

Datenvisualisierung in der Wissenschaft

Zweckmäßigkeit der Darstellung (Teil 2)

Dr. Cédric Scherer

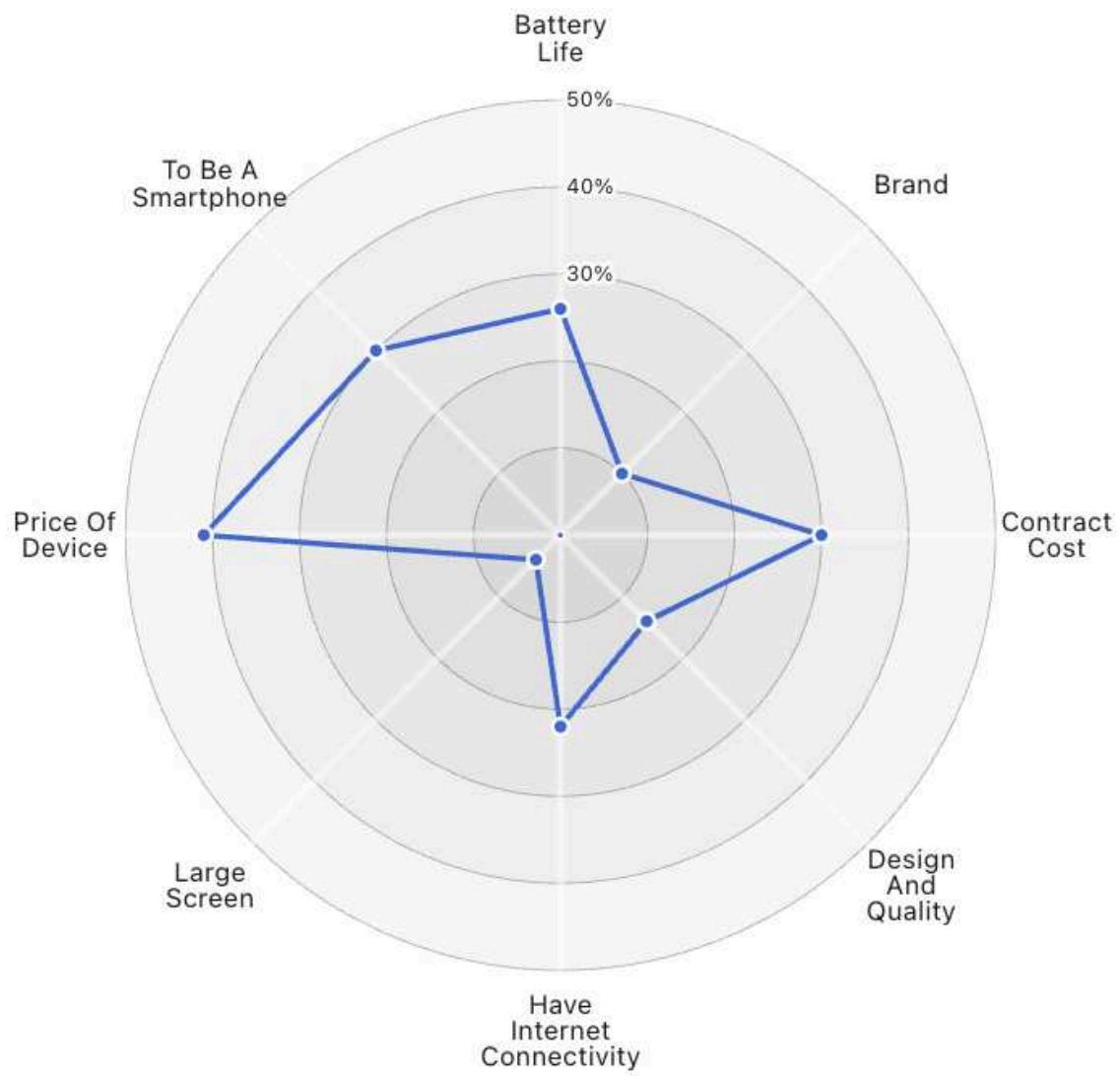
RPTU Nachwuchsring
3., 10. und 17. Juli 2025



ziel

Zweckmäßigkeit der Darstellung

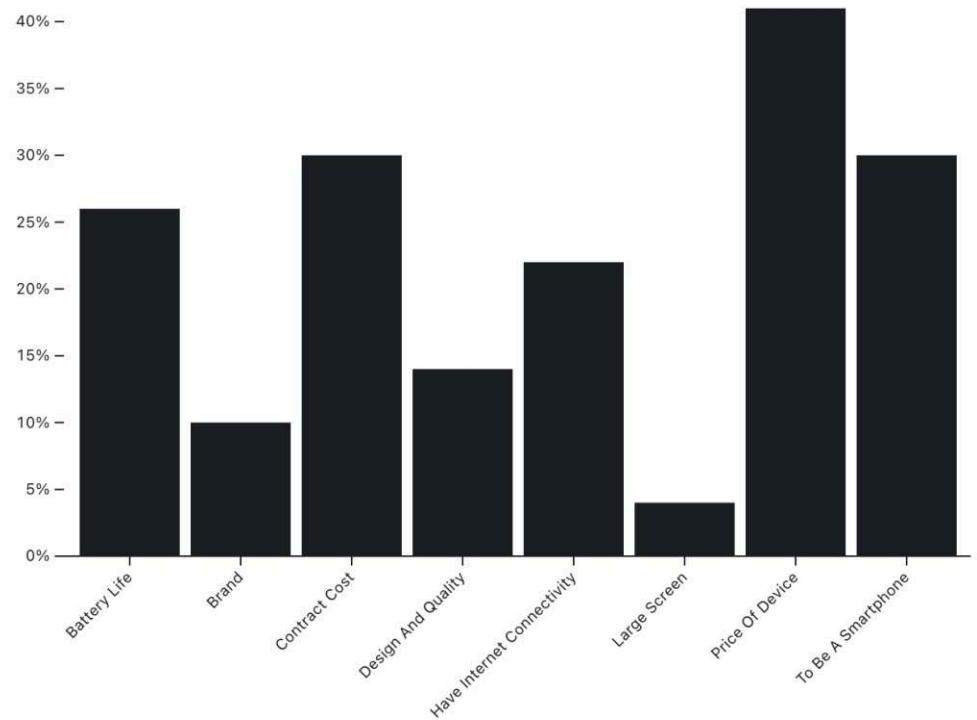
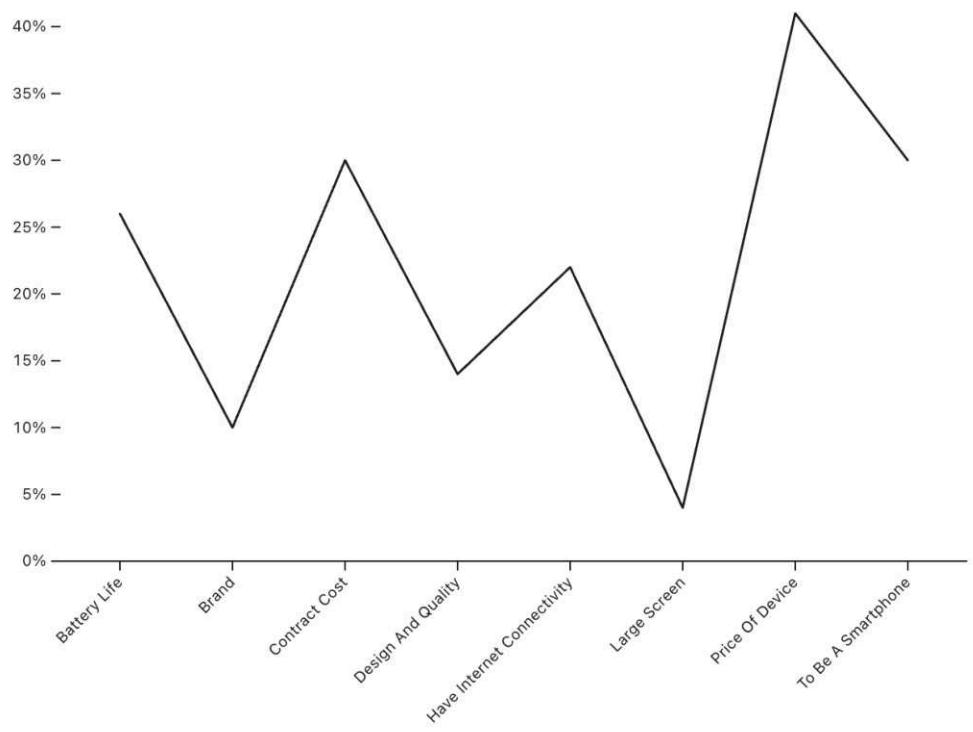




Quelle: [Observable Blog](#)

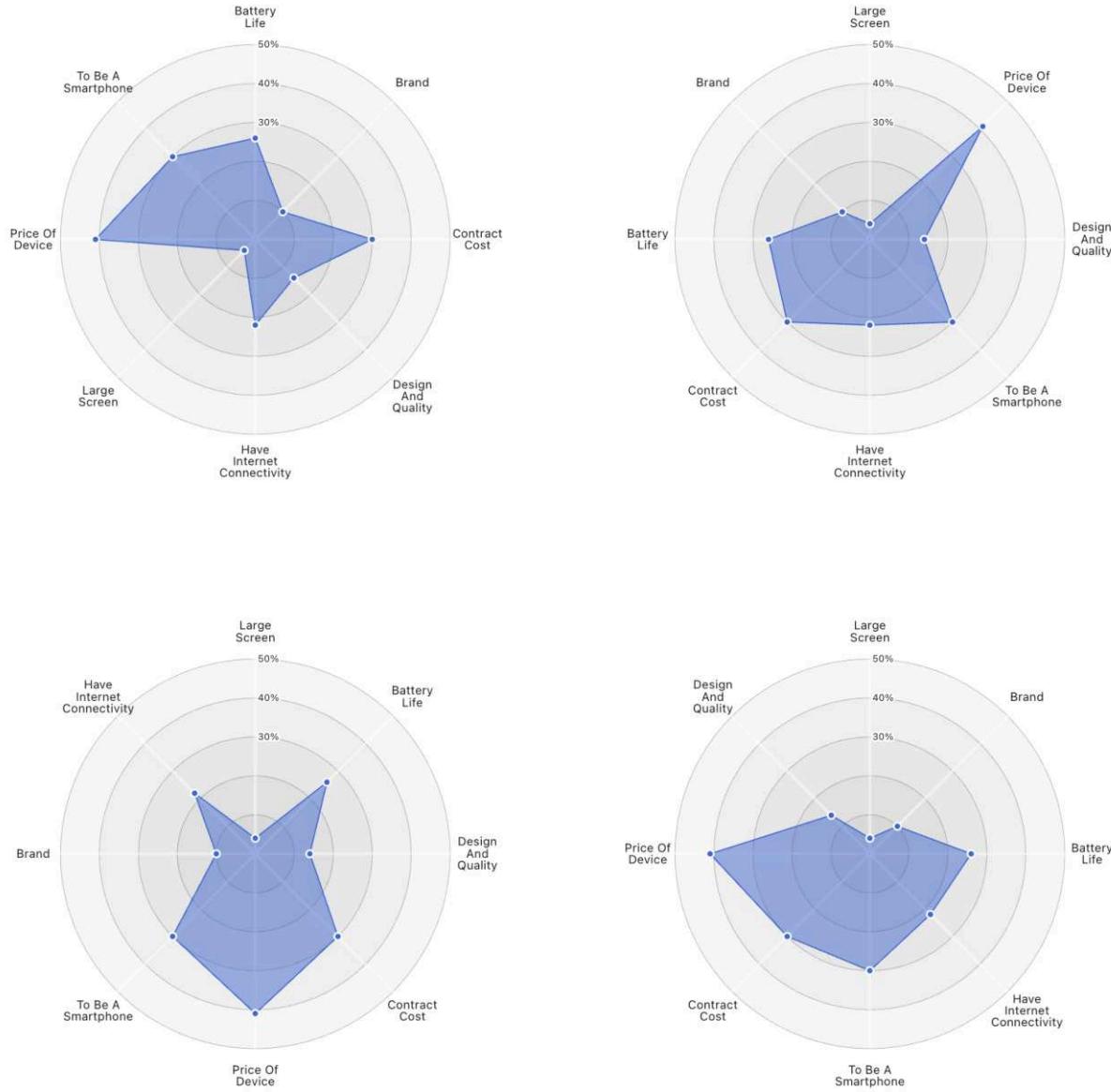
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Quelle: [Observable Blog](#)

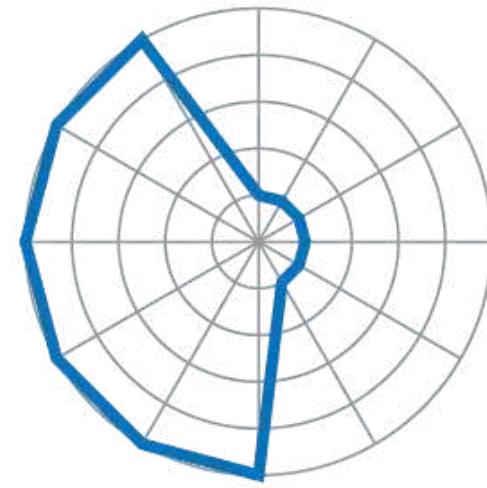
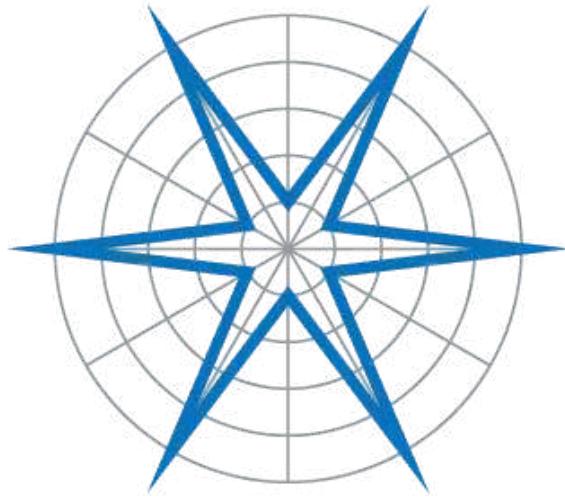




Quelle: [Observable Blog](#)

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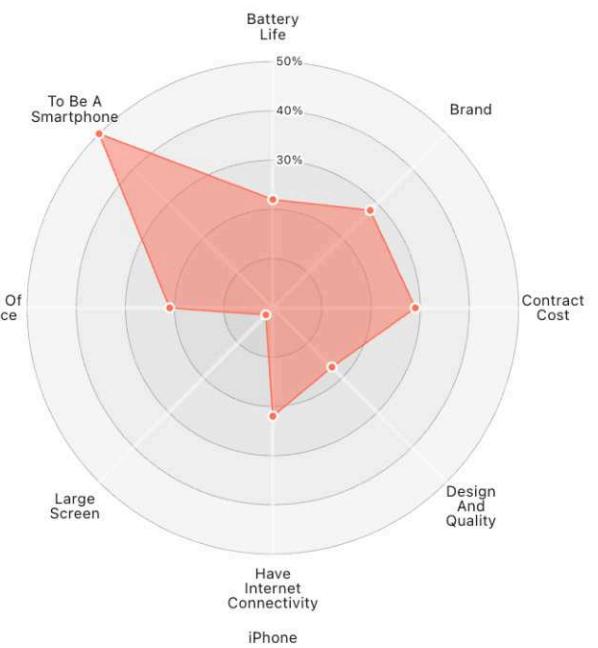
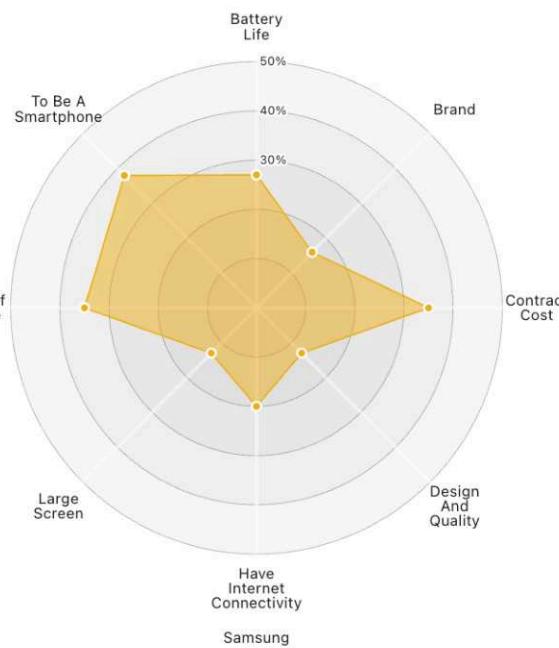




Quelle: [Jasper McChesney](#)

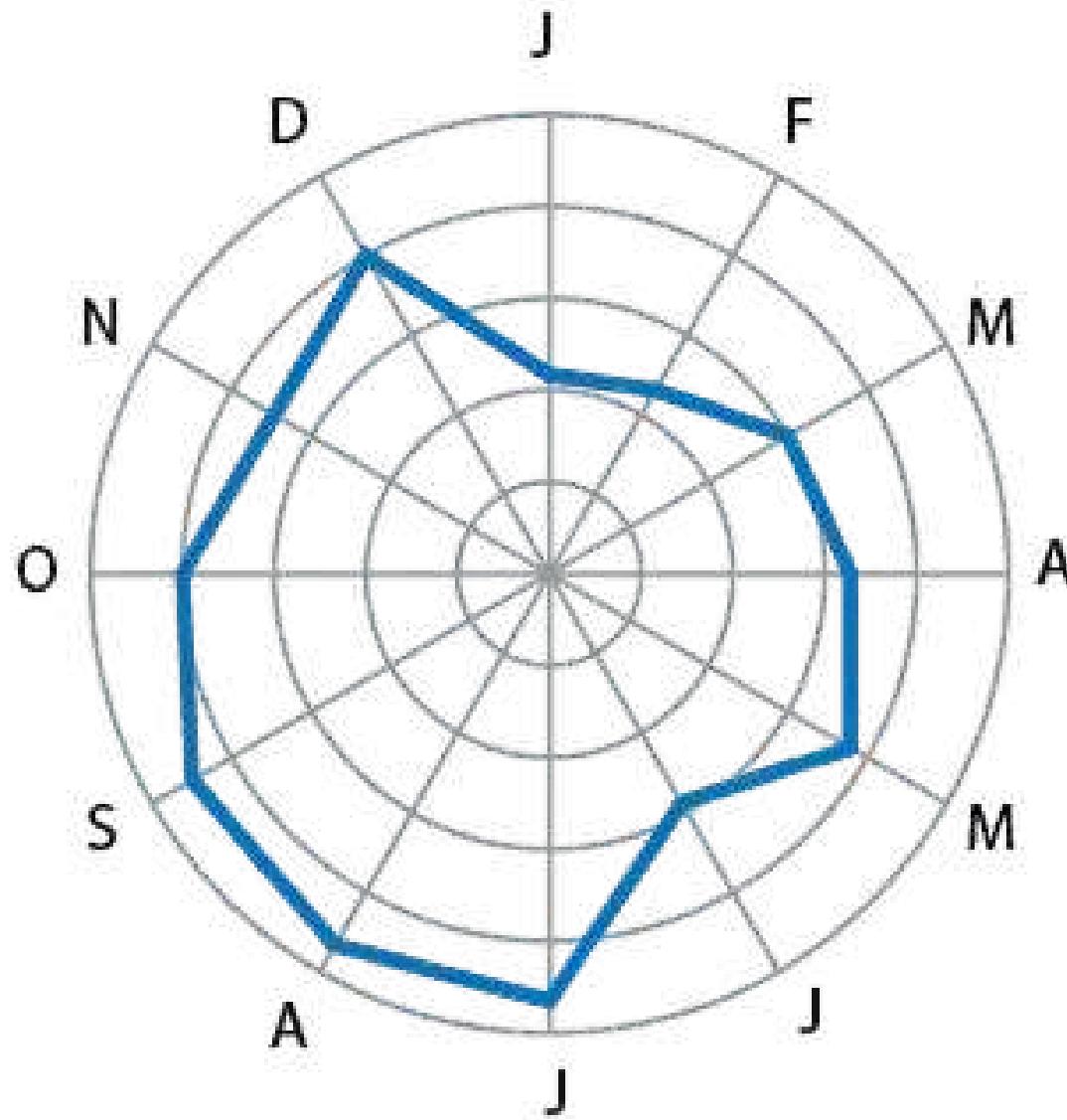


Nokia Samsung iPhone



Quelle: [Observable Blog](#)





Quelle: [Jasper McChesney](#)

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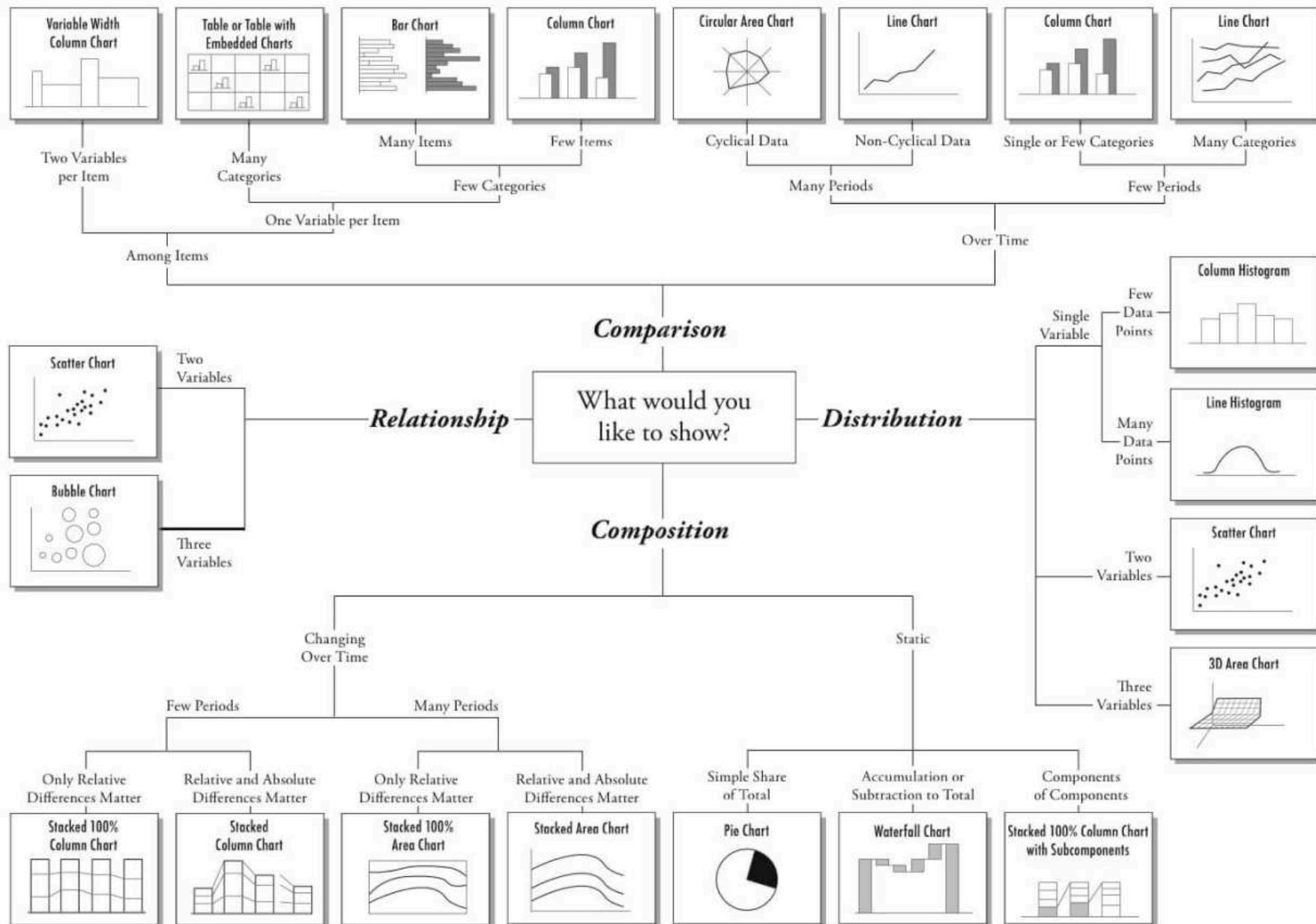


Diagrammwahl



Chart Suggestions—A Thought-Starter

www.ExtremePresentation.com
© 2009 A. Abela — a.abela@gmail.com





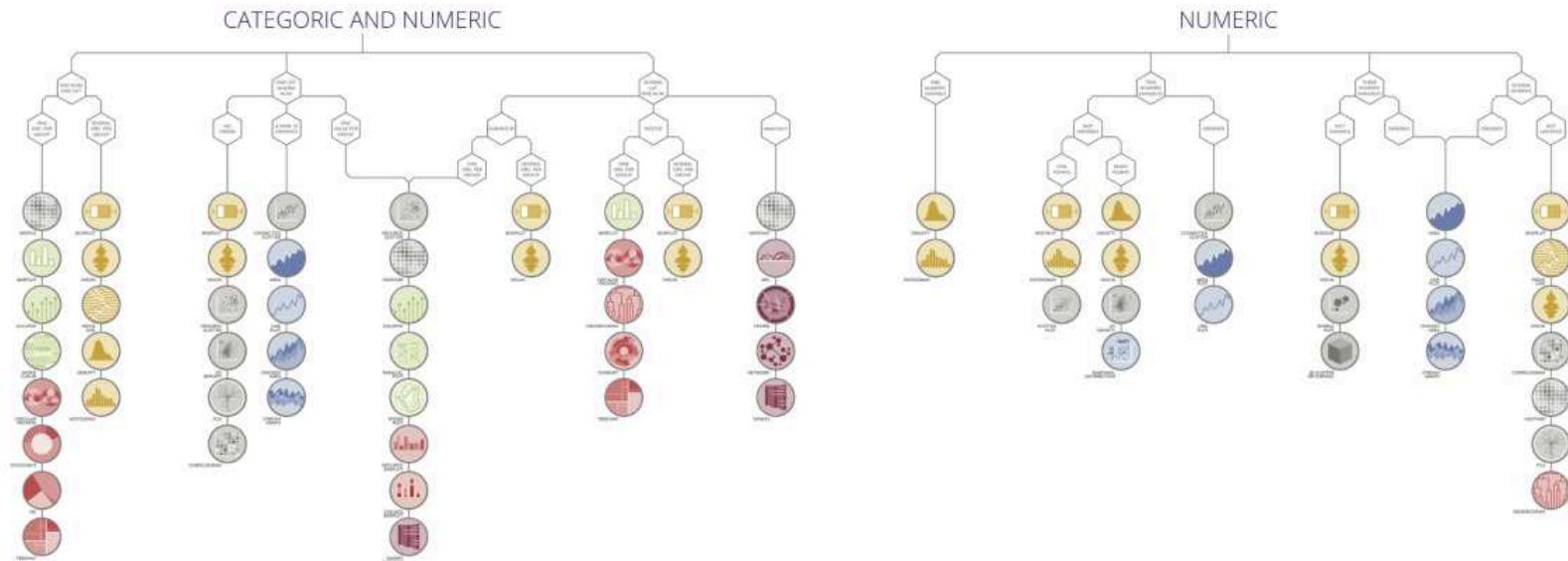
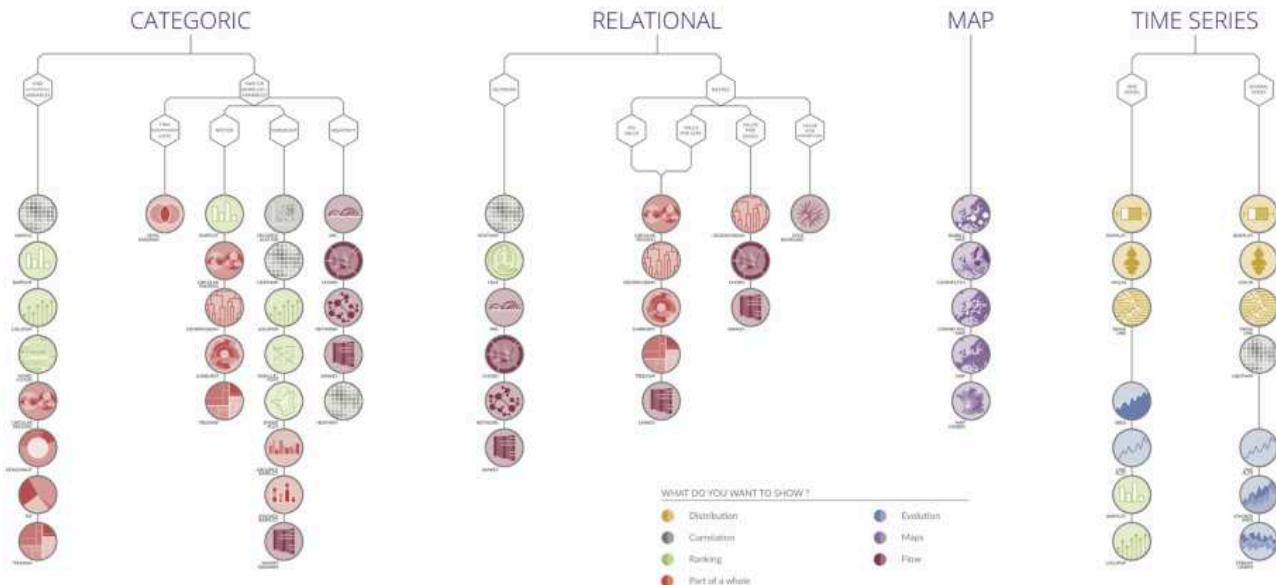
from Data to Viz

'From Data to Viz' is a classification of chart types based on input data format. It will help you find the perfect chart in three simple steps.

- ① Identify what type of data you have.
- ② Go to the corresponding decision tree and follow it down to a set of possible charts.
- ③ Choose the chart from the set that will suit your data and your needs best.

DataViz is a work in progress and this project does not claim to be exhaustive. However it should provide you with a good starting point. For an interactive version and much more, visit:

data-to-viz.com



Quelle: [From Data to Viz](http://data-to-viz.com)

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The screenshot shows a web page for 'BOXPLOT'. At the top is a yellow circular icon containing a boxplot. Below it is the title 'BOXPLOT' in green. A subtitle reads 'Summarize the distribution of numeric variables'. There are three main sections: 'About' (describing what a boxplot is), 'Common Mistakes' (with a bulleted list of three items), and 'Code' (links to R graph gallery, Python gallery, D3.js gallery, and Flourish). Below these are 'Read More' and 'See the dedicated page' links. At the bottom, there are six small circular icons representing other visualization types: Venn diagram, Doughnut, Pie chart, Dendrogram, Circular packing, and Sunburst.

POSSIBILITIES

presented in this website.

Part of a whole Evolution Map Flow

Boxplot Ridgeline Scatter

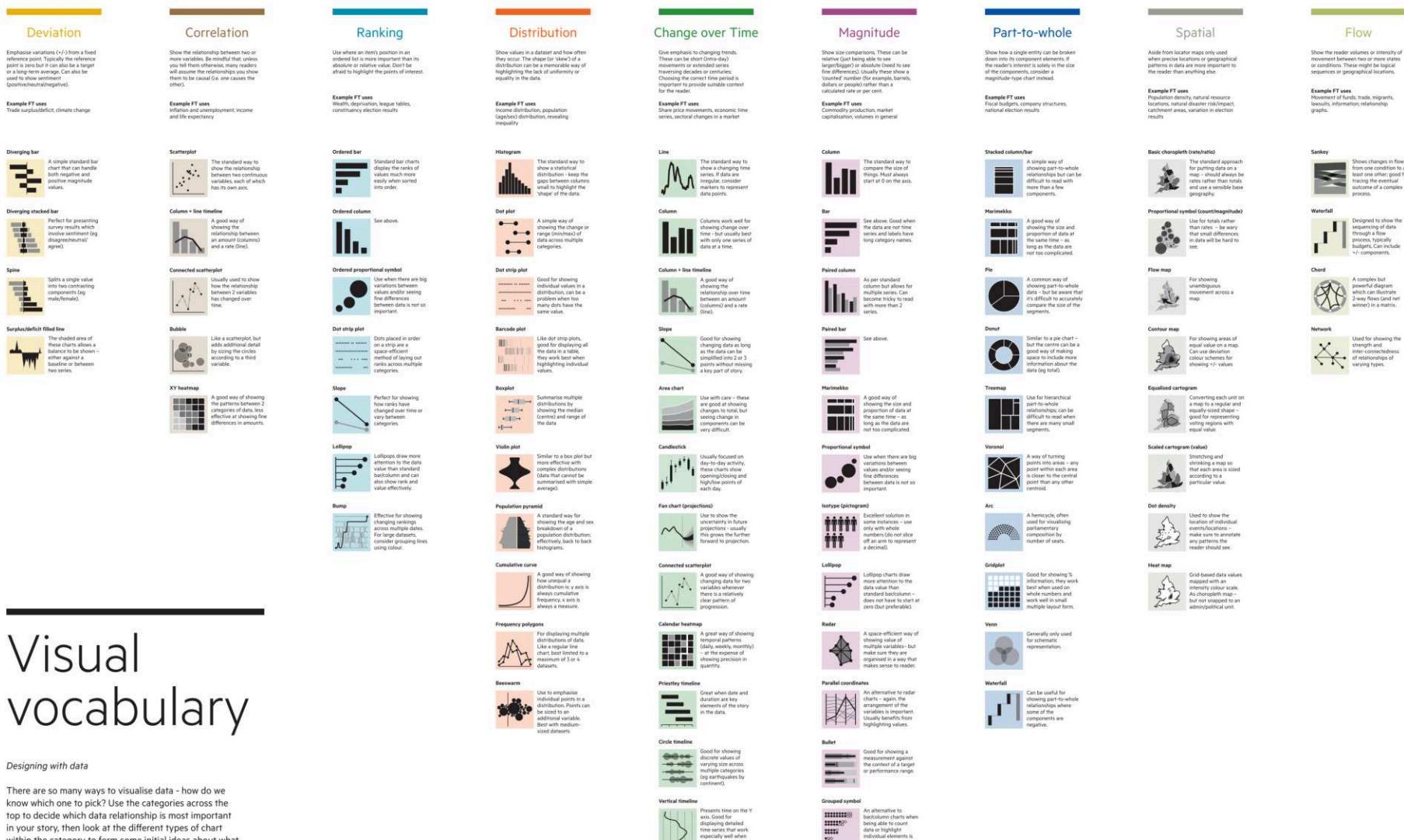
Connected scatter Density 2d Barplot

Lollipop Circular Barplot Treemap

Dendrogram Circular packing Sunburst

Quelle: [From Data to Viz](#)





Visual vocabulary

Designing with data

There are so many ways to visualise data - how do we know which one to pick? Use the categories across the top to decide which data relationship is most important in your story, then look at the different types of chart within the category to form some initial ideas about what might work best. This list is not meant to be exhaustive, nor a wizard, but is a useful starting point for making informative and meaningful data visualisations.

FT graphic: Alan Smith; Chris Curnutt; Ian Bent; Liz Farmer; Graham Parish; Billy Etheridge; Shannen; Paul McCallum; Martin Edie
Inspired by the Graphic Continuum by Jon Schwabish and Steven Wolfson



"FT Visual Vocabulary" by Alan Smith et al. ([Posters](#))

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THE GRAPHIC CONTINUUM

The Graphic Continuum shows several ways that data can be illustrated individually or combined to show relationships. Use of various shapes, chart types, and colors can help identify patterns, tell stories, and reveal relationships between different sets and types of data. Bar charts, or histograms, for example, can illustrate a distribution of data over time, but they also can show categorical or geographic differences. Scatterplots can illustrate data from a single instance or for a period, but they also can be used to identify a distribution around a mean.

This set of charts does not constitute an exhaustive list, nor do the connections represent every possible pathway for linking data and ideas; instead, the Graphic Continuum identifies some presentation methods, and it illustrates some of the connections that can bind different representations together. The six groups do not define all possibilities. Many other useful, overlapping data types and visualization techniques are possible.

This chart can guide graphic choices, but your imagination can lead the way to other effective ways to present data.

COMPARING CATEGORIES

Compare values across categories



DISTRIBUTION

Graphical representations of the distribution of data



A Histogram provides a fast way to see the distribution of data.

A Box & Whisker summarizes a box plot by showing the median and quartiles along with the highest and lowest data points.

A Volvo illustrates a distribution of data with points plotted against a normal distribution curve.

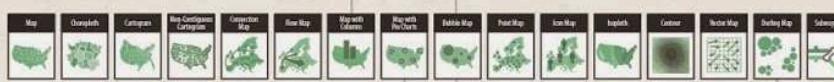
A Stock tracks changes over time.

A Confidence Interval summarizes a box plot by showing the median and quartiles along with the highest and lowest data points.

A Fan illustrates a distribution of data with points plotted against a normal distribution curve.

GEOSPATIAL

Relate data to its geography



A Map with Colors relates data to its geography by showing the same variable across the entire map.

A Choropleth relates data to its geography by shading regions according to their values.

A Cartogram relates data to its geography by distorting the shape of the map to emphasize the variable.

A Connection Map relates data to its geography by showing the connections between locations.

A Flow Map relates data to its geography by showing the flow between locations.

A Map with Per-Chart relates data to its geography by showing the same variable across the entire map.

PART-TO-WHOLE

Visualizations that relate the part of a variable to its total



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A Map with Per-Chart relates data to its geography by showing the same variable across the entire map.

RELATIONSHIP

Illustrates correlations or relationships between variables



© Jonathan Schwabish & Sverino Ribecca

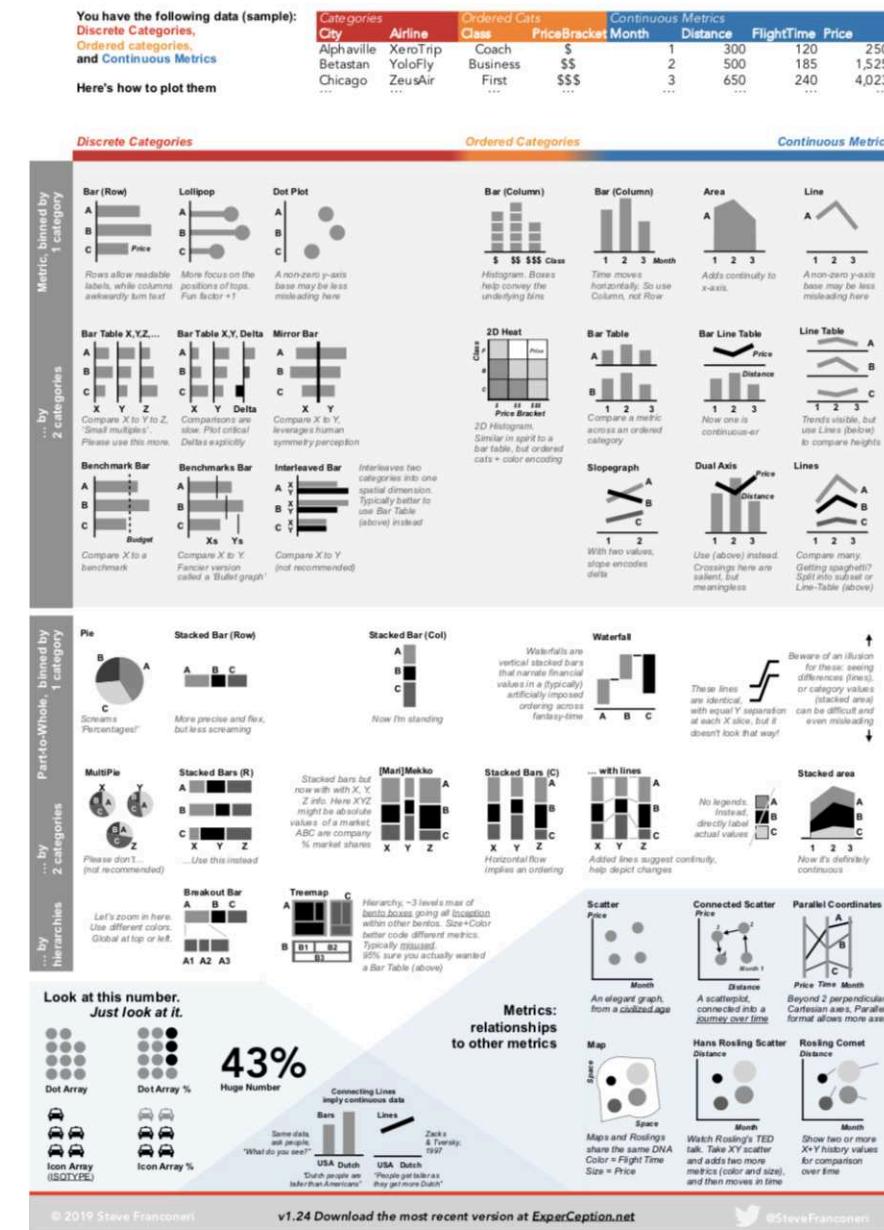
https://schwabish.org/_vizi.html

"The Graphic Continuum" by Jon Schwabish & Sverino Ribecca

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Which Visualization? A Quick Reference



"Which Visualization? A Quick Reference" by Steven Franconeri

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1 dataset 100 visualizations

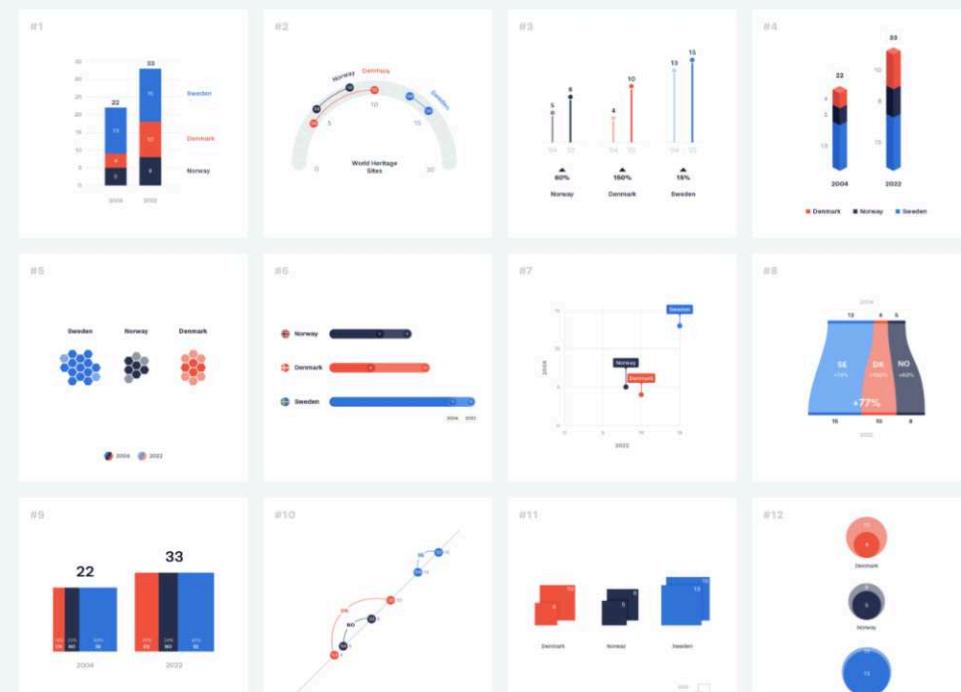
Can we come up with 100 visualizations from one simple dataset?

As an information design agency working with data visualization every day, we challenged ourselves to accomplish this using insightful and visually appealing visualizations.

We wanted to show the diversity and complexity of data visualization and how we can tell different stories using limited visual properties and assets.

Number of World Heritage Sites			
	Norway	Denmark	Sweden
2004	5	4	13
2022	8	10	15

[Learn more](#)



DataVizProject "1 Dataset 100 Visualizations"

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Choosing a chart type to show the breakdown of a total

