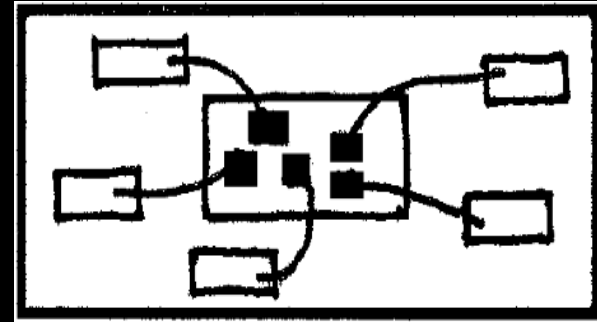
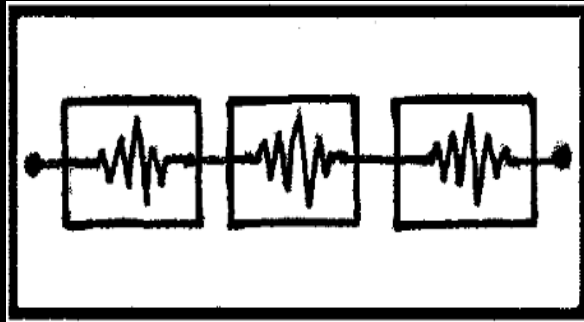
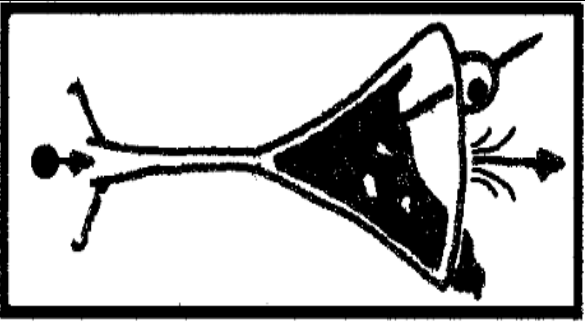


CSE 442 - Data Visualization

Narrative Visualization



Matthew Conlen University of Washington

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

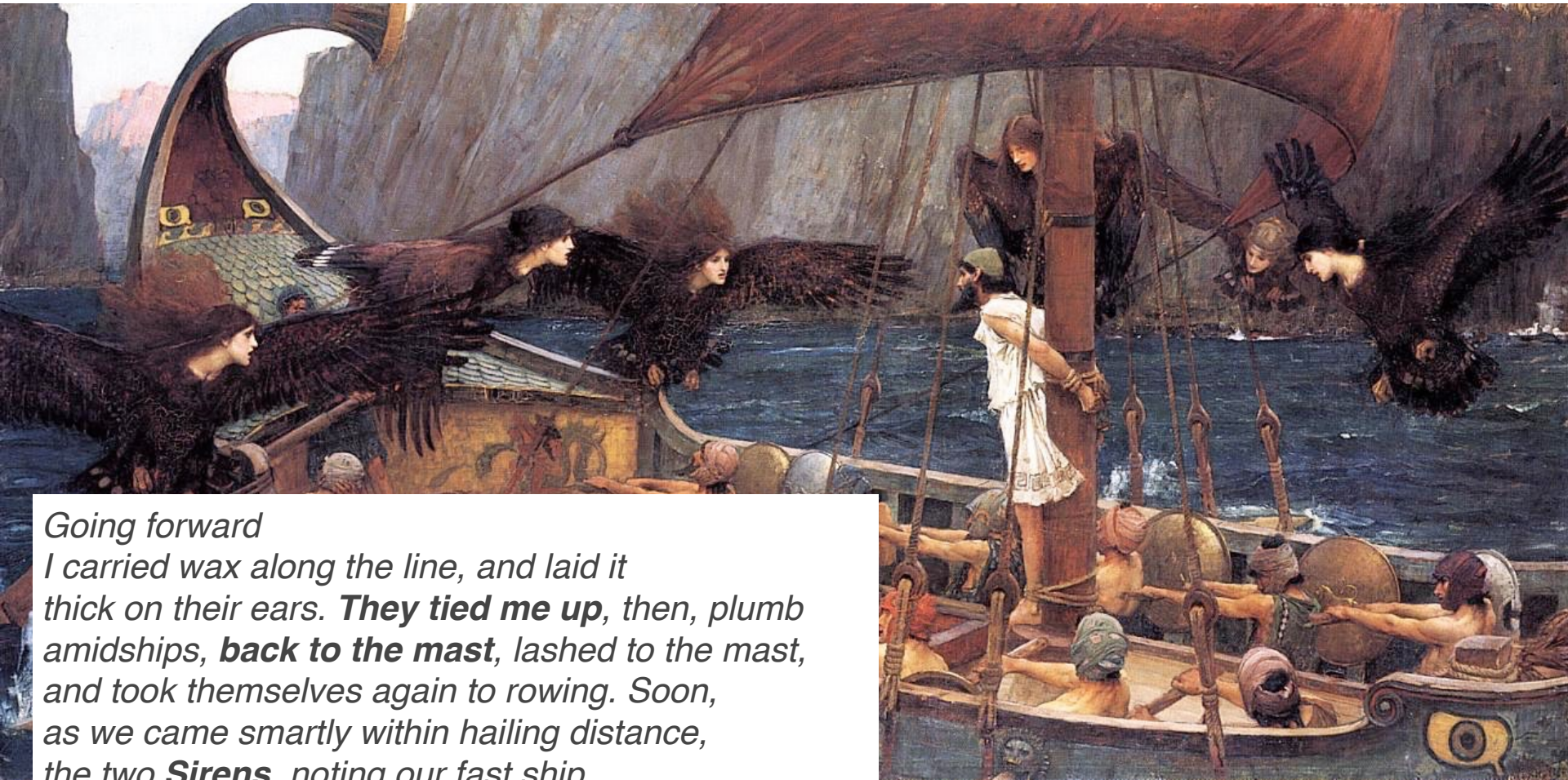
STORYTELLING

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

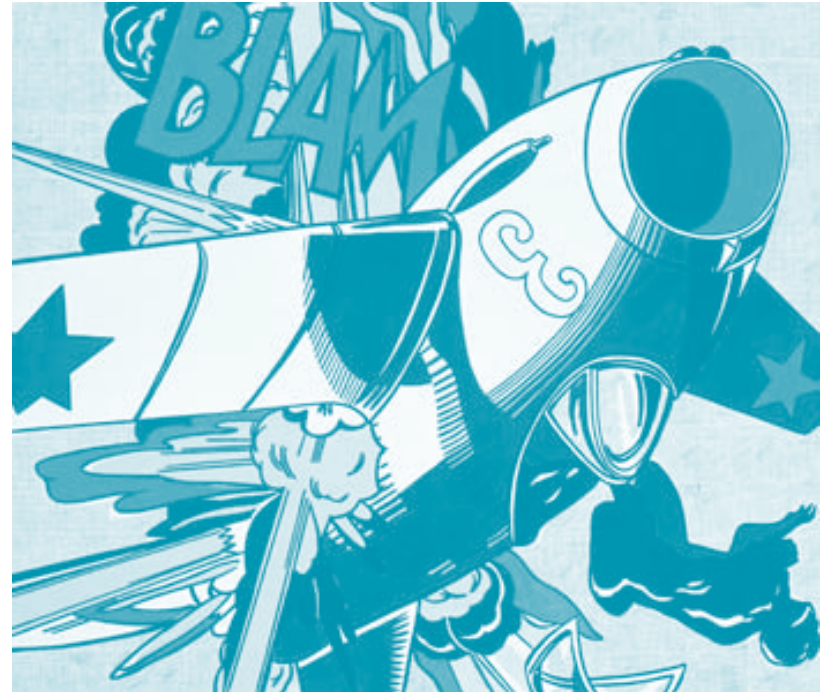
PEOPLE TELL STORIES

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

August 26, 2010

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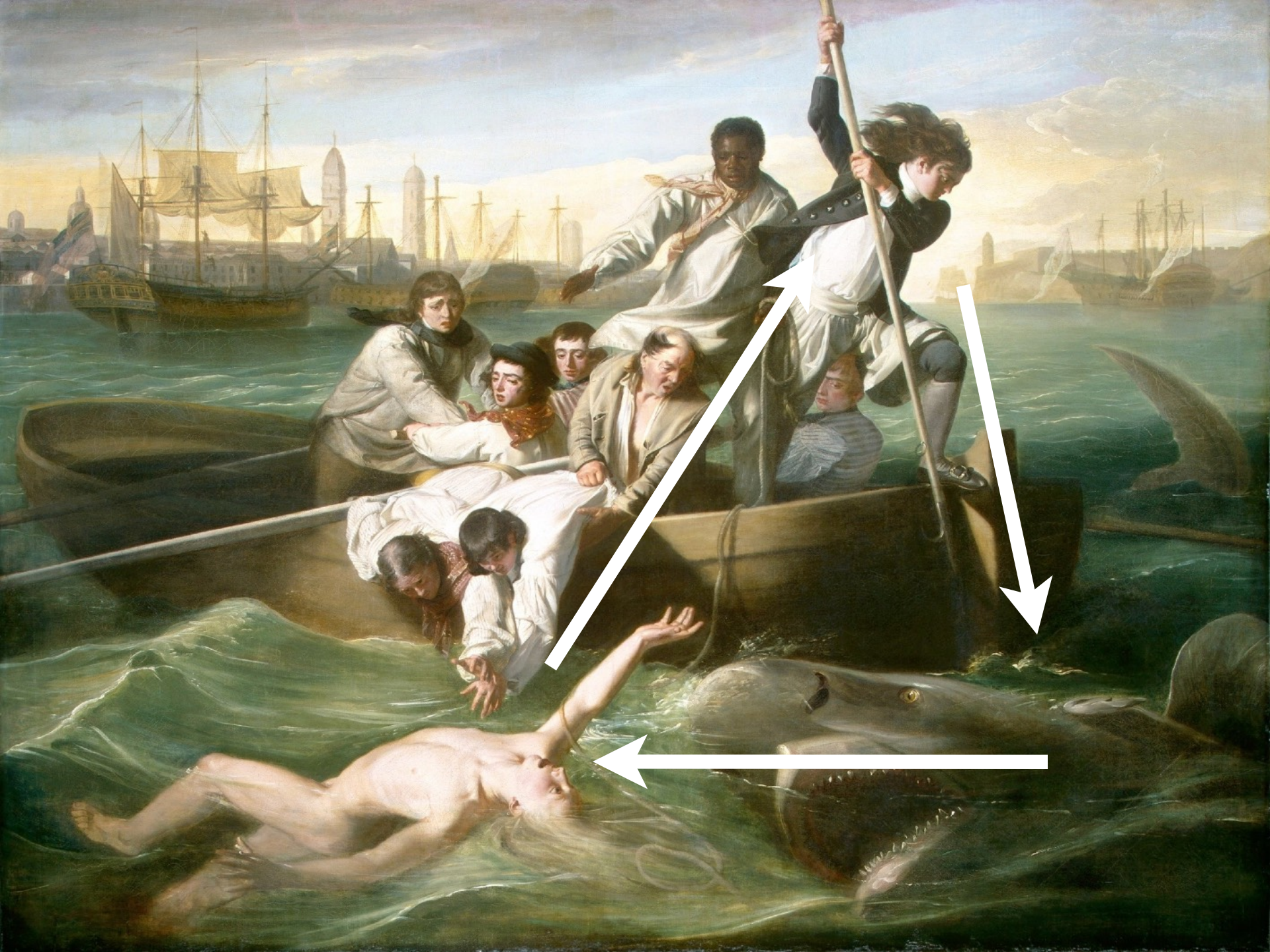
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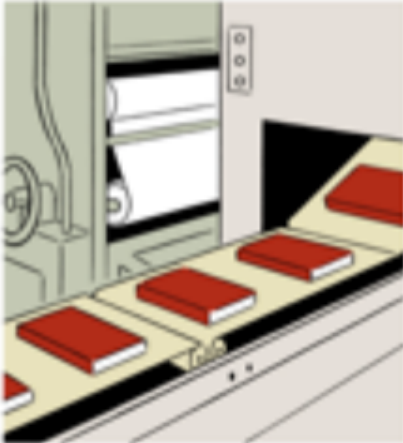
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Nut Graph

