

UVA DS2003 Communicating with Data

Fall 2026

Storytelling with Data

Narrative Visualization

Sarah Groves

based on materials by Hannah Bako and a lot of other people

Summary from last class

- Explanatory visualization is about communicating a story that you found in the data
 - It is not about manipulating the data to tell a story that you already think is true!
 - Effective storytelling should guide the viewer to the core message and allow for a restrained amount of exploration
 - In Western cultures, we read left to right and top to bottom, so most important information should be top left
- Use clear annotations and legends to highlight the main story
- Too much data/chronological “as you made them” charts will not be effective

Where failed data stories go wrong

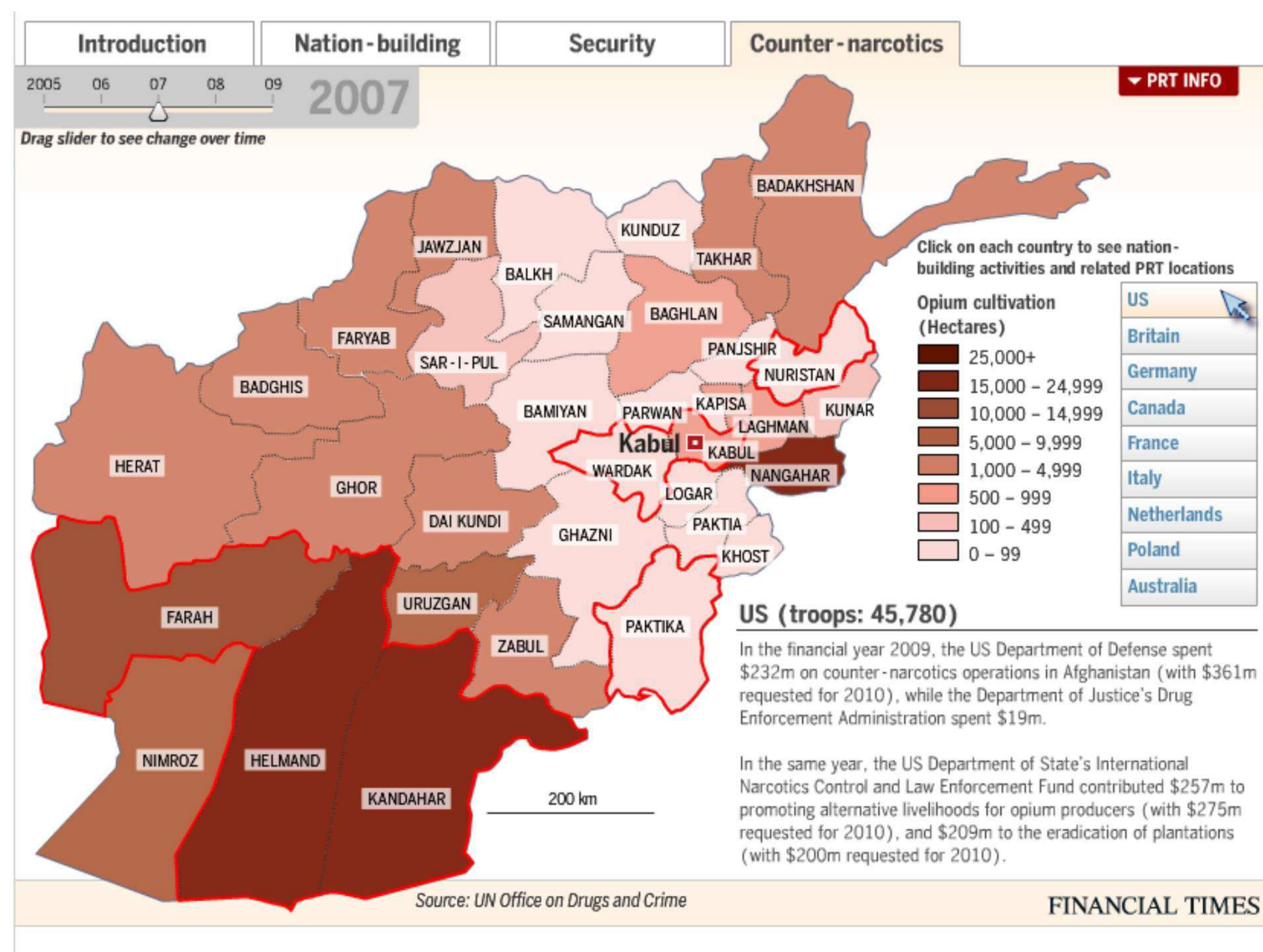
Think | Pair | Share

- Think of a time someone tried to tell you or others a story with data, and it failed.
- What do you think went wrong?
- Why was the intended message not communicated effectively?

Afghanistan: behind the front line

Intended purpose of the graphic: to establish indicators of success by which to evaluate the development work being done in Afghanistan

- Semantically consistent color
- Details on demand
- However, it does not guide the viewer through the data at all → too much flexibility → viewer can't reach meaningful conclusions intended by the designers



The graphic “suffers by putting exploratory power into the hands of the viewer without sufficient guidance”

Minnesotan Employment Explorer

Context: in July 2008, Minnesota was in recession, so Minnesota Public Radio (MPR) released “**Minnesota Slowdown:**” stories detailing the state’s economic malaise and shares interviews with residents hit hard by the downturn.

Intended purpose: engage readers in finding and telling their own stories in the data.

Only 23 people engaged, and not Minnesotans

- No tutorial and too much data → confused users
- No rich, emergent story
- Disconnected from the narrative (graphic showed 2000-2007)

Minnesota Quarterly Employment (by Industry) 2000-2007

All Minnesota Industries

93,702 (+3.7%) jobs added between 2000-2007



Share Your Insights (13/62 Comments)

These seem to be three of the areas hardest hit by the slowdown.

by Andrew H. on Jul 16

Health care has accounted for more than half of the jobs added since 2000.

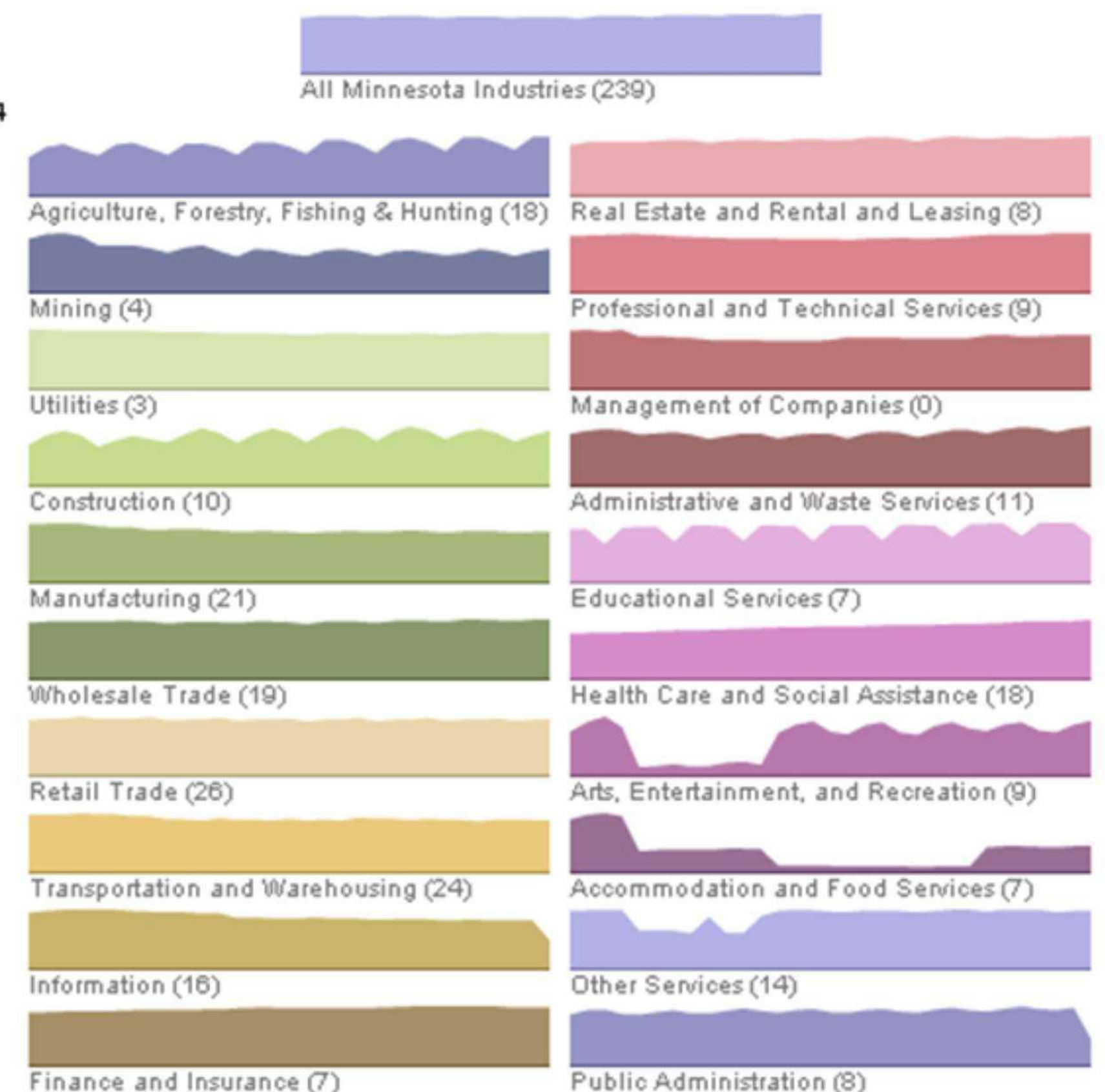
▶ by Bryan C. on Jul 18 - 1 reply

What happened to 'Information' jobs?!? 25K+ lost in one quarter? That doesn't seem possible. Or did somebody move out of state that I've overlooked?

▶ by brian s. on Jul 18 - 1 reply

Minn Dept of Econ Dev attributed 2000-2001 unemployment to the [dot.com](http://www.deed.state.mn.us/lmi/publications/trends/0701layoff.htm) bust (<http://www.deed.state.mn.us/lmi/publications/trends/0701layoff.htm>). It's interesting that the initial drop in Arts employment preceded the start in Managerial employment by 1 qtr. And Arts also bottomed out 3 qtrs before Management. Is Arts, Entertainment, and Recreation employment an indicator of future trends in White-Collar employment?

by Brad S. on Jul 19



Narrative Tactics

A design space for narrative visualization

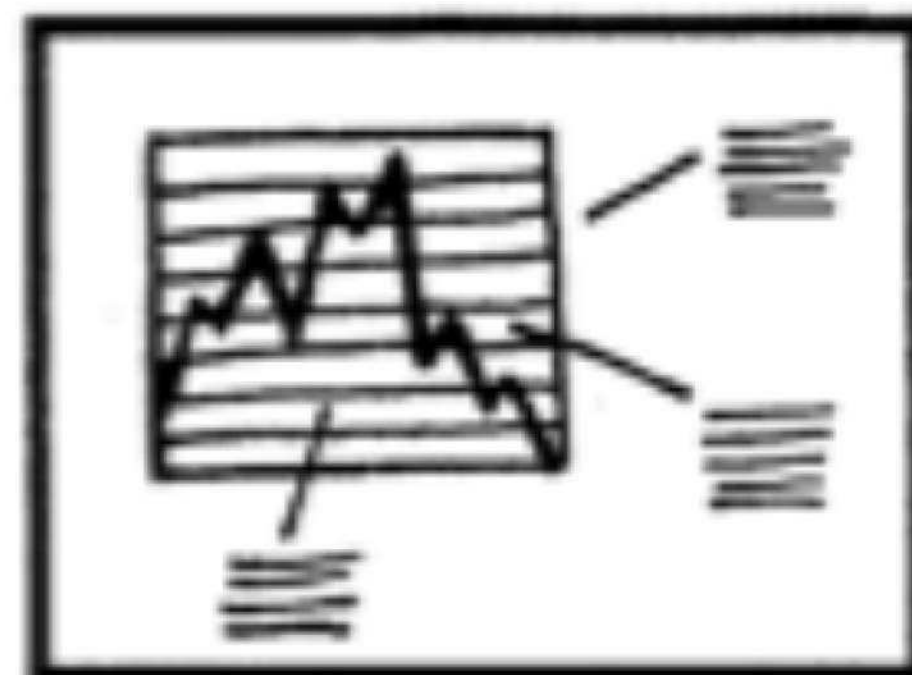
- Segel & Heer describe every narrative visualization through three sets of choices:
 - **Genre**: the form the story takes (seven genres)
 - **Visual narrative tactics**: visual devices that guide the viewer's attention
 - **Narrative structure tactics**: non-visual mechanisms that shape the path, the interaction, and the message

