

Visualization as a design process

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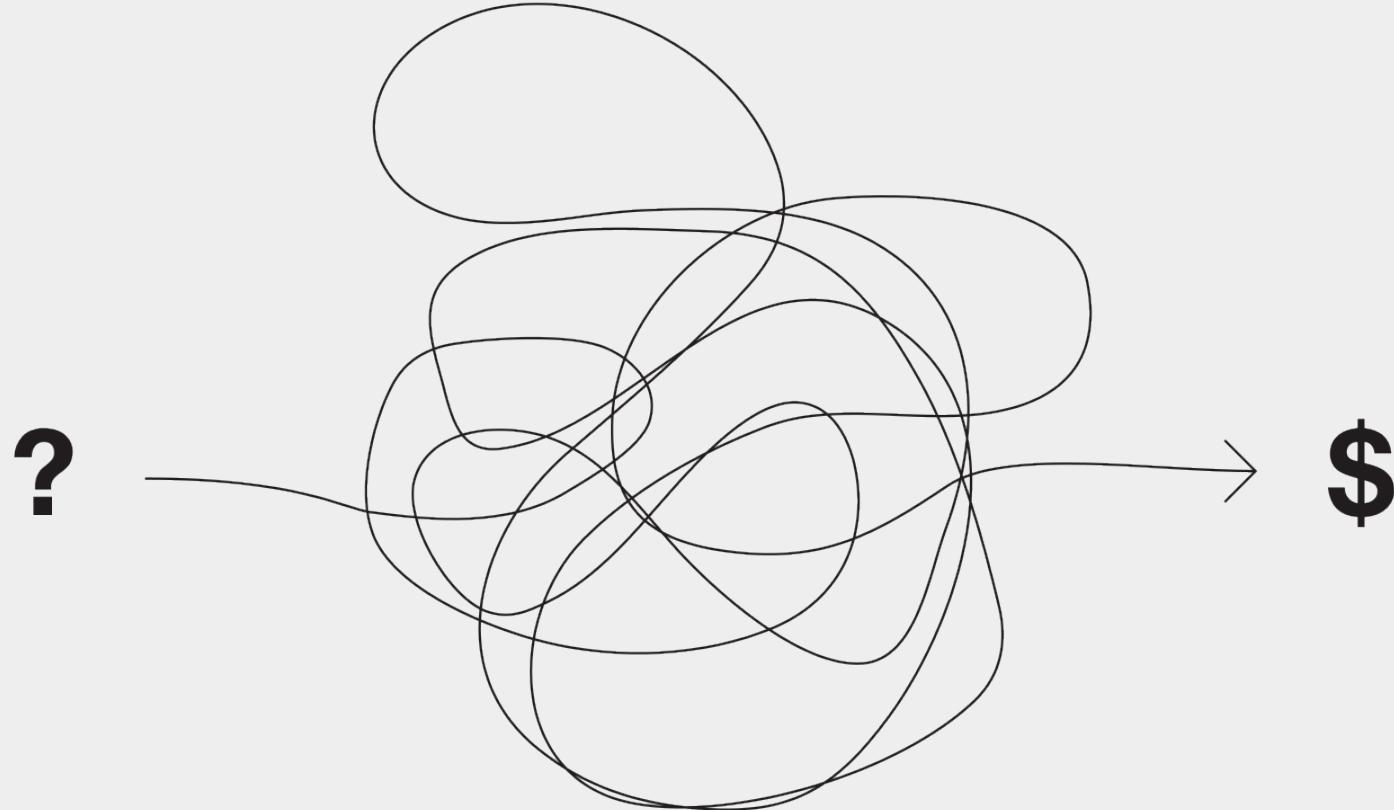


Max-Planck Odense Center on the
Biodemography of Aging

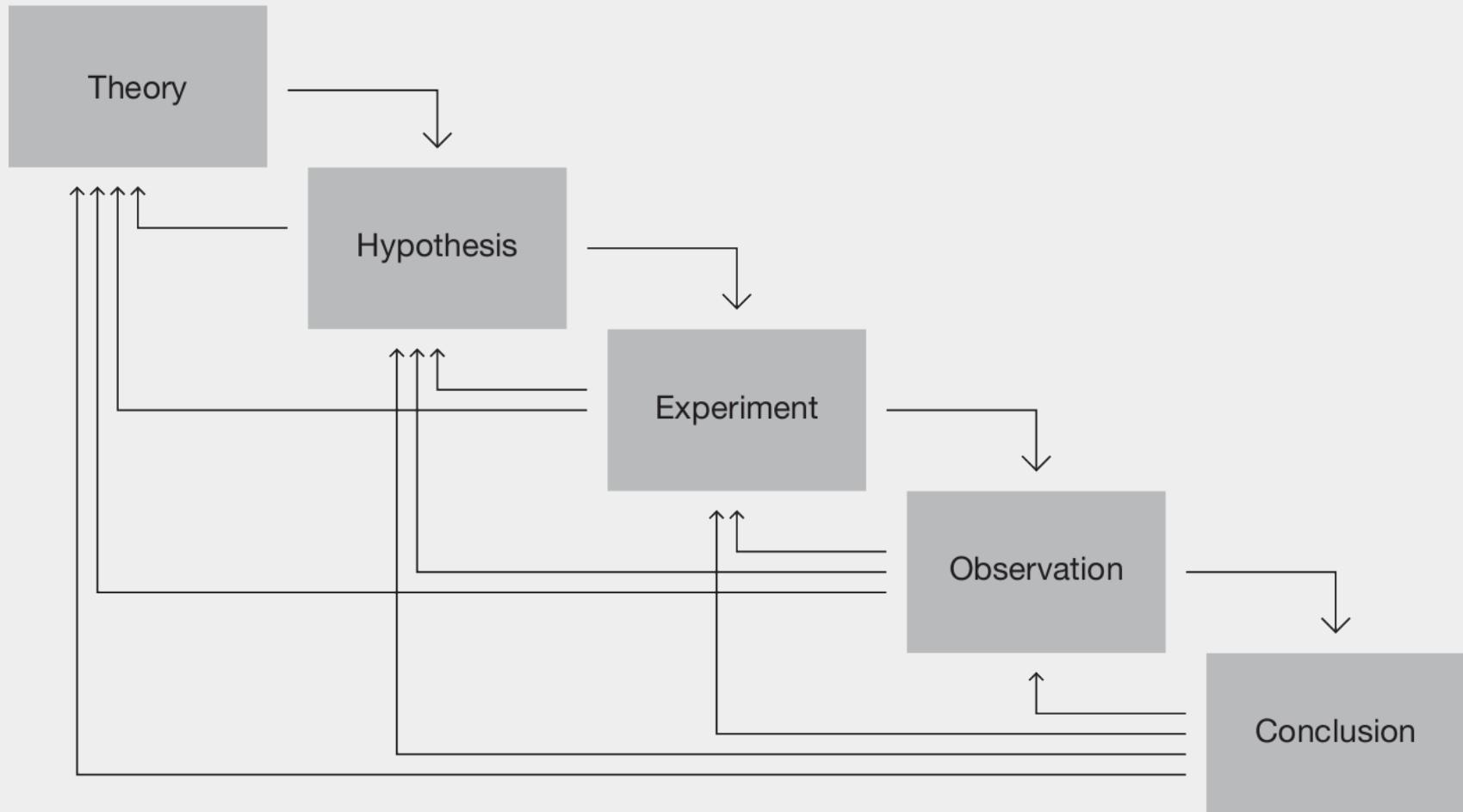


Department of Public Health
University of Southern Denmark

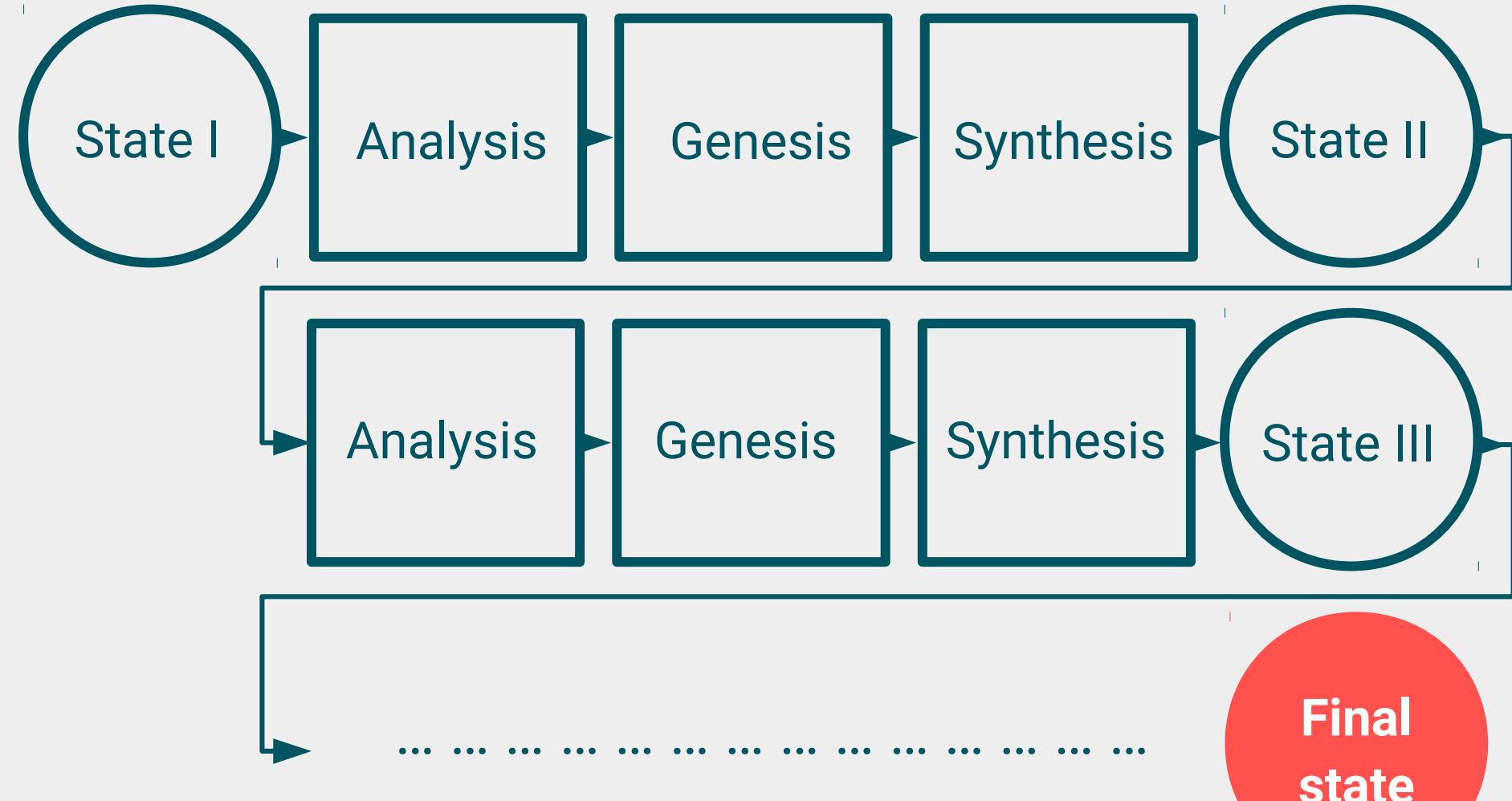
What is a design process?



A well known design process...

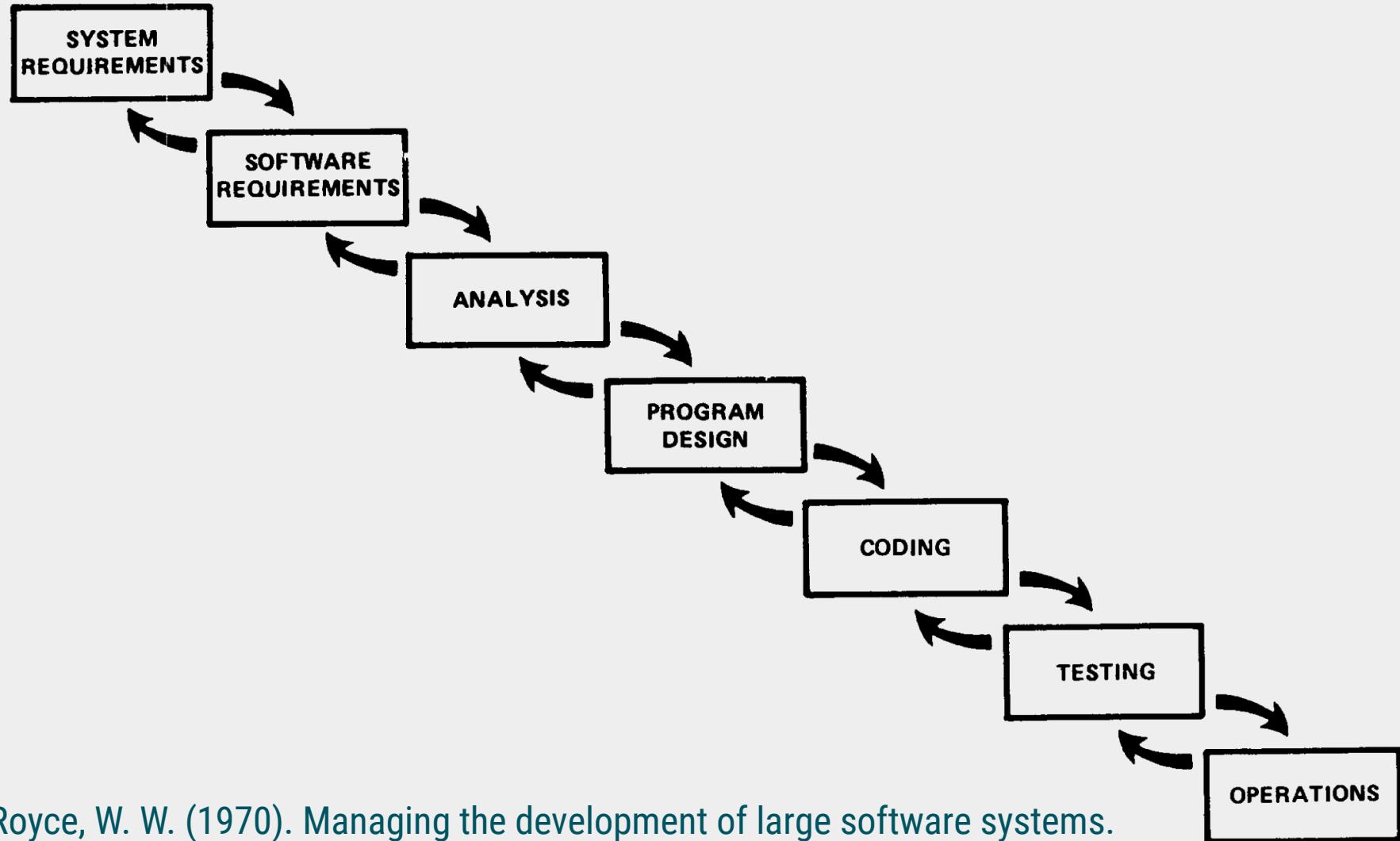


Analysis, genesis, synthesis



Doblin, J. (1987). A Short, Grandiose Theory of Design. STA Design Journal.

The Waterfall life-cycle



Royce, W. W. (1970). Managing the development of large software systems.
Electronics, 26 (August), 1–9.

