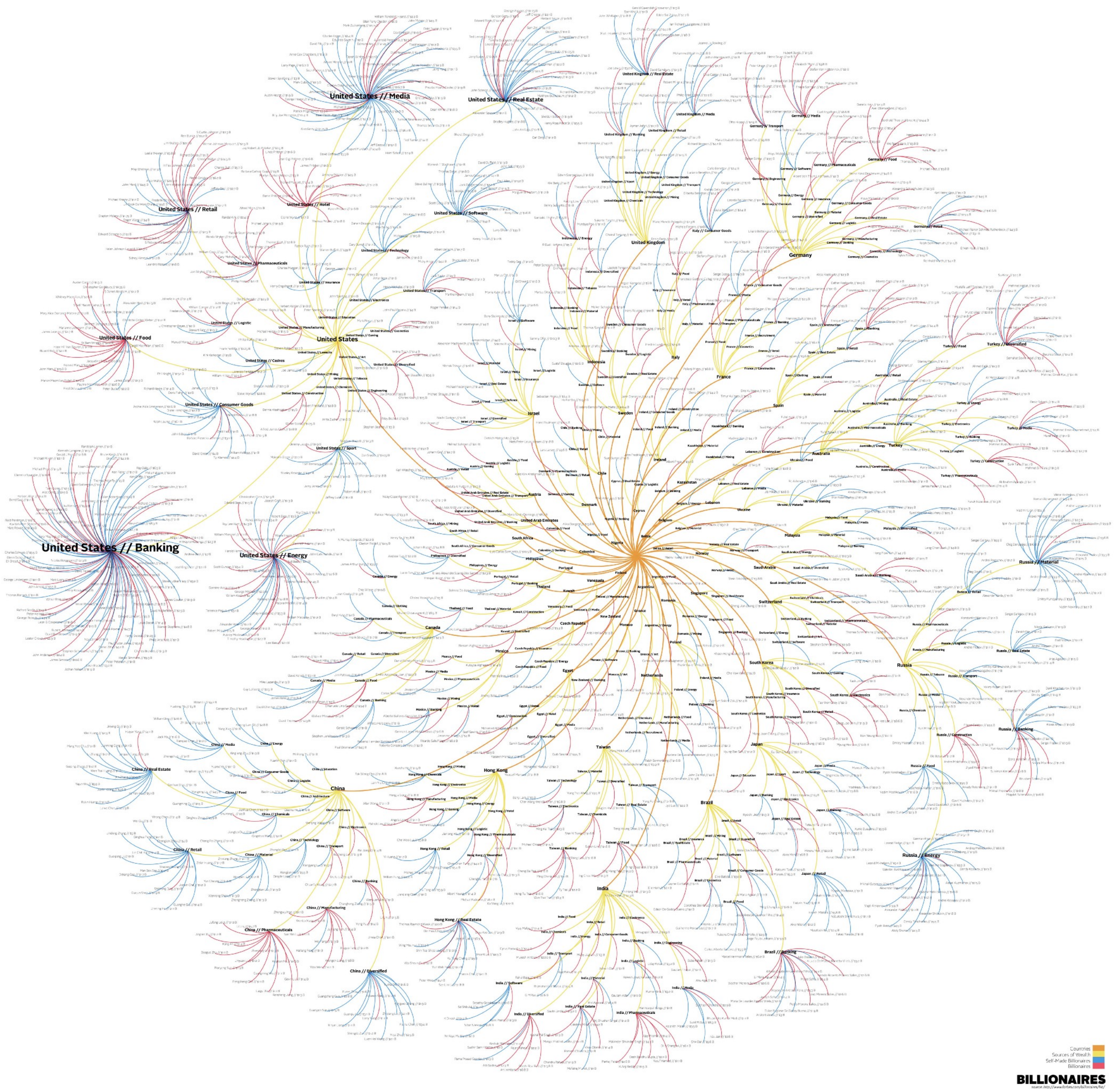
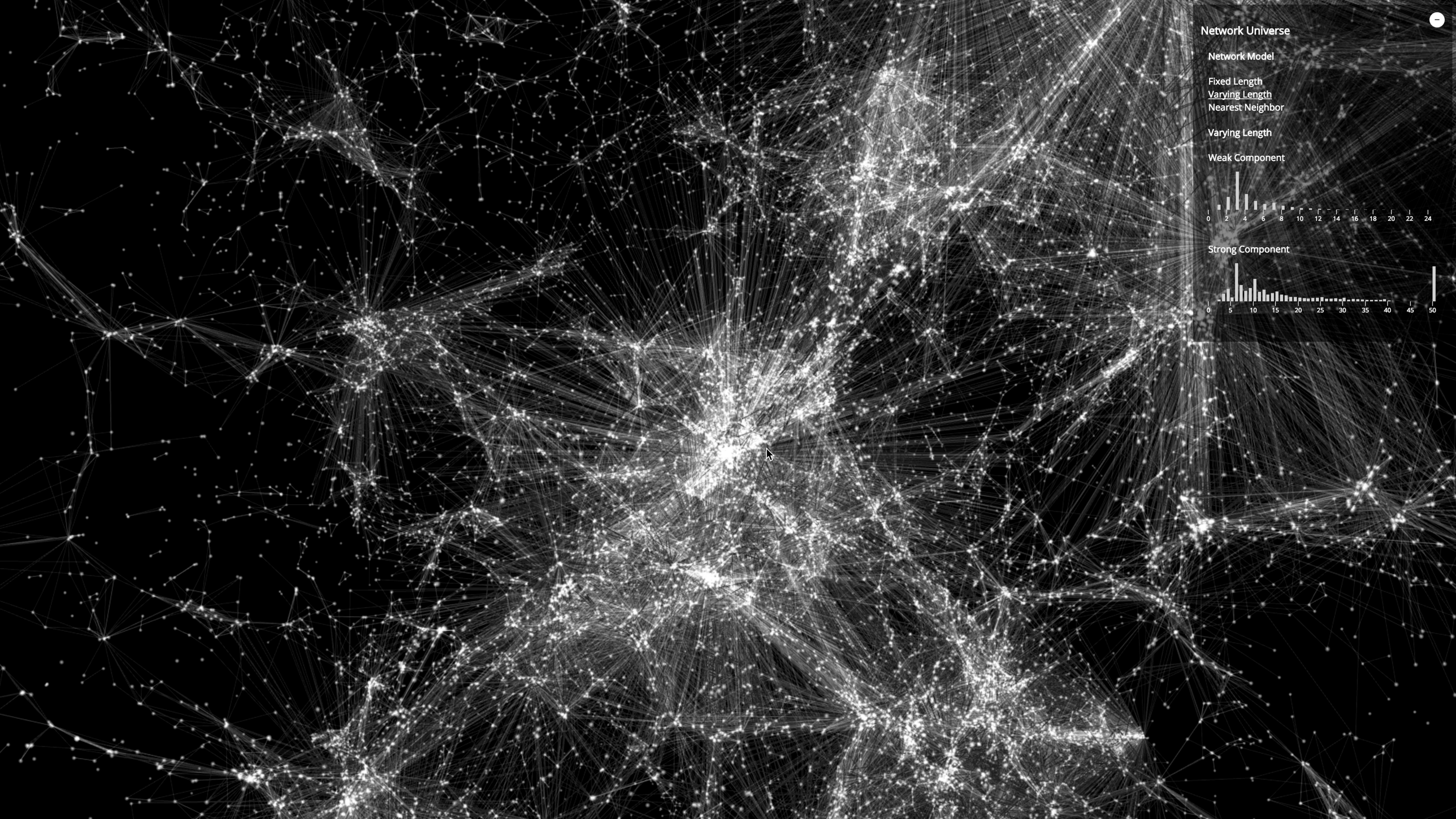
Introduction to Data Visualization
Part of a GEM – Workshop

Prof. Kim Albrecht, Film University Babelsberg KONRAD WOLF


United States // Banking
United States // Media
United States // Real Estate
United States // Retail
United States // Food
United States // Energy
United States
China
Hong Kong
India
Brazil
Russia
Countries
Sources of Wealth
Self-Made Billionaires
Billionaires
BILLIONAIRES
source: http://www.forbes.com/billionaires/list/


United States // Real Estate
United States // Software
United Kingdom // Real Estate
United Kingdom // Media
United Kingdom // Banking
United Kingdom // Retail
United Kingdom // Energy
United Kingdom // Consumer Goods
United Kingdom // Sport
United Kingdom // Transport
United Kingdom // Technology
United Kingdom // Mining
United Kingdom // Chemicals
United Kingdom
Germany // Media
Germany // Transport
Germany // Food
Germany // Pharmaceuticals
Germany // Software
Germany // Engineering
Germany // Energy
Germany // Insurance
Germany // Consumer Goods
Germany // Chemicals
Germany // Material
Germany // Diversified
Germany // Real Estate
Germany // Logistic
Germany // Retail
Germany // Manufacturing
Germany // Banking
Germany // Technology
Germany // Cosmetics
Germany
Italy // Consumer Goods
Italy // Food
Italy // Insurance
Italy // Retail
Italy // Pharmaceuticals
Italy // Material
Italy // Media
France // Consumer Goods
France // Media
France // Pharmaceuticals
France // Transport
France // Banking
France // Recruitment
France // Food
Spain // Construction
Spain // Banking
Indonesia // Energy
Indonesia // Diversified
Indonesia // Tobacco
Indonesia // Banking
Indonesia // Material
Indonesia // Food
Israel // Software
Sweden // Consumer Goods
Turkey // Diversified
Turkey // Food
George Argyros // $1.75 B
Gordon Getty // $2 B
Jeff Greene // $2.1 B
Edward Roski // $2.1 B
Herbert Simon // $1.6 B
Sam Zell // $4.7 B
Dold Bren // $12 B
Ted Lerner // $3.3 B
Richard Peery // $1.9 B
Tamara Gustavson // $2.3 B
Leonard Stern // $4.2 B
Stephen Ross // $3.1 B
Steven Roth // $1.05 B
Jerry Speyer // $1.6 B
Neil Bluhm // $2 B
David Murdock // $2.7 B
Mortimer Zuckerman // $2.2 B
Alfred Taubman // $2.5 B
Alan Casden // $1.6 B
Henry Ross Perot Jr // $1.4 B
Leon Charney // $1.3 B
John Sobrato // $2.6 B
Richard Ellrak // $5 B
Richard Rainwater // $2.3 B
Matthew Bucksbaum // $1.2 B
Igor Olenicoff // $2.6 B
Alexander Spanos // $1.1 B
Sheldon Solow // $1.9 B
Bradley Hughes // $1.8 B
Henry Ross Perot Sr // $3.5 B
John Arrillaga // $1.8 B
Carl Berg // $1.2 B
Bharat Desai // $1.35 B
David Duffield // $1.3 B
John Sall // $3.5 B
James Goodnight // $7.1 B
Paul Allen // $13.2 B
Jack Dangermond // $2.2 B
Marc Benioff // $1.9 B
Marguerite Harbert // $1.2 B
Tom Golisano // $1.4 B
Barry Diller // $1.6 B
Bill Gates // $59 B
Larry Ellison // $33 B
Kenny Troutt // $1.2 B
Bruce Halle // $3.4 B
William Ford // $1.1 B
Martha Ingram // $3 B
Gil Shwed // $1.6 B
Marius Cht // $1 B
Morris Kahn // $1 B
Lev Leviev // $1.6 B
Beny Steinmetz // $6 B
Stef Wertheimer // $4 B
Arnon Milchan // $4 B
Shlomo Eliahu // $1.1 B
Sammy Ofer // $10.3 B
Teddy Sagi // $1.2 B
Martua Sitorus // $2.7 B
Peter Sondakh // $2.2 B
Sri Prakash Lohia // $2.1 B
Liselott Persson // $3.4 B
Stefan Persson // $24.5 B
Ingvar Kamprad // $6 B
Melker Schorling // $2.9 B
Hans Rausing // $10 B
Birgit Rausing // $14 B
Thomas Sandell // $1.1 B
Fredrik Lundberg // $2.9 B
Antonia Johnson // $6.5 B
Edwin Soeryadjaya // $1.6 B
Kiki Barki // $2 B
Theodore Rachmat // $1.3 B
Kwong Low Tuck // $3.6 B
Benny Subianto // $1 B
Garibaldi Thohir // $1.5 B
Murdaya Poo // $1.1 B
Sukanto Tanoto // $1.9 B
Chairul Tanjung // $1.1 B
R Budi Hartono // $5 B
Michael Hartono // $5 B
Ennio Doris // $1.5 B
Silvio Berlusconi // $6.2 B
Diego Della Valle // $1.3 B
Stefano Pessi // $1.4 B
Francesco Gaetano Caltagirone // $1.5 B
Mario Moretti Polegato // $2.3 B
Michele Ferrero // $18 B
Luciano Benetton // $2.4 B
Carlo Benetton // $2.4 B
Giorgio Armani // $7 B
Andrea Della Valle // $1.2 B
Gilberto Benetton // $2.4 B
Leordo Del Vecchio // $11 B
Giulia Benetton // $2.4 B
Berrd Ecclestone // $4.2 B
James Ratcliffe // $2 B
John Caudwell // $1.9 B
Laurence Graff // $2.5 B
James Dyson // $2.7 B
Richard Branson // $4.2 B
Ayman Asfari // $1.7 B
Bruno Schroder // $3.7 B
Mark Coombs // $2.1 B
Alan Howard // $1.8 B
Richard Elman // $2.8 B
Joe Lewis // $3.2 B
Michael Ashley // $1.9 B
Kenneth Morrison // $1.2 B
Robert Miller 2 // $1.5 B
Philip Christopher // $7.2 B
David Frederick Barclay // $3.2 B
David Sainsbury // $1.3 B
Mohammed Ibrahim // $1.8 B
Jothan Harmsworth // $1 B
Joanne Jk Rowling //
Richard Desmond // $1.7 B
Dive Calder // $2.4 B
Gerald Cavendish Grosvenor // $1.3 B
Sser Khalili // $1 B
Eddie Sol Zakay // $2.7 B
John Whittaker // $1.8 B
Ian Richard Livingstone // $2 B
Charles Cadogan // $4.2 B
Xiu Li Hawken // $2.2 B
David Simon Reuben // $8 B
Dhmi Auchi // $1.8 B
Johan Quandt // $9.8 B
Heinz Bauer // $1.8 B
Hubert Burda // $1.5 B
Elizabeth Mohn // $3.8 B
Stefan Von Holtzbrinck // $2 B
Peter Unger // $1.3 B
Susanne Klatten // $14.6 B
Andreas Von Bechtolsheim // $2.3 B
Monika Schoeller // $2 B
Stefan Quandt // $10.7 B
Friede Springer // $3.7 B
Heinz Hermann Thiele // $2.3 B
Hans Werner Hector // $2.2 B
Otto Happel // $2.9 B
Klaus Tschira // $2 B
Maria Elisabeth Georg Schaeffler // $9.8 B
Dieter Schoel // $3.9 B
Aloys Wobben // $3.1 B
Curt Engelhorn // $6.6 B
Daniela Herz // $2.3 B
Axel Oberwelland // $3.4 B
Thomas Strungmann // $3.9 B
Hasso Plattner // $6.9 B
Berrd Broermann // $2.1 B
Andreas Strungmann // $3.9 B
Rolf Gerling // $1.6 B
Berthold Theo Jr Albrecht // $14.4 B
Gunter Herz // $2.4 B
Ingeburg Herz // $1.1 B
Wolfgang Herz // $3.8 B
Hans Riegel // $2 B
Thomas Bruch // $2.3 B
Michael Herz // $3.8 B
Heinz Horst Deichmann // $4.6 B
Albert Von Thurn Und Taxis // $2 B
Vladimir Iorich // $1.6 B
Martin Viessmann // $1.9 B
Alexandra Schorghuber // $2.3 B
Klaus Michael Kuhne // $10 B
Georg Von Opel // $1.6 B
Karl Heinz Kipp // $5.1 B
Otto Beisheim // $4.5 B
Michael Otto // $16.6 B
Karl Albrecht // $25.5 B
Michael Rainer Schmidt Ruthenbeck // $4.3 B
Anton Schlecker // $3.1 B
Erivan Haub // $4.5 B
Reinhold Wurth // $4.1 B
Ralph Dommermuth // $1.5 B
Sylvia Stroher // $1.9 B
Friedhelm Loh // $2.7 B
August Von Finck // $8.4 B
Liliane Bettencourt // $23.5 B
Berrd Arult // $4.1 B
Xavier Niel // $3.7 B
Jean Claude Decaux // $6 B
Alain Gerard Wertheimer // $6 B
Alain Merieux // $4.3 B
Serge Dassault // $3.3 B
Vincent Bollore // $1.7 B
Marc Ladreit De Lacharriere // $1.1 B
Philippe Foriel Destezet // $2.5 B
Reinold Geiger // $1.4 B
Francois Pinault // $11.5 B
Pierre Bellon // $2.9 B
Alicia Koplowitz // $2.3 B
Esther Koplowitz // $1.9 B
Florentino Perez // $1.9 B
Manuel Jove // $3 B
Rosalia Mera // $4.2 B
Enrique Banuelos // $1.4 B
Amancio Ortega // $31 B
Alberto Corti // $1.2 B
Juan Abello // $1.3 B
Alberto Alcocer // $1.2 B
Emilio Botin // $1.5 B
Frank Lowy // $4.4 B
Gerald Harvey // $1.1 B
Solomon Lew // $1.1 B
Juan Roig // $2.9 B
Isak Andic // $6.1 B
Mustafa Latif Topbas // $1.3 B
Tuncay Ozilhan // $1.4 B
Kamil Yazici // $1.8 B
Murat Ulker // $2.8 B
Ahsen Ozokur // $1.4 B
Su Kirac // $2.5 B
Mehmet Hattat // $1.2 B
Nihat Ozdemir // $1.2 B
Yildirim Ali Koc // $1.1 B
Mustafa Vehbi Koc // $1.2 B
Cigdem Sabanci Bilen // $1.8 B
Serra Sabanci // $1 B
Sevket Sabanci // $1.2 B
Suzan Sabanci Dincer // $1.1 B
Turgay Ciner // $1 B

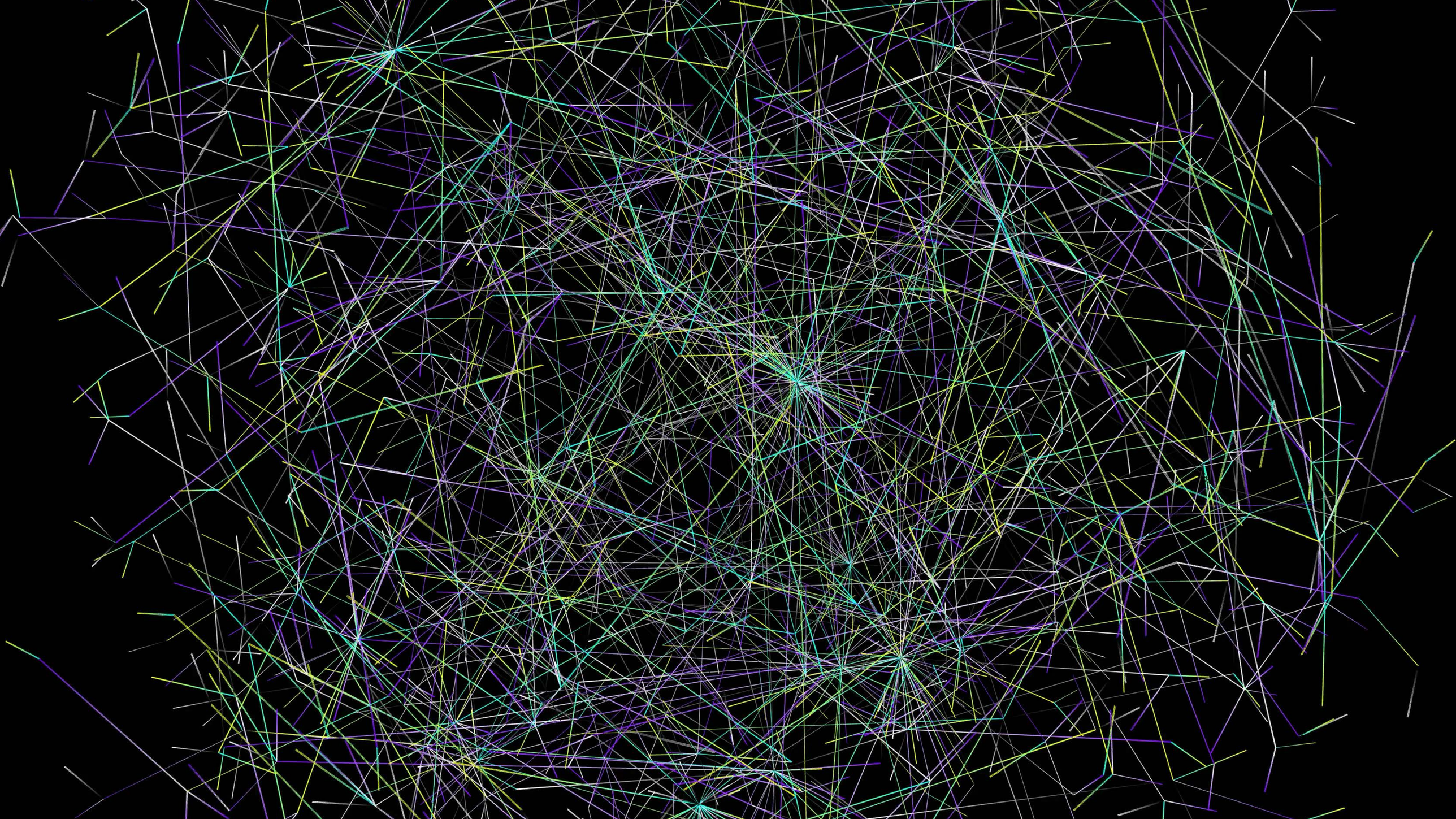

Network Universe
Network Model
Fixed Length
Varying Length
Nearest Neighbor
Varying Length
Weak Component
0 2 4 6 8 10 12 14 16 18 20 22 24
Strong Component
0 5 10 15 20 25 30 35 40 45 50


