Lecture 12:
Storylines and Interactive Graphics

April 20, 2020

Overview

Course Administration

1. Grading
   - All grades with exception of workshop comments should be up
   - Please sign up for the credit/no credit option if that is best for you
2. Presentations are due by April 27 at midnight. Instructions here
3. Presentation comments due by April 28 at midnight
4. Paper due May 4 by midnight: I will check datestamp
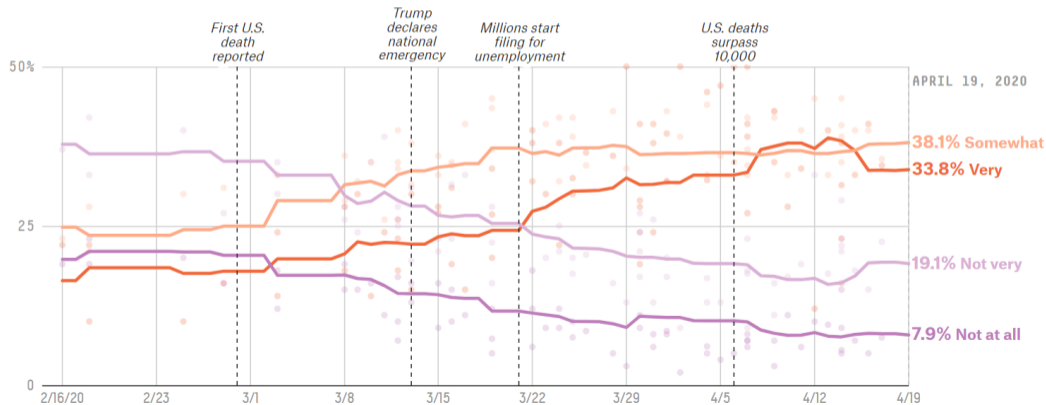5. Anything else?

Good, Bad & Ugly

The Final Good, Bad, and Ugly

Finder	Commenter
Danielle C.	Erik C.
Aaron K.	Caitlyn V.
Caitlyn V.	Lauren G.

Danielle's Example. Erik Discusses.

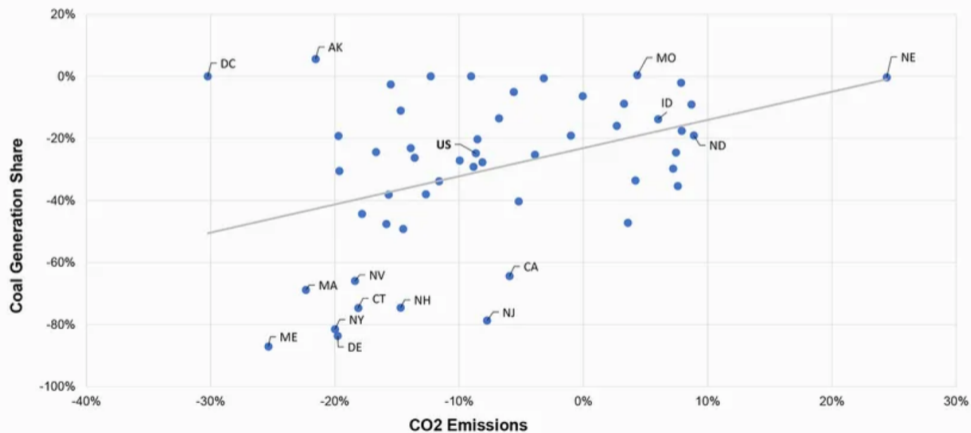**How worried are Americans about infection?**
How concerned Americans say they are that they, someone in their family or someone else they know will become infected with the coronavirus

Aaron's Example. Caitlyn Discusses.

Figure 5. Carbon emissions are declining due to less coal use at power plants
(% change in CO2 emissions and coal generation share, 2000 - 2014)

Caitlyn's Example. Lauren Discusses.

Self-reported Life Satisfaction vs GDP per capita, 2017

The vertical axis shows the national average of the self-reported life satisfaction on a scale ranging from 0-10, where 10 is the highest possible life satisfaction.

The horizontal axis shows GDP per capita adjusted for inflation and cross-country price differences.
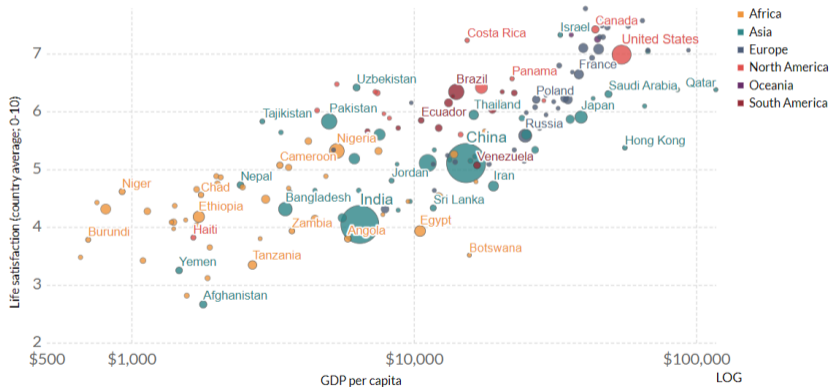
Source: World Happiness Report (2019). World Bank

Telling Stories

Four Parts of Storytelling

1. The Details: Few
2. The Sequential Story
3. The Proportional Story
4. A Fix from Knaflic

1. The Details: Few

How many small decisions impact the overall look and story. Few's "secondary data component design"

- trend lines
- reference lines
- annotations
- scales

- tick marks
- grid lines
- legends

2. The Sequential Story

- Knaflic: narrate a line graph
- Mulbrandon: narrate a set of line graphs

Sequential Stories

- Tell the story of change over time
- Highlight important inflection points
- Tell the audience how you characterize the change: big, small, steep, not
- Use a different final product for the un-narrated version

Knaflic's Sequential Story: Presentation version

Moonville: active users over time

Data source: ABC Report. For purpose of analysis "active user" is defined as the number of unique users in the past 30 days.

