

Communicating with Data –Deceptive Visualizations & Design Rules of Thumb

Dr. Ab Mosca (they/them)

Slides based off slides courtesy of Jordan Crouser (<https://jcrouser.github.io/>)

Plan for Today

- Avoiding bias and trickery in visualization design
- Design Rules of Thumb

Flashback

What are some perceptual tricks we learned about previously?

How do we avoid bias & trickery?

Inspect the data

→ Source?

→ Biases?

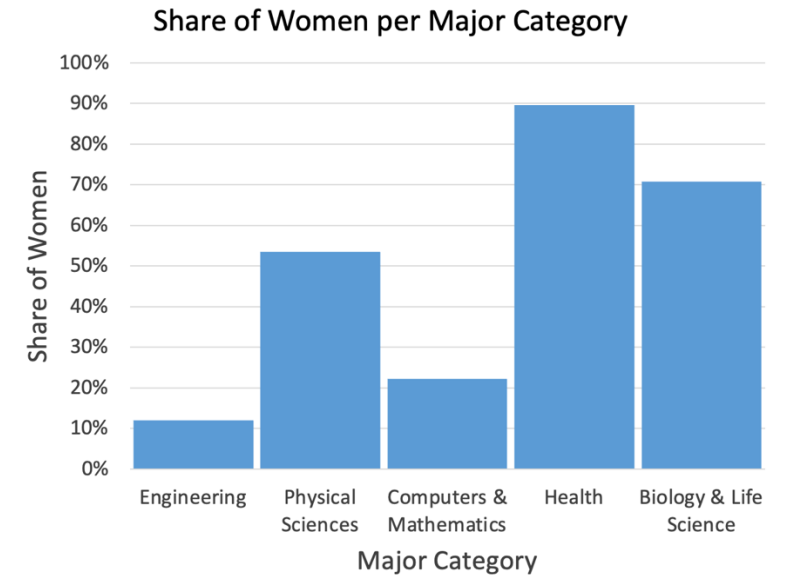
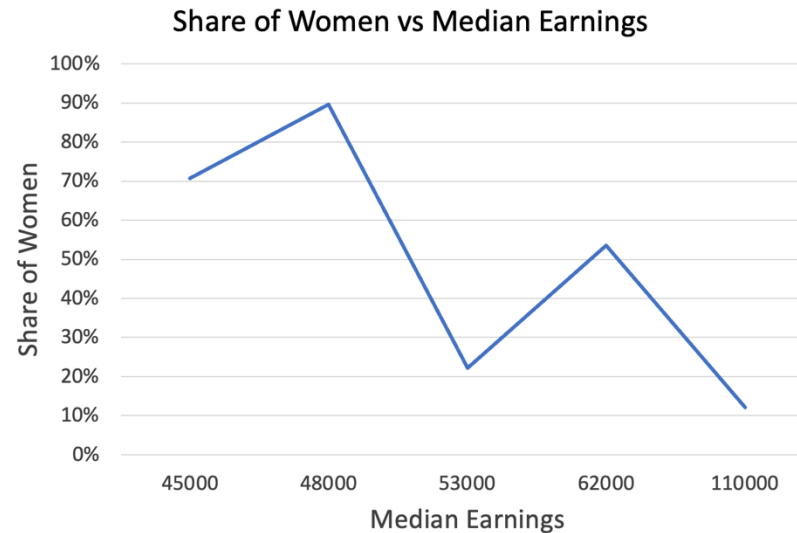
Rank	Major_category	Total	Men	Women	Share_women	Median_earnings
1	Engineering	2339	2057	282	12%	110000
7	Physical Sciences	1792	832	960	54%	62000
19	Computers & Mathematics	128319	99743	28576	22%	53000
27	Health	209394	21773	187621	90%	48000
36	Biology & Life Science	1762	515	1247	71%	45000

Data:

<https://github.com/fivethirtyeight/data/blob/master/college-majors/women-stem.csv>

How do we
avoid bias &
trickery?

Design Contentiously & Read Critically
→ What's shown vs not?



Data:

<https://github.com/fivethirtyeight/data/blob/master/college-majors/women-stem.csv>

Design Contentiously & Read
Critically

→ Goal

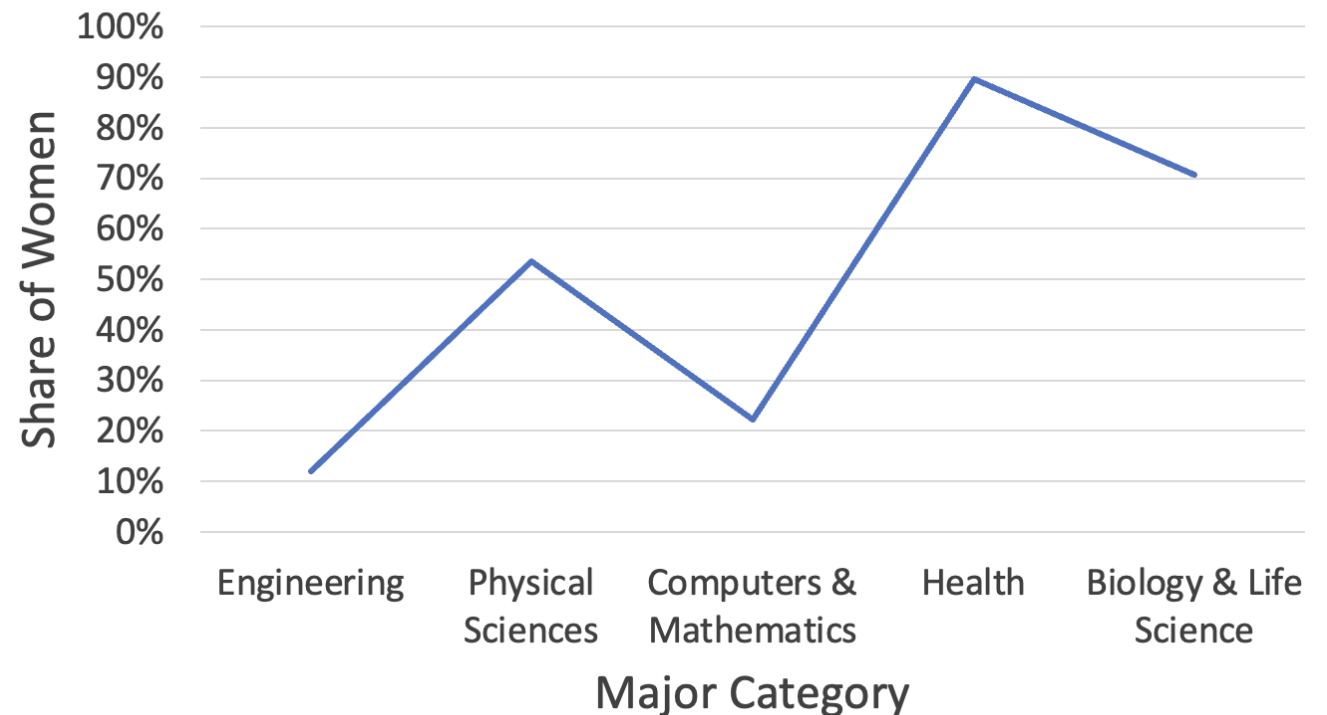
→ Data types

How do we
avoid bias &
trickery?