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Topics

Narrative visualization design

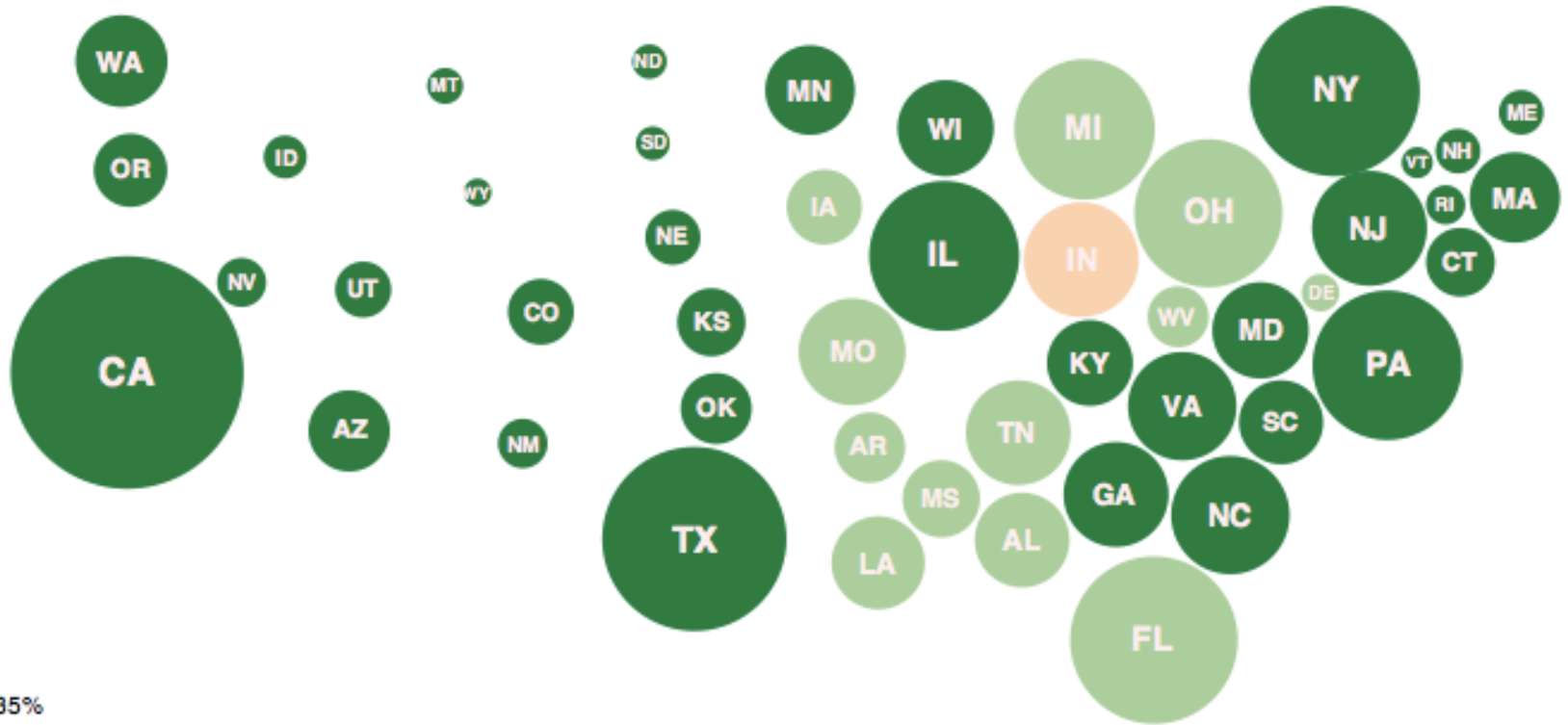
Navigation in interactive documents

Tools for creating interactive documents

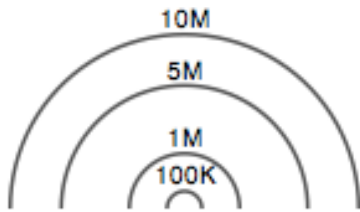
Evaluating Interactive documents

Chart sequence models

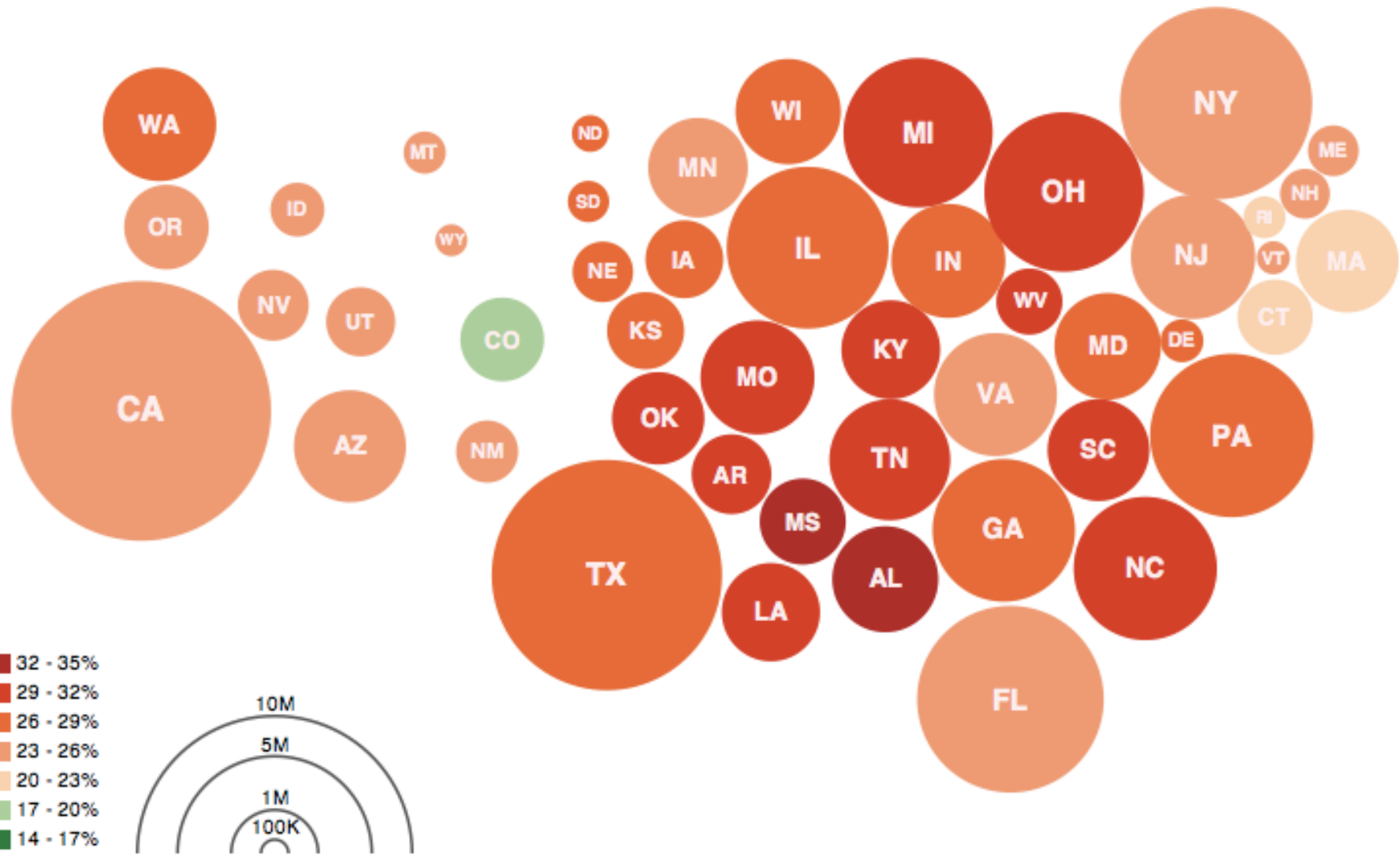
**Storytelling
... with data?**



- 32 - 35%
- 29 - 32%
- 26 - 29%
- 23 - 26%
- 20 - 23%
- 17 - 20%
- 14 - 17%



Obesity Map Vadim Ogievetsky



Obesity Map Vadim Ogievetsky



Privacy and the internet

Lives of others

BY JAMES HAMILTON

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

JOHANNE STOCOMME, Canada's privacy commissioner, interviews with Facebook in August over the social networking site's track record, agreeing to change its policies within a year to comply with the country's privacy law, says Alex Stedman, the company's attorney. It is being set as an important part of the deal, which included giving users a clear and easy-to-understand choice over whether to permit data with third parties. "It doesn't seem to me that Facebook is going to be right to opt out of this issue," she says, noting 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 provoke the ire of data watchdogs. Google endured scathing criticism this week following news that it had accessed some personal communication sent over unsecured Wi-Fi data networks in homes and offices in some 30 countries. On May 11th 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

ty moguls such as Cory Doctorow, a science-fiction author, and Iain Stewart, a politician, have abandoned Facebook. Sites such as Quia/Facebook Dismantle are urging others to do so, announcing May 20th as a mass Facebook "boycott".

There is a likelihood of top the membership of Facebook, which is poised to claim half a billion members and which draws even more visitors as a whole to its site (see chart). Criticisms have been raised at the company's headquarters in Menlo Park, where bosses are reading over how to respond. Several online folk are now linking that Facebook will soon roll out stricter privacy controls to make it easier to keep more data hidden. MySpace, a rival, is already making its controls stricter in an effort to woo disaffected Facebookers to its service.

A revolt 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 frustrated privacy activists lobbied hard to be reversed.

The switch should not have come as a surprise, truly or, many social networks

Also in this section

- 68 Spring companies
- 80 The recovery of General Motors
- 86 Business crime in China
- 70 Italian retail
- 70 Japan's drug firms are the model
- 74 Brazil's tabacaria
- 74 Schumpeter: Duernmattel

See July 2011's special section on business, and economist.com/business-features

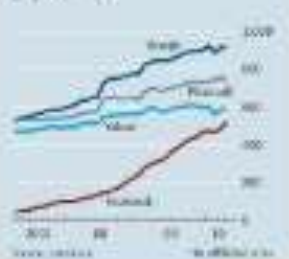
respond to tough privacy policies in order to attract and increase users. But as more joint controls are gradually loosened to encourage more sharing, as people share more, Facebook can increase the traffic against which it sells advertising. And the more it learns about users' likes and dislikes, the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

Privacy groups have been following a developers' conference last month at which Mark Zuckerberg, Facebook's boss, announced yet another series of policy changes. One that raised irritation was an "opt-out personalisation" feature that lets users 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 similar rival, LinkedIn, is so much.

Some of the risks are growing about Facebook too. This month a group of data-protection experts who advise the European Commission wrote to the social network, calling it to take on to reduce the default settings "as appropriate". And in the

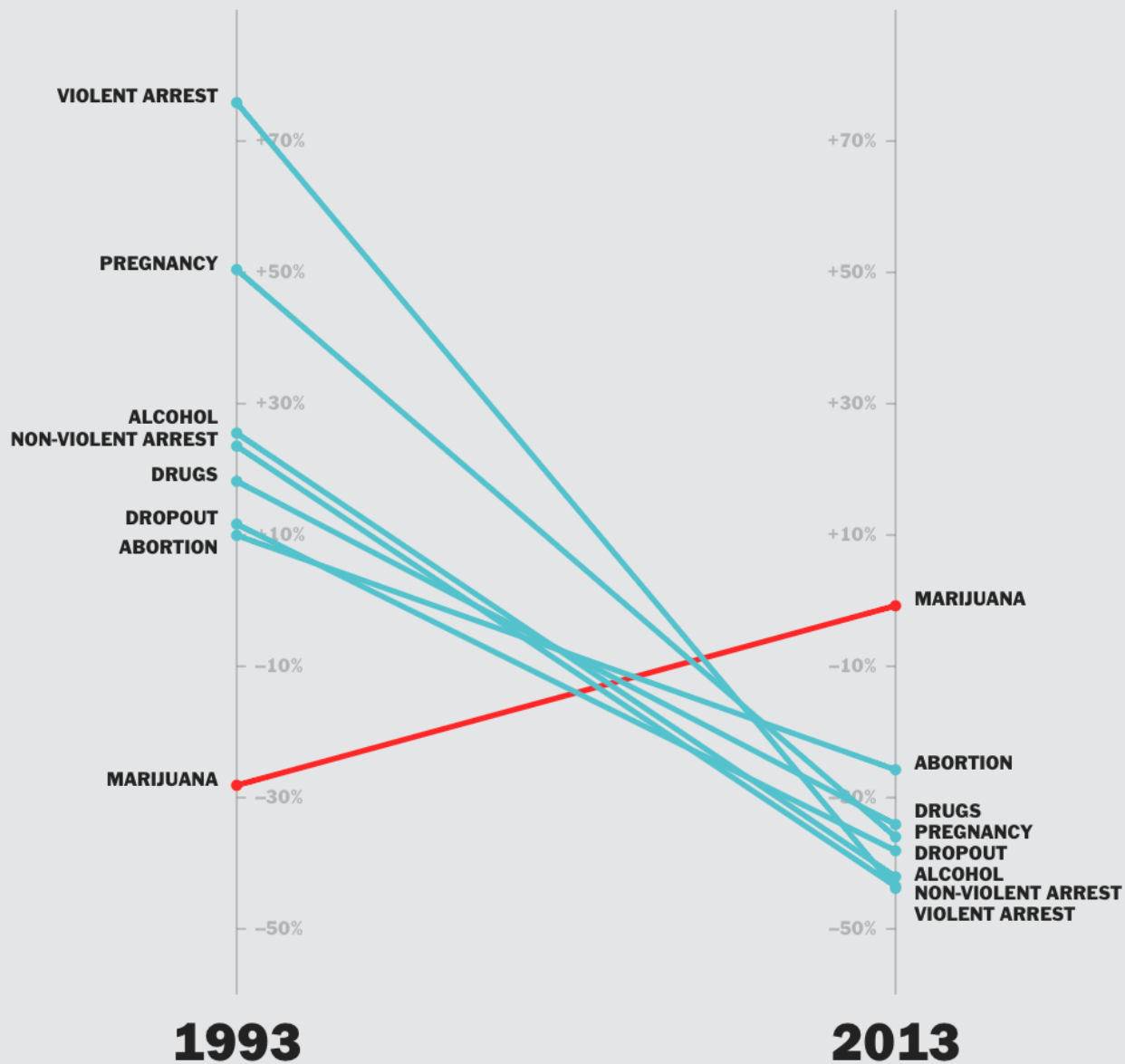
Net living large

By James Hamilton



SHENANIGANS

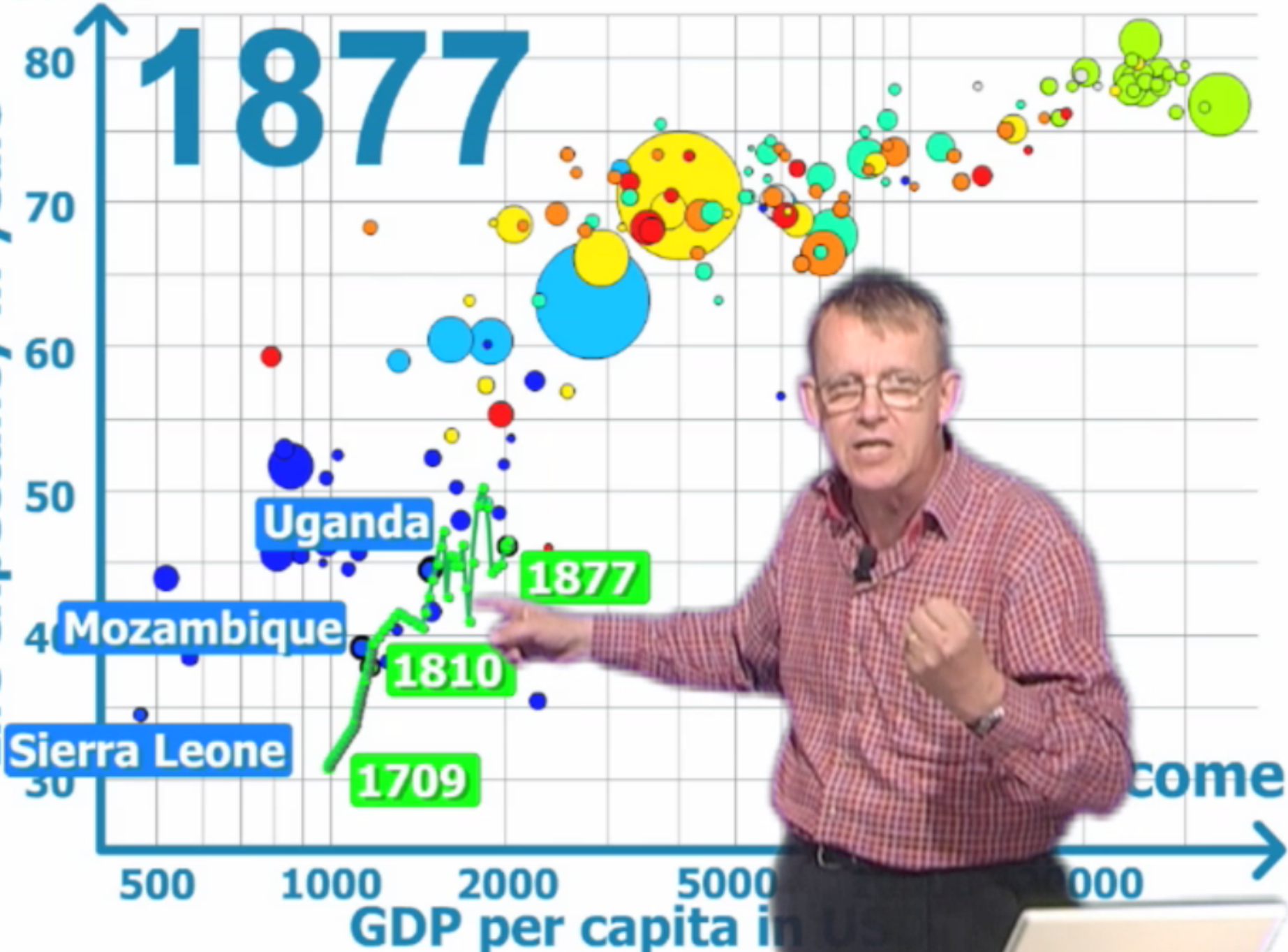
Change in teen shenanigans from 1993 to 2013.
Showing % difference from 2003 levels.



Health

Life expectancy in years

1877



Mozambique

Uganda

Sierra Leone

1810

1877

1709

Income

500 1000 2000 5000 10000

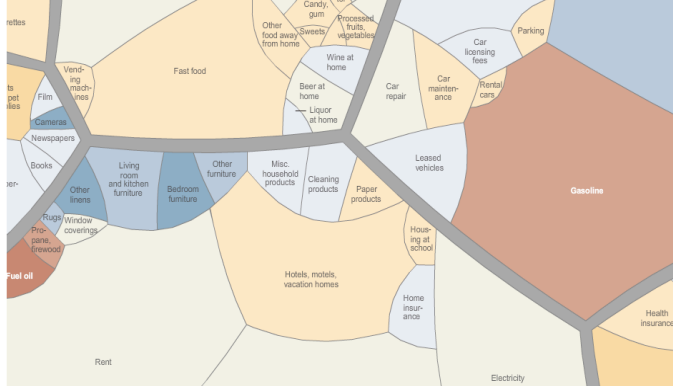
GDP per capita in US\$

Narrative Devices for Storytelling with Data

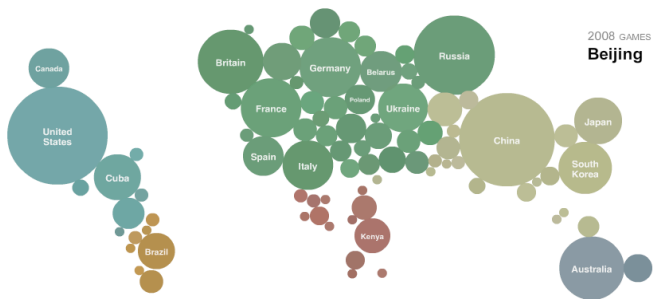
What devices communicate effectively?

... for which contexts and audiences?

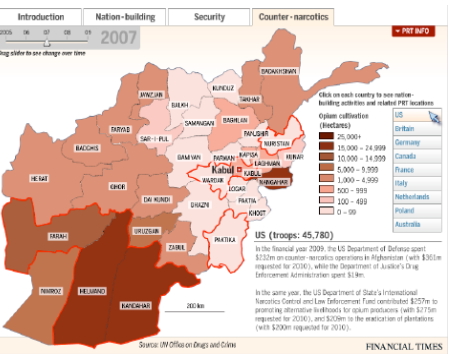
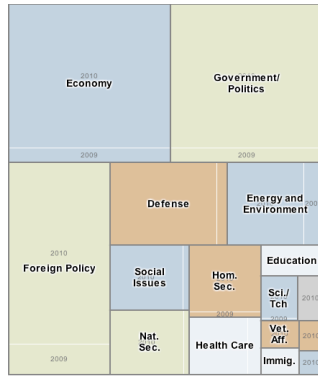
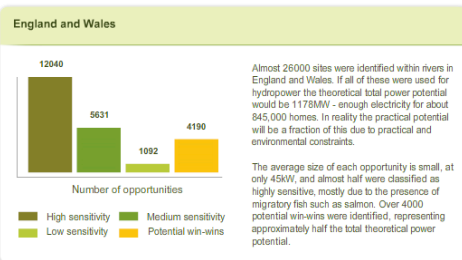
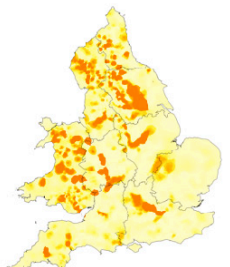
Narrative Visualization Design Space



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



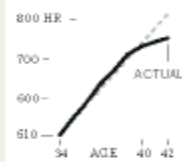
Bonds takes lead
Home runs
after 16 seasons
Bonds 567
Aaron 554
Ruth 516

755
23 seasons
714
22 seasons
600
20 seasons
Bonds was injured last season. He played 14 games and hit 5 homers.

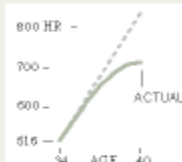
Homer Pace After Age 34

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

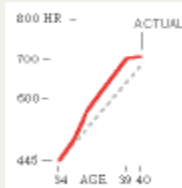
Aaron
Actual homers slightly outpace projected homers for five seasons.



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



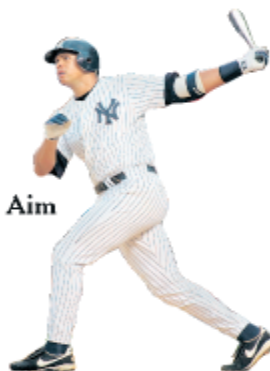
Bonds
From age 35 to 39, he averaged 14 more homers a season than projected.