Knaflic's Sequential Story: Presentation version

Moonville: active users over time

Data source: ABC Report. For purpose of analysis "active user" is defined as the number of unique users in the past 30 days

Knaflic's Sequential Story: Presentation version

Moonville: active users over time

Active users

100,000
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0

Sep Oct Nov Dec | Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec | Jan Feb Mar Apr May
2013 | 2014 | 2015

Data source: ABC Report. For purpose of analysis "active user" is defined as the number of unique users in the past 30 days.

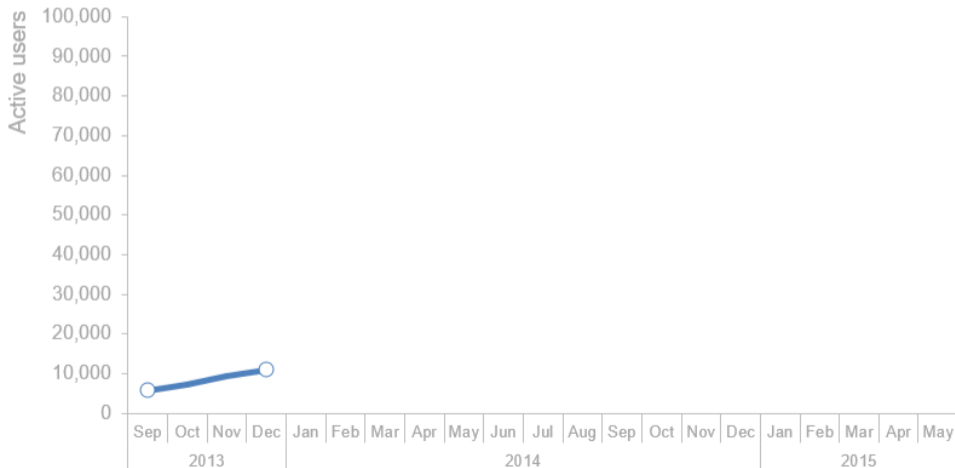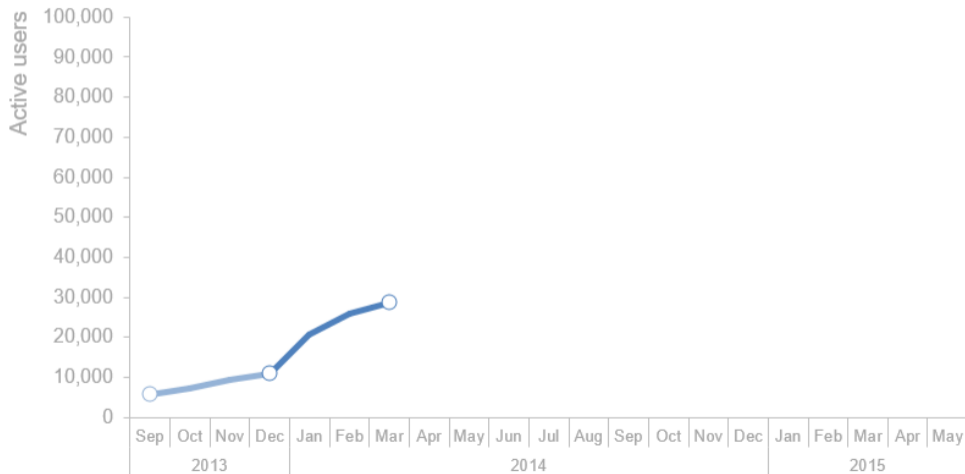# Knaflic's Sequential Story: Presentation version

Moonville: active users over time

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Knaflic's Sequential Story: Presentation version
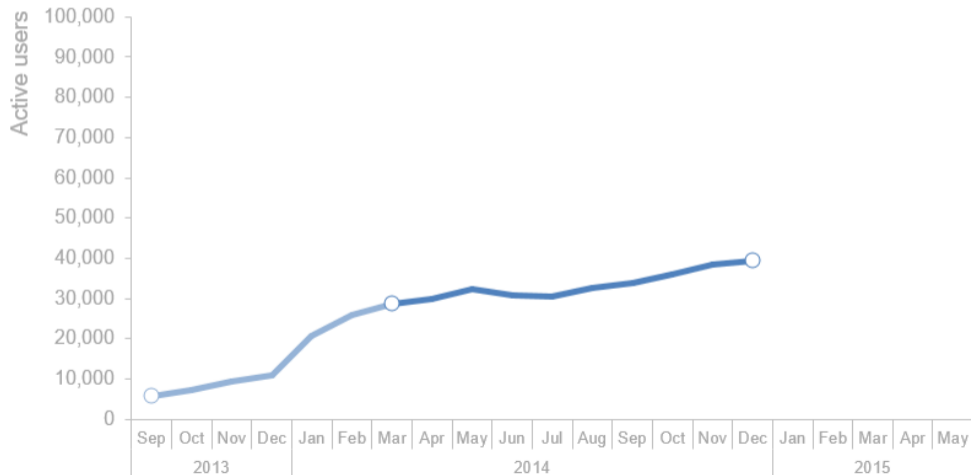
Knaflic's Sequential Story: Presentation version

