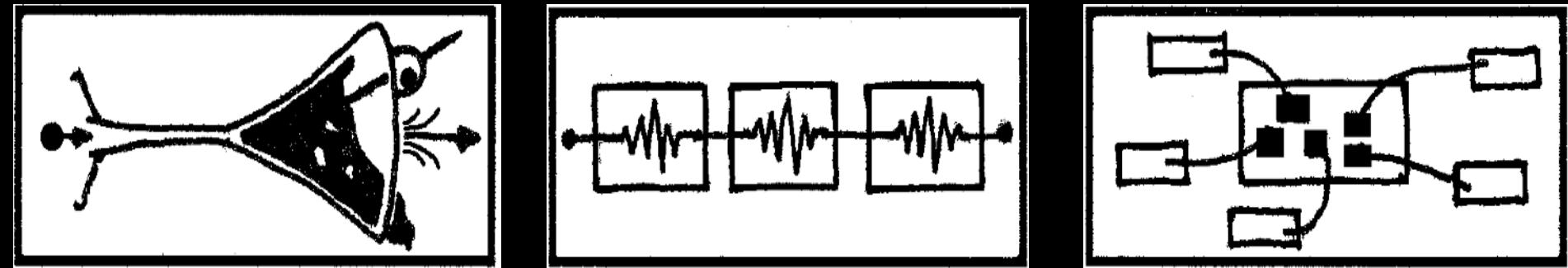


CSE 442 - Data Visualization

Narrative Visualization



Matthew Conlen University of Washington

(with material from Jeff Heer, Edward Segel, and Jessica Hullman)

STORYTELLING

as ancient as mankind



STORYTELLING

as ancient as mankind



*Going forward
I carried wax along the line, and laid it
thick on their ears. They tied me up, then, plumb
amidships, **back to the mast**, lashed to the mast,
and took themselves again to rowing. Soon,
as we came smartly within hailing distance,
the two **Sirens**, noting our fast ship,
off their point, **made ready, and they sang...***



STORYTELLING

across various media

PEOPLE TELL STORIES

WORDS TELL STORIES

IMAGES TELL STORIES

COMICS TELL STORIES

MOVIES TELL STORIES



Narrative Story-Telling

narrative (n): An account of a series of events, facts, etc., given in order and with the establishing of connections between them.

Effective story-telling “require[s] skills like those familiar to movie directors, beyond a technical expert’s knowledge of computer engineering and science.” - Gershon & Page ‘01

August 26, 2010

Generals Wary of Move to Cut Their Ranks

By GINGER THOMPSON and THOM SHANKER

WASHINGTON — Maj. Gen. Paul D. Eaton, a retired Army officer, is familiar with the perks and pitfalls of power, having commanded tens of thousands of troops at Fort Benning, Ga., managed budgets exceeding \$2 billion in Iraq, and overseen layers upon layers of staff members who helped manage both his professional duties and his personal life.

He has experienced the full range of lifestyles that come with military leadership, living at one point in an elegant antebellum mansion, and at another, with eight other officers crowded in a marble bathhouse behind one of [Saddam Hussein's](#) old palaces.

When he traveled, he was occasionally able to justify the use of military aircraft, but most times, he said, he flew coach. And today he lives on a pension worth 75 percent of his military salary, with health benefits that cover everything except dental and eye care for himself and his wife.

"We are well compensated, and we live very comfortable lives," General Eaton said, referring to the military's most senior leaders. "But when you look at all the things going on around a general, the nation is getting a very, very high return on its money."

Not everyone at the Pentagon agrees. Two weeks ago, Defense Secretary Robert M. Gates announced a sweeping effort to improve efficiency that, among other things, takes aim at the military's sacrosanct corps of generals and admirals, ordering his staff to cut at least 50 positions, and making clear that he would be happier if they cut more.

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Anecdotal Lead

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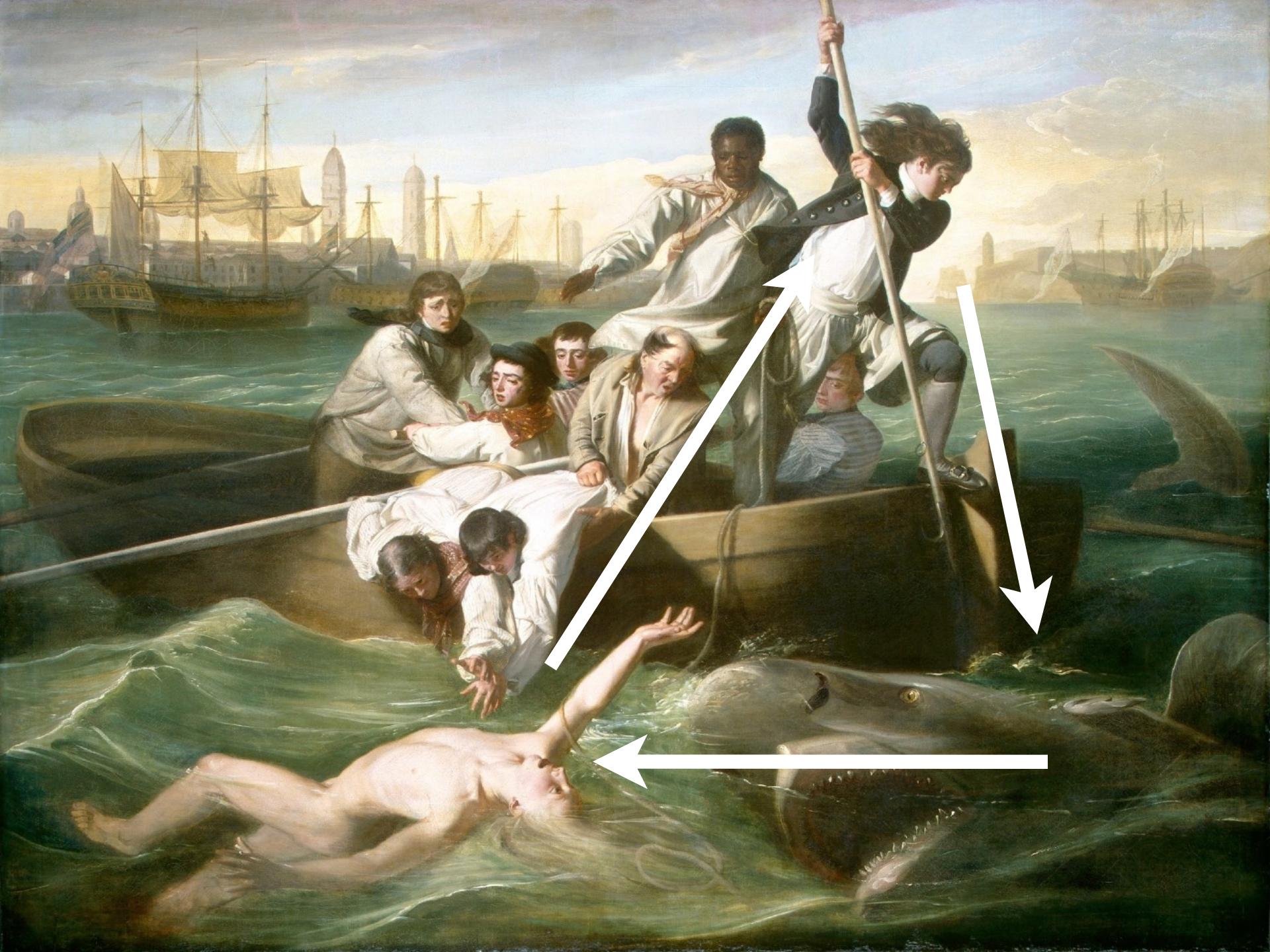
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Nut Graph

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BLAM





Topics

Narrative visualization design

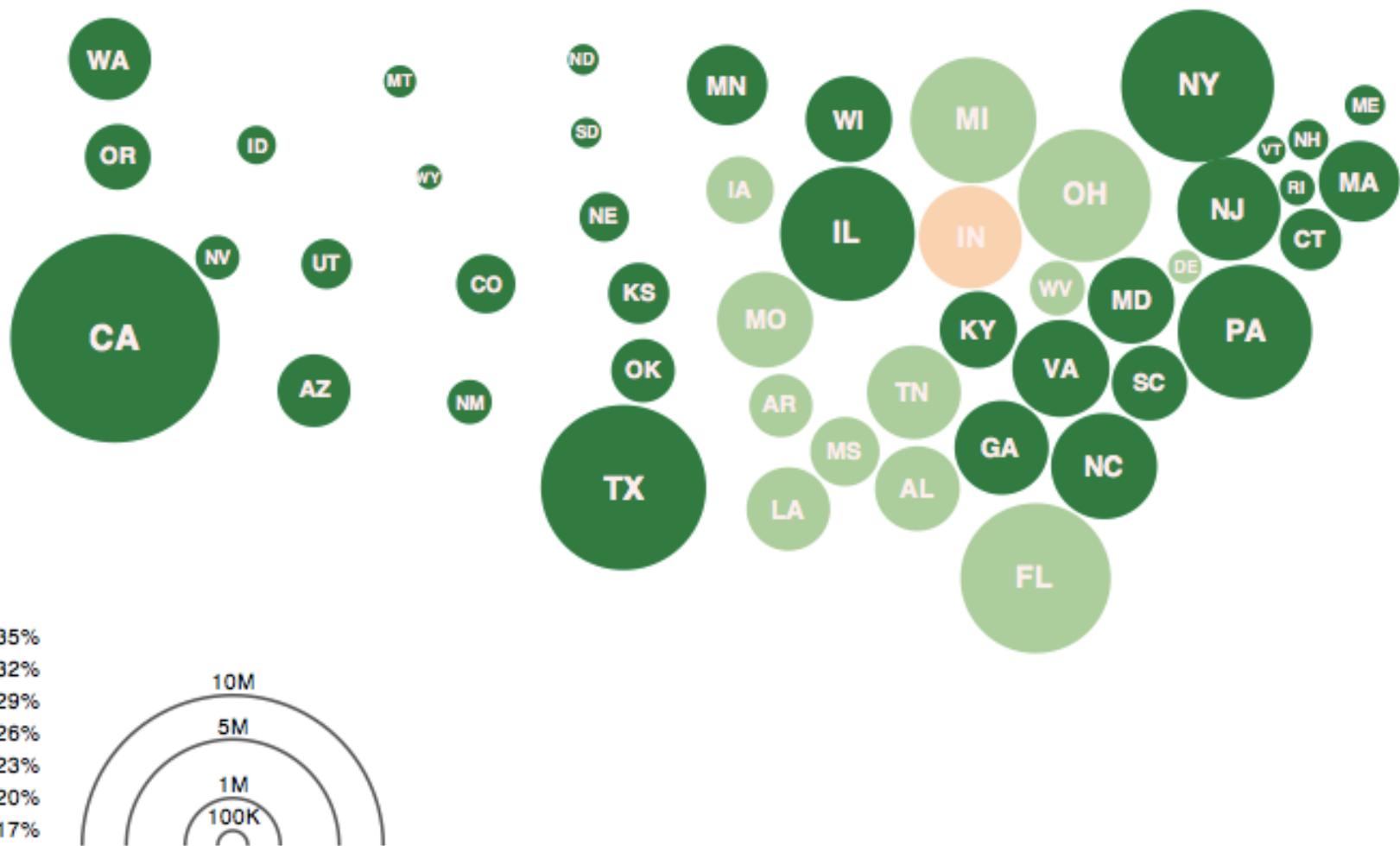
Navigation in interactive documents

Tools for creating interactive documents

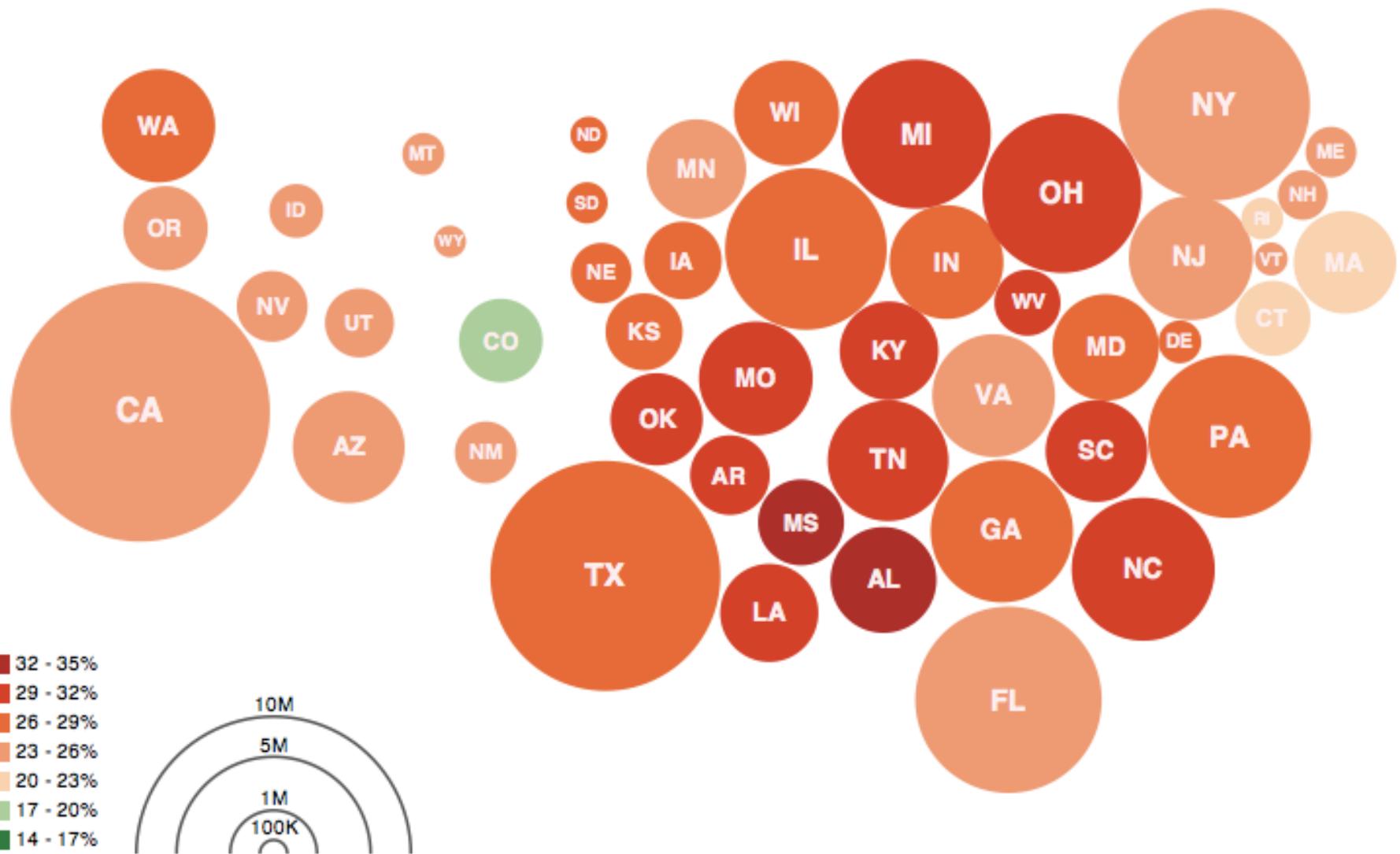
Evaluating Interactive documents

Chart sequence models

Storytelling
... with data?



Obesity Map Vadim Ogievetsky



Obesity Map Vadim Ogievetsky



Privacy and the internet Lives of others

By JENNIFER STODDART

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

JENNIFER STODDART, Canada's privacy commissioner,坐下来与Facebook在八月达成一项协议，同意在一年内修改其隐私政策以符合该国的隐私法。然而，该协议似乎正在经历一场危机，因为Facebook正面临着来自用户和监管机构的批评。Facebook表示，它将修改其隐私政策，使其更容易向用户解释其数据共享行为。但批评者们认为，Facebook可能会将其数据共享给第三方，从而损害用户的隐私权。

Facebook并不是唯一一家试图通过提供更多的数据共享选项来缓解用户担忧的公司。Google最近也在调整其隐私设置，以便更好地平衡用户的数据共享需求与他们的隐私权。然而，一些用户仍然对这些变化表示不满，认为它们并没有真正解决问题。

这些事件突显了隐私权与便利性之间的冲突。用户希望自己的数据得到保护，同时又希望能够方便地使用各种服务。然而，许多公司为了提高效率和降低成本，往往会选择牺牲用户的隐私权。

例如，Facebook的数据科学家们正在研究如何更有效地利用用户的个人信息。他们希望能够在不侵犯用户隐私的前提下，为用户提供更好的服务。然而，这可能会导致用户对他们的数据被滥用产生疑虑。

Facebook还面临着来自监管机构的压力。去年，Facebook被指控违反了美国的数据隐私法规。Facebook辩称，它只是在履行其作为一家社交媒体公司的使命，即让人们更容易地与家人和朋友保持联系。然而，批评者们认为，Facebook的数据共享行为已经超出了这一范围，侵犯了用户的隐私权。

总的来说，Facebook的数据共享政策引发了广泛的争议。虽然它可能有助于提高公司的效率，但它也可能损害用户的隐私权。因此，公司需要在满足用户的需求和保护他们的隐私之间找到一个平衡点。

The news highlights rising tension between providers of privacy and convenience. And few offer concern among web users about how private their data is made public. Several prominent internet

Also in this section

- 68 Hiring competition
- 69 The recovery of General Motors
- 70 Business comes to China
- 76 Indian retail
- 78 Japan's drug firms are the centre
- 74 Brazilian telecoms
- 78 Schumpeter: Diversified

See also [Politics and economics](#), and [economics.com/Business-focus](#)

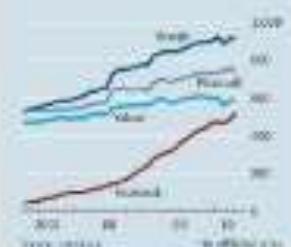
experts had to teach privacy policies in order to attract and retain users. But as more join, concerns are gradually loosened to encourage even more sharing. As people share more, Facebook can increase the ad-space against which it sells advertising. And the more it learns about users' likes and dislikes, the better even targeted ads perform—hundreds of millions of dollars.

