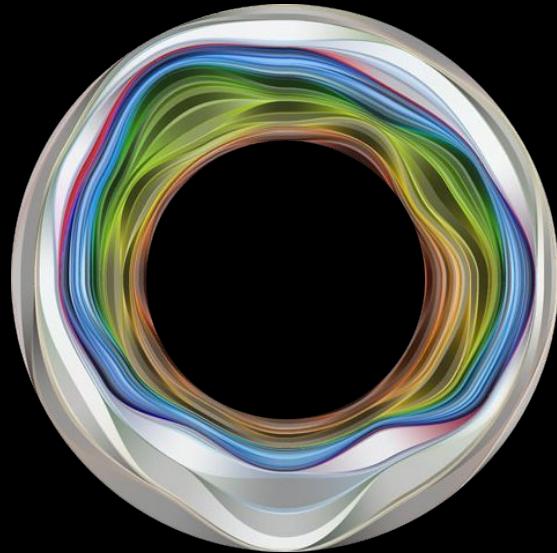


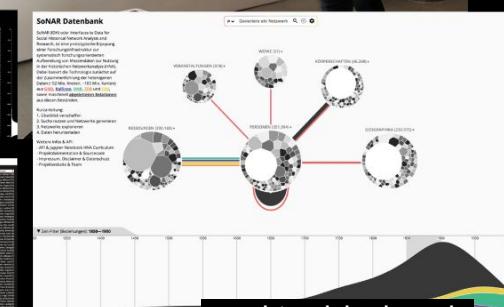
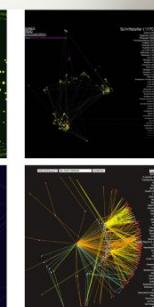
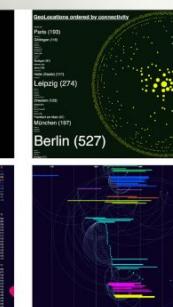
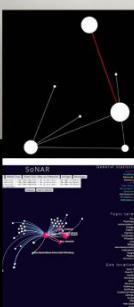
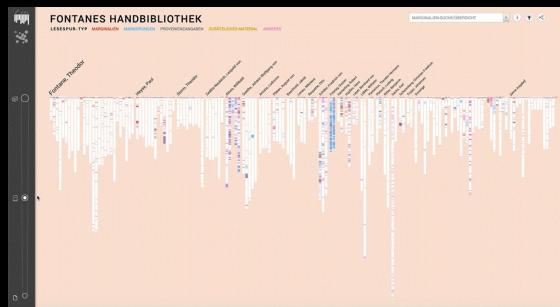
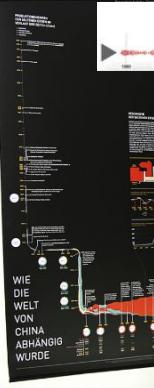
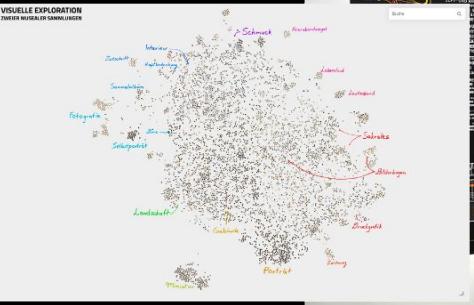
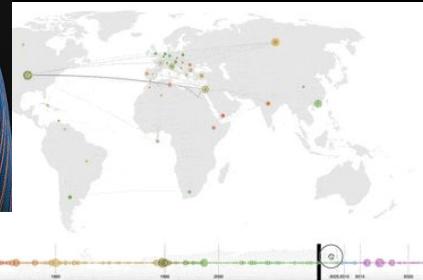
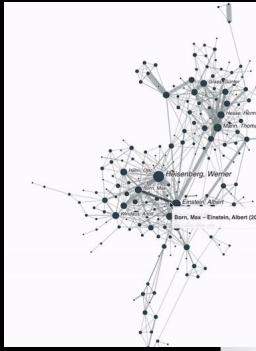
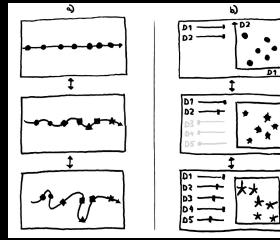
Einführung in die Datavisualisierung



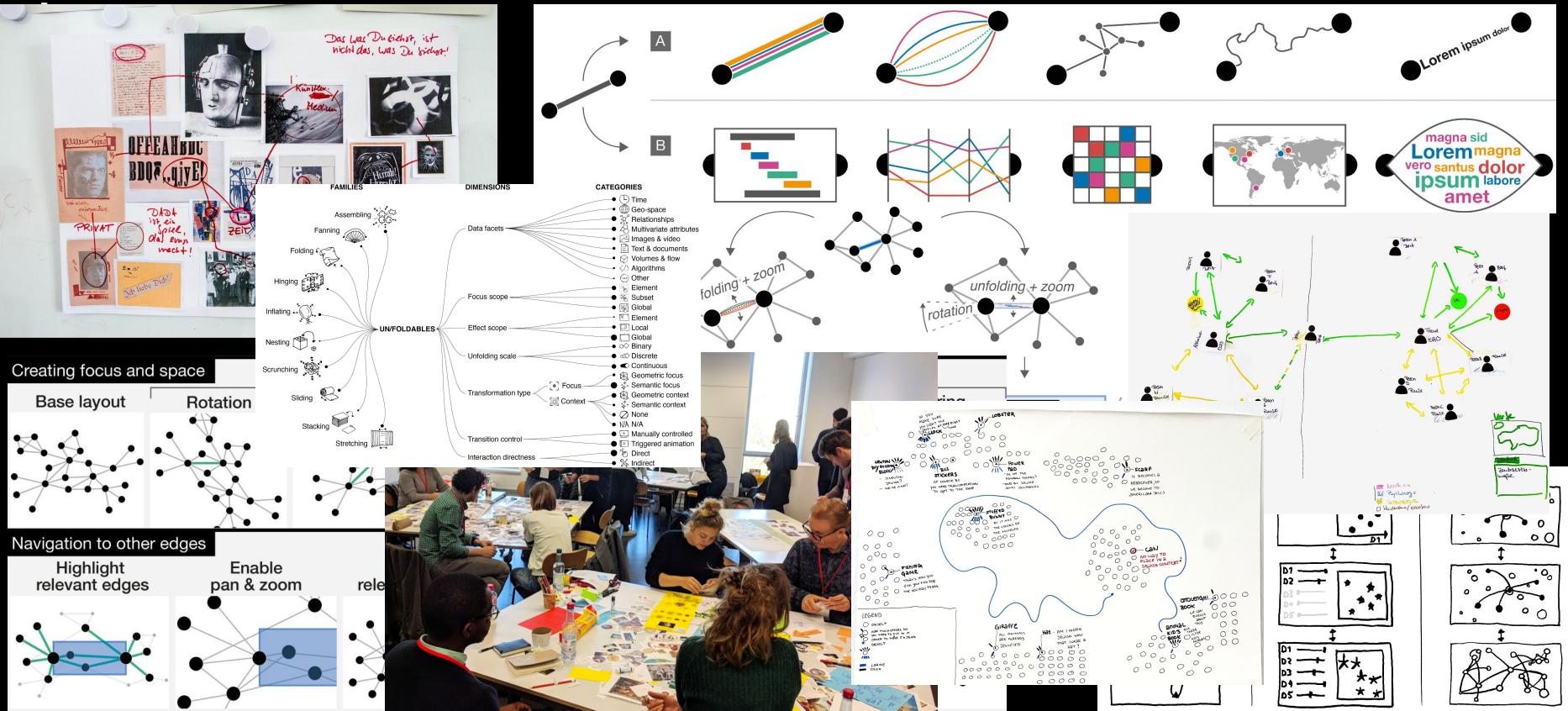
Mark-Jan Bludau
markjanbludau.de / mail@markjanbludau.de

Image credit: Flickr Flow by Martin Wattenberg & Fernanda Viégas

Über mich



markjanbludau.de



- Bludau, M. J., Dörk, M., Bruckner, S., & Tominski, C. (2025). Fluidly Revealing Information: A Survey of Un/foldable Data Visualizations. In Computer Graphics Forum
 - Bludau, M. J., Dörk, M., & Tominski, C. (2023). Unfolding Edges: Adding Context to Edges in Multivariate Graph Visualization. In *Computer Graphics Forum* (Vol. 42, No. 3)
 - Brüggemann, V., Bludau, M. J., & Dörk, M. (2020). The fold: Rethinking interactivity in data visualization. *DHQ*, 14(3).
 - Braunschweiger, D., Pütz, M., Heidmann, F., & Bludau, M. J. (2018). Mapping governance of adaptation to climate change in Switzerland. *Regional Studies, Regional Science*, 5(1), 398-401.
 - ...
- markjanbludau.de

UCLAB (Urban Complexity Lab)

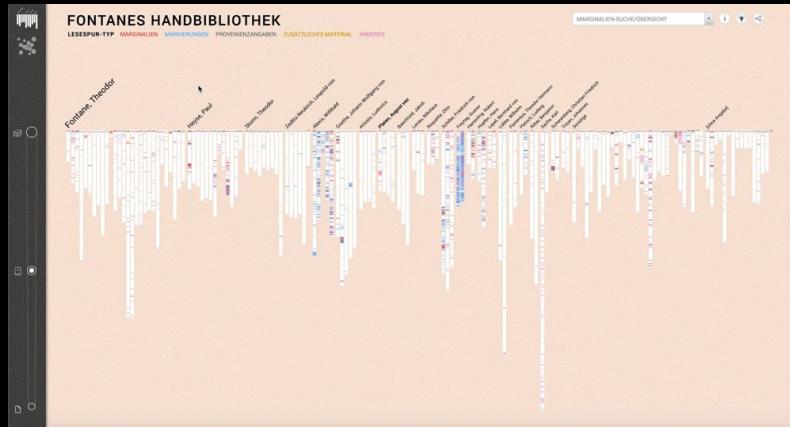


<https://uclab.fh-potsdam.de>



<https://uclab.fh-potsdam.de/closeupcloud>

Pauline Junginger, Dennis Ostendorf, Anastasia Voloshina, Barbara Vissirini, Timo Hausmann, Christopher Pietsch, Sarah Kreiseler



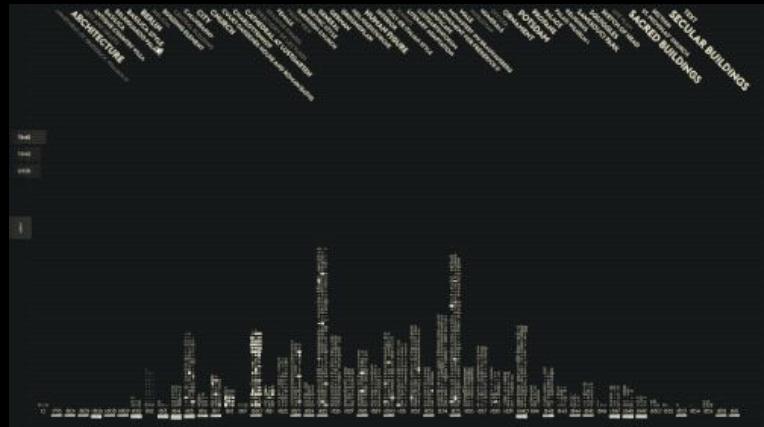
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Mark-Jan Bludau, Viktoria Brüggemann, Marian Dörk



<https://uclab.fh-potsdam.de/coins>

Flavio Gortana, Daniela Guhlmann, Franziska von Tenspolde



<https://uclab.fh-potsdam.de/fw4>

Christopher Pietsch, Katrin Glinka, Marian Dörk



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Pauline Junginger, Dennis Ostendorf, Anastasia Voloshina, Barbara Vissirini, Timo Hausmann, Christopher Pietsch, Svenja

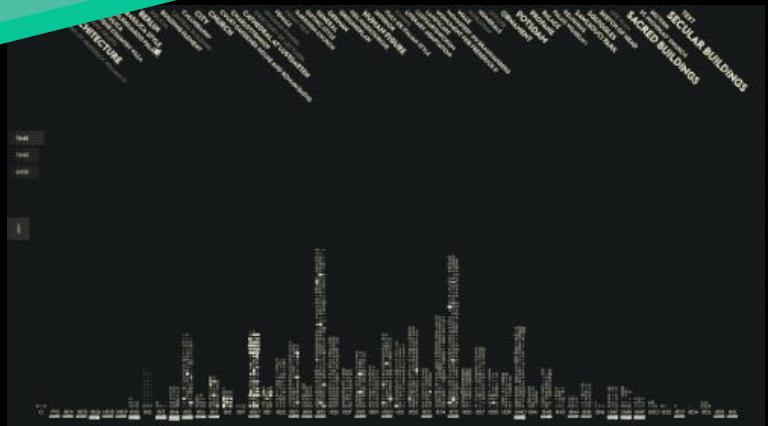


Ute Schäfer, Barbara Vissirini, Timo Hausmann, Franziska von Tenspolde



<https://uclab.fh-potsdam.de/ff>

Mark-Jan Bludau, Viktoria Brüggemann, Marian Dörk



<https://uclab.fh-potsdam.de/fw4>

Christopher Pietsch, Katrin Glinka, Marian Dörk

Information Visualization?

Definition für »Information Visualization«

»*The use of computer-supported, **interactive, visual** representations of **abstract** data to **amplify cognition.***«

explore patterns and relationships in data *utilize human visual perception*

no inherent spatial dimension *make connections and decisions*

Warm-up

Warm-up

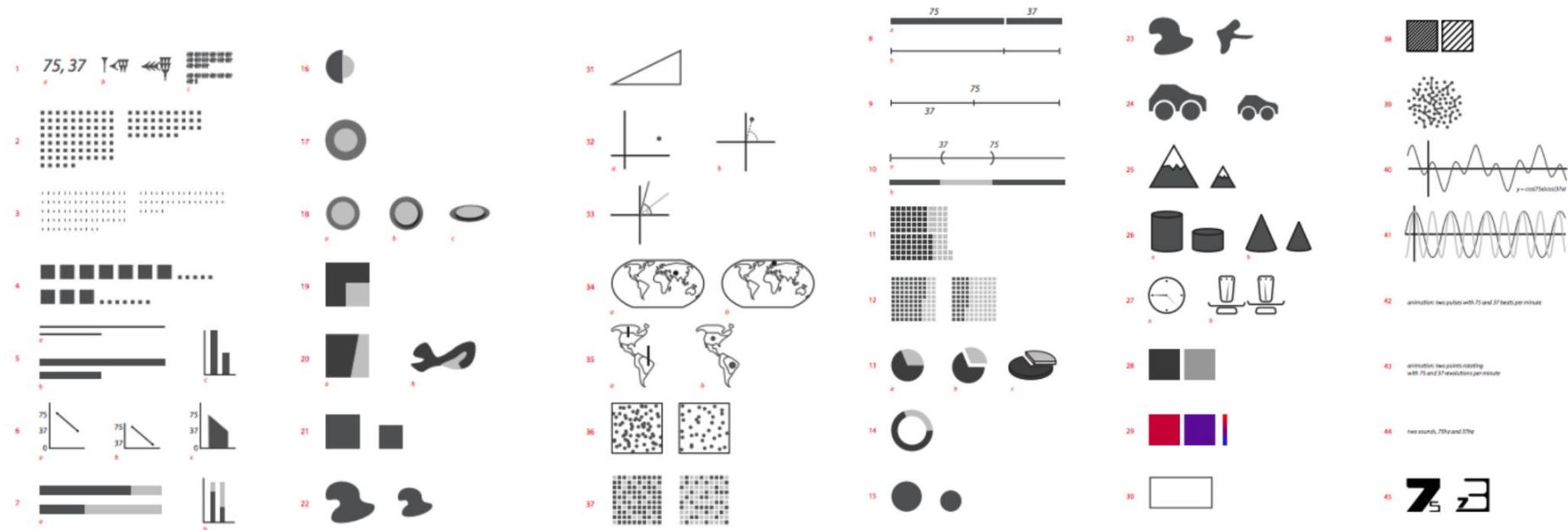
Aufgabe:

Finden Sie in 7 Minuten möglichst viele Wege, den folgenden Datensatz zu visualisieren.

Warm-up

75
37

»45 ways to communicate 2 quantities«



Warm-up: Was wäre wenn...?

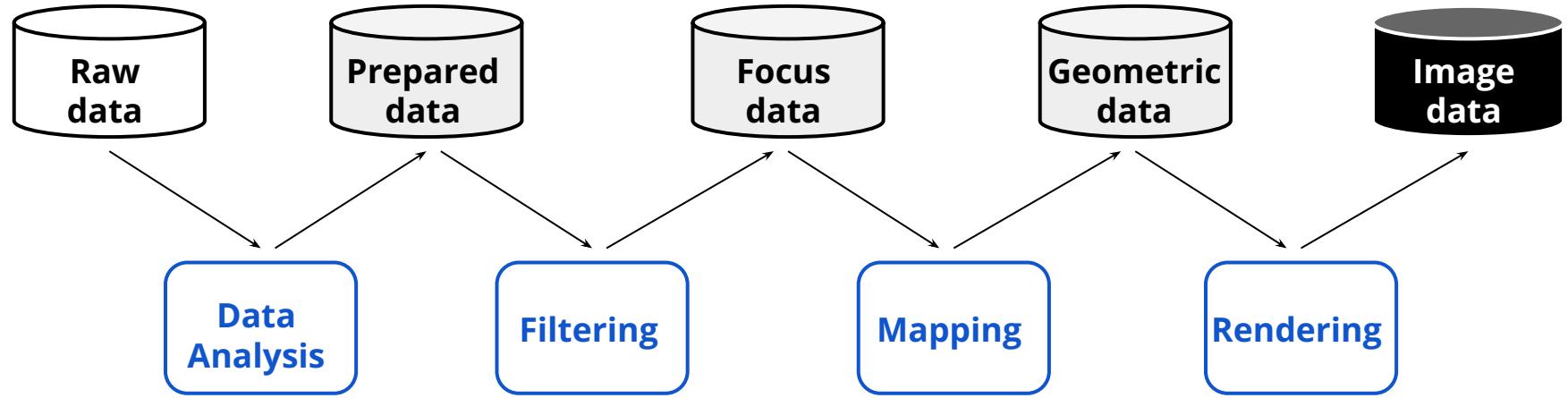
75?
ca. 37

Übungsreflektion

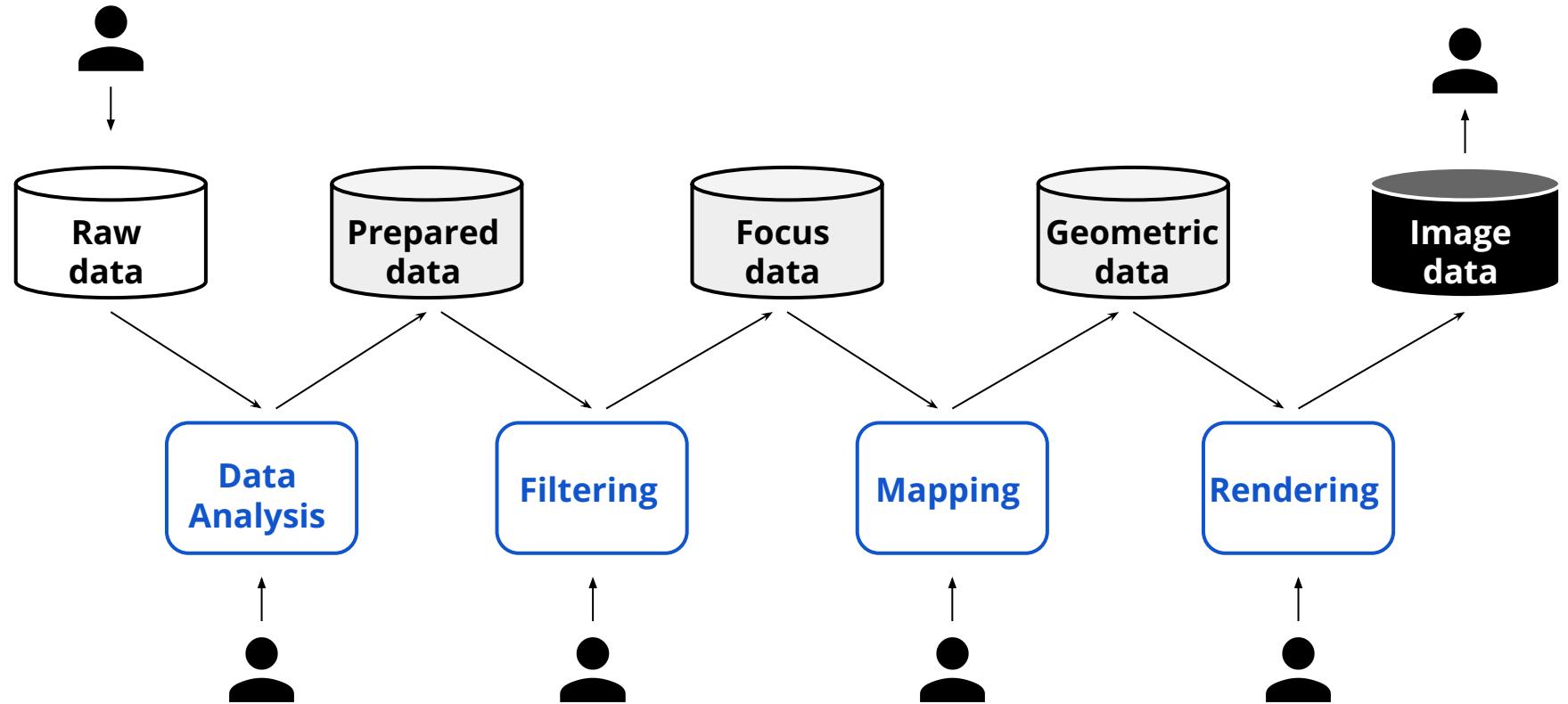
- Es gibt viele Möglichkeiten, selbst sehr kleine Datensätze zu visualisieren.
- Es gibt keine »beste« Art, einen Datensatz zu visualisieren
- Semantik und Kontext sind wichtig
- Die Größe des Datensatzes spielt eine Rolle
- Das Publikum, das die Daten liest und interpretiert, ist zu berücksichtigen
- Es ist wichtig, verschiedene Gestaltungsalternativen zu kennen (und zu erkunden) und darauf aufbauend Entscheidungen zu treffen

Grundlagen der Datenvisualisierung

Visualisierungspipeline



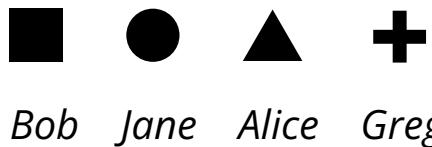
Visualisierungspipeline



Adaptiert von dos Santos, S. and Brodlie, K. Gaining understanding of multivariate and multidimensional data through visualization. Computers & Graphics, 28(3):311–325. 2004.