Note: Ages as of July 1 of each season.

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

Others Taking Aim



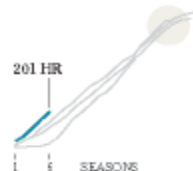
Alex Rodriguez

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



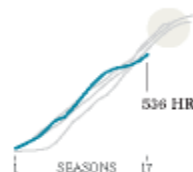
Albert Pujols

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



Ken Griffey Jr.

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



Differing Paths to the Top of the Charts

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



755

Grab attention with image and position



Hank Aaron
755 homers
23 seasons



Babe Ruth
714 homers
22 seasons



Barry Bonds
708 homers
20 seasons

Matching on content

Reduced visual priority

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Suit Is On

He needs on.

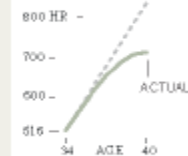
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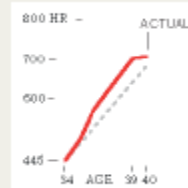
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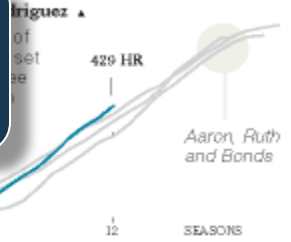


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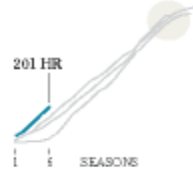


Note: Ages as of July 1 of each season.

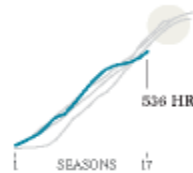
Others Taking Aim



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

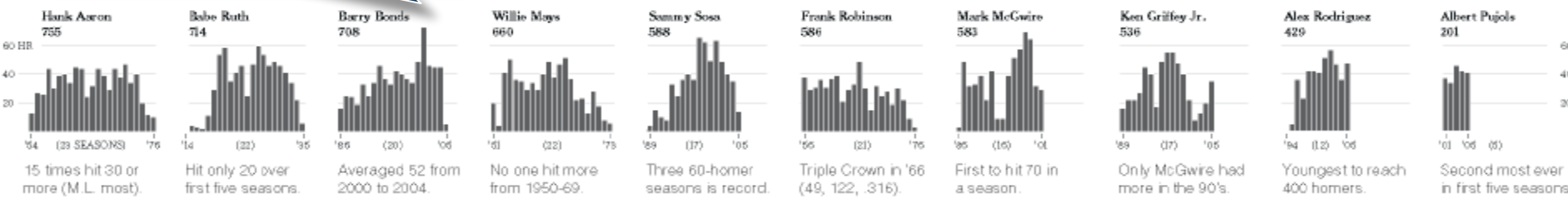


Ken Griffey Jr.
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Differing Paths to the Top of the List

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



Beginning

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755 homers
23 seasons



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714 homers
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Barry Bonds
708 homers
20 seasons

Bonds takes lead
Home runs after 16 seasons
Bonds 567
Aaron 554
Ruth 511

14th season

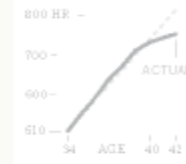
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Homer Pace After Age 34

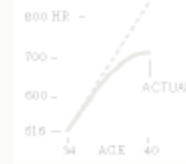
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----- PROJECTED PACE BASED ON AVERAGE OF PREVIOUS FIVE SEASONS

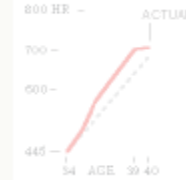
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Bonds
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Middle

Others Taking Aim



Alex Rodriguez

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Ken Griffey Jr.

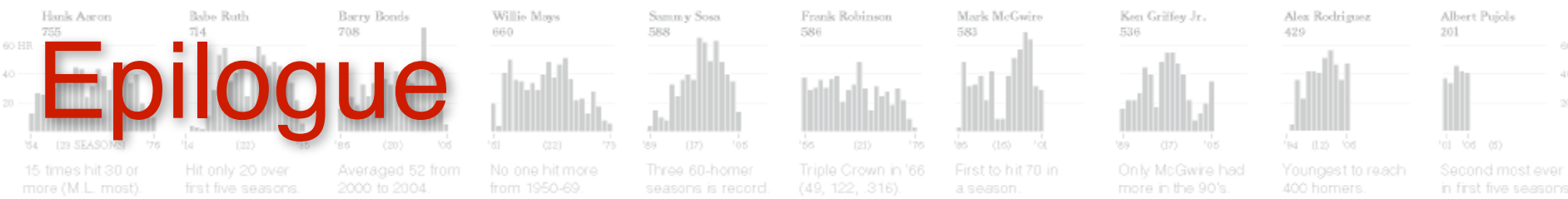
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End

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).



Epilogue

Budget 2010: reaction from around the UK

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

by **Simon Ridley** and **Carly Lewis**
Wednesday 24 March 2010 15:00 GMT

Introductory Text

Consistent Visual Platform

Smith and Fulham



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.

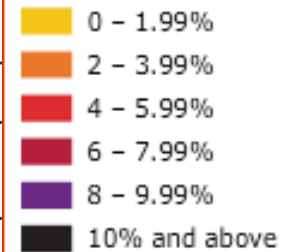
Constituency profile

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

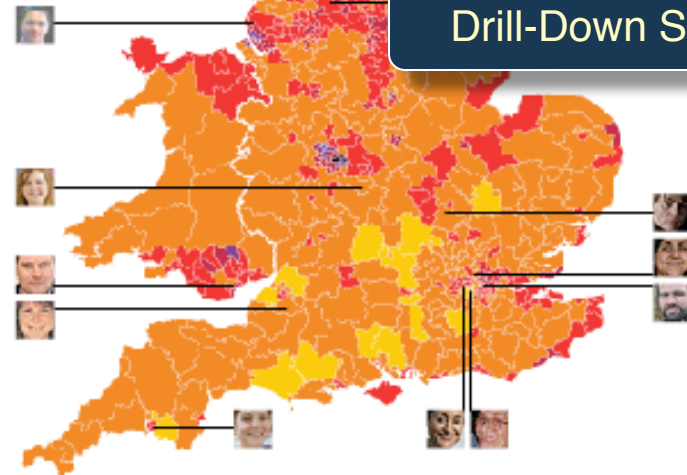
Anecdotal Stories with Data Stories

Key

Unemployment benefit claimant count, February 2010



Drill-Down Story





Gun Deaths In America

By Ben Casselman, Matthew Conlen and
Reuben Fischer-Baum

CLICK to advance



1

2

3

4

5

6

7

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10

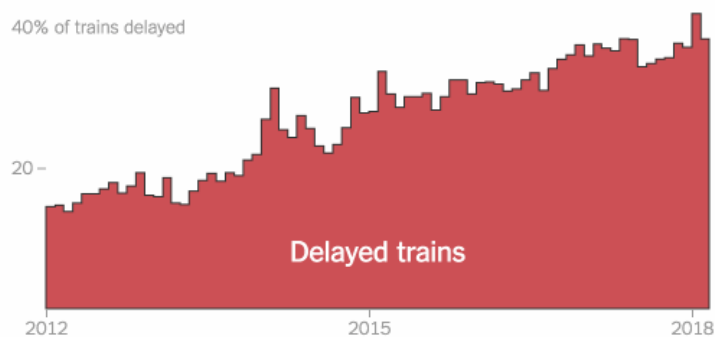
11

12

Explore the data for yourself »

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

Visualization Description

Architecture and Justice (Brooklyn Crime Blocks)
John Snow's chart of deaths from cholera
Politicians abuse their free-mailing privileges before elections
Football (soccer) drawings
Pedestrians crossing the street
The Climate Agenda
When Did Your County's Jobs Disappear?
Academics House Price Index
Banks' earnings: How compensation relates to performance
Deadly offensive: Taliban attacks in Pakistan
GDP Moves by Sector
UK economic data
Budget 2010: Reaction from around the UK
Formula One 2010: driver's rankings
Lighting up Hadrian's wall
Mapping hydropower hotspots across the UK
Moscow metro bombs: interactive map
The world economy turns the corner
A Map of Olympic Medals
All of Inflation's Little Parts
Barry Bonds visualization (interactive)
The Ebb and Flow of Movies: Box Office Receipts 1986 — 2008
The Jobless Rate for People Like You
Advertisement: Bus
Advertisement: Helicopter
Analyzing Obama's schedule
Oscars 2010: the best picture nominees
The consumer and retail price indices since 2006
UK Voting Intentions
Barry Bonds Visualizaiton (Static Image)
Comparison of Bear Markets
How Americans Spend Their Day
Michelle Obama's Family Tree
Netflix Rentals
Vancouver's Olympic Venue
On the Map: Five Major North Korean Prison Camps
A Visual Guide to the Financial Crisis
Economic Meltdown of 2008-2009
Where Did All the Money Go?
Life cycle of a beetle through a year
McCloud's "Making Comics"
How the Government Dealt with Past Recessions
Afghanistan: Behind the front line
Toyota timeline: a company history
Gapminder Human Development
Earthquakes: why they happen
Iran's nuclear programme
Shaun White's Double McTwist
Toyota's stick accelerator problem
Alpine Skiing, From Technical Turns to Tucks and Speed
Budget Forecasts vs. Reality
Mac Orientation Video
Delta Airplane Safety Video
"The Story of Stuff"
Virgin America Airplane Safety Video

Magazine Style
Annotated Graph / Map
Science Fair Poster
Flow Chart
Comic Strip
Slide Show
Film / Video / Animation

Establishing Shot / Splash Screen
Consistent Visual Platform
Progress Bar / Timerbar
"Checklist" Progress Tracker
Close-Ups
Feature Distinction (focus, color, detail, outline)
Character Direction
Motion
Audio
Zooming
Familiar Objects (but still cuts)
Viewing Angle
Viewer (Camera) Motion
Continuity Editing
Object Continuity
Animated Transitions

Random Access
User Directed Path
Linear
Hover Highlighting / Details
Filtering/Selection/Search/Breakdown/Timerbar
Navigation Buttons
Very Limited Interactivity
Explicit Instruction
Tact Tutorial
Stimulating Default Views
Captions / Headlines
Annotations
Accompanying Article
Multi-Messaging
Comment Repetition
Introductory Text (more than a sentence)
Summary/Synthesis

Observed Narrative Devices

Visualization Description

- Architecture and Justice (Brooklyn Crime Blocks)
- John Snow's chart of deaths from cholera
- Politicians abuse their free-mailing privileges before elections
- Football (soccer) drawings
- Pedestrians crossing the street
- The Climate Agenda
- When Did Your County's Jobs Disappear?
- Academics House Price Index
- Banks' earnings: How compensation relates to performance
- Deadly offensive: Taliban attacks in Pakistan
- GDP Moves by Sector
- UK economic data
- Budget 2010: Reaction from around the UK
- Formula One 2010: driver's rankings
- Lighting up Hadrian's wall
- Mapping hydropower hotspots across the UK
- Moscow metro bombs: interactive map
- The world economy turns the corner
- A Map of Olympic Medals
- All of Inflation's Little Parts
- Barry Bonds visualization (interactive)
- The Ebb and Flow of Movies: Box Office Receipts 1986 — 2008
- The Jobless Rate for People Like You
- Advertisement: Bus
- Advertisement: Helicopter
- Analyzing Obama's schedule
- Oscars 2010: the best picture nominees
- The consumer and retail price indices since 2006
- UK Voting Intentions
- Barry Bonds Visualizaiton (Static Image)
- Comparison of Bear Markets
- How Americans Spend Their Day
- Michelle Obama's Family Tree
- Netflix Rentals
- Vancouver's Olympic Venue
- On the Map: Five Major North Korean Prison Camps
- A Visual Guide to the Financial Crisis
- Economic Meltdown of 2008-2009
- Where Did All the Money Go?
- Life cycle of a beetle through a year
- McCloud's "Making Comics"
- How the Government Dealt with Past Recessions
- Afghanistan: Behind the front line
- Toyota timeline: a company history
- Gapminder Human Development
- Earthquakes: why they happen
- Iran's nuclear programme
- Shaun White's Double McTwist
- Toyota's stick accelerator problem
- Alpine Skiing, From Technical Turns to Tucks and Speed
- Budget Forecasts vs. Reality
- Mac Orientation Video
- Delta Airplane Safety Video
- "The Story of Stuff"
- Virgin America Airplane Safety Video

Visualization Description	Magazine Style	Visual Structure	Highlighting	Transition Guidance	Ordering	Interactivity	Messaging
Architecture and Justice (Brooklyn Crime Blocks)	+	+	+				+
John Snow's chart of deaths from cholera	+						+
Politicians abuse their free-mailing privileges before elections	+						+
Football (soccer) drawings	+						+
Pedestrians crossing the street	+						+
The Climate Agenda	+						+
When Did Your County's Jobs Disappear?	+						+
Academics House Price Index	+						+
Banks' earnings: How compensation relates to performance	+	+	+				+
Deadly offensive: Taliban attacks in Pakistan	+	+	+				+
GDP Moves by Sector	+	+	+				+
UK economic data	+	+	+				+
Budget 2010: Reaction from around the UK	+	+	+				+
Formula One 2010: driver's rankings	+	+	+				+
Lighting up Hadrian's wall	+	+	+				+
Mapping hydropower hotspots across the UK	+	+	+				+
Moscow metro bombs: interactive map	+	+	+				+
The world economy turns the corner	+	+	+				+
A Map of Olympic Medals	+	+	+				+
All of Inflation's Little Parts	+	+	+				+
Barry Bonds visualization (interactive)	+	+	+				+
The Ebb and Flow of Movies: Box Office Receipts 1986 — 2008	+	+	+				+
The Jobless Rate for People Like You	+	+	+				+
Advertisement: Bus							
Advertisement: Helicopter							
Analyzing Obama's schedule	+	+	+				+
Oscars 2010: the best picture nominees	+	+	+				+
The consumer and retail price indices since 2006	+	+	+				+
UK Voting Intentions	+	+	+				+
Barry Bonds Visualizaiton (Static Image)	+	+	+				+
Comparison of Bear Markets	+	+	+				+
How Americans Spend Their Day	+	+	+				+
Michelle Obama's Family Tree	+	+	+				+
Netflix Rentals	+	+	+				+
Vancouver's Olympic Venue	+	+	+				+
On the Map: Five Major North Korean Prison Camps	+	+	+				+
A Visual Guide to the Financial Crisis	+	+	+				+
Economic Meltdown of 2008-2009	+	+	+				+
Where Did All the Money Go?	+	+	+				+
Life cycle of a beetle through a year	+	+	+				+
McCloud's "Making Comics"	+	+	+				+
How the Government Dealt with Past Recessions	+	+	+				+
Afghanistan: Behind the front line	+	+	+				+
Toyota timeline: a company history	+	+	+				+
Gapminder Human Development	+	+	+				+
Earthquakes: why they happen	+	+	+				+
Iran's nuclear programme	+	+	+				+
Shaun White's Double McTwist	+	+	+				+
Toyota's stick accelerator problem	+	+	+				+
Alpine Skiing, From Technical Turns to Tucks and Speed	+	+	+				+
Budget Forecasts vs. Reality	+	+	+				+
Mac Orientation Video	+	+	+				+
Delta Airplane Safety Video	+	+	+				+
"The Story of Stuff"	+	+	+				+
Virgin America Airplane Safety Video	+	+	+				+

Magazine Style

Unrotated Graph / Map

Science Fair Poster

Bar Chart

Comic Strip

Slide Show

Image / Video / Animation

Establishing Shot / Still / Screen

Consistent Visual Pictorial

Progress Bar / Timeline

Checklist* Progress Slider

Close-Ups

Feature Distinction (highlight, color, detail, outline)

Character Direction

Annotation

Audio

Zooming

Similar Objects (bullet points)

Zooming Angle

Zoomer (Camera) Motion

Continuity Editing

Object Continuity

Animated Transition

Random Access

User Directed Path

Zoom

Zoom Highlighting / Detail

Zooming/Selection/Scroll Breakdown/Timeline

Navigation Buttons

Very Limited Interactivity

Explicit Instruction

Click Tutorial

Simulating Default Values

Annotations / Headlines

Annotations

Companying Article

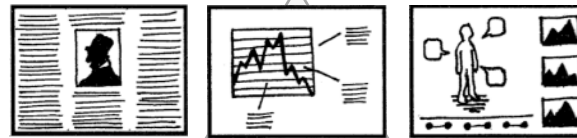
Multi-Messaging

Comment Repetition

Introductory Text (more than a sentence)

