

Datenvisualisierung in der Wissenschaft

**gestalten statt generieren,
vermitteln statt verwirren**

Dr. Cédric Scherer

RPTU Nachwuchsring
3., 10. und 17. Juli 2025



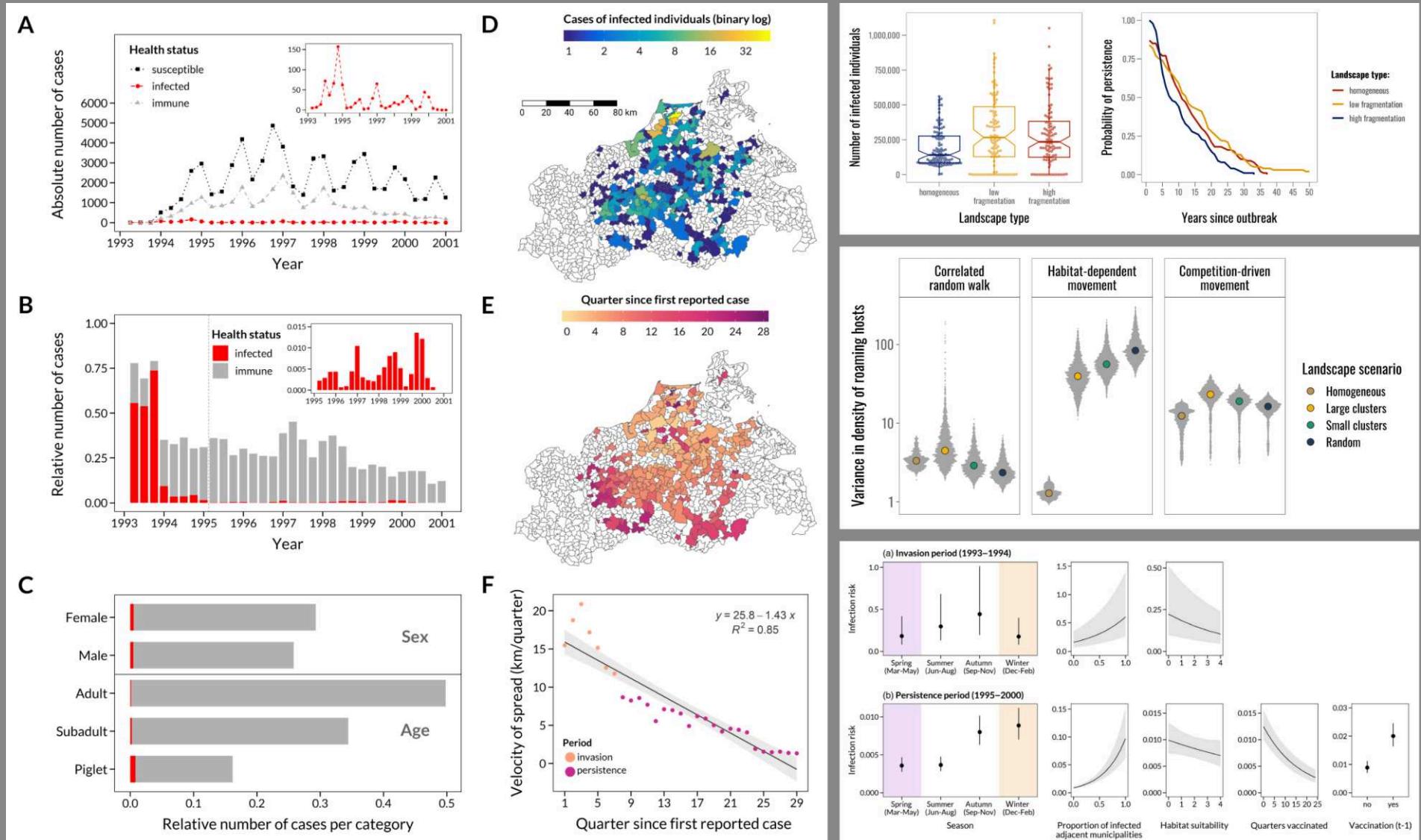
Hallo, ich bin Cédric.

hello@cedricscherer.com

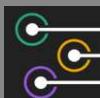
Als freiberuflicher Spezialist für
Infografiken und Datenvisualisierungen

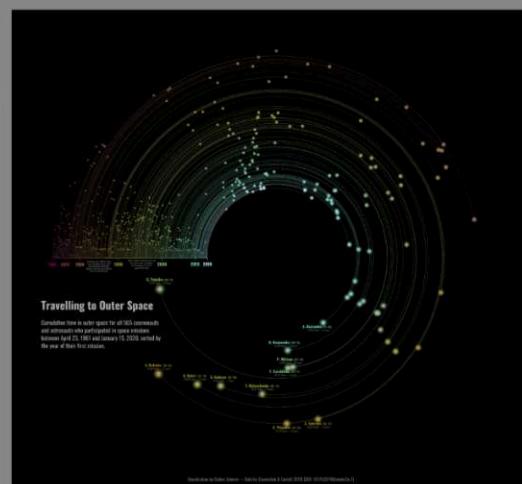
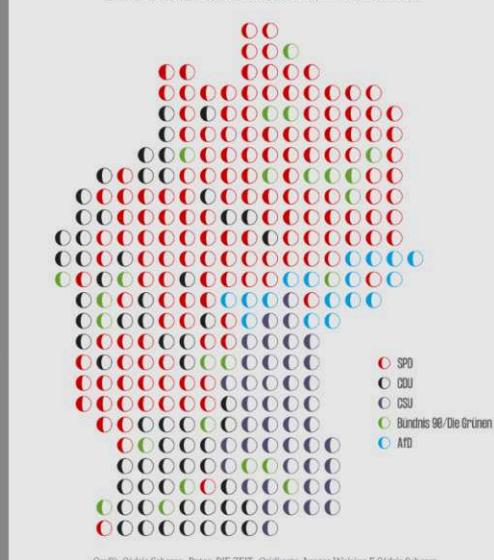
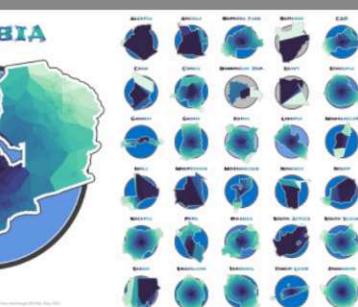
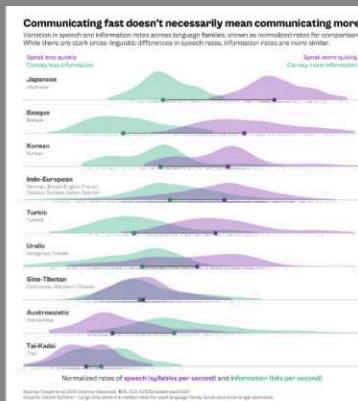
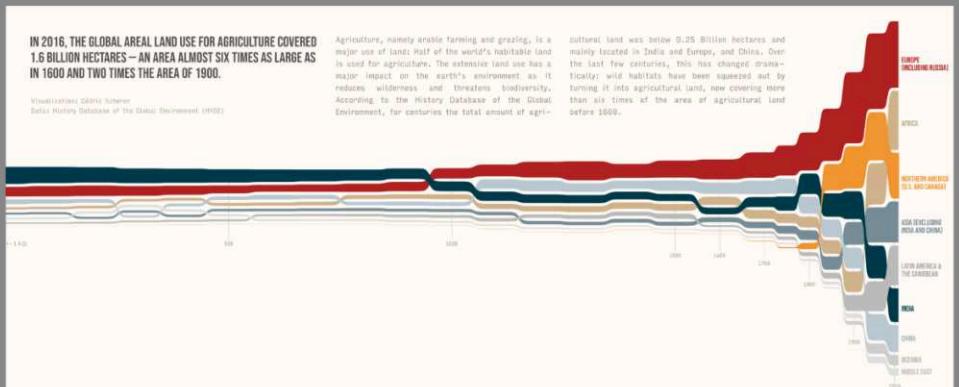
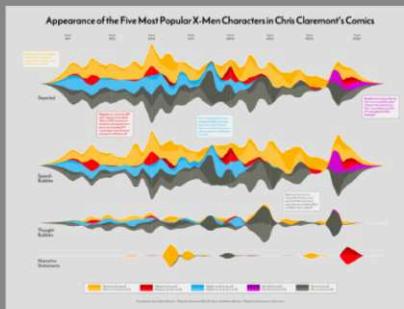
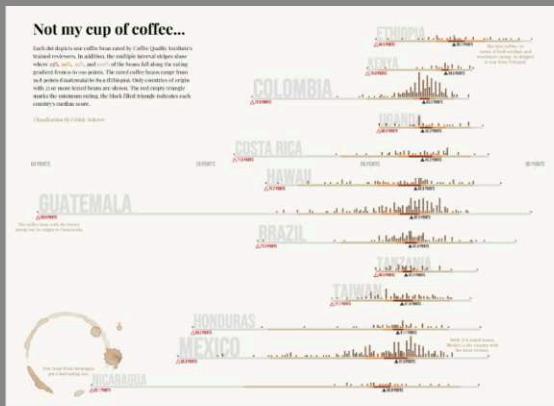
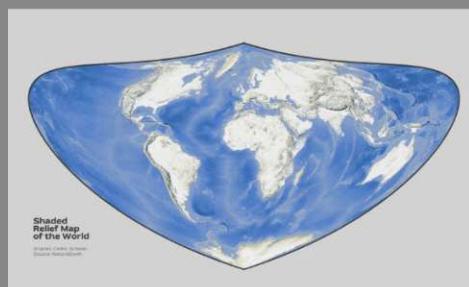
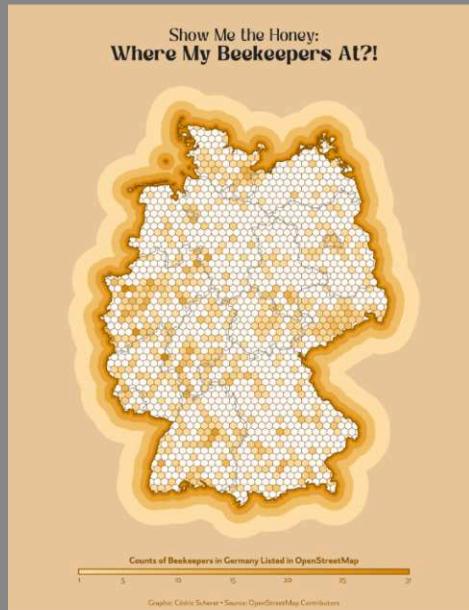
- entwickle Diagramme, Karten & interaktive Inhalte,
- optimiere Workflows zur Datenkommunikation und
- lehre den Prozess effektiver Datenvisualisierung – von Prinzipien über Design bis zur Umsetzung mit ggplot2.

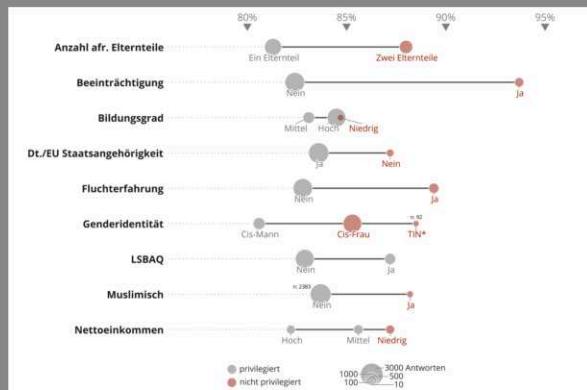
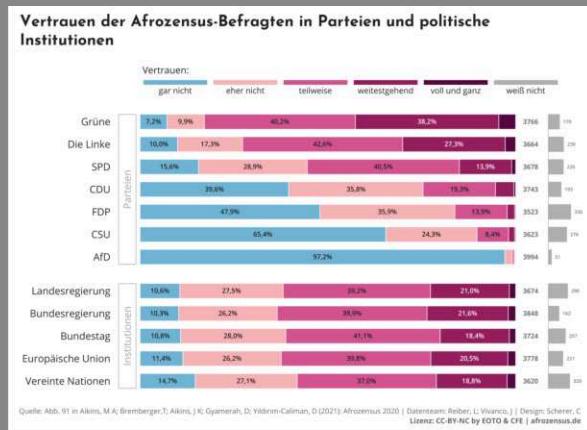
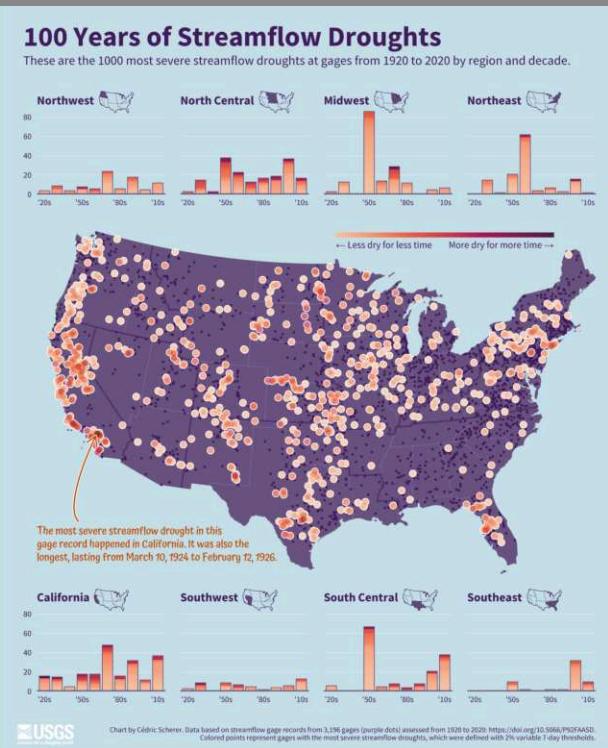
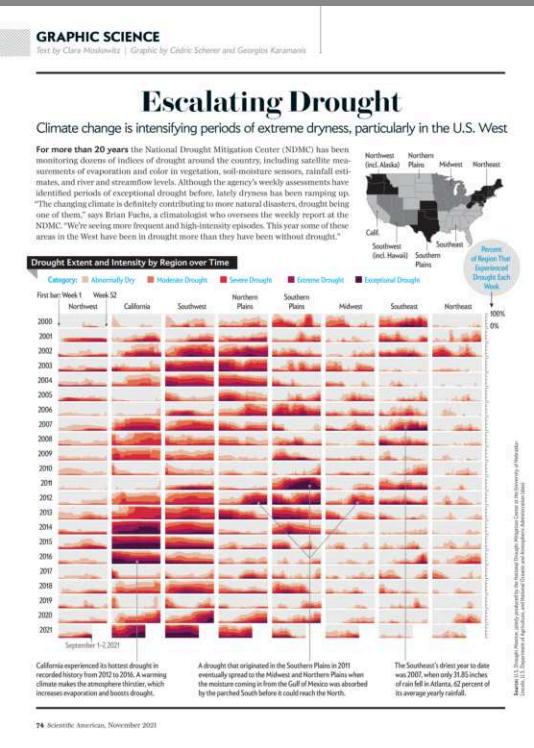




Cédric Scherer







Politiker rechnen bald mit einer Fortsetzung der Fußball-Bundesliga. Wenn auch nicht im Stadion, so ist es voraussichtlich bald wieder möglich Fußball im Fernsehen zu sehen.

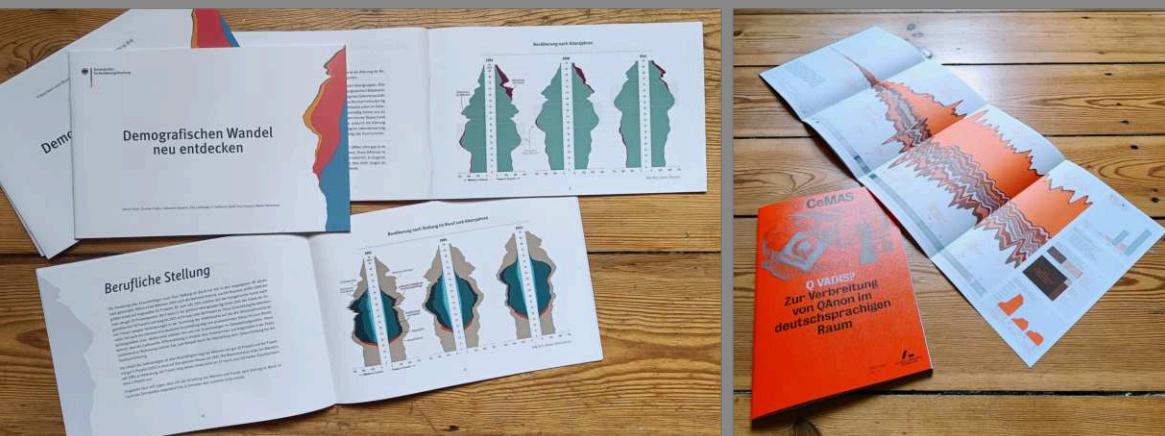
Ich habe **einen** Vertrag mit einem Anbieter für Sportübertragungen.