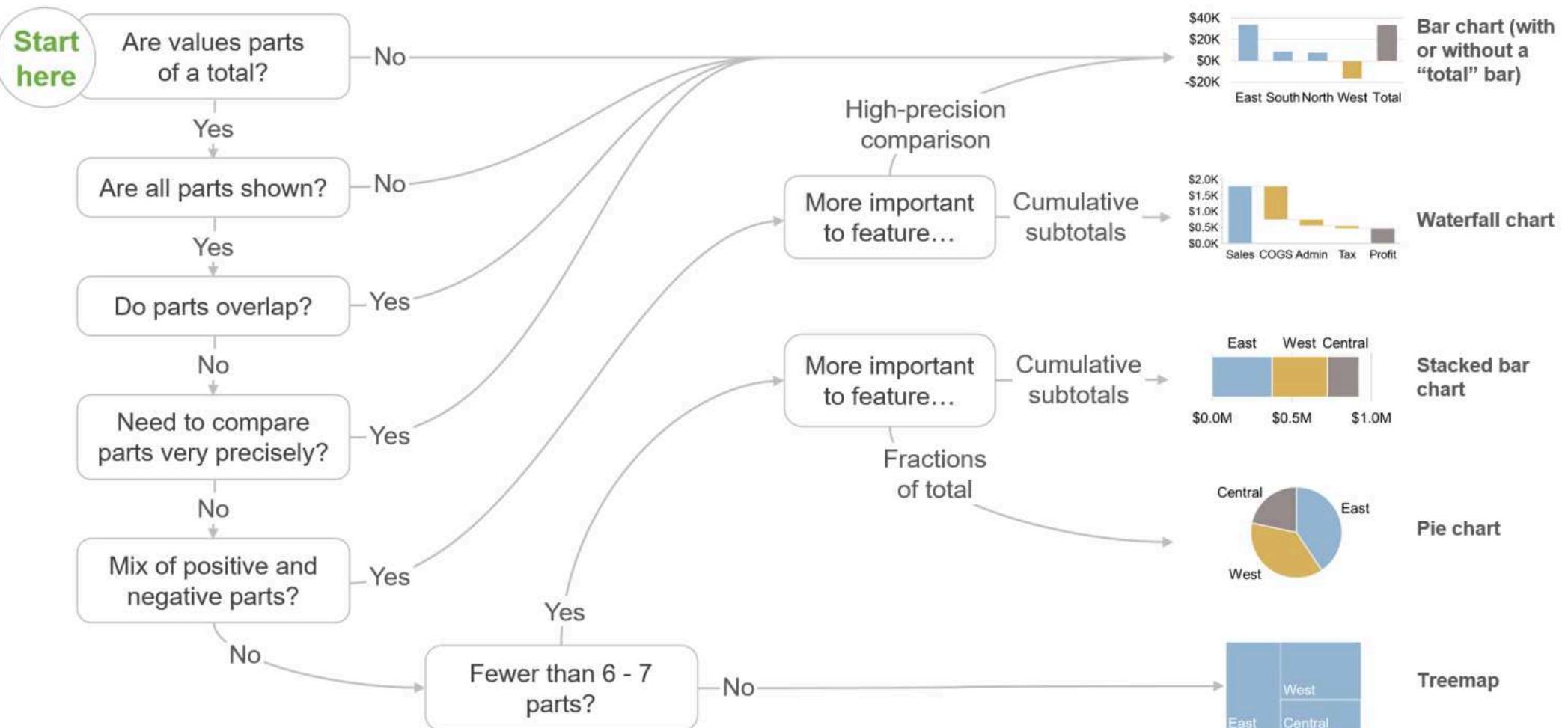


Chart Choice Decision Trees by Nick Desbarats



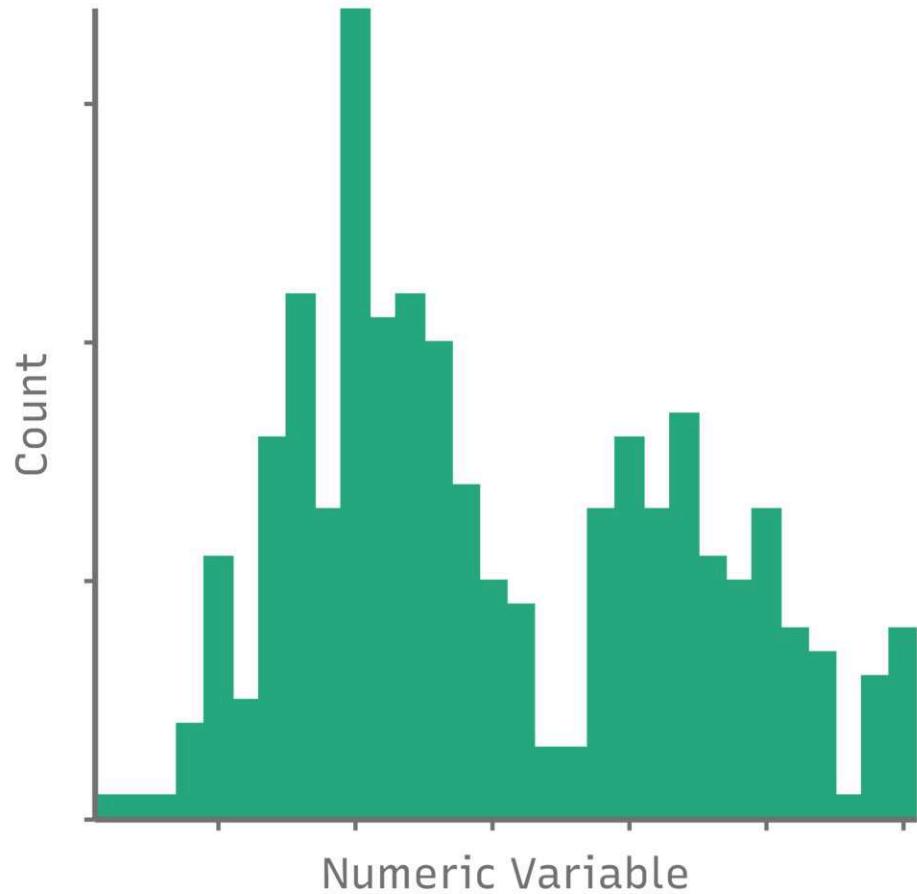
Diagrammtypen



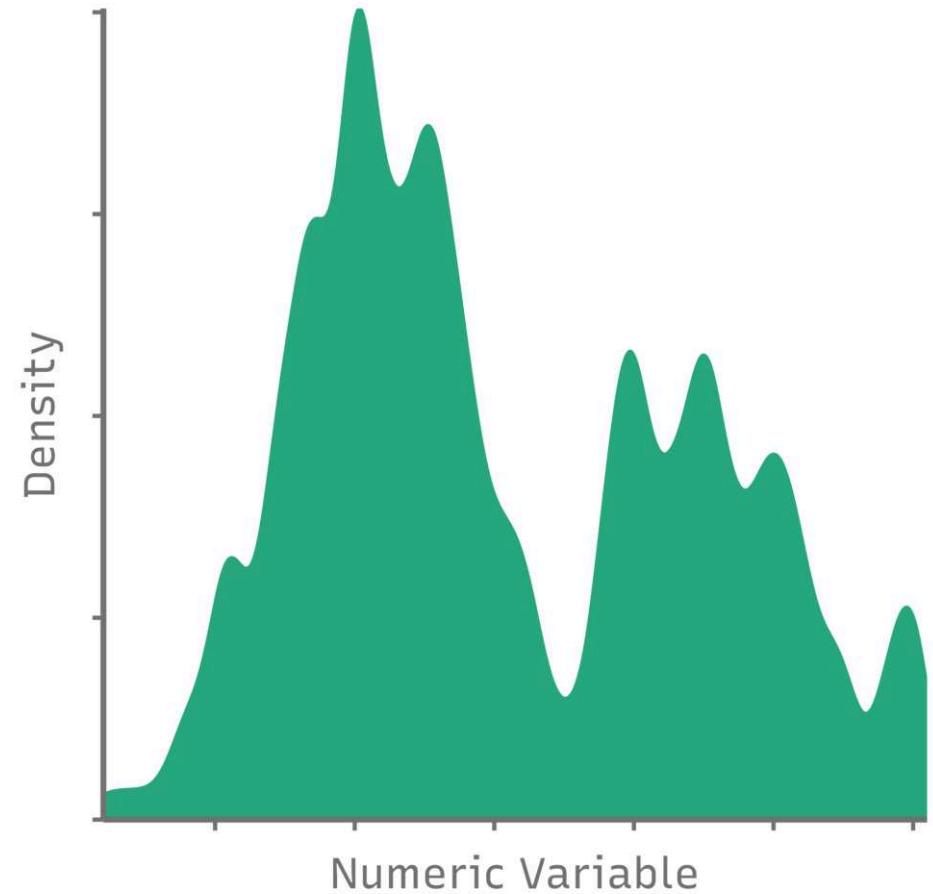
Verteilungen zeigen



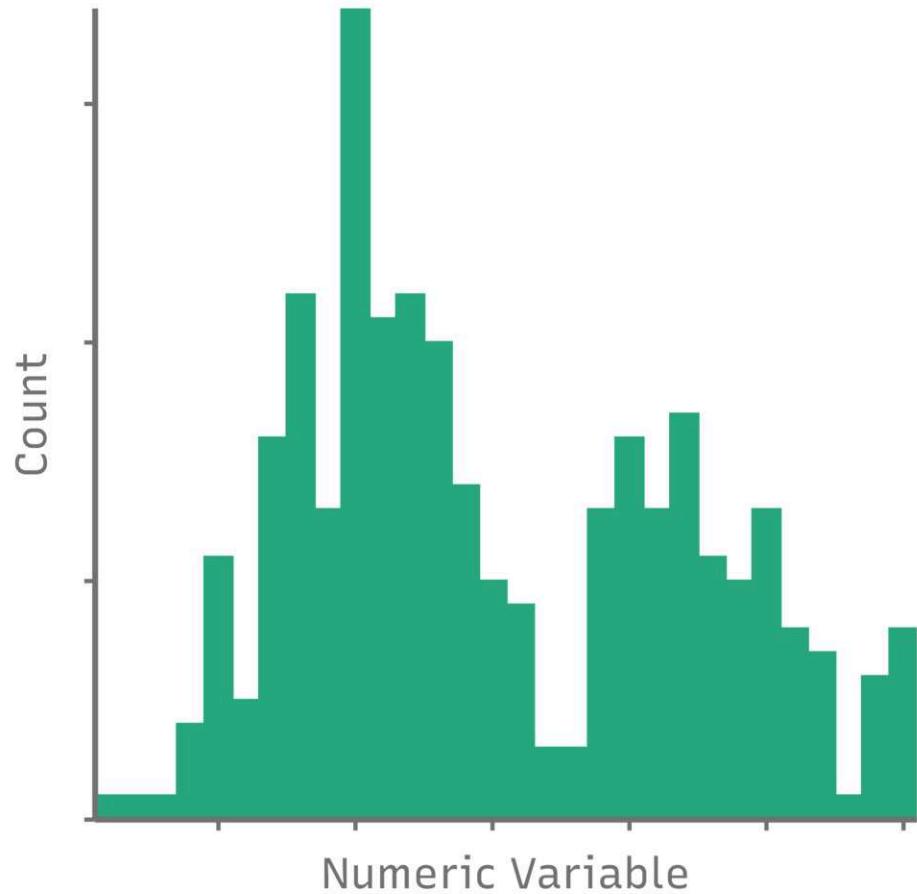
Histogram



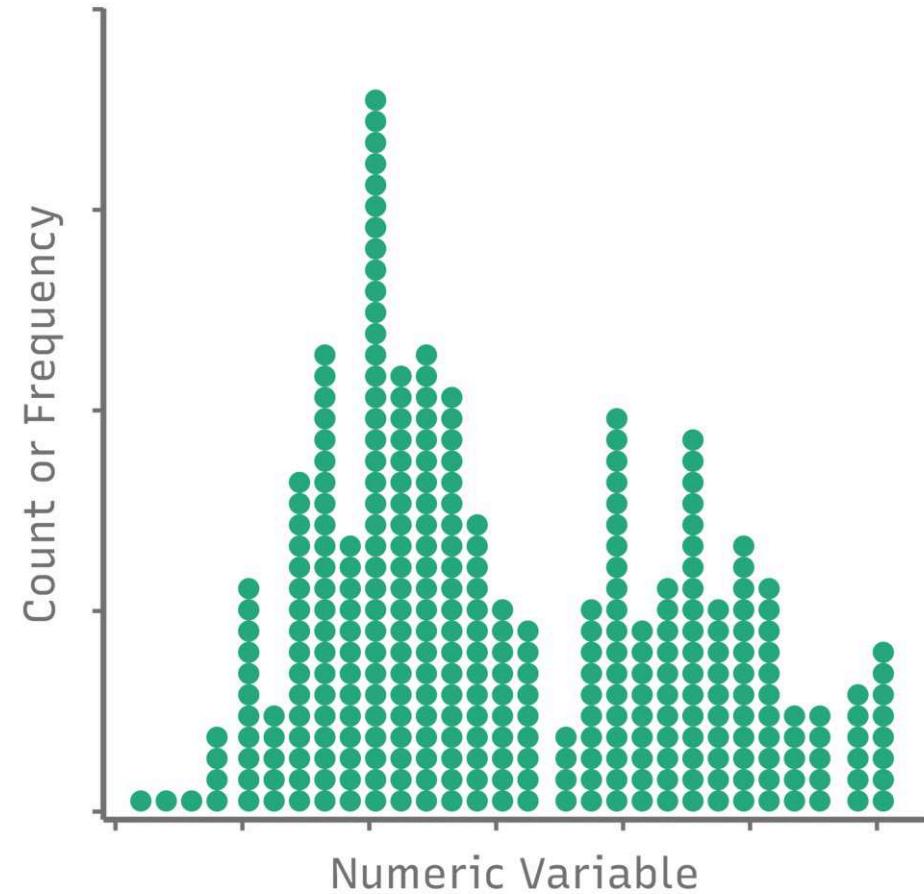
Density Plot



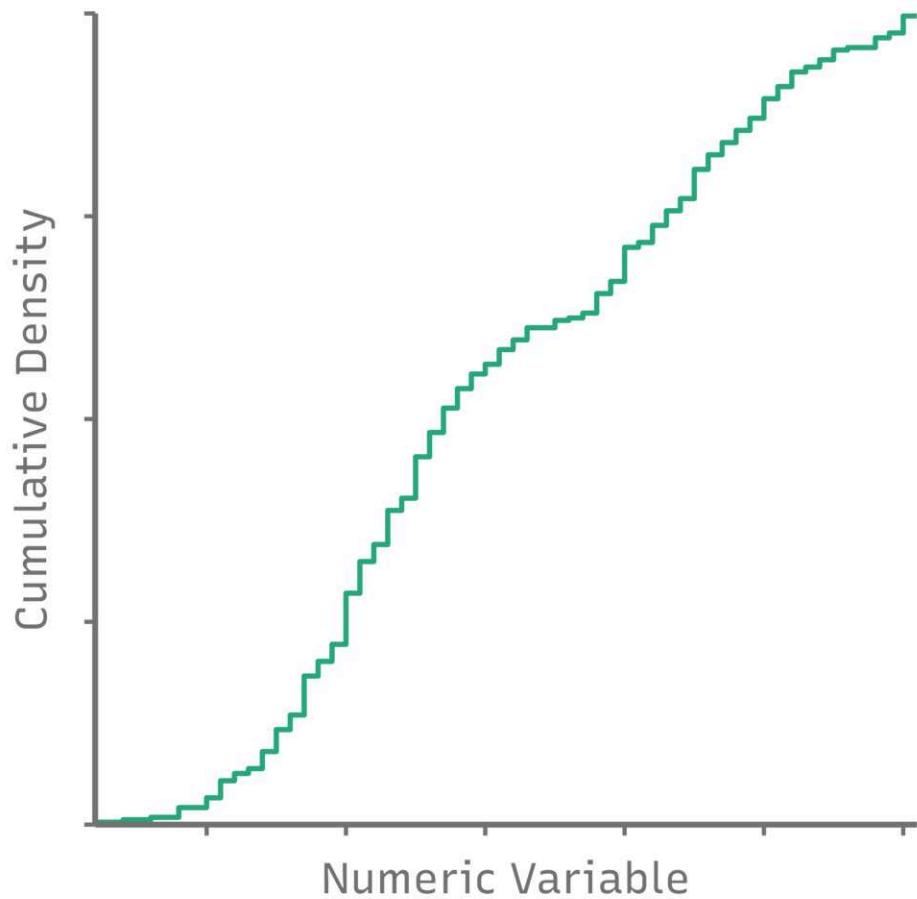
Histogram



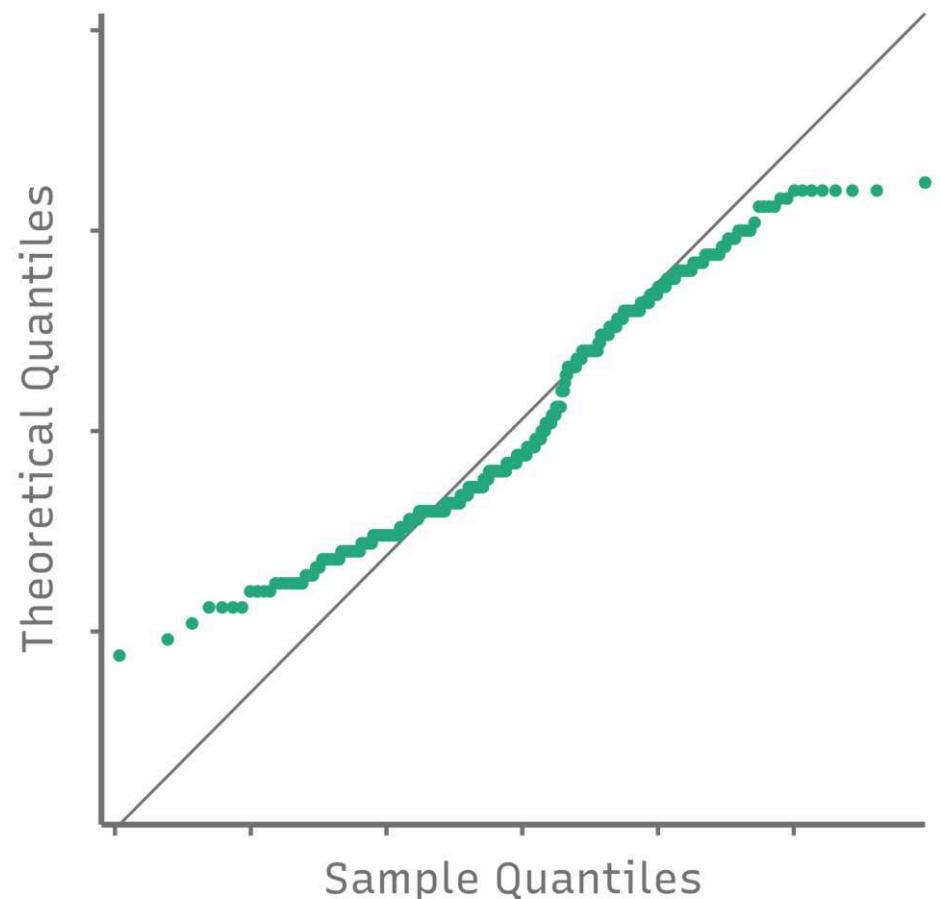
Stacked Dot Plot



Cumulative Density Plot (ECDF)



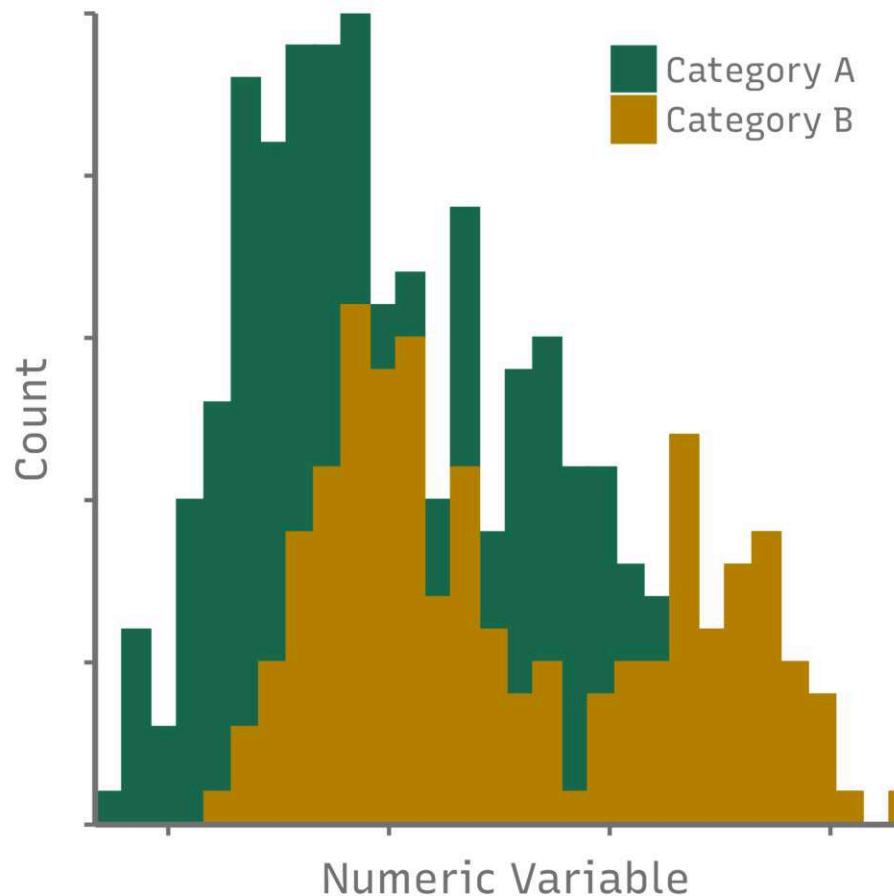
Quantile-Quantile Plot (QQ)



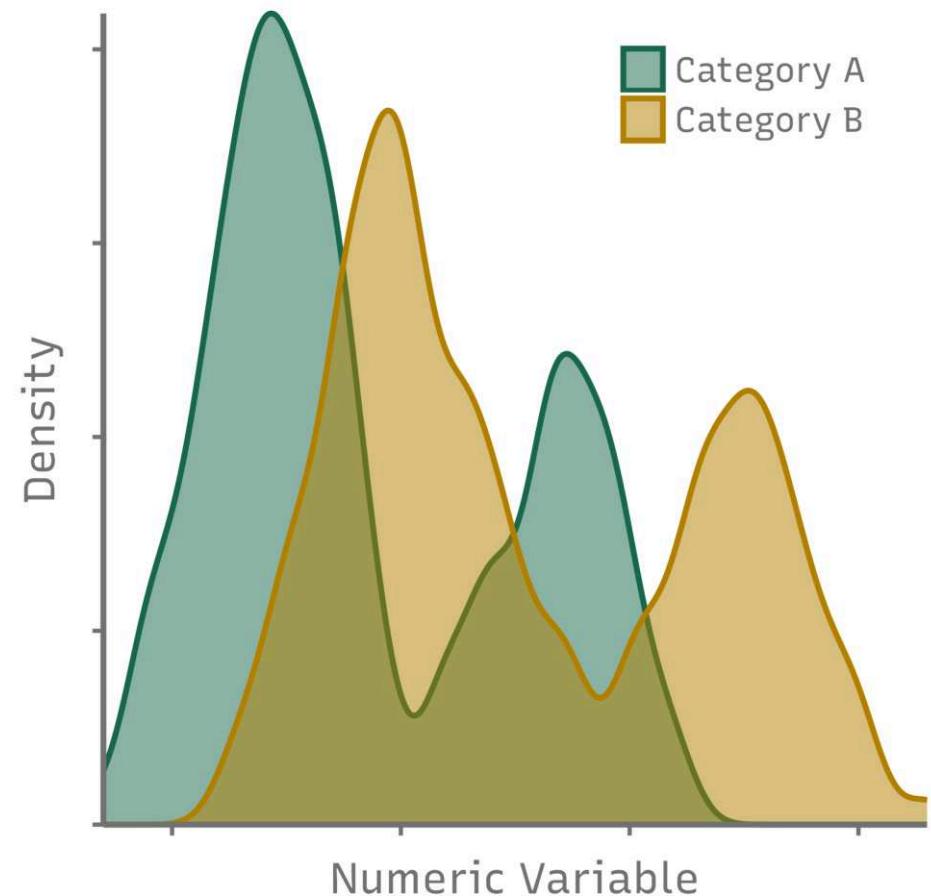
Verteilungen vergleichen



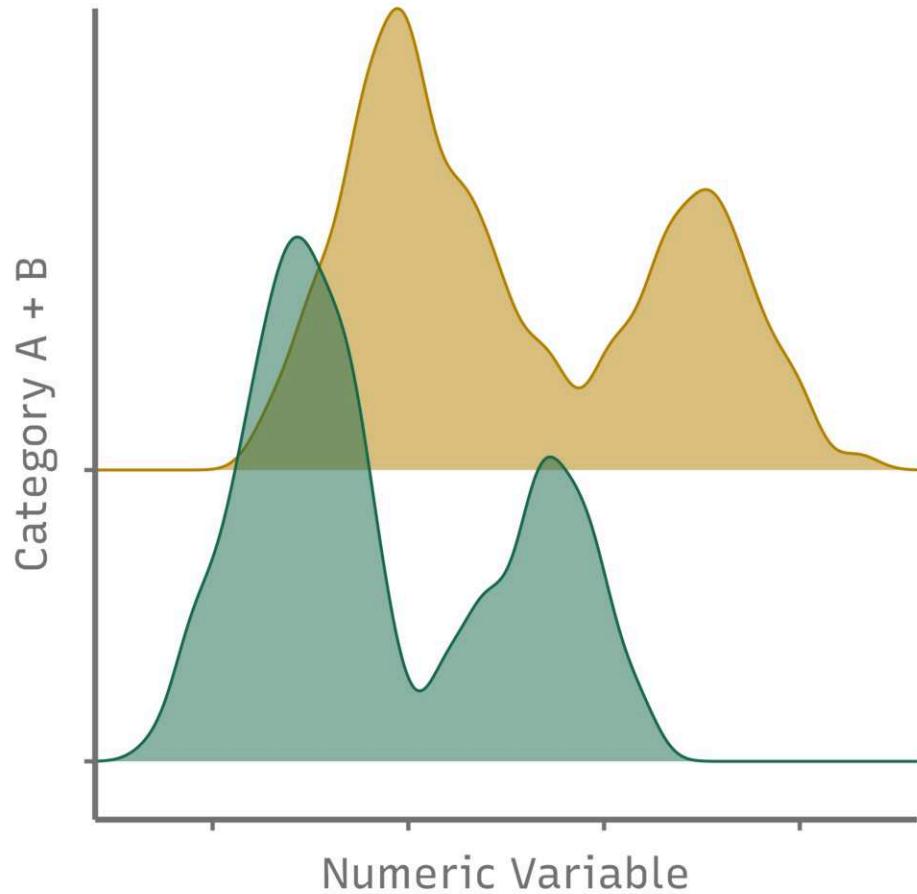
Histogram (stacked)



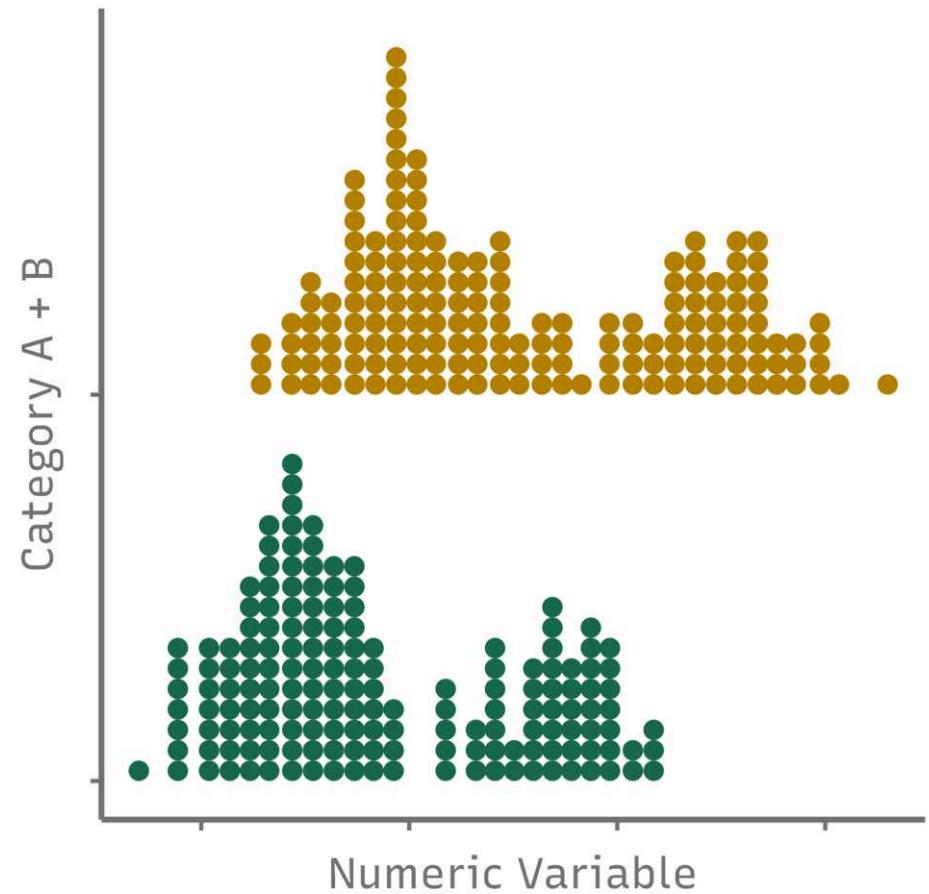
Density Plot (overlapping)



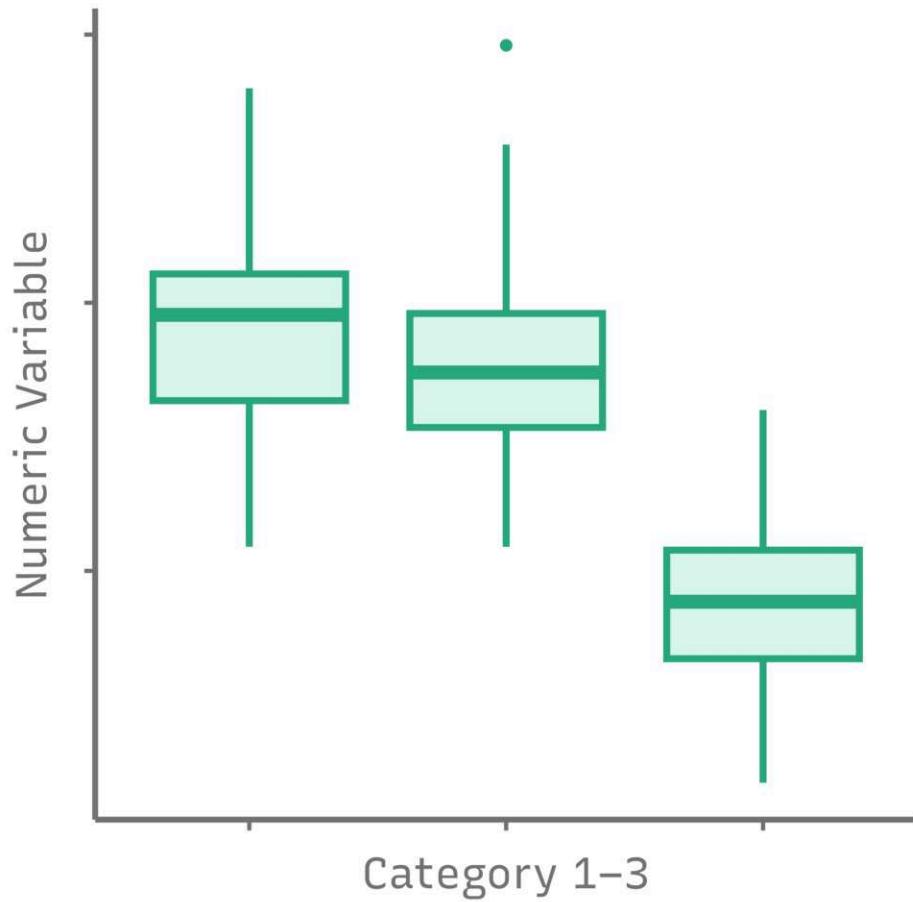
Ridgeline Plot



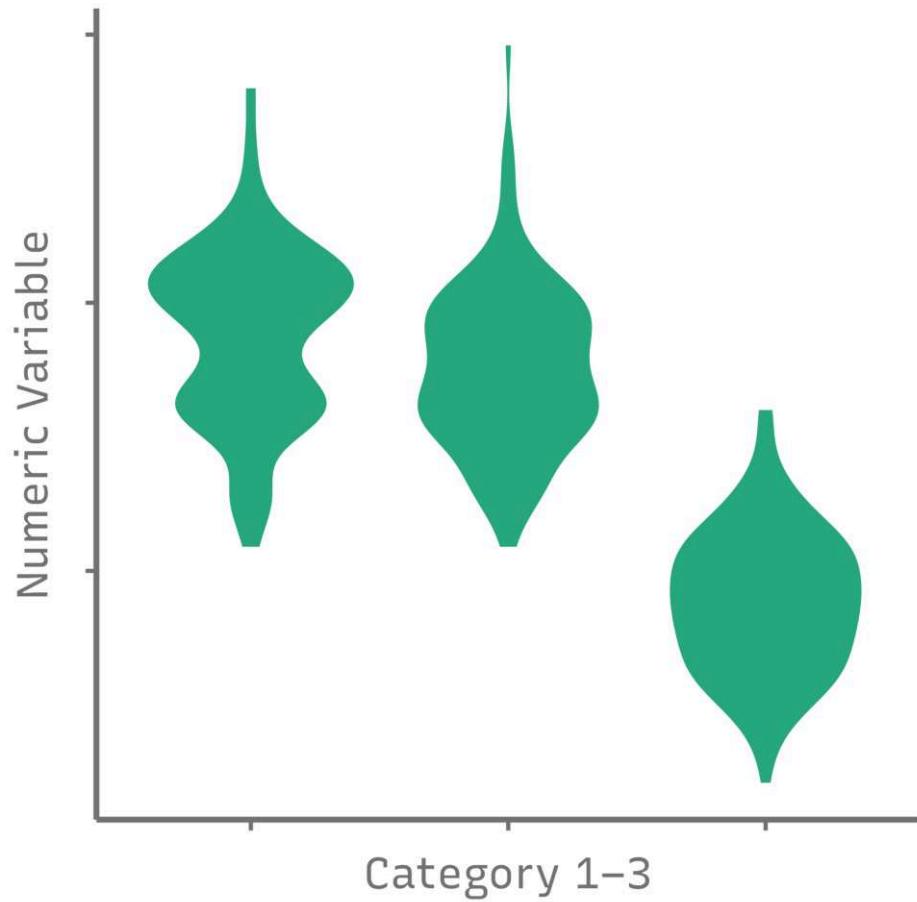
Stacked Dot Plot



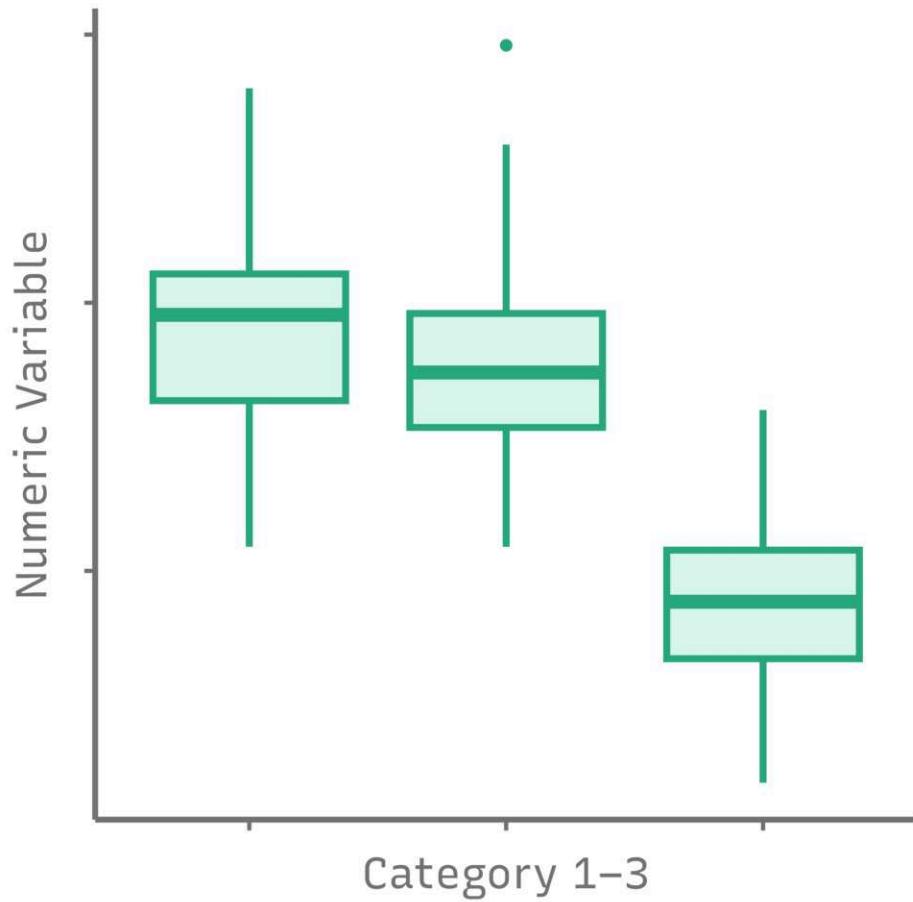
Box-Whisker Plot



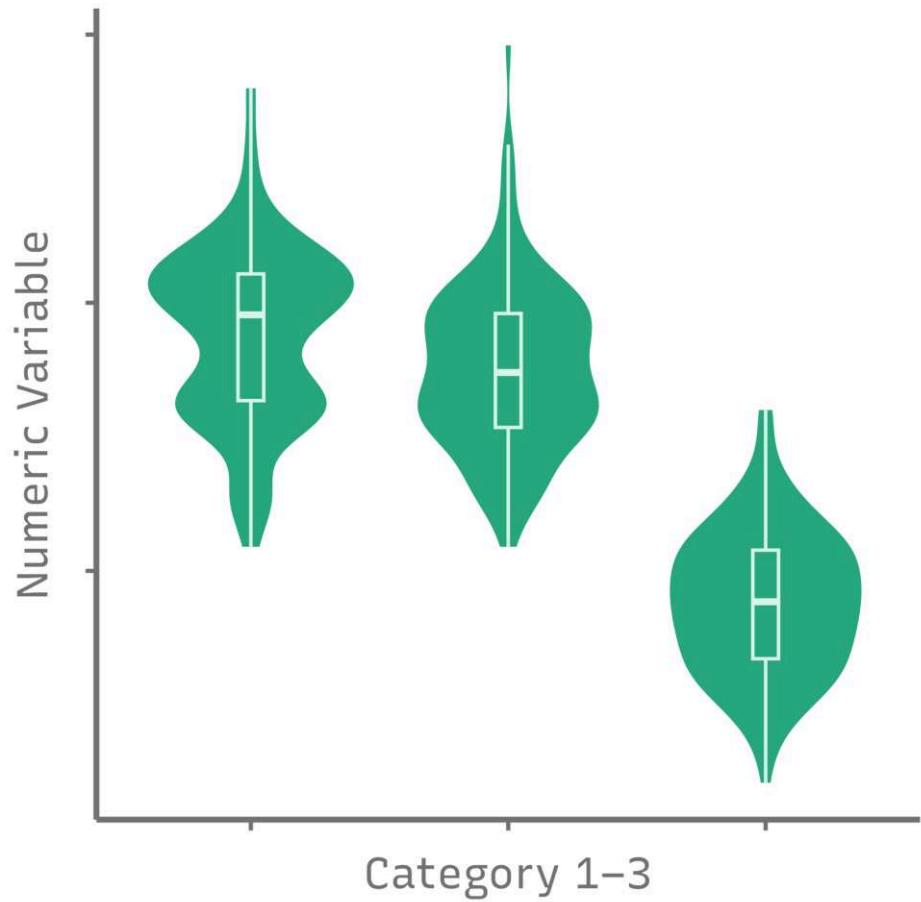
Violin Plot

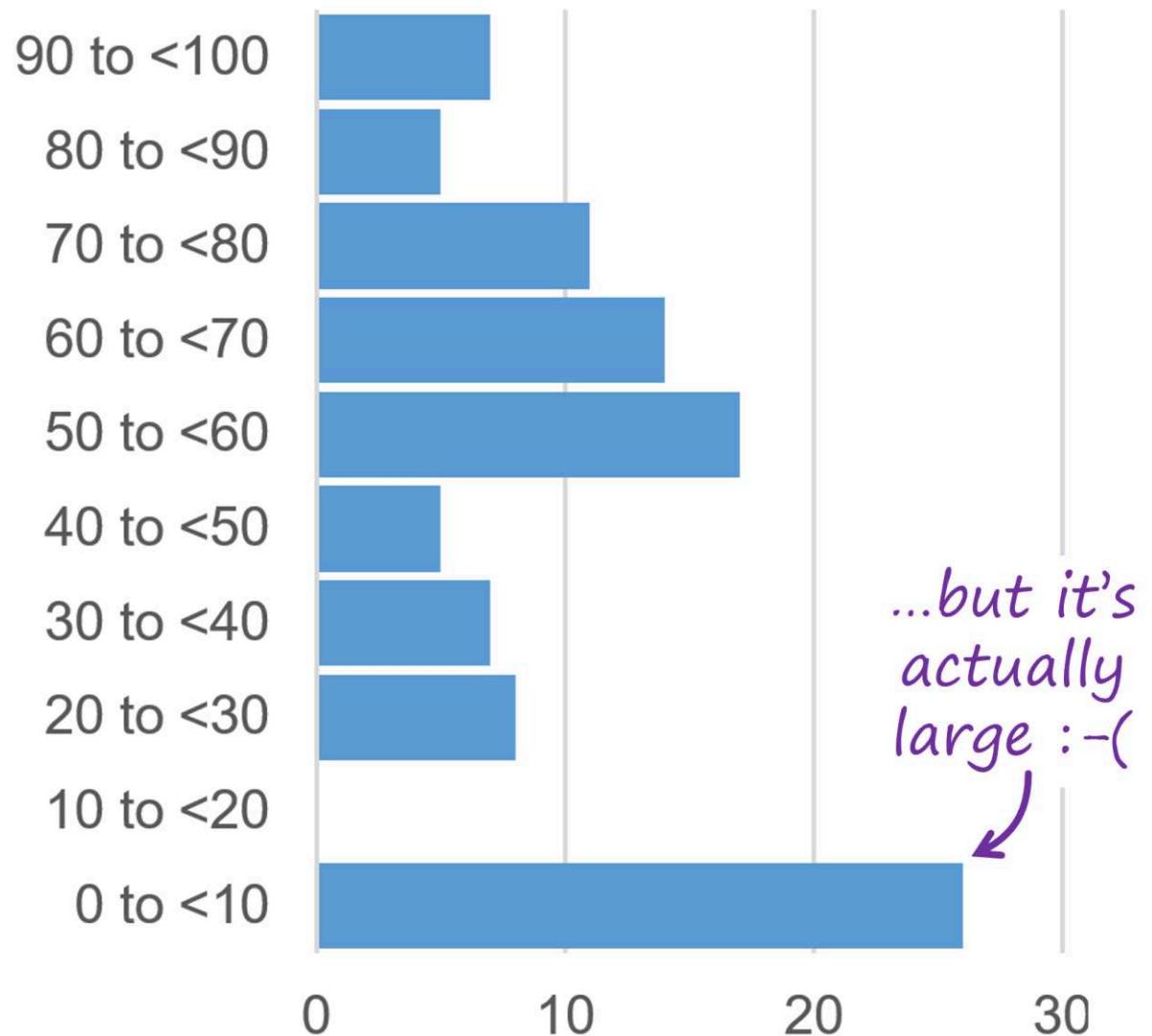
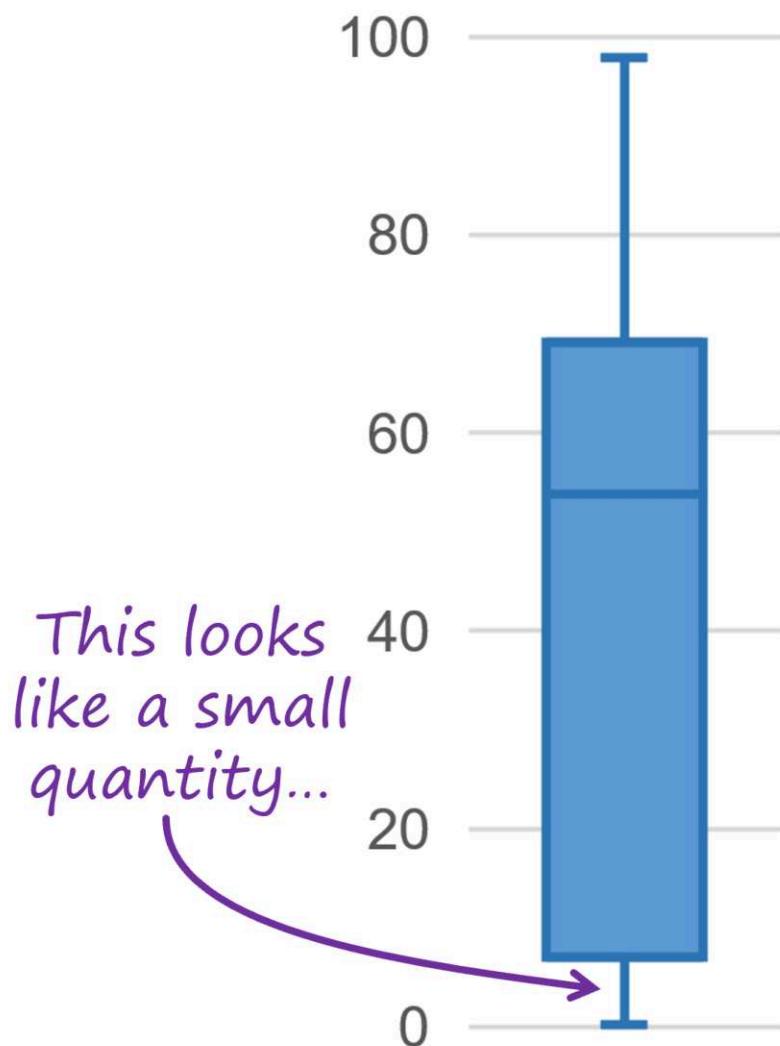


Box-Whisker Plot



Violin Plot

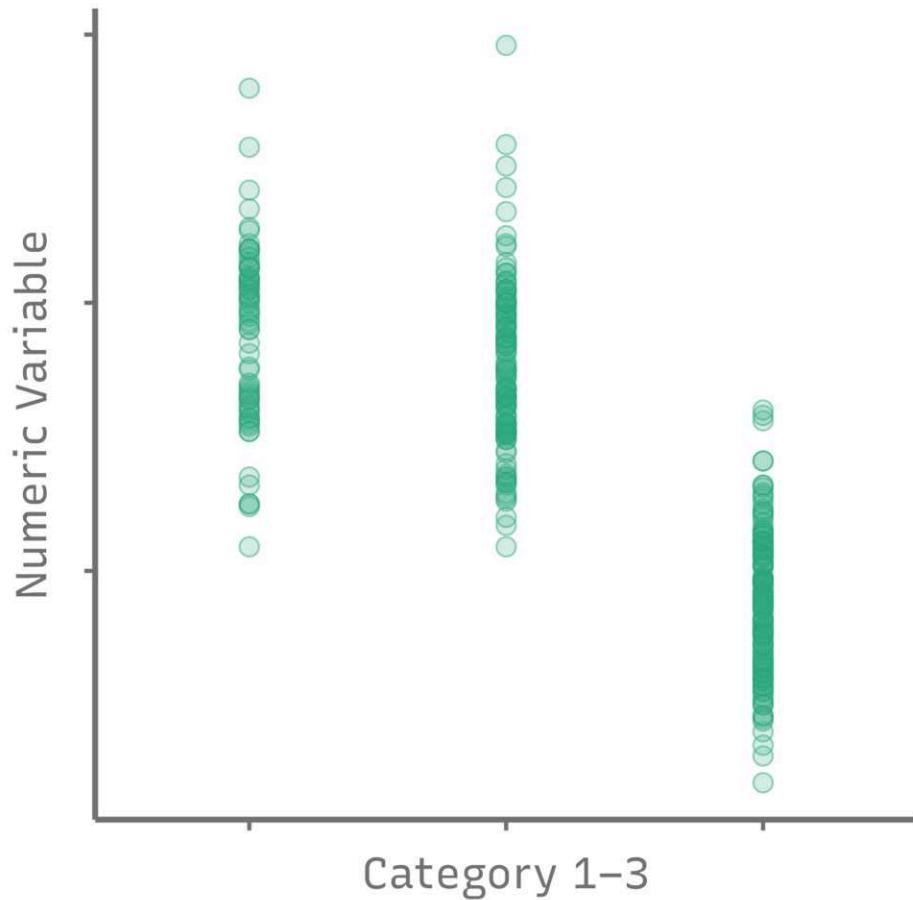




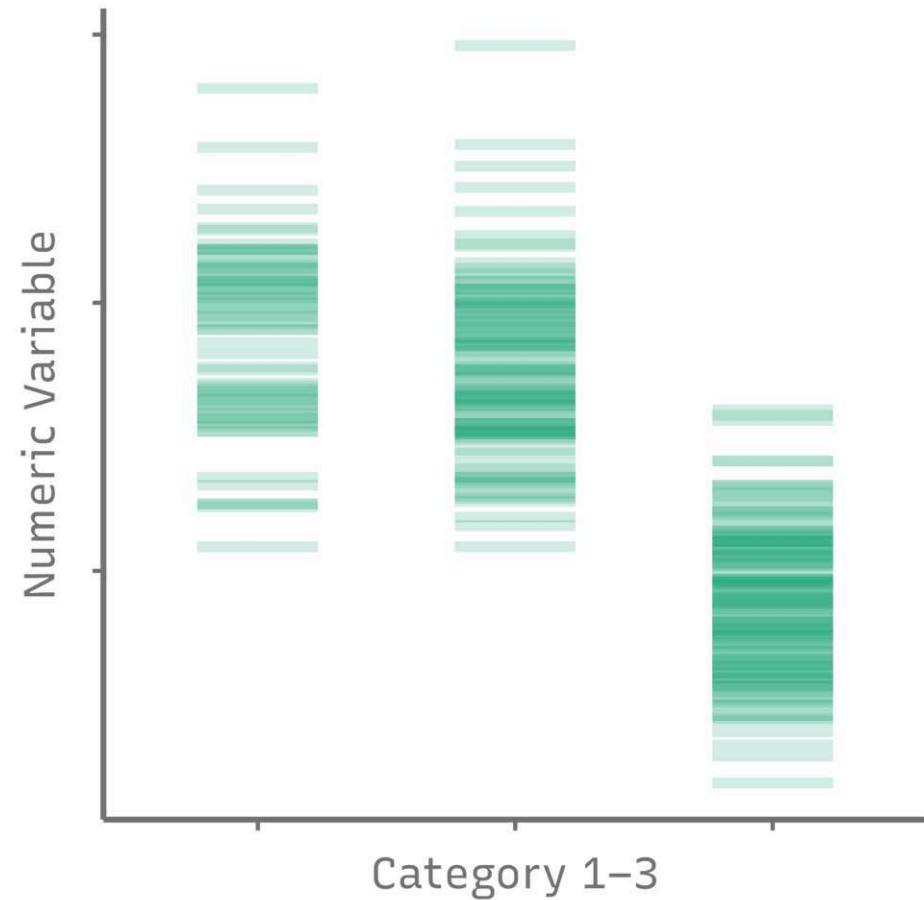
Quelle: "I've Stopped Using Box Plots. Should You?" von Nick Desbarats



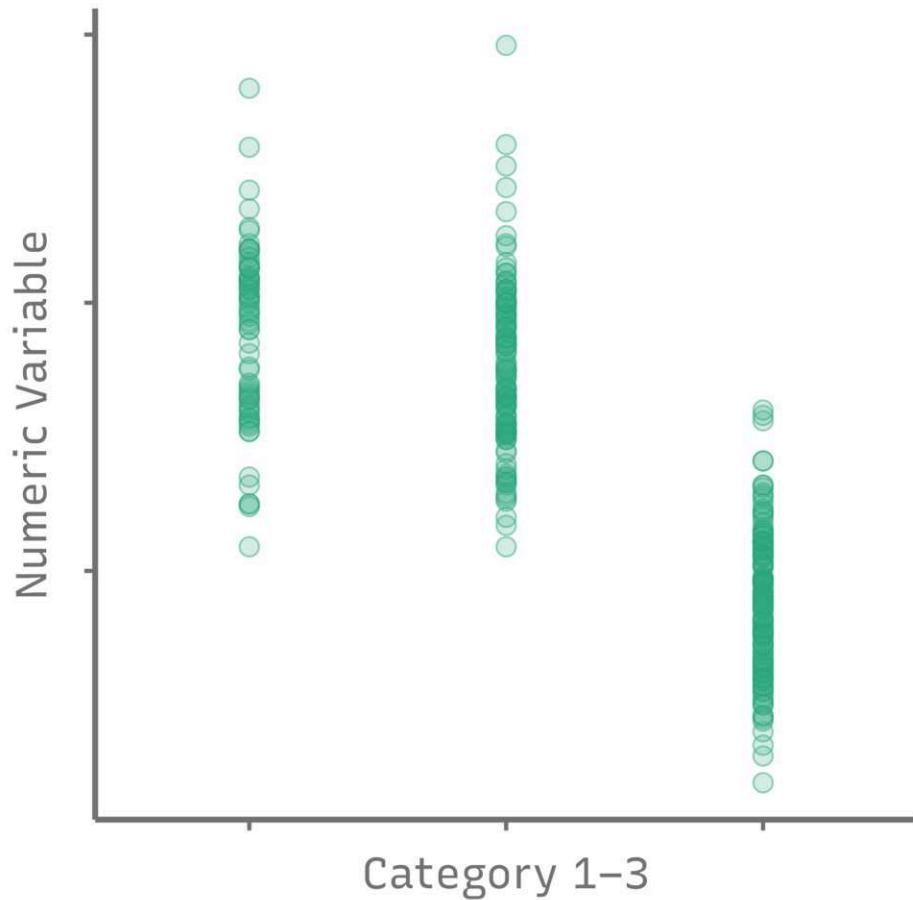
Strip Plot



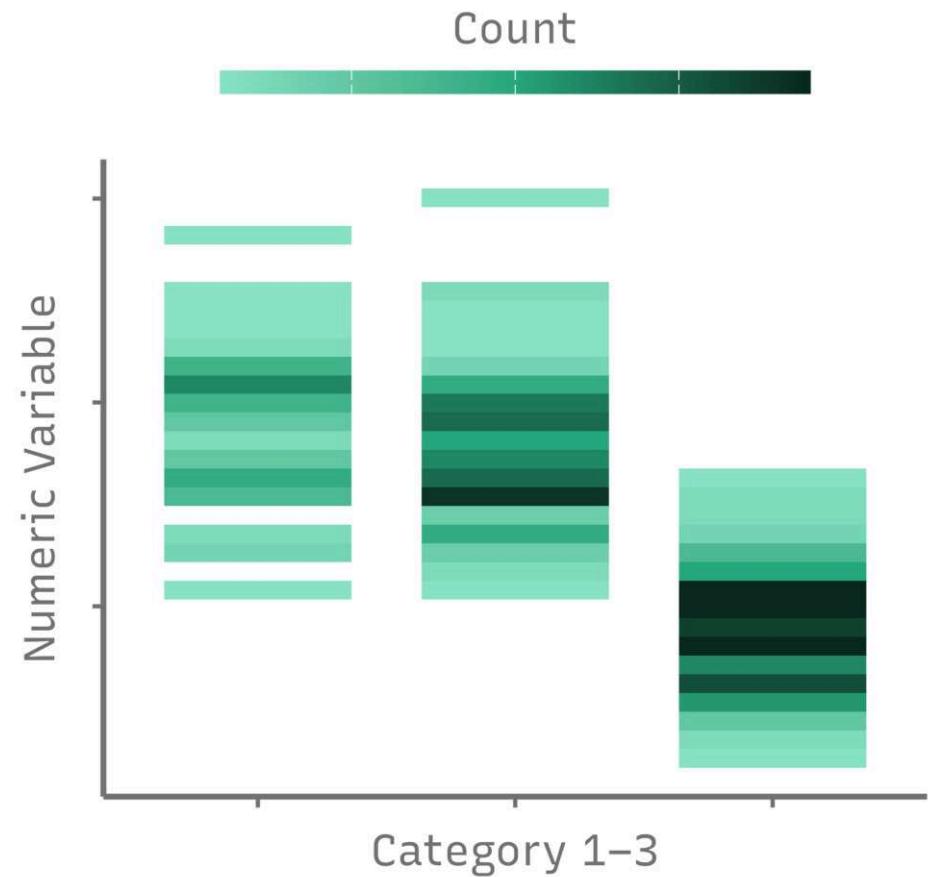
Strip Plot (Barcode Chart)



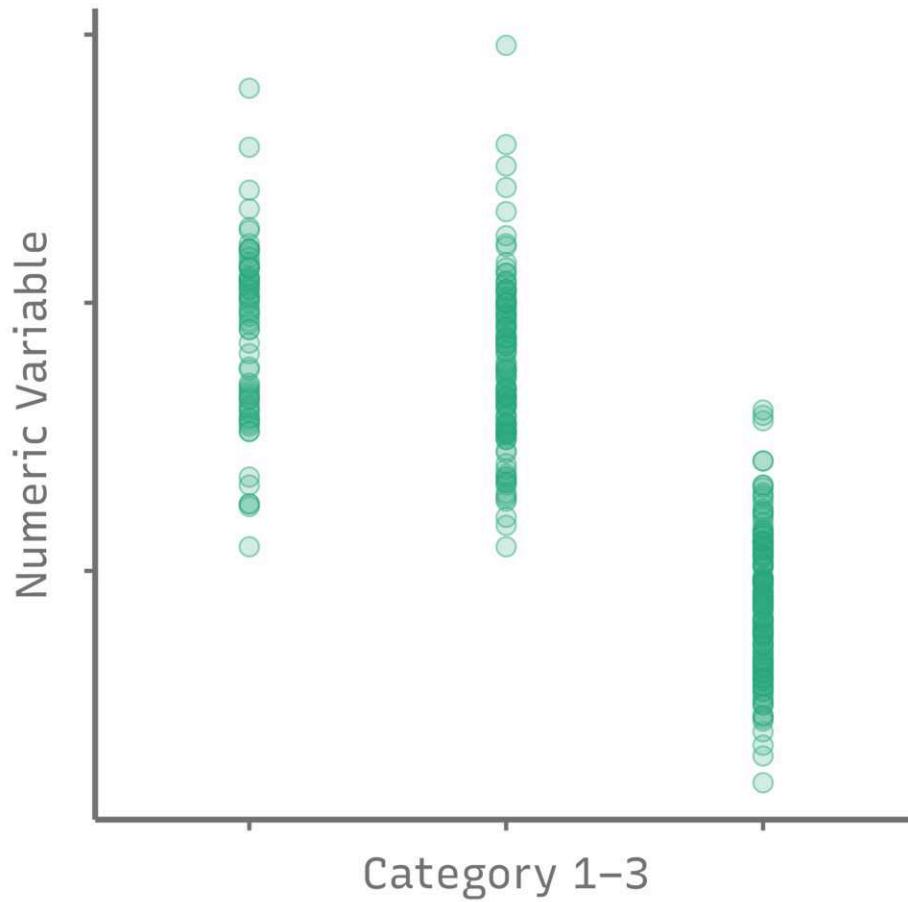
Strip Plot



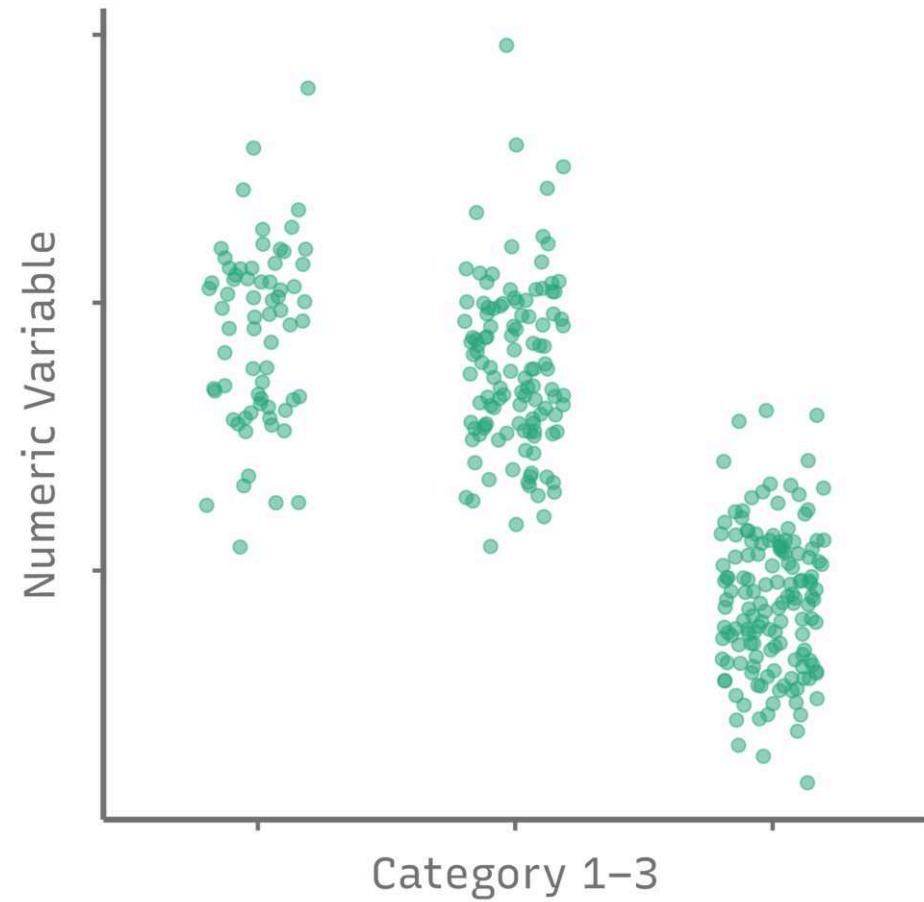
Binned Strip Plot (Heatmap)