The essence of every design process

**Iteration until converging
on a predefined goal**

The four nested levels of viz design

Domain situation

Observe target users using existing tools

Data/task abstraction

Visual encoding/interaction idiom

Justify design with respect to alternatives

Algorithm

Measure system time/memory

Analyze computational complexity

Analyze results qualitatively

Measure human time with lab experiment (*lab study*)

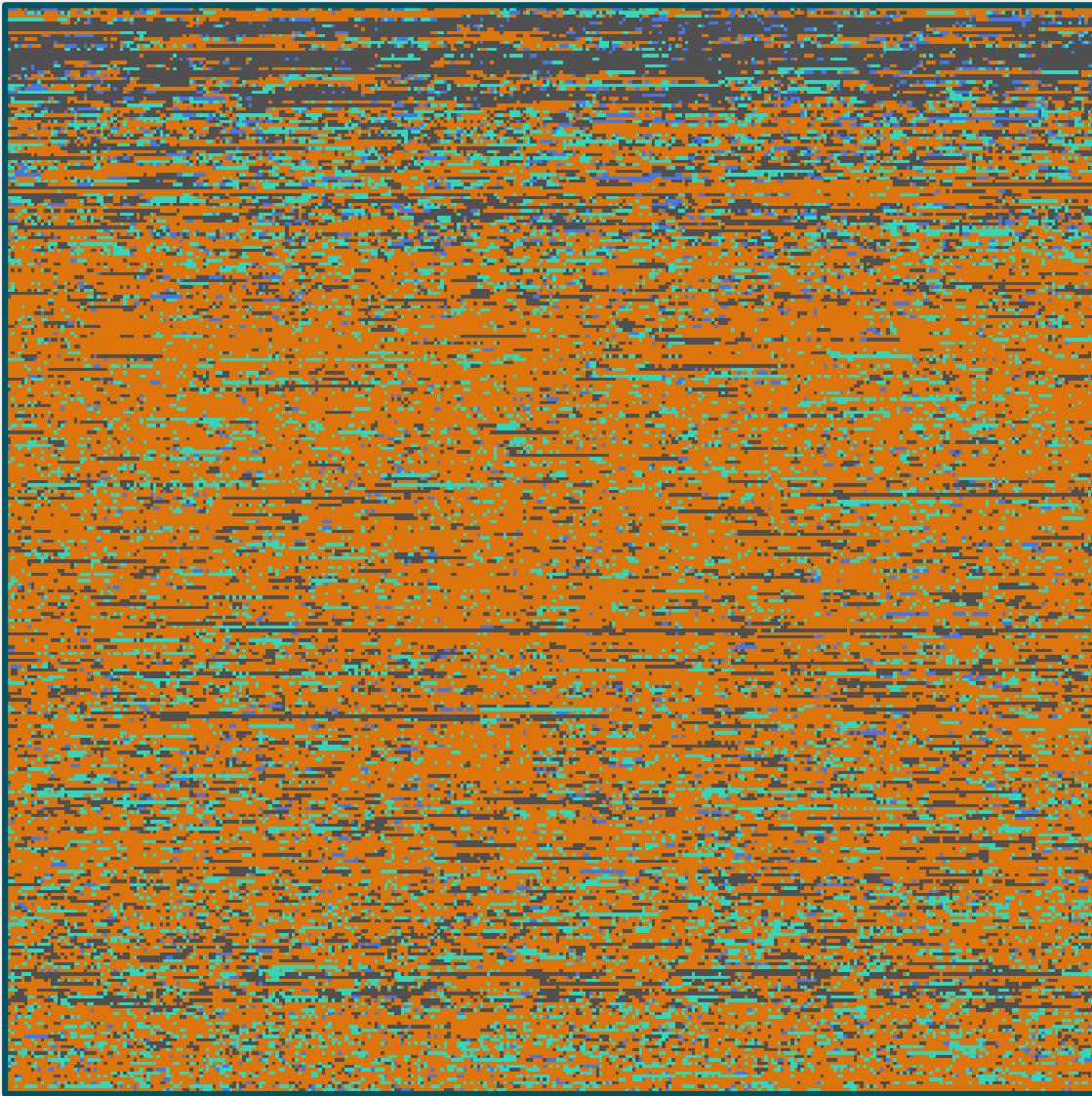
Observe target users after deployment (*field study*)

Measure adoption

Munzner, T. (2015).
Visualization
Analysis & Design.
Chapter 4.

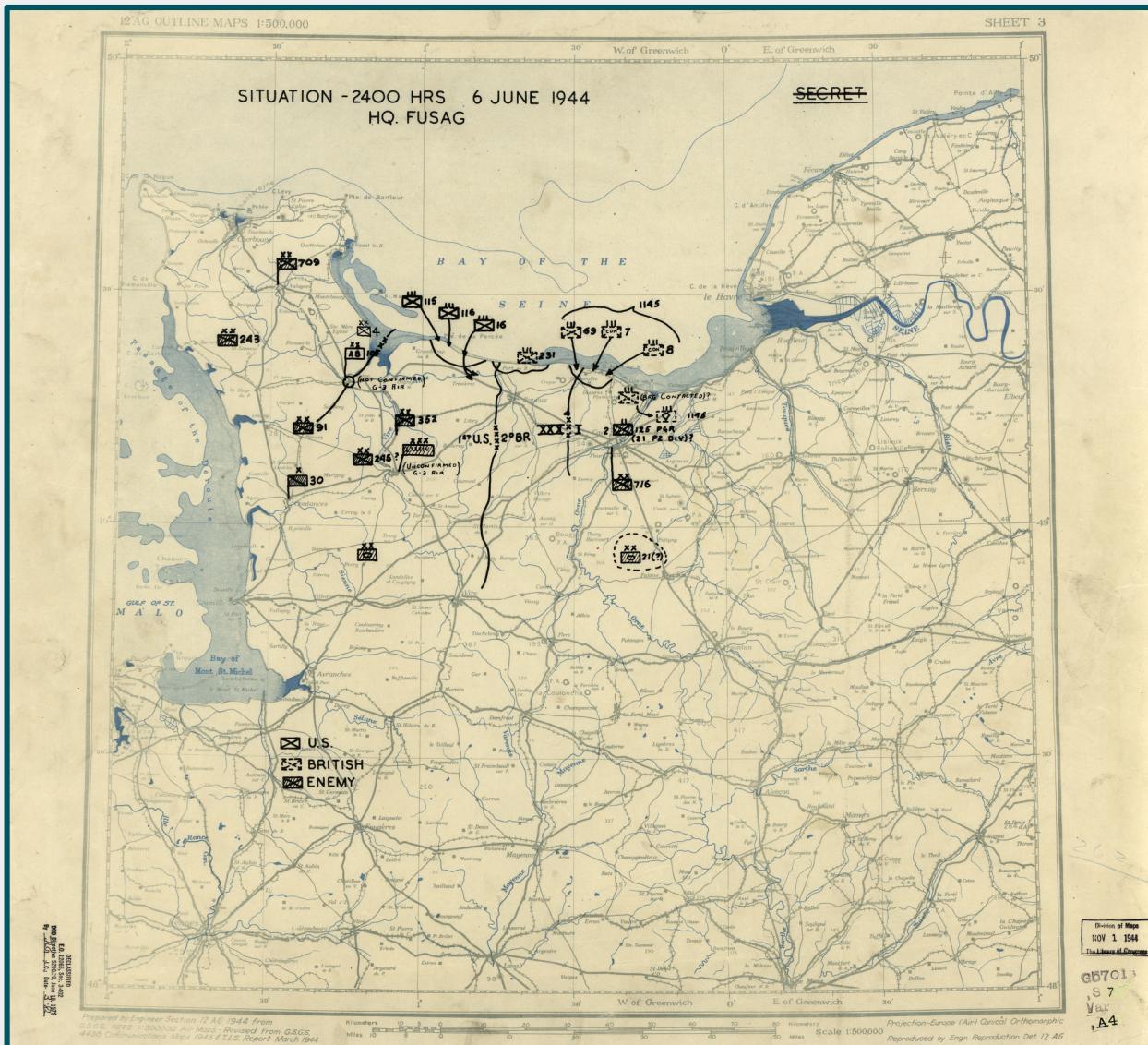
**Different domains,
different design goals**

Data-art



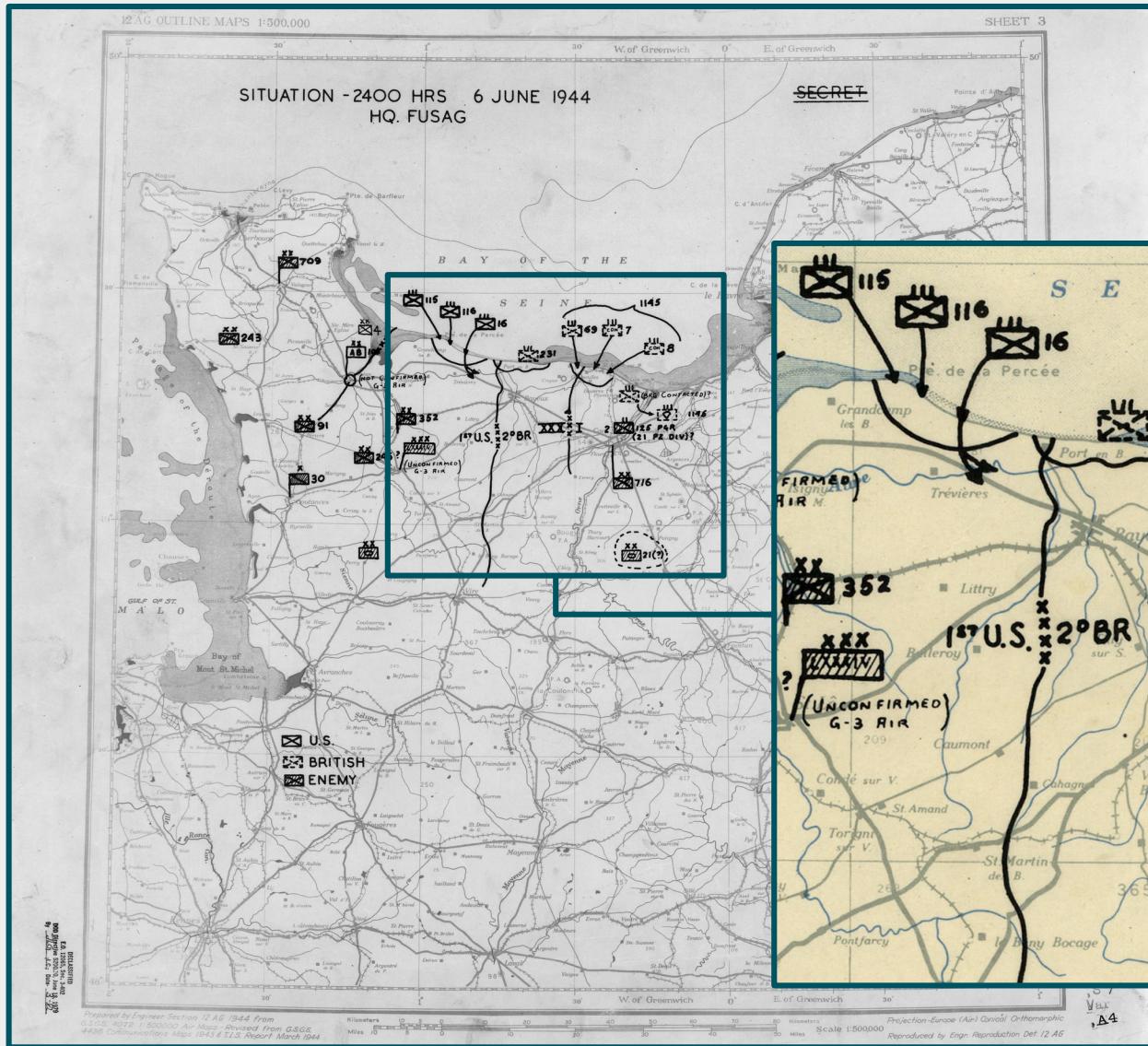
Kamel Makhlofi (2010). Function.
[cutout]

Situation room

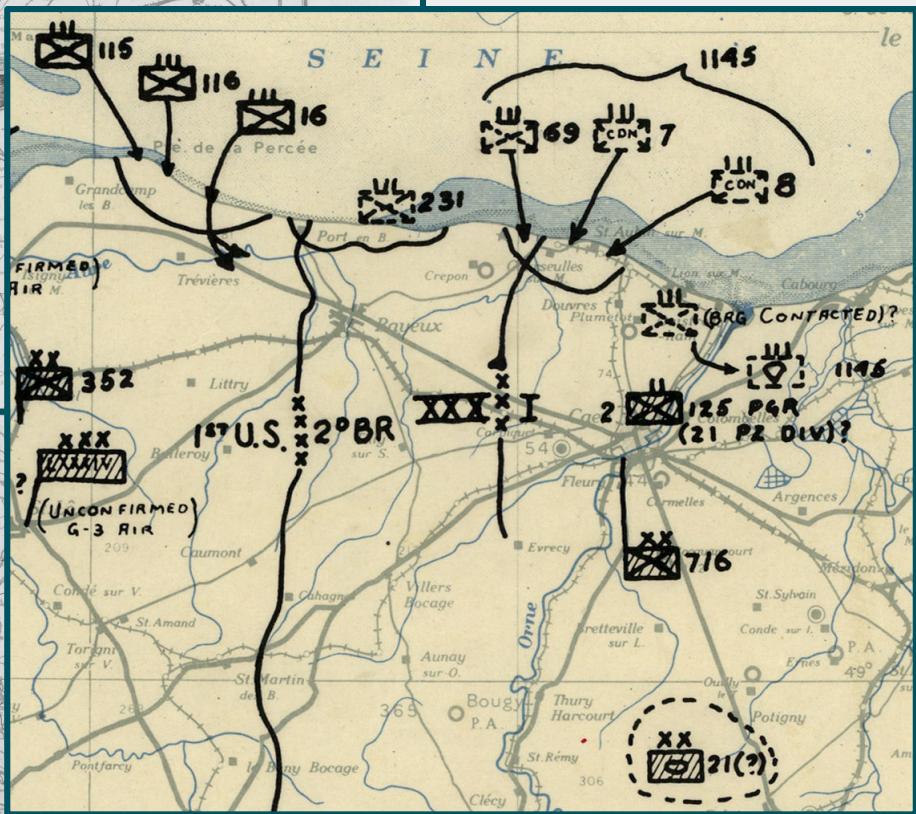


Official U.S. 12th army position map at 2400hours on D-Day.

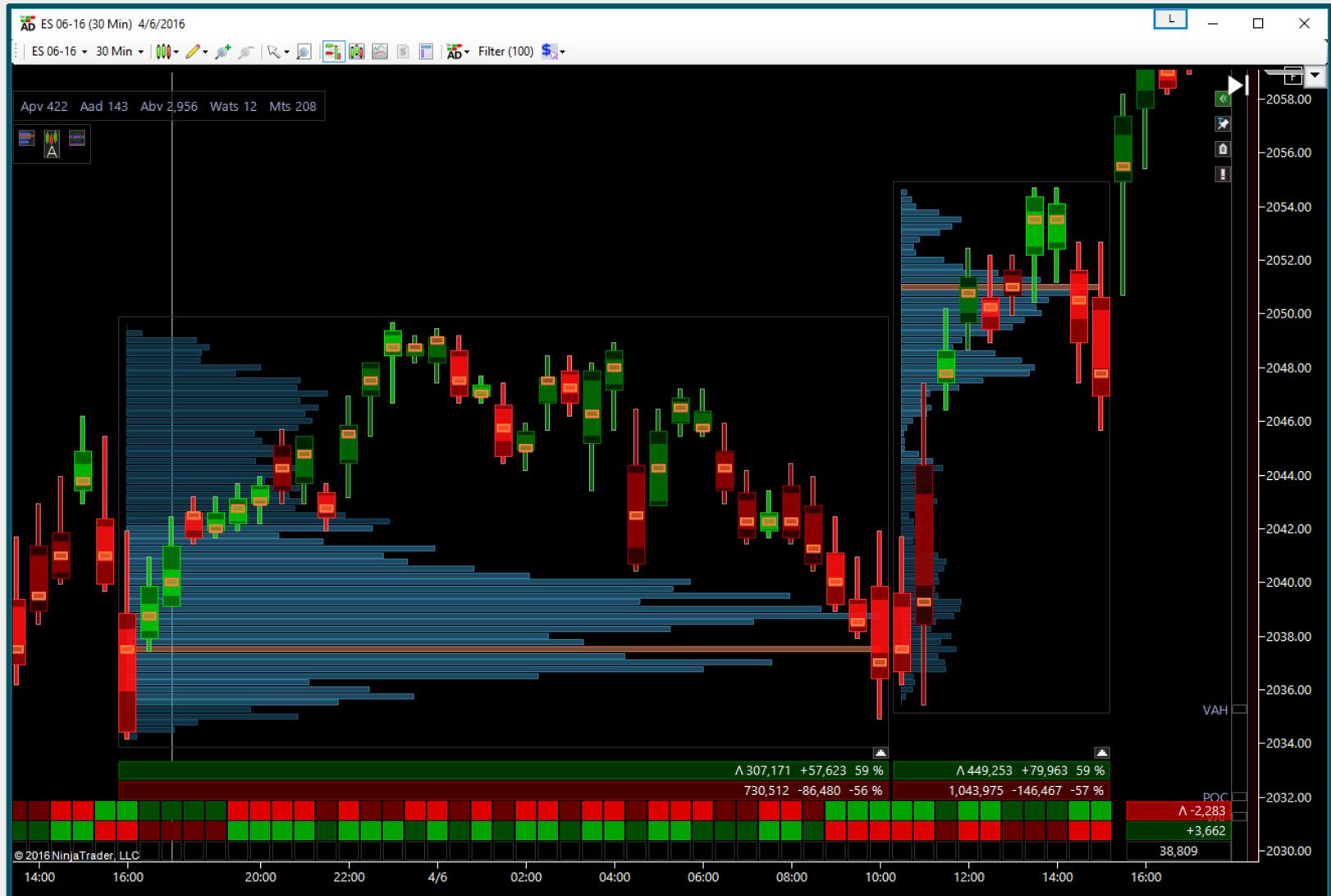
Situation room



Official U.S. 12th army position map at 2400hours on D-Day.

