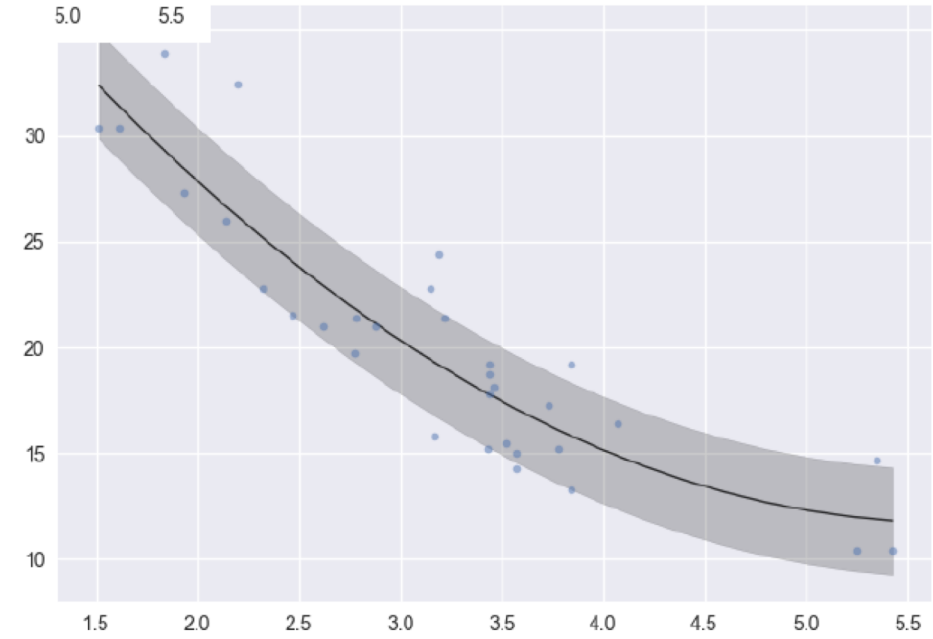
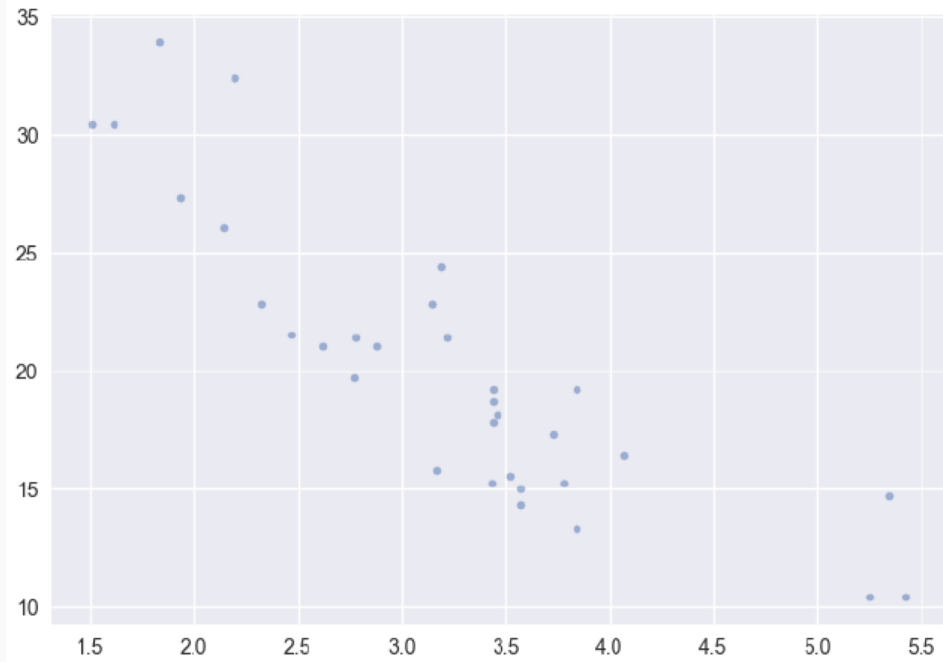