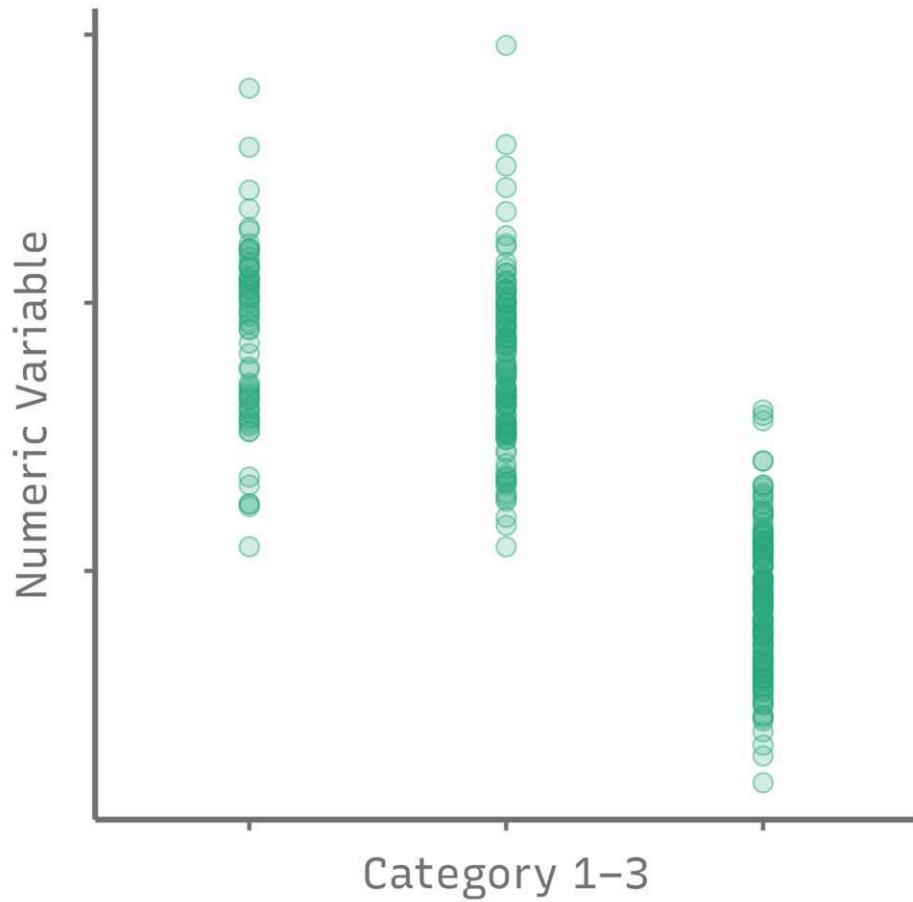
Strip Plot



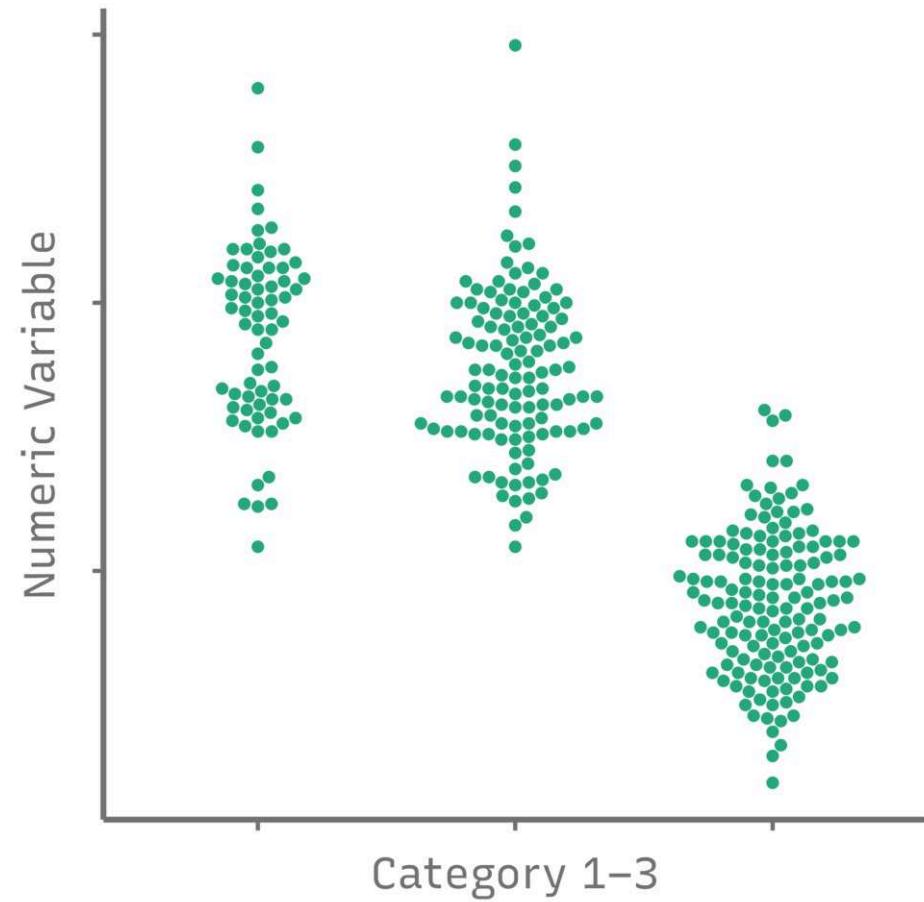
Jittered Strip Plot (Jitter Plot)



Strip Plot



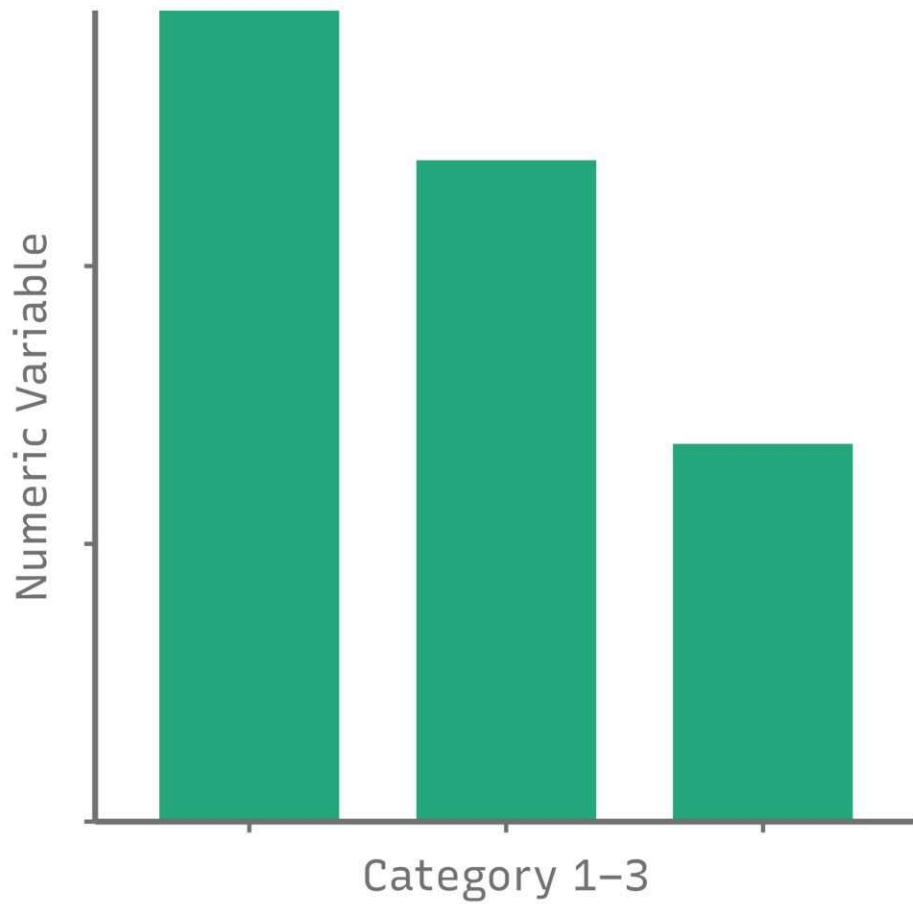
Beeswarm Plot



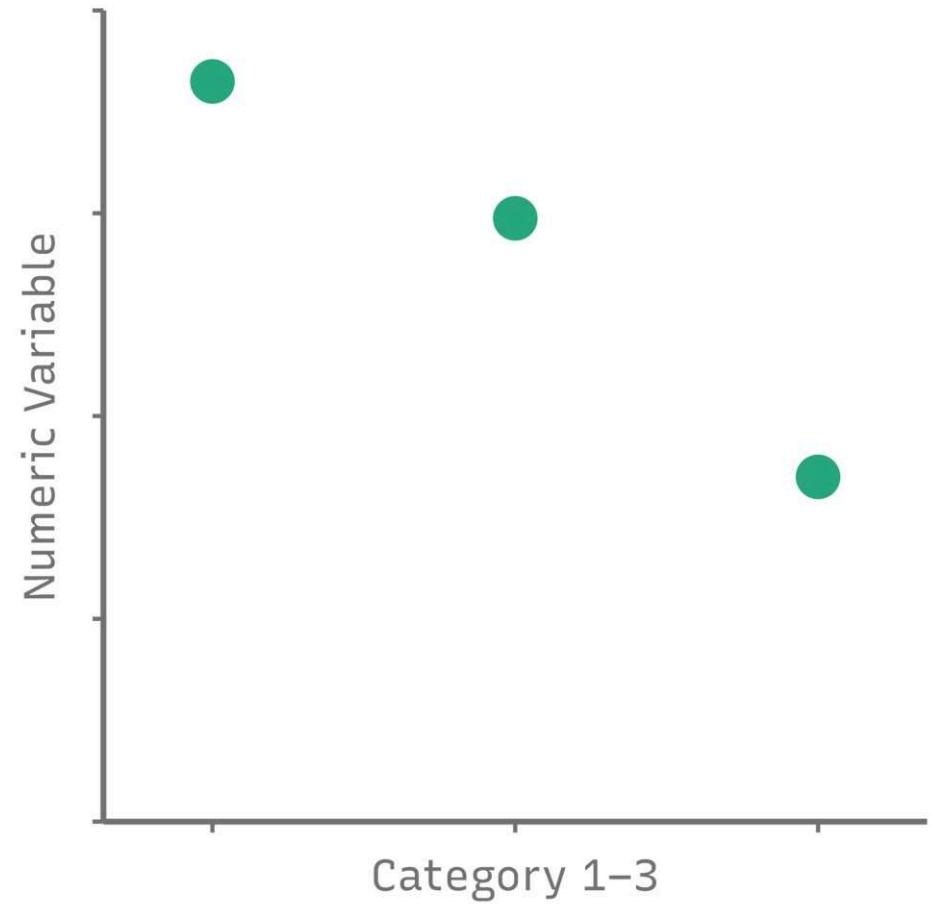
Mengen vergleichen



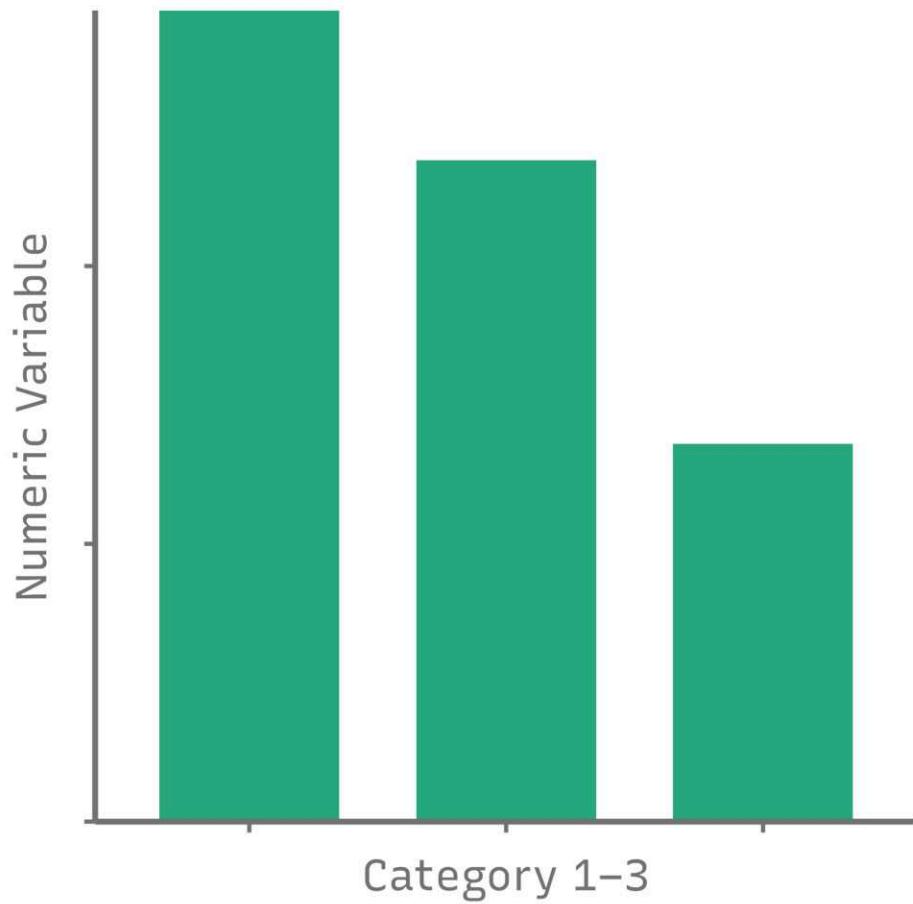
Bar Chart



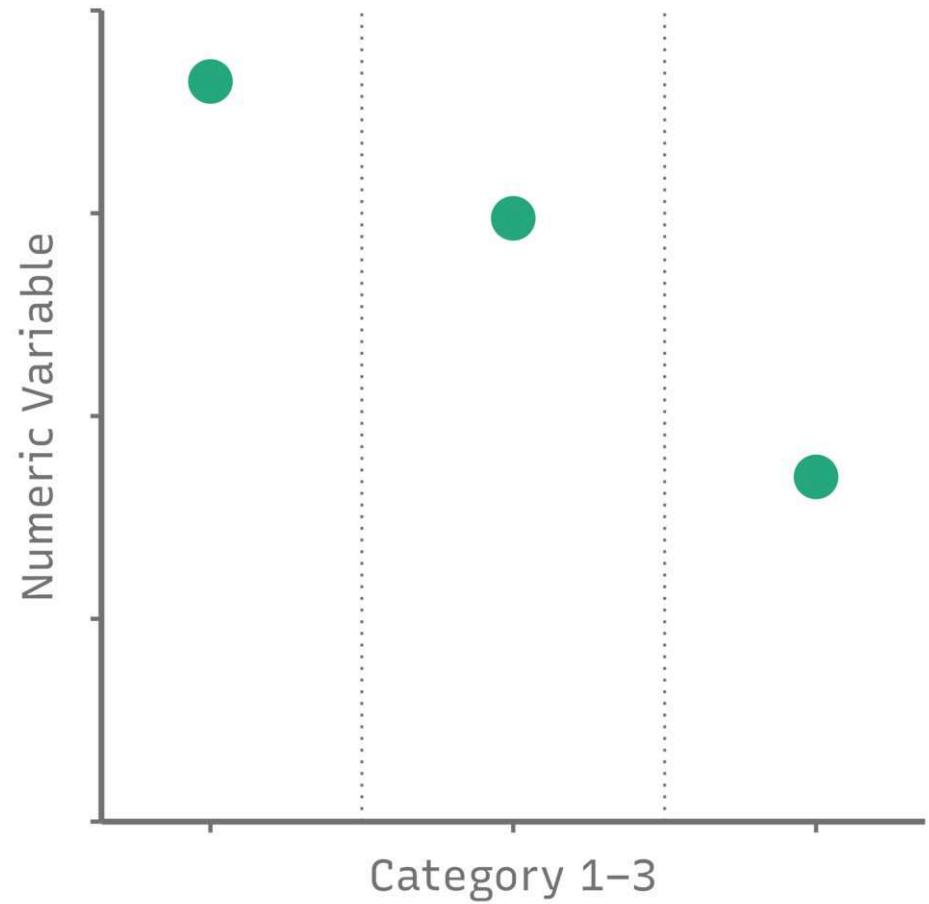
Dot Plot



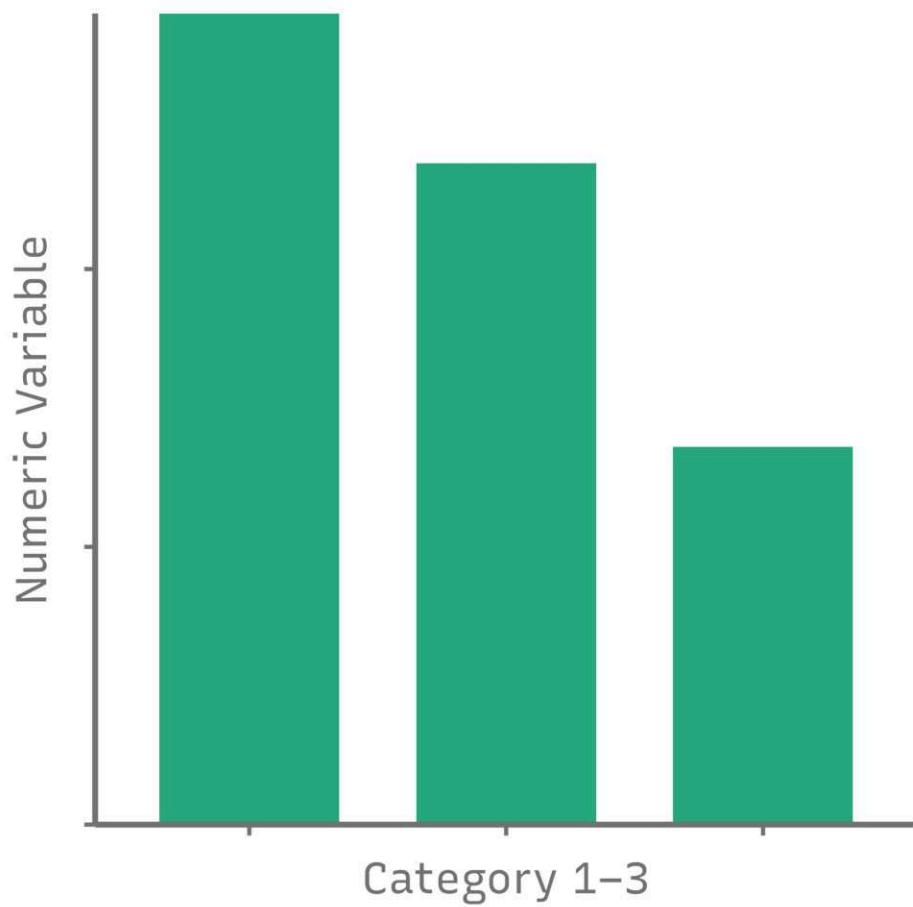
Bar Chart



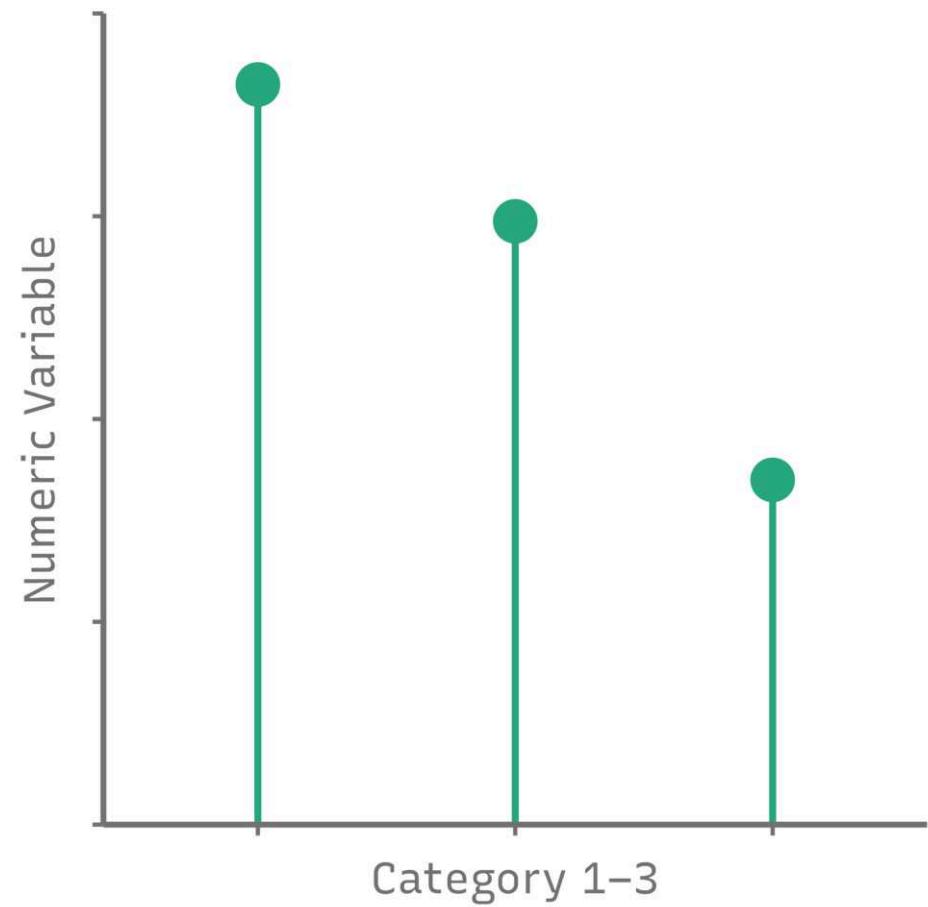
Dot Plot



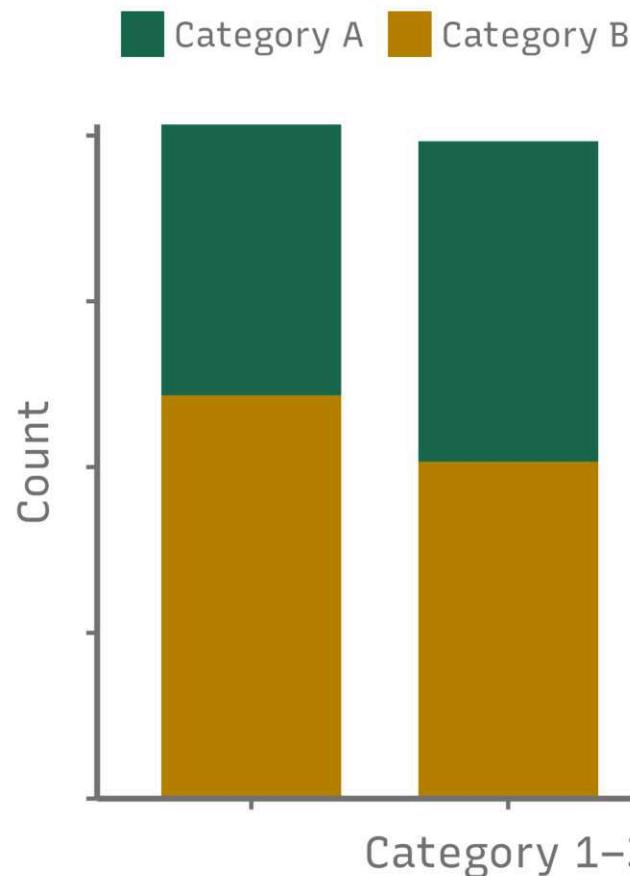
Bar Chart



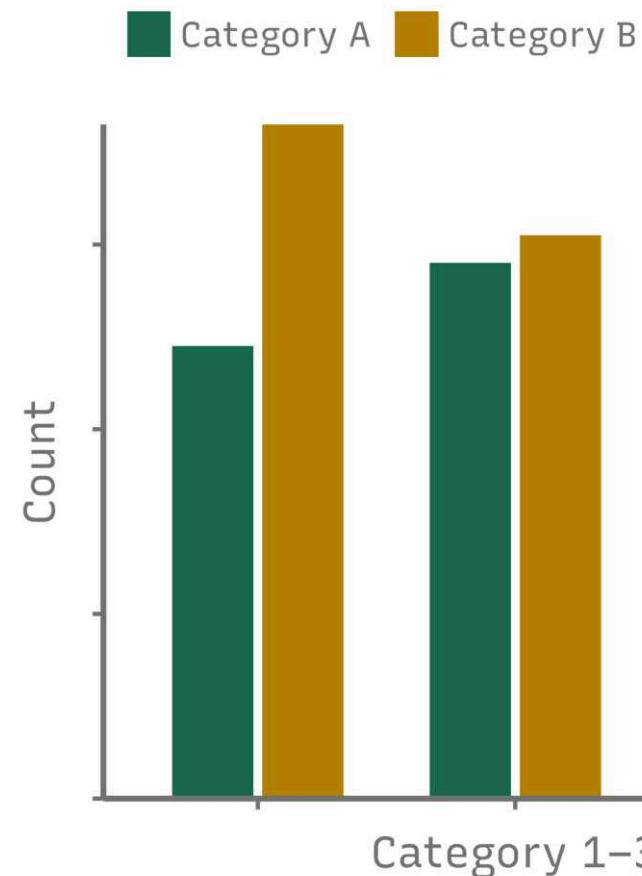
Lollipop Chart



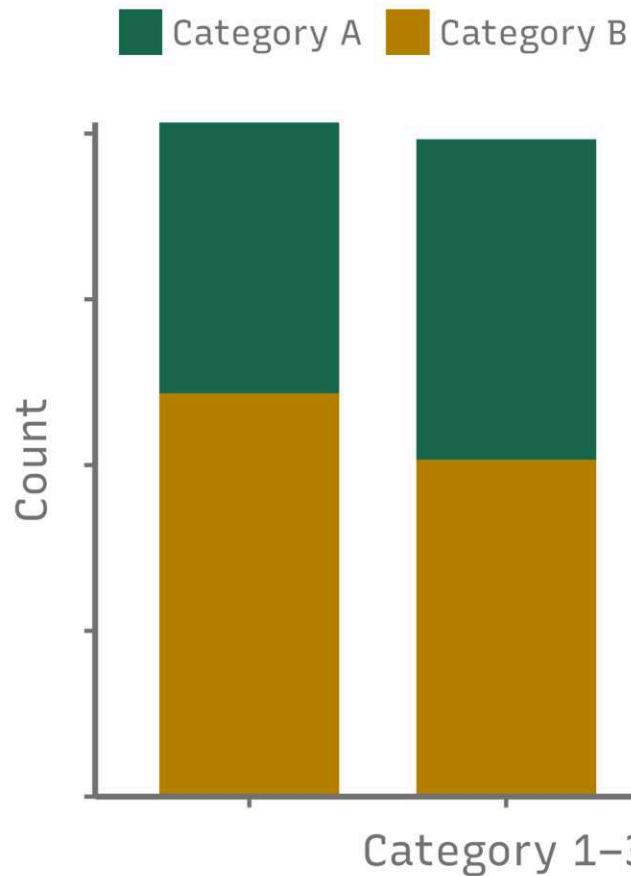
Bar Chart (stacked)



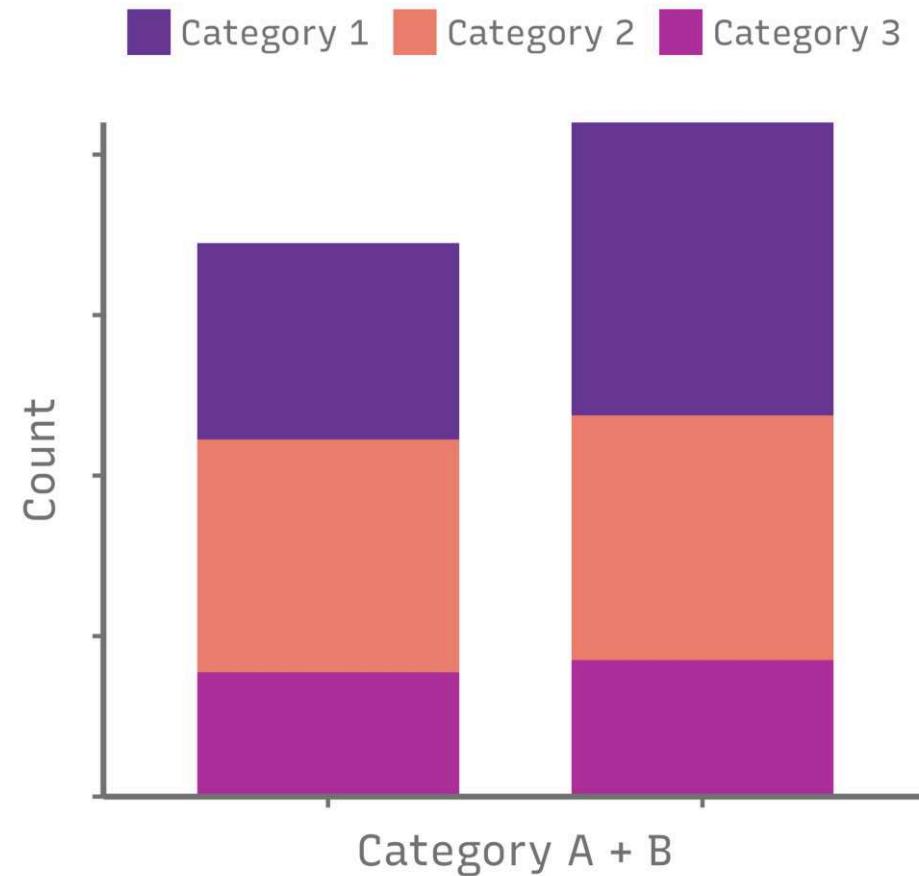
Bar Chart (grouped)



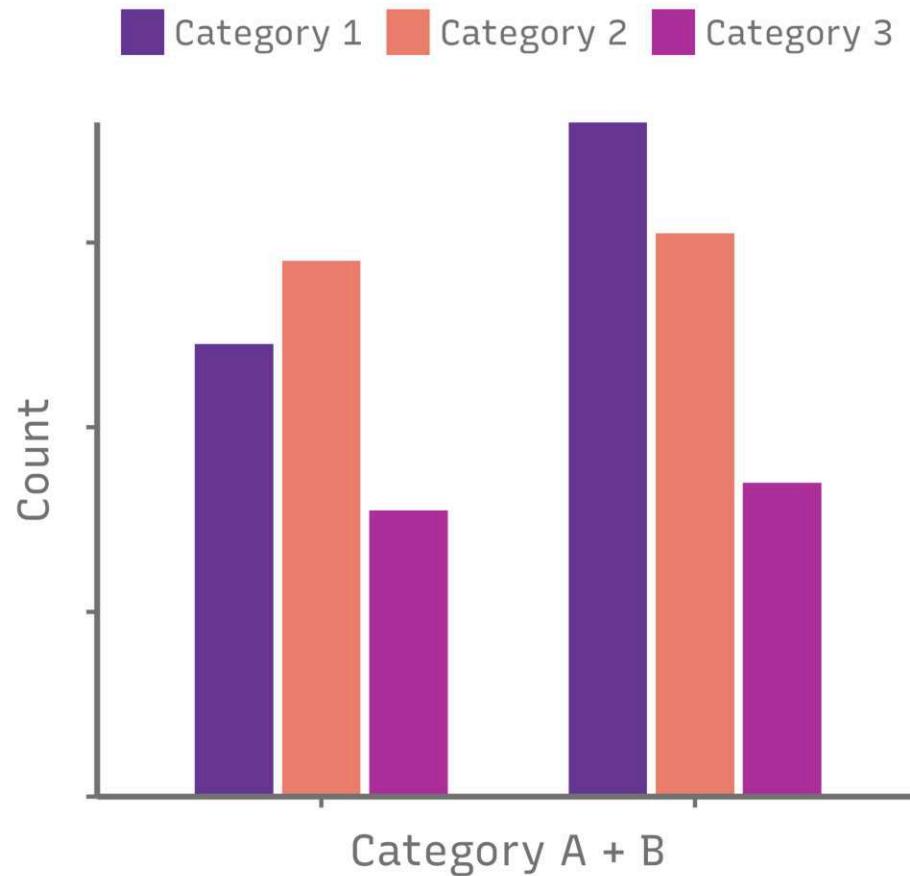
Bar Chart (stacked)



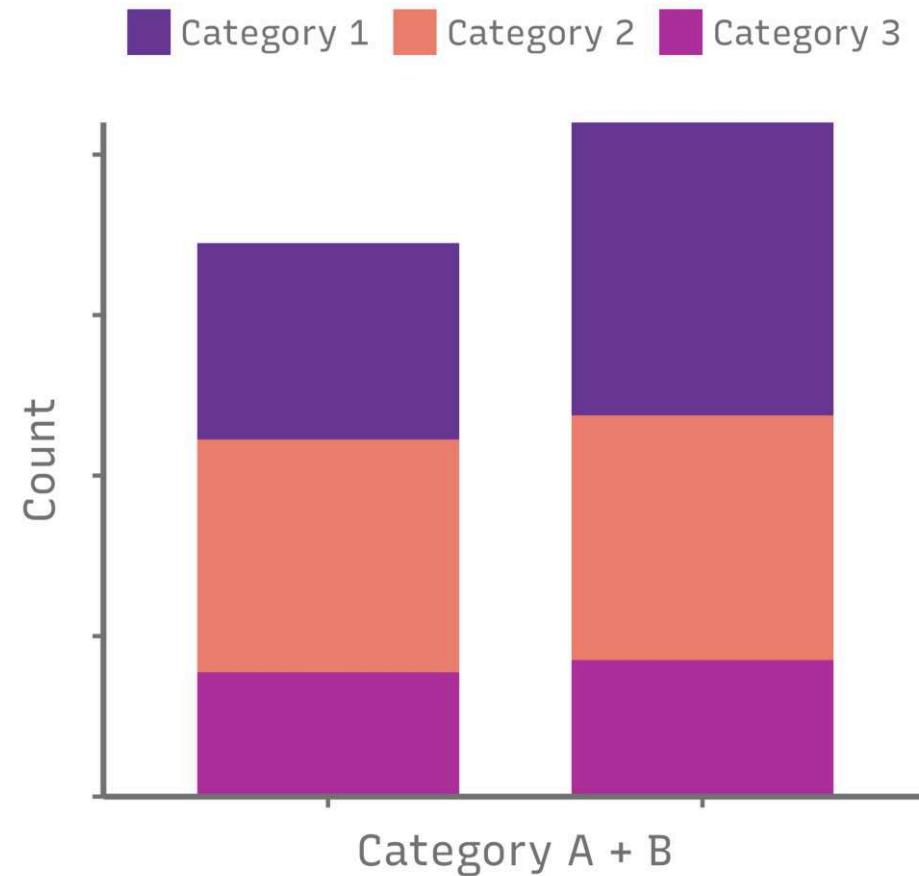
Bar Chart (stacked)



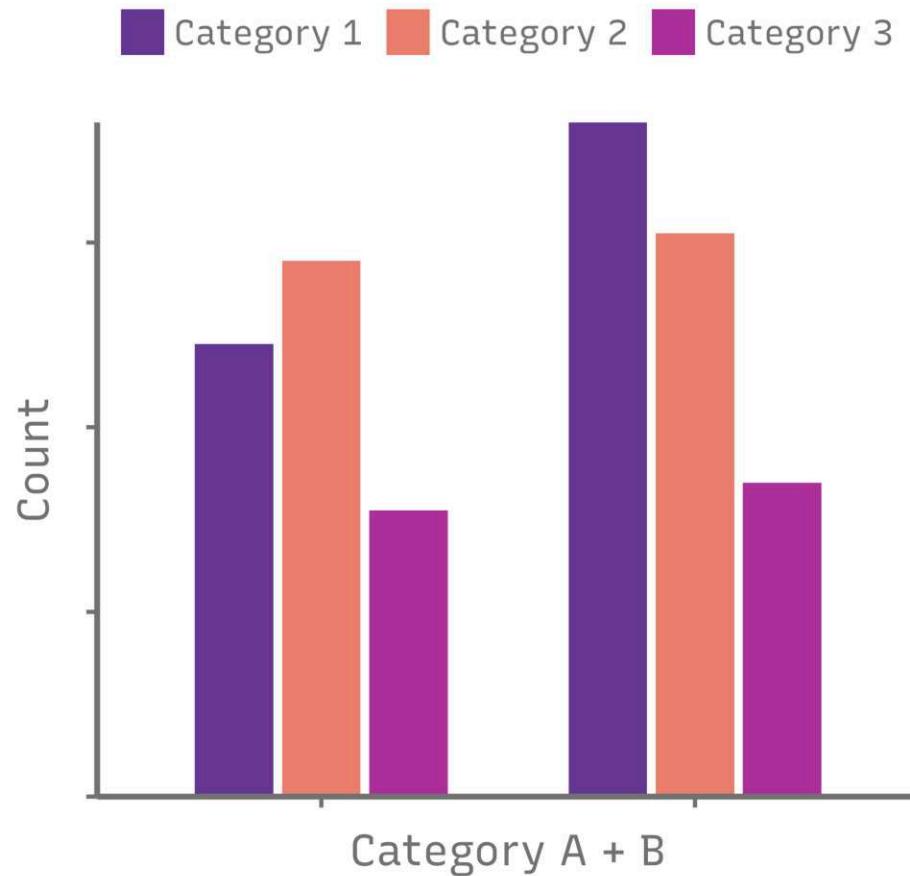
Bar Chart (grouped)



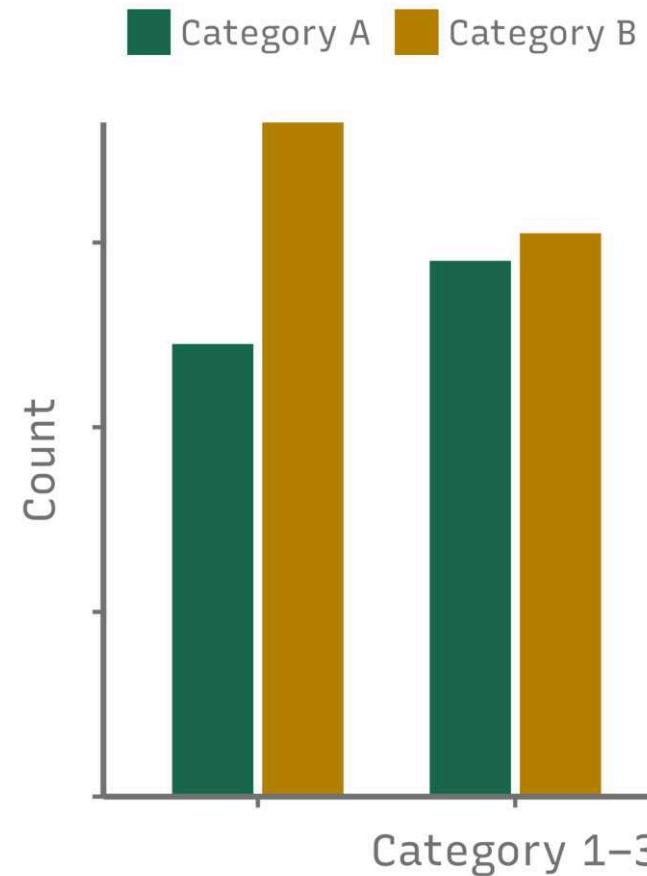
Bar Chart (stacked)



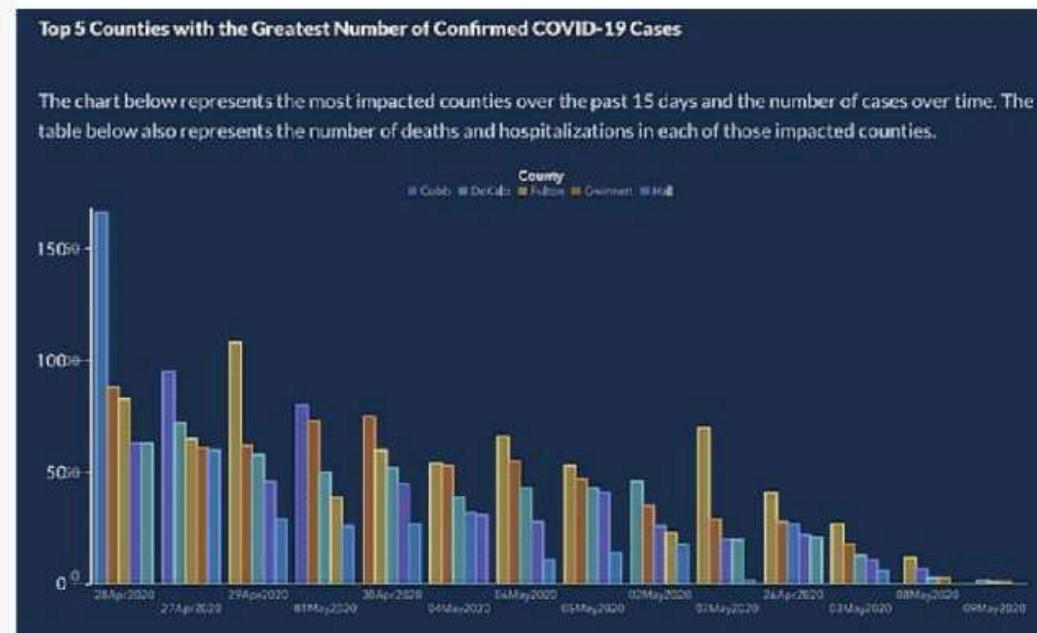
Bar Chart (grouped)



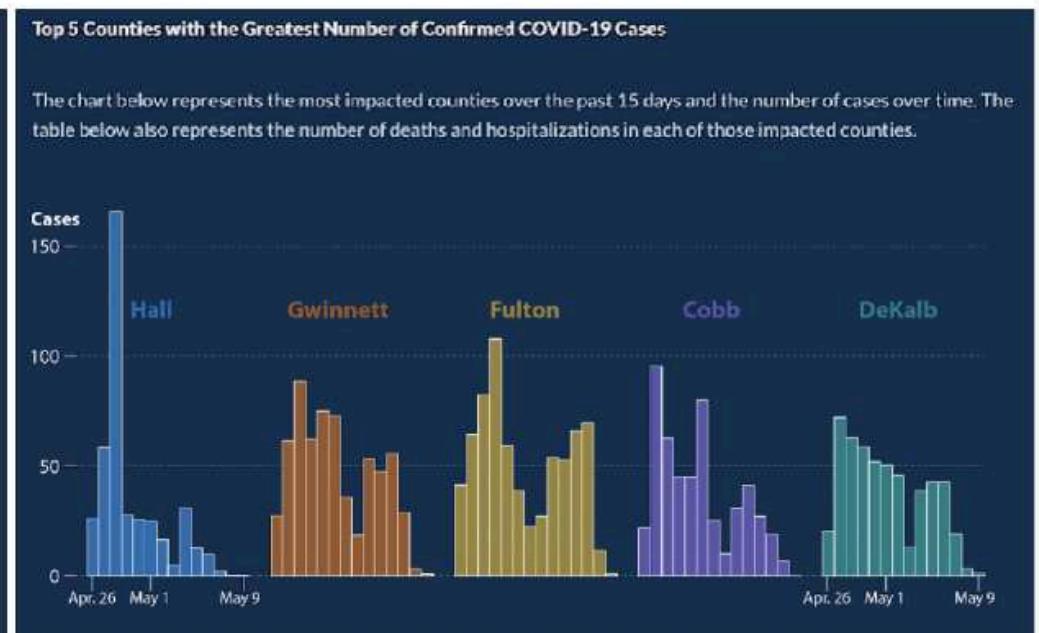
Bar Chart (grouped)



ORIGINAL



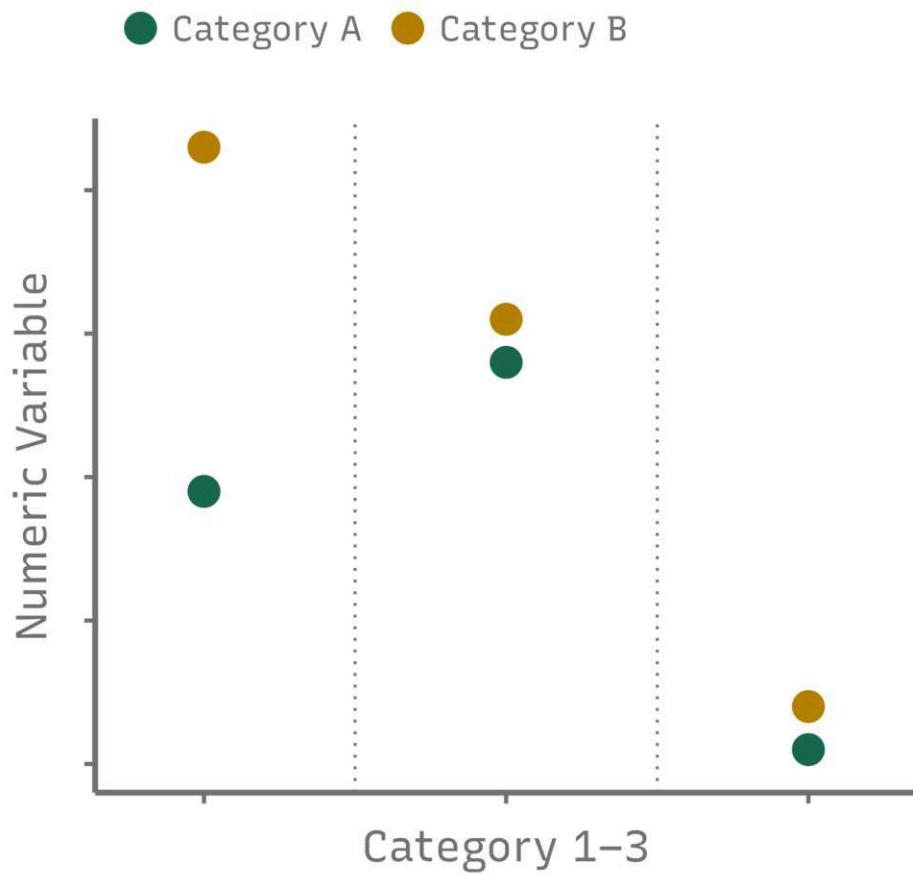
MAKEOVER



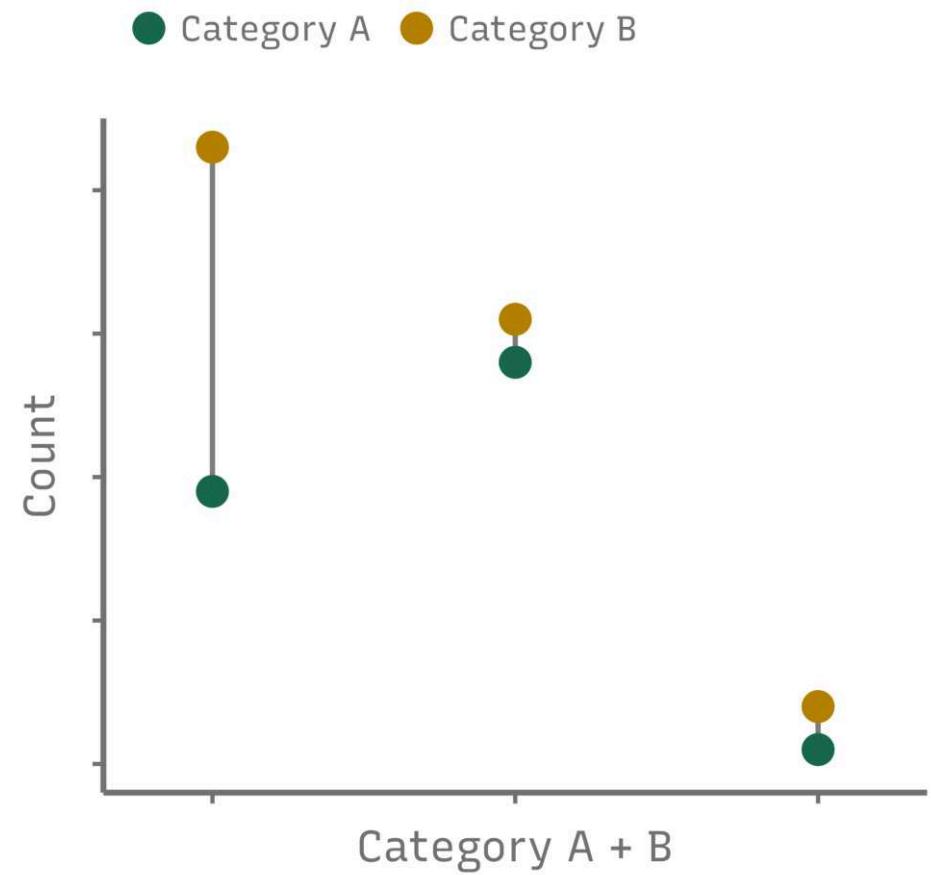
Ursprüngliches gruppiertes Balkendiagramm des Gesundheitsministeriums von Georgia (links) und neu geordnete Version von Alberto Cairo (rechts)



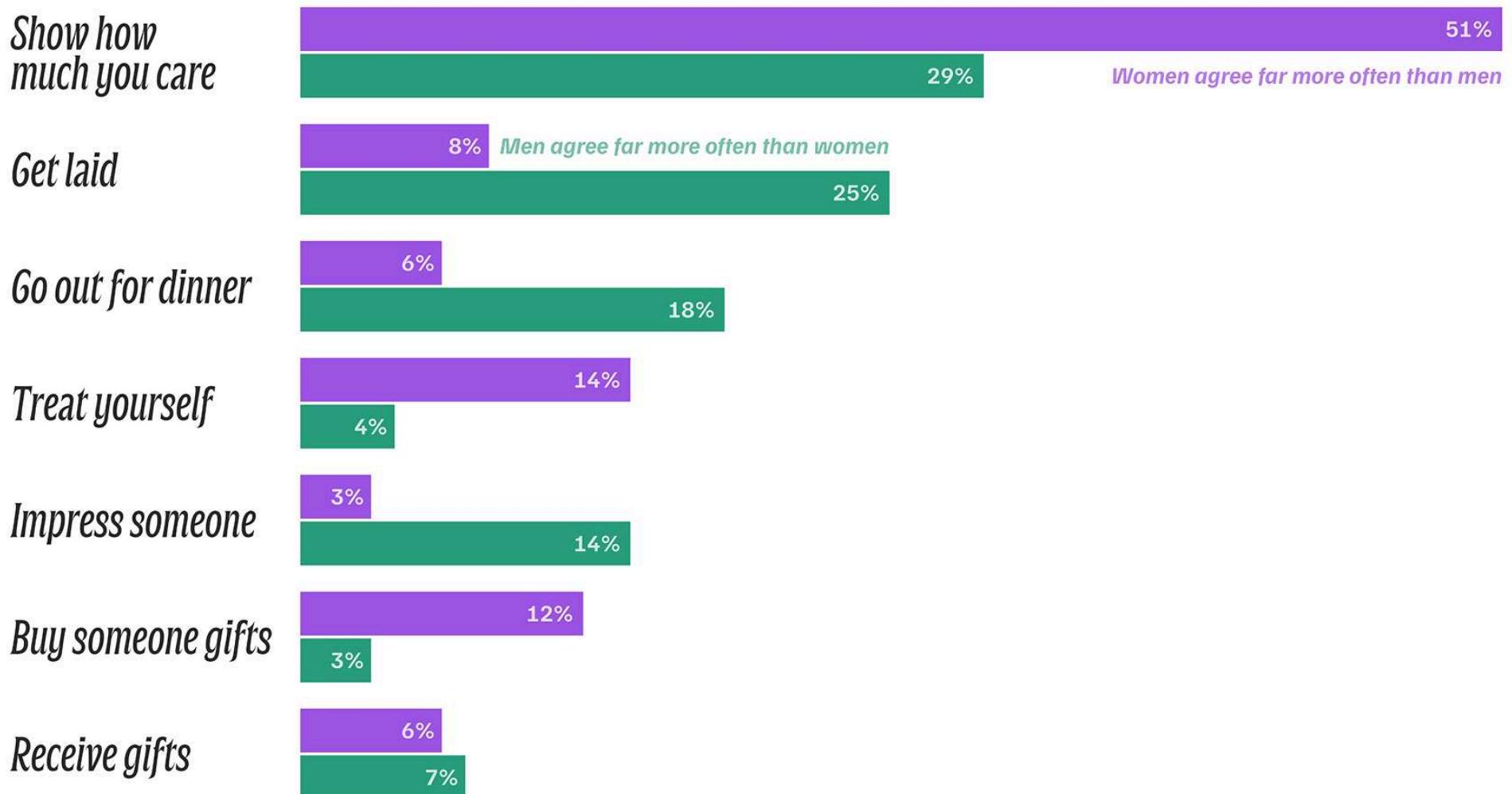
Dot Plot



Dumbbell Plot



For 25% of surveyed men, the point of Valentine's Day is to “*get laid*” —more than the half of women responded “*show how much you care*”



Visualization: Cédric Scherer • Data: UK survey in 2015 by chilisauce.co.uk

Cédric Scherer Data Visualization & Information Design



For 25% of surveyed men, the point of Valentine's Day is to “*get laid*” —more than the half of women responded “*show how much you care*”