Moonville: active users over time

Data source: ABC Report. For purpose of analysis "active user" is defined as the number of unique users in the past 30 days.
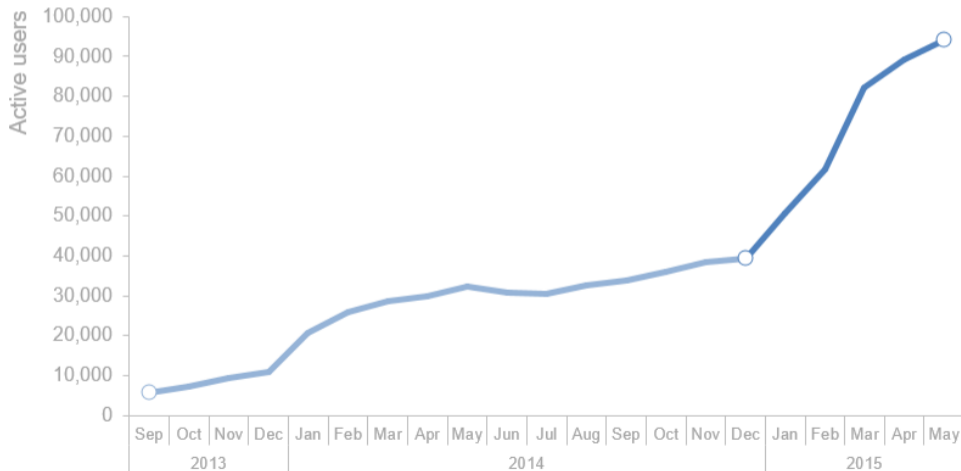
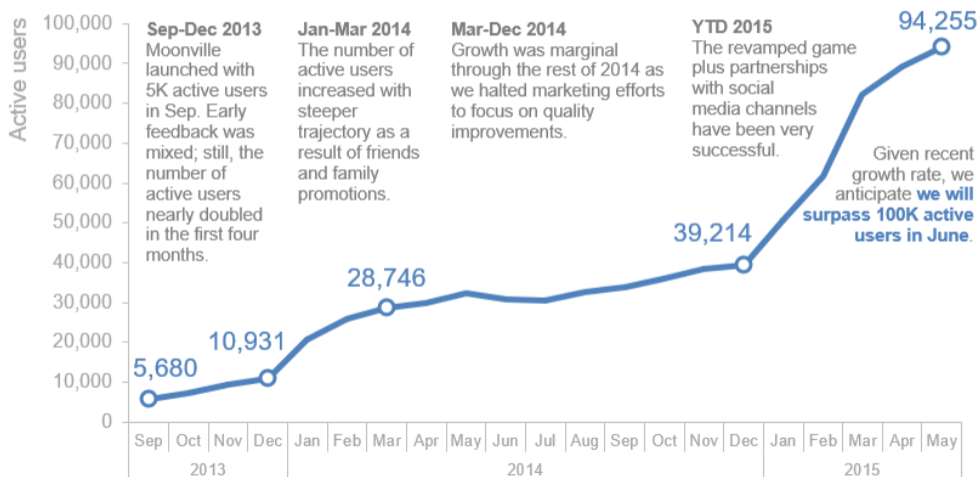# Knaflic's Sequential Story: Paper Version

Moonville: active users over time

Sep-Dec 2013
Moonville launched with 5K active users in Sep. Early feedback was mixed; still, the number of active users nearly doubled in the first four months.

Jan-Mar 2014
The number of active users increased with steeper trajectory as a result of friends and family promotions.

Mar-Dec 2014
Growth was marginal through the rest of 2014 as we halted marketing efforts to focus on quality improvements.

YTD 2015
The revamped game plus partnerships with social media channels have been very successful.

94,255

Given recent growth rate, we anticipate **we will surpass 100K active users in June.**

39,214

28,746

10,931

5,680

Data source: ABC Report. For purpose of analysis "active user" is defined as the number of unique users in the past 30 days.
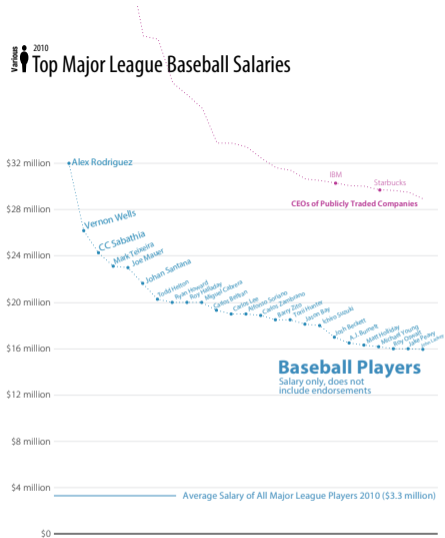
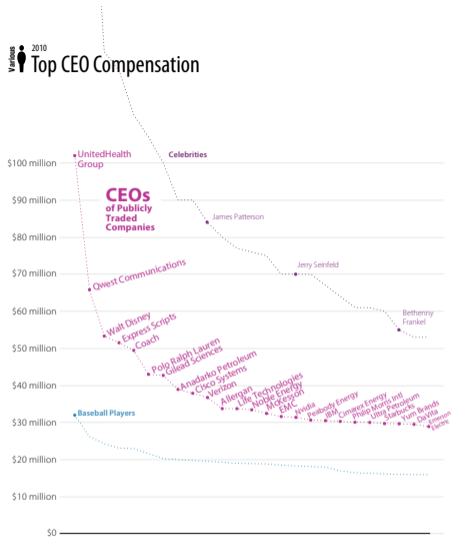# Sequence in Size: Mulbrandon and Top Salaries