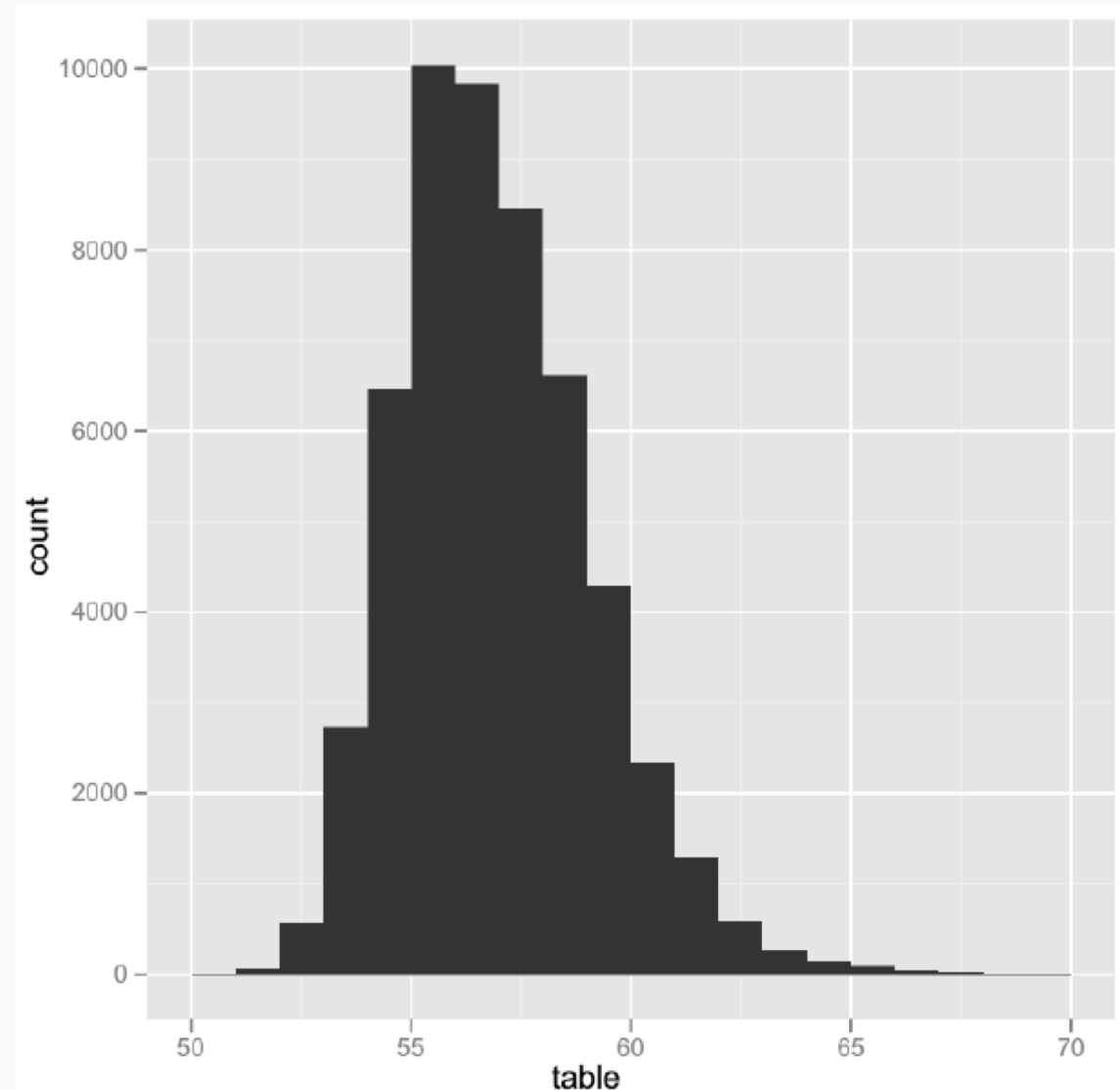
Displays: trends



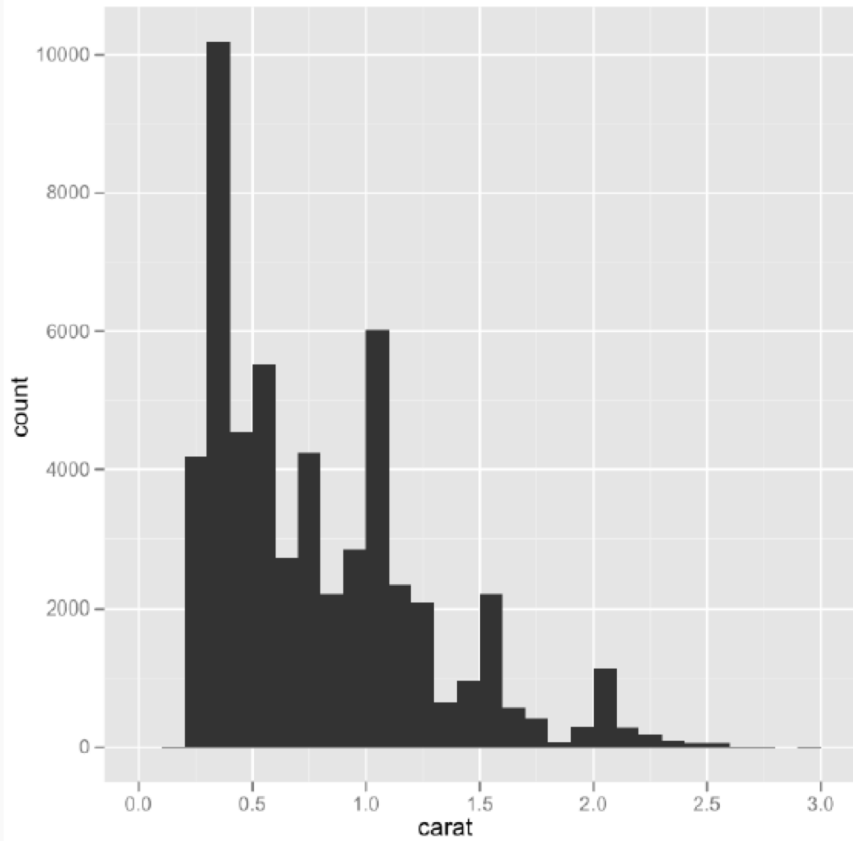
Displays: trends



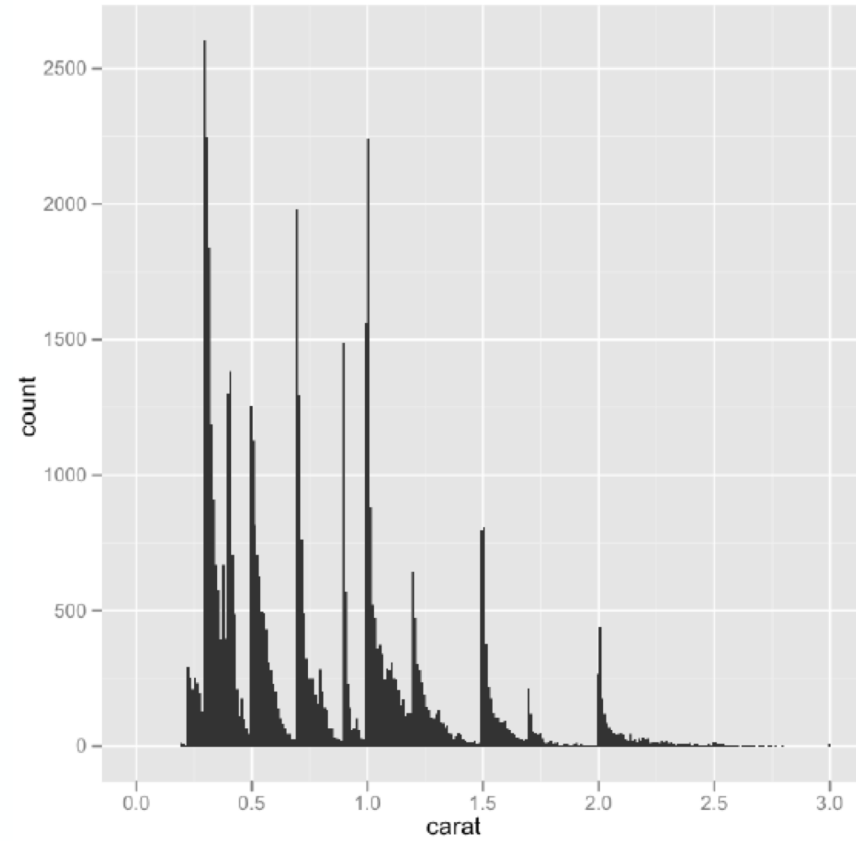
Displays: distributions



Bin Width

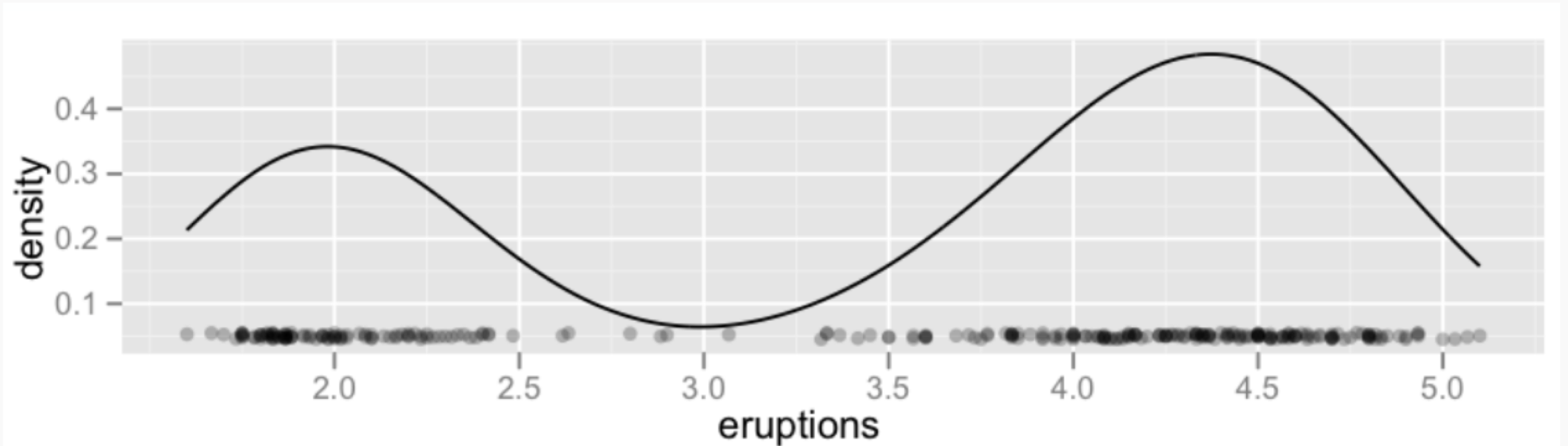


binwidth = 0.1

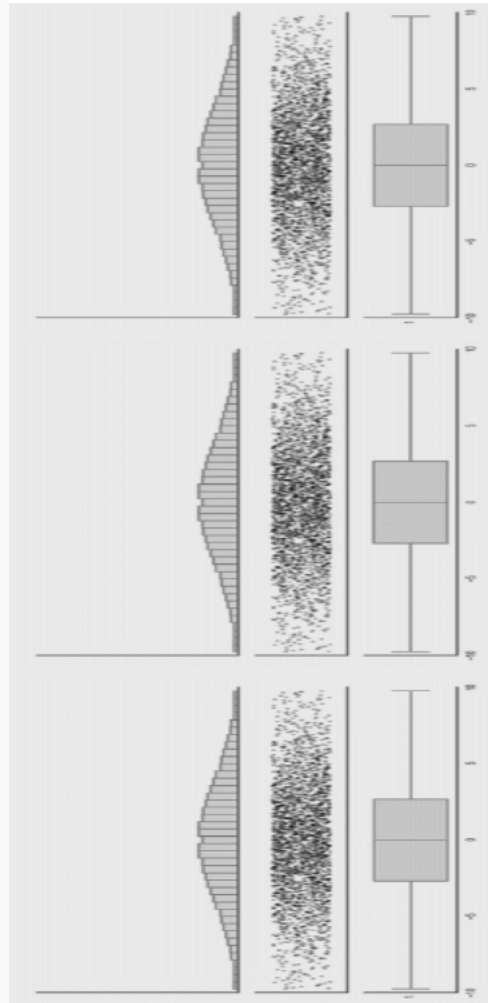


binwidth = 0.01

Displays: density plots

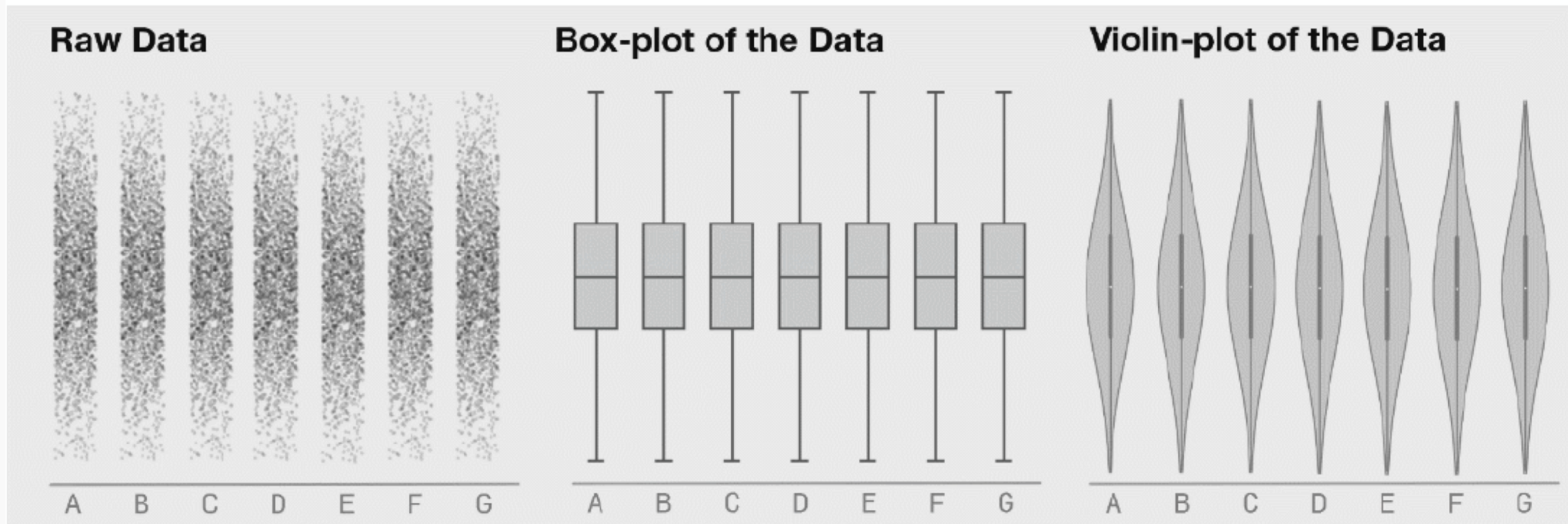


Displays: density plots

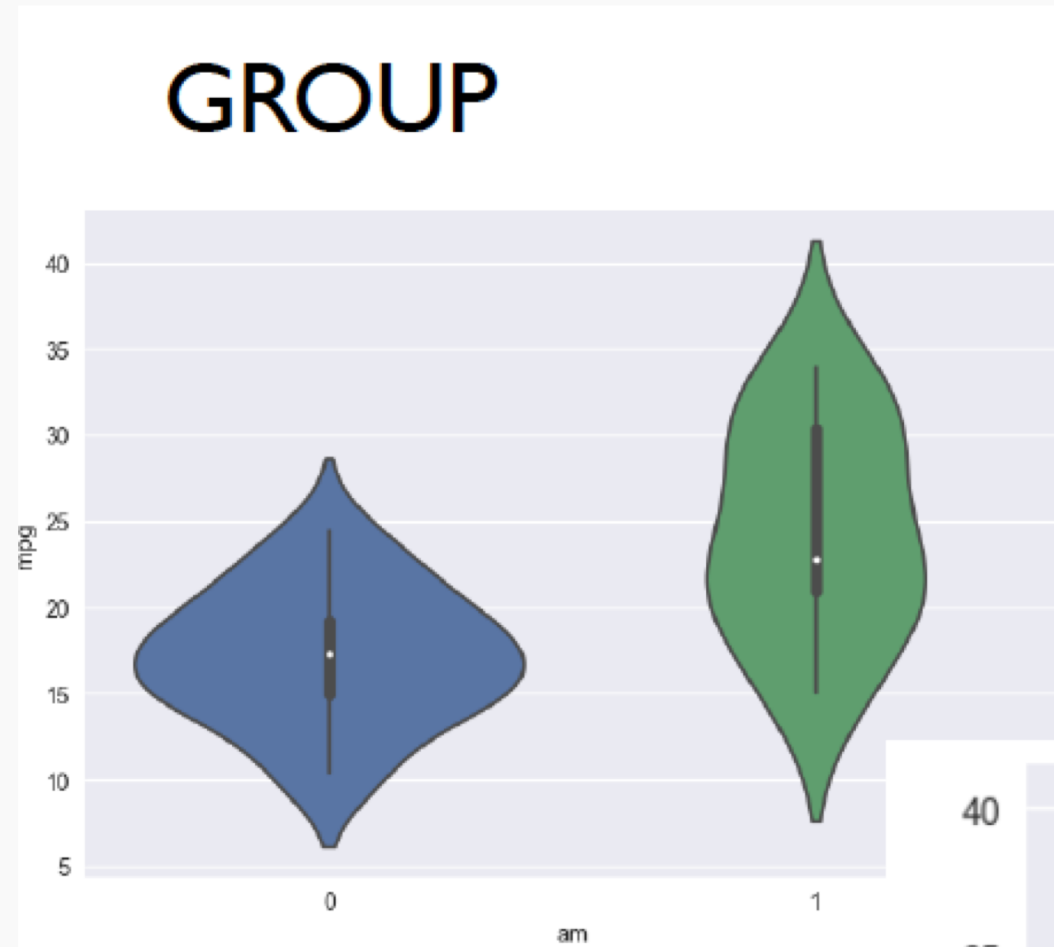


[https://
www.autodeskresearch.com/
publications/samestats](https://www.autodeskresearch.com/publications/samestats)

