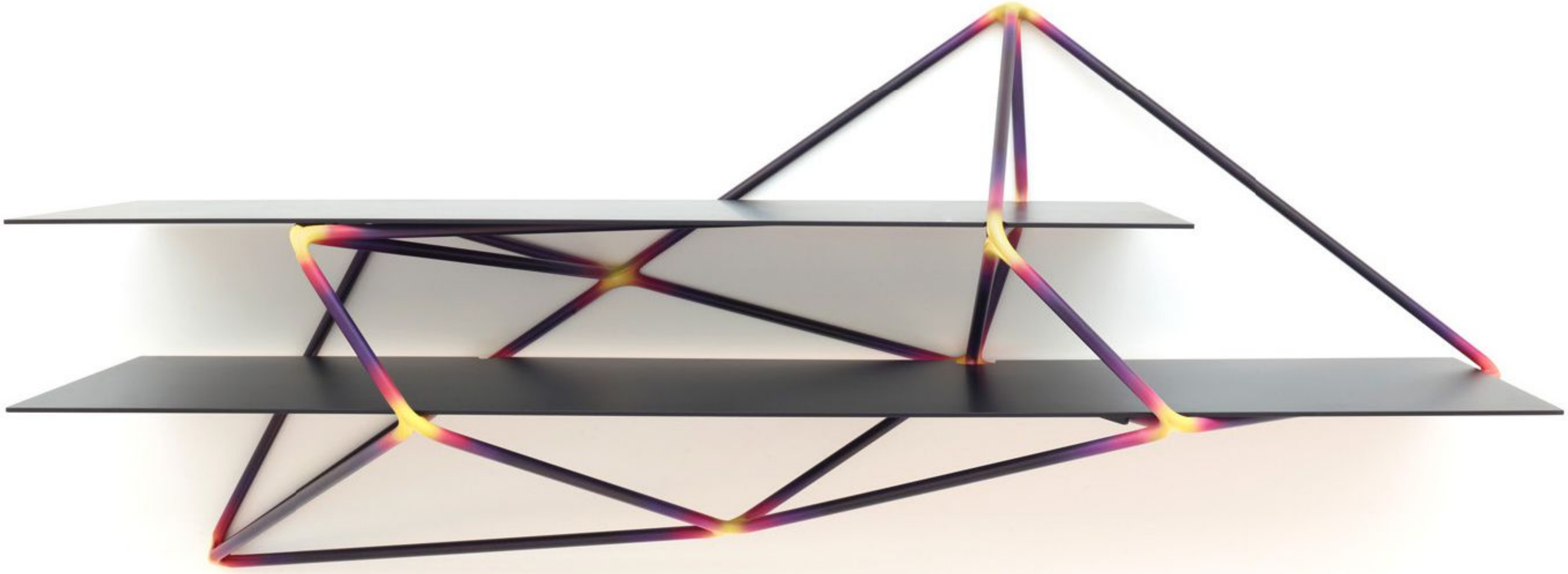
Laser Cutting
The leg cutting pattern is then transferred into the laser cutting machine where it cuts the sheet steel. Each leg is cut individually, with the bend and joint information for putting the table together engraved on the table leg itself.