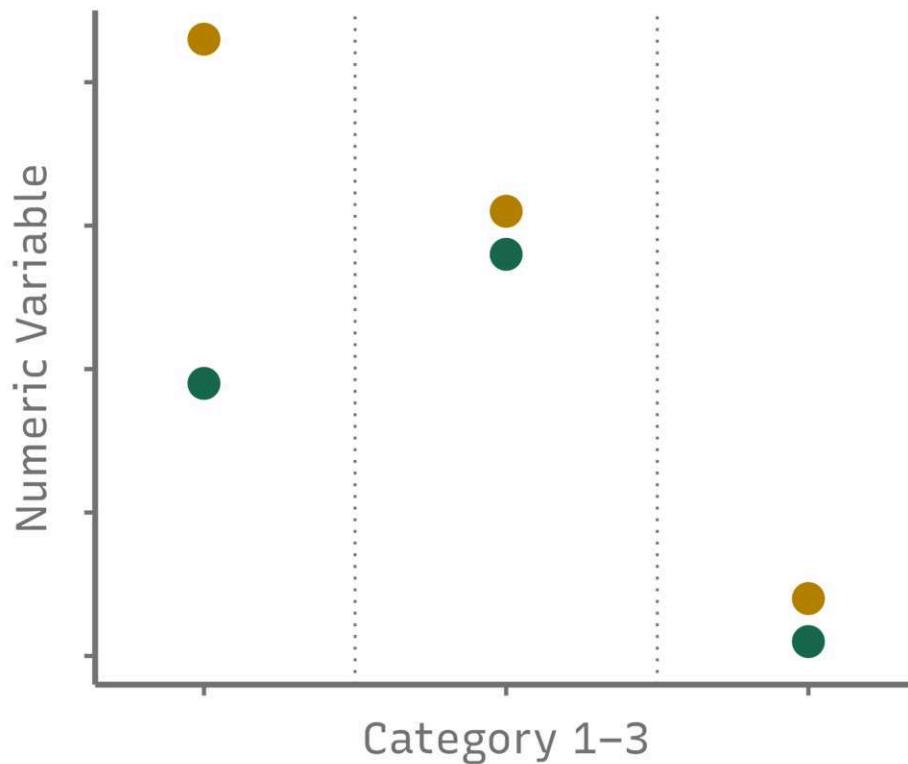
Visualization: Cédric Scherer • Data: UK survey in 2015 by chilisauce.co.uk

Cédric Scherer Data Visualization & Information Design



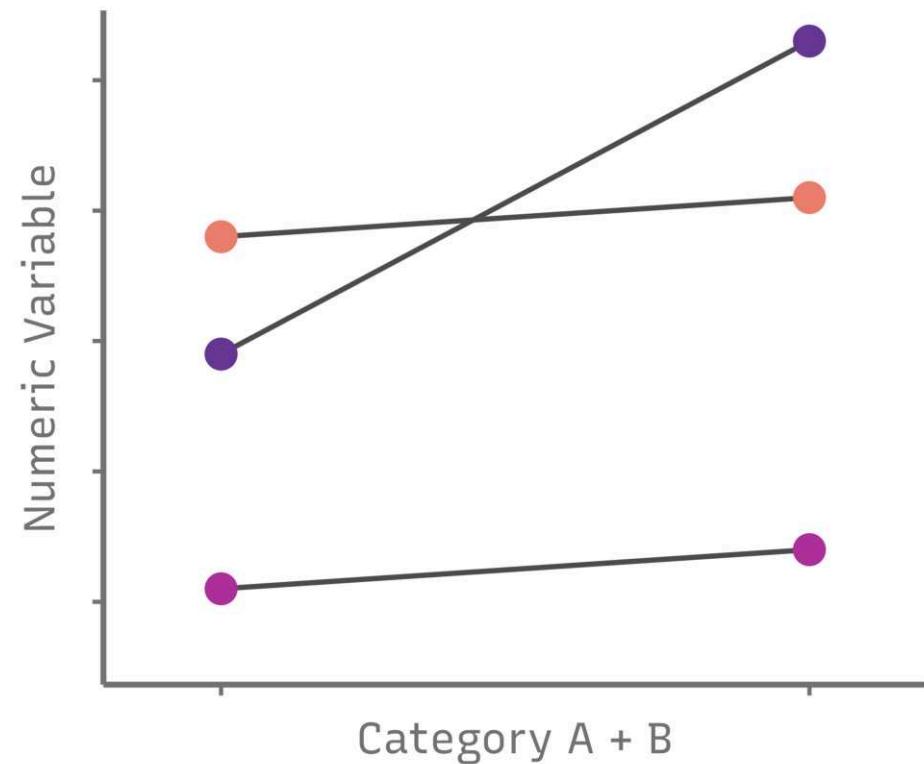
Dot Plot

● Category A ● Category B

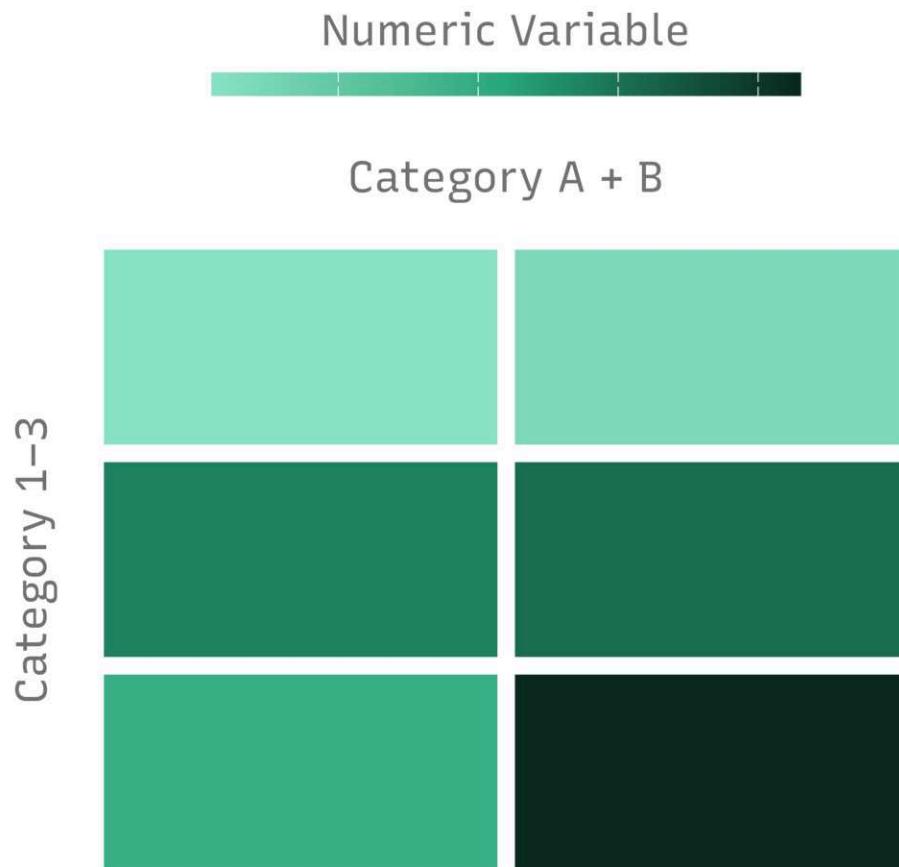


Slope Chart

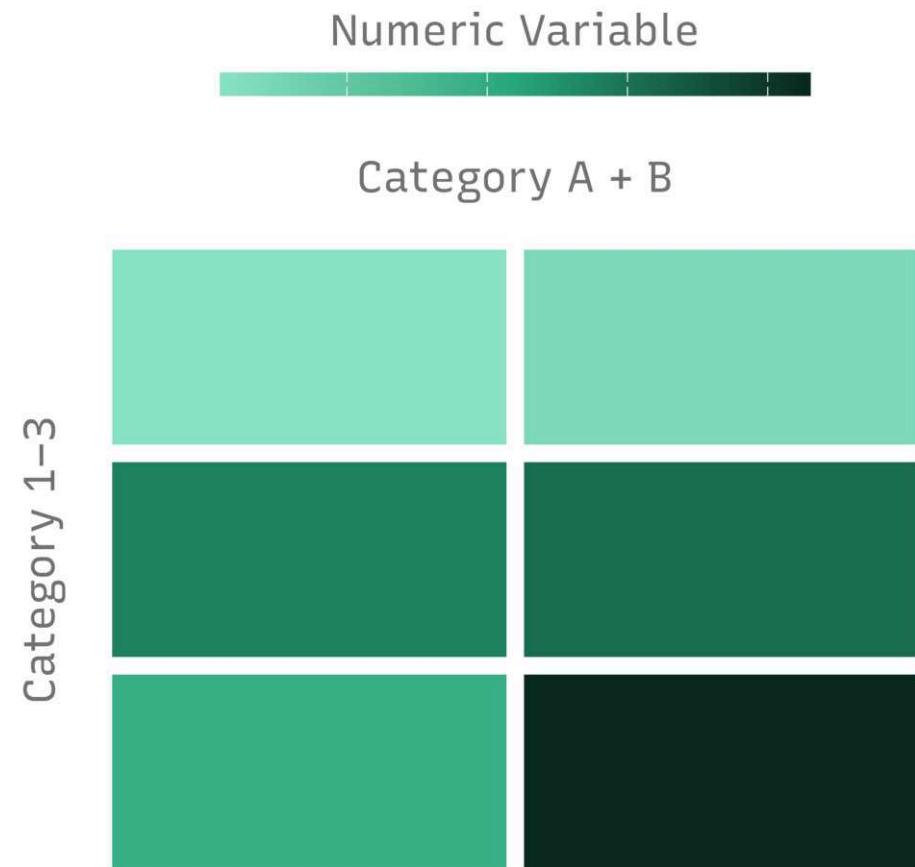
● Category 1 ● Category 2 ● Category 3



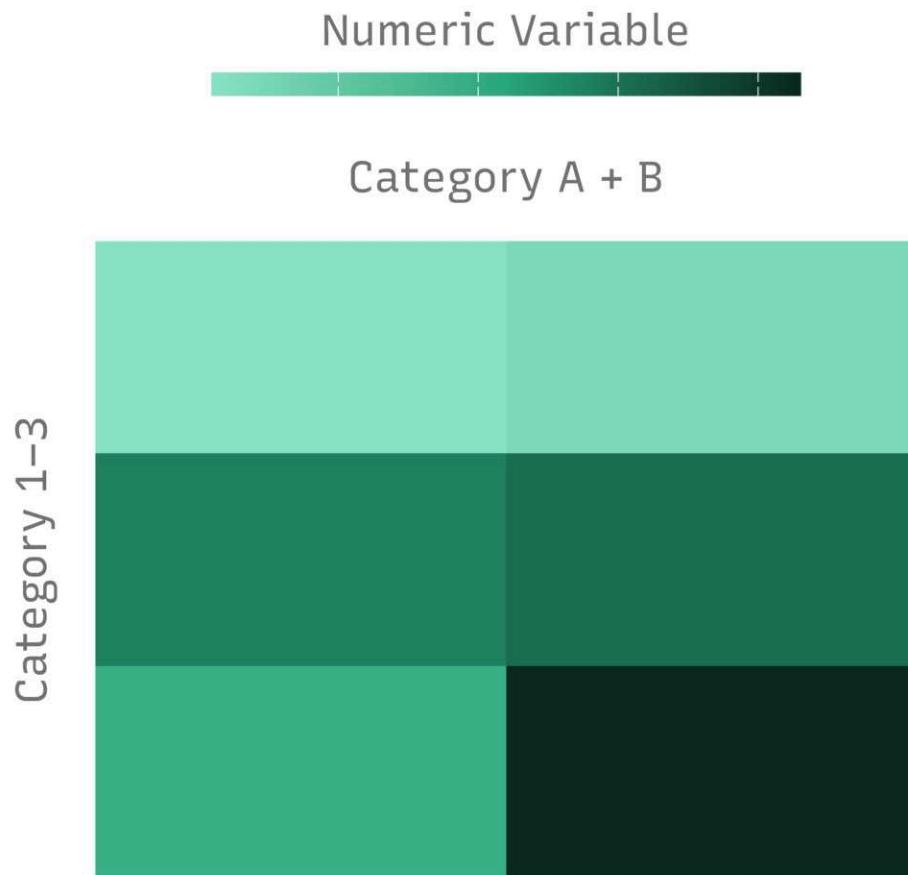
Heatmap



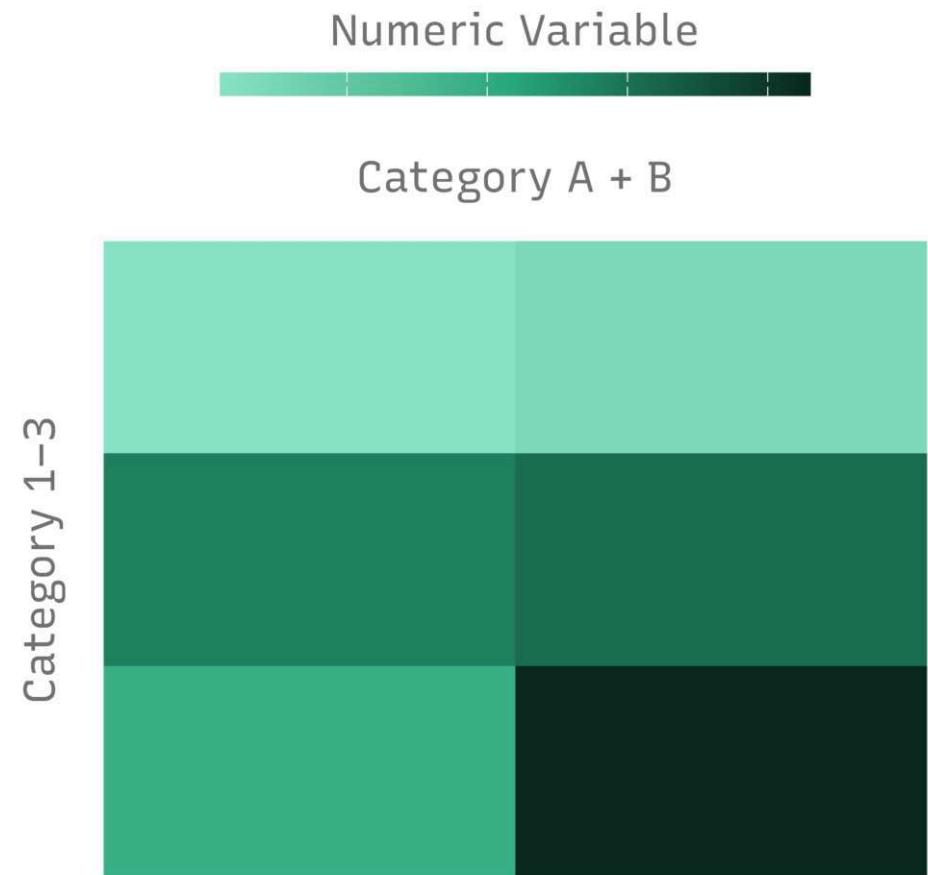
Heatmap Table



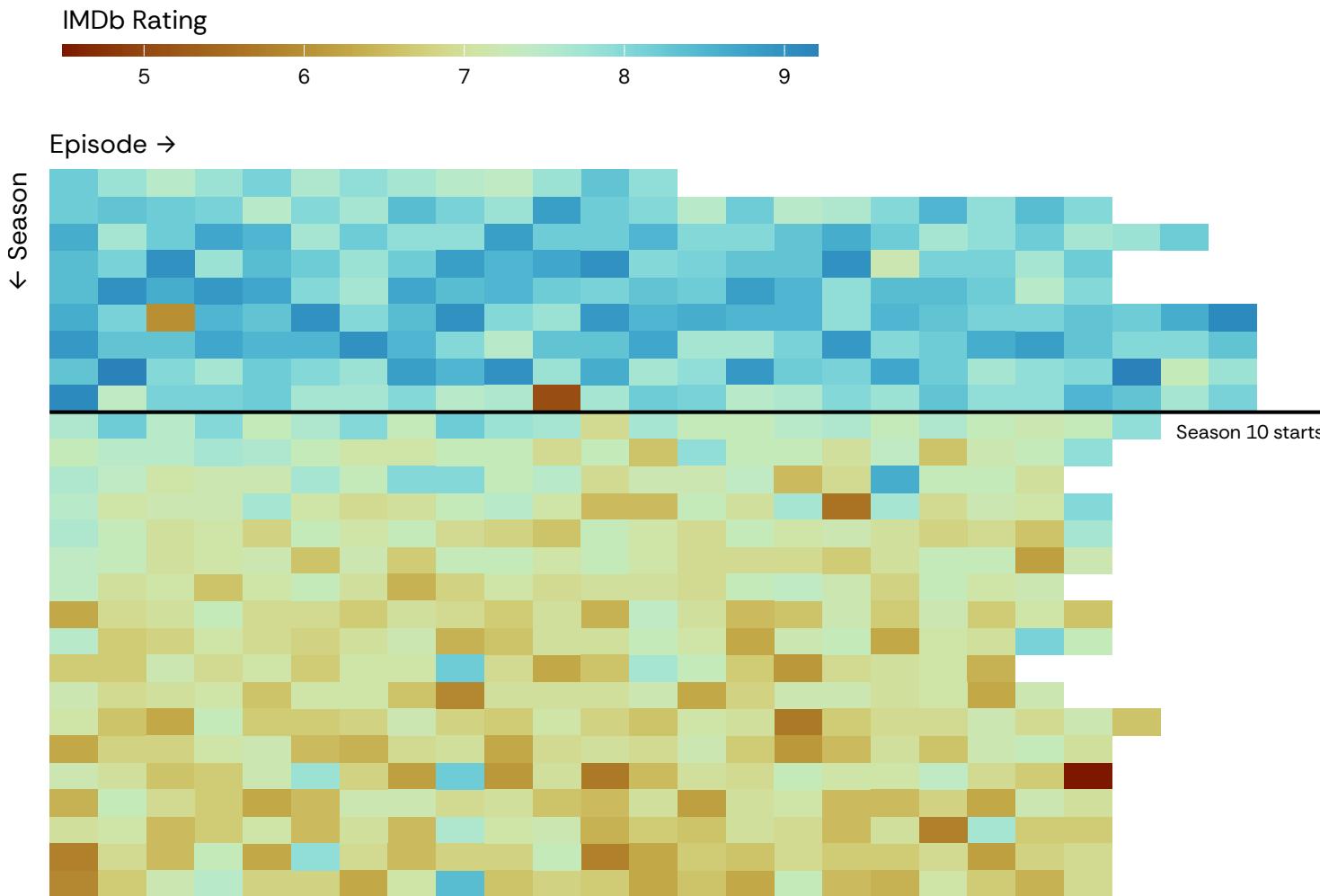
Heatmap



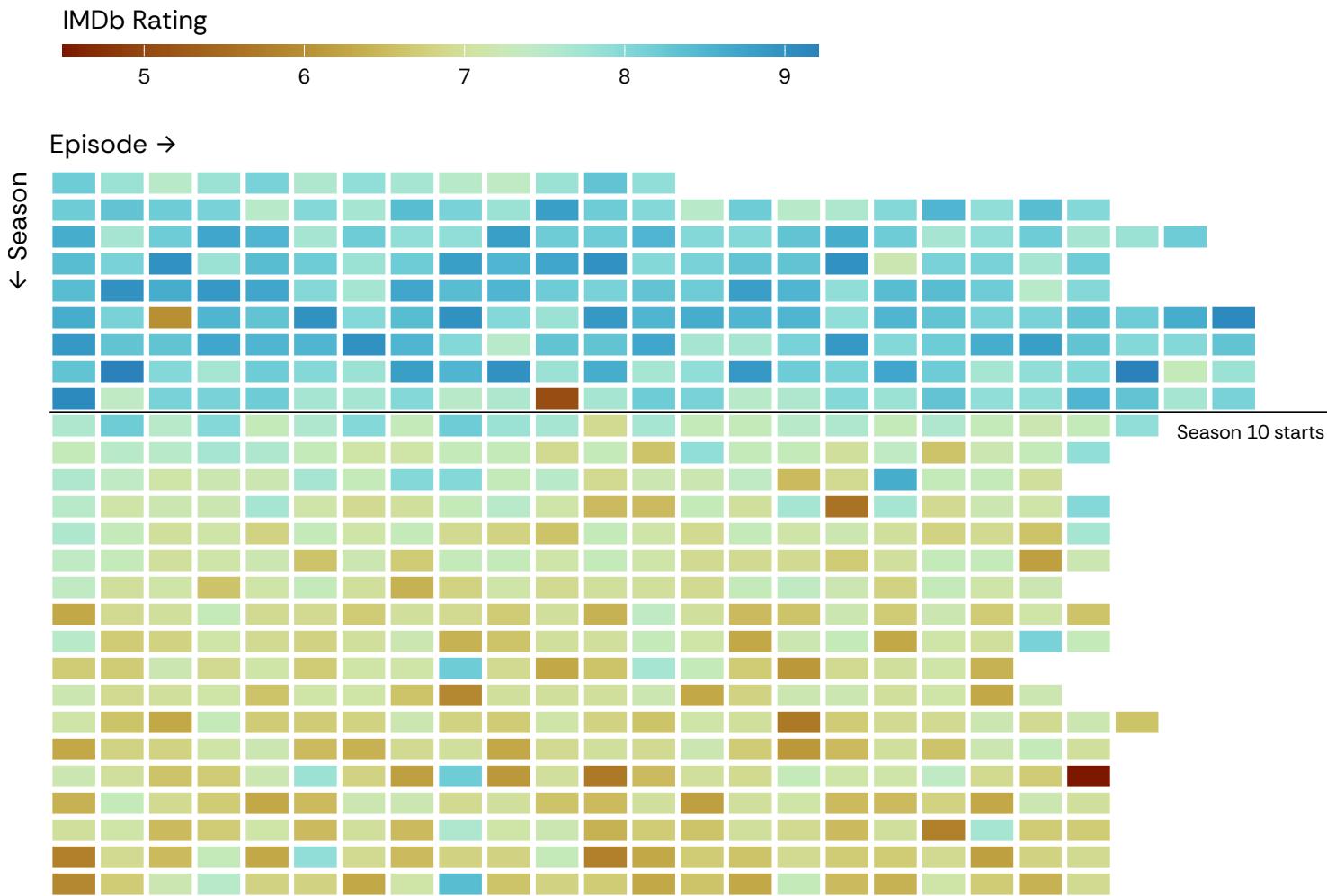
Heatmap Table



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



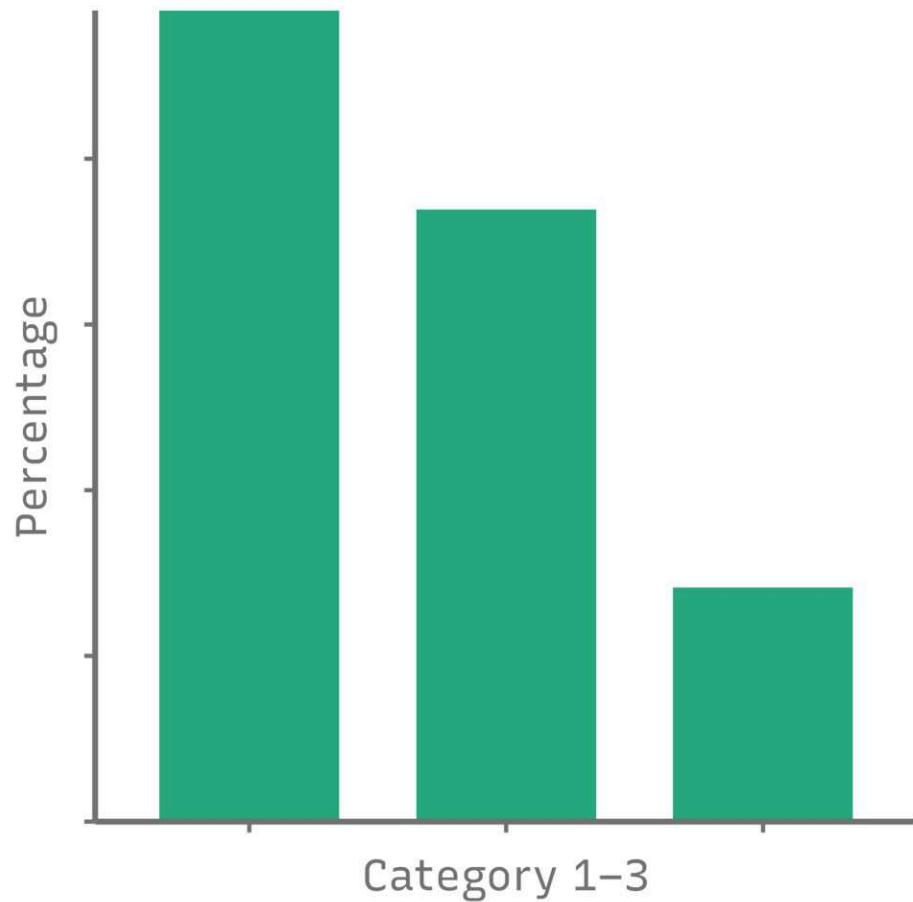
From season 10 onwards, IMDb ratings for "The Simpsons" dropped considerably



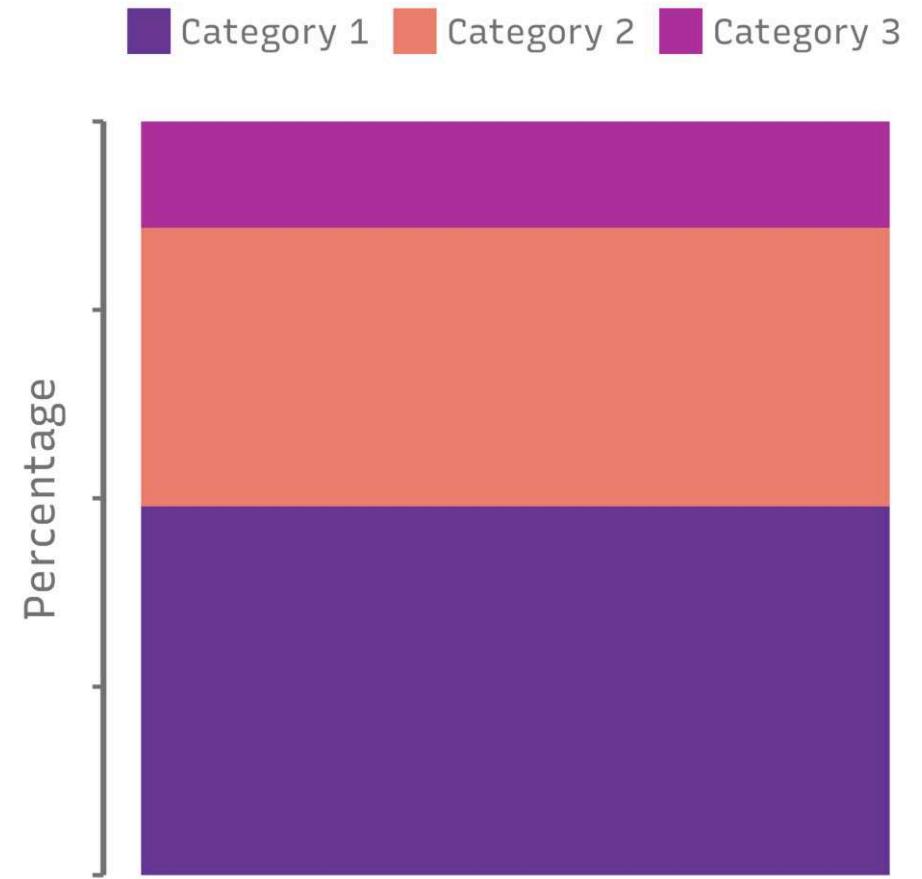
Proportionen vergleichen



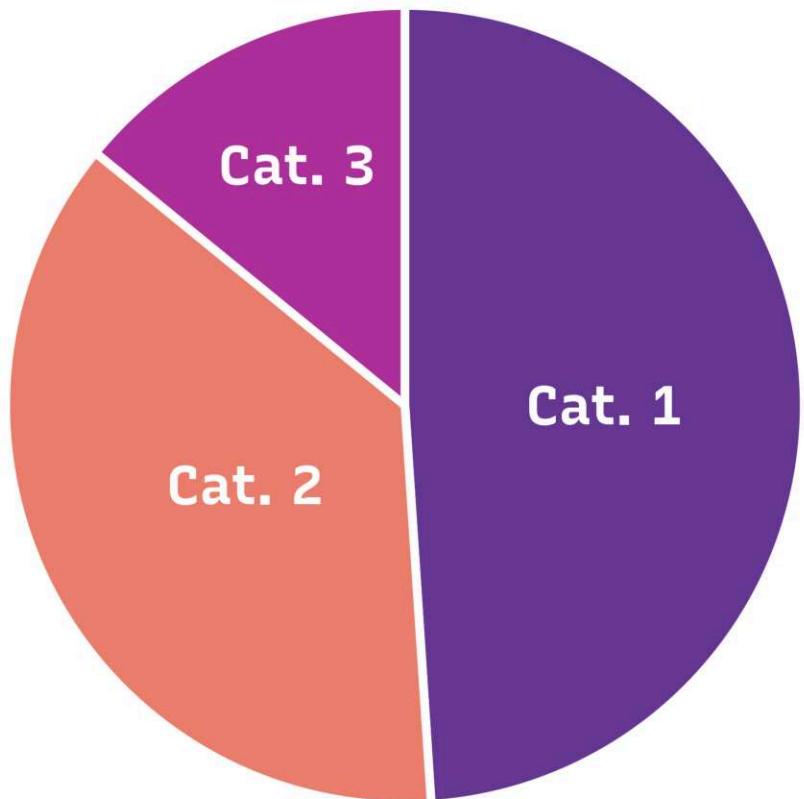
Bar Chart



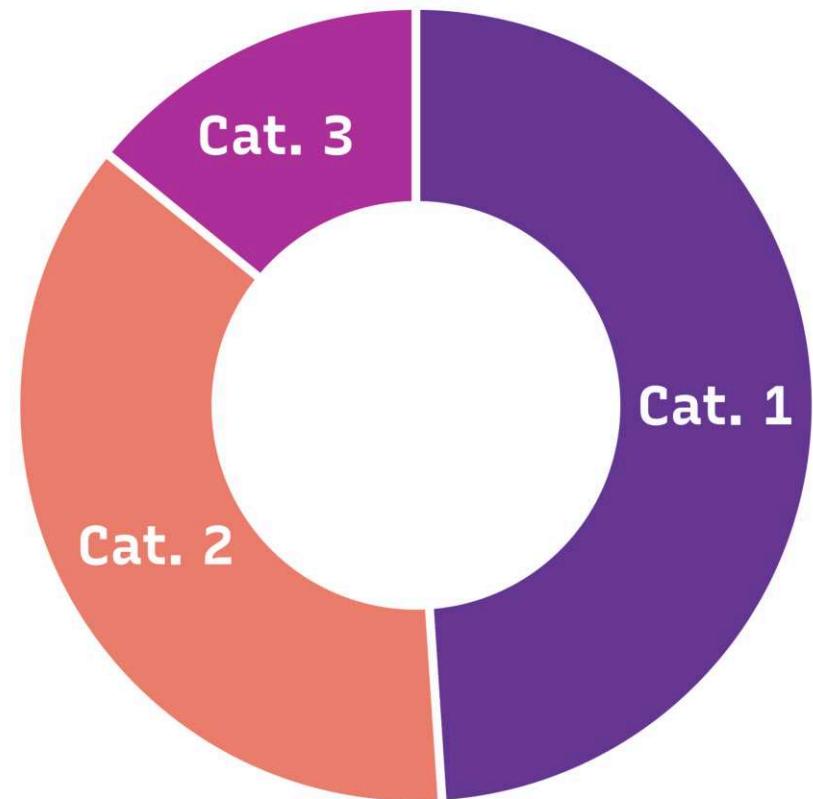
Bar Chart (stacked to 100%)



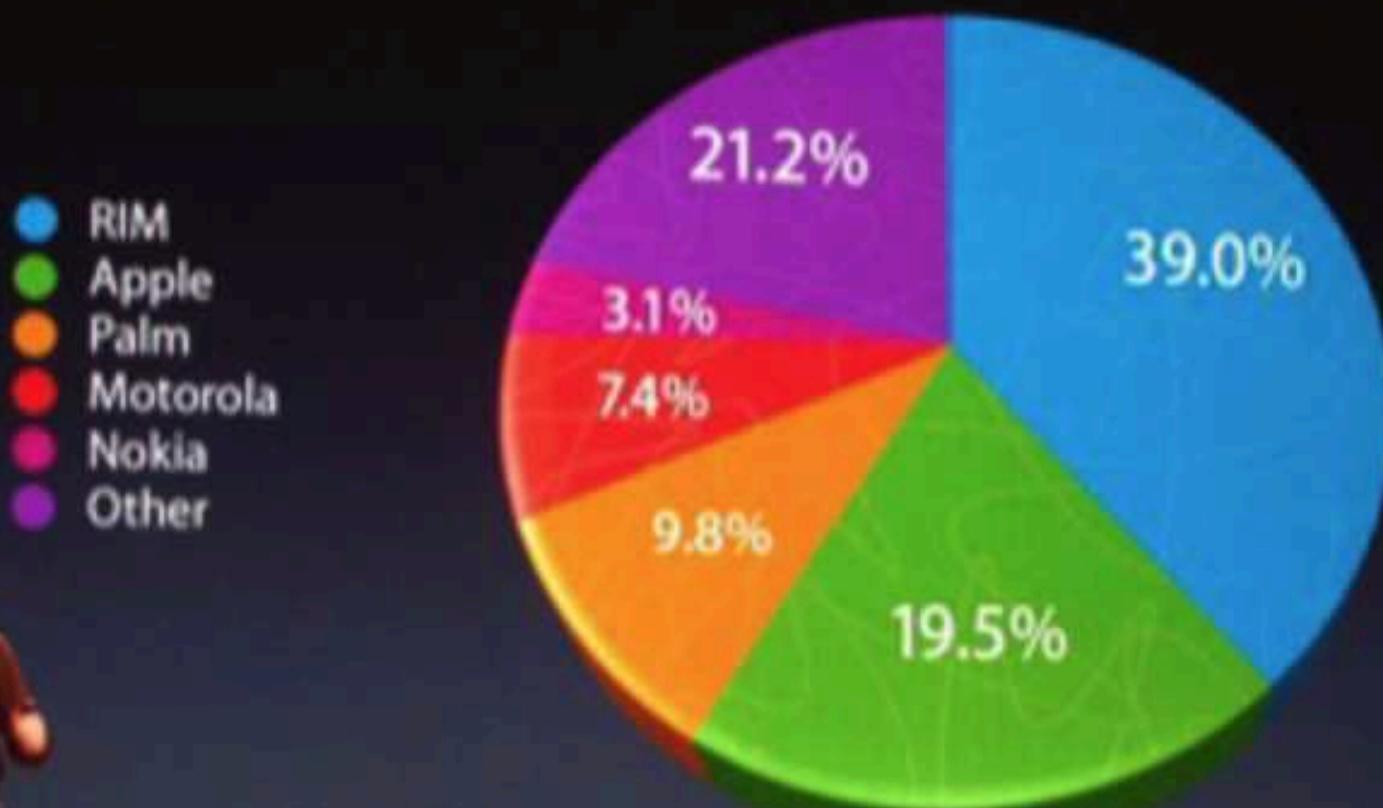
Pie Chart



Donut Chart



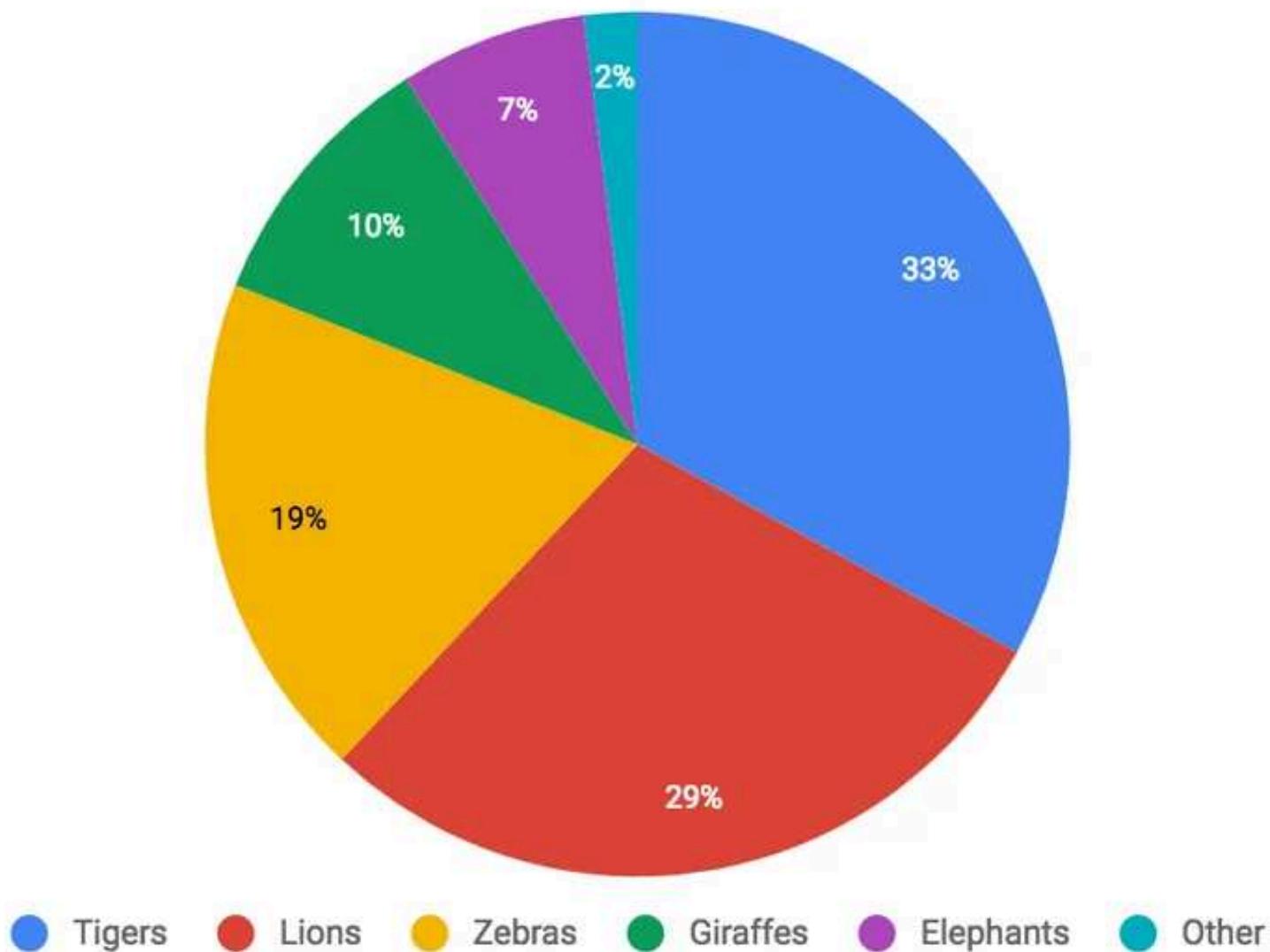
U.S. Smartphone Marketshare



Smart phone market shares presented by Steve Jobs (June 9, 2008)



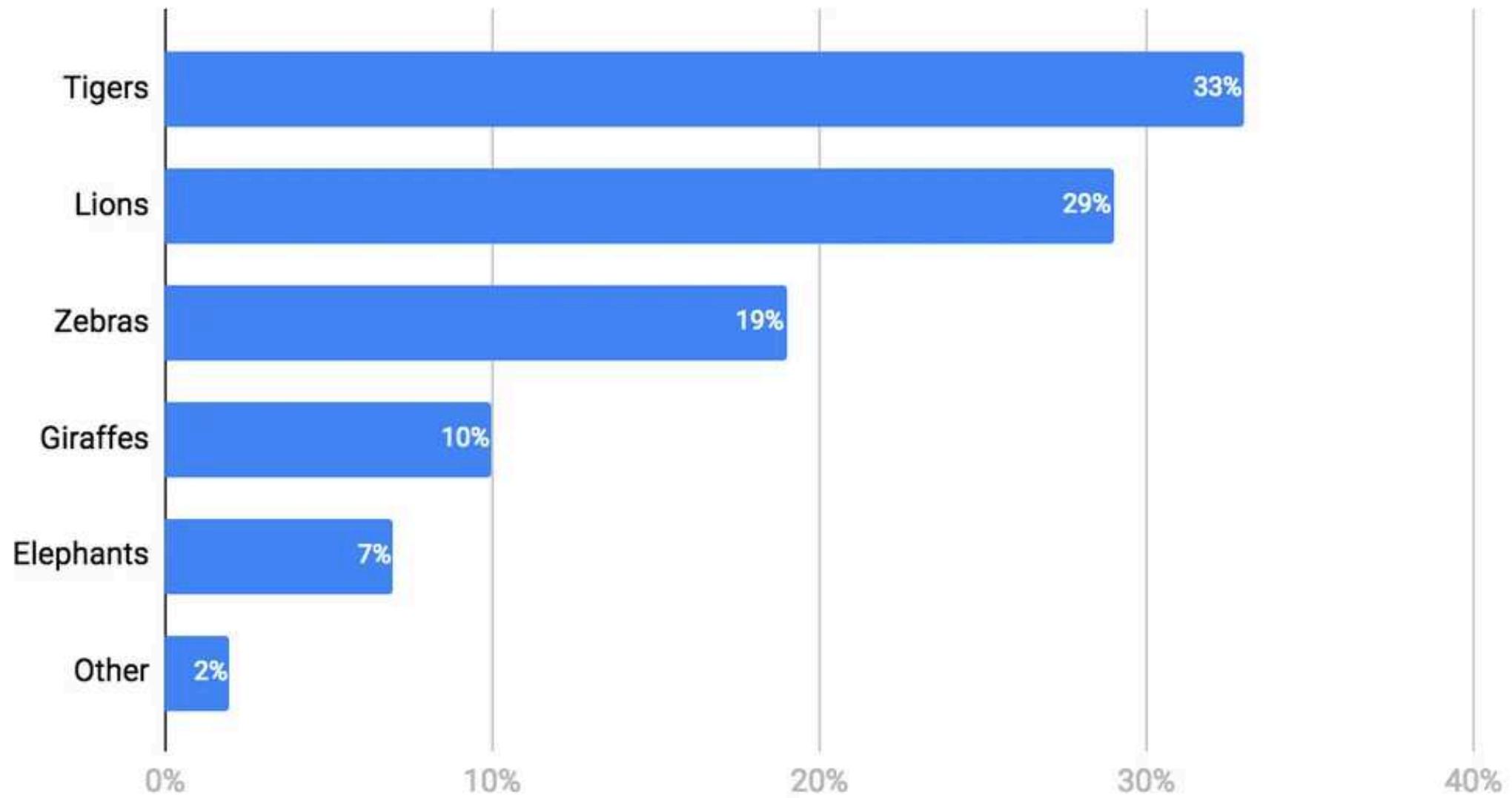
What is your favourite animal?



Quelle: [Funnel.io](#)



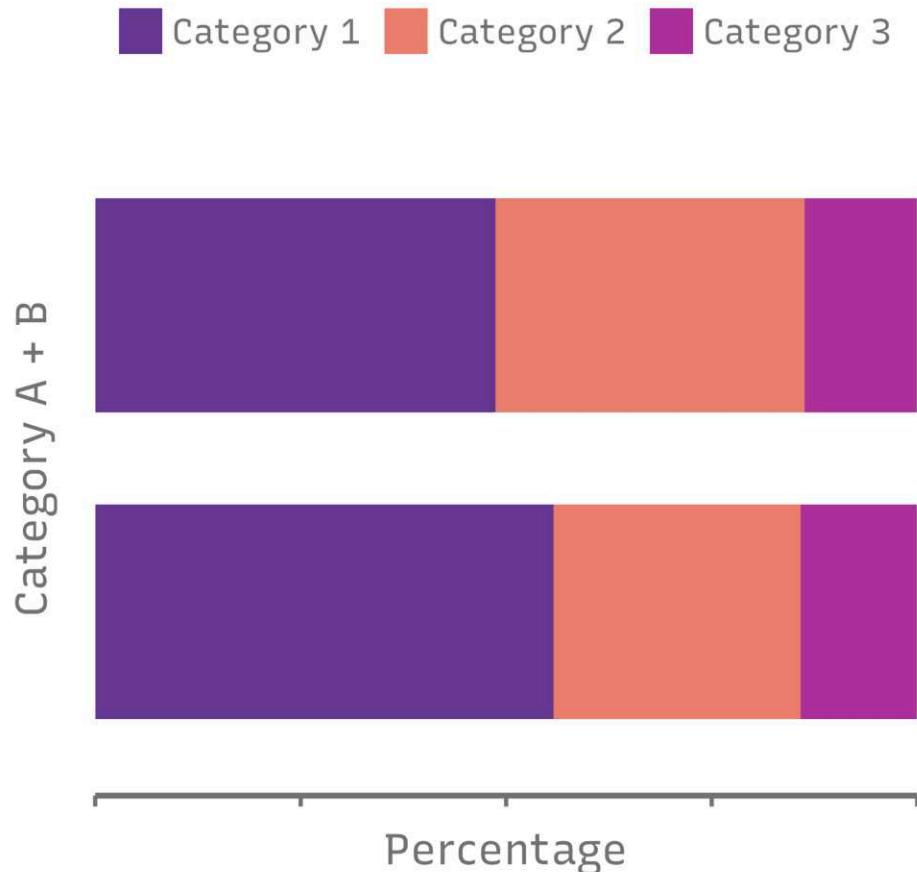
What is your favourite animal?



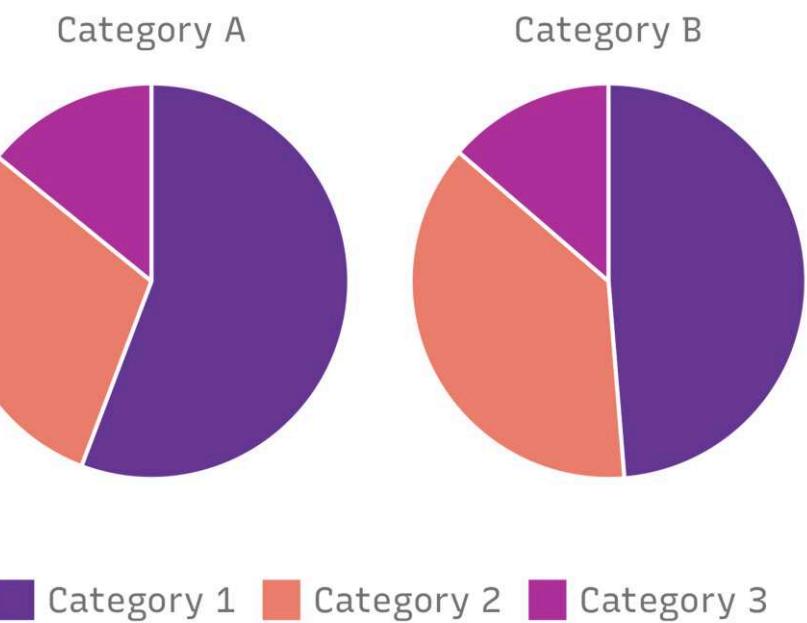
Quelle: [Funnel.io](#)



Bar Chart (stacked to 100%)



Pie Chart



Treemap



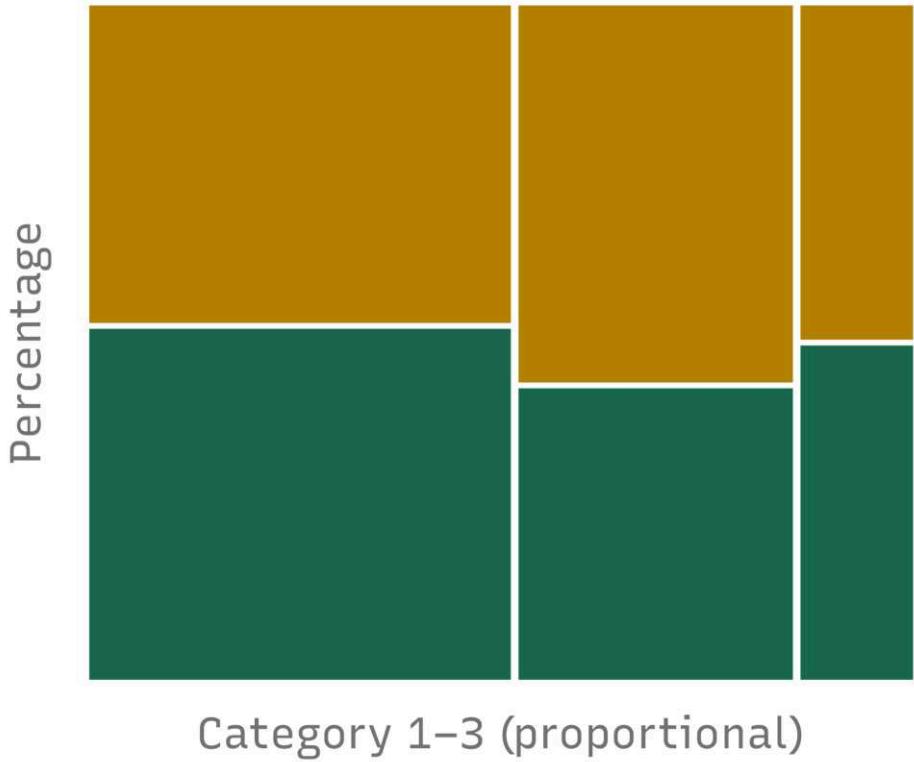
Nested Treemap

Category A Category B



Mosaic Plot (Marimekko Chart)

Category A Category B



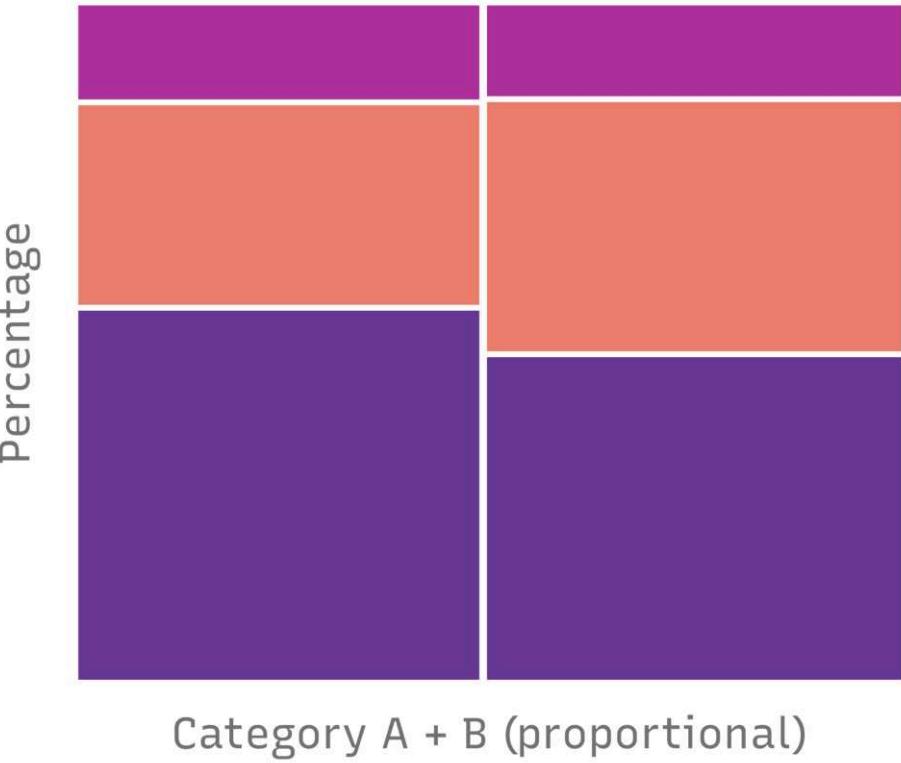
Nested Treemap

Category A Category B



Mosaic Plot (Marimekko Chart)

Category 1 Category 2 Category 3



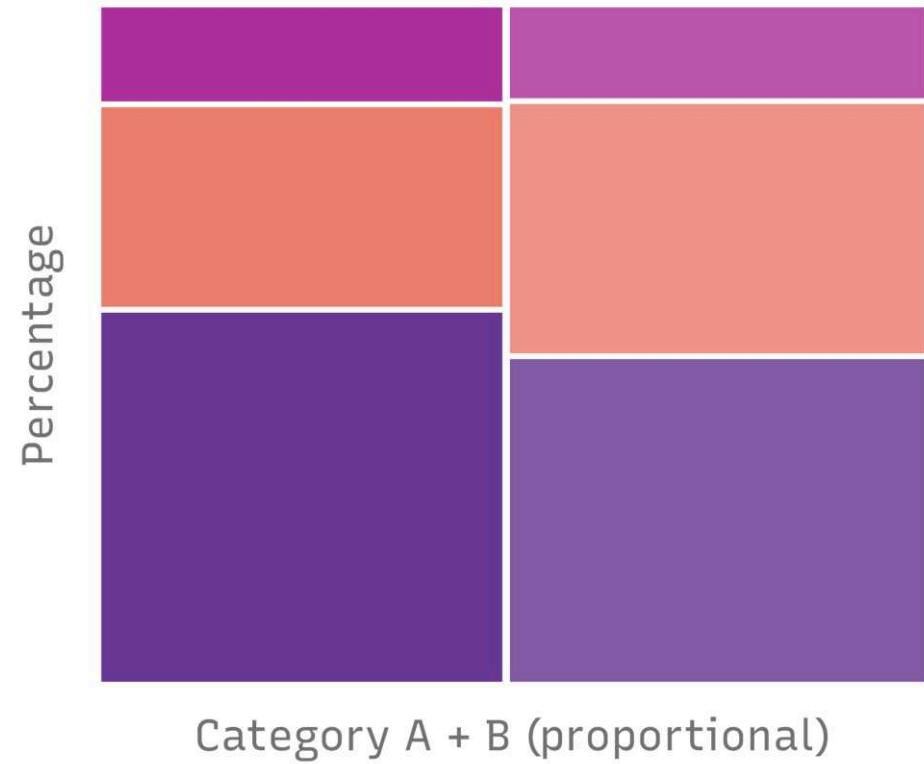
Nested Treemap

Category A Category B



Mosaic Plot (Marimekko Chart)