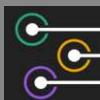
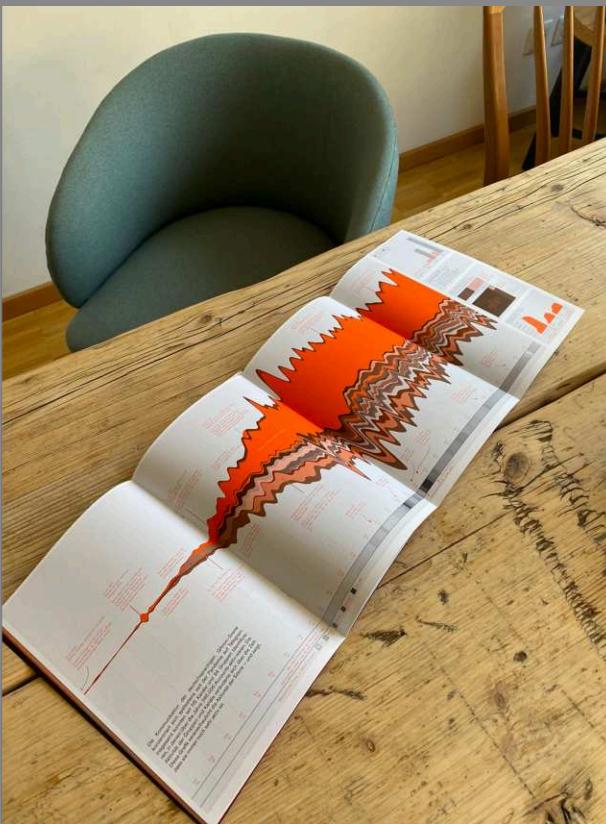


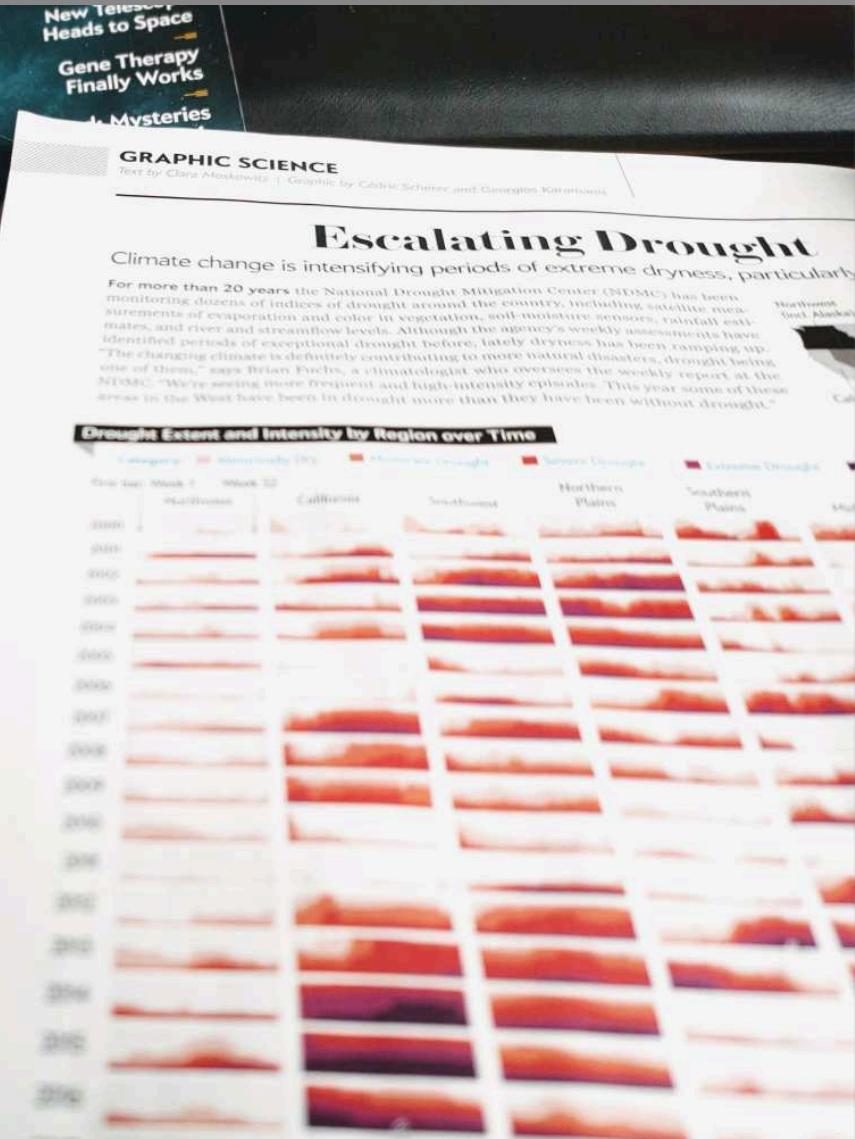
Ich habe **keinen** Vertrag mit einem Anbieter für Sportübertragungen.



Basierend auf 1018 Antworten auf eine Umfrage von KÜNDIGUNG.ORG

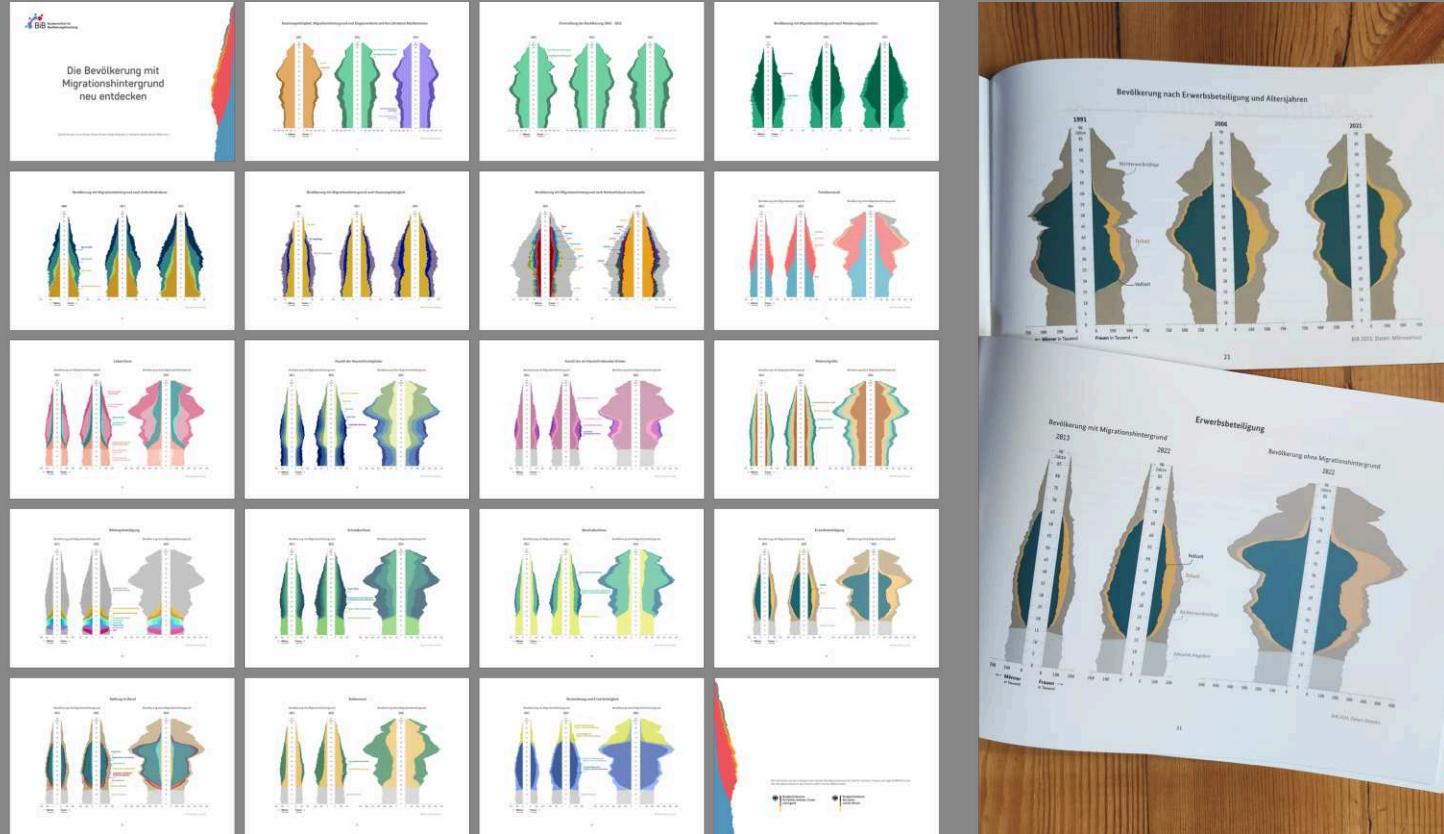


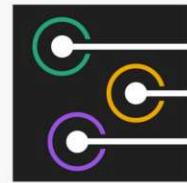




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CÉDRIC SCHERER
Data Visualization & Information Design



Consulting

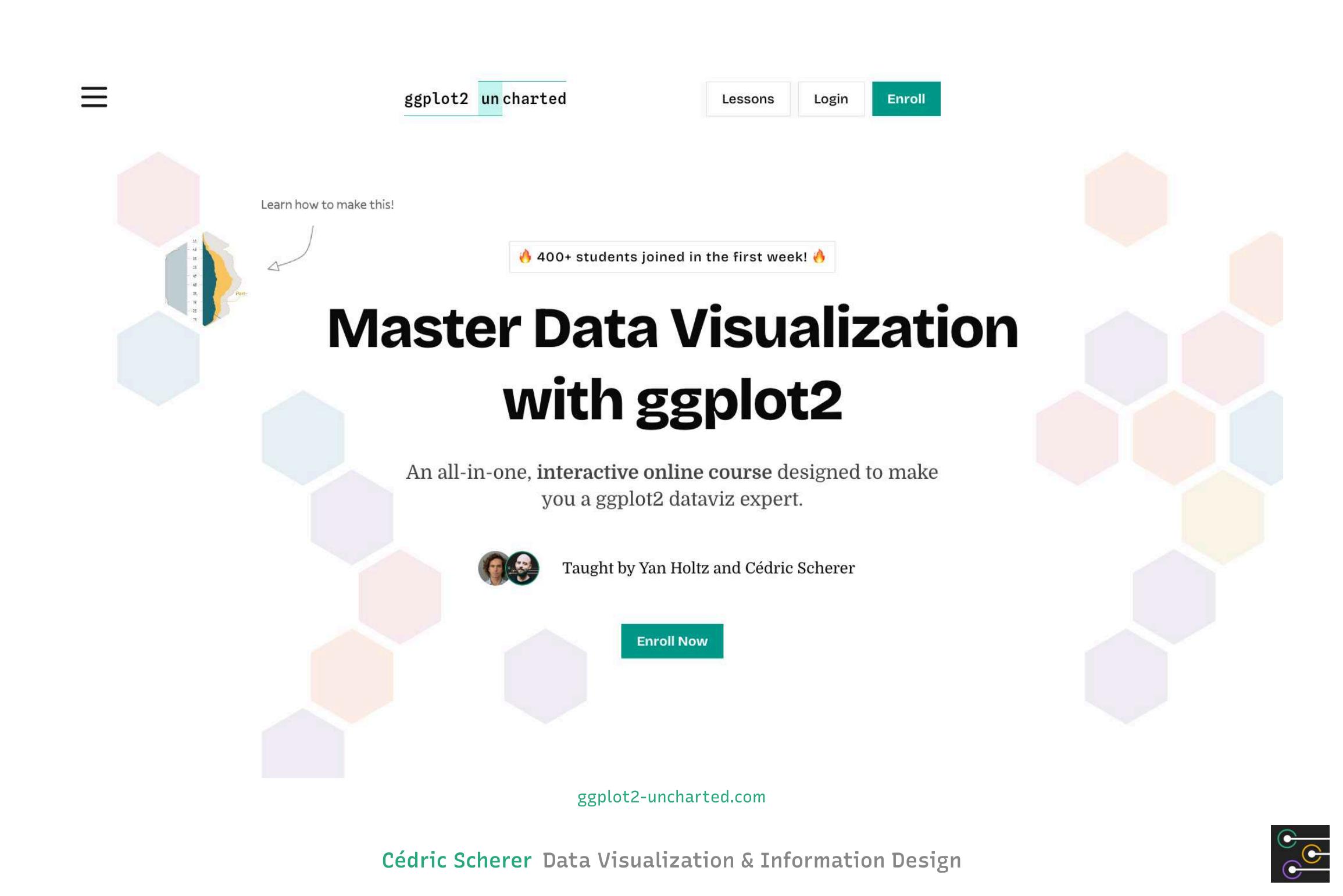


Coaching



Coding



A background pattern of overlapping hexagons in various shades of pink, light blue, and yellow.

Learn how to make this!

🔥 400+ students joined in the first week! 🔥

Master Data Visualization with ggplot2

An all-in-one, interactive online course designed to make
you a ggplot2 dataviz expert.



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Informationsdesign

ist die Gestaltung von Formen und Strukturen zur effizienten und effektiven Vermittlung von Wissen.



Konzeptionelle Information

Schematische Darstellung
von Objekten, Themen
und Prozessen

Art der Information

Messbare Information

Systematische Darstellung
von Datenwerten
(in quantifizierbarer Form)



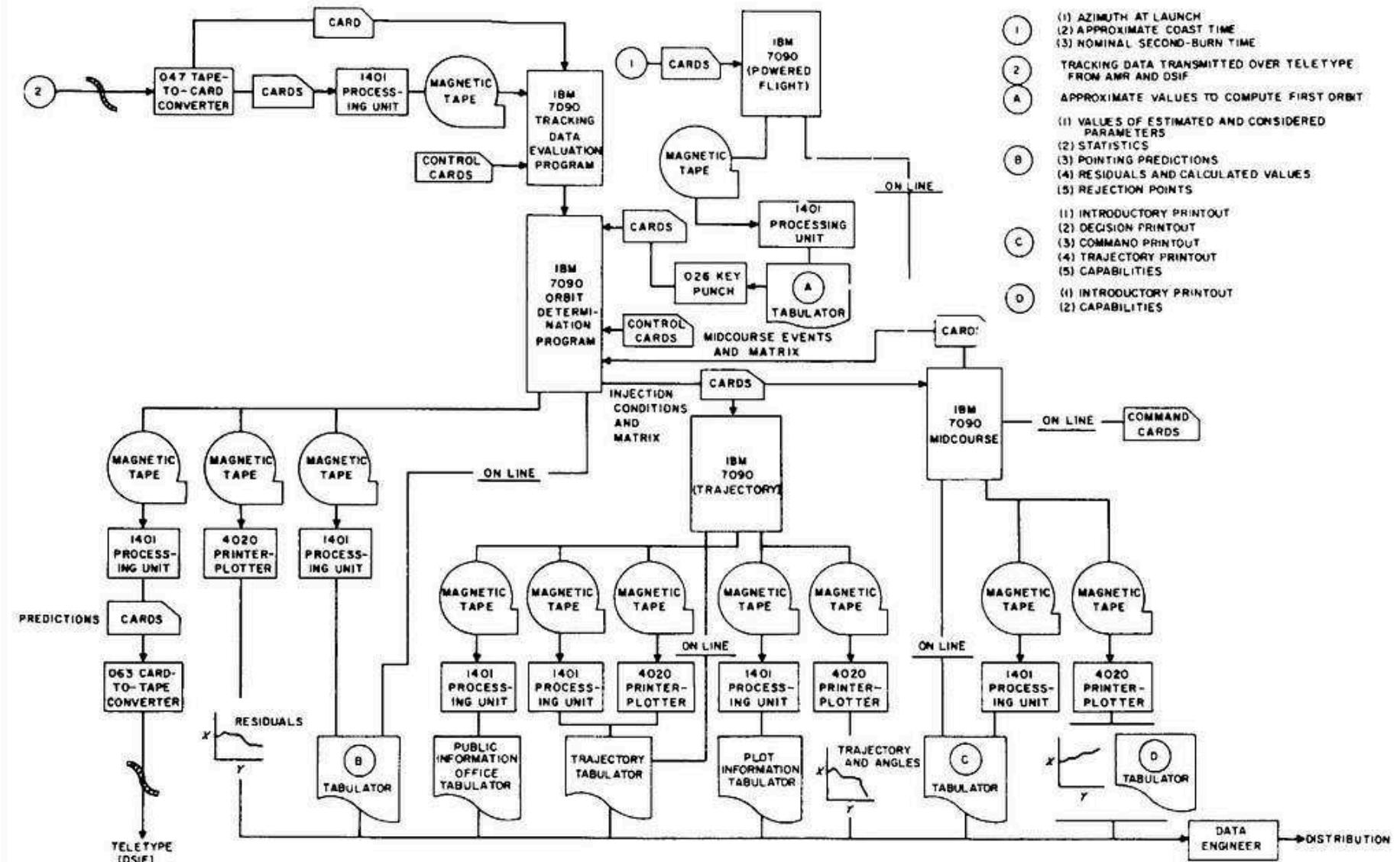
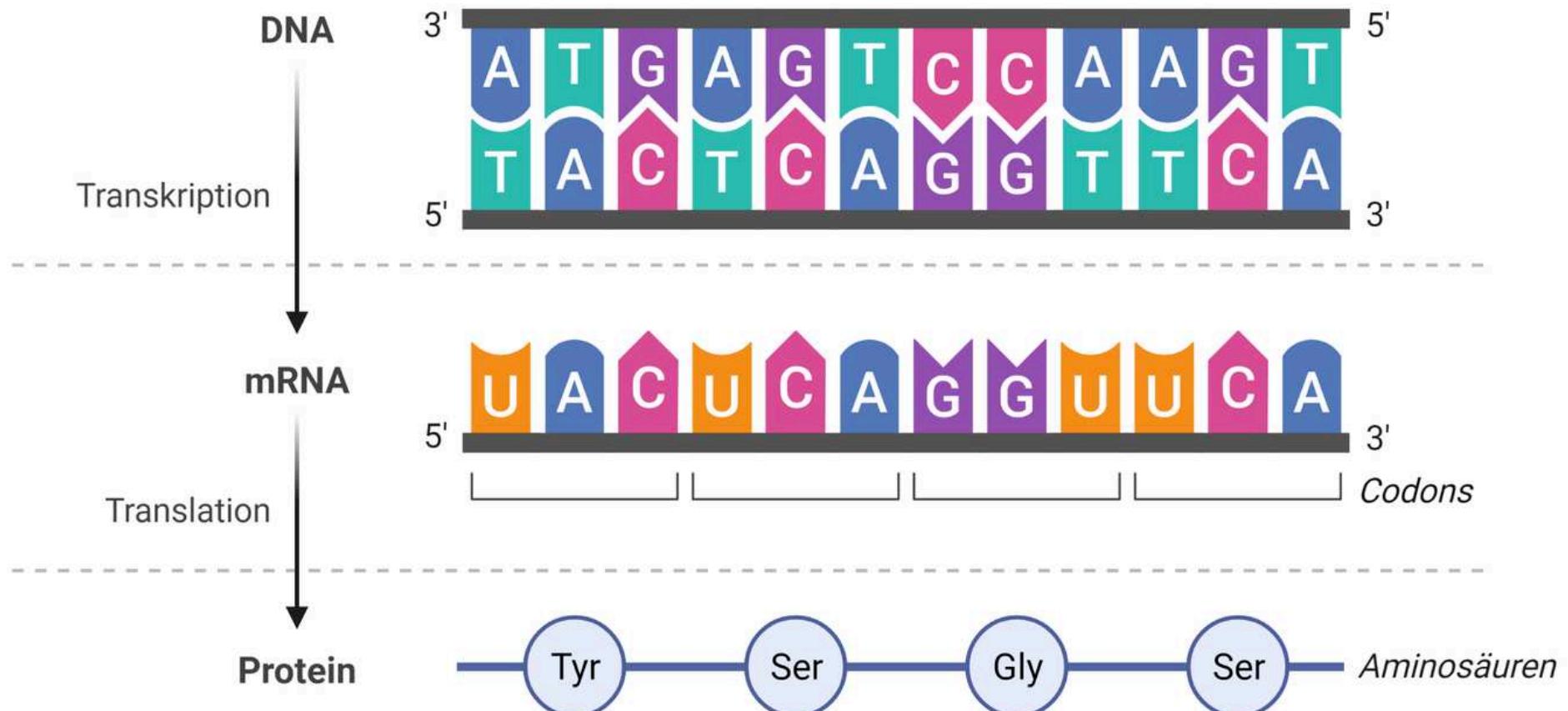