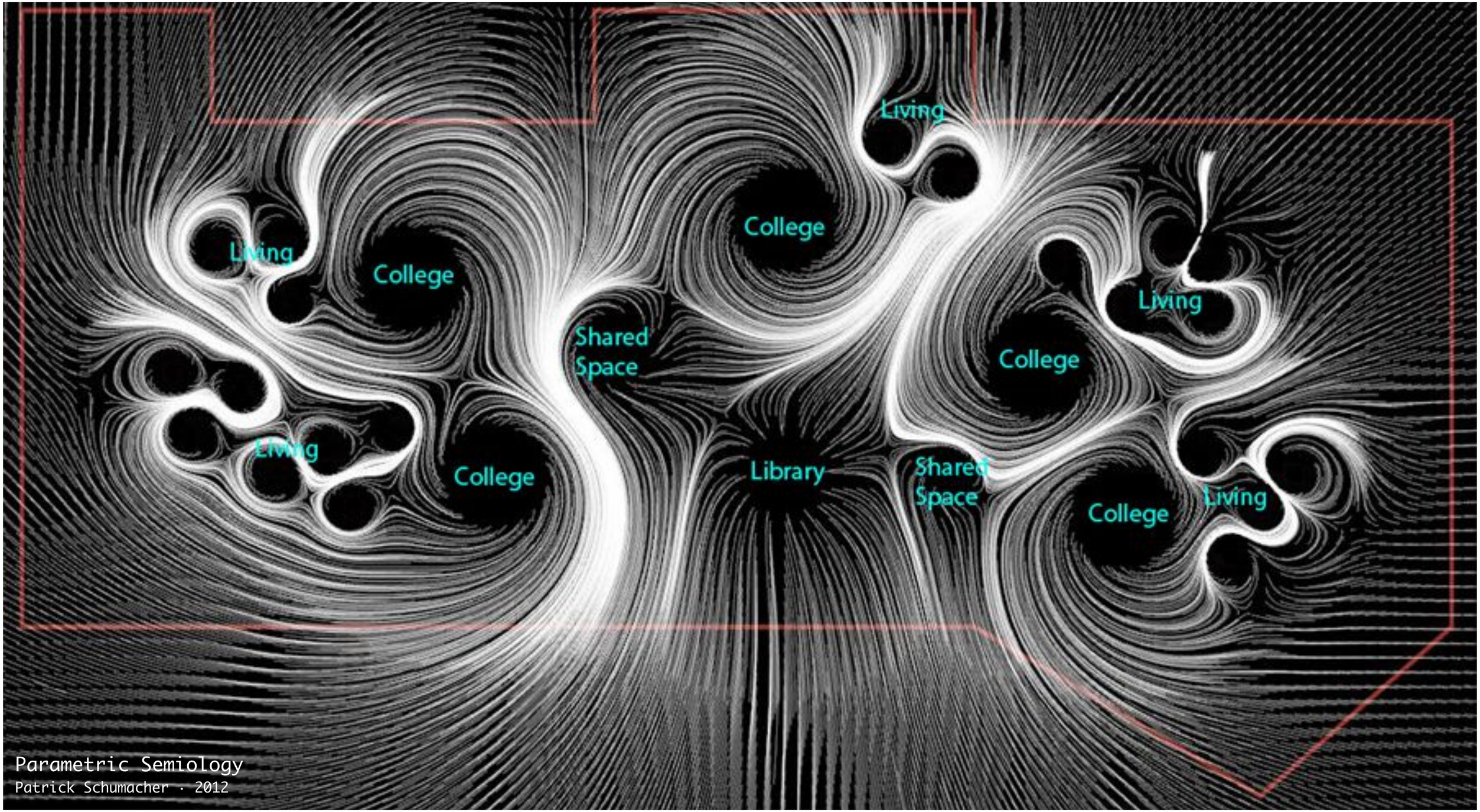
Bending
The cut flat leg is then moved to the bending machine. The bending machine technician follows the directions on the table leg, turning each bend in the table leg the specified number of degrees.

Table Structure
Once the table legs are bent, the final stages of the table construction involve joining the table legs together, painting them, and attaching the table top.