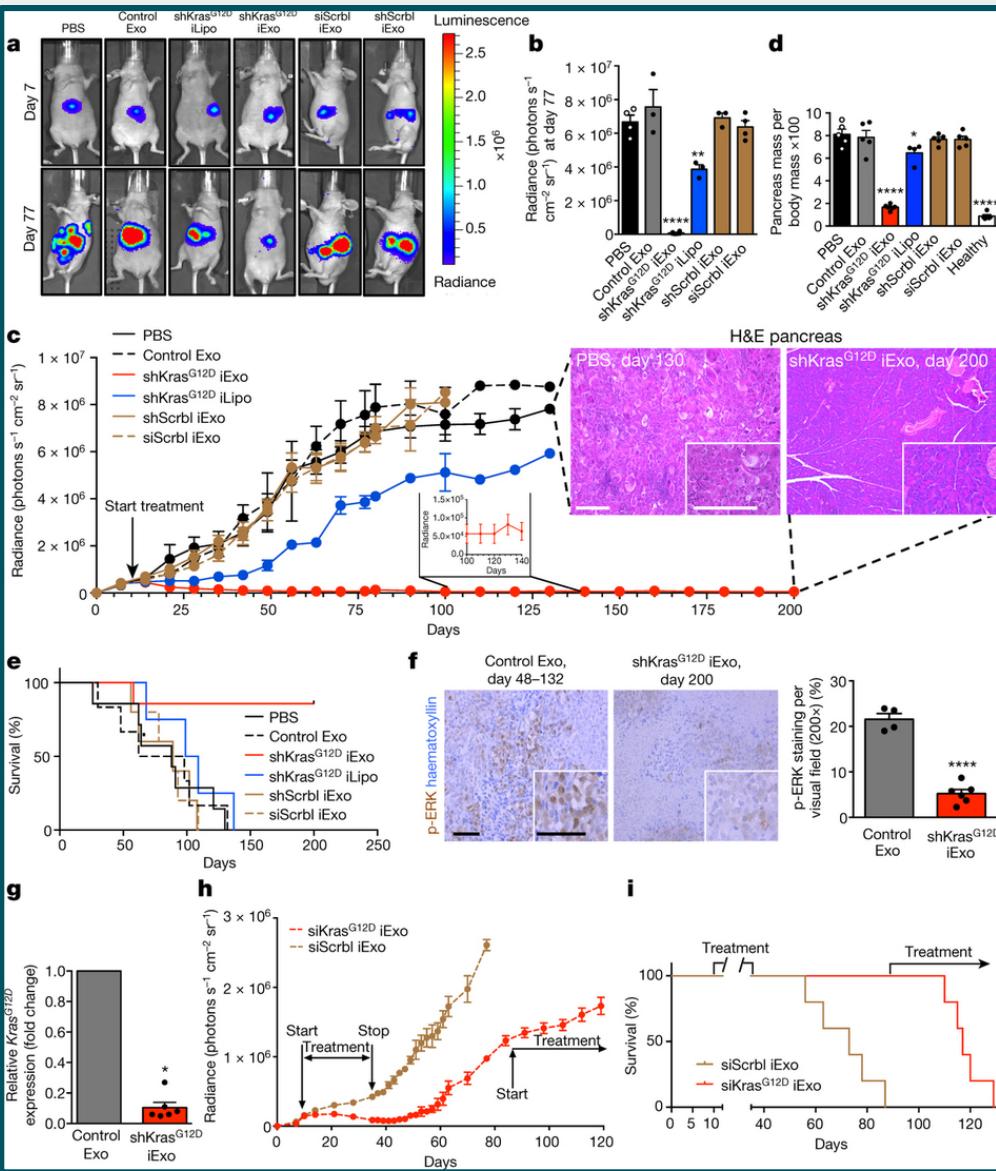


Trader terminal



Auction Dashboard™ composite volume profile view.

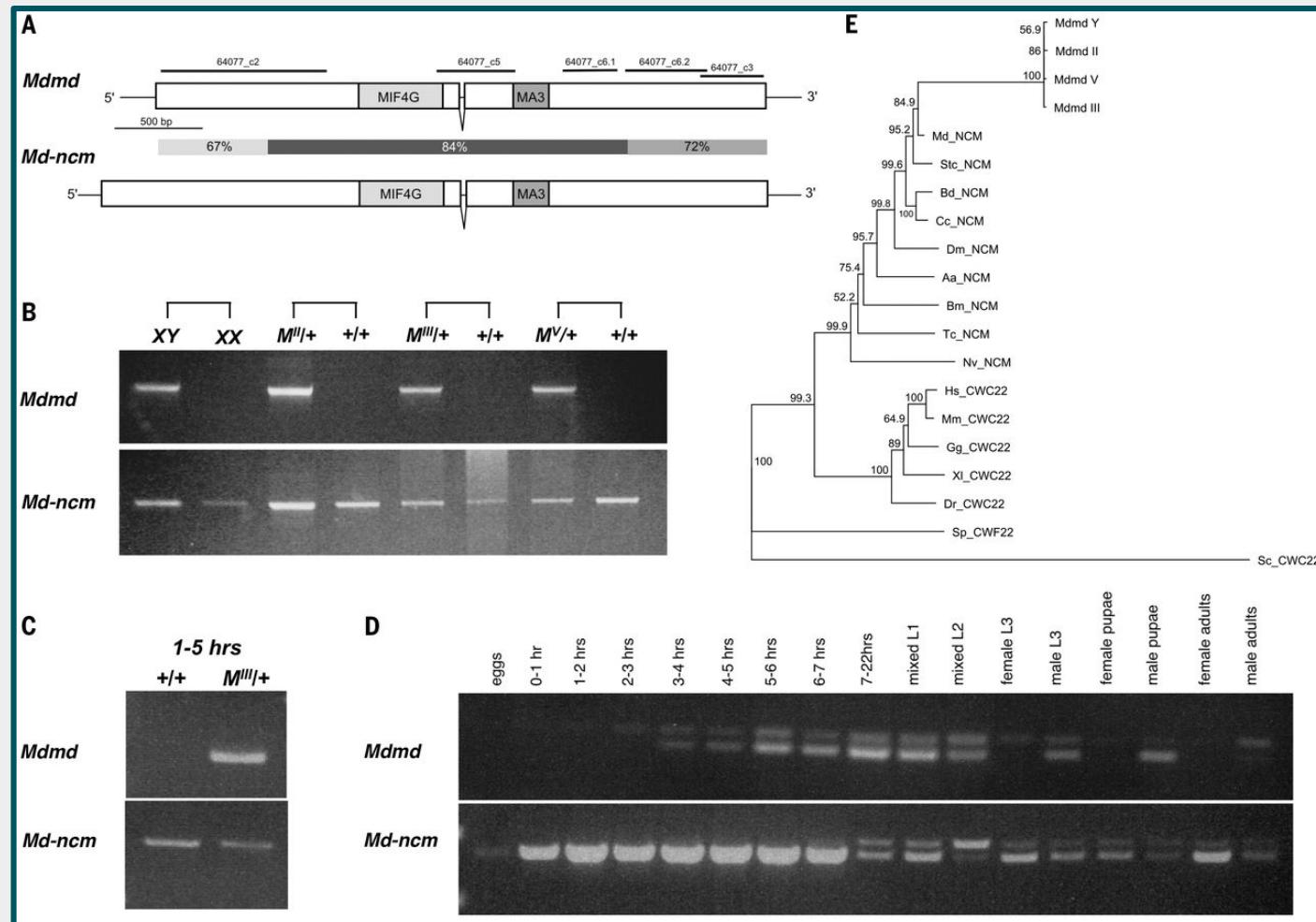
High-gloss Science



Kamerkar (2017). Exosomes facilitate therapeutic targeting of oncogenic KRAS in pancreatic cancer. Nature.

doi:10.1038/nature22341

Molecular biology



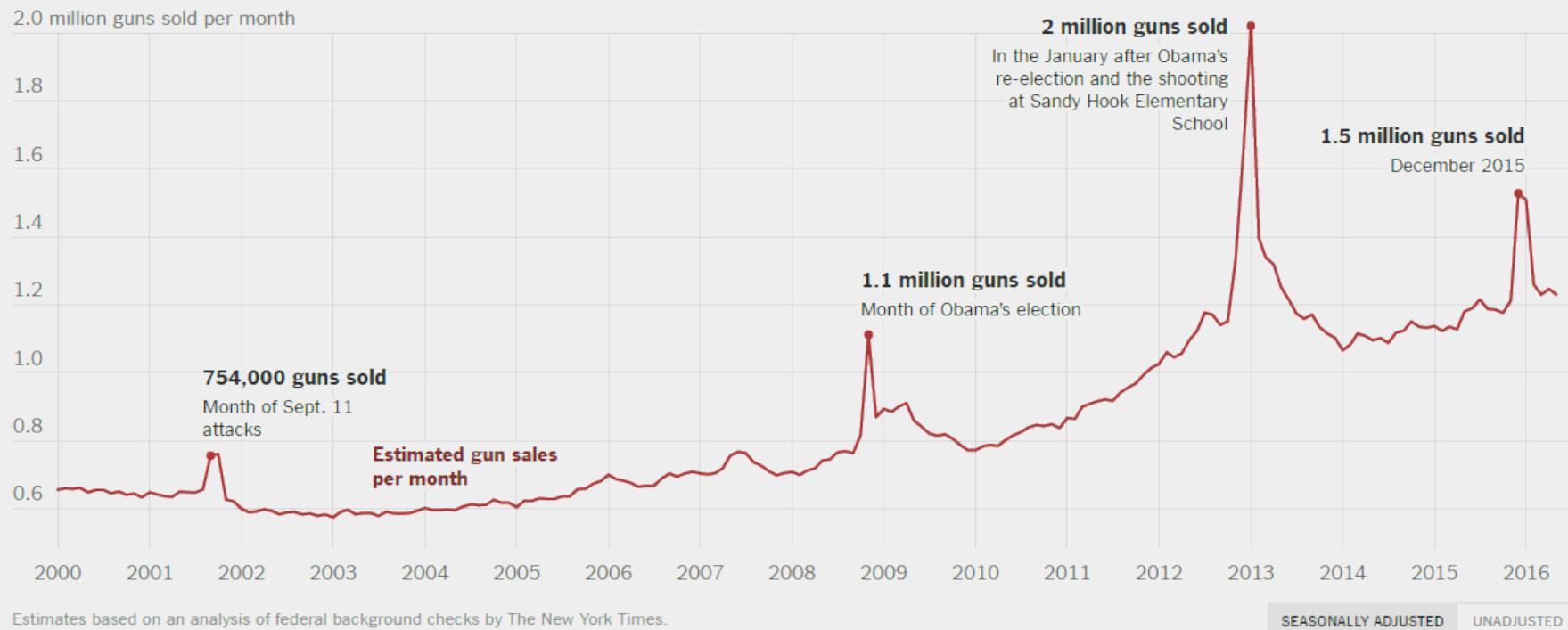
Sharma et al. (2017). Male sex in houseflies is determined by *Mdmd*, a paralog of the generic splice factor gene *CWC22*. *Science*, 356(6338), pp. 642-645.

DOI: 10.1126/science.aam5498

News graphics

What Happens After Calls for New Gun Restrictions? Sales Go Up

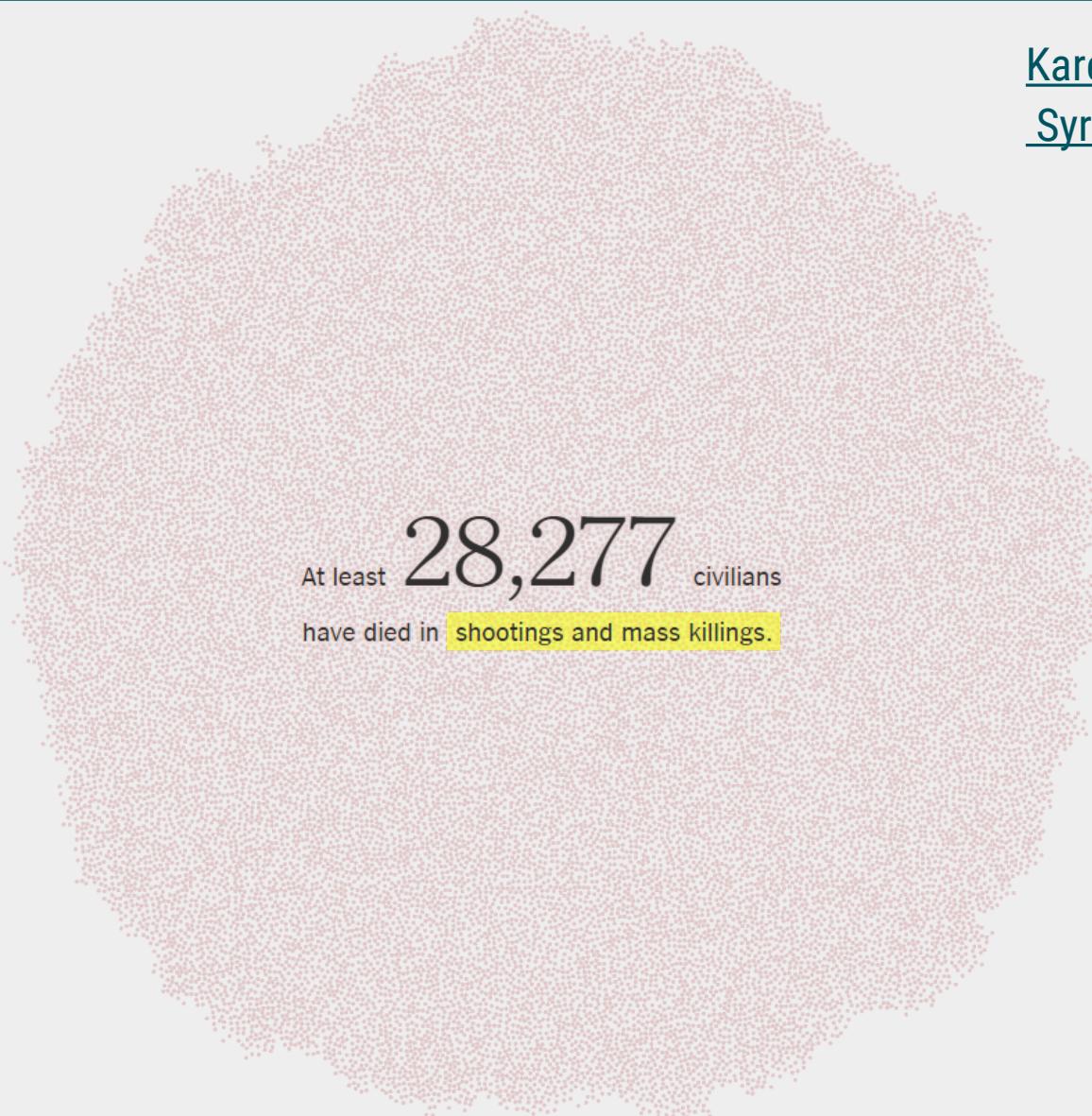
By GREGOR AISCH and JOSH KELLER UPDATED June 13, 2016



Gregor Aisch and Josh Keller (2016). What Happens After Calls for New Gun Restrictions? Sales Go Up. New York Times.

News graphics

Karen Yourish et al. (2015). Death in Syria. New York Times.



Propaganda

A STUDY IN EMPIRES



German Library of Information (1940). A study in empires. Facts in Review 2 (5).

Reprinted in Monmonier (1996). How to Lie with Maps.