Datenattribute

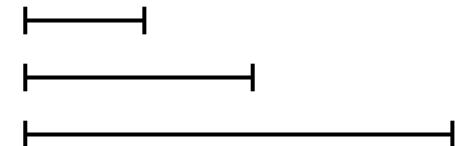
Categorical/Nominal



Ordinal



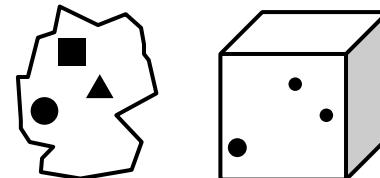
Quantitative



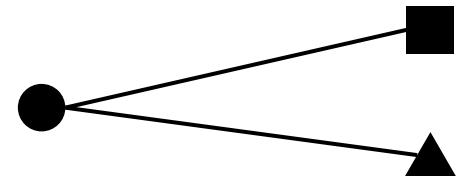
Temporal/Sequential



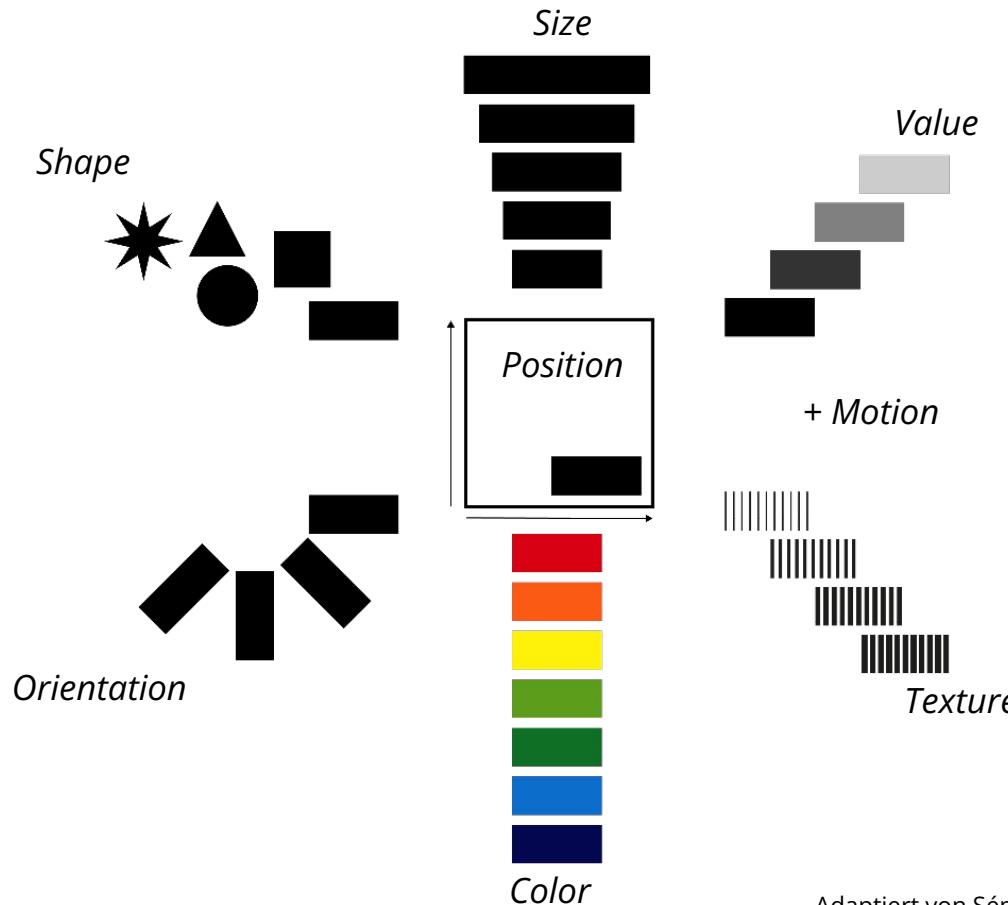
(Geo)Spatial



Relational/Hierarchical



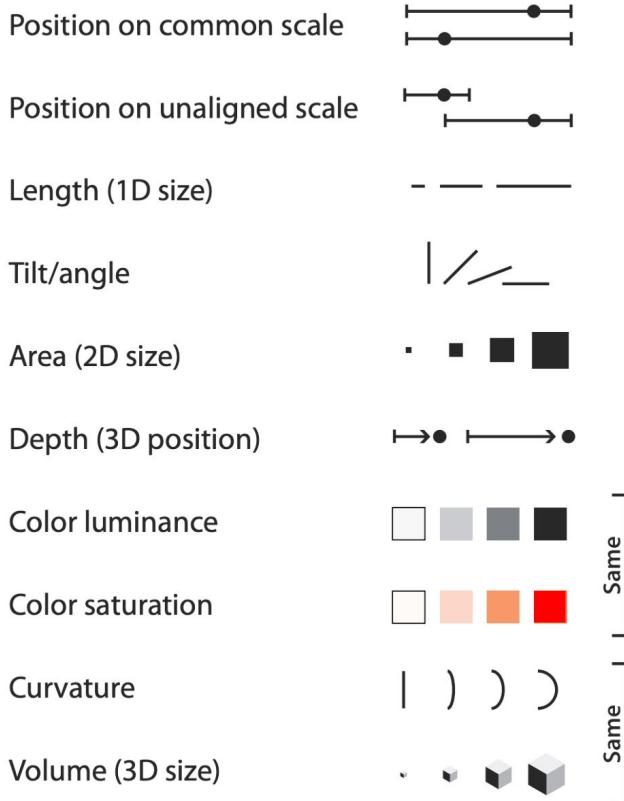
Visuelle Variablen



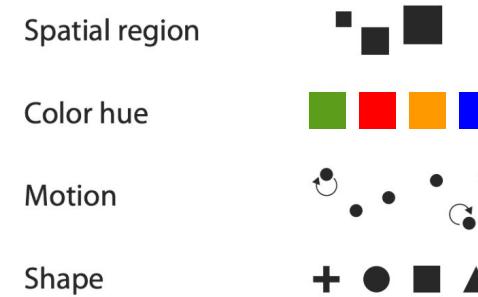
Adaptiert von Sémiologie graphique – Jacques Bertin (1967)

Effektivitäts-Ranking

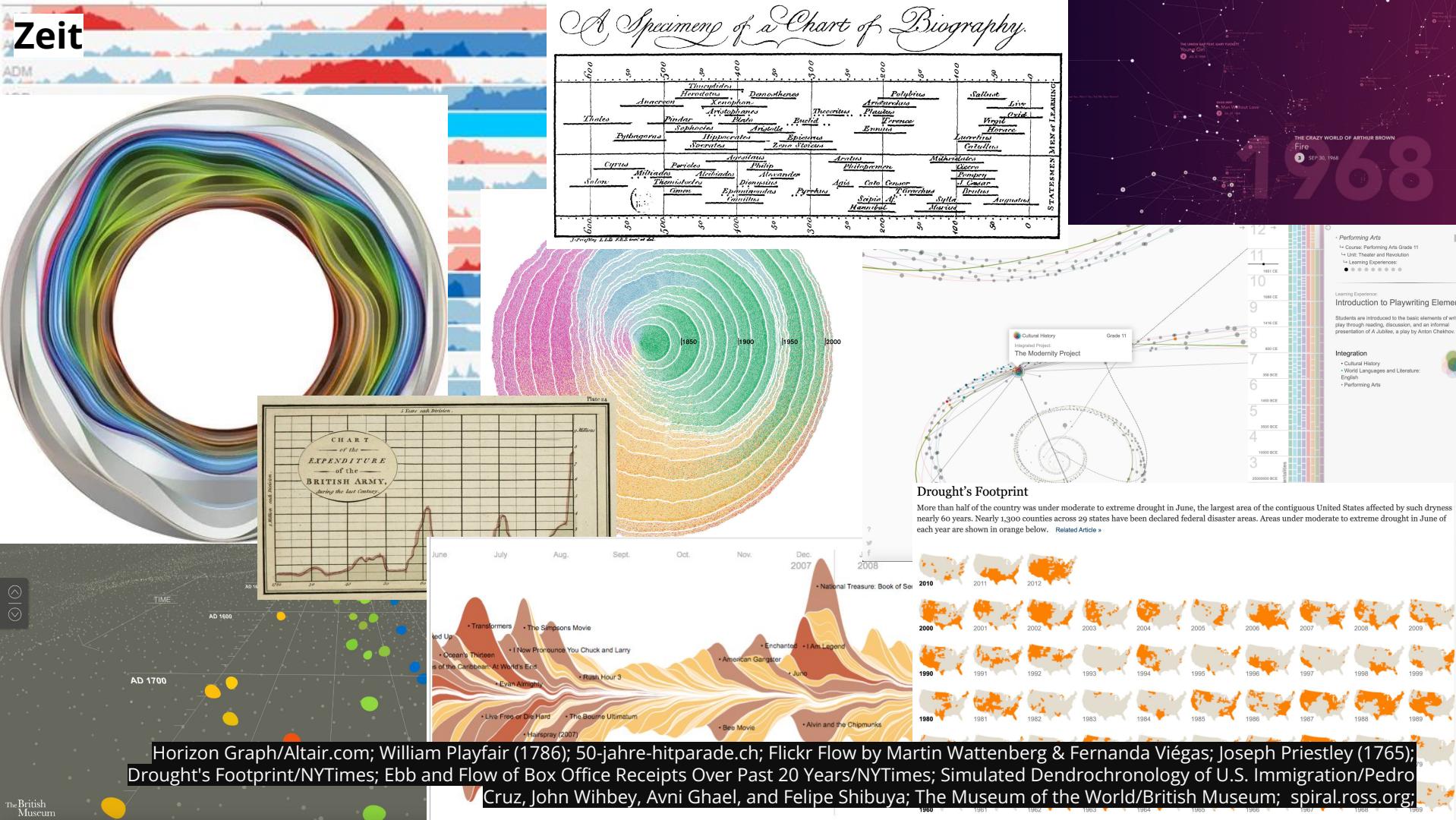
Quantitative/Ordnungs- Attribute

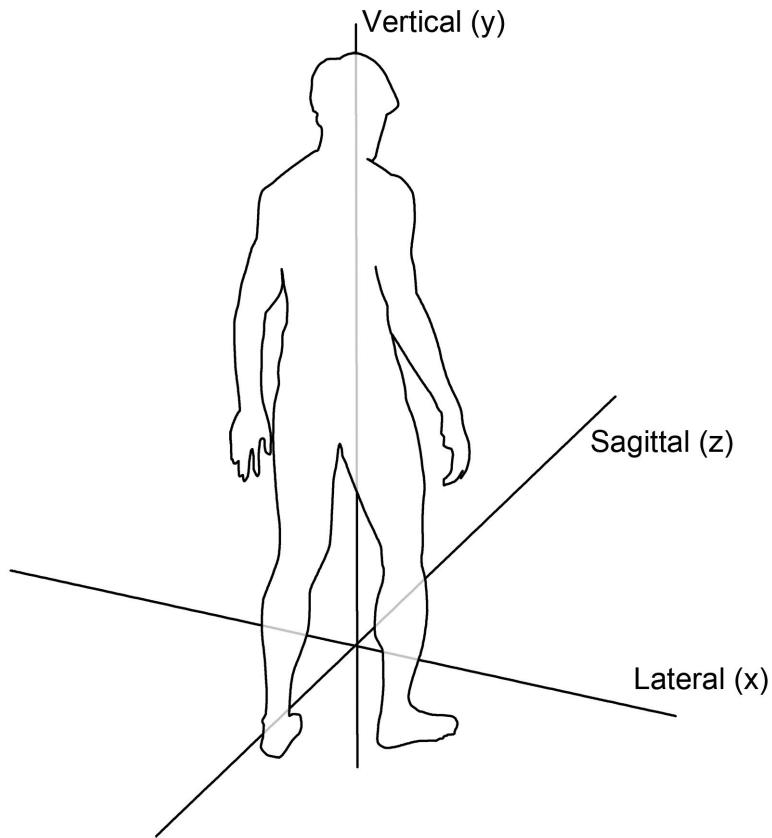


Kategorische Attribute

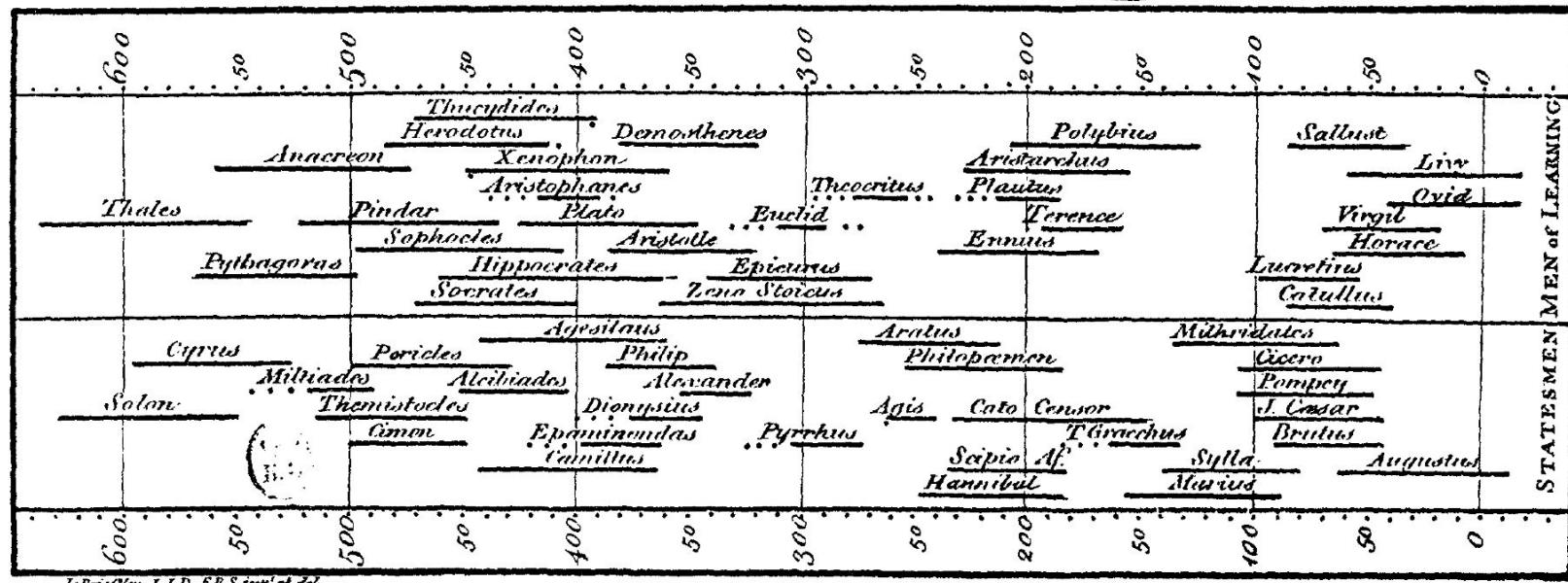


Tour durch den Visualisierungs-Zoo

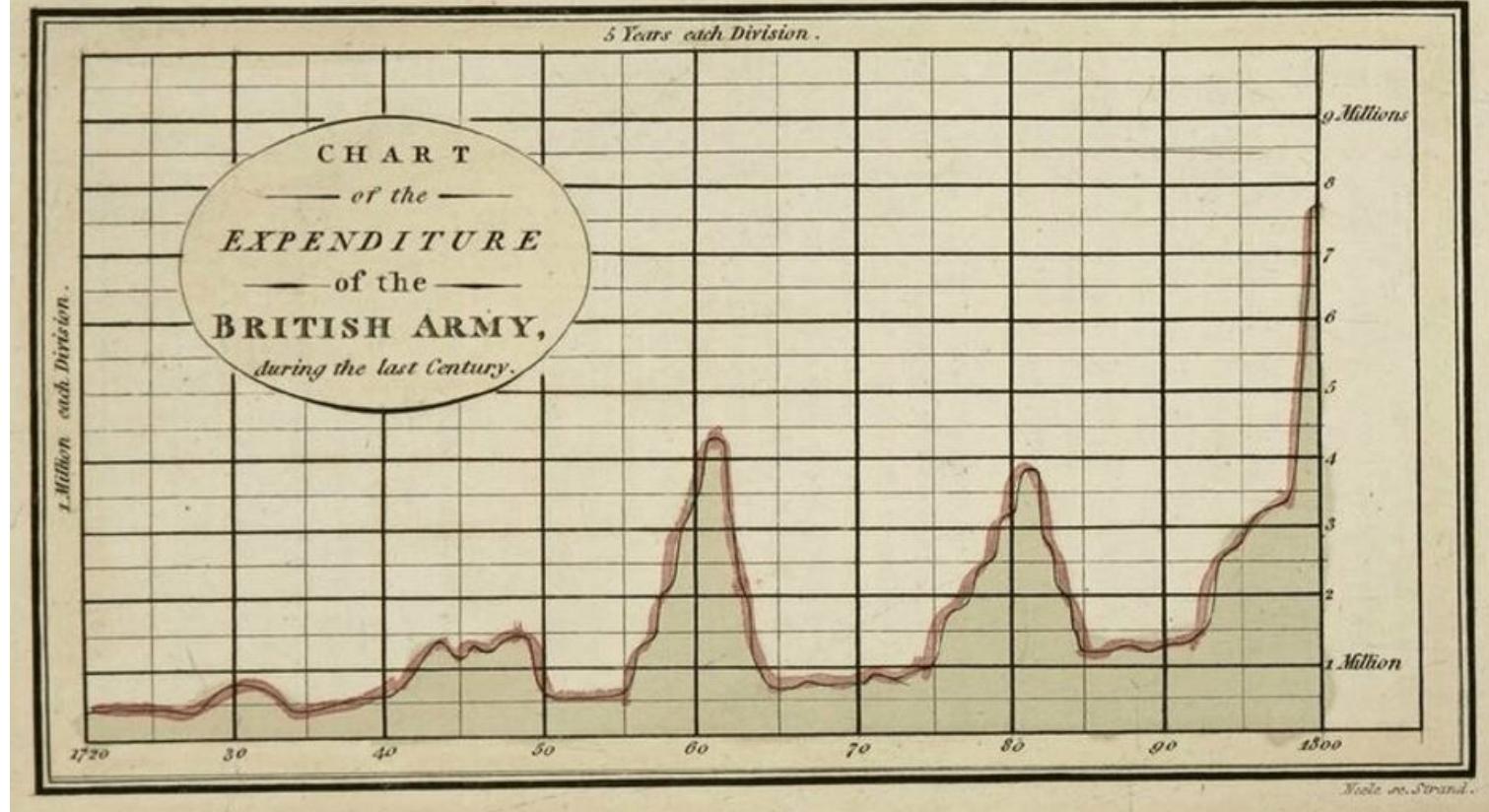




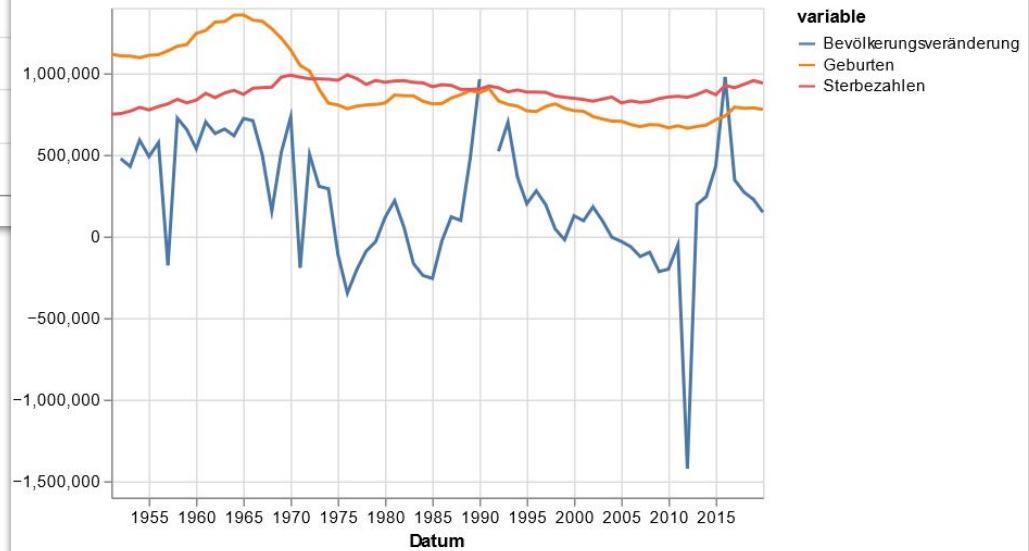
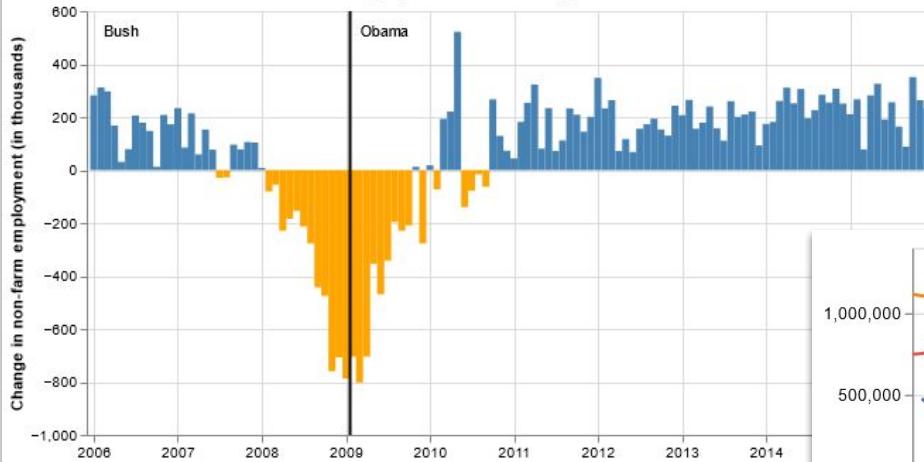
A Specimen of a Chart of Biography.



J. Priestley, L.L.D. F.R.S. invent'd & des.

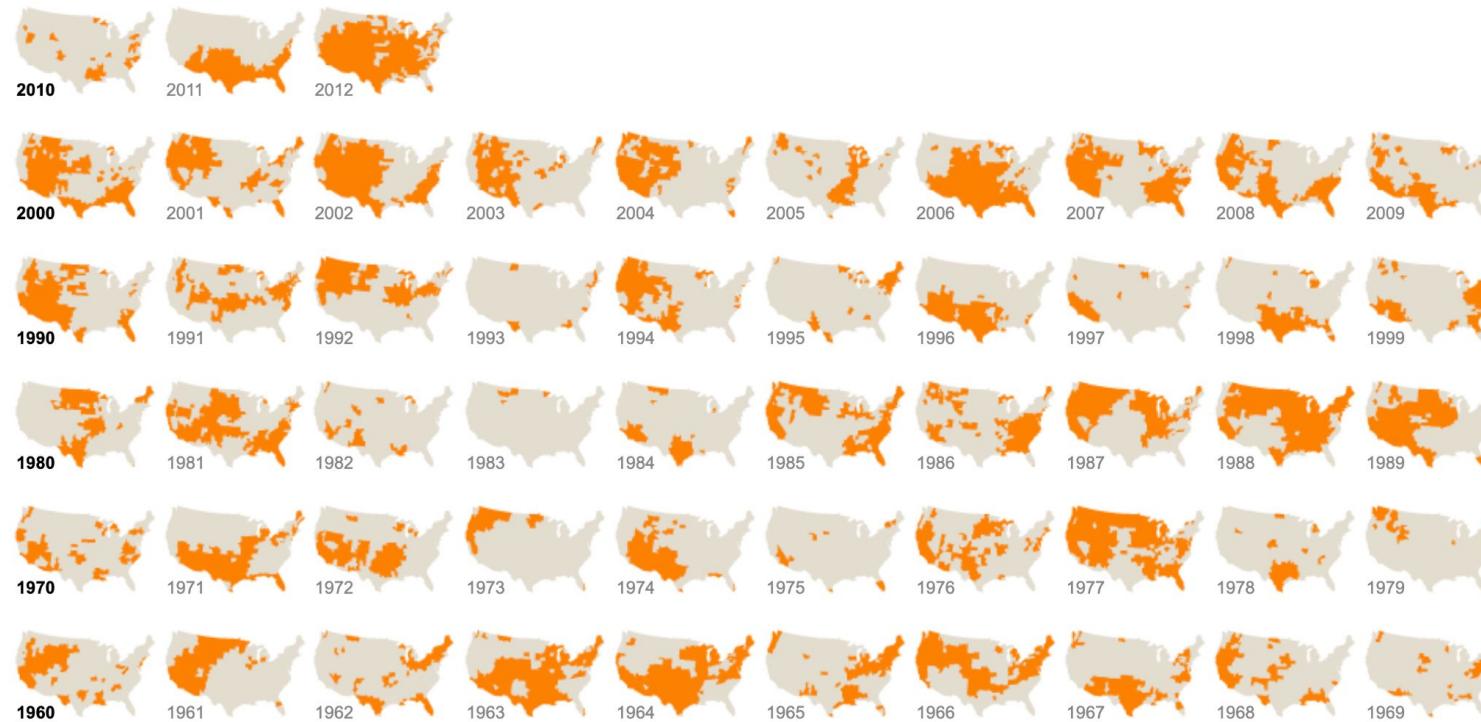


The U.S. employment crash during the Great Recession

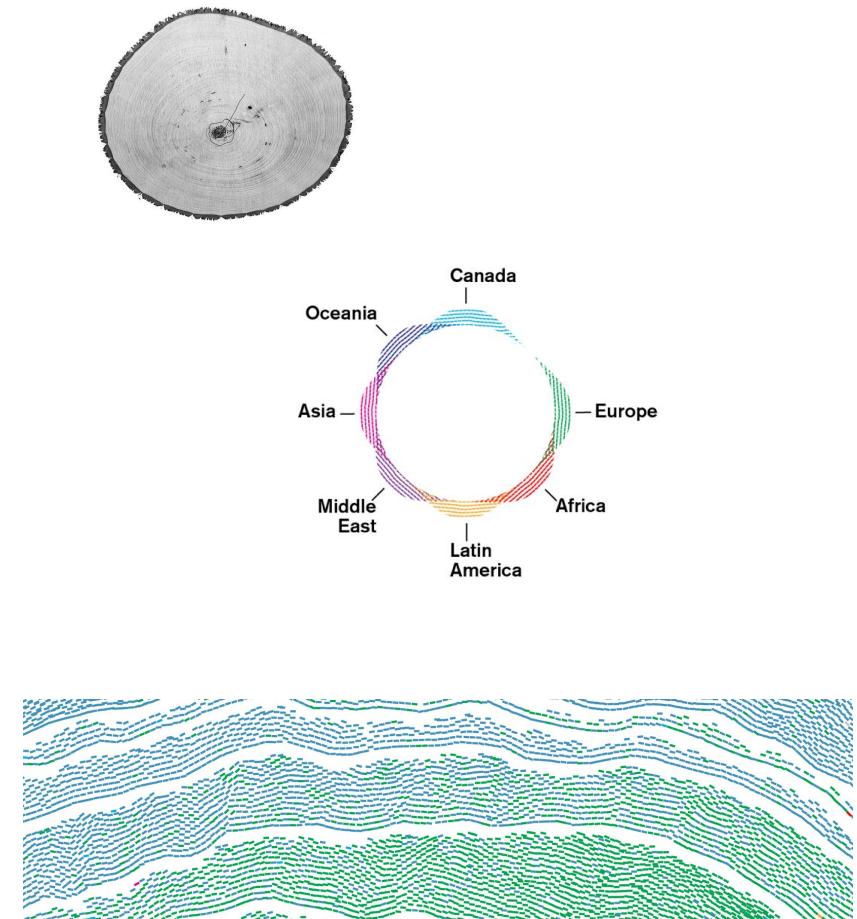
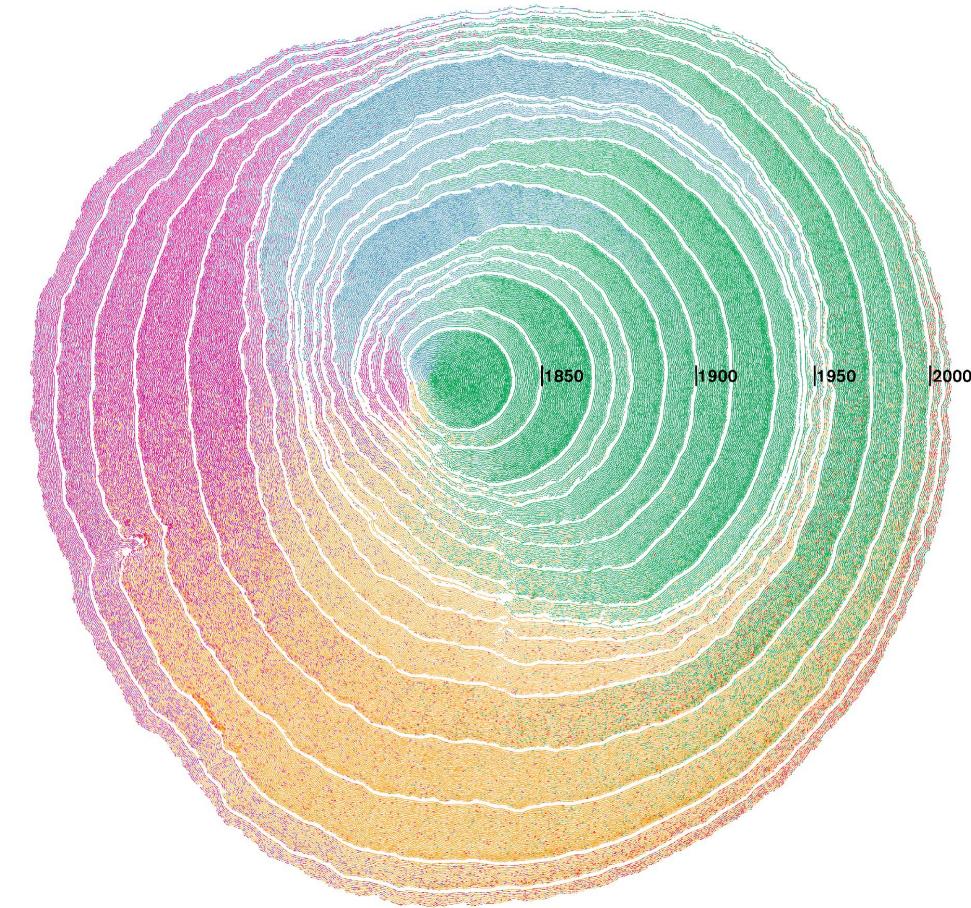