Complete Table

DIGITAL PHYSICAL



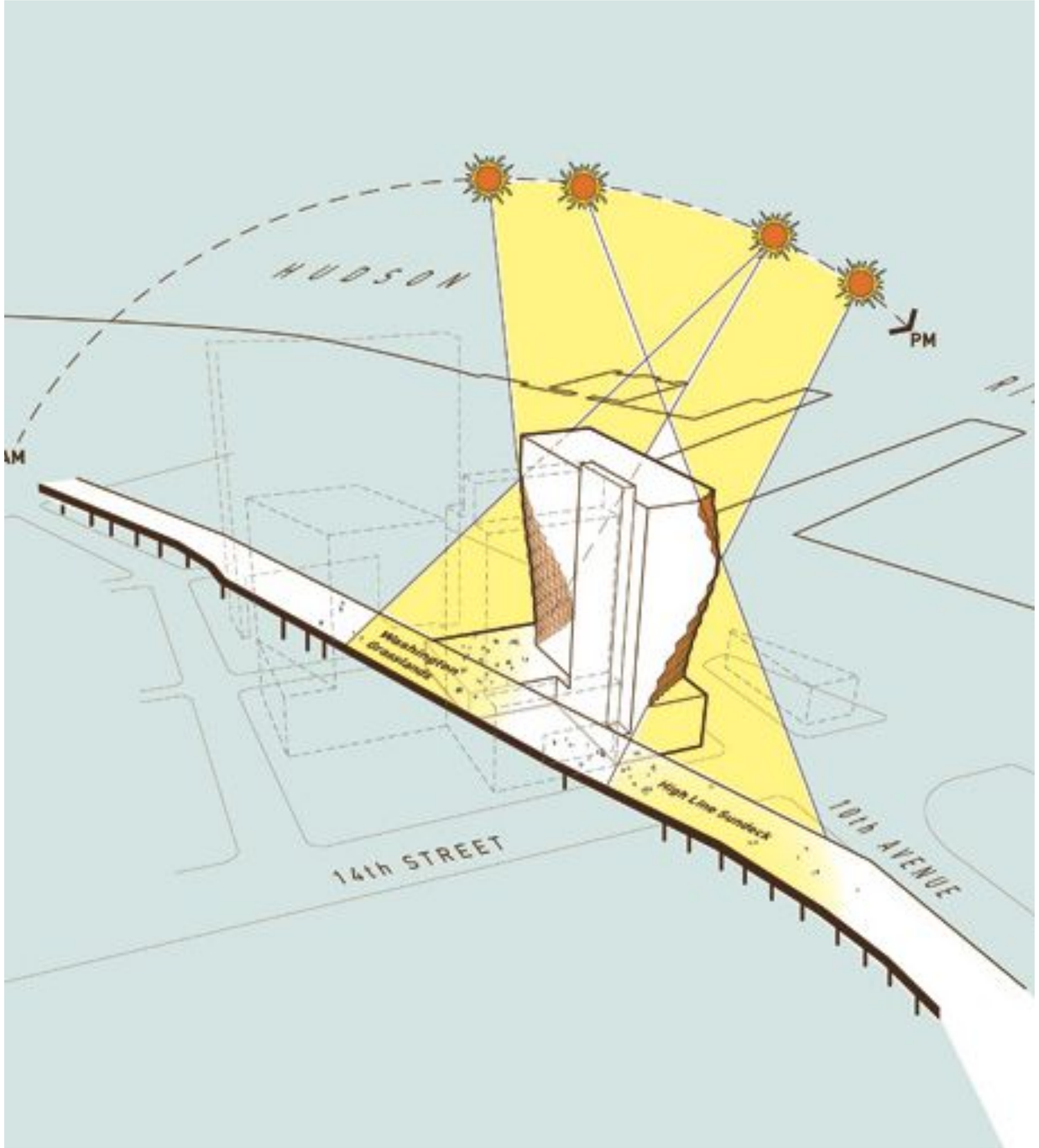


Parametric Semiology

Patrick Schumacher · 2012

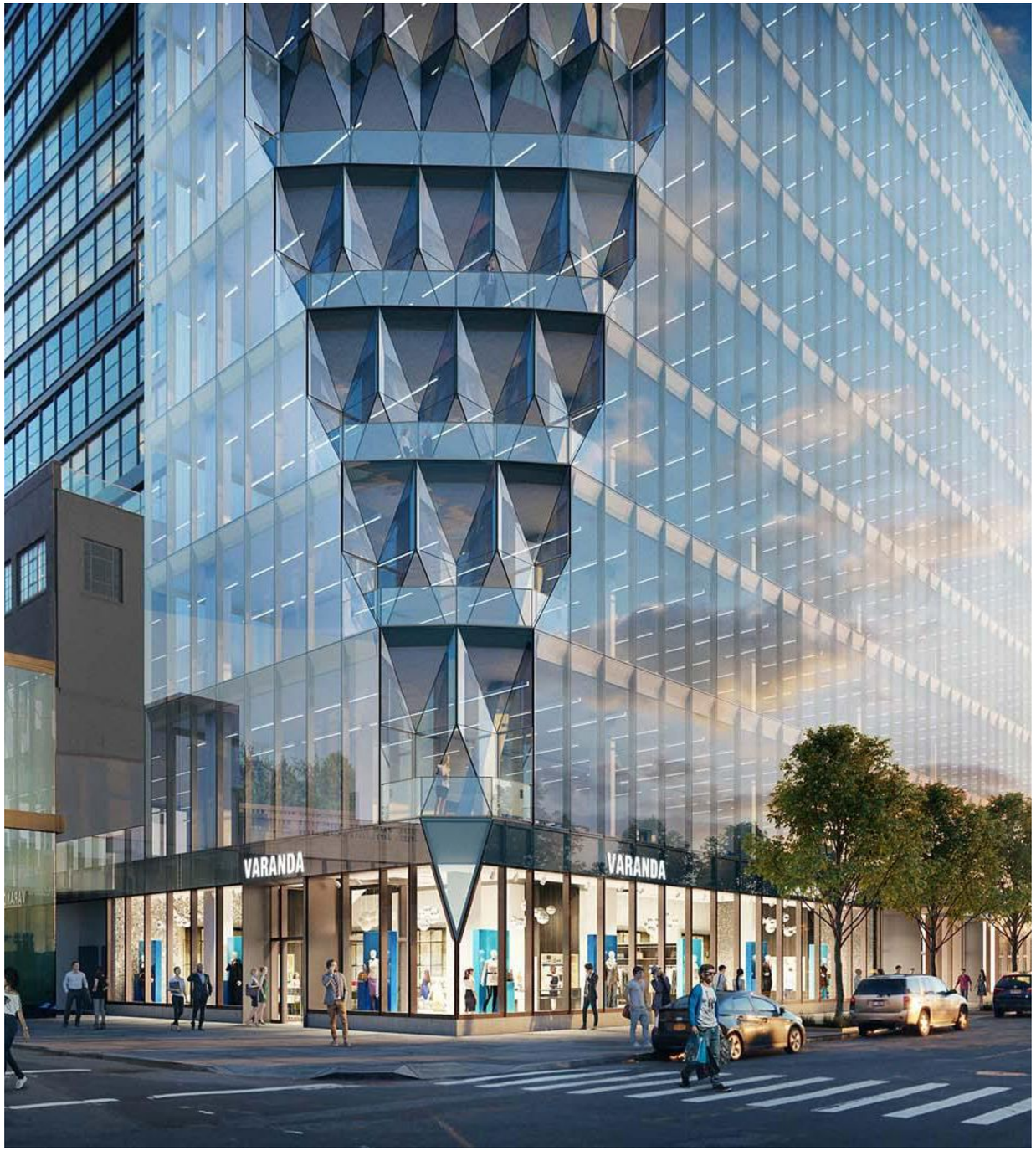