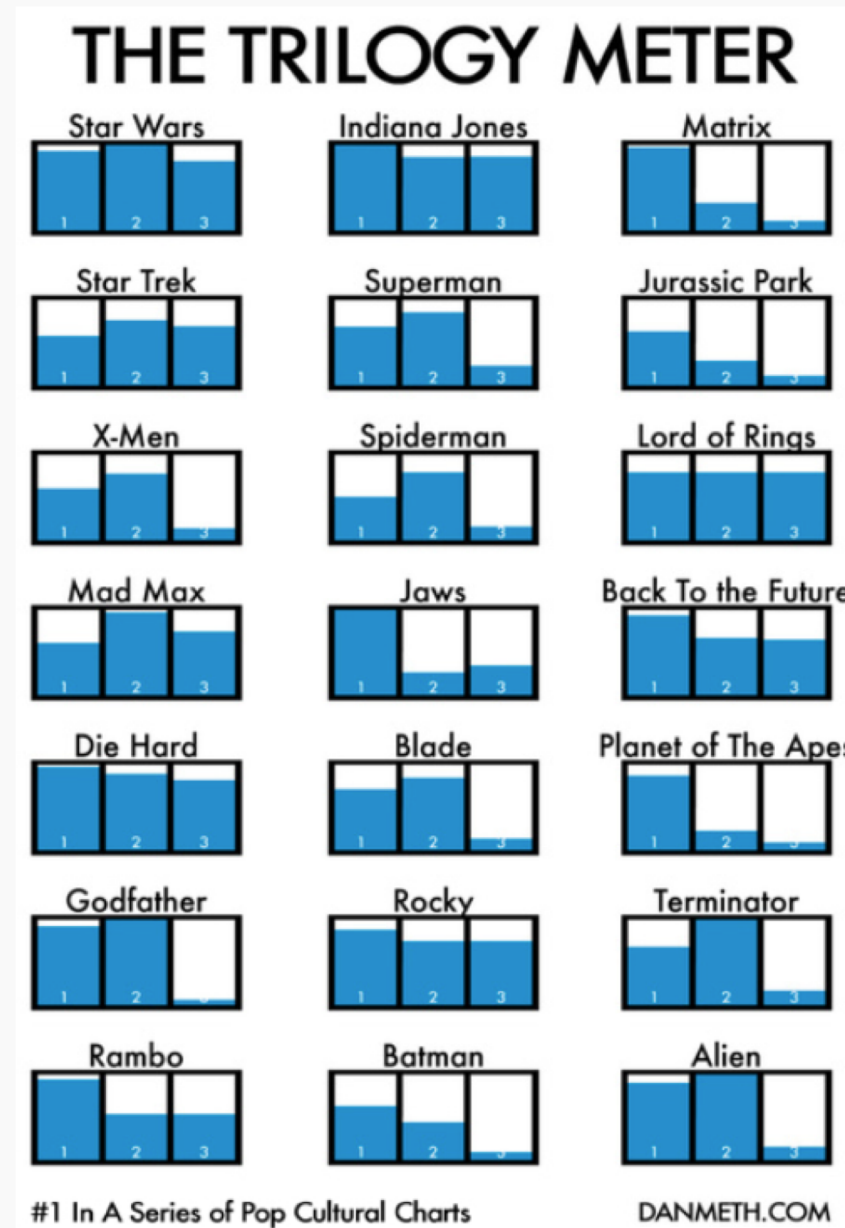
Displays: density plots



Displays: density plots

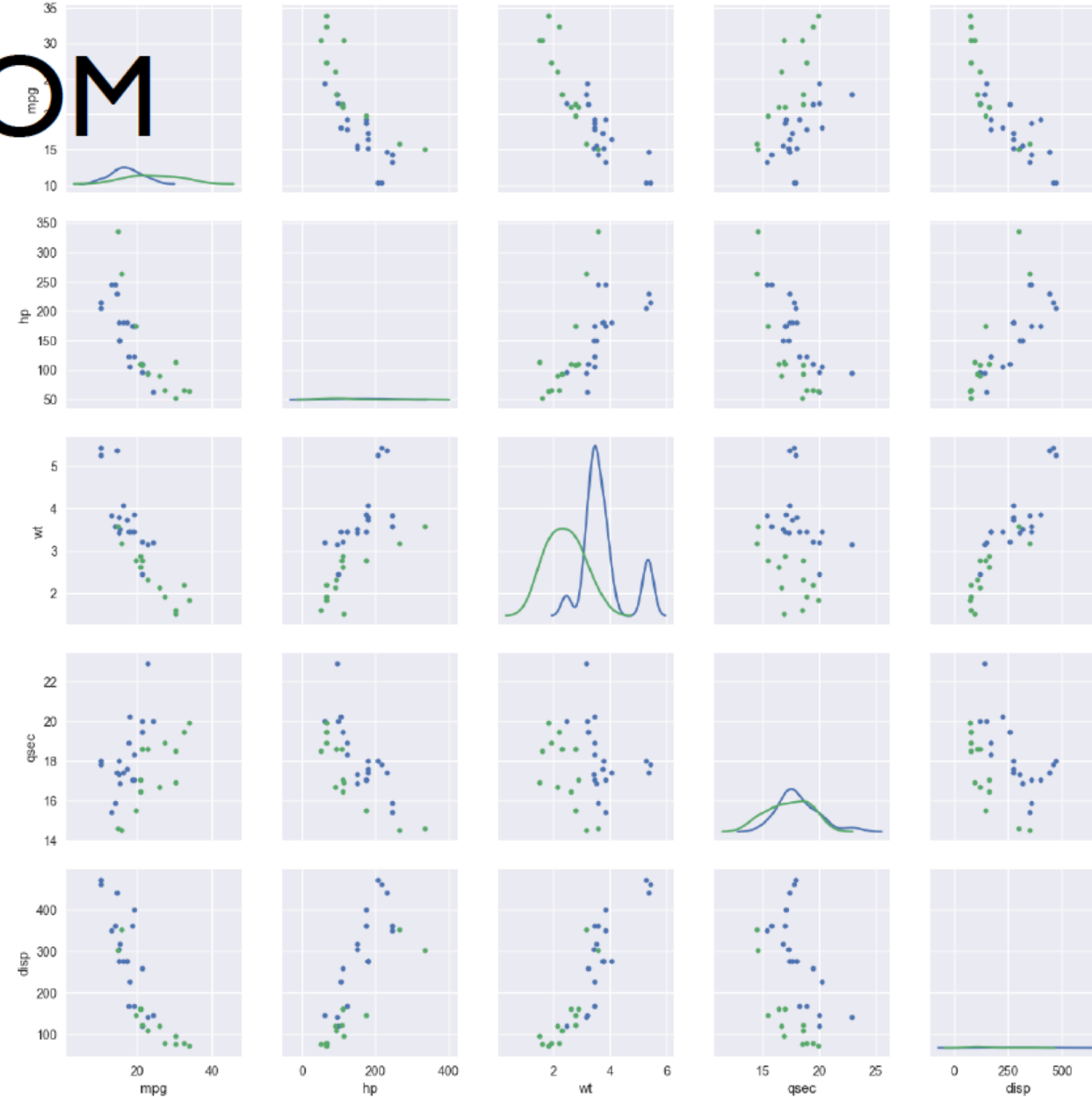


Displays: small multiples



Displays: scatter plot matrix

SPLOM



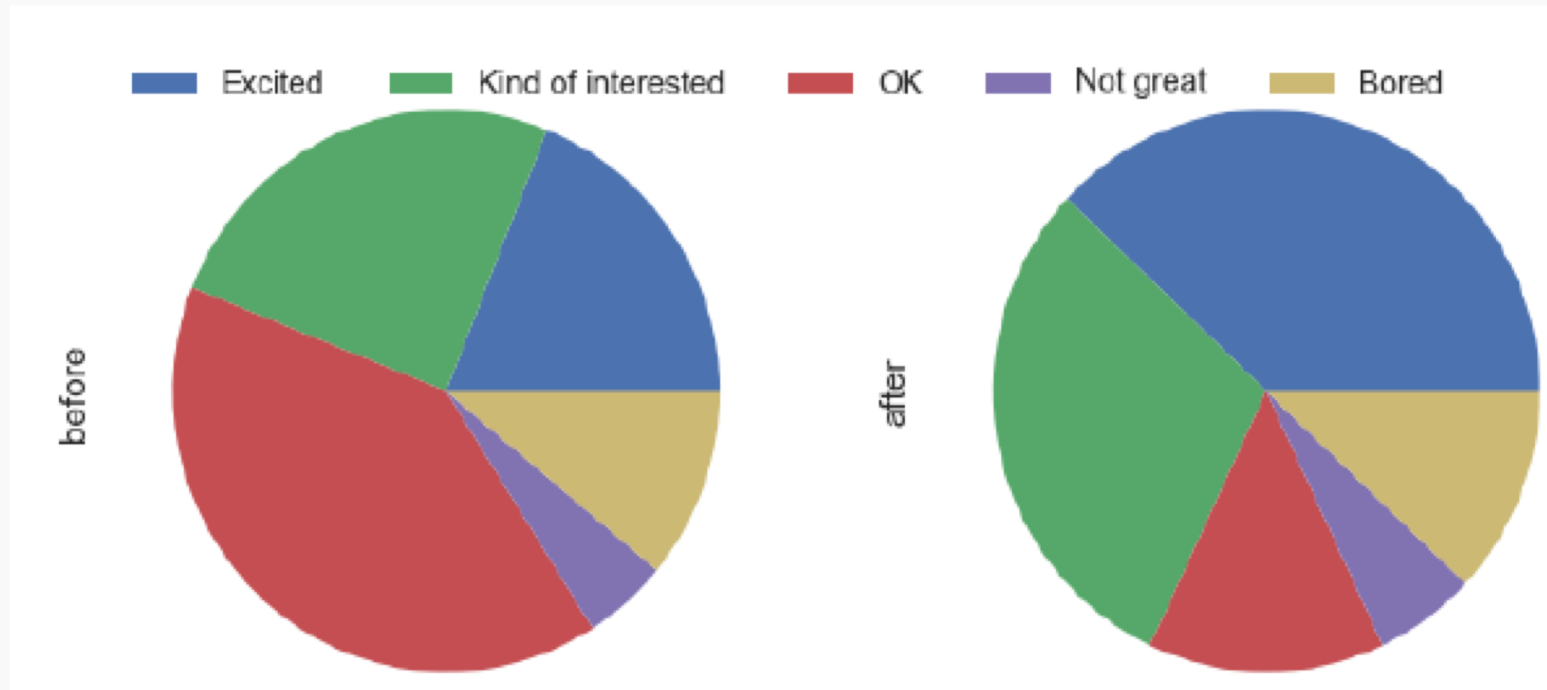
Displays: hands-on exercise

How do you feel about doing science?

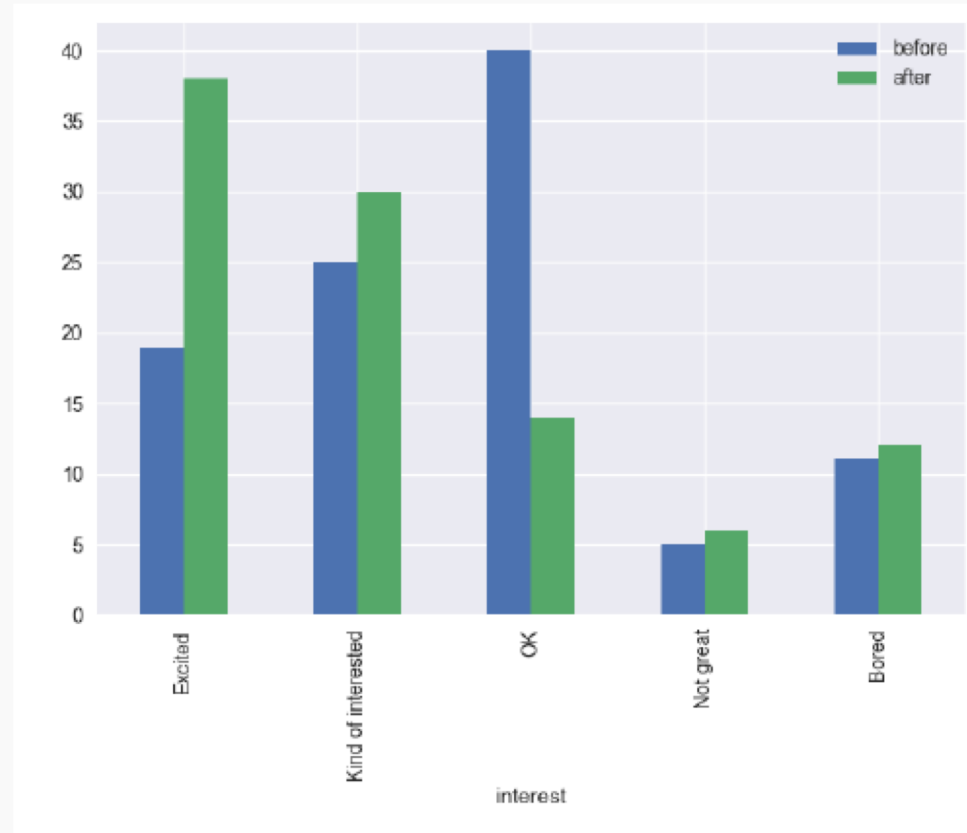
Interest	Before	After
Excited	19	38
Kind of interested	25	30
OK	40	14
Not great	5	6
Bored	11	12