FIGURE 7-30.—Tracking-data flow chart.

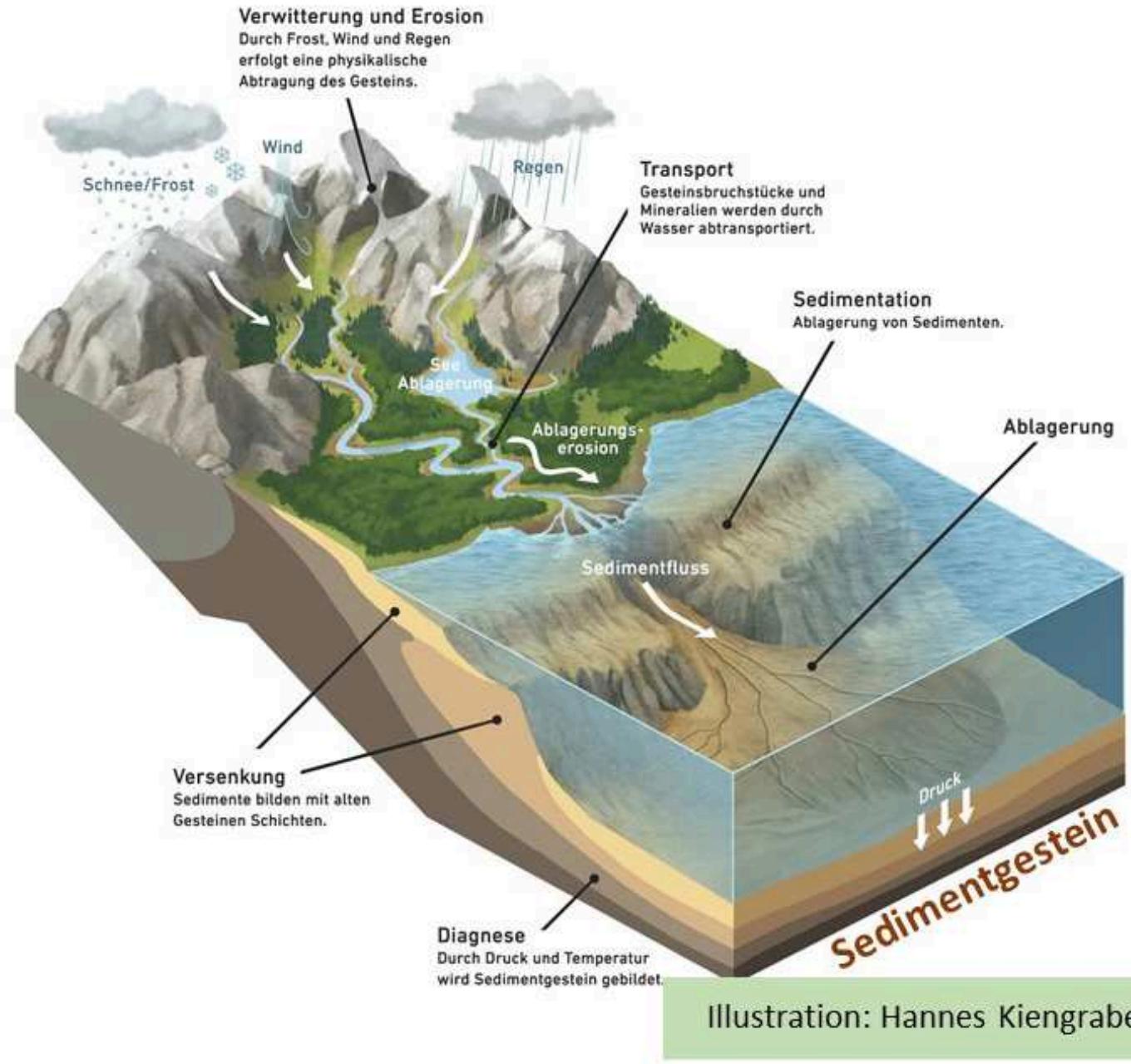
Quelle: Mariner-Venus 1962 Final Project Report NASA





Quelle: Open Science - Lebenswissenschaften im Dialog (created with BioRender.com)





Informationsgrafik für "Biber Berti" von Hannes Kiengraber

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City of anarchy

Kowloon Walled City, located not far from the former Kai Tak Airport, was a remarkable high-rise cluster even by the 1980s had 30,000 residents. A historical account of colonial Hong Kong.

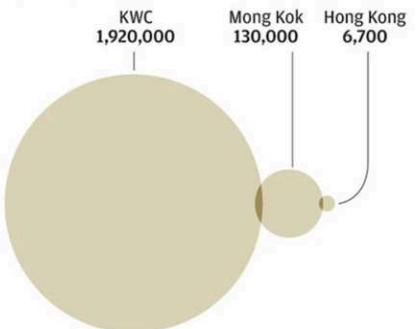
HONG KONG
WALLED CITY

The street-level shops were a mix of unlicensed dentists and doctors, market stalls and cafes that often included dog on the menu. Fish balls, barbecued and roast meat and other foodstuffs were manufactured in premises with little or no sanitation.

Brothels and gambling dens operated with impunity

Residents carried umbrellas to shield themselves from constantly dripping water pipes above the narrow alleys

Population density per square kilometre



From fortress to park

The Walled City underwent a dramatic transformation in the final decades of the 20th century

1898
700
inhabitants

Each point is
an inhabitant

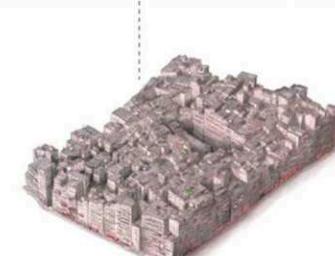
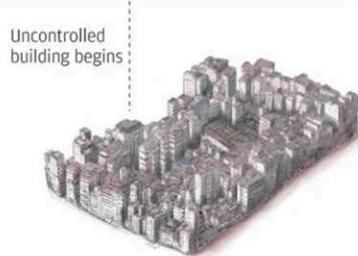
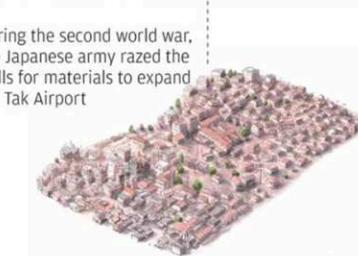
1940
2,000
inhabitants

1950
5,000
inhabitants

1973
10,000
inhabitants

1980
30,000
inhabitants

1990
50,000
inhabitants



Sources: *The Darkness City: Life in Kowloon Walled City* - Greg Girard and Ian Lambot, Leisure and Cultural Services Department



Barracks
Kai Tak Airport

1950

1973

1980

Park

SCMP Graphic: Adolfo Arranz

Fresh start

In March 1993, the settlement was demolished and a park that looked like a typical Chinese garden was built in its place. But it kept a few original elements from the Walled City, such as old cannons and remnants of the South Gate and its entrance plaques



“City of Anarchy” von Adolfo Arranz (für South China Morning Post)

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Datenvisualisierung

ist die systematische Darstellung von Zahlen, Kategorien und Beziehungen in quantifizierbarer Form.



Datenvisualisierung

hilft auf Basis von strukturierter (messbarer) Inhalte zu entdecken, erkennen, erklären und entscheiden.



Datenvisualisierung

ist einerseits Kunst und
andererseits Wissenschaft.



Erkundung von Daten

Analyse oder Anwendung
zur Gewinnung von
Erkenntnissen

Zweck der Darstellung

Erklärung von Daten

Präsentation zur
Vermittlung der Ergebnisse
und Erkenntnisse



TYPOLOGY OF INFORMATION GRAPHICS

Type of information →

Conceptual

Purely conceptual information cannot be visualized, only illustrated.

Purpose of the graphic ↓

Explanatory

Measurable

Exploratory

Visualization

Information graphics

Quelle: "Data Visualization Handbook" von Juuso Koponen & Jonatan Hildén (2020), Seite 25





Höhlenmalerei im Canyon de Chelly National Monument, Arizona
Foto: [Robert Alexander/Getty Images](#)



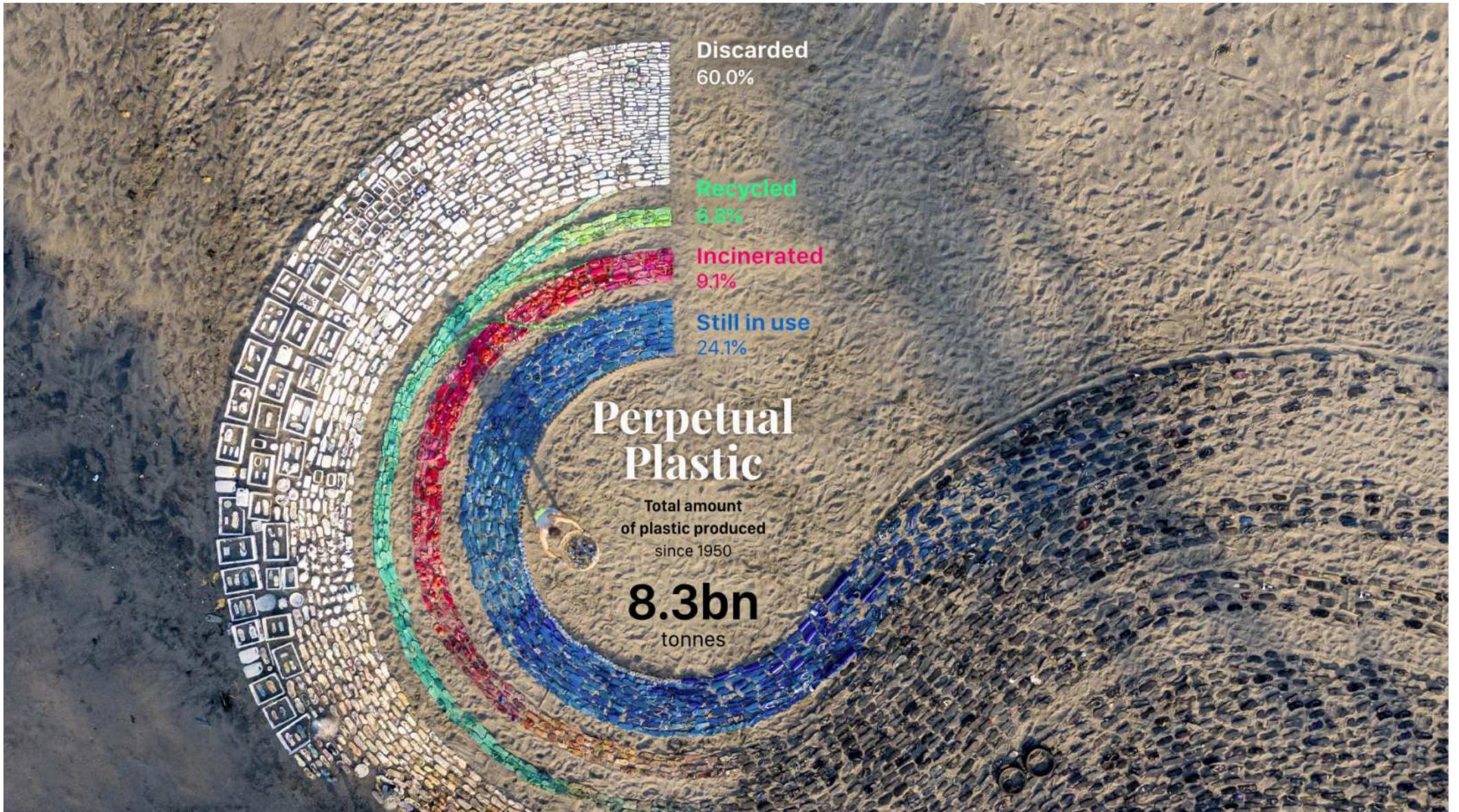


Sorting Sea Shells

Quelle: [TheChocolateMuffinTree Blog](#)