Summary/Synthesis

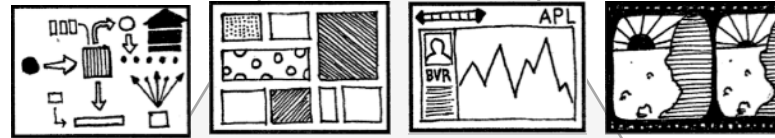
Visual Design



MAGAZINE
STYLE

ANNOTATED
CHART

SCIENCE FAIR
POSTER



FLOWCHART

COMICSTRIP

SLIDESHOW

MOVIE

Duo-Specific

Captions

Annotations

Attached
Article

Summaries

Interpret

Headlines

Tacit
Tutorial

Selection

Navigation

Details on
Demand

Timelines

Filtering

Highlighting

Messaging

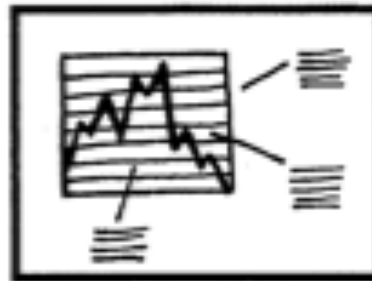
Interactivity

MORE

Seven Genres



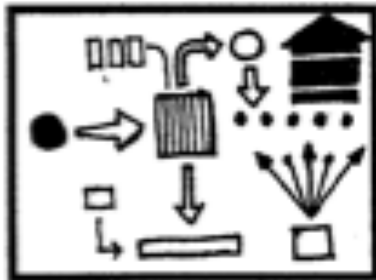
Magazine Style



Annotated Chart



Partitioned Poster



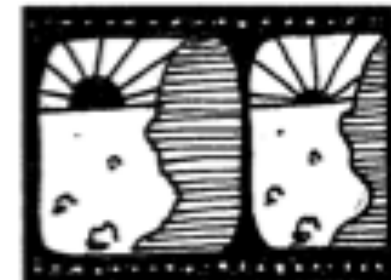
Flow Chart



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

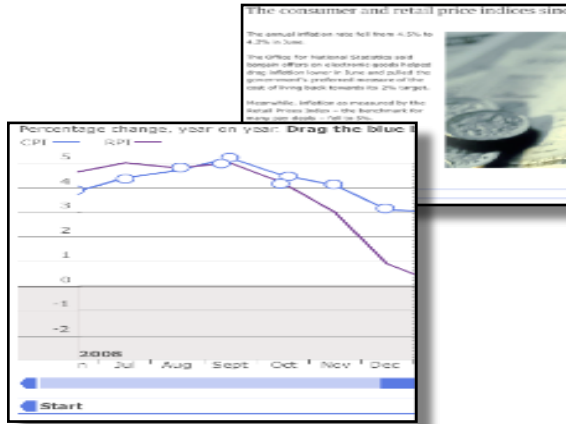
Reader Driven

weak ordering
light messaging
free interactivity

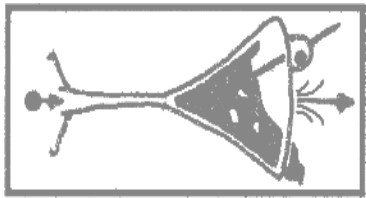
ASK QUESTIONS

EXPLORE

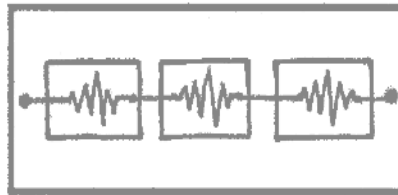
FIND



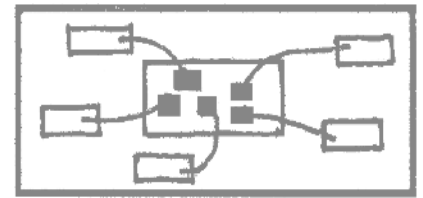
martini glass



interactive slideshow



drill-down story



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

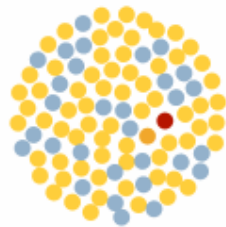
Watch how the measles outbreak spreads when kids get vaccinated - and when they don't

😊 vaccinated 🟡 susceptible 😊 vaccinated but susceptible 😞 infected ● contact with an infected person



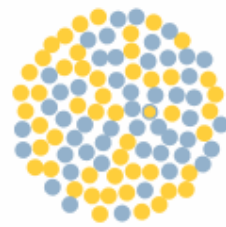
NOT PROTECTED

10.0% vax rate

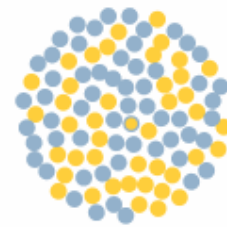


NOT PROTECTED

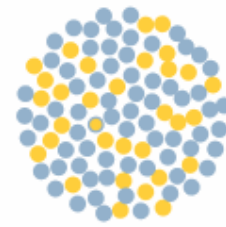
30.0% vax rate



50.0% vax rate



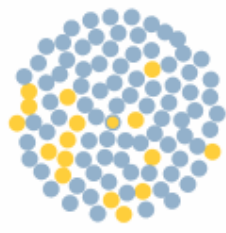
58.5% vax rate, similar to Okanagan County, WA



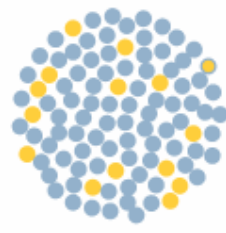
68.9% vax rate, similar to Thurston County, WA



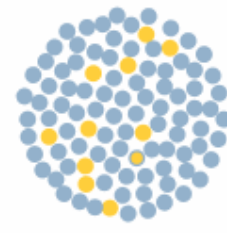
74.4% vax rate, similar to Island County, WA



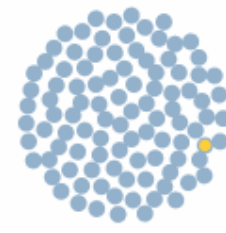
83.8% vax rate, similar to Santa Cruz County, CA



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?

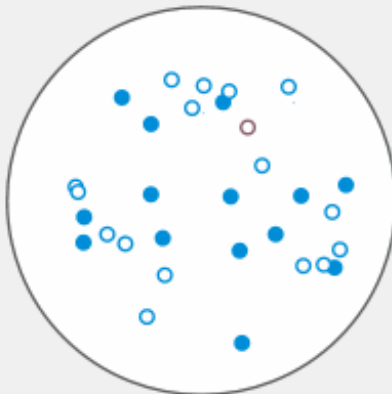
Even the best risk assessments yield probabilities, not certainties. That means they label as "high risk" some people who won't commit another crime and label as "low risk" some people who will. This simulation lets you sort offenders into risk categories based on the results of an assessment. Think 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



- - Will reoffend
- - Will not reoffend

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.



LOW RISK



MEDIUM RISK



HIGH RISK



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

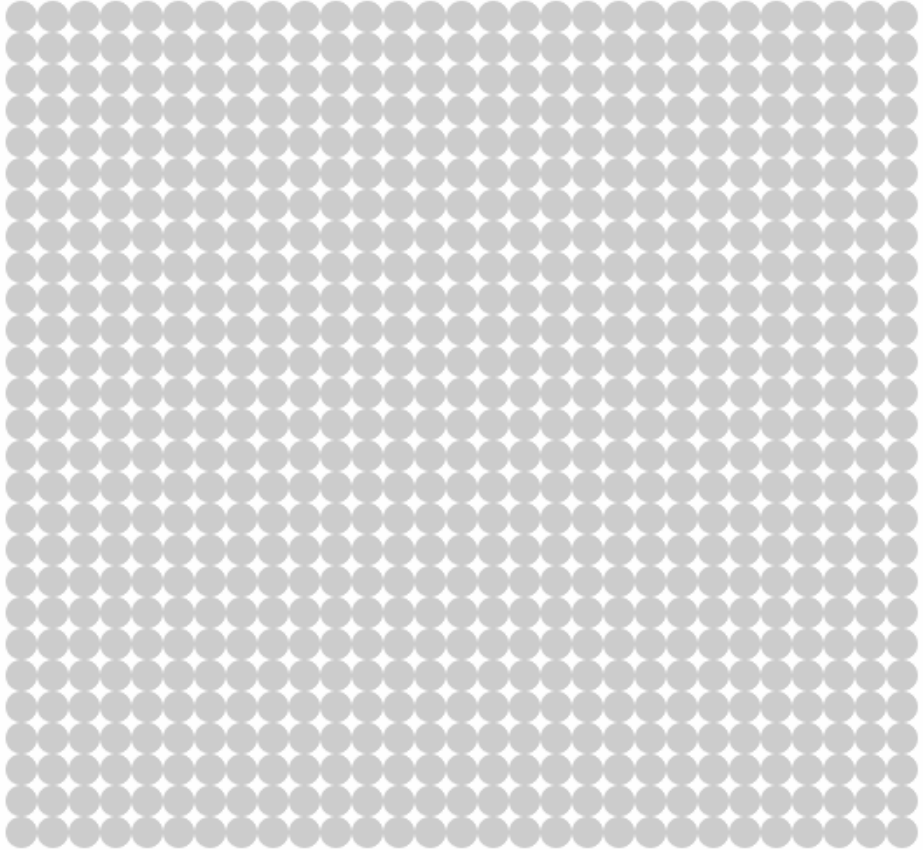
DENIED PAROLE



14%

DENIED PAROLE BUT WOULDN'T HAVE REOFFENDED

I am female White and currently 23 years old.



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

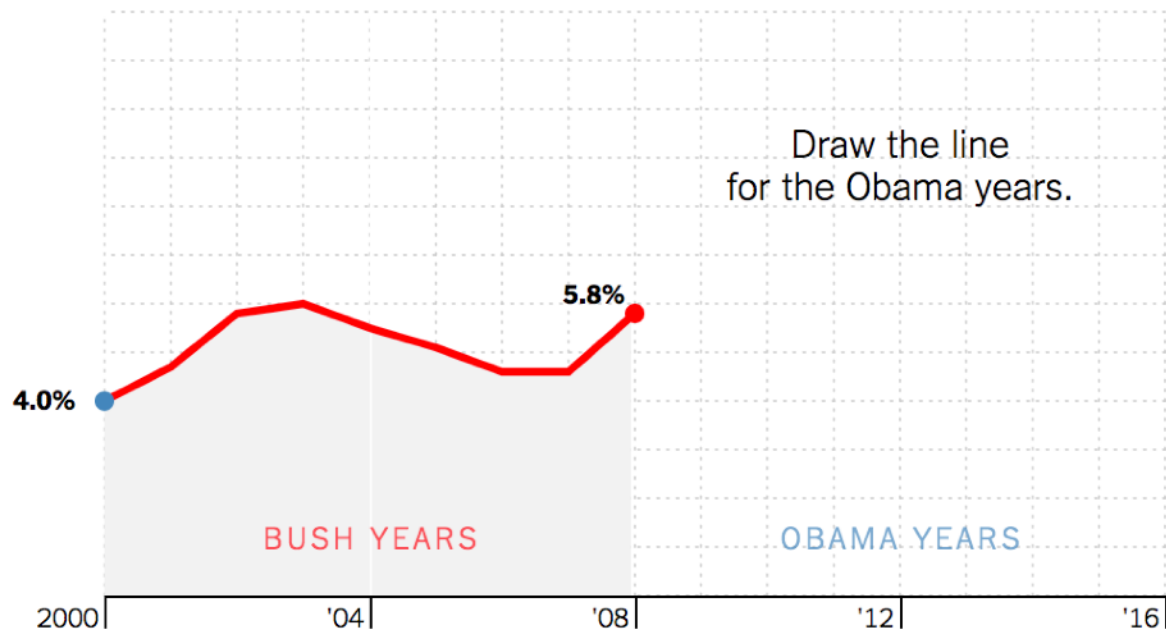
- CAUSE OF DEATH SO FAR
- 0% Infection
 - 0% Cancer
 - 0% Blood
 - 0% Endocrine
 - 0% Mental
 - 0% Nervous
 - 0% Circulatory
 - 0% Respiratory
 - 0% Digestive
 - 0% Musculoskeletal
 - 0% Genitourinary
 - 0% Perinatal
 - 0% Congenital
 - 0% External Causes
 - 0% Other

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

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

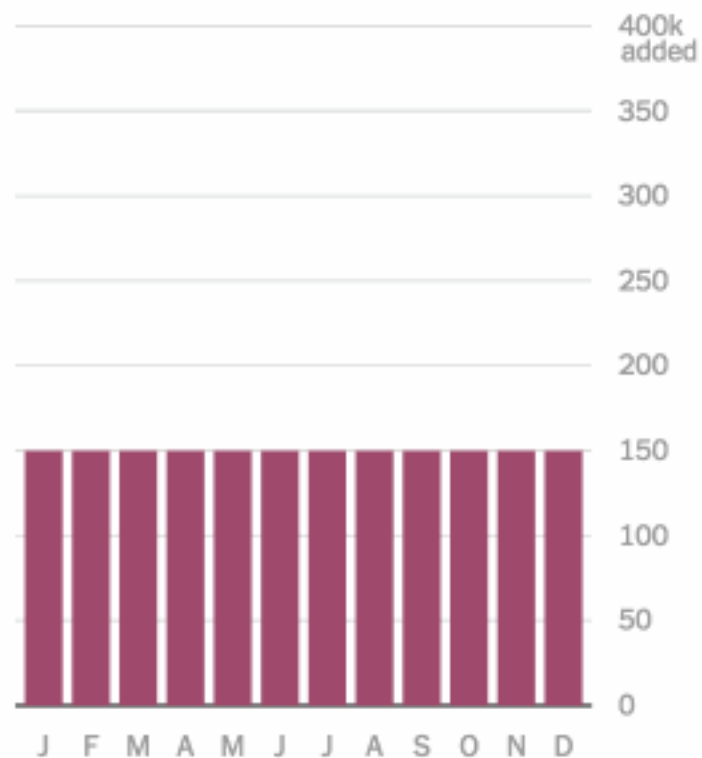
Draw your guesses on the charts below to see if you're as smart as you think you are.

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



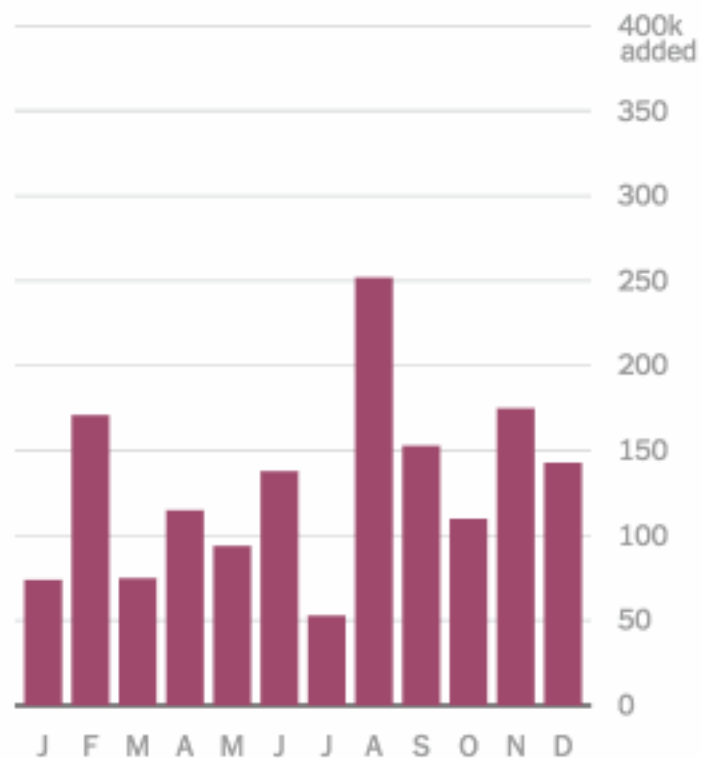
Show me how I did.

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

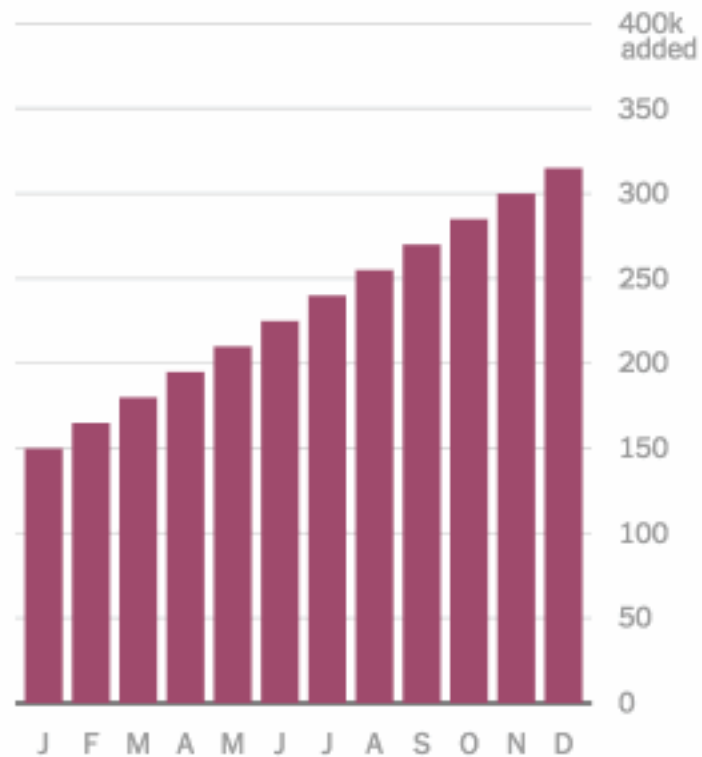


...the jobs report **could look like this:**

Pause

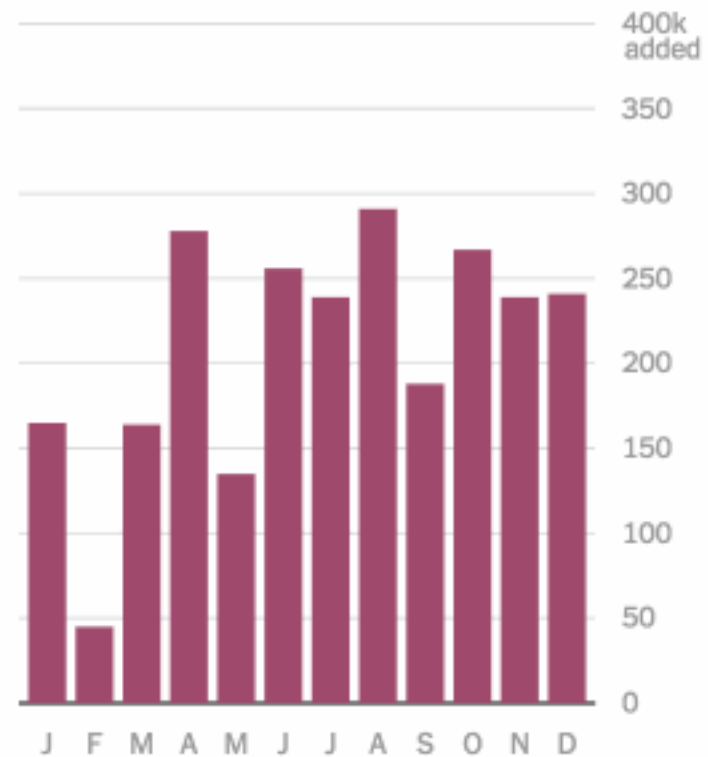


If job growth **had**
been accelerating...