Solar Carve Tower

Studio Gang · 2016

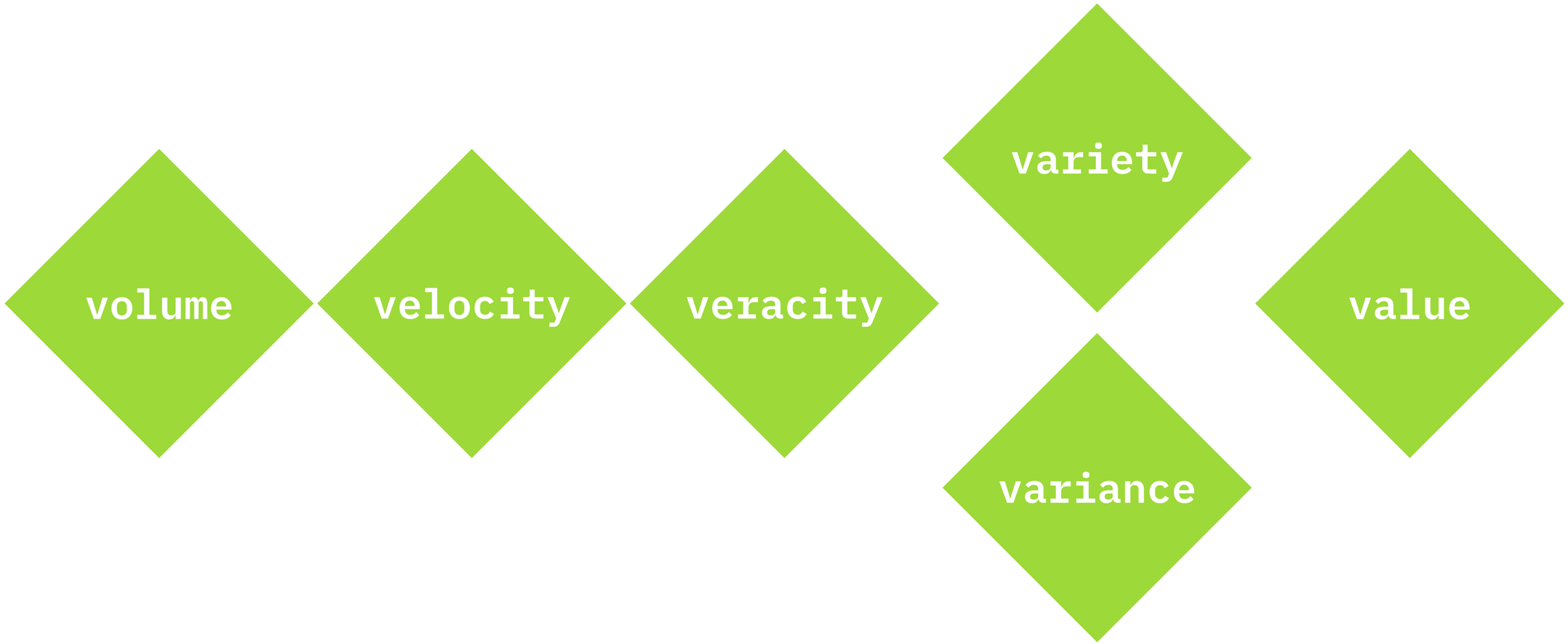


Solar Carve Tower

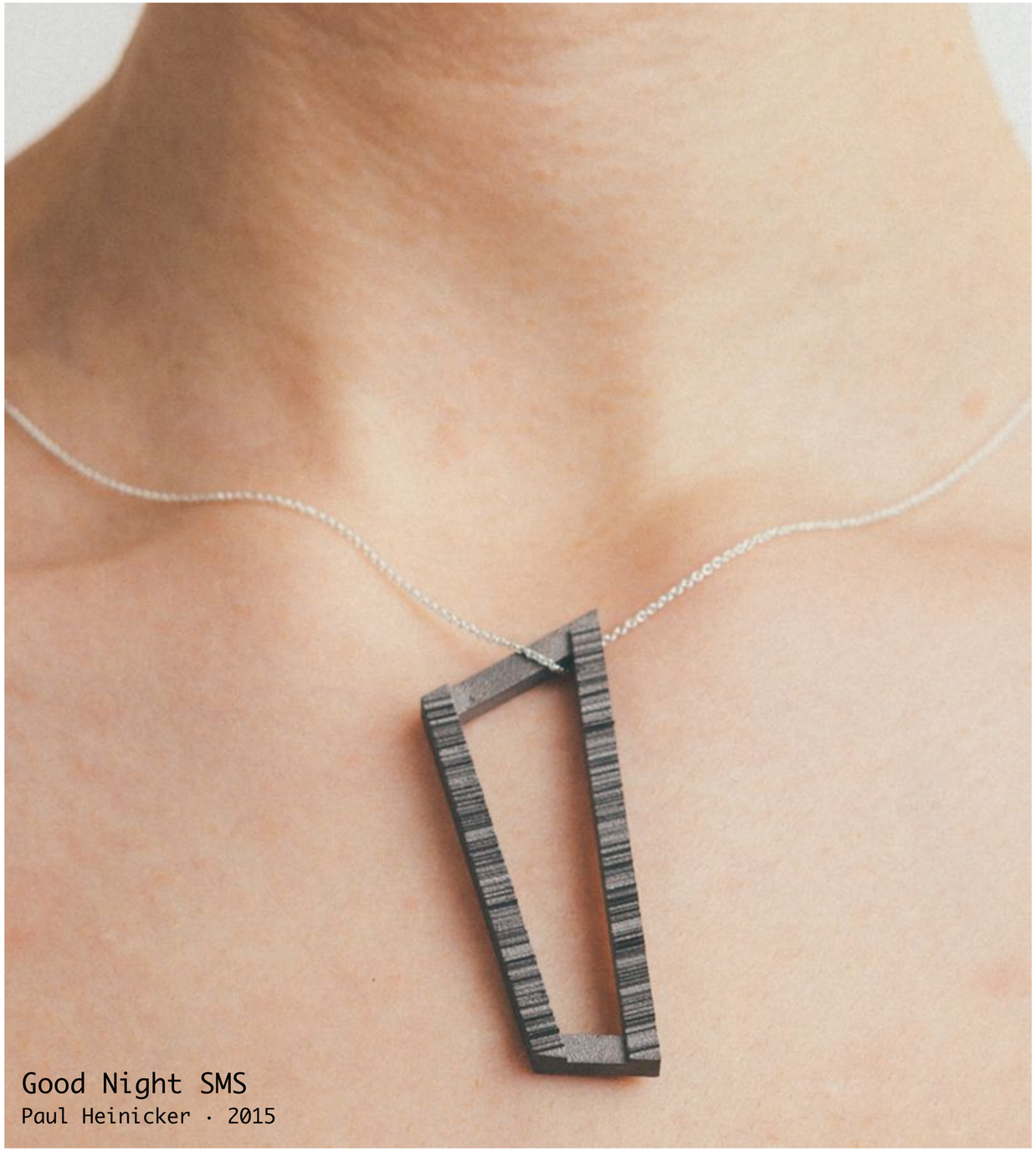