Facebook's gene locus is still following a paradigmatic trajectory, but recently, when Mark Zuckerberg, Facebook's boss, announced yet another series of policy changes, one that caused consternation was an "extreme personalization" feature that lets certain third-party websites access Facebook data when people visit. Critics say that Facebook has created a risk to privacy in this forum, which may explain why its stock price has fallen so much.

European officials are grumbling about Facebook too. This month a group of data-protection experts who advise the European Commission wrote to the social network, calling its decision to lower the default settings "unacceptable". And as the in-

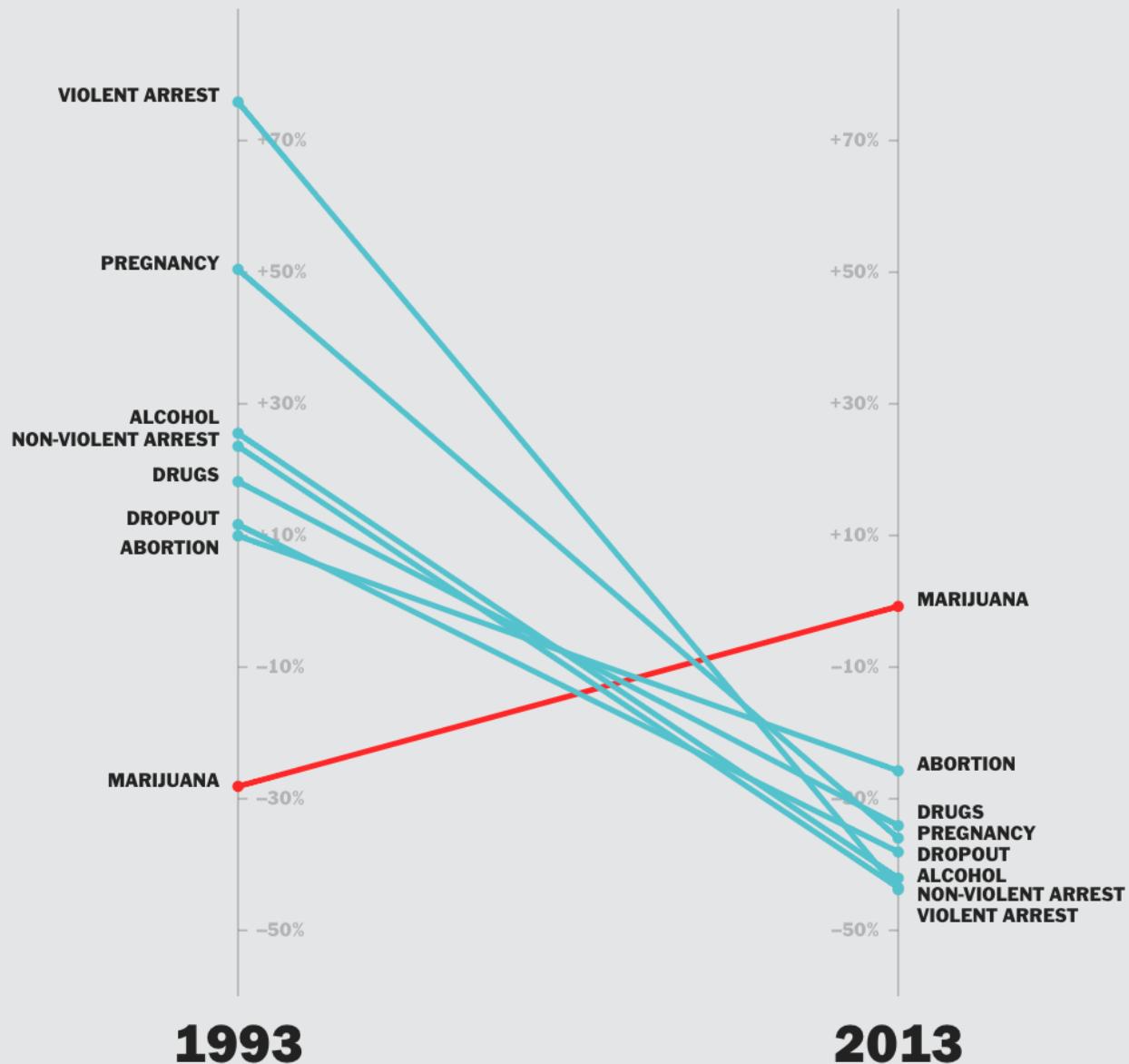
Hiring fare

By Jennifer Stoddart



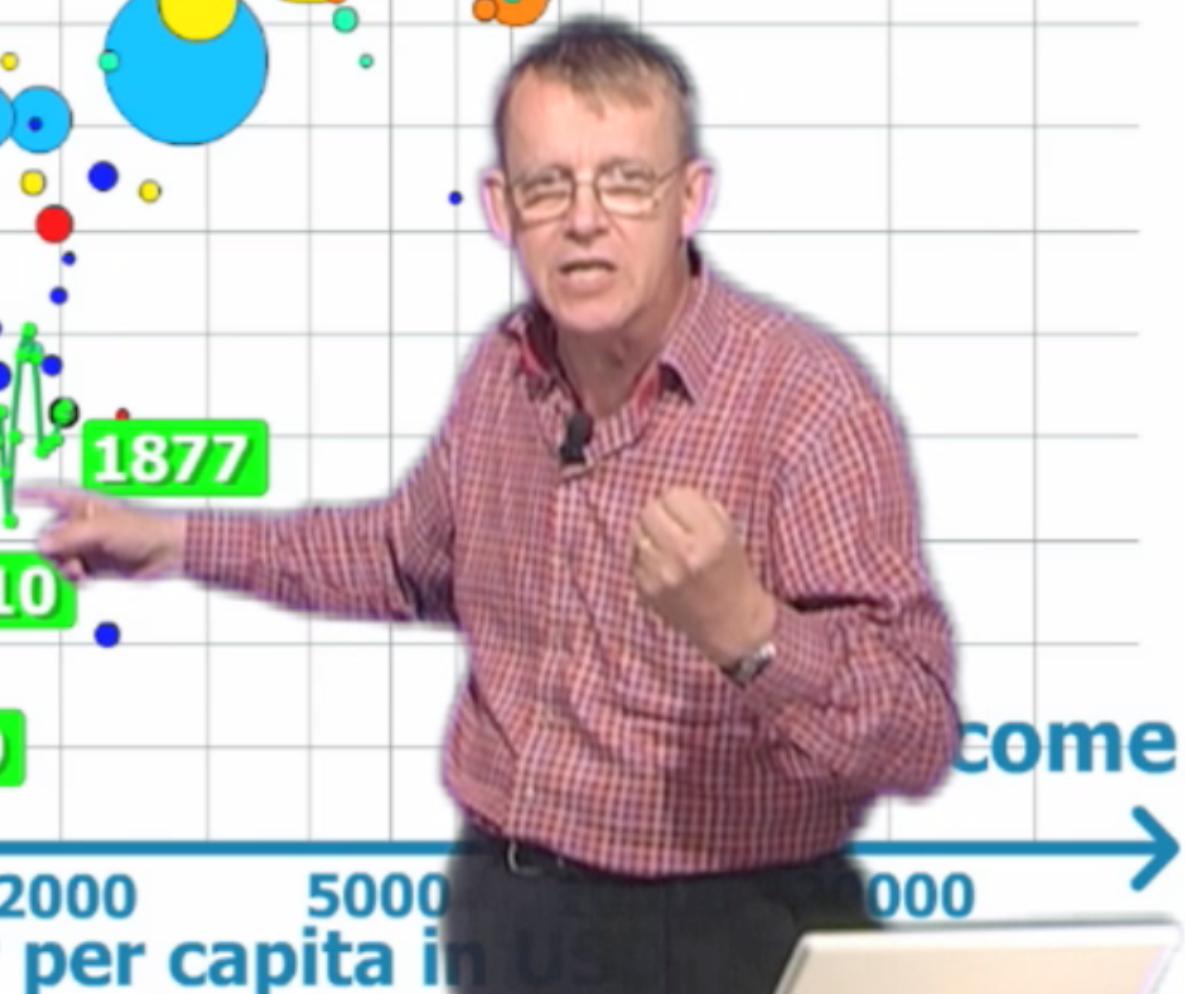
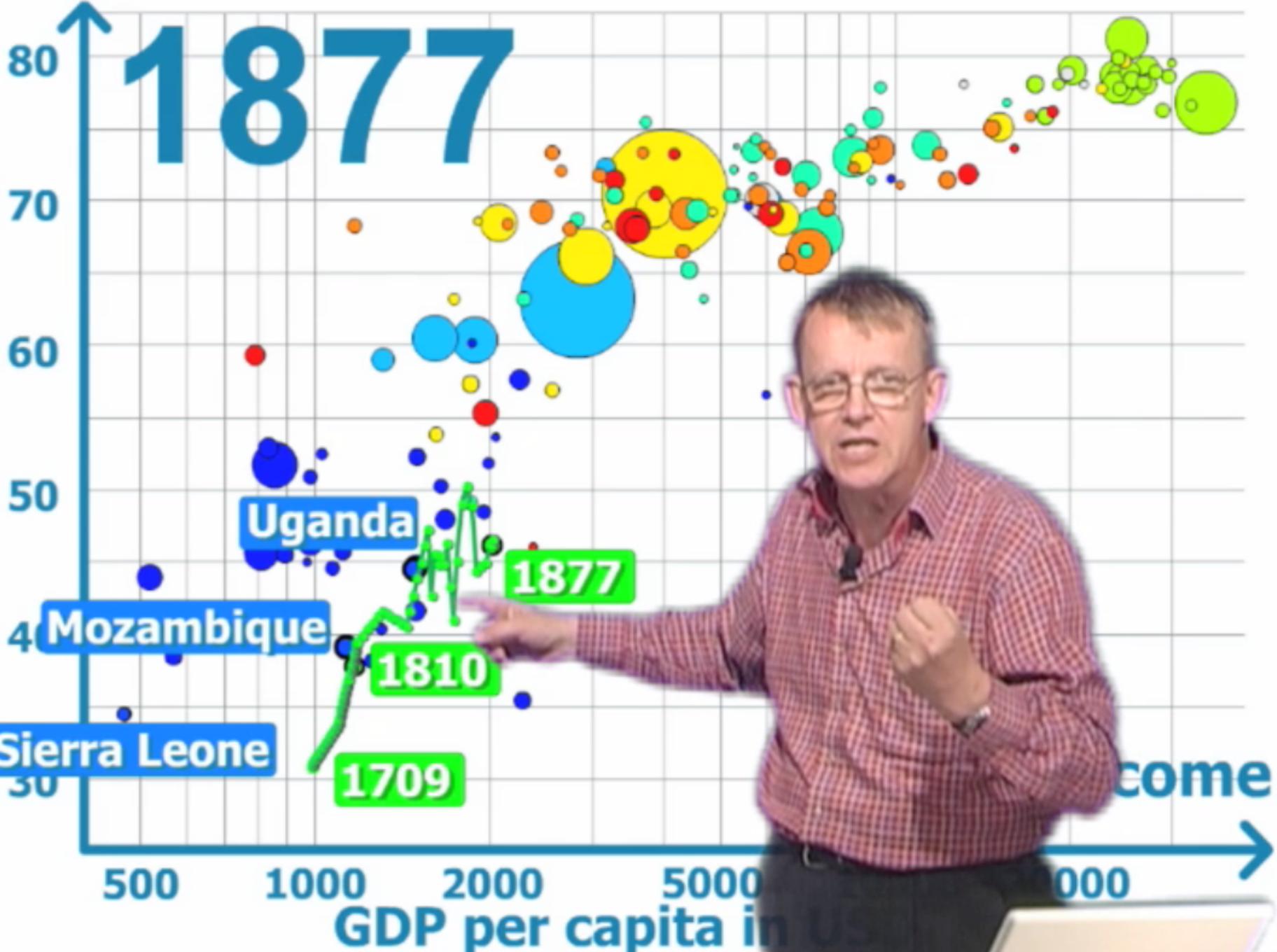
SHENANIGANS

Change in teen shenanigans from 1993 to 2013. Showing % difference from 2003 levels.



Health

Life expectancy in years

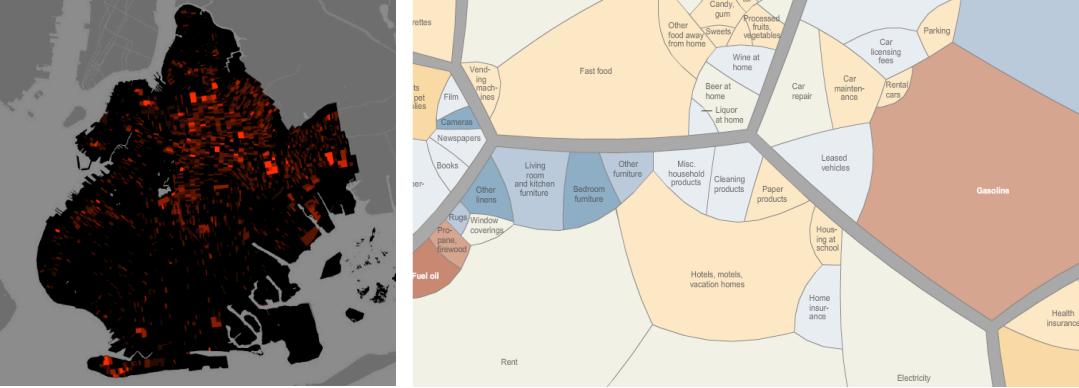


Narrative Devices for Storytelling with Data

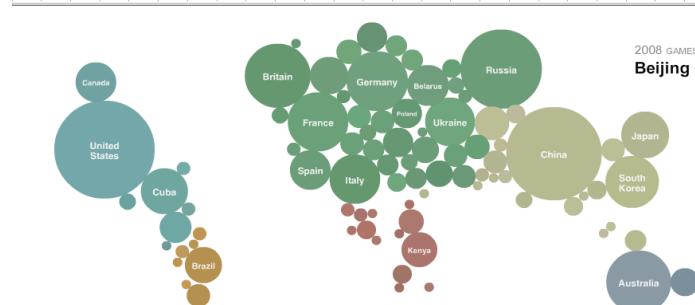
What devices communicate effectively?

... for which contexts and audiences?

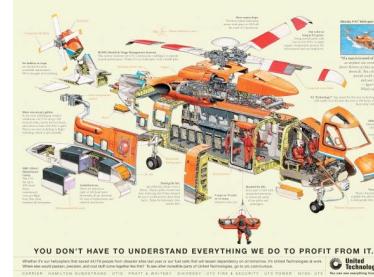
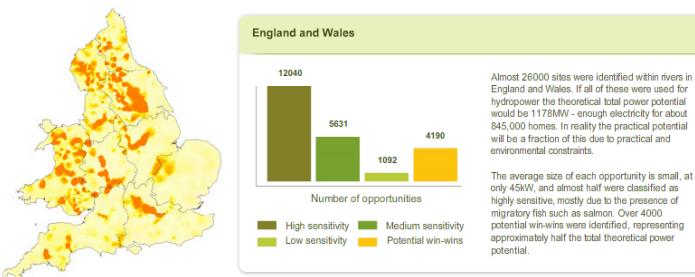
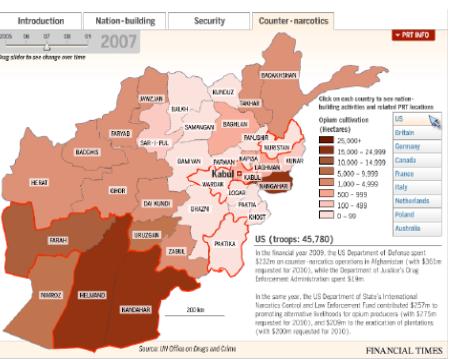
Narrative Visualization Design Space



GEOGRAPHIC VIEW BY RANKING
1896 1900 1904 1908 1912 1920 1924 1928 1932 1936 1948 1952 1956 1960 1964 1968 1972 1976 1980 1984 1988 1992 1996 2000 2004 2008



2008 Medal Count



58

CASE STUDIES

70% Journalism
20% Business
10% Research

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

600

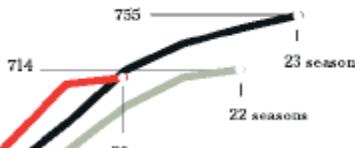
400

200

0

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.



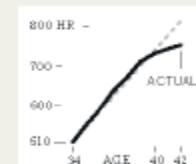
Bonds was injured last season. He played 14 games and hit 5 homers.

Homer Pace After Age 34

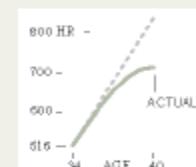
If the accusations are correct, Bonds was 34 in his first season on steroids. Here are projected home run paces for each player after age 34.

PROJECTED PACE BASED ON AVERAGE OF PREVIOUS FIVE SEASONS

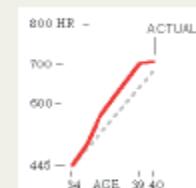
Aaron
Actual homers slightly outpace projected homers for five seasons.



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

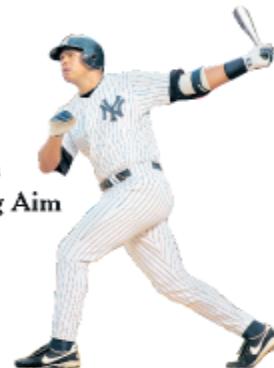


Bonds
From age 35 to 39, he averaged 14 more homers a season than projected.



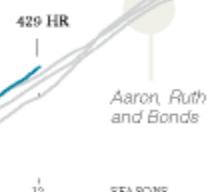
Note: Ages as of July 1 of each season.