- These charts manage to show things that don't actually fit on the same scale
- Impossible in one graph, but possible in two
- And notice that this is a line graph not in time

Various **2010**
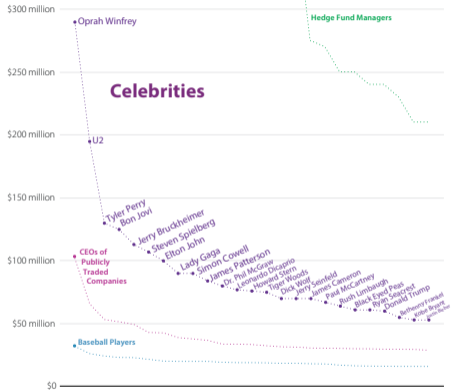# Top Major League Baseball Salaries

$32 million — • Alex Rodriguez

IBM
Starbucks
CEOs of Publicly Traded Companies

$28 million —

• Vernon Wells

$24 million —
• CC Sabathia
• Mark Teixeira
• Joe Mauer
• Johan Santana
• Derek Jeter
• Ryan Howard
• Roy Halladay
• Miguel Cabrera
• Carlos Lee
• Carlos Beltran
• Alfonso Soriano
• Barry Zito
• Aramis Ramirez
• Alex Rios
• Ichiro Suzuki
• Josh Beckett
• A.J. Burnett
• Adam Holliday
• Michael Young
• Carlos Crawford
• Jason Bay

$20 million —

Baseball Players
Salary only, does not
include endorsements

$16 million —

$12 million —

$8 million —

$4 million —
Average Salary of All Major League Players 2010 ($3.3 million)

$0 —

Top CEO Compensation

$100 million — **UnitedHealth Group** ● **Celebrities**

CEOs of Publicly Traded Companies

$90 million

James Patterson

$80 million

$70 million — Qwest Communications ● Jerry Seinfeld

$60 million — Bethenny Frankel

Walt Disney
Express Scripts
$50 million — Coach
Polo Ralph Lauren
Gilead Sciences

$40 million — Anadarko Petroleum
Cisco Systems
Verizon
Allergan
Life Technologies
Noble Energy
McKesson
EMC
Nvidia Peabody Energy

$30 million — **Baseball Players**
IBM Comcast Energy
Philip Morris Int'l
Ultra Petroleum
Starbucks
Yum! Brands
DaVita
Fiserv

$20 million

$10 million

$0

Various Top Celebrity Income

$300 million

Hedge Fund Managers

$250 million

Celebrities

$200 million

• Oprah Winfrey

• U2

$150 million

• Tyler Perry
• Bon Jovi
• Jerry Bruckheimer
• Steven Spielberg
• Elton John

$100 million

CEOs of Publicly Traded Companies

• Lady Gaga
• Simon Cowell
• James Patterson
• Dr. Phil McGraw
• Leonardo DiCaprio
• Howard Stern
• Tiger Woods
• Dick Wolf
• Jerry Seinfeld
• James Cameron
• Paul McCartney
• Rush Limbaugh
• Black Eyed Peas
• Ryan Seacrest
• Donald Trump

$50 million

• Baseball Players

$0

Top Hedge Fund Manager Income

Hedge Fund Managers

$5 billion — • John Paulson

$4 billion

$3 billion — • Ray Dalio

• James Simons

• David Tepper

$2 billion

• Steve Cohen

• Eddie Lampert

$1 billion — • Carl Icahn

• Bruce Kovner

• George Soros
• Phil Falcone
• Paul Tudor Jones II
• Ken Griffin
• John Arnold
• Marc Lasry
• Chris Hohn
• William Ackman
• Dan Och
• Andy Englander
• David Shaw
• Michael Platt
• Stephen Mandel
• Andrew Halvorsen
• Andrew Lahde
• Louis Bacon
• Dan Loeb

Celebrities •
CEOs •
Baseball Players •

$0

3. The Proportional Story

- Knaflic: narrate a set of stacked bars
- Mulbrandon: narrate a set of dots

Proportion Stories

- Show how one item's size relates to another item's size
- For multiple items, call out specific size differences
- Tell the audience how you characterize the relative magnitude: big or small?

