

# VISUAL DESIGN & STORYTELLING

Petra Isenberg

# APPLICATIONS OF VISUALIZATIONS

ANALYSIS **EXPLORATORY**

PRESENTATION **EXPLANATORY**

# A FEW MISTAKES THAT WE ALL MAKE

- Making meaningful comparisons
- Inferring trends and differences from noise
- Assumptions about the meaning of correlations
- Claims of “significance”

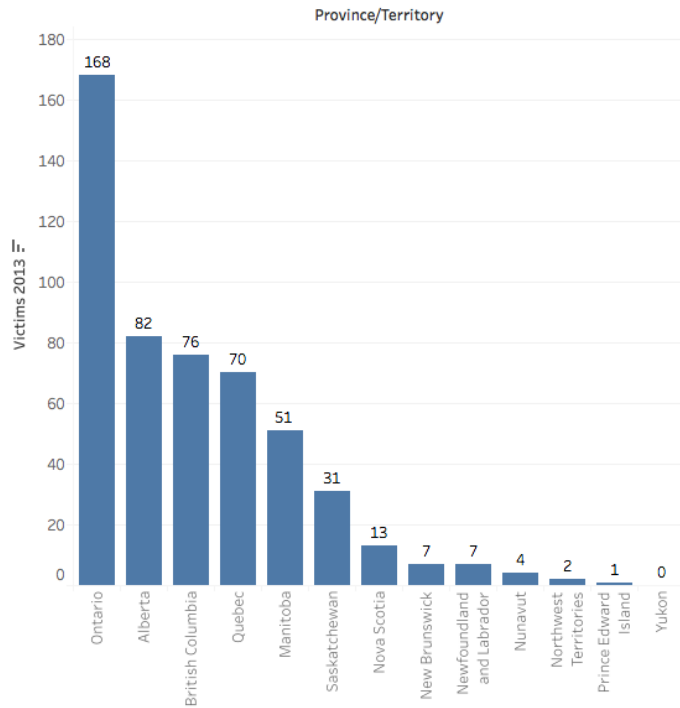
# MAKING MEANINGFUL COMPARISONS

- **Normalized vs. Non-normalized Counts**
  - Murders / Capita
  - Failing grades / 100 Students
  - Etc.
- **Counts vs. Distinct Counts**
  - # visits vs. # of customers

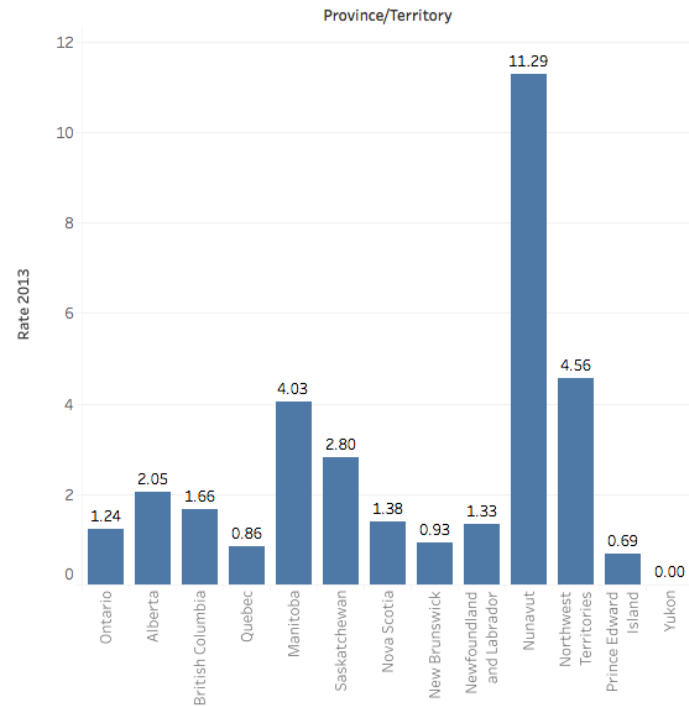


# WHAT IS THE MOST DANGEROUS PROVINCE?

Victims by Province/Territory 2013



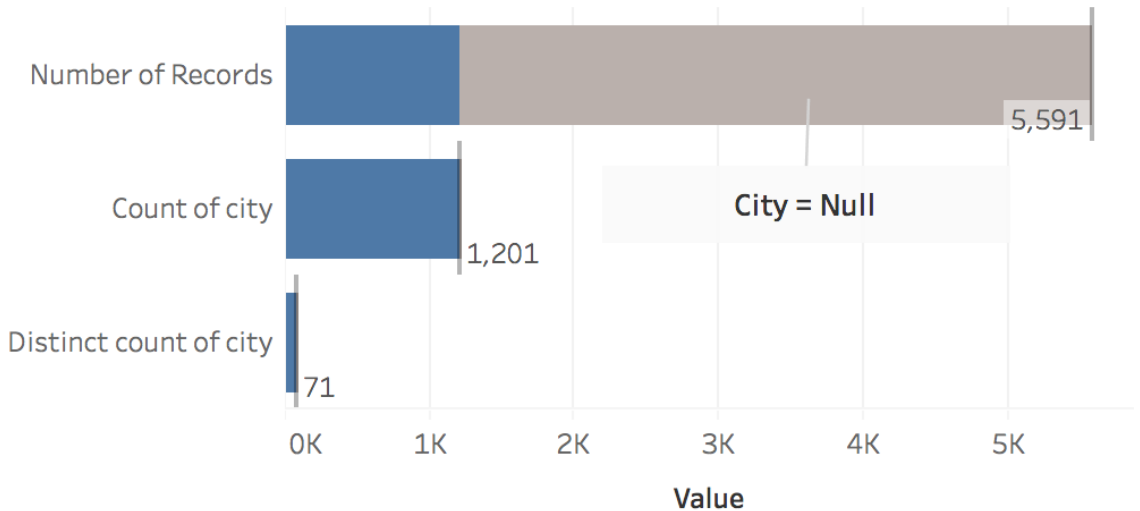
Victims per 100,000 residents by Province/Territory 2013



# COUNT VS COUNT DISTINCT

- **Number of Records =**
- How many individual rows are there?
- **Count =**
- How many rows have a value for this column?
- **Count Distinct =**
- How many distinct values are there in this column?

Yelp - Businesses near Montreal



# A FEW MISTAKES THAT WE ALL MAKE

- Making meaningful comparisons
- Inferring trends and differences from noise
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- Claims of “significance”

WE ALMOST ALWAYS  
KNOW LESS THAN WE  
THINK WE DO

(Even after we've looked at the data.)

# LOOKING FOR PATTERNS IN STATIC

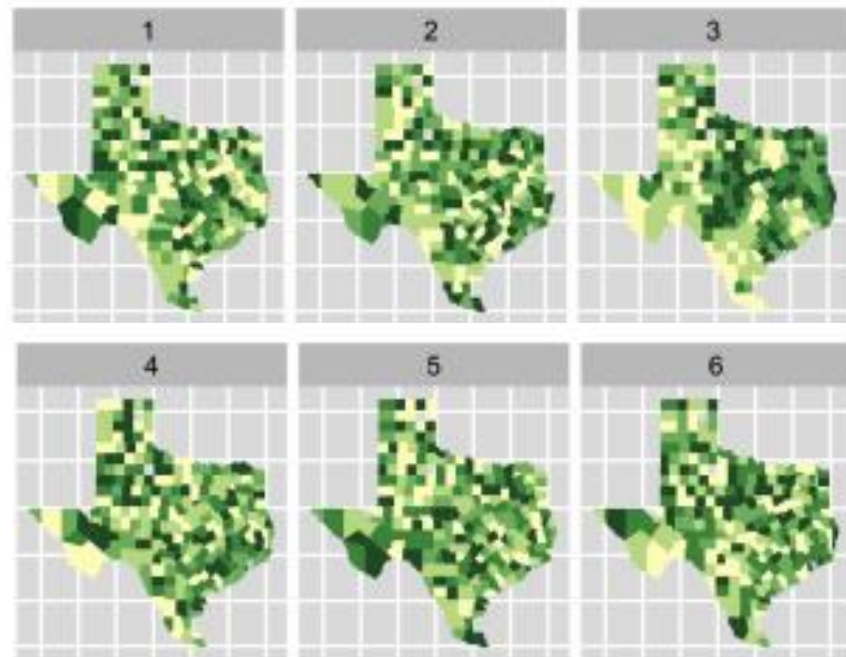
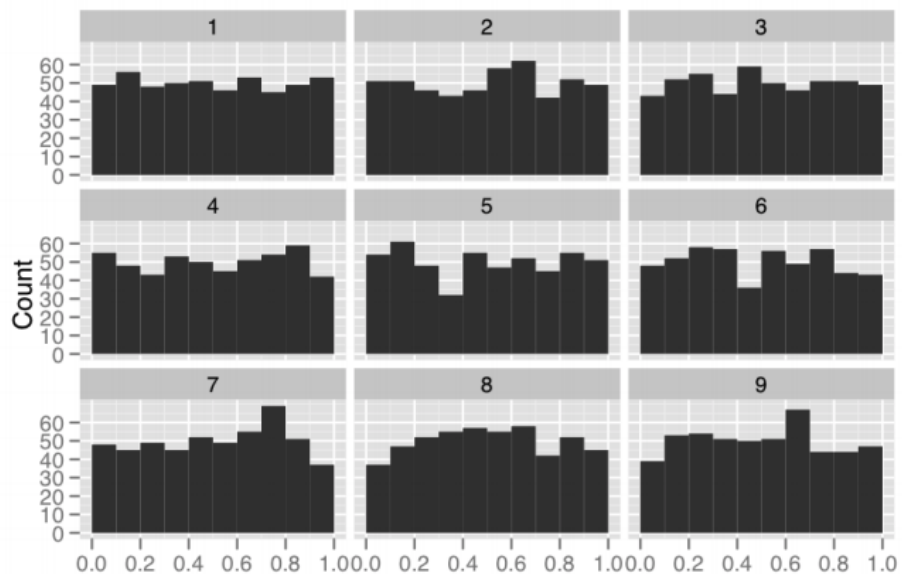
- Almost all data has noise, errors, and variability.
- We are great at seeing patterns — **even when we shouldn't.**



# IT'S VERY EASY TO TELL STORIES AROUND DATA

...but it's harder to show that those stories are robust!