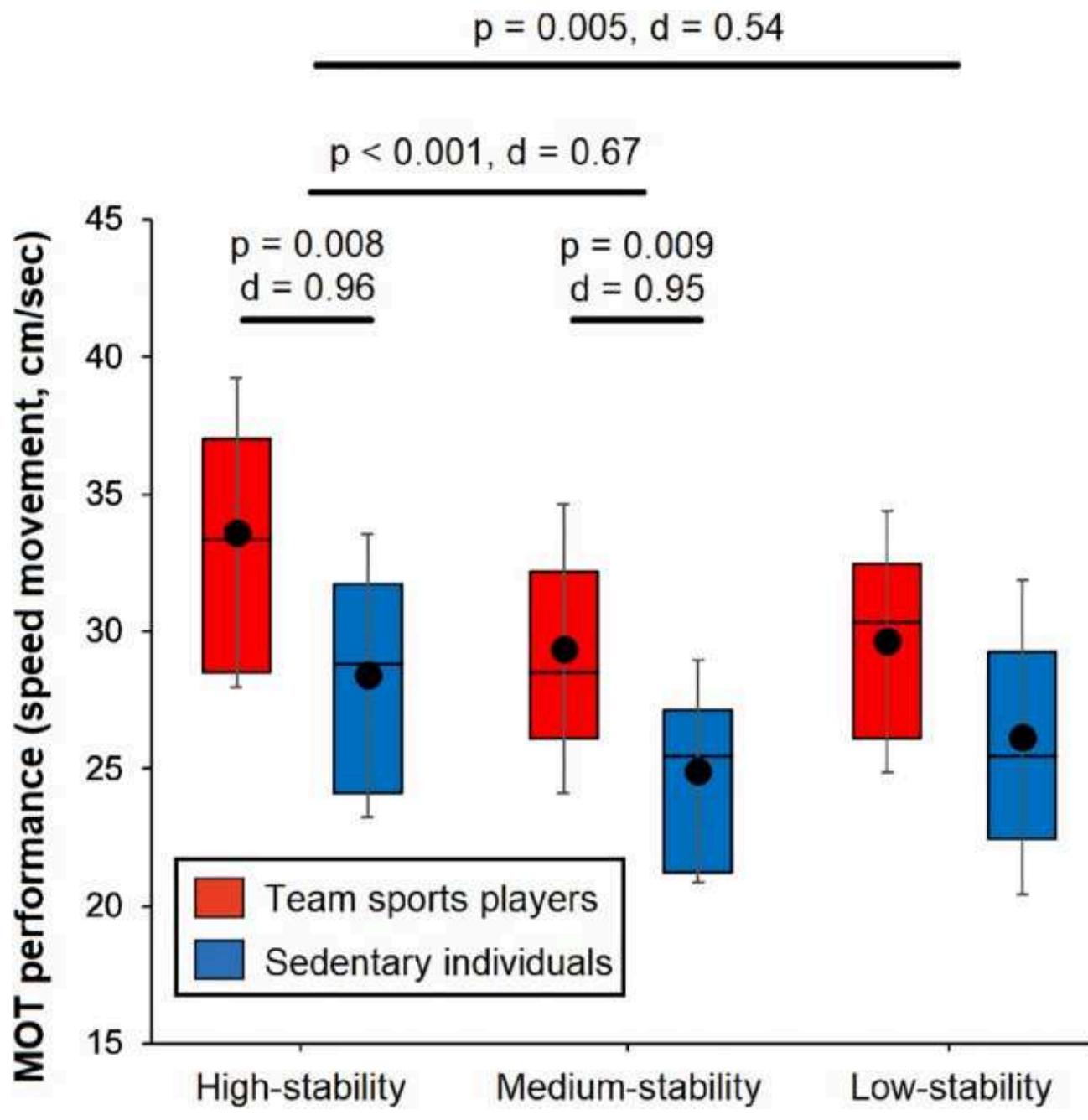
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"Perpetual Plastic" von Liina Klauss, Skye Morét & Moritz Stefaner





Zwierko et al. 2022



US stocks have underperformed global markets in 2025

Indices rebased, year to date



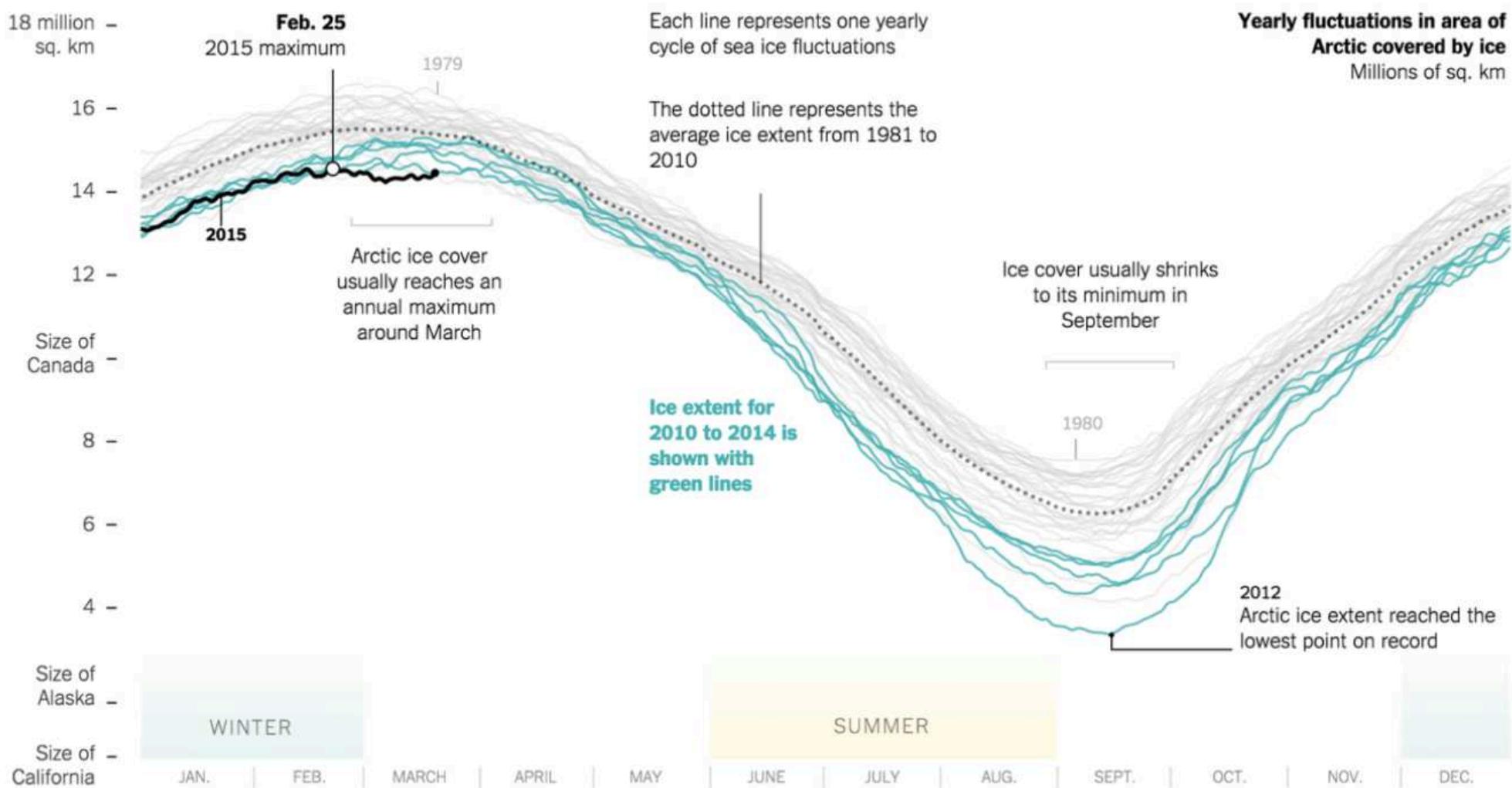
FINANCIAL TIMES

Source: LSEG

Quelle: Financial Times

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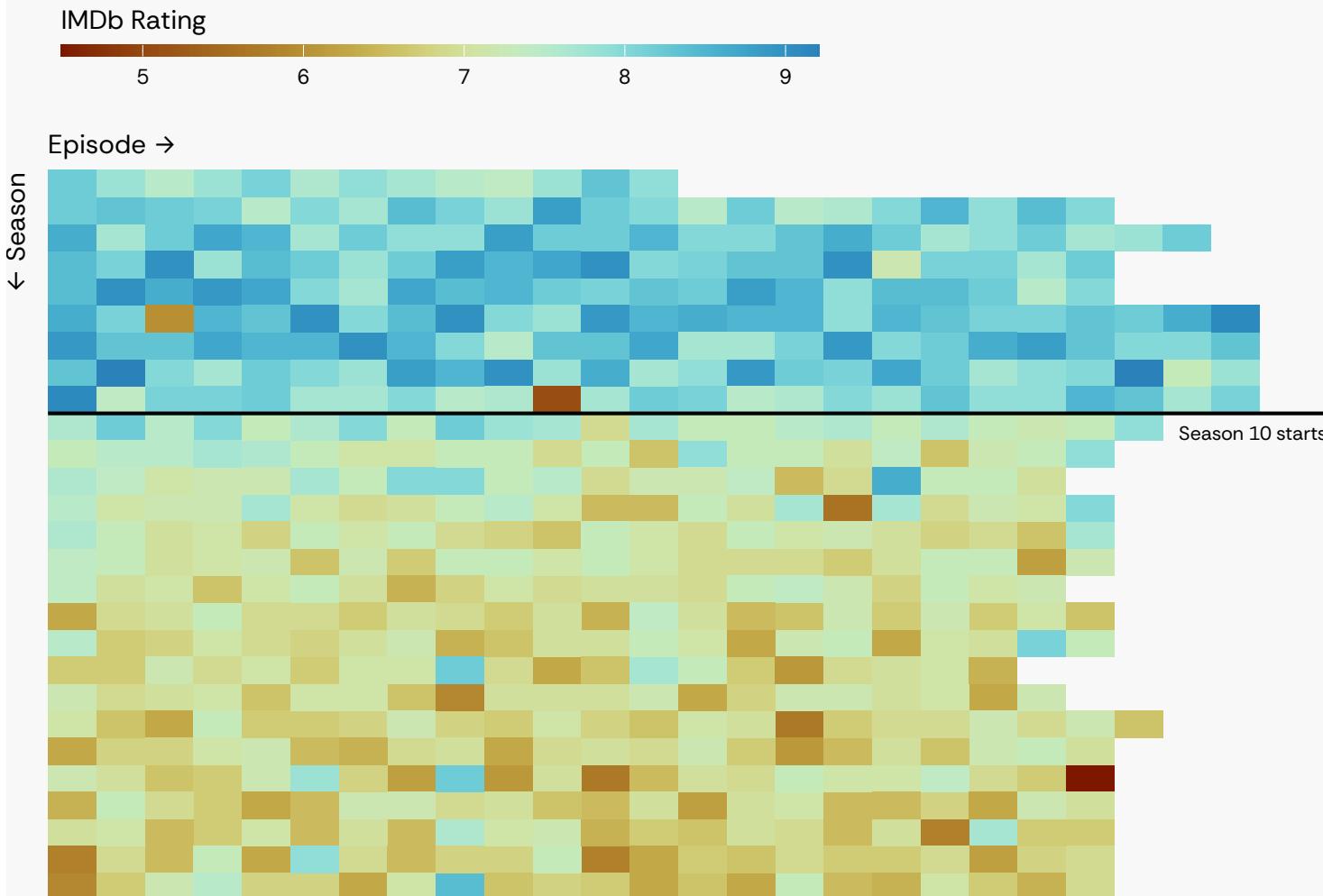


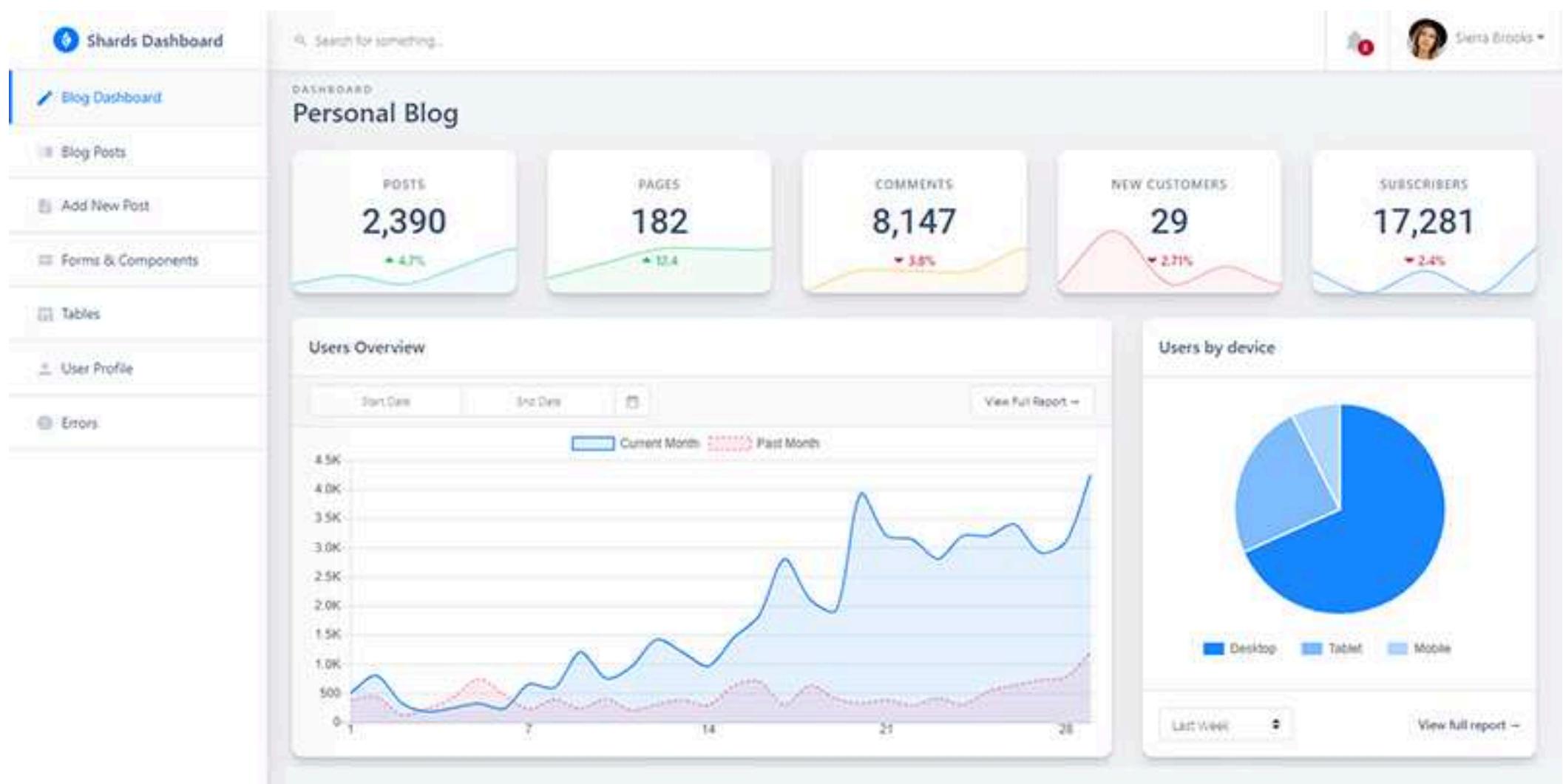


"Yearly Fluctuations in Area of Arctic Covered by Ice" von Derek Watkins (New York Times)



From season 10 onwards, IMDb ratings for "The Simpsons" dropped considerably





Quelle: bypeople.com





"Patchwork Kingdoms" by Nadieh Bremer

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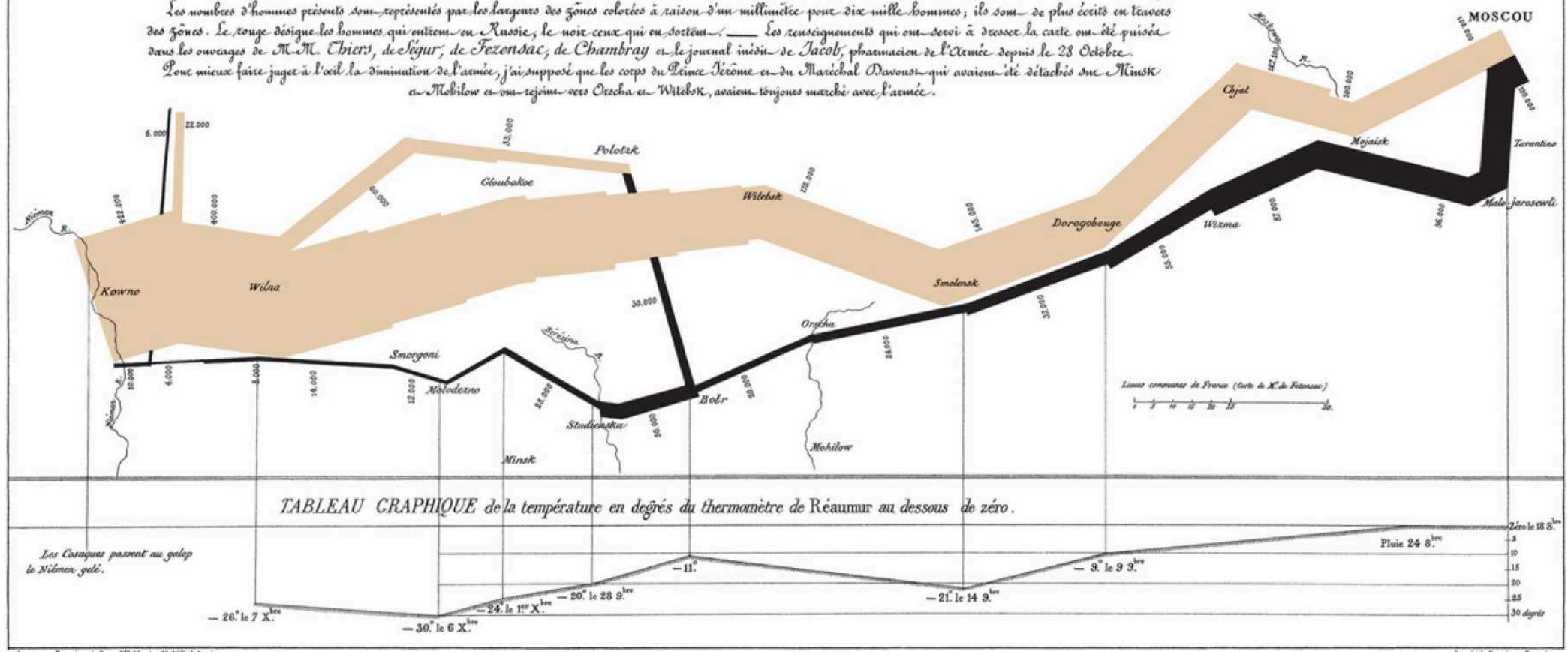


Carte Figurative des pertes successives en hommes de l'Armée Française dans la Campagne de Russie 1812-1813.