Knaflic's Proportion Considerations: Presentation version

How satisfied have you been with each of these features?
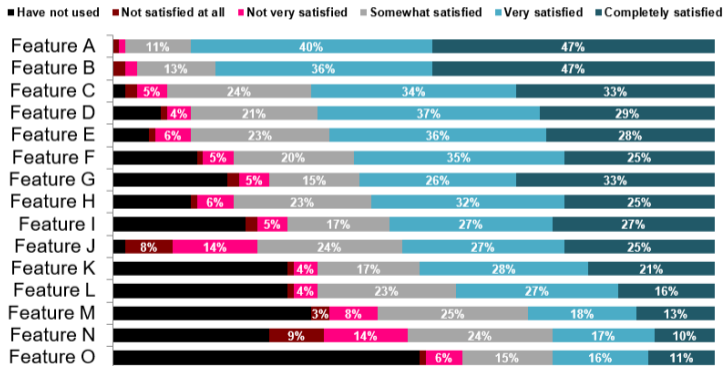
Knaflic's Proportion Considerations: Presentation version

Features A & B top user satisfaction

Product X User Satisfaction: **Features**

■ **Completely satisfied** ■ **Very satisfied** ■ Somewhat satisfied ■ Not very satisfied ■ Not satisfied at all ■ Have not used
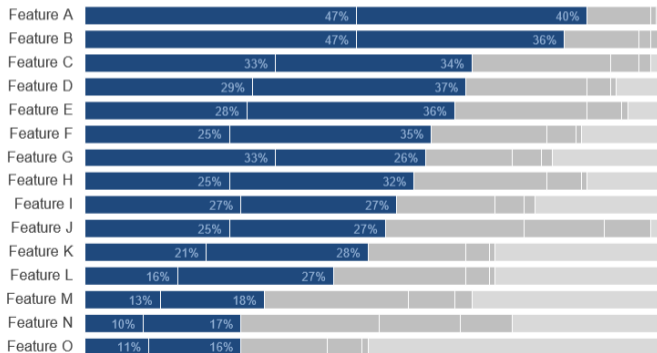
Responses based on survey question "How satisfied have you been with each of these features?".
Need more details here to help put this data into context: How many people completed survey? What proportion of users does this represent?
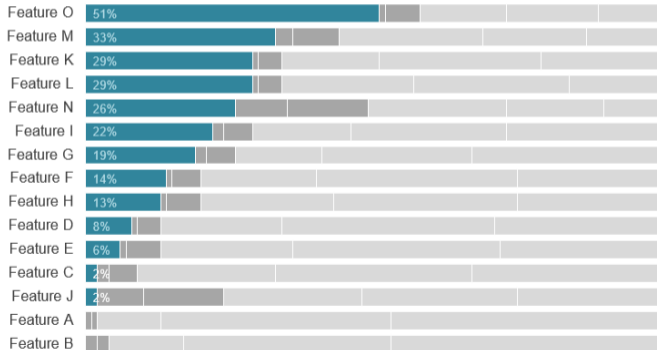Do those who completed survey look like the overall population, demographic-wise? When was the survey conducted?

Knaflic's Proportion Considerations: Presentation version

Users least satisfied with Features N and J

Product X User Satisfaction: **Features**

- Not satisfied at all ■ Not very satisfied ■ Somewhat satisfied ■ Very satisfied ■ Completely satisfied ■ Have not used
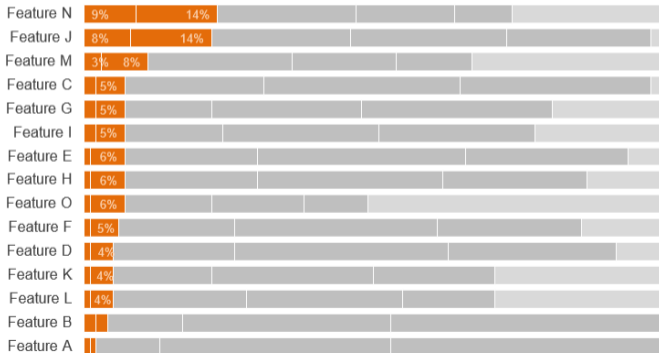
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Need more details here to help put this data into context: How many people completed survey? What proportion of users does this represent?
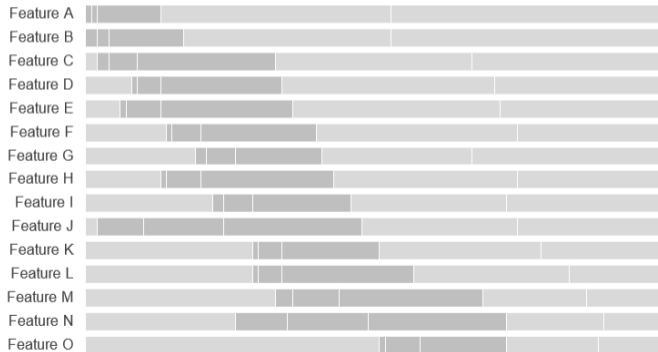Do those who completed survey look like the overall population, demographic-wise? When was the survey conducted?

Knaflic's Proportion Considerations: Presentation version

Feature O is least used

Product X User Satisfaction: **Features**

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

Feature O	51%
Feature M	33%
Feature K	29%
Feature L	29%
Feature N	26%
Feature I	22%
Feature G	19%
Feature F	14%
Feature H	13%
Feature D	8%
Feature E	6%
Feature C	2%
Feature J	2%
Feature A	
Feature B	

Responses based on survey question "How satisfied have you been with each of these features?".
Need more details here to help put this data into context: How many people completed survey? What proportion of users does this represent?
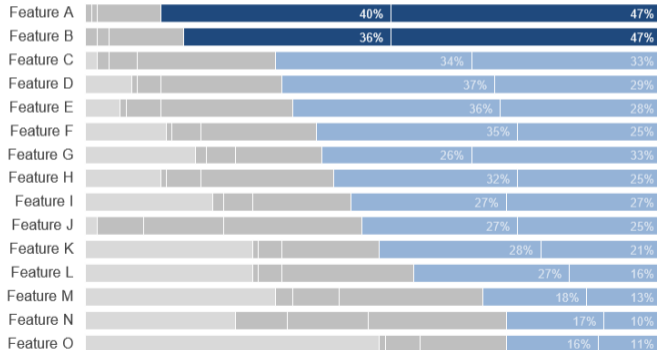Do those who completed survey look like the overall population, demographic-wise? When was the survey conducted?