# RANDOM DATA VS REAL DATA



[Wickham et al. 2010](#)

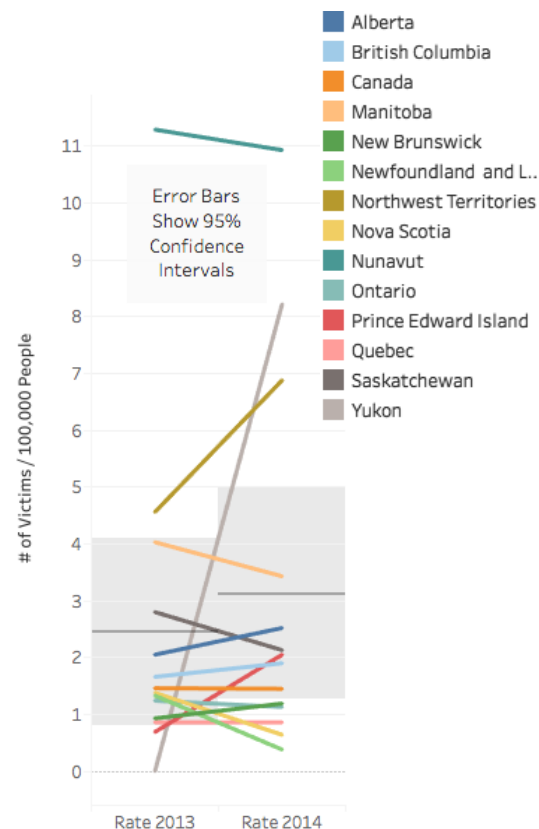
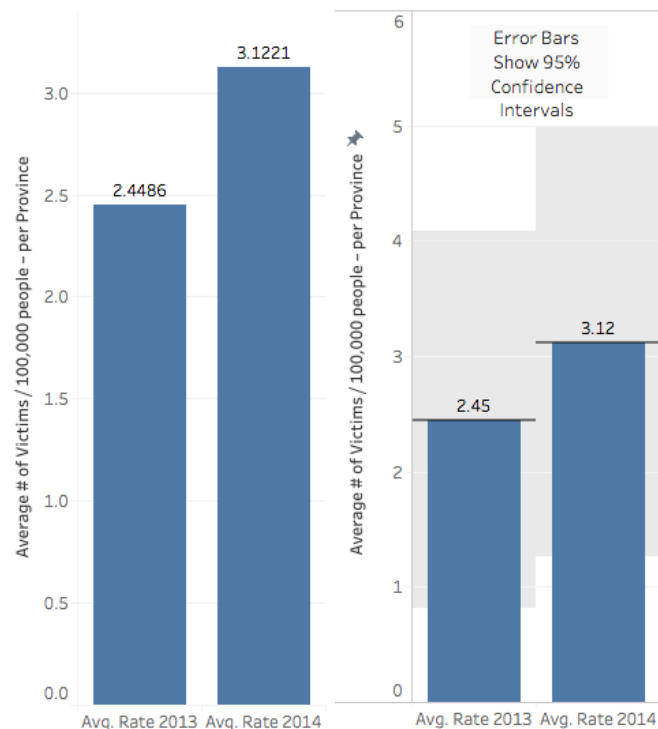
A “RORSCHACH” PROTOCOL



# IGNORING EFFECT SIZE AND VARIABILITY

Victims by Province Territory Table

Province/Territory	Rate 2013	Rate 2014
Alberta	2.05	2.52
British Columbia	1.66	1.90
Manitoba	4.03	3.43
New Brunswick	0.93	1.19
Newfoundland and Labra..	1.33	0.38
Northwest Territories	4.56	6.88
Nova Scotia	1.38	0.64
Nunavut	11.29	10.93
Ontario	1.24	1.13
Prince Edward Island	0.69	2.05
Quebec	0.86	0.86
Saskatchewan	2.80	2.13
Yukon	0.00	8.22



# A FEW MISTAKES THAT WE ALL MAKE

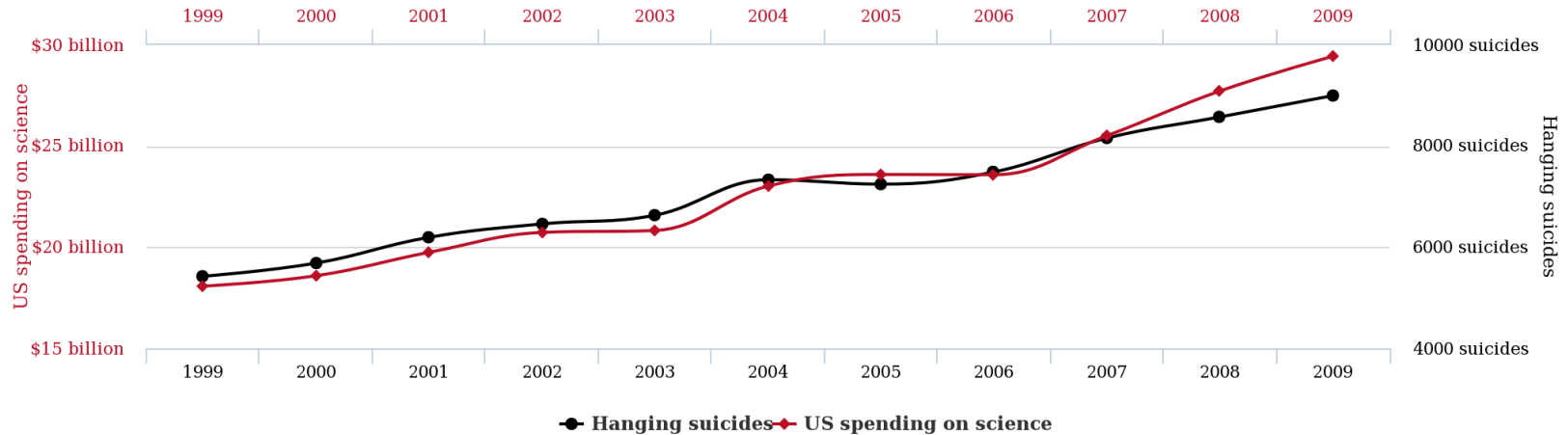
- Making meaningful comparisons
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# CORRELATIONS

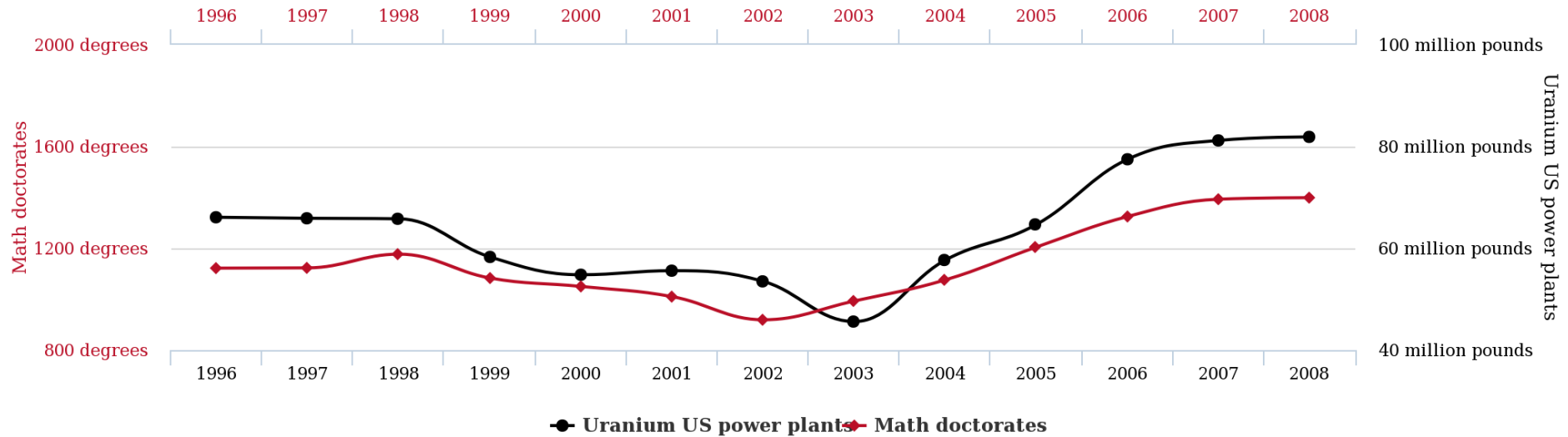
- Is there **really** a correlation?
- How **strong** is it?
- Is it **corroborated** by other data?
- Does it **make sense**?