Data courtesy of Cole Nussbaumer

Displays: exercise options

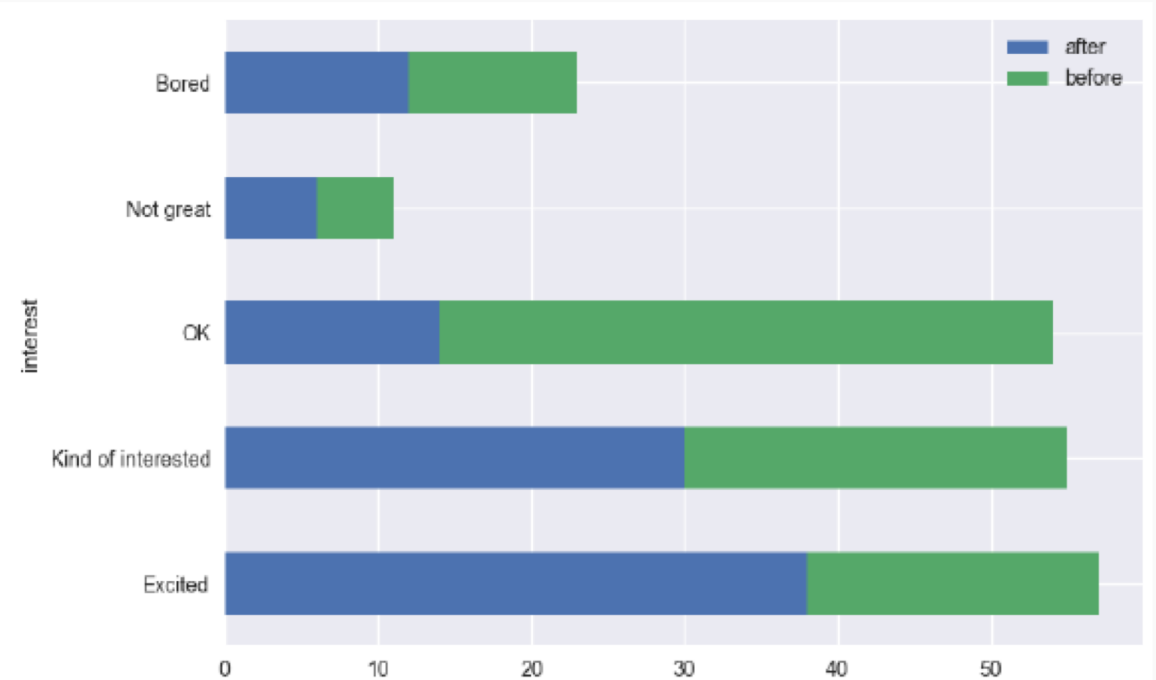


Displays: exercise options

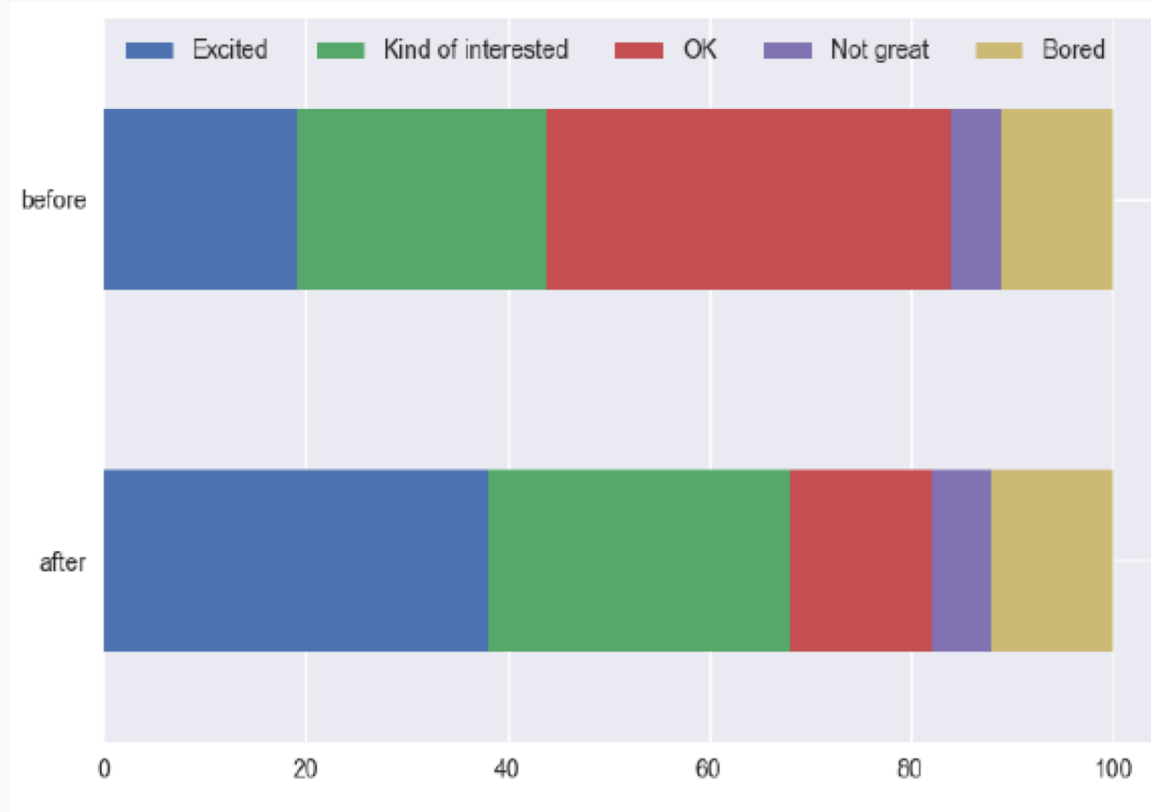


Displays: exercise options

Stacked bar, not very useful

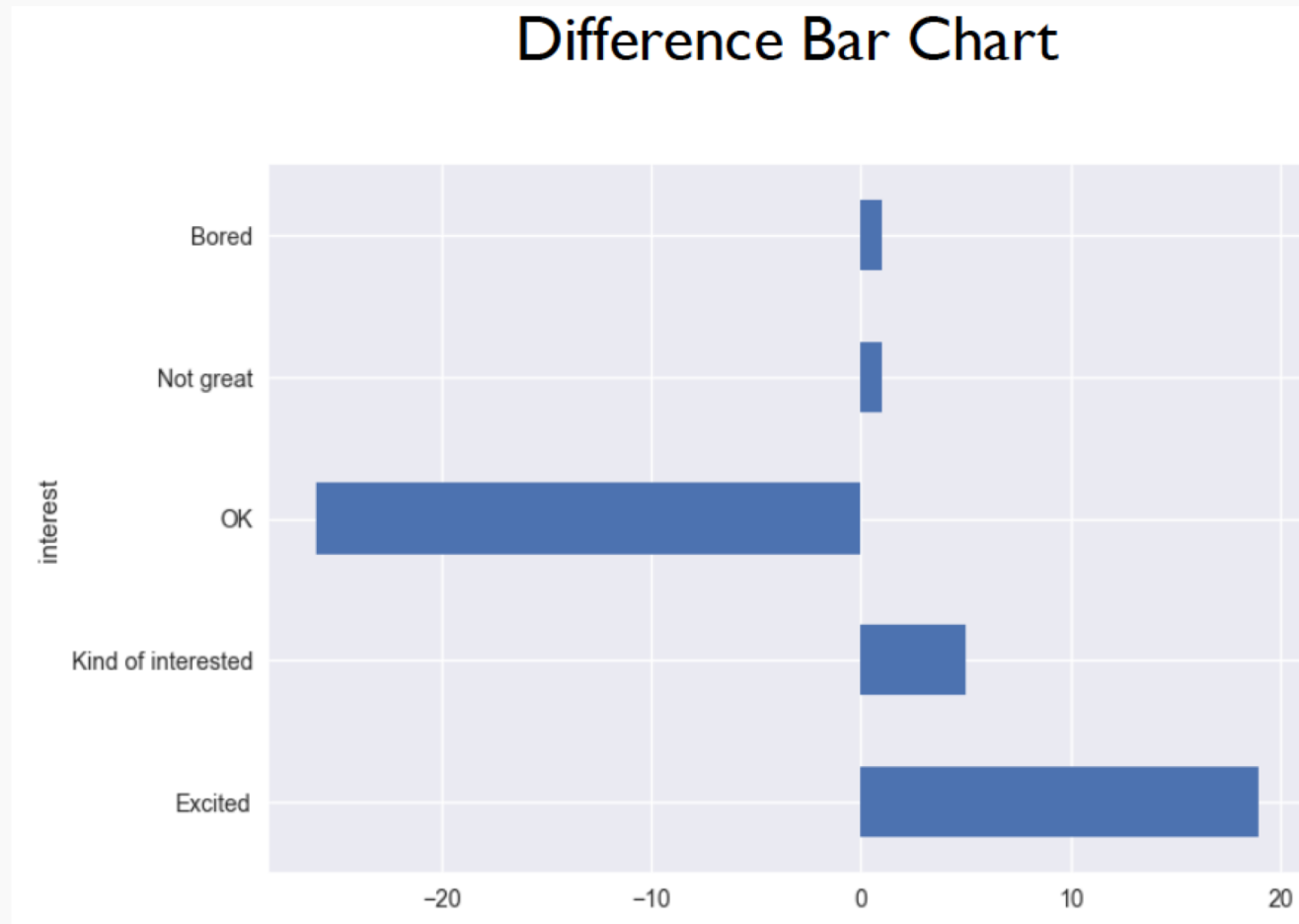


Displays: exercise options



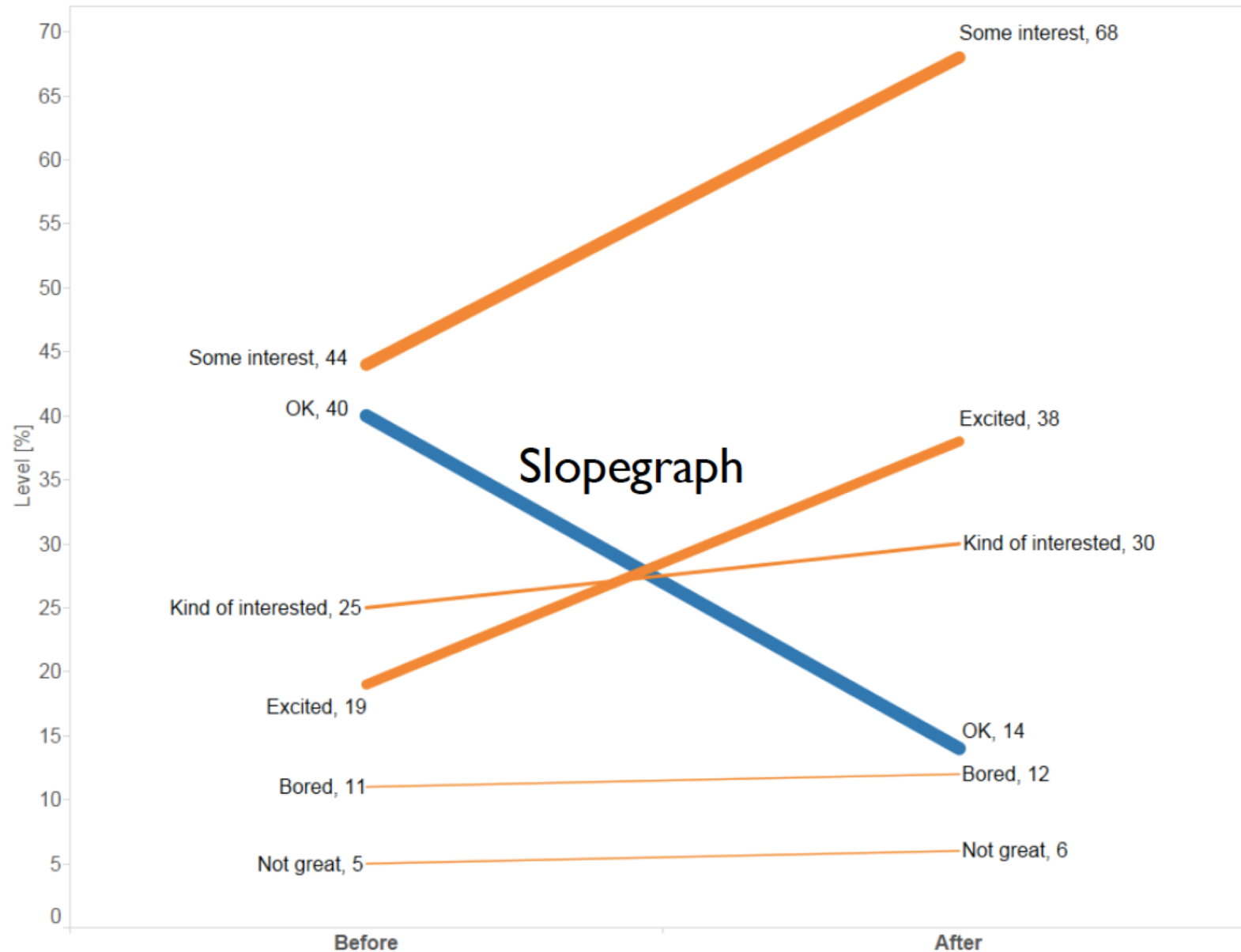
Data Transposed Bar Chart

Displays: exercise options



Displays: exercise options

How do you feel about doing science?



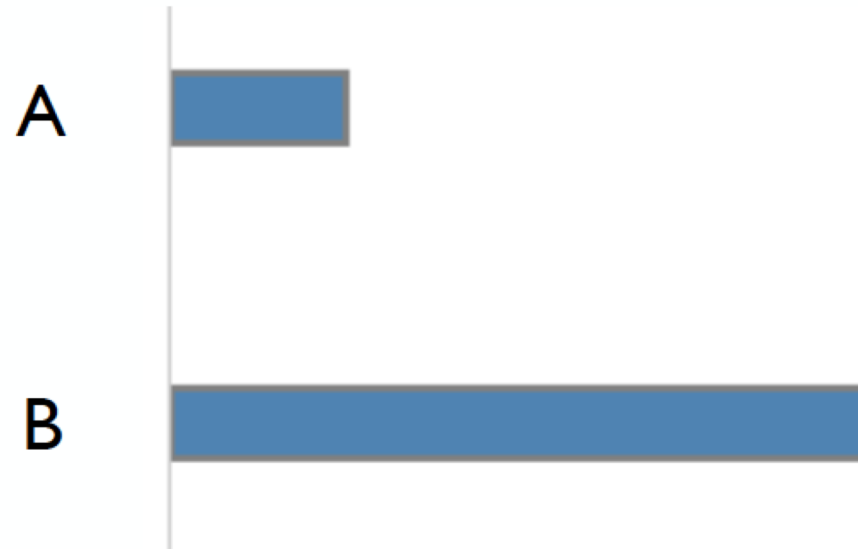
Displays: exercise options

After the pilot program,

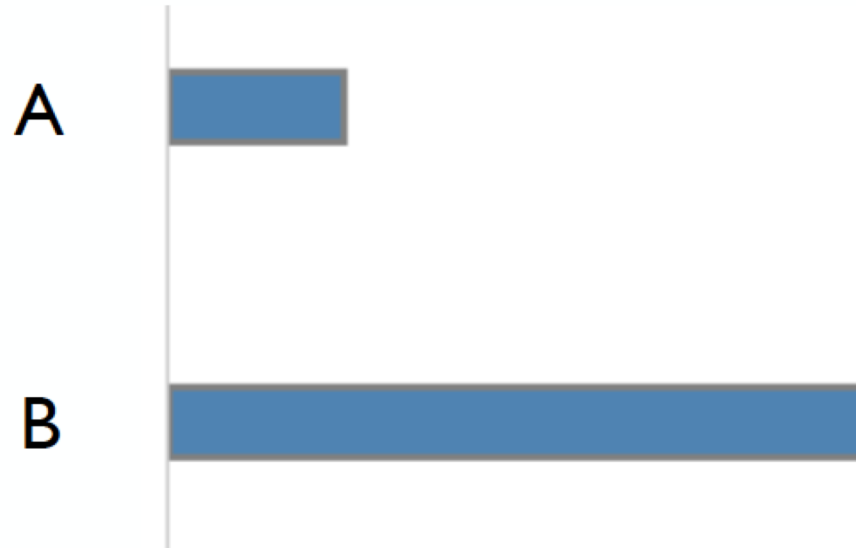
68%

of kids expressed interest towards science,
compared to 44% going into the program.

How much longer?

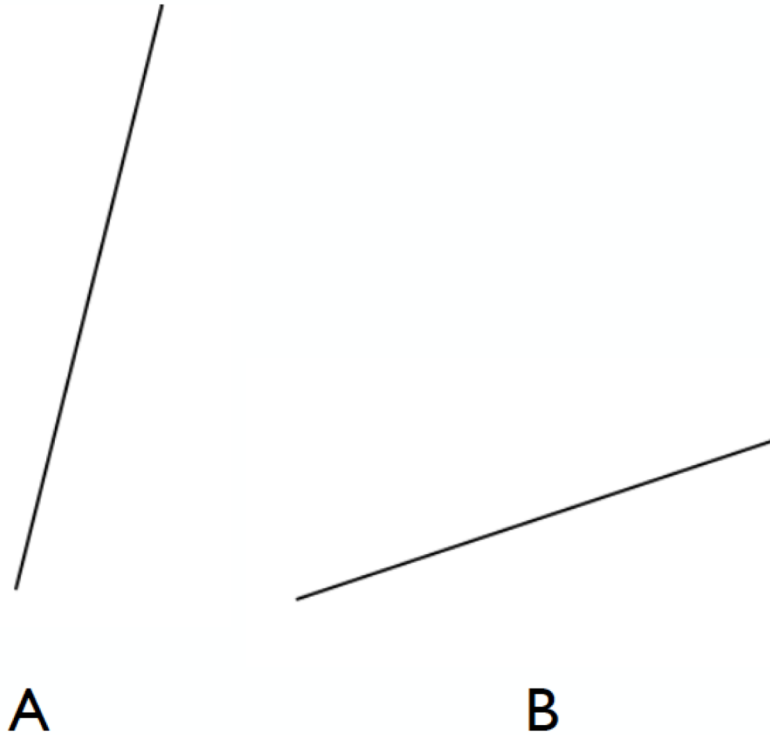


How much longer?



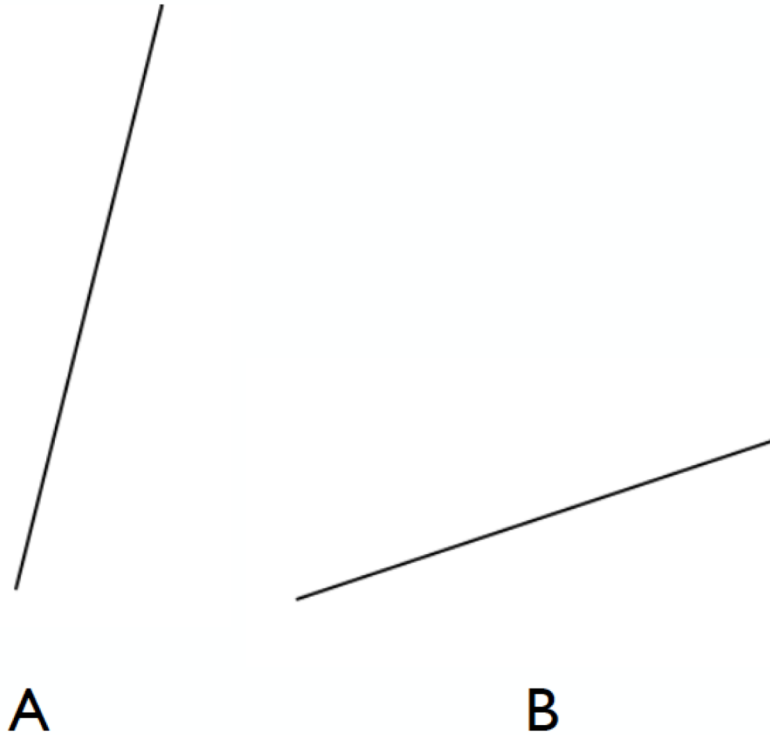
4x

How much steeper slope?



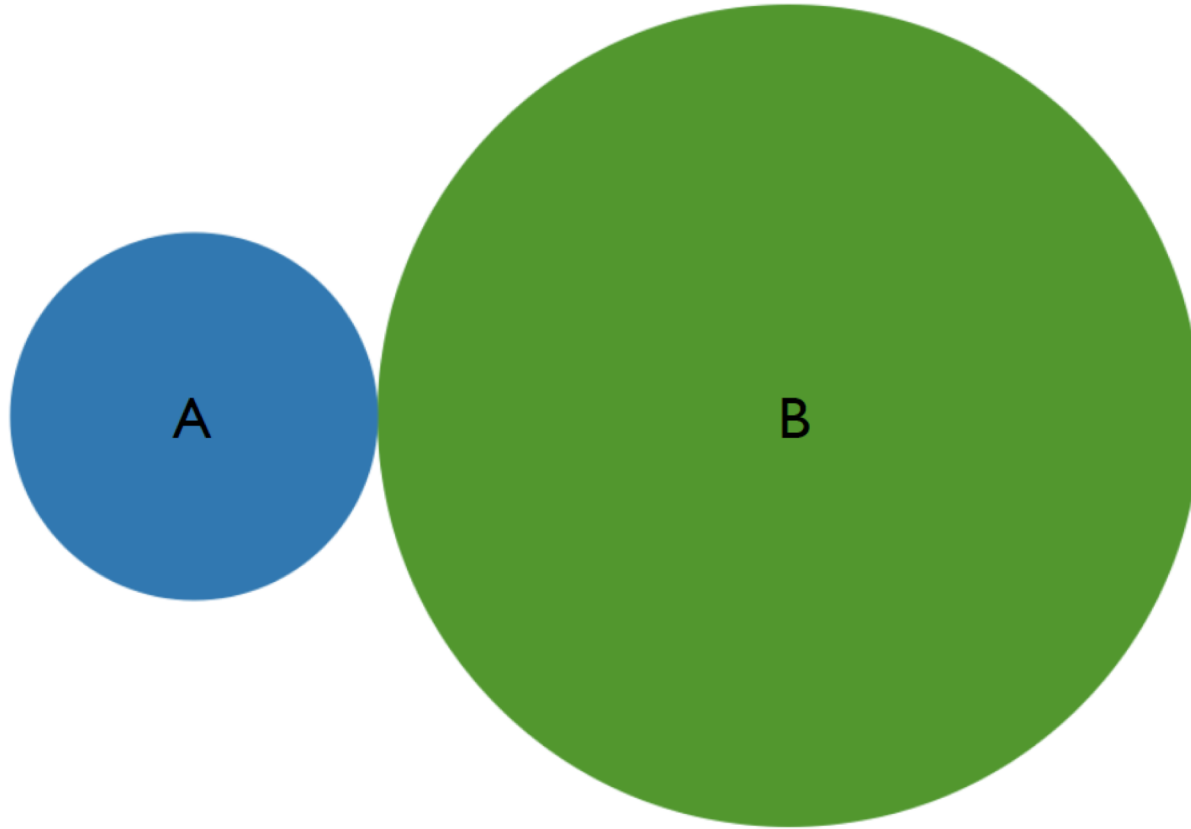
Displays: perceptual effectiveness

How much steeper slope?