Knaflic's Proportion Considerations: Presentation version

Knaflic's Proportion Considerations: Presentation version

User satisfaction varies greatly by feature

Product X User Satisfaction: **Features**

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

Feature		
Feature A	40%	47%
Feature B	36%	47%
Feature C	34%	33%
Feature D	37%	29%
Feature E	36%	28%
Feature F	35%	25%
Feature G	26%	33%
Feature H	32%	25%
Feature I	27%	27%
Feature J	27%	25%
Feature K	28%	21%
Feature L	27%	16%
Feature M	18%	13%
Feature N	17%	10%
Feature O	16%	11%

Features A and B continue to top user satisfaction

Responses based on survey question "How satisfied have you been with each of these features?".
Need more details here to help put this data into context: How many people completed survey? What proportion of users does this represent?
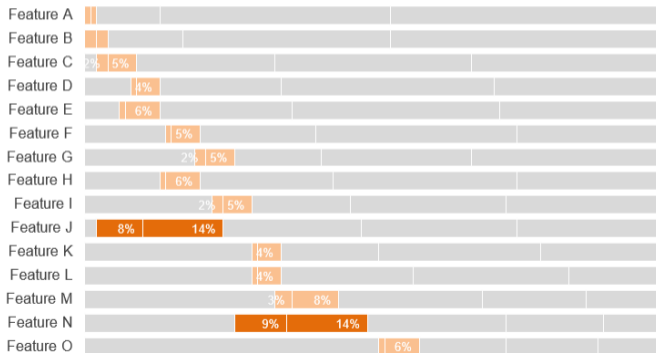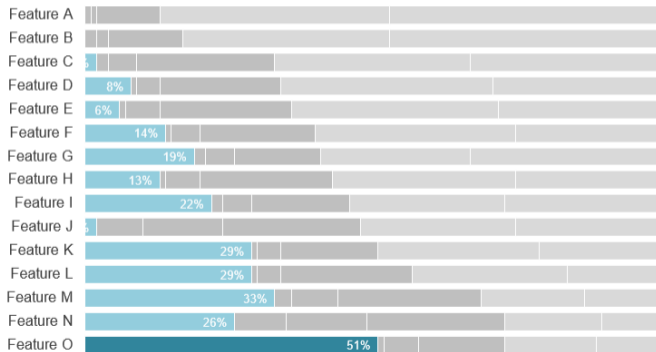Do those who completed survey look like the overall population, demographic-wise? When was the survey conducted?

Knaflic's Proportion Considerations: Presentation version

User satisfaction varies greatly by feature

Product X User Satisfaction: **Features**

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

Feature	
Feature A	
Feature B	
Feature C	5%
Feature D	4%
Feature E	6%
Feature F	5%
Feature G	2% 5%
Feature H	6%
Feature I	2% 5%
Feature J	8% 14%
Feature K	4%
Feature L	4%
Feature M	3% 8%
Feature N	9% 14%
Feature O	6%

Users are least satisfied with Features J and N; what improvements can we make here for a better user

Responses based on survey question "How satisfied have you been with each of these features?".
Need more details here to help put this data into context: How many people completed survey? What proportion of users does this represent?
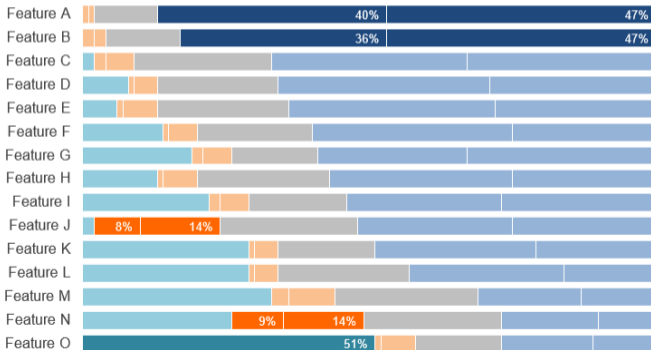Do those who completed survey look like the overall population, demographic-wise? When was the survey conducted?

Knaflic's Proportion Considerations: Presentation version

Knaflic's Proportion Considerations: Paper version

User satisfaction varies greatly by feature

Product X User Satisfaction: **Features**

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

Feature A	40%	47%
Feature B	36%	47%
Feature J	8%	14%
Feature N	9%	14%
Feature O	51%	

Features A and B continue to top user satisfaction

Users are least satisfied with Features J and N; what improvements can we make here for a better user

Feature O is least used. What steps can we proactively take with existing users to increase utilization?