Others Taking Aim



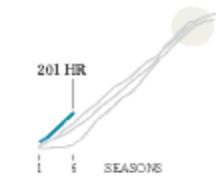
Alex Rodriguez

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



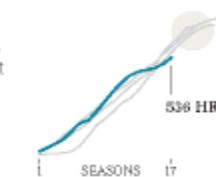
Albert Pujols

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).

Hank Aaron



15 times hit 30 or more (M.L. most).

Babe Ruth



Hit only 20 over first five seasons.

Barry Bonds



Averaged 52 from 2000 to 2004.

Willie Mays



No one hit more from 1950-69.

Sammy Sosa



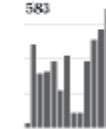
Three 60-homer seasons is record.

Frank Robinson



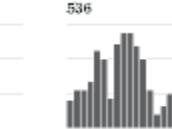
Triple Crown in '66 (49, 122, 316).

Mark McGwire



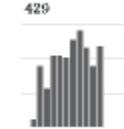
First to hit 70 in a season.

Ken Griffey Jr.



Only McGwire had more in the 90's.

Alex Rodriguez



Youngest to reach 400 homers.

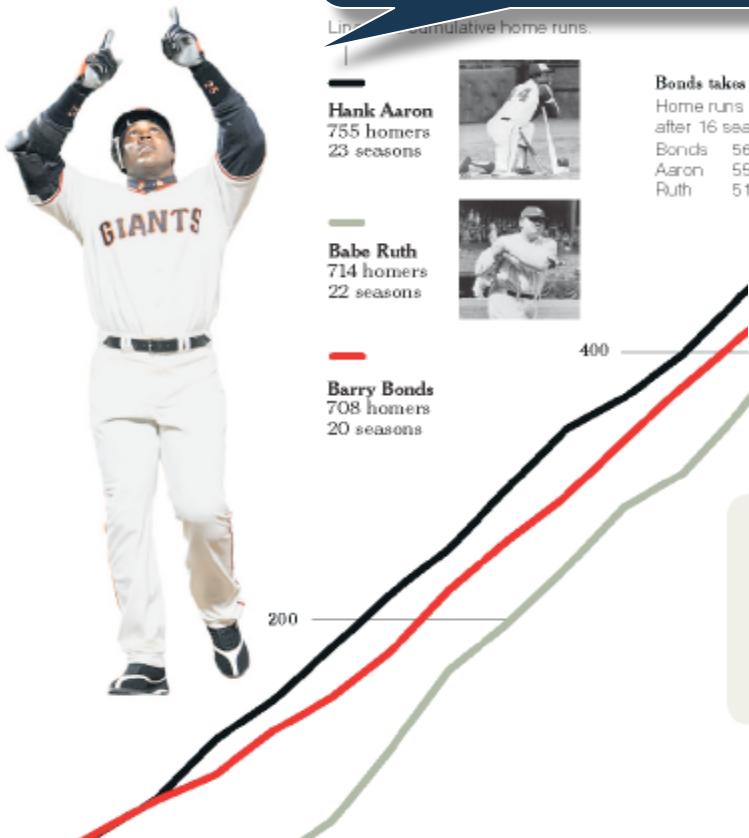
Albert Pujols



Second most ever in first five seasons.

755

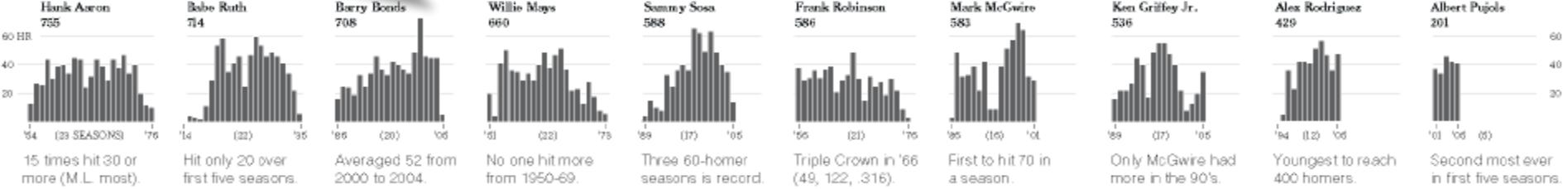
Grab attention with image and position



Reduced visual priority

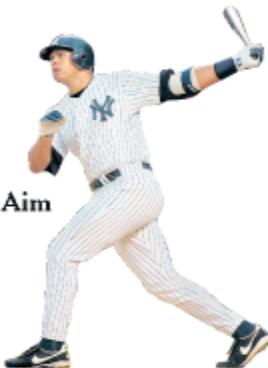
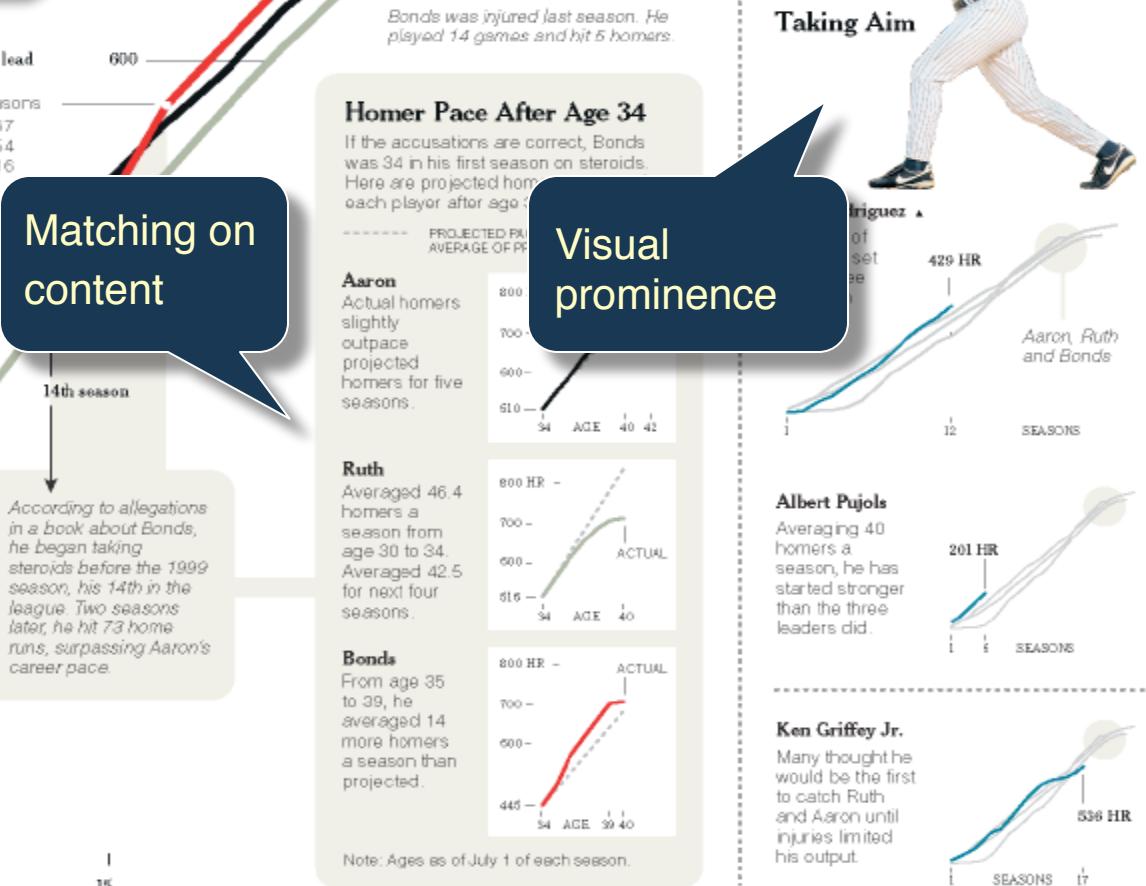
Differing Paths to the Top of the List

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

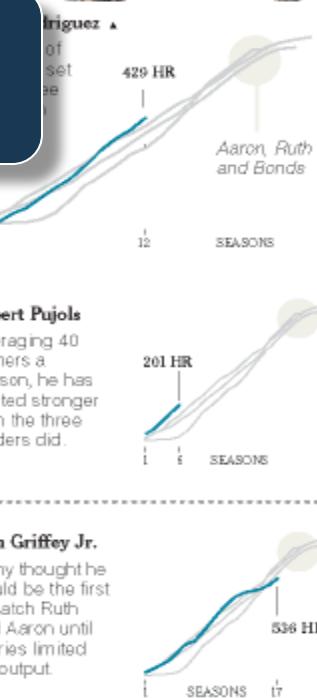


suit Is On

He needs
on.



Others
Taking Aim



Beginning

Steroids or Not, the Pursuit Is On

Barry Bonds is taking aim at the career home run record. He needs 15 more to surpass Babe Ruth and 47 to equal Hank Aaron.

He is currently five from the record.

He has 708 career home runs.

He has 20 seasons.

Hank Aaron
755 home runs
23 seasons

Babe Ruth
714 home runs
22 seasons

Barry Bonds
708 home runs
20 seasons

Bonds takes lead

Home runs

after 16 seasons

Bonds 567

Aaron 554

Ruth 511

60

50

40

30

20

10

0

10

20

30

40

50

60

70

80

90

100

110

120

130

140

150

160

170

180

190

200

210

220

230

240

250

260

270

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290

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2880

Budget 2010: reaction from around the UK

People in key constituencies around the country give their responses to Alistair Darling's budget

Consistent Visual Platform

Introductory Text



Shilpa Wymer, 40, is managing director of two branches of Pitman Training Ltd, a training school specialising in secretarial and PA training

Enquiries from individuals suddenly dropped off a cliff from October 2008 and in January last year we had to lay off a couple of people, though things have picked up since. The budget seems very positive and shows the government are thinking about small and medium sized businesses at last. I think the measures will help businesses be more confident, which will have a knock-on effect on us. It has turned my head and made me think about which way I will vote.

Constituency profile

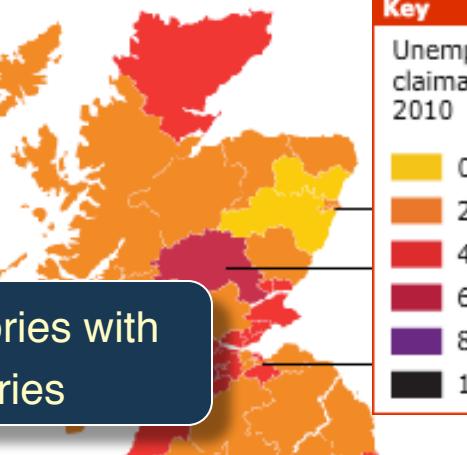
MP: Greg Hands, Conservative. Majority: 5,029
Unemployment benefit claimants, Feb 2010:
3,281 (up 13% over last year)

Anecdotal Stories with Data Stories

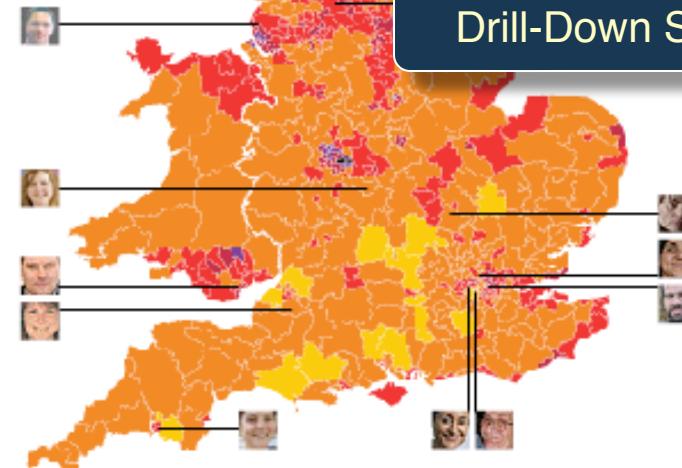
Key

Unemployment benefit claimant count, February 2010

0 – 1.99%
2 – 3.99%
4 – 5.99%
6 – 7.99%
8 – 9.99%
10% and above



Drill-Down Story





Gun Deaths In America

By Ben Casselman, Matthew Conlen and
Reuben Fischer-Baum

CLICK to advance



How 2 M.T.A. Decisions Pushed the Subway Into Crisis

By ADAM PEARCE MAY 9, 2018



Source: M.T.A. on-time performance data

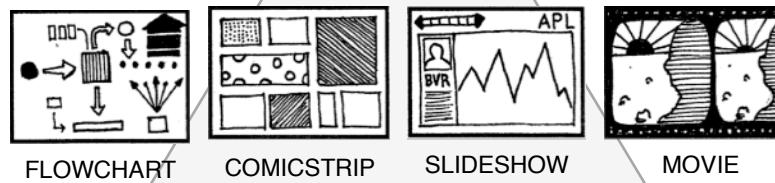
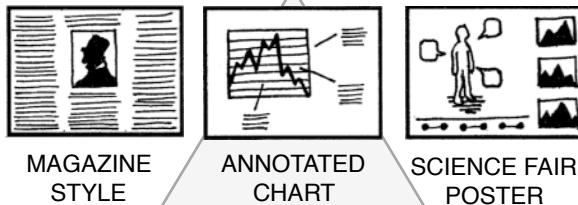
By now, New York City commuters are familiar with the wait. We descend from the bitter cold or the stifling heat to find subway platforms teeming with other bodies trying to make it to work on time. Delays ripple through the system, so there's barely room to squeeze into the next train that

Observed Narrative Devices

Case Studies

Visualization Description
Architecture and Justice (Brookings Institution)
Political Cartoons (Politico)
Food Safety (Food Safety News)
Pedestrian Deaths (USA Today)
Climate Agenda (The New York Times)
Did Your County's Jobs Go Away? (USA Today)
Academy Award Nominees (Academy of Motion Picture Arts and Sciences)
Earnings: How competitive is your state? (USA Today)
Deadly Attacks (USA Today)
GDP by Sector (USA Today)
Economic Data (USA Today)
Budget 2010: Reaction from the Tea Party (USA Today)
Formula One 2010: driver's race (USA Today)
Lighting up Hadrian's wall (BBC News)
Mapping hydropower hotspots (USA Today)
Moscow metro bombs: interactive map (USA Today)
The world economy turns the corner (USA Today)
A Map of Olympic Medals (USA Today)
Inflation's Little Parts (USA Today)
Bonds visualization (Interactive Brokers)
The In and Out Flow of Money (USA Today)
Jobless Rate for People Living Alone (USA Today)
Advertisement: Bus (USA Today)
Advertisement: Helicopter (USA Today)
Zoning Obama's schedule (USA Today)
Oscars 2010: the complete list (USA Today)
Consumer anger over price increases (USA Today)
UK Spending Intentions (USA Today)
Bonds Visualization (Standard & Poor's)
Comparison of Bear Markets (USA Today)
How Americans Spend Their Money (USA Today)
Michelle Obama's Family Tree (USA Today)
Netscape Rentals (USA Today)
Javuer's Olympic Venue Map (USA Today)
On the Map: Five Major Northern European Cities (USA Today)
A Visual Guide to the Financial Crisis (USA Today)
The Meltdown of 2008-2009 (USA Today)
Where Did All The Money Go? (USA Today)
Cycle of a beetle through a bud's "Making Comics" (USA Today)
How the Government Deal with Afghanistan: Behind the frontlines (USA Today)
A timeline: a company history (USA Today)
Under Human Development (USA Today)
Earthquakes: why they happen (USA Today)
Iran's nuclear programme (USA Today)
Sarah Palin's Double McTwist (USA Today)
Toyota's stick accelerator problem (USA Today)
Skiing, From Technical to Artistic (USA Today)
Budget Forecasts vs. Reality (USA Today)
Orientation Video (USA Today)
Delaware Safety Video (USA Today)
The Story of Stuff (USA Today)
Virgin America Airplane Safety Video (USA Today)

Visual Design



Duo-Specific

Captions

Annotations

Attached Article

Summaries

Interpret

Headlines

Tacit Tutorial

Selection

Navigation

Details on Demand

Timelines

Filtering

Highlighting

Messaging

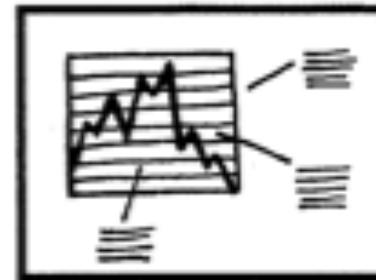
Interactivity

MORE

Seven Genres



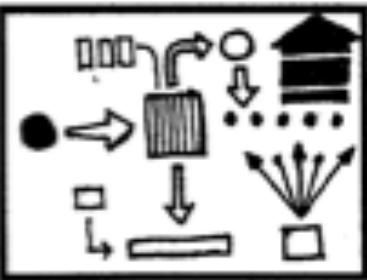
Magazine Style



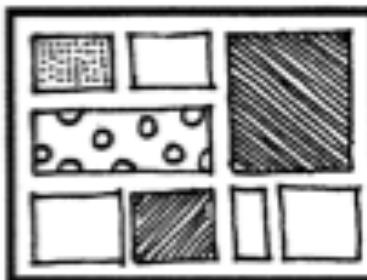
Annotated Chart



Partitioned Poster



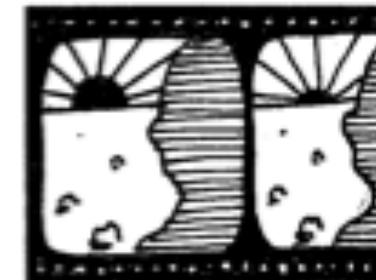
Flow Chart



Comic Strip



Slide Show



Film/Video/Animation

Genres for Narrative Visualization (2010)

Missing “scrolly-telling” designs...