Drought's Footprint

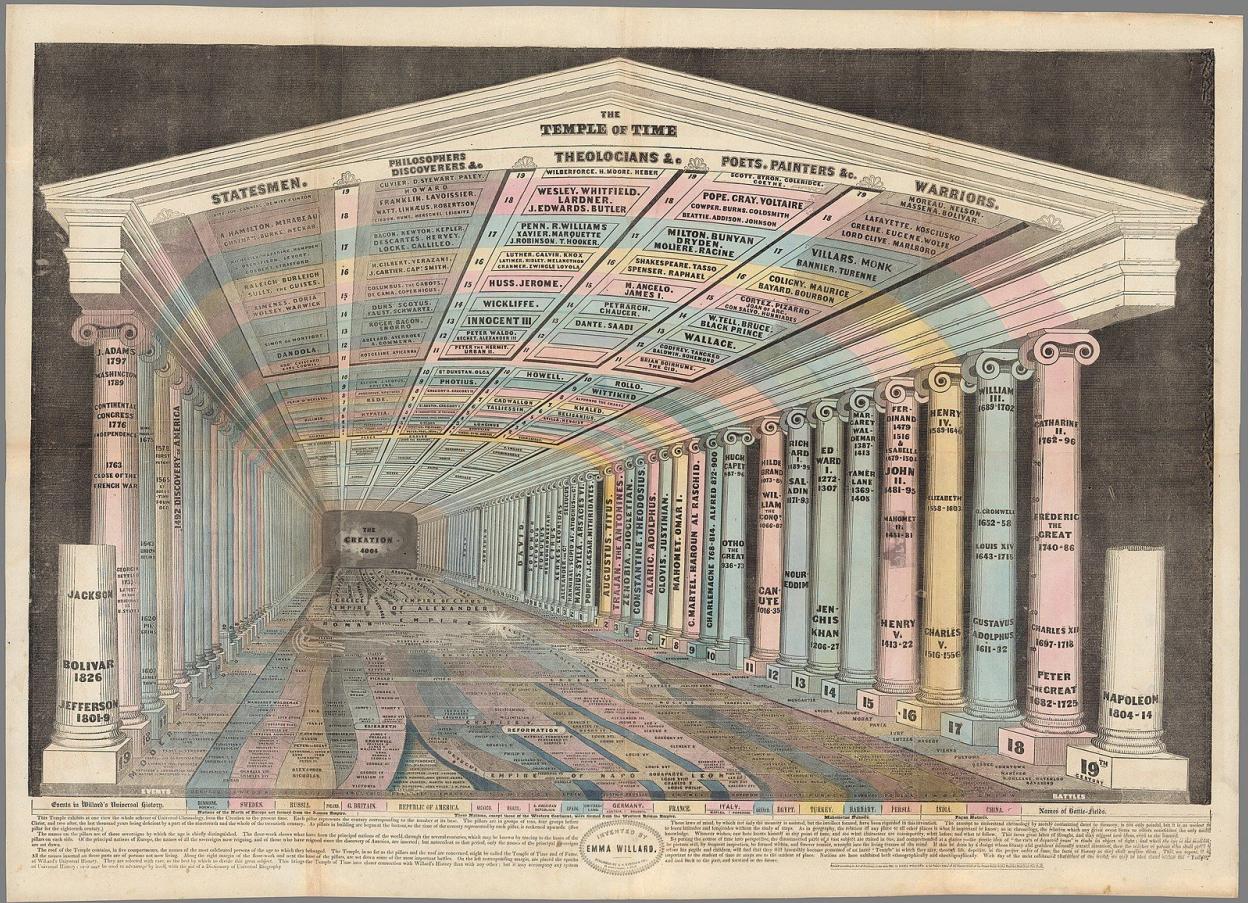
More than half of the country was under moderate to extreme drought in June, the largest area of the contiguous United States affected by such dryness nearly 60 years. Nearly 1,300 counties across 29 states have been declared federal disaster areas. Areas under moderate to extreme drought in June of each year are shown in orange below. [Related Article »](#)



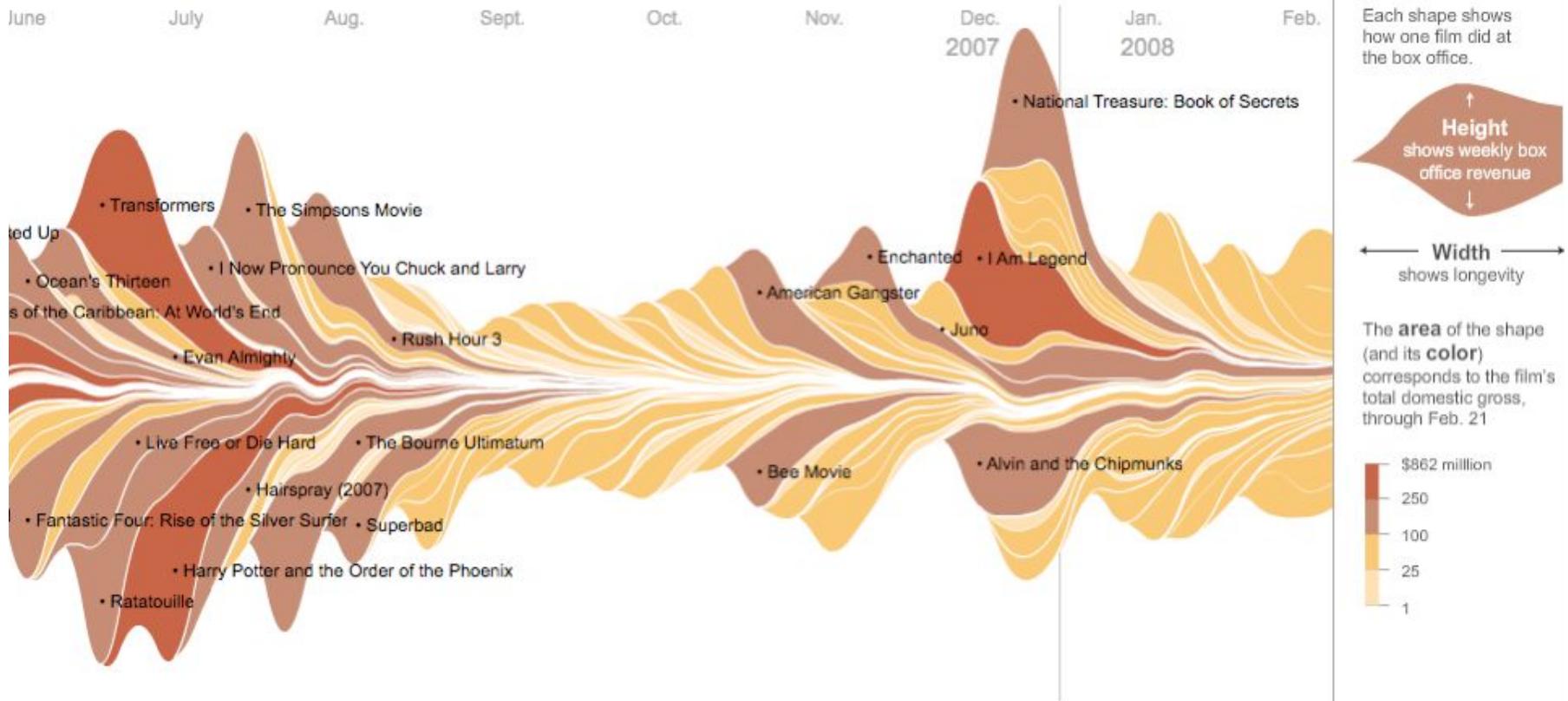
history range from  – Clear;  – Fair;  – Cloudy to  – Light Rain;  – Rain and  – Snow. The image



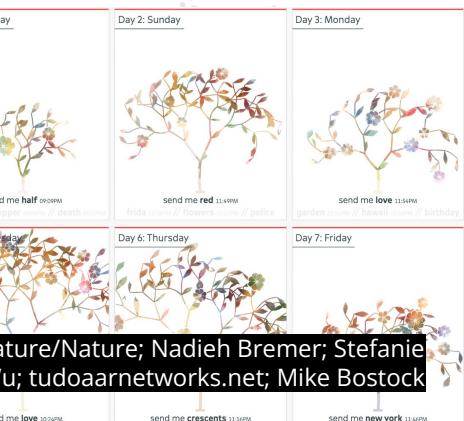
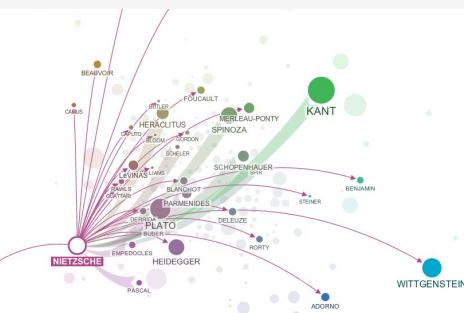
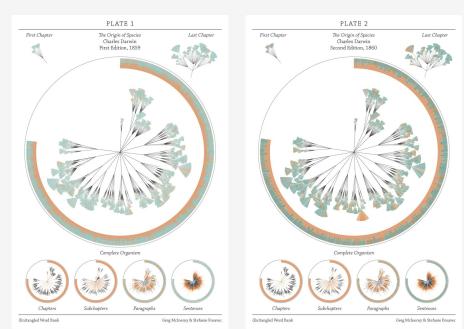
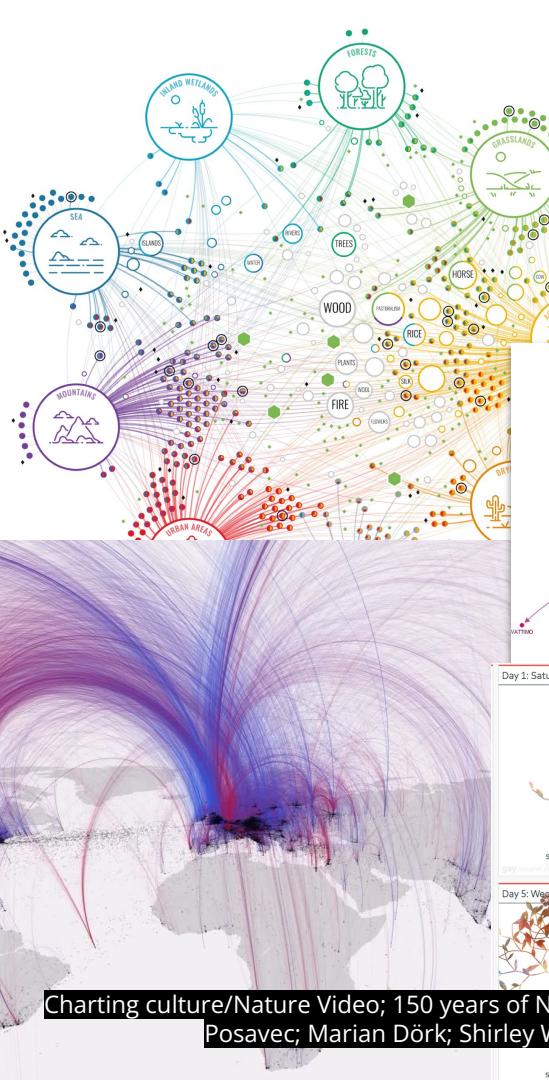
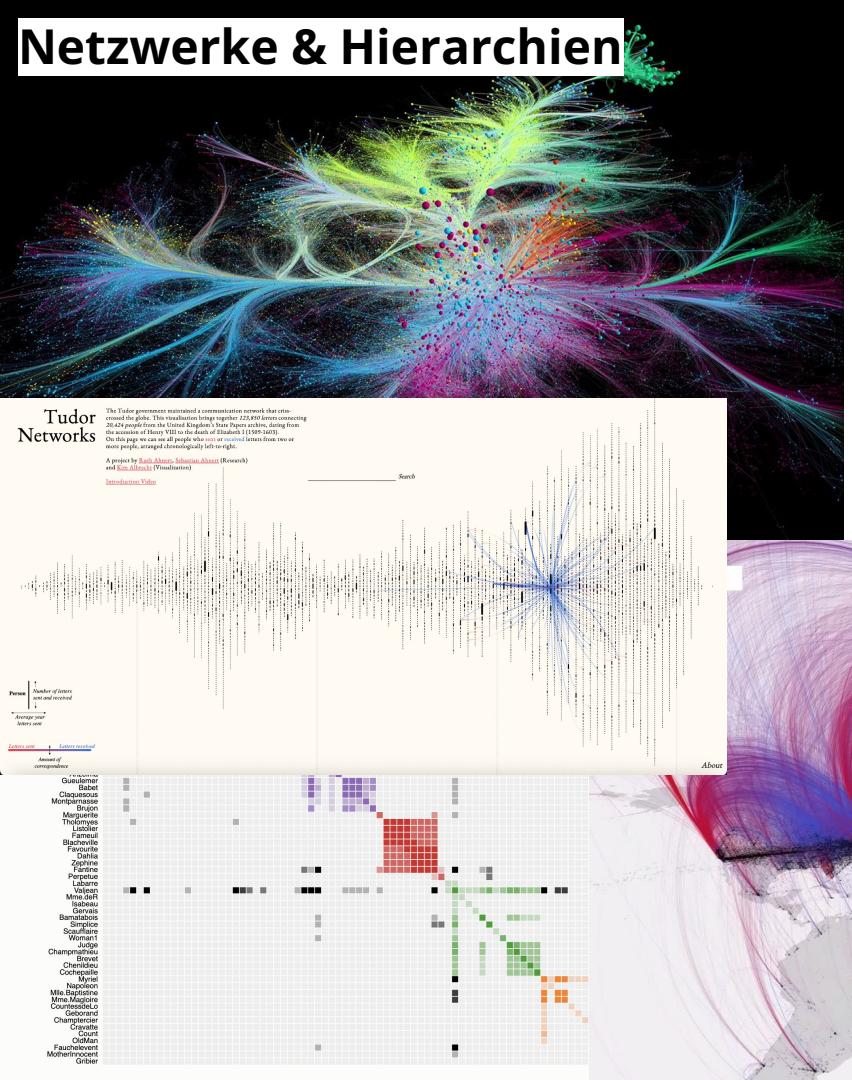
Simulated Dendrochronology of U.S. Immigration:
<https://web.northeastern.edu/naturalizing-immigration-dataviz/>



Emma Willard's Temple of Time (1846)



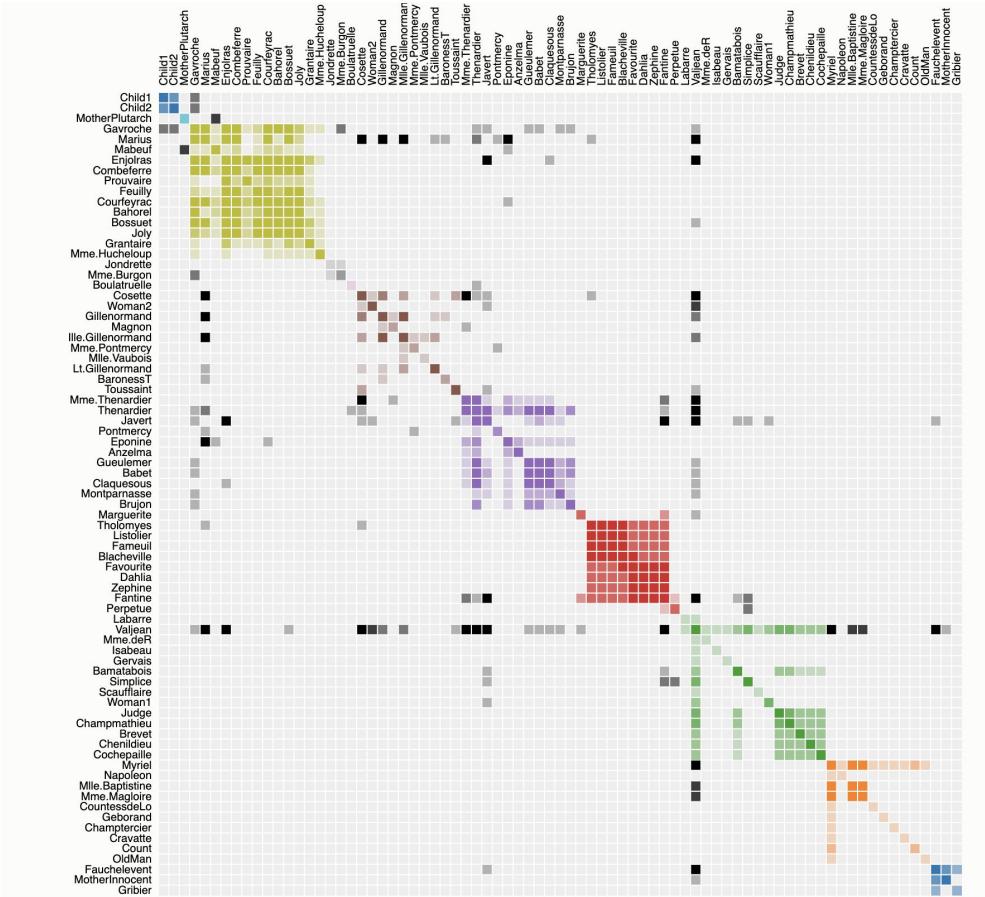
Netzwerke & Hierarchien



Charting culture/Nature Video; 150 years of Nature/Nature; Nadieh Bremer; Stefanie Posavec; Marian Dörk; Shirley Wu; tudoarnetworks.net; Mike Bostock

send me love 10:24PM send me crescents 11:34PM send me new york 11:44PM





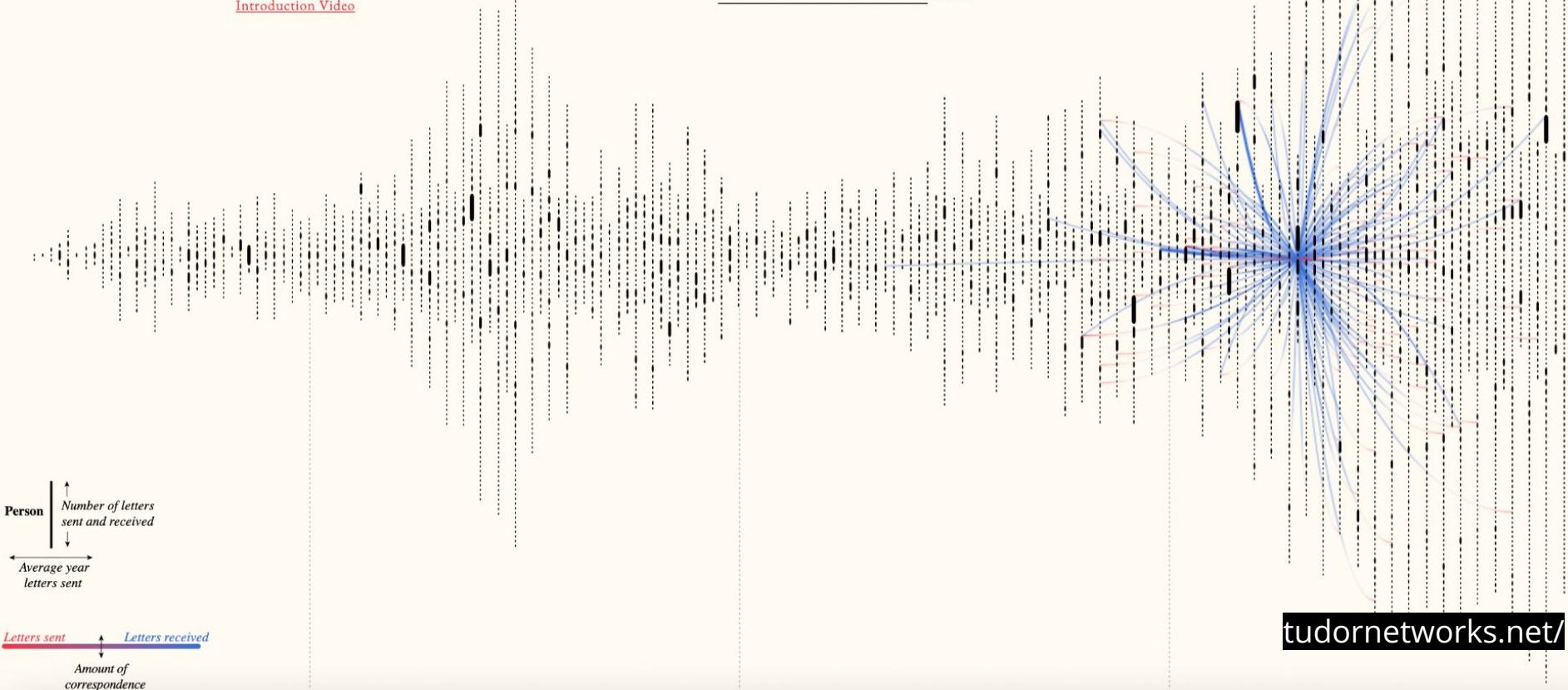
Tudor Networks

The Tudor government maintained a communication network that criss-crossed the globe. This visualisation brings together 123,850 letters connecting 20,424 people from the United Kingdom's State Papers archive, dating from the accession of Henry VIII to the death of Elizabeth I (1509-1603). On this page we can see all people who [sent](#) or [received](#) letters from two or more people, arranged chronologically left-to-right.

A project by [Ruth Ahnert](#), [Sebastian Ahnert](#) (Research)
and [Kim Albrecht](#) (Visualization)

[Introduction Video](#)

Search

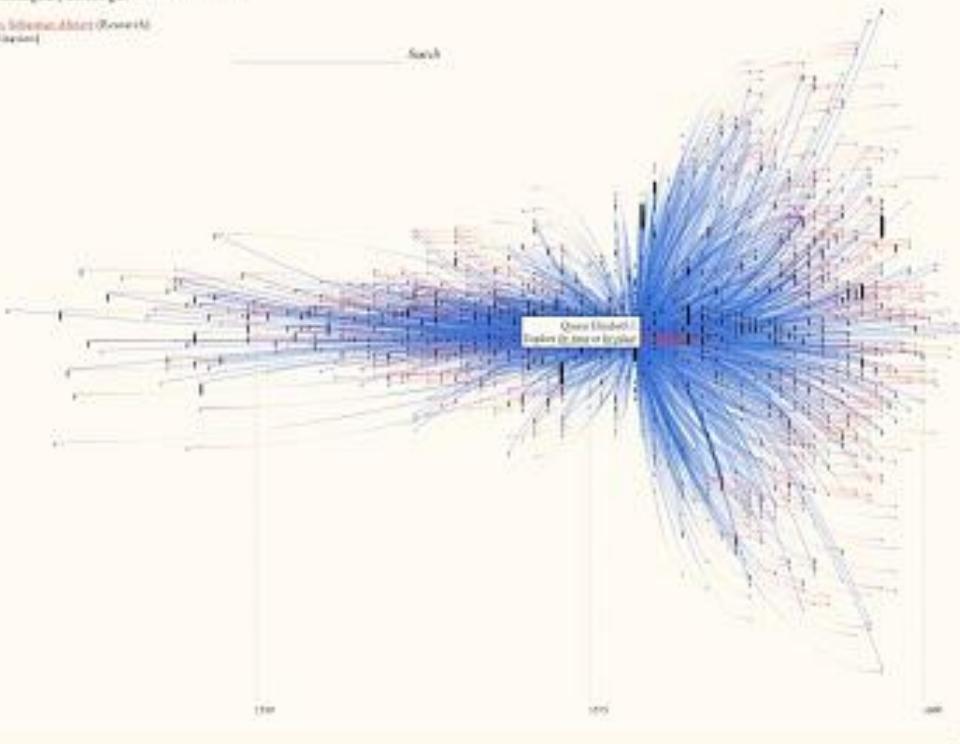


Tudor Networks

The Tudor government maintained a communication network that spanned around the globe. This visualization brings together 223,000 known connections between 20,624 people from the United Kingdom's State Papers archive, dating from the accession of Henry VII to the death of Elizabeth I (1485-1603). On this page we can see all people who sent or received letters from over 20,000 people, arranged chronologically left to right.

A project by [Rachael Atchley](#), [Sébastien Alléché](#) (PowerViz)

Search



Power
1
Abundance of letters sent and received
0
Strongly correlated letters sent

Letters sent
Letters received
Letters of correspondence

1485

1500

1550

1600

About

Karten und Geodaten

The data from these cities has been compiled to build the first picture of America's homeless relocation programs. Over the period for which our data is most complete, we are able to track 20,000 homeless people have been sent to and from within the United States.