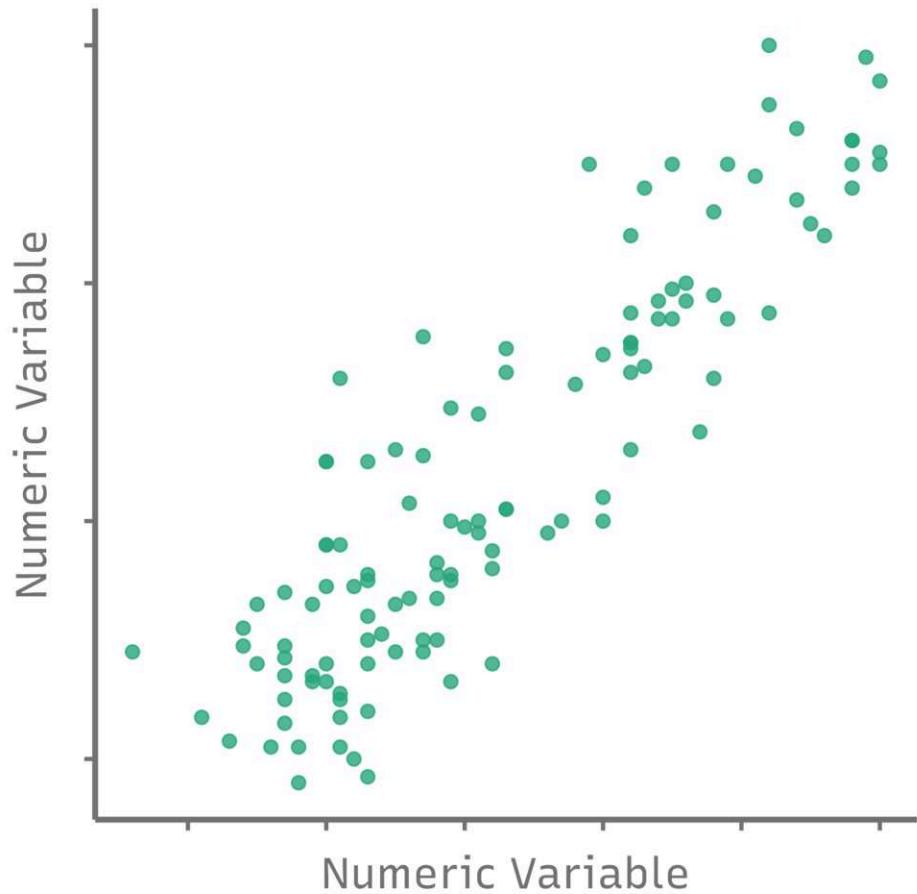
Category 1 Category 2 Category 3



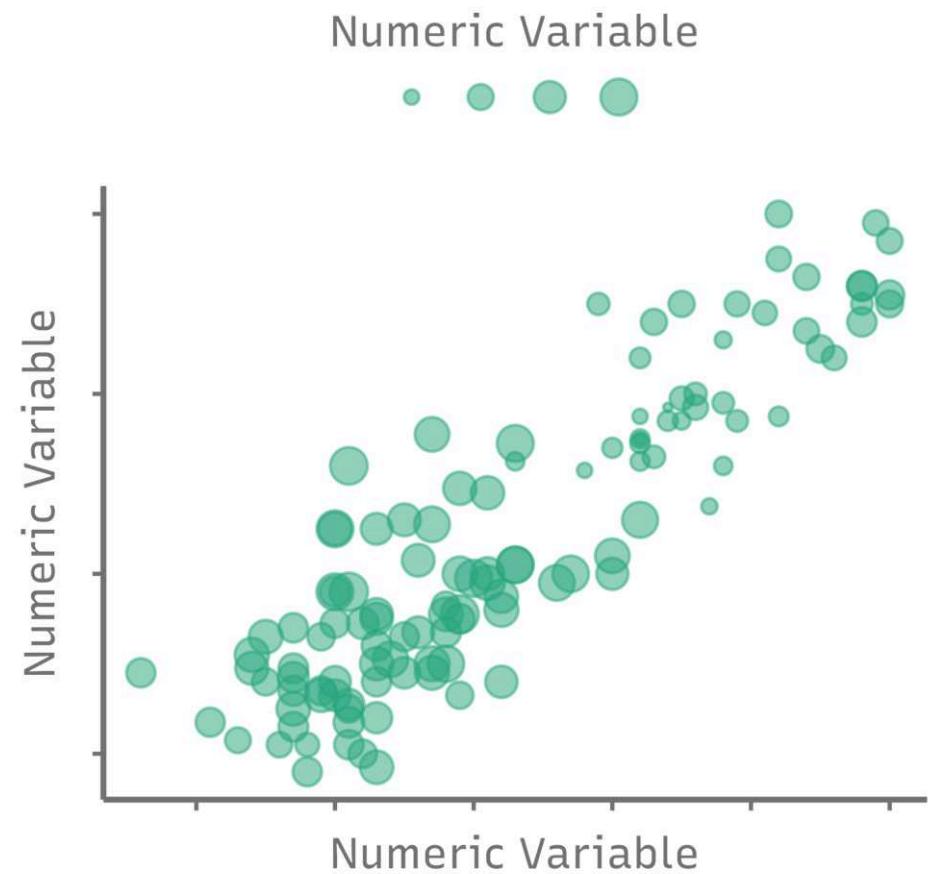
Beziehungen darstellen



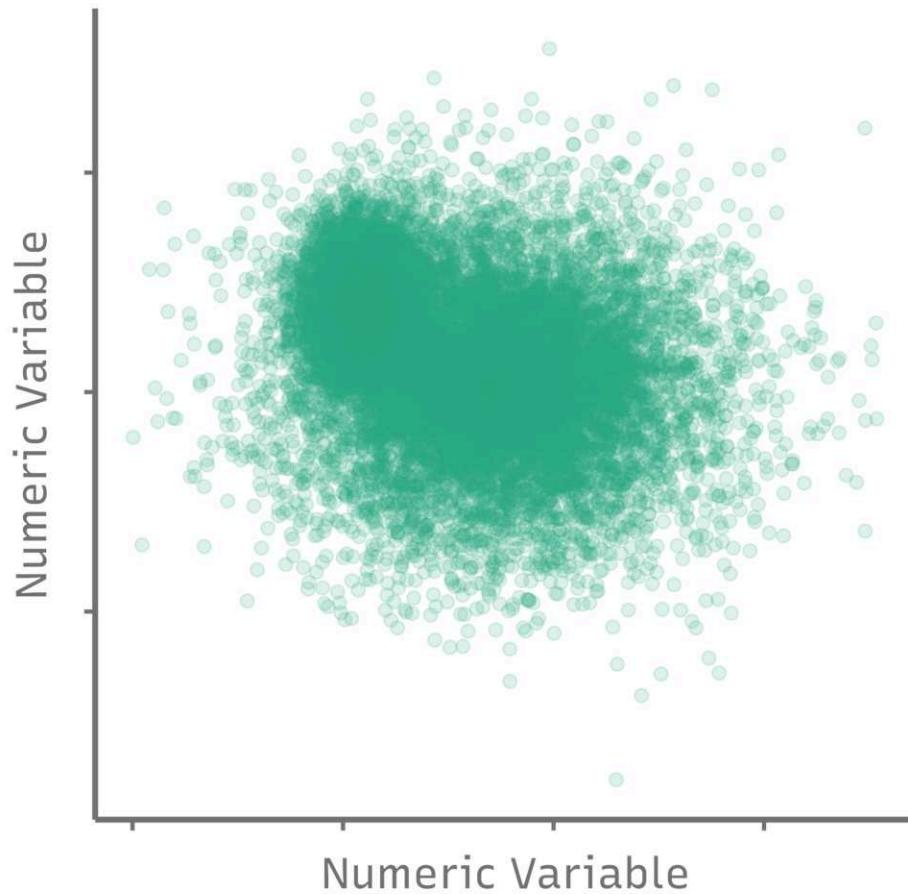
Scatter Plot



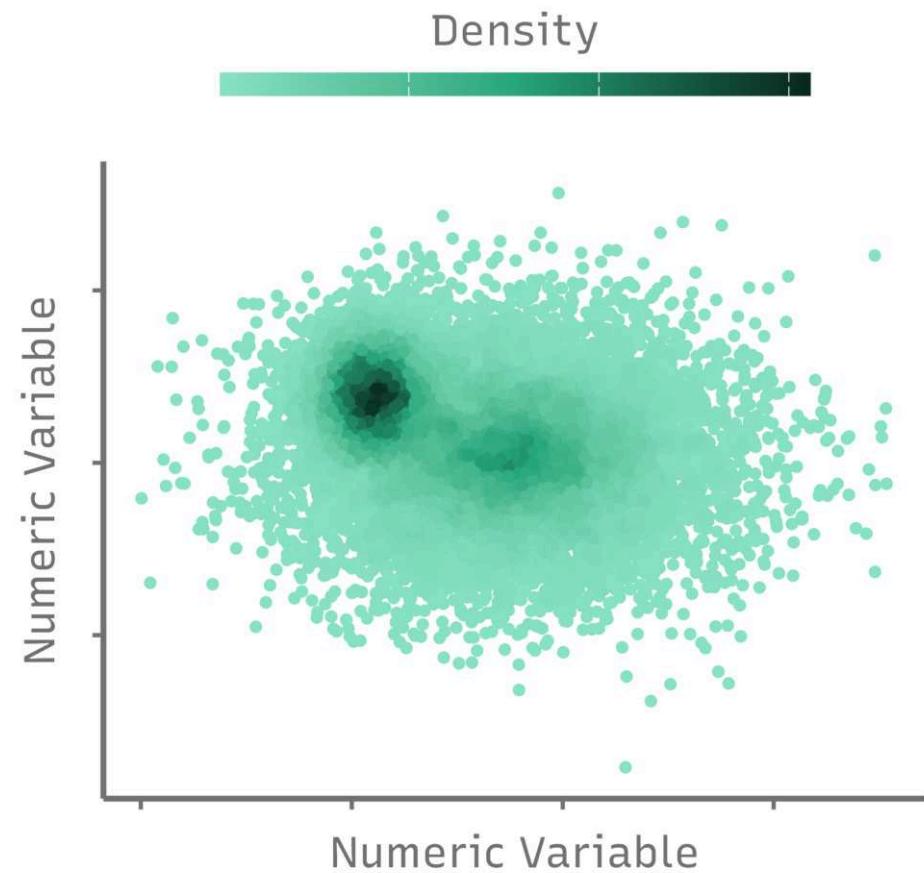
Bubble Chart



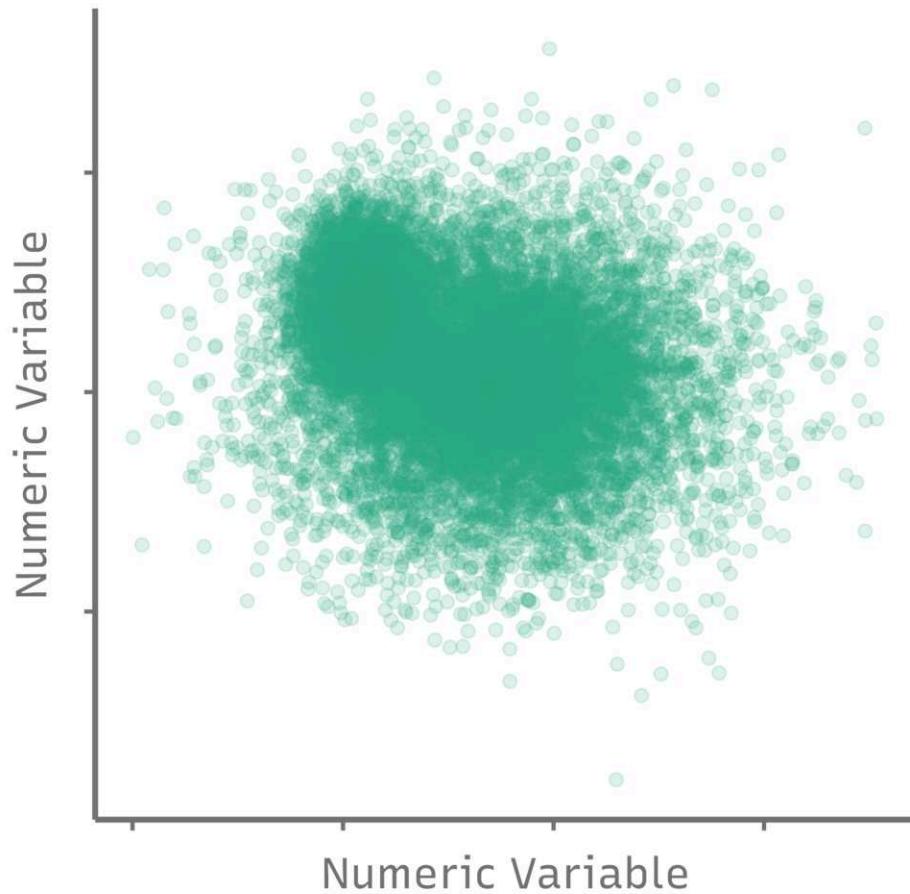
Scatter Plot



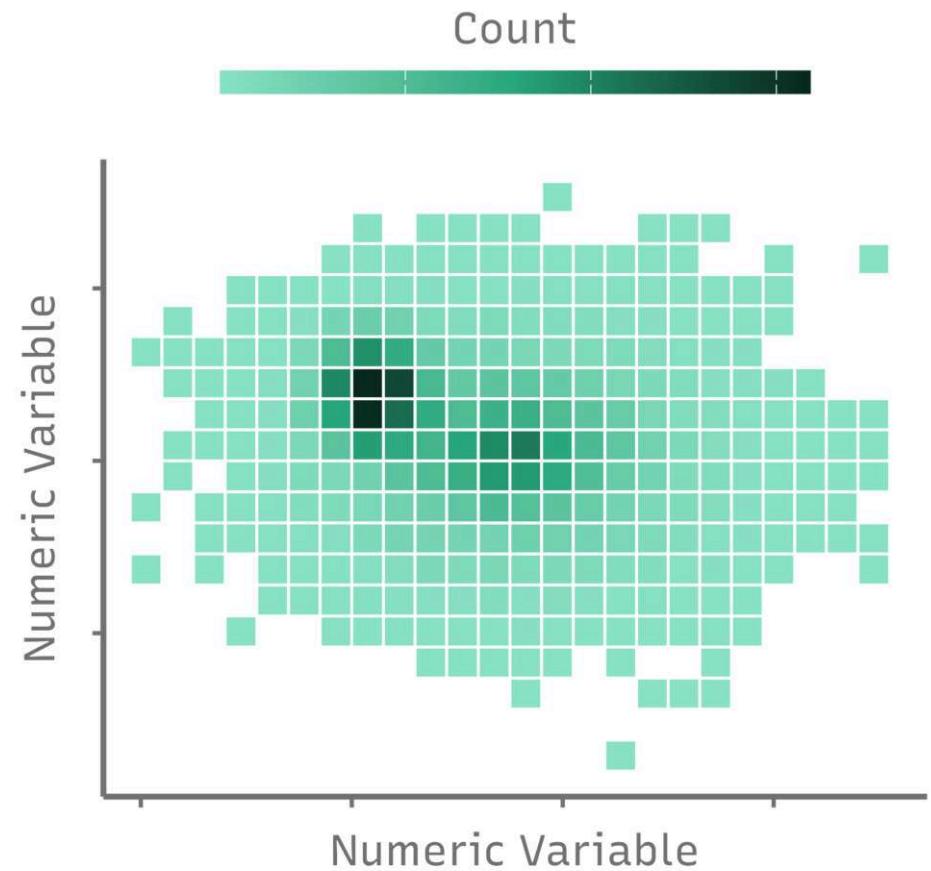
Scatter Plot: Point Density



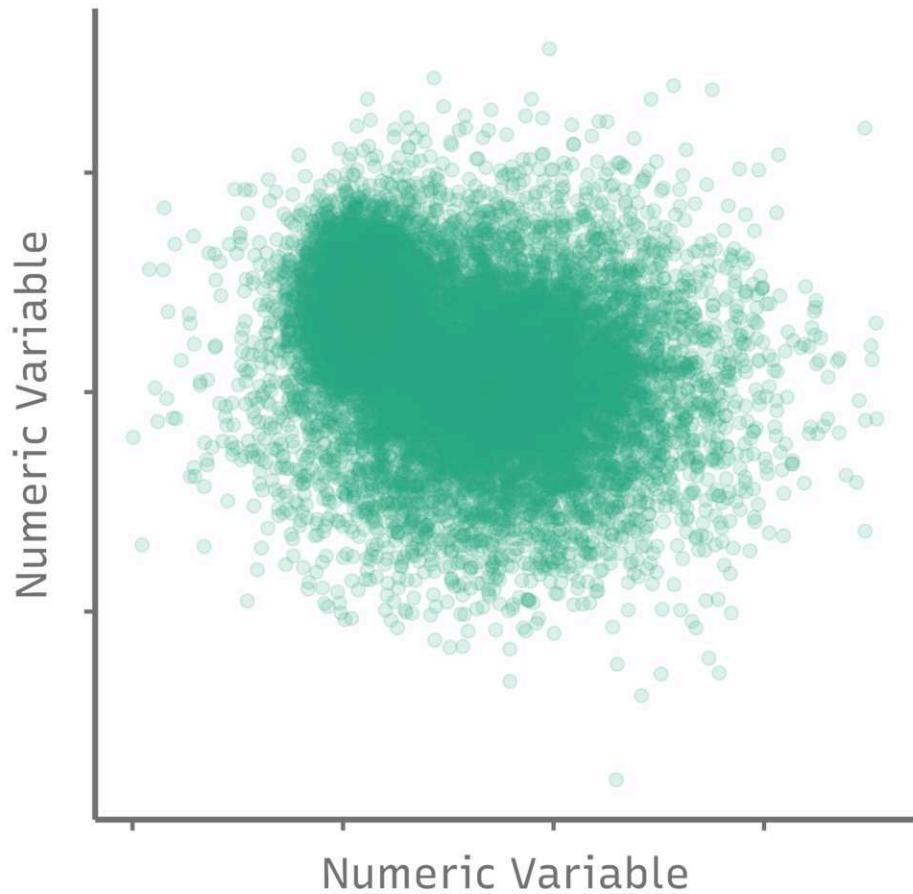
Scatter Plot



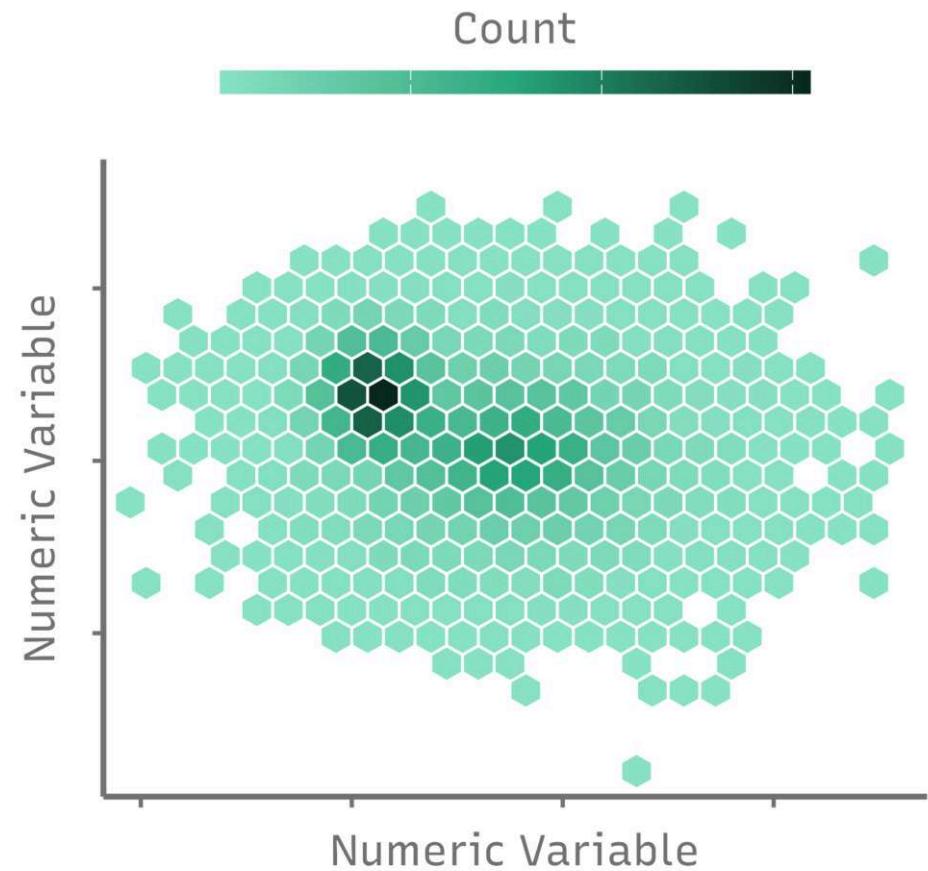
Binned Scatter Plot: Tile Grid



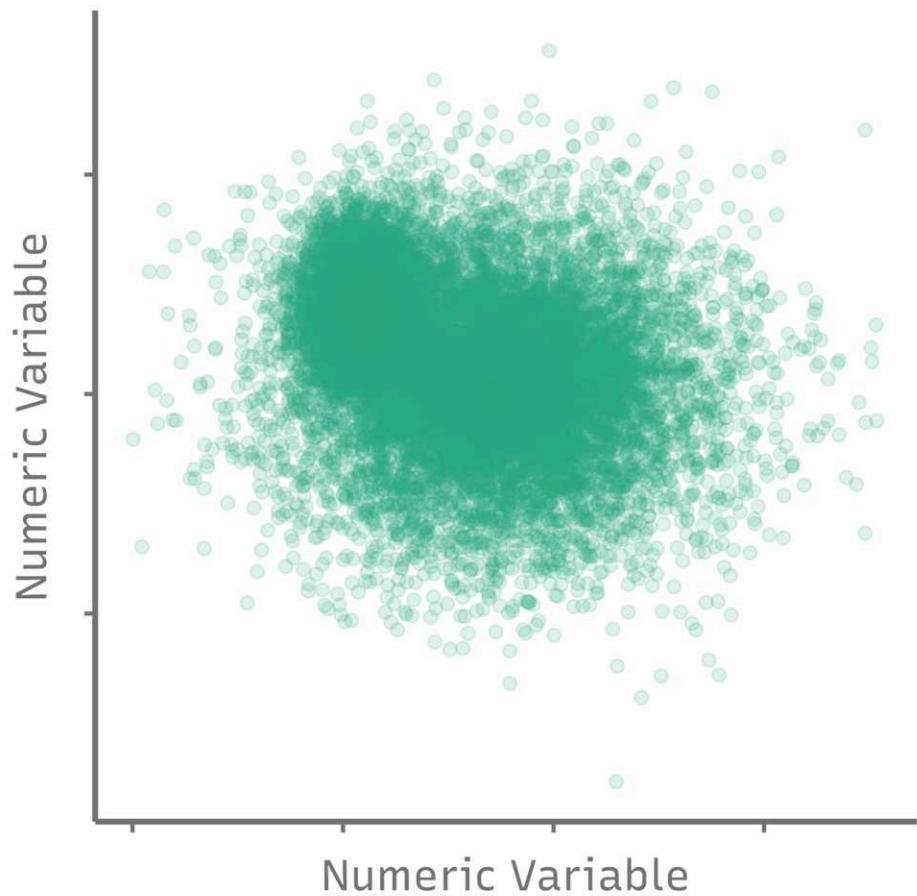
Scatter Plot



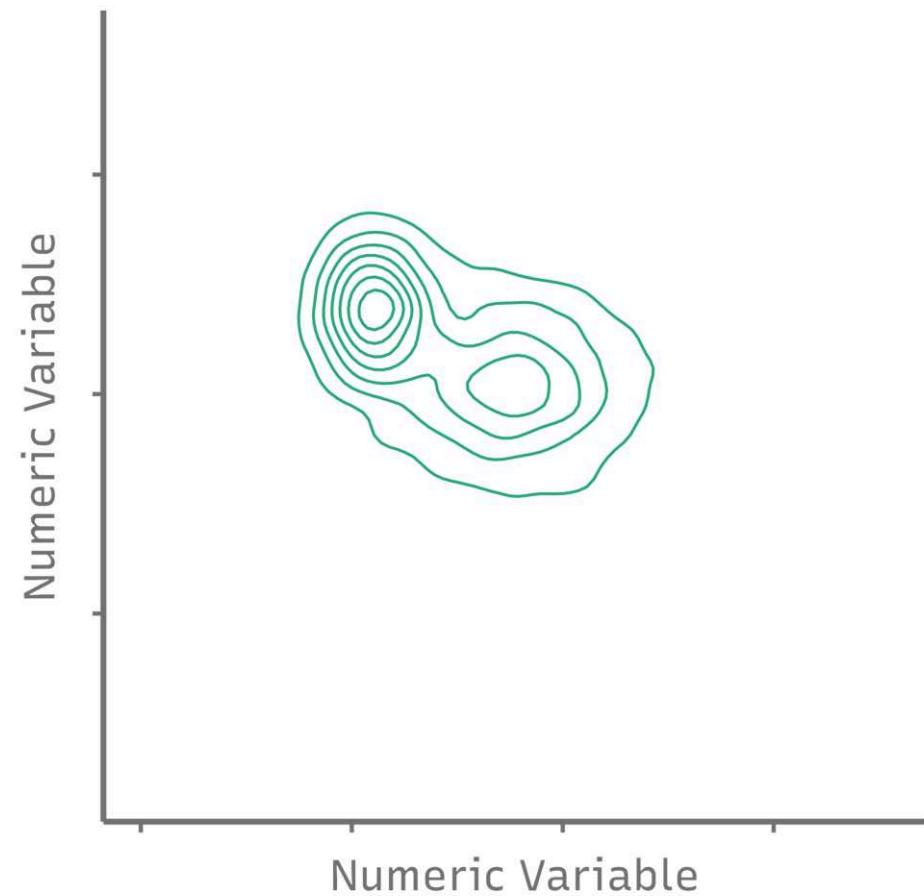
Binned Scatter Plot: Hex Grid



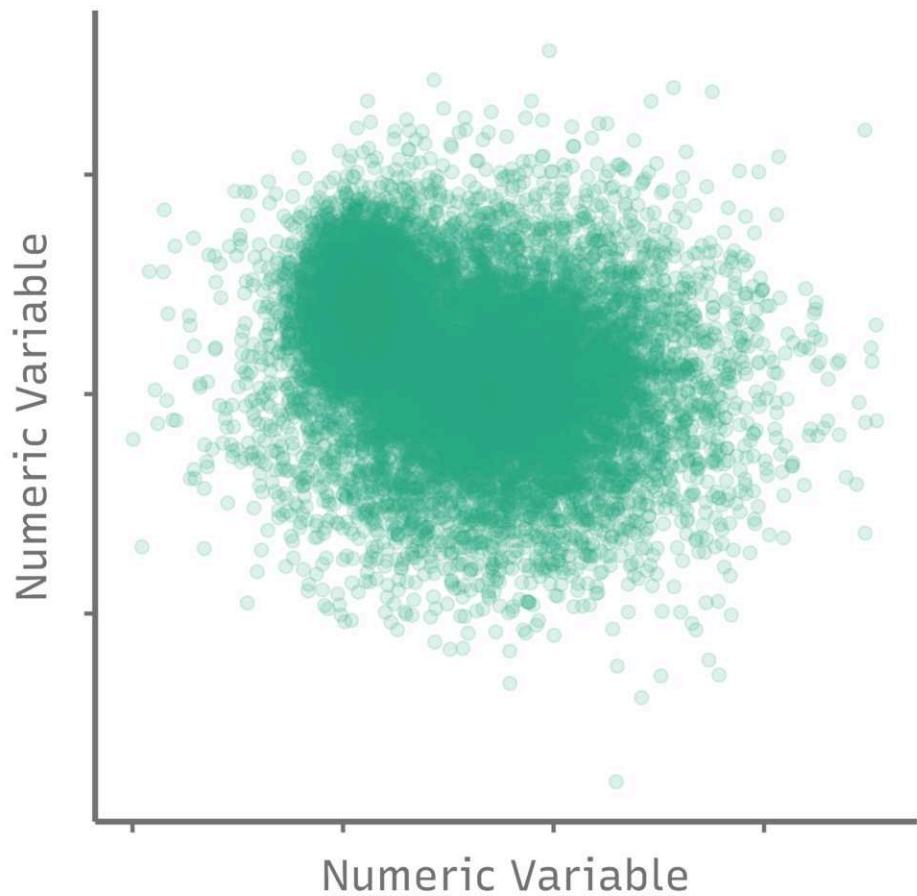
Scatter Plot



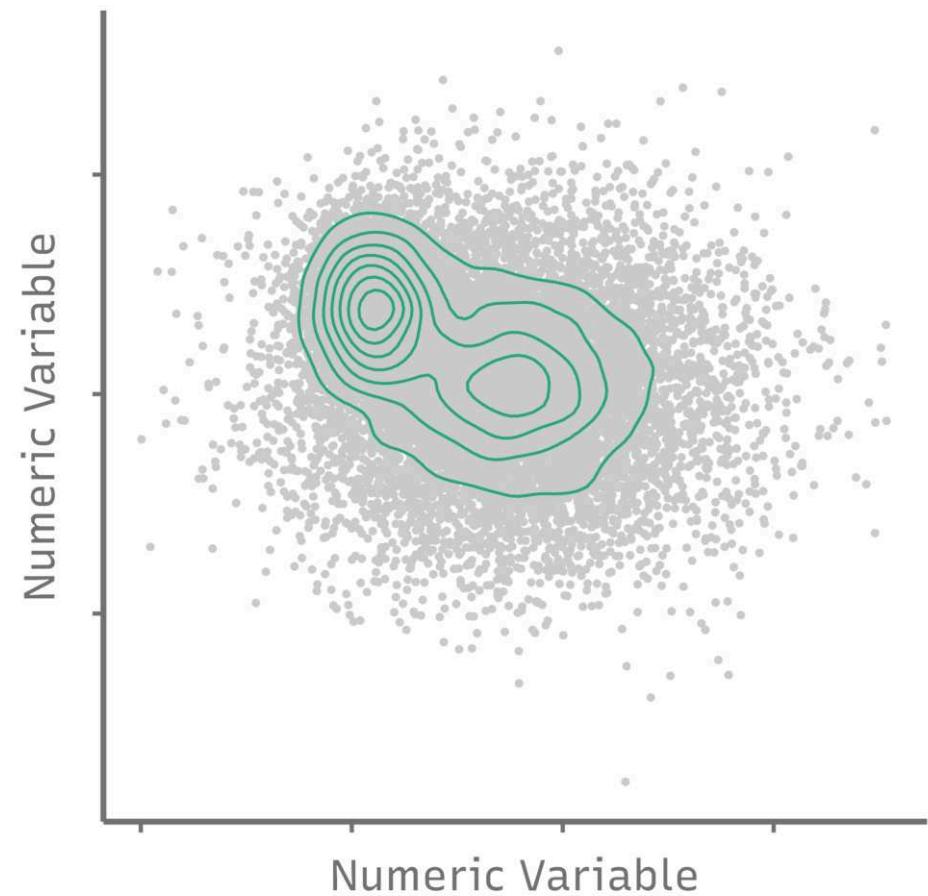
Density Contour Plot



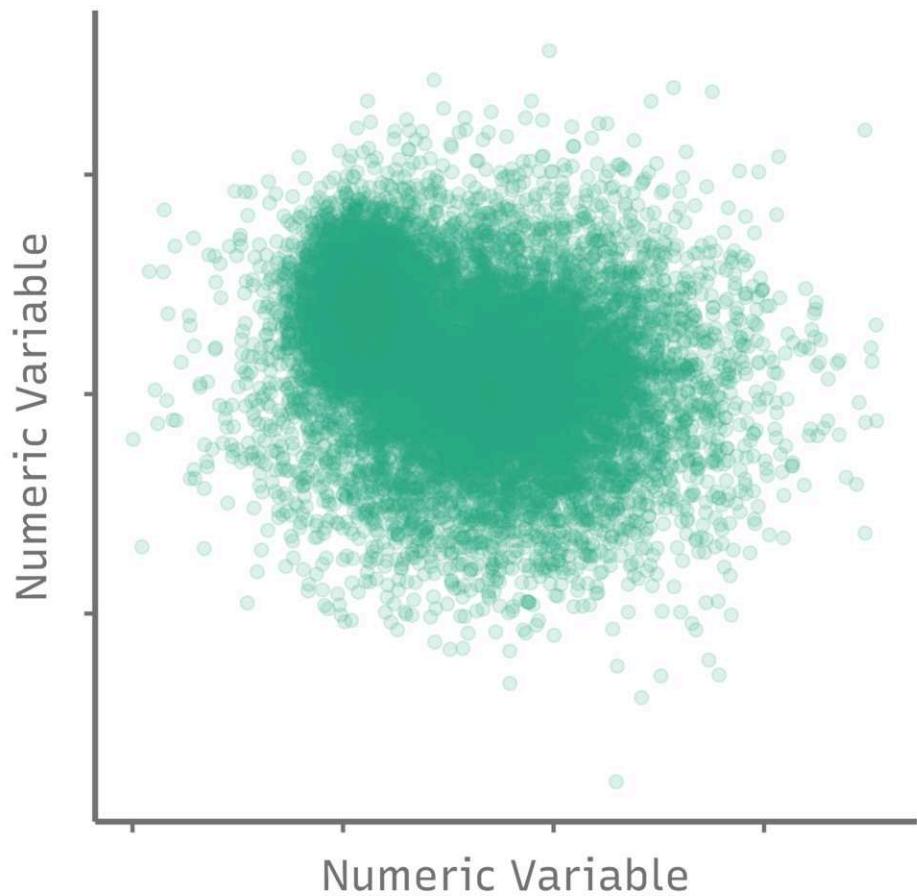
Scatter Plot



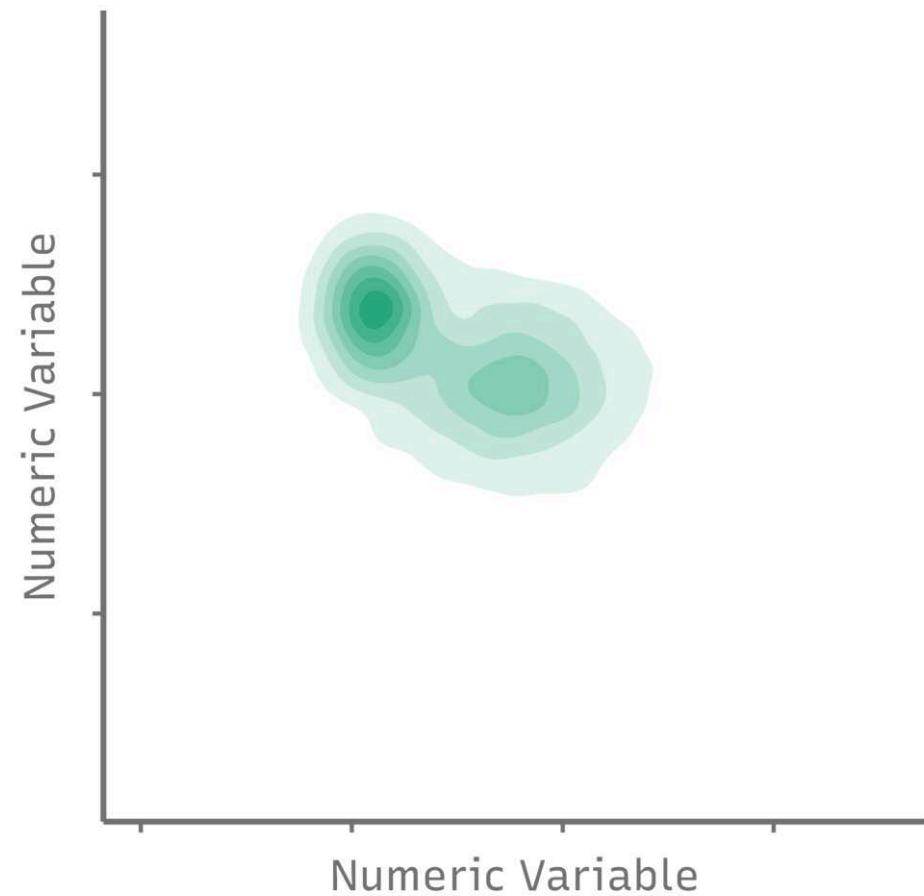
Density Contour Plot



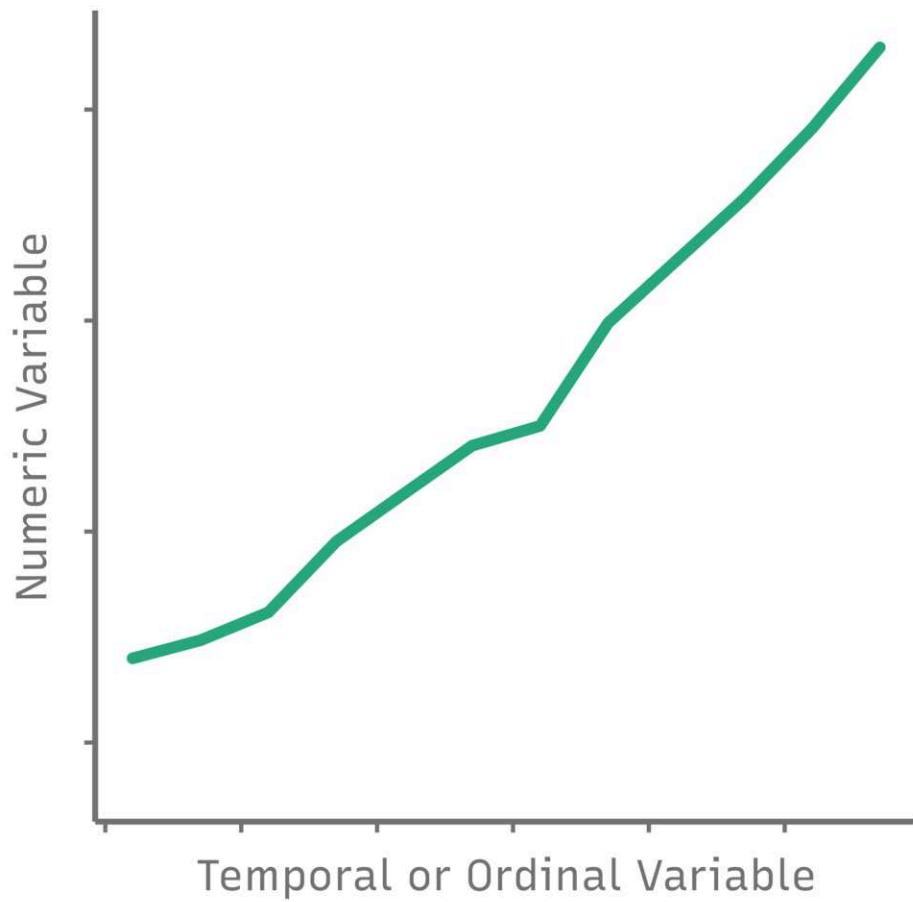
Scatter Plot



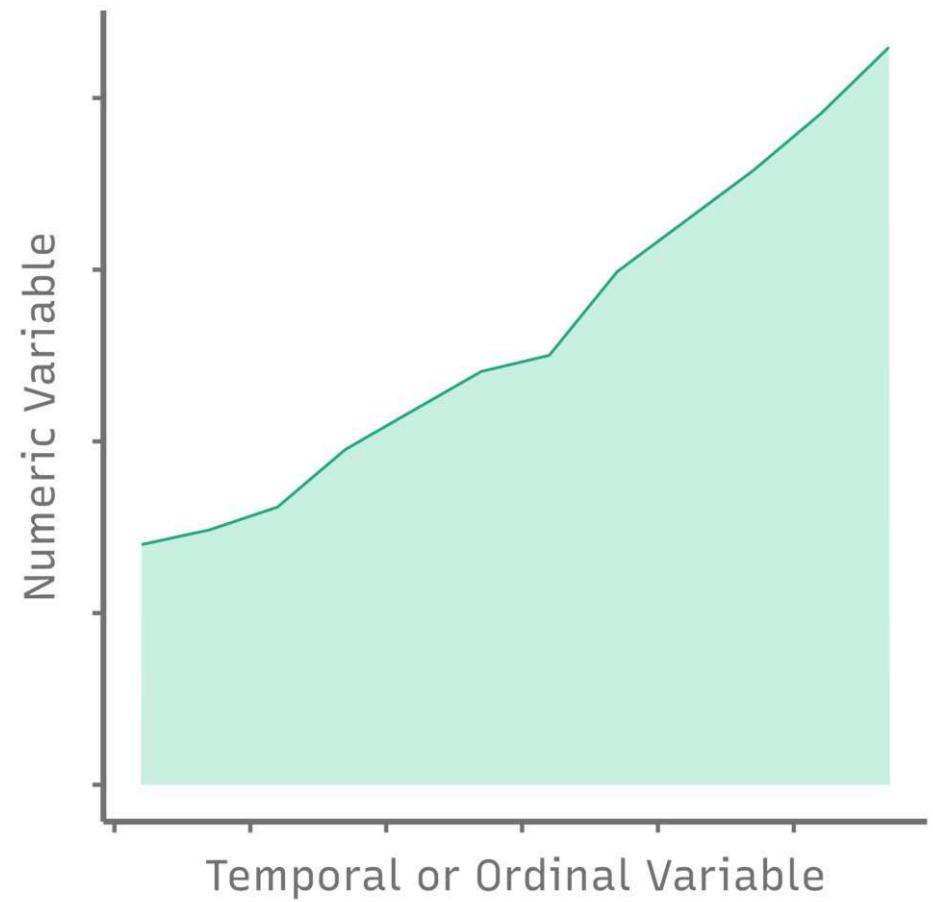
Density Contour Plot



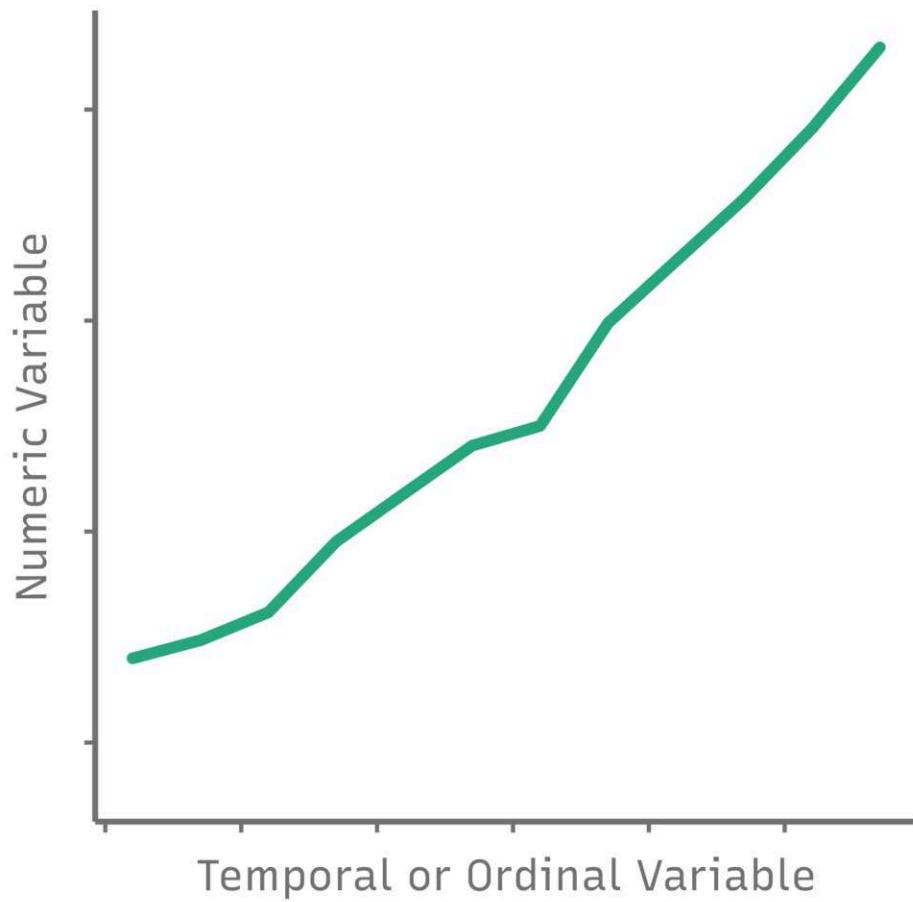
Line Chart (Time Series)



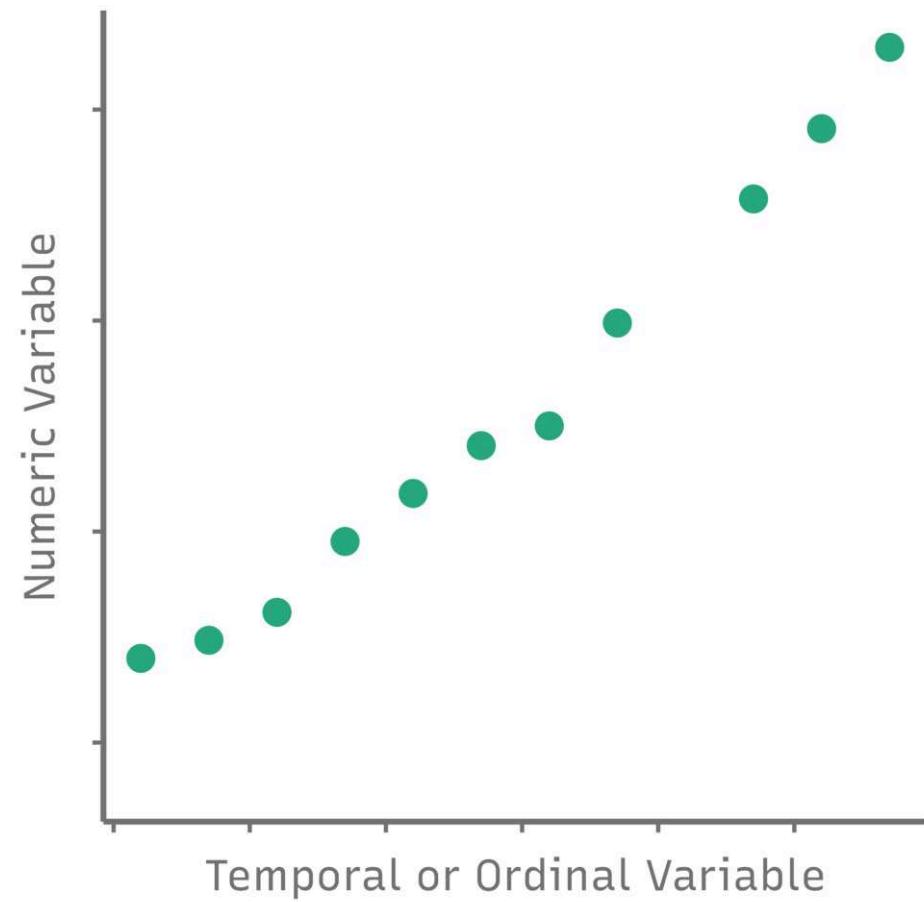
Area Chart (Time Series)



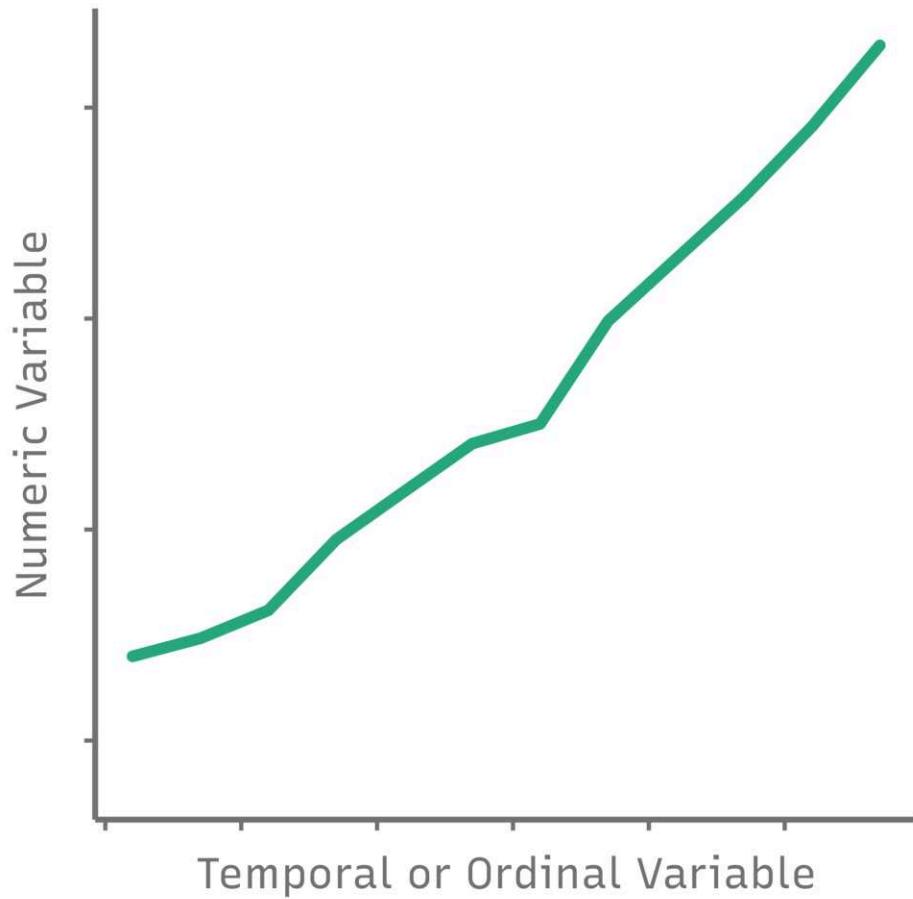
Line Chart (Time Series)



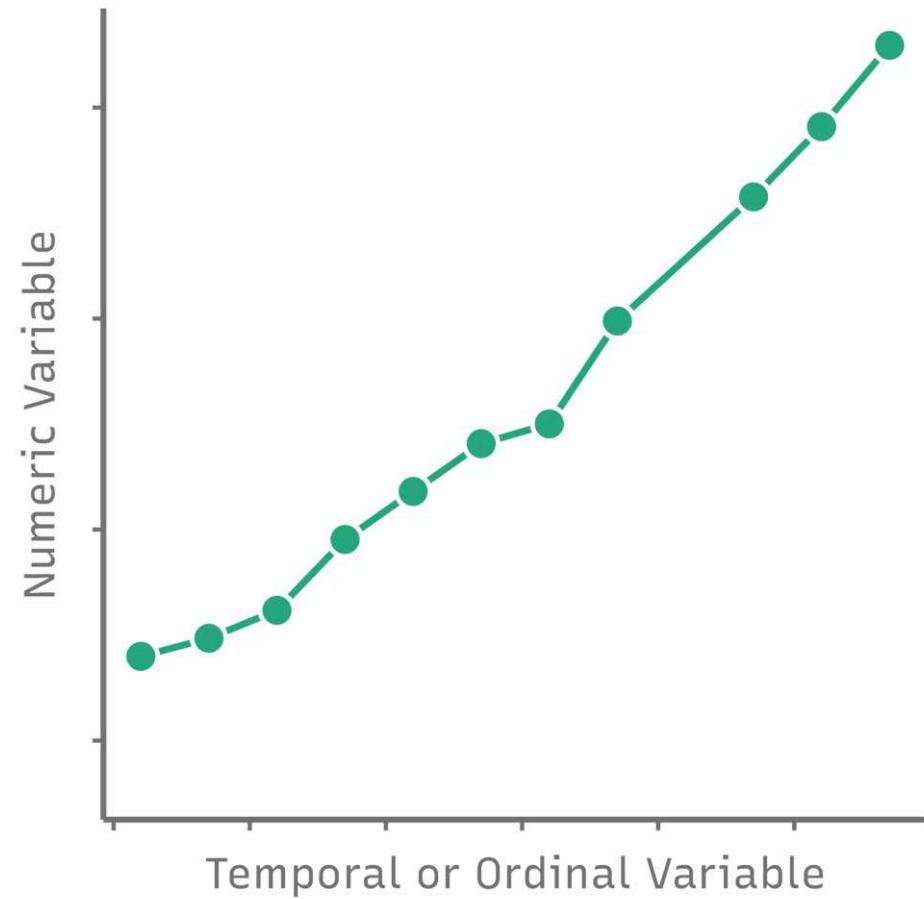
Scatter Plot (Time Series)