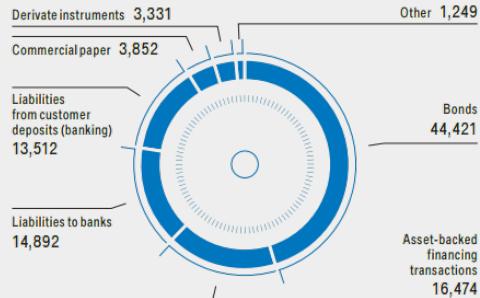
The executive report

BMW Group (2016). Annual report 2016. [excerpt].

BMW Group financial liabilities

→ 45

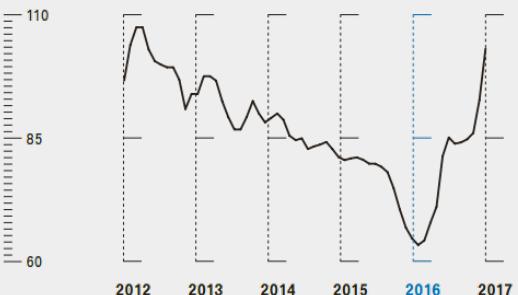
in € million



Steel price trend

→ 18

Index: January 2012 = 100



Proportion of female executives within management/function levels I and II at BMW AG

→ 65

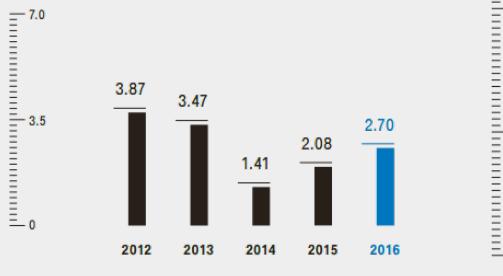
in %



Employee attrition rate at BMW AG*

→ 36

as a percentage of workforce



BMW Group value added 2016

→ 51

in %

Depreciation and amortisation 8.7

Cost of materials 52.5

14.1 Other expenses

24.7 Net value added

48.8 % Employees

8.3 % Providers of finance

13.7 % Government/public sector

9.7 % Shareholders

19.3 % Group

0.2 % Minority interest

Visualization design goals

Table look-up

Precision

Truthfulness

Clarity

Pattern-perception

Accessibility

Attention
Engagement

Persuasion

Memorability

Tamara Munzner: Why visualize?

Munzner, T. (2015).
Visualization Analysis & Design.

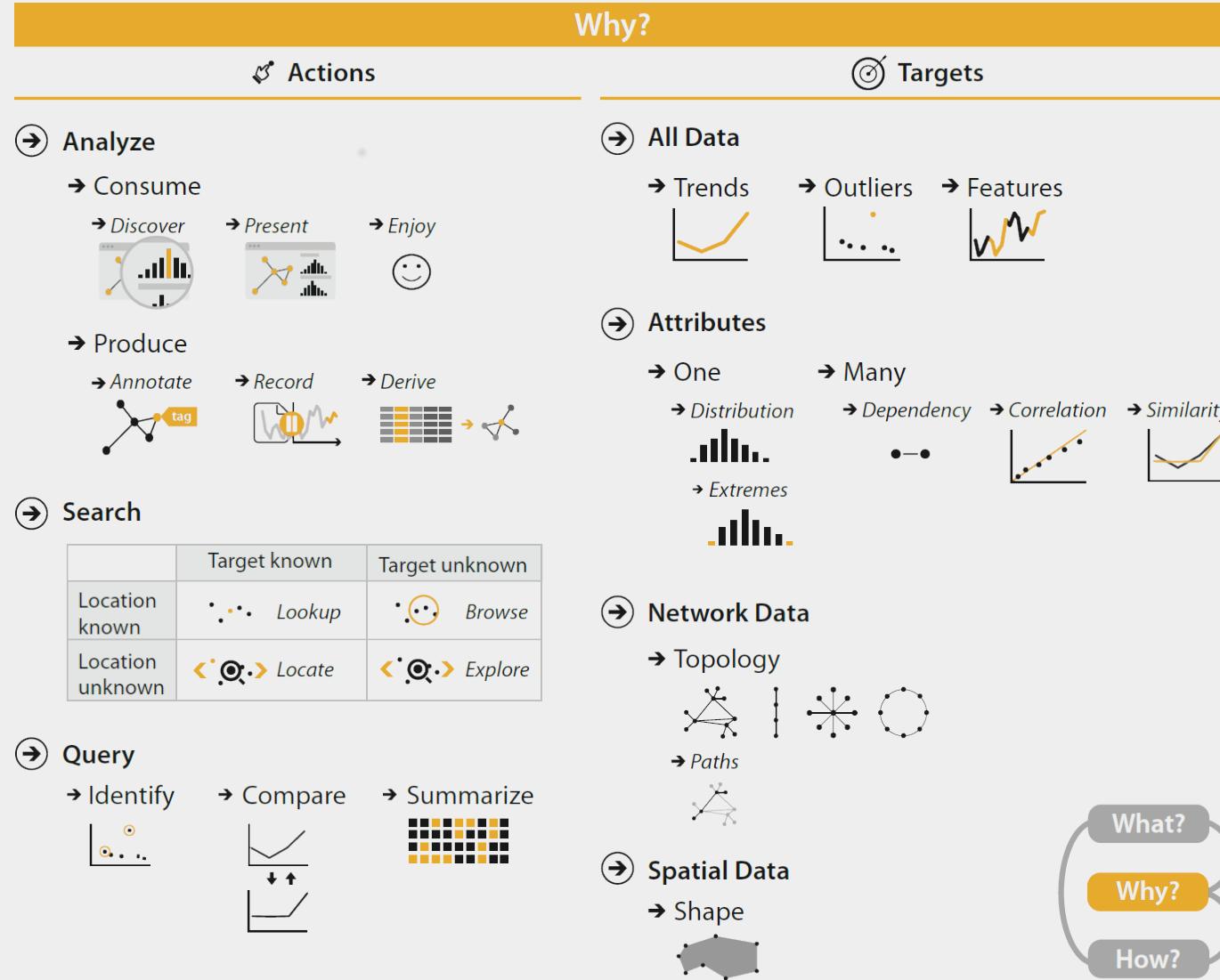


Figure 3.1. Why people are using vis in terms of actions and targets.

Lisa C. Rost: Goals of data viz

@lisacrost

Attention
& Beauty

Under-
standing

Implication

Goals of Data Vis

- | | | |
|--|---|---|
| <ul style="list-style-type: none">1. Get them to read2. Attract different learning types3. Go with the hype4. Create beauty | <ul style="list-style-type: none">1. Understand2. Explain3. Get people to explore | <ul style="list-style-type: none">1. Prove2. Correct views3. Evoke feelings4. Evoke actions5. Go meta |
|--|---|---|

Rost (2017). Why do we visualize data? INCH conference presentation.

Clarity & Effectiveness

Testable hypothesis in viz research

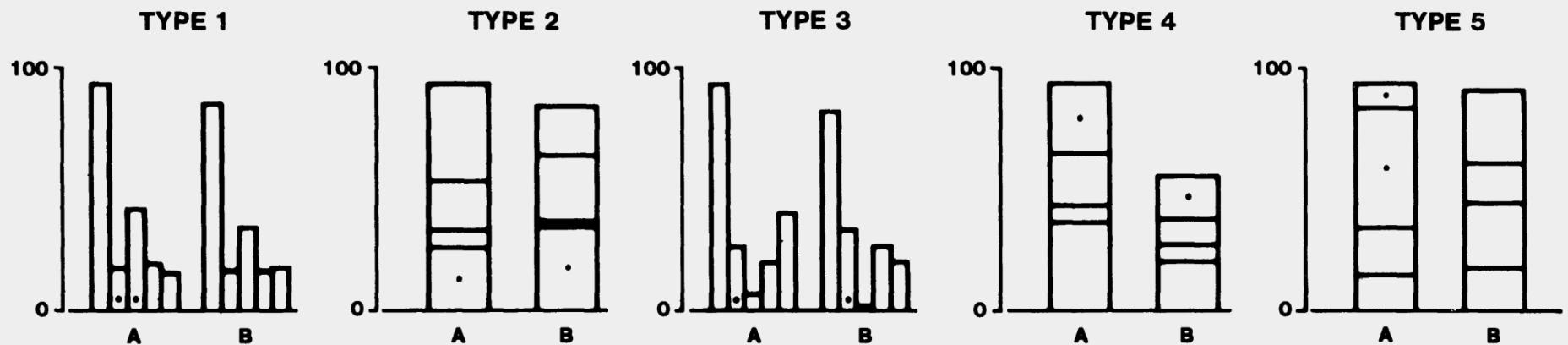


Figure 4. Graphs from position-length experiment.

Cleveland, W. S., & McGill, R. (1984). Graphical Perception: Theory, Experimentation, and Application to the Development of Graphical Methods. *Journal of the American Statistical Association*, 79(387), 531.

What makes a visualization engaging?

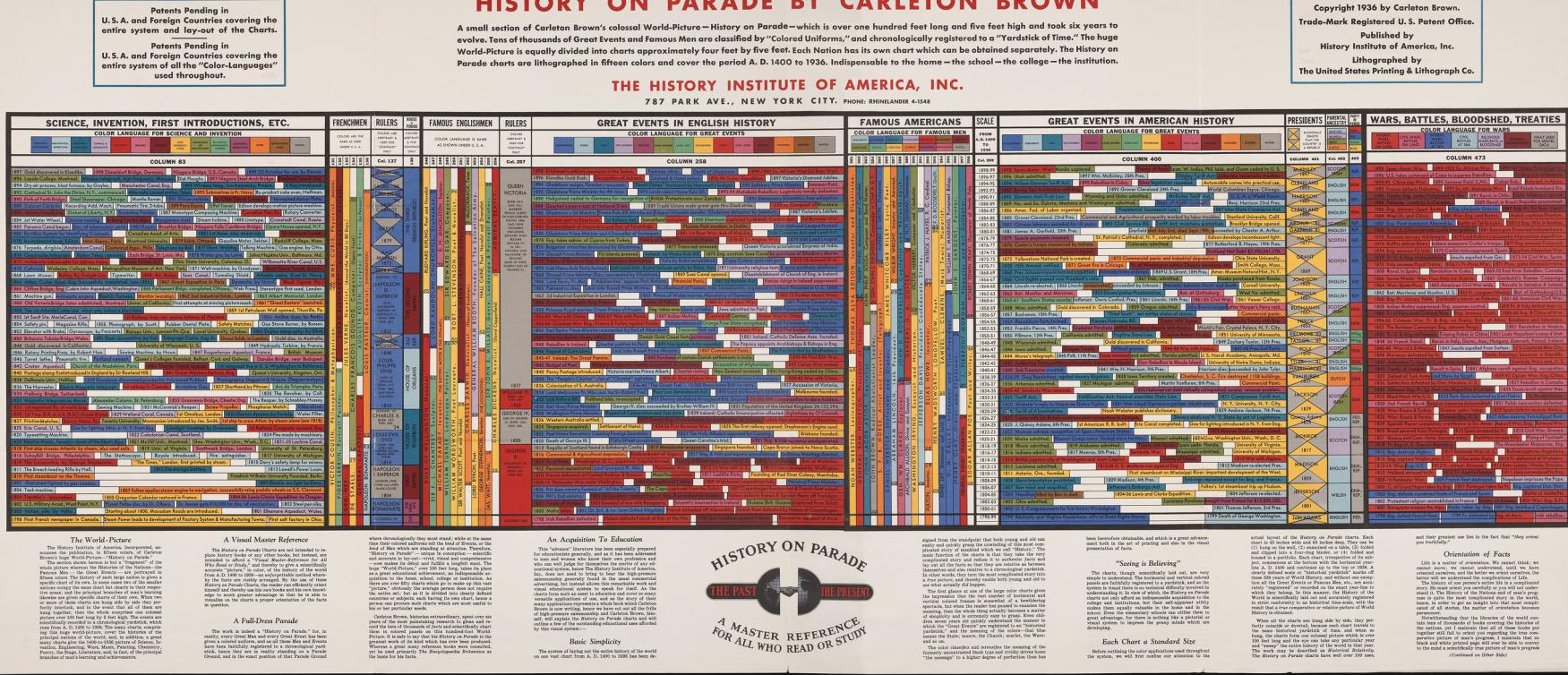
“Wimmelbilder”