Types of Data Stories

Seven Genres



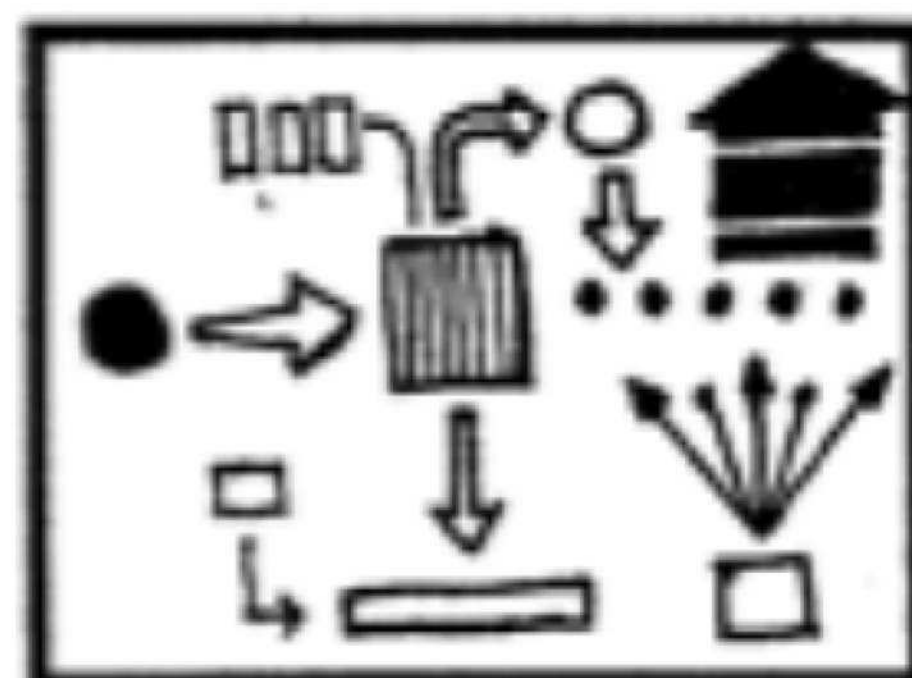
Magazine Style



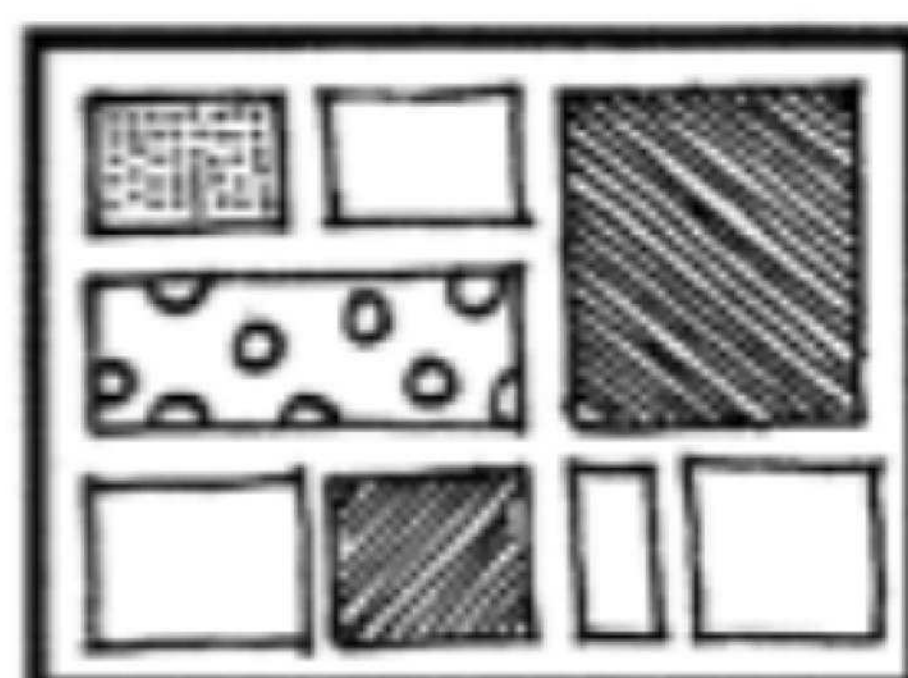
Annotated Chart



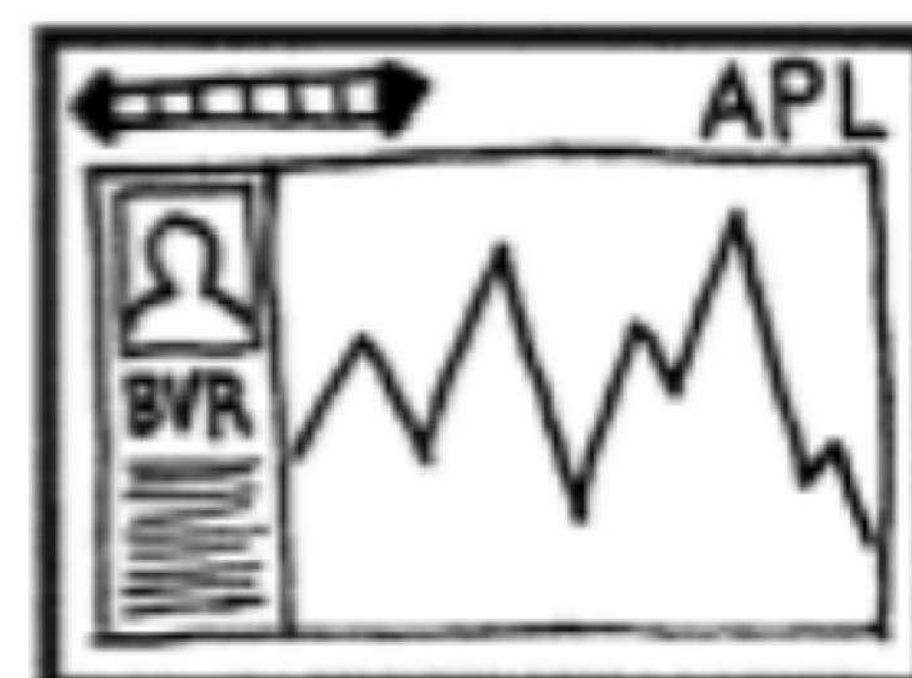
Partitioned Poster



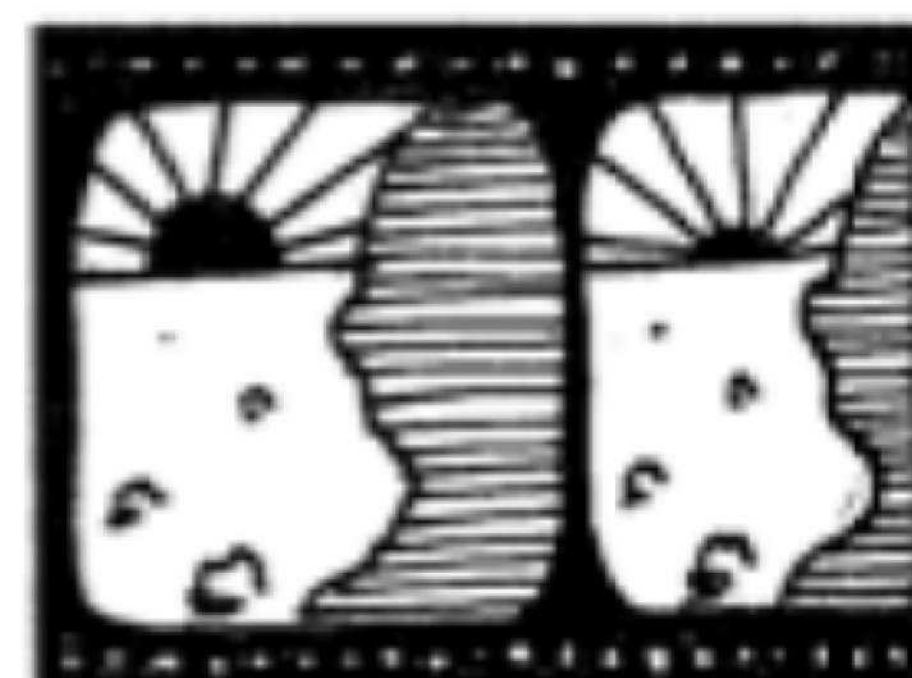
Flow Chart



Comic Strip



Slide Show



Film/Video/Animation

Magazine Style

When you embed a particular visualization in a story.

Business

The Economist May 2012 67



Also in this section

- 68 Saving companies
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- 71 Schumpeter: Overstretched

For daily analysis and comment on business, visit economist.com/business-features

Privacy and the internet Lives of others

BY JENNIFER STODOLSKY

Facebook and Google face a backlash from users and regulators alike as the way they have handled sensitive data

JENNIFER STODOLSKY, Canada's privacy commissioner, is furious with Facebook. In August 2011, the social networking site struck a deal, agreeing to change its policies within a year to comply with the country's privacy law. Now, says Ms Stodolsky, the company appears to be leaving an important part of that deal, which included giving users a clear and easy-to-implement choice over whether to share private data with third parties, "it doesn't seem to me that Facebook is going in the right direction on this issue," she says, fearing that, without a change of course, the firm could soon become the subject of another formal investigation by her organisation.

Facebook is not the only internet giant to provide the head of data watchdogs. Google ended advertising contracts this week following news that it had recorded users' personal communications over unsecured Wi-Fi data networks in homes and offices in some 30 countries. On May 17th Peter Schaar, Germany's federal commissioner for data protection, called for an independent investigation into Google's behaviour, claiming that it had "deeply disrupted normal rules in the development and usage of software."

The cases highlight rising tension between guardians of privacy and internet firms. And they reflect concern among web users about how private data are made public. Several prominent internet

types such as Cory Doctorow, a science-fiction author, and Ian Japane, a politician, have abandoned Facebook. Sites such as Quantcast and Digg.com are urging others to do the same, warning May 19th for a mass Facebook "boycott".

This is unlikely to stop the momentum of Facebook, which is poised to claim half a billion members and which draws even more visitors as a whole to be the free chart, but moves have been made at the company's headquarters in Menlo Park, where bosses are calling over how to respond. Several senior folk are now hinting that Facebook will soon roll out simpler privacy controls to make it easier to keep more data hidden. MySpace, a rival, is already making it easier to strip it in an effort to woo disaffected Facebookers to its service.

A trial over Facebook's handling of privacy has been brewing for some time. In December the social network changed the default settings on its privacy controls so that individuals' personal information would be shared with "everyone" rather than selected friends. Facebook argued this reflected a shift in society towards greater openness and noted that users could still adjust privacy settings. Back again, but increased privacy activists lobbied for it to be reversed.

The switch should not have come as a surprise, only on many social networks

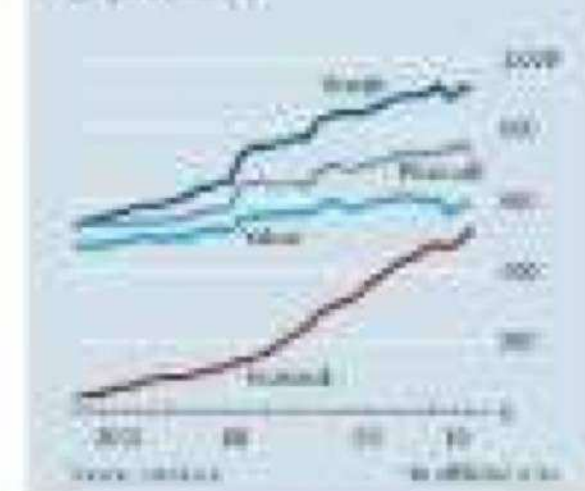
impose fairly tough privacy policies in order to attract and maintain users. But as more join, controls are gradually loosened to encourage more sharing. As people share more, Facebook can increase the traffic against which it sells advertising. And the more it learns about users' likes and dislikes, the better it can target ads that generate hundreds of millions of dollars.

Privacy groups have been following a development conference last month at which Mark Zuckerberg, Facebook's boss, announced yet another series of policy changes. One that raised eyebrows was an "extended permission" feature that lets remote third-party websites access Facebook data when people visit. Critics say that Facebook has made it tricky to disable this feature, which may explain why its standard settings have been so much.