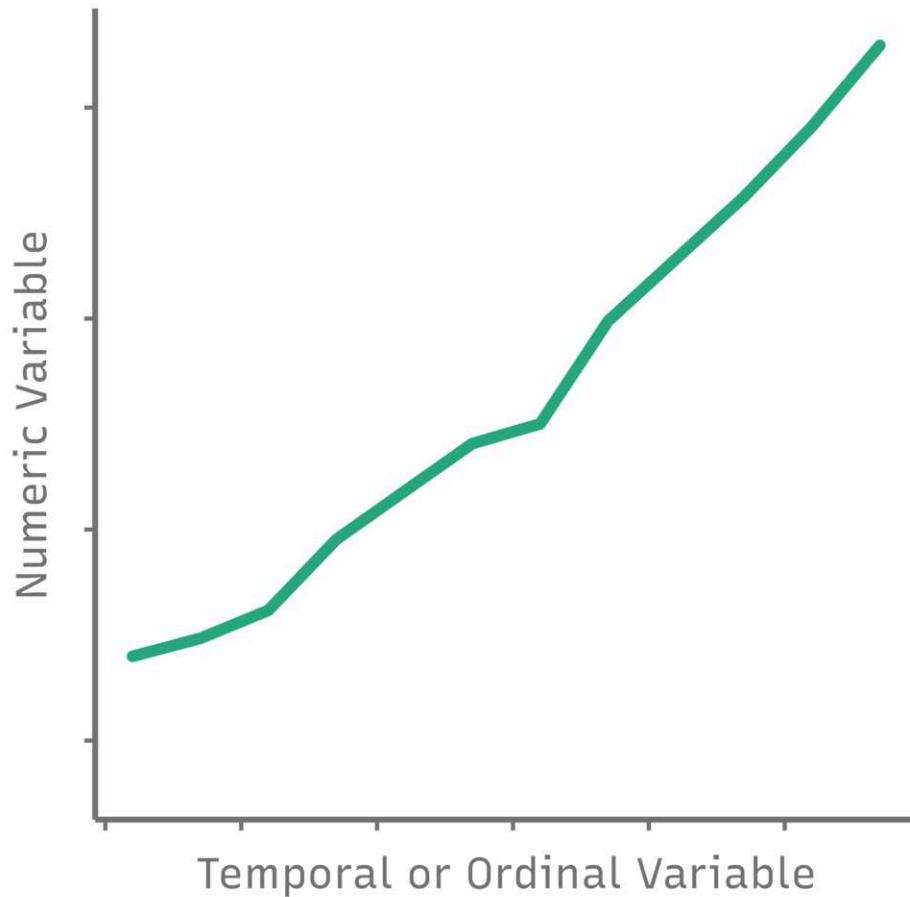
Line Chart (Time Series)



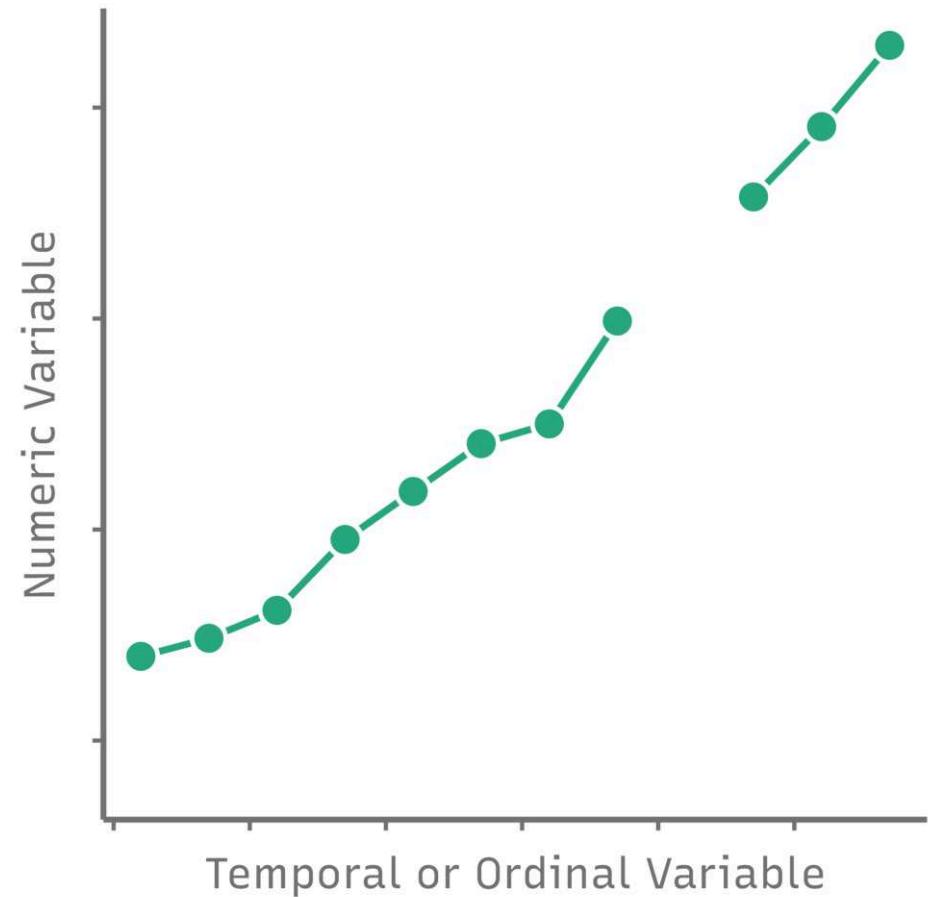
Line Chart with Markers



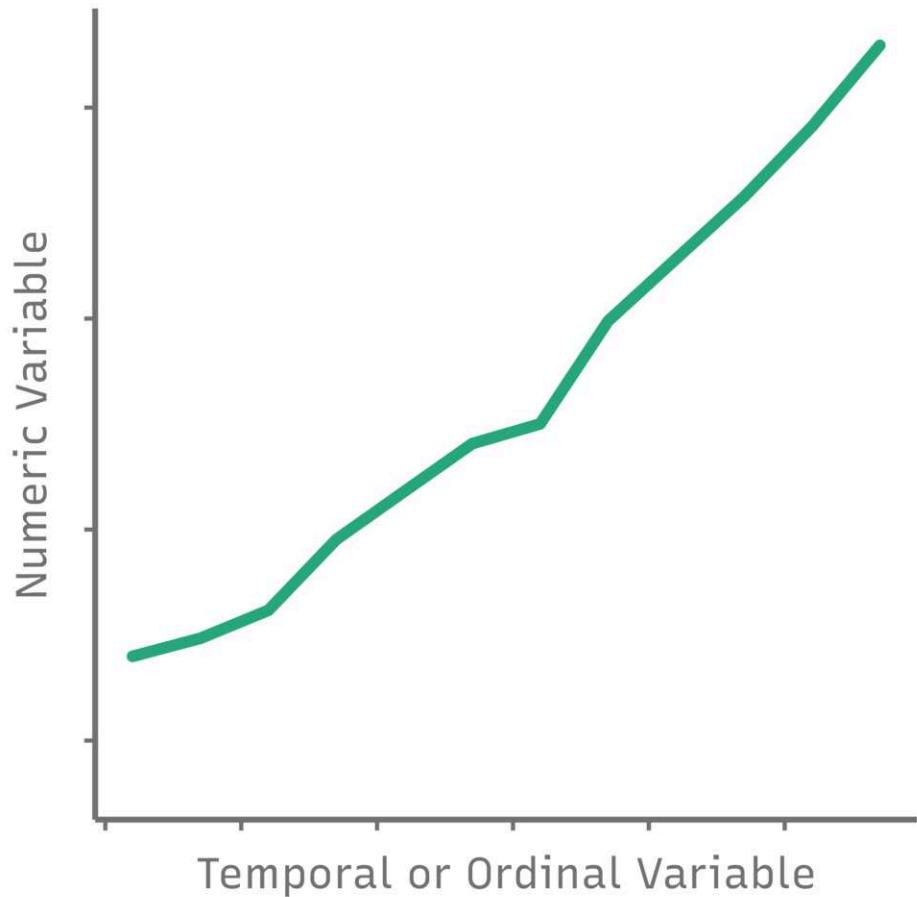
Line Chart (Time Series)



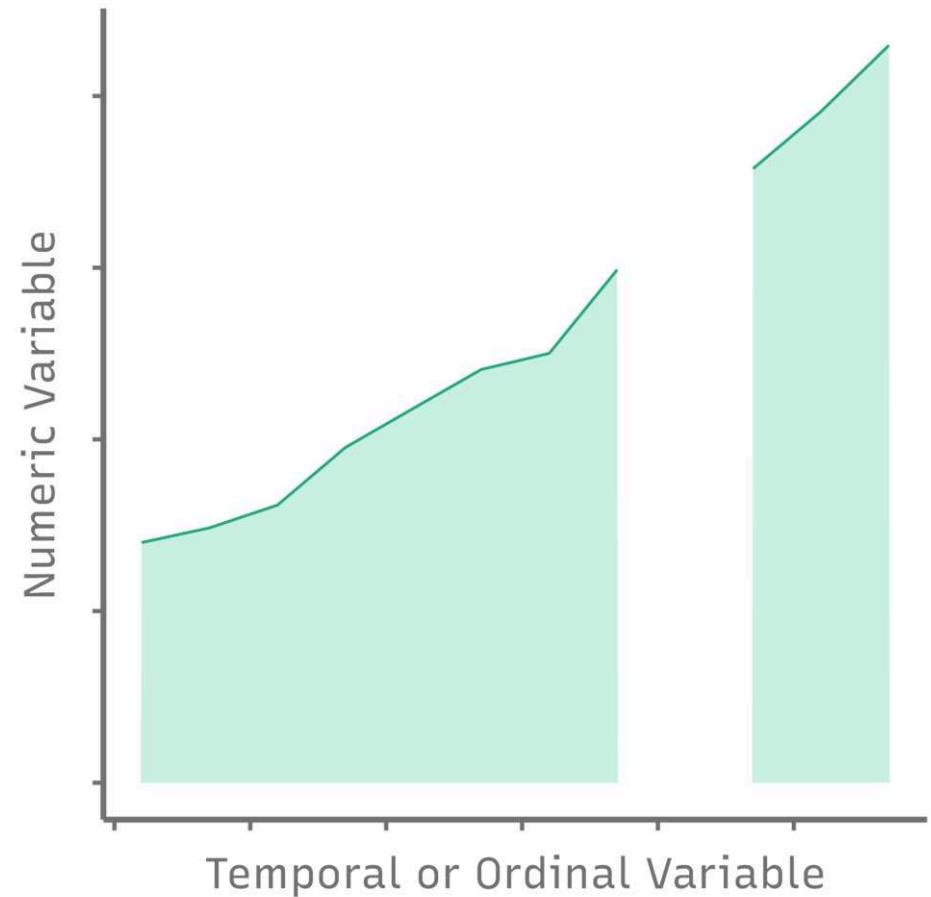
Line Chart with Markers + Gap



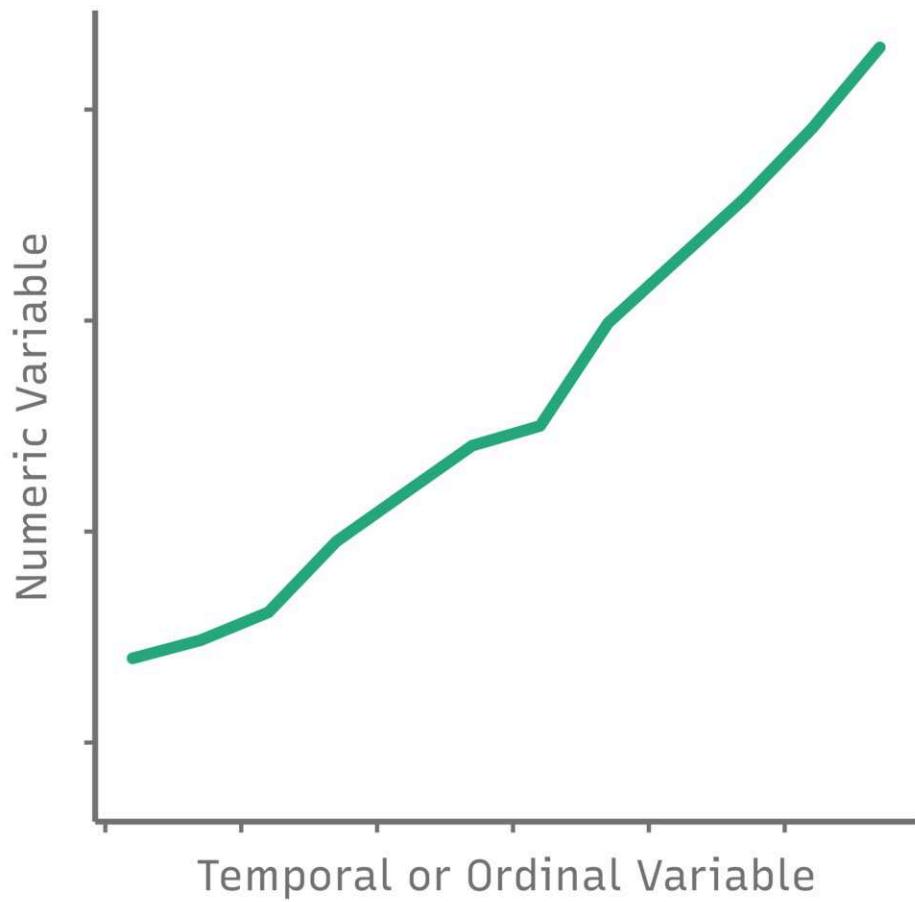
Line Chart (Time Series)



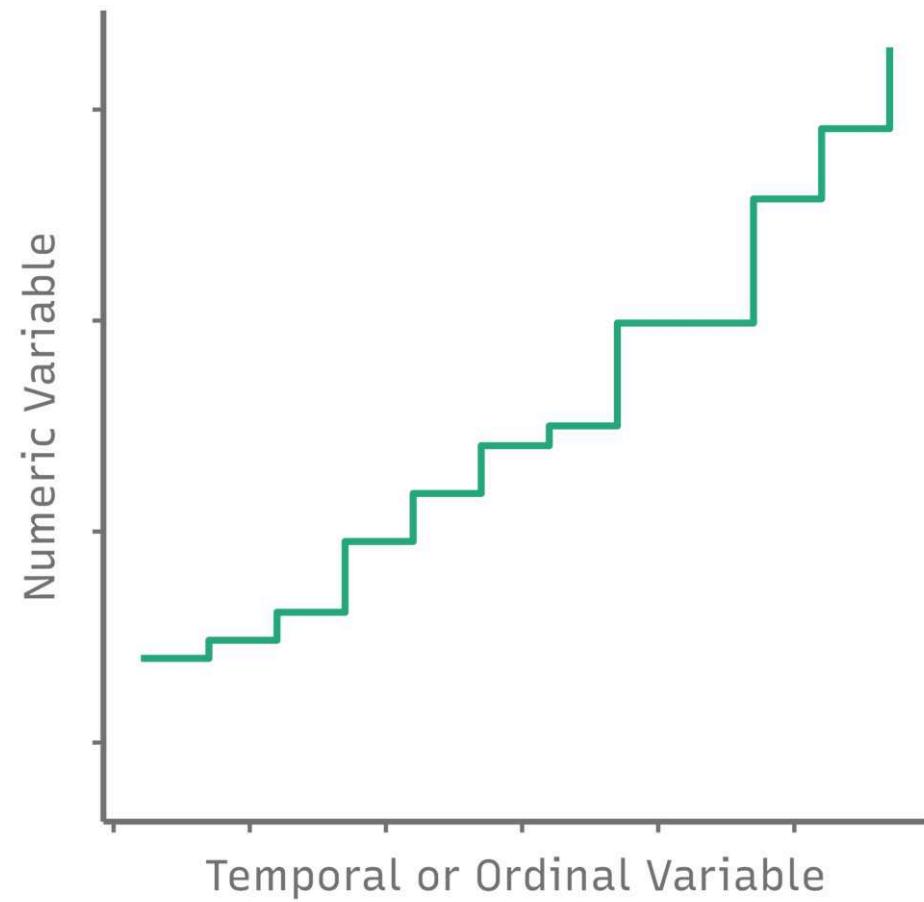
Area Chart with Gap



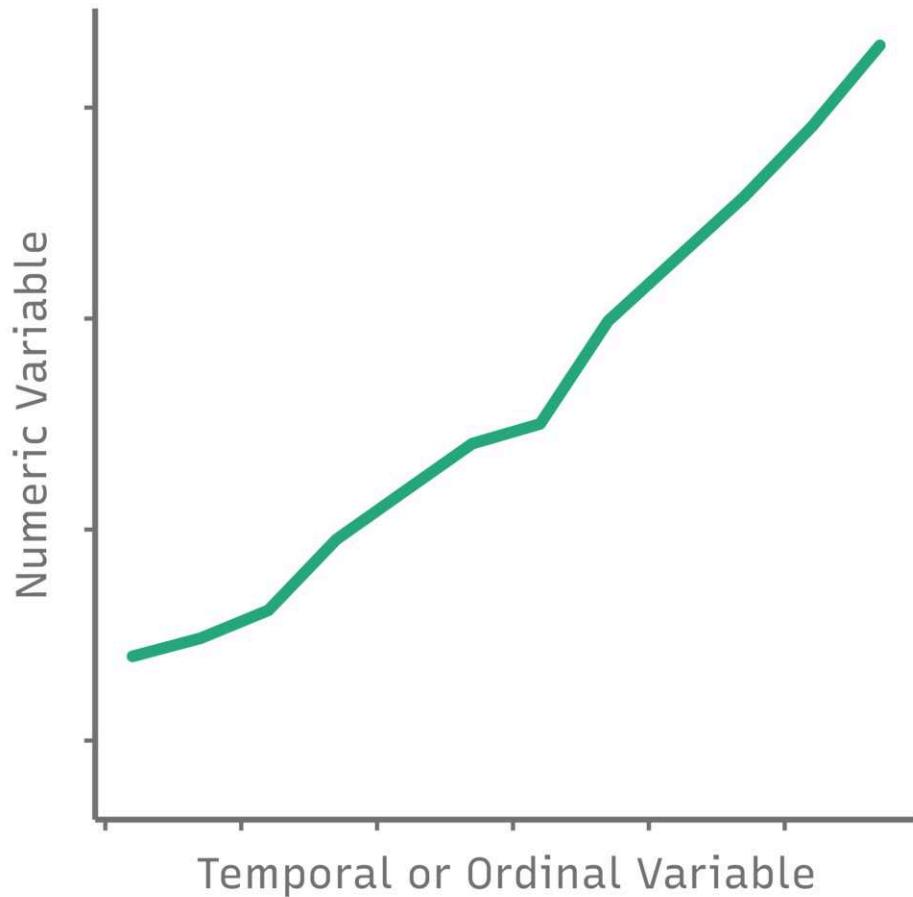
Line Chart (Time Series)



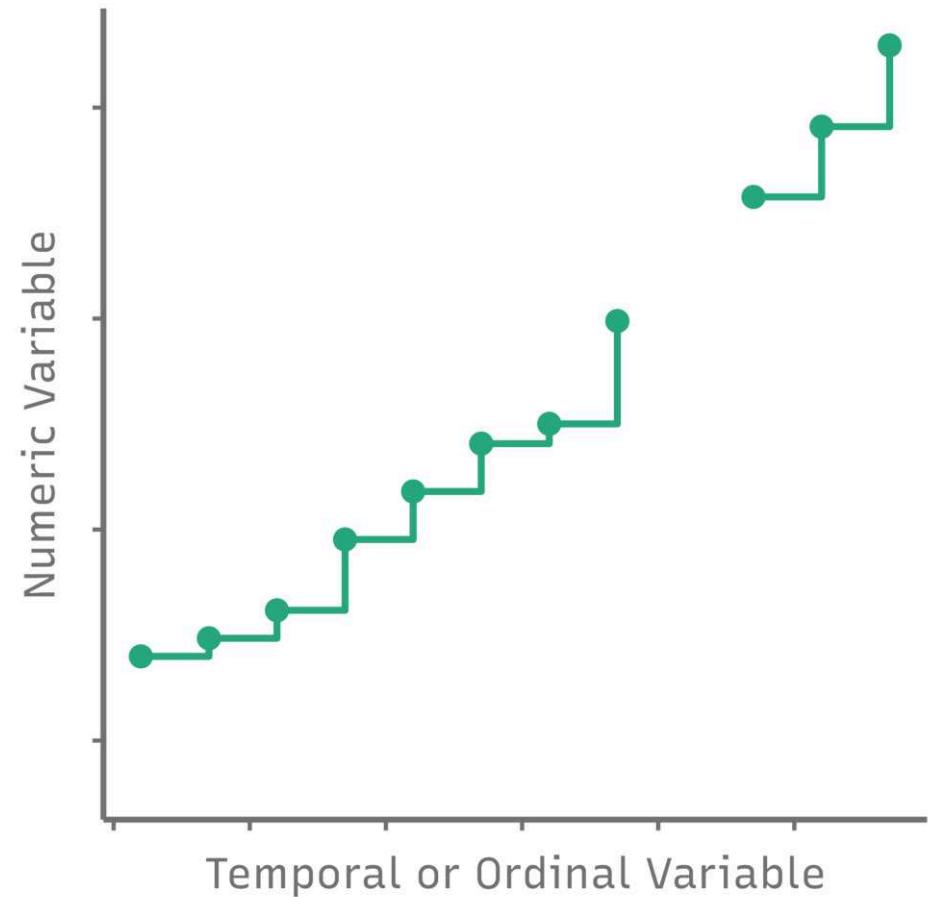
Step Chart



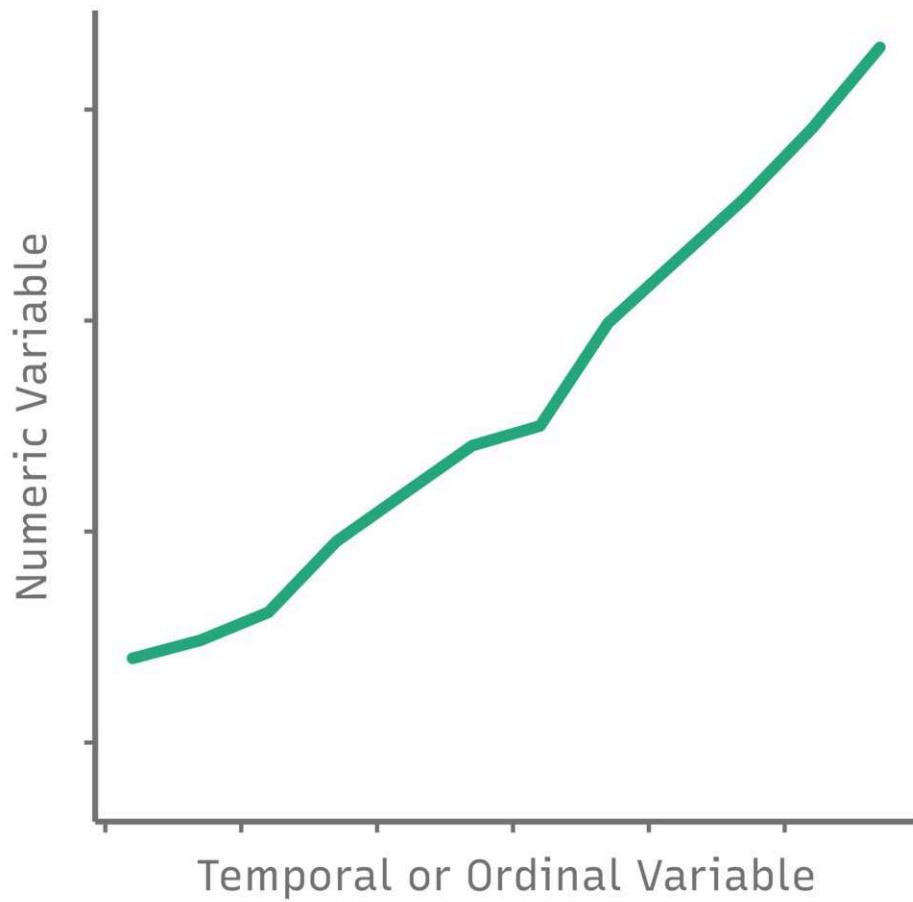
Line Chart (Time Series)



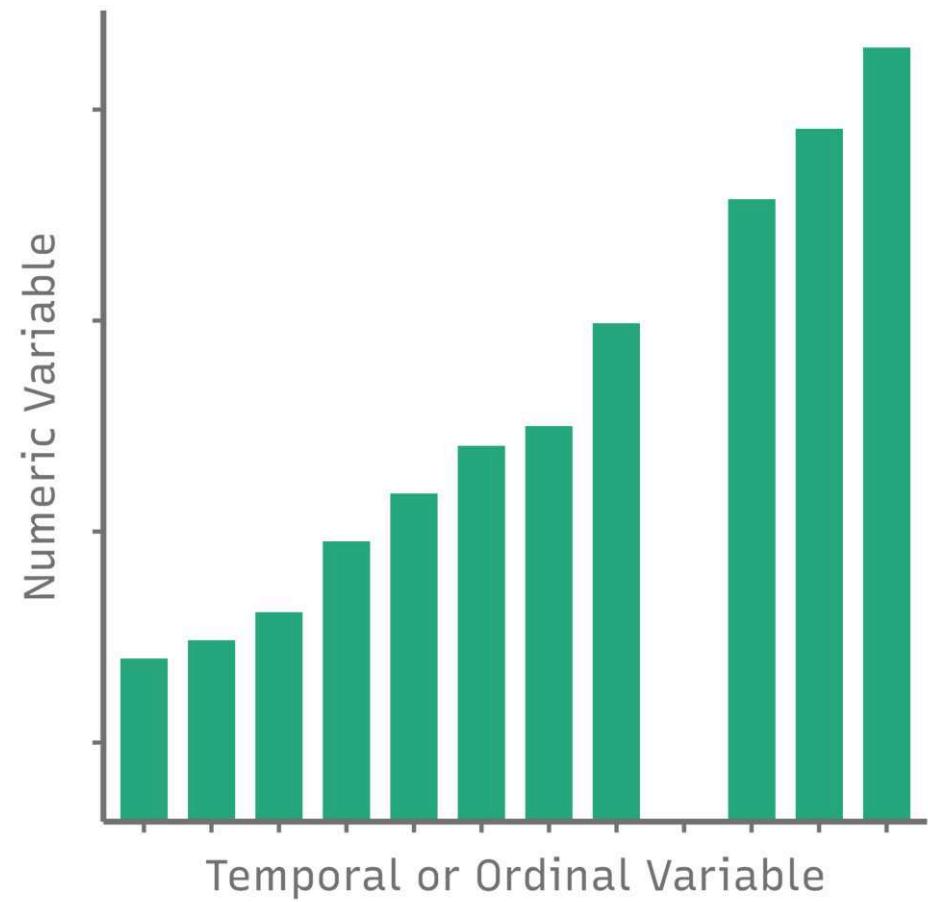
Step Chart with Markers + Gap



Line Chart (Time Series)



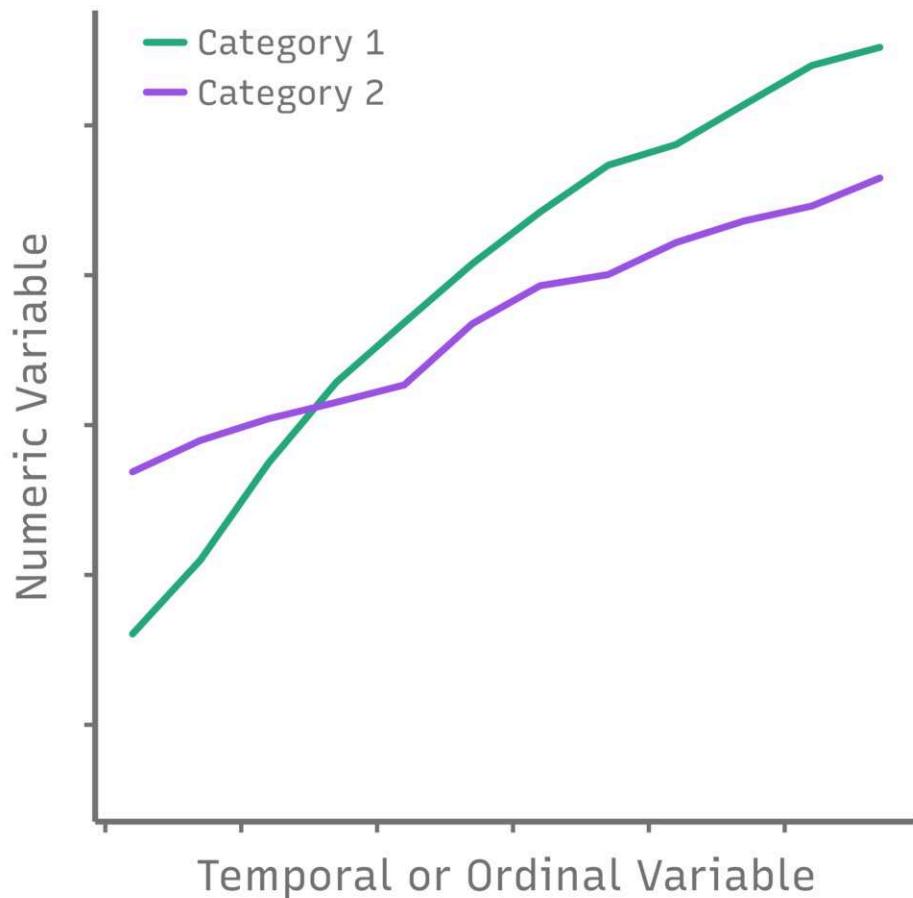
Bar Chart (Time Series)



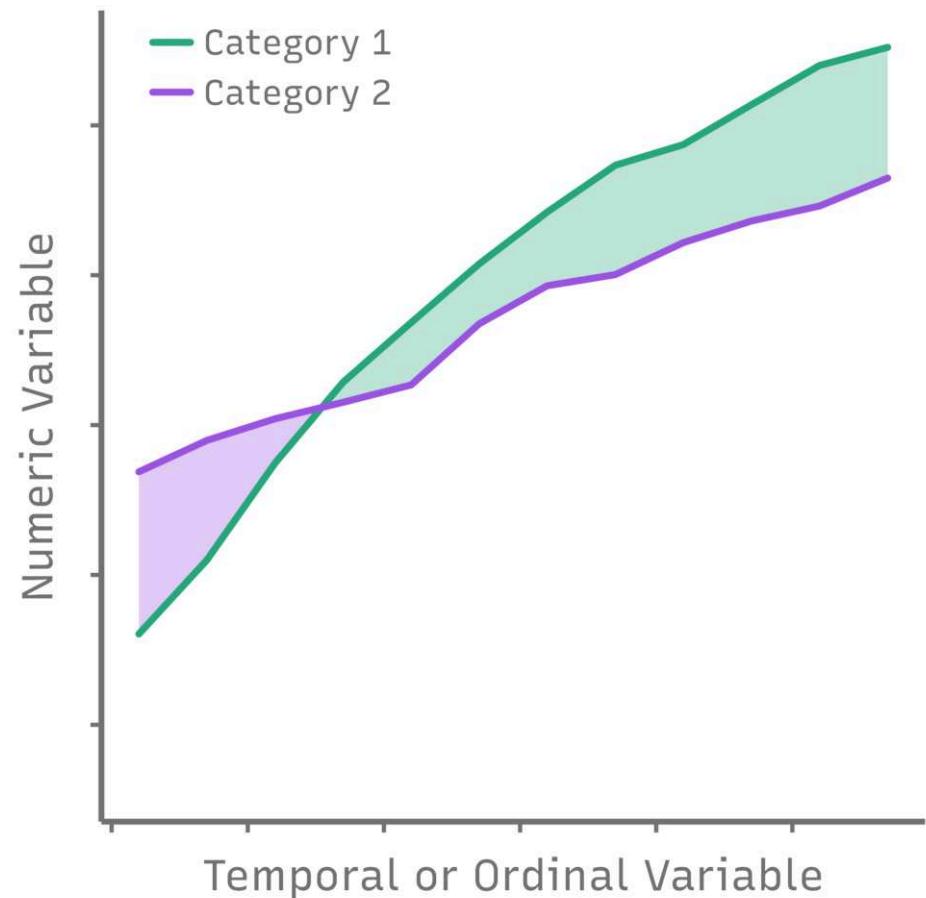
Beziehungen vergleichen



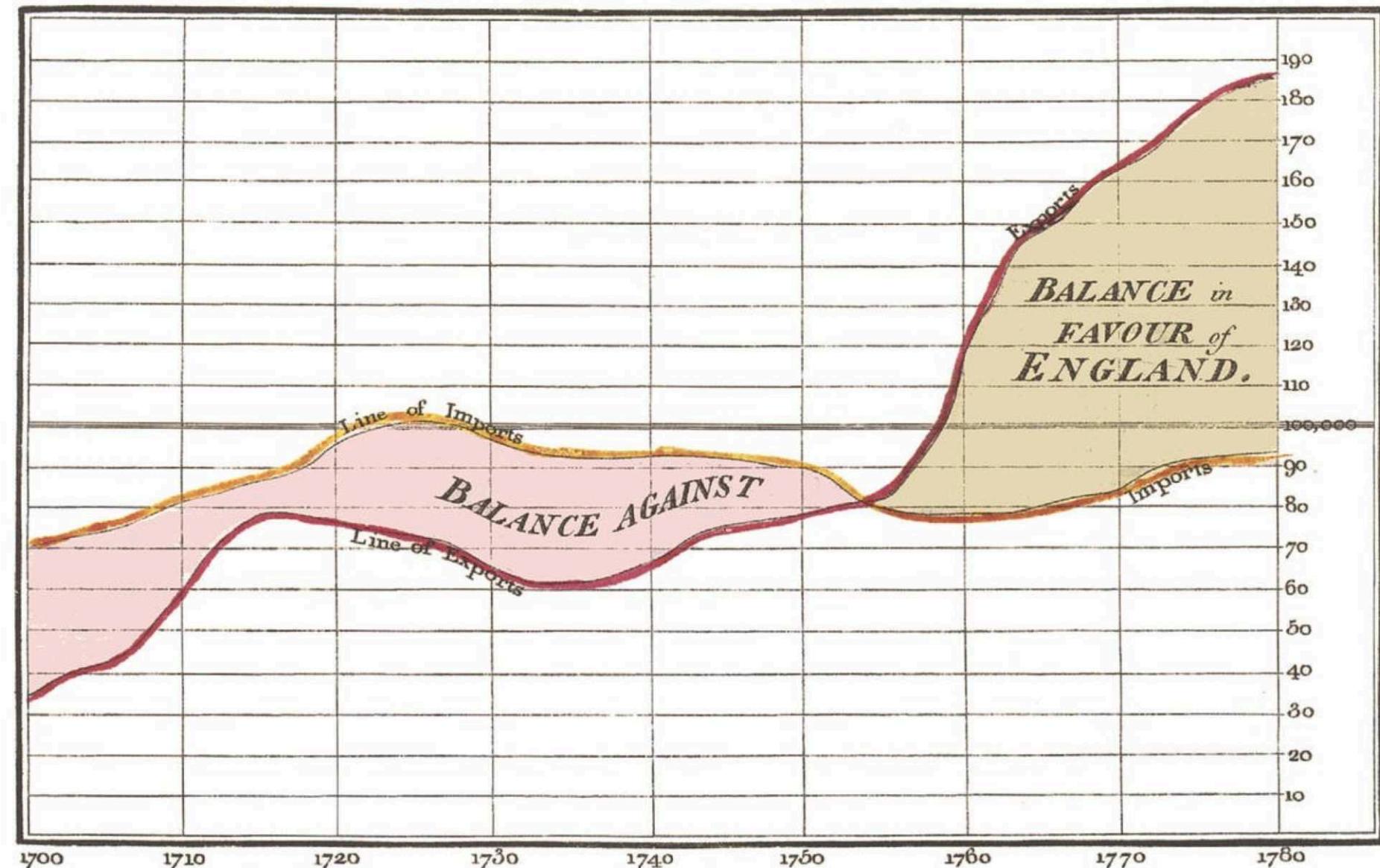
Line Chart (Time Series)



Line Chart with Filled Areas



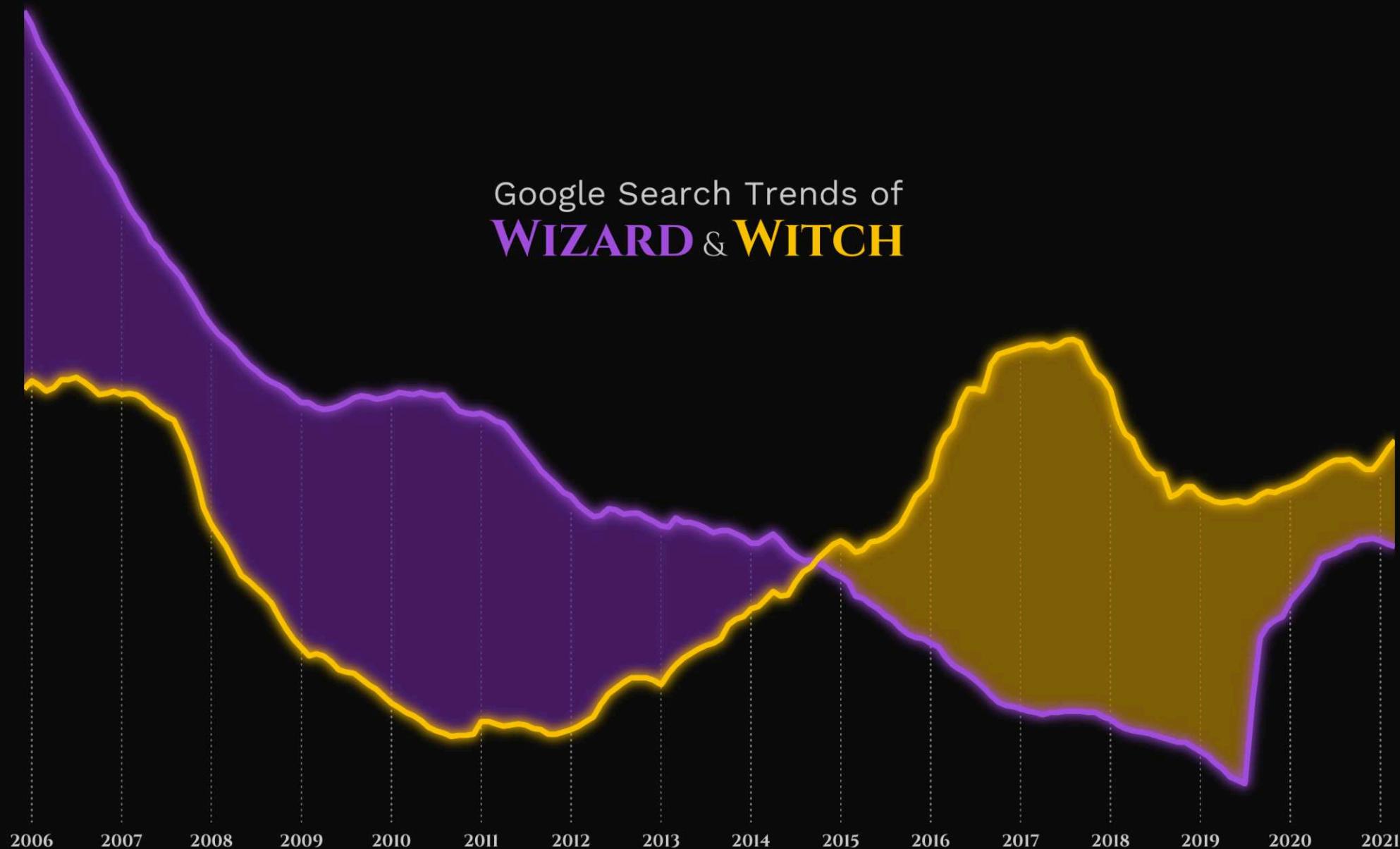
Exports and Imports to and from DENMARK & NORWAY from 1700 to 1780.



Time series with annotations by William Playfair from "The Commercial and Political Atlas and Statistical Breviary" (1786)



Google Search Trends of **WIZARD** & **WITCH**

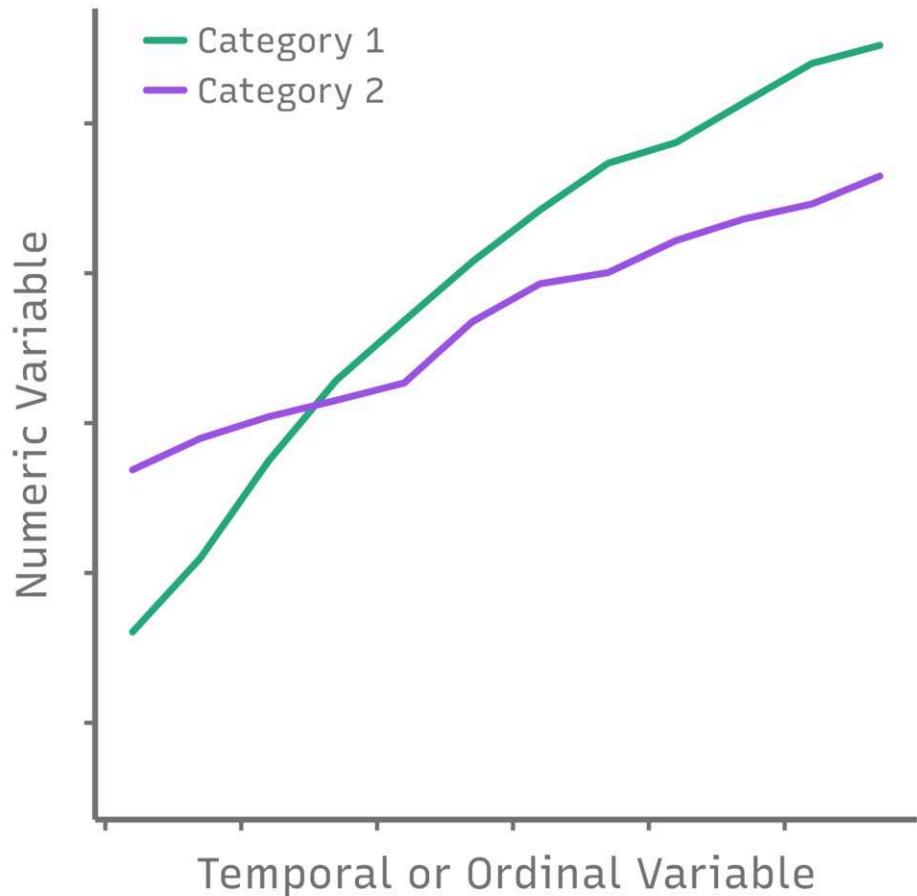


Visualization: Cédric Scherer | Data: Global Google Search Trends (derived 2021-04-02) as rolling average • #30DayChartChallenge 2021 | Day 4: Magical

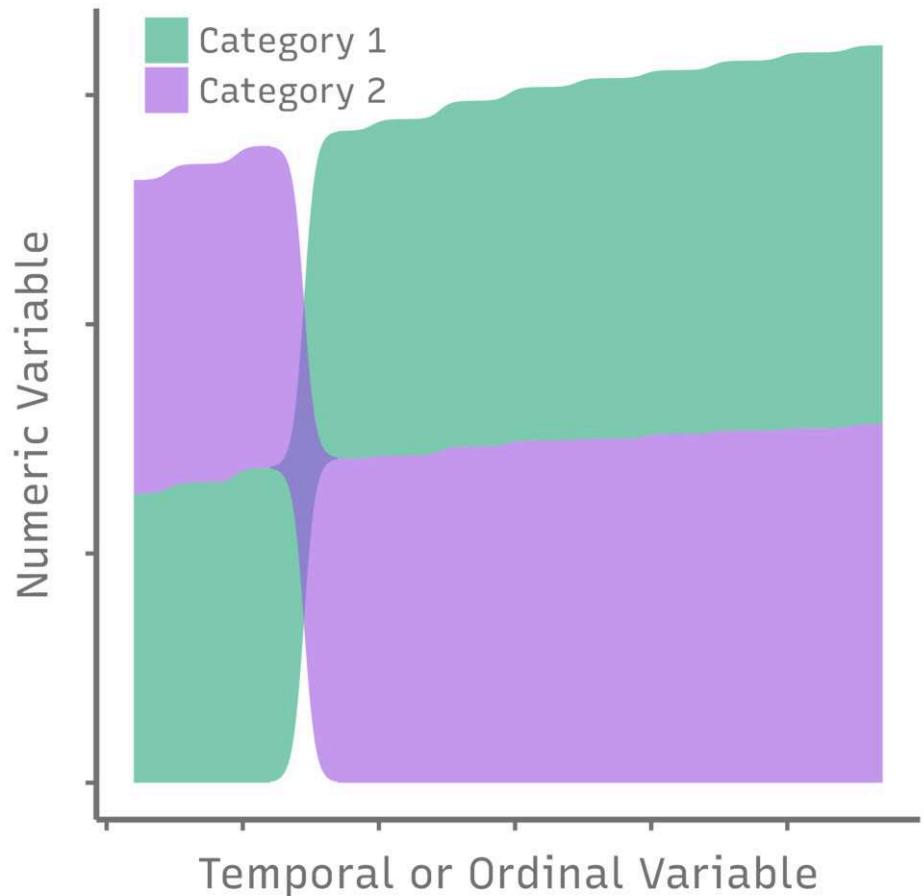
Cédric Scherer Data Visualization & Information Design



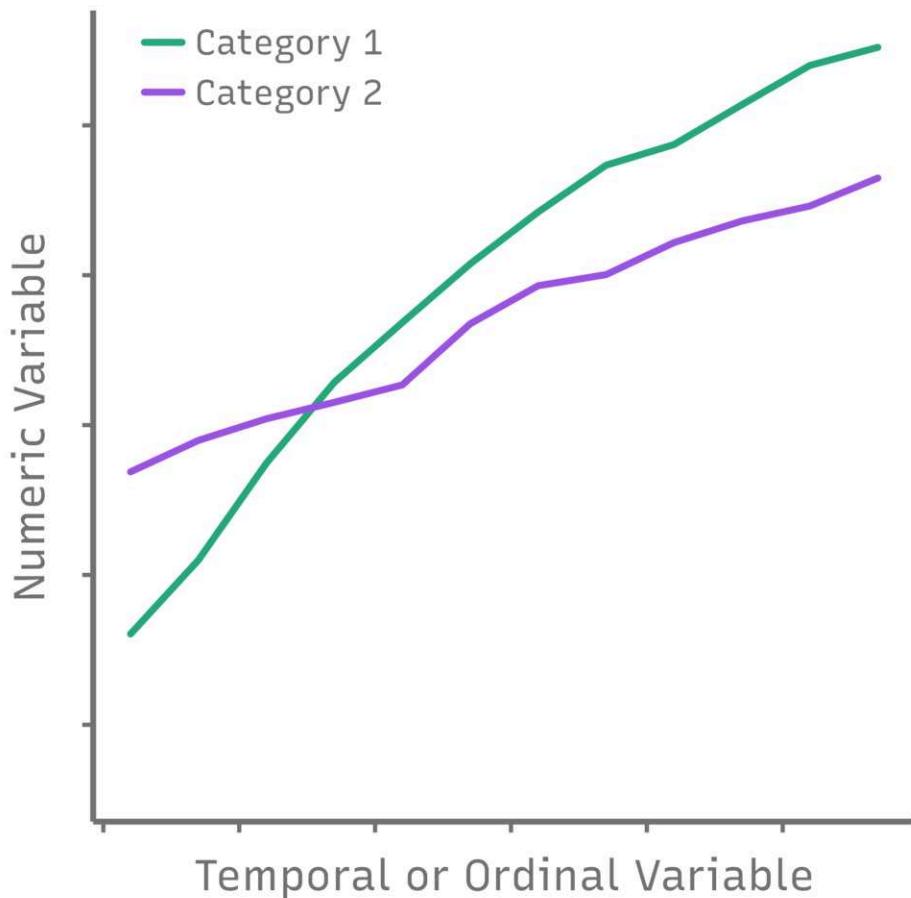
Line Chart (Time Series)



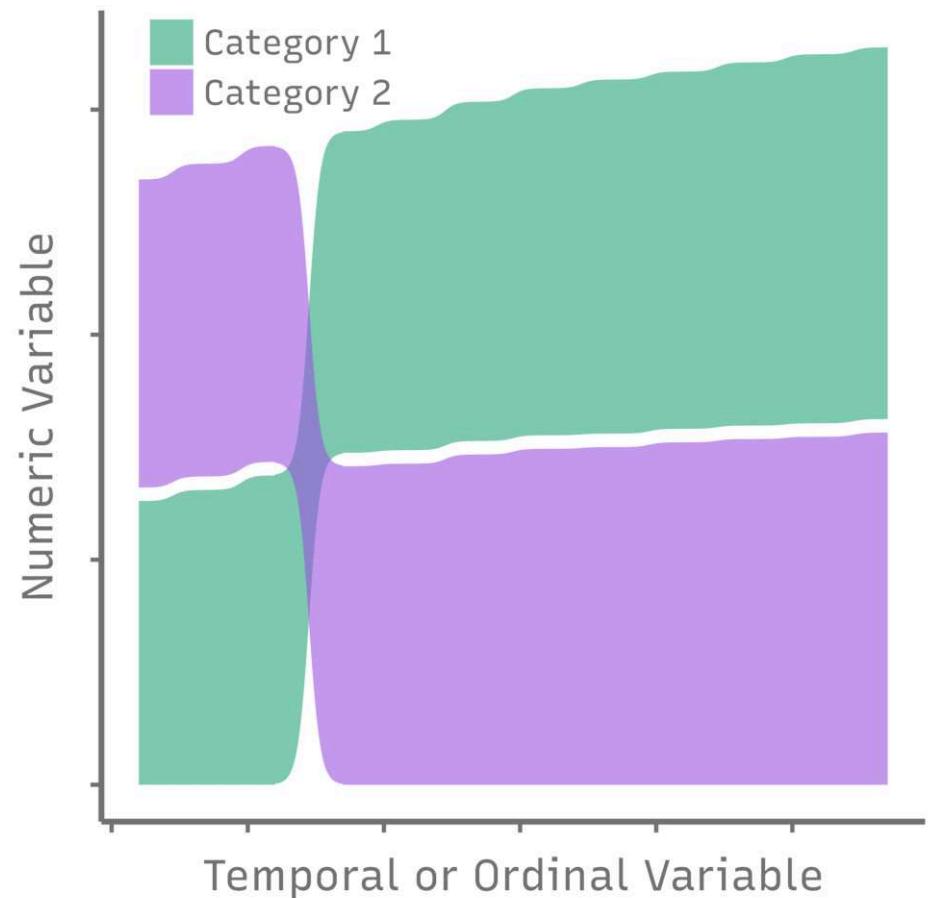
Sankey Bump Chart



Line Chart (Time Series)



Ribbon or Sankey Bump Chart



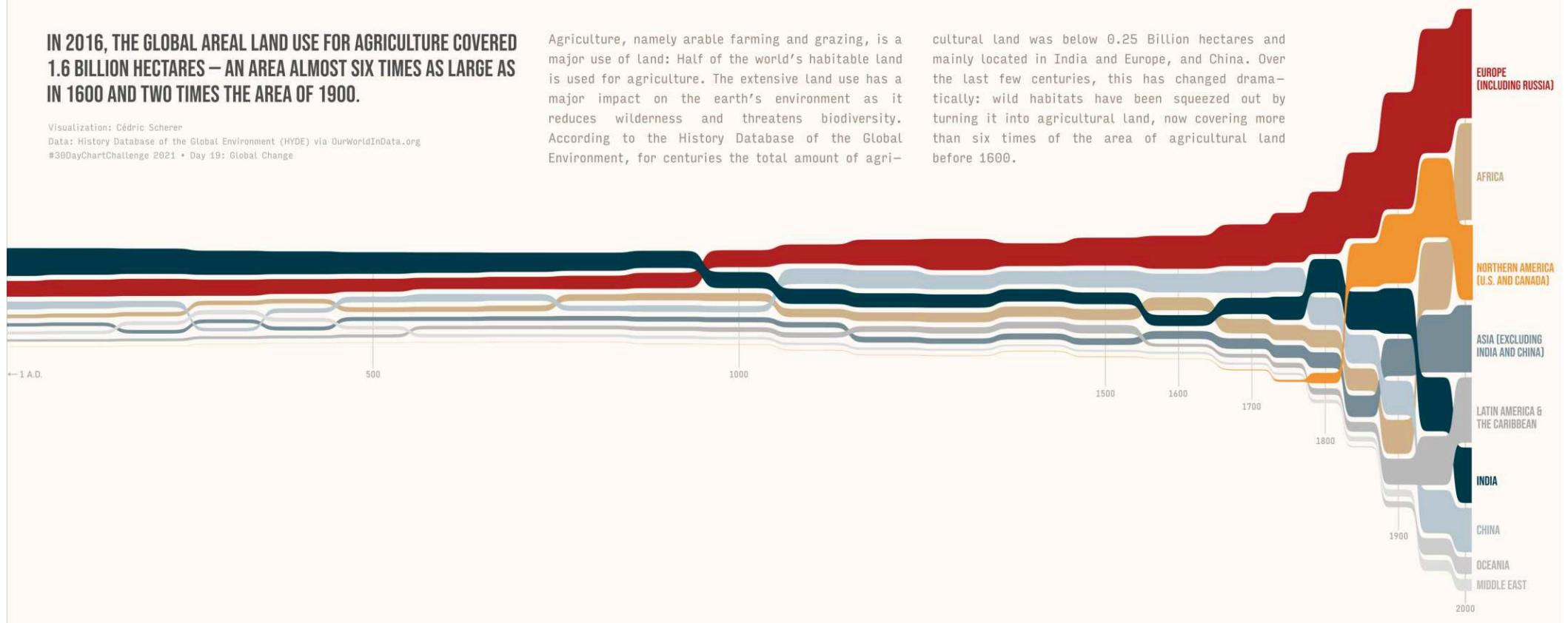
IN 2016, THE GLOBAL AREAL LAND USE FOR AGRICULTURE COVERED 1.6 BILLION HECTARES – AN AREA ALMOST SIX TIMES AS LARGE AS IN 1600 AND TWO TIMES THE AREA OF 1900.