# EVEN STRONG CORRELATIONS MIGHT NOT MEAN ANYTHING!

## US spending on science, space, and technology correlates with Suicides by hanging, strangulation and suffocation



# Math doctorates awarded correlates with Uranium stored at US nuclear power plants



**TRY THIS!**

[http://tylervigen.com/view\\_correlation](http://tylervigen.com/view_correlation)

# A FEW MISTAKES THAT WE ALL MAKE

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# THE “LITERALLY” OF DATA ANALYSIS





**“SIGNIFICANTLY...**

**DIFFERENT**

**HIGHER/LOWER**

**BIGGER/SMALLER**

**MORE/LESS**

**MORE IMPORTANT**

**ETC...**

**NEVER SAY THIS ...**

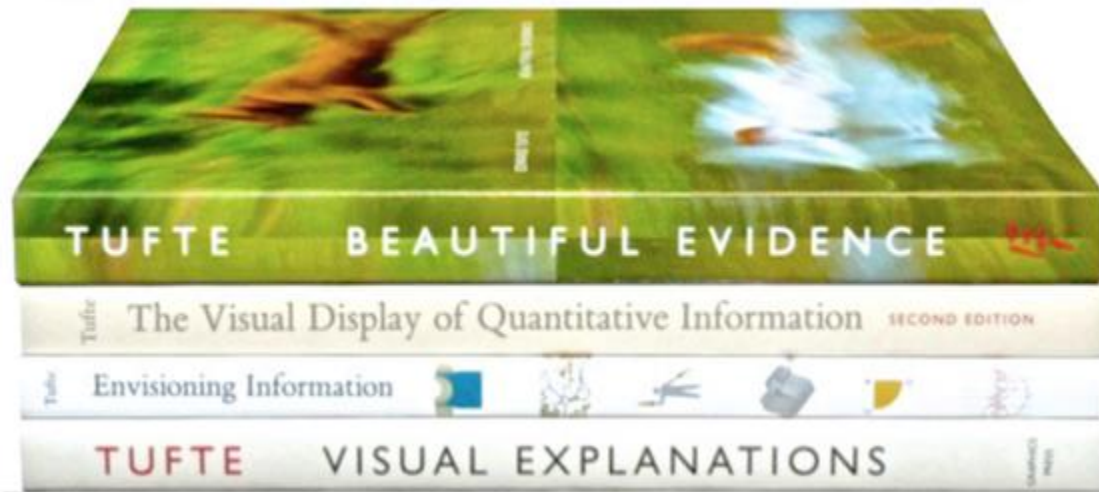
**UNLESS YOU'RE SURE THAT YOU  
HAVE PERFORMED THE CORRECT  
STATISTICAL SIGNIFICANCE TEST  
AND CAN REPORT P-VALUES, EFFECT  
SIZES, ETC.**

# **COMMUNICATING ASSUMPTIONS AND LIMITATIONS**

A good analysis must avoid overstating claims, and be honest about what you don't or can't know!

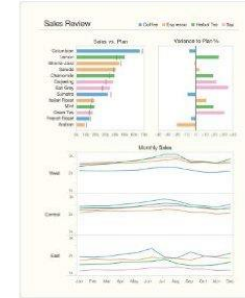


**Edward Tufte**



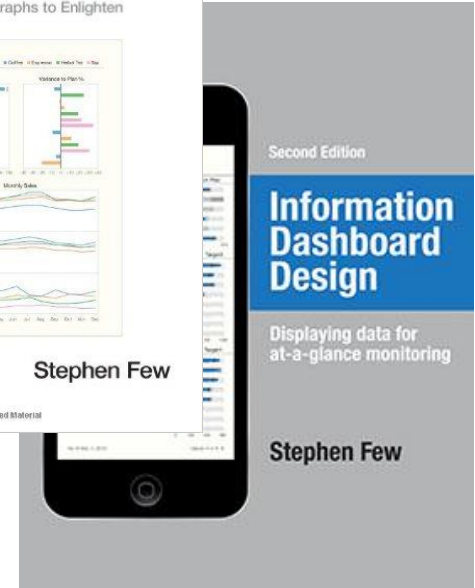
**Stephen Few**

**Show Me the Numbers**  
Designing Tables and Graphs to Enlighten



**Stephen Few**

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# GRAPHICAL INTEGRITY

- Well-designed presentation of interesting data
  - Substance, statistics, and design
- Complex ideas communicated with **clarity, precision** and **efficiency**
- Gives the viewer **greatest number of ideas** in the **shortest amount of time**, with the **least ink** and **smallest space**
- Nearly always **multivariate**
- Requires **telling the truth**



**Edward Tufte**

# HOW TO COMMUNICATE DATA HONESTLY TO AN AUDIENCE

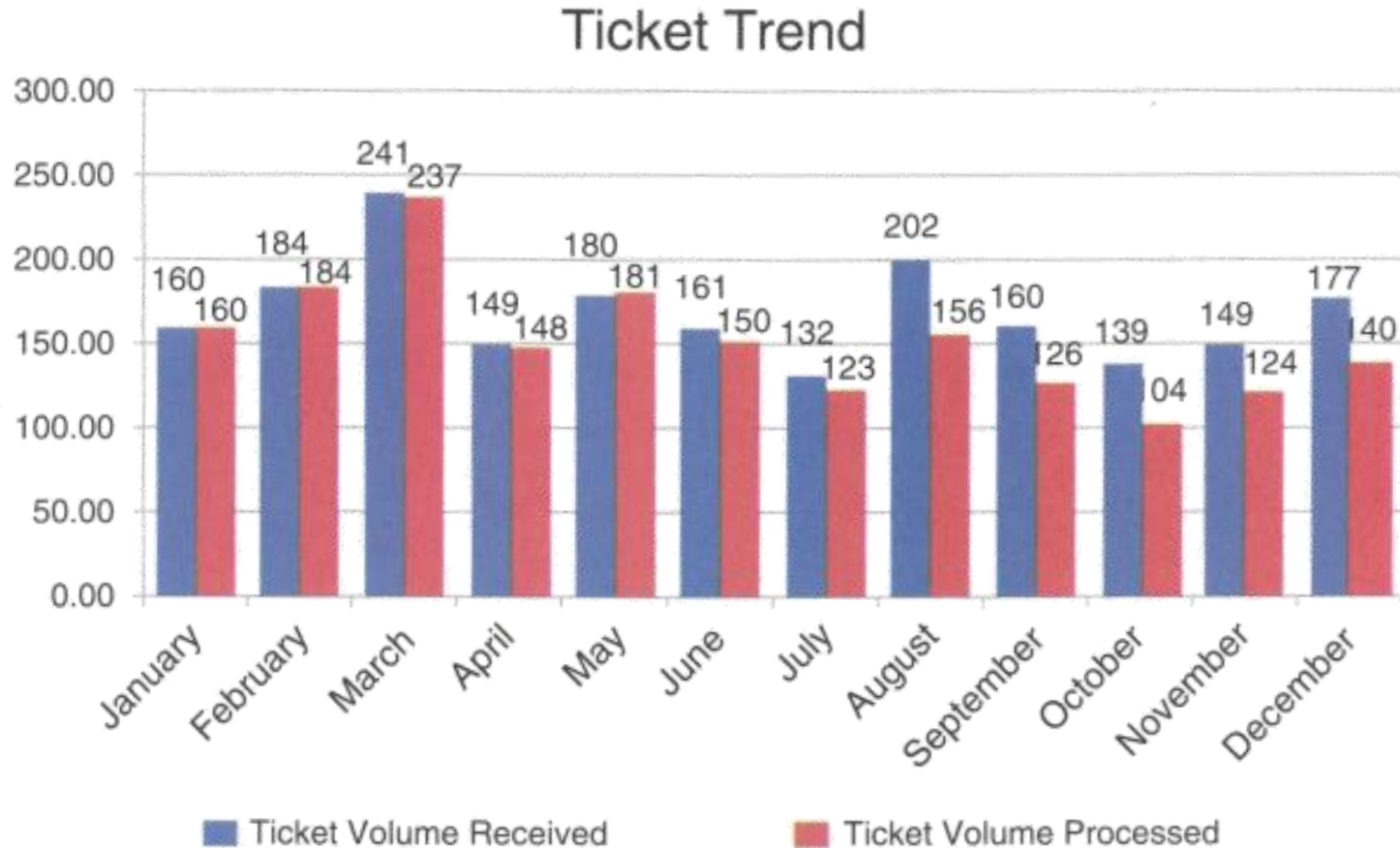
(W. Willett)

1. Be clear
2. **Emphasize** the important parts
3. **Acknowledge assumptions and ambiguity**
4. **Avoid overstating results**