50
60
70
80
90
100
110
120
Pulse > 100
CHRISTIANE
40
ID 202
40
ID 227
40
ID 232
41
ANNA O
ID 240
44
ID 211
47
ID 216
48
ID 218
51
ID 234
51
ID 236
51
ID 212
52
ID 221
53
ID 229
56
ID 204
57
ID 207
61
ID 215
61
ID 239
64
ID 205
66
ID 226
74
ID 230
75
ID 206
81
ID 209
81
ID 231
ID 208
101
ID 214
102
ID 233
112

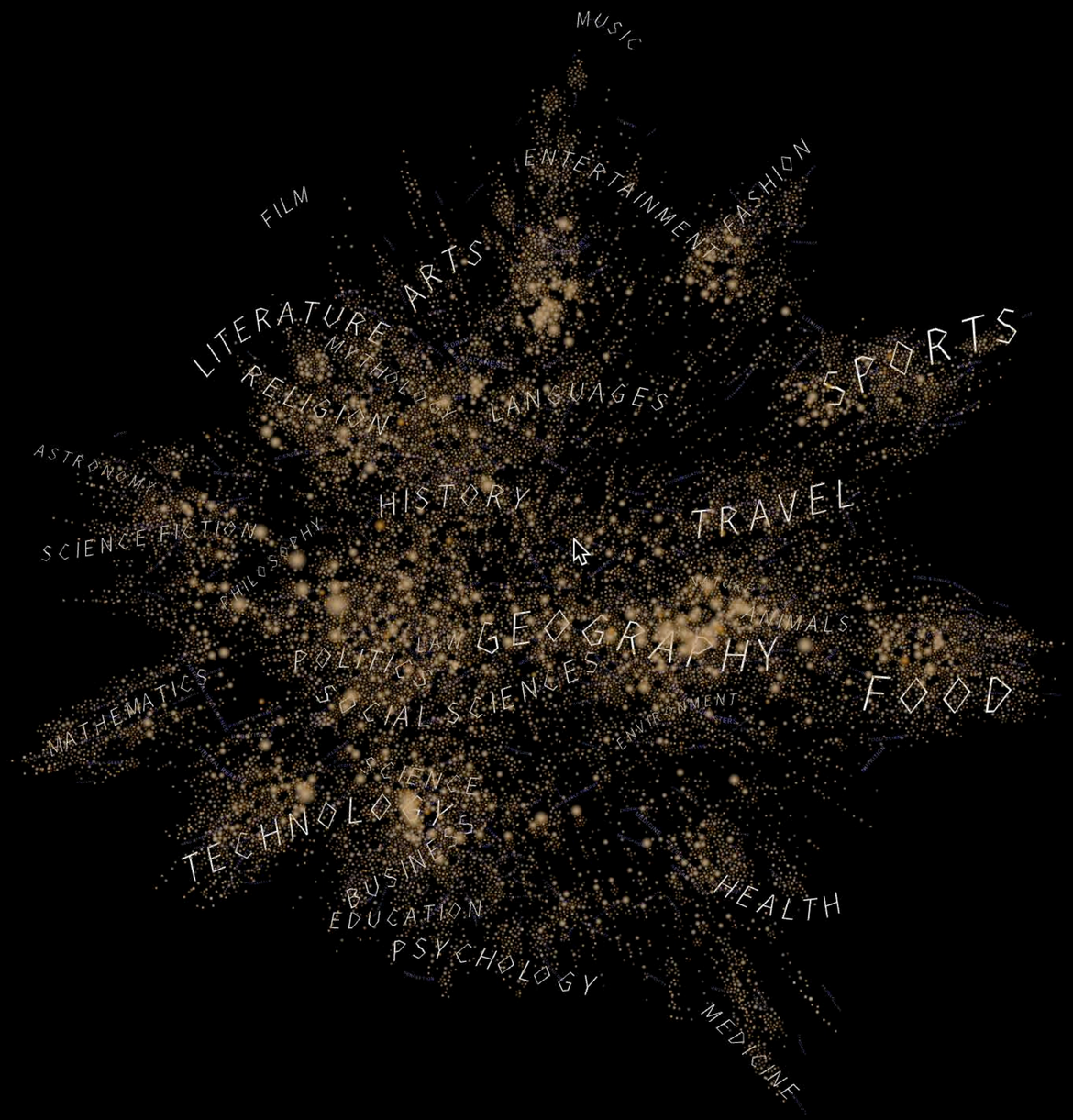
2017 2018


Sort by: ID Pulse
Filter by: Show all


Sort by: ID Avg Pulse
Filter by: Show all No Average Pulse < 70 Pulse 70 - 90 Pulse > 100
19:54
21:11
40 50 60 70 80 90 100 110 120 130 140 150
CHRIS
ANNA O
ID 226
ID 205
ID 229
ID 209
ID 206
ID 207
ID 222
ID 214
ID 208
ID 219
ID 220
ID 212
ID 215
ID 234
ID 240
ID 230
ID 203
ID 217
ID 232



Artificial Worldviews

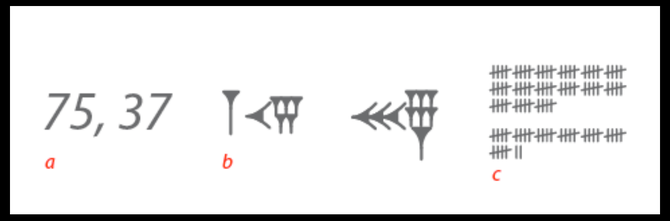


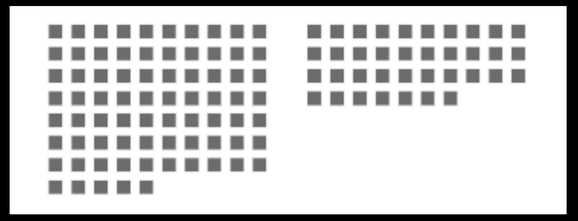
VISUALIZATION ("PICTORIALIZATION")

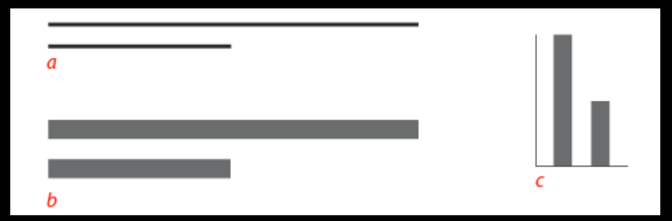
Visualize two numbers:

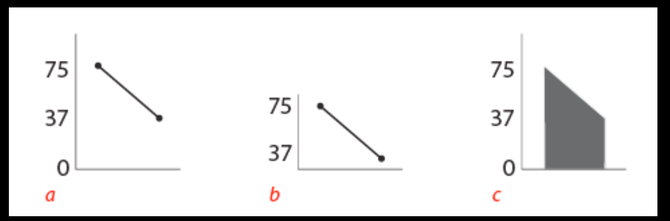
75 and 37

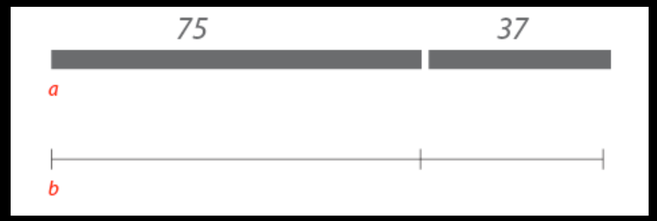
VISUALIZATION ("PICTORIALIZATION")

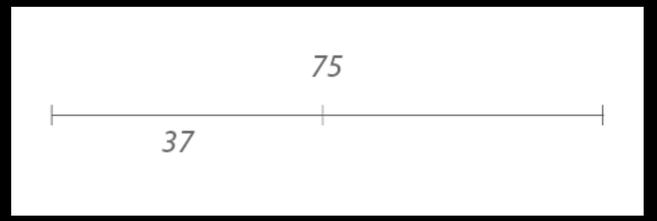


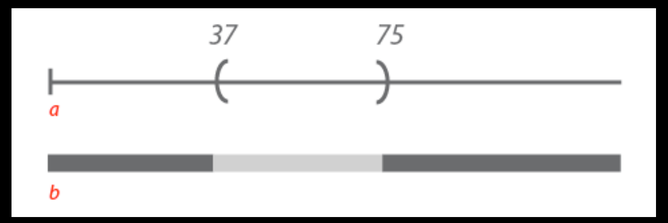


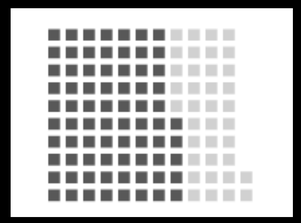


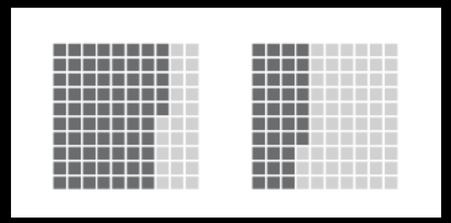


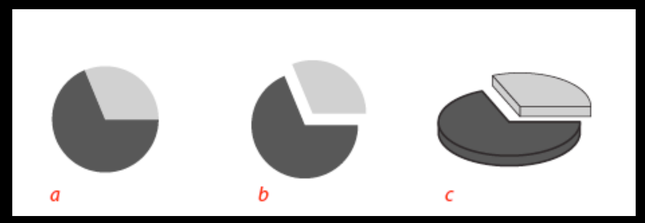


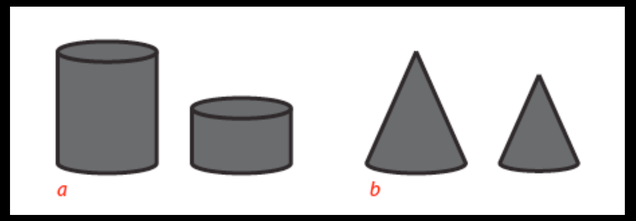


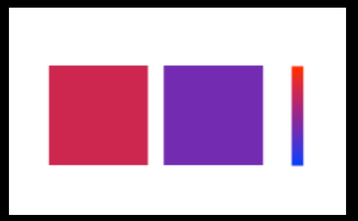


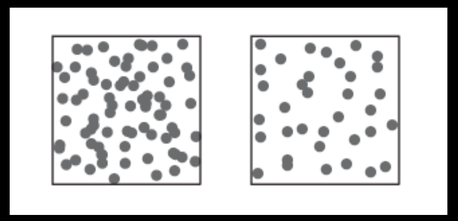






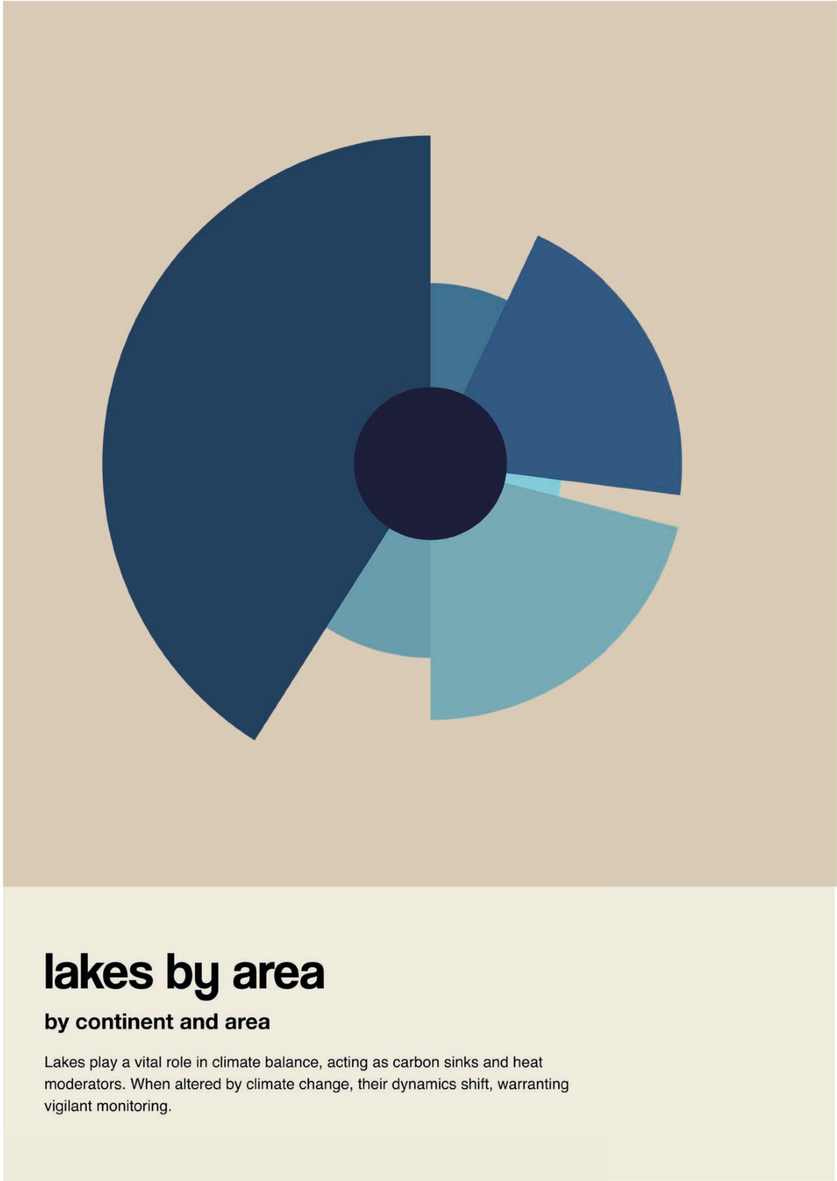






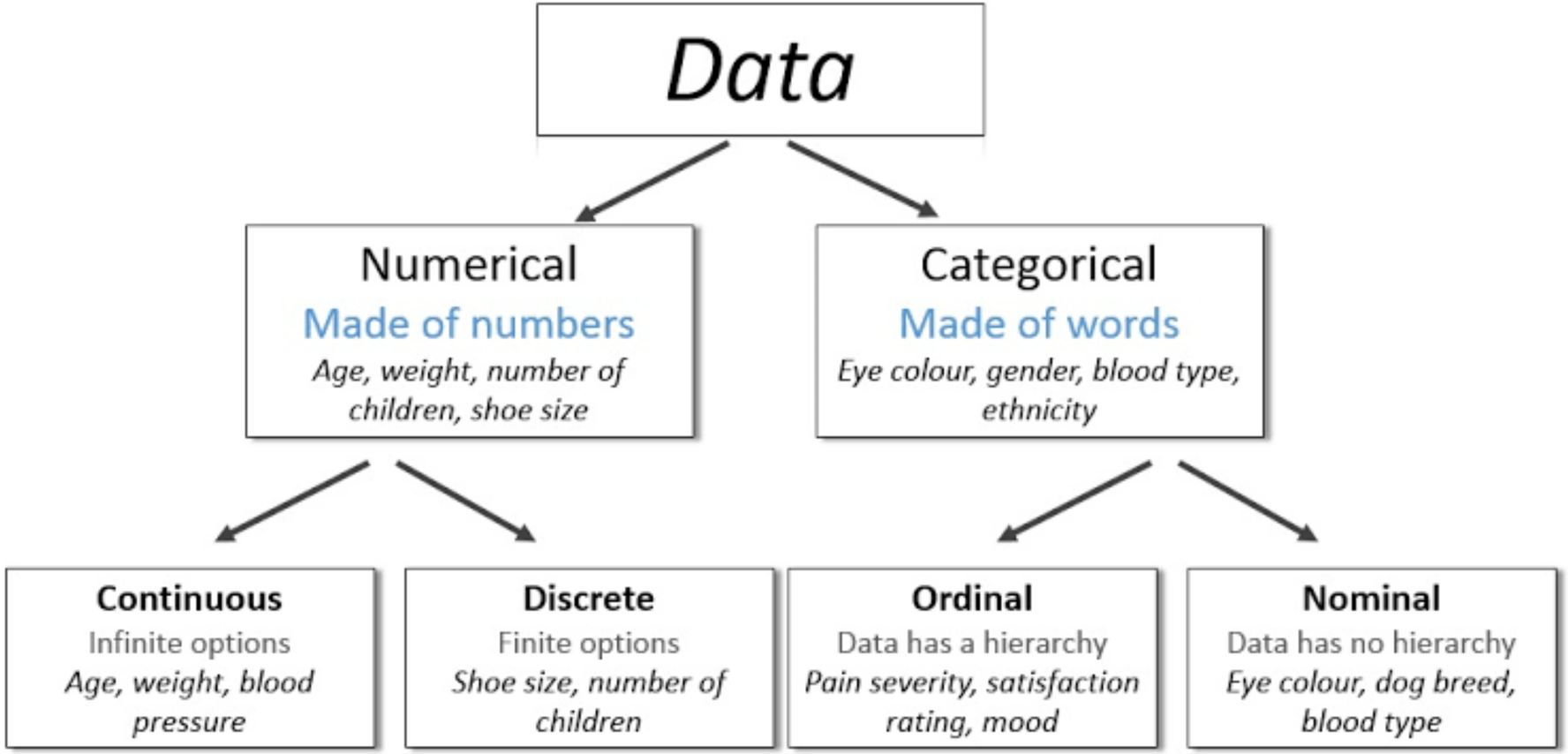
https://rockcontent.com/blog/45-ways-to-communicate-two-quantities/