Genres + Interactivity + Messaging =

DESIGN SPACE

STORYTELLING

CLARITY

SPEED

Author Driven

strong ordering
heavy messaging
limited interactivity

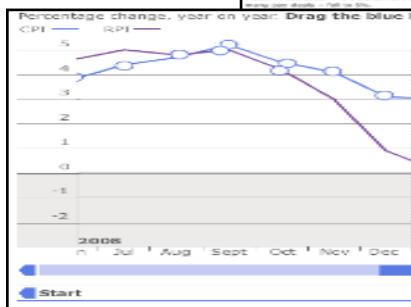
Reader Driven

weak ordering
light messaging
free interactivity

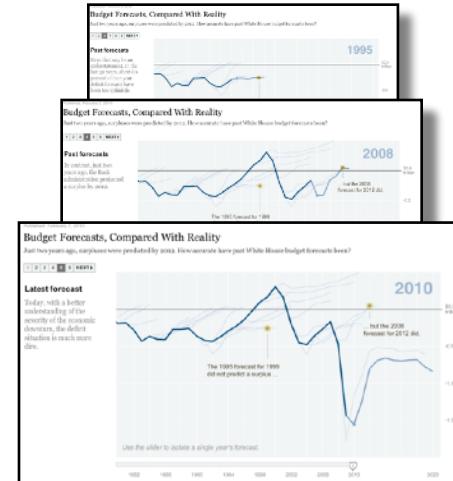
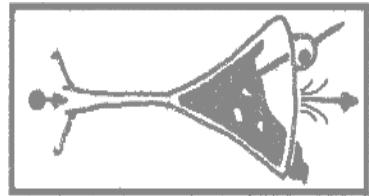
ASK QUESTIONS

EXPLORE

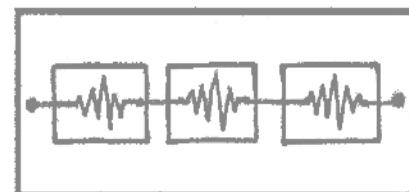
FIND



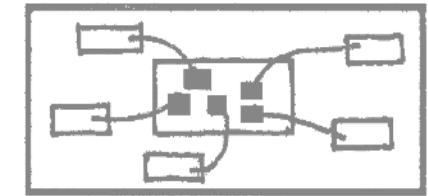
martini
glass



interactive
slideshow



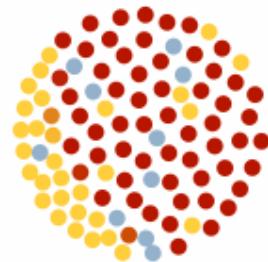
drill-down
story



Other techniques:
simulation, games,
rhetorical, draw the trend

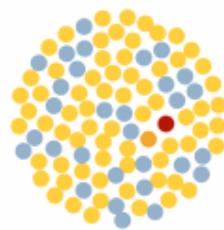
Watch how the measles outbreak spreads when kids get vaccinated – and when they don't

😊 vaccinated 😐 susceptible 😕 vaccinated but susceptible 😢 infected 🍁 contact with an infected person



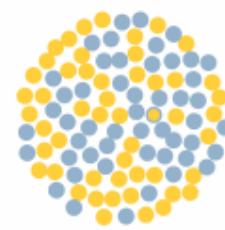
NOT PROTECTED

10.0% vax rate

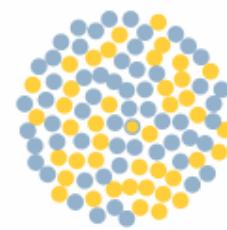


NOT PROTECTED

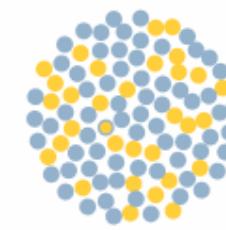
30.0% vax rate



50.0% vax rate



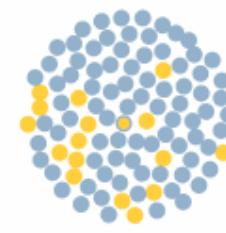
58.5% vax rate, similar to
Okanagan County, WA



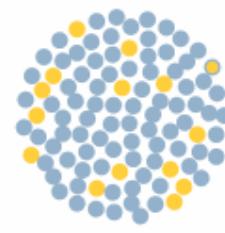
68.9% vax rate, similar to
Thurston County, WA



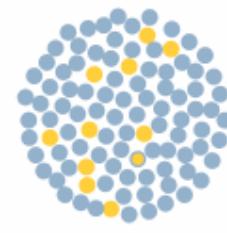
74.4% vax rate, similar to
Island County, WA



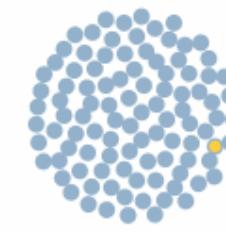
83.8% vax rate, similar to
Santa Cruz County, CA



86.0% vax rate, similar to
Los Angeles County, CA



90.0% vax rate, similar to
Orange County, CA



99.7% vax rate, similar to
Gadsden County, FL

Who Should Get Parole?

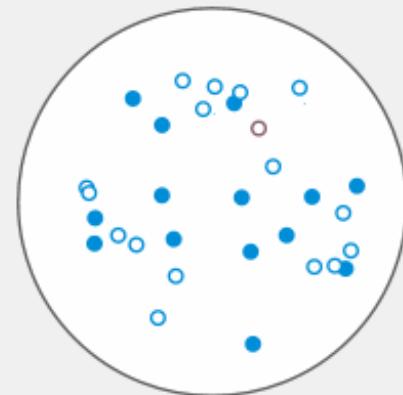
Even the best risk assessments yield probabilities, not certainties. That means they label as "high risk" some people who won't commit another crime and label as "low risk" some people who will. This simulation lets you sort offenders into risk categories based on the results of an assessment. Think we should rarely lock up anyone who wouldn't reoffend? Set the "low risk" threshold high and the "high risk" threshold even higher. Have little tolerance for recidivism? Try the opposite. In the real world, policymakers have to strike a balance. [Read more »](#)

1

The prisoners in this simulation are up for parole. Some will reoffend if released and some won't. They each take an assessment, which estimates the chance they will reoffend.

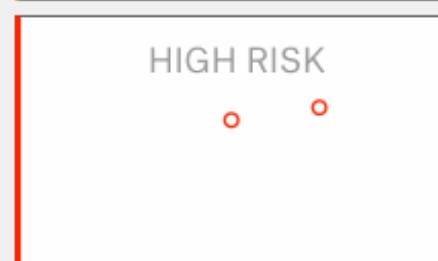
Stop

PAROLE-ELIGIBLE PRISONERS



2

Prisoners are placed in one of three categories based on these estimates. **Move the slider** to change the cutoffs for each category. "Low risk" prisoners will be awarded parole. "High risk" prisoners will be denied.



3

Some people you let out reoffended. Some people you left in prison wouldn't have. **Are you OK with the results?**

AWARDED PAROLE



18%
AWARDED PAROLE
AND THEN
REOFFENDED

DENIED PAROLE

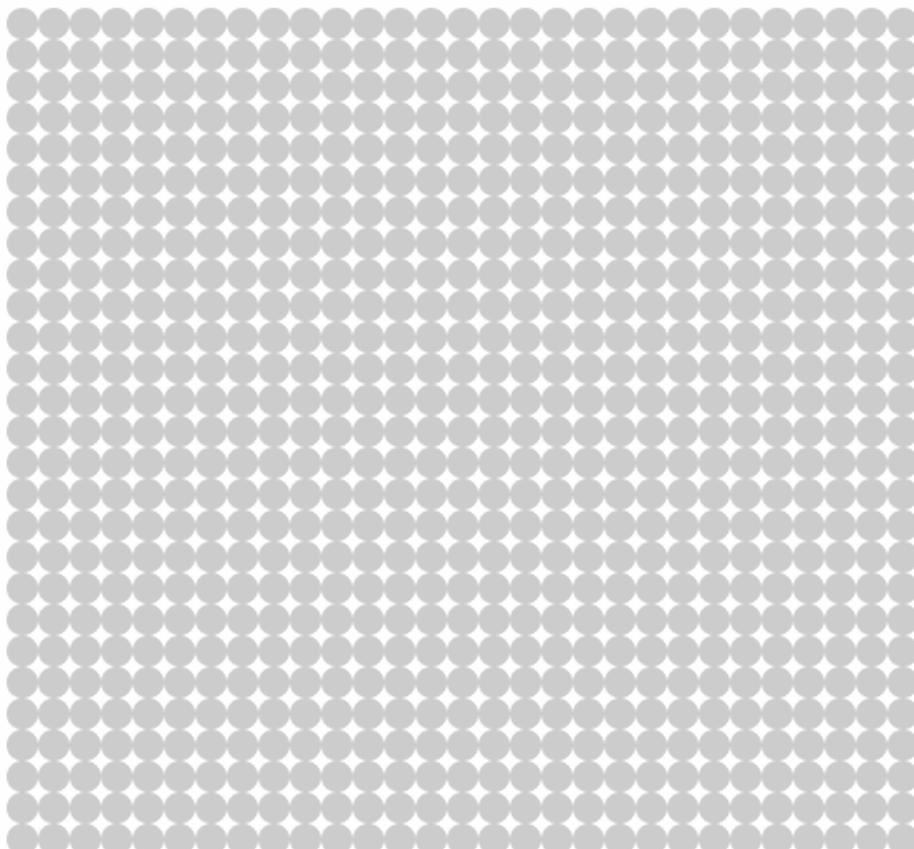


14%
DENIED PAROLE BUT
WOULDN'T HAVE
REOFFENDED

I am female ▾ White ▾ and currently

23 

LIVE



AGE OF DEATH	DIED SO FAR	STILL ALIVE
23 years	1%	99%

CAUSE OF DEATH SO FAR

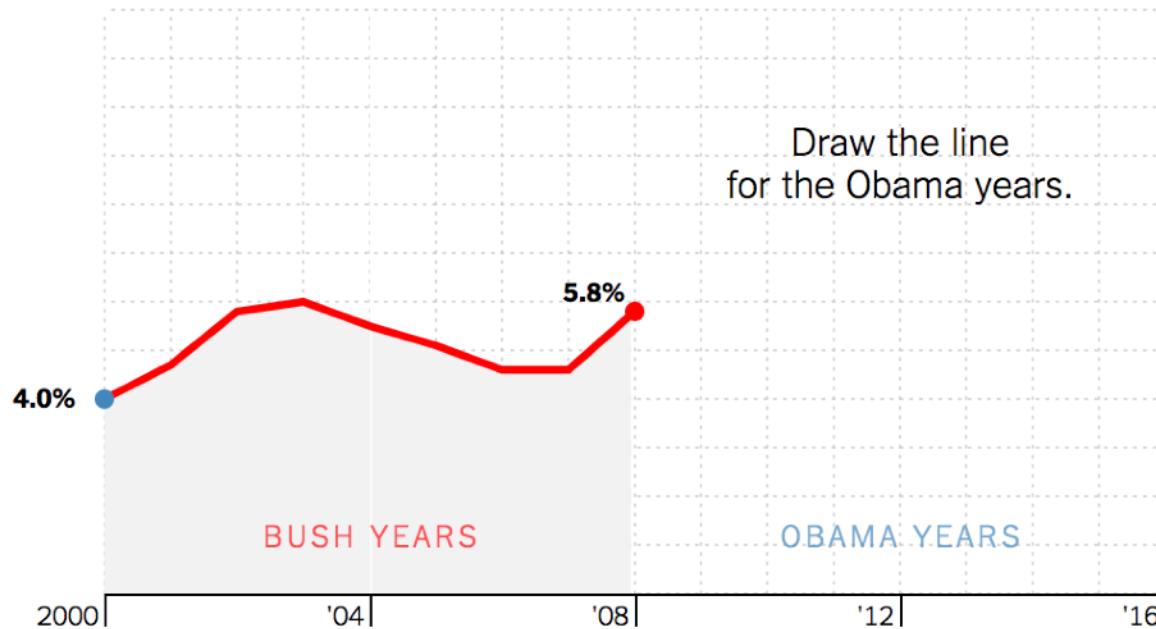
- 0% Infection
- 0% Cancer
- 0% Blood
- 0% Endocrine
- 0% Mental
- 0% Nervous
- 0% Circulatory
- 0% Respiratory
- 0% Digestive
- 0% Musculoskeletal
- 0% Genitourinary
- 0% Perinatal
- 0% Congenital
- 0% External Causes
- 0% Other

You Draw It: What Got Better or Worse During Obama's Presidency

By LARRY BUCHANAN, HAEYOUN PARK and ADAM PEARCE JAN. 15, 2017

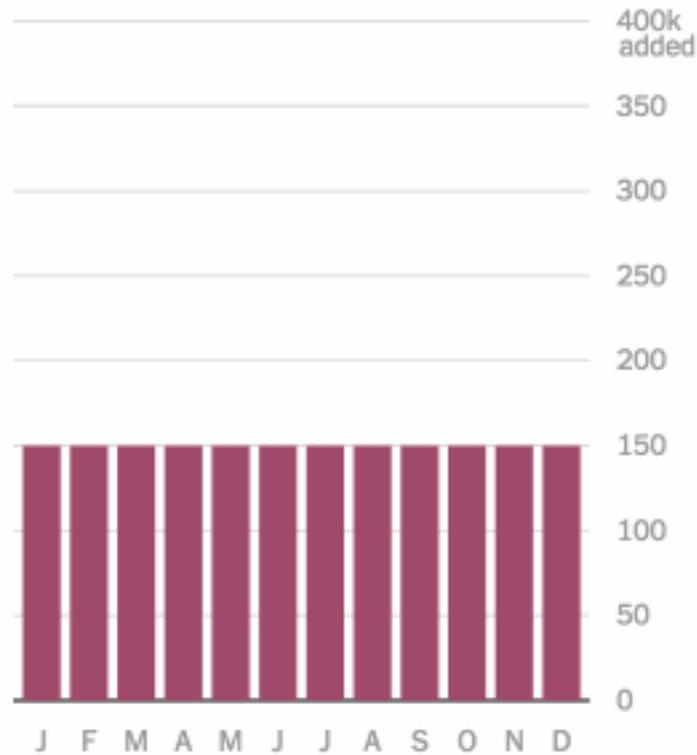
Draw your guesses on the charts below to see if you're as smart as you think you are.

Under President Obama, the **unemployment rate** ...



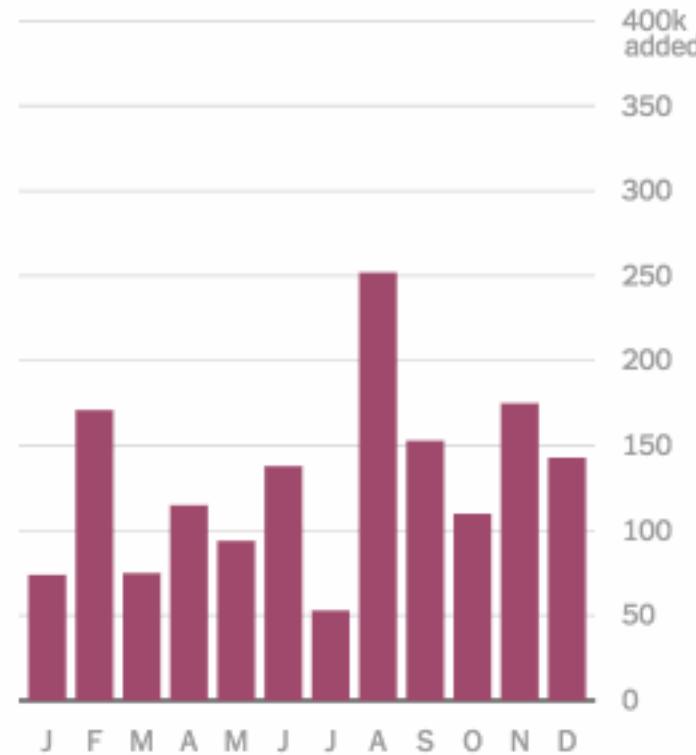
Show me how I did.

If job growth **were actually steady**
over the last 12 months...

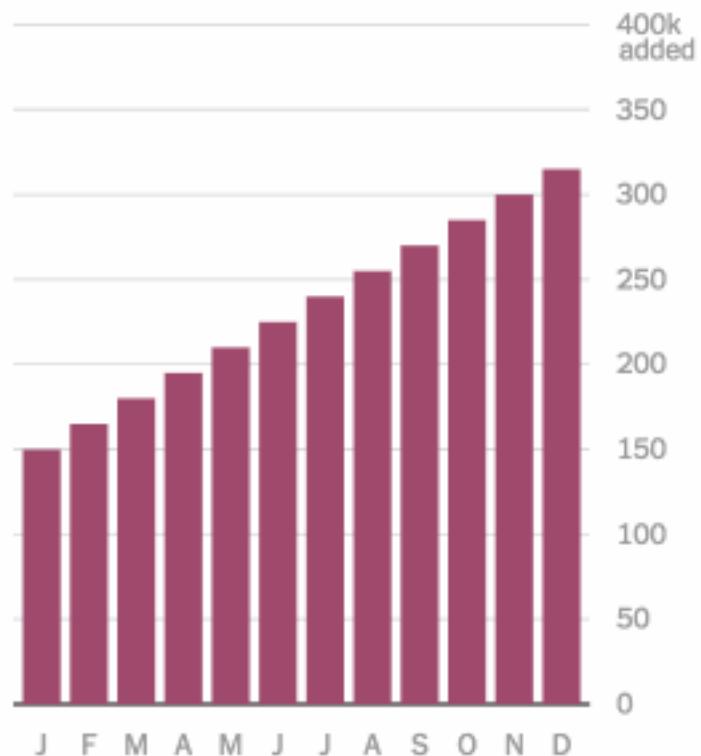


...the jobs report
could look like this:

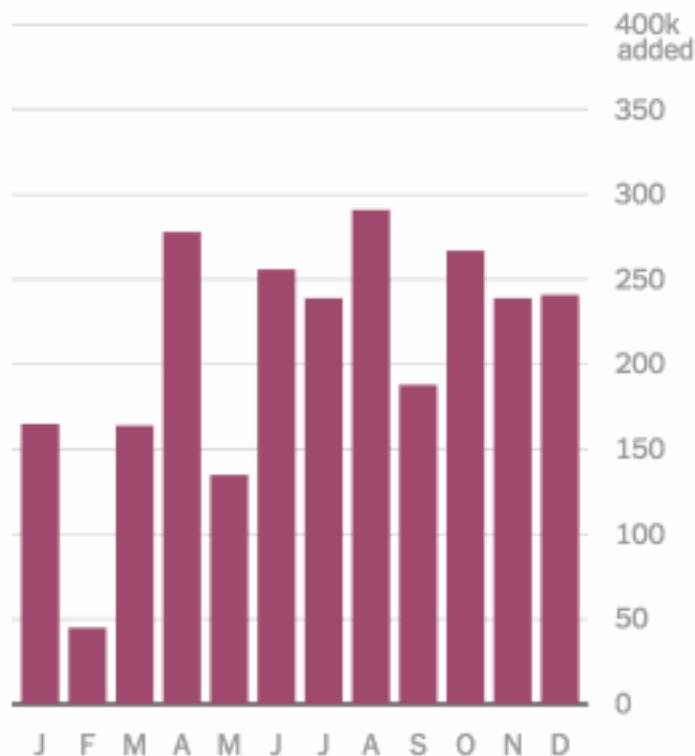
Pause



If job growth **had**
been accelerating...