Data:

<https://github.com/fivethirtyeight/data/blob/master/college-majors/women-stem.csv>

Share of Women per Major Category



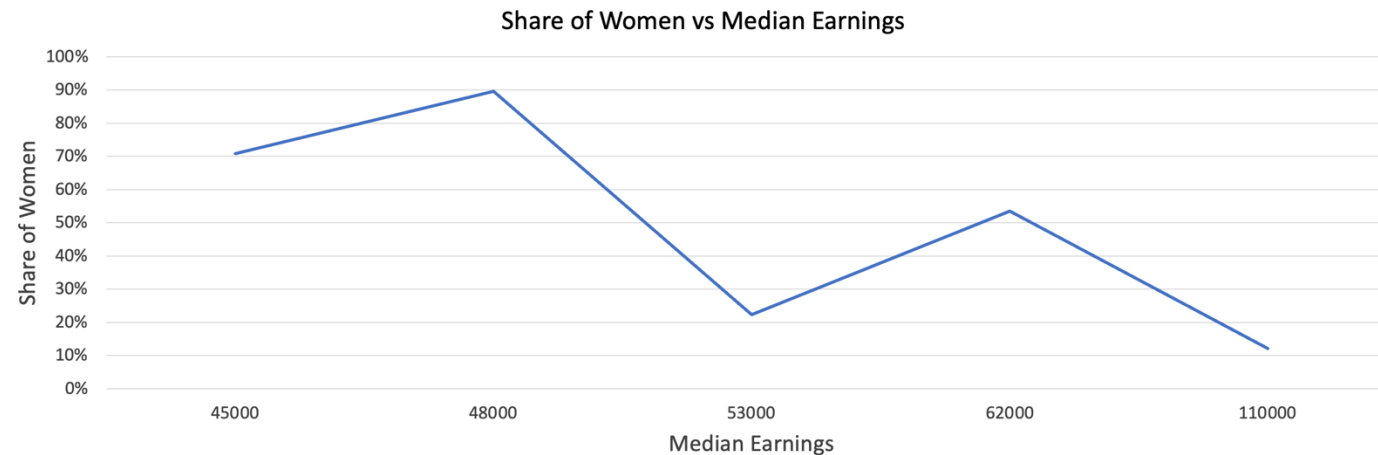
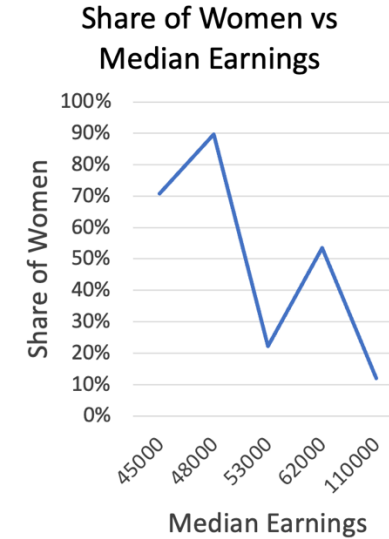
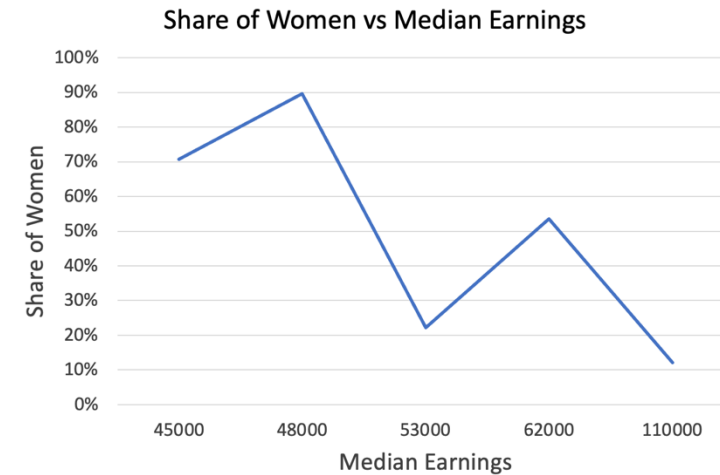
Design Contentiously & Read Critically

→ Aspect ratio

How do we
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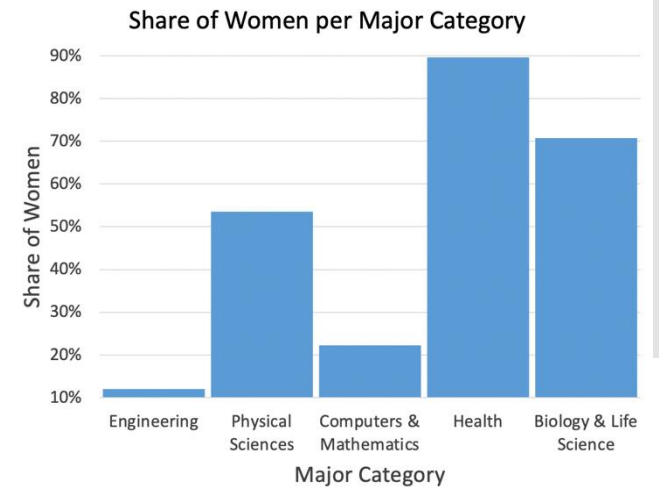
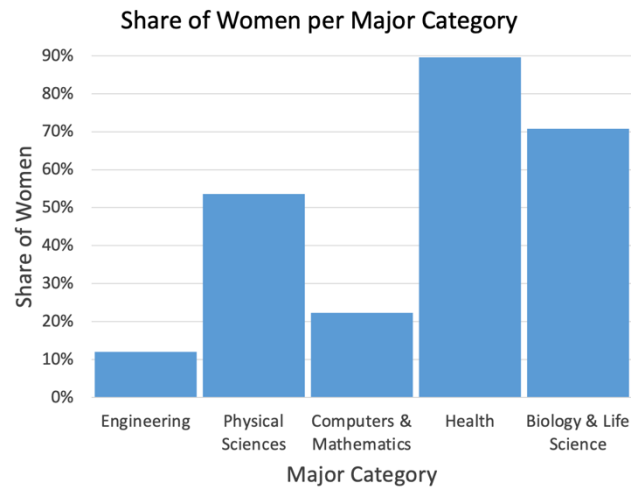
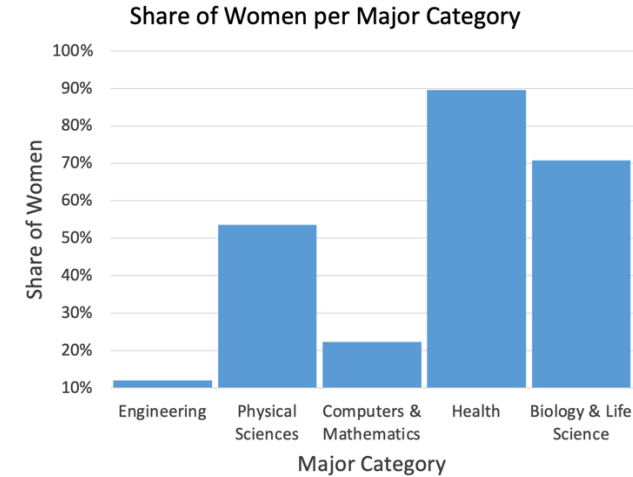
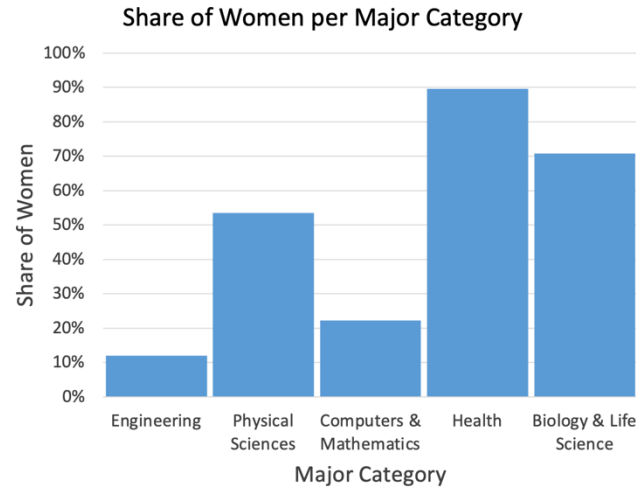