Visualization Design Process



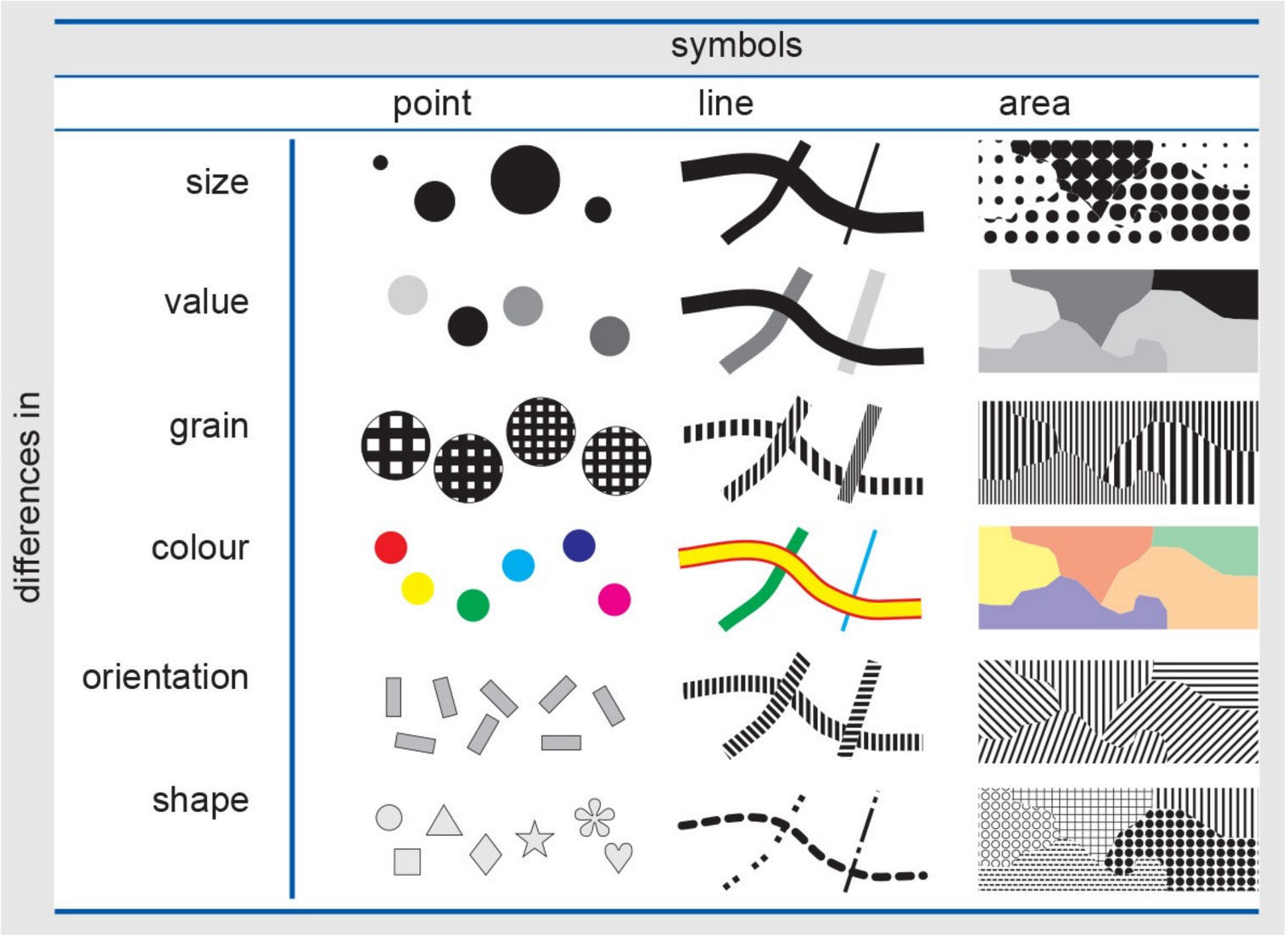
Data Dimensions > Visual Variables

Data Dimensions



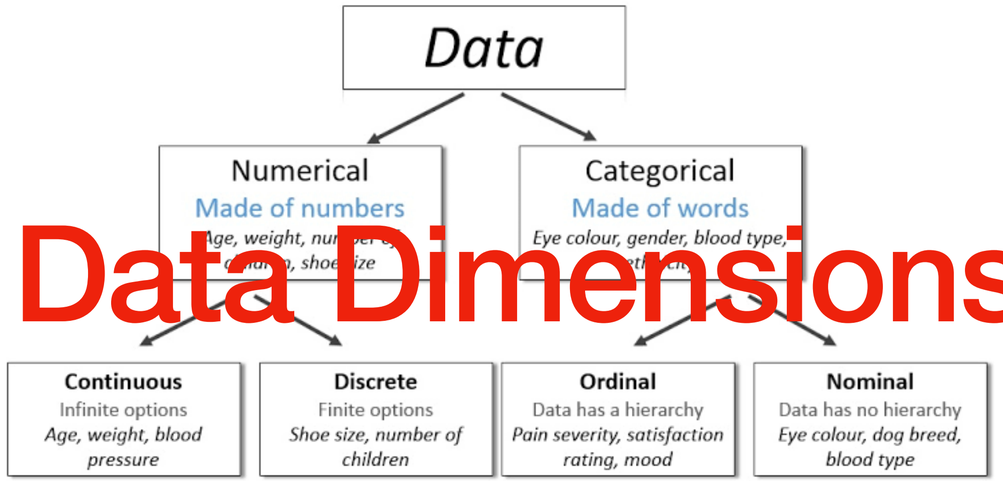
https://medium.com/dsnaiplusui/lesson-2-introduction-to-statistics-1e0a14da1ed9

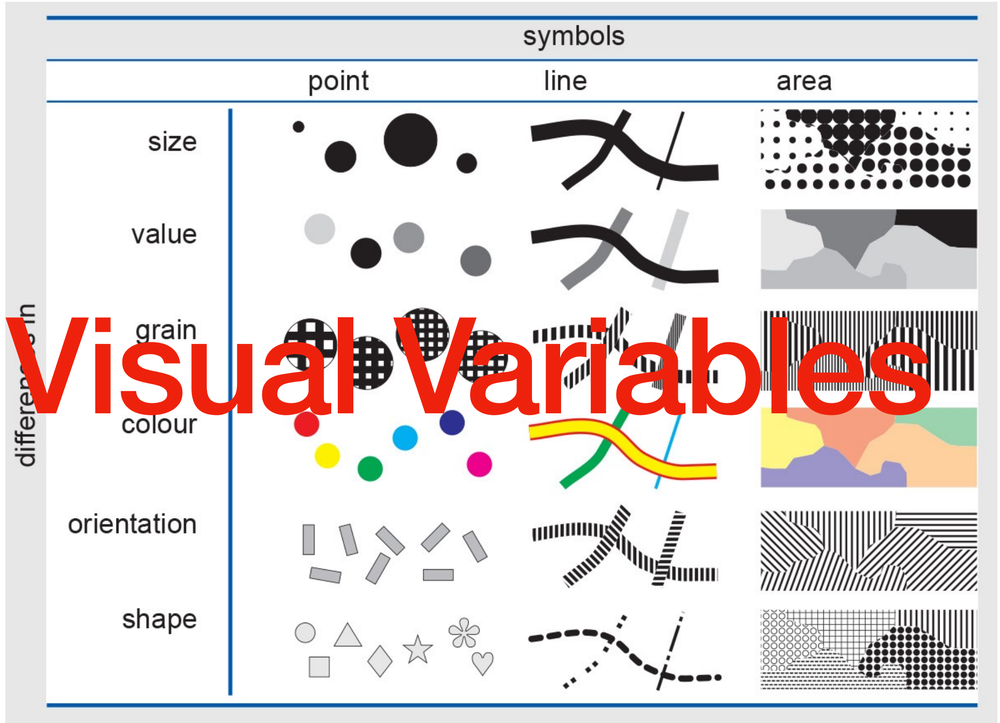
Visual Variables

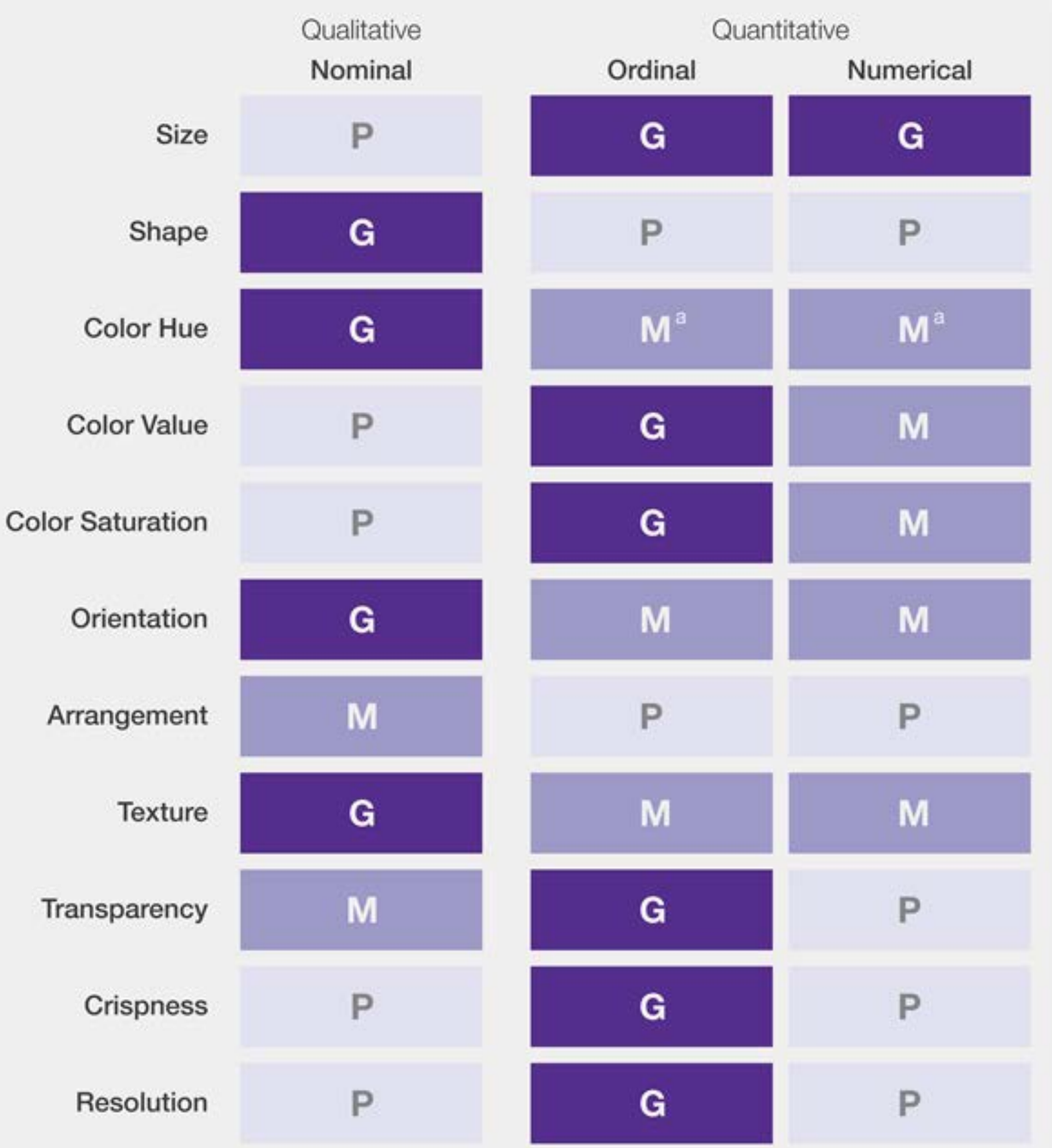


https://ltb.itc.utwente.nl/page/498/concept/81666

Data Dimensions > Visual Variables

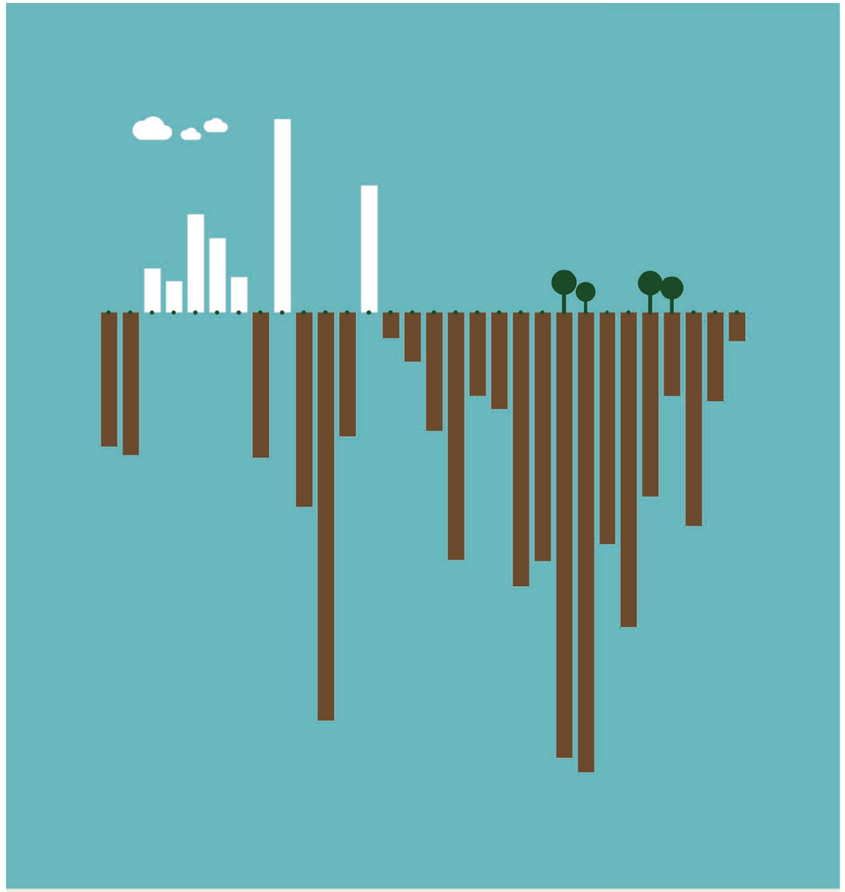






https://gistbok.ucgis.org/bok-topics/symbolization-and-visual-variables

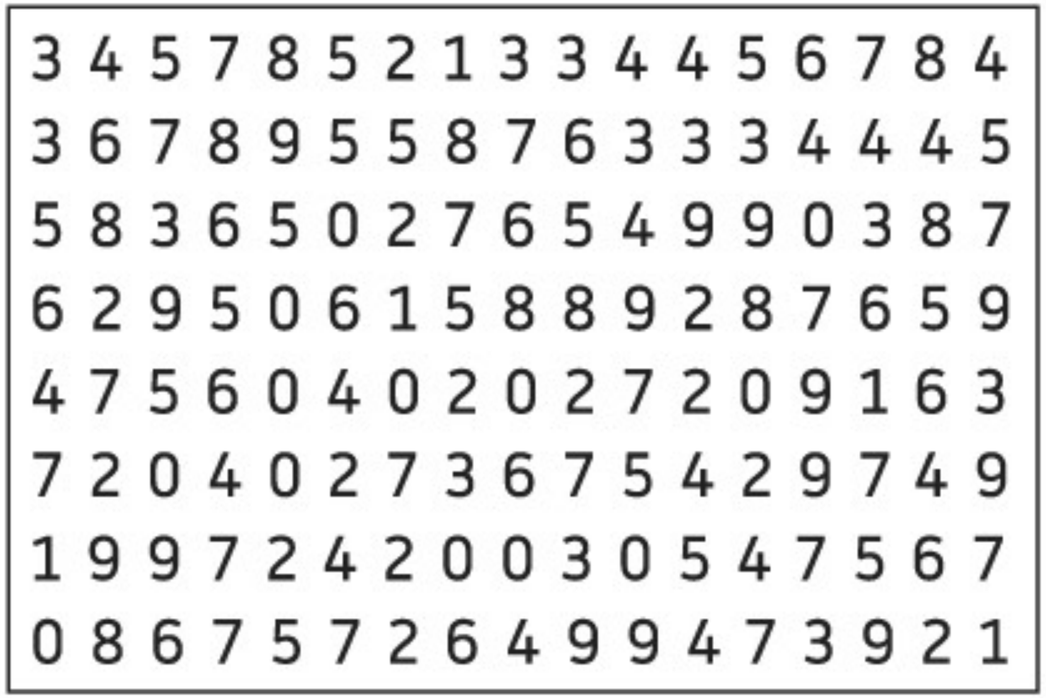
Visualization & Perception



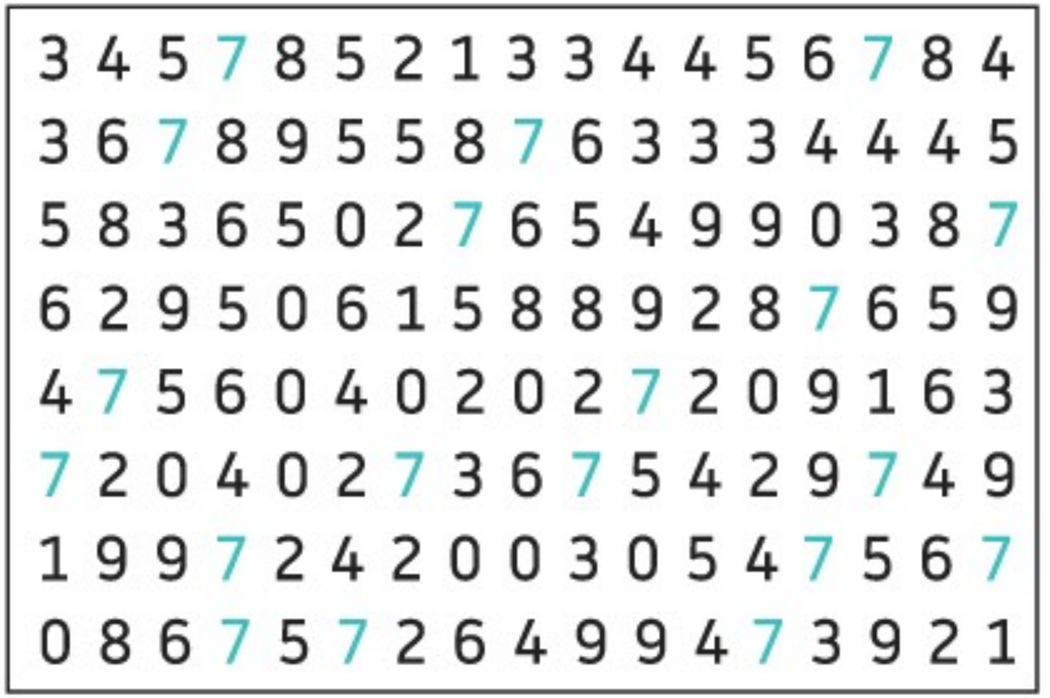
greenhouse gas inversions

1990–2019

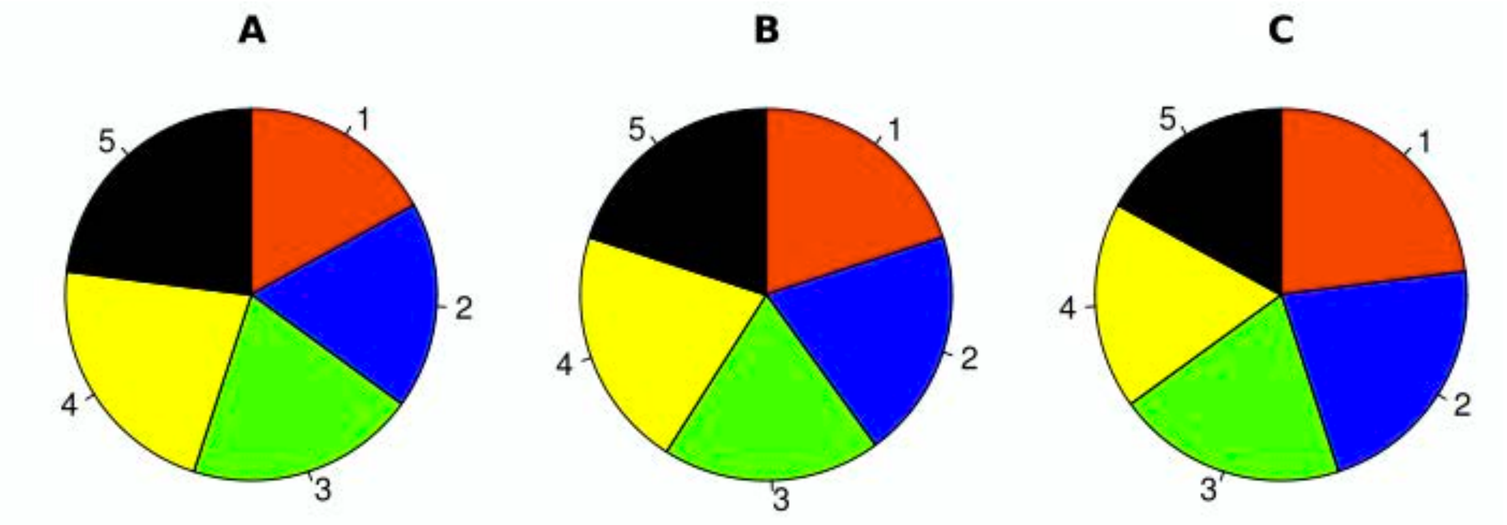
This bar chart contrasts the difference between reported versus measured carbon dioxide levels in Brazil. Positive values, in white, depict years where Brazil has emitted more carbon dioxide than reported. Brown bars indicate negative values where Brazil absorbed more carbon dioxide than reported.