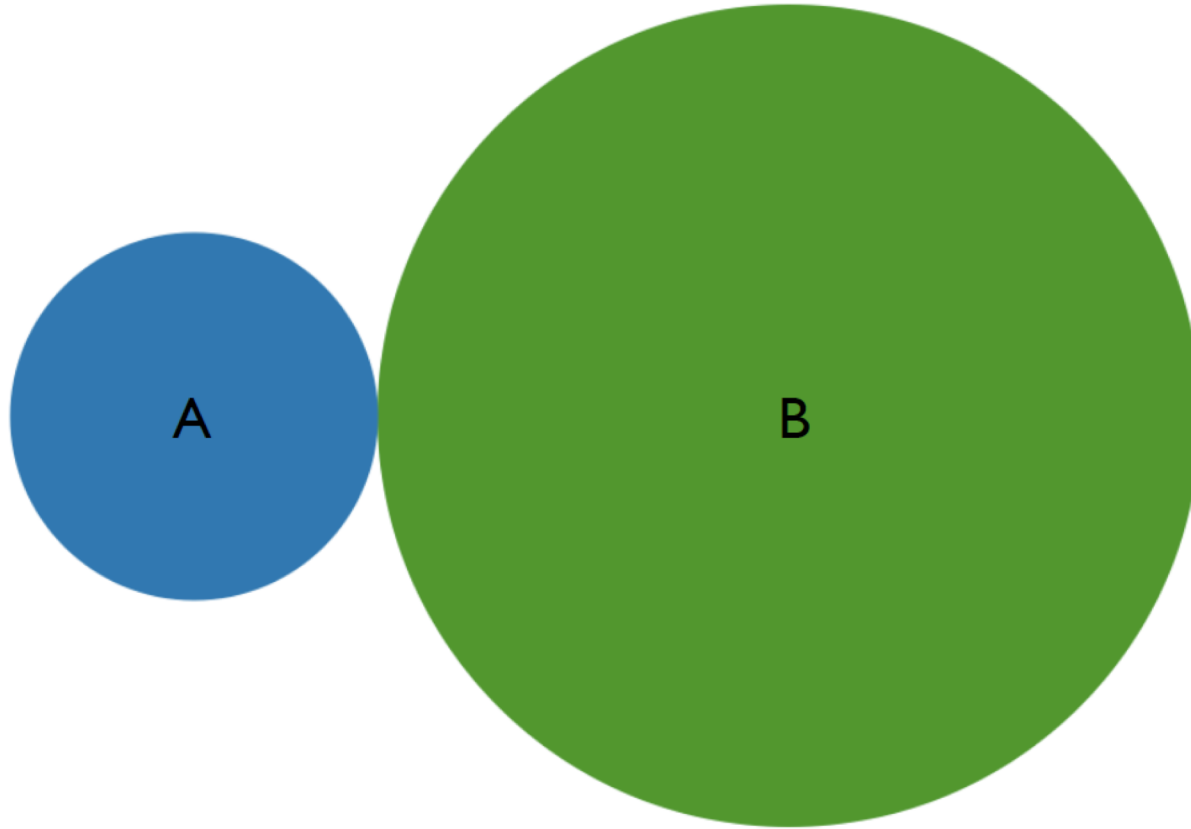


4x

How much larger area?



How much larger area?



10x

Displays: perceptual effectiveness

How much darker?



A



B

Displays: perceptual effectiveness

How much darker?



A



B

2x

How much bigger value?



A



B



How much bigger value?



A

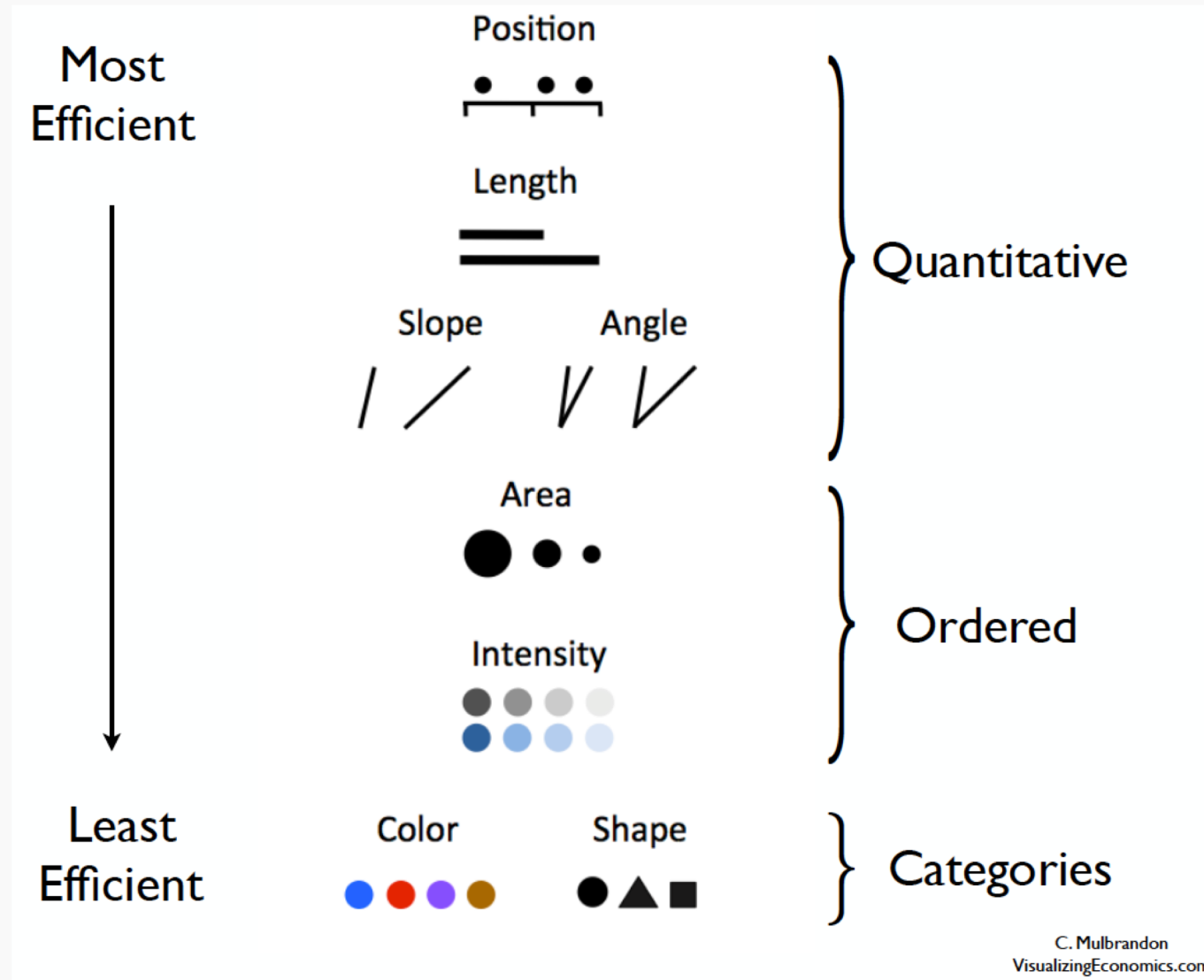


B



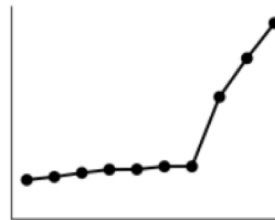
4x

Displays: perceptual effectiveness

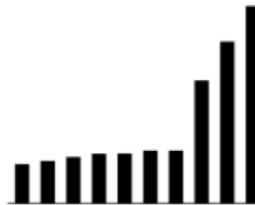
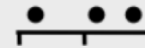


Displays: perceptual effectiveness

Most Effective



Position



Length



VisualizingEconomics.com

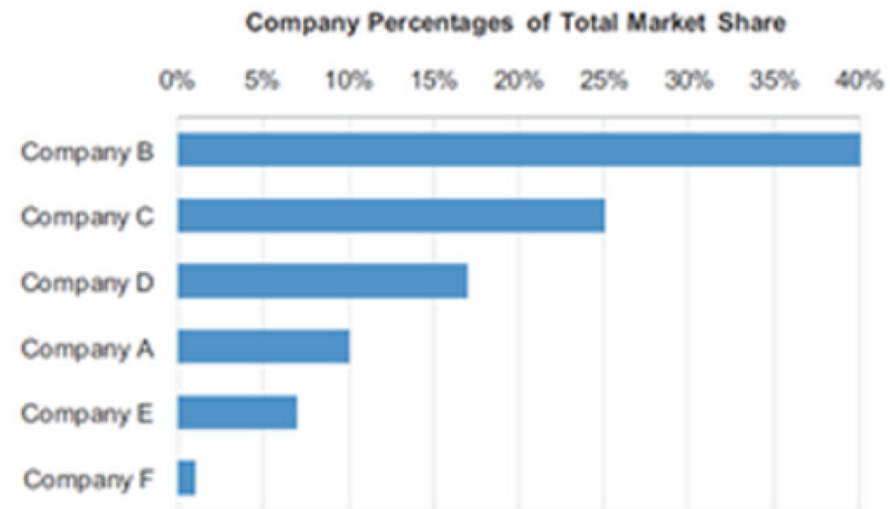
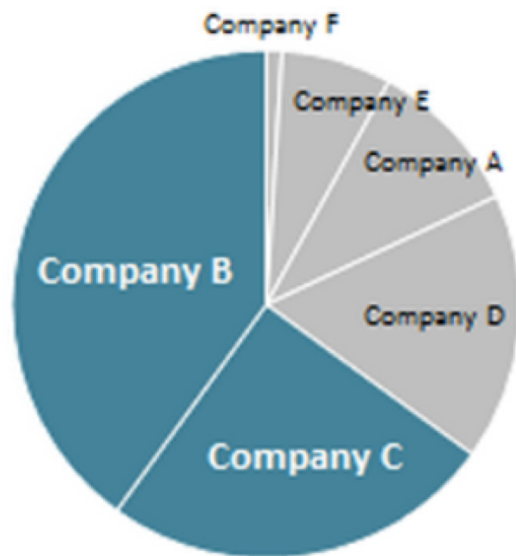
Displays: perceptual effectiveness

Less Effective



Pie vs. Bar Charts

65% of the market is controlled by companies B and C



Lecture Outline

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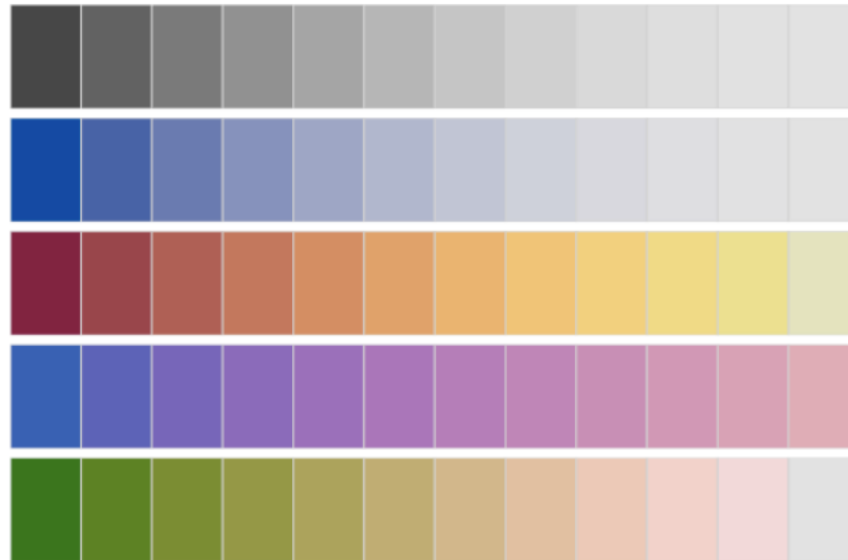
Colors for Categories