Wimmelbild „Recht auf Stadt“

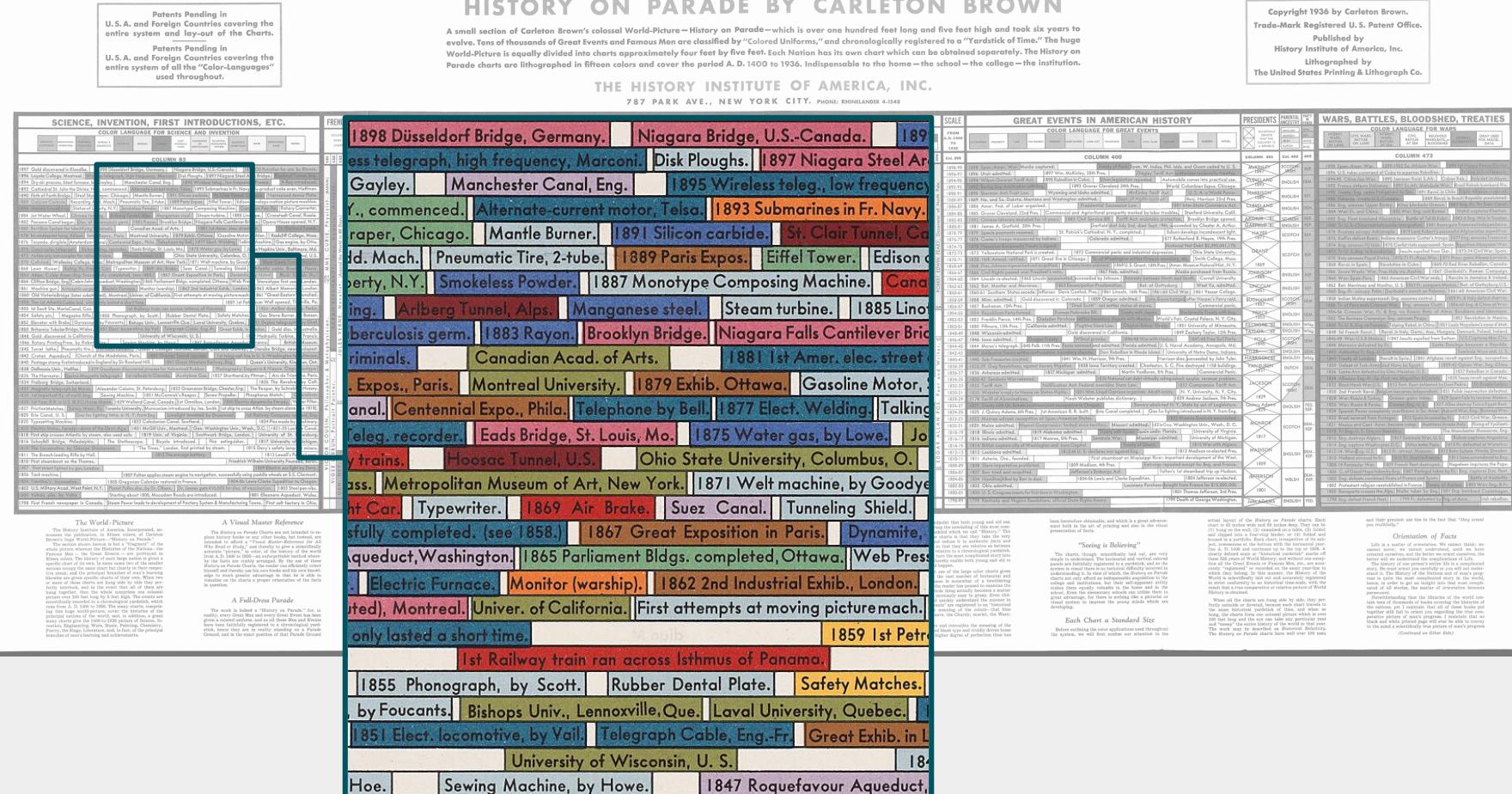
wimmelbild.animationsfilm.de

Macro view

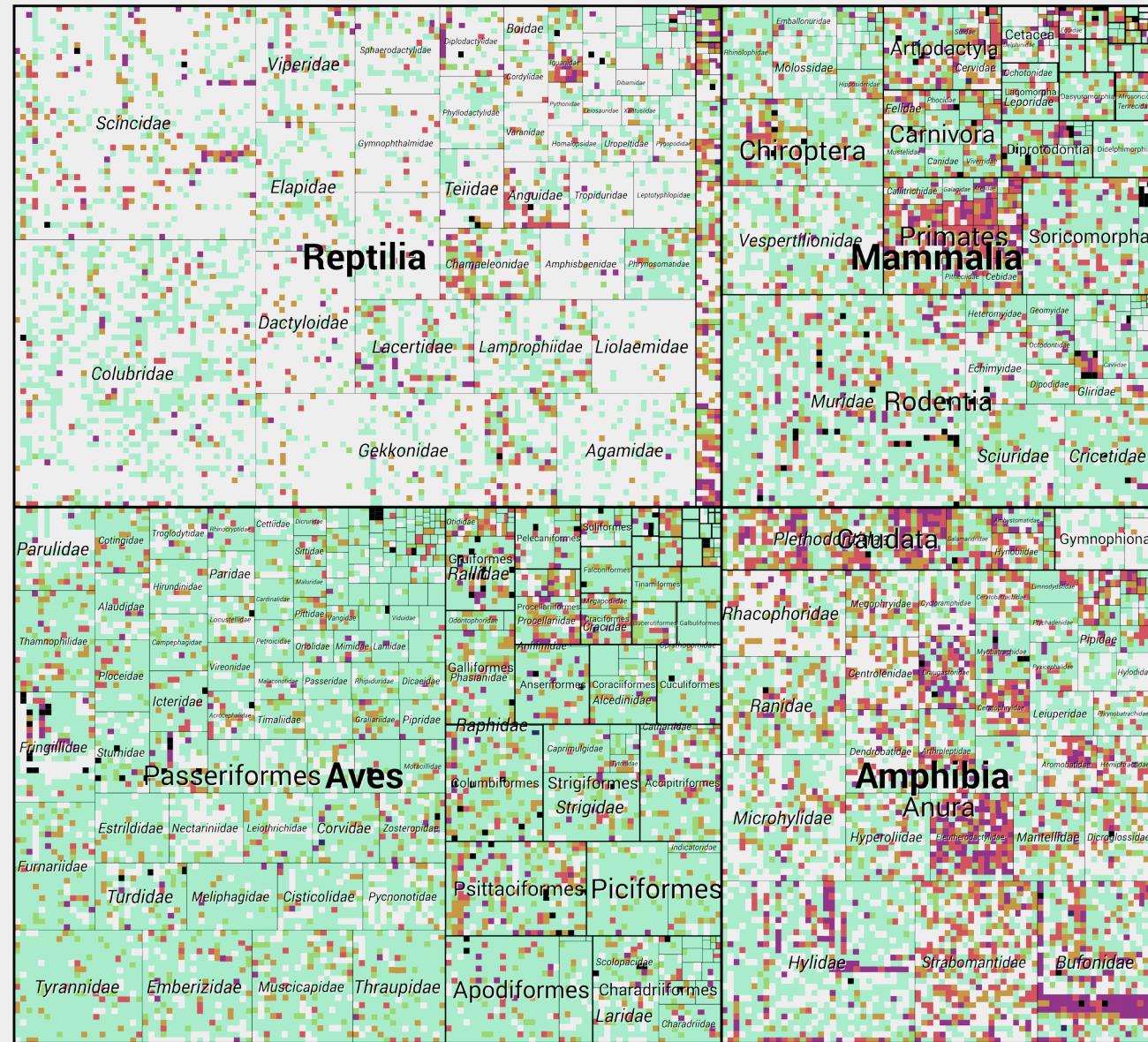


Carleton Brown (1936). History on parade by Carleton Brown. History Institute of America, Inc.
http://brbl-dl.library.yale.edu/vufind/Record/3534525?image_id=1094201

Micro view

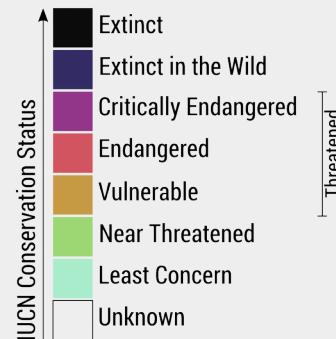


Macro view



The State of Vertebrate Conservation

IUCN Red List conservation status for each species



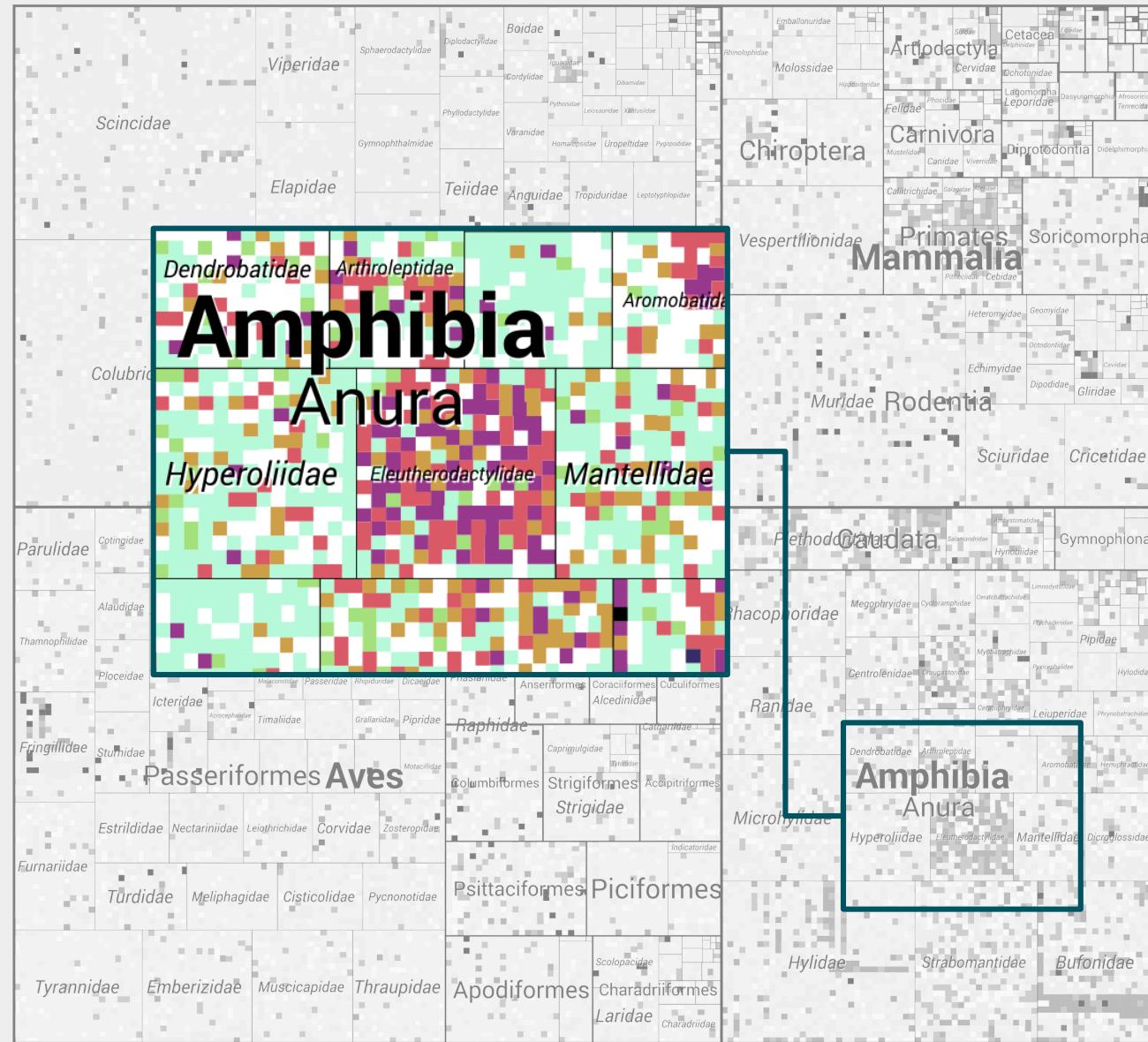
Threatened

Taxonomic Rank



by DISKo
Demographic Index
of Species Knowledge

Micro view



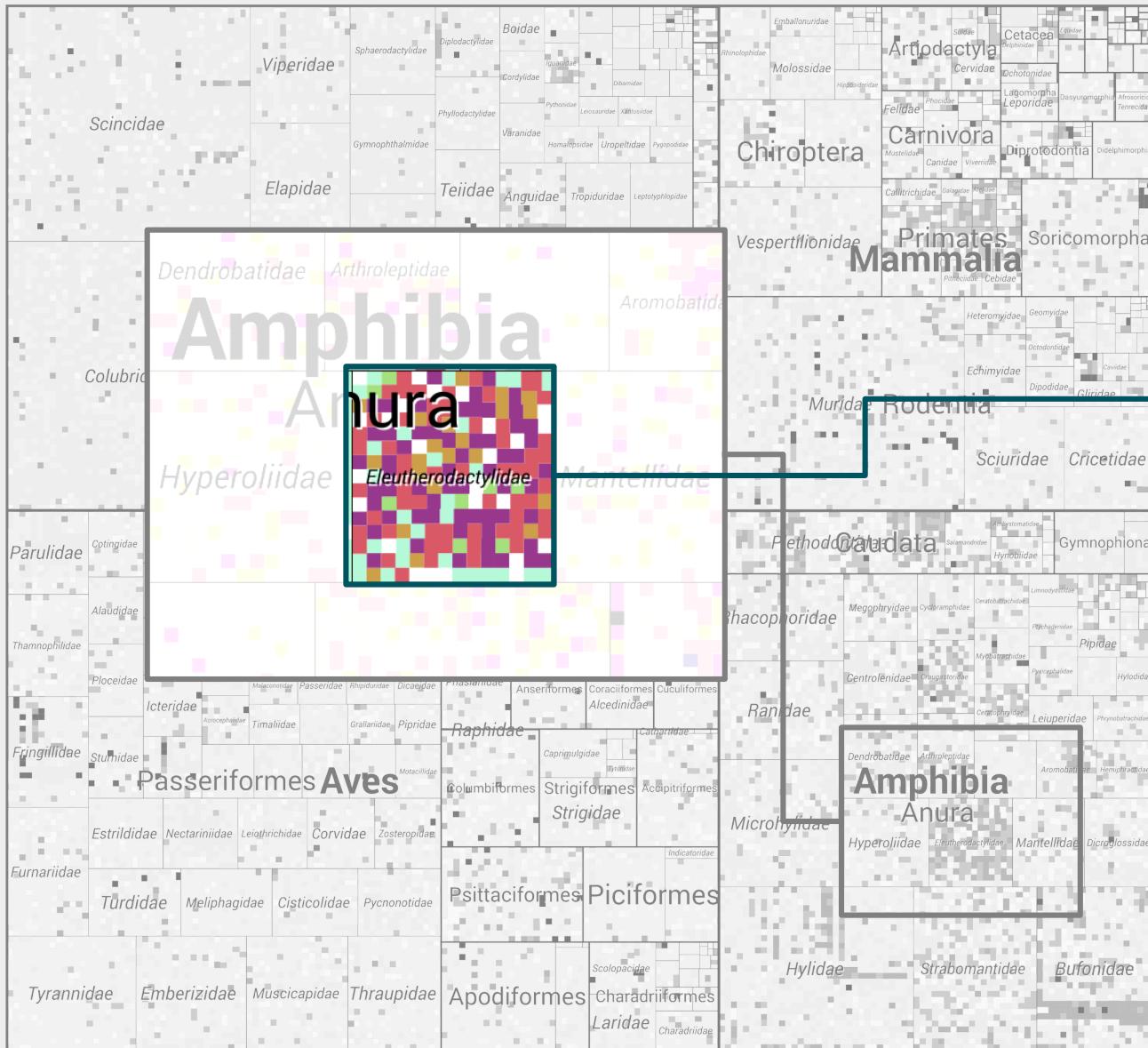
The State of Vertebrate Conservation

IUCN Red List conservation status for each species



by DISKo
Demographic Index
of Species Knowledge

Micro-micro view (drill down)