# STORYTELLING WITH DATA

Design of Visualization for Communication

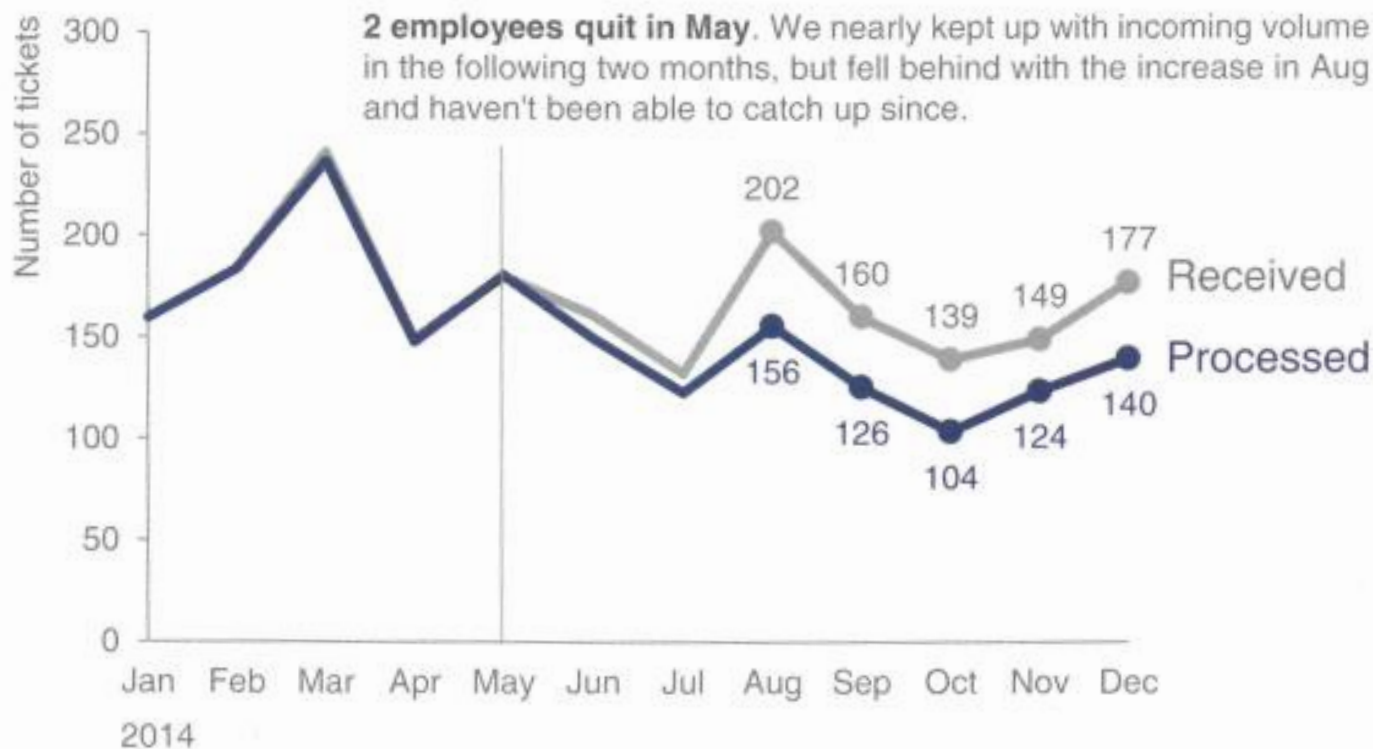
The chart was designed to argue for the hire of more two employees



# Please approve the hire of 2 FTEs

to backfill those who quit in the past year

## Ticket volume over time



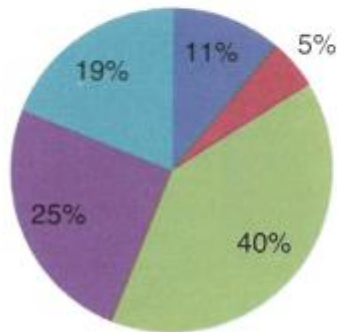


# EXAMPLE - EXERCISE

## Survey Results

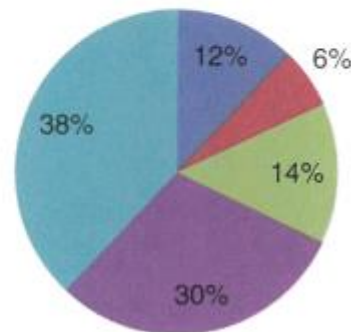
PRE: How do you feel about doing science?

■ Bored ■ Not great ■ OK ■ Kind of interested ■ Excited



POST: How do you feel about doing science?

■ Bored ■ Not great ■ OK ■ Kind of interested ■ Excited



survey conducted on 100 students before and after a pilot program

SKETCH – 10 MINUTES

DESIGN A CHART THAT BETTER CONVEYS THE OUTCOME OF THE PROGRAM

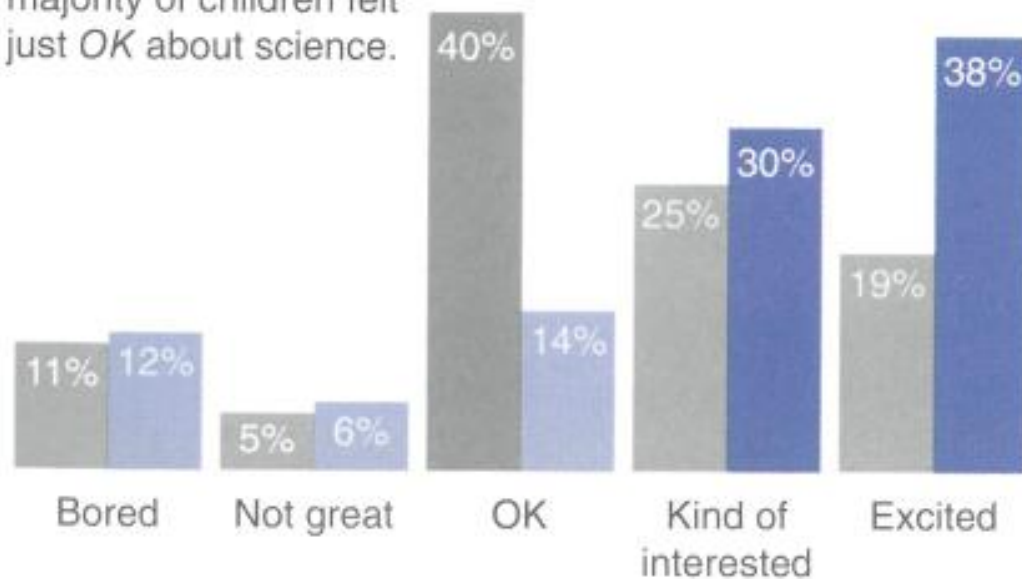
# QUESTIONS ON YOUR

- WHAT **POINT** DID YOU TRY TO MAKE?
- WHAT **LAYOUT** DID YOU CHOOSE?
- DID YOU PUT A **TITLE**?
- DID YOU PUT A **SUBTITLE**?
- DID YOU **HIGHLIGHT** ANY DATA?
- DID YOU ADD ANYTHING ELSE TO HELP **COMMUNICATE**?

# Pilot program was a success

How do you feel about science?

**BEFORE** program, the majority of children felt just *OK* about science.



**AFTER** program, more children were *Kind of interested & Excited* about science.

# KNOW YOUR CONTEXT

AUDIENCE, MEDIUM, MESSAGE

**WHO DO YOU WANT TO  
COMMUNICATE TO?**

# YOUR AUDIENCE

AVOID:

ANYONE WHO IS INTERESTED

INTERNAL AND EXTERNAL STAKEHOLDERS

BE MORE SPECIFIC, FIND OUT ABOUT THEM:

WILL THEY BE SUPPORTIVE OF YOUR MESSAGE?

DO THEY KNOW THE DATA?

# YOUR AUDIENCE

WHAT DO THEY WANT TO KNOW?

WHAT DO THEY NEED TO DO?

*accept / agree / begin / believe / change / collaborate / commence /  
create / defend / desire / differentiate / do / empathize / empower /  
encourage / engage / establish / examine / facilitate / familiarize /  
form / implement / include...*

**WHAT IS YOUR MEDIUM?**



# MEDIUM

- how much control does the audience have over the presentation?
- how much detail can they get?