European officials are granting a boost to Facebook too. This month a group of data-protection experts asked the European Commission to move to the social network, calling its default privacy settings "unacceptable". And in the US

Not looking pure

By David G. H. Jones



Annotated Chart

a chart with notes, highlights or meta-information to improve comprehension or provide context

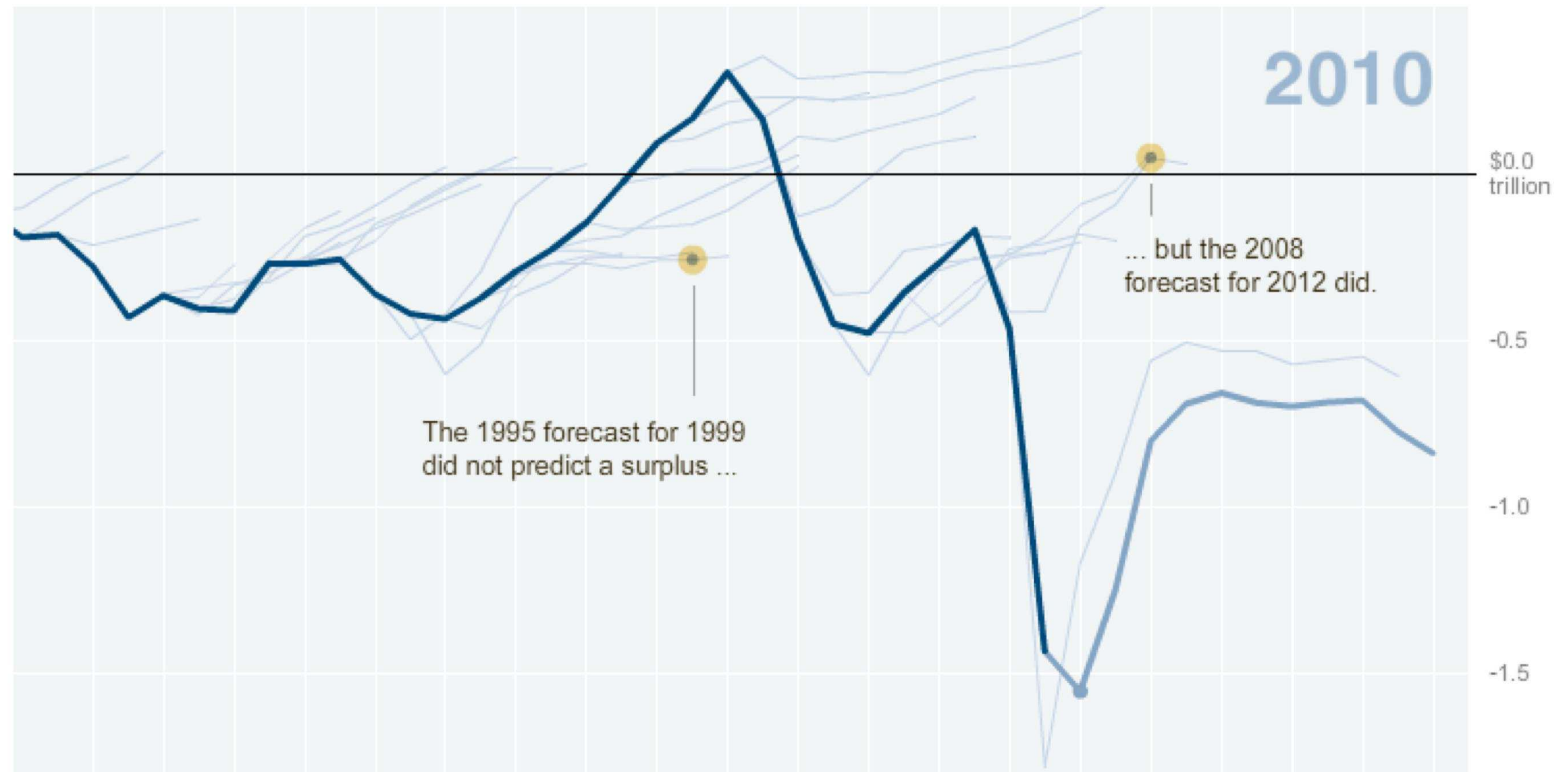
Published: February 2, 2010

Budget Forecasts, Compared With Reality

Just two years ago, surpluses were predicted by 2012. How accurate have past White House budget forecasts been?

Latest forecast

Today, with a better understanding of the severity of the economic downturn, the deficit situation is much more dire.



Annotated Chart + Slideshow

Published: February 2, 2010

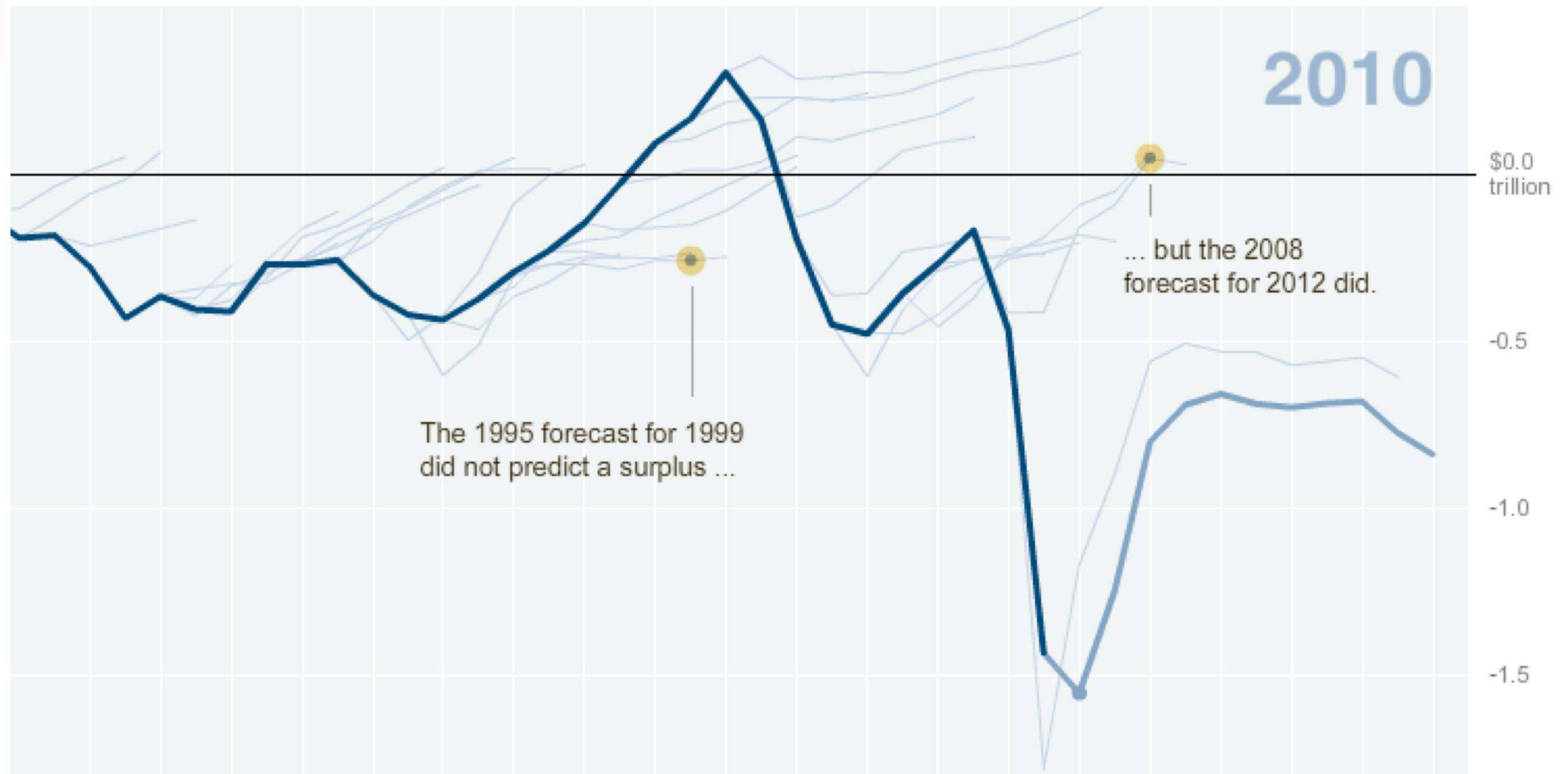
Budget Forecasts, Compared With Reality

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1 2 3 4 5 6 NEXT ►

Latest forecast

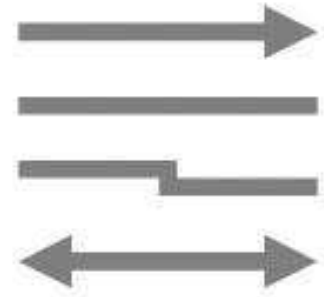
Today, with a better understanding of the severity of the economic downturn, the deficit situation is much more dire.



Annotation Types



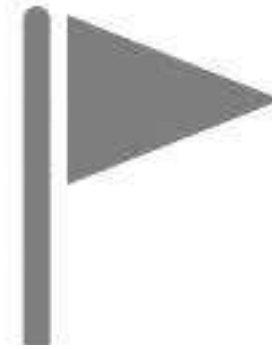
enclosure



connector



text



glyph



color



indicator



geometric

Partitioned Poster

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

14th season

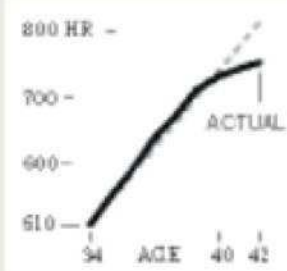
According to allegations in a book about Bonds, he began taking steroids before the 1999 season, his 14th in the league. Two seasons later, he hit 73 home runs, surpassing Aaron's career pace.

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.

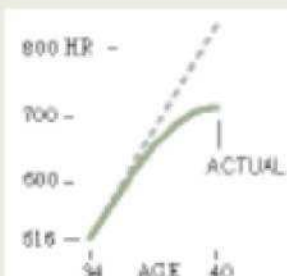
Aaron

Actual homers slightly outpace projected homers for five seasons.



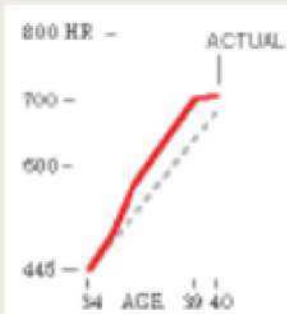
Ruth

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



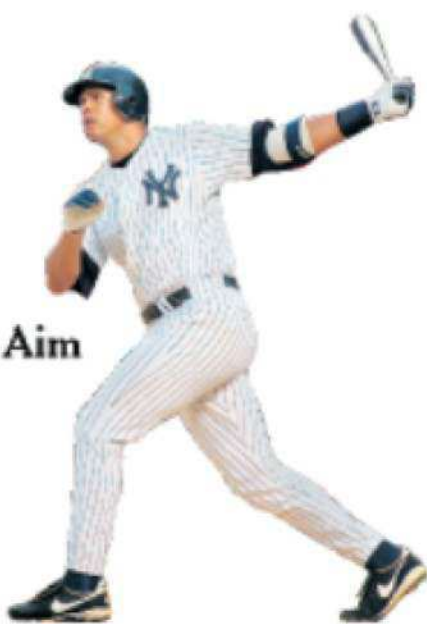
Bonds

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



Note: Ages as of July 1 of each season.

Others Taking Aim



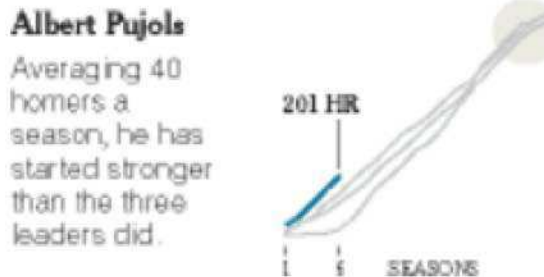
Alex Rodriguez

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



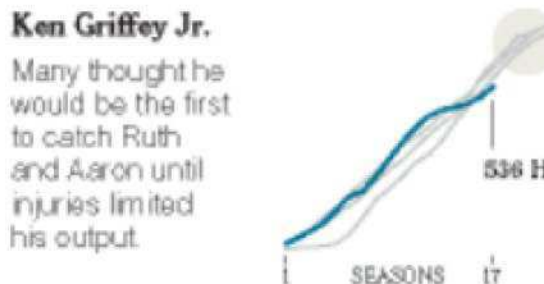
Albert Pujols

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



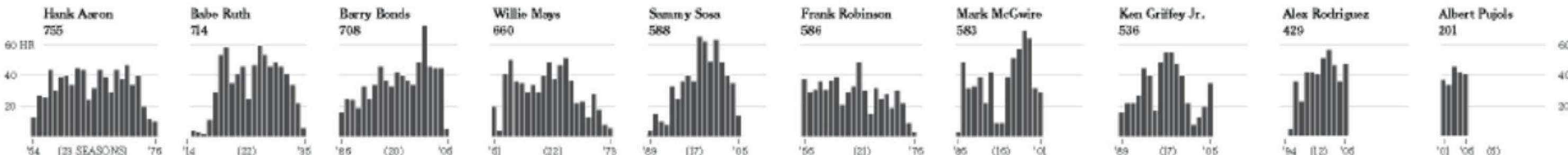
Ken Griffey Jr.