Responses based on survey question "How satisfied have you been with each of these features?".
Need more details here to help put this data into context: How many people completed survey? What proportion of users does this represent?
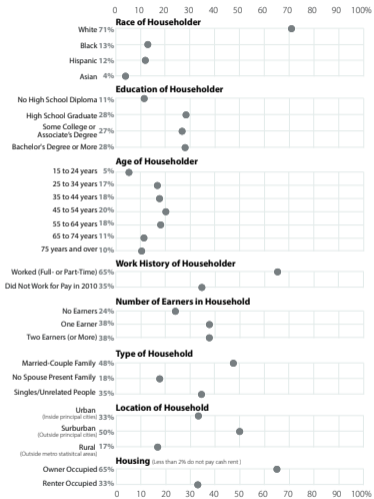Do those who completed survey look like the overall population, demographic-wise? When was the survey conducted?
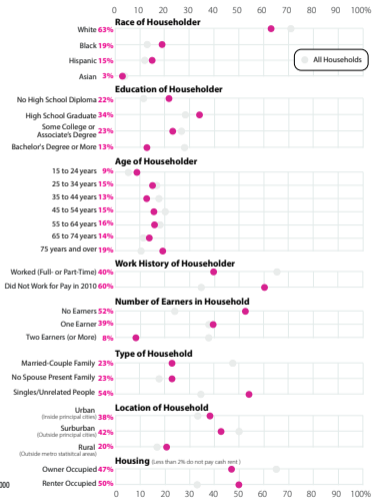
Mulbrandon on the Relative Size of Things

Demographics of All Incomes

Census

0   10   20   30   40   50   60   70   80   90   100%

Race of Householder

White	71%
Black	13%
Hispanic	12%
Asian	4%

Education of Householder

No High School Diploma	11%
High School Graduate	28%
Some College or Associate's Degree	27%
Bachelor's Degree or More	28%

Age of Householder

15 to 24 years	5%
25 to 34 years	17%
35 to 44 years	18%
45 to 54 years	20%
55 to 64 years	18%
65 to 74 years	11%
75 years and over	10%

Work History of Householder

Worked (Full- or Part-Time)	65%
Did Not Work for Pay in 2010	35%

Number of Earners in Household

No Earners	24%
One Earner	38%
Two Earners (or More)	38%

Type of Household

Married-Couple Family	48%
No Spouse Present Family	18%
Singles/Unrelated People	35%

Location of Household

Urban (Inside principal cities)	33%
Surburban (Outside principal cities)	50%
Rural (Outside metro statistical areas)	17%

Housing (Less than 2% do not pay cash rent)

Owner Occupied	65%
Renter Occupied	33%

0   10   20   30   40   50   60   70   80   90   100%

Demographics of Incomes below $30,000

0   10   20   30   40   50   60   70   80   90   100%

Race of Householder

All Households

- White **63%**
- Black **19%**
- Hispanic **15%**
- Asian **3%**

Education of Householder

- No High School Diploma **22%**
- High School Graduate **34%**
- Some College or Associate's Degree **23%**
- Bachelor's Degree or More **13%**

Age of Householder

- 15 to 24 years **9%**
- 25 to 34 years **15%**
- 35 to 44 years **13%**
- 45 to 54 years **15%**
- 55 to 64 years **16%**
- 65 to 74 years **14%**
- 75 years and over **19%**

Work History of Householder

- Worked (Full- or Part-Time) **40%**
- Did Not Work for Pay in 2010 **60%**

Number of Earners in Household

- No Earners **52%**
- One Earner **39%**
- Two Earners (or More) **8%**

Type of Household

- Married-Couple Family **23%**
- No Spouse Present Family **23%**
- Singles/Unrelated People **54%**

Location of Household

- Urban (Inside principal cities) **38%**
- Surburban (Outside principal cities) **42%**
- Rural (Outside metro statistical areas) **20%**

Housing (Less than 2% do not pay cash rent)

- Owner Occupied **47%**
- Renter Occupied **50%**

0   10   20   30   40   50   60   70   80   90   100%

$30,000

Source: US Census Bureau, 2006–2010 American Community Survey

4. The Fix

Knaflic's fix of an existing graphic to highlight the story

- Instead of the book's example, another from her website
- Transforming hard-to-read bars to easier-to-read formats
- Many similar ideas apply
- I'll just narrate the first one

Pew Charts on Number of Newly Married Adults

What's Wrong and How to Fix?

ORIGINAL

Number of Newly Married Adults

In millions

Year	Value
2012	4.32
2011	4.21
2010	4.23
2009	4.45
2008	4.51
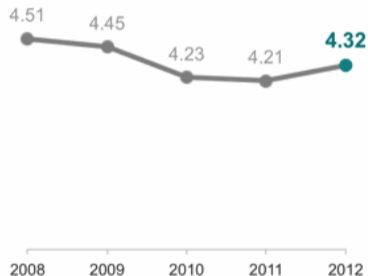
Note: "Newly married" refers to adult respondents who reported marrying within the past twelve months of the interview.

Source: Pew Research Center tabulations of the 2008-2012 American Community Survey (ACS) data

PEW RESEARCH CENTER

Show Change Over Time

Can You Pick Out the Point Here?