LIVE PRESENTATION vs. ONLINE VISUALIZATION

**WHAT DO YOU WANT TO SHOW?**

# QUESTIONS

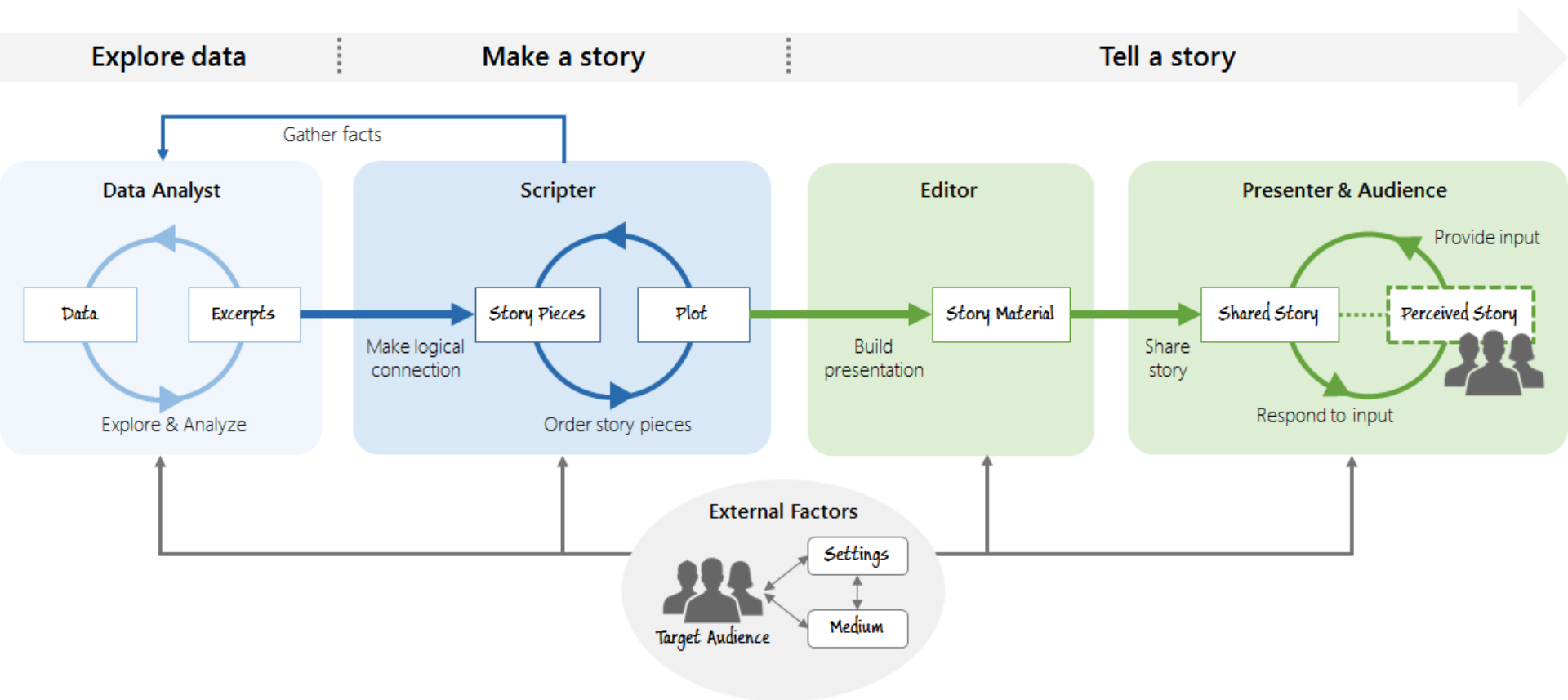
IN A SINGLE SENTENCE

IN 3 MINUTES

WHAT IS YOUR MESSAGE?

WHAT DOES YOUR AUDIENCE NEED TO  
KNOW?

FIGURE THIS OUT BEFORE YOU IMPLEMENT ANYTHING



**LAYOUT**

FEATURED

## U.S. Says It May Not Need Apple's Help to Unlock iPhone

By KATIE BENNER and MATT APUZZO 2:51 PM ET



Mario Jose Sanchez/Associated Press

A court hearing set for Tuesday was canceled in the Justice Department's bid to gain access to phone data in the San Bernardino mass shooting inquiry.

404 Comments

- Breaking Down Apple's iPhone Fight With the U.S. Government
- White Collar Watch: Apple May Be Willing to Risk Contempt Charge

MORE NEWS

### Chip-Card Payment System Delays Frustrate Retailers

By RACHEL ABRAMS 3:53 PM ET

Many complications were widely predicted, but a lag in certifying payment terminals has added an unexpected wrinkle — and lots of finger-pointing.



TECH TIP

### Keeping Up With Android Security Patches

By J. D. BIERSDORFER

After a nasty Android bug surfaced last summer, Google has been sending out monthly updates for the software on its Nexus hardware.

### Apple and Yahoo Each Struggle for Control of Their Futures

By QUENTIN HARDY

Apple is in a courtroom fight with the Justice Department, while Yahoo is contending with a sliding stock price and an activist hedge fund.



### CrowdSignals Aims to Create a Marketplace for Smartphone Sensor Data

By STEVE LOHR

A new project seeks to collect, label and pay for mobile sensor data and encourage innovation in many fields.



### Andrew S. Grove, Intel Chief Who Spurred Semiconductor Revolution, Dies at 79

By JONATHAN KANDELL

The semiconductor chip was a development as momentous as hydrocarbon fuels, electricity and telephones were in



BITS

Insight and analysis on Silicon Valley and the technology industry.

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PERSONAL TECHNOLOGY

### Instagram May Change Your Feed, Personalizing It With an Algorithm

By MIKE ISAAC

As our online networks of friends have grown and the social media companies have matured, feeds are evolving, too.



APP SMART

### Checklists and Tips to Help Streamline Spring Cleaning

By KIT EATON

It's time for spring cleaning again, and some apps can help users stay organized while getting their homes in order.



TECH TIP

### Speaking Your Mind to Google Docs

By J. D. BIERSDORFER

An external microphone can help you be better understood by Google's online word-processing program when you type by talking.

TECH TIP

### Marking Up a Mac's iBook Pages

By J. D. BIERSDORFER

Apple's e-books program for OS X includes tools for making margin notes, highlighting passages and sharing your favorite parts of the story.

TECH TIP

### Recording Live Television in Windows 10

By J. D. BIERSDORFER

If you miss the digital-video recording functions of Windows Media Center, you can find other ways to watch and record your favorite broadcast shows.



TECH TIP

### Getting the Weather Report From Windows

By J. D. BIERSDORFER

Windows 10 offers several ways to get a forecast on your screen.

APP SMART

### Mobile Games to Make Time Fly

By KIT EATON

Here are some of the best games to take the boredom out



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- Bits: Flinging Emojis, Twitch Chatters Revel as Julia Child Cooks
- Apple vs. the F.B.I.: How the Case Could Play Out
- Breaking Down Apple's iPhone Fight With the U.S. Government
- Apple's New iPhones Say: Small Is Beautiful, Too
- Judge in Apple Case Seen as Unfazed by Stress, Even a Plane Crash
- Tech Tip: Logging Into Windows 10 With a Favorite Photo

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### The Terminator and the Washing Machine

What the legendary matches between supercomputer Deep Blue and chess grandmaster Garry Kasparov reveal about today's artificial intelligence and machine learning fears.

# LARLAR

Most of us like to think we can get ahead in life while keeping our noses clean. But, as **Ian Leslie** explains, we only got to the top of the evolutionary tree because we had a gift for misrepresentation

**Y**ou could call it humanity's dirty little secret. What helped to make us the most intelligent species on Earth was, to be honest, our talent for deception.

The human brain, possibly evolution's most impressive achievement, is also a bit of a mystery. We have much bigger brains, relative to our bodies, than any other mammal. Our hominid ancestors had brains about a third the size of ours. At some point between 2 and 1.5 million years ago, our ancestors' brains began to expand, and at quite a rate. Scientists have never been sure why.

For a long time, the nearest thing to an accepted explanation was that our intelligence resulted from our facility for making tools. But in the early 1980s, two young primatologists at the University of St Andrews began to wonder if it wasn't linked to something less flattering to our self-image: a capacity for deceit.

Richard Byrne and Andy Whiten had read descriptions of chimpanzee trickery in the works

of Jane Goodall, and during their own fieldwork in the Drakensberg mountains of South Africa they noticed baboons engaging in deceptive behaviour. For instance: a young baboon gets in trouble with several elders, including his mother, for attacking another member of the group. When he hears them coming for him, grunting aggressively, he stands and stares into the distance. The elders, thinking that a predator or rival troop must be approaching, stop and stare too. There is no threat. But the elders are distracted enough to forget what they came running over for.

Another example: an adult male baboon shoves a female off her feeding patch. Rather than protest or retreat, she flicks her gaze in a characteristic way from him to a younger male who is happily feeding nearby. The first male charges over to the younger one and chases him away. The female, meanwhile, returns to her patch and resumes feeding.

When Byrne and Whiten asked around, their colleagues regaled them with similar anecdotes. The two developed a hunch: that these stories represented something beyond aberrant aspects of primate behaviour, and that our closest relatives — chimps, gorillas and orang utans — are practised, habitual deceivers. Byrne and Whiten also began to suspect that such behaviour might be linked to the development of primate intelligence: those animals with the mental sophistication to trick their way into getting more food, as our female baboon did, would have had a reproductive edge. Through the slow work of natural selection, the primate brain evolved to cope with the demands of such trickery.

So a connection between deception and mental capacity in our primate ancestors might help to explain the development of our own brains. This was an exciting thought. But initially, Byrne and Whiten found it hard to get any of their research published despite amassing a substantial body of evidence. Deception just was not a subject that many in their field took seriously.

## BRAIN SIZE

2.5-1.6 million years ago  
(*Homo habilis*)

1.8-1 million years ago  
(*Homo erectus*)

600,000 years ago  
(*Homo neanderthalensis*)

200,000 years ago  
(*Homo sapiens*)



**VERVET**  
Average group size

24



Average neocortex size  
(cubic centimetres)

61.4



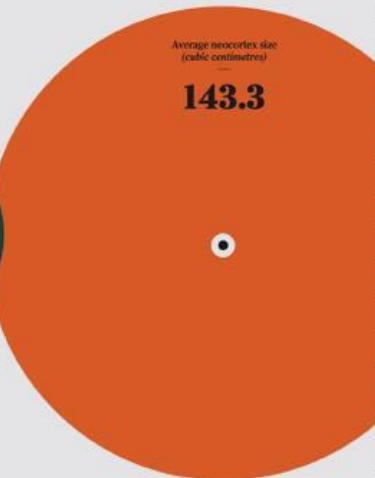
**YELLOW BABOON**  
Average group size

39



Average neocortex size  
(cubic centimetres)

143.3



In 1982, however, they gained new impetus from a book that gave a gripping account of the shifting relationships within a colony of chimpanzees in a Dutch zoo. Frans de Waal's *Chimpanzee Politics* reads like the script of a soap opera or gangster movie. Alliances are formed, broken and re-formed, individuals are manipulated, violence is selectively employed, females are fought over and seduced. De Waal prefaced his book with quotes from Hobbes and Machiavelli, suggesting that this was a vision of human politics in the raw. Byrne and Whiten were fascinated, particularly by those episodes that showed deceptive behaviour, as when a chimp, presenting himself as a friend, would suddenly attack an unsuspecting rival.