SHIFTED MAPS

Travel Duration: 3 days
Avg. Duration: 30 minutes

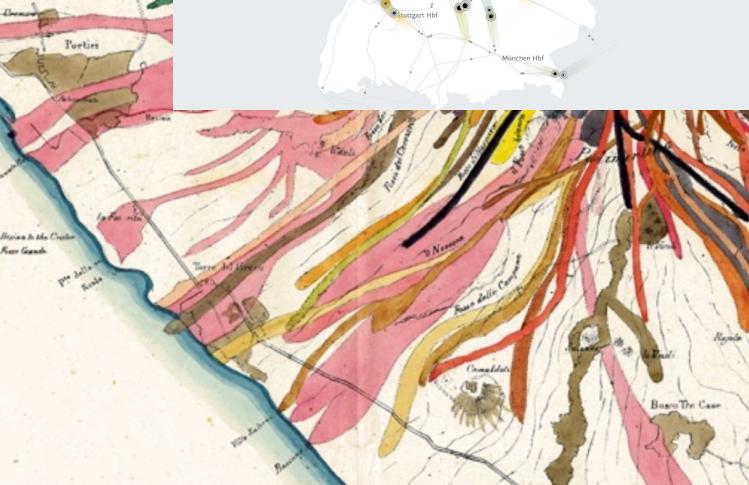
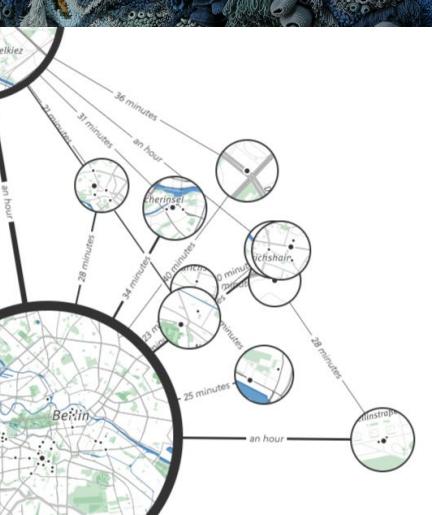
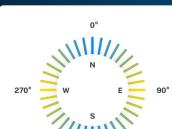


TRAILS OF WIND

The architecture of airport runways

DATE May 14th 2019 BY Figures

TAGS Trailsofwind



<https://shifted-maps.com/> ; <https://trailsofwind.figures.cc/> ; Botanical Tapestry by Vanessa Barragão ; <https://truth-and-beauty.net/projects/peakspotting> ; <https://www.theguardian.com/us-news/ng-interactive/2017/dec/20/bussed-out-america-moves-homeless-people-country-study> ;

Map of Vesuvius showing the direction of the streams of Lava in the Eruptions from 1631 AD. to 1831 AD. / John Auldridge

Arktischer
Ozean

Arktischer
Ozean

Arktischer
Ozean

The True Size Of ...

eg... Ghana

Quick Comparisons

JP vs US

US vs IN

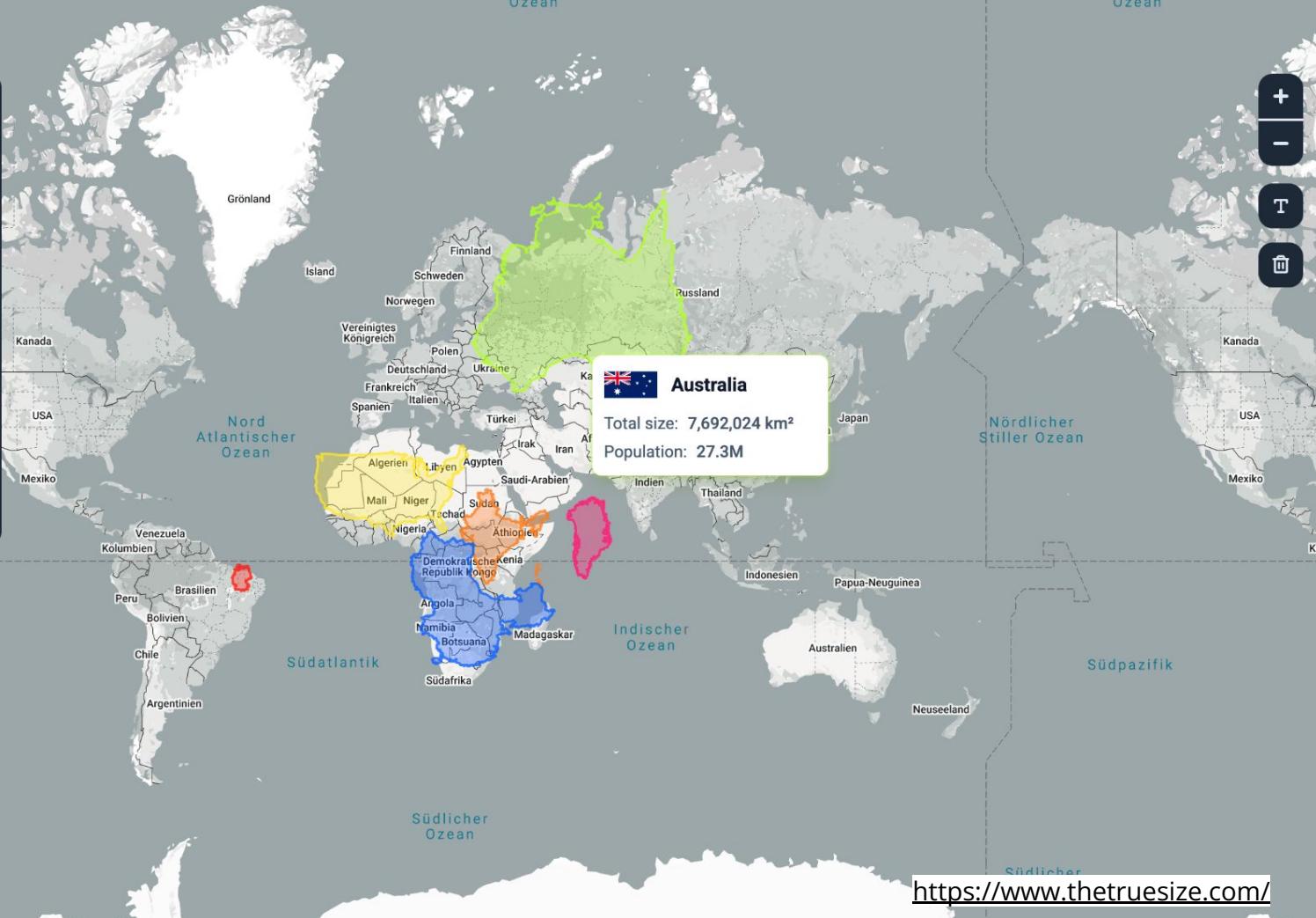
Australia

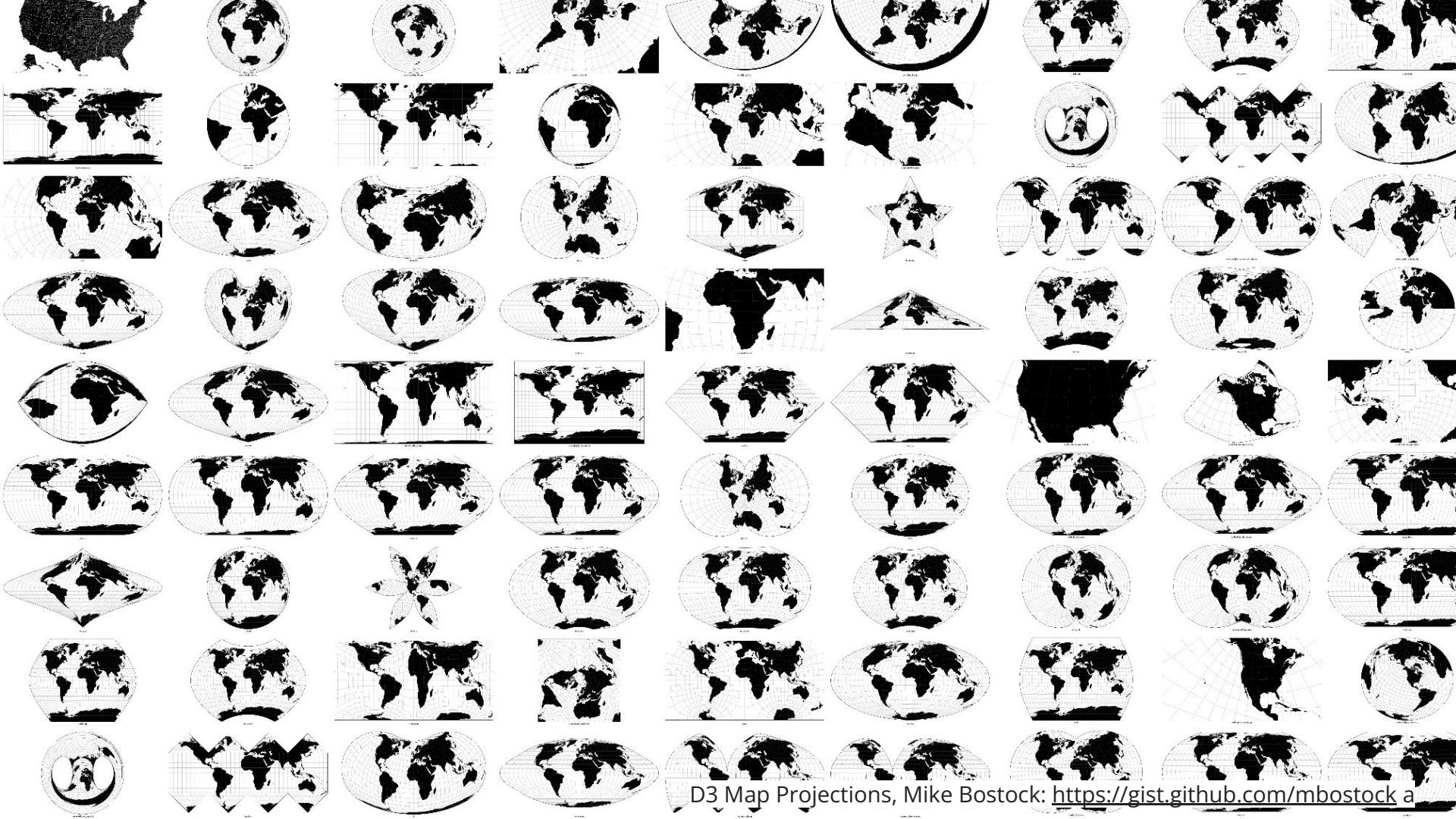
7,692,024 km²

27.3M

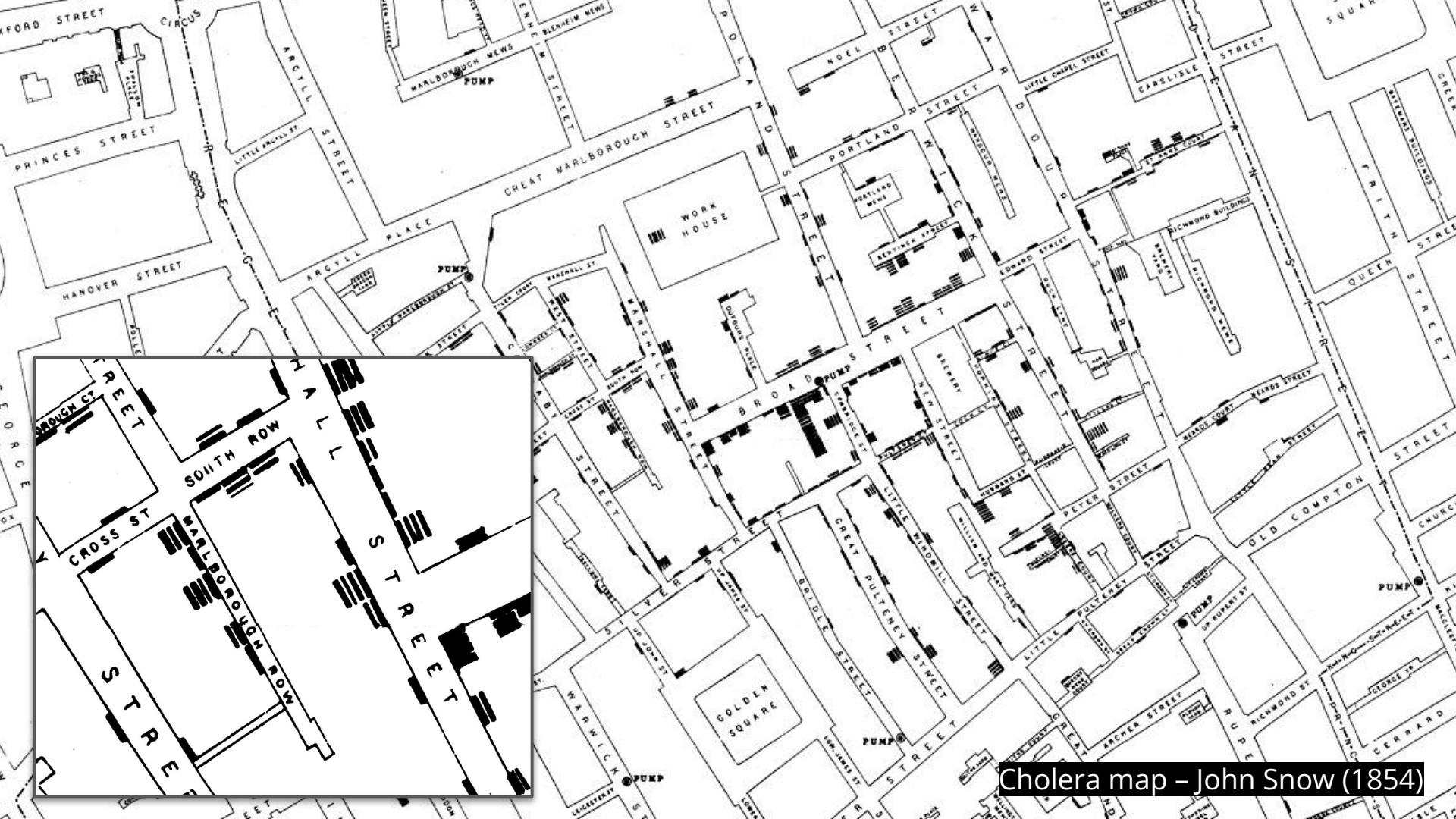
[About](#) | [How it works](#) | [Privacy Policy](#)

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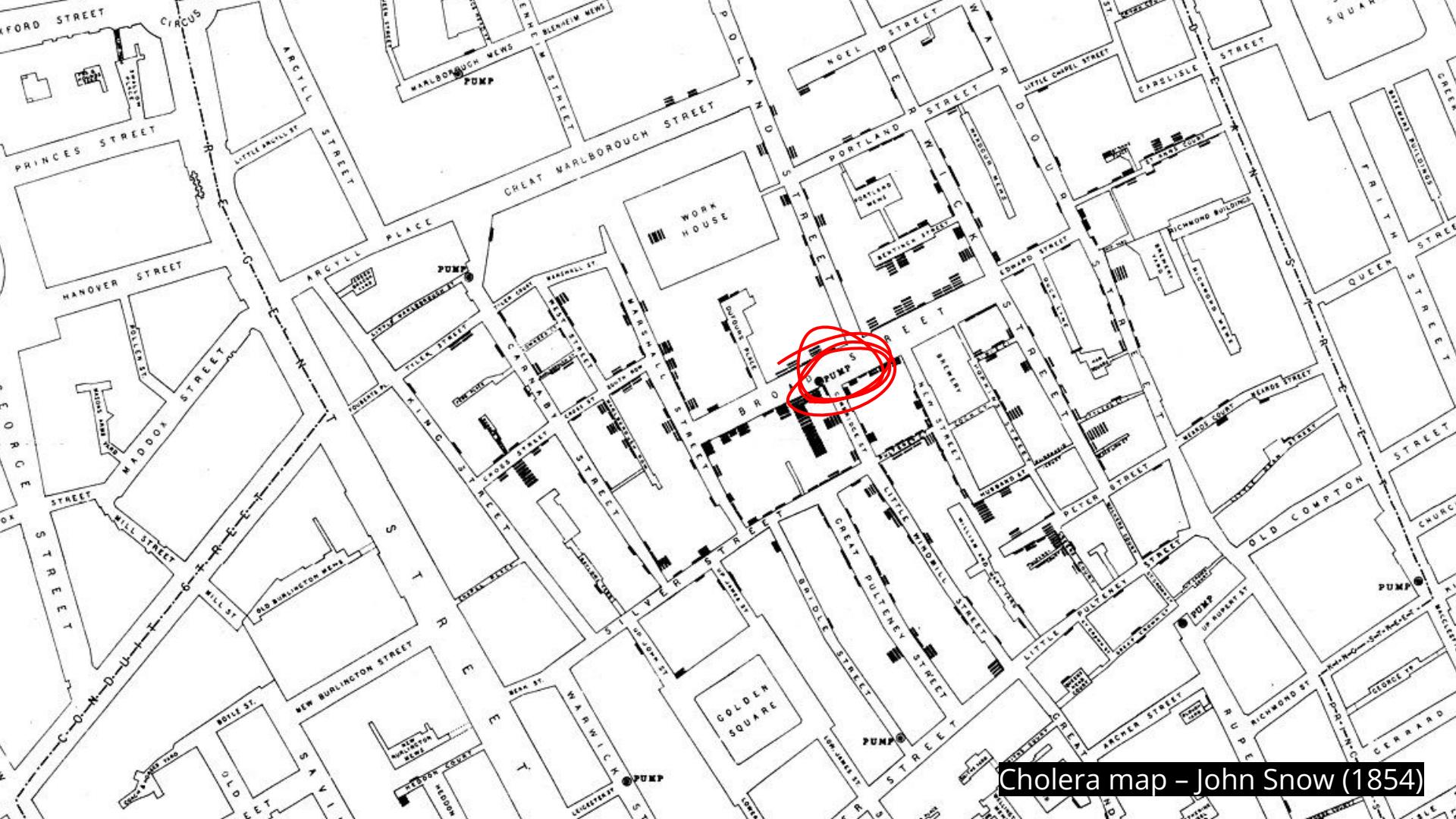




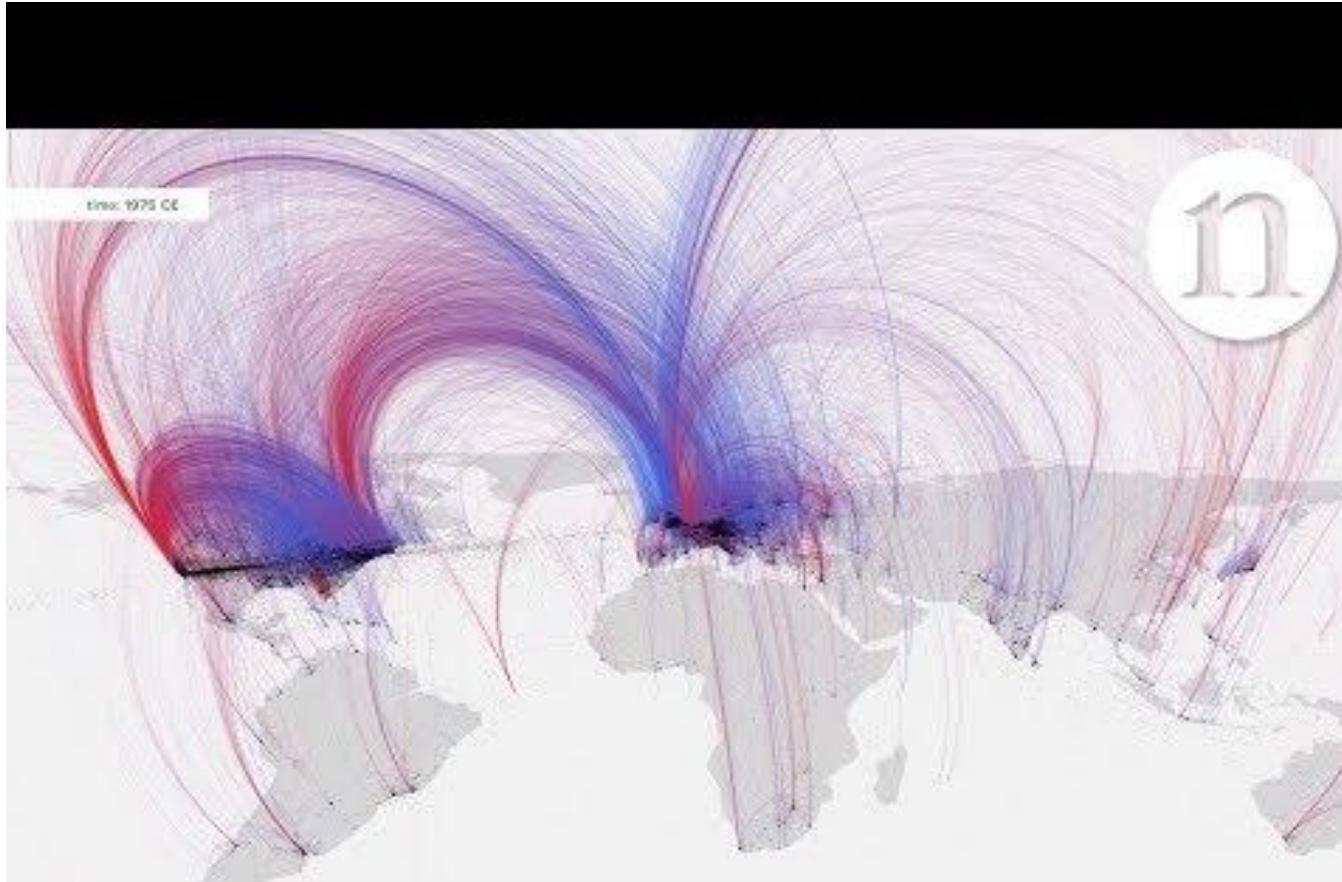
D3 Map Projections, Mike Bostock: <https://gist.github.com/mbostock>



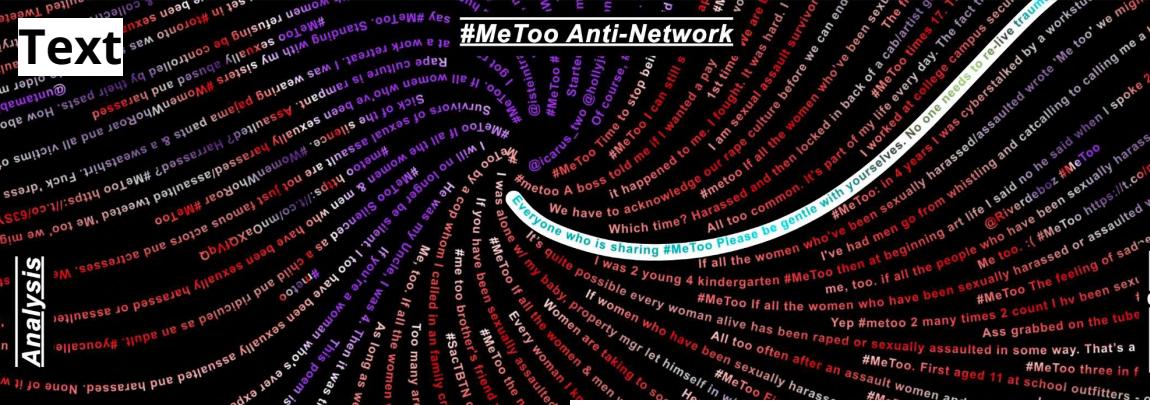
Cholera map – John Snow (1854)



Cholera map – John Snow (1854)

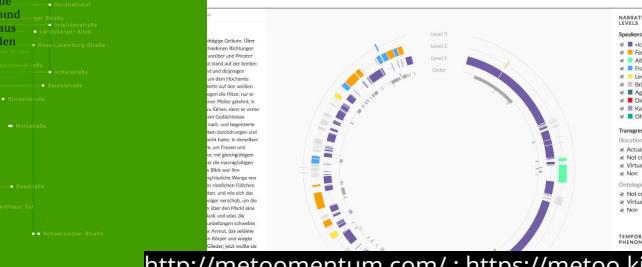
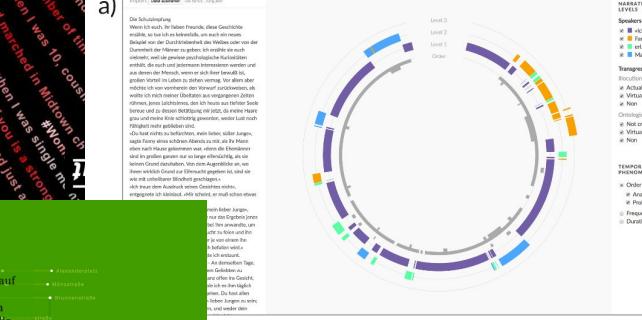


<https://www.youtube.com/watch?v=4gIhRkCcD4U>



Berlin Alexanderplatz

Alfred Döblin

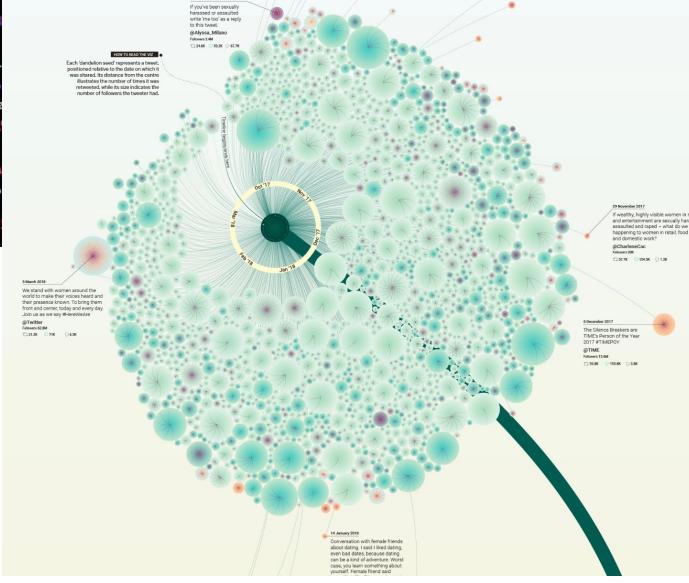


<http://metoomentum.com/> ; <https://metoo.kimalbrecht.com/> ; <https://uclab.fh-potsdam.de/NCM/index.de.html>
https://de.wikipedia.org/wiki/V_wordcloud_skill.png ; <https://dhq.digitalhumanities.org/vol/13/3/000414/000414.html>