...the jobs report
could look like this:

Pause



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:

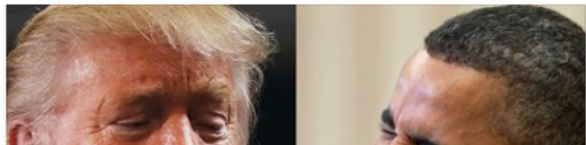
- PRESIDENT TRUMP
- HEALTH CARE
- GUNS
- ABORTION
- ISIS
- BUDGET
- EXECUTIVE ORDER
- IMMIGRATION


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.

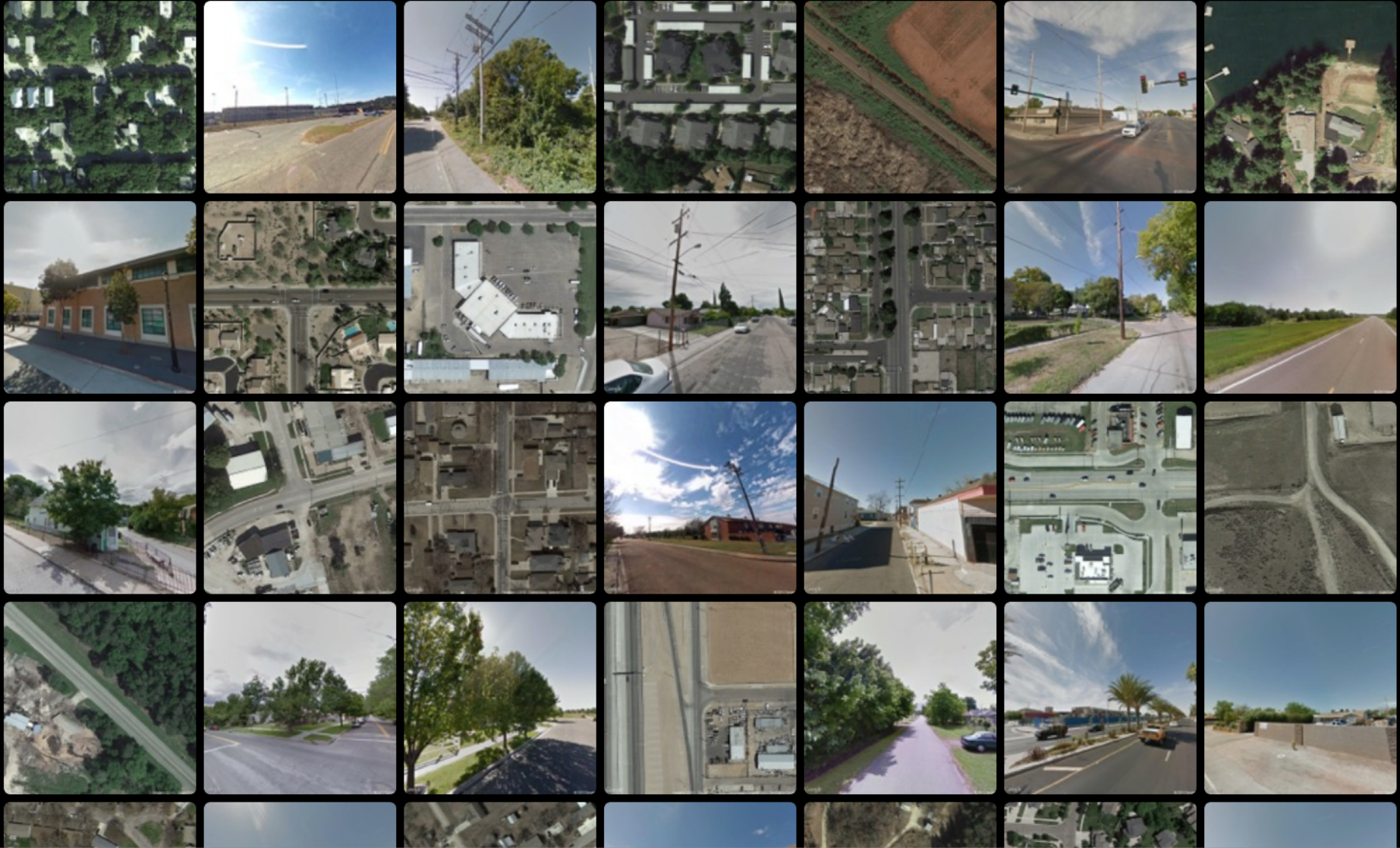




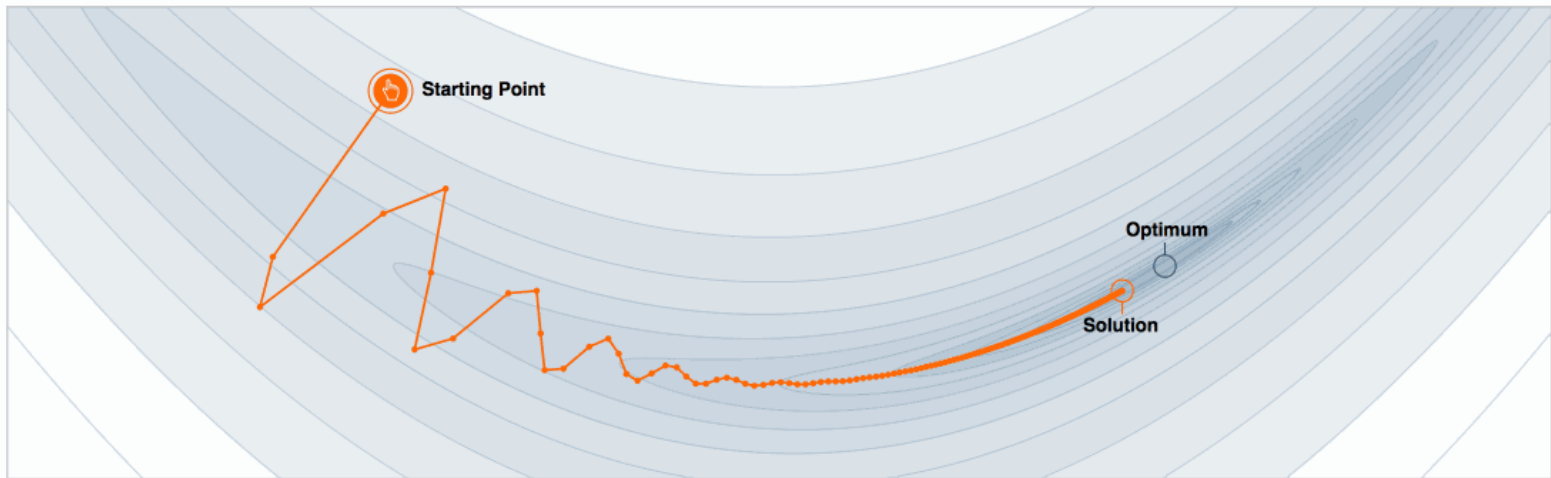
The Federalist Papers ✓
9 hours ago

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





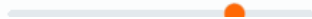
Why Momentum Really Works



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

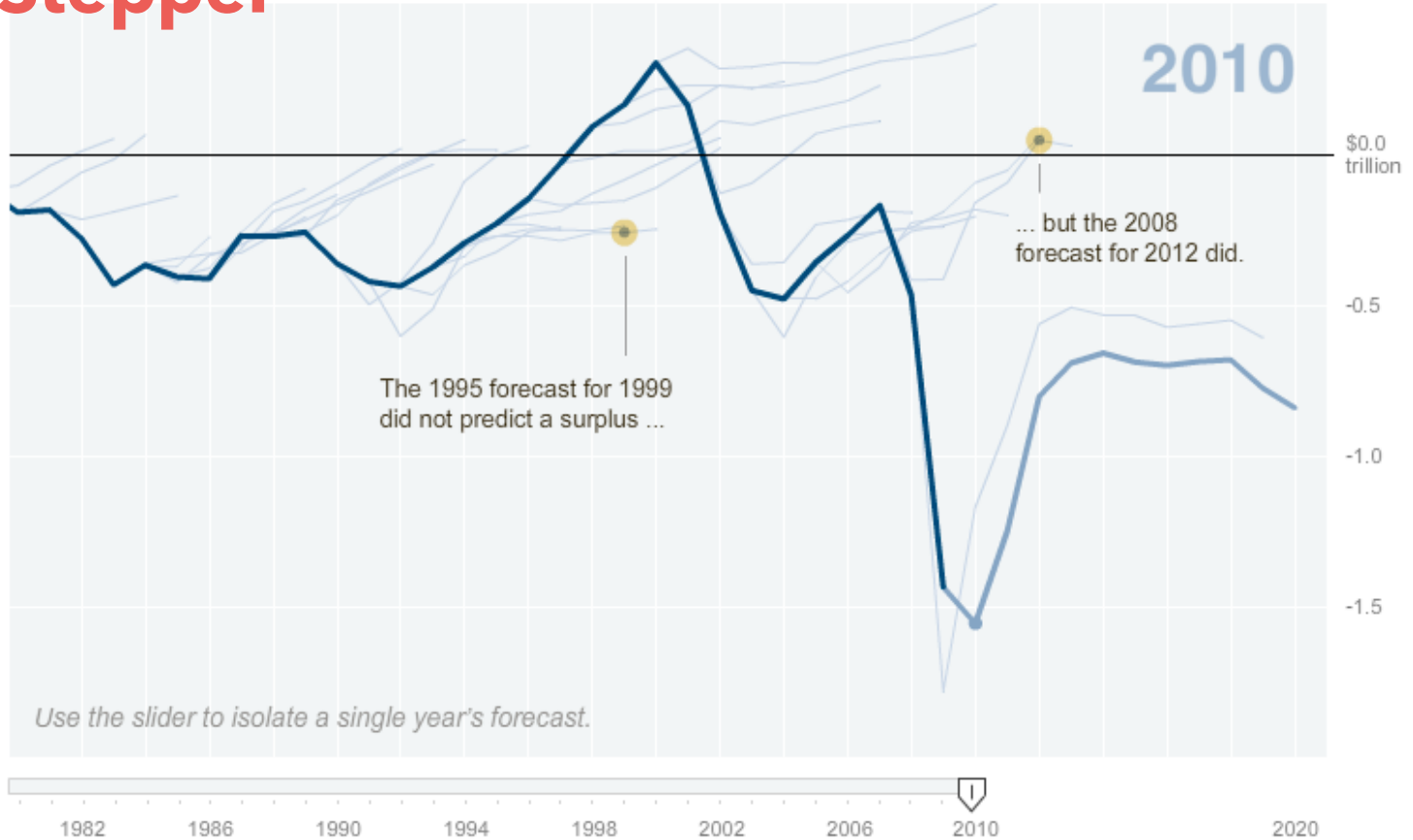
Just two years ago, surpluses were predicted by 2012. How accurate have past White House budget forecasts been?

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 disenchanting 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



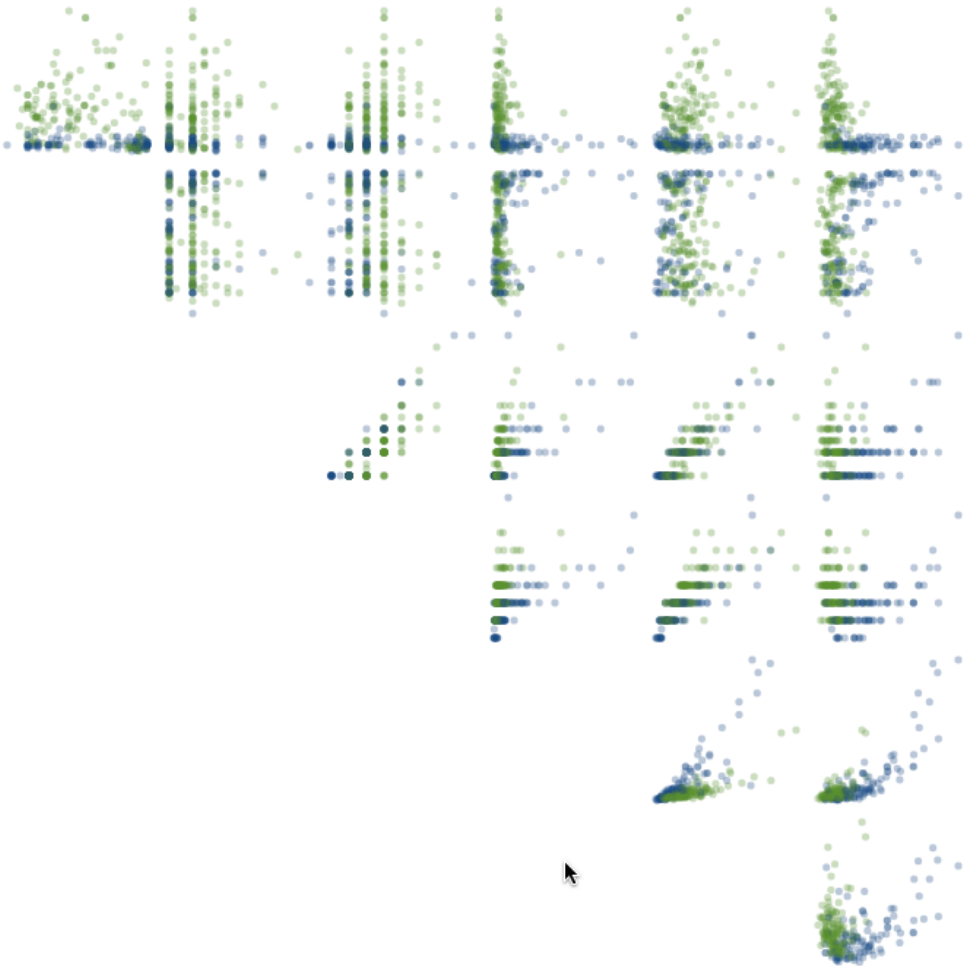
R2
D3

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.