3 4 5 7 8 5 2 1 3 3 4 4 5 6 7 8 4
3 6 7 8 9 5 5 8 7 6 3 3 3 4 4 4 5
5 8 3 6 5 0 2 7 6 5 4 9 9 0 3 8 7
6 2 9 5 0 6 1 5 8 8 9 2 8 7 6 5 9
4 7 5 6 0 4 0 2 0 2 7 2 0 9 1 6 3
7 2 0 4 0 2 7 3 6 7 5 4 2 9 7 4 9
1 9 9 7 2 4 2 0 0 3 0 5 4 7 5 6 7
0 8 6 7 5 7 2 6 4 9 9 4 7 3 9 2 1

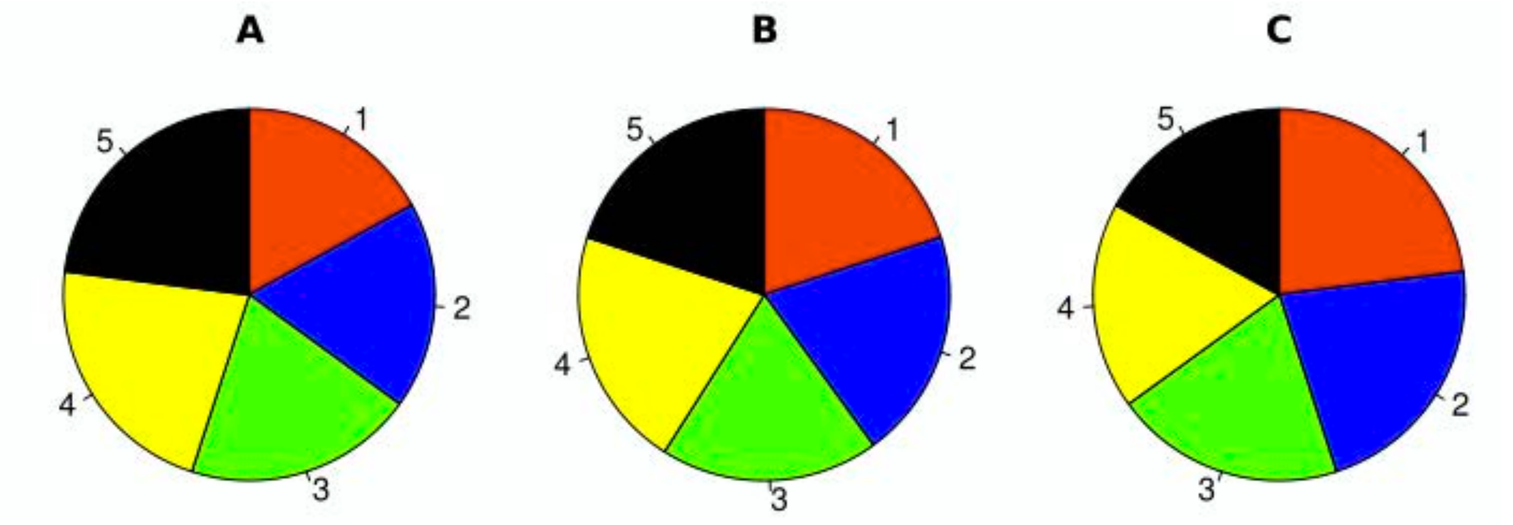
3	4	5	7	8	5	2	1	3	3	4	4	5	6	7	8	4
3	6	7	8	9	5	5	8	7	6	3	3	3	4	4	4	5
5	8	3	6	5	0	2	7	6	5	4	9	9	0	3	8	7
6	2	9	5	0	6	1	5	8	8	9	2	8	7	6	5	9
4	7	5	6	0	4	0	2	0	2	7	2	0	9	1	6	3
7	2	0	4	0	2	7	3	6	7	5	4	2	9	7	4	9
1	9	9	7	2	4	2	0	0	3	0	5	4	7	5	6	7
0	8	6	7	5	7	2	6	4	9	9	4	7	3	9	2	1

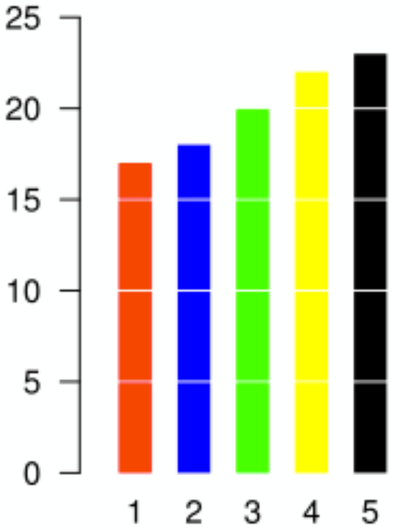


Source: Moritz Stefaner, Weltbilder

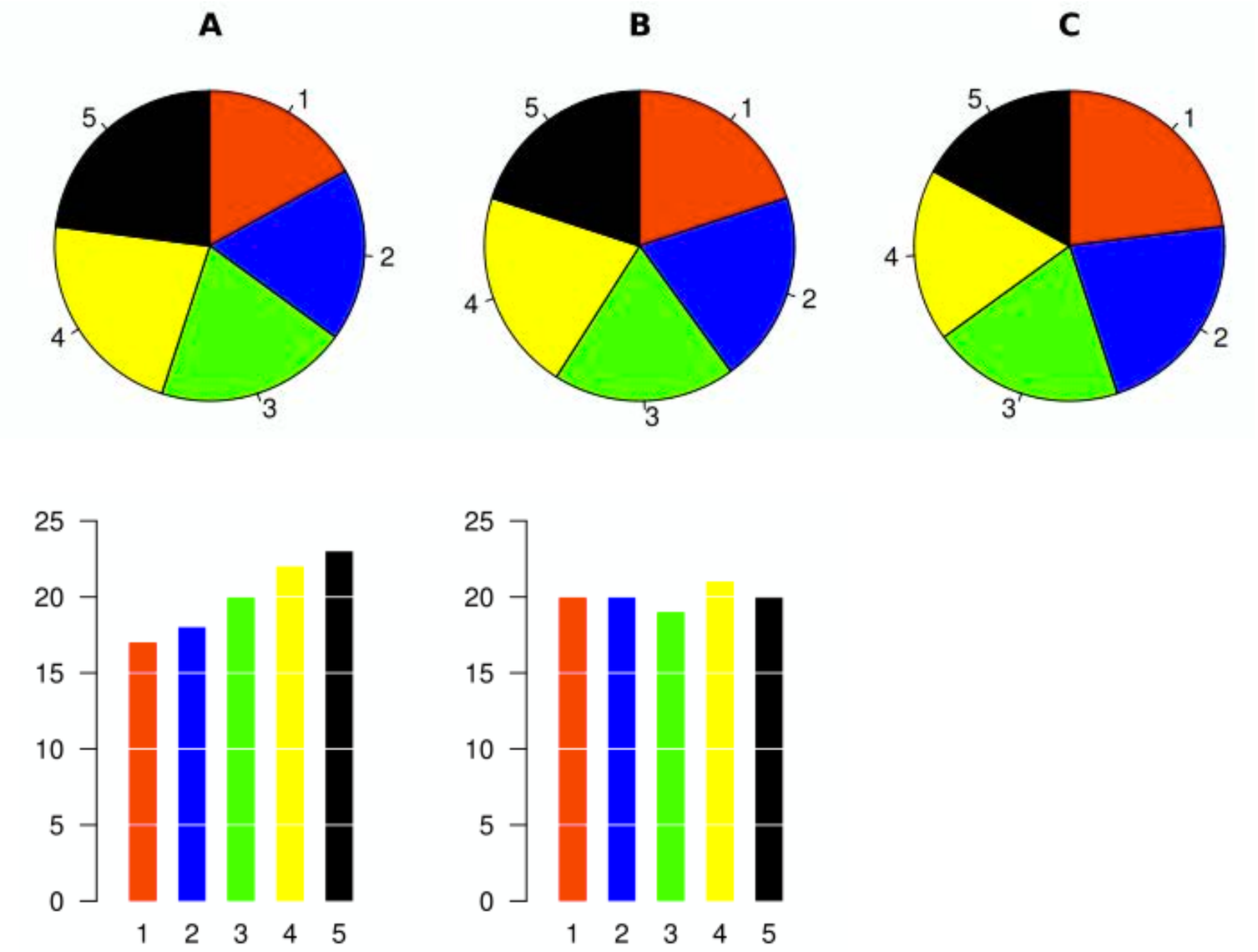


Source: Moritz Stefaner, Weltbilder





Source: Moritz Stefaner, Weltbilder



Source: Moritz Stefaner, Weltbilder

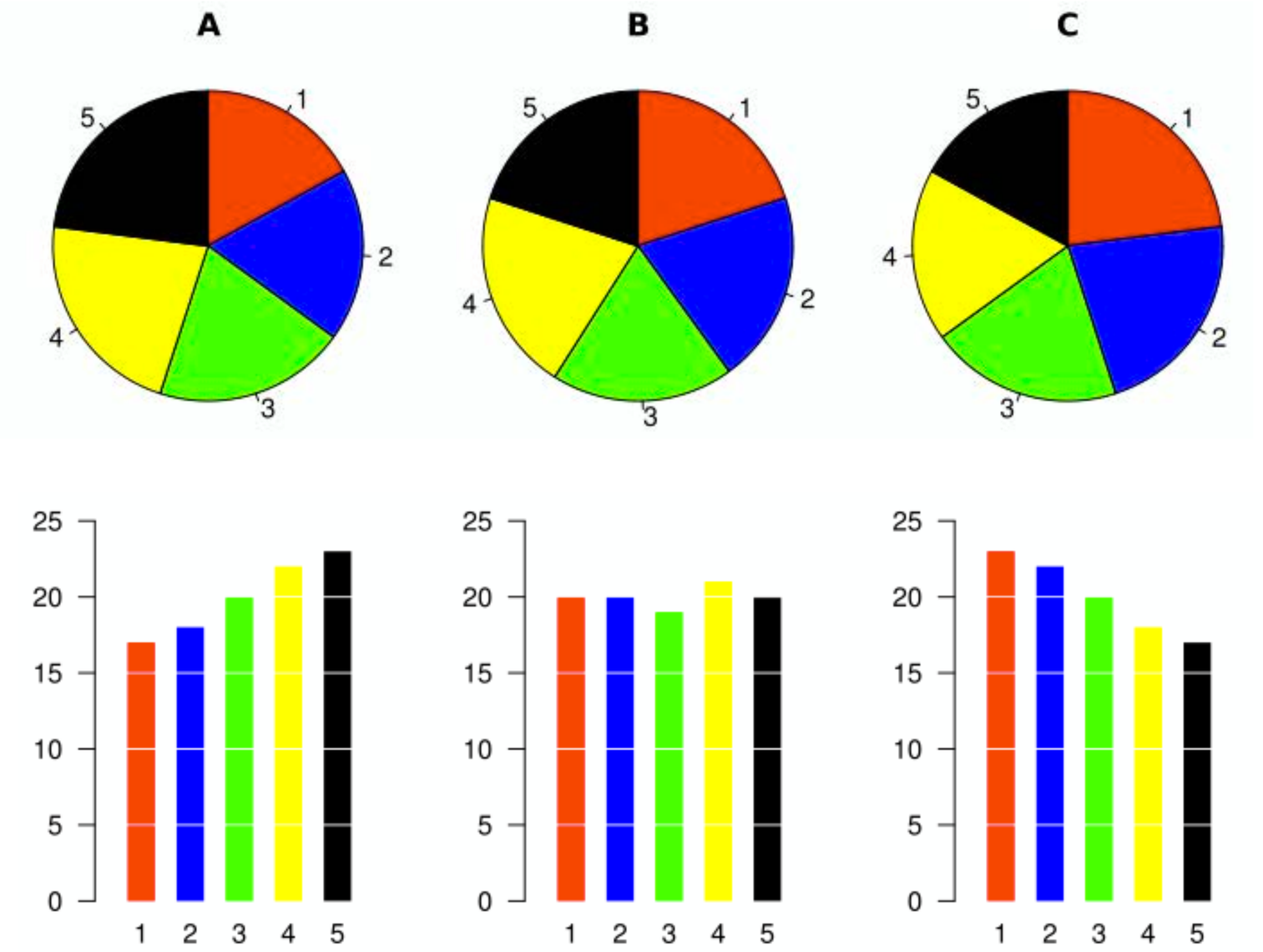


Figure 6.13 When the goal is to allow readers to make accurate comparisons, a chart based on bars or lines sitting on a single horizontal or vertical axis beats other forms of representation.

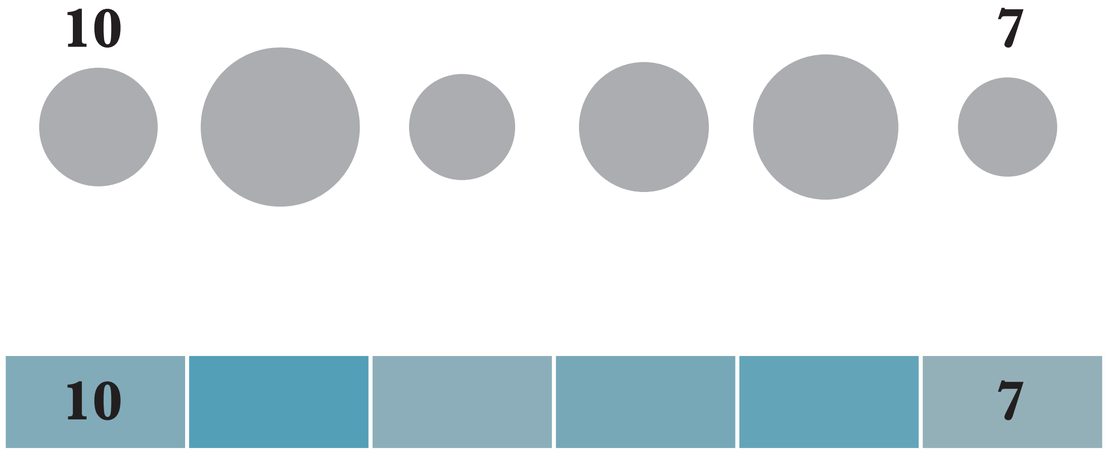


Figure 6.13 When the goal is to allow readers to make accurate comparisons, a chart based on bars or lines sitting on a single horizontal or vertical axis beats other forms of representation.

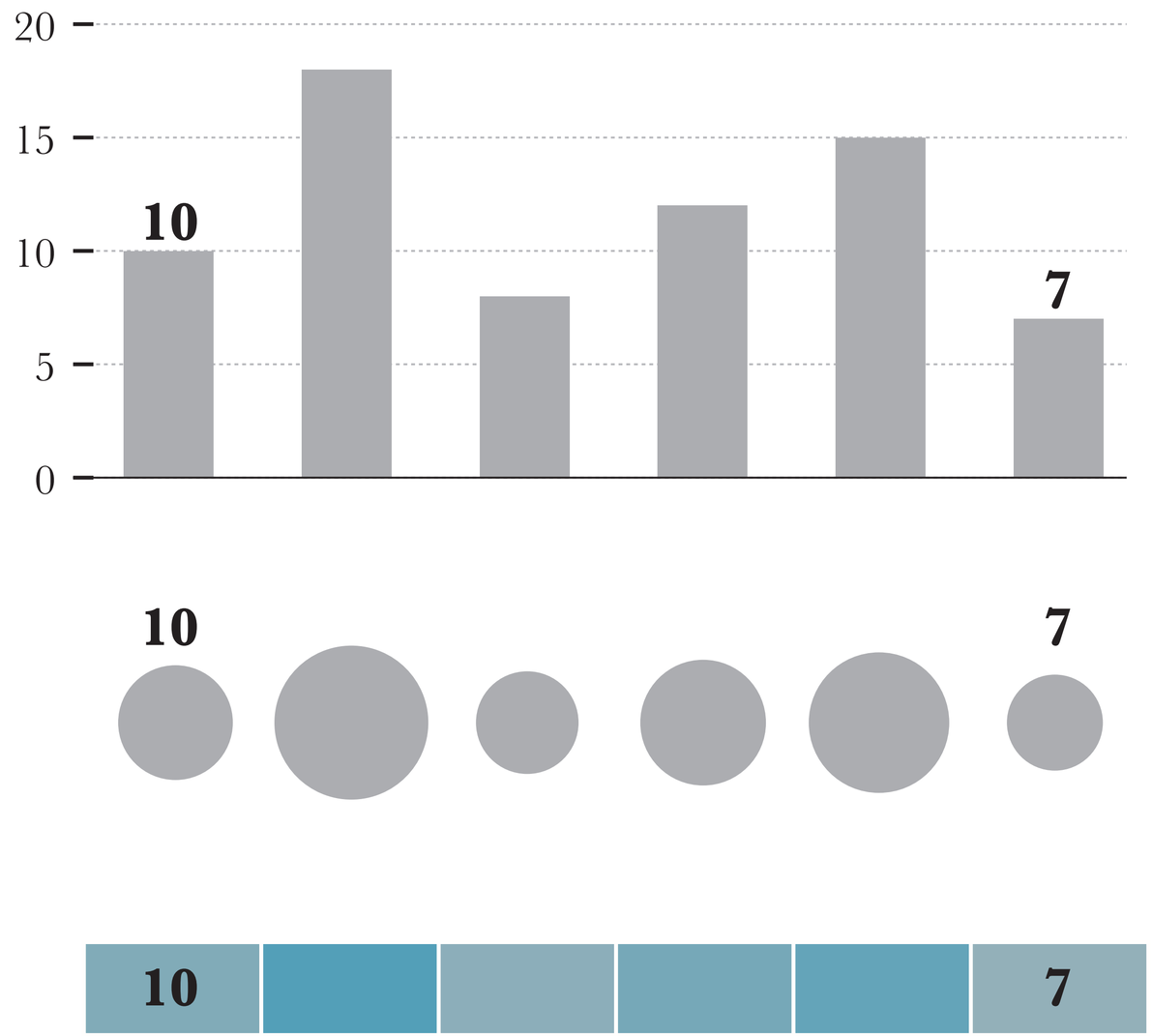


Figure 6.13 When the goal is to allow readers to make accurate comparisons, a chart based on bars or lines sitting on a single horizontal or vertical axis beats other forms of representation.