Do not use more than 5-8 colors at once



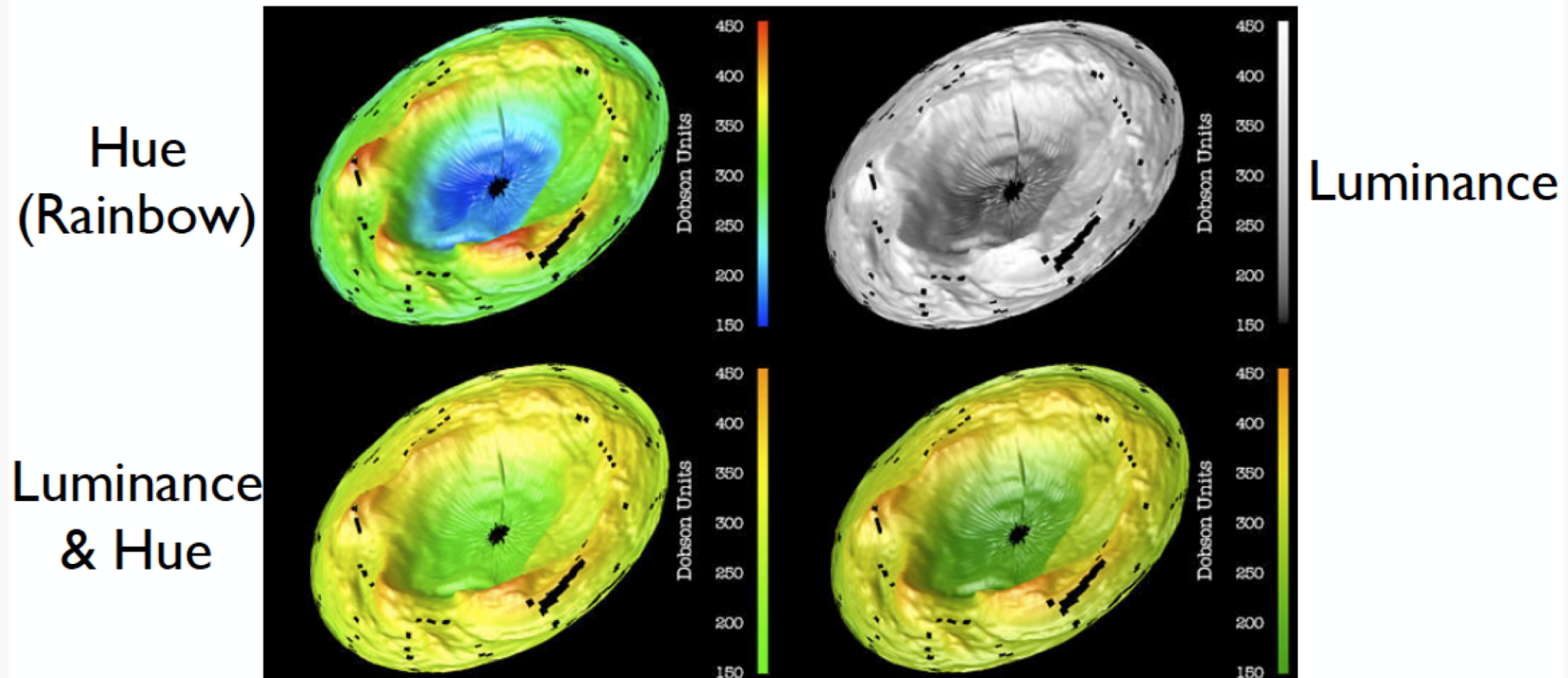
Colors for Ordinal Data

Vary luminance and saturation



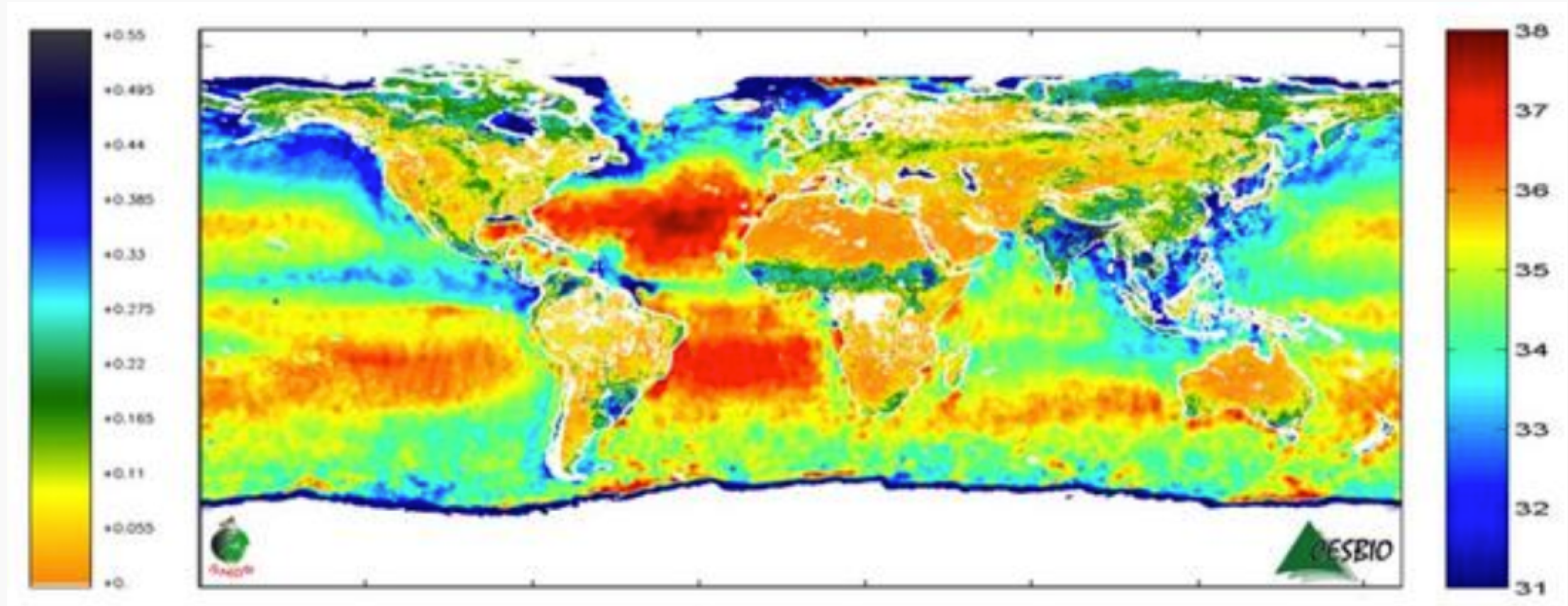
Zeilis et al, 2009, "Escaping RGBland: Selecting Colors for Statistical Graphics"

Colors for Quantitative Data



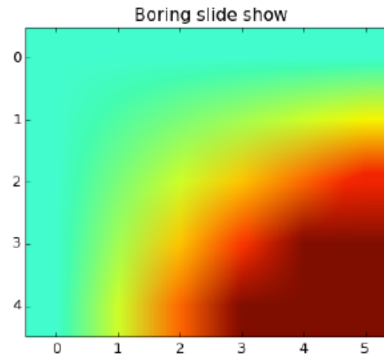
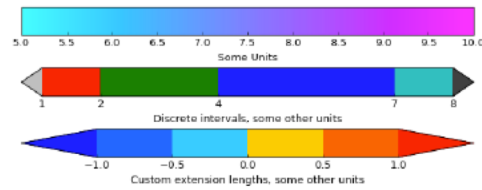
Rogowitz and Treinish, Why should engineers and scientists be worried about color?

Sensible Design: colors

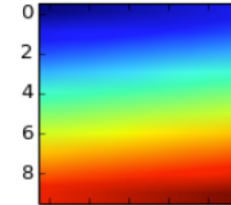


Sensible Design: colors

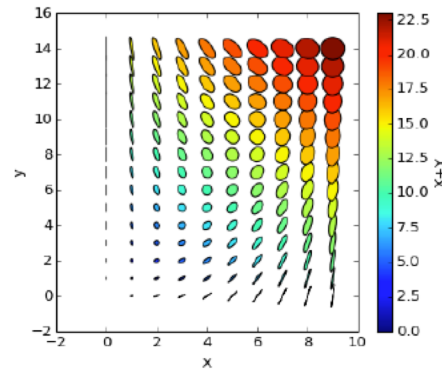
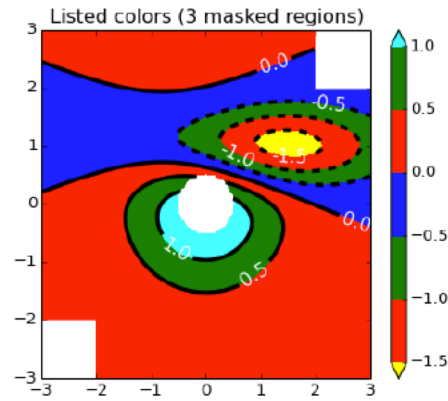
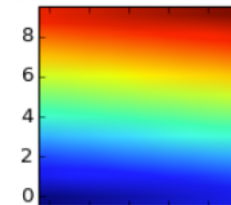
Avoid Rainbow Colors!



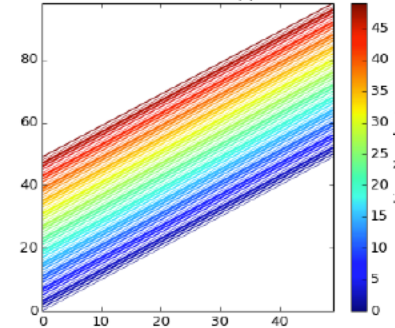
blue should be up



blue should be down



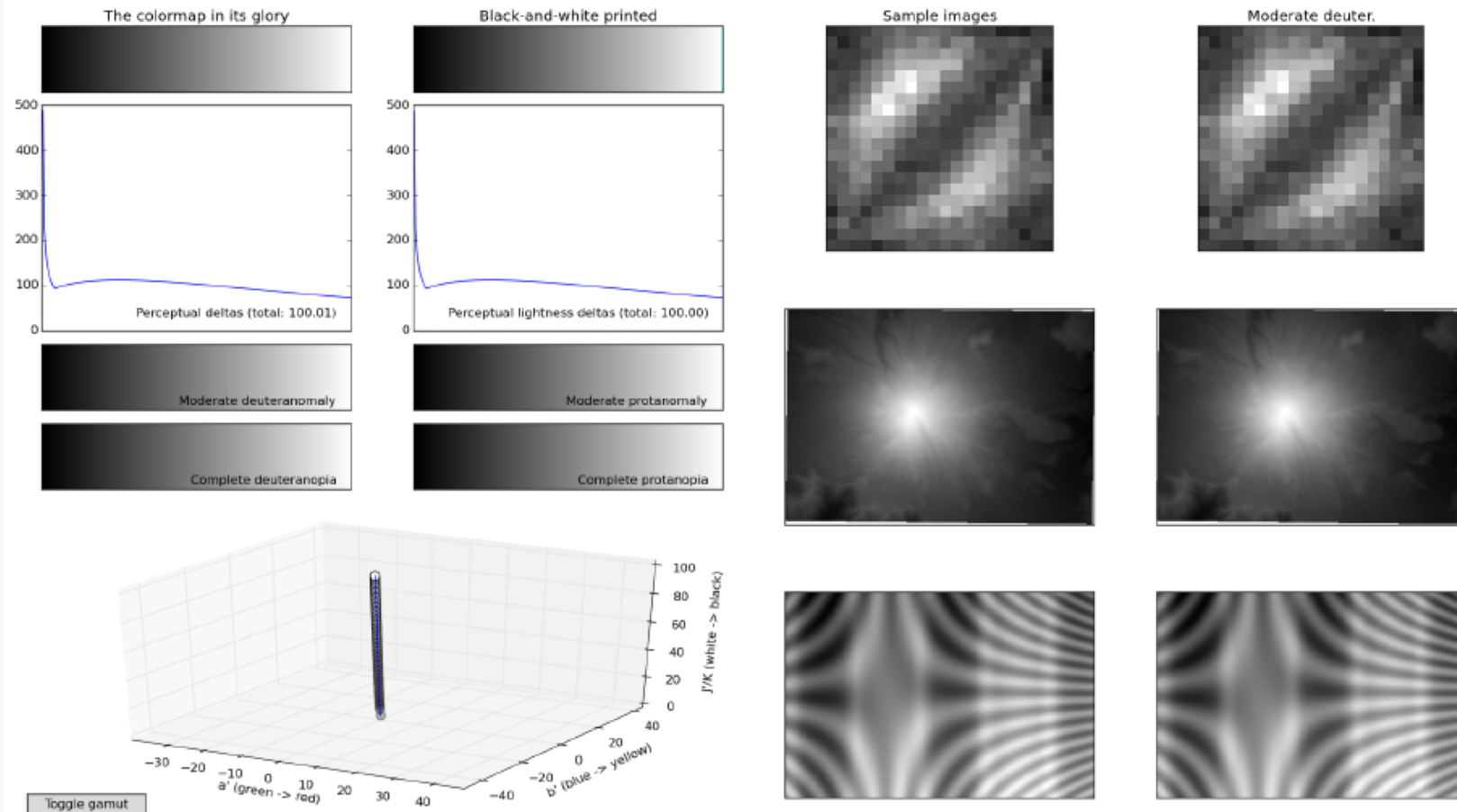
Line Collection with mapped colors



matplotlib gallery

Gray

Colormap evaluation: gray



Color Blindness



Protanope

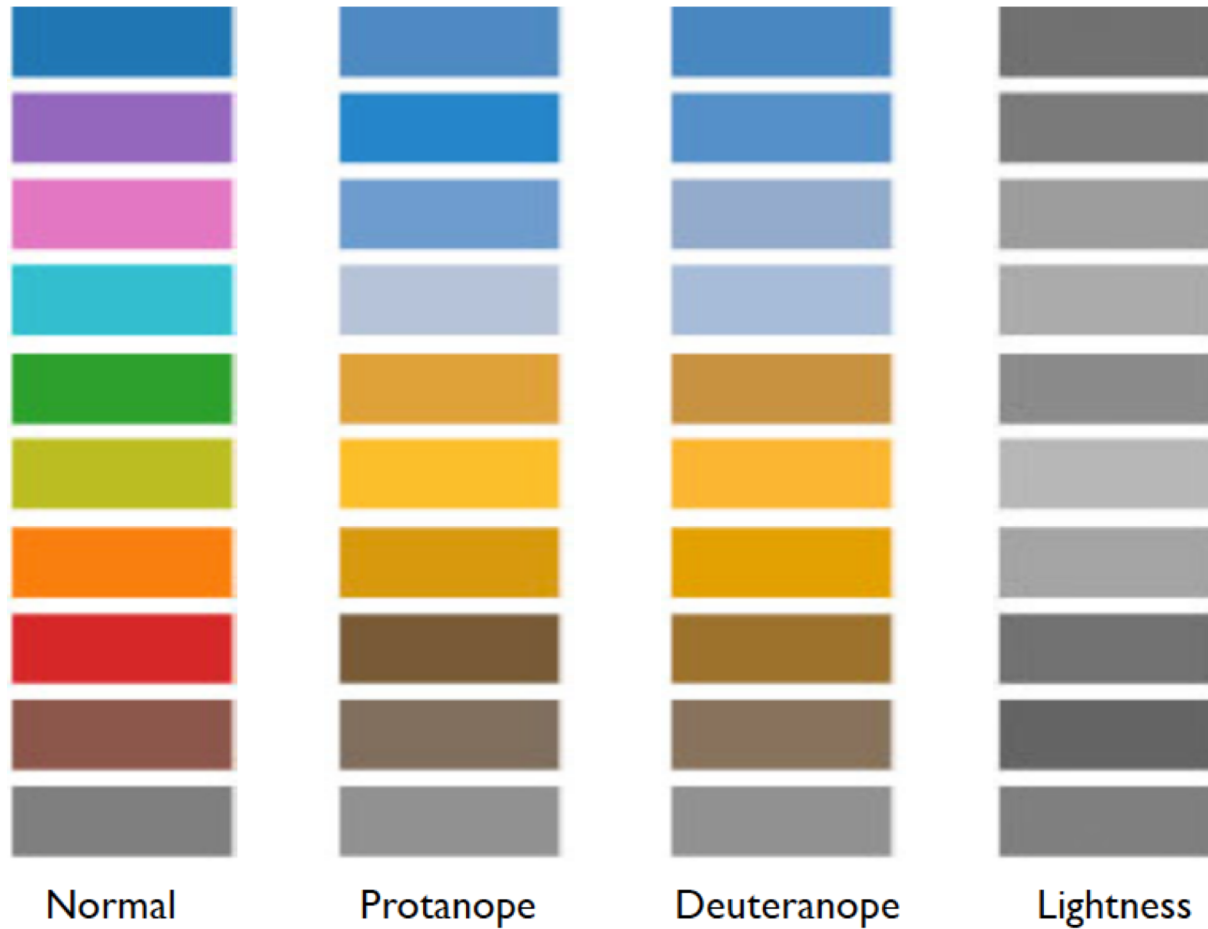
Deuteranope

Tritanope

Red / green
deficiencies

Blue / Yellow
deficiency

Color Blindness

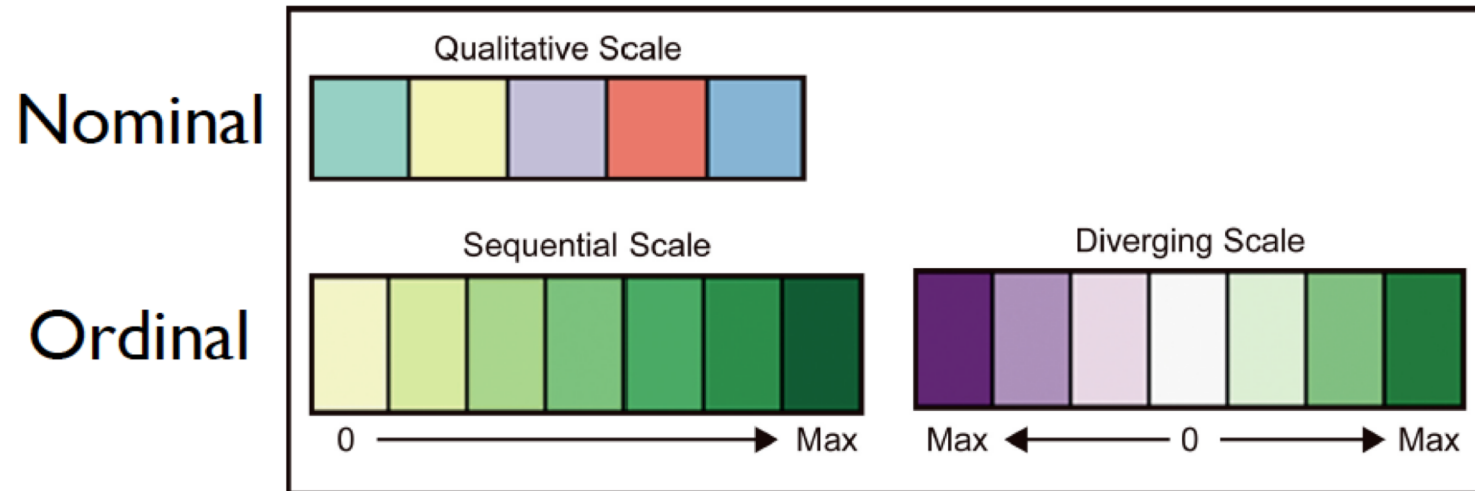


Sensible Design: colors

Great sites for selecting color schemes:

- <http://colorbrewer2.org>
- <https://colors.co/>

Color Brewer



Sensible Design: colors

number of data classes on your map
3 [learn more >](#)

the nature of your data
sequential [learn more >](#)

pick a color scheme: GnBu

pick a color system
224, 243, 219
168, 221, 181
67, 162, 202

adjust map context
 roads
 cities
 borders

select a background
 solid color
 terrain

color transparency

how to use | updates | credits

COLORBREWER 2.0
color advice for cartography

EXPORT YOUR COLORS >>

SCORE CARD

© Cynthia Brewer, Mark Harrower and The Pennsylvania State University
[Support](#)
[Back to ColorBrewer 1.0](#)

axm

Sensible Design: colors

The screenshot shows the COOLORS website interface. At the top left, the logo "COOLORS" is displayed. To its right is an advertisement for Squarespace: "Ad Squarespace - Get a domain and create a website with Squarespace Start A Free Trial". The navigation bar includes "Generate" (highlighted), "Explore", "iOS App", "Add-on", "More", "Login", and "Sign Up". Below the navigation bar, a prompt reads "Press the spacebar to generate color schemes!". A toolbar contains icons for help, settings, camera, navigation, and actions like "Export" and "Save".