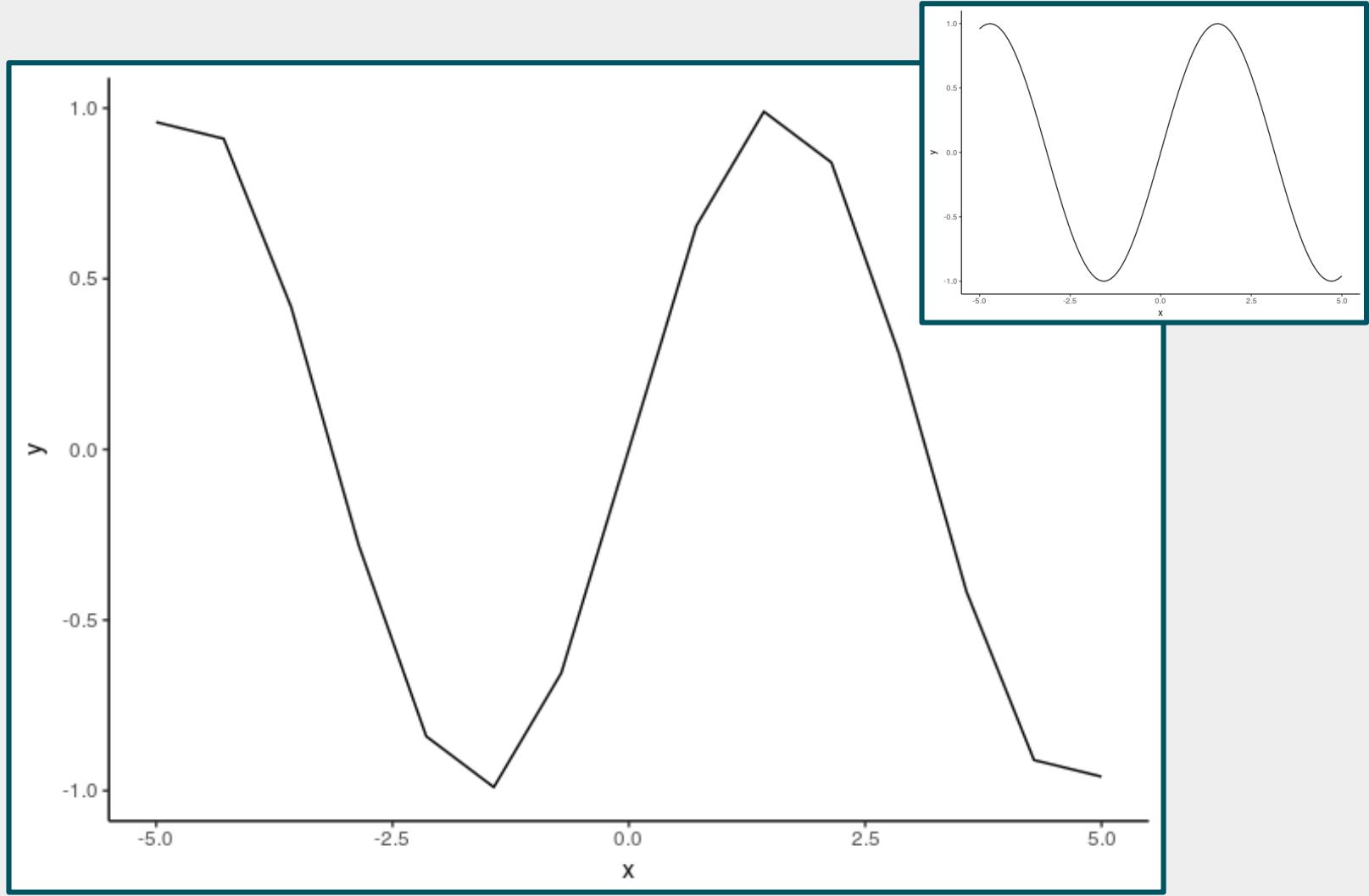


Eleutherodactylidae

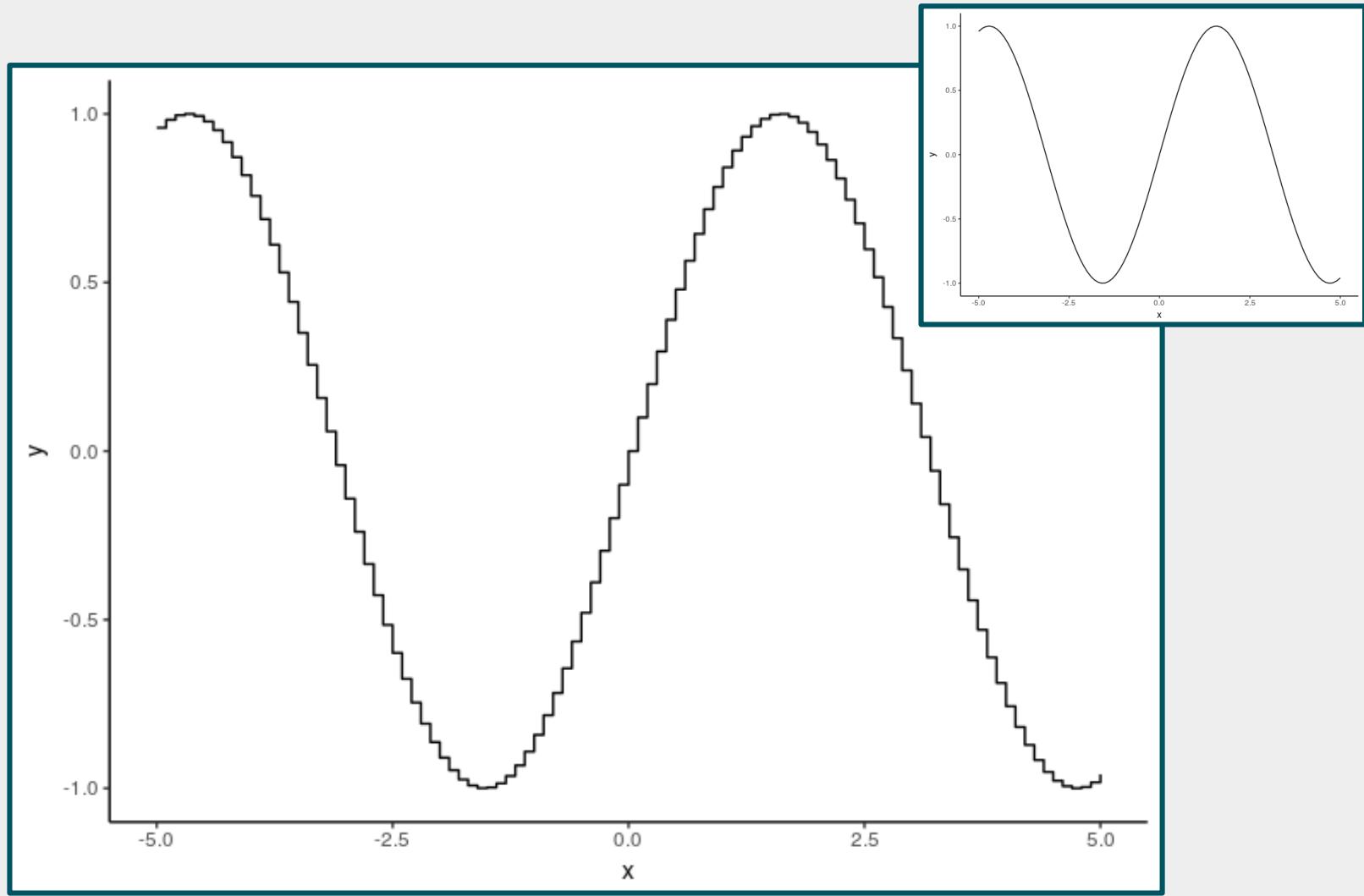
Eleutherodactylus danae

Precision

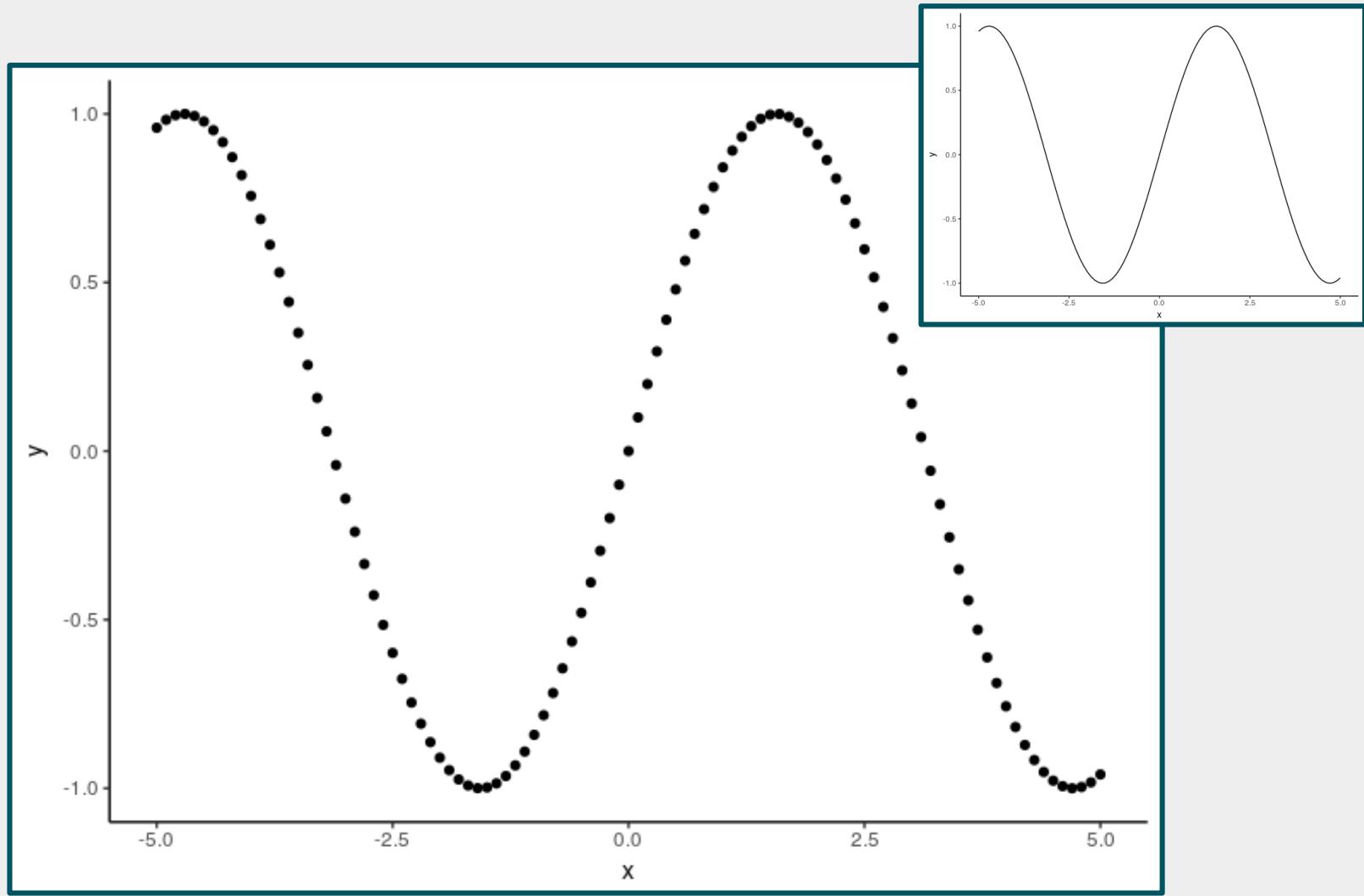
Be precise when it counts



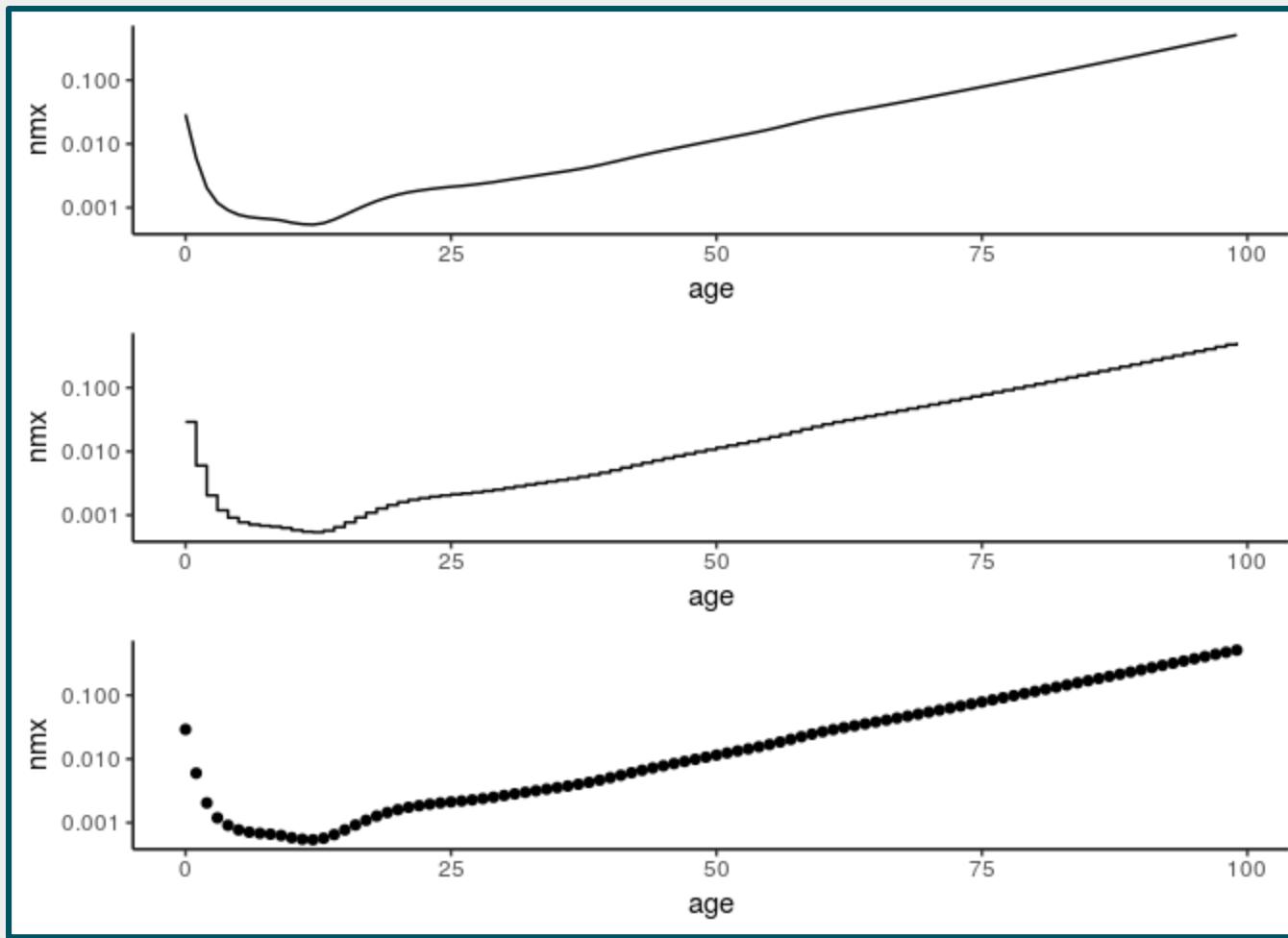
Be precise when it counts



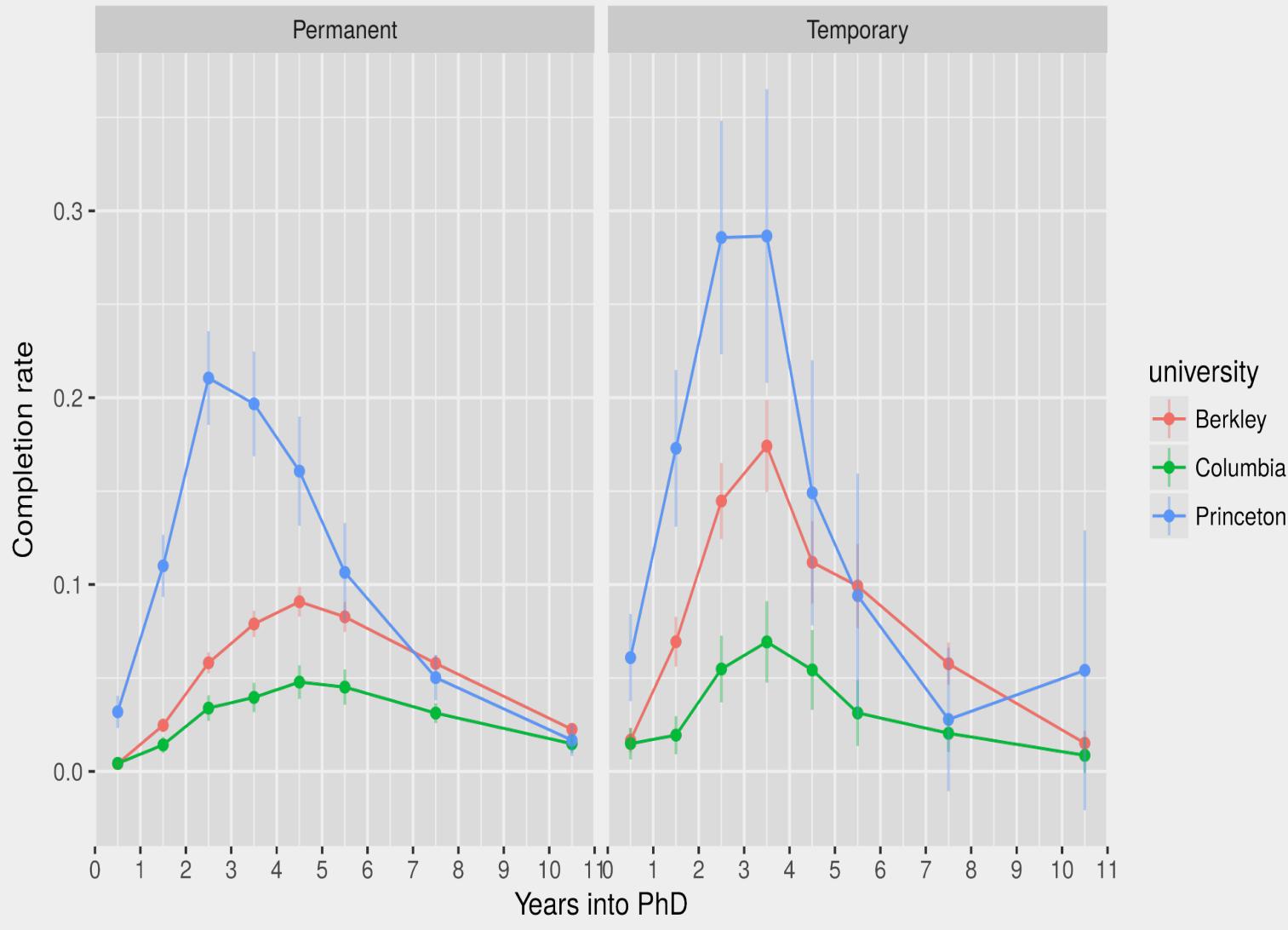
Be precise when it counts



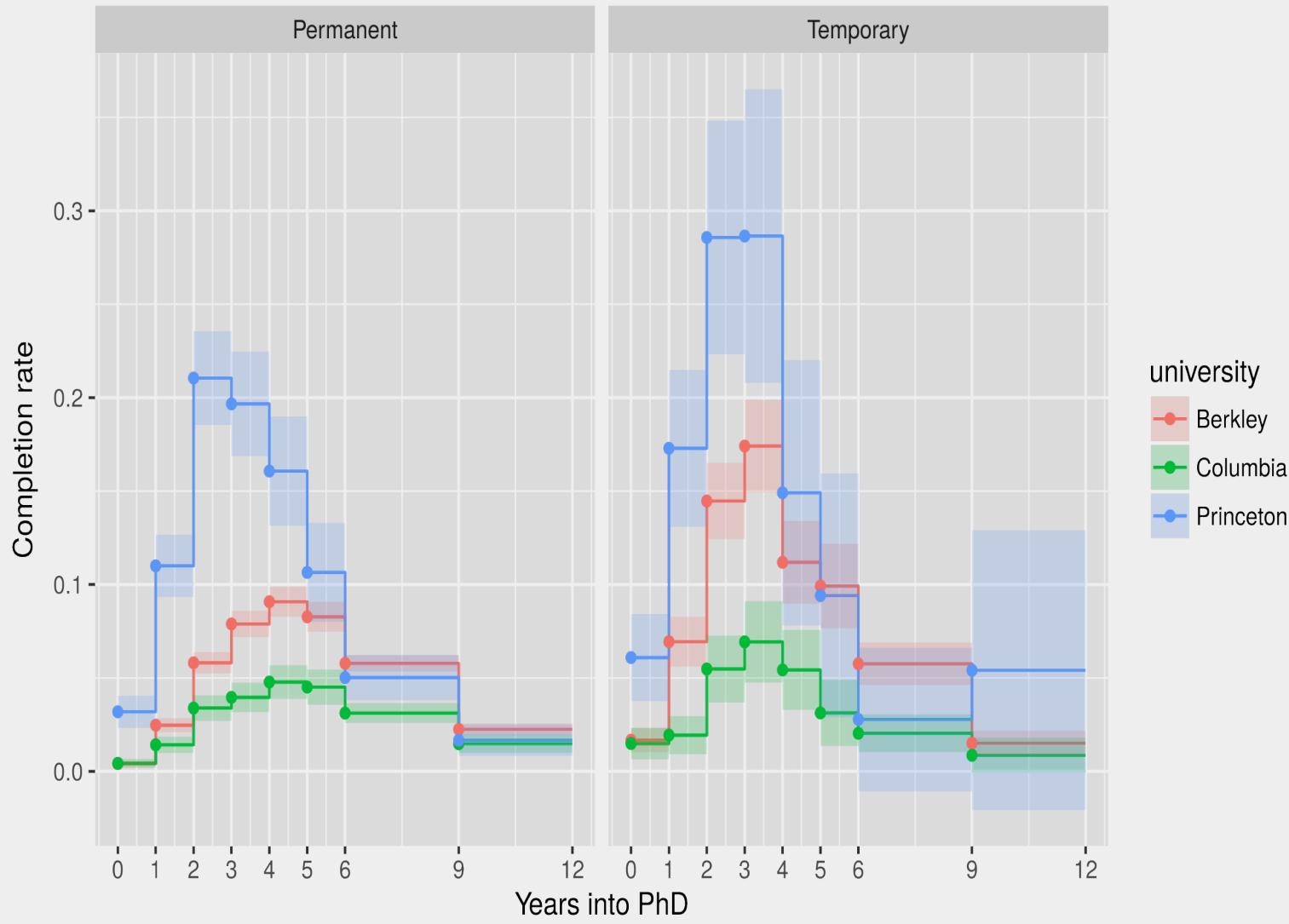
Are those the same?