In 1988 the two primatologists finally published their work in the form of a book, *Machiavellian Intelligence*. An unsettling read, it explored "the idea that intelligence began in social manipulation, deceit and cunning co-operation", showing that animals, far from living in a state of innocence, are as manipulative and underhand as the worst of our own species. It was persuasive too, making a big impact not only in primatology but in psychology, anthropology and medicine.

Byrne and Whiten believed that what they termed Machiavellian intelligence was linked to the size of the group an animal lived in: the bigger the group, the more complex the calculations individuals needed to make to survive. But there was little hard evidence for this until 1992, when Robin Dunbar, at the University of Liverpool, came up with a way to demonstrate a link between brain size and the complexity of an animal's social life.

Dunbar, too, had noticed that the size of a primate's brain appeared to be related to the size of the group it lived in. Baboons have big brains and live in big groups; vervets, who have smaller brains, live in smaller groups. He decided to investigate by looking at the neocortex. This is the "thinking" part of the brain: the part that deals with abstraction, self-reflection and planning. It was also the part that showed such rapid expansion in primates — especially humans — two million years ago.

Dunbar plunged into the vast accumulation of primate data from around the world, looking for a correlation between the size of an animal's neocortex and the size of its social groups. He found a link so strong that he was able to predict, with impressive accuracy, the group size of a species he hadn't looked at, just by knowing its brain size. He even came up with a prediction for human →

## SEEING IS DECEIVING

Many species, not just primates, practise deception as one of their survival strategies. The eastern hognose snake will, if threatened, fake its own death by rolling over on its back, emitting a foul stench and letting its tongue loll out of its mouth. The mimic octopus, found in the waters off Bali in Indonesia, can disguise itself as one of several other sea creatures, all the better to lure its prey.

Even plants deceive. The mirror orchid of North Africa produces small flowers to attract potential pollinators. The flowers have no nectar, but the orchids have a special ruse to seduce the wasps that pollinate them: they impersonate female wasps. The blue-violet centre of the flower resembles the wings of a female wasp at rest, while a thick set of long red hairs imitates the hairs on the insect's abdomen. It's bait — insect porn for horny male wasps.

### THE MIMIC OCTOPUS...

... as a sea snake

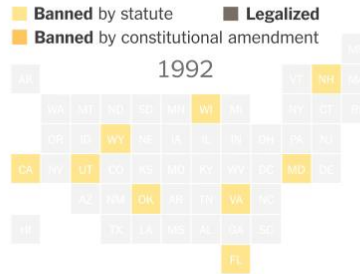


... as a lion fish



... and a flatfish

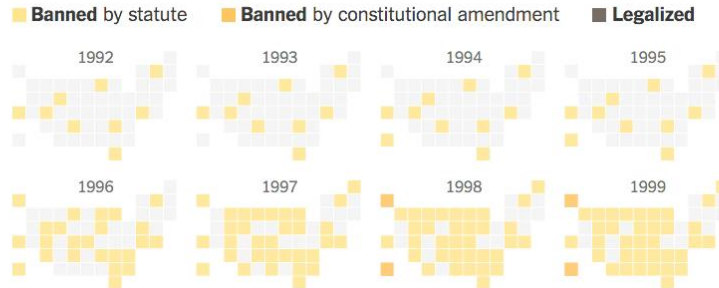




## Gay Marriage State by State: From a Few States to the Whole Nation

By HAEYOUN PARK

The Supreme Court in June said that same-sex couples had a constitutional right to marry, effectively requiring that the 13 states that prohibit such unions reverse those bans. Over the last two years, the number of states authorizing gay marriage had expanded rapidly because of legislative decisions, referendums or court orders.



A ruling by the Hawaii Supreme Court in 1993 allowing same-sex marriage, along with rising demands for marriage equality nationwide, prompted a backlash. A majority of states, including Hawaii, adopted laws or constitutional amendments that limited marriage to a man and a woman. In 1996, Congress passed the Defense of Marriage Act, banning federal recognition of same-sex marriage.

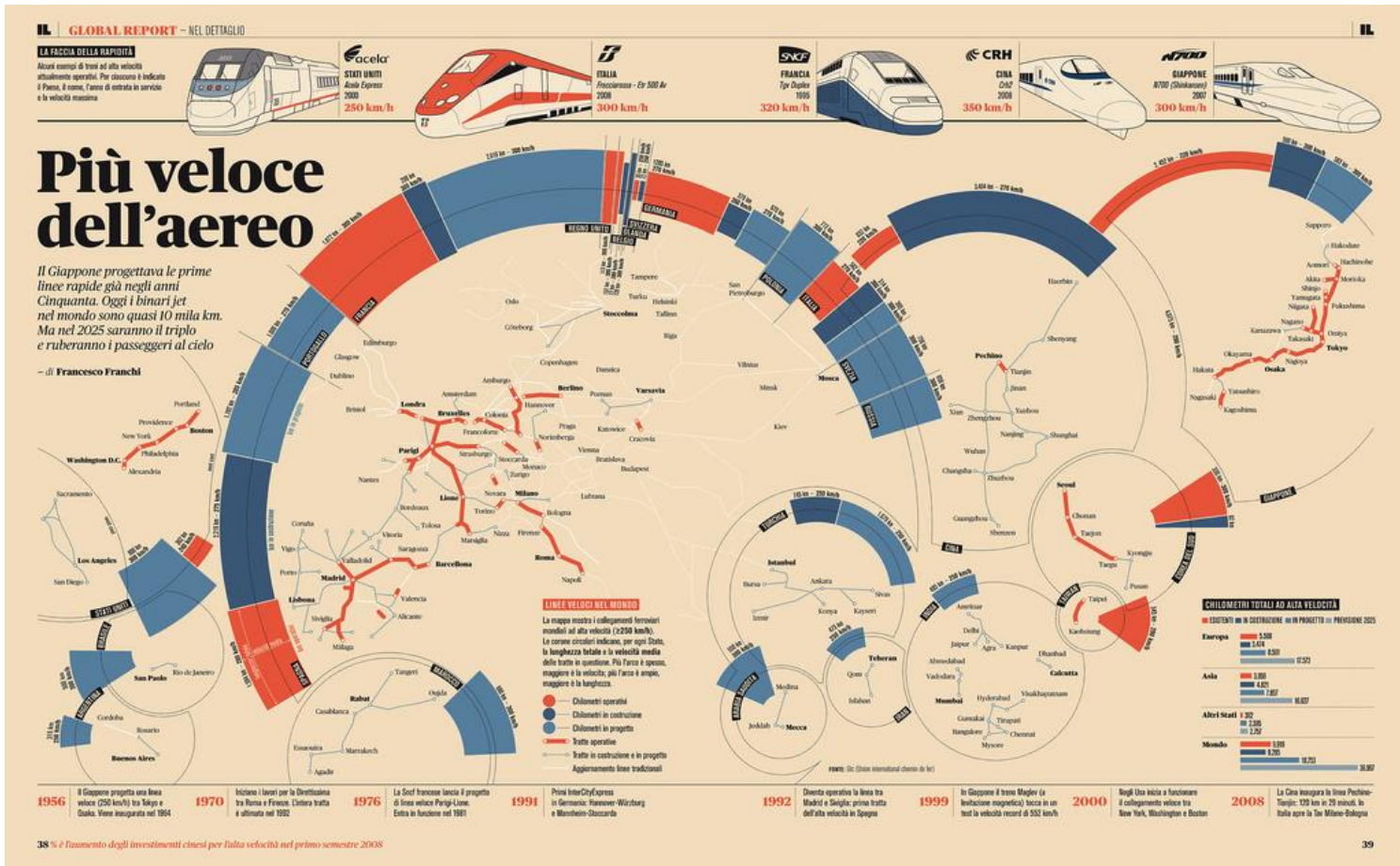




**ESPECIALLY IMPORTANT  
WHEN INTEGRATING  
VISUALIZATIONS INTO SOMETHING  
BIGGER**

A STORY, A BIGGER INTERACTIVE, ETC.