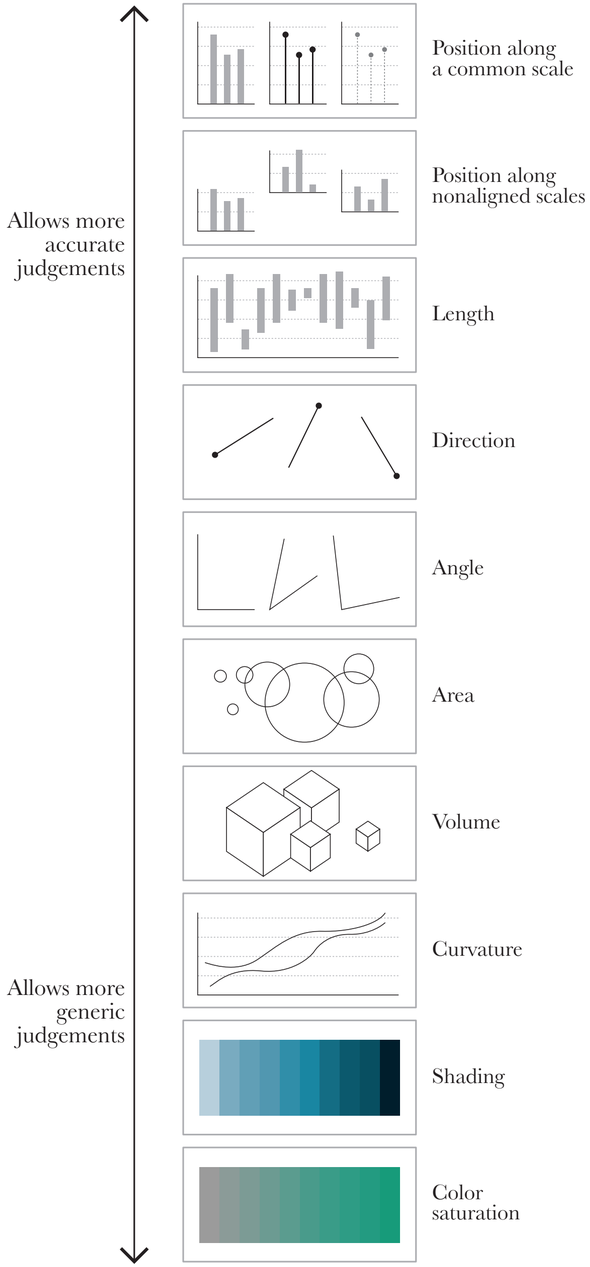
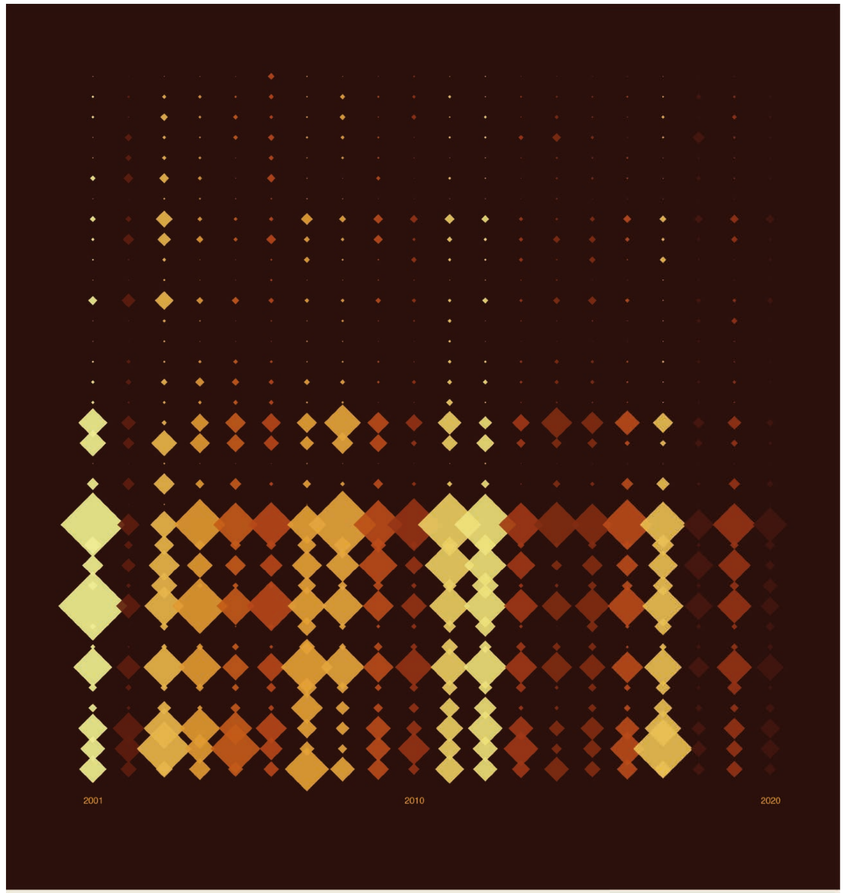


Figure 6.12 Cleveland and McGill's elementary perceptual tasks. The higher an encoding method on the scale, the more accurate the comparisons it facilitates.

MIS-
LEGI-
F OR
ICATIO N.

DON'T
TAKE
BILITY
COMMUN

Data Mapping



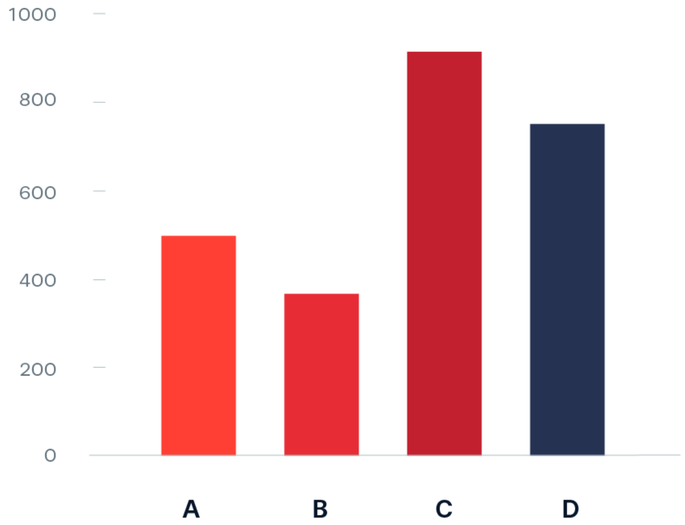
burned area in diamonds

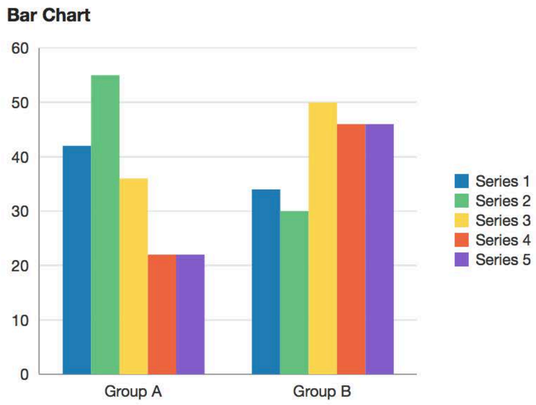
2001–2020

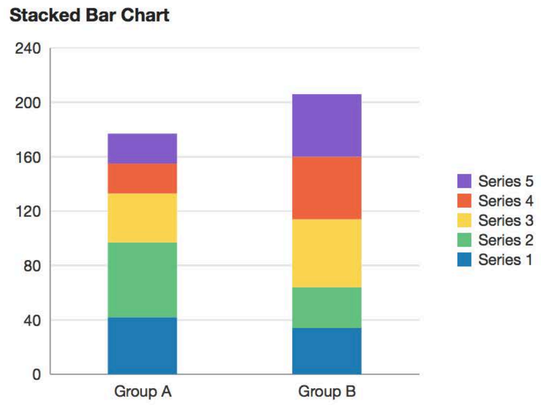
This little image uses data on burned area for European countries from 2001 to 2020 to illustrate how each country was affected by fire. Countries are oriented in rows and years as columns. A bigger diamond shows more burned area.
The colours represent the sum of burned area in Europe in the respective year.

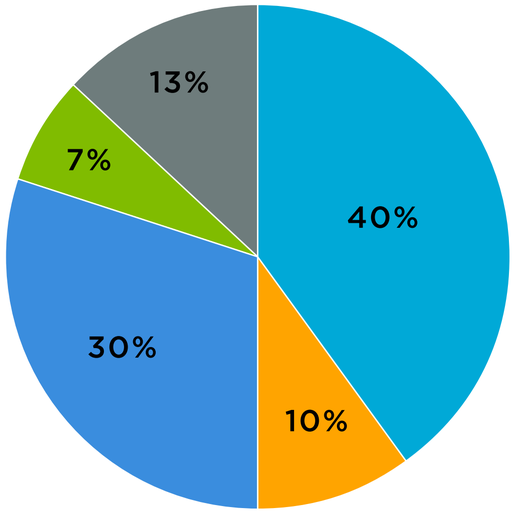
Numerical Hierachical Textual Relational Temporal Spatial

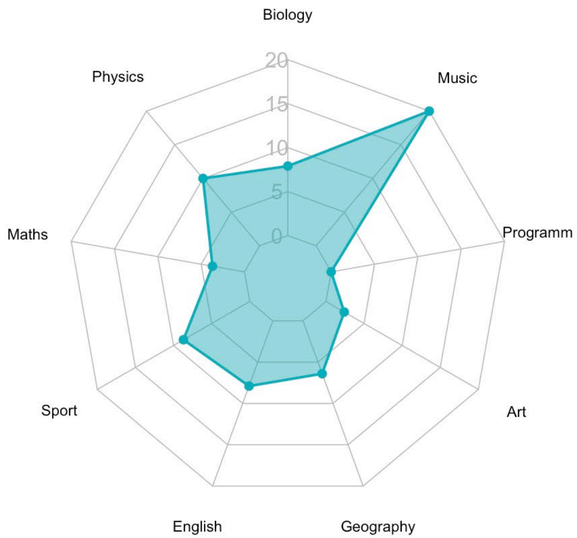
Numerical Hierachical Textual Relational Temporal Spatial



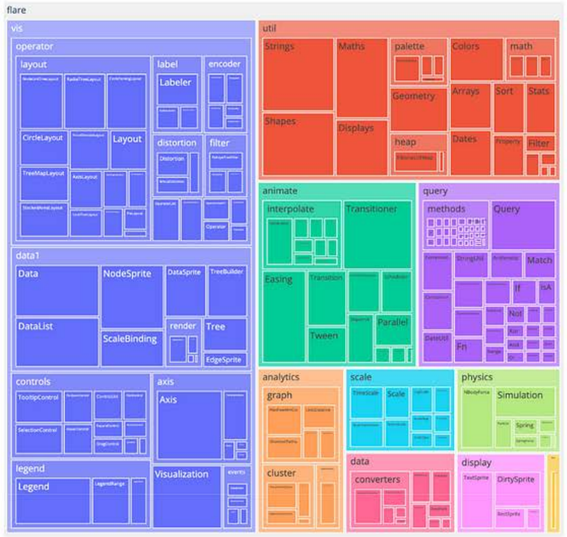


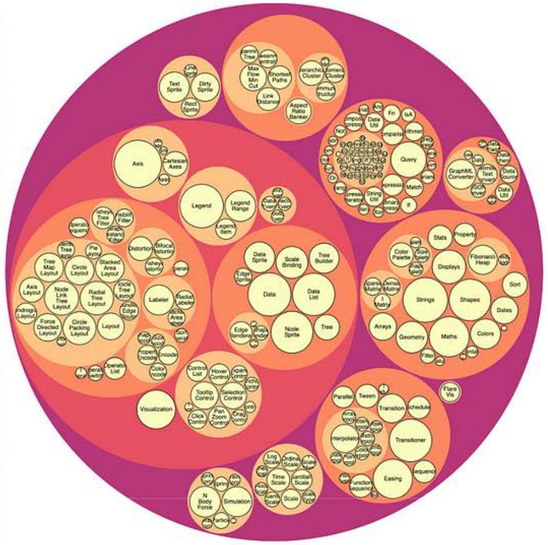


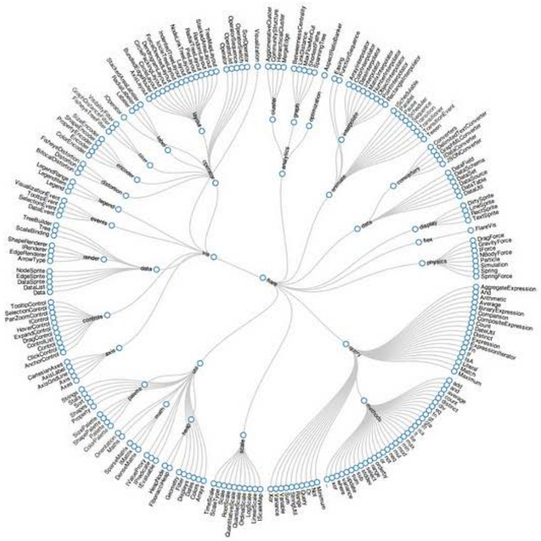


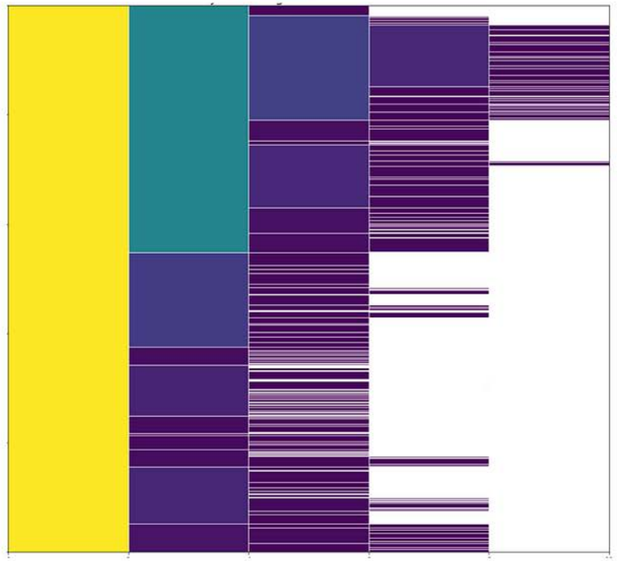


Numerical **Hierachical** Textual Relational Temporal Spatial

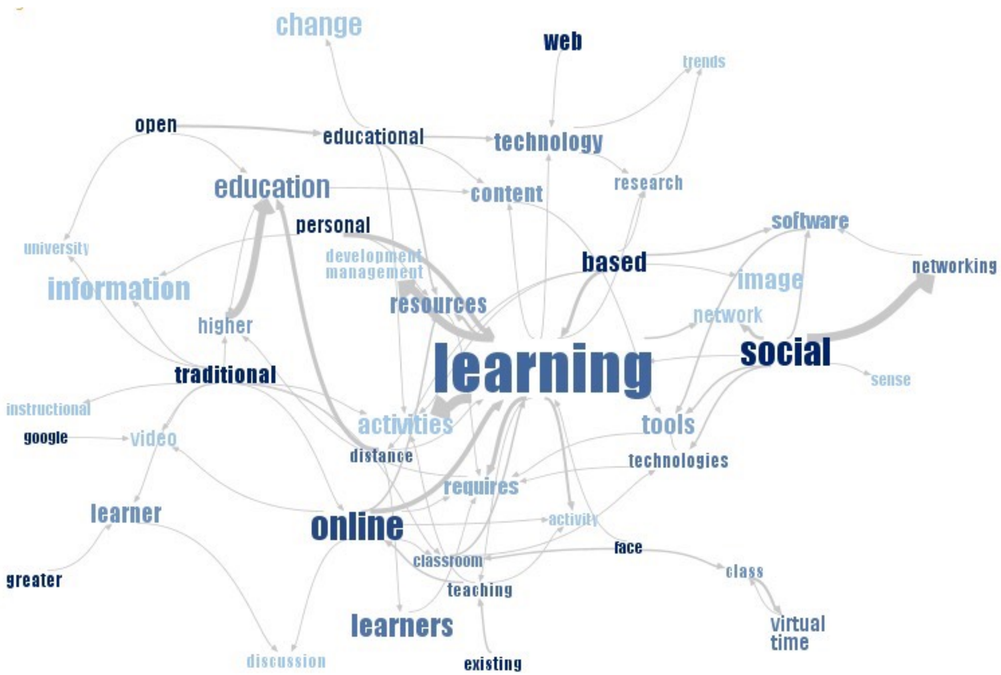






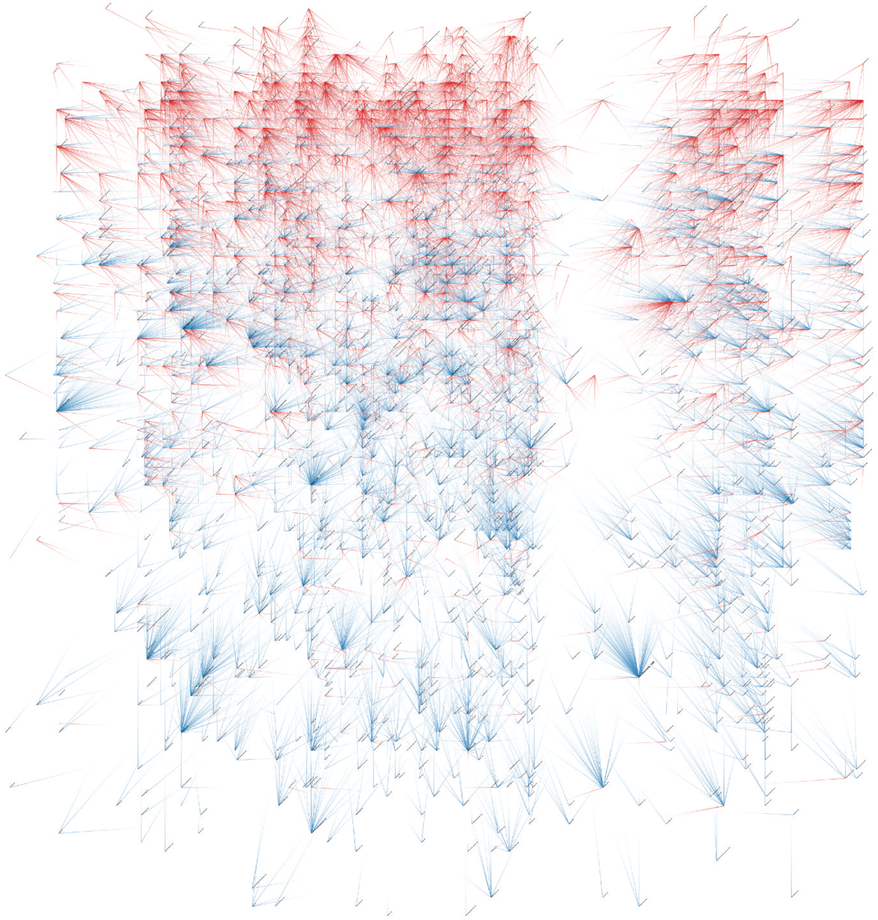


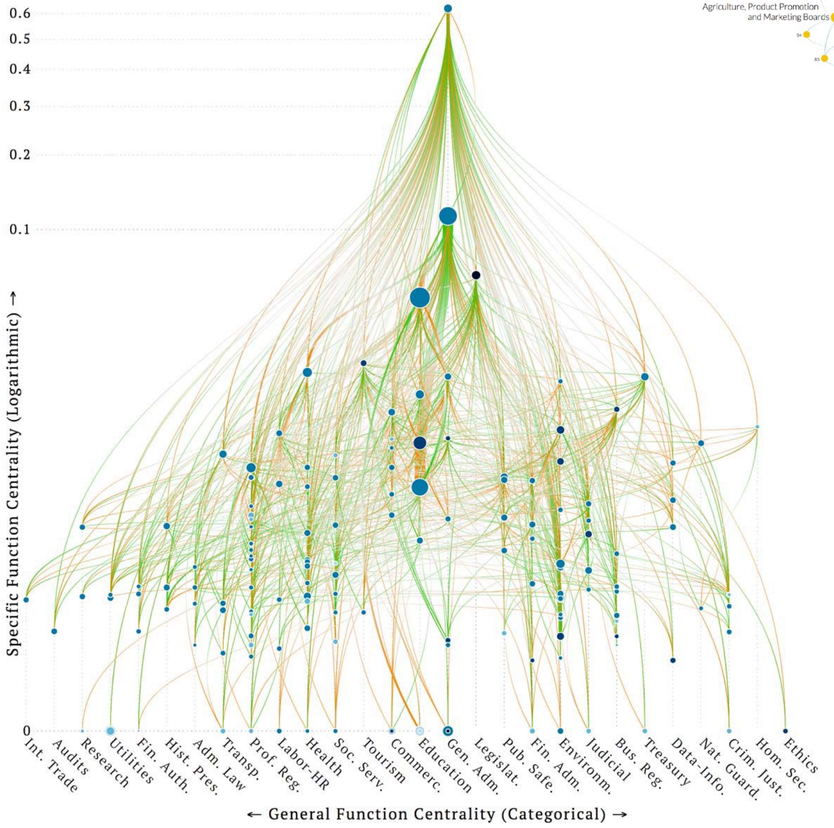
Numerical Hierachical **Textual** Relational Temporal Spatial