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

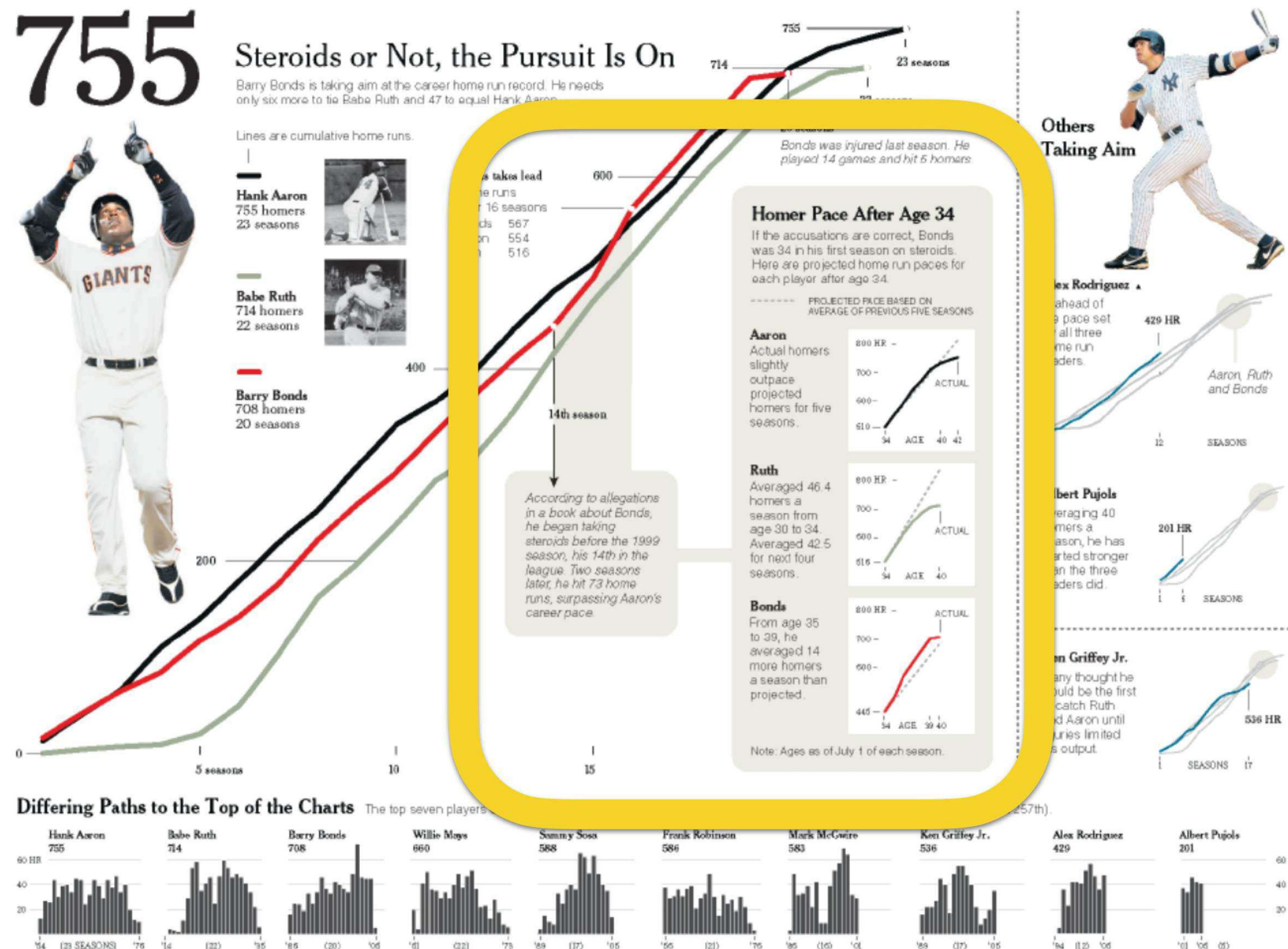


Differing Paths to the Top of the Charts

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



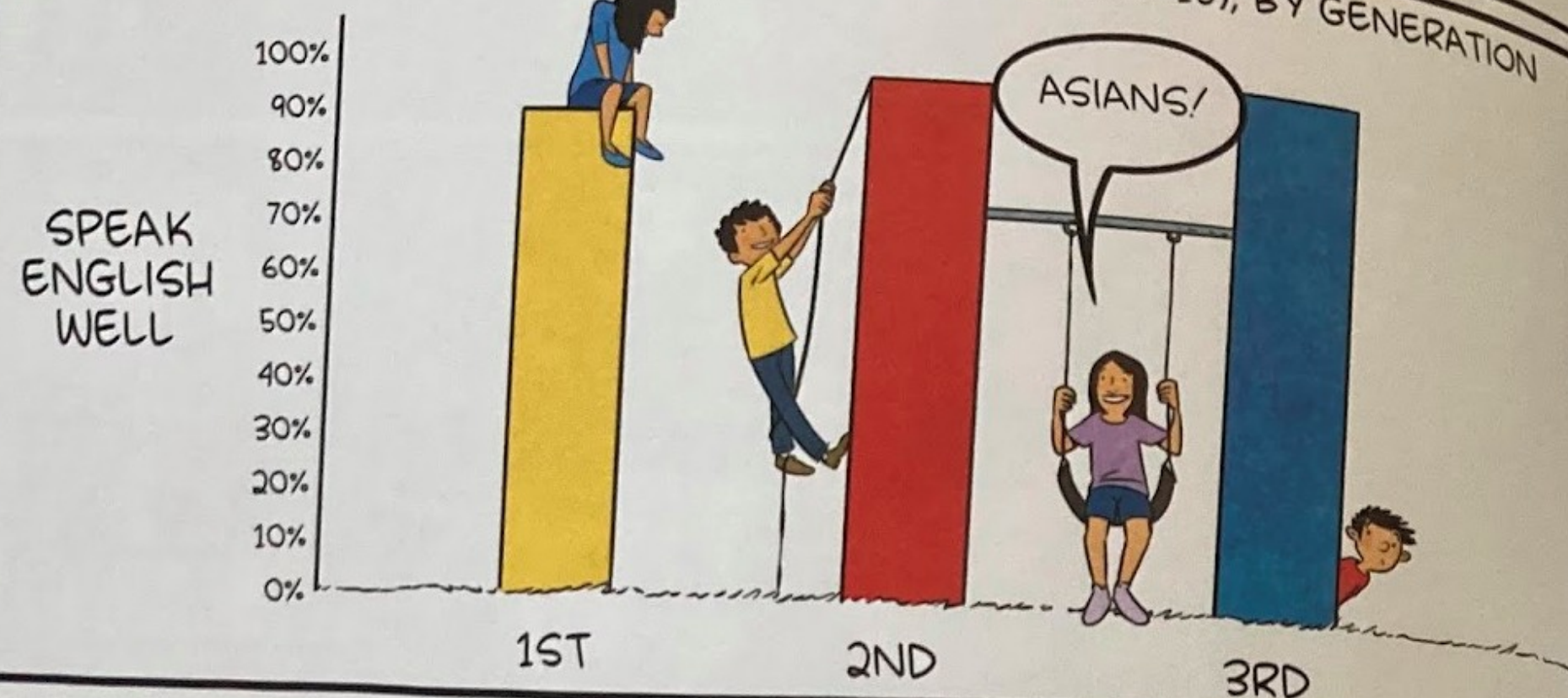
Partitioned Poster + Flow Chart



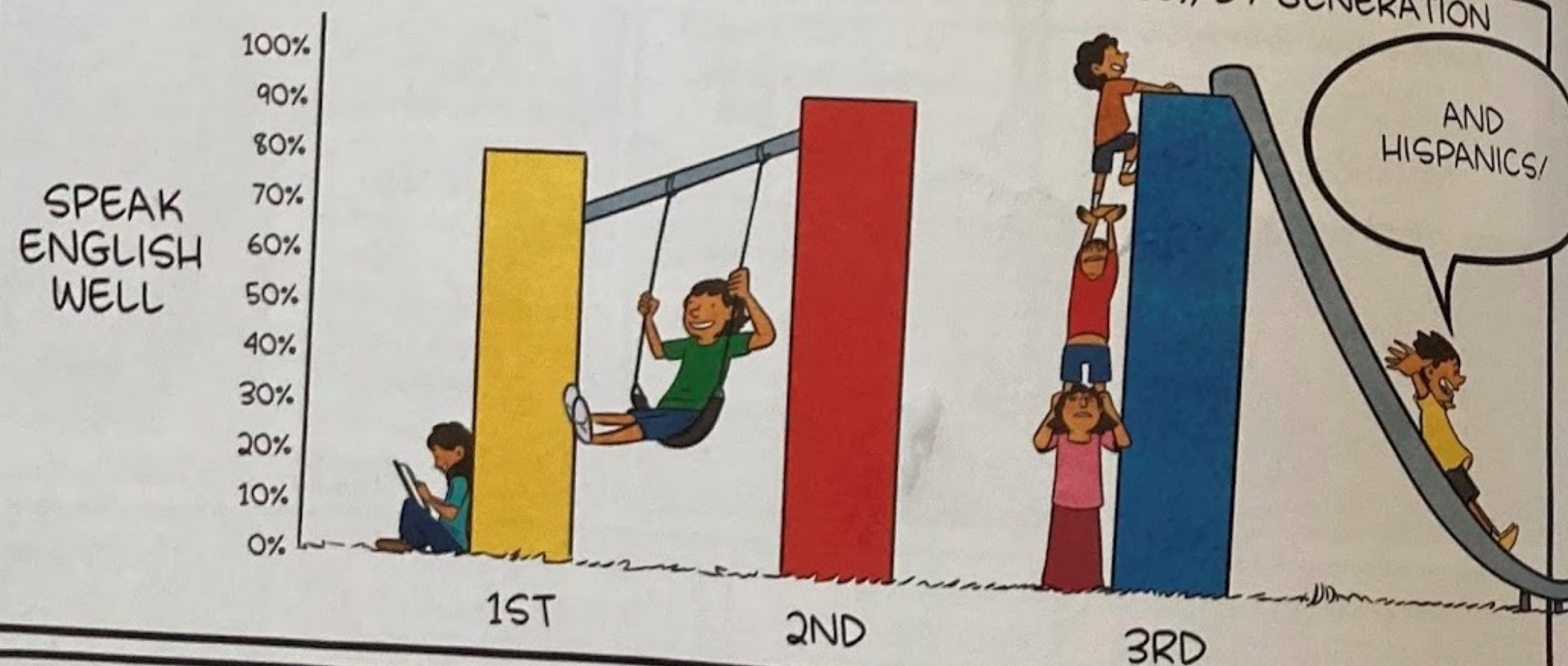


A CENTURY LATER, LITTLE HAS CHANGED. A LARGE MAJORITY OF **FIRST**-GENERATION KIDS SPEAK ENGLISH WELL. RATES FOR LATER GENERATIONS APPROACH 100%. THIS IS TRUE EVEN FOR GROUPS THAT ALLEGEDLY "DON'T LEARN ENGLISH," LIKE...

ENGLISH SKILLS—ASIAN KIDS (AGES 6–15), BY GENERATION



ENGLISH SKILLS—HISPANIC KIDS (AGES 6–15), BY GENERATION



NOTE: SINCE WE'RE TALKING ABOUT KIDS, THESE NUMBERS **UNDERSTATE** ENGLISH FLUENCY. MY WIFE, WHO IMMIGRATED WHEN SHE WAS SEVEN, NOW SPEAKS ROMANIAN WITH AN AMERICAN ACCENT, NOT ENGLISH WITH A ROMANIAN ACCENT.



IF YOU WANT THE **REAL** STORY OF ASSIMILATION, ASK AN IMMIGRANT PARENT...

MY SON JAYESH SPEAKS HINDI PERFECTLY—AND ALL MY GRANDKIDS ARE FLUENT, TOO!