Design Contentiously & Read Critically → Axes

How do we
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trickery?

Data:

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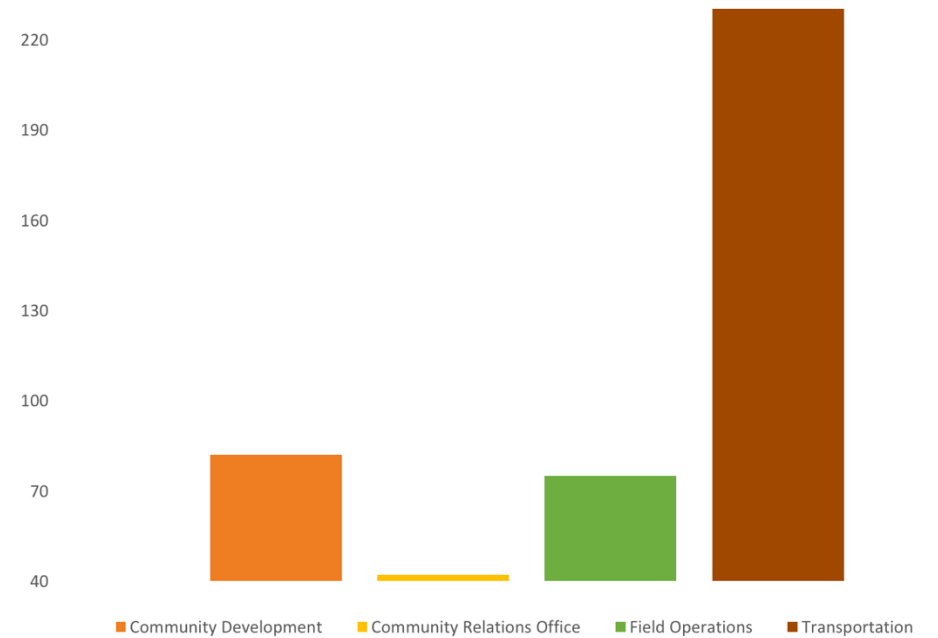


Take a critical look at this chart.
Notice anything?

Let's practice

Graffiti on public transportation off the chart in Tempe

According to City of Tempe, graffiti that city workers noticed and reported in 2015 were exceedingly high for public transportation.



Source: City of Tempe, 2015

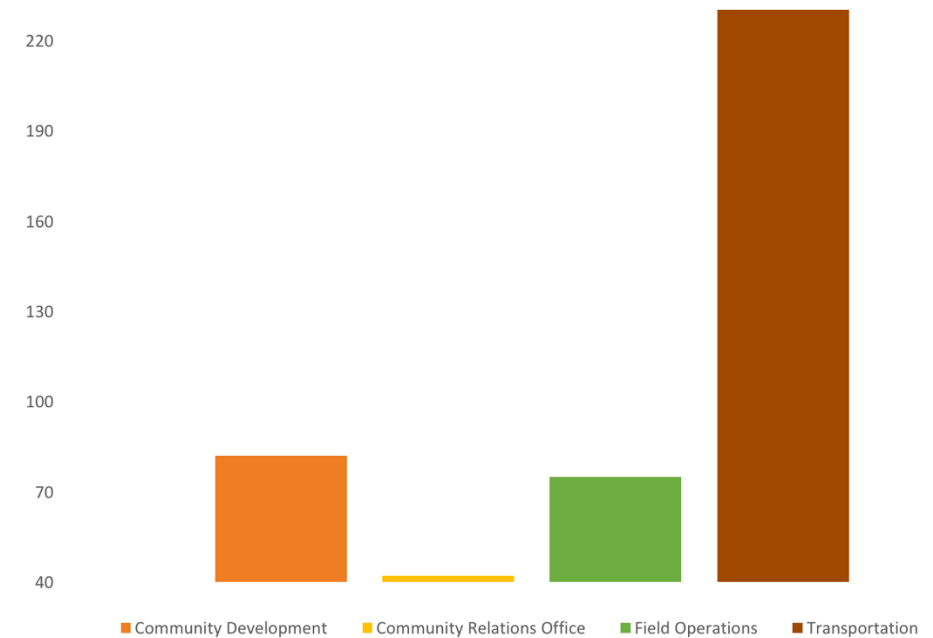
Let's practice

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Notice anything?

Re-design the chart (you can add
more data if you want)

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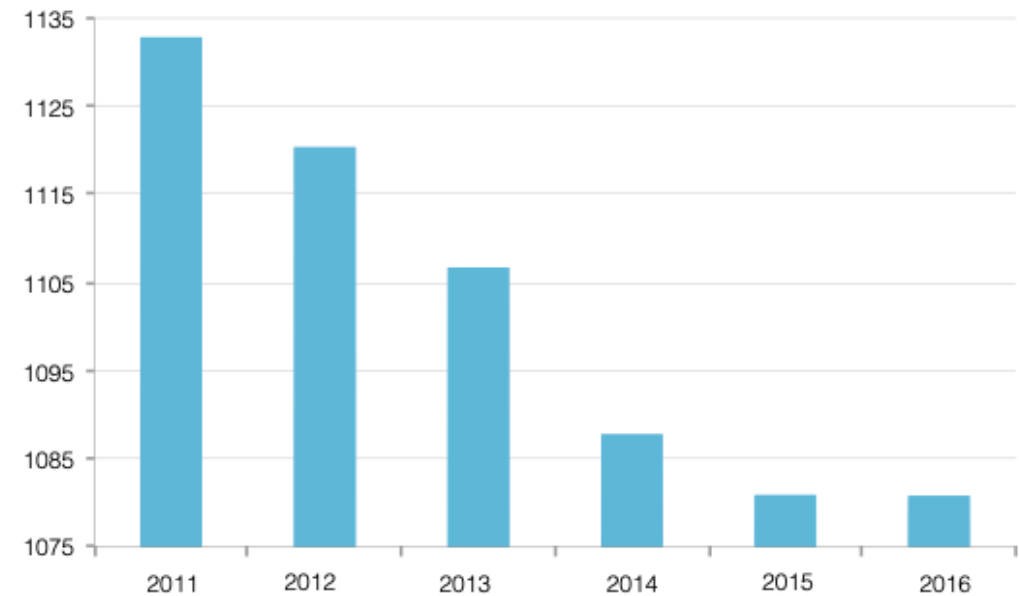
Source: City of Tempe, 2015

Let's practice

Take a critical look at this chart.
Notice anything?