BUT LAYOUT IS ALSO IMPORTANT FOR INTRODUCING  
SELF-CONTAINED **INFOGRAPHICS** AND **INTERACTIVE CHARTS**



# A 3-D View of a Chart That Predicts The Economic Future: The Yield Curve

By GREGOR AISCH and AMANDA COX MARCH 18, 2015

● ○ ○ ○ ○ ○ ○ ○ ○ ○

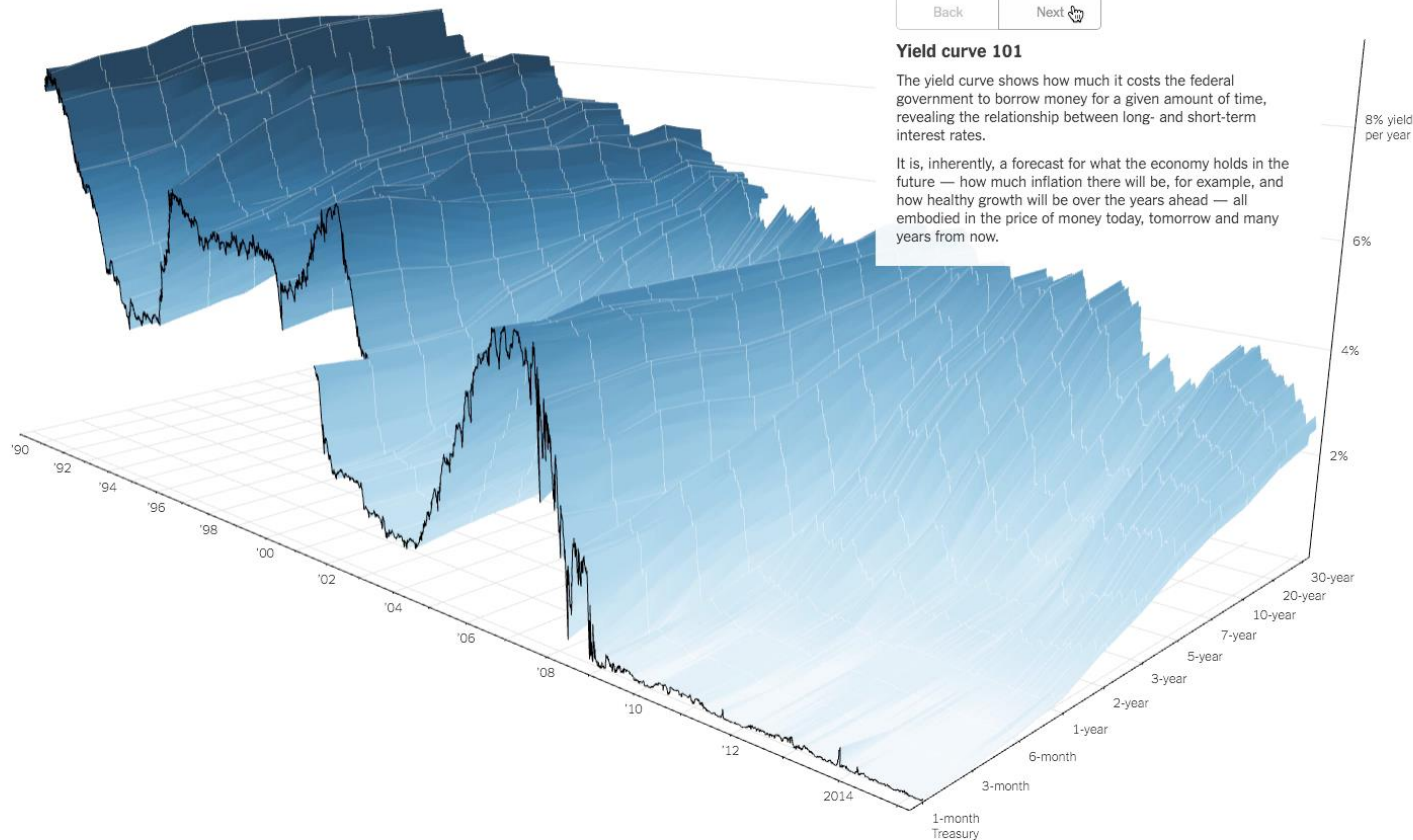
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Next

## Yield curve 101

The yield curve shows how much it costs the federal government to borrow money for a given amount of time, revealing the relationship between long- and short-term interest rates.

It is, inherently, a forecast for what the economy holds in the future — how much inflation there will be, for example, and how healthy growth will be over the years ahead — all embodied in the price of money today, tomorrow and many years from now.



# DIRECT ATTENTION

## DRAW ATTENTION TO ONE THING FIRST.

## THEN USE COLOR, SIZE, SPACE, AND PLACEMENT TO DIRECT VIEWERS TO THE NEXT IMPORTANT POINT.

Walking Skyscrapers  
New York City Walking Tours  
NYU School of Architecture  
Continuing Education Program  
Fall 2004

Experience the history and variety of Manhattan's noteworthy architectural wonders—the skyscrapers that have given the city its signature skyline and inspired its residents for nearly one hundred years.

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New York's first skyscraper and the industrial buildings of the early 20th Century

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Explore the concrete canyons that rose up on the site of New Amsterdam

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The corporate megaliths of the 1970s and 1980s

Sign up now! Space is limited.  
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## **Walking Skyscrapers**

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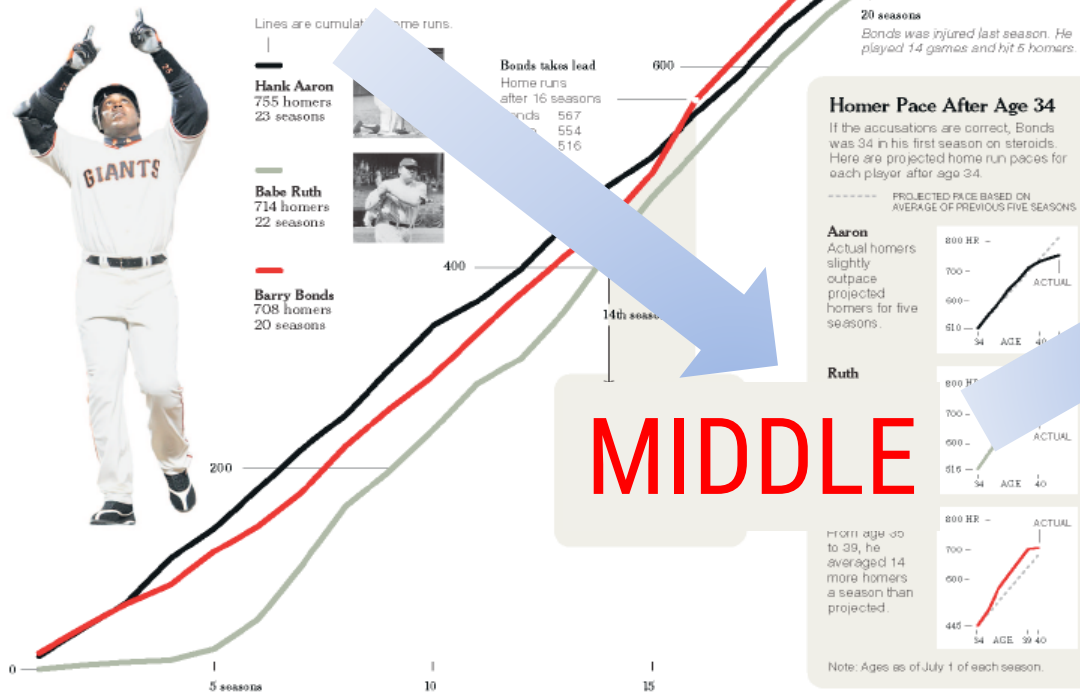


WE TEND TO SCAN TOP TO BOTTOM  
THEN LEFT TO RIGHT

BUT...

**SIZE & COLOR** CAN PREEMPT THAT  
ORDER

# BEGINNING



## Others Taking Aim



Alex Rodriguez

# END

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

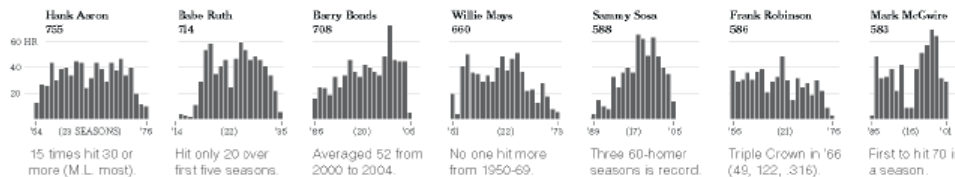
**Ken Griffey Jr.**  
Many thought he would be the first to catch Ruth and Aaron until injuries limited his output.