Studio Gang · 2016



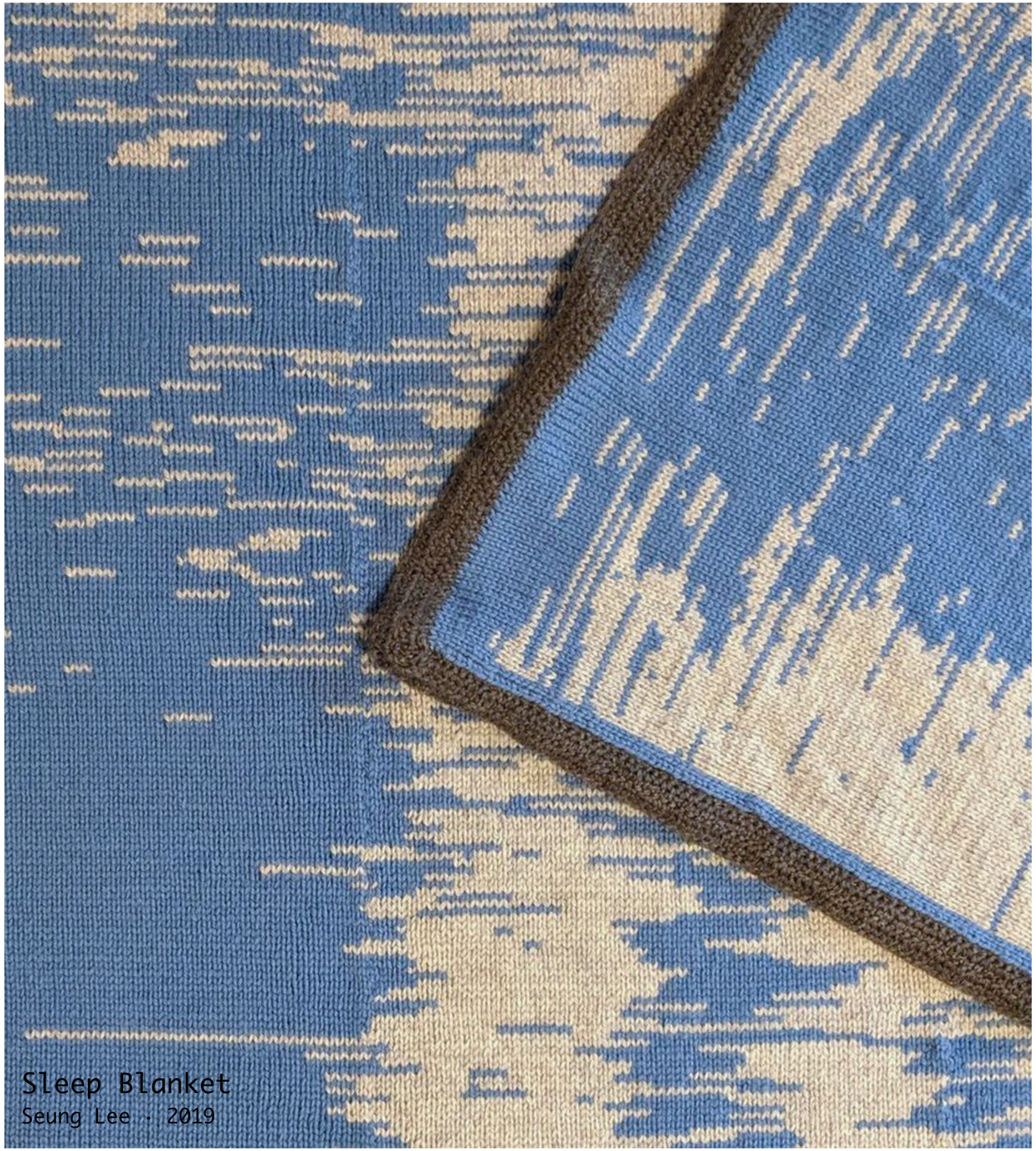
many of these projects have been located in
and facilitated by the *big data* revolution…


volume
velocity
veracity
variety
variance
value

though perhaps we also can produce intimate visualizations, based in personal *small data*