...the jobs report
could look like this:



Pause

WSJ Blue Feed, Red Feed - WSJ.co X Matthew

graphics.wsj.com/blue-feed-red-feed/#/health-care

THE WALL STREET JOURNAL.

Blue Feed, Red Feed

See Liberal Facebook and Conservative Facebook, Side by Side

By Jon Keegan

Published May 18, 2016 at 8:00 a.m. ET | Updated hourly

FILTER FEEDS BY TOPIC:

PRESIDENT TRUMP HEALTH CARE GUNS ABORTION ISIS BUDGET EXECUTIVE ORDER IMMIGRATION

LIBERAL ⓘ

SHOWING POSTS ABOUT:
"HEALTH CARE"

CONSERVATIVE ⓘ

Occupy Democrats 2 hours ago

The president thought he could undo his predecessor's legacy, but his plan isn't exactly panning out.

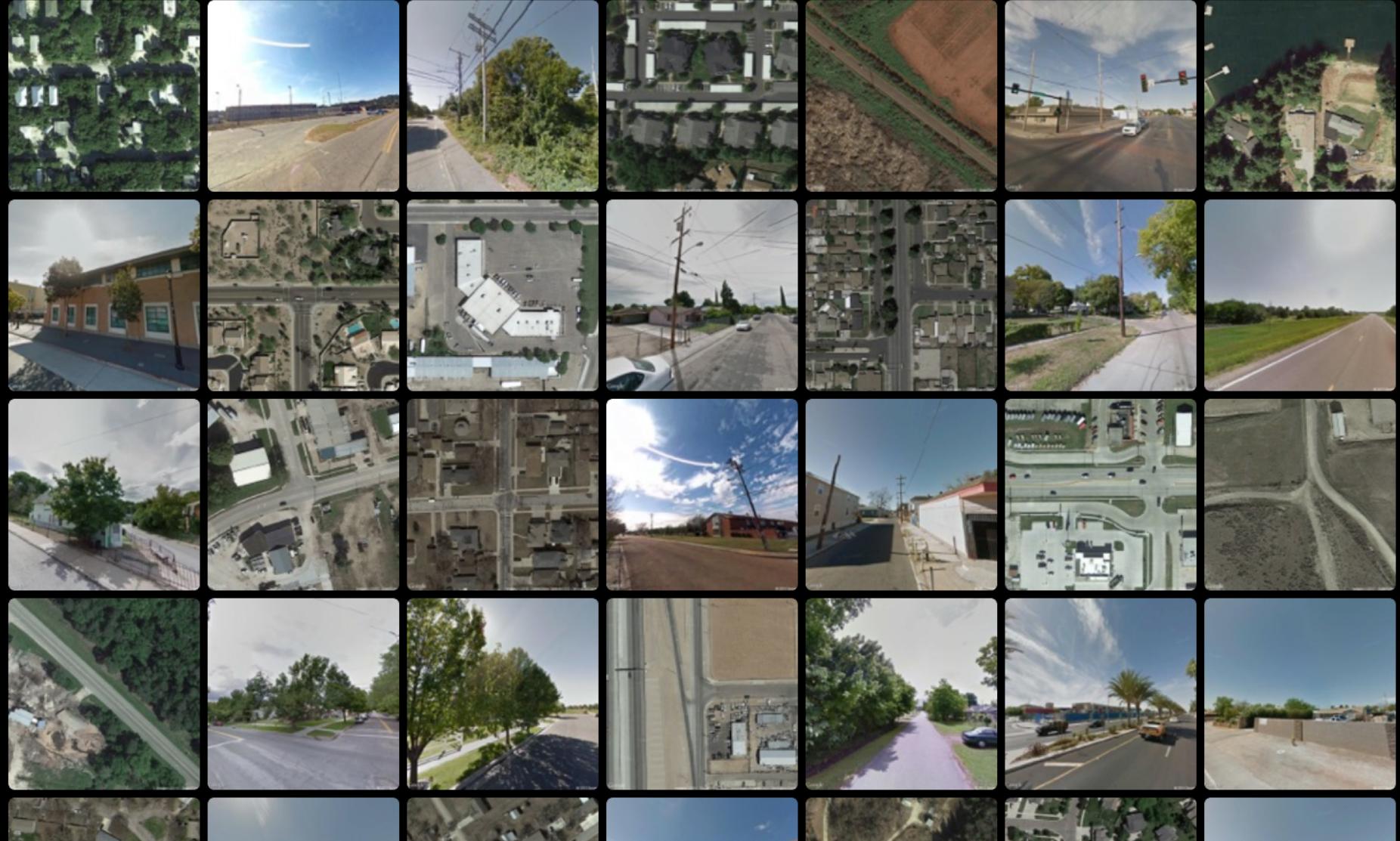


The Federalist Papers 9 hours ago

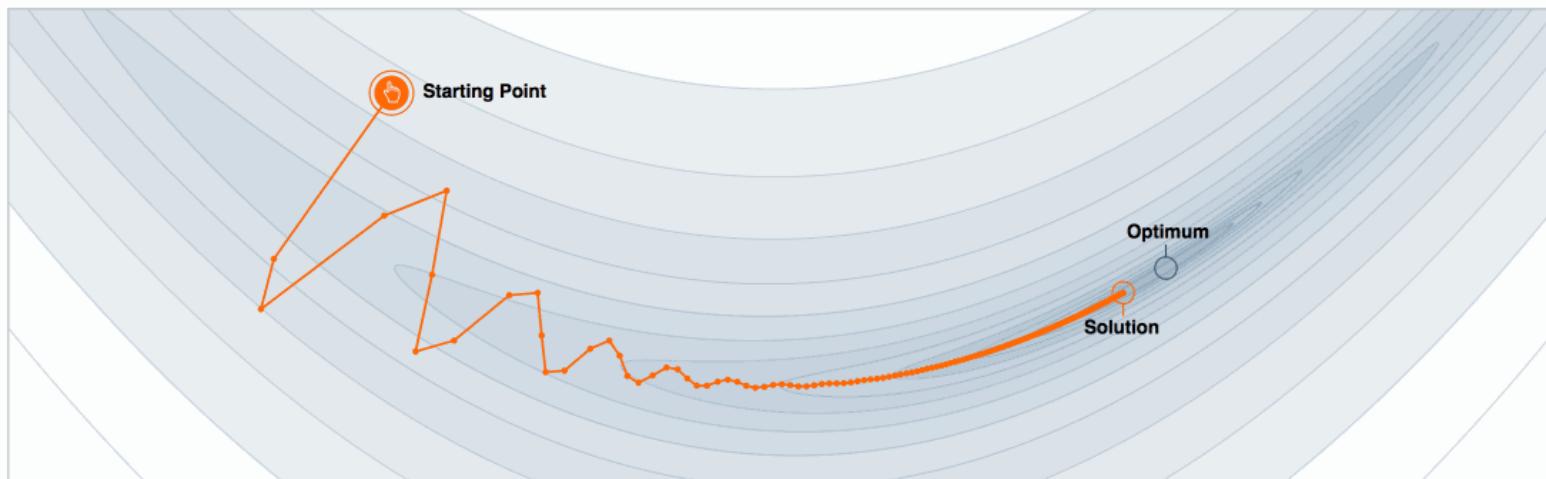
A horrible testament to what happens with government-run healthcare systems.



These Facebook posts do not represent the reporting or opinion of The Wall Street Journal, and are not verified, edited or endorsed in any way. Read our [Methodology](#).



Why Momentum Really Works



Step-size $\alpha = 0.0027$

Momentum $\beta = 0.99$

We often think of Momentum as a means of dampening oscillations and speeding up the iterations, leading to faster convergence. But it

Interactive Documents: Steppers, Scrollers, ...

Published: February 2, 2010

Budget Forecasts, Compared With Reality

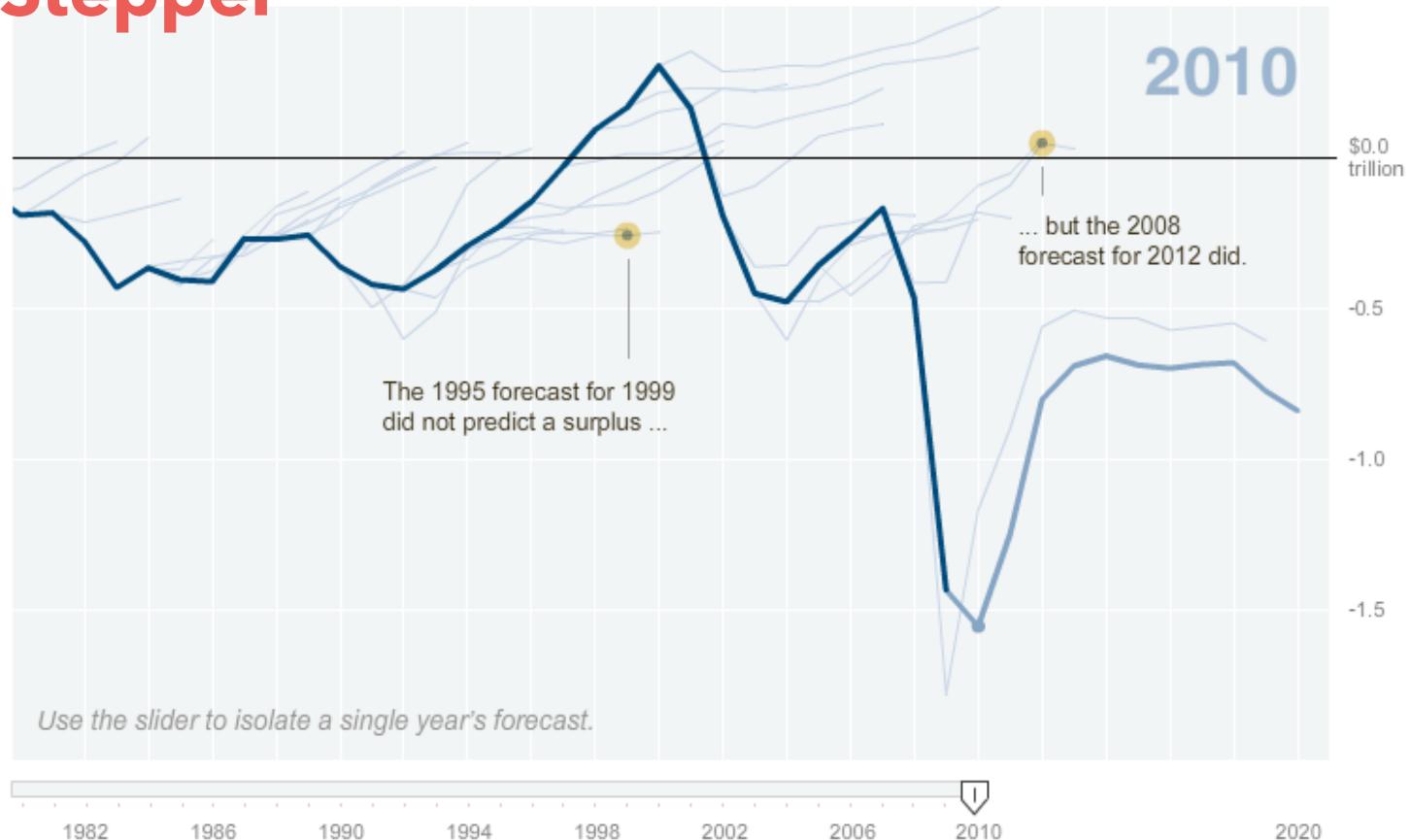
Just two years ago, surpluses were predicted by 2012. How accurate have past White House budget forecasts been?

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.

Stepper



Ramadi: The Government Provides an Opening for ISIS ISIS Control

Tensions between this city's residents, who are mostly Sunni, and the central government had been brewing here for at least a year. Then in December, Iraq's prime minister, Nuri Kamal al-Maliki, ordered security forces to dismantle a protest camp — an outlet for disenchanted Sunnis angered at their treatment by the Shiite-dominated government. The action ignited days of violence and created the opening ISIS needed to seize parts of the city, the provincial capital.

Lake Tharthar

Falluja: A Symbolic Fall ISIS Control

Just days after the raid on the camp in Ramadi, ISIS fighters destroyed the Police Headquarters and mayor's office here, planted their flag on government buildings and decreed the city to be theirs. Ten years earlier, American forces had captured this city from Qaeda-style insurgents at a considerable cost of American lives.

Lake Habbaniya

Balad



17 MILES TO BAGHDAD

Scroll



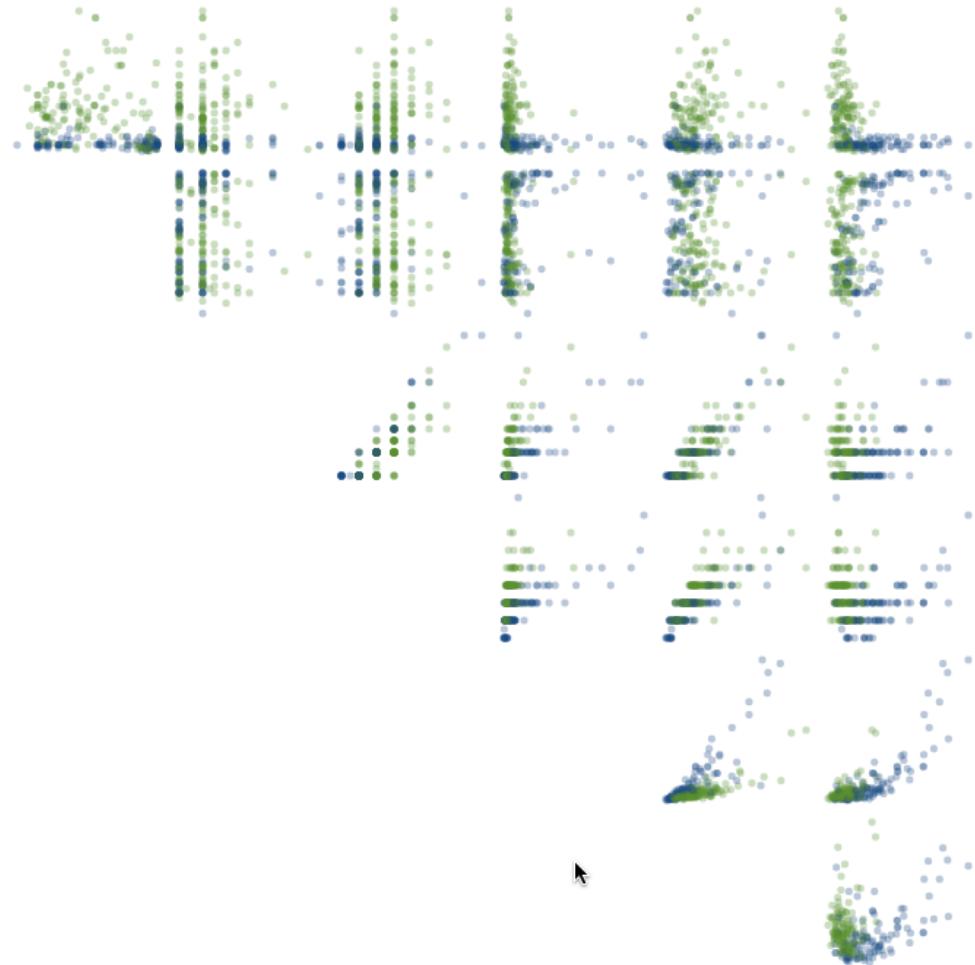
A visual introduction to machine learning

English ▾

In machine learning, computers apply **statistical learning** techniques to automatically identify patterns in data. These techniques can be used to make highly accurate predictions.

Keep scrolling. Using a data set about homes, we will create a machine learning model to distinguish homes in New York from homes in San Francisco.

SCROLL



Discrete step vs. Continuous scroll

Different means for narrative navigation.

A source of debate among practitioners!

Step: sequential frames as in a slideshow

Simple and familiar, but less engaging?