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

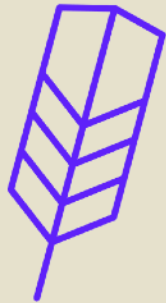
Monitor scroll position & element positions

Guidance: [M. Bostock](#), [J. Vallandingham](#)

Third-Party Support

Helper Libraries

Interactive Document Formats: Idyll

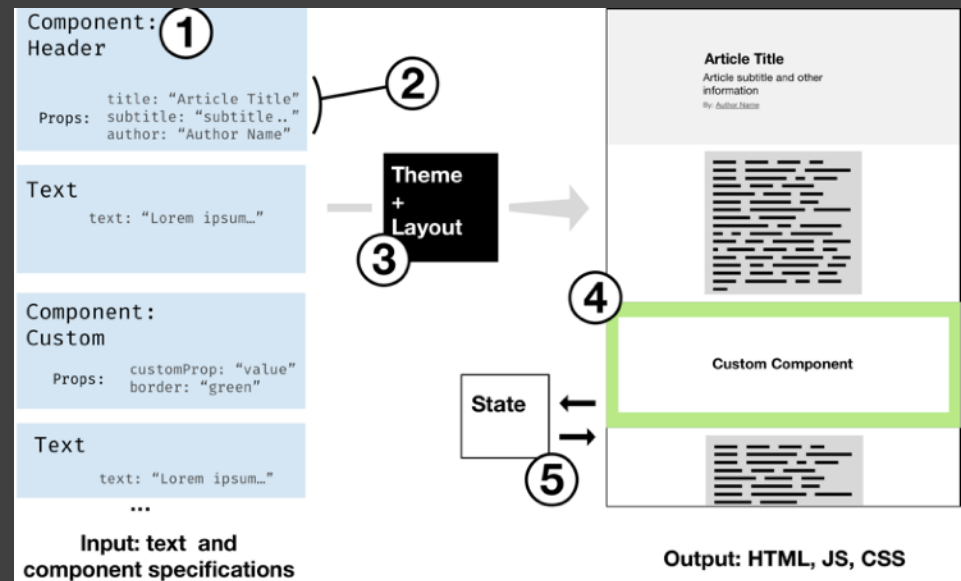


idyll

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

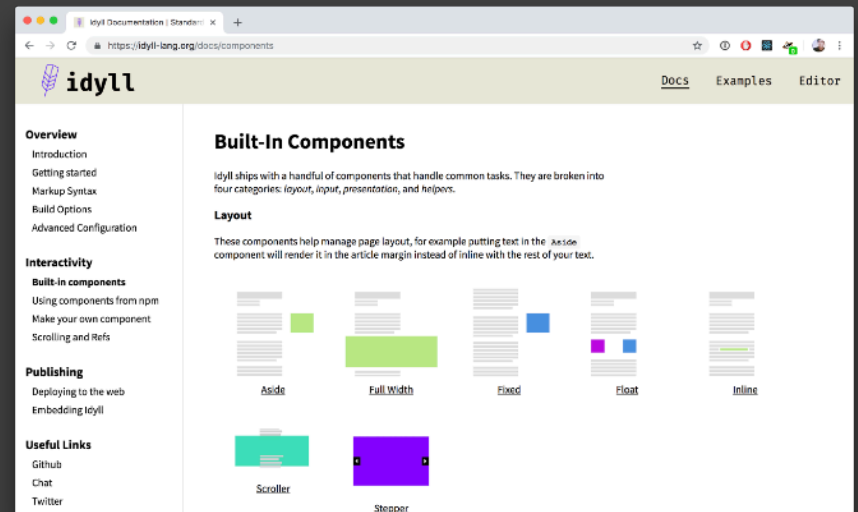
```
[Display value:x format:"d" /].
```

Overview

Document model for
interactive articles

Markdown-based
specification language

Component library
supporting common needs



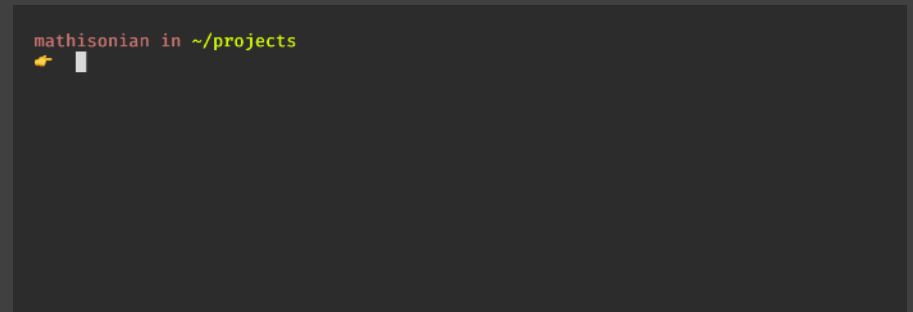
Overview

Document model for
interactive articles

Markdown-based
specification language

Component library
supporting common needs

Suite of build, runtime, and
deployment tools

A terminal window with a dark background. The prompt 'mathisonian in ~/projects' is displayed in green text. Below the prompt, there is a yellow cursor arrow pointing left and a white vertical bar representing the cursor's position.

```
mathisonian in ~/projects  
└─┬─  
   │  
   └─
```

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]
```



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  
  onView:"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  
    });  
  }  
}
```

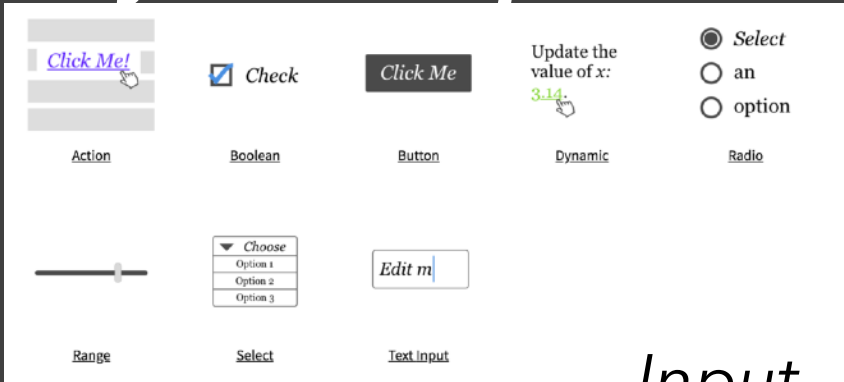
Hello World

The value of x is 5.