New Marriage Rate by Education

Number of newly married adults per 1,000 marriage eligible adults

'08 '09 '10 '11 '12

All: 41.4 ... 36.7

Less than high school: 26.8 ... 23.4

High school graduate: 35.9 ... 30.1

Some college: 42.5 ... 36.5

Bachelor's degree or more: 61.5 ... 56.7
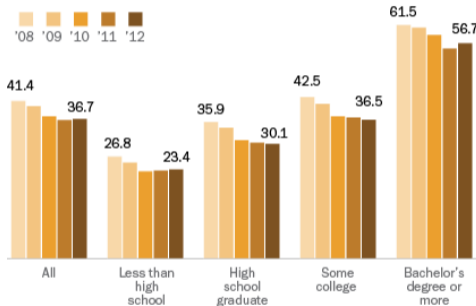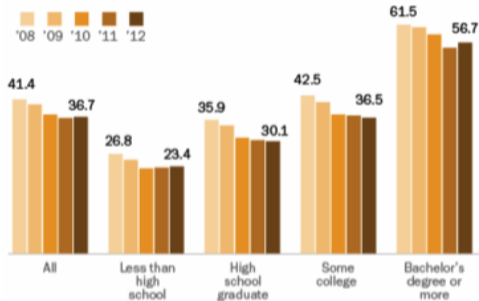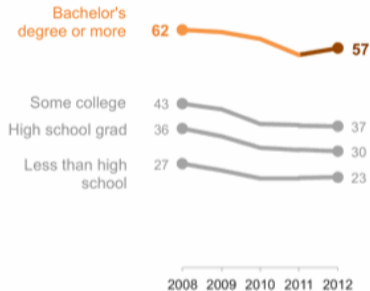
Note: Marriage eligible includes the newly married plus those widowed, divorced or never married at interview.
Source: US Census

PEW RESEARCH CENTER

Highlighting the Increase for You Guys

What Would You Want to Pull Out?
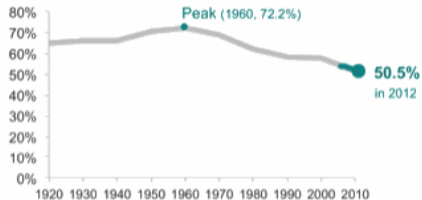

ORIGINAL

Adults Currently Married
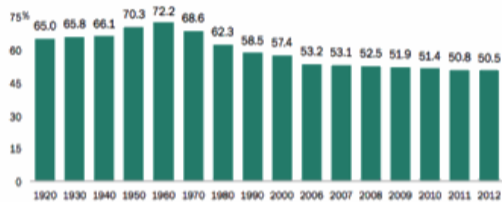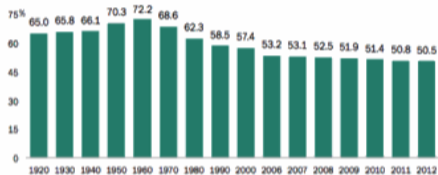
Notes: Based on adults age 18 and older. Currently married includes respondents reporting "married, spouse absent." Those reporting "separated" are not included in "currently married."

Source: Pew Research Center tabulations of the 1920-2000 Decennial Census data and 2006-12 American Community Survey (ACS) Integrated Public Use Micro Samples

PEW RESEARCH CENTER

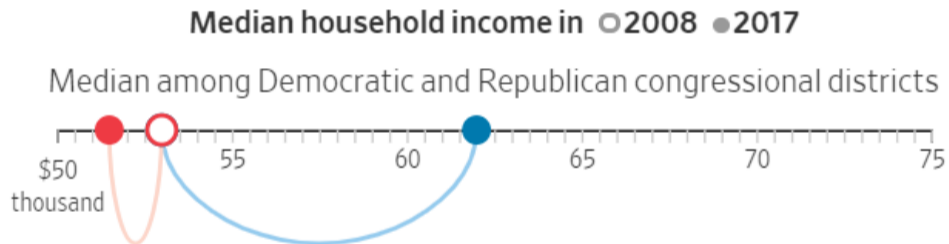# Highlighting Peak and Trough

R Notes

Don't Use An Interactive Chart to Tell a Story

- the point of a chart is for you to tell a specific story
- don't let readers make up their own story!

Don't Use An Interactive Chart to Tell a Story

- the point of a chart is for you to tell a specific story
- don't let readers make up their own story!
- interactive charts let readers modify your work
- but they can be excellent for letting people "see" or "play" with the data

A Great Set of Moving (not Interactive) Charts

Median household income in ○2008 ●2017

Median among Democratic and Republican congressional districts

$50 thousand · 55 · 60 · 65 · 70 · 75

WSJ: Democrats and Republicans..., 9/19/2019.

Interactive Graphics in R

You can move the slider and change the histogram. There are many more beautiful examples. See tutorial for links.

Today in R: Interactive Charts

1. The components of a Shiny app
2. How to save a Shiny app
3. How to run a Shiny app
4. Try it!

1. Components of a Shiny App

```r
# 1. load package
library(shiny)
# 2. define user interface
ui.def <- fluidPage()
# 3. define computed output to user interface
server.def <- function(input, output){}
# 4. call the app
shinyApp(ui = ui.def,
         server = server.def)
```

2. How to Save a Shiny App

- Each Shiny app must be named app.R
- Each Shiny app must be saved in a separate directory

2. How to Save a Shiny App

- ▶ Each Shiny app must be named app.R
- ▶ Each Shiny app must be saved in a separate directory

So important that I will repeat

- ▶ Each Shiny app must be named app.R
- ▶ Each Shiny app must be saved in a separate directory

3. How to Run a Shiny app

```
runApp("[directory where you saved app.R]")
```

Highlight this line of code, and run **only this line**

4. Try it!

In today's tutorial, you'll use the Arlington property data again

- ▶ you'll try examples of Shiny apps
- ▶ create one of your own
- ▶ modify it

The End

- If you have suggestions for a wrap up/culmination, please let me know
- I'll look forward to your presentations and briefs
- Please stay safe and healthy