WHAT IMMIGRANT PARENTS NEVER SAY

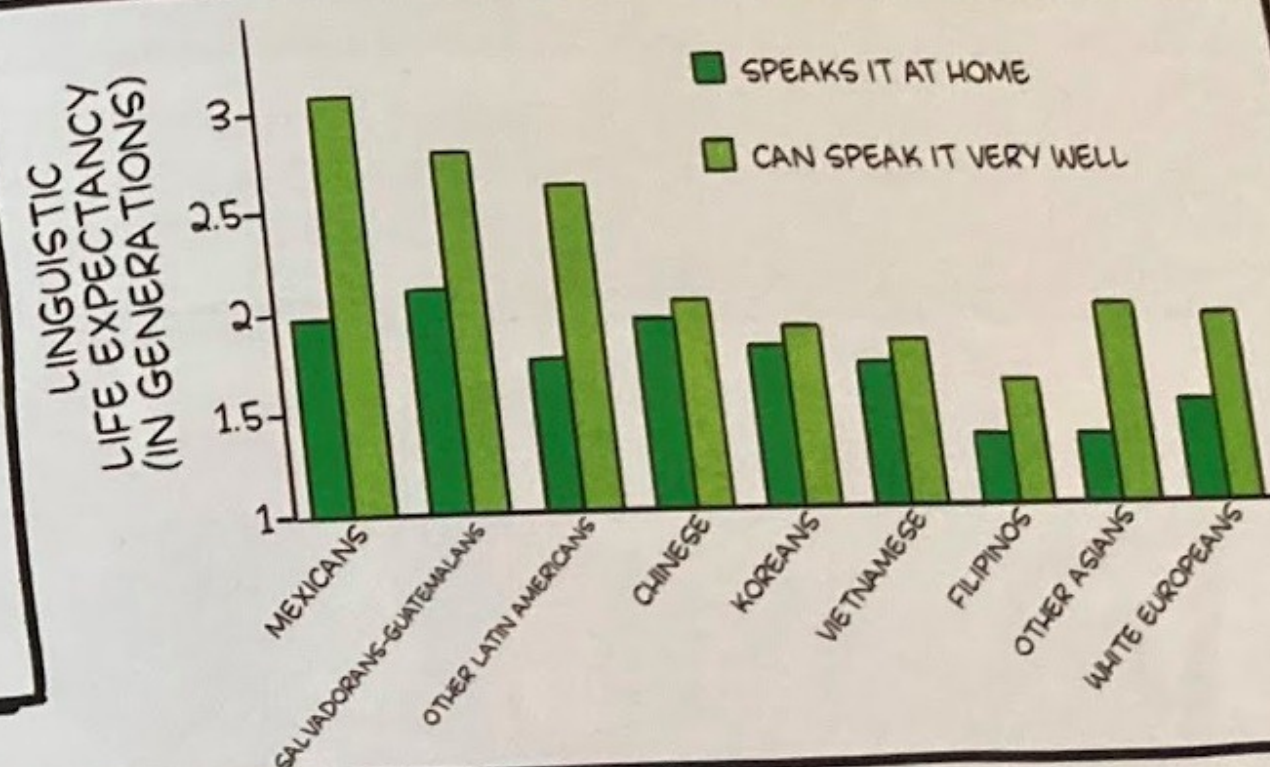
THEY COULDN'T CARE LESS ABOUT AMERICAN CULTURE. IT'S ALL INDIA, INDIA, INDIA FOR THEM!

MY SON JAYESH WON'T EVEN SPEAK OUR LANGUAGE. WHATEVER I SAY, HE RESPONDS IN ENGLISH. MY GRANDKIDS DON'T KNOW A **WORD** OF HINDI!

WHAT THEY ALWAYS SAY

OUR CULTURE MEANS NOTHING TO THEM. BOLLYWOOD, CRICKET, GANDHI—IT'S ALL THE SAME AS FAR AS THEY'RE CONCERNED!

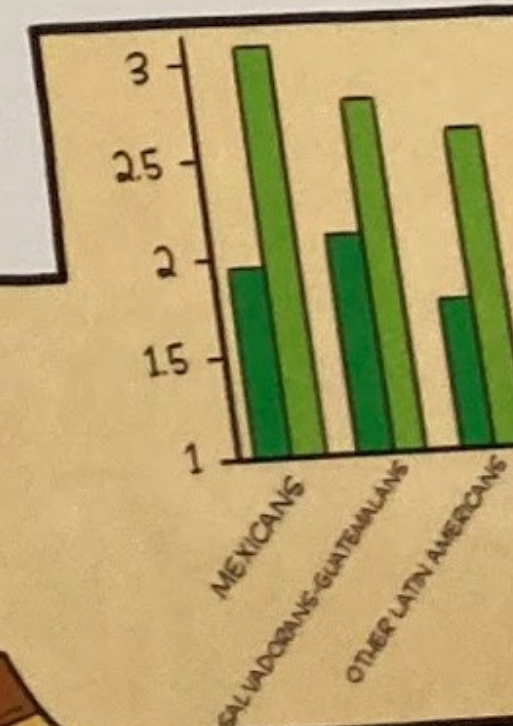
RESEARCHERS ACTUALLY MEASURE "LINGUISTIC LIFE EXPECTANCIES"—THE AVERAGE NUMBER OF GENERATIONS A FOREIGN LANGUAGE SURVIVES. HERE ARE THE NUMBERS FOR "MULTICULTURAL" SOUTHERN CALIFORNIA:



ON AVERAGE, FOR EXAMPLE, IT TAKES LESS THAN TWO GENERATIONS FOR KOREAN IMMIGRANTS TO LOSE KOREAN FLUENCY.



WHAT'S SPECIAL ABOUT HISPANICS IN PLACES LIKE CALIFORNIA ISN'T THAT THEY "DON'T LEARN ENGLISH," BUT THAT THEY RETAIN FLUENT SPANISH FOR ONE EXTRA GENERATION!



Visual narrative tactics

- **Visual structuring:** *where am I in the story?*
 - Orient the viewer early: establishing shot, checklist, consistent visual platform
 - Track progress: progress bar, timeline slider
- **Highlighting:** *where should I look?*
 - Make an element stand out from its surroundings: color, motion, framing, size, audio
 - Many are borrowed from film, art, and comics
- **Transition guidance:** *how did I get here?*
 - Move within or between scenes without disorienting the viewer: continuity editing, animated transitions, object continuity, camera motion

Narrative structure tactics

non-visual mechanisms

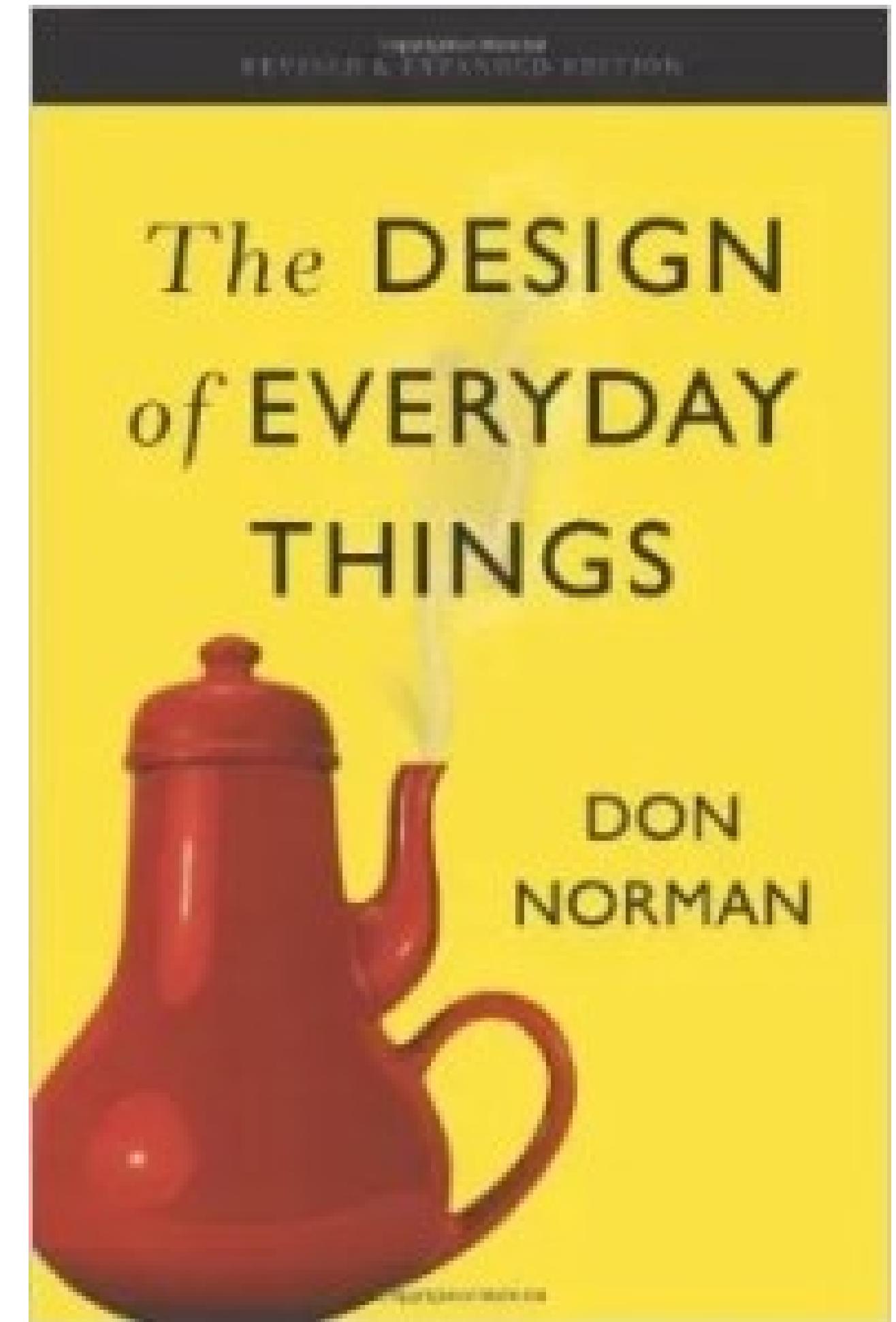
- **Ordering:** *what path do I take?*
 - *Linear* (author prescribes the path), *random access* (no path suggested), *user-directed* (reader picks among alternatives)
- **Interactivity:** *what can I do, and how do I learn it?*
 - Filtering, selecting, searching, navigating
 - Learned through explicit instruction, a tacit tutorial, or the initial configuration
- **Messaging:** *what am I being told?*
 - Short text: labels, captions, headlines, annotations
 - Longer text: articles, introductions, summaries

Project 2: your Nov 15 narrative outline should name your ordering, visual structuring, and messaging choices

Interactivity

Affordance

- User's perception of whether some action is possible



Often design is hidden and we only notice it when it fails

What's an example of a time *bad design* prevented you from interacting with something?