Plummeting
Water Supply

Within the last 5 years, our water supply at Lake Mead has plummeted.



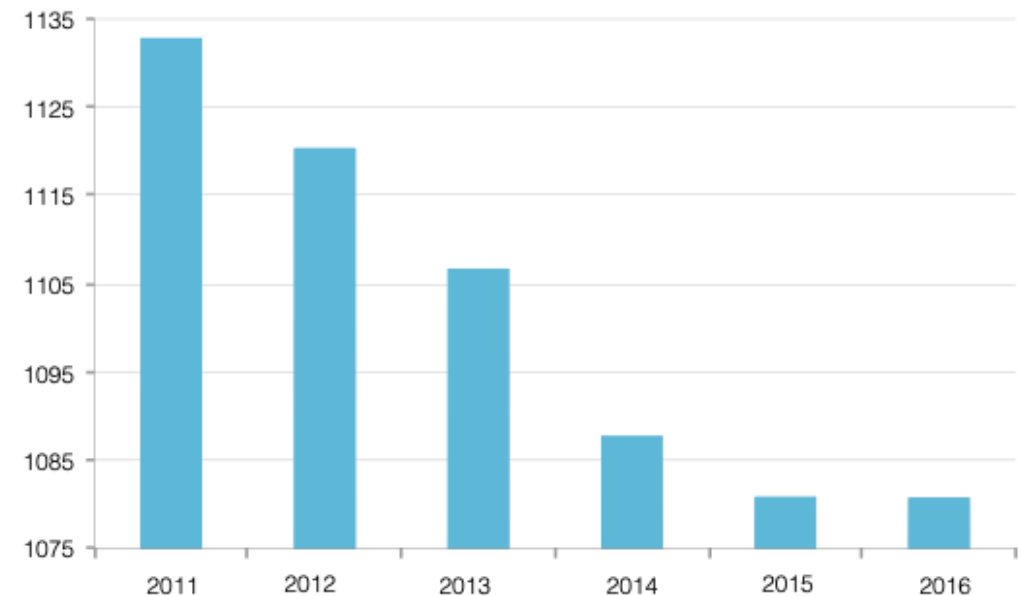
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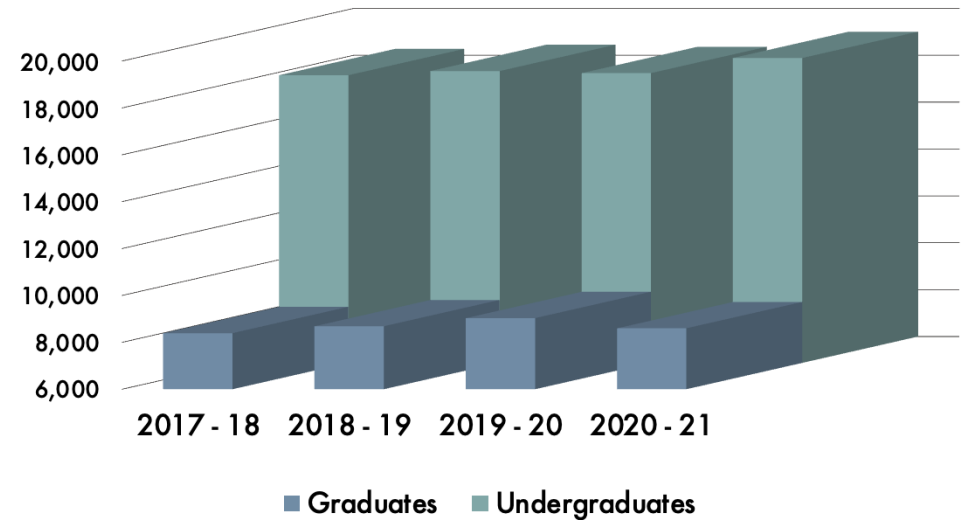
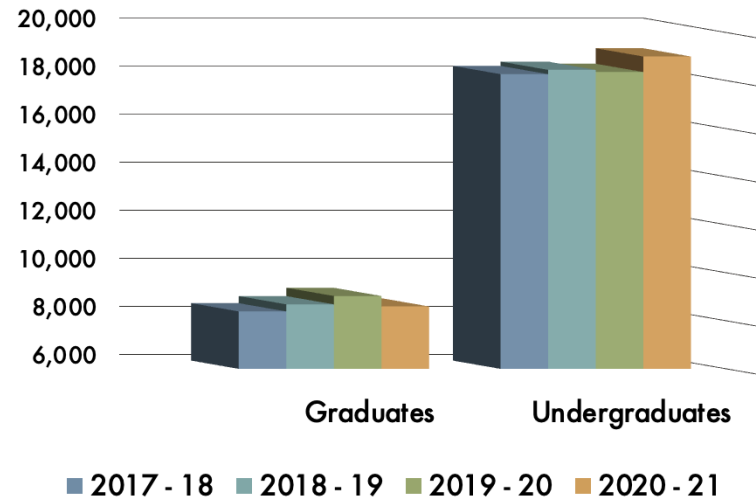
Design Rules of Thumb