Visualization: Cédric Scherer

Data: History Database of the Global Environment (HYDE) via OurWorldInData.org
#30DayChartChallenge 2021 • Day 19: Global Change

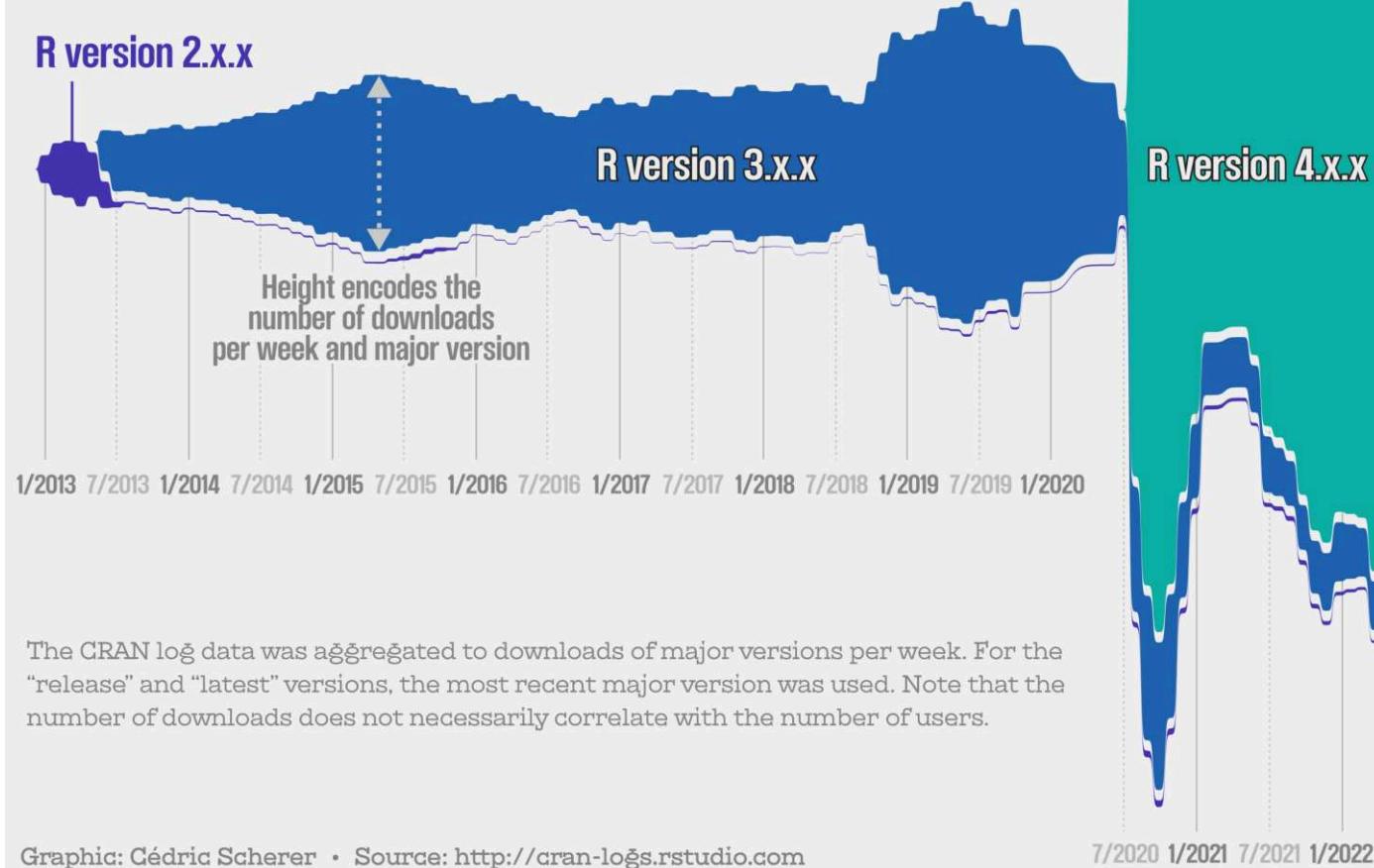
Agriculture, namely arable farming and grazing, is a major use of land: Half of the world's habitable land is used for agriculture. The extensive land use has a major impact on the earth's environment as it reduces wilderness and threatens biodiversity. According to the History Database of the Global Environment, for centuries the total amount of agri-

cultural land was below 0.25 Billion hectares and mainly located in India and Europe, and China. Over the last few centuries, this has changed dramatically: wild habitats have been squeezed out by turning it into agricultural land, now covering more than six times of the area of agricultural land before 1600.



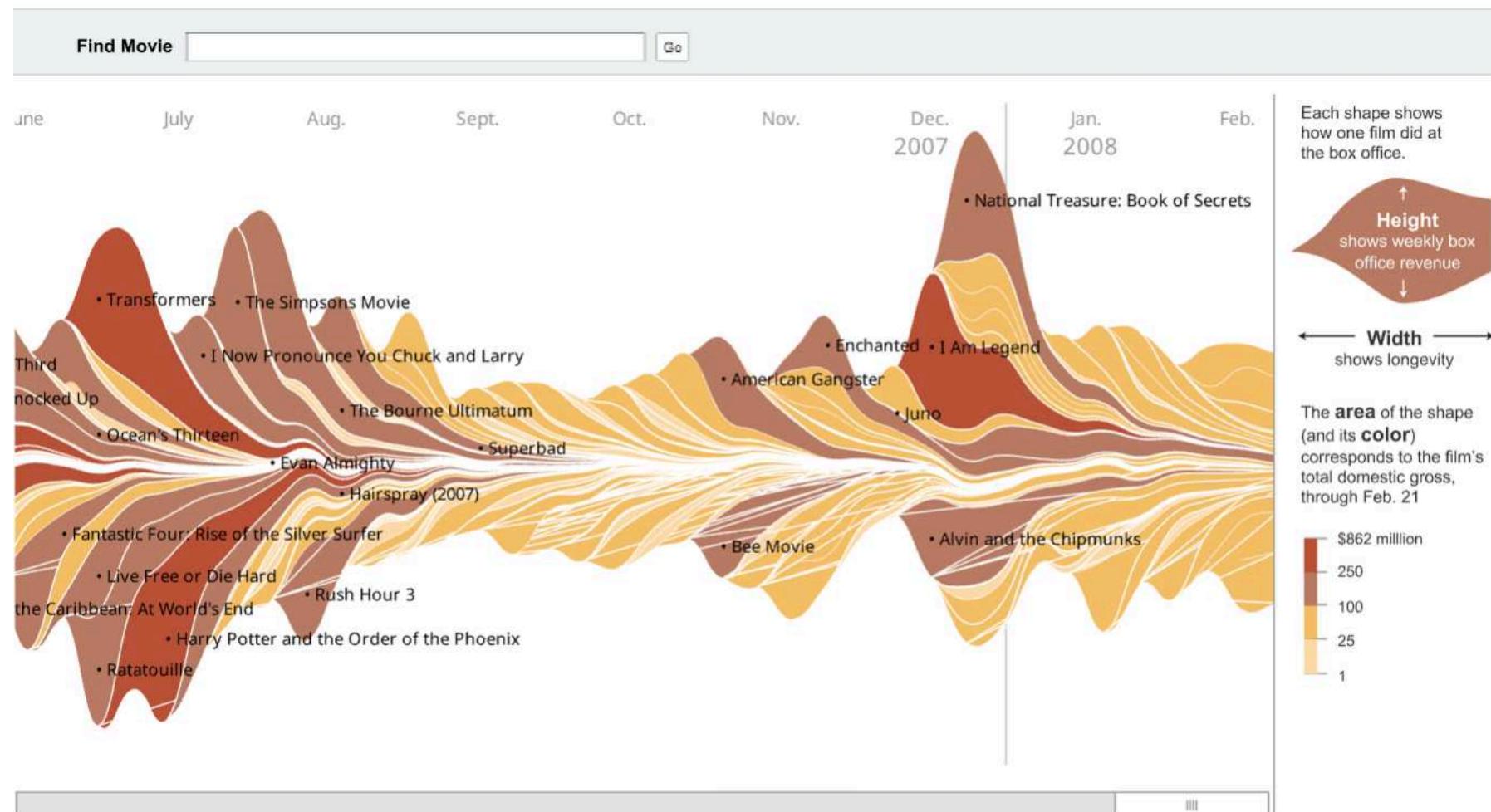
Weekly Downloads of the R Programming Language

Trends of downloads of R, which is a free software environment for statistical computing and graphics



The Ebb and Flow of Movies: Box Office Receipts 1986 – 2008

Summer blockbusters and holiday hits make up the bulk of box office revenue each year, while contenders for the Oscars tend to attract smaller audiences that build over time. Here's a look at how movies have fared at the box office, after adjusting for inflation.

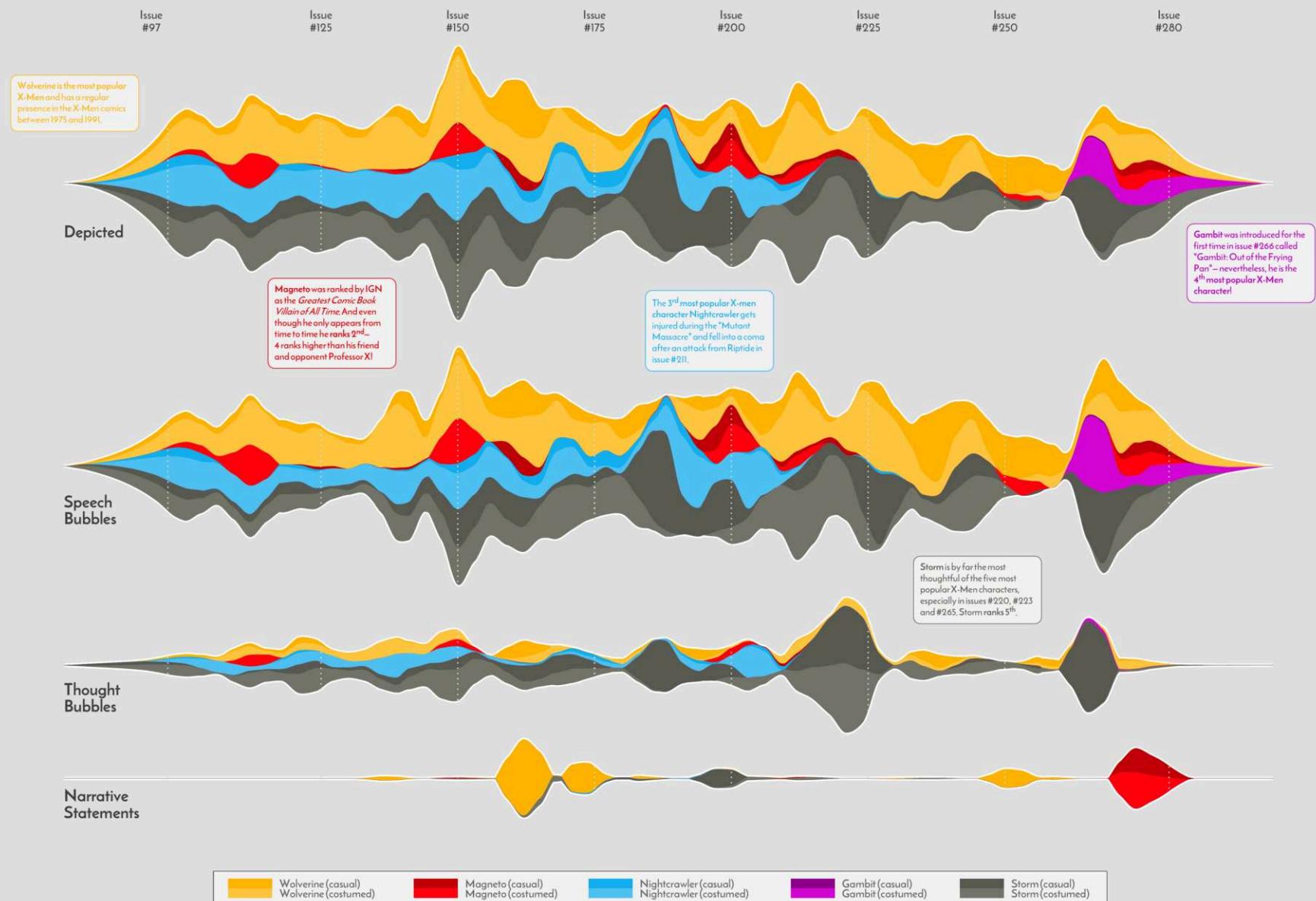


Sources: Baseline StudioSystems; Box Office Mojo

Mathew Bloch, Lee Byron, Shan Carter and Amanda Cox



Appearance of the Five Most Popular X-Men Characters in Chris Claremont's **X-MEN** Comics

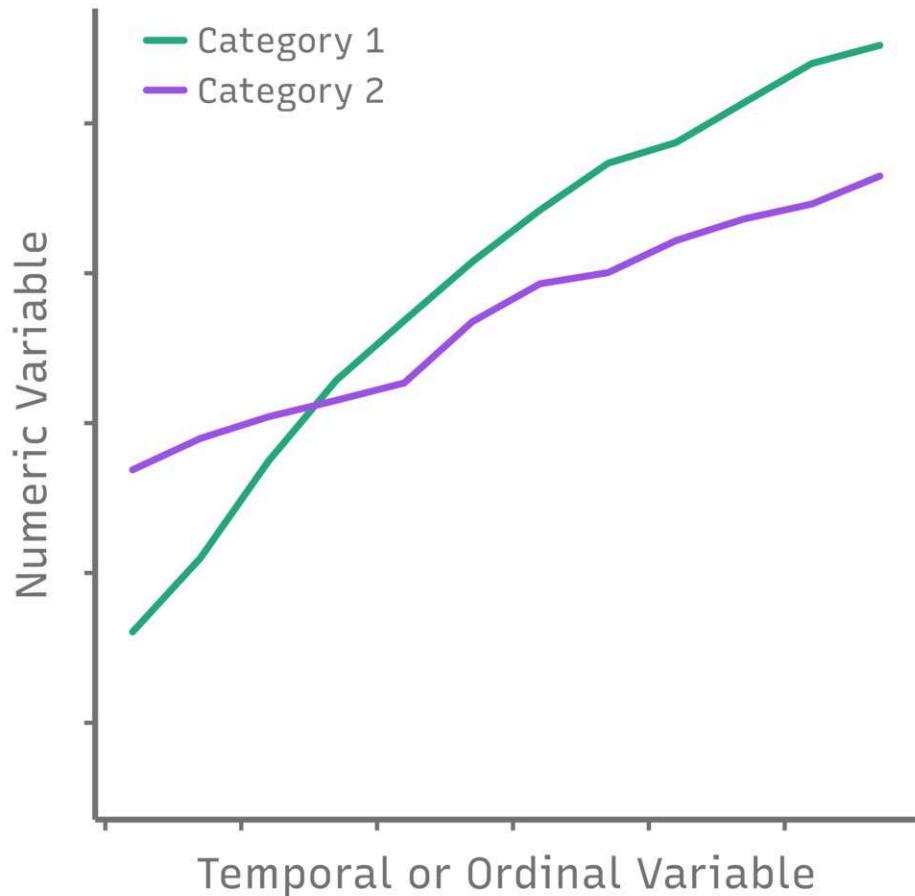


Visualization by Cédric Scherer • Data by Claremont Run Project via Malcolm Barret • Popularity Scores by ranker.com • Logo by Comicroft

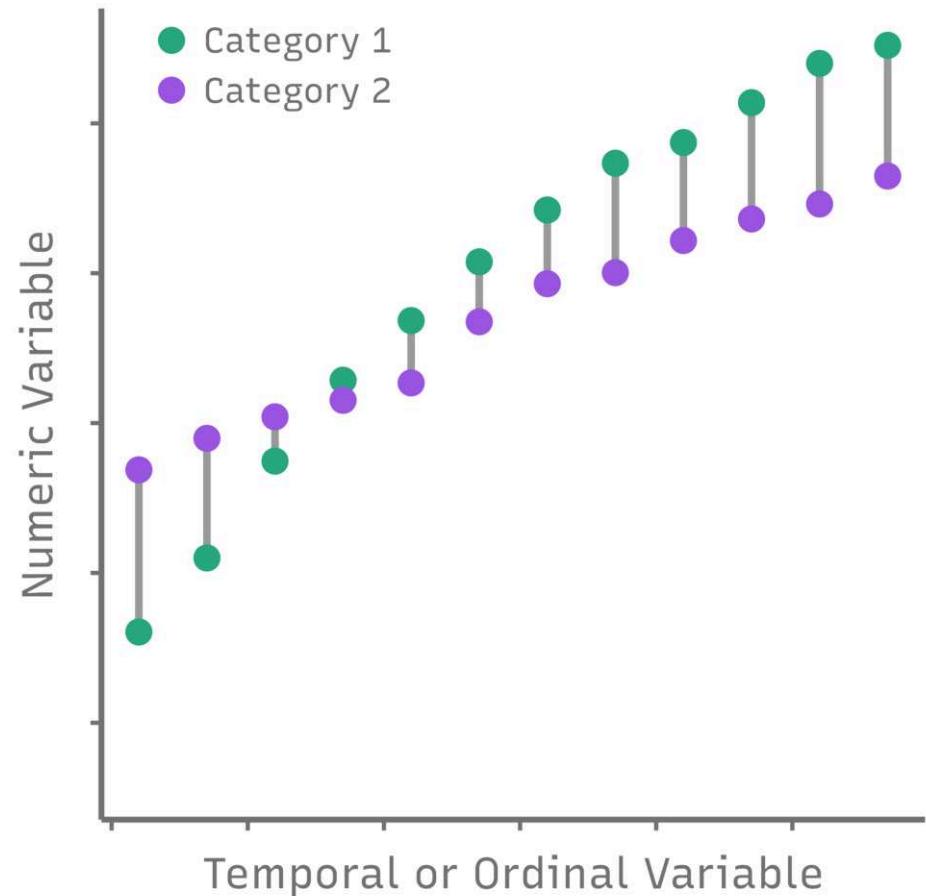
Cédric Scherer Data Visualization & Information Design



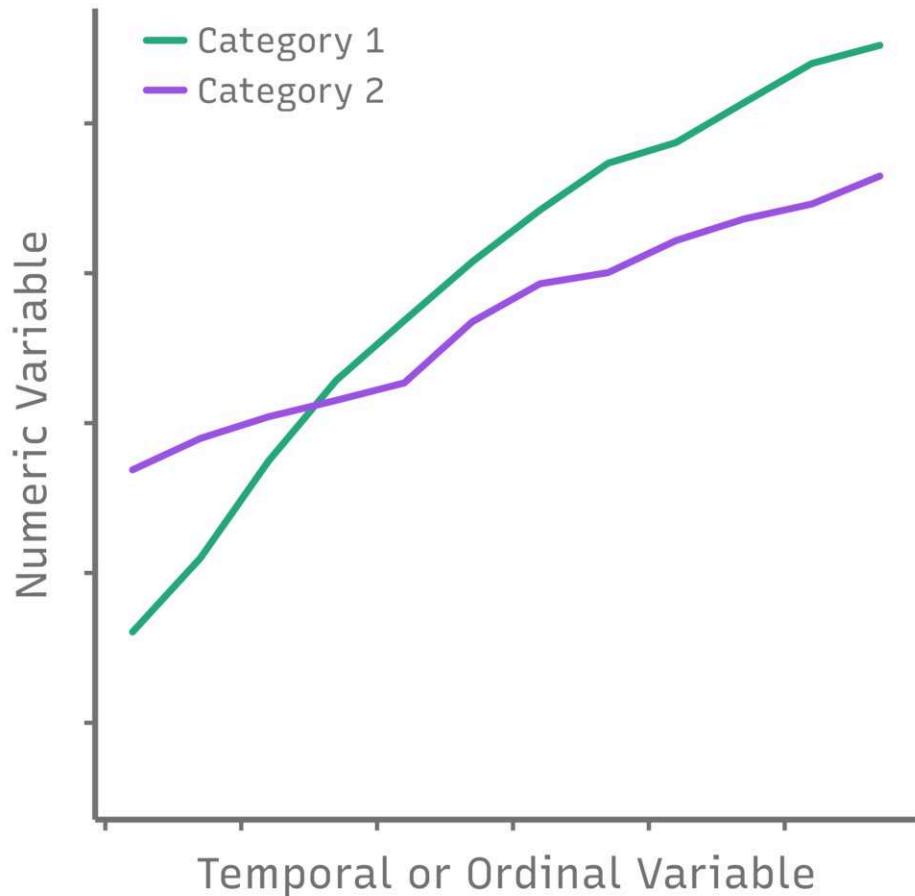
Line Chart (Time Series)



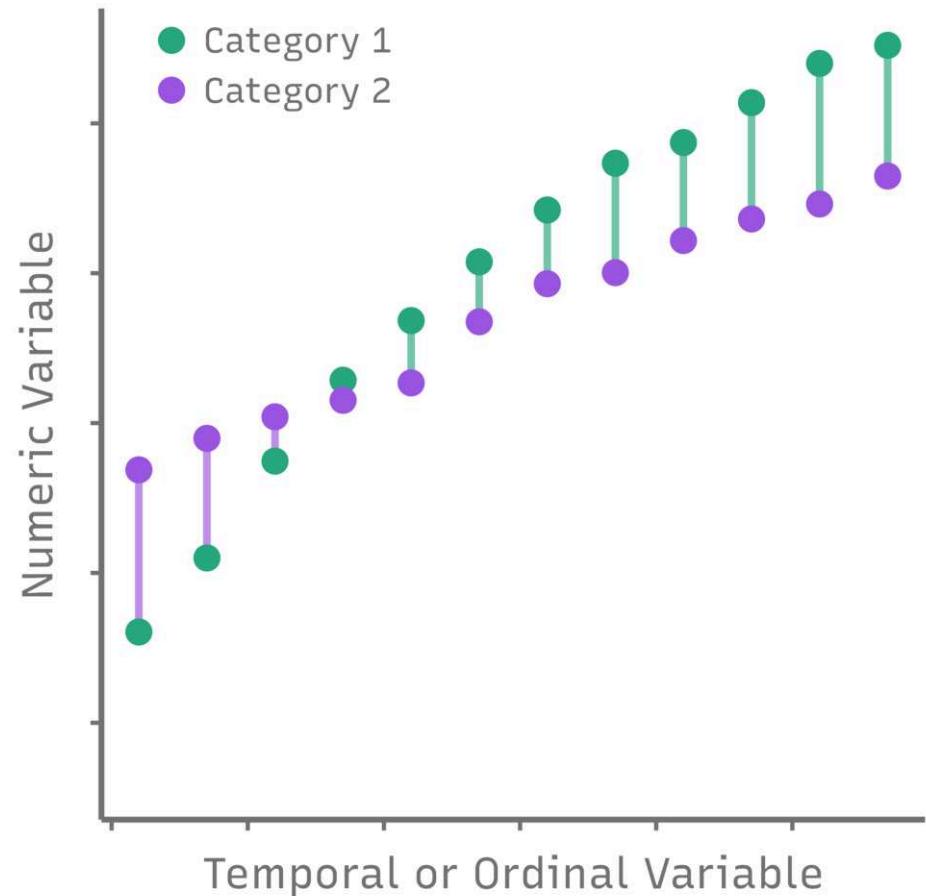
Dumbbell Plot



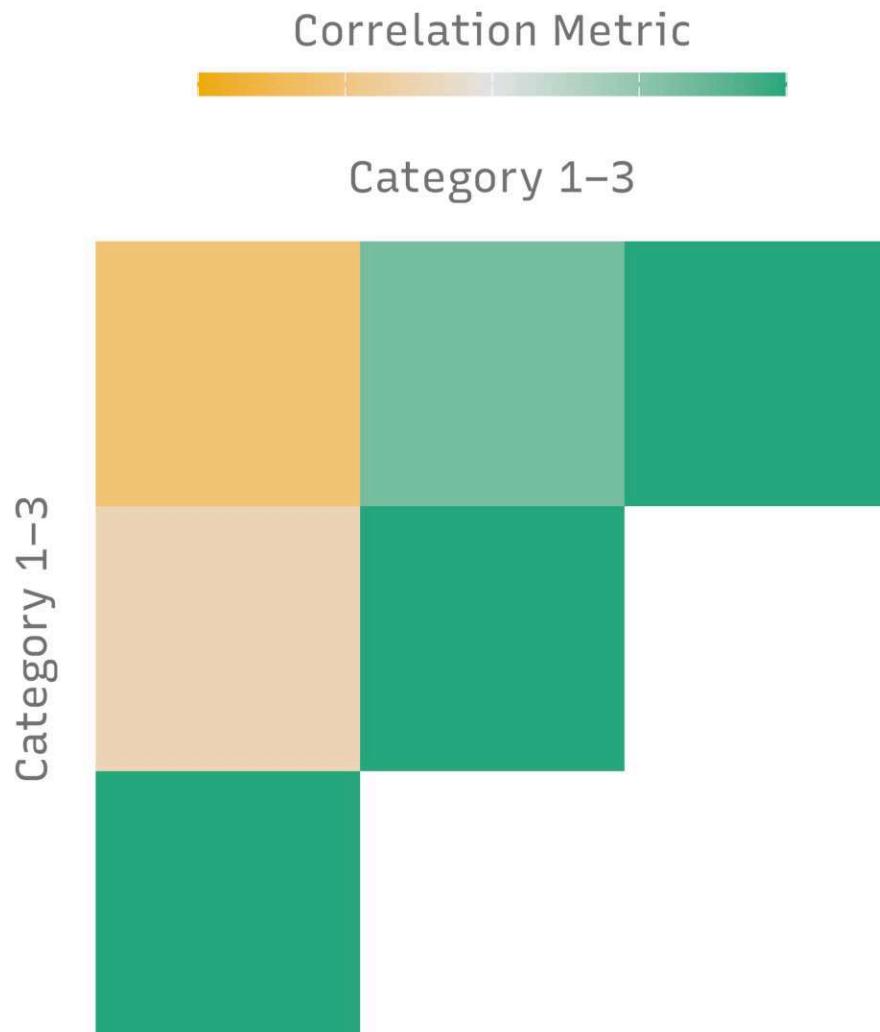
Line Chart (Time Series)



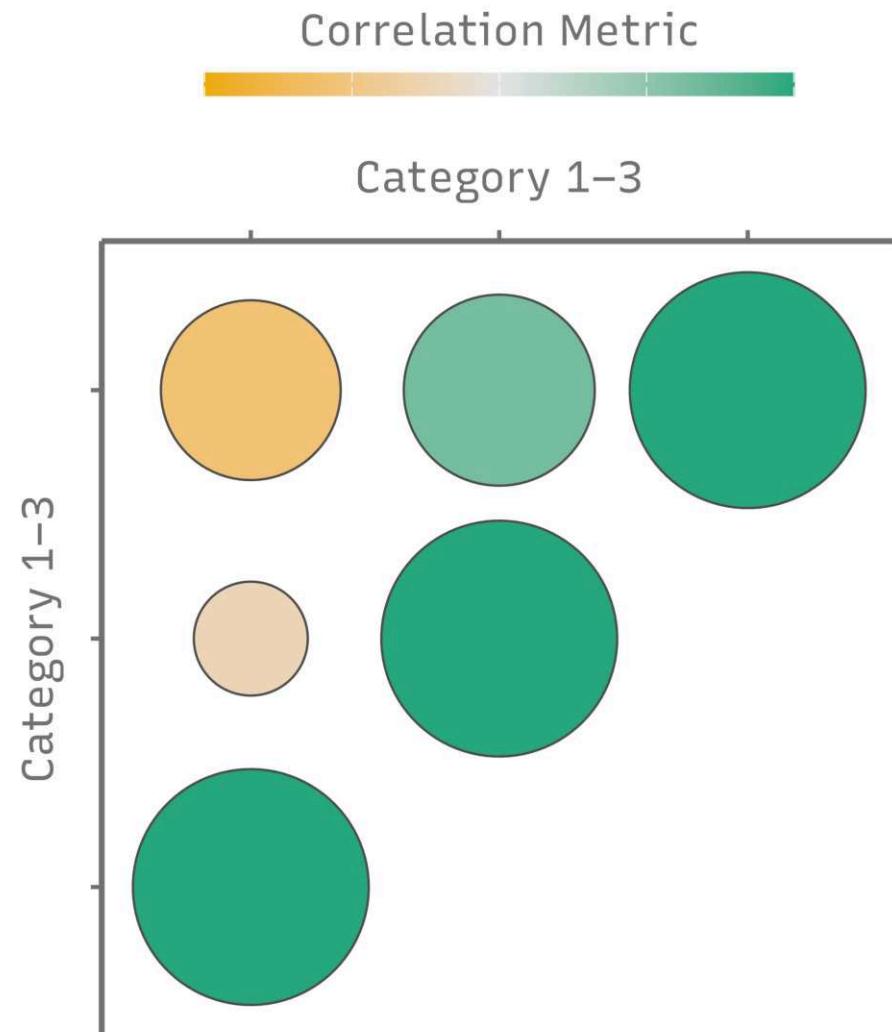
Dumbbell Plot



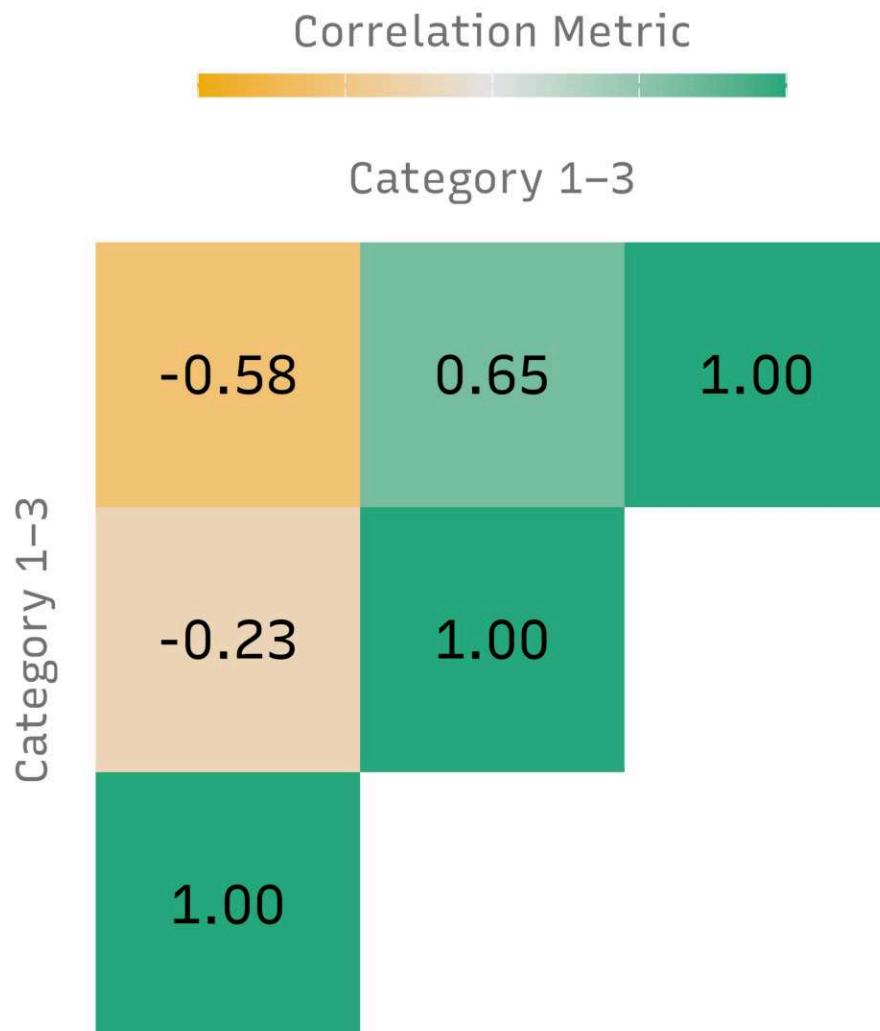
Correlogram (Tiles)



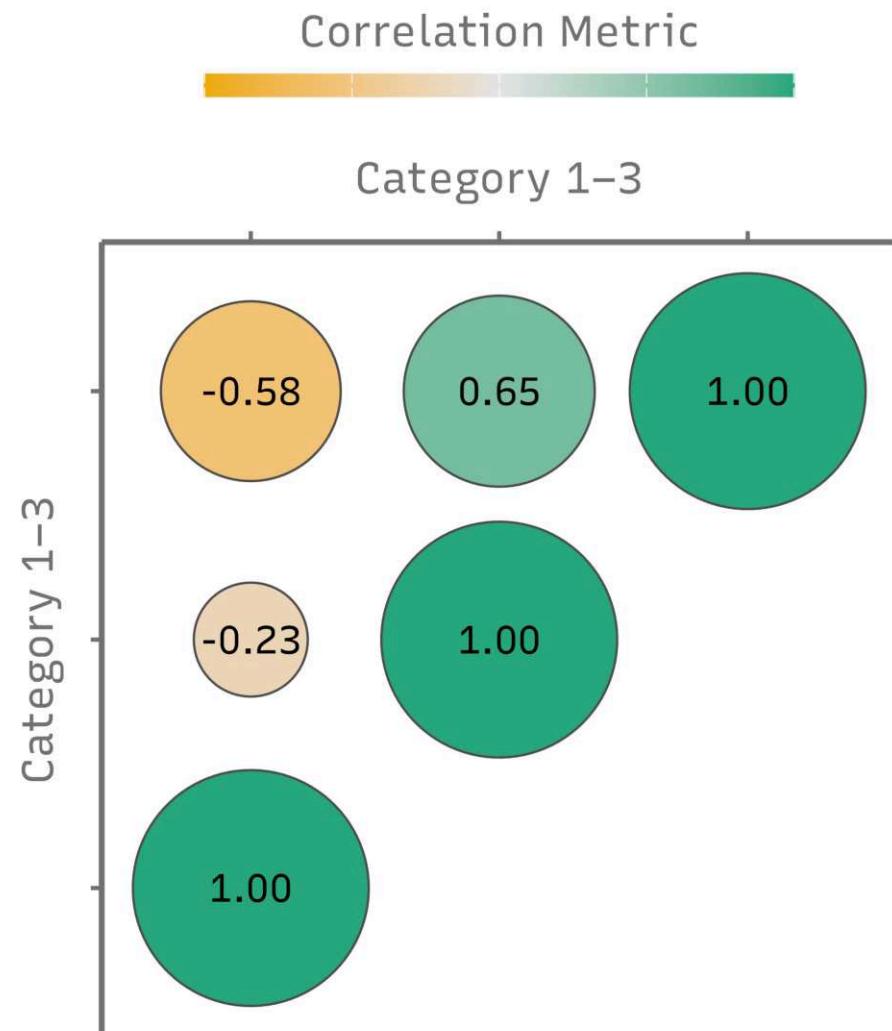
Correlogram (Bubbles)



Correlogram (Tiles)



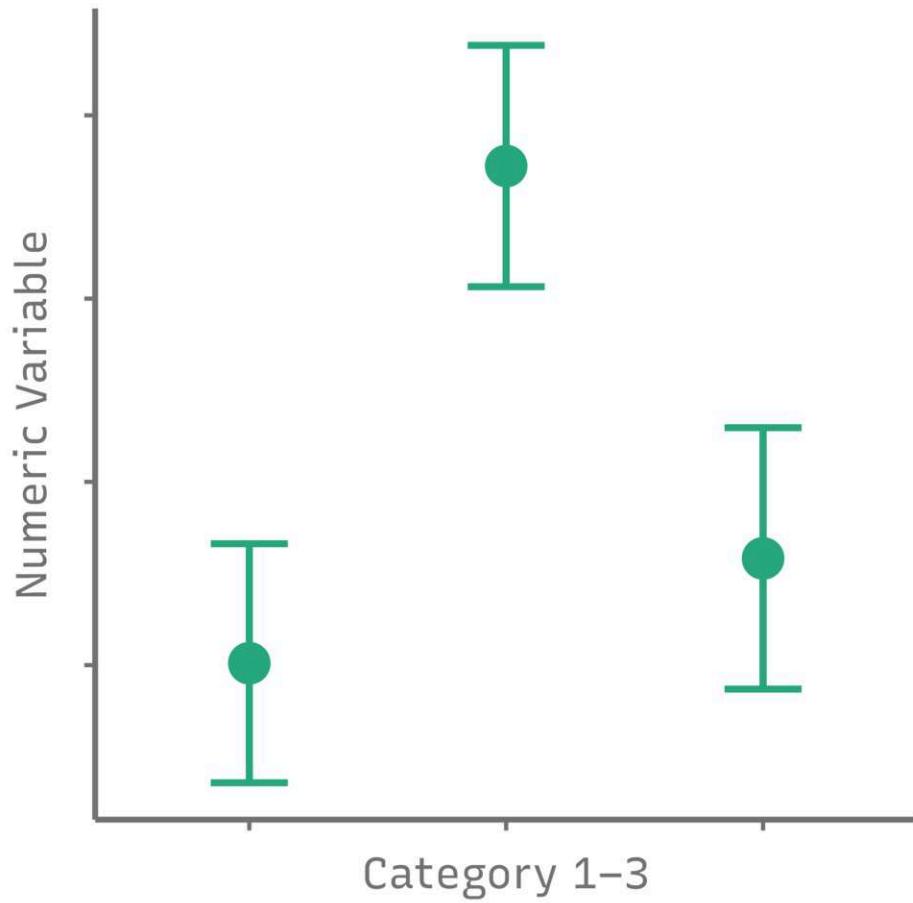
Correlogram (Bubbles)



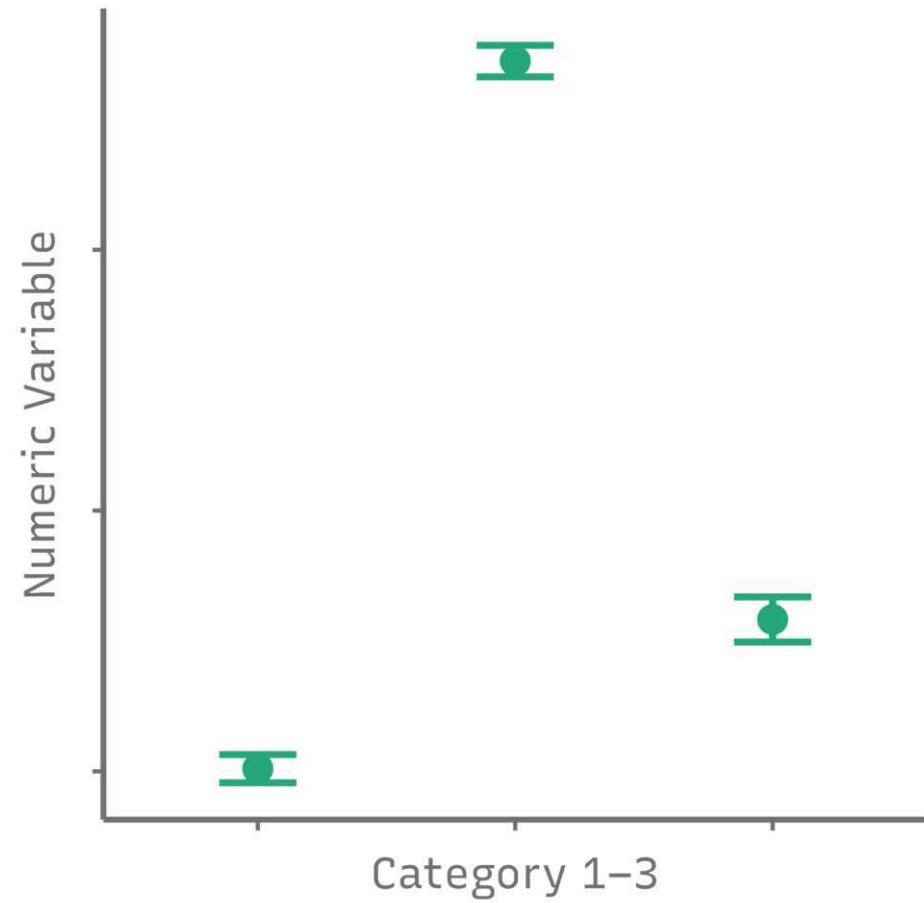
Unsicherheit darstellen



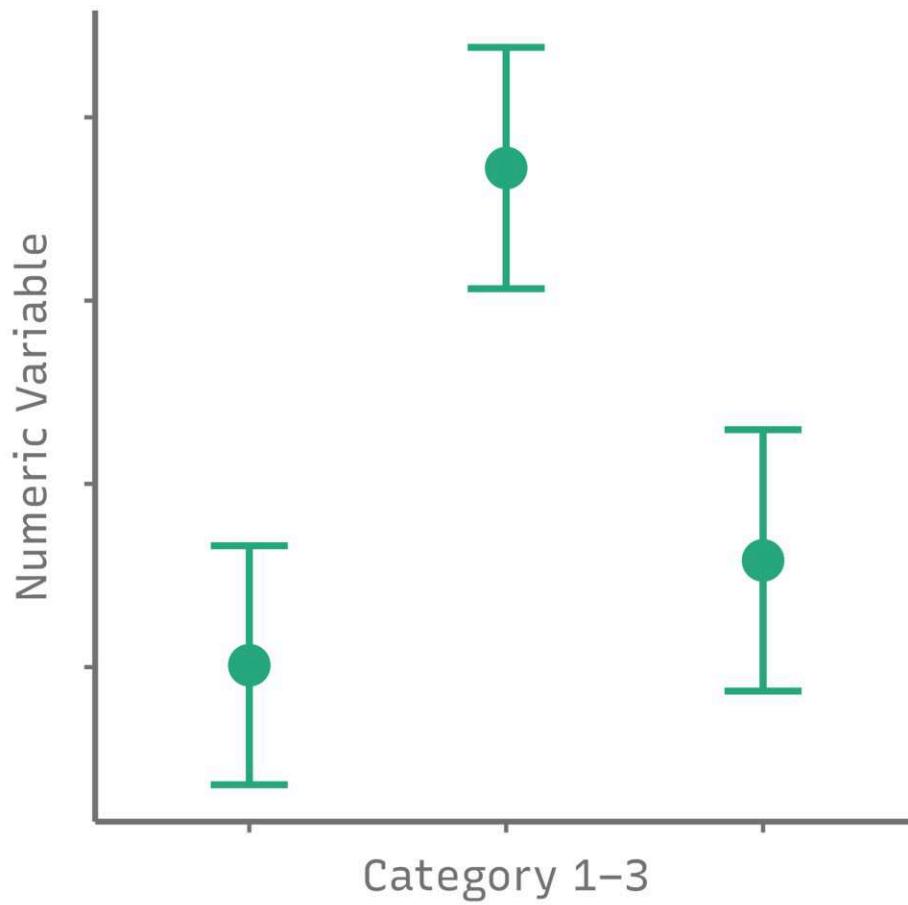
Error Bars: mean \pm SD



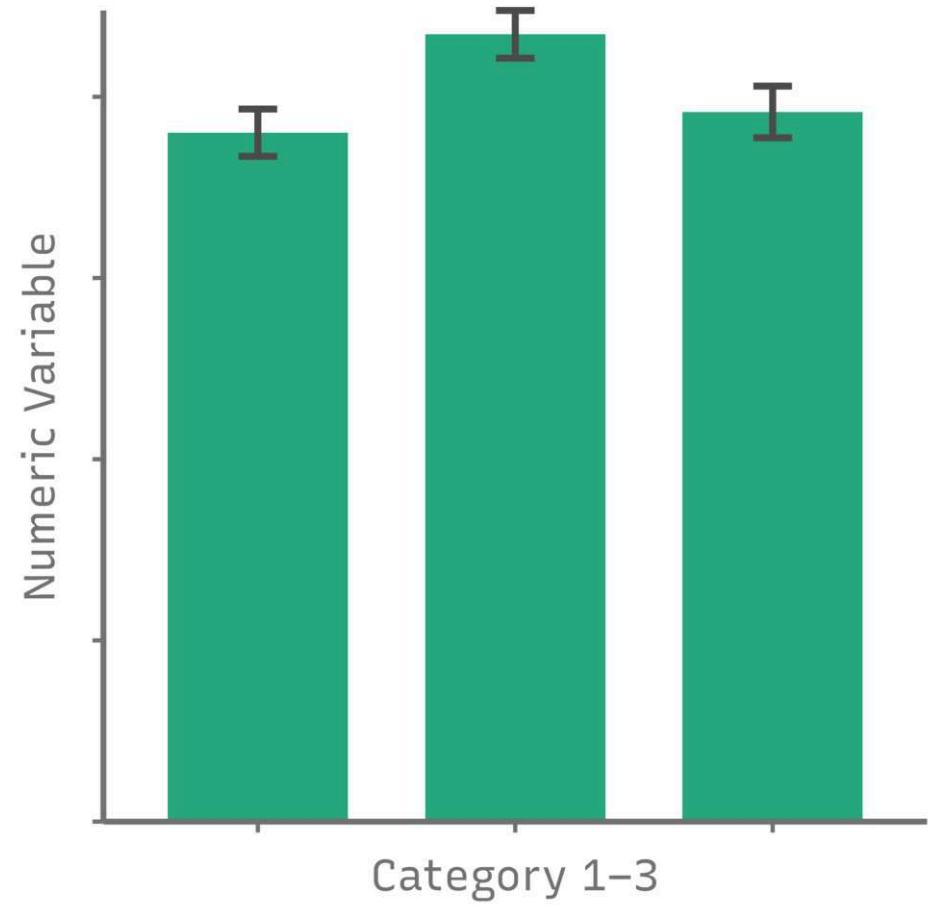
Error Bars: mean \pm SE

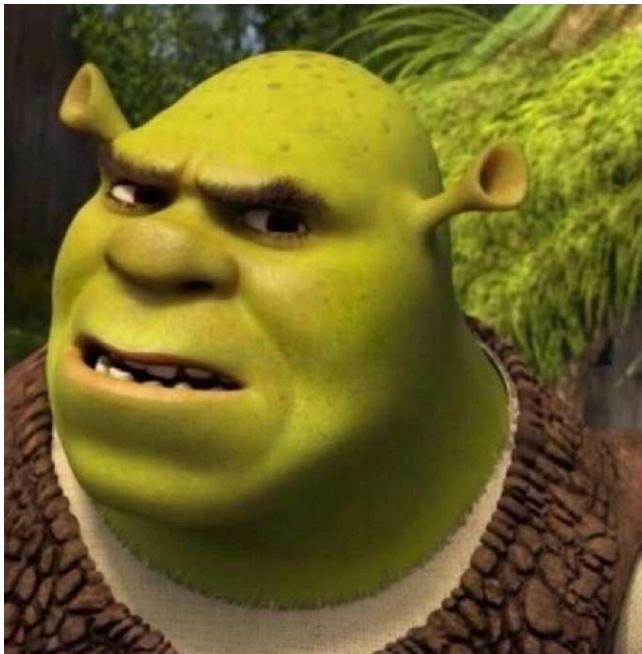


Error Bars

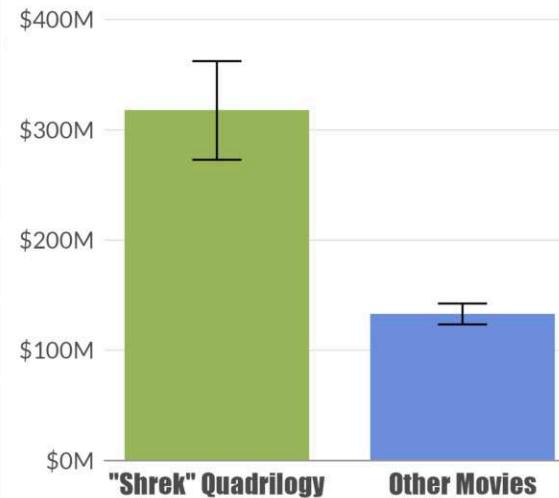


Dynamite Plots



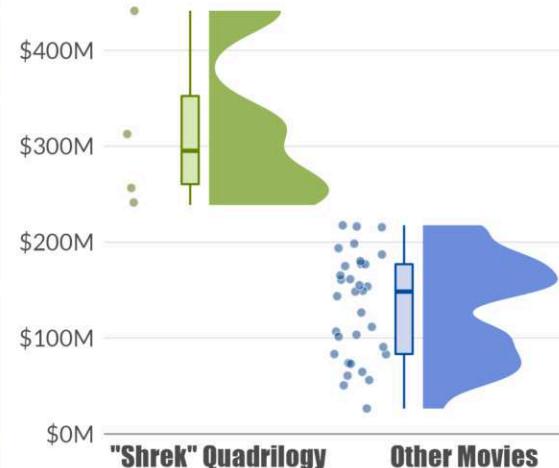


Domestic Box Office of DreamWorks Movies



© Dreamworks Animation

Domestic Box Office of DreamWorks Movies



Why Dynamite Plots Are Terrible—and Why You Should Use Something Else | Cédric Scherer | #30DayChartChallenge 2021 | Day 27: Educational

"Why Dynamite Plots are Twerrible"

Cédric Scherer Data Visualization & Information Design



PERSPECTIVE

Beyond Bar and Line Graphs: Time for a New Data Presentation Paradigm

Tracey L. Weissgerber¹*, Nataša M. Milic^{1,2}, Stacey J. Winham³, Vesna D. Garovic¹

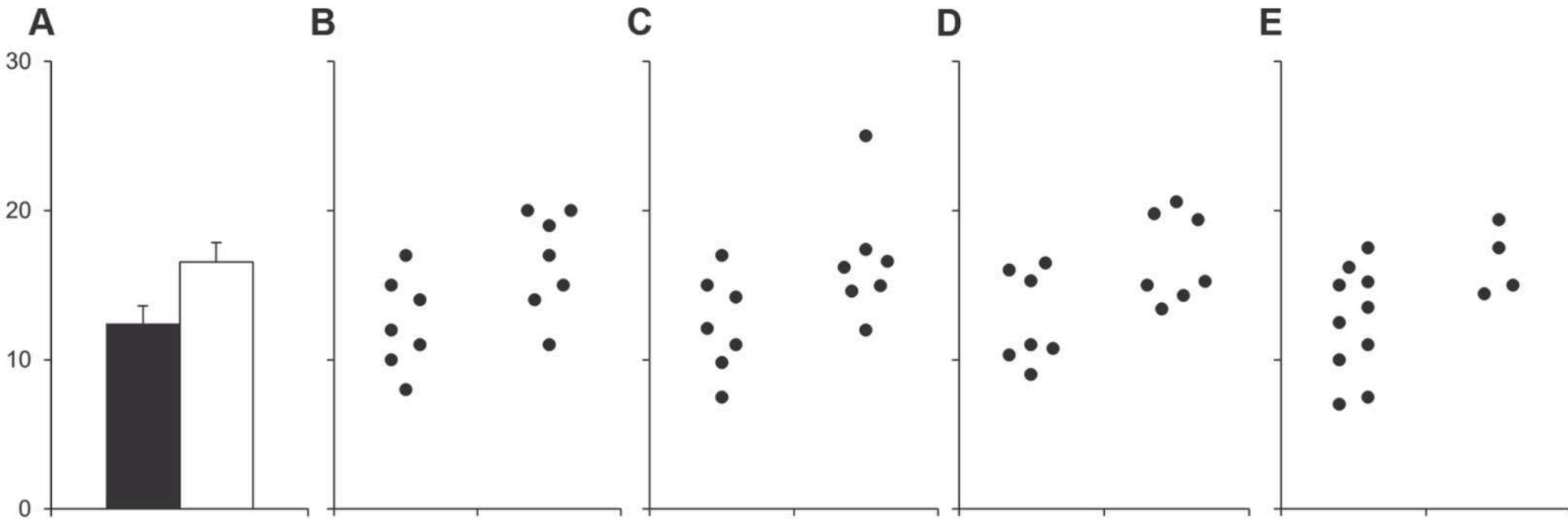
1 Division of Nephrology & Hypertension, Mayo Clinic, Rochester, Minnesota, United States of America,

2 Department of Biostatistics, Medical Faculty, University of Belgrade, Belgrade, Serbia, **3** Division of Biomedical Statistic and Informatics, Mayo Clinic, Rochester, Minnesota, United States of America