Scroll: continuous navigation of page

Parameterize content by scroll position

May cause usability / scrolljacking issues

Hybrids: scroller with discrete sections

Narrative Implementation

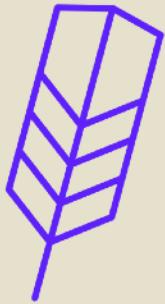
Do-It-Yourself

Monitor scroll position & element positions
Guidance: [M. Bostock, J. Vallandingham](#)

Third-Party Support

Helper Libraries

Interactive Document Formats: Idyll

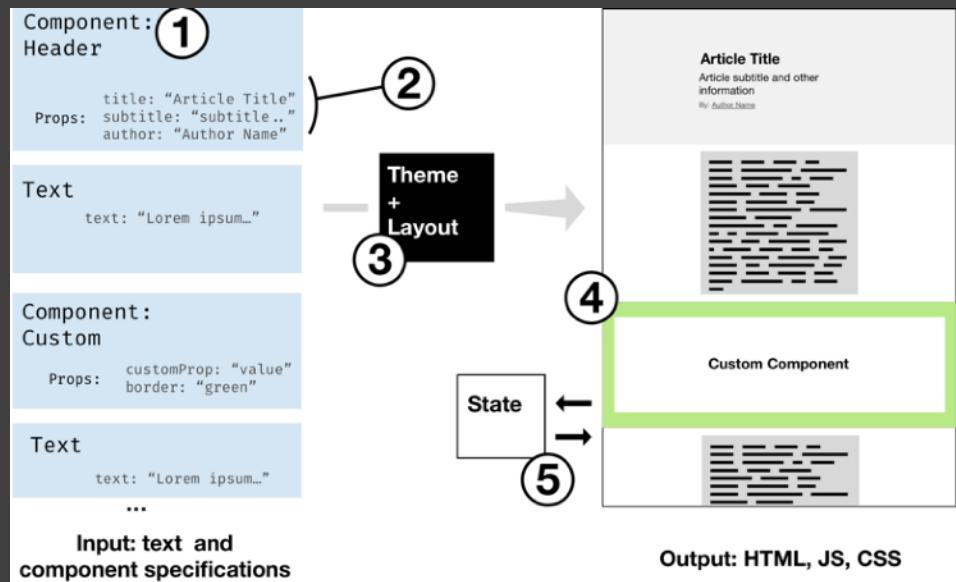


idyll

A toolkit for creating data-driven stories
and explorable explanations.

Overview

Document model for interactive articles



Overview

Document model for
interactive articles

Markdown-based
specification language

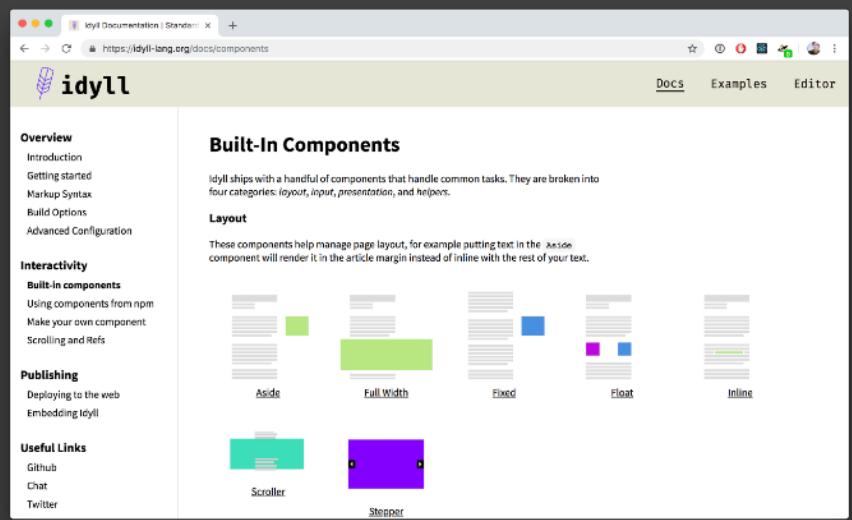
```
[var name:"x" value:5 /]
```

```
# Hello World
```

The value of x is
[Display value:x format:"d" /].

Overview

Document model for
interactive articles
Markdown-based
specification language
Component library
supporting common needs

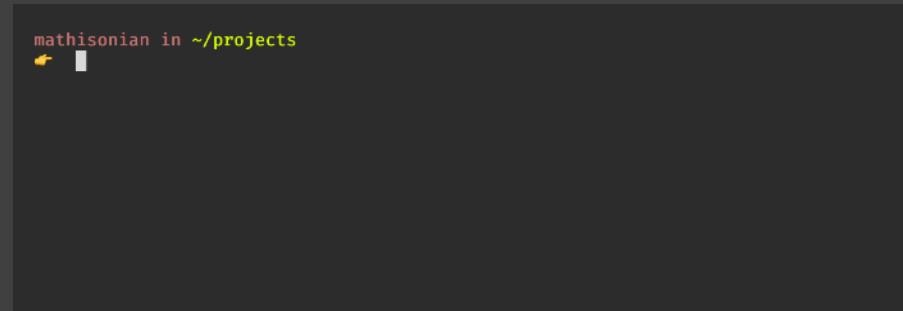


Overview

Document model for
interactive articles

Markdown-based
specification language

Component library
supporting common needs
Suite of build, runtime, and
deployment tools



In action...

```
[section]

# A Sad Guitar.

Take a second and strum the guitar. It doesn't sound
so good, does it?

We've just taken it out of storage and *it's all out of tune...*

[/section]

[section onEnterViewFully:'guitarState = 'headstock'; playScale = false;']

# Electric Tuner to the Rescue.

Tune the guitar using the tuner. Click and drag the tuning
knobs on the right to tighten and loosen the strings.
// Need a reward state to let them know when a string is in tune

[Tuner selectedString:targetString currFreq:currentFrequency /]

[conditional if:isInTune]
Great work, scroll on.
[/conditional]

[/section]
```

The screenshot shows a web browser window with the URL <https://mathisonian.github.io/dyll/how-to-tune-a-guitar/>. The page title is "How To: Tune a Guitar". It features a black electric guitar on the right side. At the top left is a speaker icon. Below the title, it says "By Matthew Conlen and Alex Kale". The main content area contains text and images related to tuning a guitar.

Document Model

Data and state variables

```
[var name:"x" value:10 /]  
[data name:"y" source:"data.csv" /]
```

Document Model

Data and state variables

Components that affect
layout and render content

```
[var name:"x" value:10 /]  
[data name:"y" source:"data.csv" /]
```

```
[Table  
  data:y  
  onEnterView:`x += 1` /]
```

Document Model

Data and state variables

Components that affect
layout and render content

Implementation

```
[var name:"x" value:5 /]
```

```
# Hello World
```

The value of x is

```
[Display value:x format:"d" /].
```

```
[Range value:x min:0 max:10 /]
```

Hello World

The value of x is 5.



Implementation

```
[Range value:x min:0 max:10 /]
```

```
class Range extends Component {  
  
  handleChange(event) {  
    updateProps({  
      value: +event.target.value  
    });  
  }  
}
```

Hello World

The value of x is 5.



Idyll Components

Action Boolean Button Dynamic Radio

Range Select Text Input

Input

Aside Full Width Fixed Float Inline

Scroller Stepper

Layout

28 components included

Chart Conditional Display Equation Gist

This is the headline
and the deck, byline, etc.

An inline link.

Header Link SVG

Presentation

1,234 views

< / >

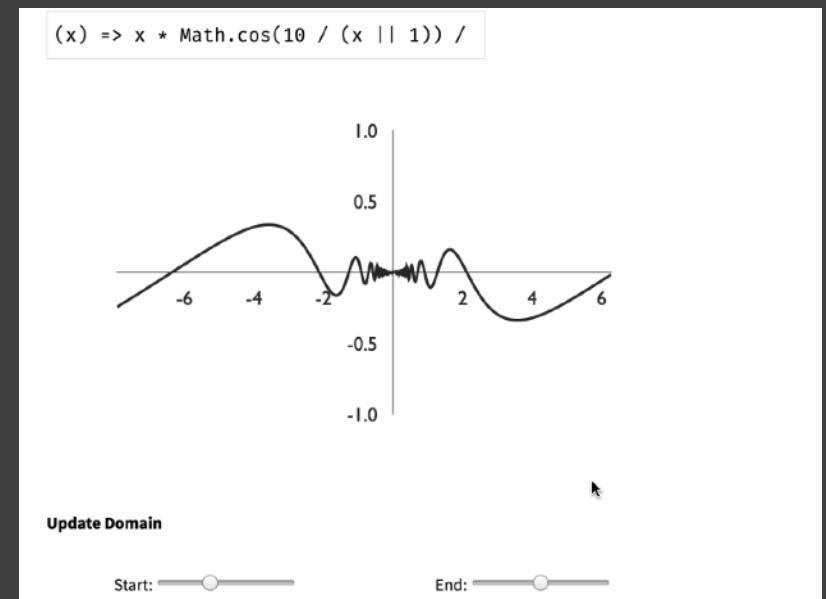
Analytics Meta Preload

Helpers

Idyll Components



28 components included



Idyll Components

28 components included

The screenshot shows a grid of input components. In the first row, there are two buttons labeled "Click Me!" and "Check". In the second row, there is a button labeled "Button" and a radio group labeled "Select" with three options: "an" and "option". In the third row, there is a range slider labeled "Range" and a select dropdown labeled "Select" with three options: "Option 1", "Option 2", and "Option 3". In the fourth row, there is a text input field labeled "Text Input" with the placeholder "Edit me!". A large, semi-transparent "Input" title is overlaid on the bottom right of this section.

The screenshot shows a grid of layout components. In the first row, there are five columns labeled "Aside", "Full Width", "Fixed", "Float", and "Inline", each with a corresponding visual representation of a container element. In the second row, there are two columns labeled "Scroller" and "Stepper", each with a corresponding visual representation of a scrollable container or a step control.

Layout



Build and Deploy

Abstracts away the need to
use complex build tools

Build and Deploy

Abstracts away the need to
use complex build tools

JavaScript best practices are
included by default
(minification, server side
rendering, bundling,
transpilation)

Build and Deploy

Abstracts away the need to
use complex build tools

JavaScript best practices are
included by default
(minification, server side
rendering, bundling,
transpilation)

```
| mathisonian in ~/projects/my-idyll-project
```

Evaluation

Is it expressive?

*Is it an improvement over raw
JS/HTML?*

*Can technical and editorial
colleagues collaborate?*

Evaluation

Iterative Design

Open-source release

Pilot Studies

Usage in the wild

Evaluation

Iterative Design

Open-source release

Pilot Studies

Usage in the wild

Based on existing workflow
model *Lee et al. 2015*

Informal interviews with 13
experts (journalism,
scientific publishing,

Evaluation

Iterative Design

Open-source release

Pilot Studies

Usage in the wild

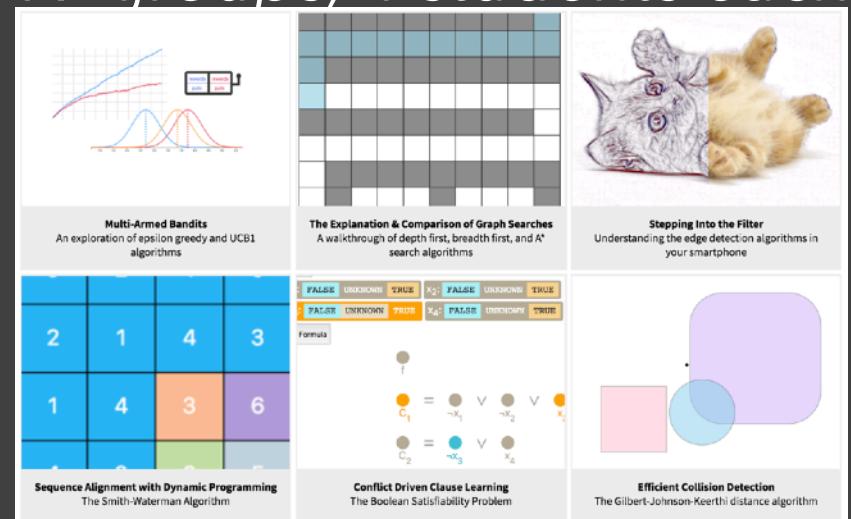
>120k page views of
documentation and
examples

>30k downloads of the
command line tool

Evaluation

Iterative Design
Open-source release
Pilot Studies
Usage in the wild

Undergraduate students
19 groups, 4 students each



Evaluation

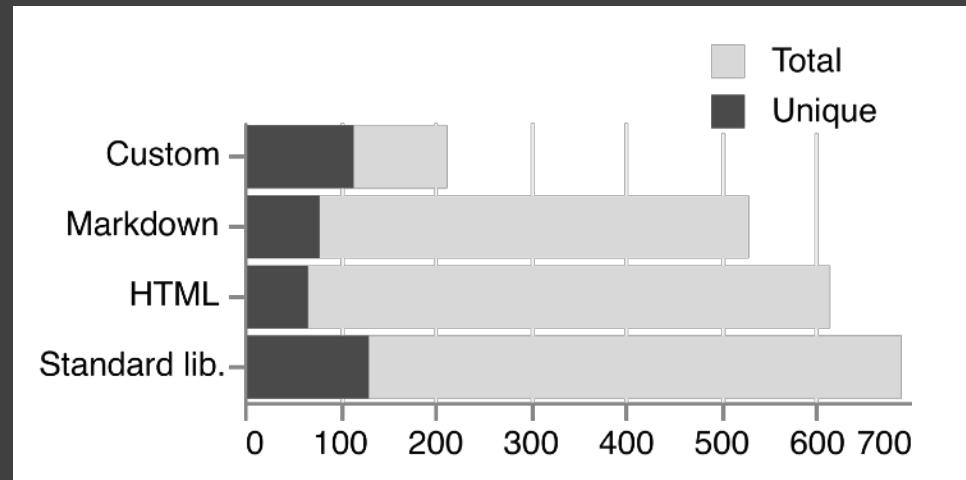
Iterative Design

Open-source release

Pilot Studies

Usage in the wild

Undergraduate students



Evaluation

Iterative Design

Open-source release

Pilot Studies

Usage in the wild

Folo Media



Evaluation

Iterative Design

Open-source release

Pilot Studies

Usage in the wild

Folo Media



Evaluation

Iterative Design

Open-source release

Pilot Studies

Usage in the wild

Used by programmers,
researchers on personal
blogs

Accepted as a submission
format at VisXAI workshop
at IEEE Vis

Evaluation

Iterative Design

Open-source release

Pilot Studies

Usage in the wild

Demand for more blog/
book oriented tooling

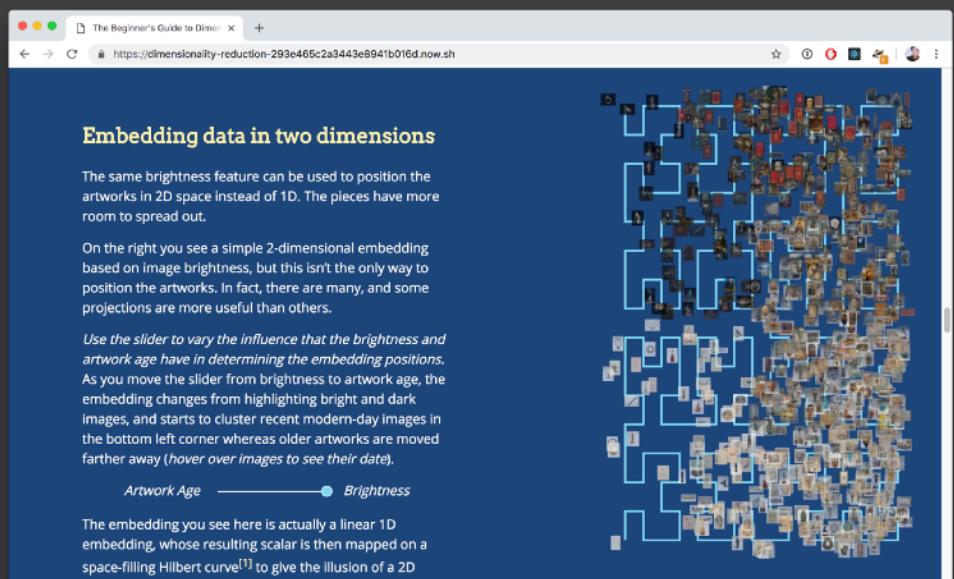
Popular with educators

Integration with tools,

Evaluating Interactive Articles

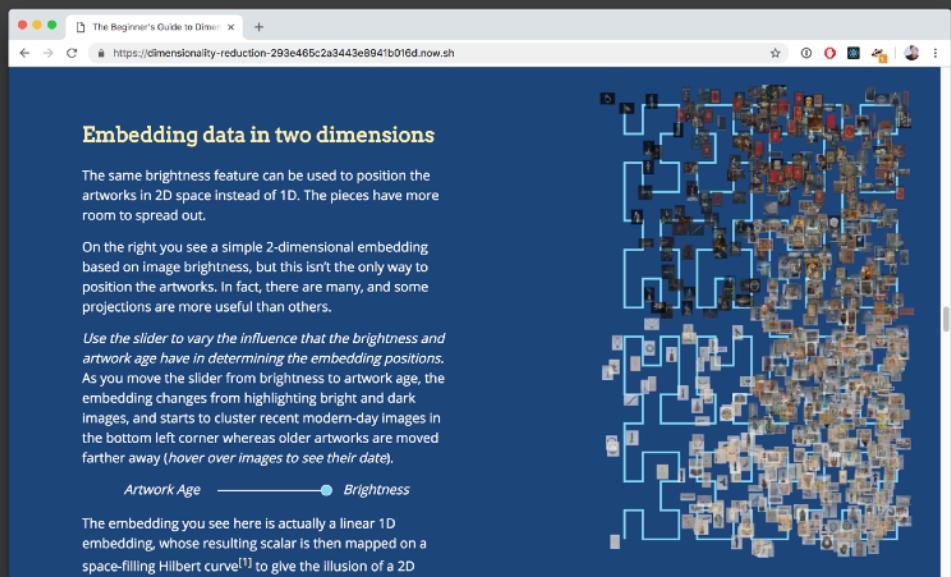
Research from education and journalism suggests interactives are effective for conveying complex topics to a wide audience.

But more data needed!