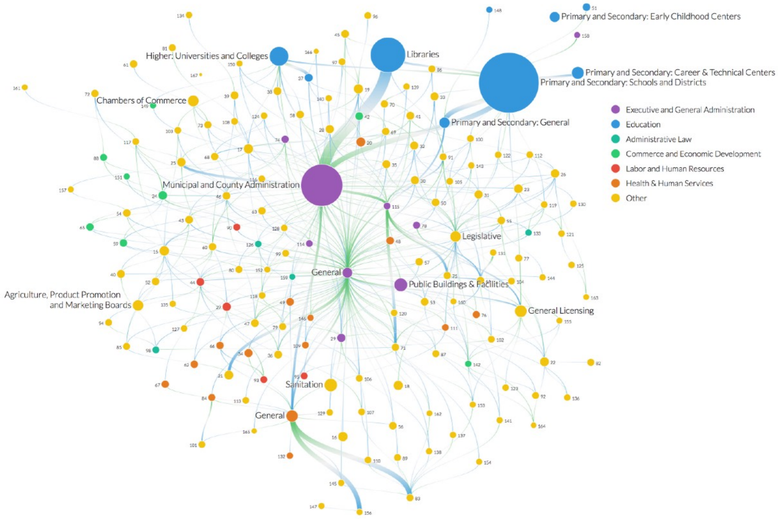


Phrase Net

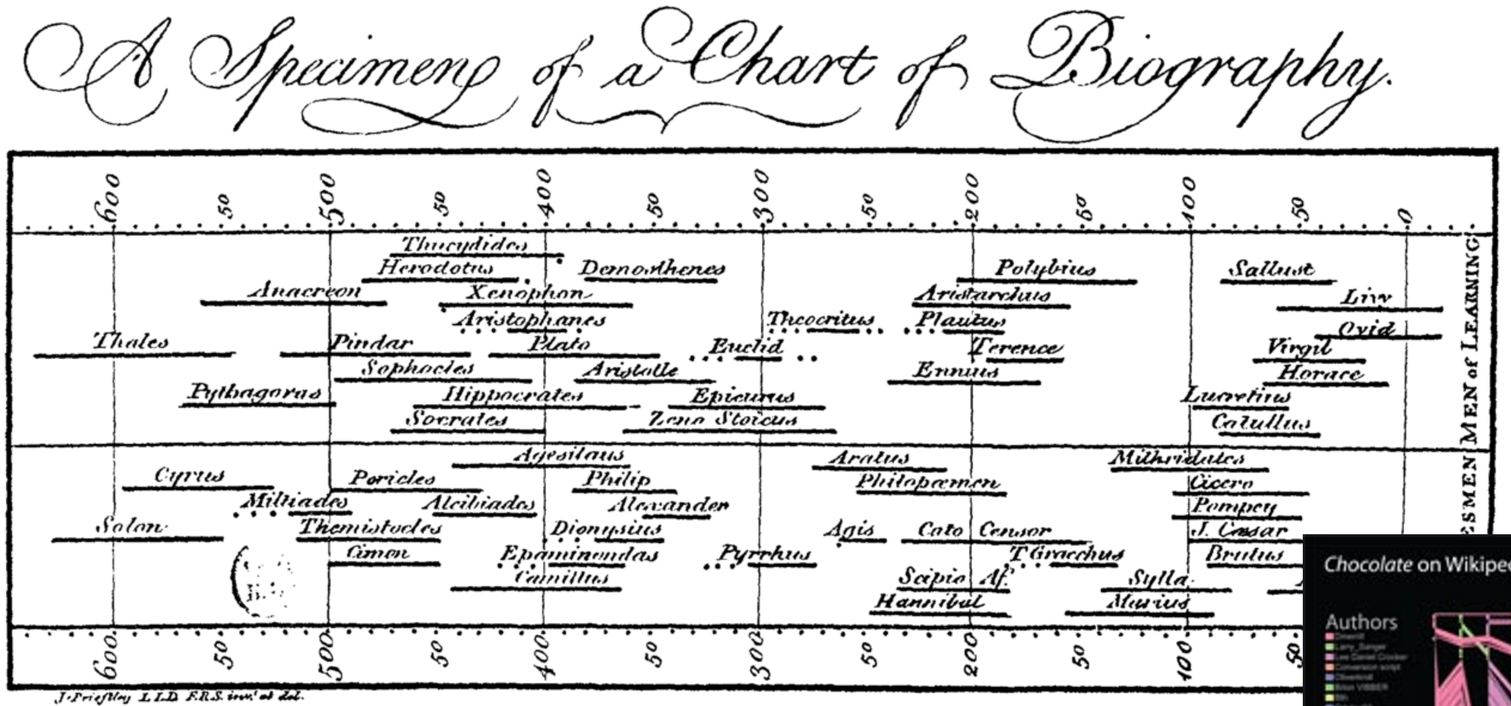
Numerical Hierachical Textual **Relational** Temporal Spatial