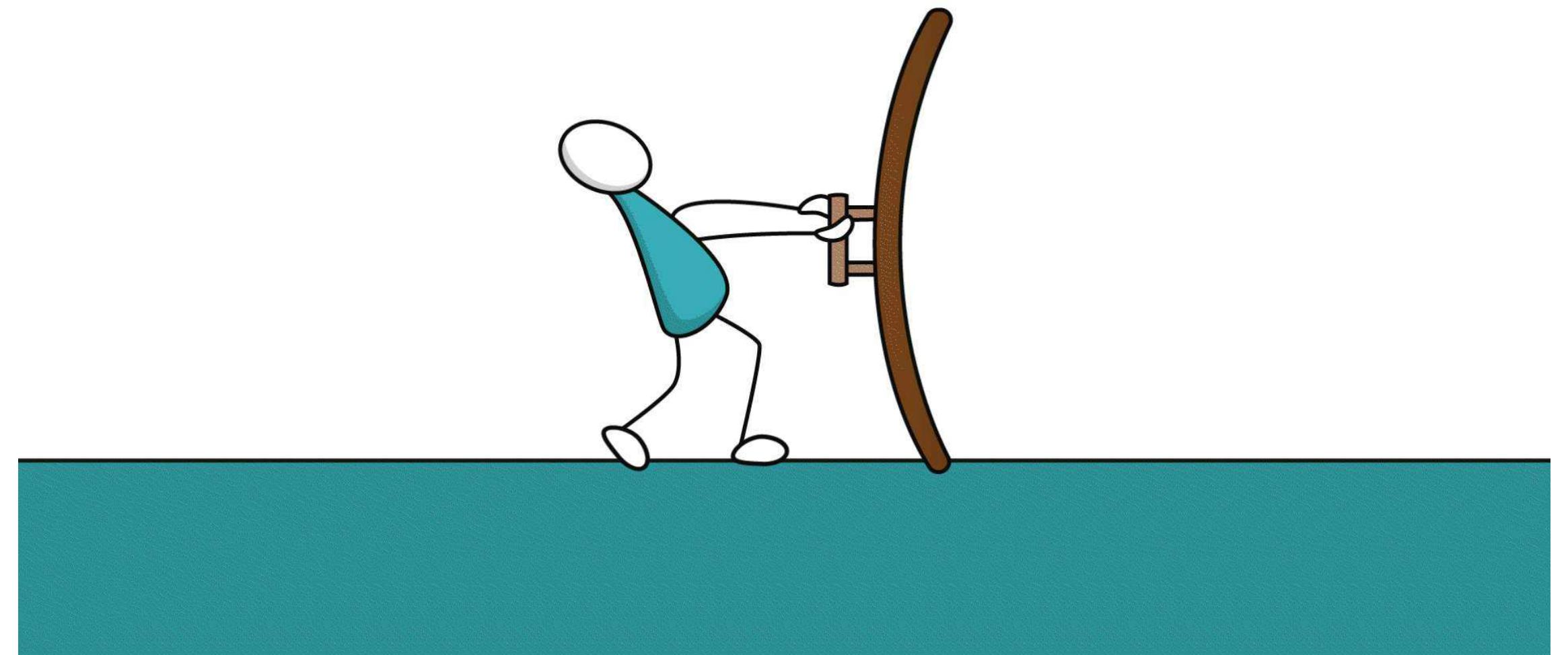
Affordance: Example



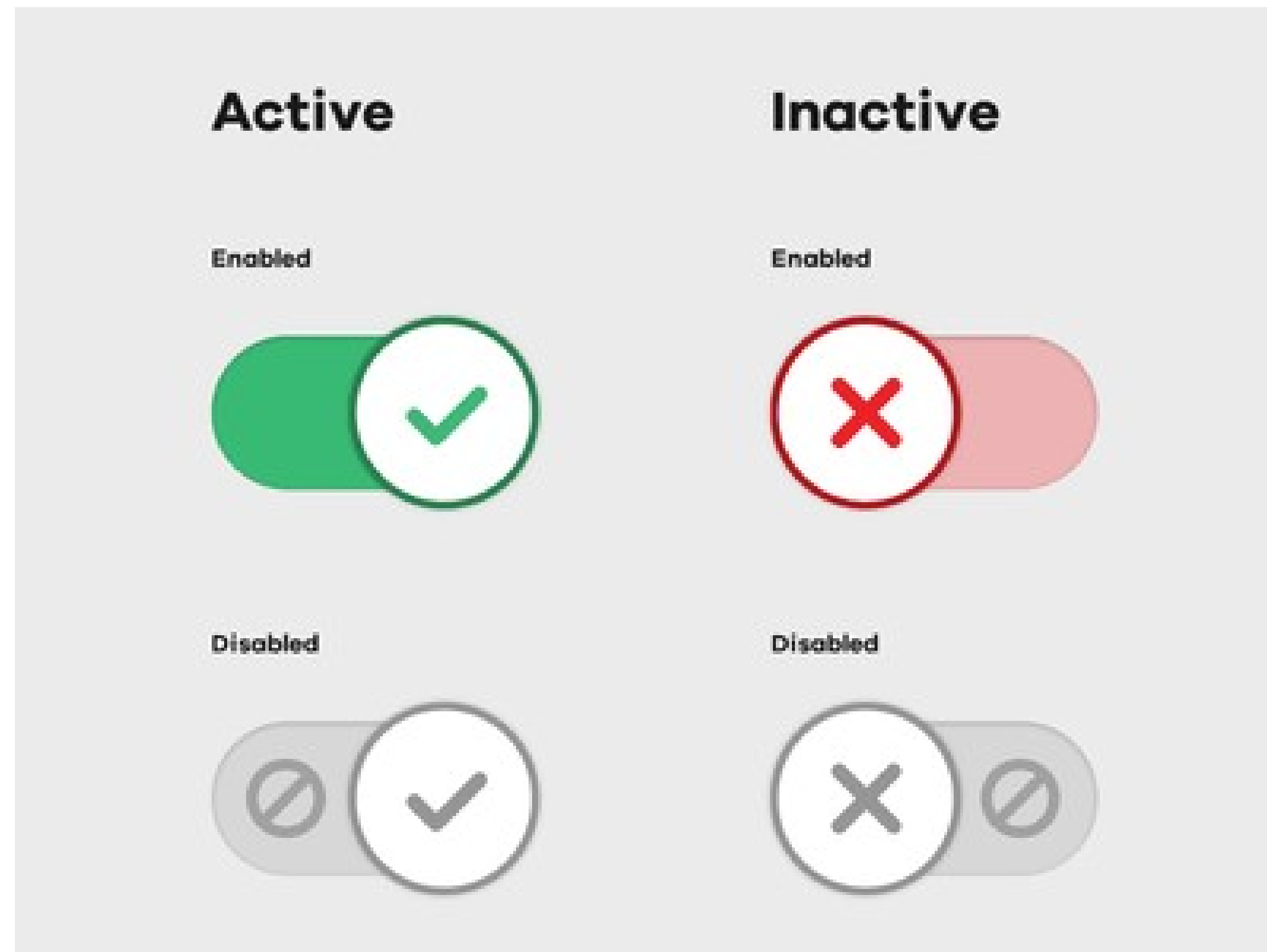
A Norman Door is one of those f*&king doors, that has the same handle on both sides. Giving you no indication as to if ...you should push it... or pull it.

IMO, if a 'push' or 'pull' label is required, the design sucks.
↳ The best design is intuitive.

- Elijah Szasz



Can you think of any examples in user interfaces?



Interactivity in visualization

Yi et al's Taxonomy

- Surveyed 59 papers and 51 systems
- Resulted in 311 individual interaction techniques implemented in Infovis systems
- Focus on **user intent**:
what users achieve by using the interaction techniques
rather than how the techniques provided by Infovis systems work
- Many different styles of interaction techniques serve a relatively small set of purposes

Seven Categories

- **Select:** mark something as interesting
- **Explore:** show me something else
- **Reconfigure:** show me a different arrangement
- **Encode:** show me a different representation
- **Abstract/Elaborate:** show me more or less detail
- **Filter:** show me something conditionally
- **Connect:** show me related items

Selection

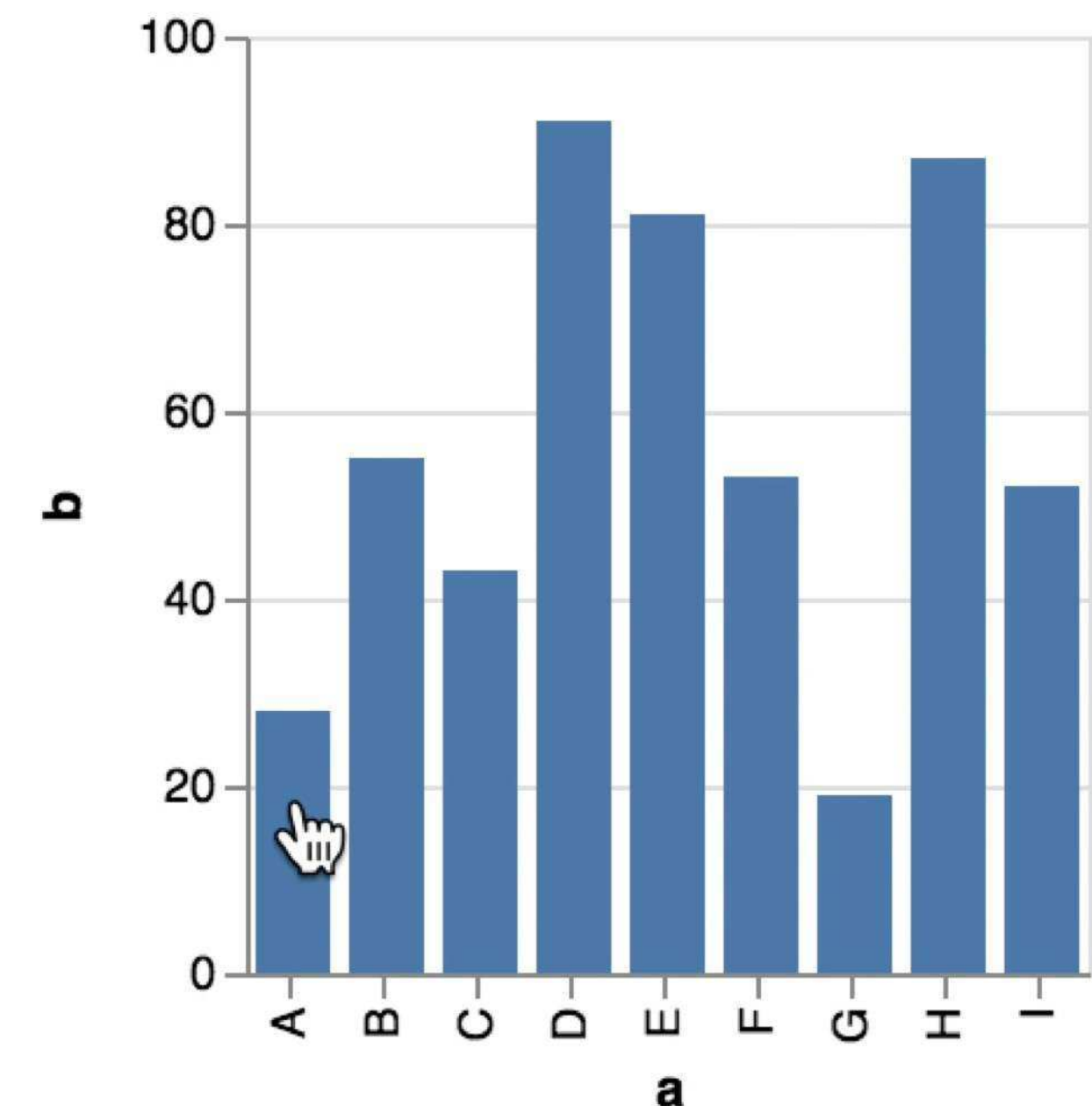
identify something as interesting

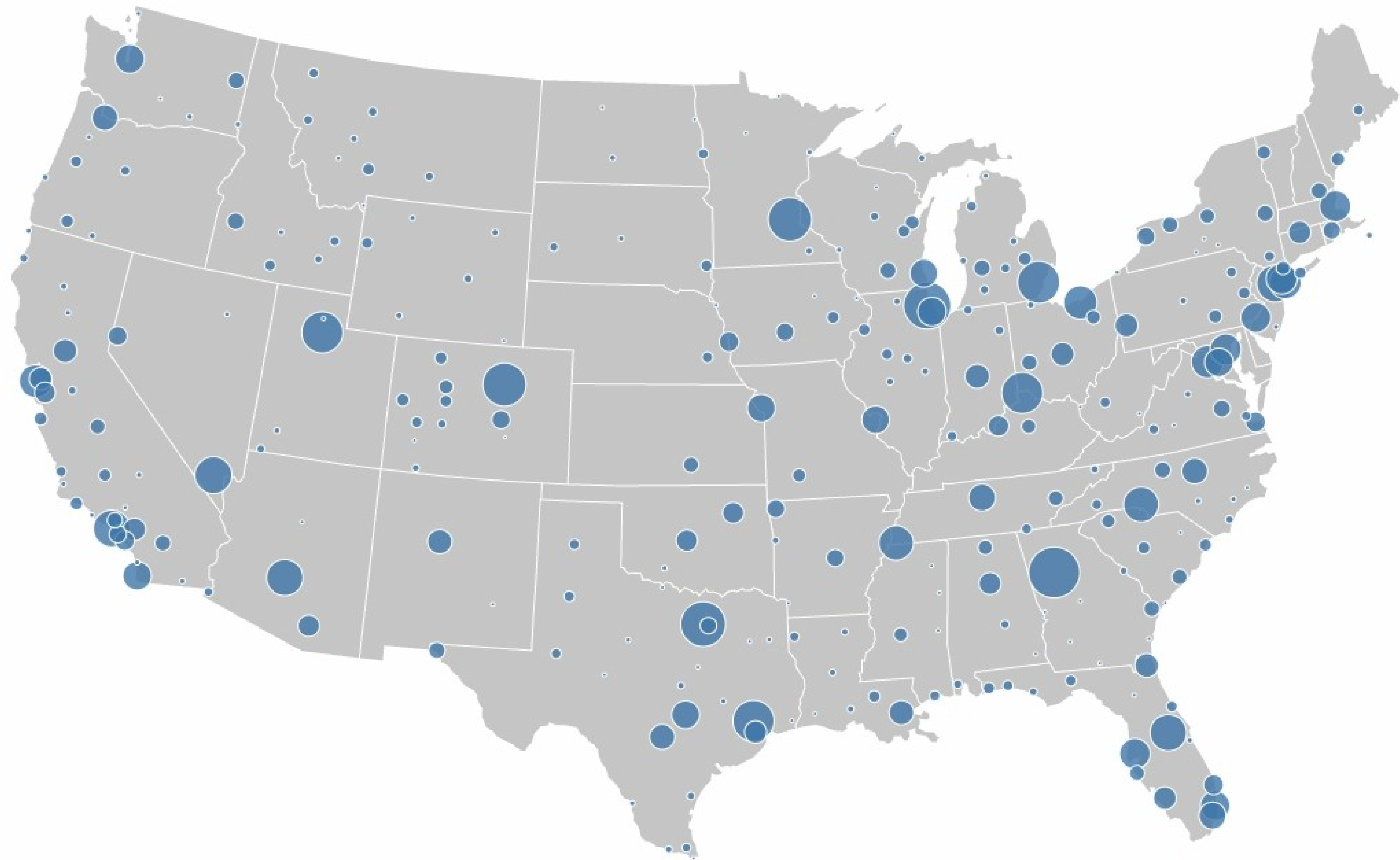
Select discrete data values.