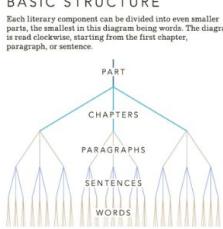
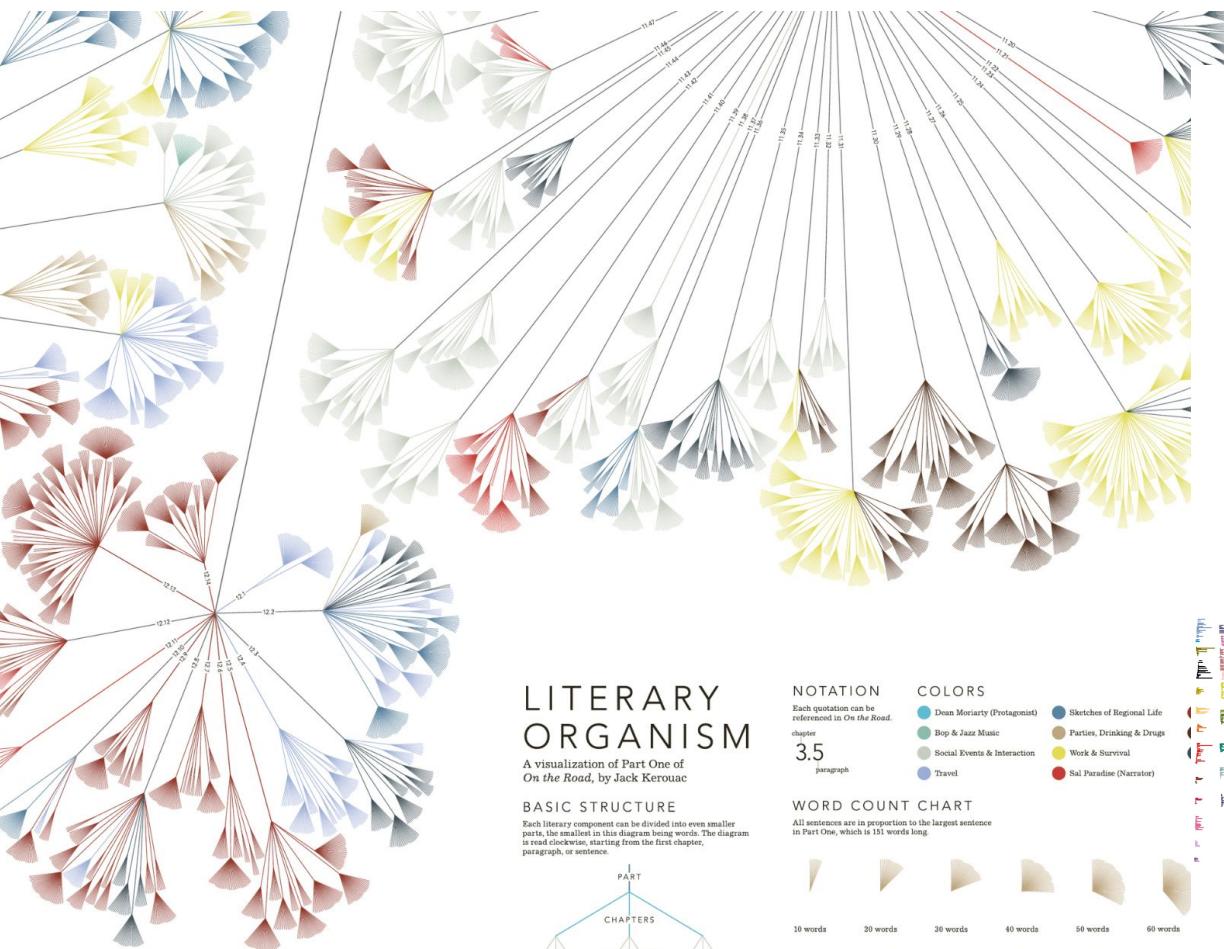
trending

The activist Tarana Burke started the MeToo Movement more than ten years ago, but it gained momentum in October 2017 when celebrity Alyssa Milano shared a viral tweet encouraging victims of sexual assault and harassment to speak out. This sparked a global conversation and the rise of the hashtag #MeToo.

Each Vanelemon shows a moment's focus, progression and what was shared. Its distance from the center indicates how many people are interested, while its size indicates the number of followers the message has.



things media since interesting strategic lot
using different professional now including design various
technical want International experienced interested English know
web management general use Language Wiki
business like systems think World much
company related projects contribute involved
time student topics developed education Member
science well worked Information community India
work Computer languages programming languages
Wikipedia people several website University

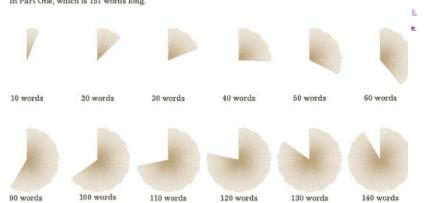


NOTATION
Each quotation can be referenced in *On the Road*.

3.5
paragraph

COLORS
● Dean Moriarity (Protagonist)
● Bop & Jazz Music
● Social Events & Interaction
● Travel
● Sketches of Regional Life
● Parties, Drinking & Drugs
● Work & Survival
● Sal Paradise (Narrator)

WORD COUNT CHART
All sentences are in proportion to the largest sentence in Part One, which is 151 words long.



and ran out to see, and to do this, he had to rub pell-mell through a long bar of brawling drinkers in white shirtsleeves, go to the middle of the street, and look at the post signs. He did this, crunched low, to the ground like Groucho Marx. His feet carried him on, his head was very light, his heart was like an aspinator, with his balloon thumb stuck in the night, and came to a whirling stop in the middle of the road, looking everywhere above him for the signs! They were hard to see in the dark, and he spun a dozen times in the road, thump upended, in a wild, aimless, sprawling, a wildcat's leap, with a tail snapping, held up like a spear, a spear of the sky, and spinning in the dark, the other hand distractingly inside his pants. Ed Fournier was saying, 'I blow a sweet tone wherever I go and if people don't like it I ain't nothing I can do about it. Say man, that buddy of yours is a crazy one, looks him over there.' The sign posts were scattered all the time, everywhere as Dean saw the signs all rushed back in the bar, practically going under someone's legs as they came out and gliding so fast through the heat that everybody had to do a double take to see him! A moment later Roy Johnson showed up and with the same amazing swiftness Dean didn't even notice and without a word he was gone again.

(10) Now Roy, I know you're all hungup with your wife about this thing but we absolutely must make Forty-sixth and Geary in the incredible time of three minutes or everything is lost. Ahem! Yes! (coups-coups!) In the morning San I am leaving for New York and then I'm coming out last night of kicks and I'll be back in time for the opening of the new show.

(11) No! Roy Johnson didn't say a word, he only drove through every light because that's what married couples do along our highways. As always went home to San Francisco and I had a cold with a sore throat. So I went to bed. I was still awake, I was thinking about what I had just said to Roy Johnson, and I was thinking about what I had just said to Sal Paradise, and I was thinking about what I had just said to Dean Moriarity, and I was thinking about what I had just said to Bop & Jazz Music, and I was thinking about what I had just said to Sketches of Regional Life, and I was thinking about what I had just said to Parties, Drinking & Drugs, and I was thinking about what I had just said to Work & Survival, and I was thinking about what I had just said to Sal Paradise (Narrator).

Writing Without Words

(Stefanie Posavec)



and he went upstairs and the old man was kind enough to give us the entire bed. I have to get up, anyway," he said and retired to the little kitchenette to brew coffee. He began telling stories about his railroading days. I've remembered one of my father's stories, which was about the time he was a brakeman, having to unhitch his teeth and burlap around and say, "Yes, that's right, to everything he said. Finally we slept; and in the morning Frost came back from a Western Division run and took the bed as Dean and I got up. Now Old Mr Frost had a bad back, so he said, his middleaged sweetheart, she put on a green tweed suit, a cloth cap, also green tweed, and stuck a flower in her lapel.

(12) These romantic old broken-down Frisco brakemen live sad but eager lives of their own. I told Dean in the toilet. "It was very kind of him to let us sleep here."

"Yes, yes," said Dean, not wanting me to rush out to get another story. "My job was to haul to Galatas Donckels, for our base. She was sitting on the floor with her fortune telling cards."

"We're good boy, Galatas, and I hope everything works out fine for you."

"When we're back we're going to take him to a荷蘭花園 (Holland flower) garden every night and let him get his fill of mandarins. Do you think that will work? Sal, I don't know what to do."

"What do the cards say?"

"The ace of spades is far away from home. The heart card shows a horse running away from the stable. This means that you have to leave your home town. Dean's always been afraid of horses."

"Well, we're leaving for New York in an hour."

"Someday Dean's going to go on one of these trips and never come back."

"She'll be like a son and daughter to him. I said good-bye. I took the long downtown and hailed a Frisco taxi-jinny, which was an ordinary taxi that ran a regular route and you could hail it from any corner and ride to any corner you want for about fifteen cents, crammed with other passengers like on a bus, but talking and telling jokes like in a private car. Mission Street that day in Frisco was a great spot of ~~old~~ ^{new} street life. Children playing, shopping, ~~visitors~~ ^{tourists} coming,

Multivariate Daten



Now You See Me 2

The Legend of Tarzan

Independence Day:
Resurgence

Central Intelligence

2015



Terminator Genisys

Straight Outta
Compton

Ant-Man

Mission: Impossible -
Rogue Nation

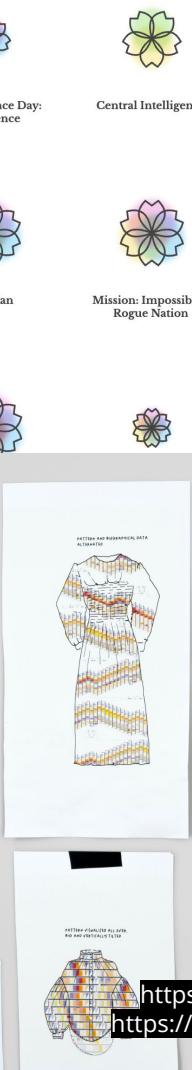
2014



Teenage Mutant Ninja
Turtles

22 Jump Street

2013



<https://shirleywu.studio/filmflowers/> ; Dear Data / Giorgia Lupi & Stefanie Posavec; Federica Fragapane;
<https://giorgialupi.com/giorgia-lupi-otherstories> ; <https://www.domesticstreamers.com/work/data-strings/>

2016



Now You See Me 2



The Legend of Tarzan



Independence Day:
Resurgence



Central Intelligence



Finding Dory

2015



Terminator Genisys



Straight Outta
Compton



Ant-Man



Mission: Impossible -
Rogue Nation



Minions

film flowers

top summer blockbusters
reimagined as flowers

(shirley wu)

2014



Teenage Mutant Ninja
Turtles



22 Jump Street



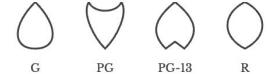
Dawn of the Planet of
the Apes



Transformers: Age of
Extinction



Guardians of the
Galaxy



Drama Comedy Adventure Action Other



1k imbd votes



414k



827k



1,240k



1,653k

2013



World War Z



Monsters University



Gravity



Man of Steel



Despicable Me 2



2012



Ice Age: Continental
Drift



Ted



Brave



The Amazing Spider-
Man



The Dark Knight Rises

Film Flowers – Shirley Wu
<https://shirleywu.studio/filmflowers/>

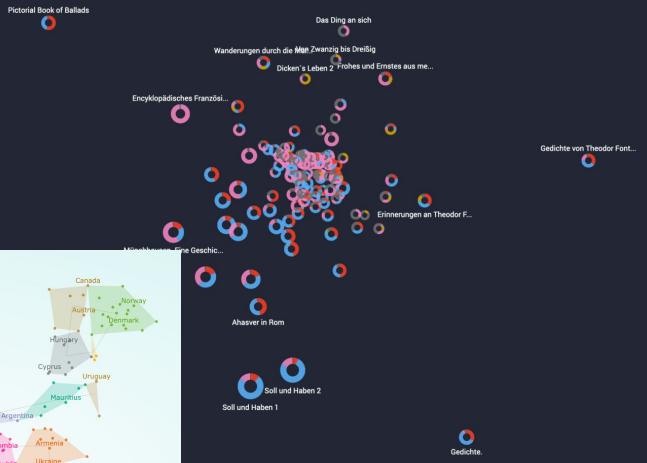
Ähnlichkeitsbasierte Darstellungen



What visual similarities can a computer vision algorithm find to connect a silhouette with a drawing?



<https://truth-and-beauty.net/projects/multiplicity>
https://artexperiments.withgoogle.com/xdegrees/8gHu5Z5RF4BsNg/BgHD_Fxb-V_K3A
<https://christian-parsons.com/mapamundi-wdvp/>
<https://uclab.fh-potsdam.de/ff> <https://visualisierung.smb.museum/>



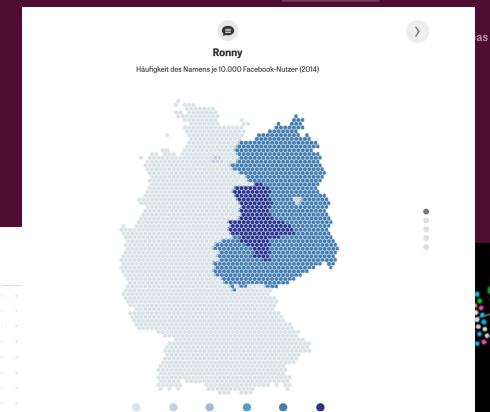
Narrative und Storytelling



East-West Exodus

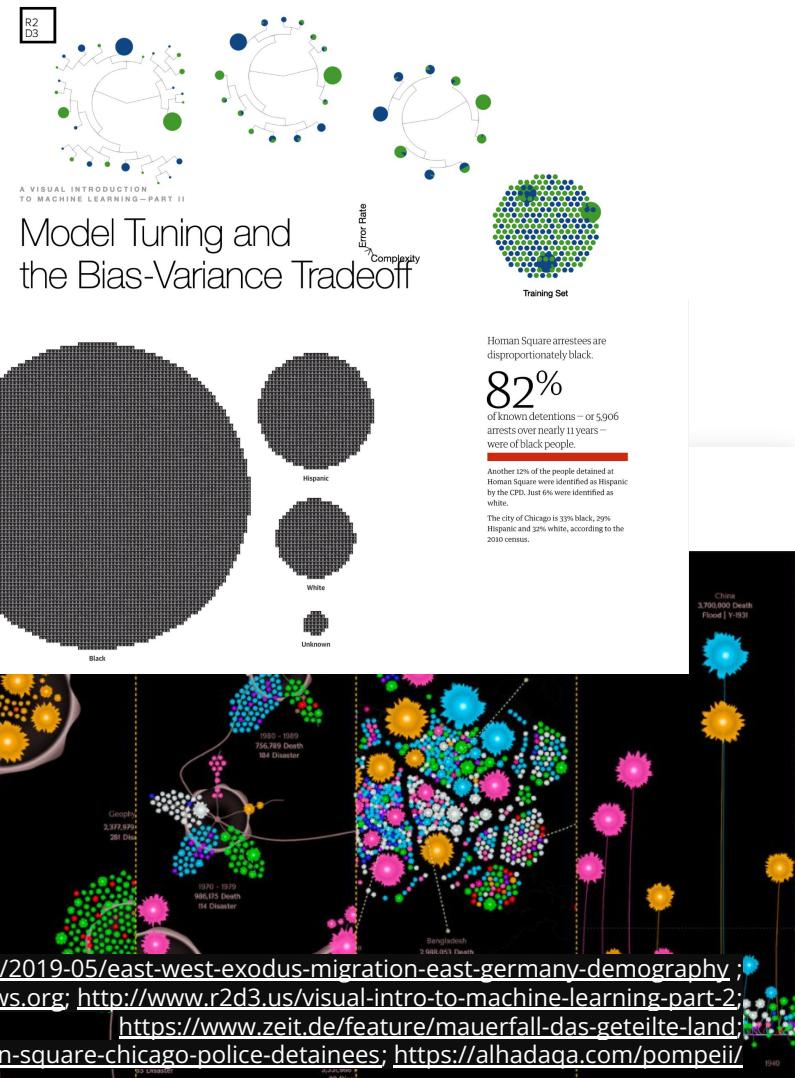
The Millions Who Left

Since Germany's reunification, millions of people have left the East, triggering a demographic crisis. Data now shows exactly what happened – and why there's cause for hope.

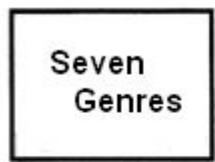


<https://www.zeit.de/politik/deutschland/2019-05/east-west-exodus-migration-east-germany-demography>;
<https://connections.spectrumnews.org>; <http://www.r2d3.us/visual-intro-to-machine-learning-part-2>;

<https://www.theguardian.com/us-news/ng-interactive/2015/oct/19/homan-square-chicago-police-detainees>; <https://alhadqa.com/pompeii/>



Narrative visualization: Telling stories with data



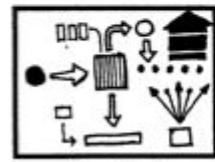
Magazine Style



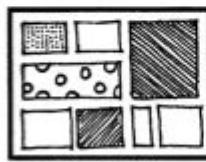
Annotated Chart



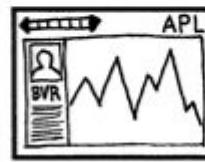
Partitioned Poster



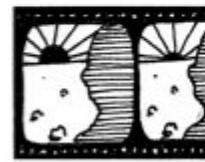
Flow Chart



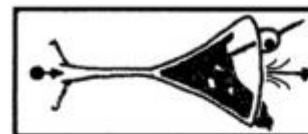
Comic Strip



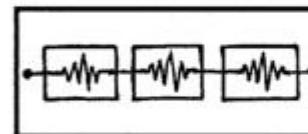
Slide Show



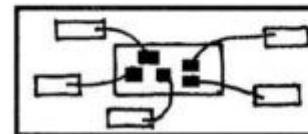
Film/Video/Animation



Martini glass structure



Interactive slideshow



Drill down story

I WANT A BETTER CATASTROPHE

A flowchart for navigating our climate predicament

Global warming is projected to rocket past the 1.5°C limit, throwing lifelong activist Andrew Boyd into a crisis of hope, and off on a quest to learn how to live with the “impossible news” of climate breakdown. With gallows humor and a broken heart, Andrew steers us through our climate angst as he walks his own. This flowchart is an invitation to join him on his narrative path and explore our predicament on your own.

Want to re-explore from the beginning?

Reset progress and start over

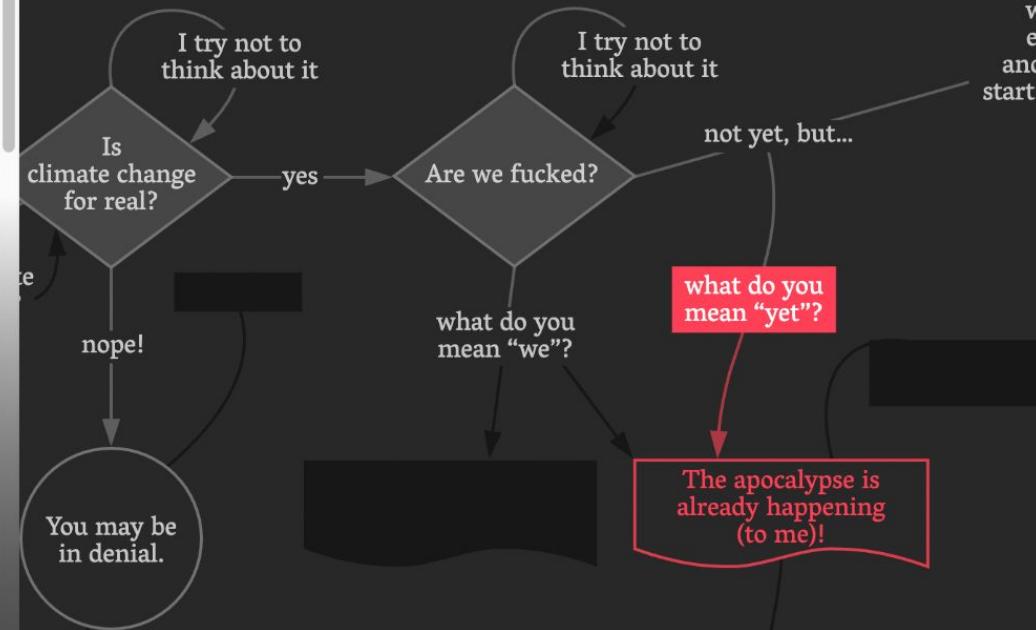
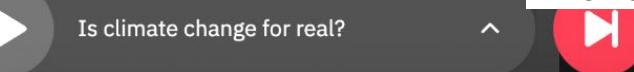
BACKGROUND

Use the buttons below to stop (and resume) Andrew's explanations, chart the flowchart, or also explore the chart via the navigation items and moving between panels. The original version of



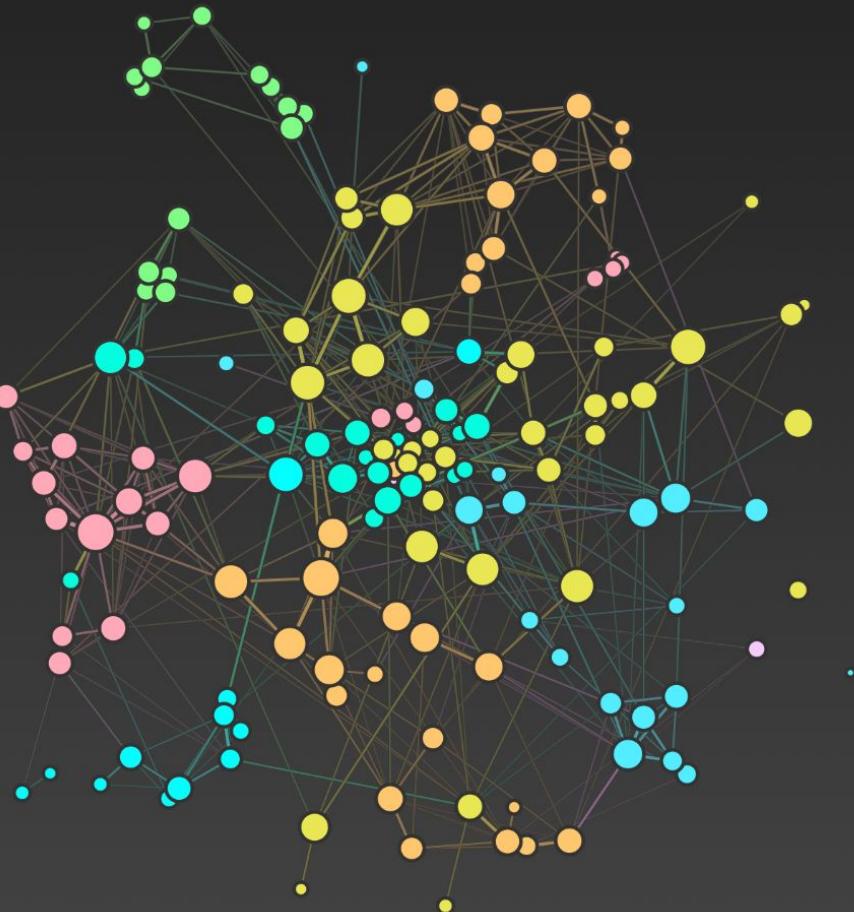
Is climate change for real?

I Want a Better Catastrophe – Jona Pomerance, Marian Dörk, Andrew Boyd
<https://flowchart.bettercatastrophe.com/>



we're in an emergency and we need to start acting like it!

EXPLORE



You can also explore the 150-researcher network yourself. Select a name to find that researcher's connectedness scores and top collaborators.

Enter exploration mode

...or scroll down for more information.

<https://connections.spectrumnews.org>

Das Familienbildnis der Hohenlohe

Die Beschreibung und Interpretation des Ölgemäldes bietet mehrere Zugänge an: Auf den ersten Blick zeigt es drei elegante junge Damen und zwei Herren in einer Landschaft. Jeder der abgebildeten Figuren ist ein Attribut zugeordnet, z. B. ein Vogel oder ein Spiegel. Diese Attribute verweisen auf die fünf menschlichen Sinne - Schmecken, Riechen, Sehen, Hören und Tasten - eines der vielfältigsten und reizvollsten Themen der europäischen Malerei. Zugleich ist das Werk auch ein Familienporträt von fünf Geschwistern einer Familie aus dem Nordosten Baden-Württembergs, dem ehemaligen Fürstentum des Hauses Hohenlohe. Darüber hinaus stellt es die Mode aus der Zeit des 30-jährigen Krieges in Deutschland dar.

Sabine de Günther
11. September 2023



Bildnis der fünf Kinder Graf Philipp Ernst zu Hohenlohe-Langenburg als Allegorie der Fünf Sinne: Eva Christina, Anna Magdalena, Maria Juliana, Heinrich Friedrich, Joachim Albrecht



title: An example of a possible essay.
date: "2023-12-03"
color: "blue"
author: Giacomo Nanni
isPublic: true
lang: en
description: "Lorem ipsum dolor sit amet, consectetur adipiscing. Sed vel augue viverra, suscipit nisi sagittis, molestie neque."
cover: "<https://uclab.fh-potsdam.de/refa-catalog/files/large/c70c26ab79548a46866fc31bf517afc08127c66.jpg>"



Lorem ipsum dolor sit amet, consectetur adipiscing[elit] (item/9790). Sed vel augue viverra, suscipit nisi sagittis, molestie neque. Fusco tincidunt quam non metus luctus ultrices. Etiam ullamcorper, sapien non lacinia scelerisque, diam diam ultrices nisi, accumsan ornare massa velit a eros. Suspendisse condimentum lectus leo, vel convallis velit ornare id. [Fusco](item/7740) at ipsum non turpis fermentum fermentum. Curabitur convallis erat id ante maximus porttitor. Sed gravida interdum efficitur. Praesent tincidunt quam elit.