Good Night SMS
Paul Heinicker · 2015



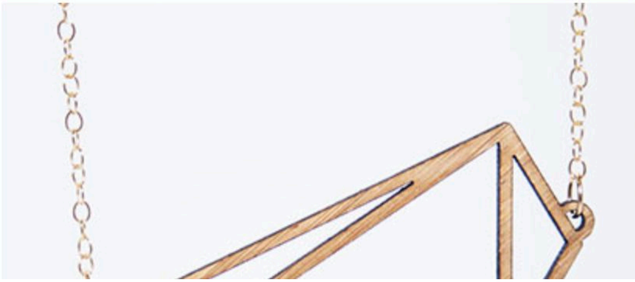
Sleep Blanket
Seung Lee · 2019

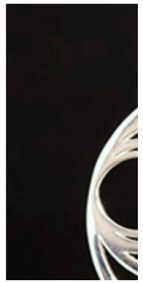
meshu turns your places into beautiful objects

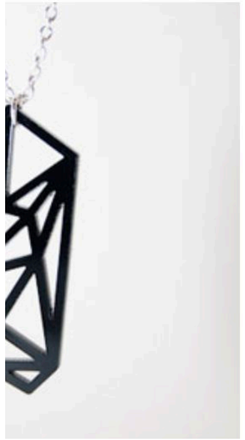
get started

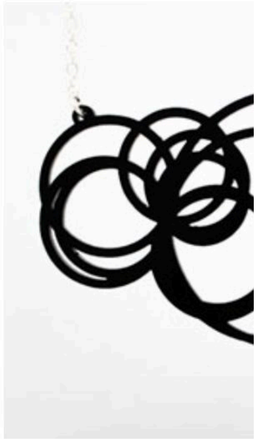
whether it's celebrating a trip or remembering your home, meshu helps you create mementos from the places that are importar

Data Jewelry
meshu.io · 2014









Look of Love

Haelo Design + Zach Pino · 2016

Look of Love

Haelo Design + Zach Pino · 2016

Look of Love

Haelo Design + Zach Pino · 2016

and finally, what about emergent, participatory data visualization?

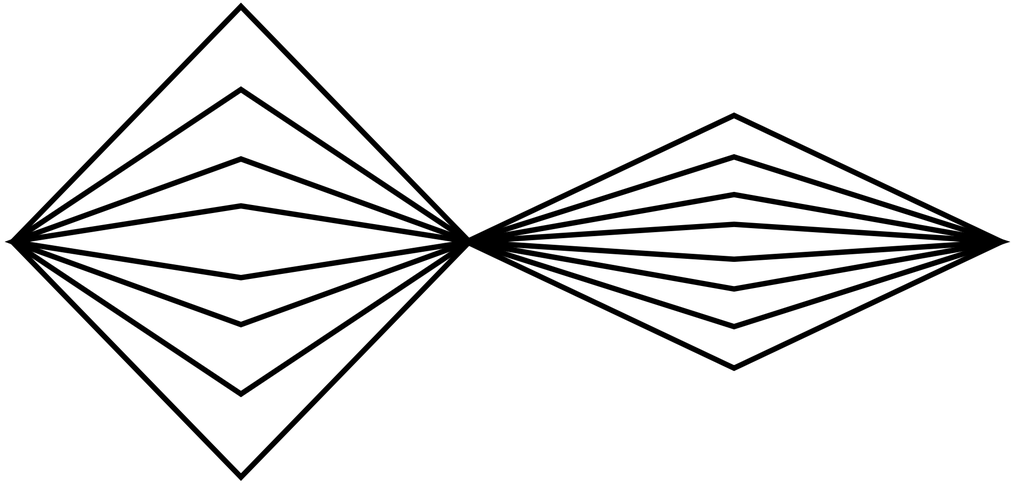
Floyd Legs

Floyd · 2016

where does *data* belong in the design process?

where does the *designer* belong in the design process?

🤔



let’s do something, visit Miro!