Dessinée par M. Minard, Inspecteur Général des Ponts et Chaussées en retraite. Paris, le 20 Novembre 1869.

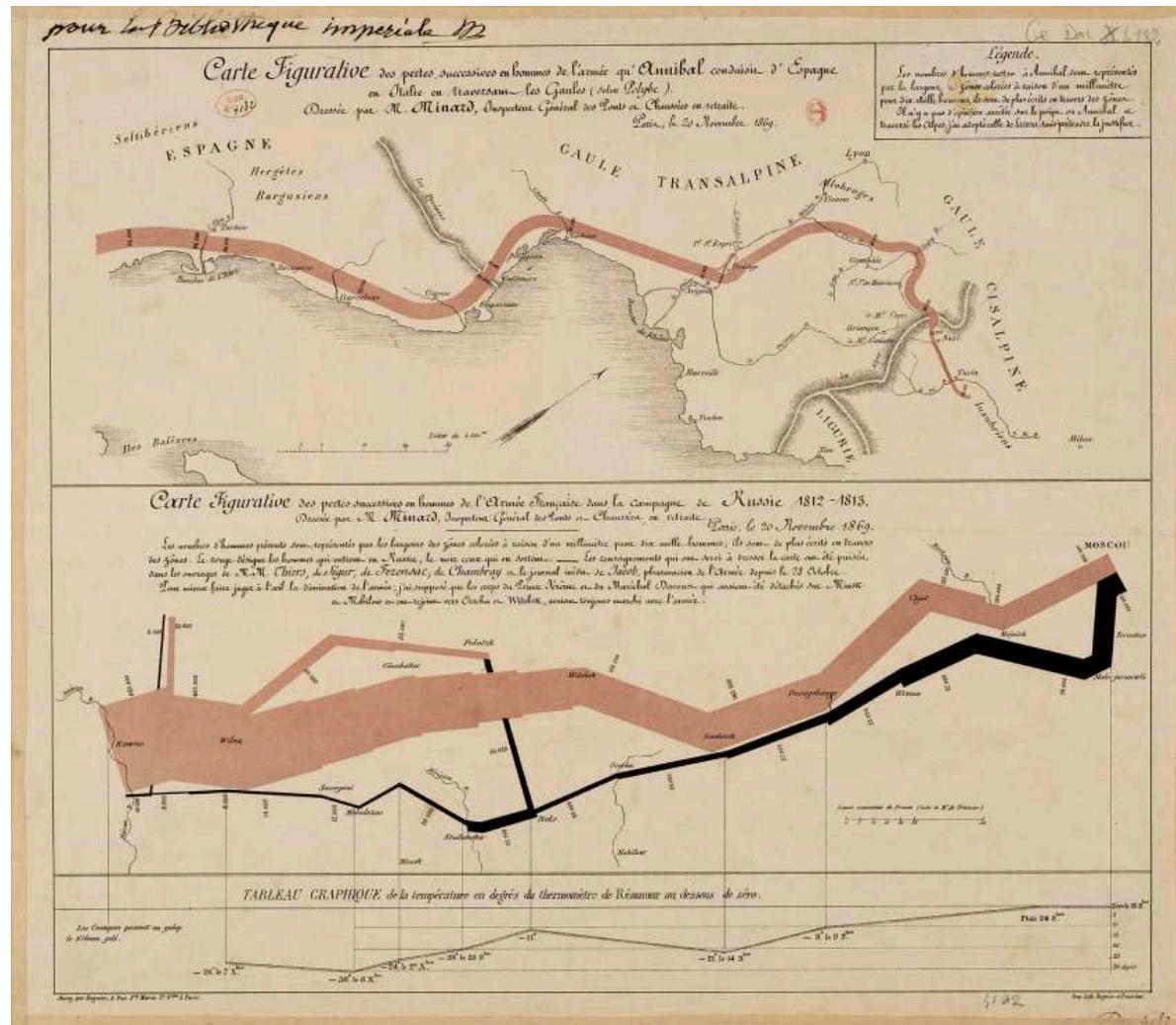
Les nombres d'hommes perdus sont représentés par les largeurs des zones colorées à raison d'un millimètre pour dix mille hommes; ils sont de plus écrits en lettres de zones. Le rouge désigne les hommes qui entrent en Russie, le noir ceux qui en sortent. — Les renseignements qui ont servi à dresser la carte ont été pris dans les ouvrages de M. M. Chier, de Léger, de Fezensac, de Chambray et le journal intime de Jacob, pharmacien de l'Armée depuis le 28 Octobre.

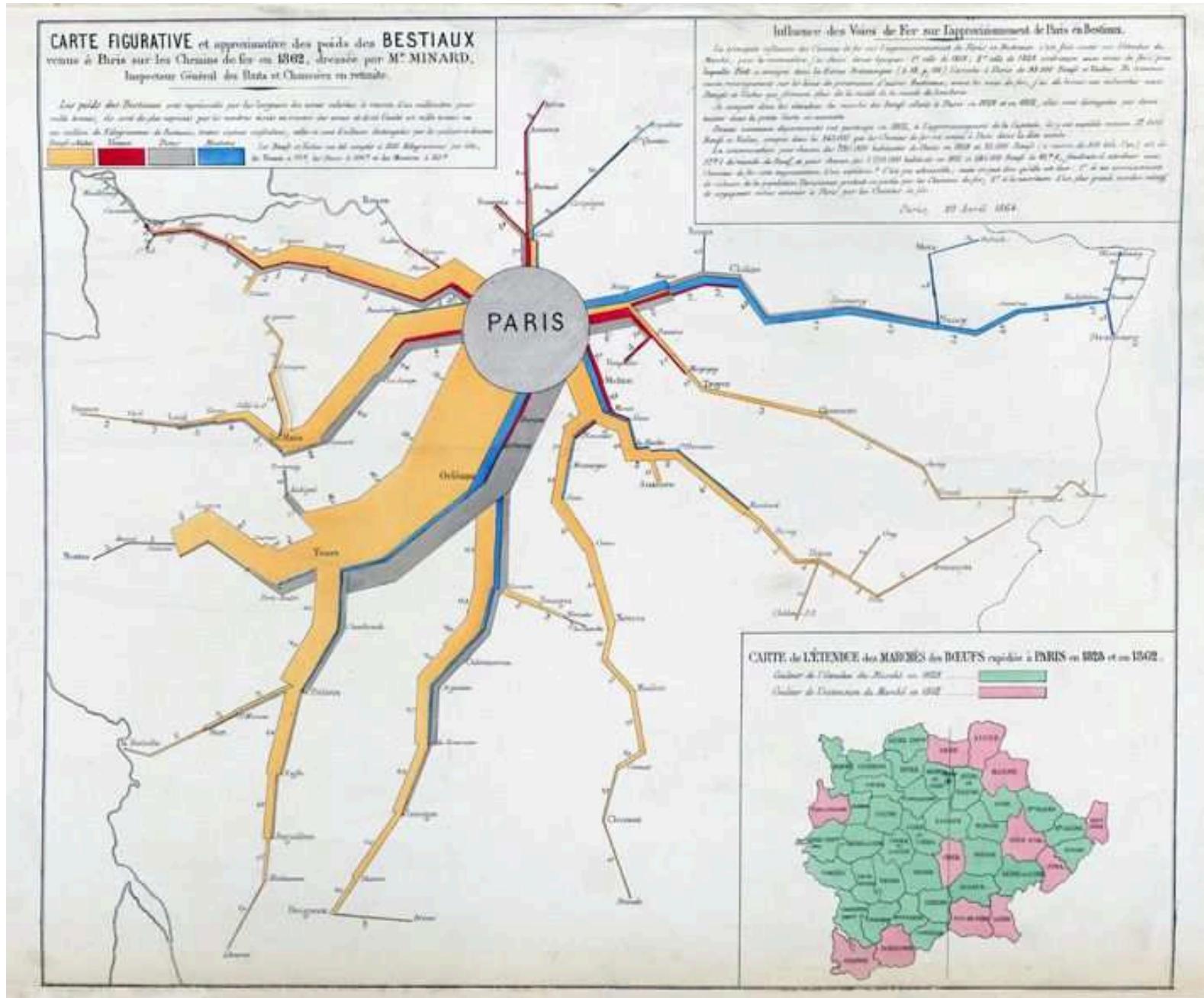
Pour mieux faire juger à l'œil la diminution de l'armée, j'ai supposé que les corps du Prince Napoléon et du Maréchal Davout, qui avaient été détachés sur Minsk et Mogilow et qui rejoignirent Ossaka en Wilensk, avaient toujours marché avec l'armée.



"Carte figurative des pertes successives en hommes de l'Armée Française dans la campagne de Russie 1812-1813" von Charles Joseph Minard (1869)







"Carte figurative et approximative des poids des bestiaux venus à Paris sur les chemins de fer en 1862" von Charles Joseph Minard (1864)



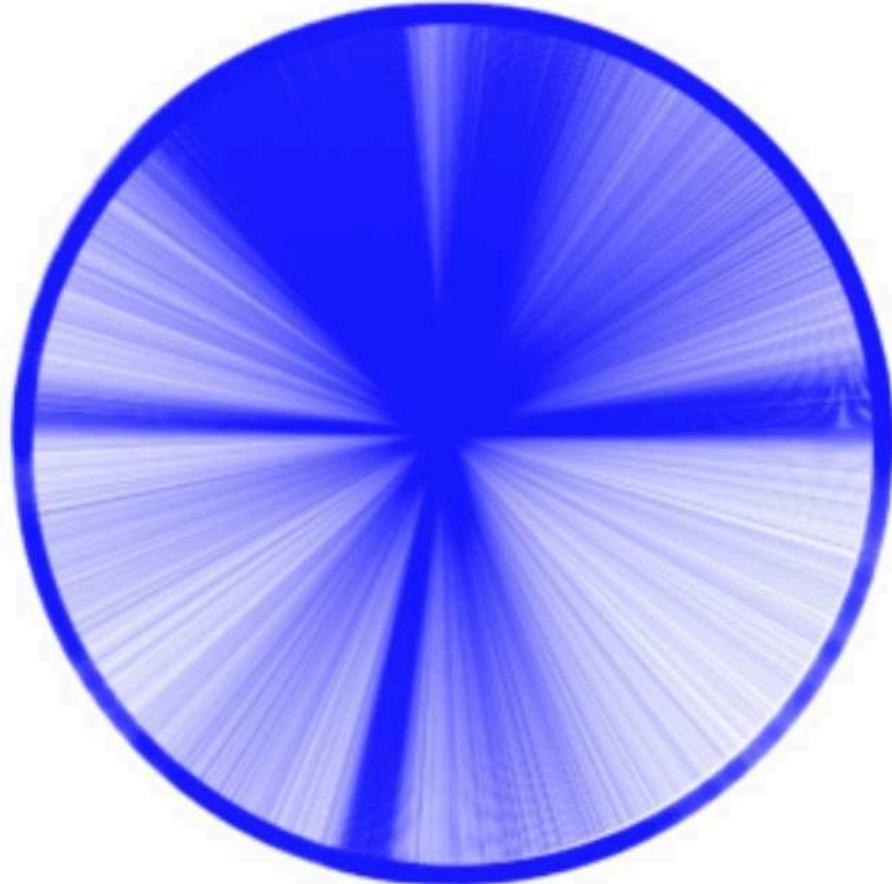
Experiment



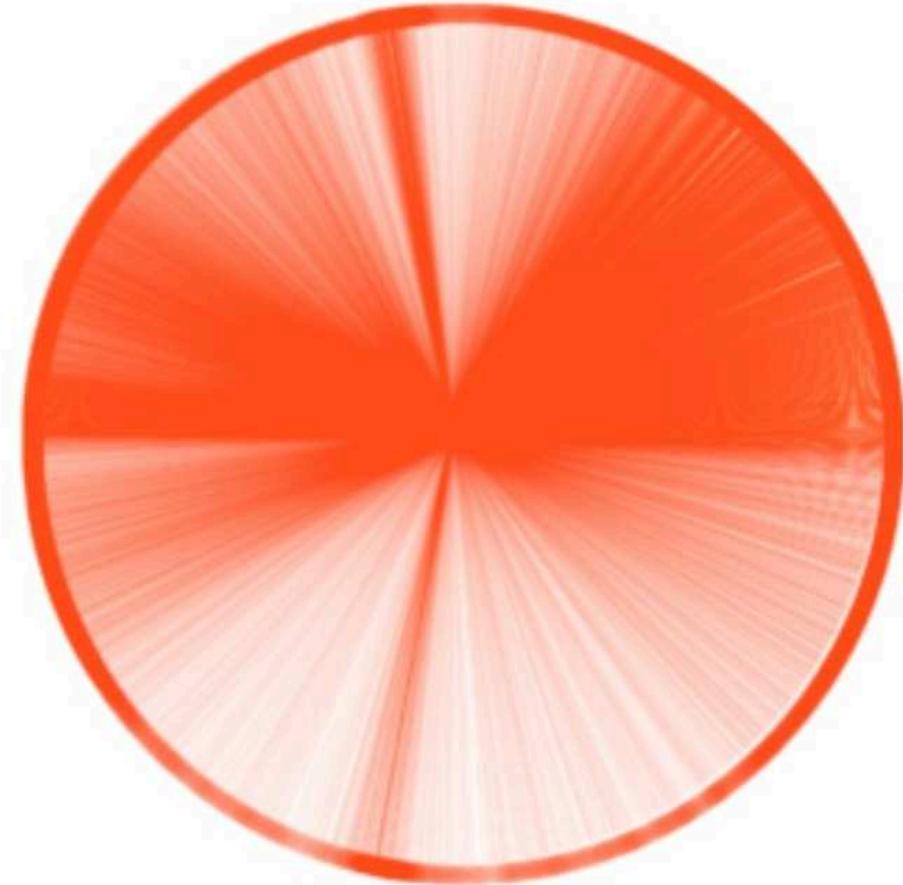
Wenn das Jahr ein Kreis ist — wo befinden sich März und Dezember?

- Zeichne einen Kreis, der das Jahr symbolisiert.
- Markiere darauf die Positionen von März und Dezember.
- Füge einen Pfeil hinzu, der die Richtung anzeigt.
- Überlege, ob du darüber schon einmal nachgedacht hast.
- Vergleiche deine Darstellung mit denen der Anderen.