* weissgerber.tracey@mayo.edu

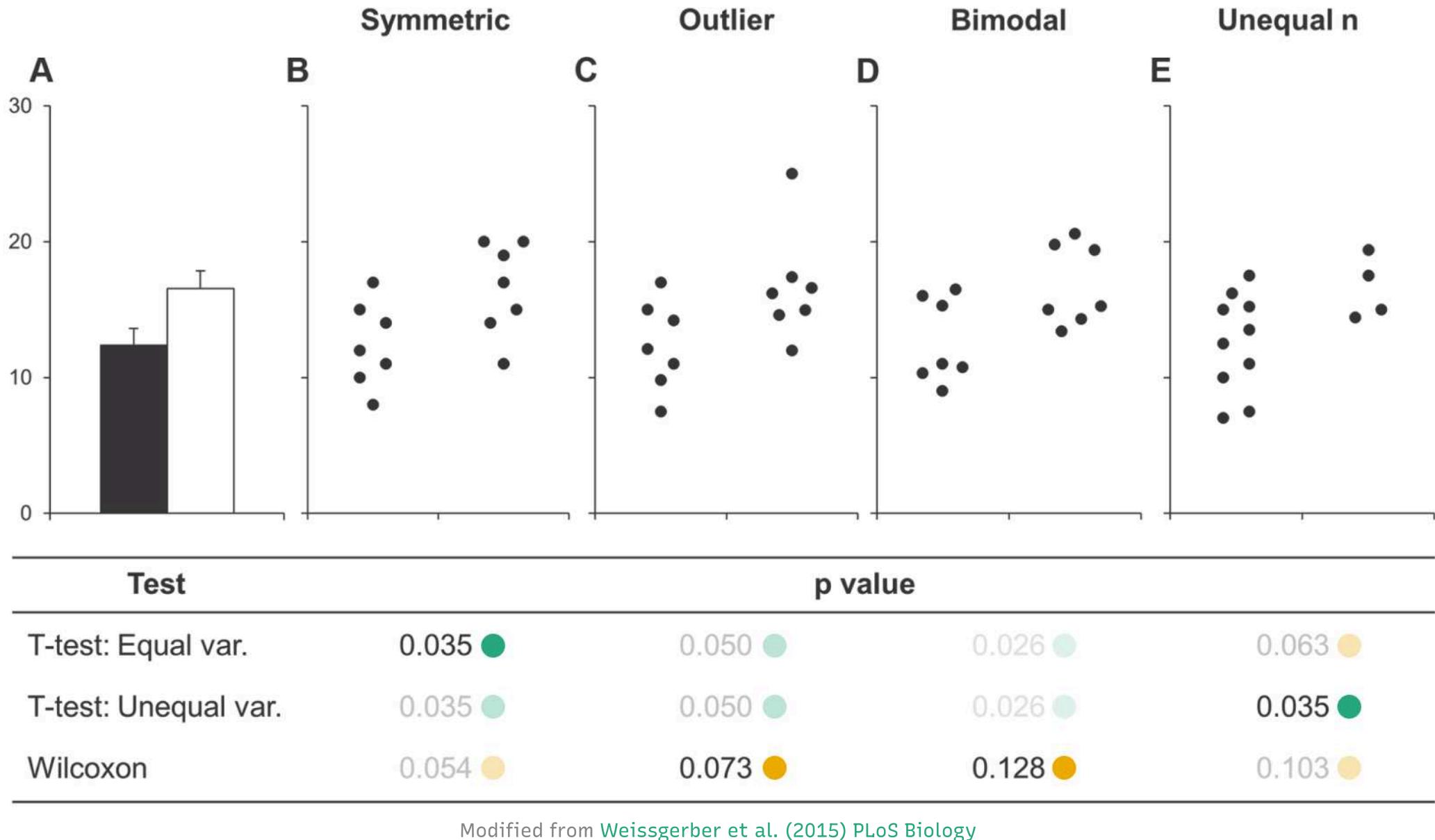
Weissgerber et al. (2015) PLoS Biology

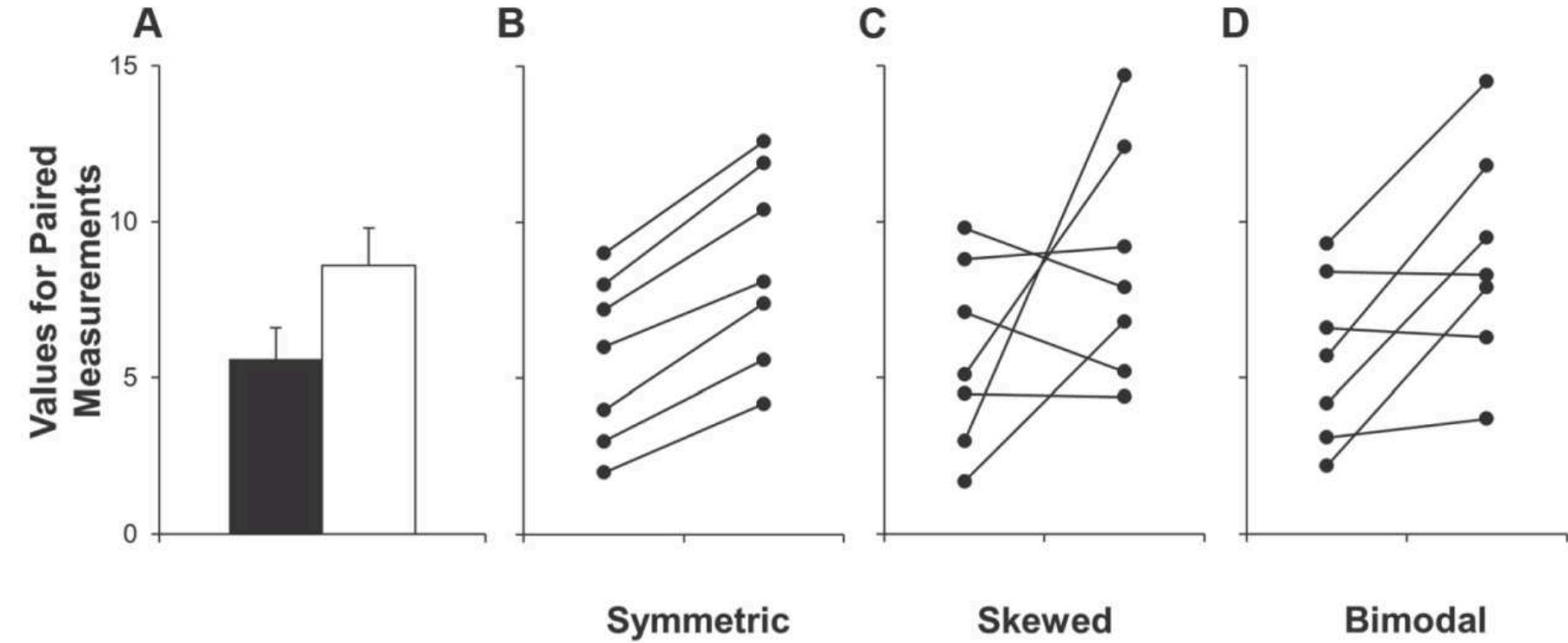


Symmetric**Outlier****Bimodal****Unequal n**

Modified from Weissgerber et al. (2015) PLoS Biology



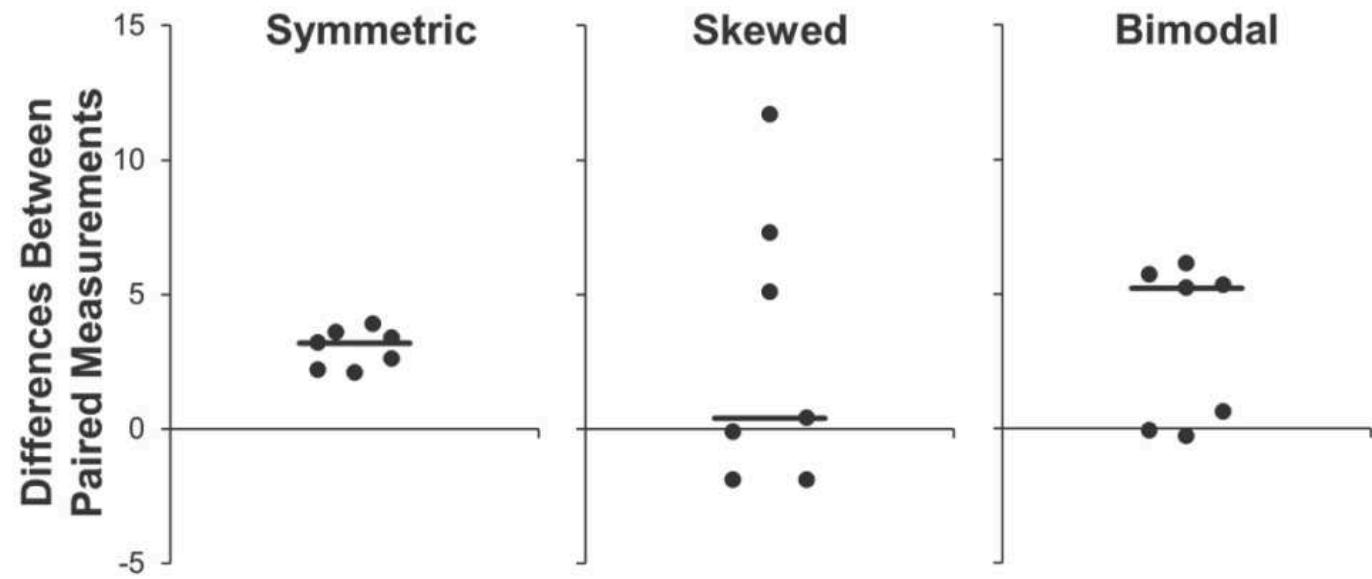
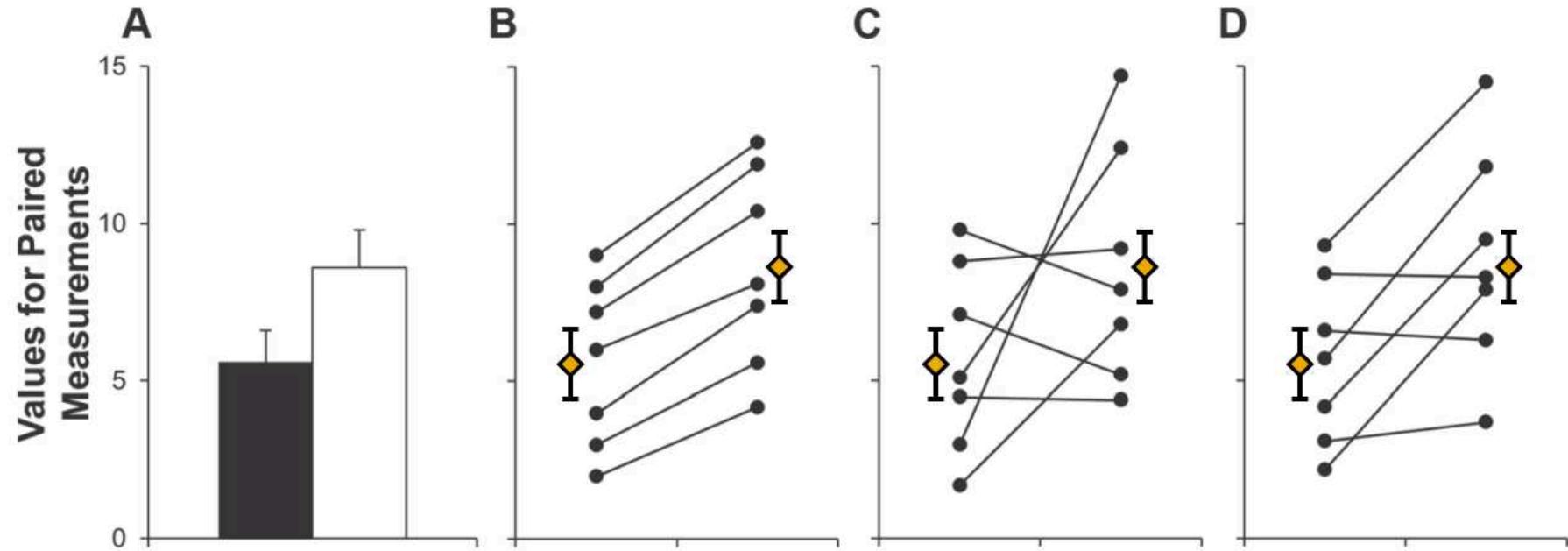




Modified from Weissgerber et al. (2015) PLoS Biology

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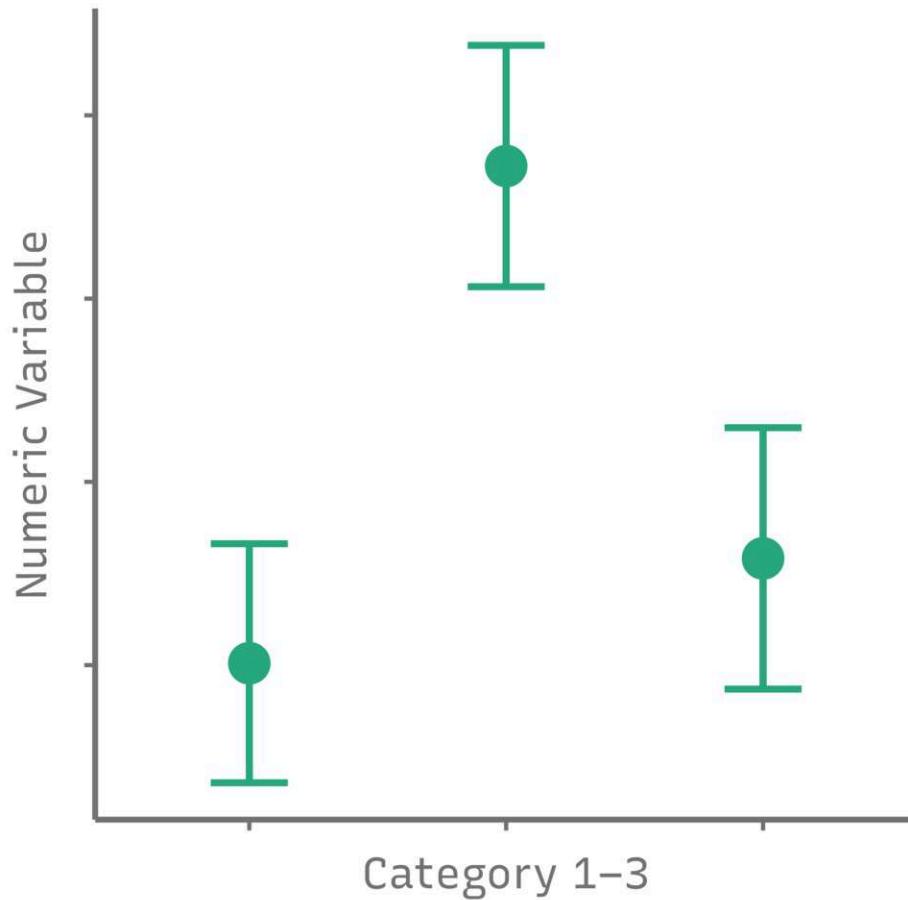


Modified from Weissgerber et al. (2015) PLoS Biology

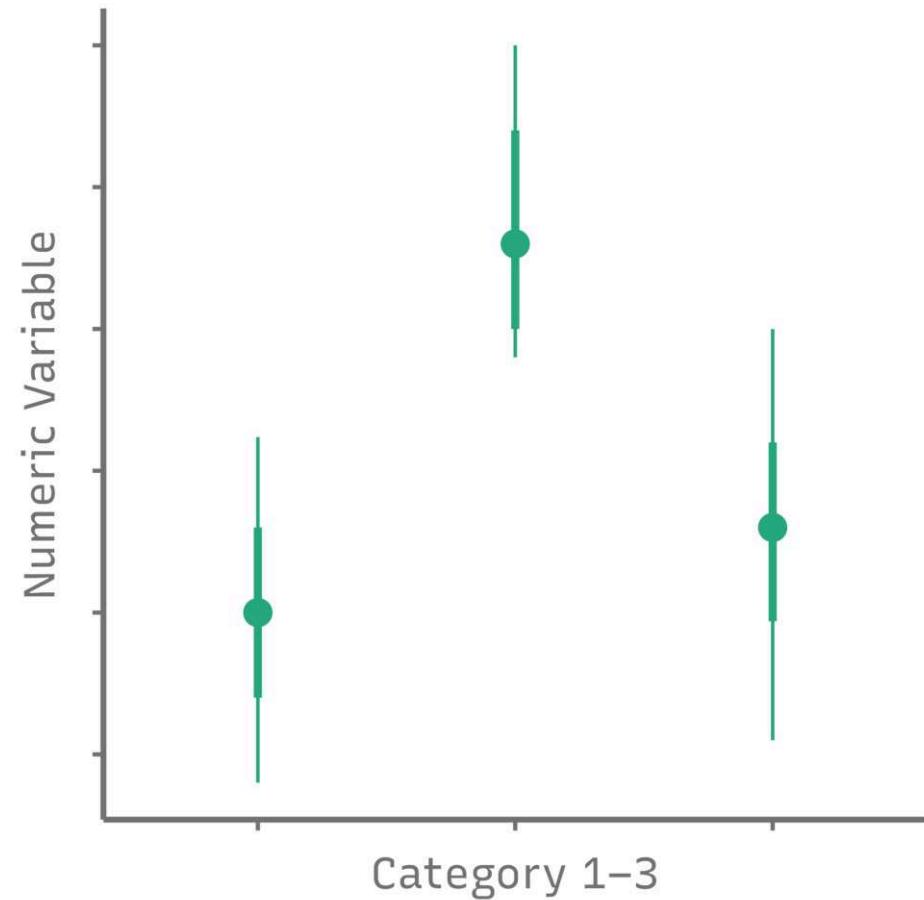
Cédric Scherer Data Visualization & Information Design



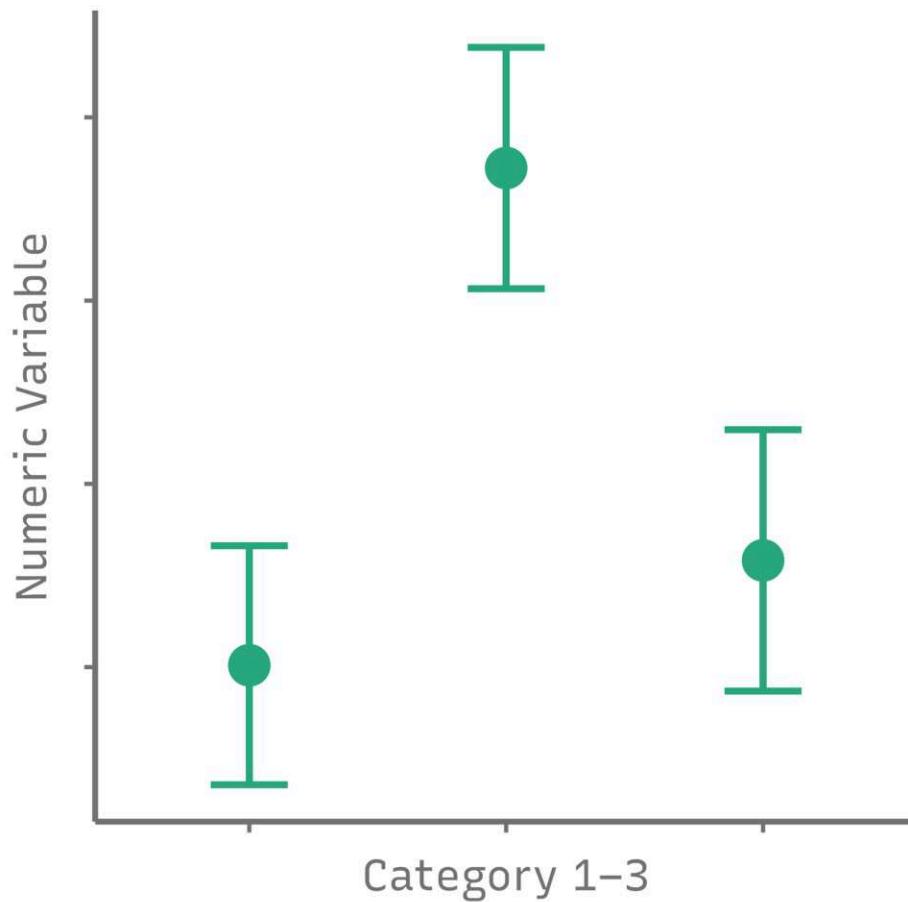
Error Bars



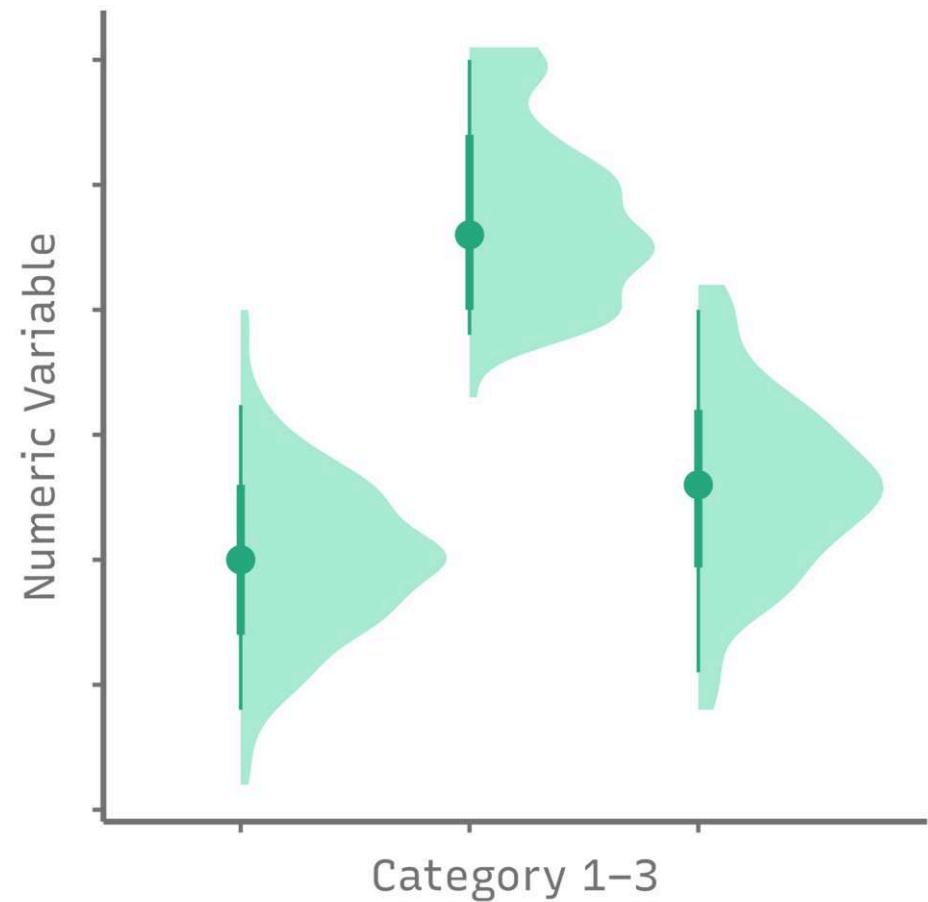
Multi-Interval Errors Bars



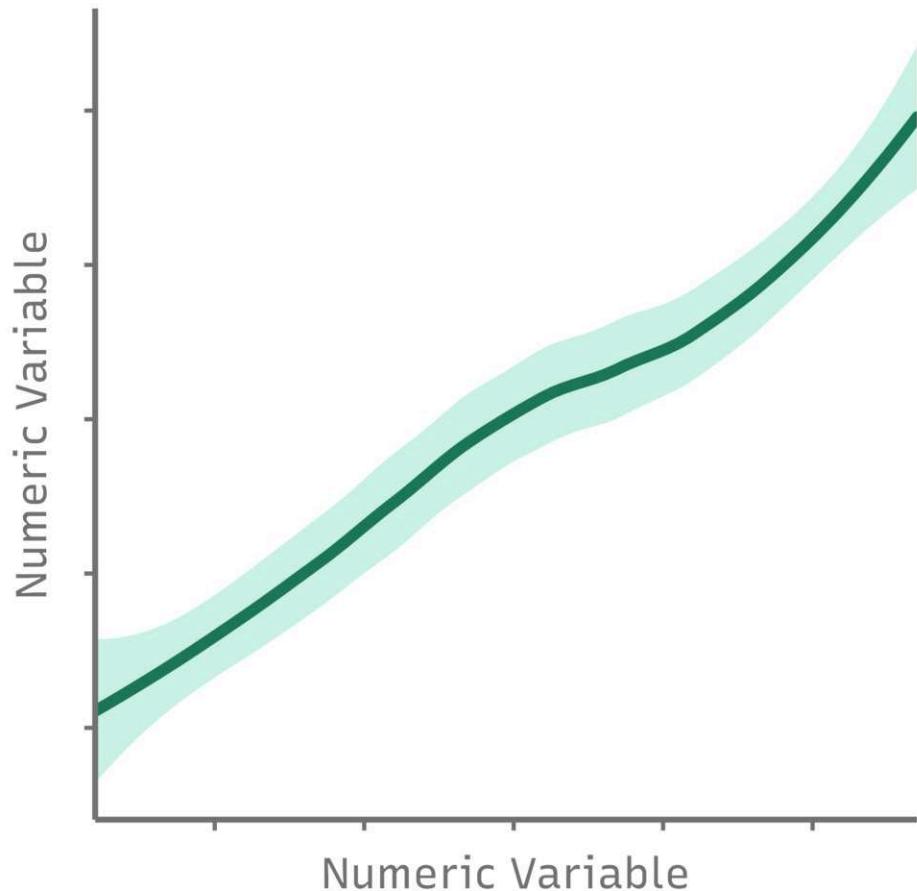
Error Bars



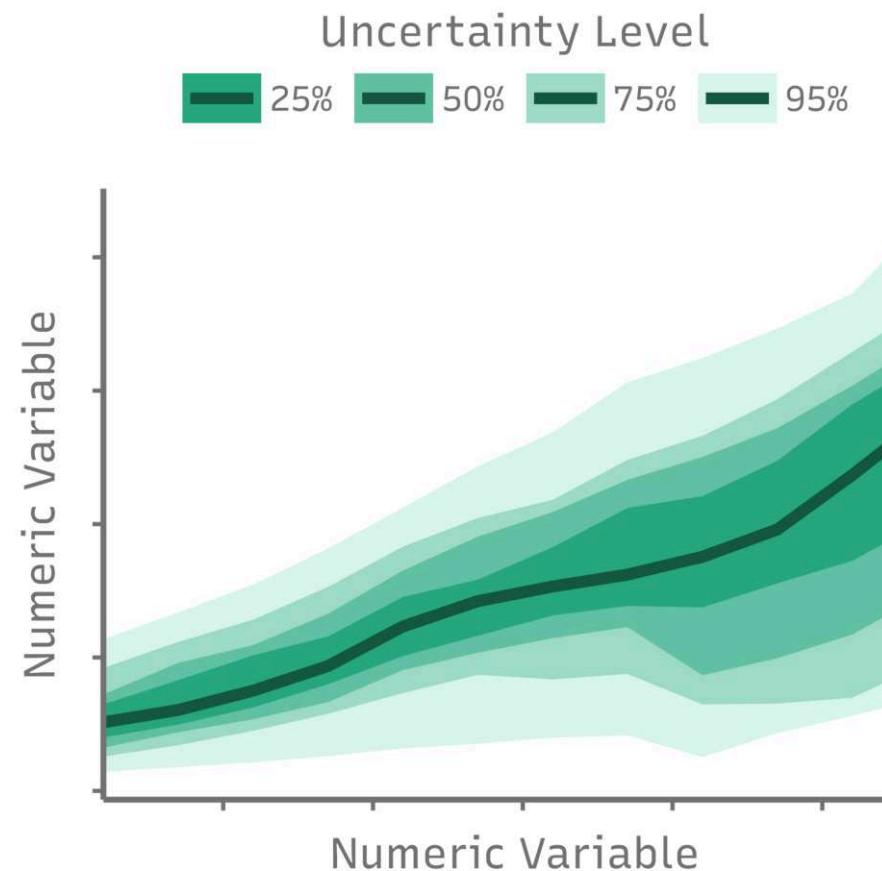
Half-Eye Plots



Confidence Band



Graded Confidence Bands

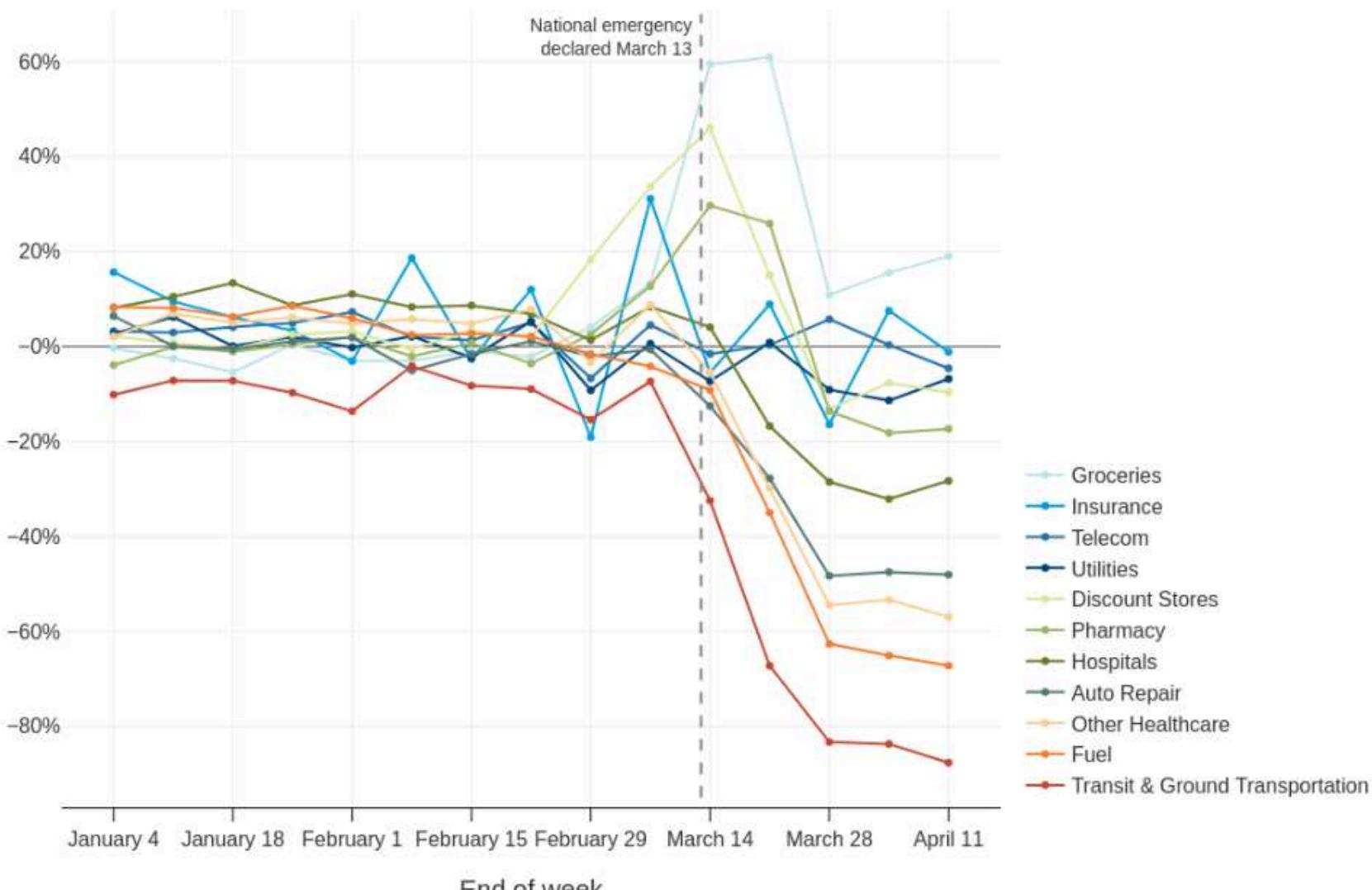


“Spaghetti Plots”

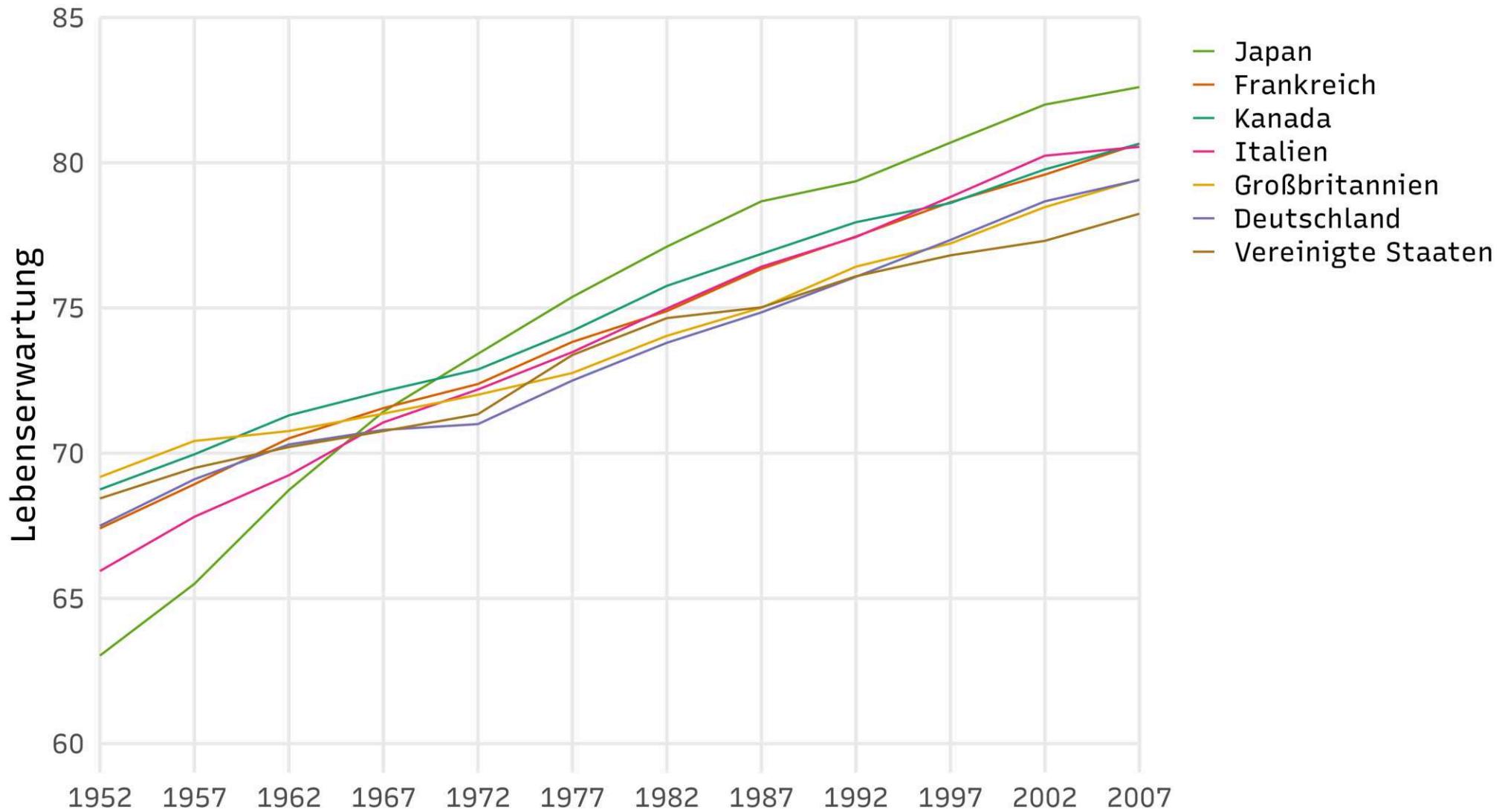


“Spaghetti Plots”

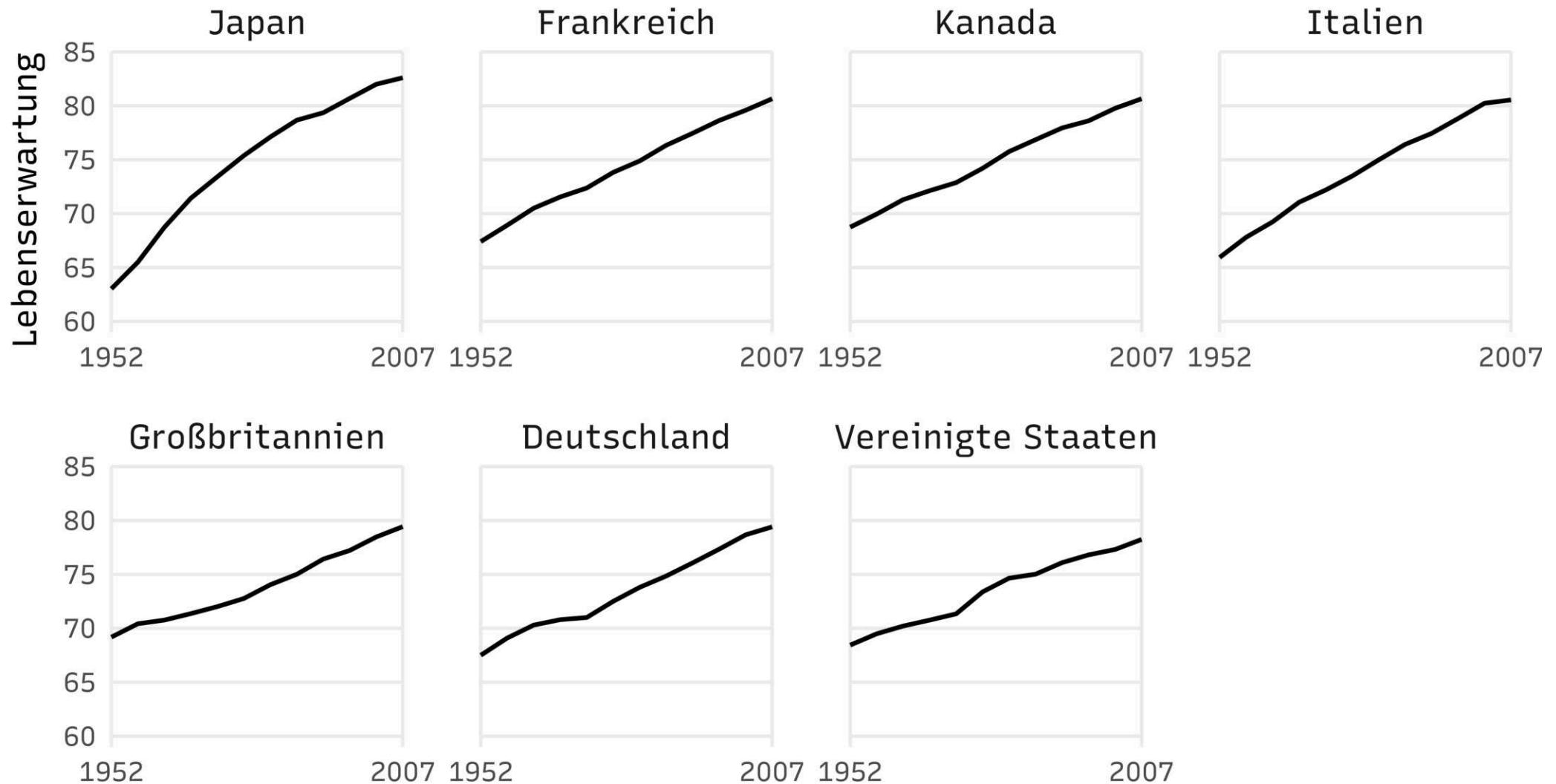
Year-over-year percent change in spending by essential category



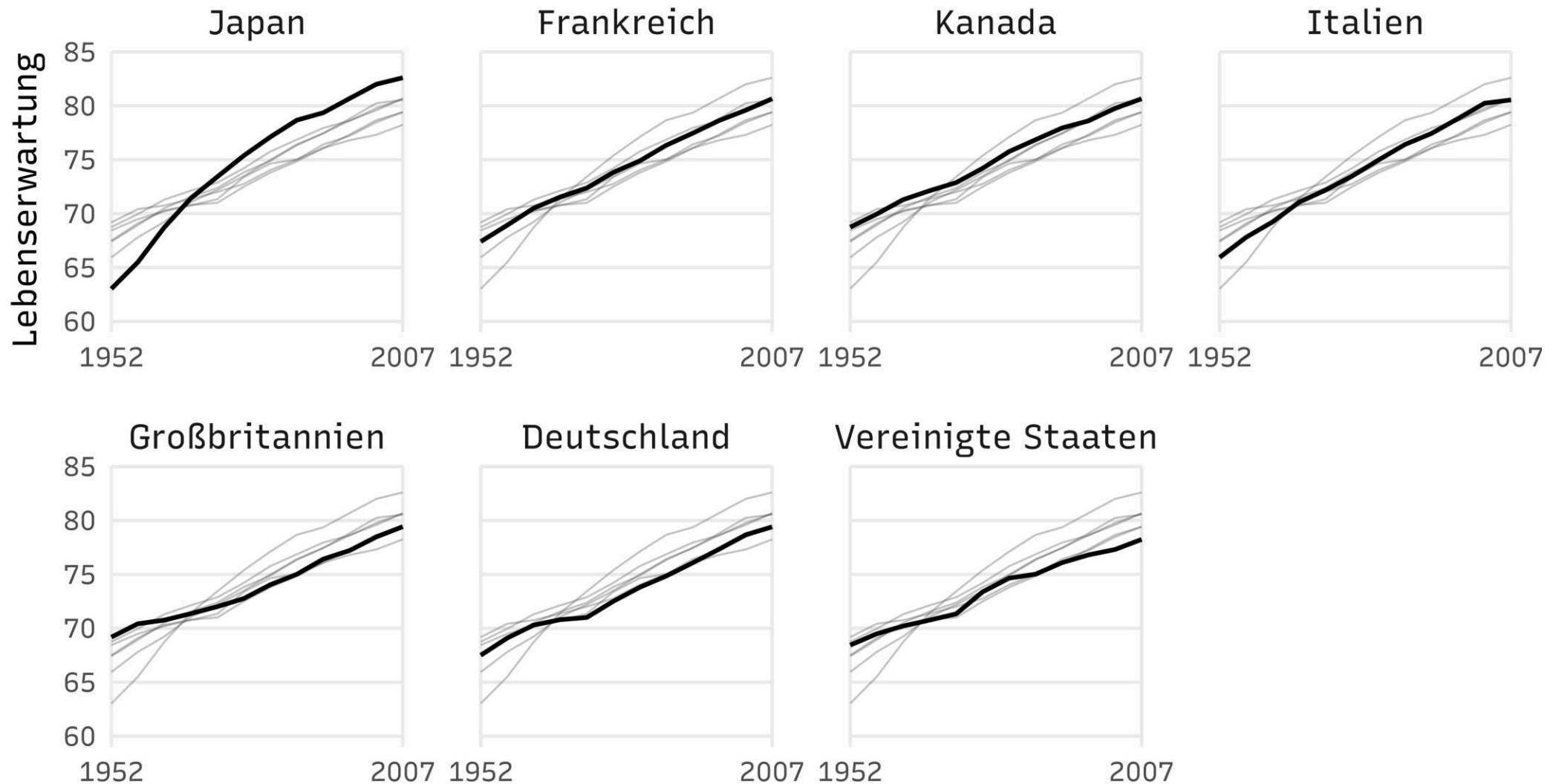
“Spaghetti Plots”

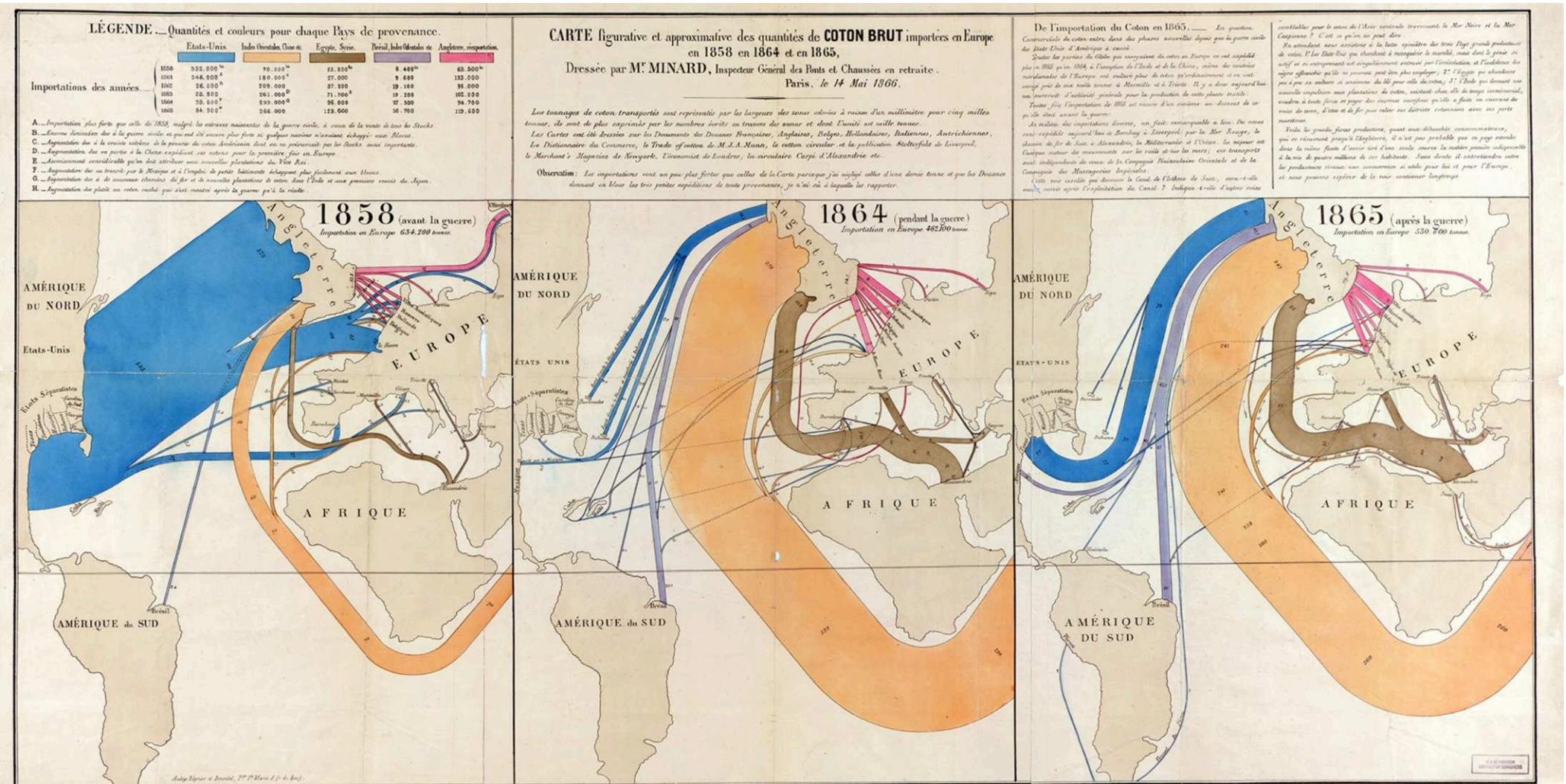


"Small Multiples"



"Small Multiples"





"Carte figurative et approximative des quantités de coton brut importées en Europe en 1858, en 1864 et en 1865" von Charles Joseph Minard (1866)



Übungsteil

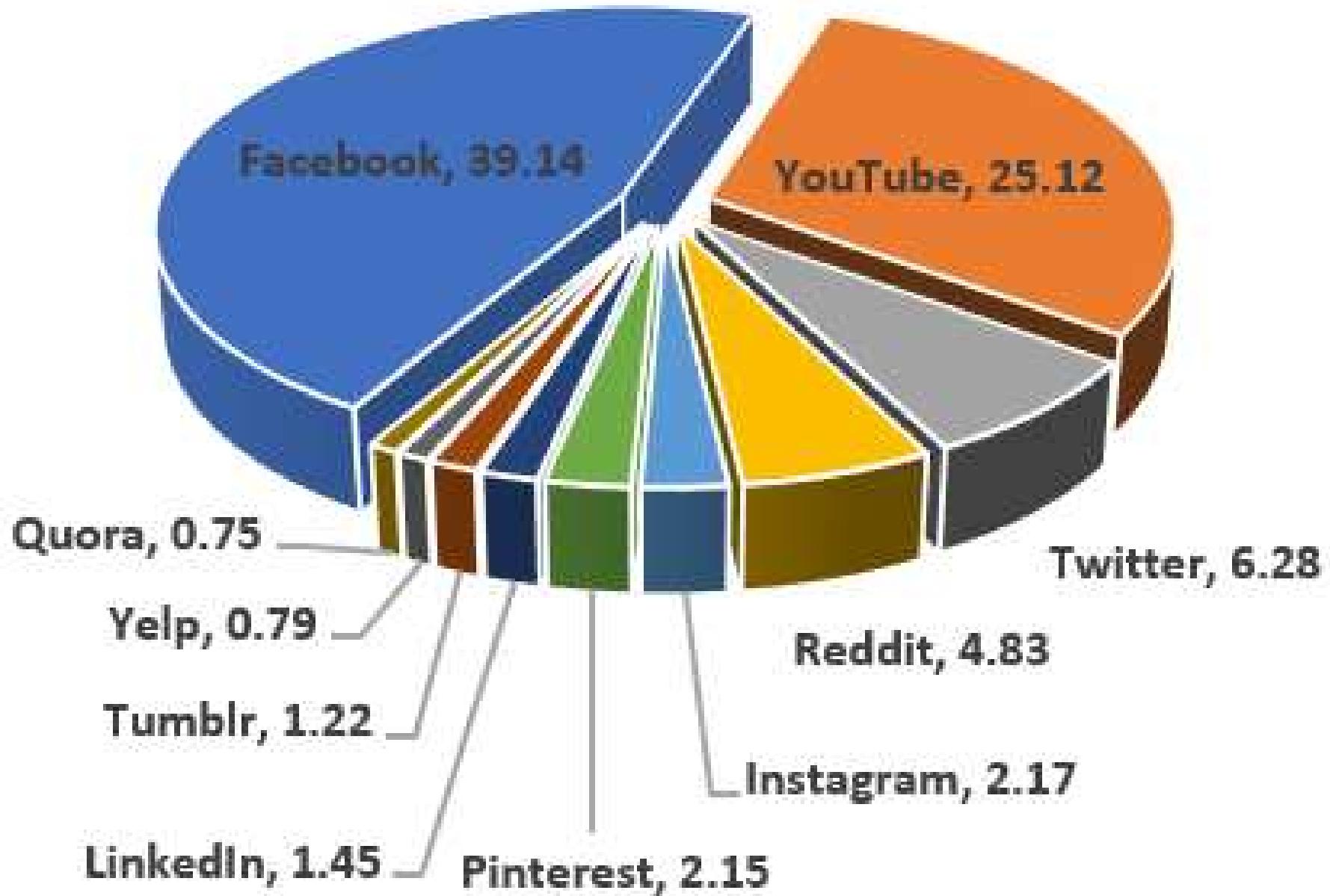


Übung

Diskutiere die folgende Grafik.

- Sind die dargestellten Werte plausibel und die Daten einwandfrei aufbereitet?
- Welche zentrale Botschaft vermittelt die Visualisierung?
- Sind alle gezeigten Daten relevant für diese Botschaft?
- Unterstützt der gewählte Diagrammtyp die Aussage? Was funktioniert gut – und was nicht?
- Welche Möglichkeiten gäbe es, das Kuchendiagramm zu verbessern?
- Welcher alternative Diagrammtyp könnte die Aussage klar und wirkungsvoll vermitteln?
- Skizziere eine alternative Darstellung.





Market share of visits to social network sites in November 2017,
gefunden in einem Artikel zu "[Why you shouldn't use pie charts](#)" by The University of Melbourne



Übung

Eine Befragung ergab, dass 85% (+22 Prozentpunkte seit 2015) der städtischen Bevölkerung und 78% (+44 Prozentpunkte) der ländlichen Bevölkerung das Internet nutzen. Die Nutzungssteigerung in ländlichen Gebieten ist deutlich höher, auch wenn der absolute Anteil noch leicht hinter dem der Städte liegt.

Jüngere Erwachsene (18–29 Jahre) erreichen mit 95% auf dem Land und 96% in der Stadt die höchsten Nutzungsquoten, während bei älteren Personen (60+) die Differenz zwischen Stadt (62%) und Land (45%) weiterhin deutlich ist.

Die Altersgruppe der 30- bis 49-Jährigen zeigt ebenfalls eine hohe Nutzung auch in der ländlichen Bevölkerung: mit 86% auf dem Land liegen sie nur sechs Prozentpunkte hinter ihren Altersgenossen in der Stadt.



Übung

Lies den Text aufmerksam und arbeite die inhaltlichen Schwerpunkte heraus:

- Welche Informationen werden vermittelt? Notiere zentrale Zahlen, Gruppen und Entwicklungen.
- Was ist die zentrale Botschaft oder eine mögliche Erzählrichtung der Darstellung?
- Welche Vergleiche oder Unterschiede könnten visuell betont werden?
- Nutze deine Erkenntnisse, um geeignete Diagrammtypen zu skizzieren, die die Botschaft klar und effektiv vermitteln.



Übung

Nutze deine Erkenntnisse, um geeignete Diagrammtypen zu skizzieren, die die Botschaft klar und effektiv vermitteln.

Zeichne Varianten, mit denen sich zum Beispiel:

- die aktuellen Nutzungsanteile von Stadt- und Landbevölkerung gegenüberstellen lassen;
- sowohl aktuelle Werte als auch Veränderungen sichtbar machen lassen – mit Fokus auf die Entwicklung im ländlichen Raum;
- Unterschiede zwischen Altersgruppen in der Internetnutzung herausarbeiten lassen.

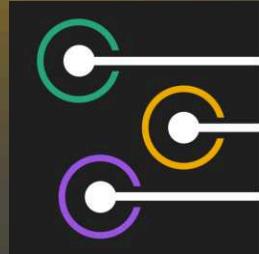


Projektarbeit

- Wähle mehrere **potentielle Diagrammtypen** aus, die zu deinen Datentypen und gewählten Kodierungen passen.
- **Skizziere mögliche Umsetzungen** basierend auf den Typen und der Struktur in deinem Datesatz – oder erstelle direkt erste Visualisierungen auf Basis deiner Daten.
- Erprobe unterschiedliche **Varianten**, z.B. durch den Wechsel der Perspektive oder der Farbpalette.
- Beurteile, wie gut jedes Diagramm deine **zentrale Botschaft** unterstützt. Ordne die Diagramme nach Zweckmäßigkeit.
- Reflektiere, welche Varianten auch im Hinblick auf **Publikum, Storytelling und gestalterische Originalität** besonders geeignet sind.
- Notiere, welche Diagrammtypen du für weniger geeignet hältst – und begründe deine Einschätzung.



Dankeschön!



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