1) No unjustified 3D / 2D

Design Rules of Thumb

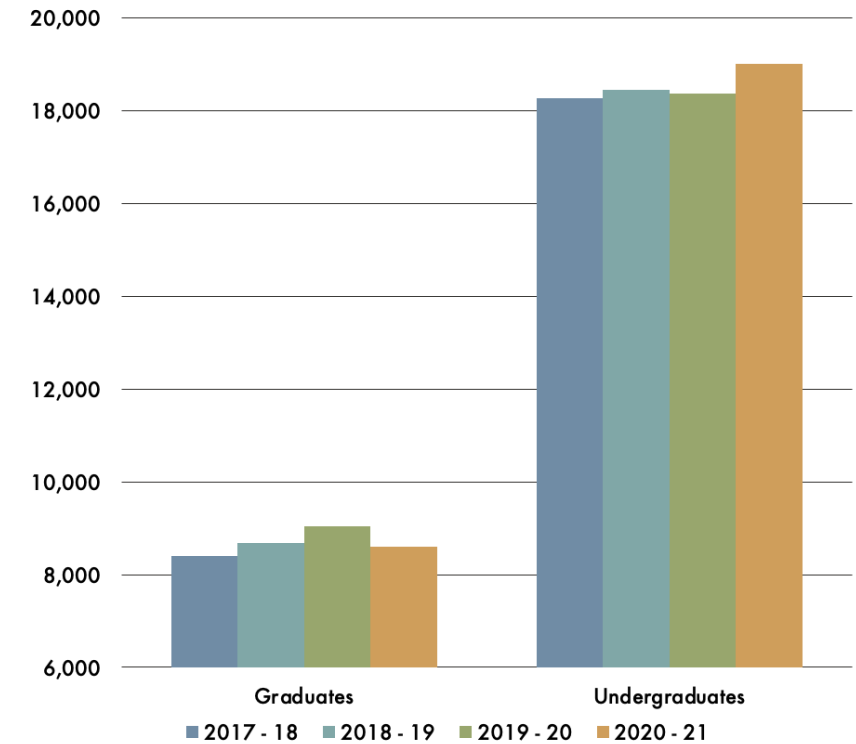
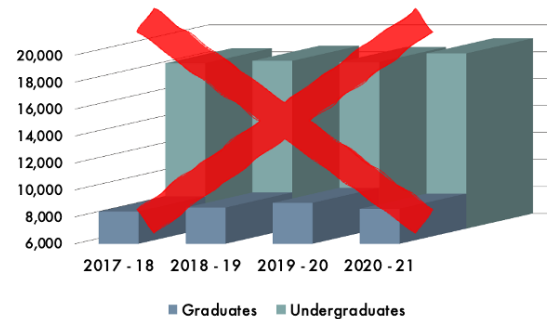
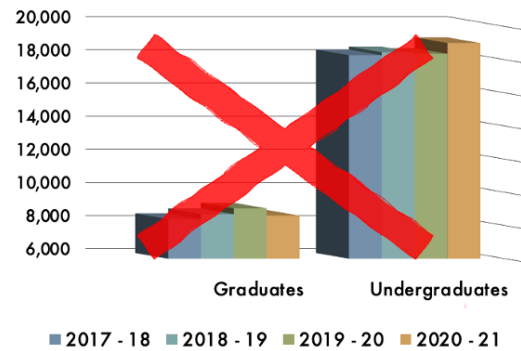
No unjustified 3D

- What do we gain from using 3D here? (What does the 3rd dimension encode?)
- What do we lose from using 3D here?



No unjustified 3D

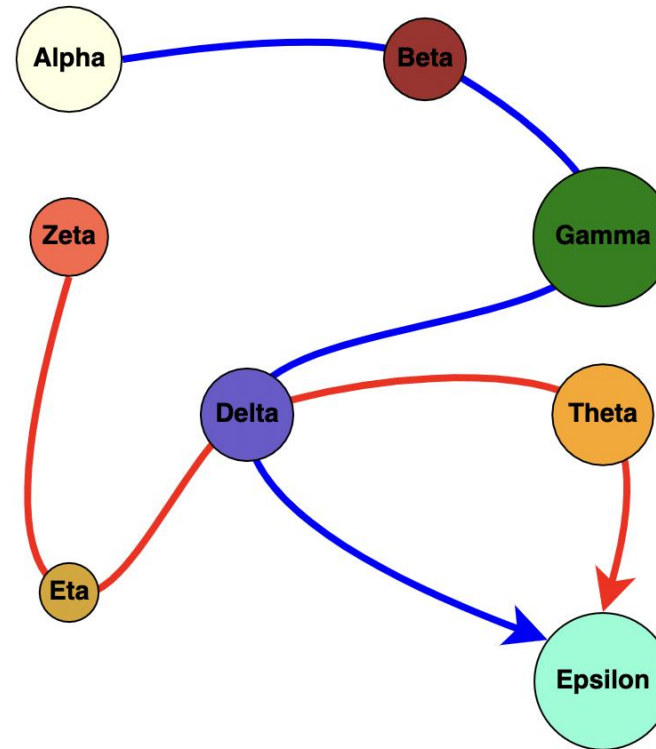
Design Rules of Thumb



Design Rules of Thumb

No unjustified 2D

Your task: What color is Delta?



Design Rules of Thumb

No unjustified 2D

Your task: What color is Delta?

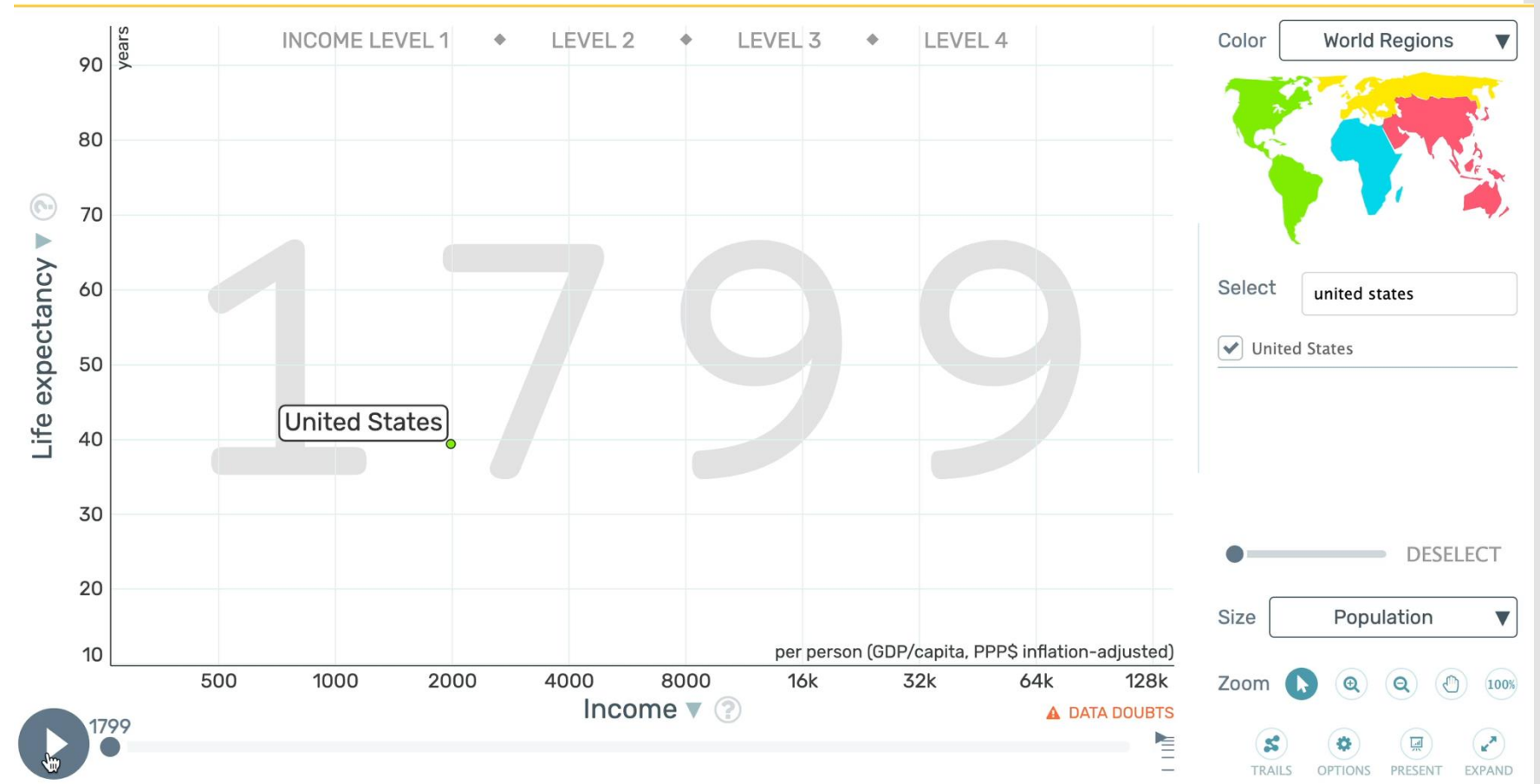
Node	Color
Alpha	White
Beta	Maroon
Delta	Purple
Epsilon	Teal
Eta	Mustard Yellow
Gamma	Green
Theta	Orange
Zeta	Pink