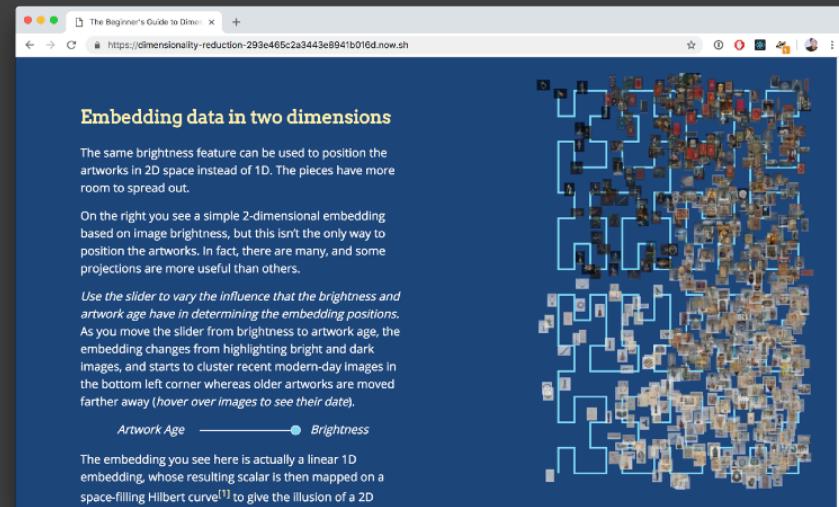
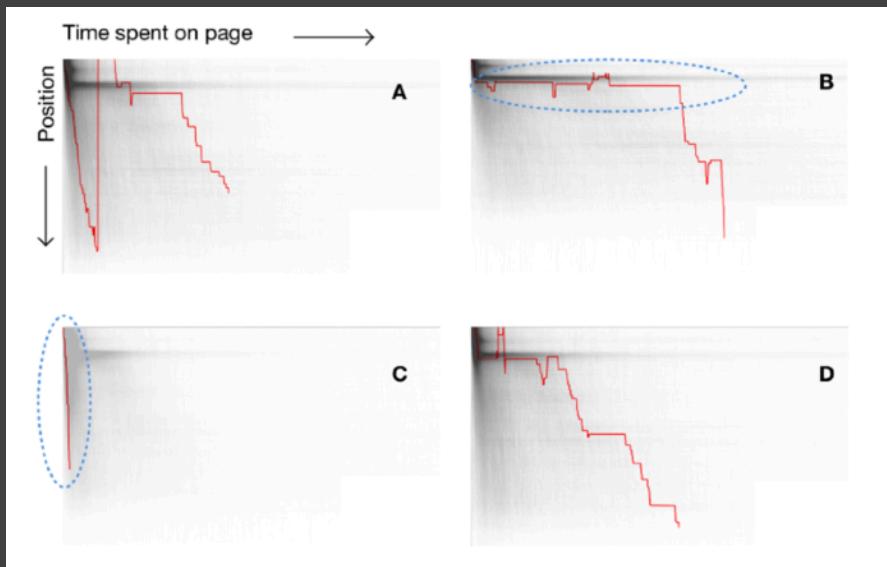


Evaluating Interactive Articles

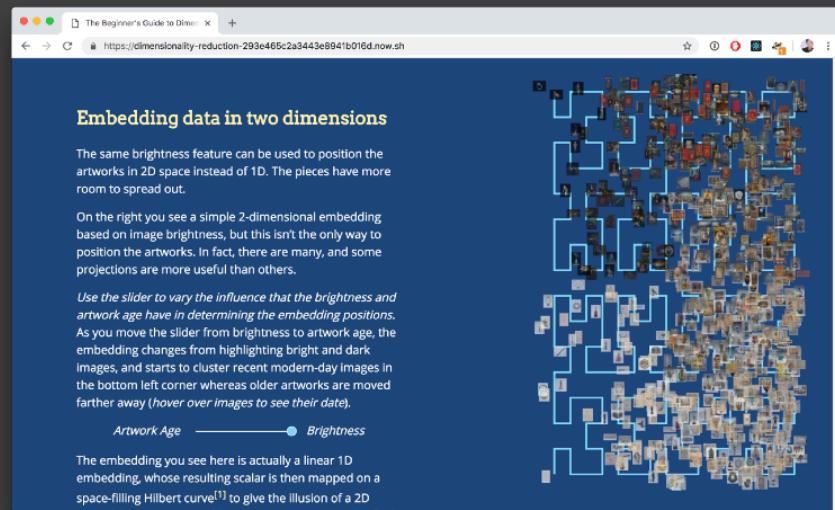
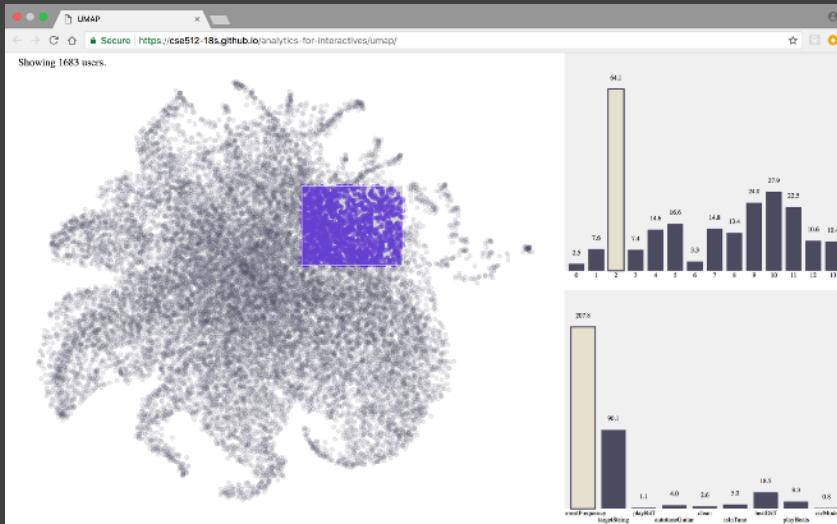
Instrumented articles
created with Idyll,
recorded >50k user
sessions



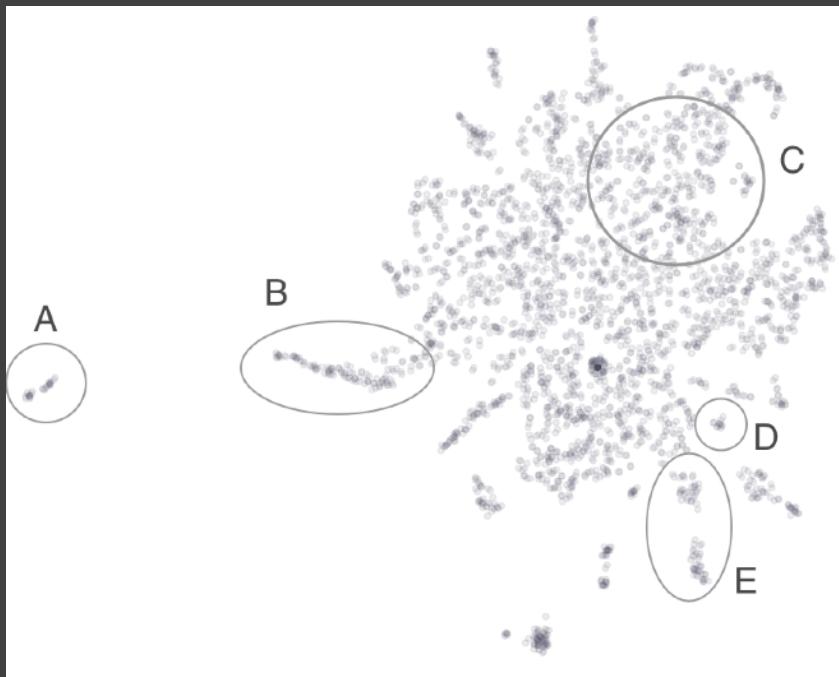
Evaluating Interactive Articles



Evaluating Interactive Articles



Evaluating Interactive Articles



The Beginner's Guide to Dimensionality Reduction

Embedding data in two dimensions

The same brightness feature can be used to position the artworks in 2D space instead of 1D. The pieces have more room to spread out.

On the right you see a simple 2-dimensional embedding based on image brightness, but this isn't the only way to position the artworks. In fact, there are many, and some projections are more useful than others.

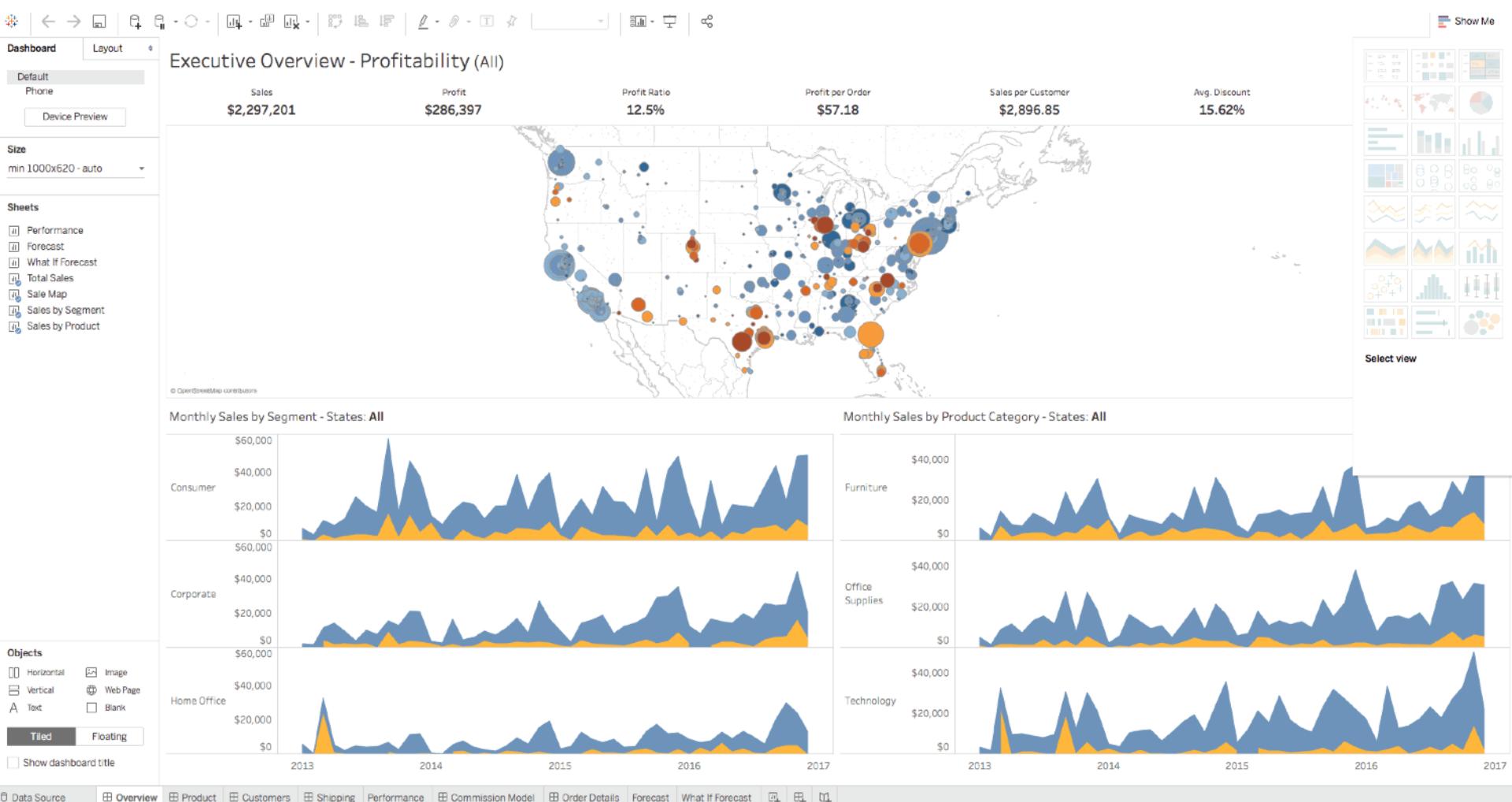
Use the slider to vary the influence that the brightness and artwork age have in determining the embedding positions. As you move the slider from brightness to artwork age, the embedding changes from highlighting bright and dark images, and starts to cluster recent modern-day images in the bottom left corner whereas older artworks are moved farther away (hover over images to see their date).

Artwork Age ————— Brightness

The embedding you see here is actually a linear 1D embedding, whose resulting scalar is then mapped on a space-filling Hilbert curve^[1] to give the illusion of a 2D

Chart Sequence Models

Multiple Charts in Data Analysis



Multiple Charts in Story Telling

Copenhagen: Emissions, Treaties and Impacts

At the Copenhagen climate conference, discussions are likely to cover emissions levels, the legacy of the Kyoto Protocol and the risks of inaction on global warming. Explore each issue in the tabs below.

Global Emissions Lessons From Kyoto Possible Impact

1 **2** 3 4 5 6 7 8 9 10 11 NEXT ►

Almost every country in the world signed and ratified the protocol. The treaty's aim was to provide a starting point for reducing global carbon dioxide emissions.

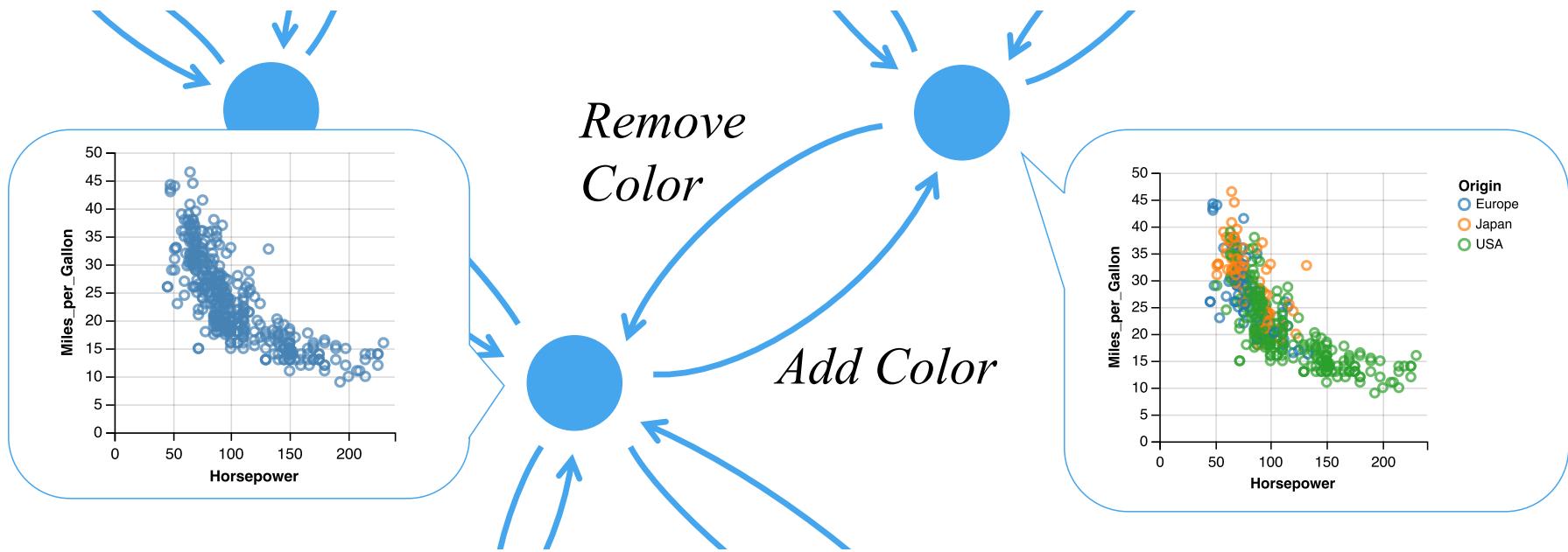
Countries that ratified Kyoto

Roll over countries to learn more

In many cases, data is conveyed via a sequence of charts.

How might we evaluate different orderings of visualizations?

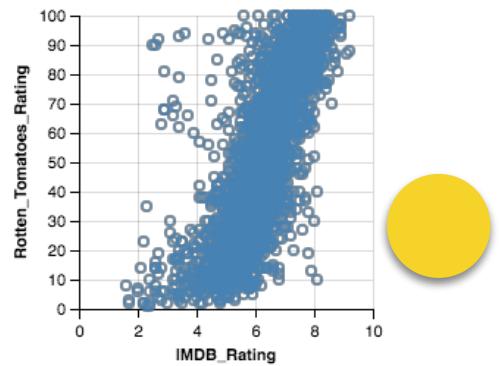
GraphScape: A Directed Graph Model



Nodes are Vega-Lite specifications. Edges represent edit operations, weighted by estimated transition costs.

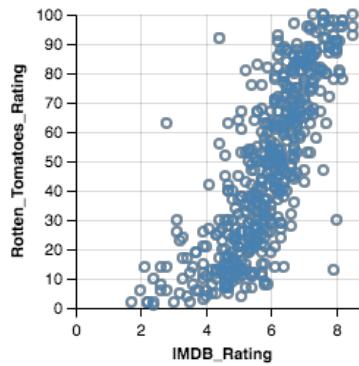
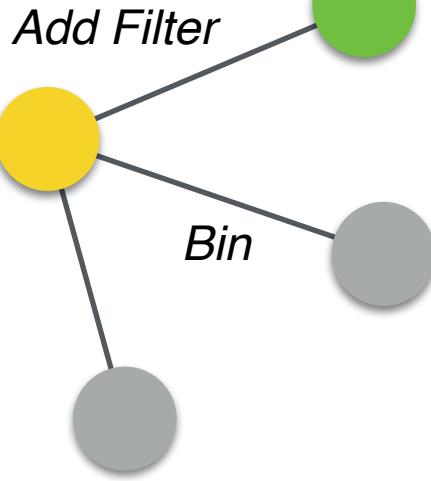
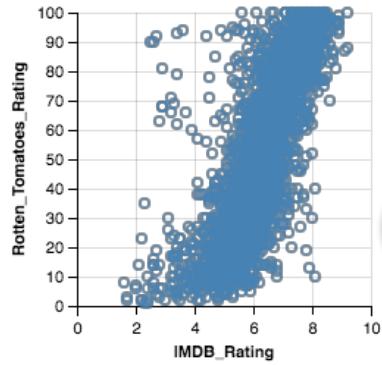
Design Alternatives

“Too many data points !”