How many points are selected? 1, 2, 3, ...

How are points selected? Mouse hover, click, tap, ...

- Point Selection
- Mouse Hover / Click
- Touch / Tap
- Select Nearby Element (e.g., Voronoi-based Point Picker)



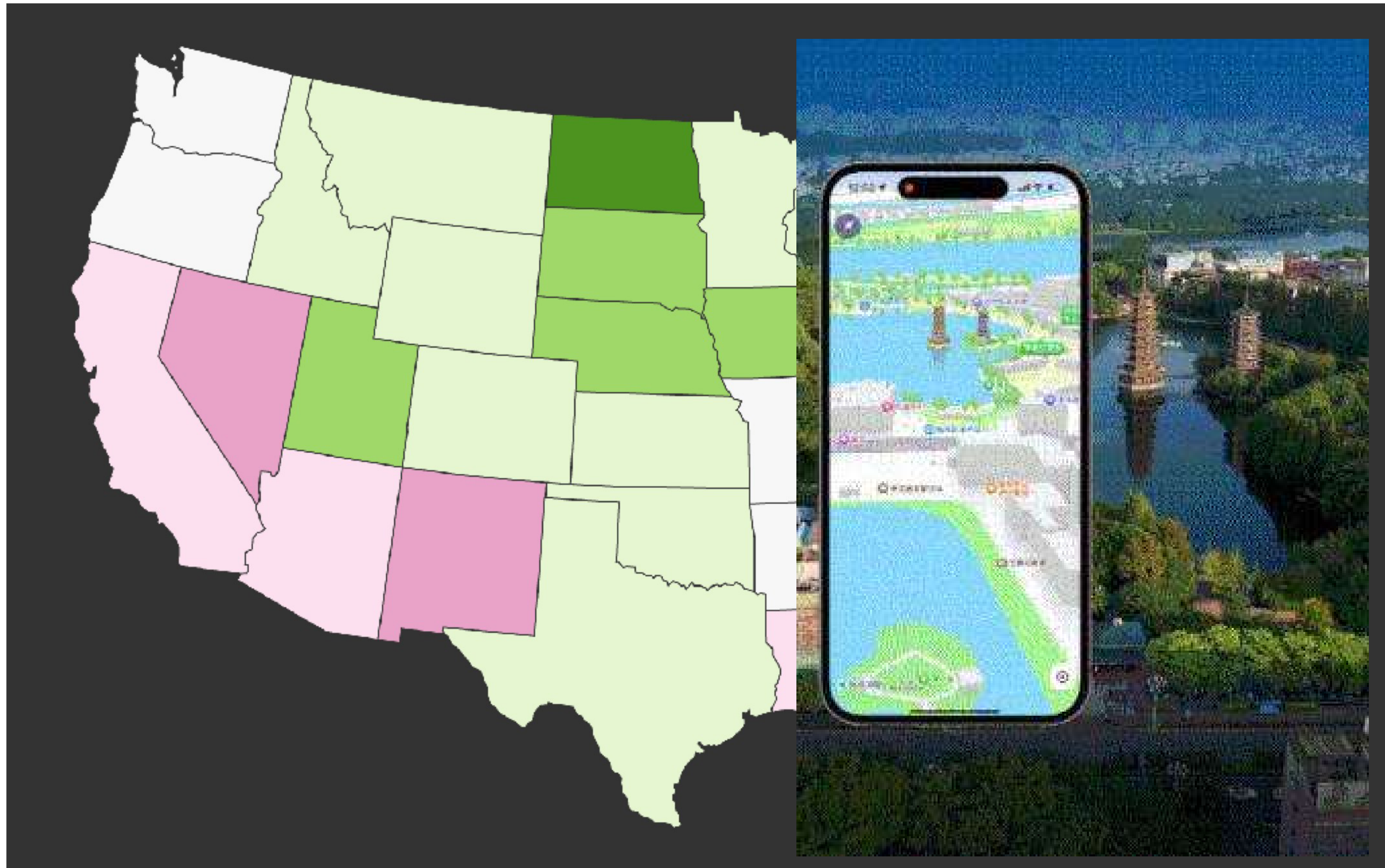


San Diego International-Lindbergh, 2008
great arcs and symbol map

☐ show Voronoi

Explore

show me something else



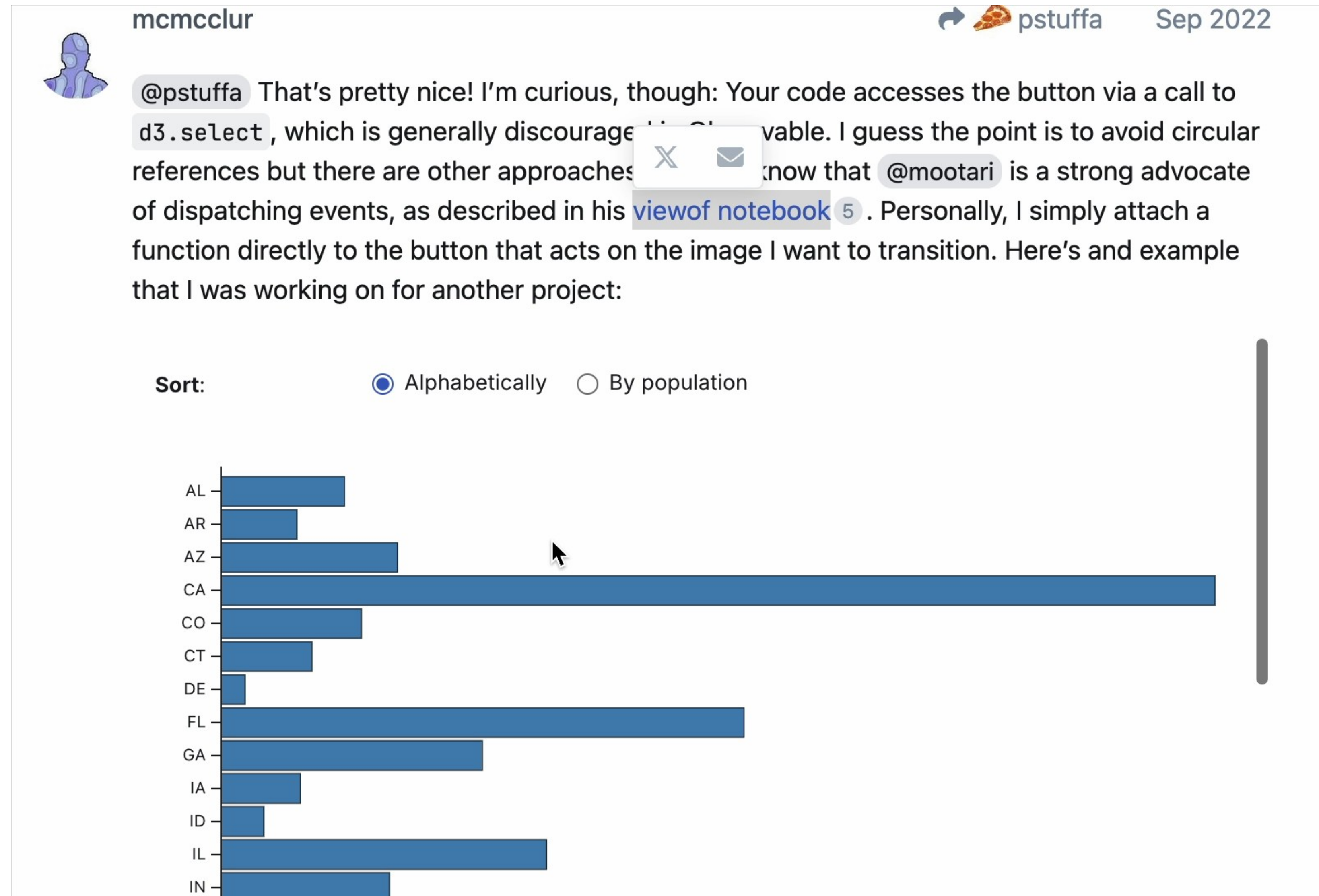
- Typically only viewing a subset of the data due to screen limitations
- Avoid complete changes in the data being viewed
- instead, some new data items enter the view as others are removed.
- Panning

Reconfigure

Show a different arrangement

Sort Bars on click

- Changing the spatial arrangement of representations
- To reveal hidden characteristics of data and the relationships between them



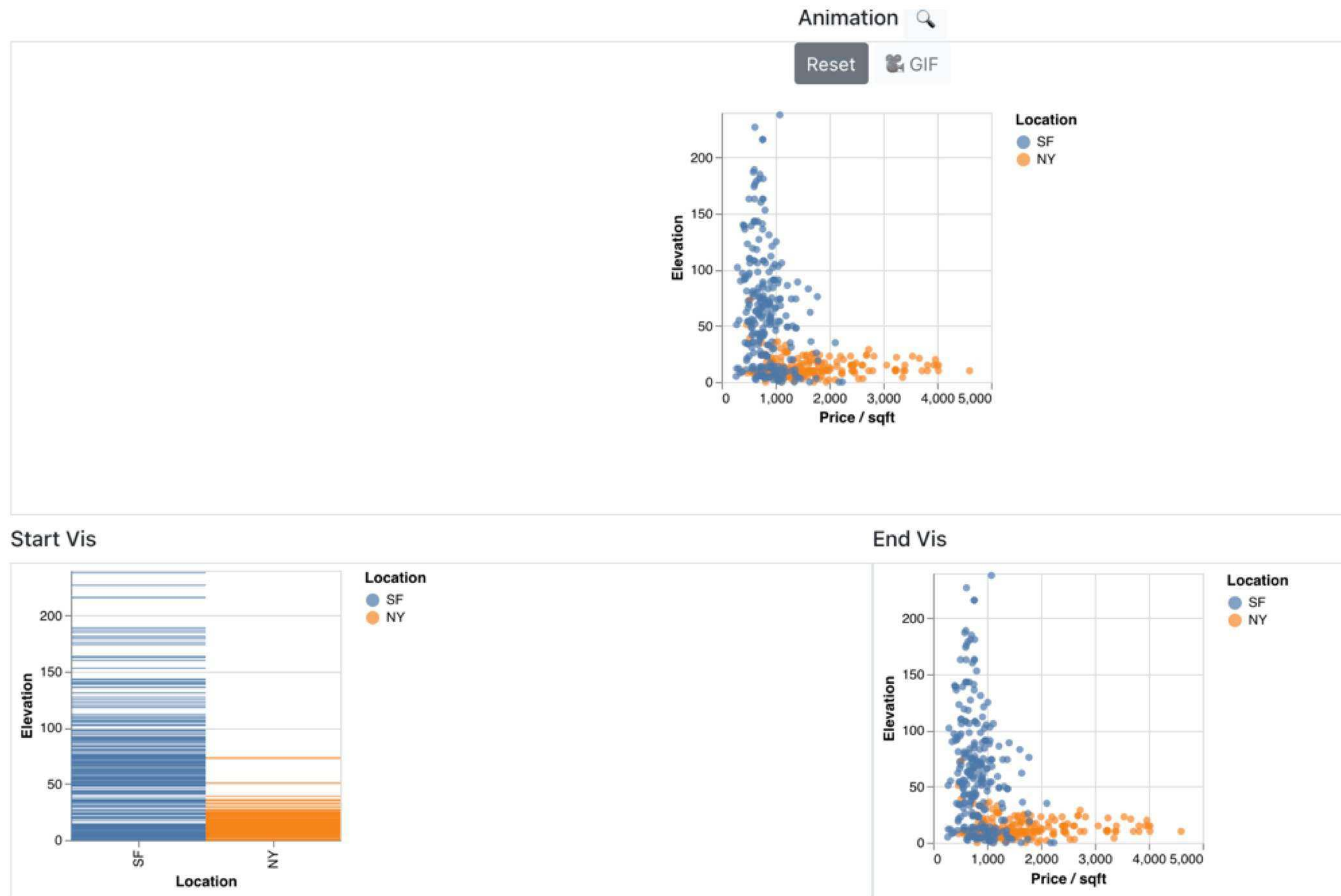
Encode

show me a different visual representation

<https://uwdata.github.io/gemini-editor/>

-> dot plot to scatter plot

- Change the visual encodings
- Alter the fundamental visual representation of the data (e.g., color, size, and shape)



Abstract/Elaborate

Show more or less detail

HISTORIC CHARM, MODERN MOVES.
Central Virginia, meet Corcoran Wiley.

Get to know our real estate professionals.