Design Rules of Thumb

- 1) No unjustified 3D / 2D
- 2) Eyes beat memory

Eyes beat memory

Design Rules of Thumb

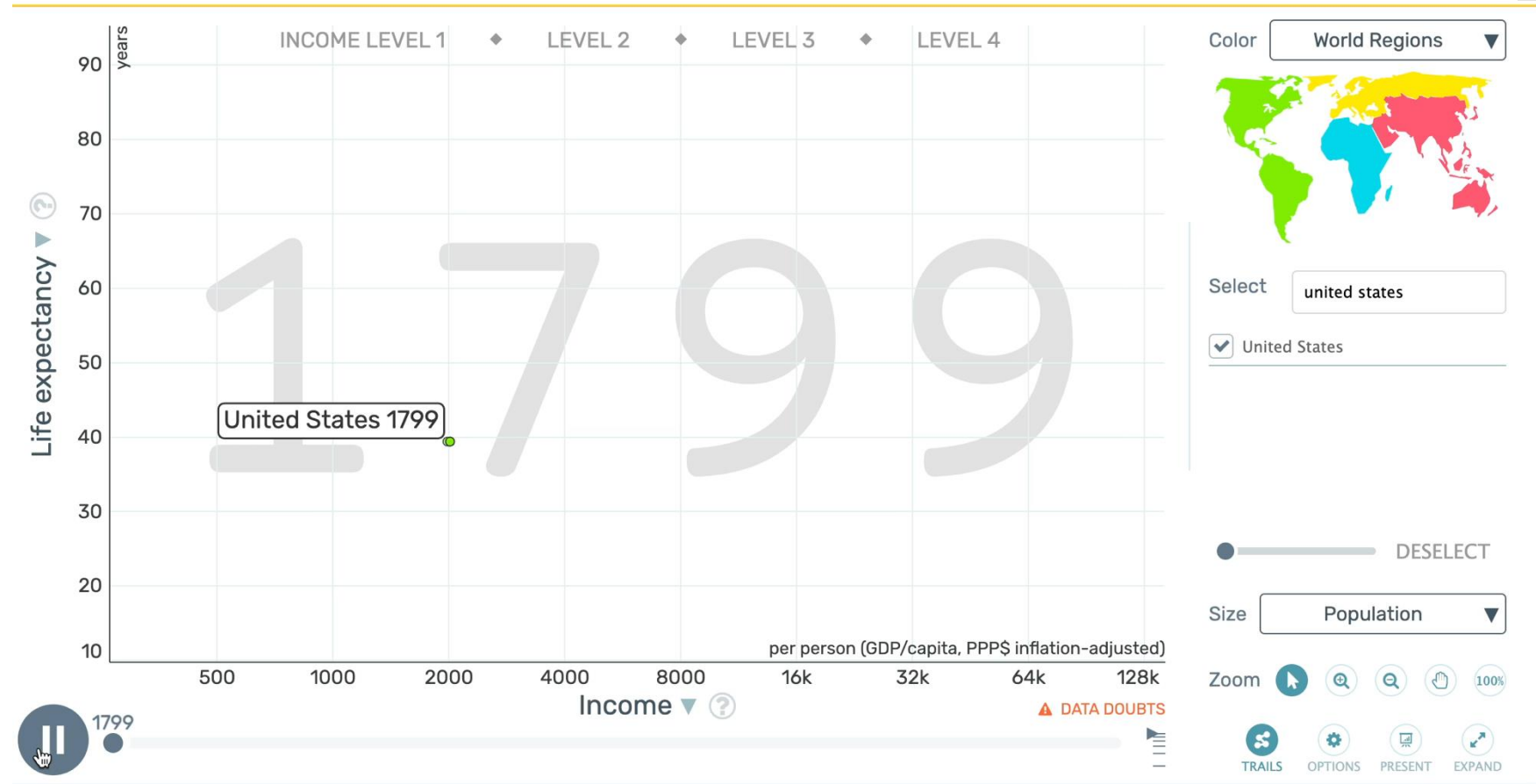


Eyes beat memory – What did the United State's trajectory look like from 1804 to 2018?

Design Rules
of Thumb

Design Rules of Thumb

Eyes beat memory – What did the United State's trajectory look like from 1804 to 2018?

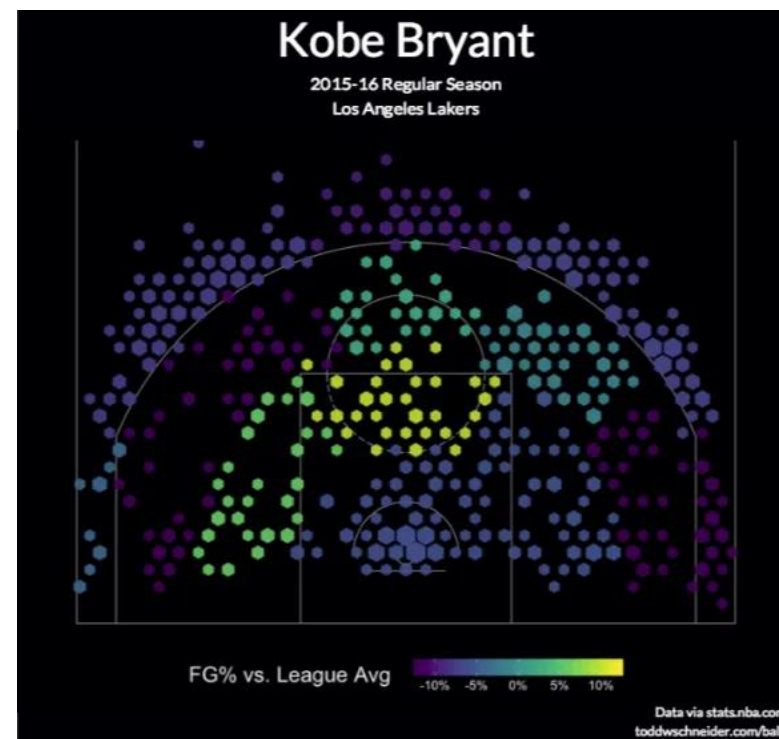
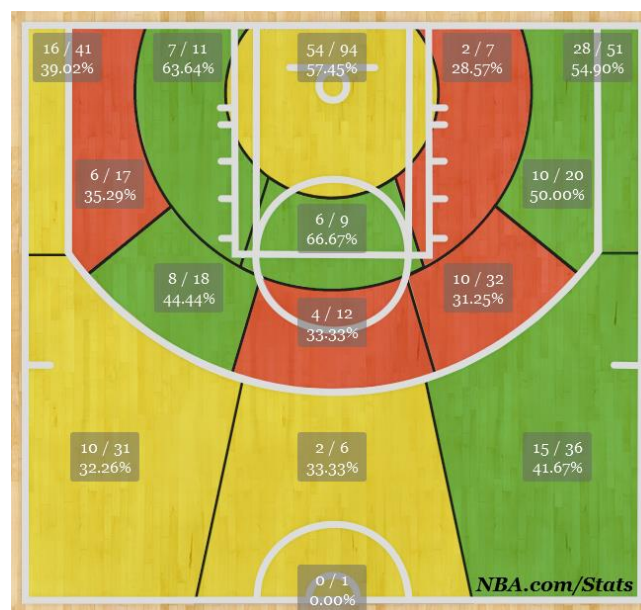


Design Rules of Thumb

- 1) No unjustified 3D / 2D
- 2) Eyes beat memory
- 3) Resolution over immersion

Resolution over immersion – Immersion often comes at the cost of resolution and isn't always feasible. A high-res display can achieve a lot.