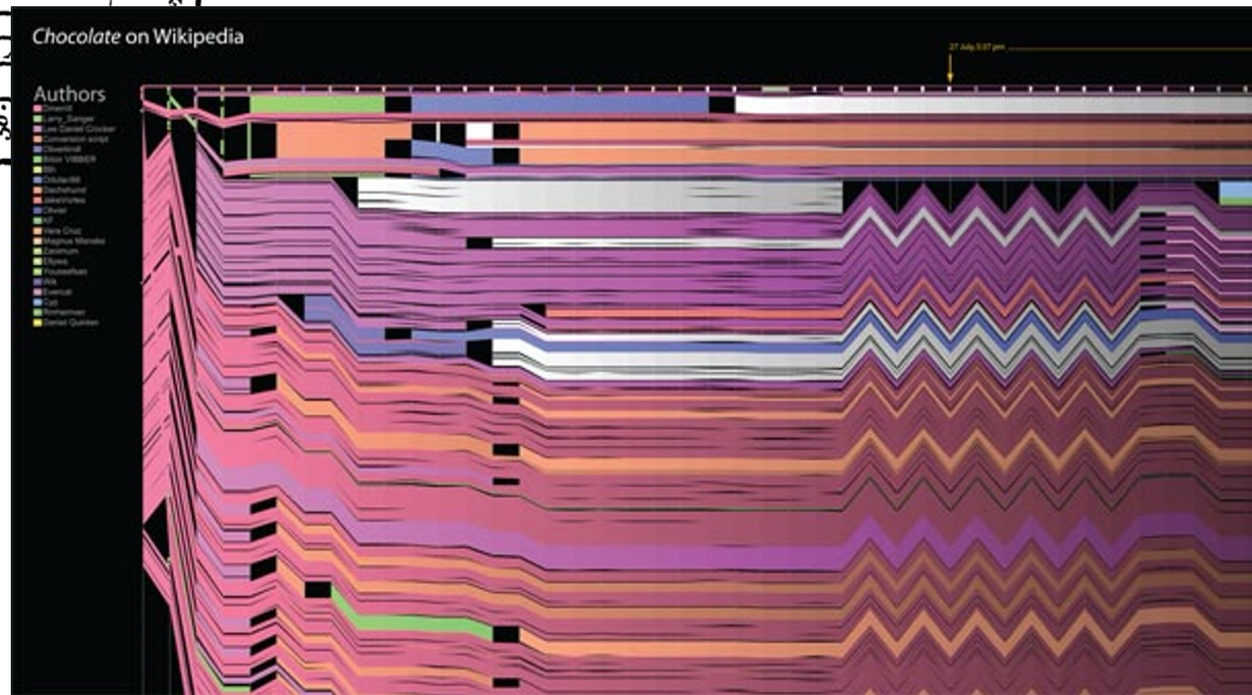




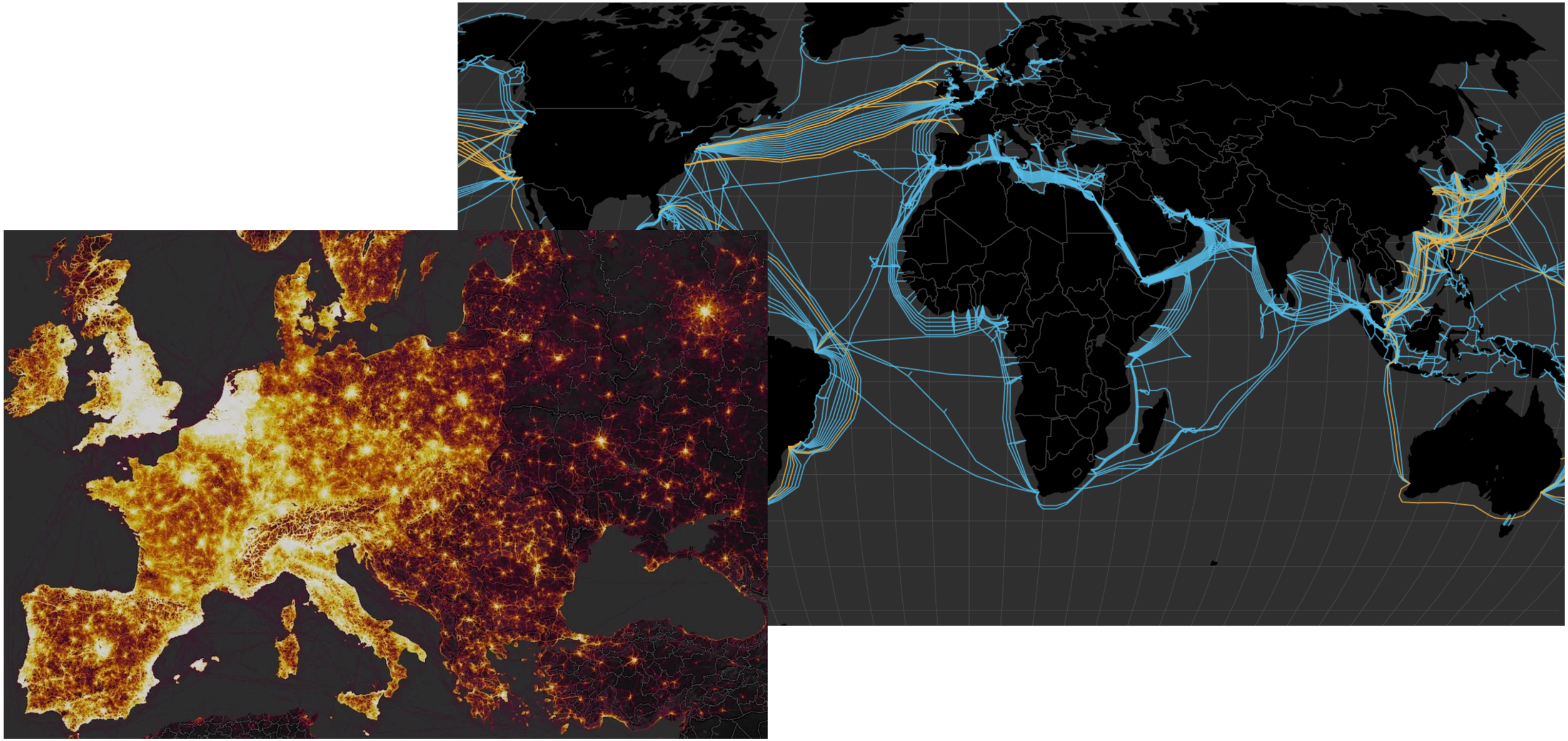


Numerical Hierachical Textual Relational **Temporal** Spatial

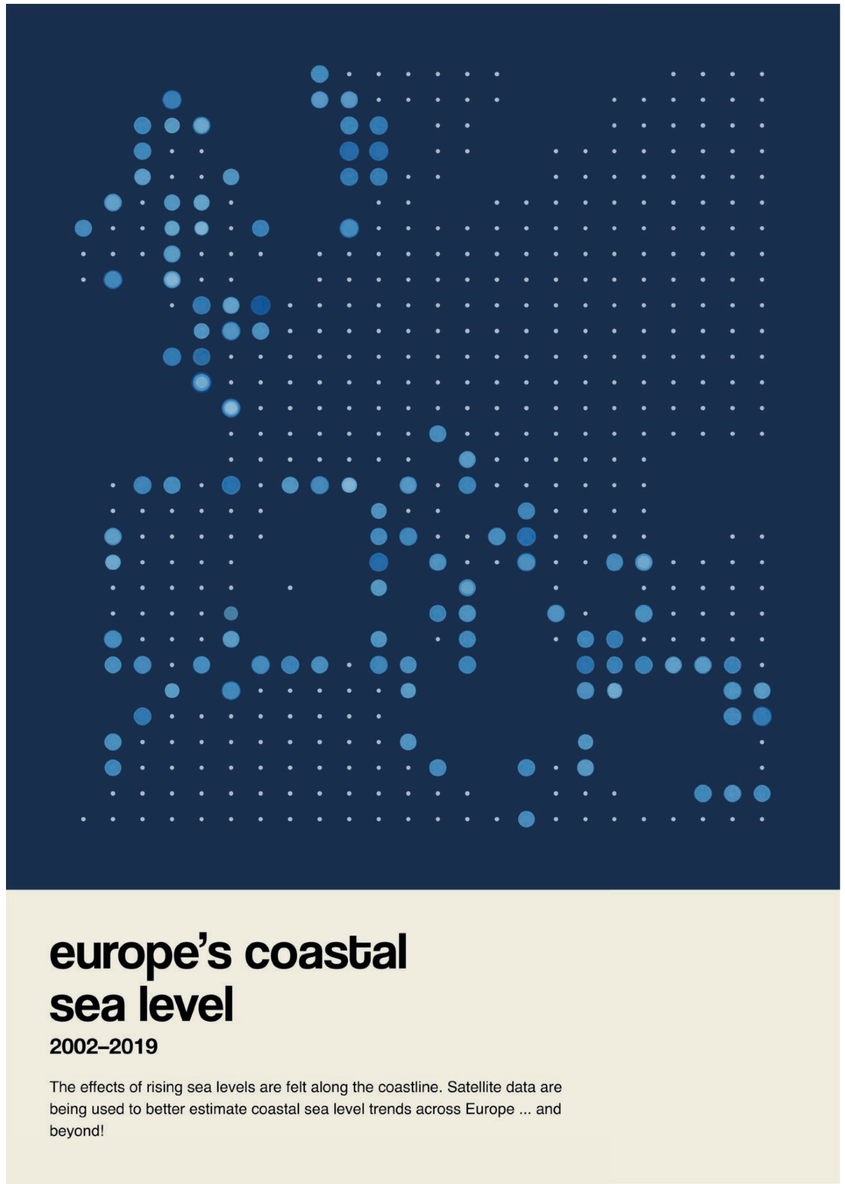


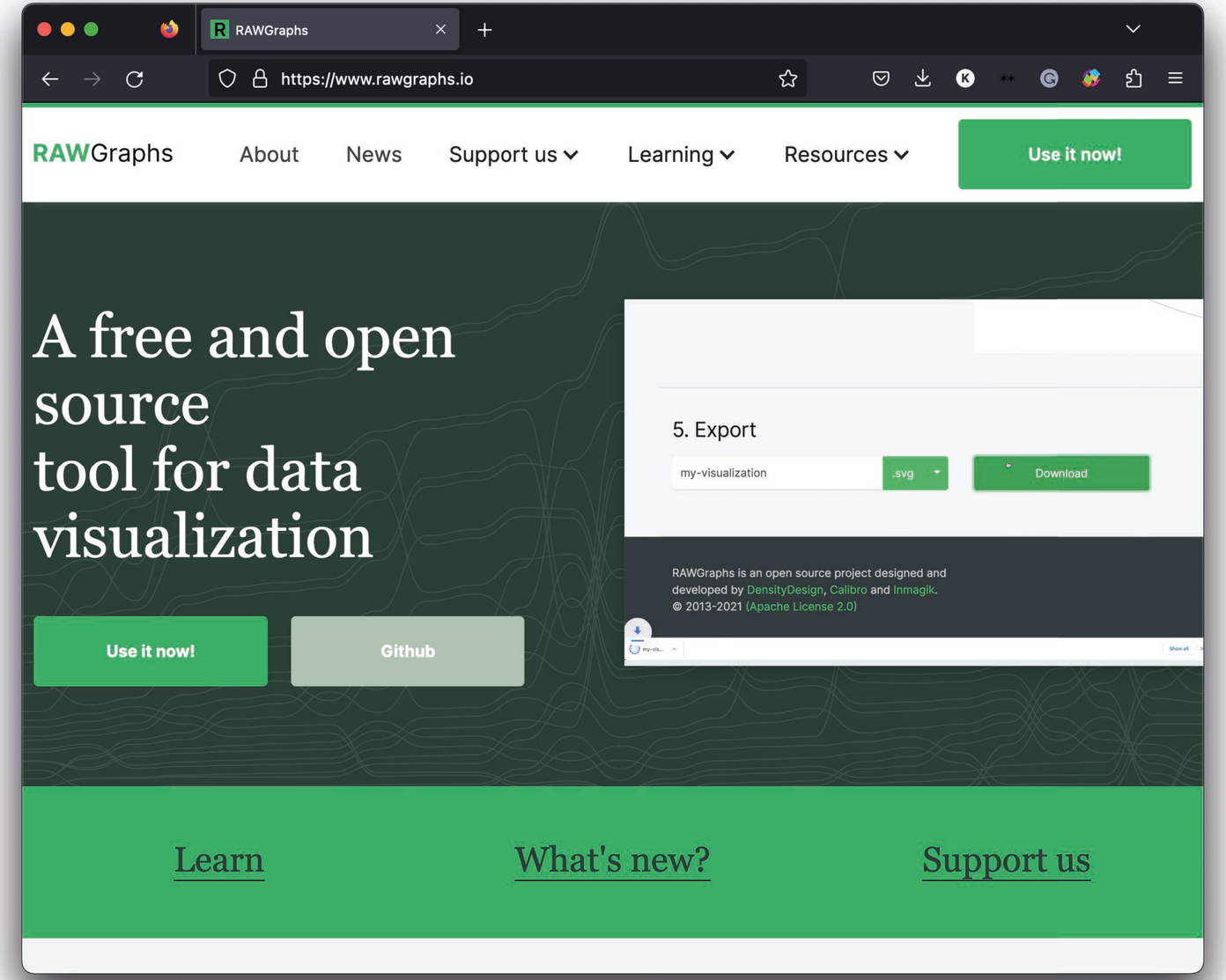


Numerical Hierachical Textual Relational Temporal **Spatial**

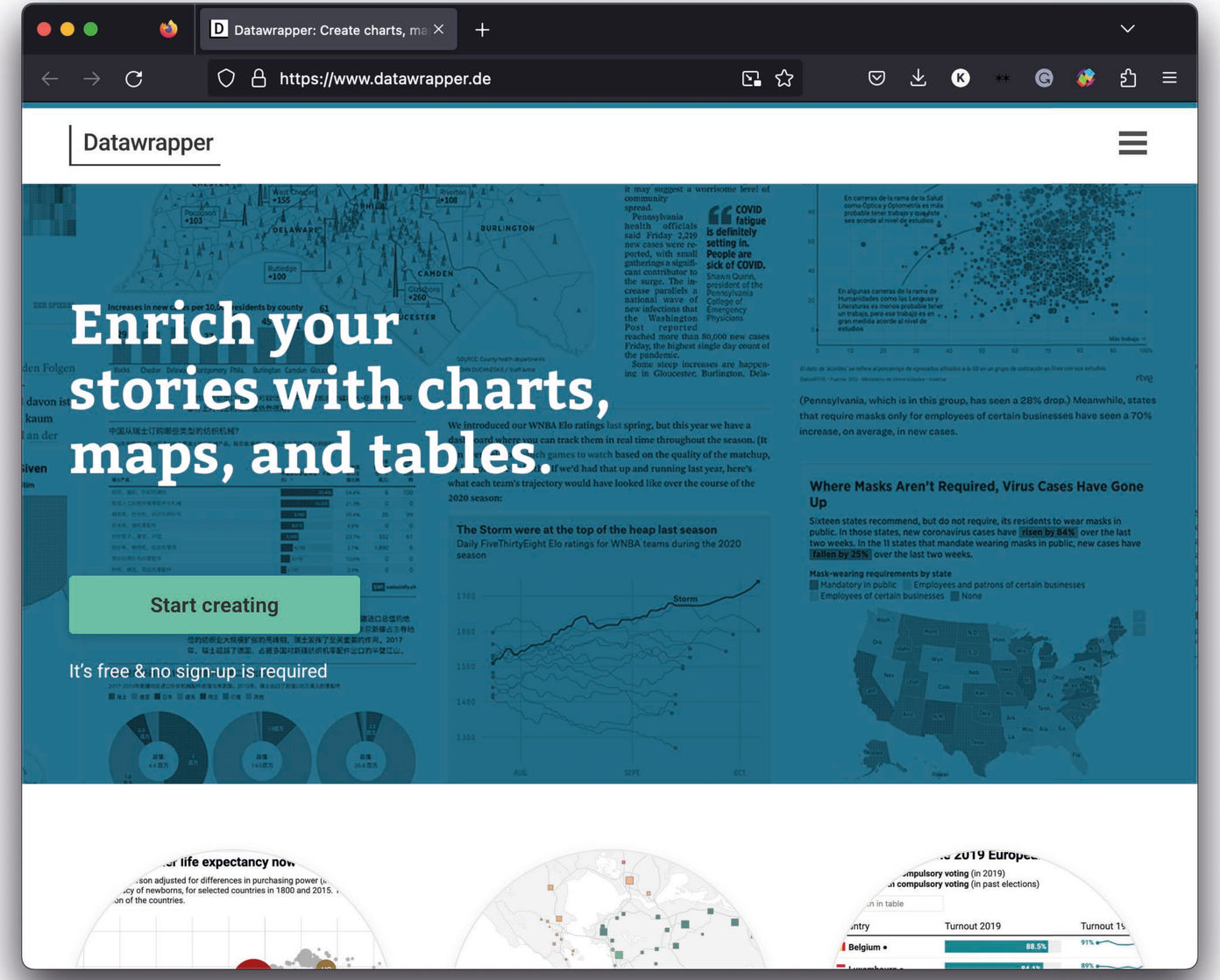


Tools

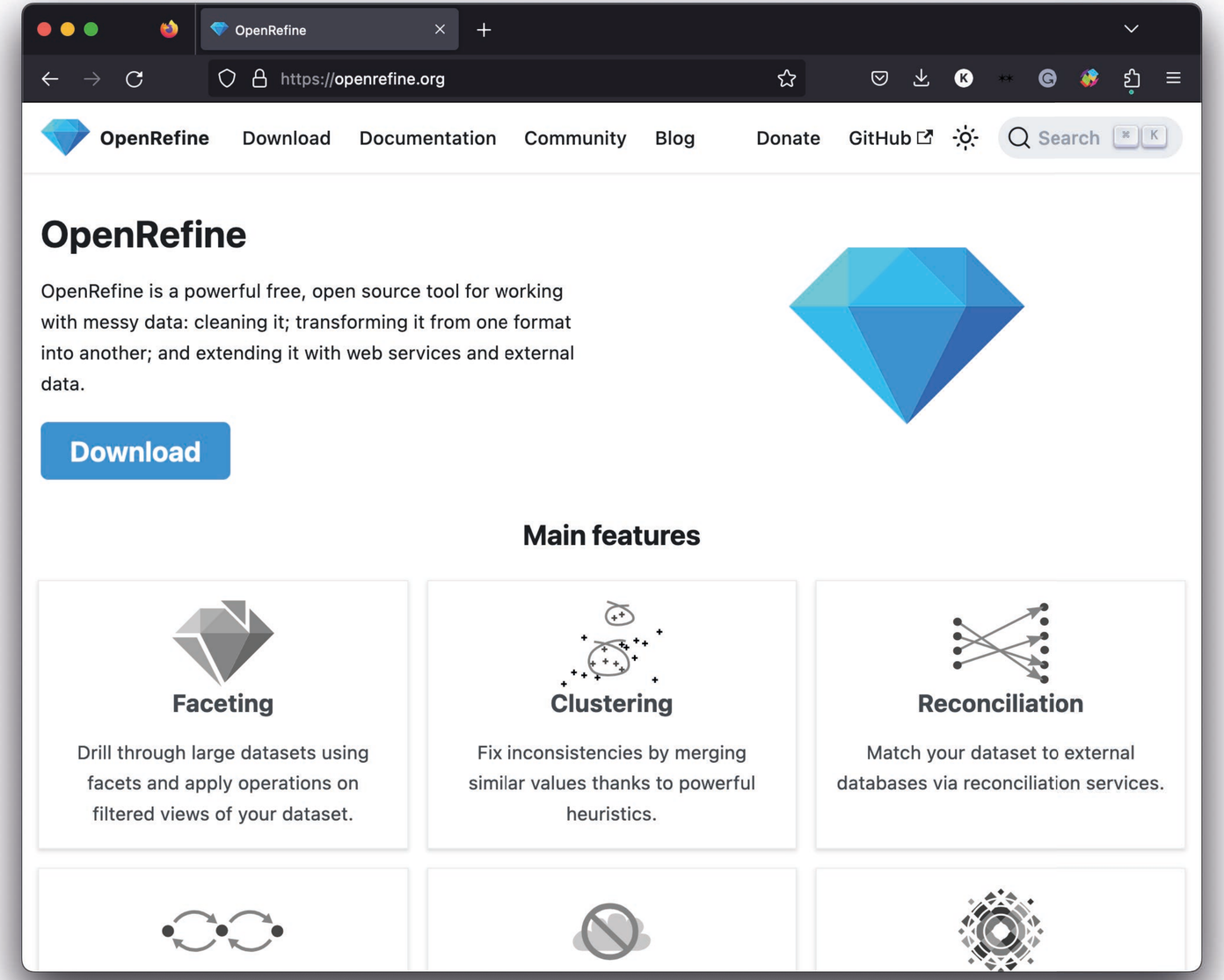

europe’s coastal
sea level
2002–2019
The effects of rising sea levels are felt along the coastline. Satellite data are being used to better estimate coastal sea level trends across Europe ... and beyond!