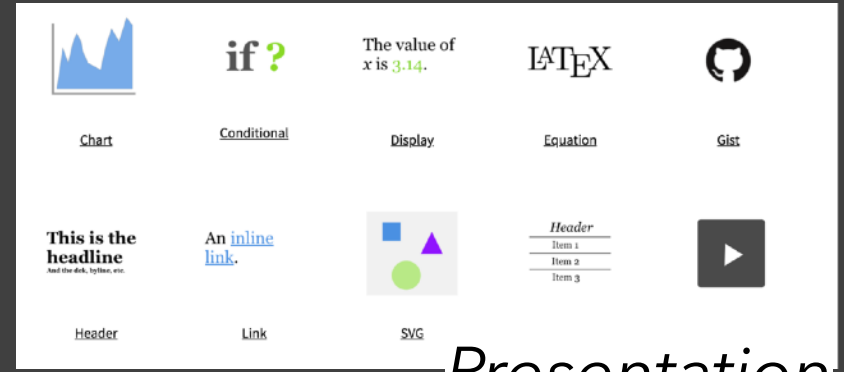


Idyll Components

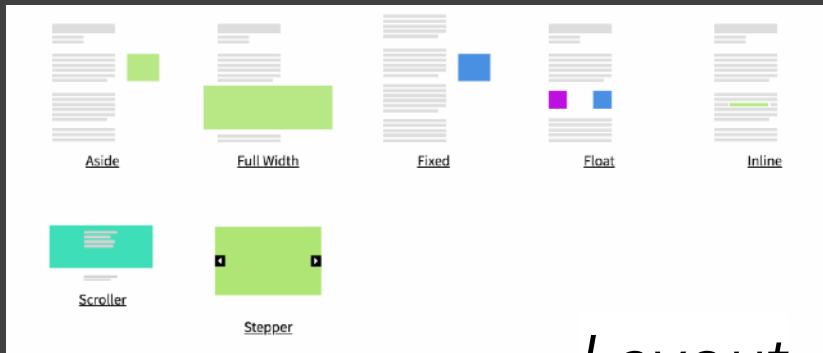
28 components included



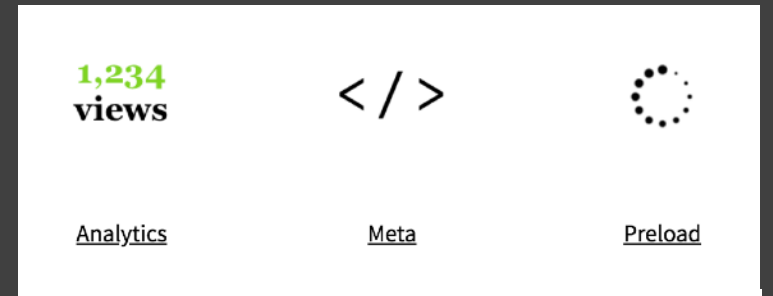
Input



Presentation



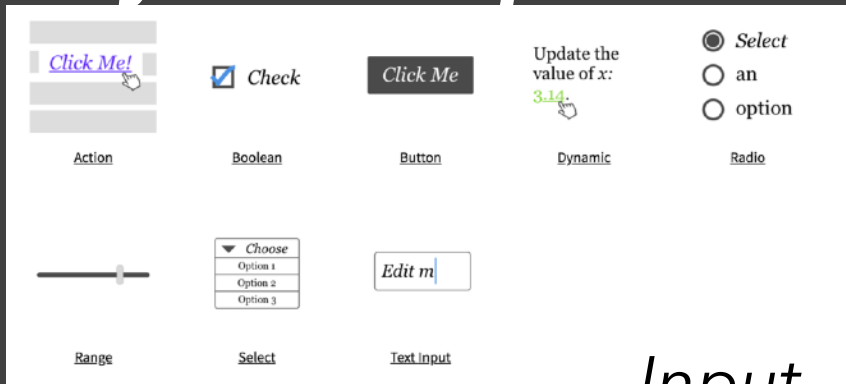
Layout



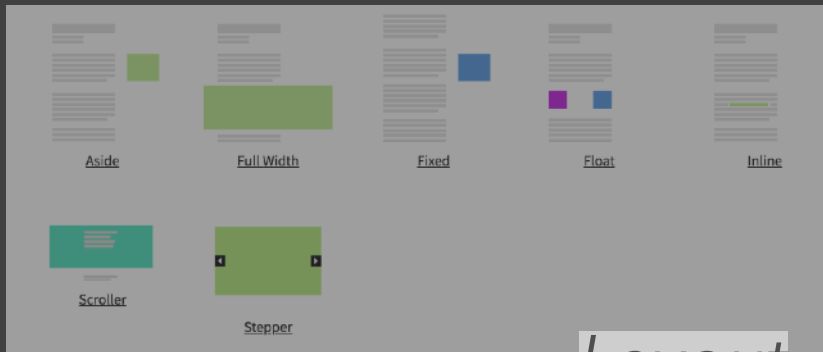
Helpers

Idyll Components

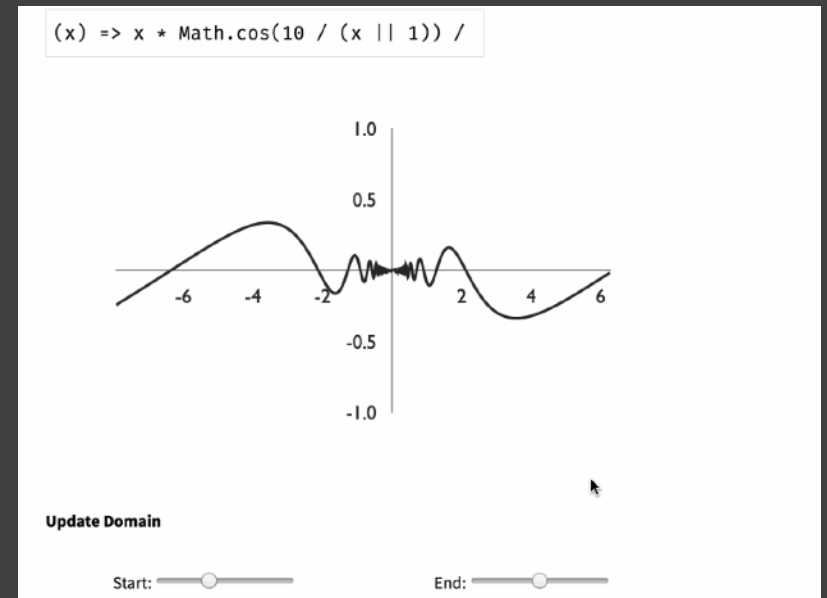
28 components included



Input

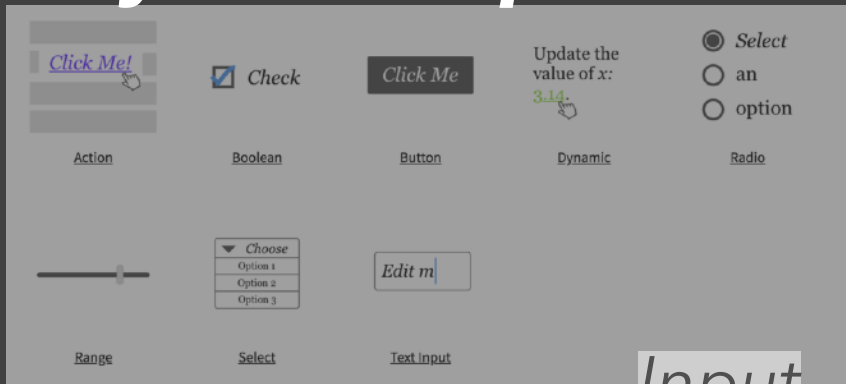


Layout

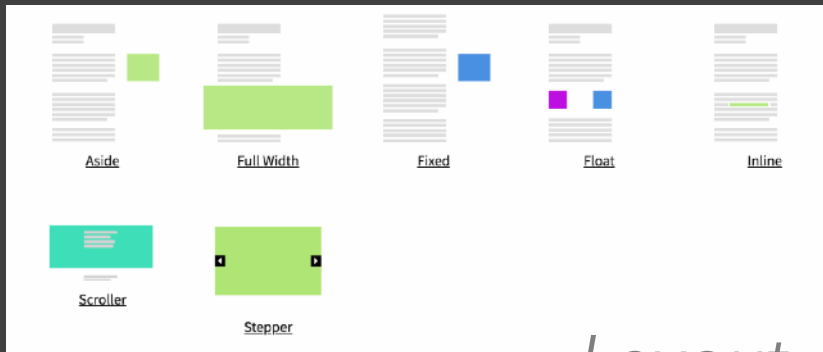


Idyll Components

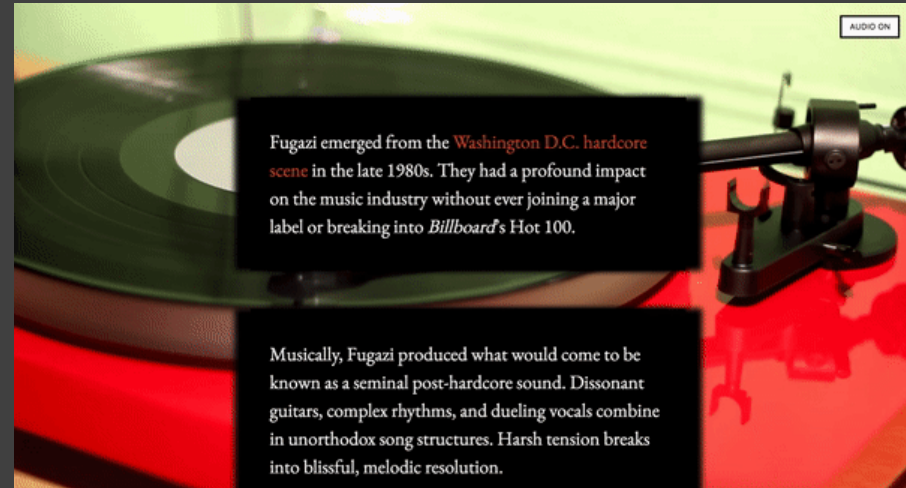
28 components included



Input



Layout



Build and Deploy

Abstracts away the need to
use complex build tools

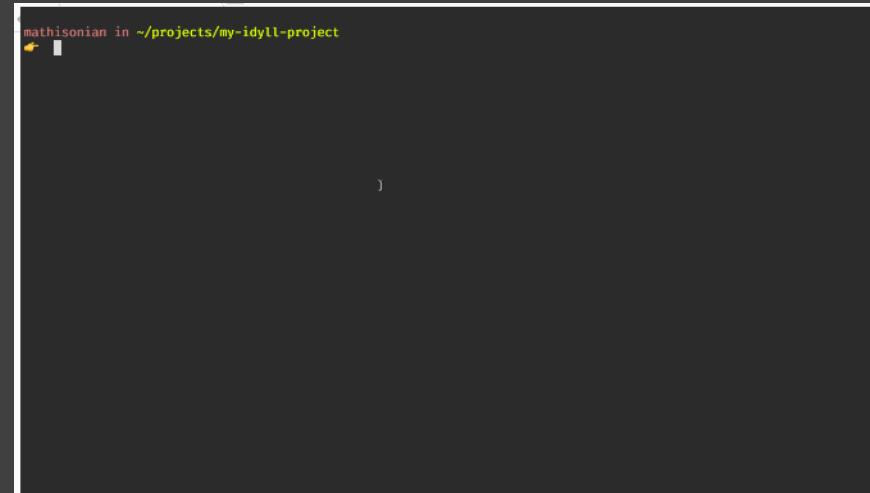
Build and Deploy

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

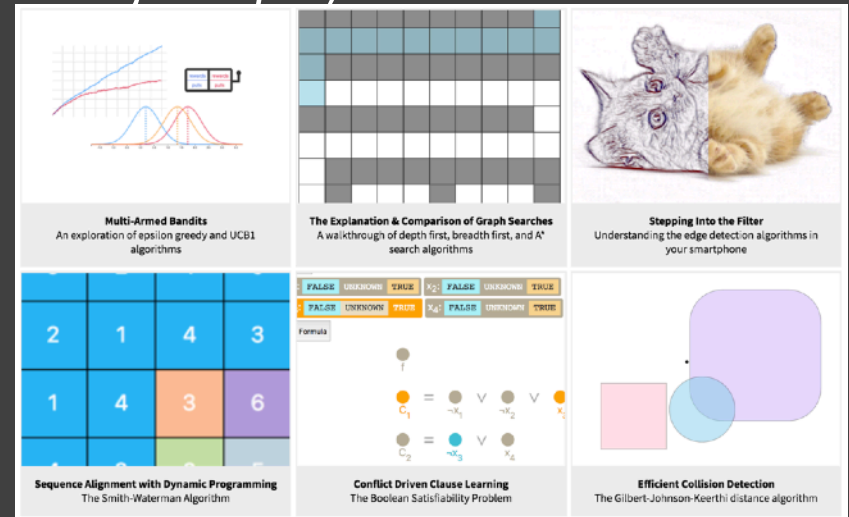
Iterative Design

Open-source release

Pilot Studies

Usage in the wild

Undergraduate students
19 groups, 4 students each



Evaluation

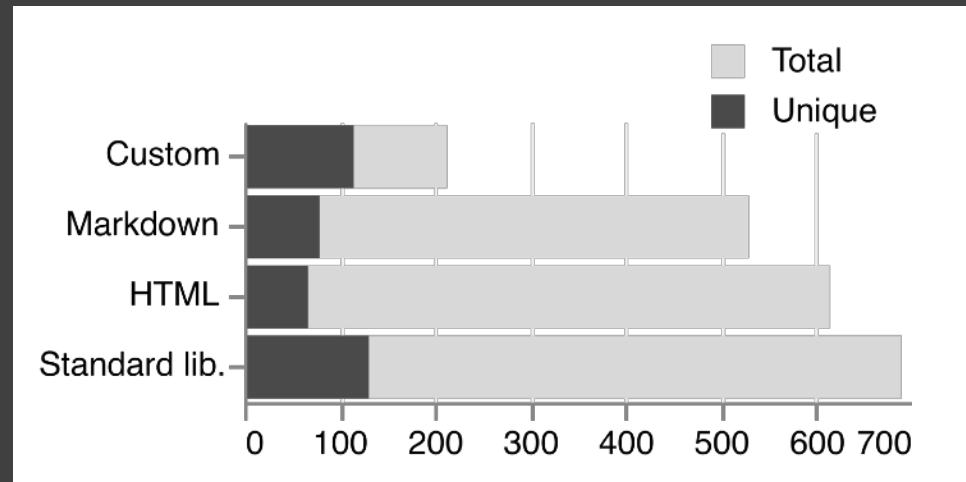
Iterative Design

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

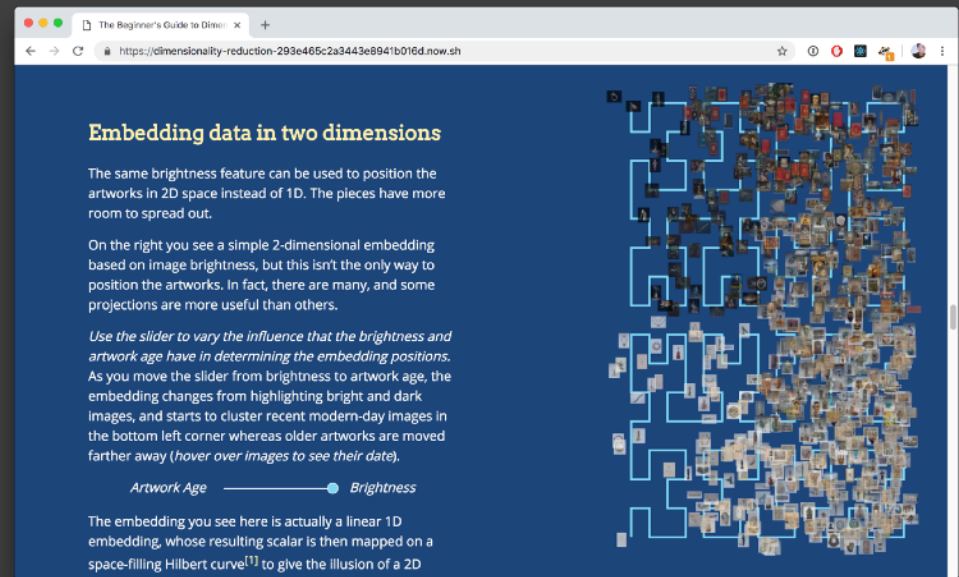
Popular with educators

Integration with tools,

Evaluating Interactive Articles

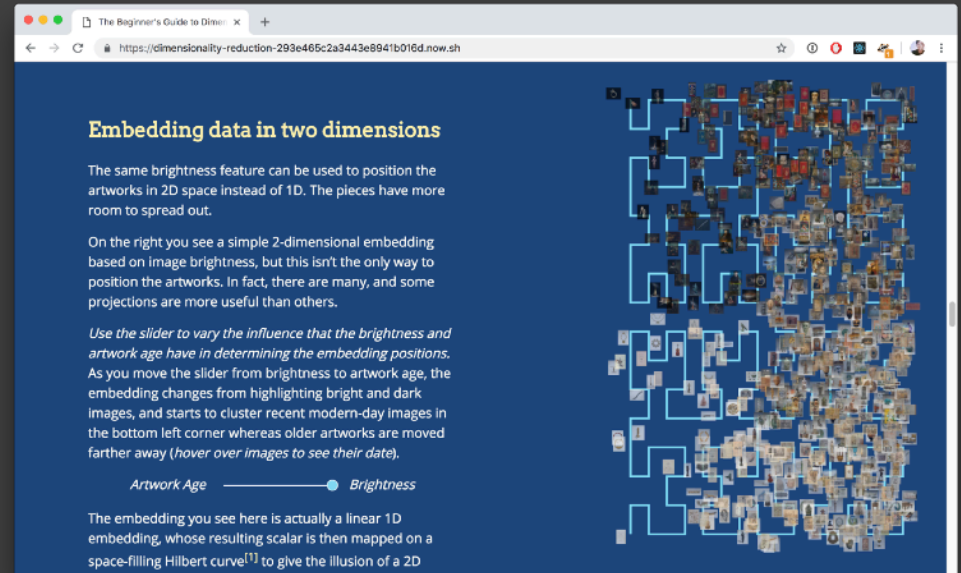
Research from education and journalism suggests interactives are effective for conveying complex topics to a wide audience.

But more data needed!



Evaluating Interactive Articles

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



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.

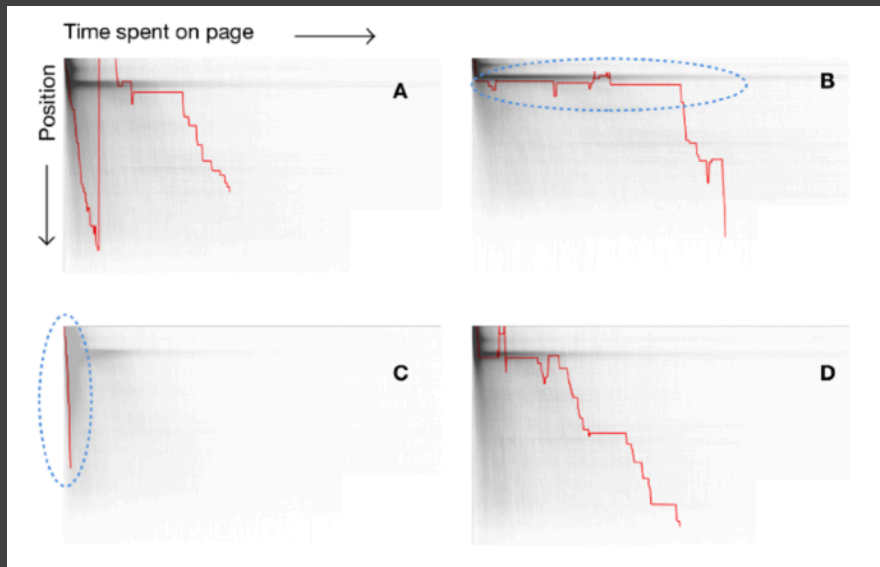
On the right you see a simple 2-dimensional embedding based on image brightness, but this isn't the only way to position the artworks. In fact, there are many, and some projections are more useful than others.

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

Evaluating Interactive Articles



The screenshot shows a web browser window with the URL <https://dimensionality-reduction-293e466c2a3443e8941b016d.now.sh>. The article is titled "Embedding data in two dimensions" and discusses the use of image brightness to position artworks in 2D space. It includes a slider for "Artwork Age" and "Brightness" and a large visualization of artworks arranged in a 2D space.

Embedding data in two dimensions

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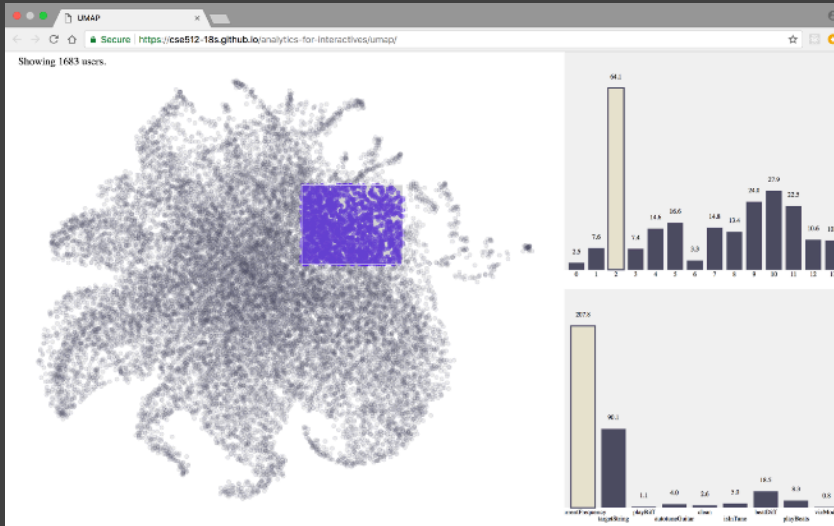
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Evaluating Interactive Articles



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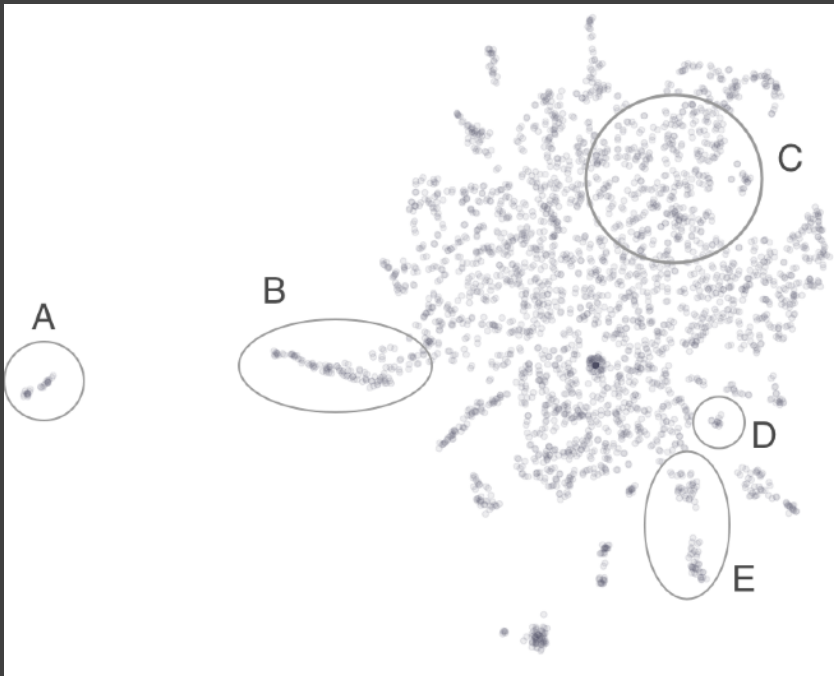
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Evaluating Interactive Articles



The Beginner's Guide to Dimensionality Reduction

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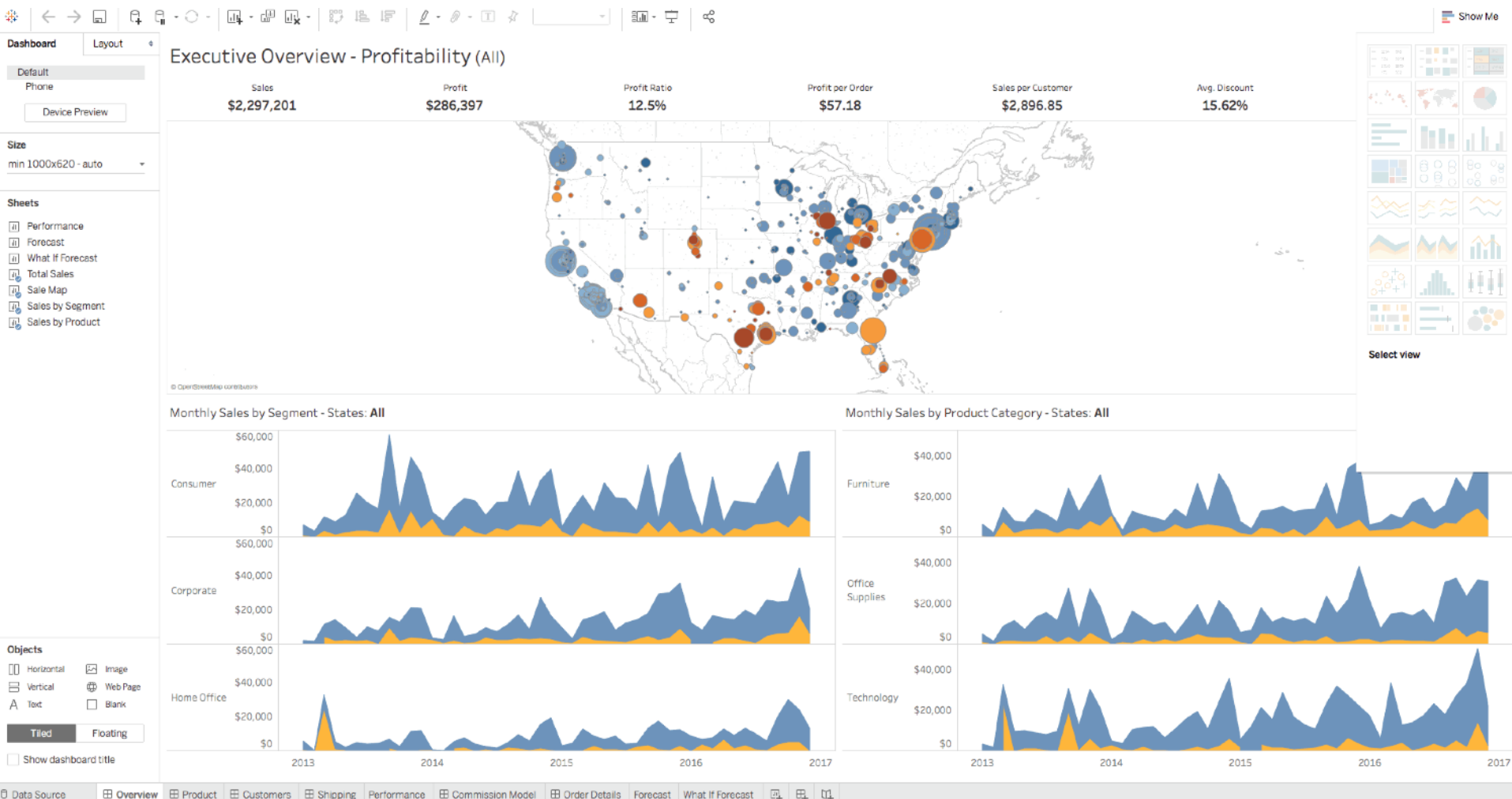
Artwork Age ————— Brightness

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A 2D embedding of artworks showing a dense cluster of small images. A blue branching structure is overlaid on the cluster, representing a Hilbert curve. The images are arranged in a way that suggests a 2D space, with older artworks clustered in the bottom left and newer ones in the top right.

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

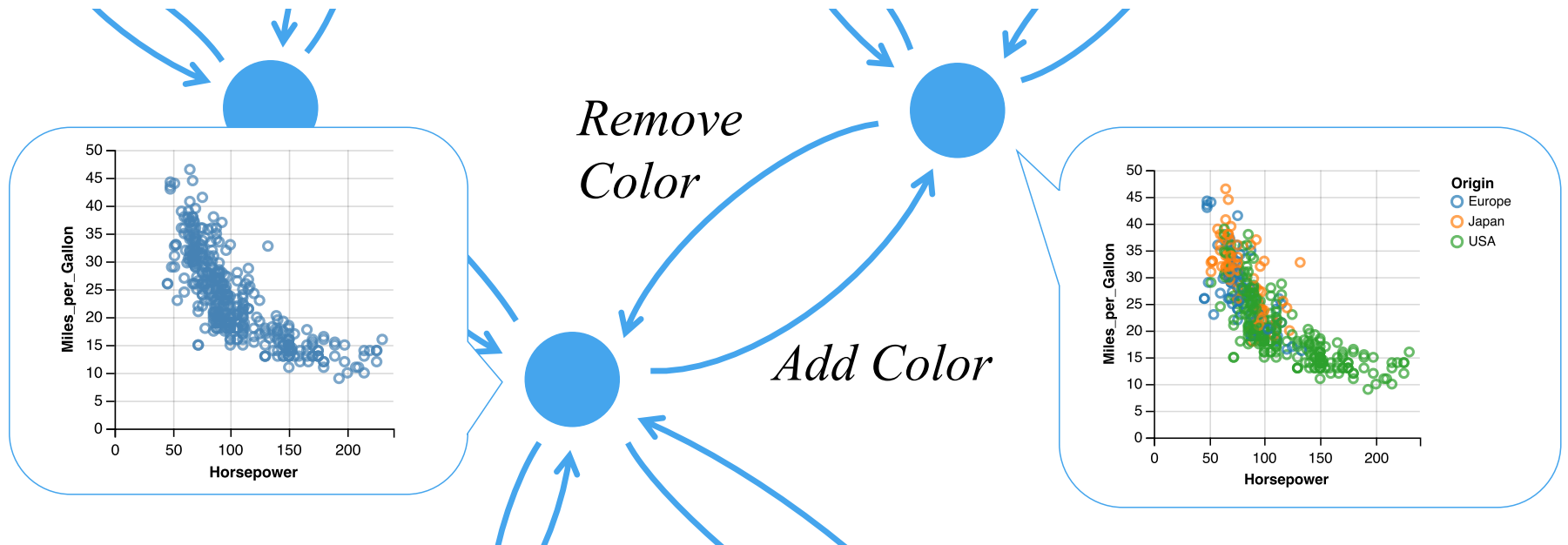


Roll over countries to learn more

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

**How might we evaluate different
orderings of visualizations?**

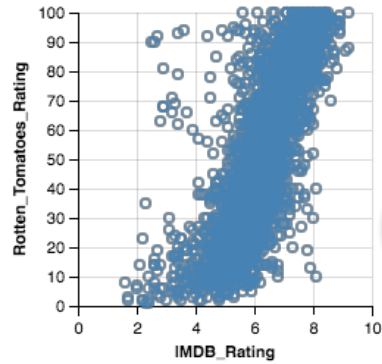
GraphScape: A Directed Graph Model



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

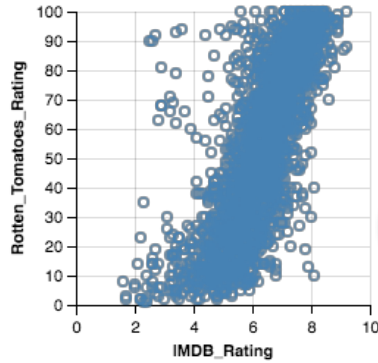
Design Alternatives

"Too many data points !"