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Künstlerische Datenvisualisierung

Artistic Data Visualization: Beyond Visual Analytics

Fernanda B. Viégas and Martin Wattenberg

Visual Communication Lab, IBM Research, 1 Rogers St,
Cambridge, MA 02142, USA
{viegasf, mwatten}@us.ibm.com

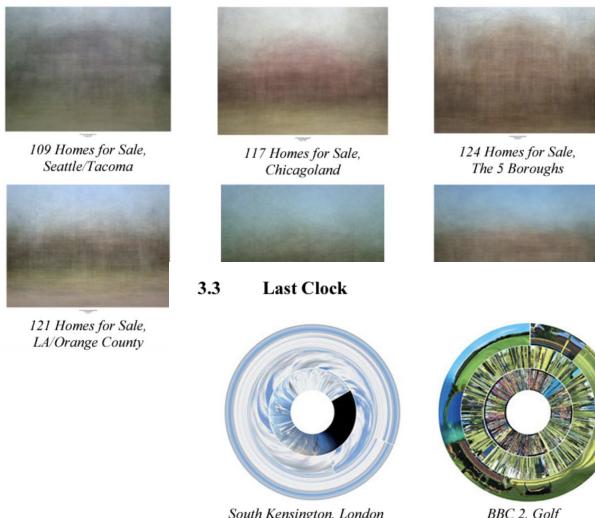


Fig. 6. *Last Clock*, by Jussi Ängeslevä & Ross Cooper.

Abstract. Information visualization is traditionally viewed as a tool for data exploration and hypothesis formation. Because of its roots in scientific reasoning, visualization has traditionally been viewed as an analytical tool for sensemaking. In recent years, however, both the mainstreaming of computer graphics and the democratization of data sources on the Internet have had important repercussions in the field of information visualization. With the ability to create visual representations of data on home computers, artists and designers have taken matters into their own hands and expanded the conceptual horizon of infovis as artistic practice. This paper presents a brief survey of projects in the field of artistic information visualization and a preliminary examination of how artists appropriate and repurpose “scientific” techniques to create pieces that actively guide analytical reasoning and encourage a contextualized reading of their subject matter.

Keywords: Visualizatio

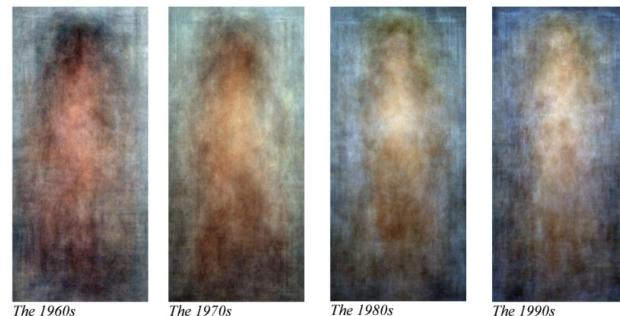
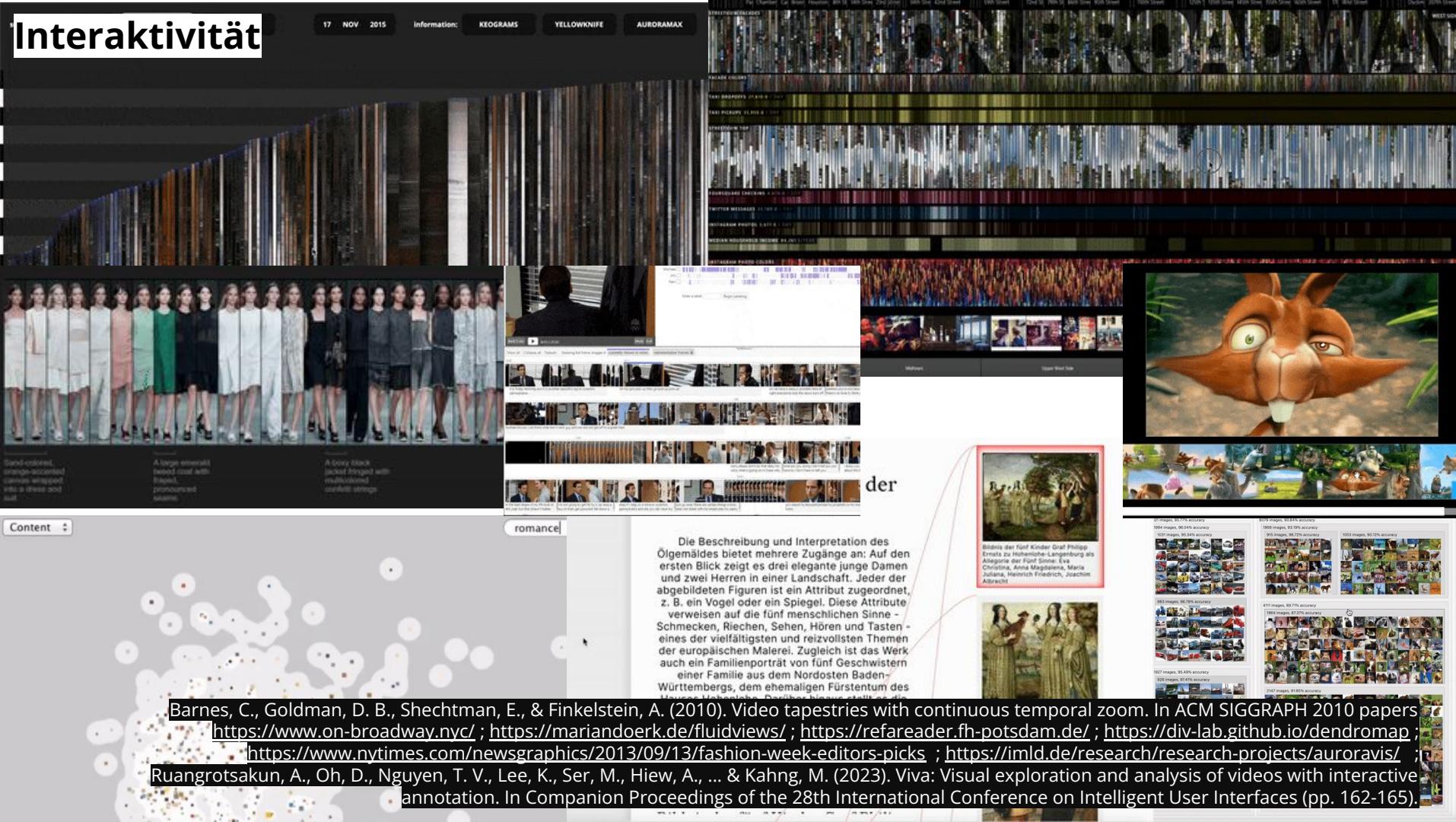


Fig. 3. *Every Playboy Centerfold, The Decades (normalized)*, by Jason Salavon

Viégas, F. B., & Wattenberg, M. (2007). Artistic data visualization: Beyond visual analytics. In Online Communities and Social Computing: Second International Conference, OCSC 2007, Held as Part of HCI International 2007, Beijing, China, July 22-27, 2007. Proceedings 2 (pp. 182-191). Springer Berlin Heidelberg.

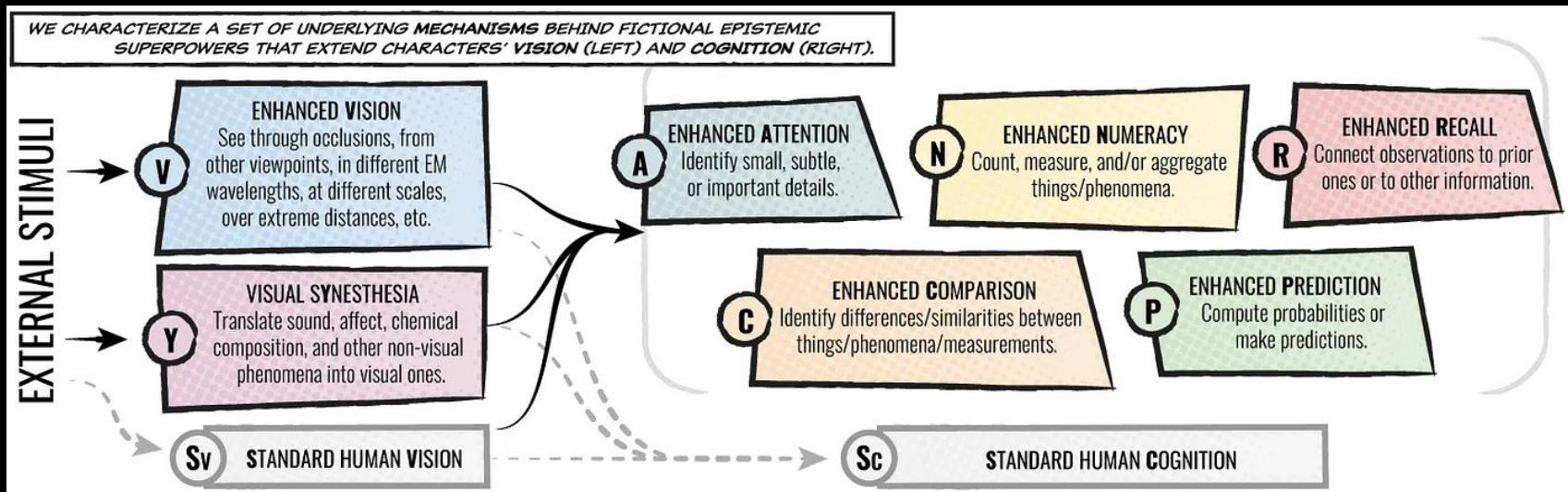
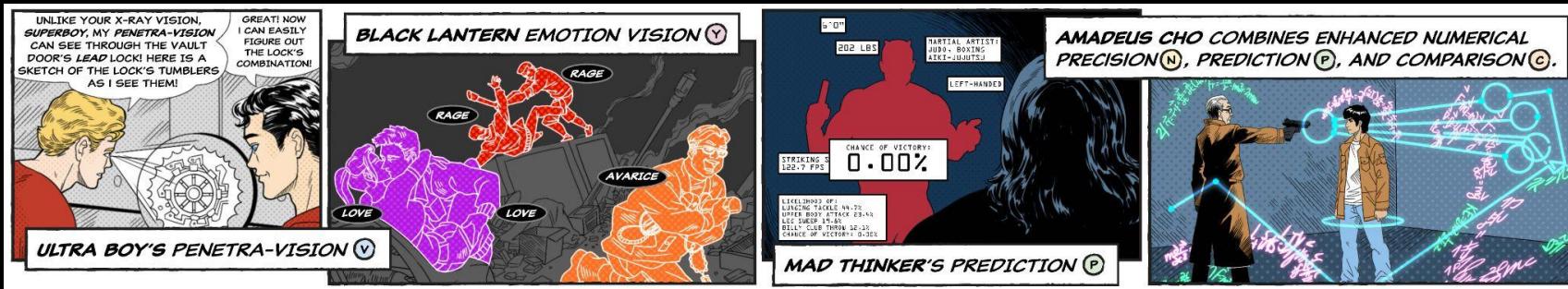


Flickr Flow: Fernanda Viégas

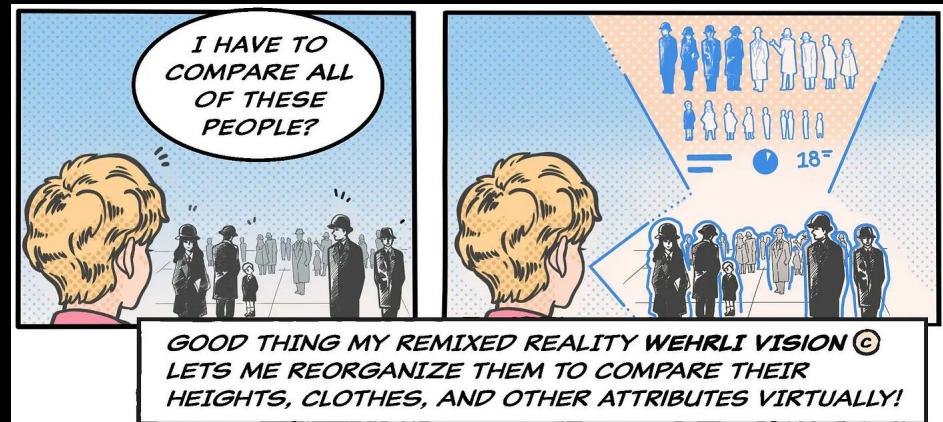
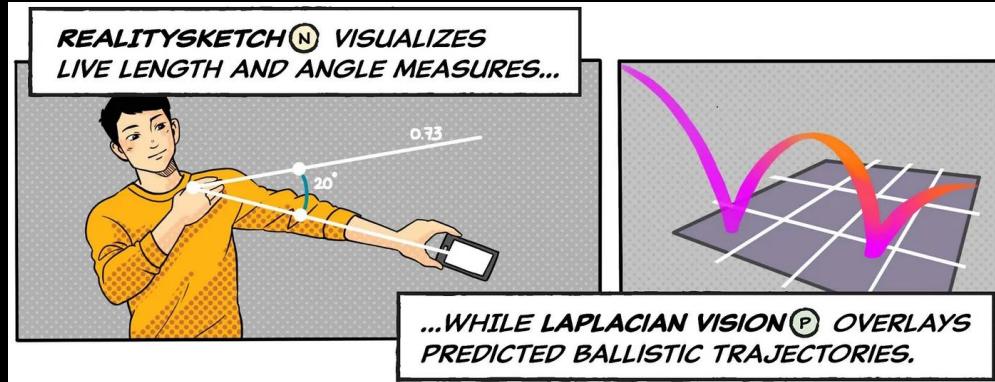


(Kritische) Datenpraktiken

Visualisierung als Superkraft



Visualisierung als Superkraft



Visualisierung genutzt von Superschurken



Willett, W., Aseniero, B. A., Carpendale, S., Dragicevic, P., Jansen, Y., Oehlberg, L., & Isenberg, P. (2021). Perception! immersion! empowerment! superpowers as inspiration for visualization. *IEEE transactions on visualization and computer graphics*, 28(1), 22-32.

Können Daten objektiv sein?

»Visualizations are interpretative translations, but they pass themselves off as images of data.«

»Data are capta, taken not given, constructed as an interpretation of the phenomenal world, not inherent in it.«

- Johanna Drucker

The Persuasive Power of Data Visualization

Anshul Vikram Pandey, Anjali Manivannan,
Oded Nov, Margaret Satterthwaite, and Enrico Bertini, *Member, IEEE*

Abstract—Data visualization has been used extensively to inform users. However, little research has been done to examine the effects of data visualization in influencing users or in making a message more persuasive. In this study, we present experimental research to fill this gap and present an evidence-based analysis of persuasive visualization. We built on persuasion research from psychology and user interfaces literature in order to explore the persuasive effects of visualization. In this experimental study we define the circumstances under which data visualization can make a message more persuasive, propose hypotheses, and perform quantitative and qualitative analyses on studies conducted to test these hypotheses. We compare visual treatments with data presented through barcharts and linecharts on the one hand, treatments with data presented through tables on the other, and then evaluate their persuasiveness. The findings represent a first step in exploring the effectiveness of persuasive visualization.

Index Terms—Persuasive visualization, elaboration likelihood model, evaluation



Daten sind persönlich

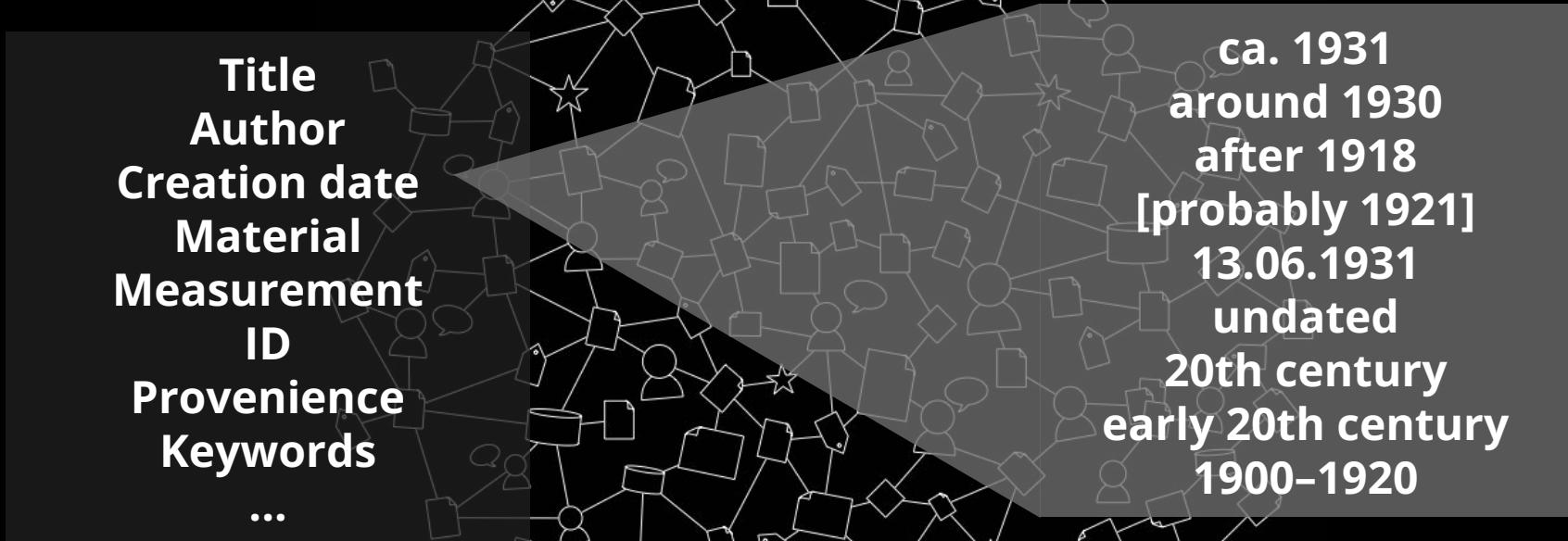
ABSTRACT

Many of the guidelines that inform how designers create data visualizations originate in studies that unintentionally exclude populations that are most likely to be among the “data poor”. In this paper, we explore which factors may drive attention and trust in rural populations with diverse economic and educational backgrounds - a segment that is largely underrepresented in the data visualization literature. In 42 semi-structured interviews in rural Pennsylvania (USA), we find that a complex set of factors intermix to inform attitudes and perceptions about data visualization - including educational background, political affiliation, and personal experience. The data and materials for this research can be found at <https://osf.io/uxwts/>

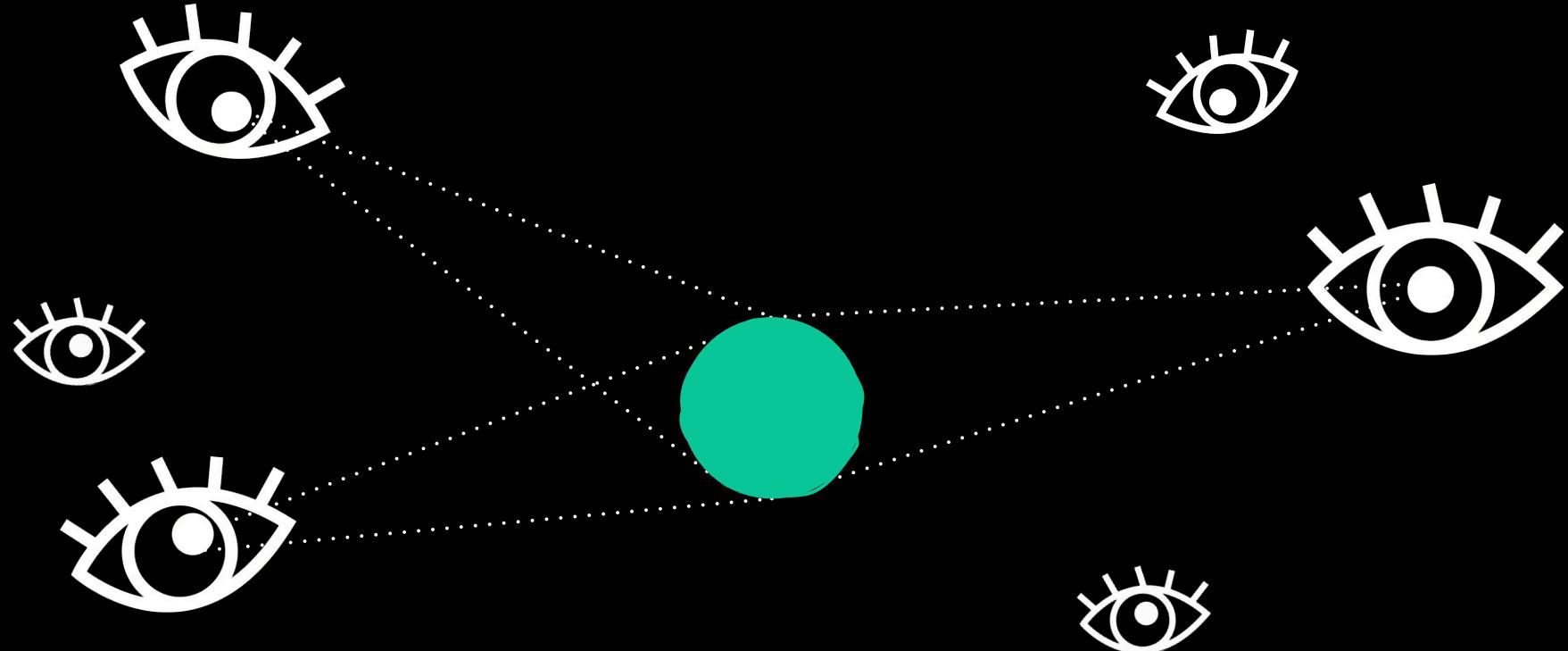


Figure 4: The graphs shown to participants. Each graph was presented on an independent sheet of paper

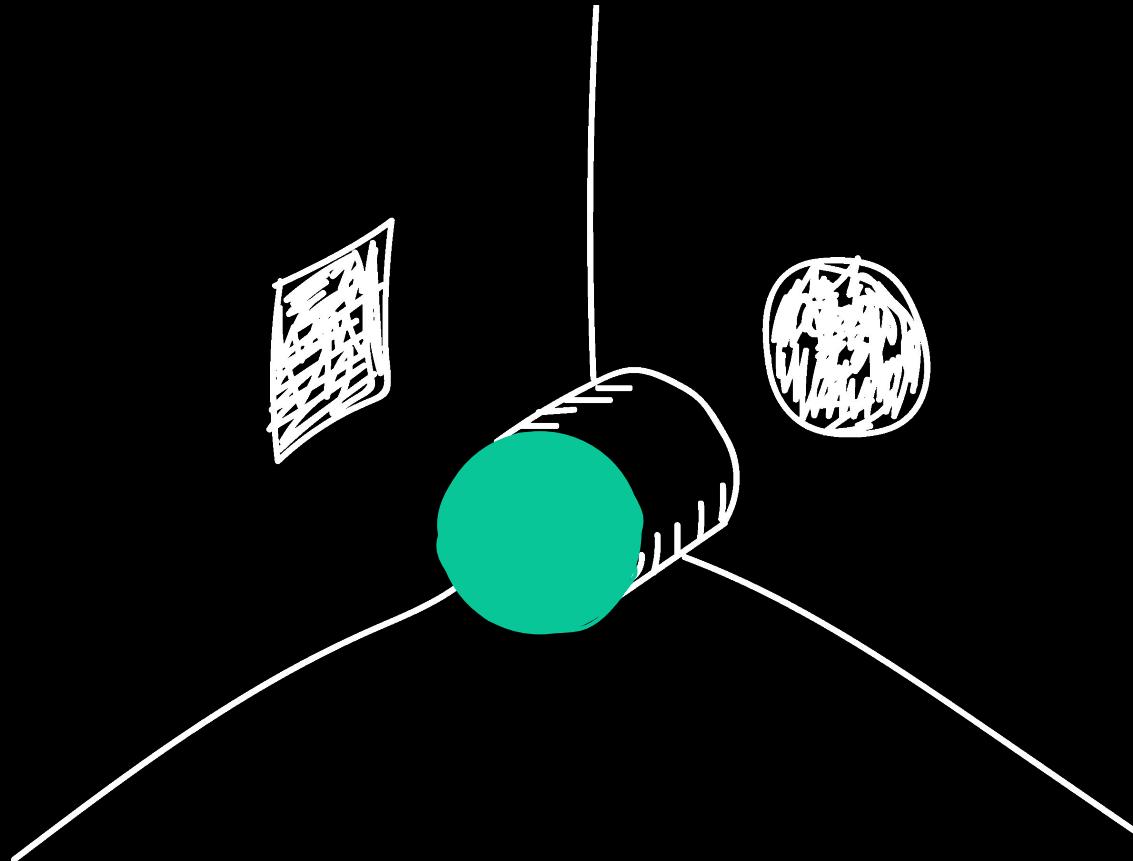
Unpräzise, unvollständige, unstrukturierte und fehlerhafte Daten



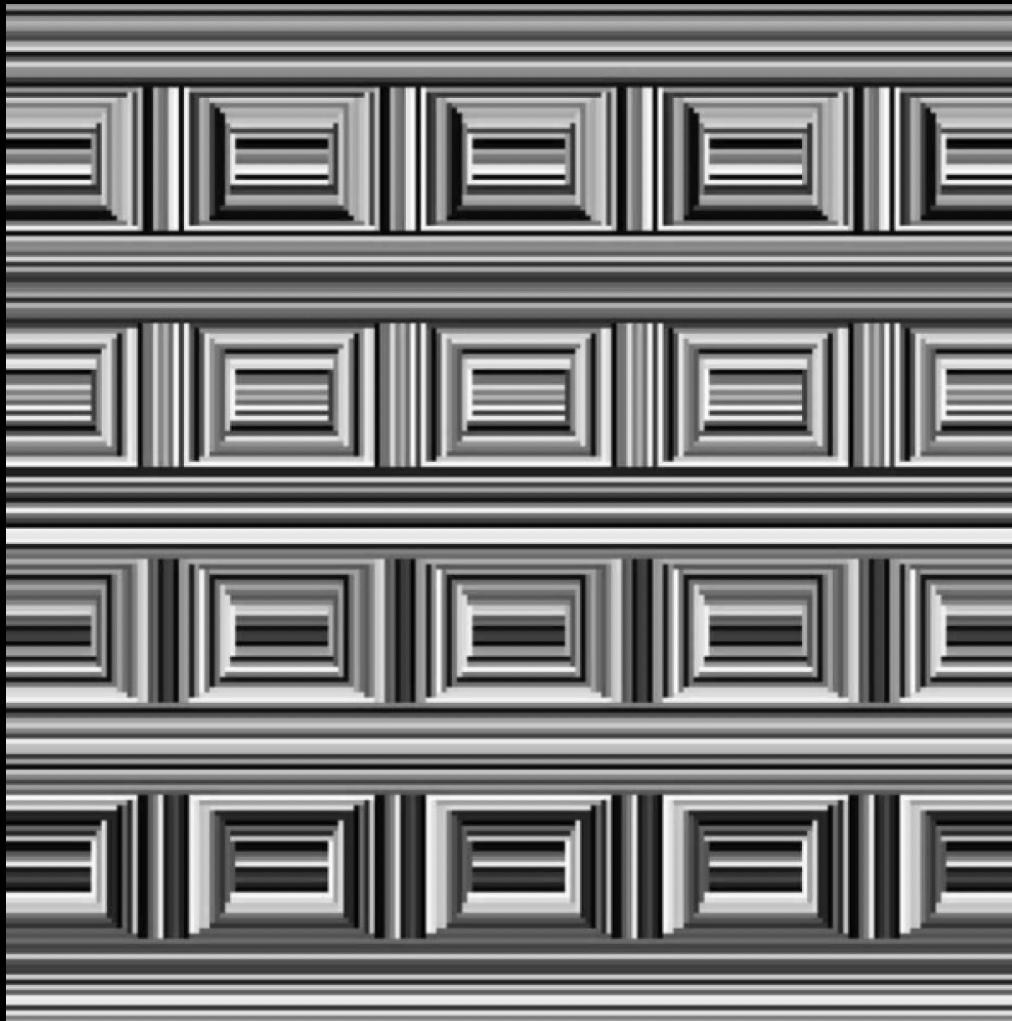
Perspektive und Situiertheit



Perspektive und Situiertheit



Was sieht man?