Design Alternatives

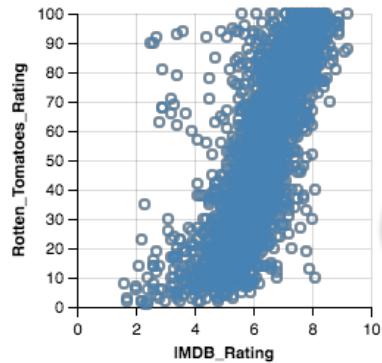
"Too many data points!"



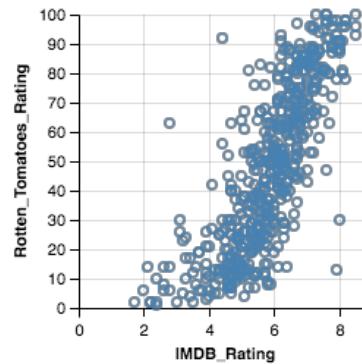
*Random
Sample*

Design Alternatives

"Too many data points!"



Add Filter

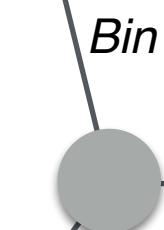


*Random
Sample*

Bin

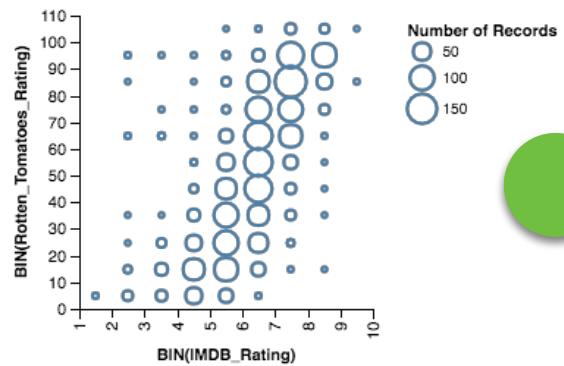


Bin



Bin

Binned Scatter Plot

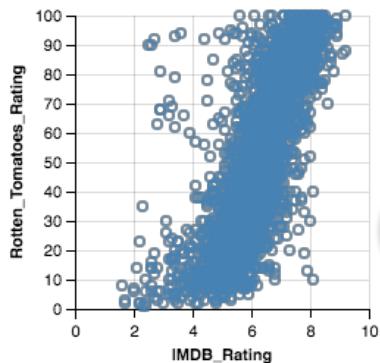


Add Size(count)

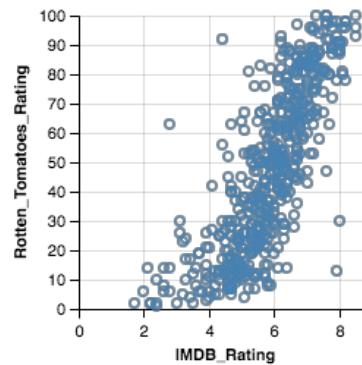


Design Alternatives

"Too many data points!"



Add Filter

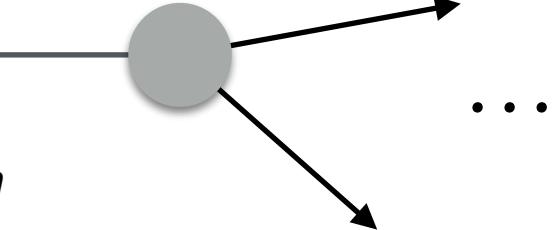


Random Sample

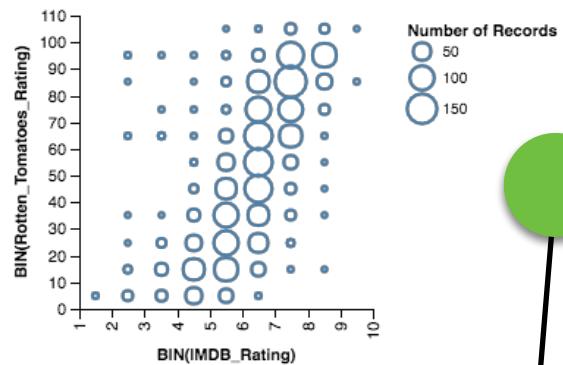
Bin



Bin



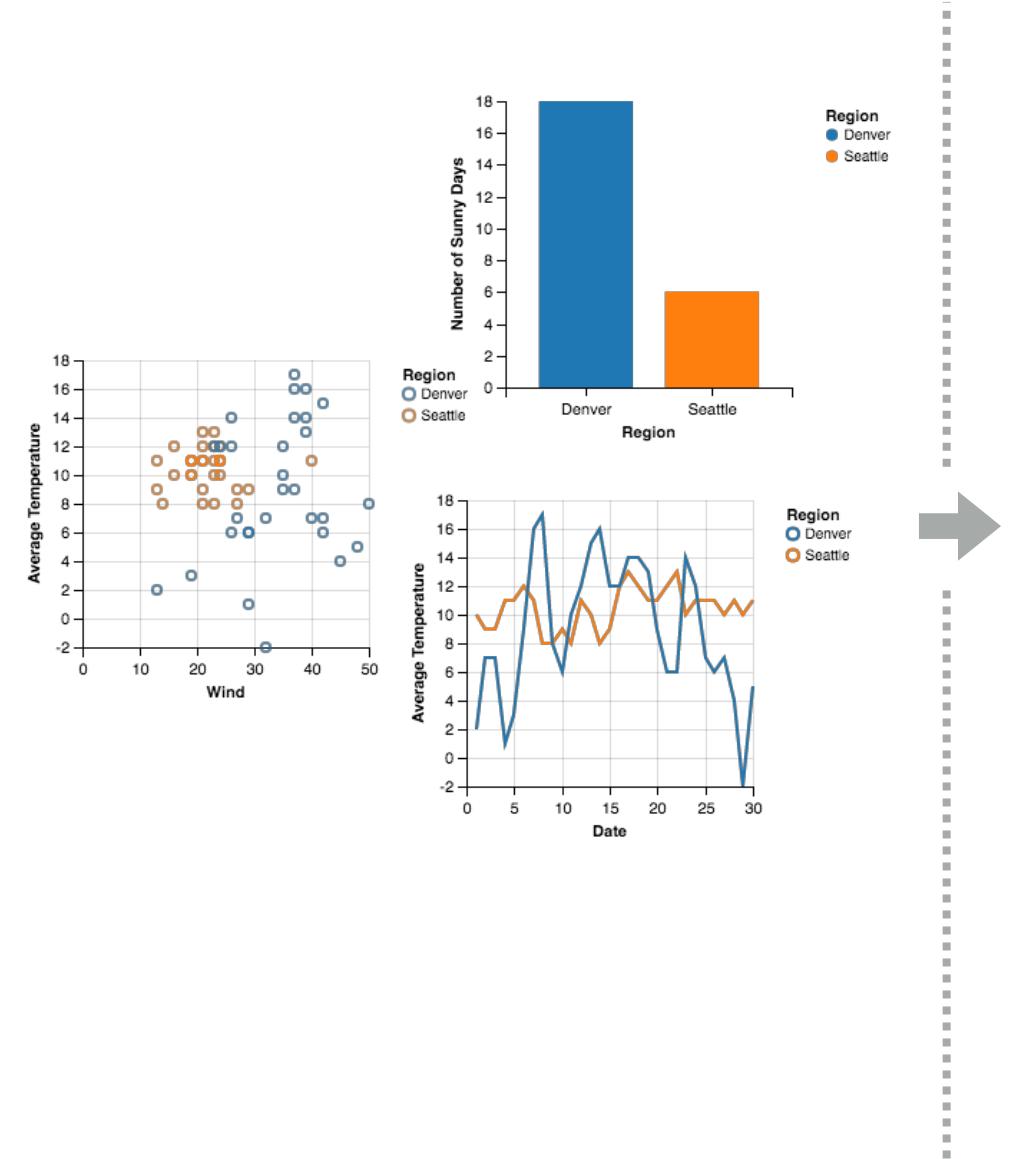
Binned Scatter Plot



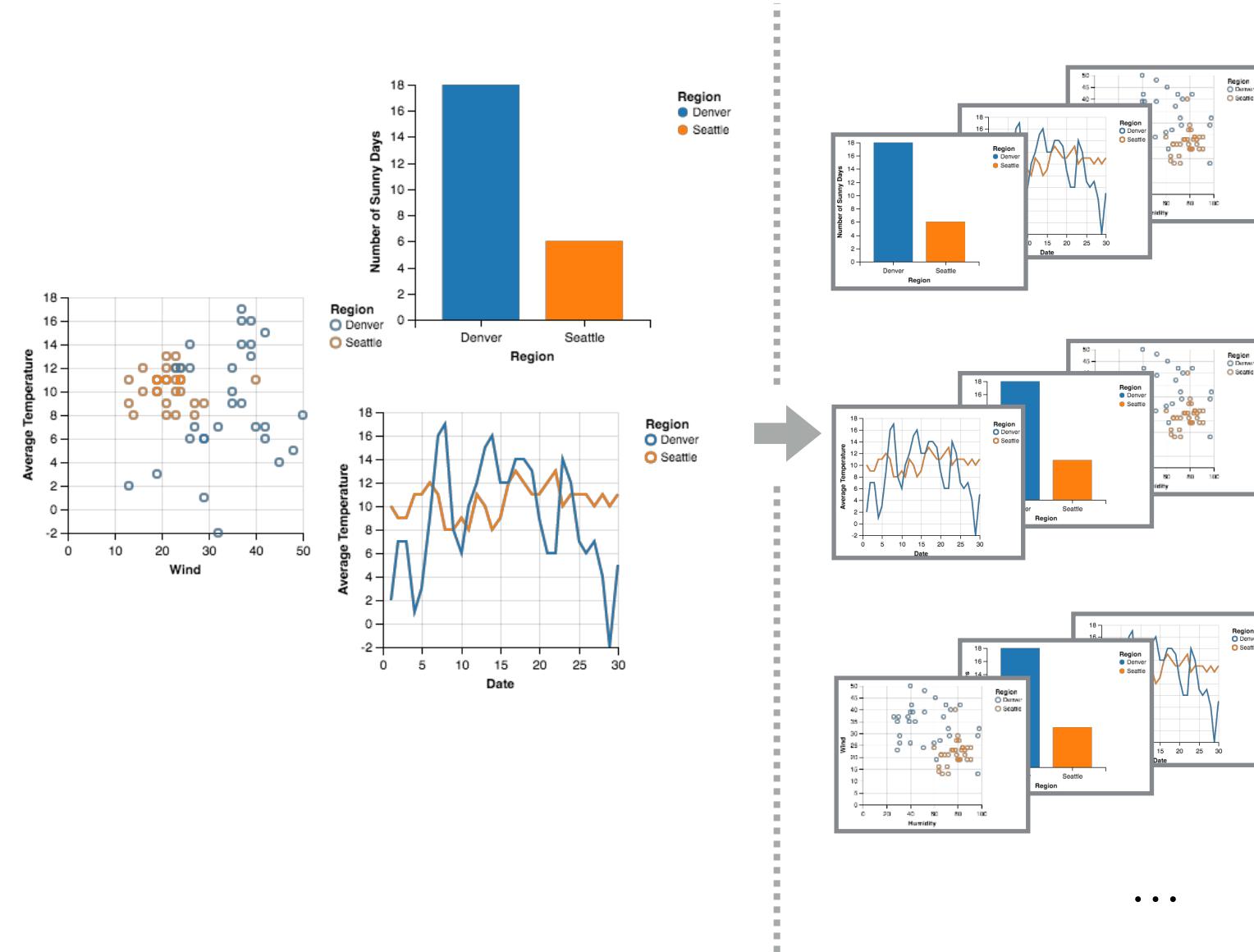
Add Size(count)



Sequence Recommendation



Sequence Recommendation



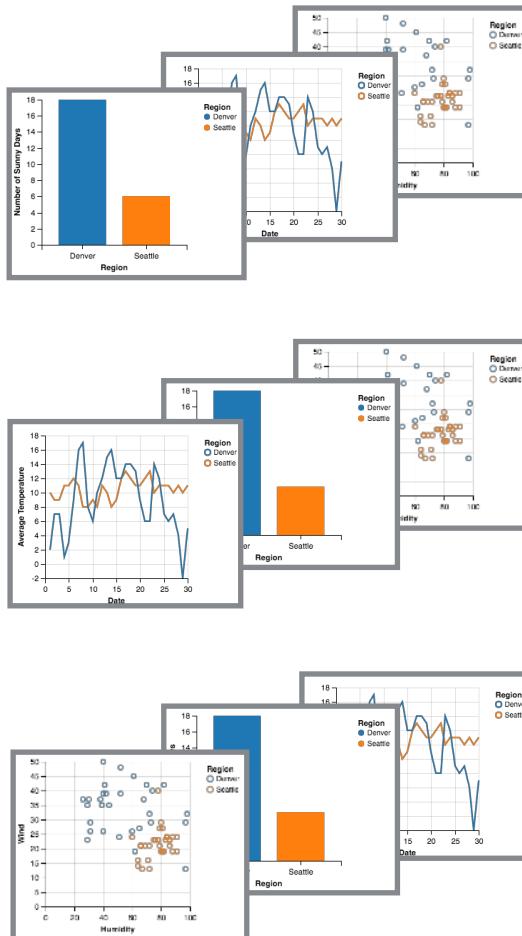
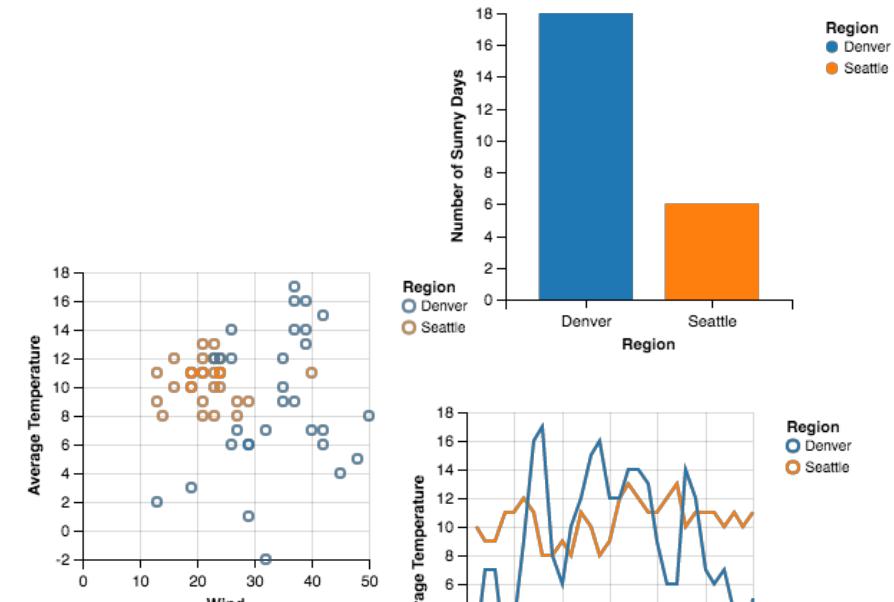
Sequence Recommendation

Sequence
Cost

: 10

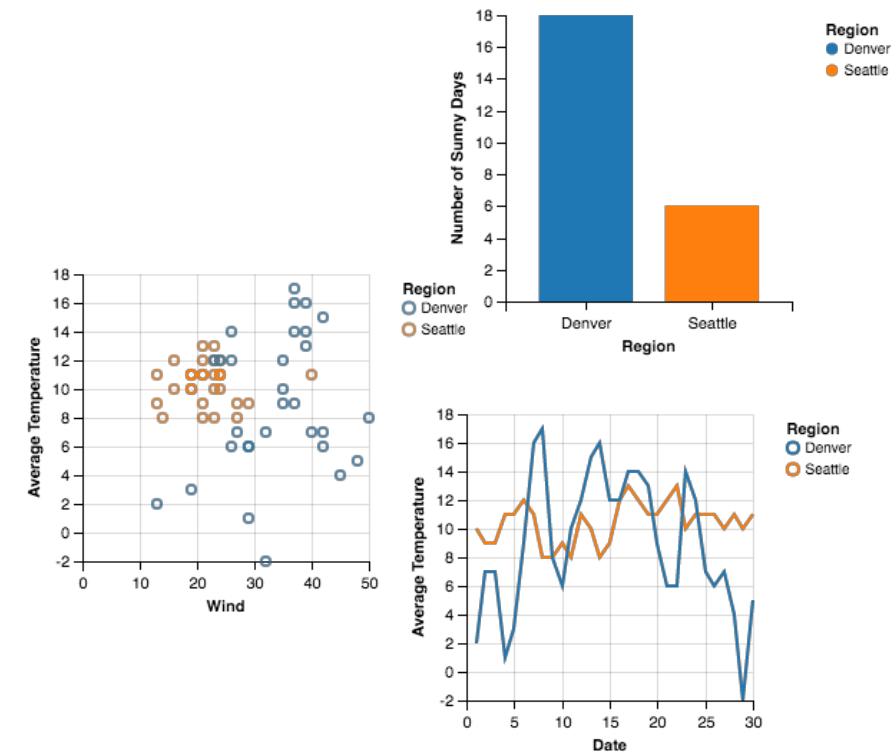
: 12

: 13



...

Sequence Recommendation



...

Sequence
Cost

: 10

: 12

: 13

GraphScape

Previously we've discussed approaches for automatic design of a **single visualization**.

GraphScape supports automated design methods for **collections of visualizations**.

Plenty of future work to do here!