Design Rules of Thumb



Design Rules of Thumb

- 1) No unjustified 3D / 2D
- 2) Eyes beat memory
- 3) Resolution over immersion
- 4) Overview First, Zoom and Filter, Detail on Demand

Design Rules of Thumb

Overview first, zoom and filter, details on demand – Motto that guides most visualization design

The Eyes Have It: A Task by Data Type Taxonomy for Information Visualizations

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Abstract

A useful starting point for designing advanced graphical user interfaces is the Visual Information-Seeking Mantra: overview first, zoom and filter, then details on demand.

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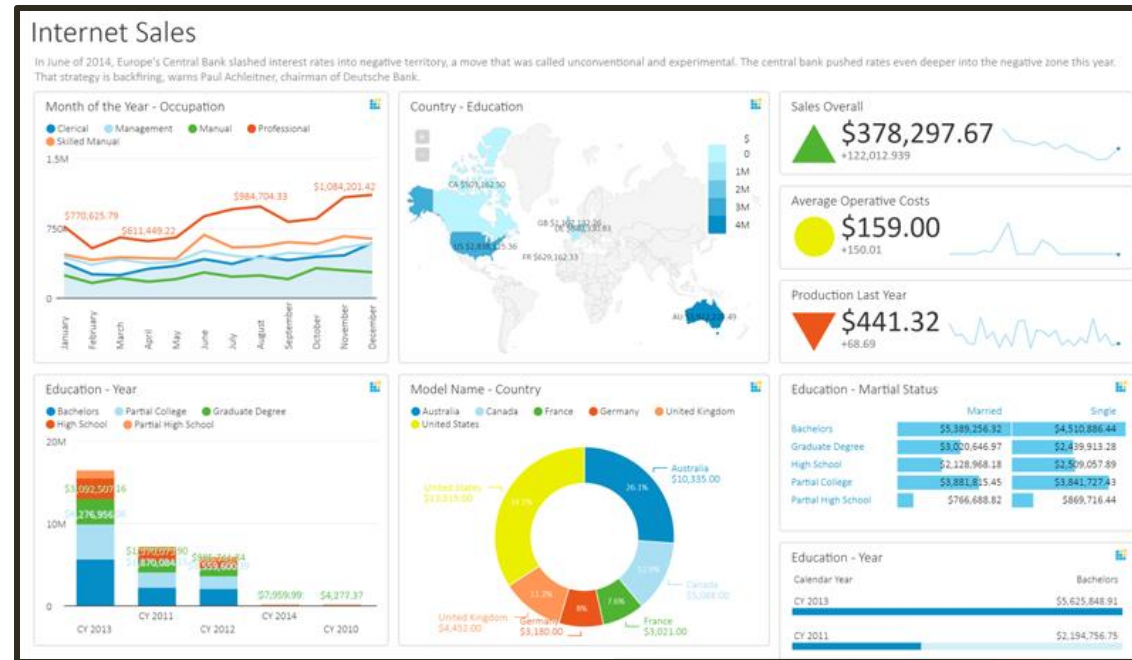
There are many visual design guidelines but the basic principle might be summarized as the Visual Information Seeking Mantra:

Overview first, zoom and filter, then details-on-demand
Overview first, zoom and filter, then details-on-demand
Overview first, zoom and filter, then details-on-demand
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Overview first, zoom and filter, then details-on-demand

Each line represents one project in which I found myself rediscovering this principle and therefore wrote it down it as a reminder. It proved to be only a starting point

Overview first, zoom and filter, details on demand – Motto that guides most visualization design

Design Rules of Thumb



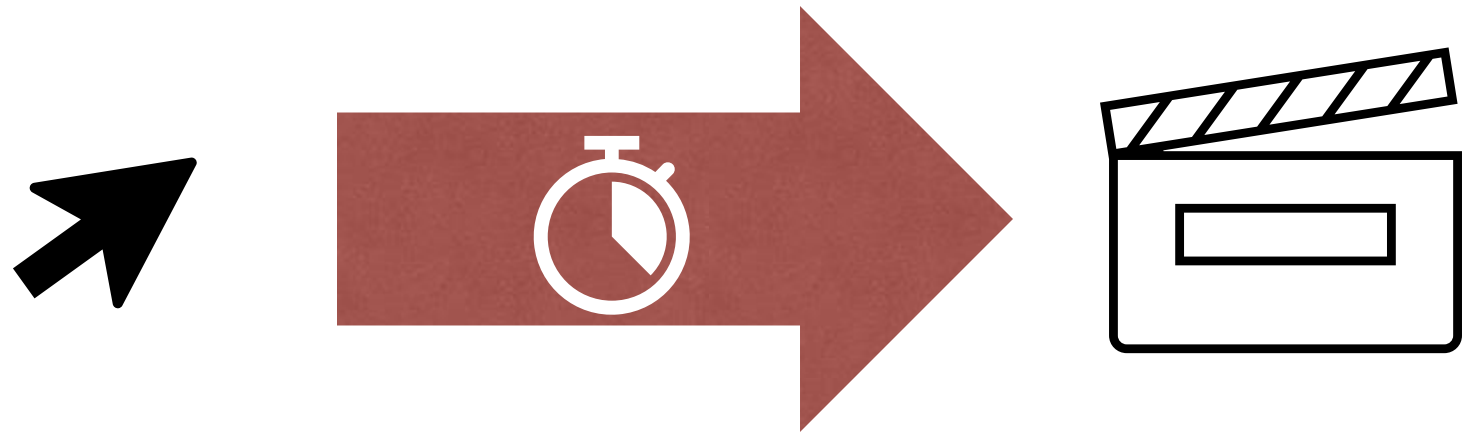
*This design guideline is most common for **visual analytic tools**

Design Rules of Thumb

- 1) No unjustified 3D / 2D
- 2) Eyes beat memory
- 3) Resolution over immersion
- 4) Overview First, Zoom and Filter, Detail on Demand
- 5) Responsiveness is required