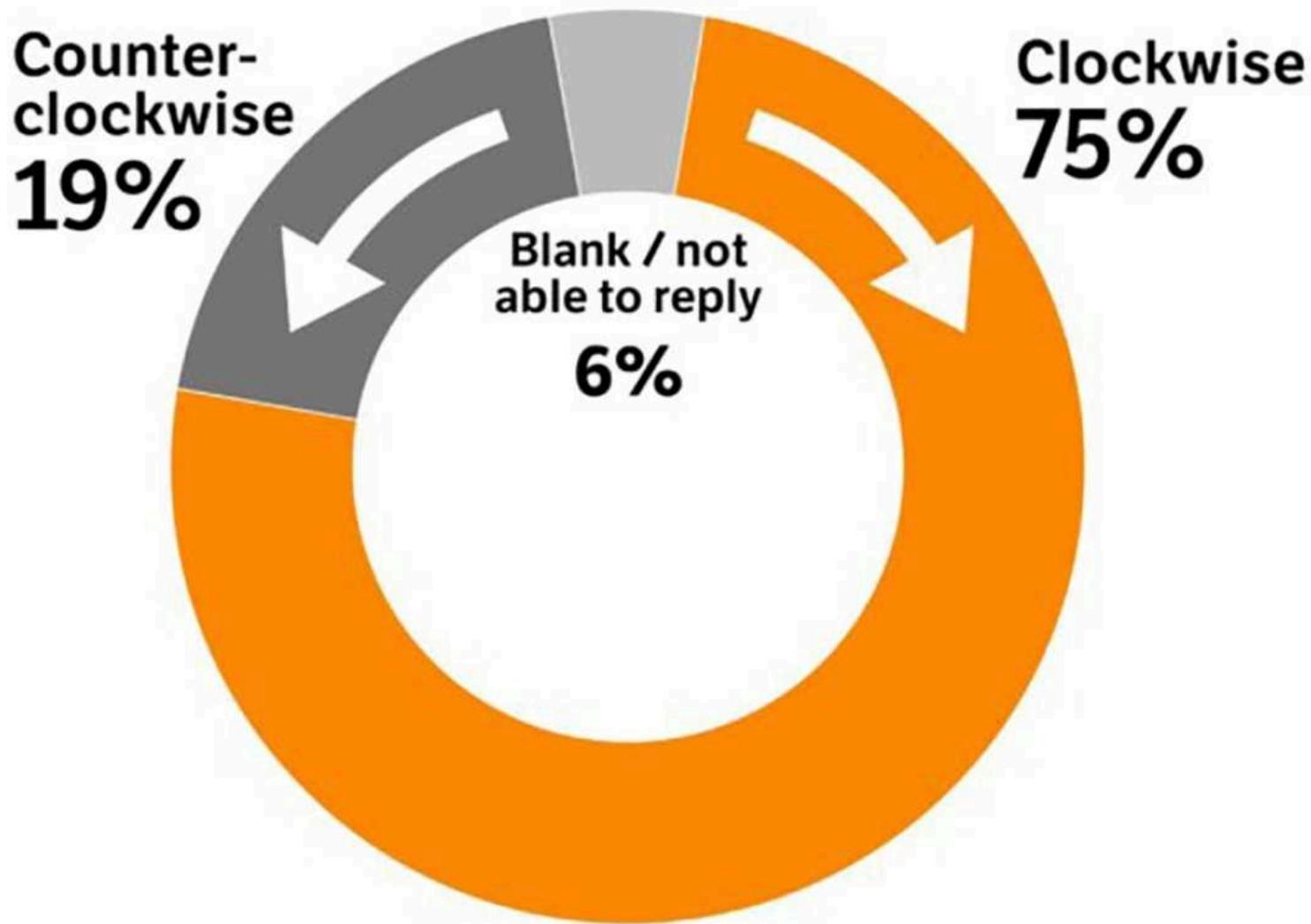
December



March

76,922 Platzierungen der Monate Dezember und März entlang eines Kreises.
Visualisierung: Henrik Lied, NRKbeta [Laeng & Hofseth, *Front Psychol.* 2019](#)





Anteil der Befragten gruppiert nach Richtung der Zeit auf dem Jahresrad.
Visualisierung: Vidar Kvien, NRK Laeng & Hofseth, *Front Psychol.* 2019





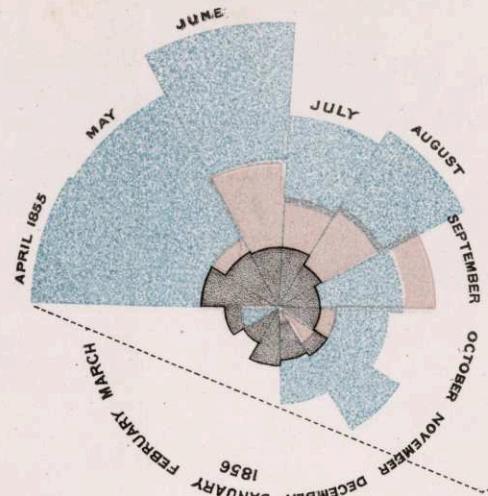
Buchcover des Kinderbuchs "My 1st Book of Seasons" von Sara Kale

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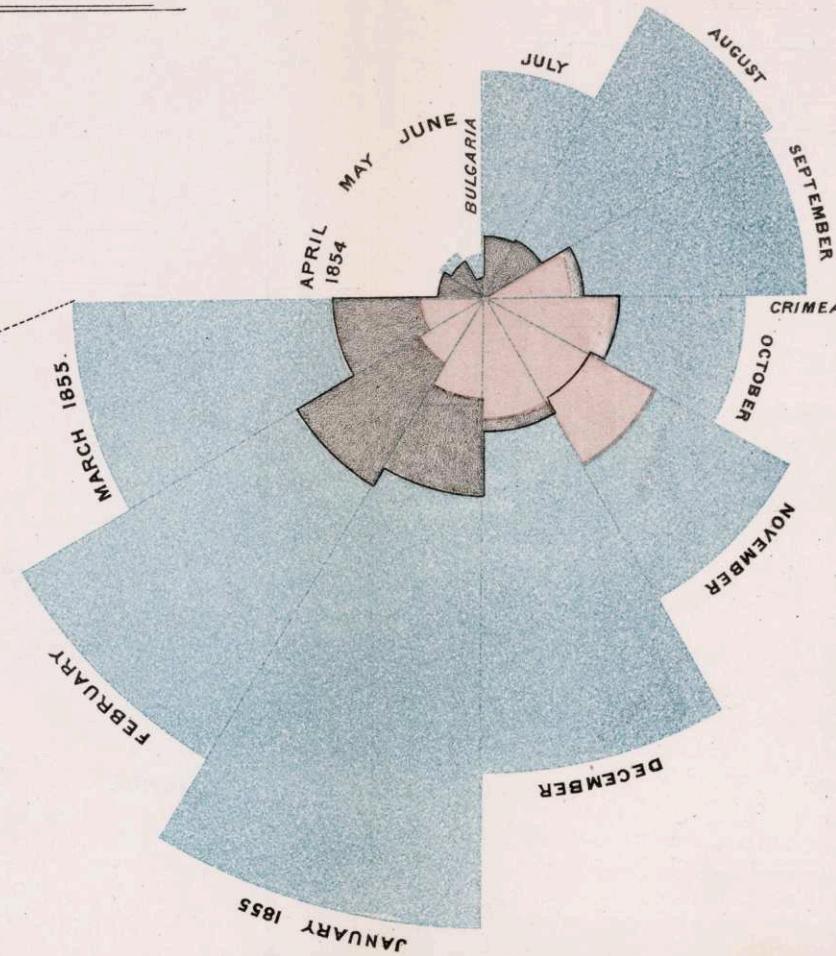


DIAGRAM OF THE CAUSES OF MORTALITY
IN THE ARMY IN THE EAST.

2.
APRIL 1855 TO MARCH 1856.



1.
APRIL 1854 TO MARCH 1855.



The Areas of the blue, red, & black wedges are each measured from the centre as the common vertex.

The blue wedges measured from the centre of the circle represent area for area the deaths from Preventible or Mitigable Zymotic diseases, the red wedges measured from the centre the deaths from wounds, & the black wedges measured from the centre the deaths from all other causes.

The black line across the red triangle in Nov. 1854 marks the boundary of the deaths from all other causes during the month.

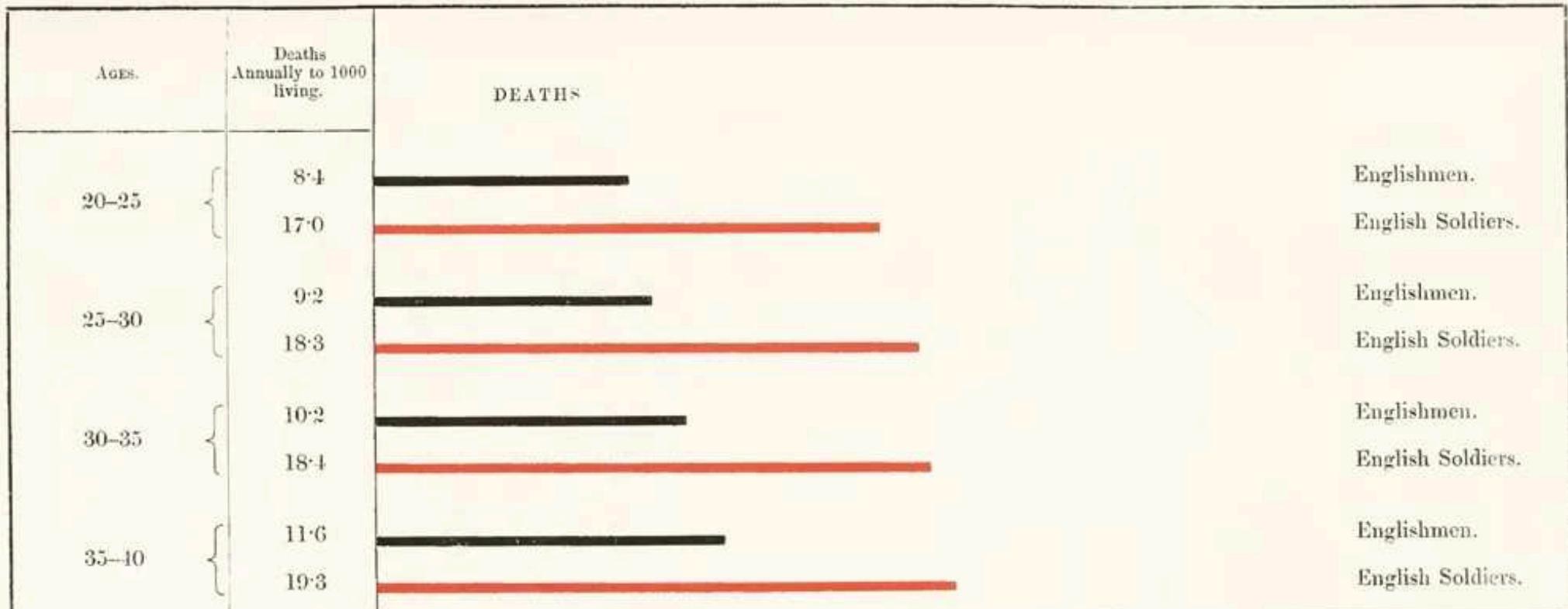
In October 1854, & April 1855, the black area coincides with the red; in January & February 1856, the blue coincides with the black.

The entire areas may be compared by following the blue, the red & the black lines enclosing them.

"Diagram of the causes and mortality in the army in the East" (genannt coxcomb oder rose diagram) von Florence Nightingale (1858)



Representing the Relative Mortality of the Army at Home and of the English Male Population at corresponding Ages.



JAMES LEWIS, del.

"Relative mortality of the army at home and of the English male population at corresponding ages" von Florence Nightingale (1858)



Visualisiere deine Daten!



**“... make both calculations and graphs.
Both sorts of output should be studied;
each will contribute to understanding.”**

F. J. Anscombe (1973)



Anscombe's Quartet

	I	II	III	IV			
10	8.04	10	9.14	10	7.46	8	6.58
8	6.95	8	8.14	8	6.77	8	5.76
13	7.58	13	8.74	13	12.74	8	7.71
9	8.81	9	8.77	9	7.11	8	8.84
11	8.33	11	9.26	11	7.81	8	8.47
14	9.96	14	8.1	14	8.84	8	7.04
6	7.24	6	6.13	6	6.08	8	5.25
4	4.26	4	3.1	4	5.39	19	12.5
12	10.84	12	9.13	12	8.15	8	5.56
7	4.82	7	7.26	7	6.42	8	7.91
5	5.68	5	4.74	5	5.73	8	6.89



Anscombe's Quartet

I

$$\begin{aligned}\mu_x &= 9 \\ \sigma_x &= 3.16\end{aligned}$$

$$\begin{aligned}\mu_y &= 7.5 \\ \sigma_y &= 1.94\end{aligned}$$

$$r = 0.82$$

II

$$\begin{aligned}\mu_x &= 9 \\ \sigma_x &= 3.16\end{aligned}$$

$$\begin{aligned}\mu_y &= 7.5 \\ \sigma_y &= 1.94\end{aligned}$$

$$r = 0.82$$

III

$$\begin{aligned}\mu_x &= 9 \\ \sigma_x &= 3.16\end{aligned}$$

$$\begin{aligned}\mu_y &= 7.5 \\ \sigma_y &= 1.94\end{aligned}$$

$$r = 0.82$$

IV

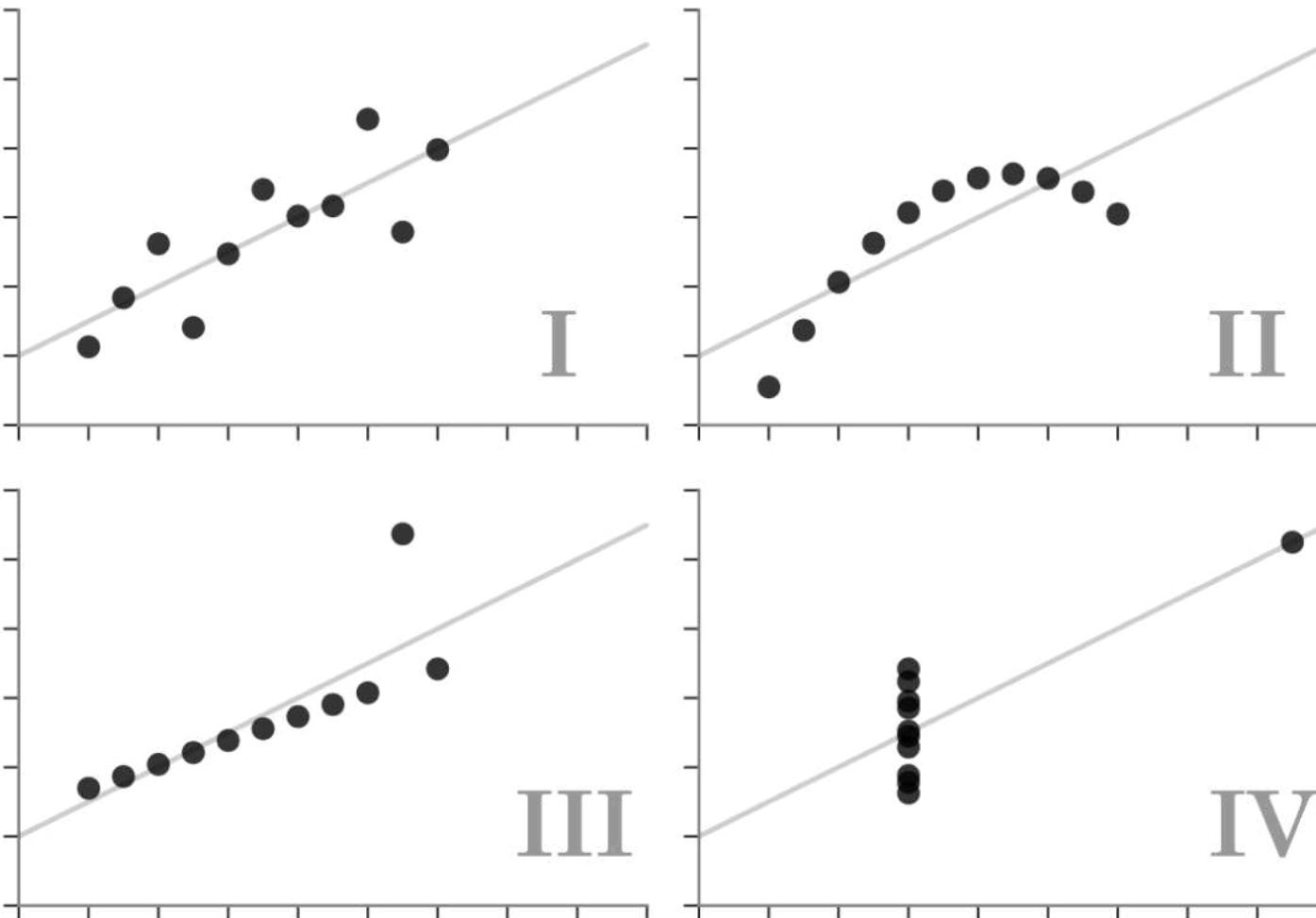
$$\begin{aligned}\mu_x &= 9 \\ \sigma_x &= 3.16\end{aligned}$$

$$\begin{aligned}\mu_y &= 7.5 \\ \sigma_y &= 1.94\end{aligned}$$

$$r = 0.82$$



Anscombe's Quartet



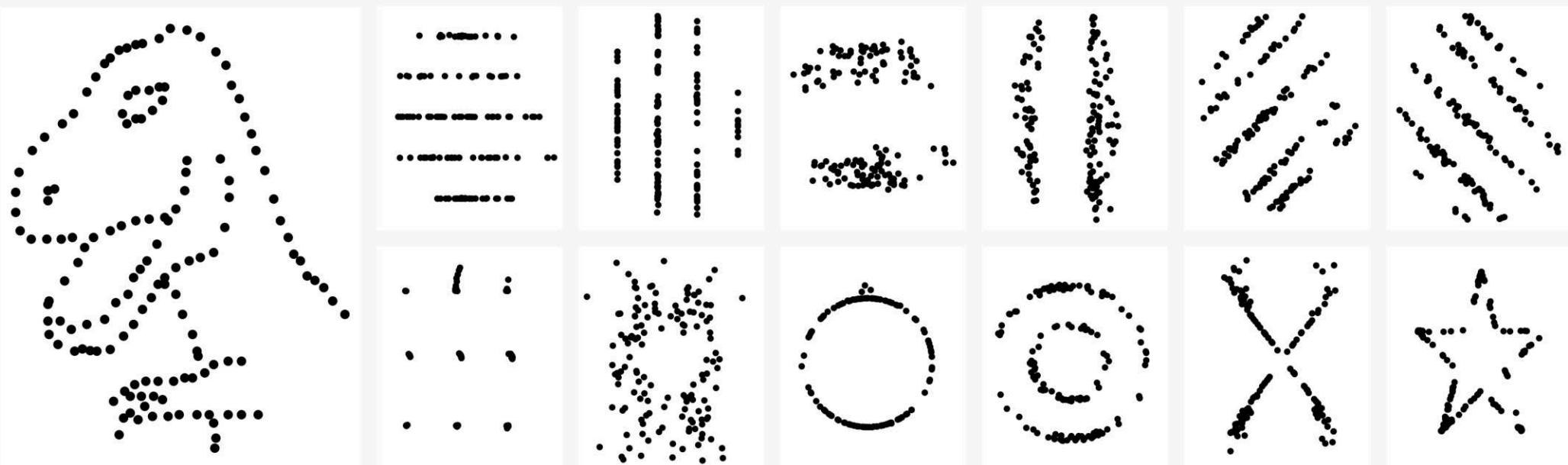
Quelle: Matejka & Fitzmaurice (2017)

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The Datasaurus Dozen

A set of 13 datasets with nigh-identical summary statistics, which could lead one to believe the datasets are quite similar. After visualizing the data, it becomes clear that they are clearly different and visually distinct.