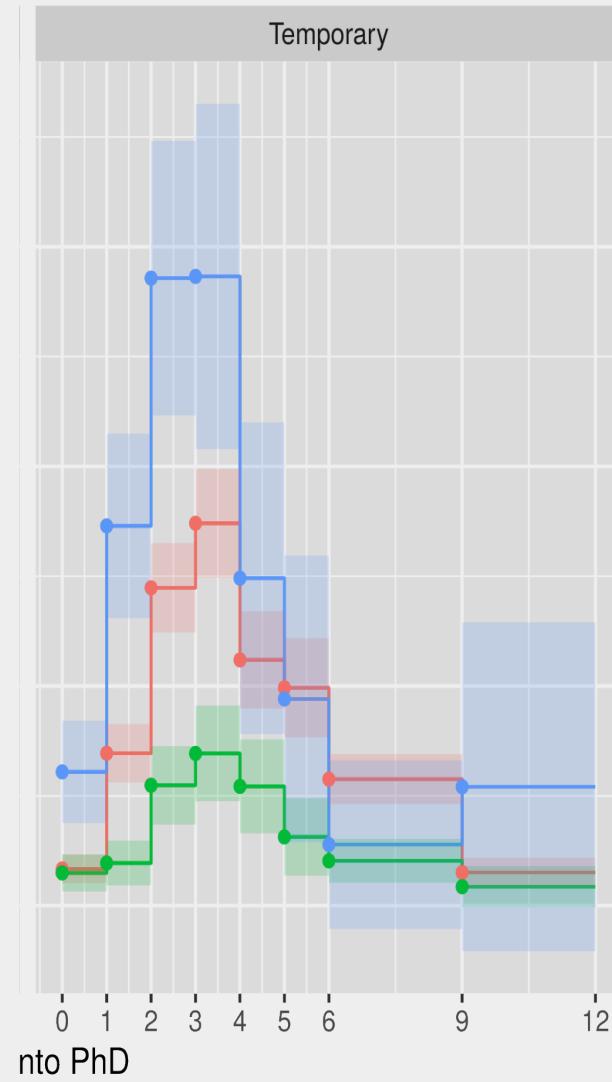
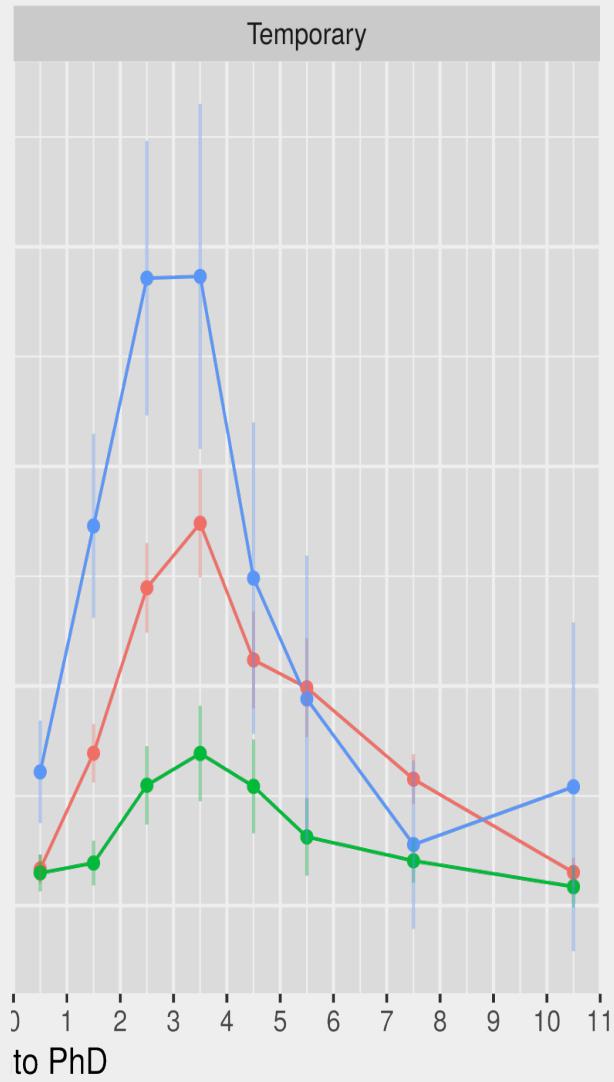
Precision versus clarity



Precision versus clarity



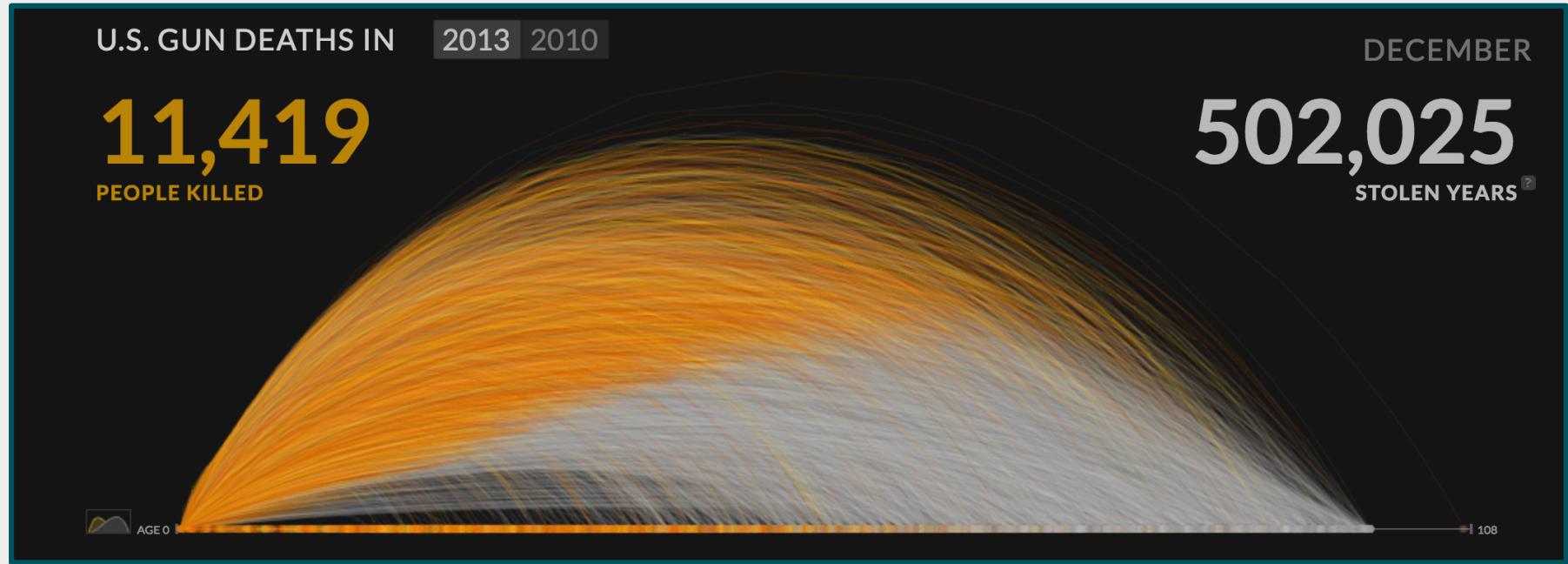
Precision versus clarity



Truthfulness, persuasion

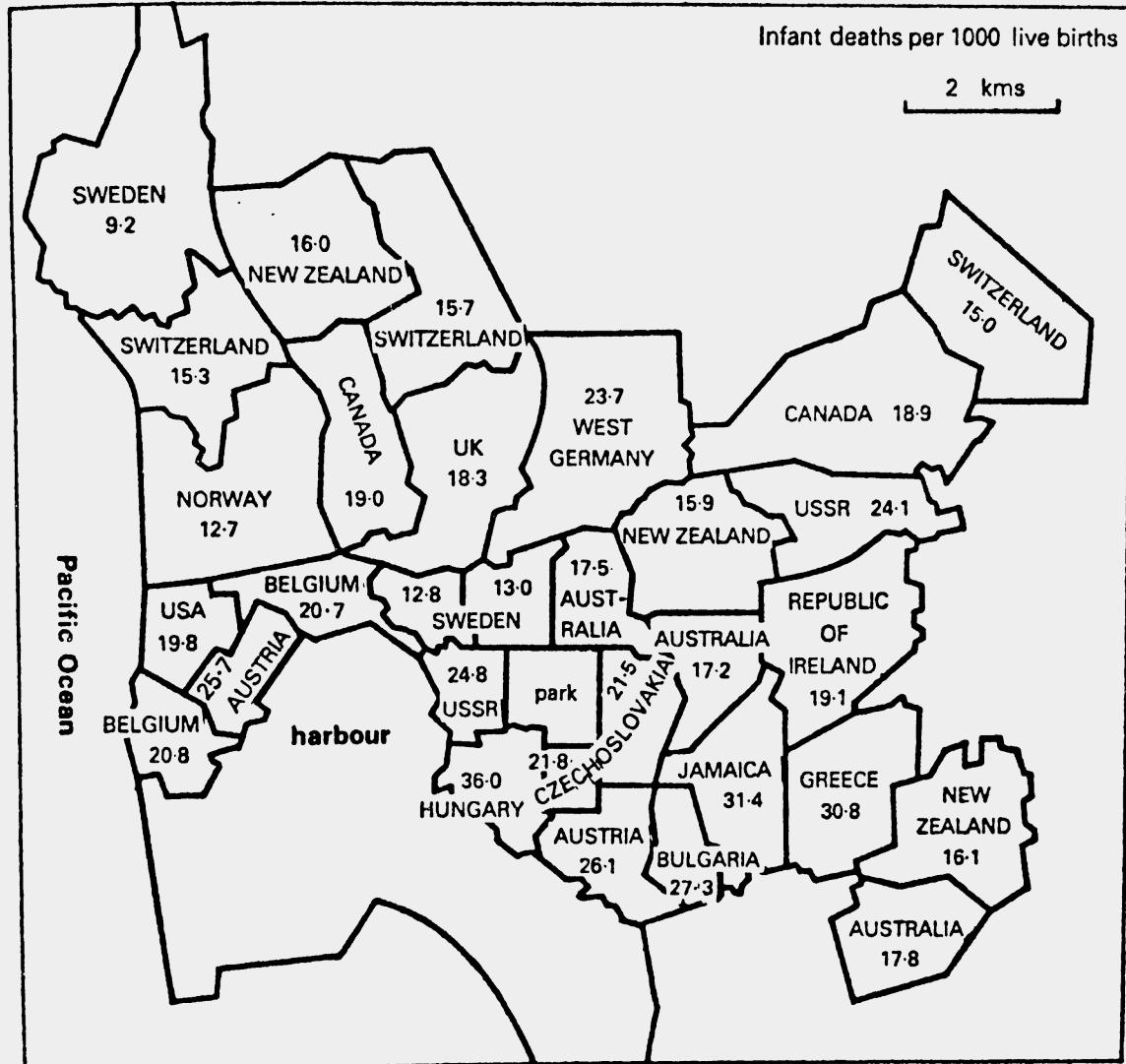
Truthful persuasion?

Overwhelm with data, use intuitive units



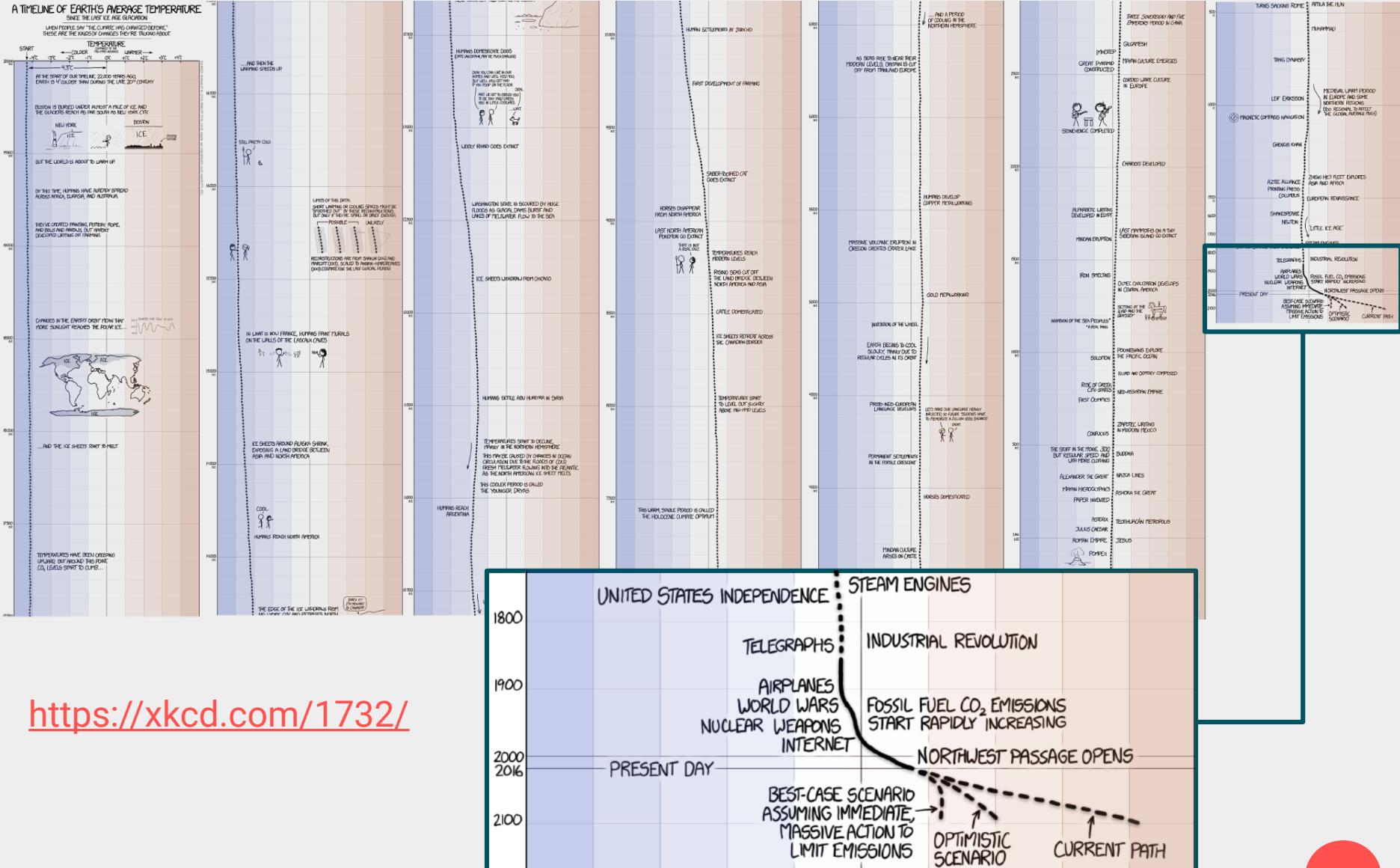
<http://guns.periscopic.com/>

Make intuitive comparisons



Infant mortality rates for parts of San Diego, California expressed in national rates of comparable nations. Monmonier (1996). How to lie with maps.