Design Rules of Thumb

Responsiveness is required – Be aware of time from click to response



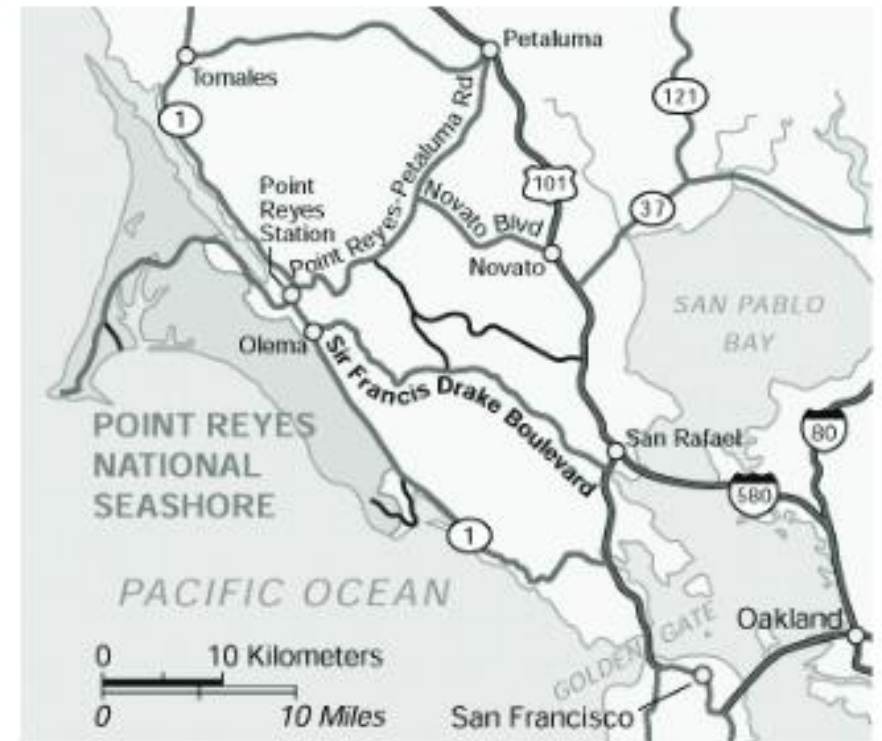
Time Constant	Value (in seconds)
perceptual processing	0.1
immediate response	1
brief tasks	10

Design Rules of Thumb

- 1) No unjustified 3D / 2D
- 2) Eyes beat memory
- 3) Resolution over immersion
- 4) Overview First, Zoom and Filter, Detail on Demand
- 5) Responsiveness is required
- 6) Get it right in black and white

Get it right in black and white – Use luminance to communicate data, and consider hue and saturation secondary

Design Rules of Thumb

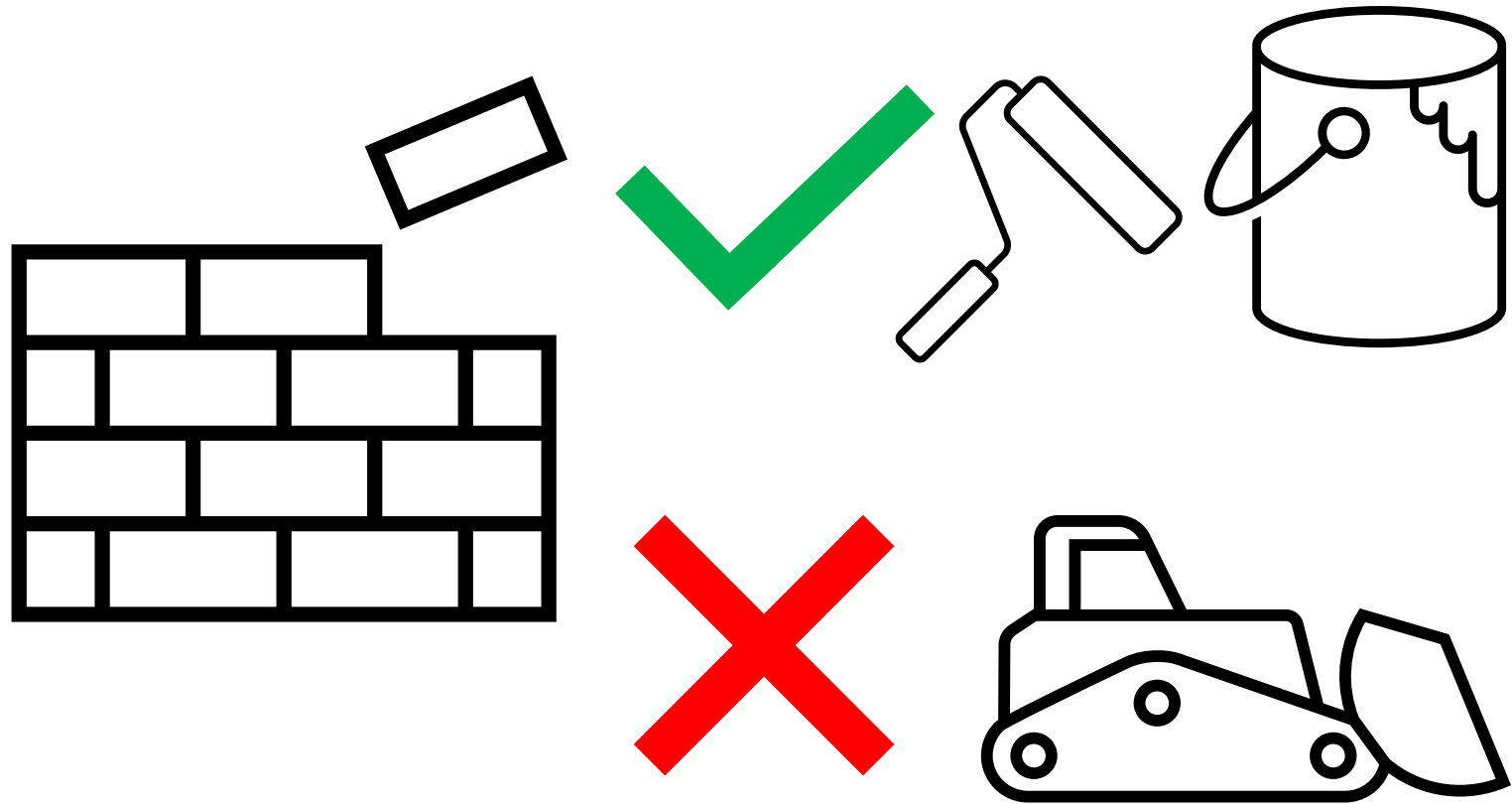


Design Rules of Thumb

- 1) No unjustified 3D / 2D
- 2) Eyes beat memory
- 3) Resolution over immersion
- 4) Overview First, Zoom and Filter, Detail on Demand
- 5) Responsiveness is required
- 6) Get it right in black and white
- 7) Function first, form next

Design Rules of Thumb

Function first, form next – Aesthetics are easy fixes, functionality is not



Practice

- Find a partner to work with
- Choose a dataset of interest to you
- Build a visualization that shows something interesting in the data
- Modify your visualization:
 - Make a version that follow's Tufte's Data-Ink Ratio guidelines
 - Make a version that uses "Chart Junk" to entice the reader
 - Make a version that is deceptive
 - Make a version the violates a design rule of thumb