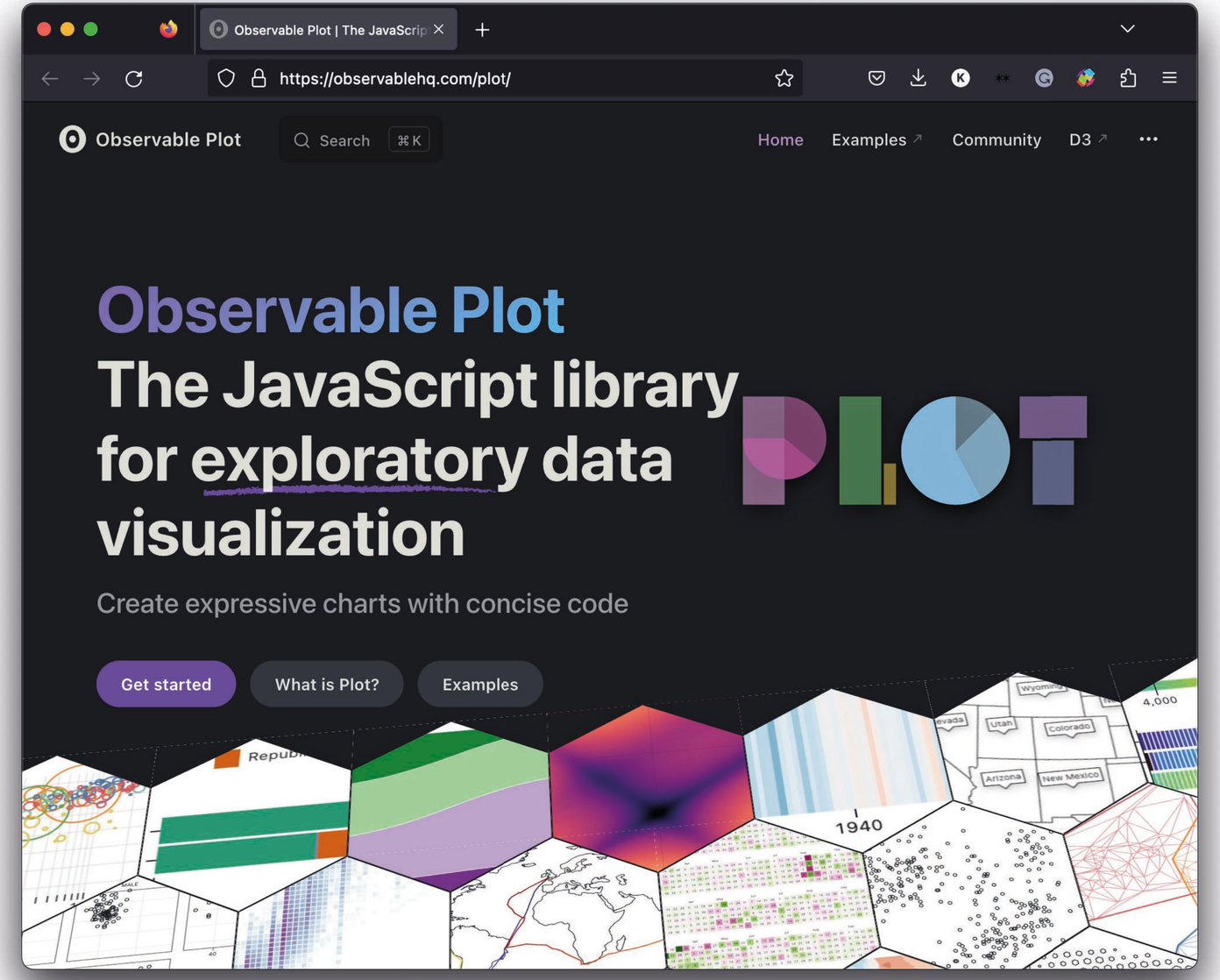
https://www.rawgraphs.io/



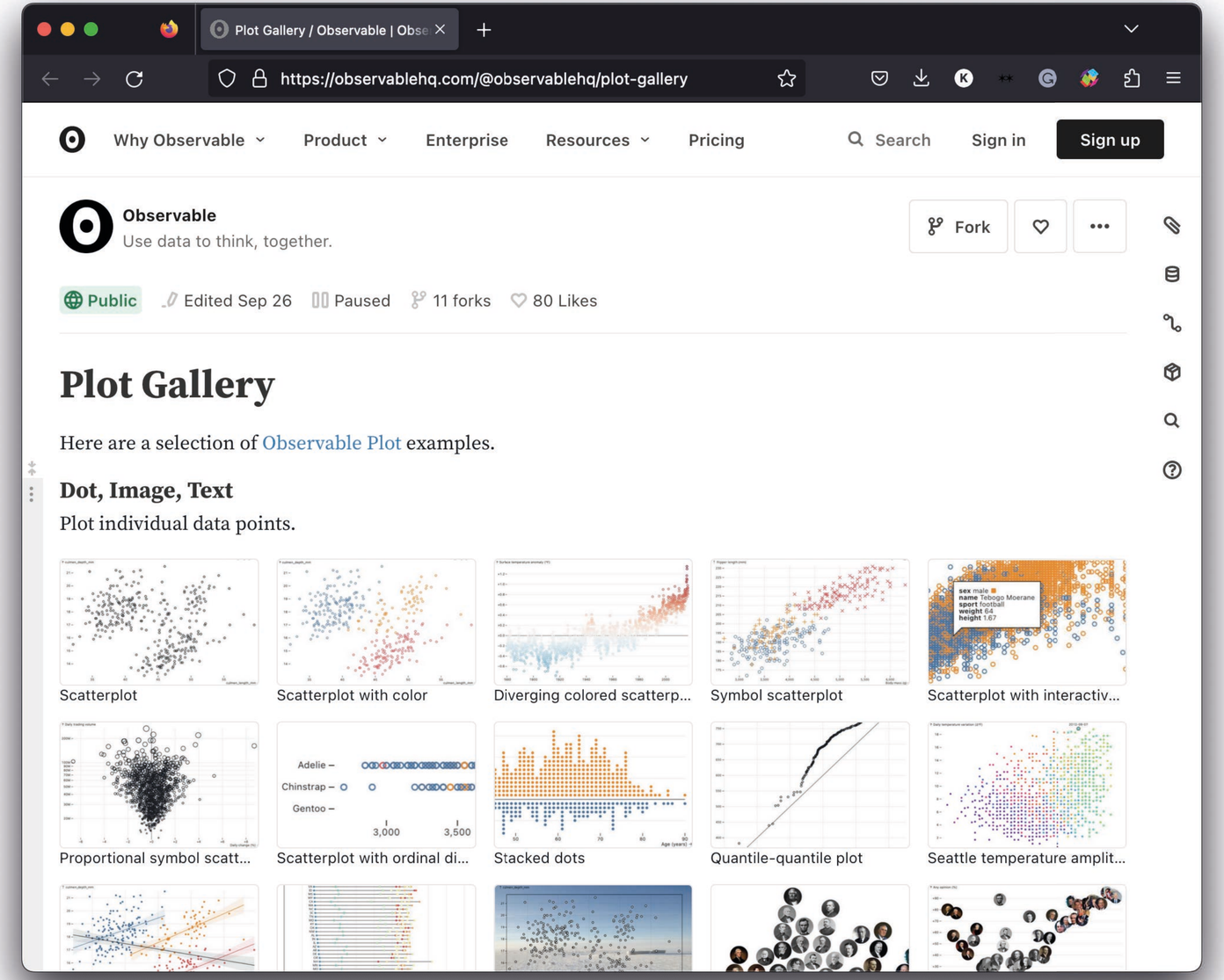
https://www.datawrapper.de/



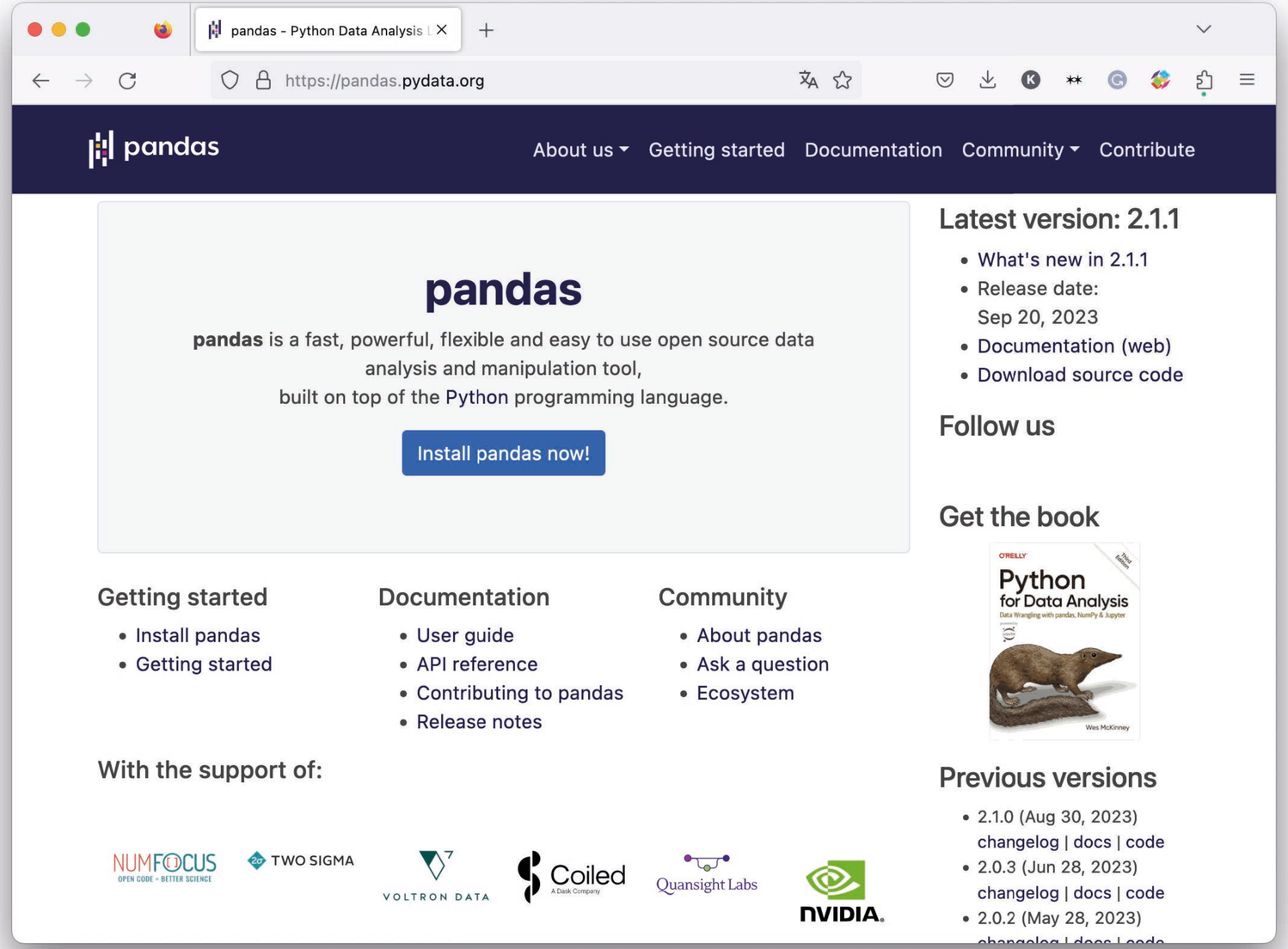
https://openrefine.org/



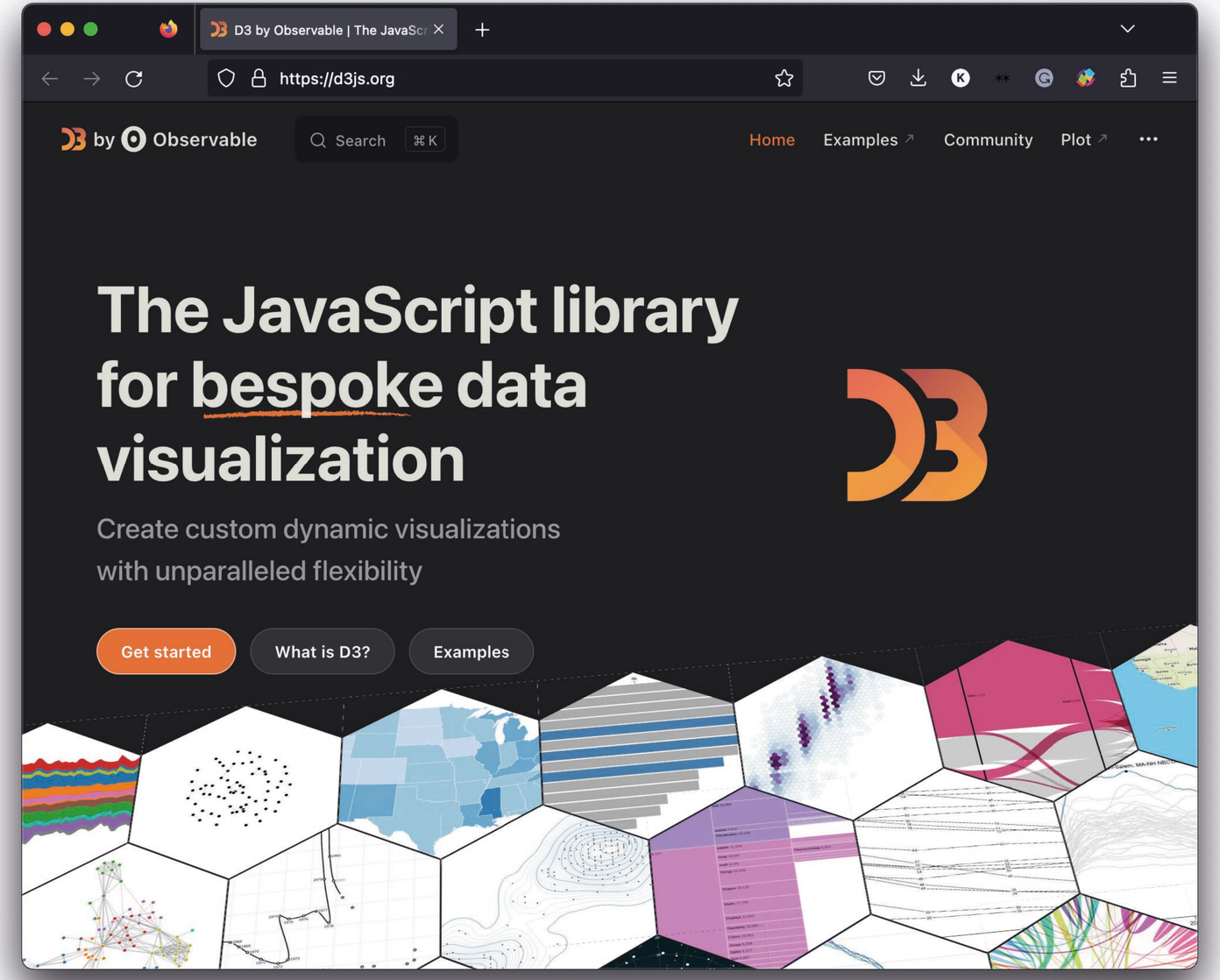
https://observablehq.com/plot/



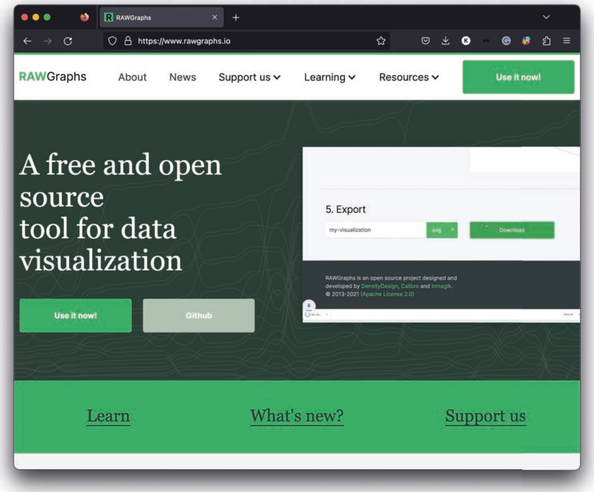
https://observablehq.com/plot/

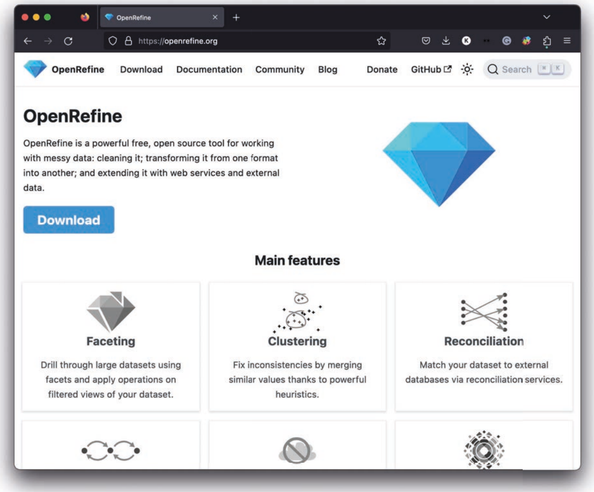


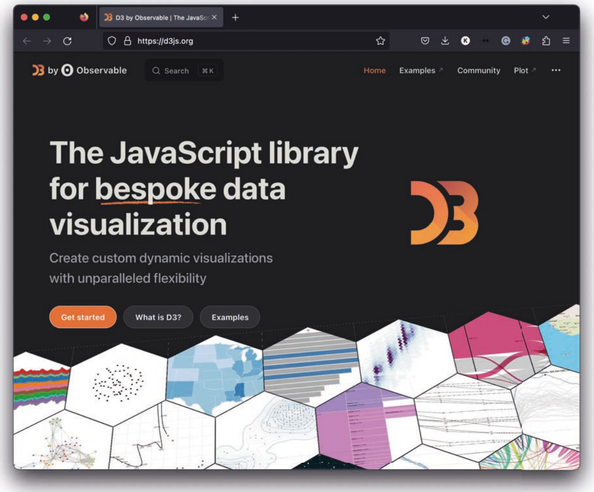
https://pandas.pydata.org/



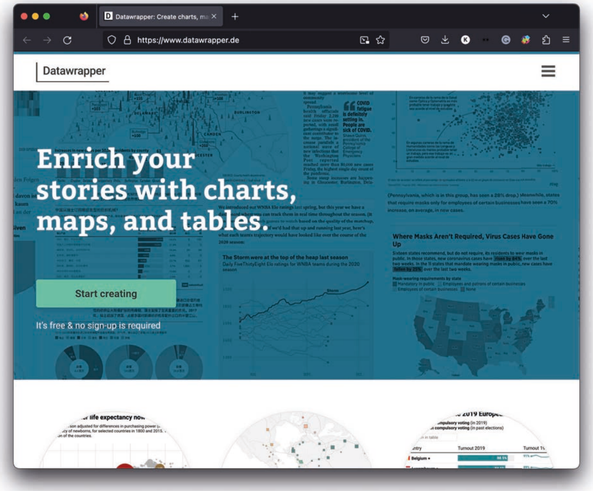
https://d3js.org/

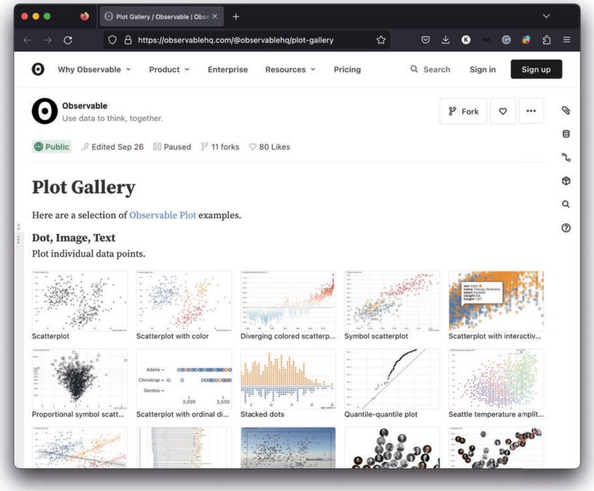


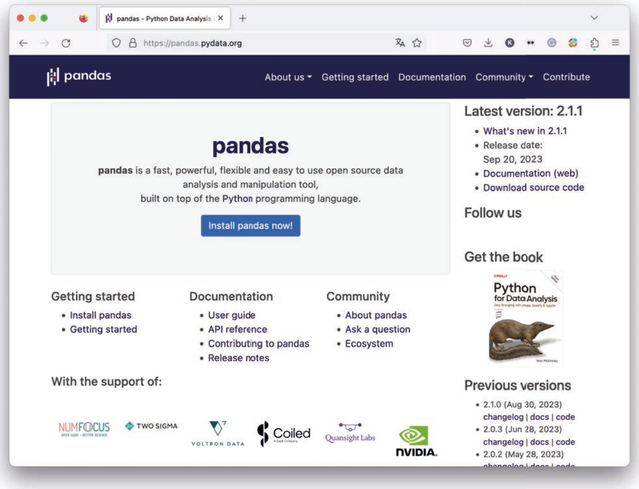




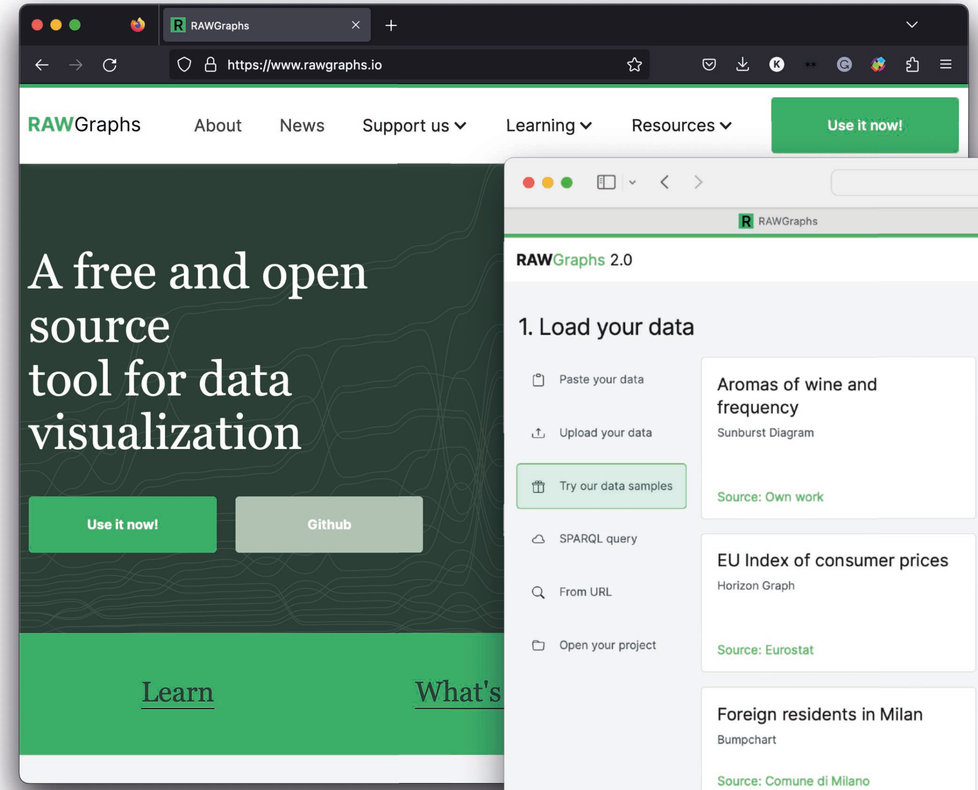
Simplicity ⟵ ⟶ **Freedom**



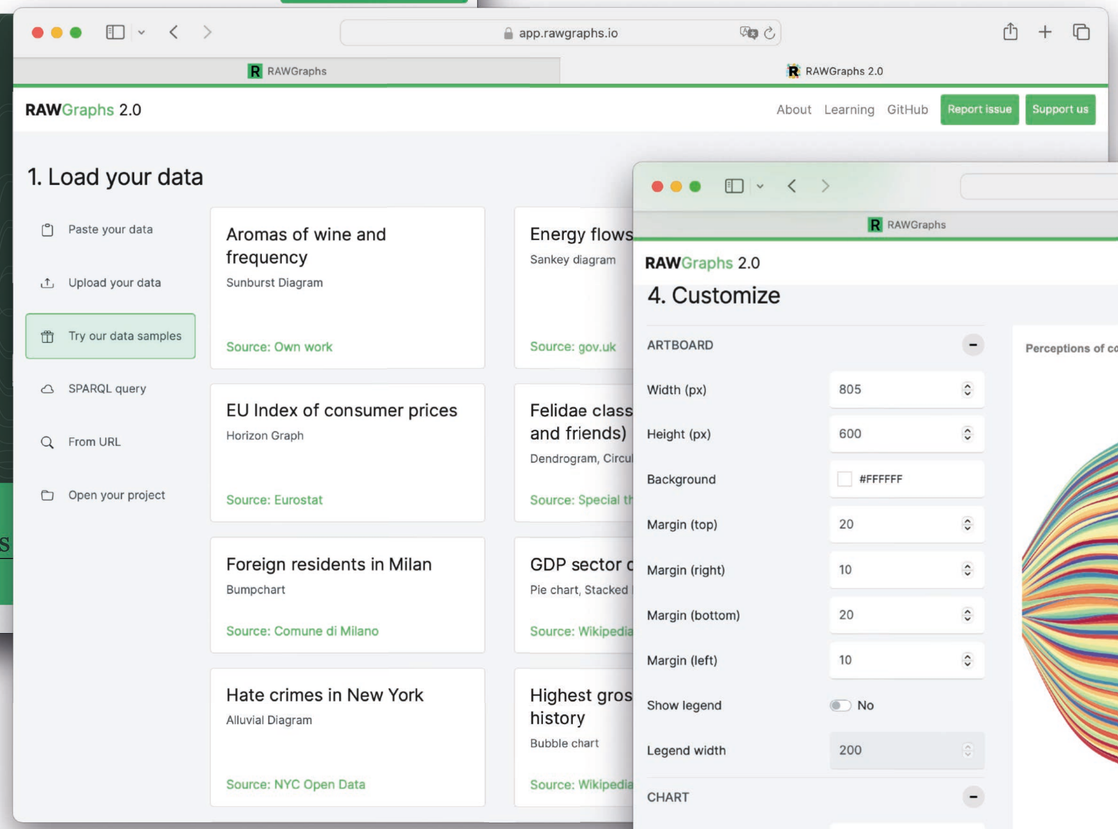




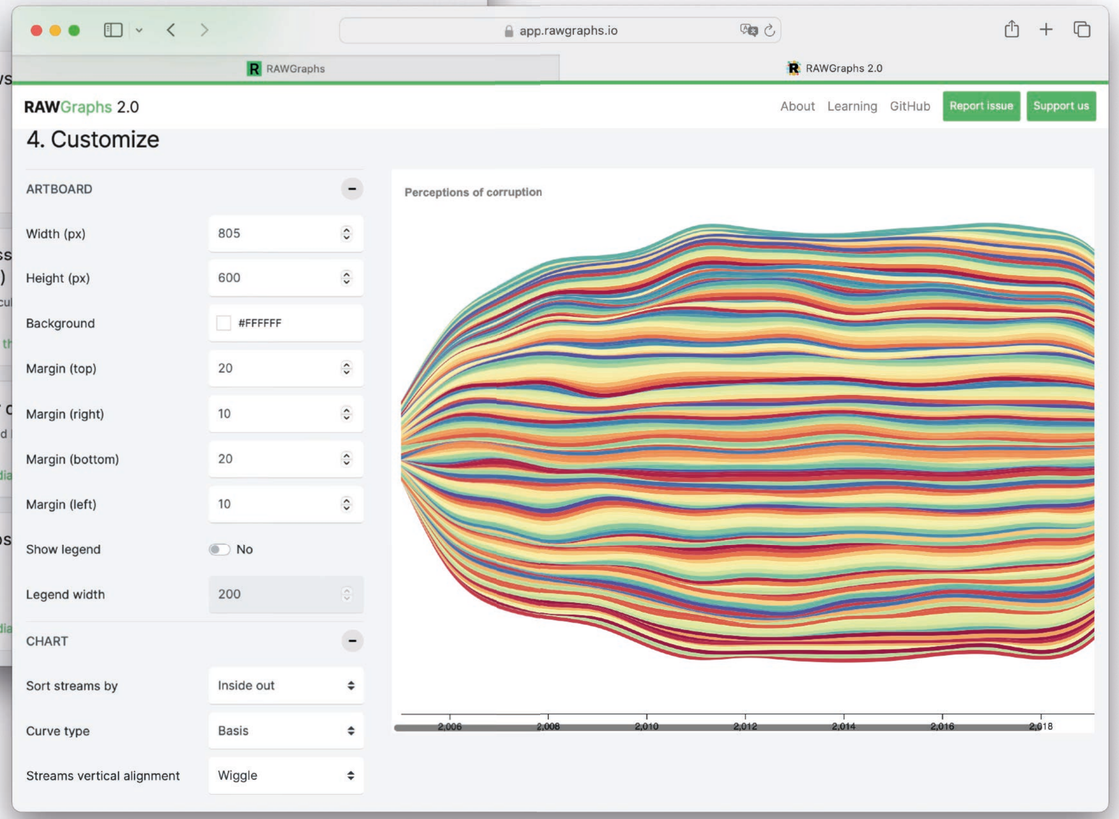
Task



https://www.rawgraphs.io/

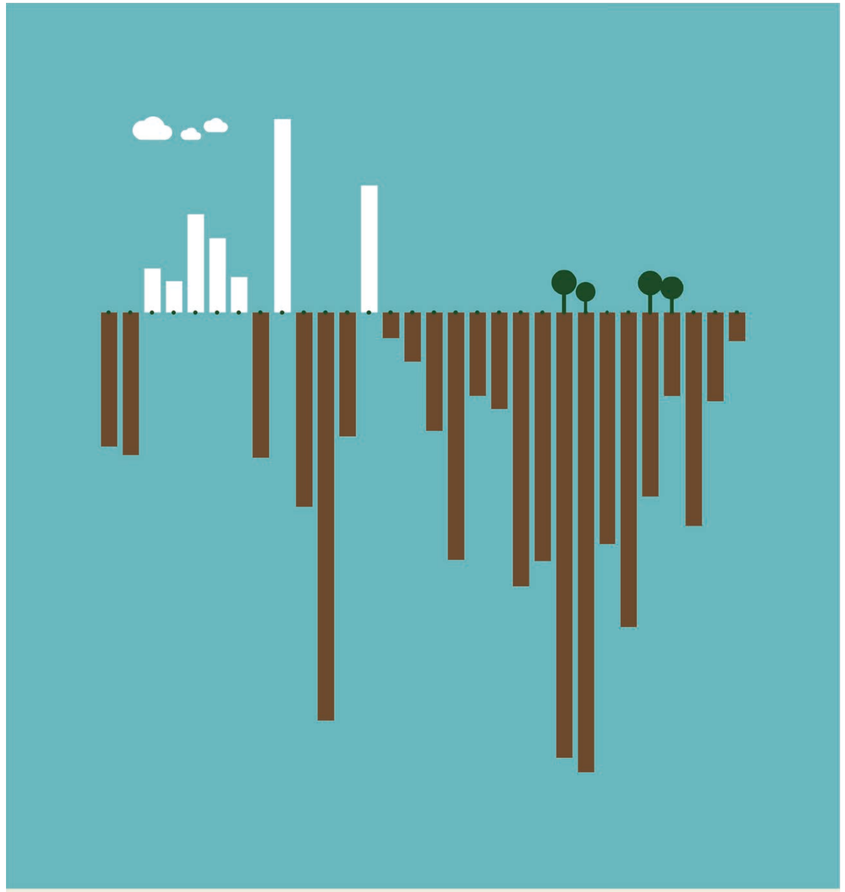


Find a sample dataset



Create a first visualization

Task



greenhouse gas inversions

1990–2019

This bar chart contrasts the difference between reported versus measured carbon dioxide levels in Brazil. Positive values, in white, depict years where Brazil has emitted more carbon dioxide than reported. Brown bars indicate negative values where Brazil absorbed more carbon dioxide than reported.

Task

Until May 14th

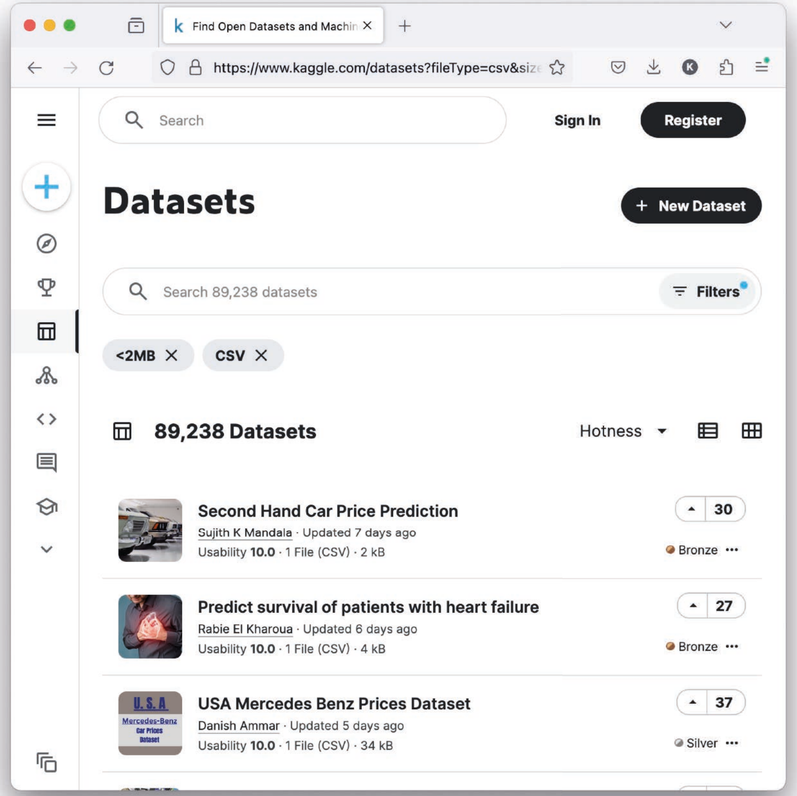
1. Find a dataset you are interested in.

Kaggle is a good resource. CSV (comma-separated value) files are easy to work with. Don’t use a dataset that is too large.
Are are almost 90.000 datasets to choose from: https://www.kaggle.com/datasets?fileType=csv&sizeEnd=2%2CMB&minUsabilityRating=8.00+or+higher

2. Visualize the dataset to tell a story.

Feel free to use raw graphs or any other tool you like to use.

3. Export an image of your visualization to present it on the 14th



The GEM Consortium

FILMUNIVERSITÄT
BABELSBERG
KONRAD WOLF

National and Kapodistrian
UNIVERSITY OF ATHENS

Tampere University
of Applied Sciences

Lodz
Film
School

Tampere University

L-Università
ta' Malta

ACADEMY OF DRAMATIC ART
UNIVERSITY OF ZAGREB

JAGIELLONIAN
UNIVERSITY
IN KRAKÓW

THE INSTITUTE
FOR ART AND
INNOVATION

Co-funded by the European Union

The creation of these resources has been (partially) funded by the ERASMUS+ grant program of the European Union under grant no. 2022-1-DE01-KA220-HED-000088645.