SEARCH NOW

corcoran
WILEY

TheUpshot

How the Recession Reshaped the Economy, in 255 Charts

By JEREMY ASHKENAS and ALICIA PARLAPIANO Updated: JUNE 6, 2014

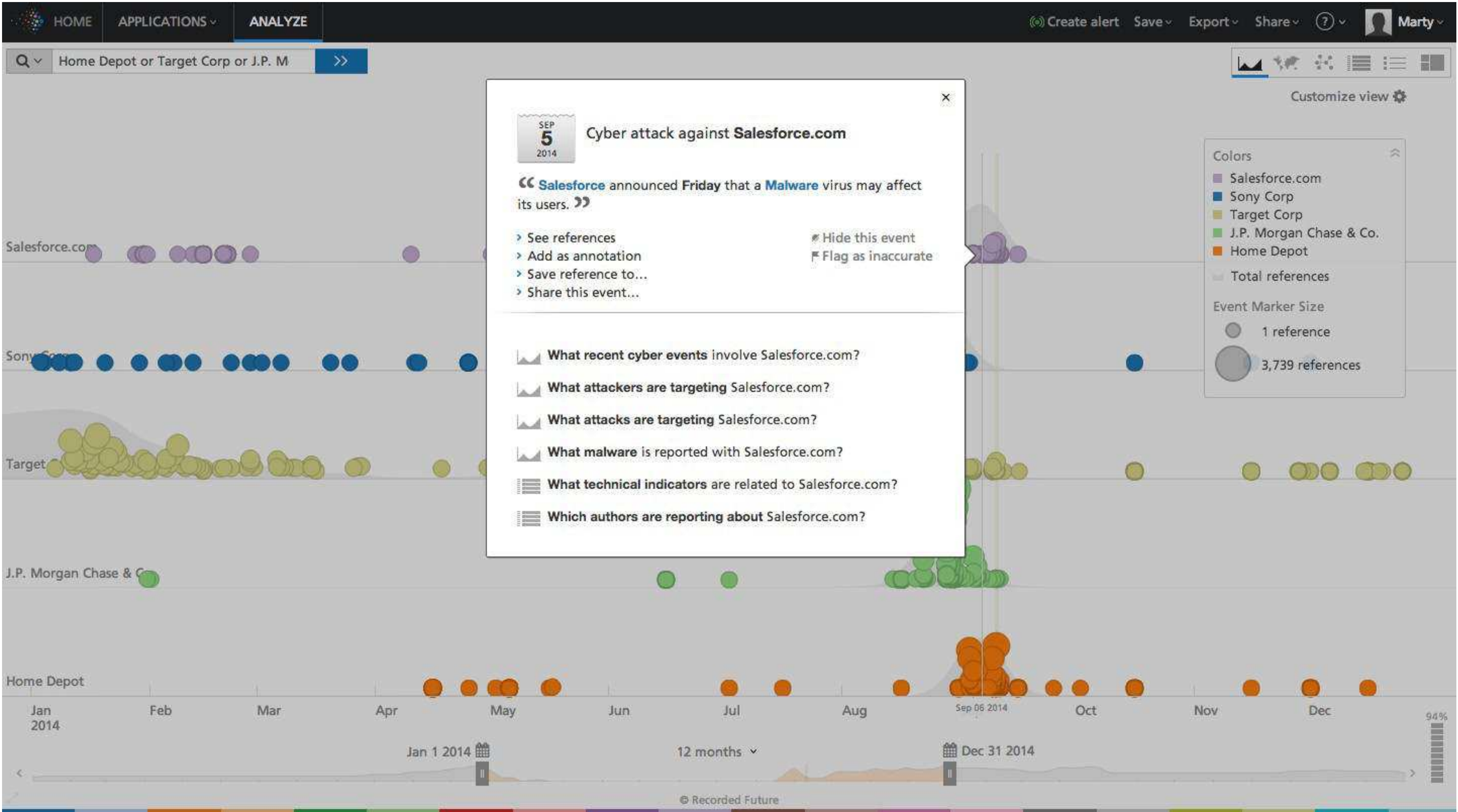
Five years since the end of the Great Recession, the economy has finally regained the nine million jobs it lost. But not all industries recovered equally. Each line below shows how the number of jobs has changed for a particular industry over the past 10 years. Scroll down to see how the recession reshaped the nation's job market, industry by industry.

SCROLL

Cite

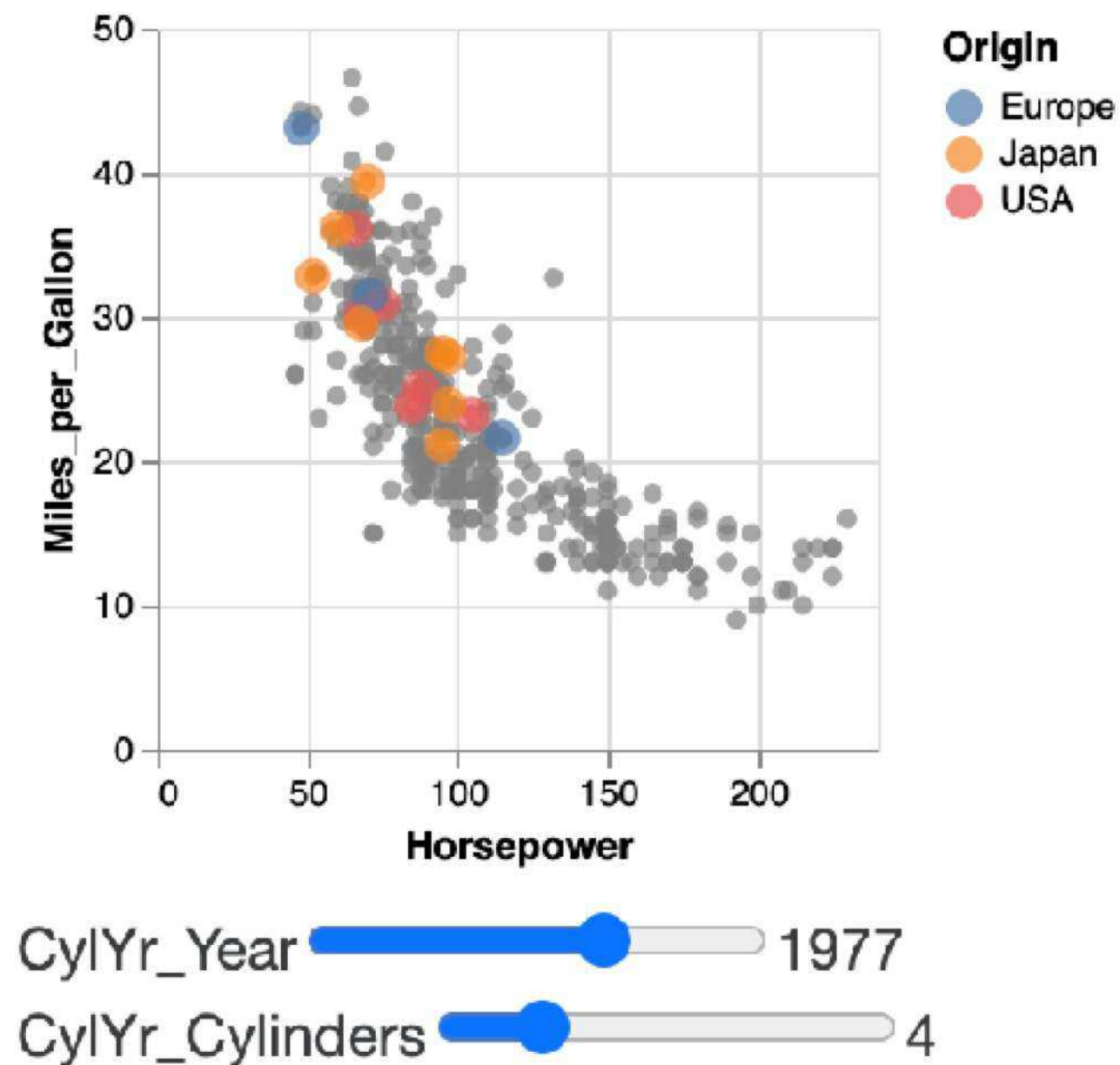
<https://www.nytimes.com/interactive/2014/06/05/upshot/how-the-recession-reshaped-the-economy-in-255-charts.html>

Detail-on-demand



Filter

show me something conditionally



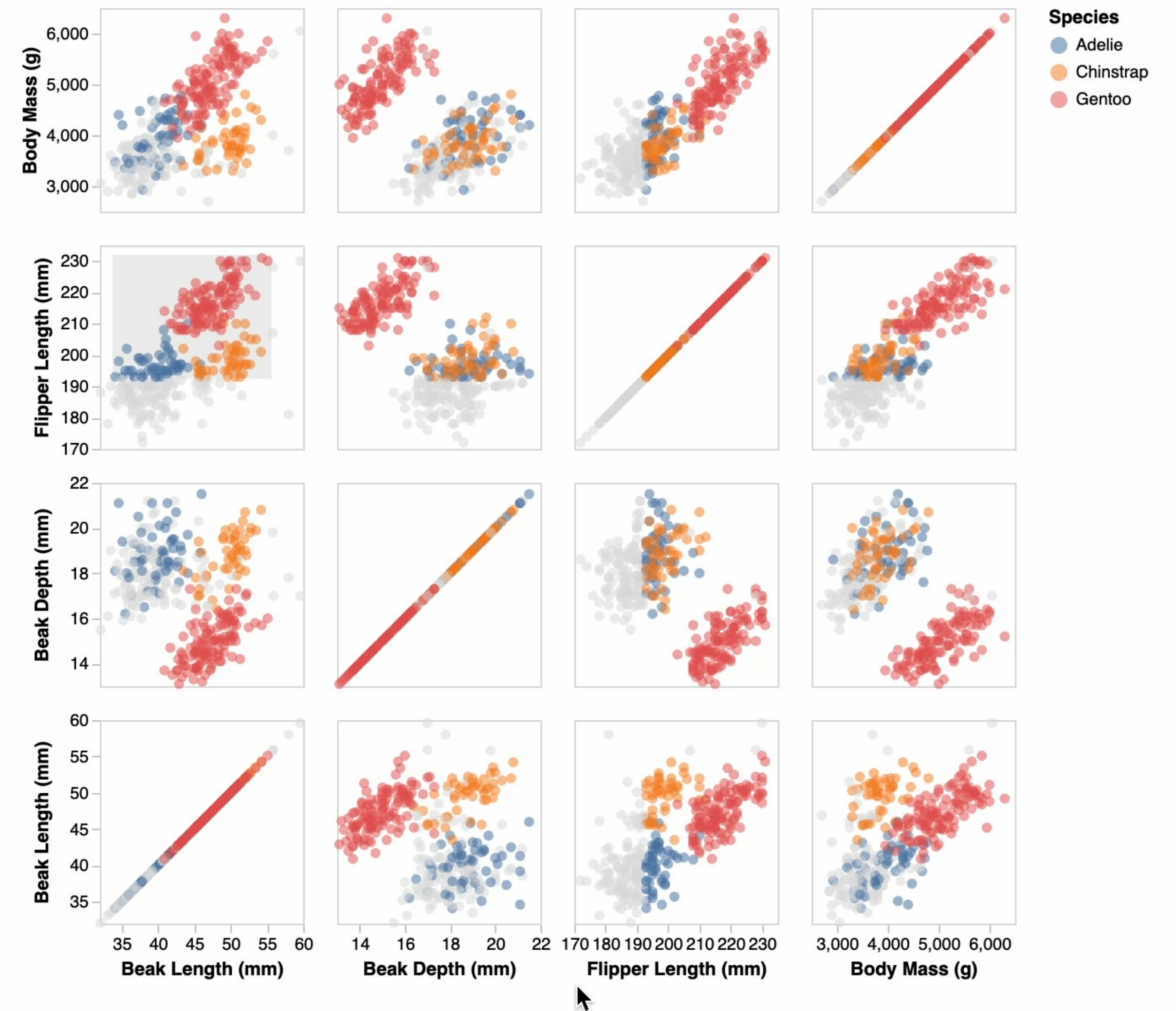
- change the set of data items being presented based on some specific conditions
- not changing perspective on the data
- actual data usually remain unchanged so that whenever users reset the criteria, the hidden or differently shown data items can be recovered

https://vega.github.io/vega-lite/examples/interactive_query_widgets.html

Connect

Show related items

- Brushing and Linking: selection is called a brush and related items are shown in linked views
- Link by tuple: explicitly identify and match the same data values across all views



[View in Online Vega Editor](https://vega.github.io/vega/examples/brushing-scatter-plots/)

Summary

- Narrative tactics: both visual and non-visual structure clarifies narrative visualization
- Types of data stories: for your Project 2, you will probably lean most on annotated charts, partitioned poster (infographic), flow chart, and slide show
- Interactive design should be intuitive: need testing and feedback from others (Project 2 design critique!)
- Seven categories of interactivity
 - We will learn how to use plotly and ipywidgets to do a majority of these techniques

Information Visualization: Mantra



- Overview, zoom & filter, details-on-demand
- Overview, zoom & filter, details-on-demand
- Overview, zoom & filter, details-on-demand
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Slide courtesy of Ben Shneiderman