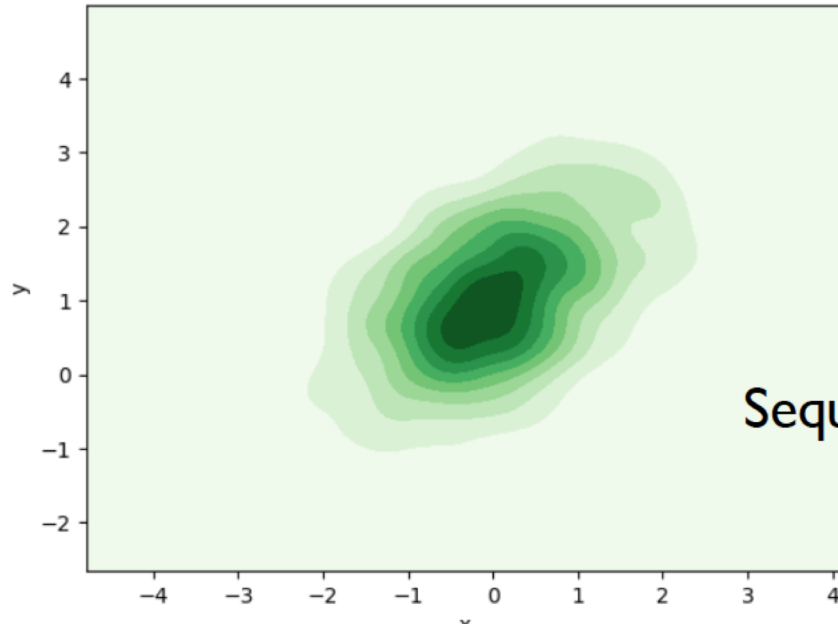
The main content area displays five vertical color swatches, each with a hex code and a name:

- #E0E2DB GAINSBORO
- #D2D4C8 PASTEL GRAY
- #B8BDB5 ASH GREY
- #889696 ROMAN SILVER
- #5F7470 NICKEL

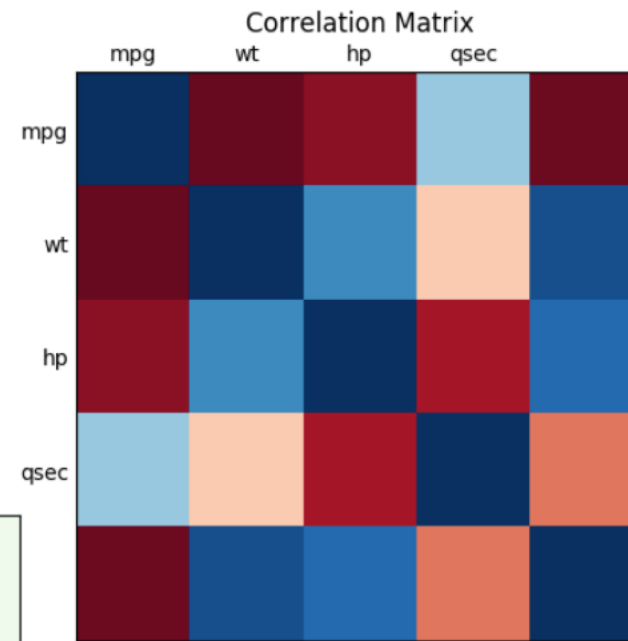
On the right side of the palette, there is a Vimeo advertisement with the text: "Vimeo Before it's complete, it's confidential. Learn more".

Sensible Design: colors

Diverging Palette for
Quantitative or Ordinal



Sequential Palette for Densities



How much do you trust this text?

How much do you trust this text?

How much do you trust this text?

How much do you trust this text?

Sensible Design: intuitive

The everyday items that are designed the best are the ones that we never have to think about how to use/interact with it.

Can you think of examples?

Lesson: design matters

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Analysis vs Communication

Analyze (Exploratory)

- Explore the data
- Assess a situation
- Determine how to proceed
- Decide what to do

Communicate (Explanatory)

- Present data and ideas
- Explain and inform
- Provide evidence and support
- Influence and persuade

The Persuasive Power of Data Visualization

Anshul Vikram Pandey

New York University

Anjali Manivannan

New York University

Oded Nov

New York University

Margaret L. Satterthwaite

NYU School of Law, satterth@exchange.law.nyu.edu

Enrico Bertini

New York University

After looking into common effects in attitude formation and change we searched for specific mentions to the graphical appearance of charts as a driver for persuasion. Some of the comments we collected seem to back up the findings we found in our results. Some participants explicitly mention the charts as being the main reason for their change: "I already knew that increased incarceration didn't lower crime, but I wasn't sure of the statistics. To see it on the graphs is really eye opening."; "I was influenced by the bar graph showing the reasons why the survey respondents played video games."; "I would not know exact numbers on this issue - the graphs gave a visual and helped identify the numbers"; "Seeing the graphs conflicted with my previous opinion, so I feel like I need to reevaluate my stance in a way."

It is also important to mention that the graphical appearance of charts is not the only factor that has a strong impact on people's attitude. In our collected feedback, we found numerous references to statistics and numbers, suggesting that mere exposure to data does have a persuasive effect – maybe at least partially due to the increased sense of objectivity evidence supported by numbers carries. We found comments like: "It was concrete data that seemed compelling"; "Seeing numbers is a good indicator of change rather than just reading what someone has to say"; "It showed a large amount of different sources, which made it more credible". More research is needed to disentangle what kind of specific effects each of these components have on persuasion.

Communicate

755



Steroids or Not, the Pursuit Is On

Barry Bonds is taking aim at the career home run record. He needs only six more to tie Babe Ruth and 47 to equal Hank Aaron.

Lines are cumulative home runs

Hank Aaron
755 homers
23 seasons



Babe Ruth
714 homers
22 seasons



Barry Bonds
708 homers
20 seasons

Bonds takes lead
Home runs after 16 seasons
Bonds: 567
Aaron: 554
Ruth: 516

755
23 seasons
714
22 seasons
20 seasons
Bonds was injured last season. He played 14 games and hit 5 homers

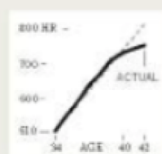
Homer Pace After Age 34

If the accusations are correct, Bonds was 34 in his first season on steroids. Here are projected home run paces for each player after age 34.

----- PROJECTED PACE BASED ON AVERAGE OF PREVIOUS FIVE SEASONS

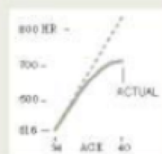
Aaron

Actual homers slightly outpace projected homers for five seasons.



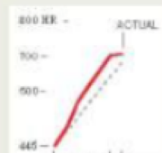
Ruth

Averaged 46.4 homers a season from age 30 to 34. Averaged 42.5 for next four seasons.



Bonds

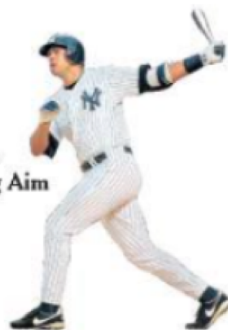
From age 35 to 39, he averaged 14 more homers a season than projected.



Note: Ages as of July 1 of each season.

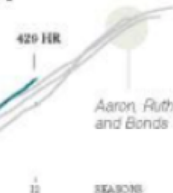
According to allegations in a book about Bonds, he began taking steroids before the 1999 season, his 14th in the league. Two seasons later, he hit 73 home runs, surpassing Aaron's career pace.

Others Taking Aim



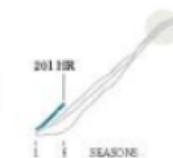
Alex Rodriguez

Is ahead of the pace set by all three home run leaders.



Albert Pujols

Averaging 40 homers a season, he has started stronger than the three leaders did.



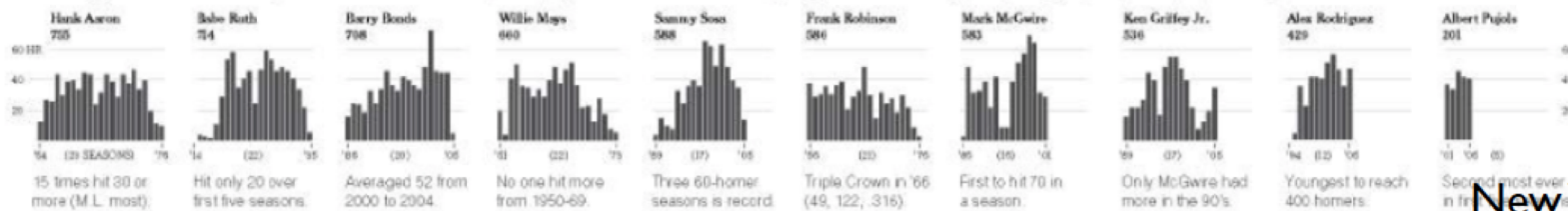
Ken Griffey Jr.

Many thought he would be the first to catch Ruth and Aaron until injuries limited his output.

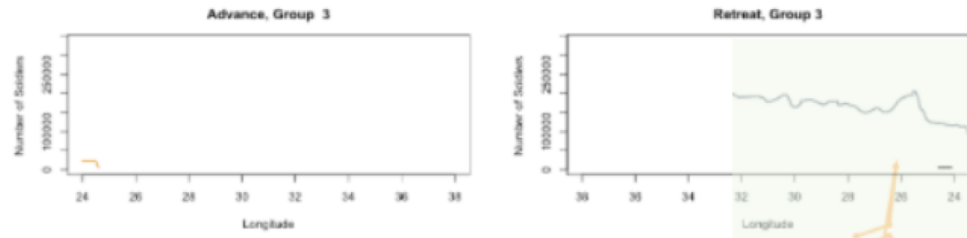
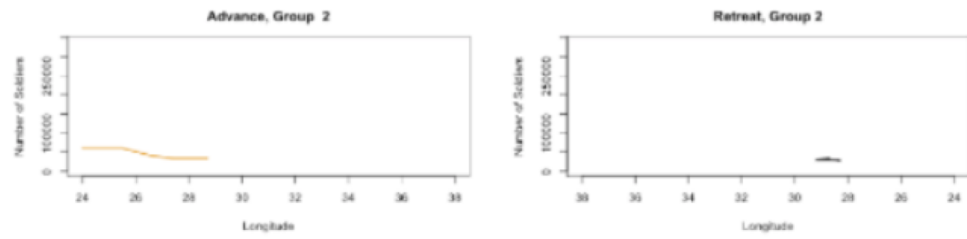
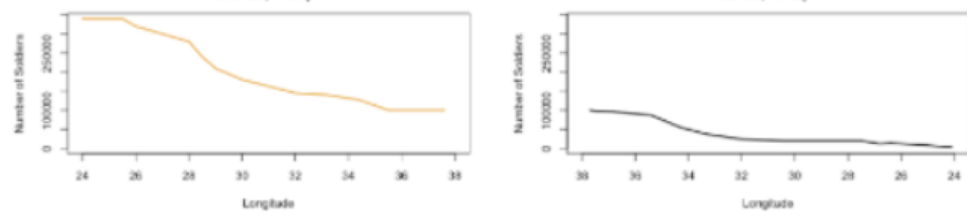


Differing Paths to the Top of the Charts

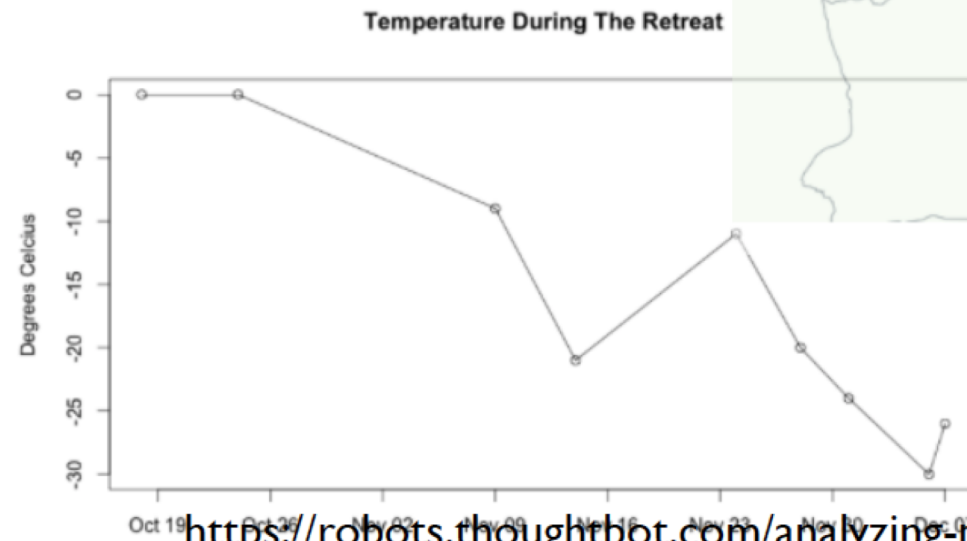
The top seven players on the career home run list, along with a look at Griffey (12th), Rodriguez (37th) and Pujols (tied 257th).



Napoleon's March to Russia



Next, the temperature experienced by his troops when winter settled in on the return trip.



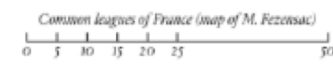
Minard's Graphic on Napoleon's Russia Campaign

Figurative Map of the successive losses in men of the French Army in the Russian campaign 1812 ~ 1813

Drawn by M. Minard, Inspector General of Bridges and Roads (retired).