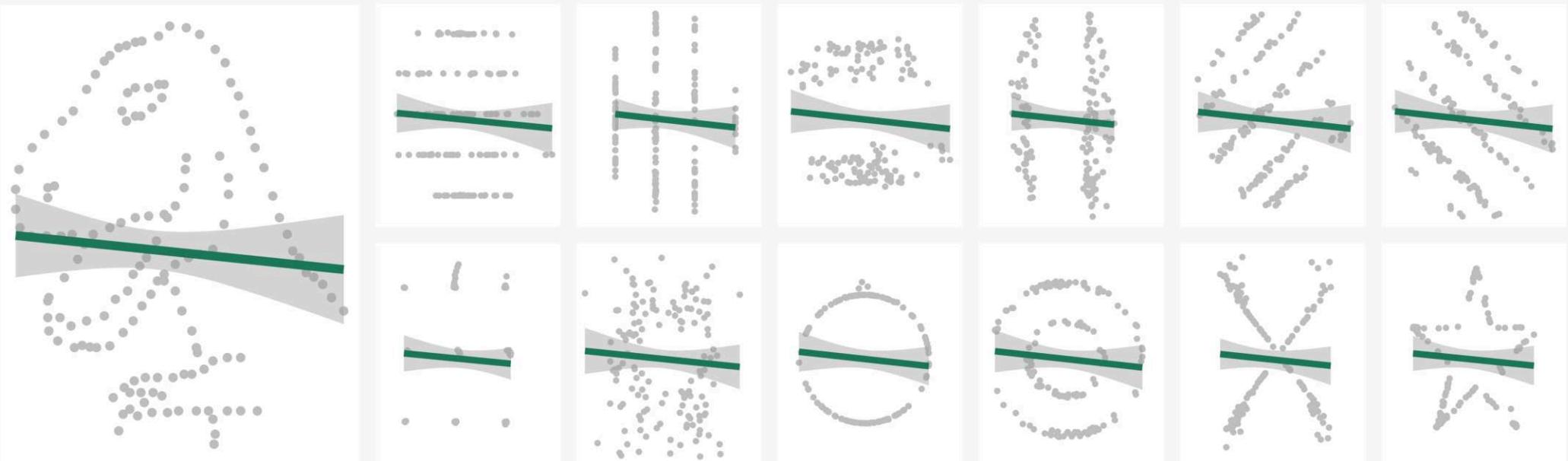


"Same Stats, Different Graphs: Generating Datasets with Varied Appearance and Identical Statistics through Simulated Annealing" by Justin Matejka & George Fitzmaurice (2017)



The Datasaurus Dozen

A set of 13 datasets with **high-identical summary statistics**, which could lead one to believe the datasets are quite similar. After visualizing the data, it becomes clear that they are clearly different and visually distinct.



"Same Stats, Different Graphs: Generating Datasets with Varied Appearance and Identical Statistics through Simulated Annealing" by Justin Matejka & George Fitzmaurice (2017)

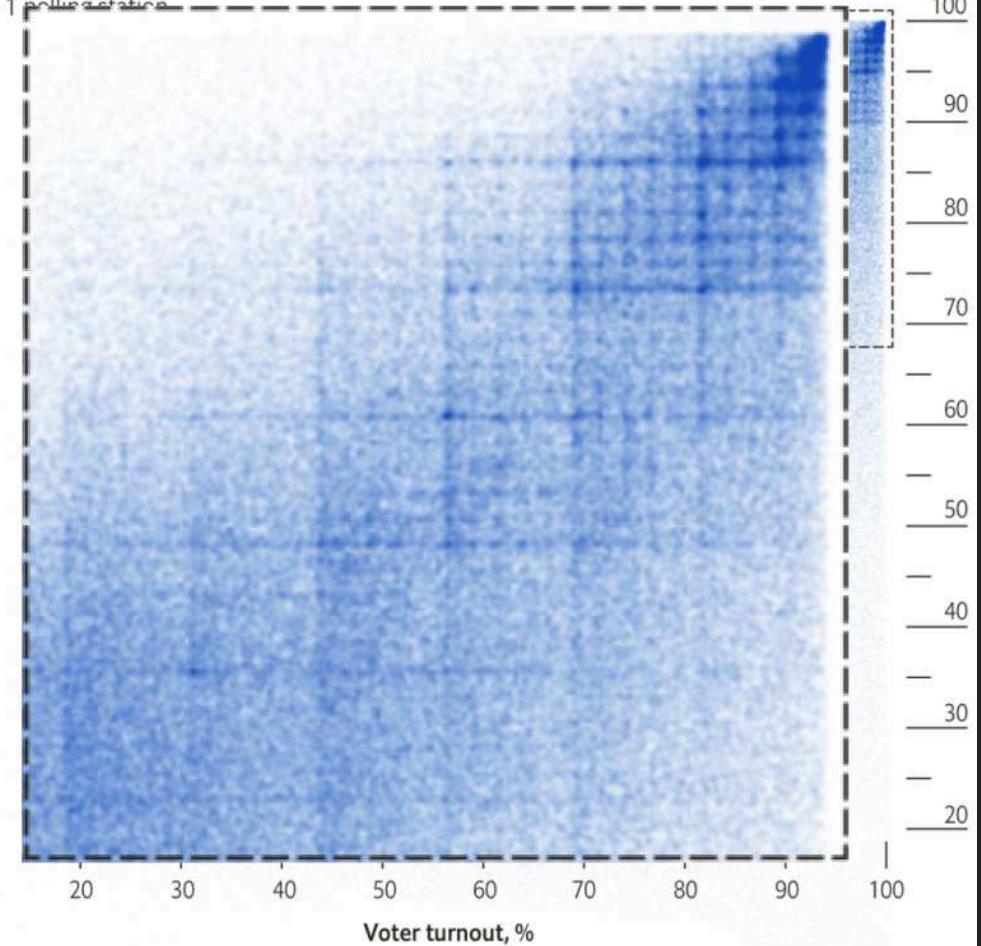


Fair and square?

Russian federal elections, 2000-21

Putin, Medvedev or United Russia result, %

● 1 dot = 1 poll station



Source: Kobak and Shpilkin (2021)

"When Dmitry Kobak and Sergey Shpilkin [...] analysed the results, they found that **an unusually high number of turnout and vote-share results were multiples of five** (eg, 50%, 55%, 60%), a tell-tale **sign of manipulation.**"

"Russian elections once again had a suspiciously neat result"
by The Economist

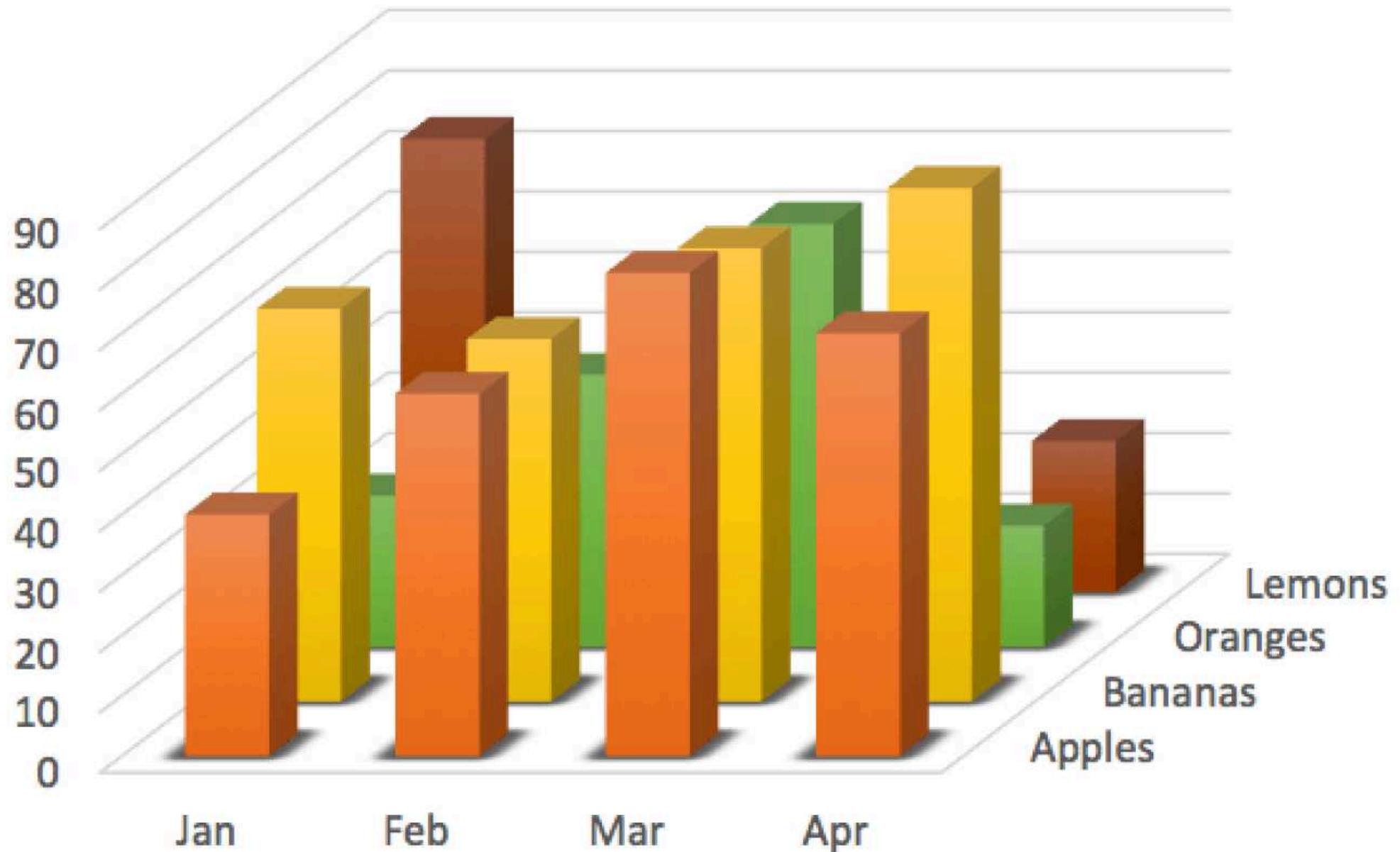


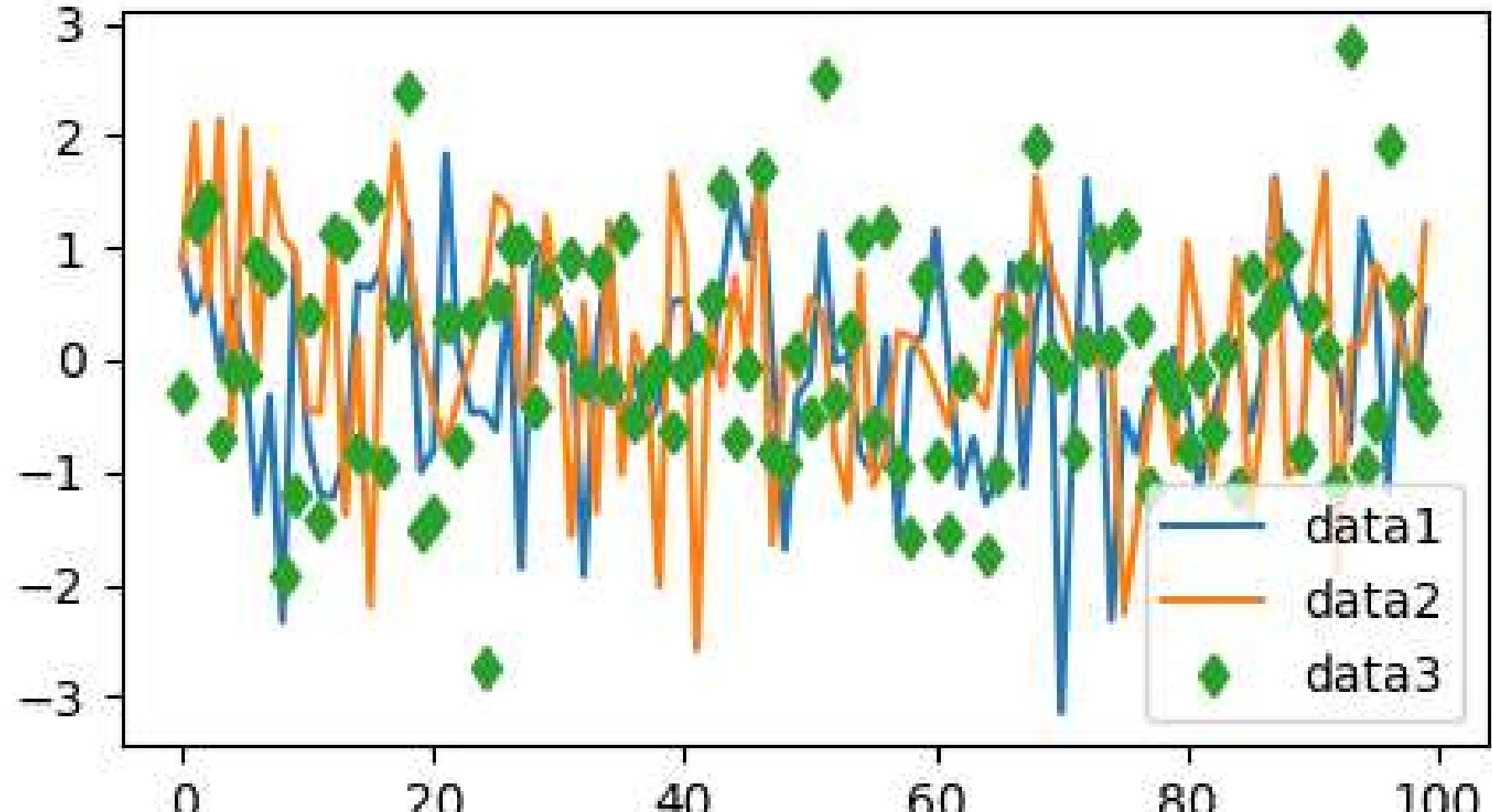
Was macht eine gute Datenvizualisierung aus?



- » **Integrität** (Information)
- » **Bedeutsamkeit** (Erzählung)
- » **Zweckmäßigkeit** (Ziel)
- » **Eleganz** (Visuelle Form)

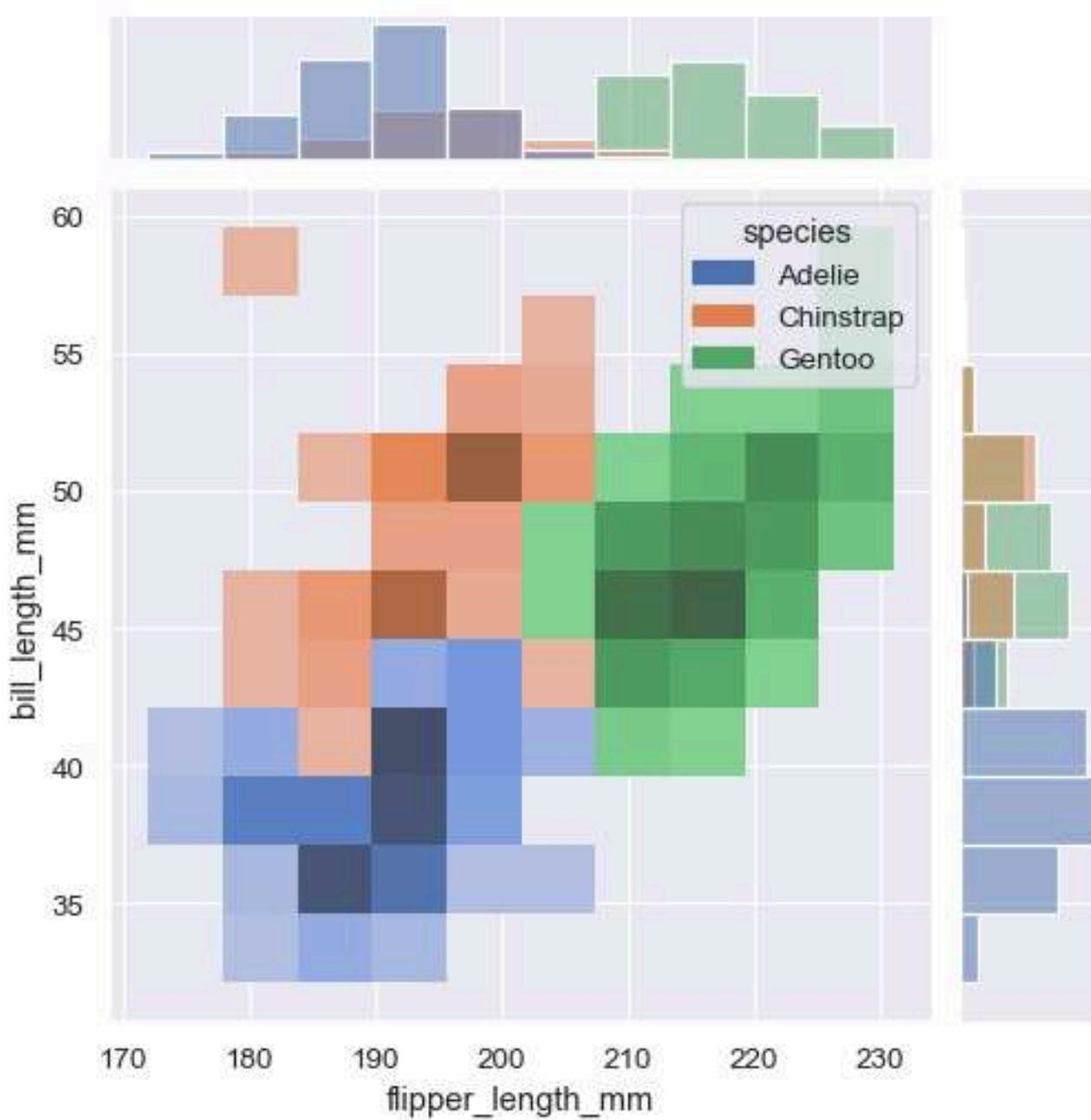






Quelle: savioglobal.com





Quelle: savioglobal.com

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Joshua Stevens  @jscarto · 10m
Visualizing data vs Data Visualization