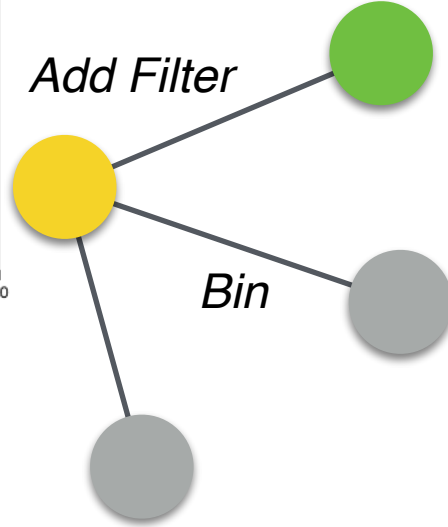


Design Alternatives

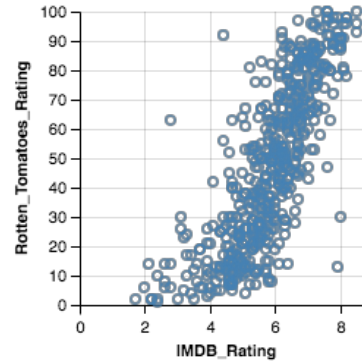
"Too many data points !"



Add Filter



Bin

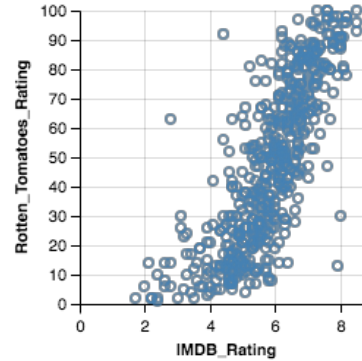
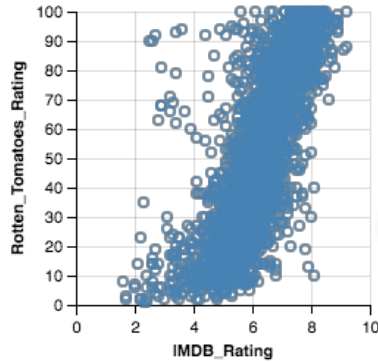


Random Sample

Design Alternatives

"Too many data points !"

Random
Sample

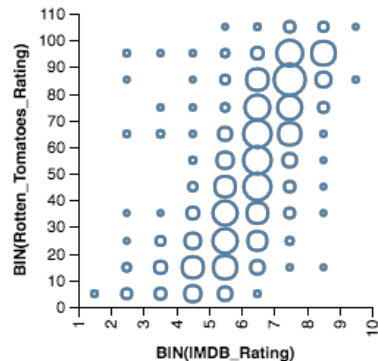


Add Filter

Bin

Bin

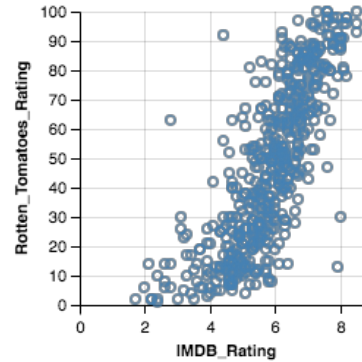
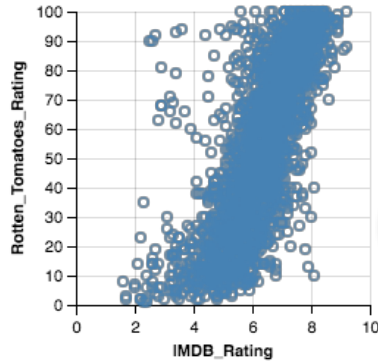
Binned Scatter Plot



Add Size(count)

Design Alternatives

"Too many data points !"



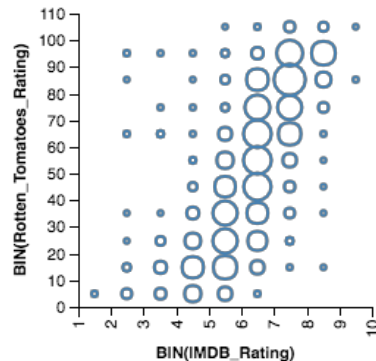
Random
Sample

Add Filter

Bin

Bin

Binned Scatter Plot



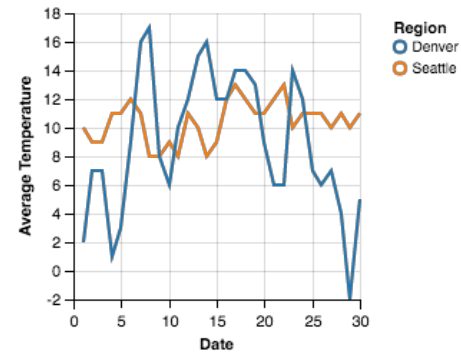
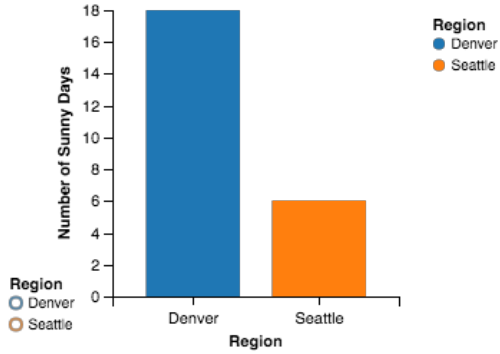
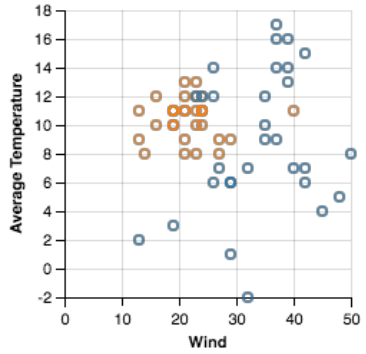
Add Size(count)

...

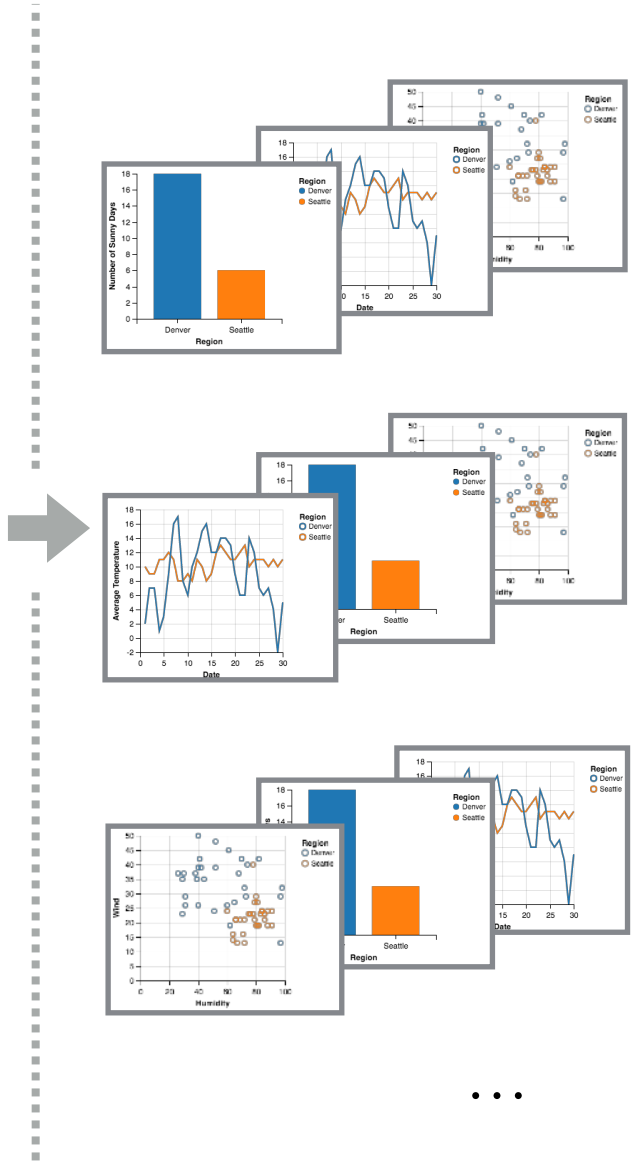
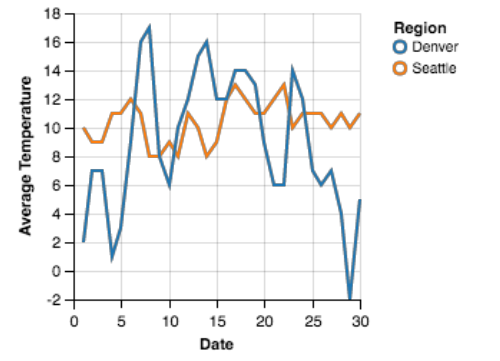
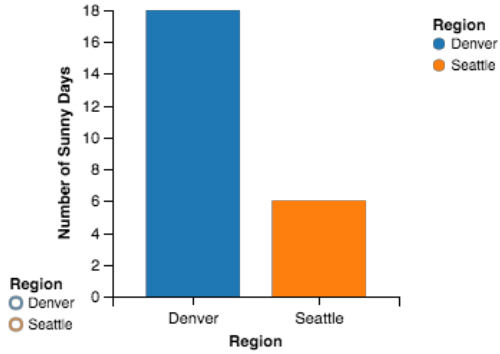
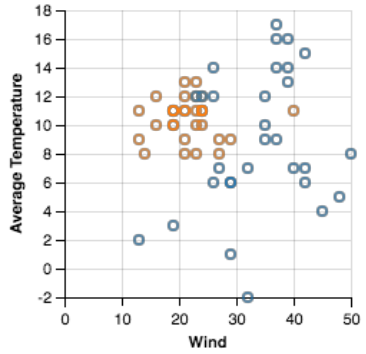
...

...

Sequence Recommendation

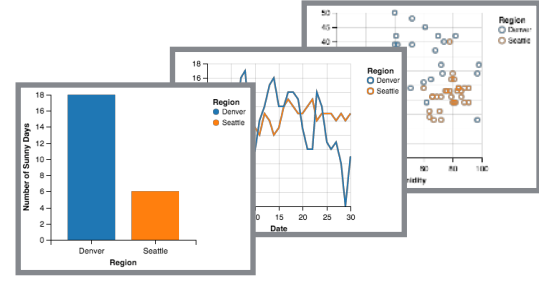
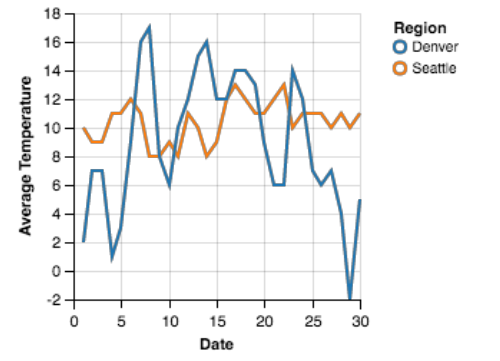
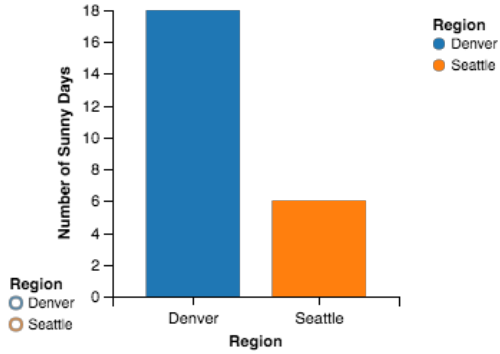
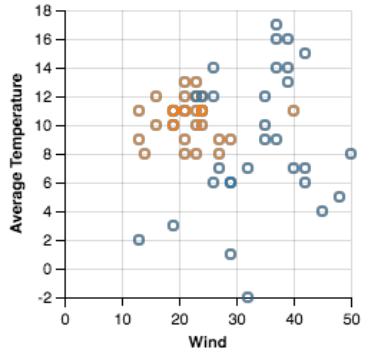


Sequence Recommendation

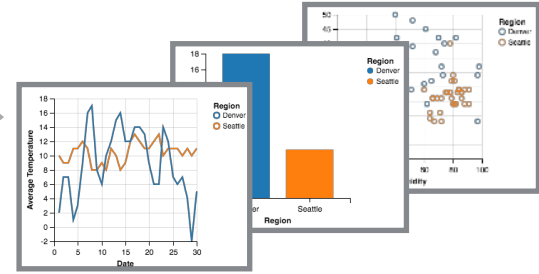


Sequence Recommendation

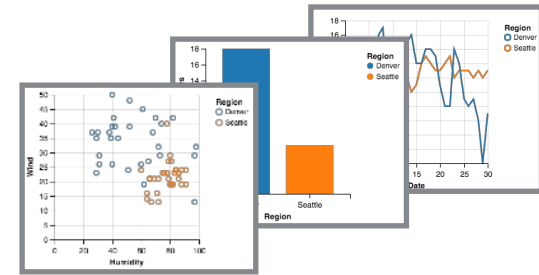
Sequence
Cost



: 10



: 12

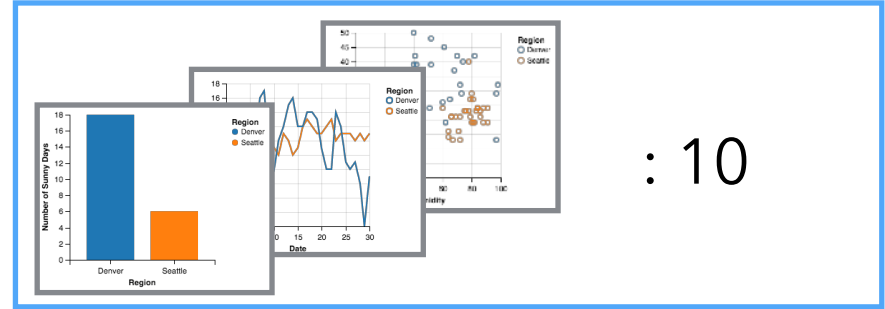
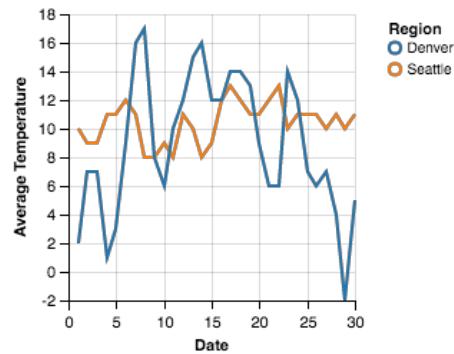
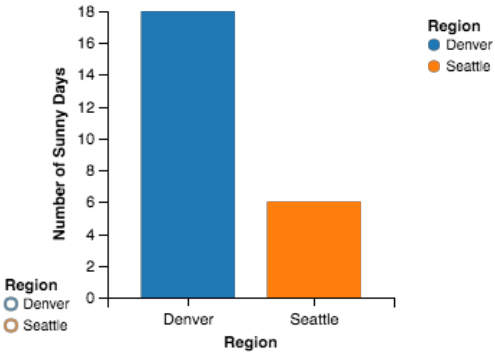
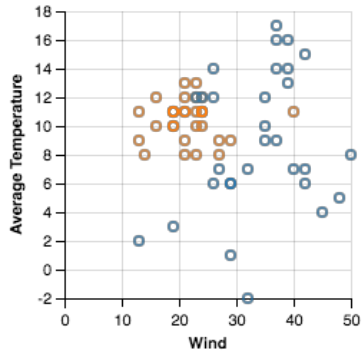


: 13

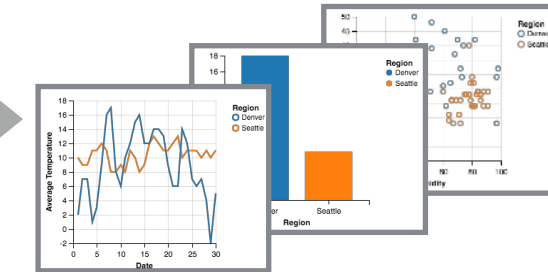
...

Sequence Recommendation

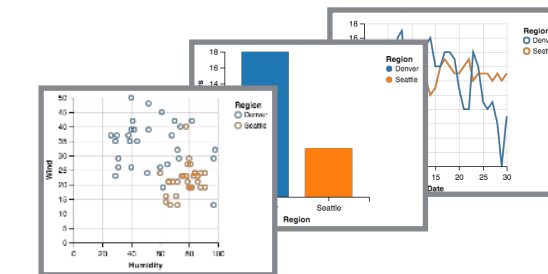
Sequence
Cost



: 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!