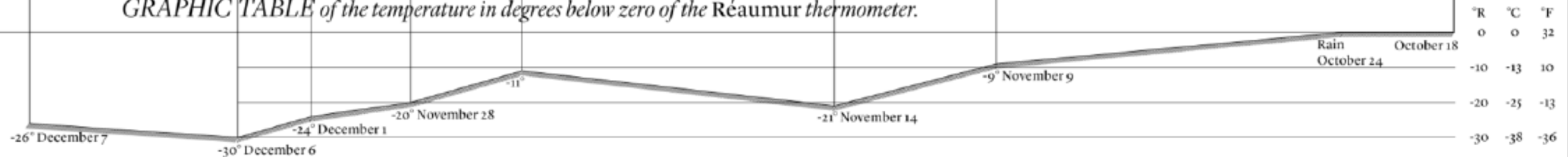
Paris, November 20, 1869.

The numbers of men present are represented by the widths of the colored zones at a rate of one millimeter for every ten thousand men; they are further written across the zones. The red designates the men who enter Russia, the black those who leave it. — The information which has served to draw up the map has been extracted from the works of M.M. Thiers, de Ségur, de Fezensac, de Chambray and the unpublished diary of Jacob, the pharmacist of the Army since October 28th. In order to better judge with the eye the diminution of the army, I have assumed that the troops of Prince Jérôme and of Marshal Davout, who had been detached at Minsk and Mogilev and have rejoined near Orsha and Vitebsk, had always marched with the army.



GRAPHIC TABLE of the temperature in degrees below zero of the Réaumur thermometer.

The Cossacks pass the frozen Neman at a gallop.



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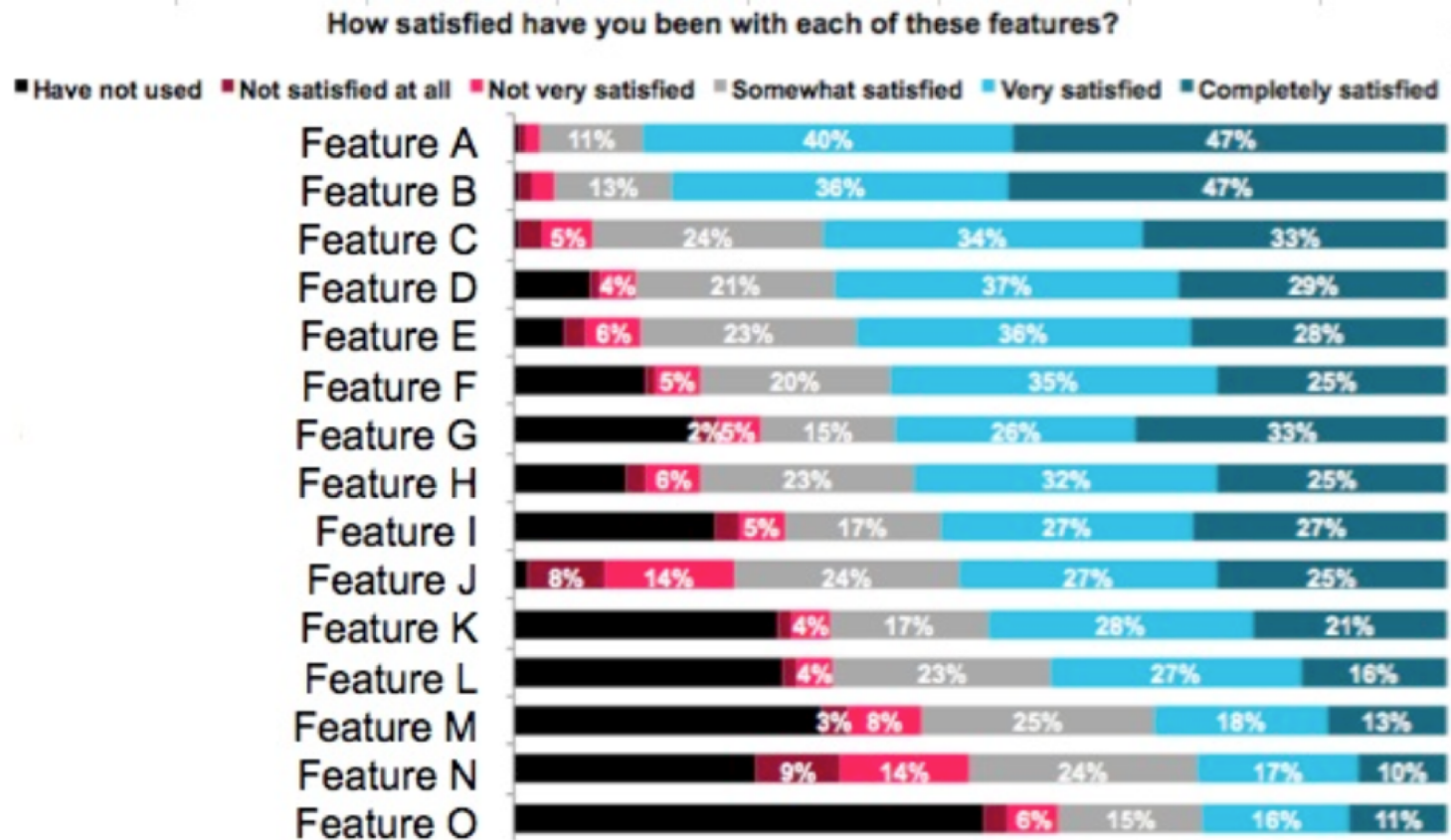
Key Considerations

- Who is your **audience**
- What questions are you answering?
- Why should the audience care?
- What are your major insights and surprises?
- What change do you want to affect?

Don't Make Them Think!

- Your audience does not want to spend cognitive effort on things you know and can just show them
- Lead them through the major steps of your story
- Point out interesting key facts and insights using captions and annotations

Don't Bury the Lead



User satisfaction varies greatly by feature

Product X User Satisfaction: Features

* Completely satisfied * Very satisfied * Somewhat satisfied * Not very satisfied * Not satisfied at all * Have not used

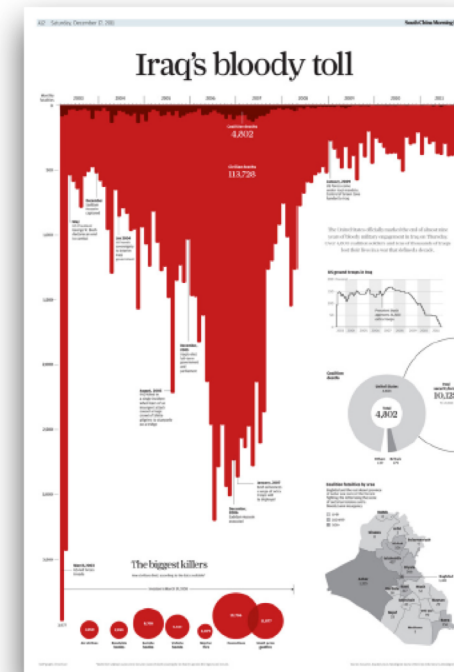
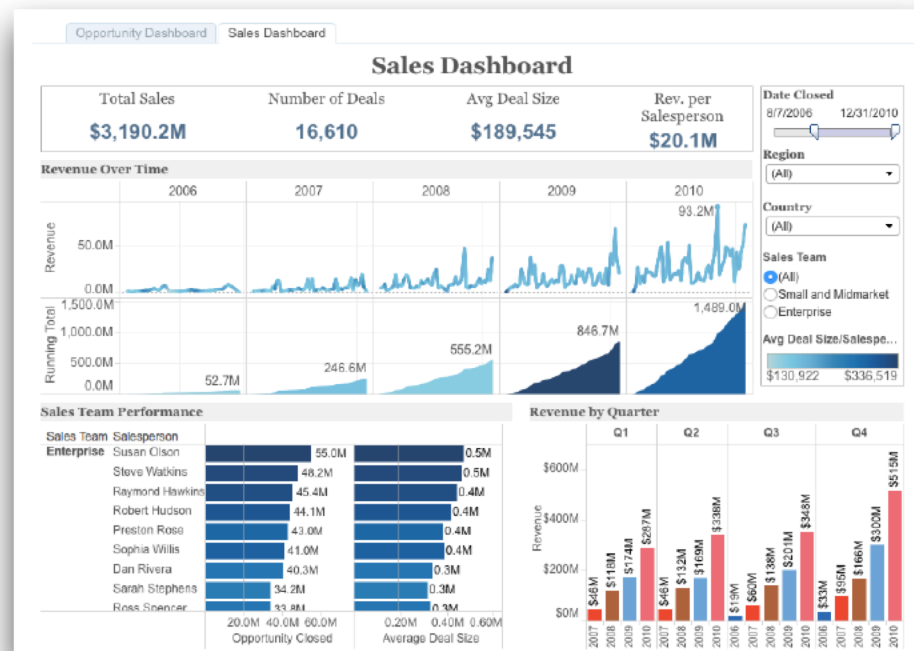


Feature O is least-used feature; what steps can we proactively take with existing users to increase use?

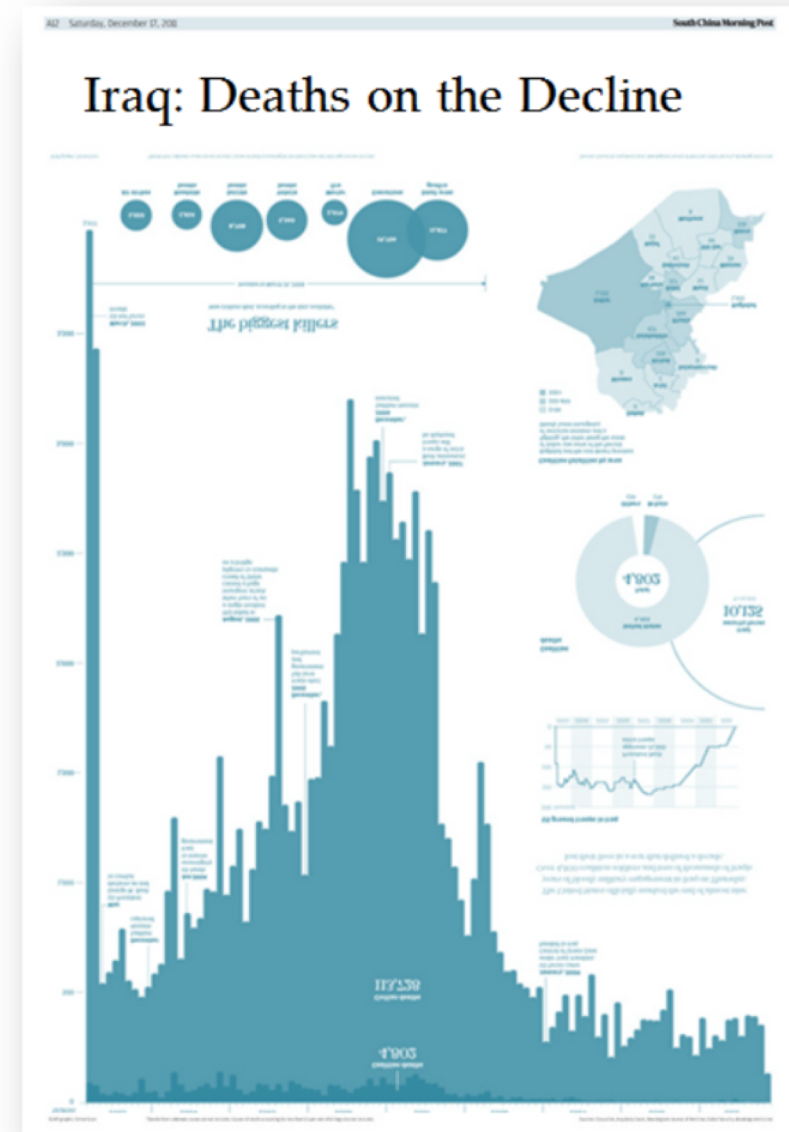
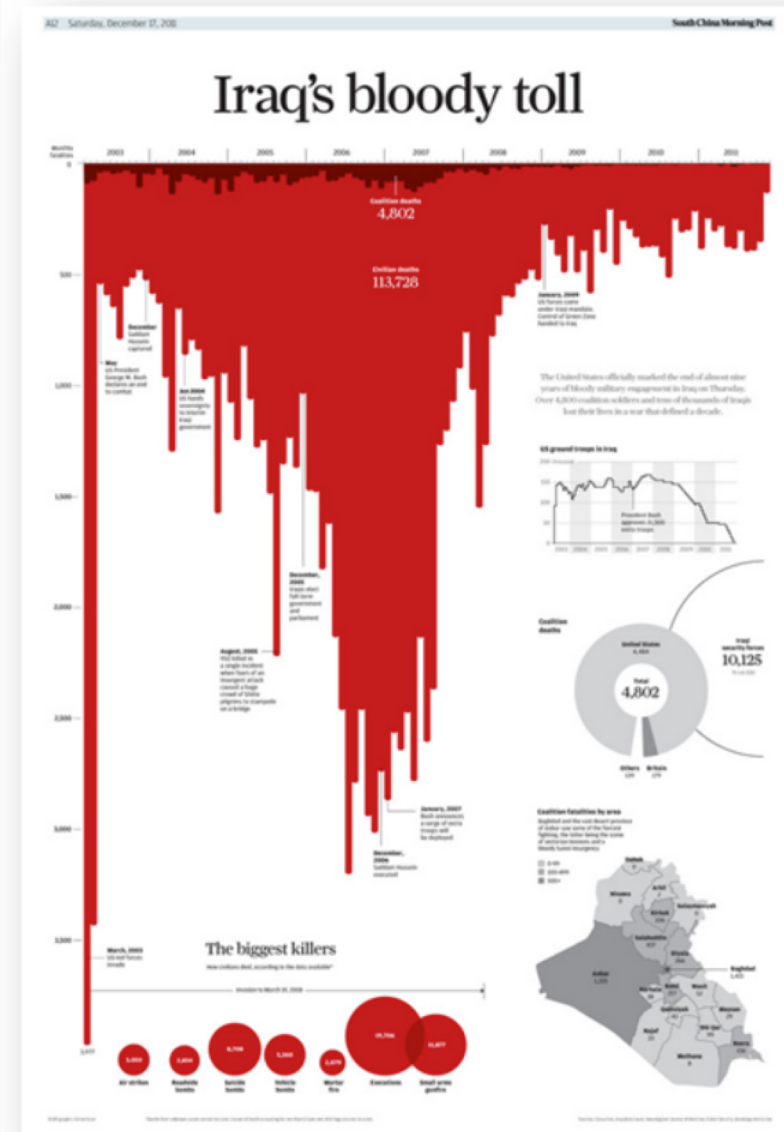
What is the message?

Exploratory
Neutral

Explanatory
Opinionated



Communication



Final Takeaways

- How you choose to display your data greatly influences how people interpret the data
- Humans are visual, *emotional* creations; make graphs that don't make others feel confused, insulted, etc
- Your graphs should illicit good feelings and effectively convey your narrative