Kulturelle Unterschiede der visuellen Wahrnehmung

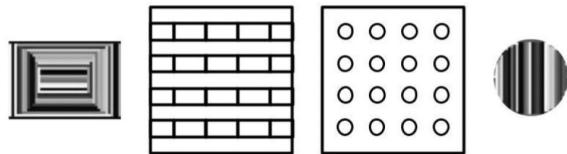
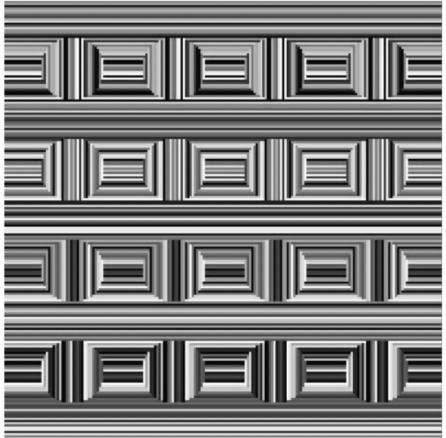


Fig. 1. The Coffer illusion (6), above, and cut-outs and schematics of the two percepts in the Coffer illusion, rectangular (left) and circular (right), below.

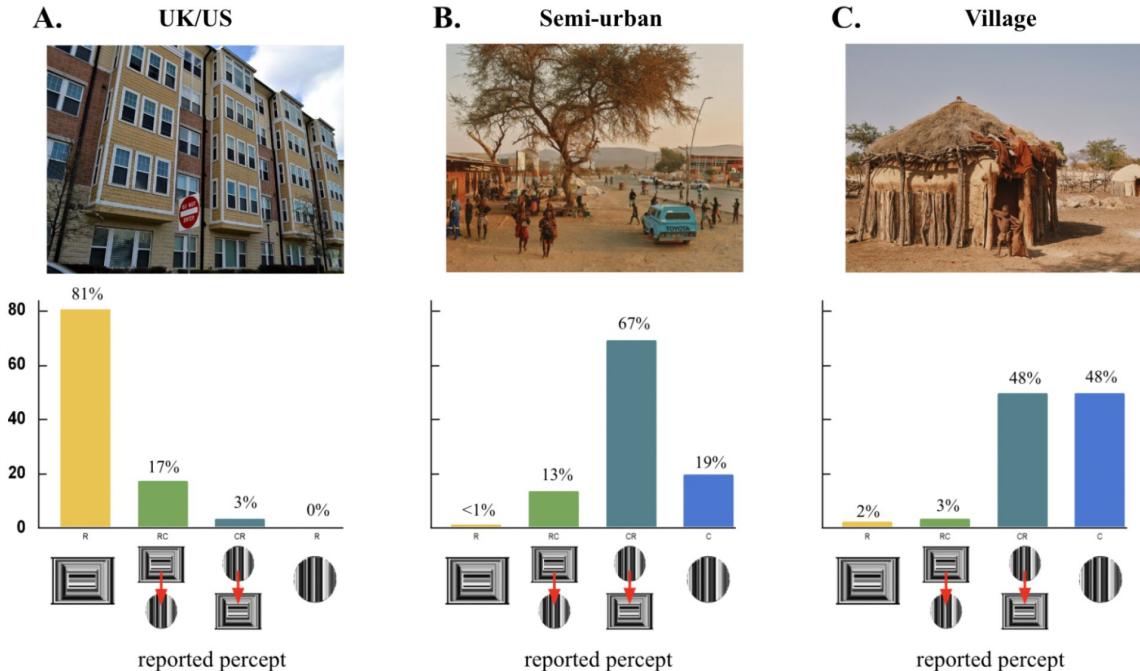
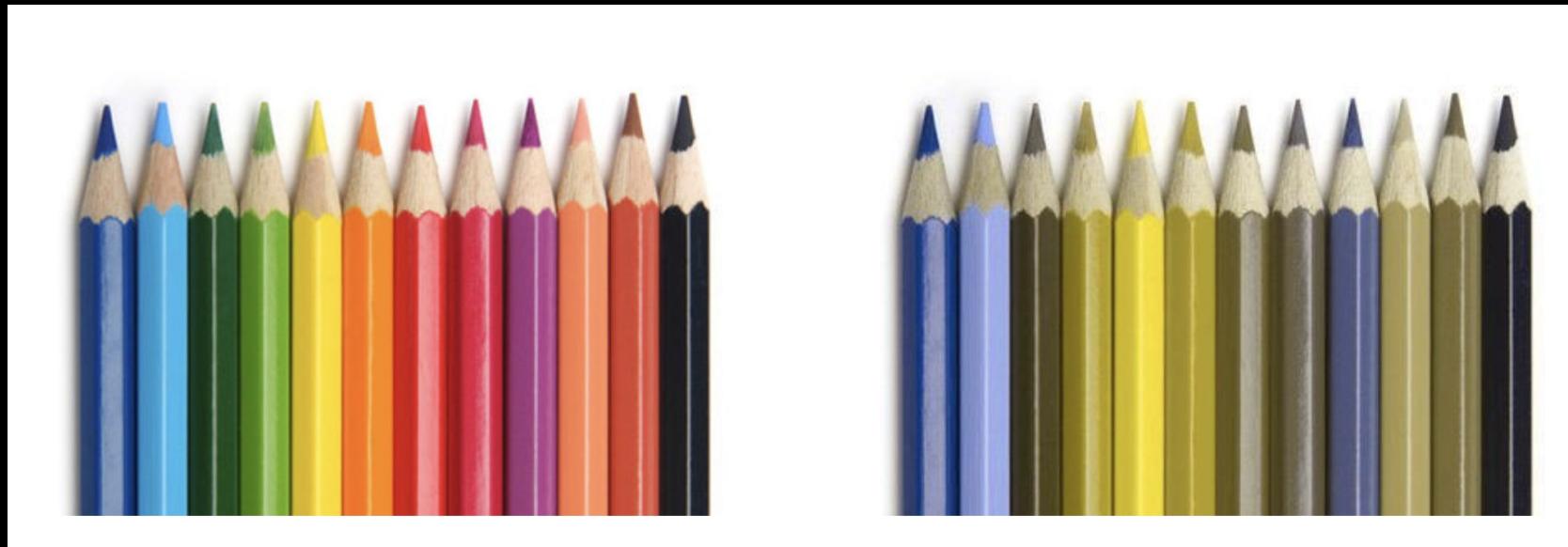


Fig. 2. Proportion of participants responding in one of the four patterns on the Coffer illusion across three samples (UK/US, semi-urban town, rural villages, respectively) in Experiment 1. Response types from left to

Zugänglichkeit und Barrierefreiheit

»Color blindness (color vision deficiency, or CVD) affects approximately **1 in 12 men (8%)** and **1 in 200 women (0.5%)**.«



Zugänglichkeit und Barrierefreiheit

»According to recent research in 2017, around 36 million people were estimated to be blind (**~0.4% of the global population**), while approximately 217 million people had moderate to severe visual impairment (**~3%**). The numbers are growing with the growth and aging of the world's population. The increasing barriers to access visualizations can widen the information gap for the blind and visually impaired.«



Visuelle Verzierungen und »Chartjunk«

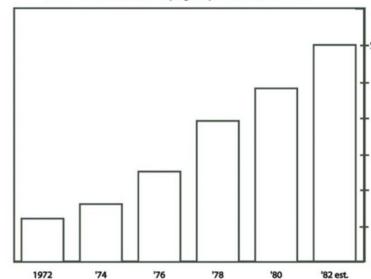
MONSTROUS COSTS

Total House and Senate campaign expenditures, in millions



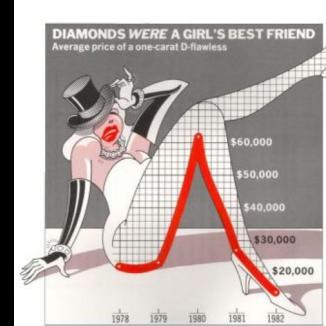
MONSTROUS COSTS

Total House and Senate campaign expenditures, in millions



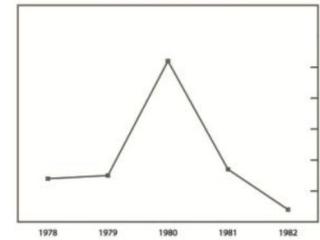
DIAMONDS WERE A GIRL'S BEST FRIEND

Average price of a one-carat D-flawless



DIAMONDS WERE A GIRL'S BEST FRIEND

Average price of a one-carat D-flawless



Bateman, S., Mandryk, R. L., Gutwin, C., Genest, A., McDine, D., & Brooks, C. (2010, April). Useful junk? The effects of visual embellishment on comprehension and memorability of charts. In Proceedings of the SIGCHI conference on human factors in computing systems (pp. 2573-2582).

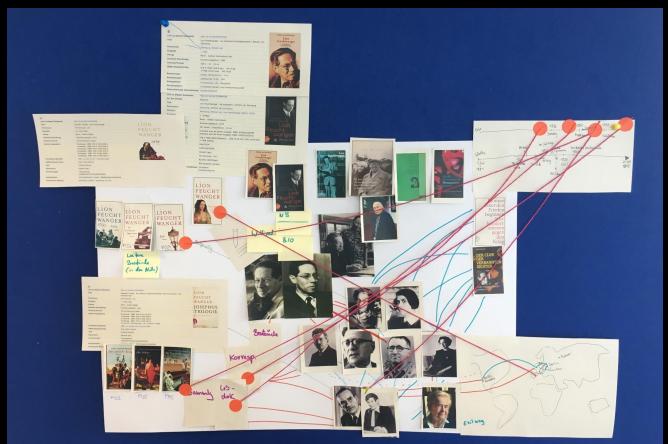
Lücken zwischen den Zahlen



»What are we making inherently unknowable by making the world more measurable, familiar, and predictable?« – Romi Morrison

Morrison, Romi Ron "Gaps Between the Digits: On the Fleshy Unknowns of The HUMAN", Information Visualization, Information Design Journal (25:1). Fall 2019

Co-design



Dörk, M., Müller, B., Stange, J.-E., Herseni, J., and Dittrich, K. (2020). Co-designing visualizations for information seeking and knowledge management. Open Information Science, 4:217–235. <https://dx.doi.org/10.1515/opis-2020-0102>

Datenfeminismus



Datenhumanismus

DATA HUMANISM

SMALL / big data

data bandwidth / **QUALITY**

imperfect / infallible data

subjective / impartial data

INSPIRING / descriptive data

SERENDIPITOUS / predictive data

data conventions / POSSIBILITIES

data to simplify complexity / DEPICT

data processing / DRAWING



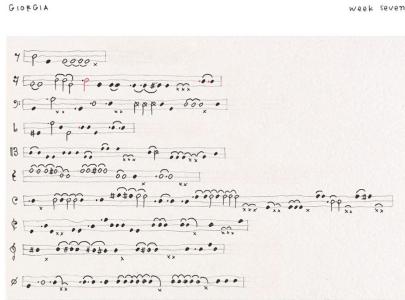
SPEND save / time with

data is numbers / **PEOPLE**

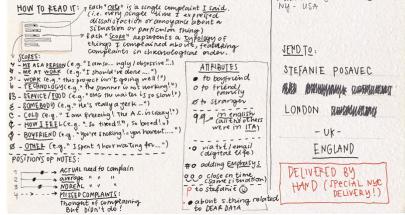
data will make us more efficient / **HUMAN.**

Dear Data

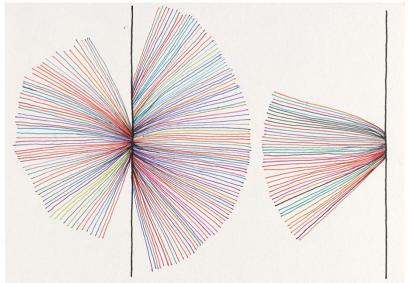
GIORGIA



"DEAR DATA
WEEK 07: MUSICAL COMPLAINTS

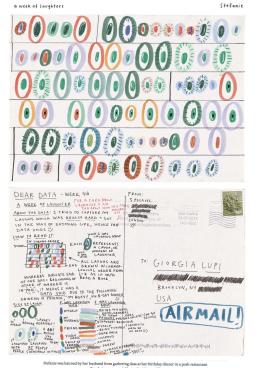
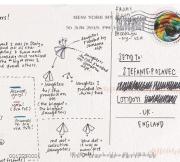


A WEEK OF COMPLAINTS



Stefanie

DEAR DATA - WEEK 07
A WEEK OF COMPLAINTS
HOW TO READ IT: (I'M SORRY! I'M AFRAID! I'M SICK! I'M SAD! I'M COLD! I'M HUNGRY! I'M TIRED! I'M ALONE!)



Dear Data (Giorgia Lupi & Stefanie Posavec)
<http://www.dear-data.com/theproject>

Data humanism, Giorgia Lupi :
<https://vimeo.com/241617101>

Daten, Ressourcen & Tools

CSV (Comma-Separated Values)

	A	B	C	D	E
1	source	target	Beziehung	Beziehungs-Property	Richtung (ungerichtet, unidirektional)
2	Goltz, Friedrich Leopold	Physiologe	Beruf		ungerichtet
3	Goltz, Friedrich Leopold	Anatomisches Institut Universität I	Affiliation		ungerichtet
4	Goltz, Friedrich Leopold	Physiologisches Institut Universitä	Affiliation		ungerichtet
5	Goltz, Friedrich Leopold	Physiologisches Institut Universitä	Affiliation		ungerichtet
6	Goltz, Friedrich Leopold	Naturforscherversammlung	Konferenzbesuch		ungerichtet
7	Goltz, Friedrich Leopold	Medizin	Sachbegriff		ungerichtet
8	Goltz, Friedrich Leopold	Physiologie	Sachbegriff		ungerichtet
9	Goltz, Friedrich Leopold	Zentralnervensystem	Sachbegriff		ungerichtet
10	Goltz, Friedrich Leopold	Lokalisation seelischer Funktioner	Sachbegriff		ungerichtet
11	Goltz, Friedrich Leopold	Schrader, M.E.	beruflich	"Schüler"	bidirektional
12	Goltz, Friedrich Leopold	Ewald, Ernst Julius Richard	beruflich	"Schüler"	bidirektional
13	Goltz, Friedrich Leopold	Gaule, Justus	beruflich	"Schüler"	bidirektional
14	Goltz, Friedrich Leopold	Bethe, Albrecht	beruflich	"Schüler"	bidirektional
15	Goltz, Friedrich Leopold	Mehring, Joseph von	beruflich	"Schüler"	bidirektional
16	Goltz, Friedrich Leopold	Loeb, Jacques	beruflich	"Schüler"	bidirektional
17	Goltz, Friedrich Leopold	Freusberg, Adolf			
18	Goltz, Friedrich Leopold	Bickel, Adolf			
19	Goltz, Friedrich Leopold	Bethe, Albrecht			
20	Anatomisches Institut Universit	Königsberg			
21	Physiologisches Institut Univers	Halle			
22	Physiologisches Institut Univers	Straßburg			
23	Naturforscherversammlung	Hannover			
24	Wittich, Wilhelm Heinrich von	Physiologe			
25	Wittich, Wilhelm Heinrich von	Albertus-Universität zu Königs			
26	Wittich, Wilhelm Heinrich von	Naturforscherversammlung			

```

id,name,label,p.PerGender,p.PerDateApprox,p.PerDateStrict,p.EntityVariation
(DE-588)115568808,"Fritsch, Gustav",,[PerName],1,1838-1927,"","Fritsch,
(DE-588)116917423,"Hitzig, Eduard",,[PerName],1,1838-1907,06.02.1838-20.
(DE-588)117185930,"Munk, Hermann",,[PerName],1,1839-1912,03.02.1839-01.1
(DE-588)118800000,"Fick, Adolf",,[PerName],1,1829-1901,03.09.1829-21.08.
(DE-588)118896202,"Zuntz, Nathan",,[PerName],1,1847-1920,07.10.1847-22.0
(DE-588)119133628,"Loeb, Jacques",,[PerName],1,1859-1924,07.04.1859-11.0

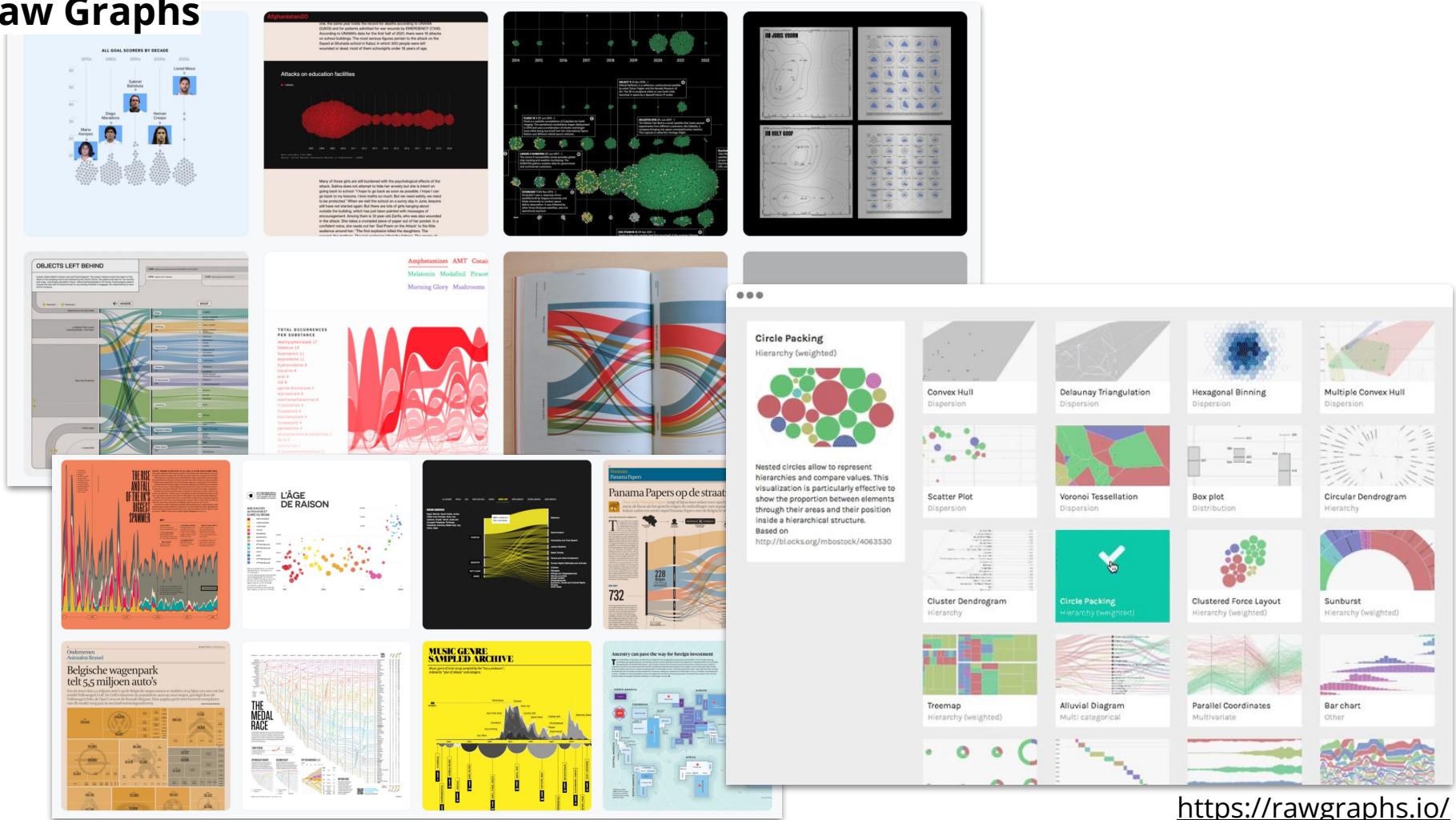
```

JSON (JavaScript Object Notation)

```
{  
  "data": [  
    {  
      "name": "Alice",  
      "age": 28,  
      "gender": "Female",  
      "salary": 65000,  
      "department": "Marketing"  
    },  
    {  
      "name": "Bob",  
      "age": 35,  
      "gender": "Male",  
      "salary": 80000,  
      "department": "Finance"  
    },  
    {  
      "name": "Charlie",  
      "age": 42,  
      "gender": "Male",  
      "salary": 95000,  
      "department": "Engineering"  
    }  
  ]  
}
```

```
{  
  "nodes": [  
    {"id": "Myriel", "group": 1},  
    {"id": "Napoleon", "group": 1},  
    {"id": "Mlle.Baptistine", "group": 1},  
    {"id": "Mme.Magloire", "group": 1},  
    {"id": "CountessdeLo", "group": 1},  
    {"id": "Geborand", "group": 1},  
    {"id": "Champtercier", "group": 1},  
    {"id": "Cravatte", "group": 1}  
  ],  
  "links": [  
    {"source": "Napoleon", "target": "Myriel", "value": 1},  
    {"source": "Mlle.Baptistine", "target": "Myriel", "value": 8},  
    {"source": "Mme.Magloire", "target": "Myriel", "value": 10},  
    {"source": "Mme.Magloire", "target": "Mlle.Baptistine", "value": 6},  
    {"source": "CountessdeLo", "target": "Myriel", "value": 1},  
    {"source": "Geborand", "target": "Myriel", "value": 1},  
    {"source": "Champtercier", "target": "Myriel", "value": 1},  
    {"source": "Cravatte", "target": "Myriel", "value": 1},  
    {"source": "Count", "target": "Myriel", "value": 2},  
    {"source": "OldMan", "target": "Myriel", "value": 1},  
    {"source": "Valjean", "target": "Labarre", "value": 1}  
  ]  
}
```

Raw Graphs



DataWrapper

1 Daten hochladen ✓ 2 Prüfen & Beschreiben ✓ 3 Visualisieren 4 Veröffentlichen & Einbetten

Diagramm-typ Anpassen Beschreiben Design

Hier Titel einfügen
Apple sales by product in shipped units, 2000 to 2017.

Bar Balken Balken (separat) Balken (gestapelt) Balken (gruppiert)

Bullet Balken Dot-Plot Intervalle Pfeile

Säulen Säulen (gruppiert) Säulen (gestapelt) Flächen

Linien Tortendiagramm Donut-diagramm Mehrere Torten

Mehrere Donuts

Apple stopped to report iPod sales at the end of 2014.

What kind of map do you want to create?

Choose the map type that fits your data:

Choropleth map
Color regions to show data like unemployment rates or election results on a map. Upload your own map or use any of our more than 3000 maps. The resulting map is responsive & interactive.

[Learn more about choropleth maps](#)

Symbol map
Create symbols sized and colored according to your data. Works great for specific locations (like cities). Upload your own map or use any of our more than 3000 maps. The resulting map is responsive & interactive.

[Learn more about symbol maps](#)

Locator map
Add markers to a map to show where something is located or happened, e.g. events within a city. Perfect for showing readers the places you mention in an article. The resulting map is responsive and static.