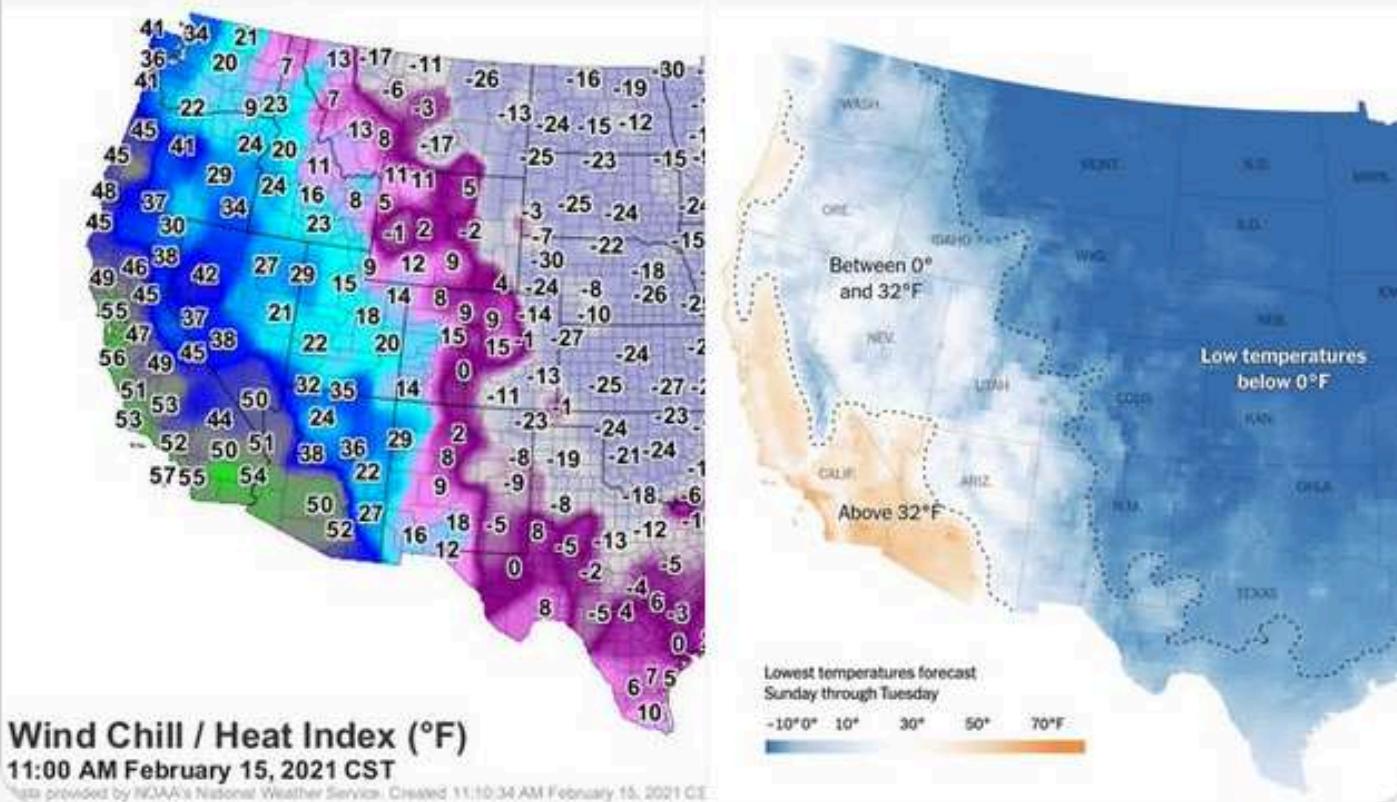
...



Ben Jones  @DataRemixed · 3h

Same variable, same territory, same week, two different color palettes & two different styles. @okmesonet & @nytimes.

[Show this thread](#)



4

8

17



Übungsteil



Übung

Schaue dir die Visualisierungen an und notiere:

- Dient die Abbildung zur **Erkundung oder Erklärung**?
- Welche **Erkenntnis** bringt dir die Datenvisualisierung?
- Was könnte die eigentliche **Erzählung** ("Take-Home Message") sein?
- Sind alle gezeigten Daten **sinnvoll gewählt und relevant**?
- Ist die Darstellung **zielführend und zweckmäßig**?
→ Denke kurz über Möglichkeiten zur (besseren) Darstellung nach.
- Wie passend ist die **Auswahl der Farben**?
- Wie bewertest du die **visuelle Form**, wie **wirkt** die Grafik?
→ elegant – überfüllt – langweilig – unausgewogen – ...



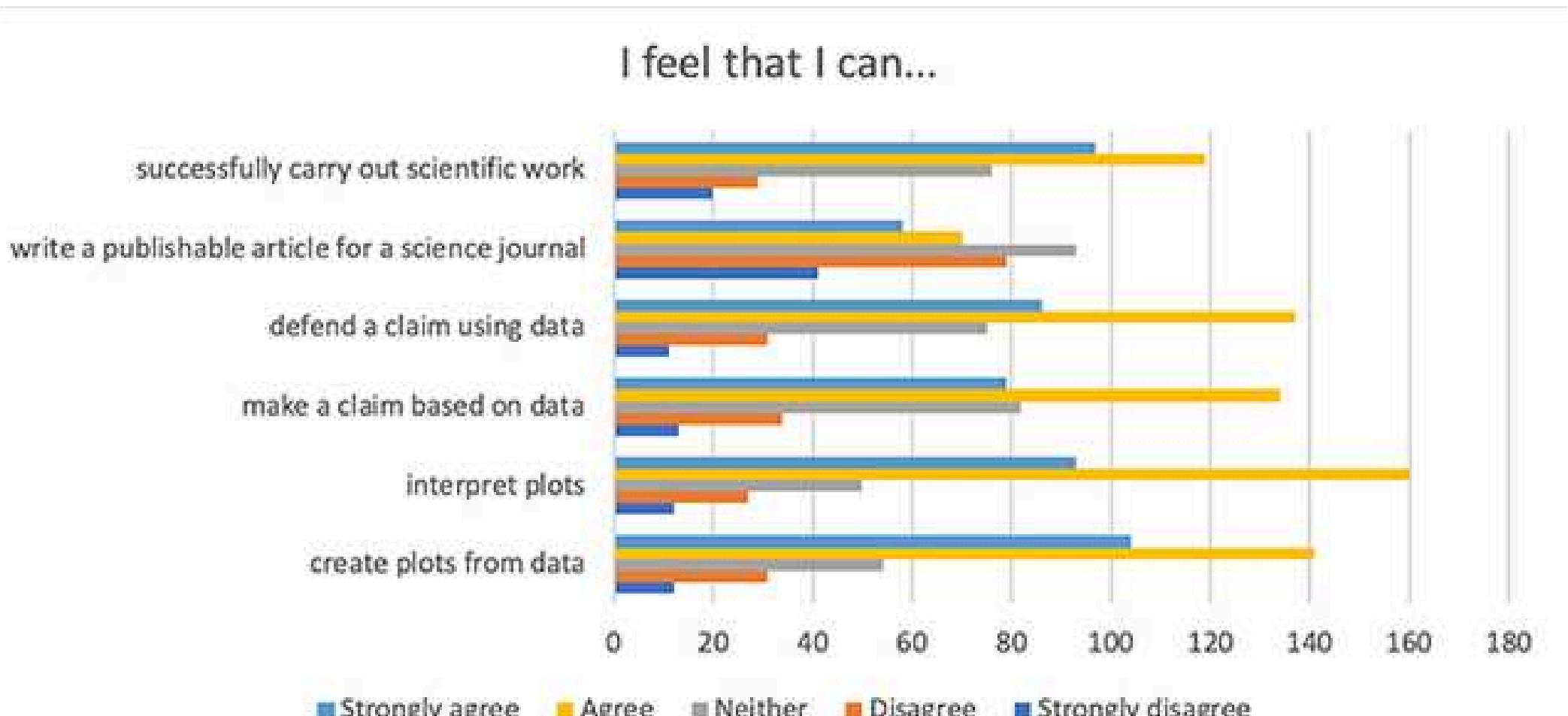


Figure 6

Histogram of responses to questions regarding perceived data analysis and reporting skills (N = 490).

Crowston, Mitchell & Østerlund (2019) doi: 10.5334/cstp.166



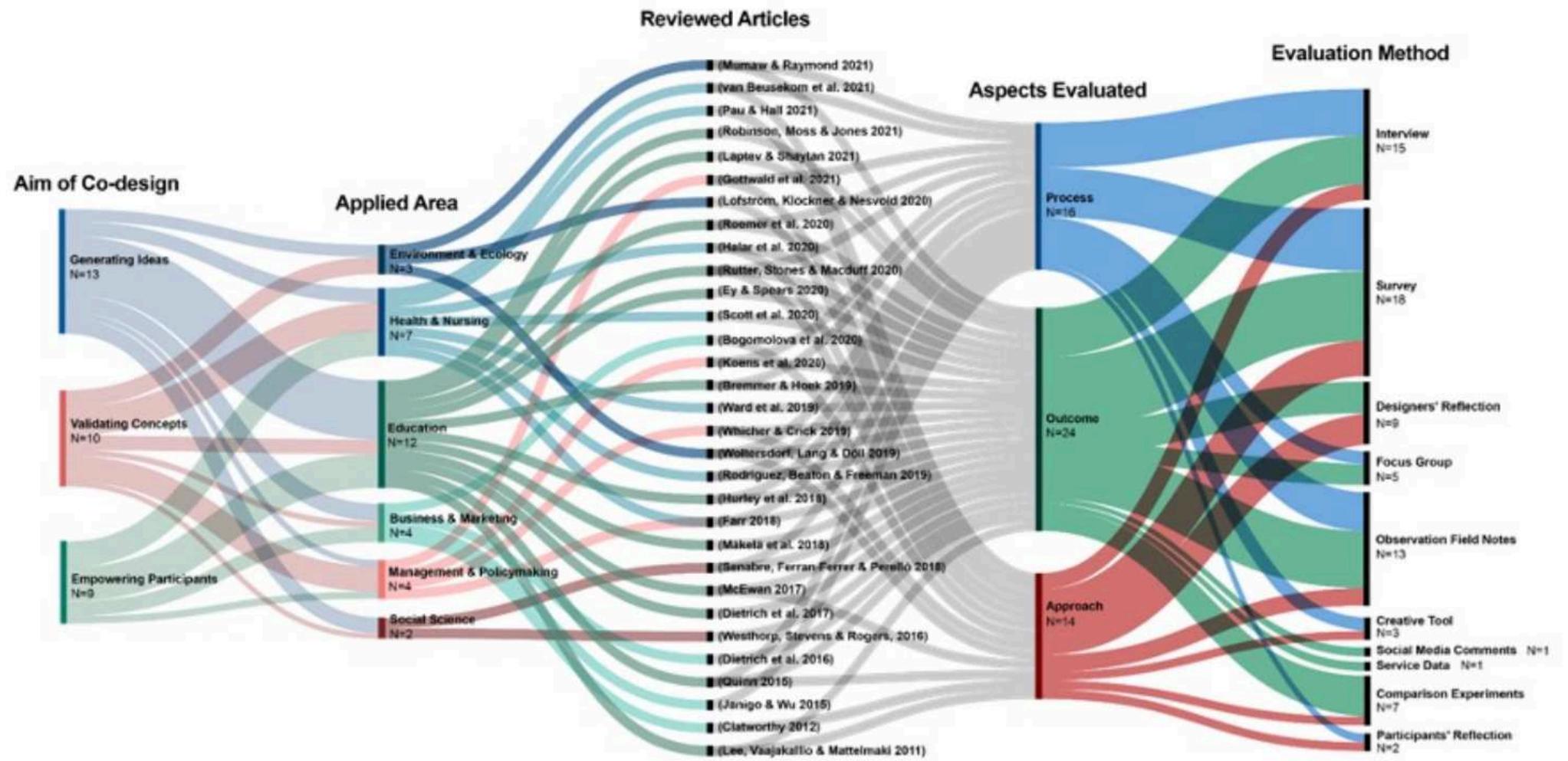


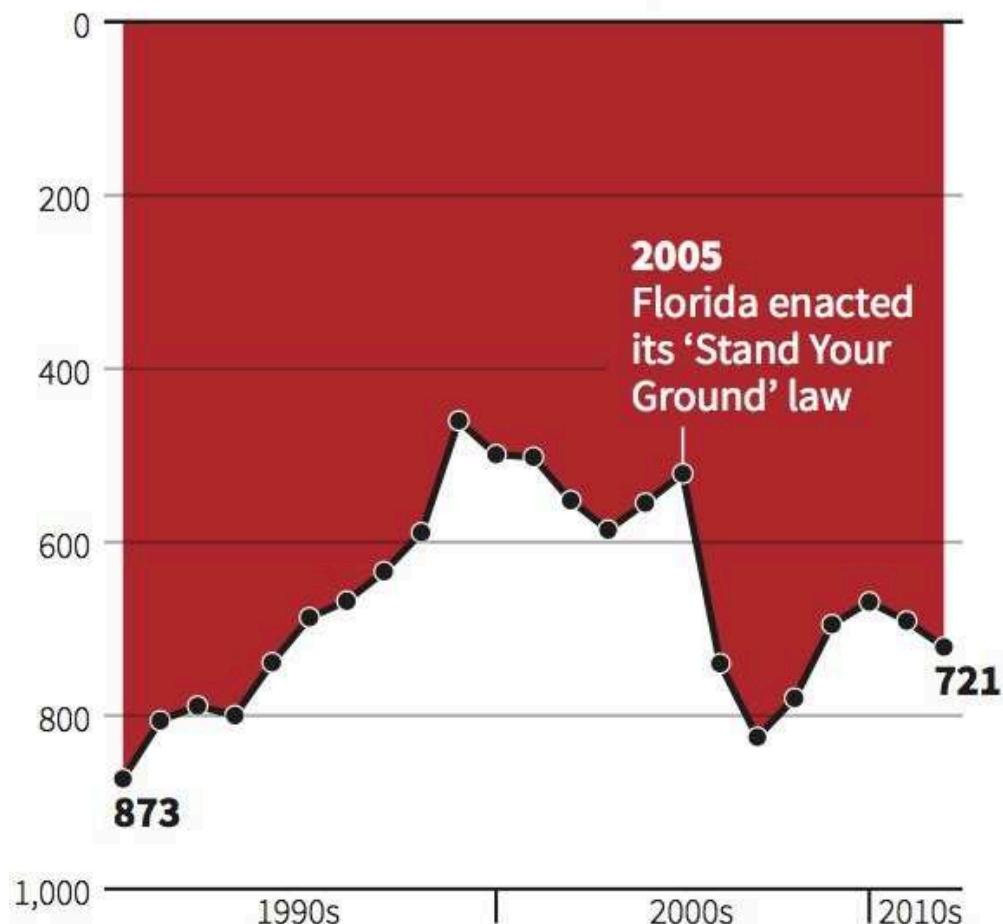
Figure 3. Data visualization of reviewed articles.

Wang et al. (2022) in Lockton et al. (eds.) doi: [10.21606/drs.2022.774](https://doi.org/10.21606/drs.2022.774)



Gun deaths in Florida

Number of murders committed using firearms



Source: Florida Department of Law Enforcement

C. Chan 16/02/2014

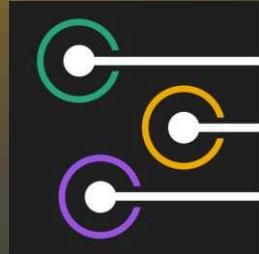
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Dankeschön!



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