Overwhelm with data, make relevant comparisons



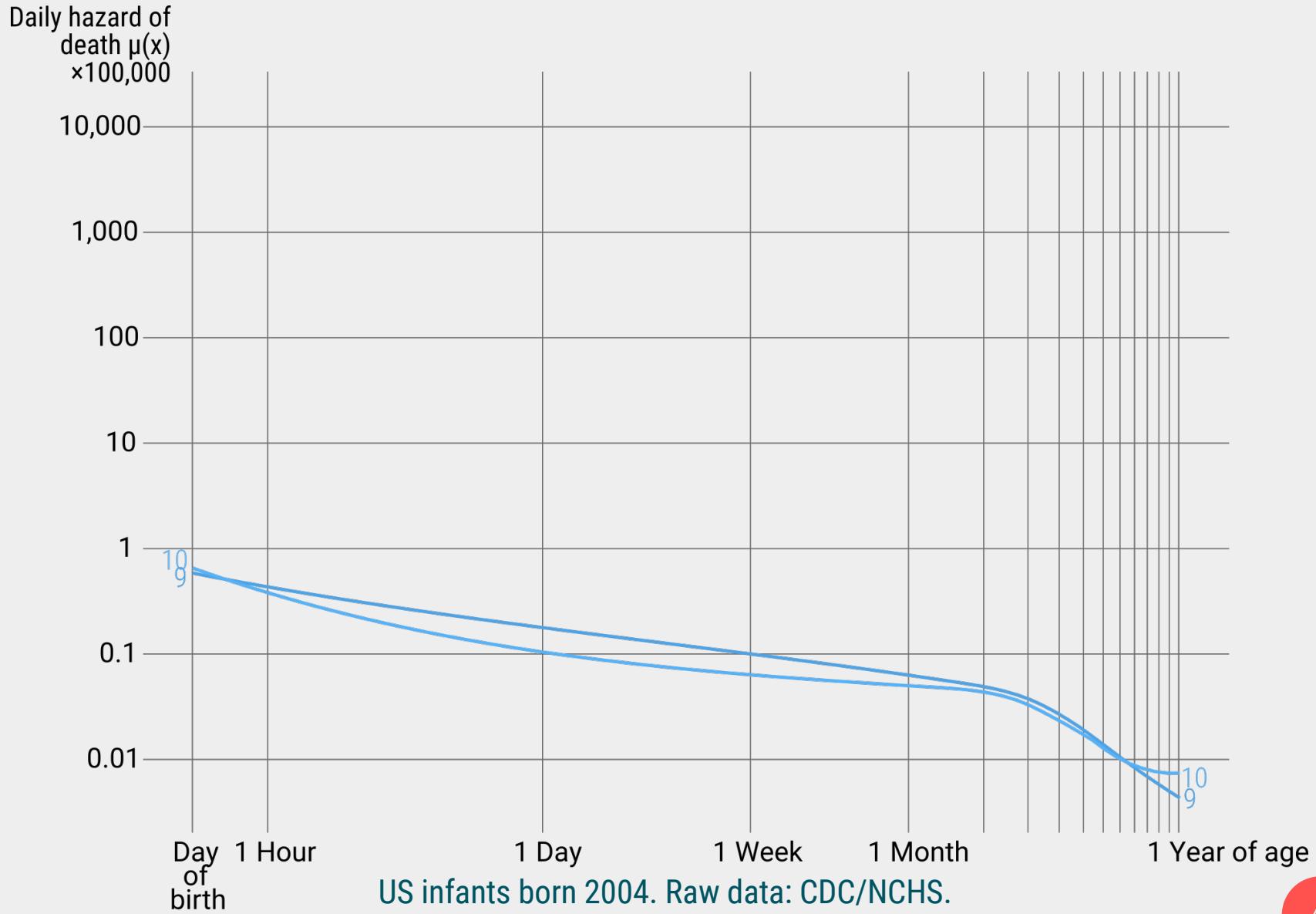
<https://xkcd.com/1732/>

Focusing attention

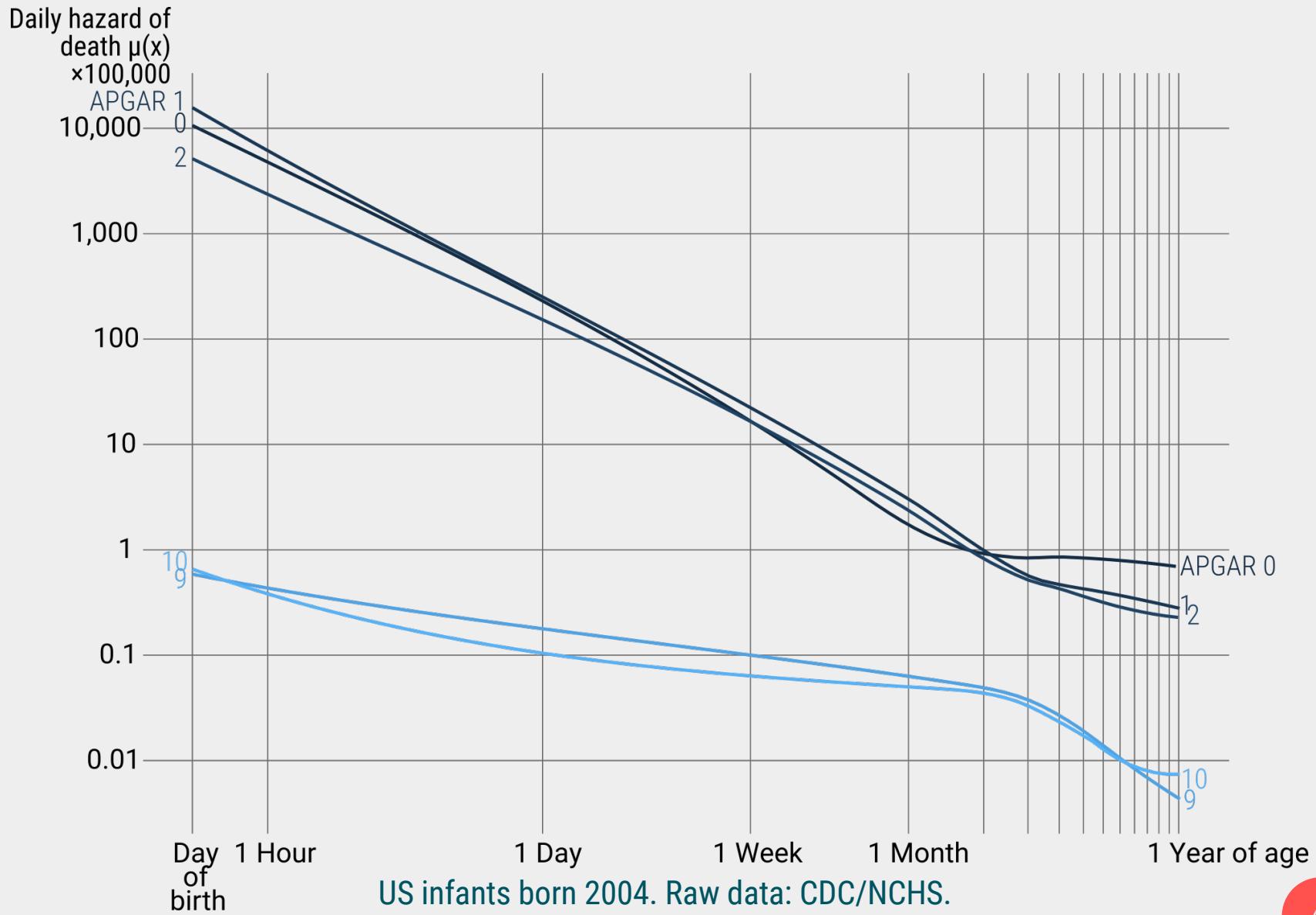
Visual storytelling

What's really warming the world?

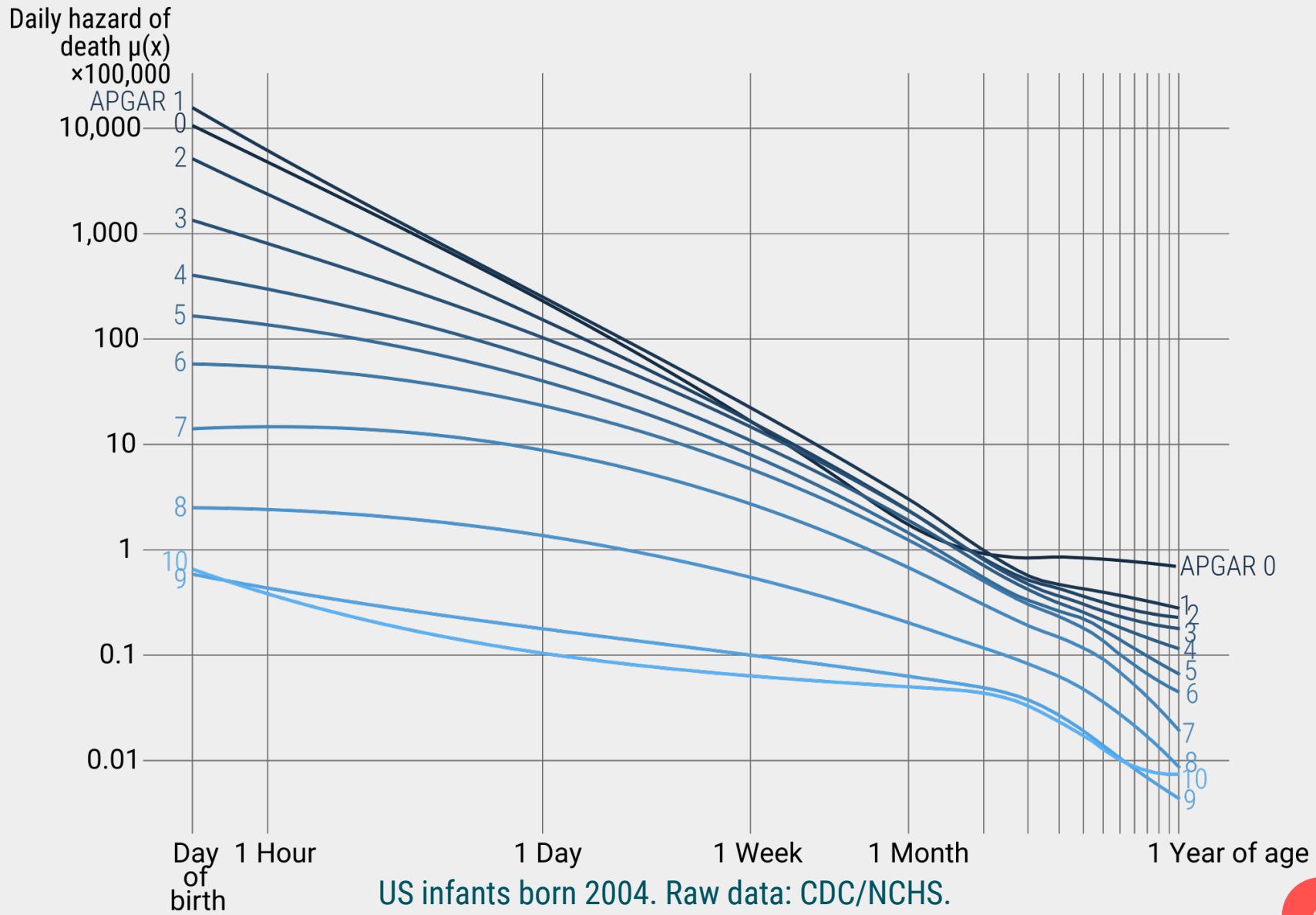
A demonstration of mortality selection



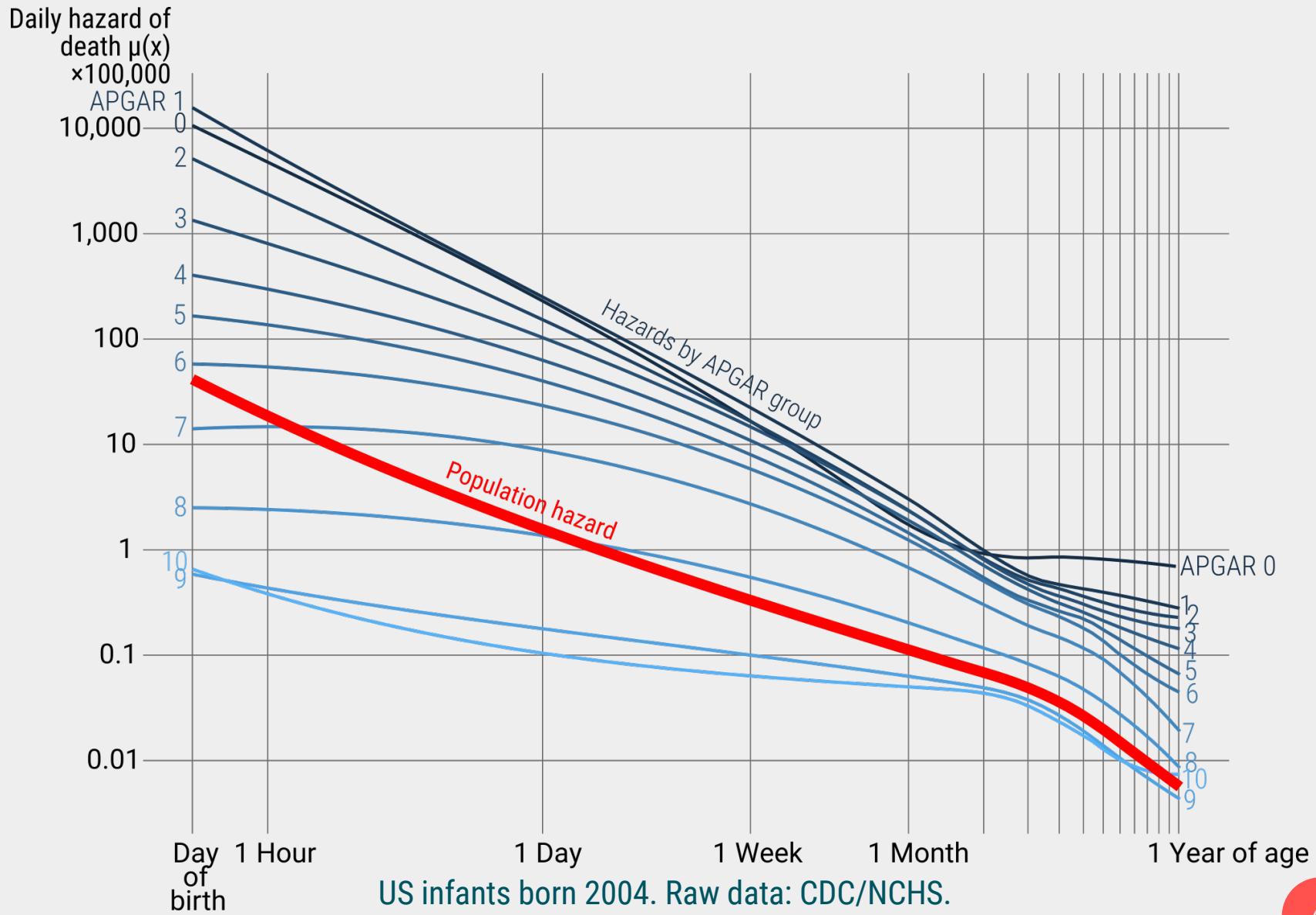
A demonstration of mortality selection



A demonstration of mortality selection



A demonstration of mortality selection



Today's exercise

Prepare **3 visualizations** of the **same data**

1. For publication in a peer-reviewed journal
2. For presentation at a conference
3. For publication as a news highlight to the general public

Prepare to discuss your **design choices**.

Use whatever data and tools you're most comfortable with.

Once you're done put your visualizations into the shared

Dropbox folder. Use your initials as filename, e.g. js1.png, js2.png, js3.png

Slides available at
github.com/jschoeley

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