[Learn more about locator maps](#)

Chart type Refine Annotate Design

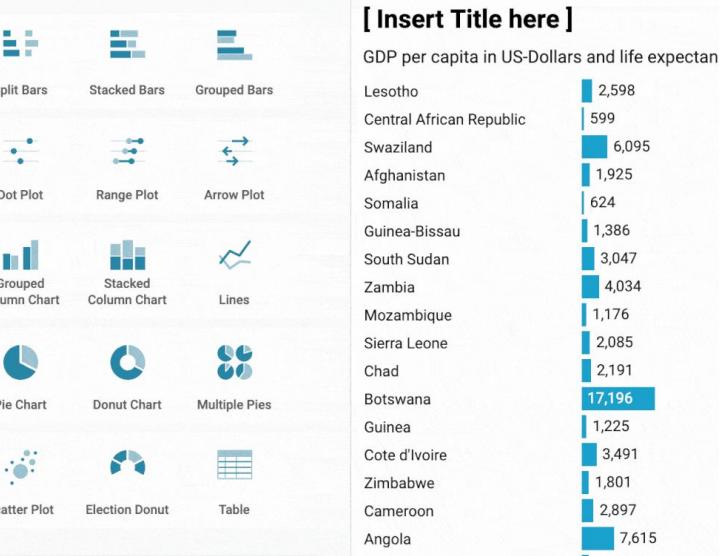
Bar Chart Split Bars Stacked Bars Grouped Bars

Bullet Bars Dot Plot Range Plot Arrow Plot

Column Chart Grouped Column Chart Stacked Column Chart Lines

Area Chart Pie Chart Donut Chart Multiple Pies

Multiple Donuts Scatter Plot Election Donut Table

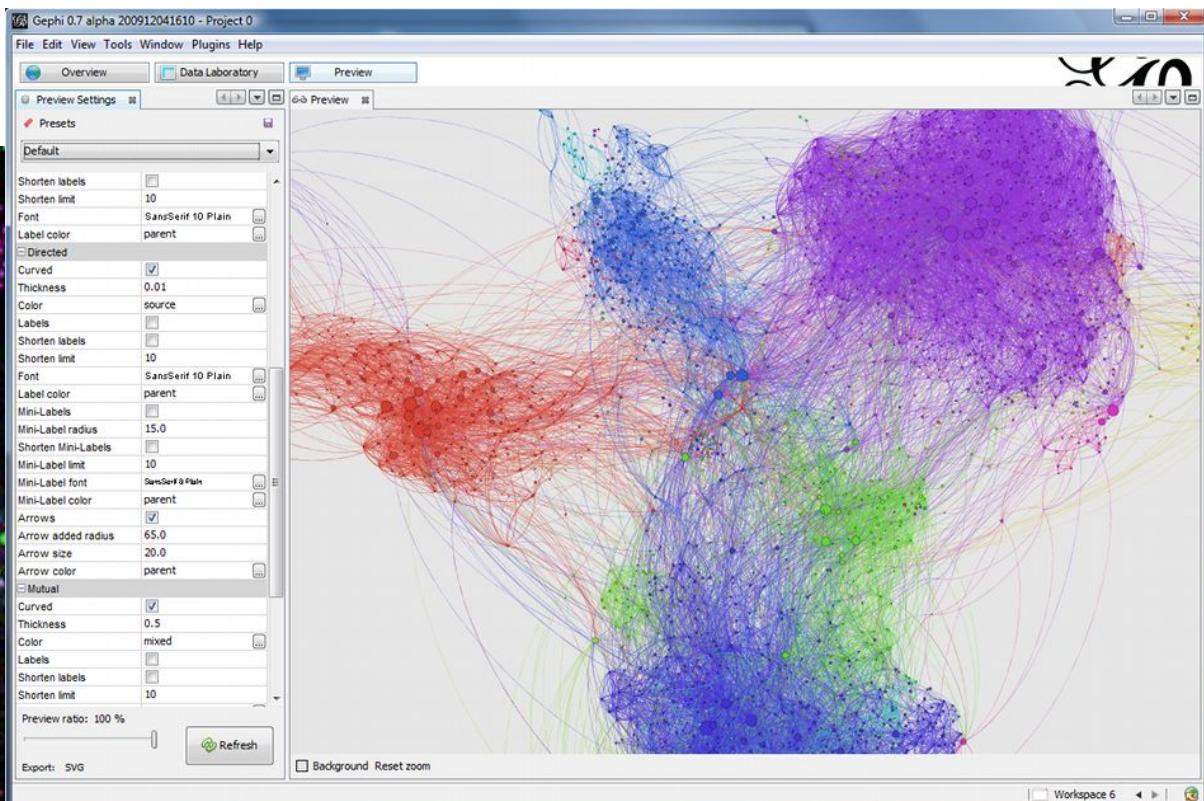


<https://app.datawrapper.de/>
<https://app.datawrapper.de/select/map>

Flourish Studio



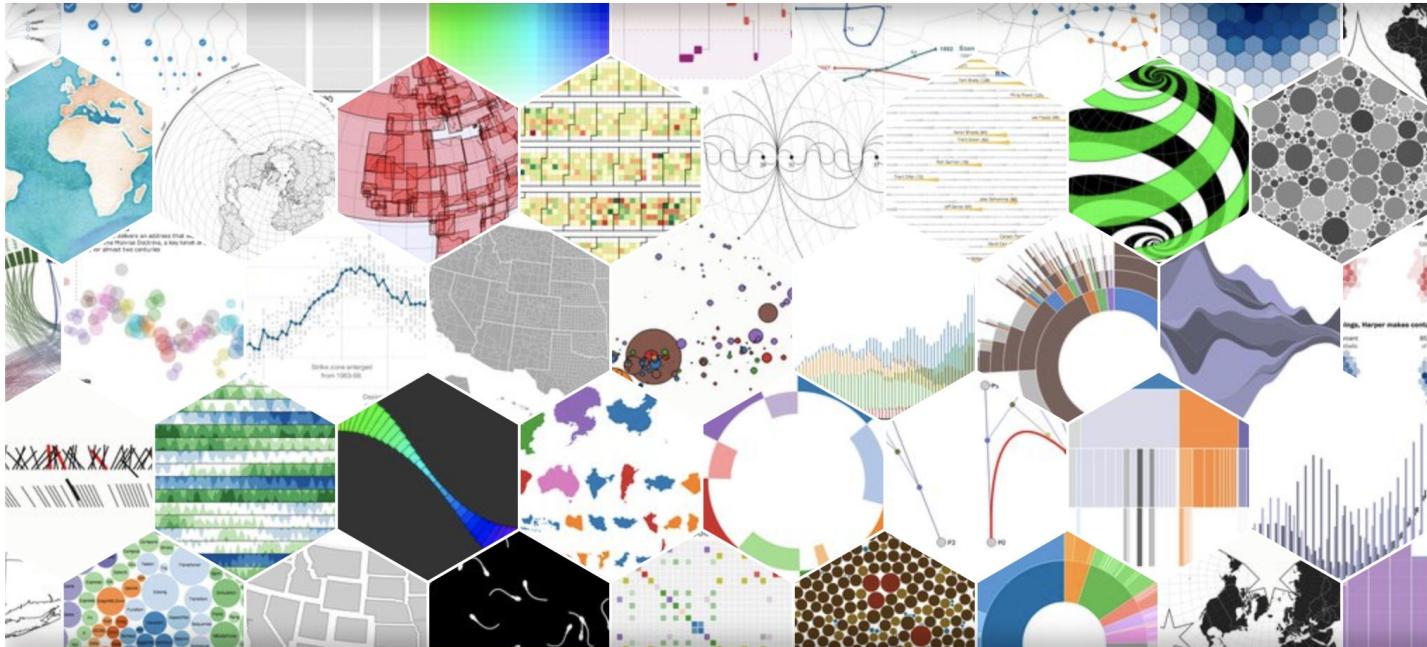
Gephi



<https://gephi.org>
<https://lite.gephi.org>



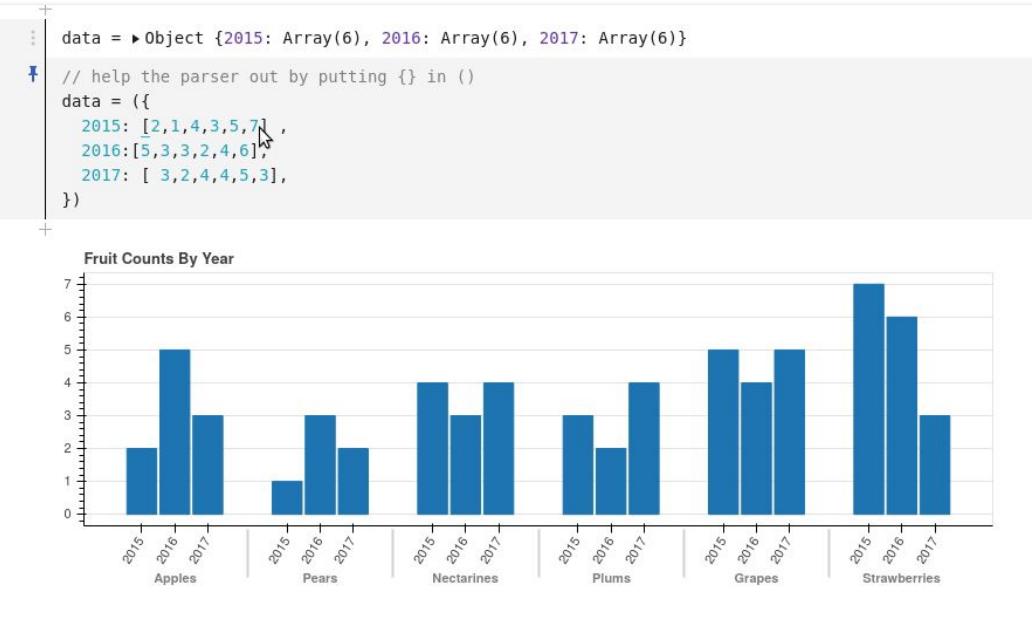
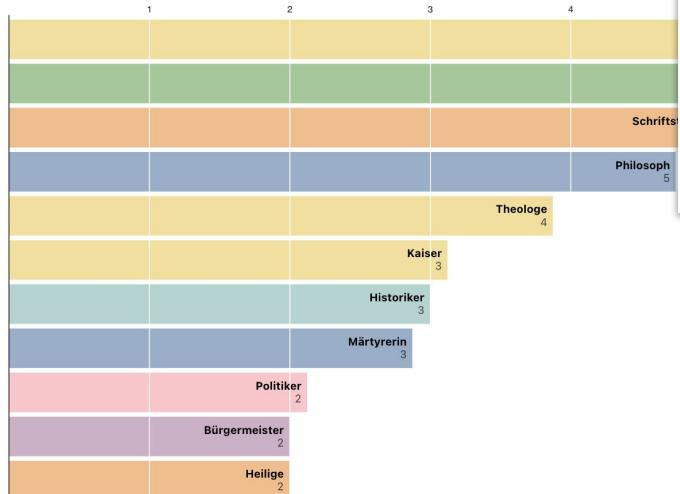
Data-Driven Documents



Observable

Top Topic Terms (~Professions) inside the GND throughout History

Number of relations of top topic terms (mostly professions) to persons recorded in the GND (Integrated Authority File) over history --> project #sonaridh
Bar chart race template by @mbostock



<https://observablehq.com>

Visualization Technique Catalog

ALL FAMILY INPUT FUNCTION SHAPE by **ferdio** hire us!

1 dataset. 100 visualizations.
Discover data viz applied to real data in our latest project!

The Data Visualisation Catalogue

About · Blog · Shop · Resources

Español Français Русский Türkçe 中文

Search by Function View by List

www.Datavizproject.com

www.Datavizcatalogue.com

Vis Tools

VISBROWSER		ADD A TOOL	ABOUT	Search							
AVAILABILITY		PROGRAMMING SKILLS		PLATFORM		FEATURES		TYPE OF DATA		VISUALIZATION	
36 Free	30 Open source	25 None	12 Javascript	18 Apple	21 Windows	24 Web-publishing	34 Numeric	12 Networks	27 Maps		
20 Paid		7 Python	2 Java	12 Linux	24 Web	27 File exports	27 Geographic	33 Basic charts			
		11 Other	1 Matlab	8 Library	1 Other	12 Other	11 Wizard	30 Temporal	14 Text		
		4 R	0 R			9 PDF Export	0 Wizard	18 Other	6 Network	18 Advanced charts	
								17 Other	16 Storytelling		

COLORBREWER 2.0

color advice for cartography

COLORBREWER
<https://colorbrewer2.org/>
Intended for use as a diagnostic tool for evaluating the robustness of individual colour schemes.

IWANTHUE

<https://medialab.github.io/iwanthue/>
Colors for data scientists. Generate and refine palettes of optimally distinct colors.

RSTUDIO

<https://rstudio.com/>
RStudio is an integrated development environment for R, a programming language for statistical computing and...

CHARTBLOCKS

<https://www.chartblocks.com/en/>
Build a chart in minutes in the easy to use chart designer, choosing from dozens of chart types and then...

GEPHI

<https://gephi.org/>
Gephi is an open-source network analysis and visualization software package written in Java on the NetBeans...

DATAVISUAL

DATAVIZ

DATAVIZ

Colors

COLORBREWER 2.0 color advice for cartography

Number of data classes: 7 how to use updates downloads credits

Nature of your data:
 sequential diverging qualitative

Pick a color scheme:
Multi-hue:
Single hue:
Multi-hue:
7-class BuGn

Only show:
 colorblind safe
 print friendly
 photocopy safe

Context:
 roads
 cities
 borders

Background:
 solid color
 terrain
 color transparent

VIZ PALETTE By Elijah Meeks & Susie Lu

PICK

Use Chroma.js Add Replace

Use Categorical Use Colorbrewer

Source code Back to Flash version Back to Colorbrewer

EDIT

7 Colors Add * hex #rgb * hsl

String (queries Object with metadata)
* color* color* color* color* color* color* color*

GET

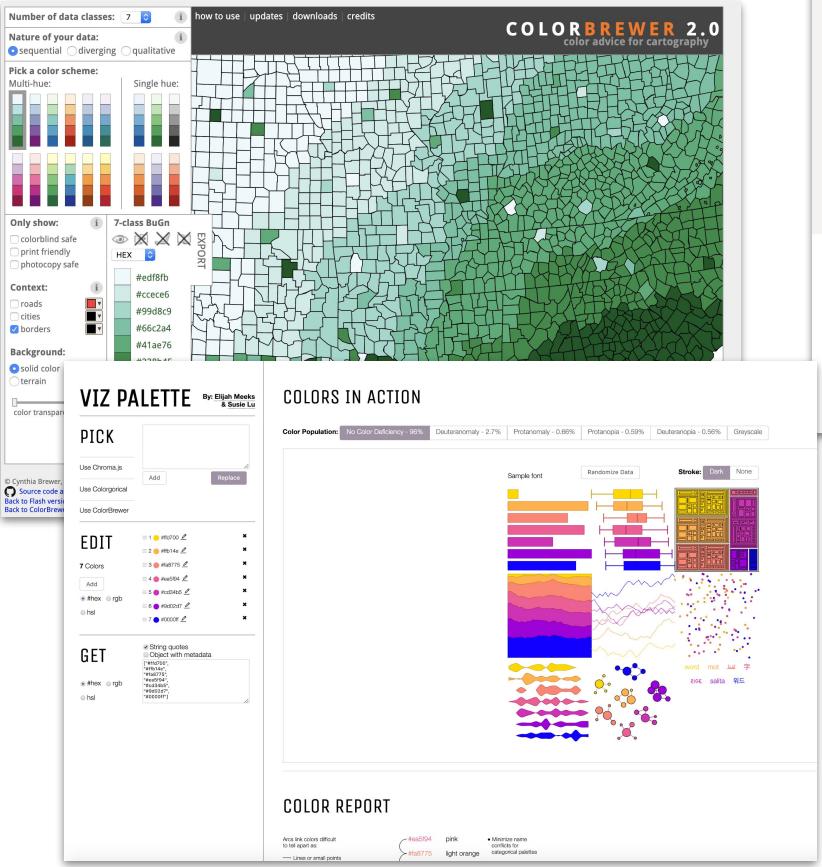
* hex * rgb * hsl

COLOR REPORT

Area ink colors difficult to tell apart as
— Lines or small points

#eaf8fb pink
#f9a777 light orange

• Minimize name conflicts for categorical palettes



i want hue

Colors for data scientists. Generate and refine palettes of optimally distinct colors.

Color space

All colors H: 0 C: 35.0 L: 0 Improve for the colorblind (slow) Dark background

Palette

5 colors hard (Force vector) Reroll palette Sort by diff hue chroma lightness random

<https://colorbrewer2.org>
<https://projects.susielu.com/viz-palette>
<https://medialab.github.io/iwanthue/>
<https://artsexperiments.withgoogle.com/artpalette>

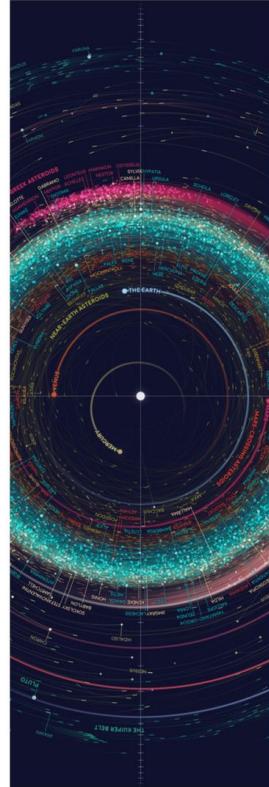
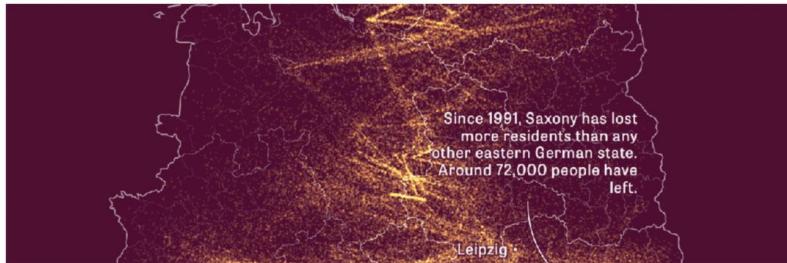
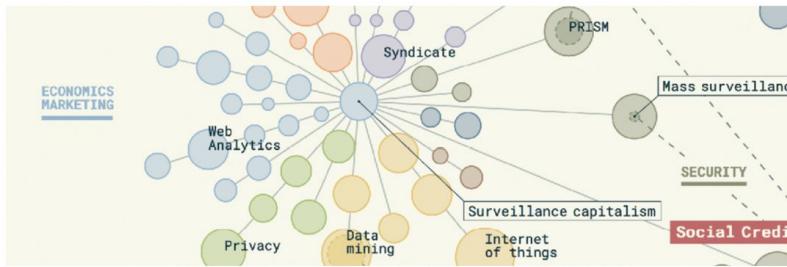
VIS Pubs (with publications from IEEE Vis, ACM CHI & Eurovis)

The screenshot shows a web application interface for managing and displaying research publications. At the top, there's a navigation bar with tabs for "VIS PUBLICATIONS" (selected), "ABOUT", and other icons for search, export, and settings. Below the header is a search bar with the placeholder "Search (Title, Author, Abstract)" and a dropdown menu currently set to "film". To the right of the search bar are buttons for font size adjustment (Aa), a refresh icon, and a close button (X). Further right are buttons for "21 papers" and "EXPORT".

The main content area lists 21 publications, each with a title, authors, and a link to its source. The publications are ordered by date:

- Understanding Narrative Linearity for Telling Expressive Time-Oriented Stories (Xingyu Lan, Xinyue Xu, Nan Cao) - CHI, 2021 [6]
- Origraph: Interactive Network Wrangling (Alex Bigelow, Carolina Nobre, Miriah D. Meyer, Alexander Lex) - VAST, 2019 [7]
- VIAN: A Visual Annotation Tool for Film Analysis (Gaudenz Halter, Rafael Ballester-Ripoll, Barbara Flückiger, Renato Pajarola) - EuroVis, 2019 [8]
- Visualizing Nonlinear Narratives with Story Curves (Nam Wook Kim, Benjamin Bach, Hyejin Im, Sasha Schriber, Markus H. Gross, Hanspeter Pfister) - InfoVis, 2017 [9]
- Has Instagram Fundamentally Altered the 'Family Snapshot?' (Effie Le Moignan, Shaun W. Lawson, Duncan A. Rowland, Jamie Mahoney, Pam Briggs) - CHI, 2017 [10]
- EventAction: Visual analytics for temporal event sequence recommendation (Fan Du, Catherine Plaisant, Neil Spring, Ben Shneiderman) - VAST, 2016 [11]
- Visualization of personal history for video navigation (Abir Al Hajri, Gregor Miller, Matthew Fong, Sidney S. Fels) - CHI, 2014 [12]
- Small Multiples, Large Singles: A New Approach for Visual Data Exploration (Stef van den Elzen, Jarke J. van Wijk) - EuroVis, 2013 [13]
- ManyNets: an interface for multiple network analysis and visualization (Manuel Freire, Catherine Plaisant, Ben Shneiderman, Jennifer Golbeck) - CHI, 2010 [14]
- Visualization in the Einstein Year 2005: a case study on explanatory and illustrative visualization of relativity and astrophysics (Daniel Weiskopf, Marc Borchers, Thomas Ertl, Martin Falk, Oliver Fechtig, Regine Frank, Frank Grave, Andreas King, Ute Kraus, Thomas Müller, Hans-Peter Nollert, Isabel Rica Mendez, Hanns Ruder, Corvin Zahn, Michael Zatloukal, Tobias Schafhitzel, Sonja Schär) - VIS, 2005 [15]
- Exploding the frame: designing for wall-size computer displays (Ben Shedd) - InfoVis, 2003 [16]
- Real-world relativity: image-based special relativistic visualization - VIS, 2000 [17]

Information is Beautiful Awards



Kuratierte Ressourcen Liste

Data Visualization Resources

Authored by [Mark-Jan Bludau](#).

Data Visualization Technique Overviews:

- [The Data Viz Project](#)
- [The Data Visualisation Catalogue](#)
- [Xenographics – Weird but \(sometimes\) useful charts](#)

Tool Overviews:

- [The Chartmaker Directory by Visualising Data](#)
- [Vis Browser](#)

(Selected) Visualization Tools and Libraries:

- [Raw Graphs](#): A free and open source tool for data visualization. Almost 30 visual models to visualize quantities, hierarchies, time series and find insights in your data. Enables you to export your visualizations as svg and edit it afterwards in Illustrator or similar tools.
- [Datawrapper](#): Create interactive, responsive & beautiful data visualizations with the online tool Datawrapper – no code required. Widely used in Newsrooms and based in Berlin. Good to get fast insights into your data without coding.
- [Gephi](#): Gephi is one of the most common visualization and exploration softwares for all kinds of graph and network visualizations. It's open-source and free and doesn't require coding skills.
- [D3.js – Data driven documents](#): D3.js is a free, open-source JavaScript library for visualizing data. It's very widely used for interactive web-based visualizations and ideal for individualized approaches. It demands html, css, javascript and svg coding basics.
- [Observable](#): Data visualization notebook-based platform by the creator of D3.js.
- [Jupyter Notebooks + Python](#): Interactive coding based notebook environment for data analysis, visualization and general computation tasks.
- [R Studio](#): Development environment for statistical and data analysis and visualization.
- [Open Refine](#): OpenRefine is a powerful free, open source tool for working with messy data: cleaning it; transforming it from one format into another; and extending it with web services and external data.
- [Flourish](#): Tool for storytelling and data visualization.
- [Mapbox/Mapbox GL JS](#): Web-based maps.
- [Scrollytelling](#): Lightweight JavaScript library for scrolllytelling by the makers of Pudding.cool.
- [Cables.js](#): Cables is a web-based visual (node-based) programming tool that also supports sensor inputs and allows quick prototyping.
- [SVG Crowdbar](#): Chrome addon to extract generated SVGs from websites to afterwards edit them in tools like Illustrator.
- [Tabula](#): Extract data tables from pdfs.
- [QGIS](#): A Free and Open Source Geographic Information System software, for creation of maps, etc.
- [Interactive FlowCharts](#): Template for audio-narrated interactive flow charts.

Research (to find research papers it's easiest to use [Google Scholar](#)):

- Franconeri, S. L., Padilla, L. M., Shah, P., Zacks, J. M., & Hullman, J. (2021). [The science of visualization](#). *Journal of visualization and data analysis*, 2(1), 110–161.
- Willett, W., Aseniero, B. A., Carpendale, S., Dragicevic, P., Jansen, Y., Oehlberg, L., & Isenberg, P. (2017). [A survey of visualization design research](#). *IEEE transactions on visualization and computer graphics*, 28(1), 22–32.
- Kim, N., & Joyner, Shakila Cherise & Riegelhuth, Amalia & Kim, Y. (2021). [Accessible Visualization: Design and Evaluation](#). *IEEE transactions on visualization and computer graphics*, 28(1), 173–188. 10.1111/cgf.14298.
- Peck, E. M., Ayuso, S. E., & El-Etr, O. (2019, May). [Data is personal: Attitudes and perceptions of data privacy](#). In *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems* (pp. 1–12).
- Meyer, M., & Dykes, J. (2019). [Criteria for rigor in visualization design study](#). *IEEE transactions on visualization and computer graphics*, 26(12), 2211–2220.
- Pandey, A. V., Manivannan, A., Nov, O., Satterthwaite, M., & Bertini, E. (2014). [The persuasive power of visualization](#). *IEEE transactions on visualization and computer graphics*, 20(12), 2211–2220.
- there is much, much, more. Check out [Google Scholar](#)!

Data Resources:

- [Kaggle Datasets](#)
- [Google Data Search](#)
- [Statista](#)
- [World bank open data](#)
- [OpenStreetMap](#)
- Government websites (EU, Germany, states, cities...)

Community:

- [DataVis.berlin](#): Data Visualization Meetup and Overview of people doing DataVis in Berlin.
- [Mastodon vis.social](#): Mastodon visualization instance.
- [Information Is Beautiful Awards](#): International Data Visualization Awards
- [Malofiej Awards](#): Infographic Awards (paused since 2021)

Surveys:

- [Time Visualization Browser](#)
- [Geospatial-Network Visualization Browser](#)
- [Data Physicalizations](#)
- [Visualizing High-Dimensional Data](#)
- [Text Visualization Browser](#)
- [Dashboard Design Patterns](#)
- [Multivariate Network Visualizations](#)
- [Networks](#)
- [Tree Visualizations](#)

Tutorials:

- [D3 Basics – D3inDepth](#)
- [D3.js Getting Started – Observable](#)

Daten:

tinyurl.com/y6szw4wa

DataWrapper:

app.datawrapper.de/create/map

RawGraphs:

rawgraphs.io

Einführung in die Datenvisualisierung

Mark-Jan Bludau
markjanbludau.de / mail@markjanbludau.de