# MIDDLE

## 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).

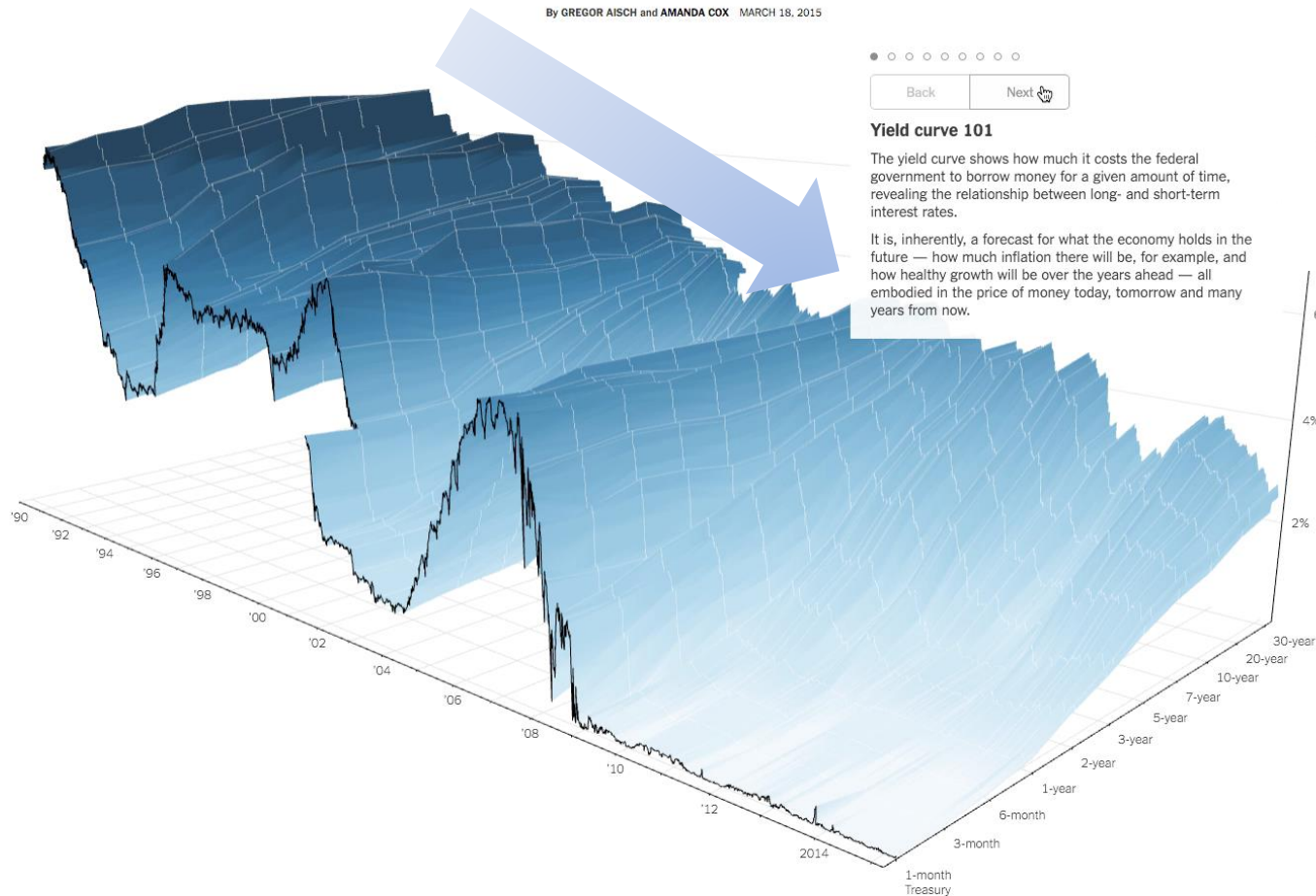


# EPILOGUE

**BEGINNING**

## A 3-D View of a Chart That Predicts The Economic Future: The Yield Curve

By GREGOR AISCH and AMANDA COX MARCH 18, 2015



**NEXT**



# THE STRUCTURE OF NEWS AND PRINT ARTICLES

CAN ALSO  
BE USEFUL FOR VISUALIZATIONS

# LAR LIAR

Most of us like to think we can get ahead in life while keeping our noses clean. But, as **Ian Leslie** explains, we only got to the top of the evolutionary tree because we had a gift for misrepresentation

## DECK OR STANDFIRST (ARTICLE SUMMARY) INTRODUCE CONTENT/PROVIDE INSTRUCTIONS

# Y

ou could call it humanity's dirty little secret. What helped to make us the most intelligent species on Earth was, to be honest, our talent for deception.

The human brain, possibly evolution's most impressive achievement, is also a bit of a mystery. We have much bigger brains, relative to our bodies, than any other mammal. Our hominid ancestors had brains about a third the size of ours. At some point between 2 and 1.5 million years ago, our ancestors' brains began to expand, and at quite a rate. Scientists have never been sure why.

For a long time, the nearest thing to an accepted explanation was that our intelligence resulted from our facility for making tools. But in the early 1980s, two young primatologists at the University of St Andrews began to wonder if it wasn't linked to something less flattering to our self-image: a capacity for deceit.

Richard Byrne and Andy Whiten had read descriptions of chimpanzee trickery in the works

of, in the best of intentions, to be sly and avoid being threatened. But the elders are distracted enough to forget what they came running over for.

Another example: an adult male baboon shoves a female off her feeding patch. Rather than protest or retreat, she flicks her gaze in a characteristic way from him to a younger male who is happily feeding nearby. The first male charges over to the younger one and chases him away. The female, meanwhile, returns to her patch and resumes feeding.

When Byrne and Whiten asked around, their colleagues regaled them with similar anecdotes. The two developed a hunch: that these stories represented something beyond aberrant aspects of primate behaviour, and that our closest relatives — chimps, gorillas and orang-utans — are practised, habitual deceivers. Byrne and Whiten also began to suspect that such behaviour might be linked to the development of primate intelligence: those animals with the mental sophistication to trick their way into getting more food, as our female baboon did, would have had a reproductive edge. Through the slow work of natural selection, the primate brain evolved to cope with the demands of such trickery.

So a connection between deception and mental capacity in our primate ancestors might help to explain the development of our own brains. This was an exciting thought. But initially, Byrne and Whiten found it hard to get any of their research published despite amassing a substantial body of evidence. Deception just was not a subject that many in their field took seriously.

Average neocortex size  
(cubic centimetres)

61.4

Average neocortex size  
(cubic centimetres)

143.3

### BRAIN SIZE

2.5-1.6 million years ago  
(*Homo habilis*)

1.8-1 million years ago  
(*Homo erectus*)

600,000 years ago  
(*Homo neanderthalensis*)

200,000 years ago  
(*Homo sapiens*)



SIDEBARS  
USEFUL SPACES FOR  
SUPPLEMENTAL  
VISUALIZATIONS, LEGENDS, AND  
OTHER IMPORTANT DETAILS

### SEEING IS DECEIVING

Many species, not just primates, practise deception as one of their survival strategies. The eastern hog-nosed snake will, if threatened, fake its own death by rolling over on its back, emitting a foul stench and letting its tongue loll out of its mouth. The mimic octopus, found in the waters off Bali in Indonesia, can disguise itself as one of several other sea creatures, all the better to lure its prey.

Even plants deceive. The mirror orchid of North Africa produces small flowers to attract potential pollinators. The flowers have no nectar, but the orchids have a special ruse to seduce the wasps that pollinate them: they impersonate female wasps. The blue-violet centre of the flower resembles the wings of a female wasp at rest, while a thick set of long red hairs imitates the hairs on the insect's abdomen. It's bait — insect porn for horny male wasps.

#### THE MIMIC OCTOPUS...

... as a sea snake



... as a lion fish



... and a flatfish



# The Changing Nature of Middle-Class Jobs

HEADLINE

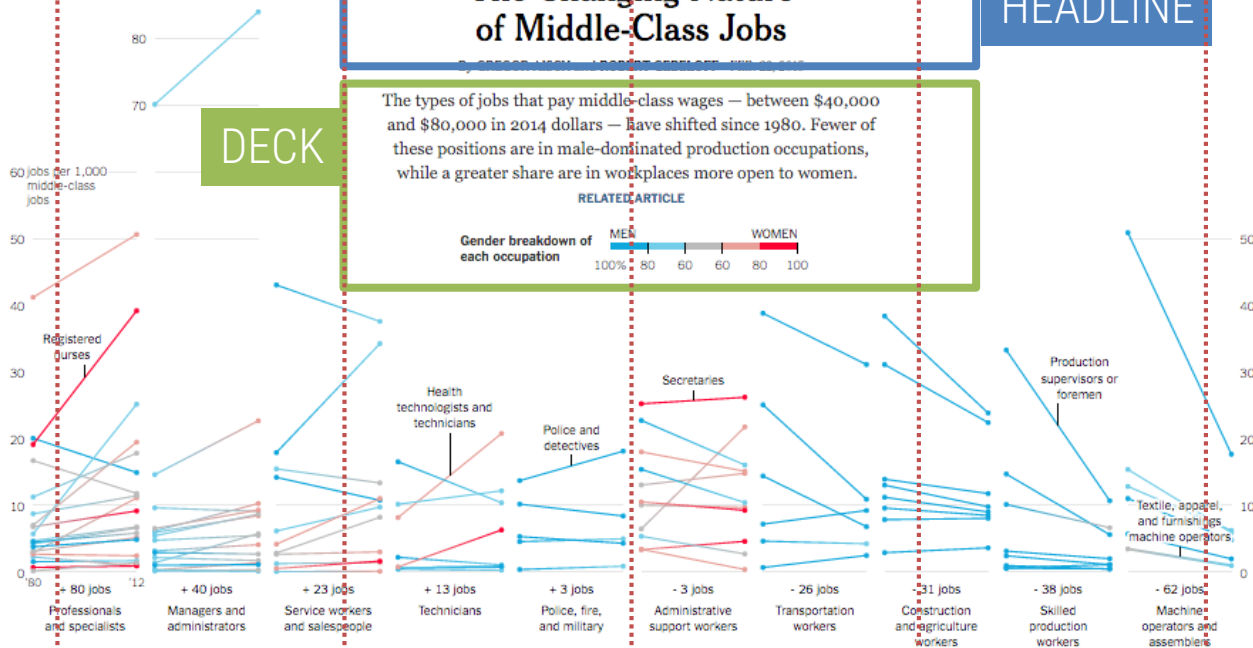
DECK

The types of jobs that pay middle-class wages — between \$40,000 and \$80,000 in 2014 dollars — have shifted since 1980. Fewer of these positions are in male-dominated production occupations, while a greater share are in workplaces more open to women.

## RELATED ARTICLE

Gender breakdown of each occupation

MEN 100% 80 60 40 20 0 20 40 60 80 100 WOMEN



## Biggest Gainers and Losers

Registered nurses and other speciality occupations accounted for the largest share of growth in the middle-class wage range. In 1980, 19 of every 1,000 middle-class jobs were held by registered nurses. Today, the rate is 39 per 1,000.

### Top 20 occupations that gained share

Occupation	1980	2012	Change
Registered nurses	19	39	+20
Mathematical and computer scientists	6	25	+19
Supervisors and proprietors of sales jobs	18	34	+16
Adjusters and investigators	6	22	+15
Managers and administrators	70	84	+14
Health technologists and technicians	8	21	+13
Other teachers and counselors	7	19	+12
Elementary school teachers	41	51	+9
Health therapists	3	11	+8
Accountants and auditors	15	23	+8
Health assistants	4	11	+7

### Jobs per 1,000 middle-class jobs

Occupation	1980	2012	Change
Machine operators and tenders, except precision	51	18	-33
Production supervisors or foremen	33	11	-23
Construction trades, except electricians	38	24	-15
Freight, stock and material handlers	25	11	-14
Assemblers of electrical equipment	15	6	-9
Precision metal working occupations	15	6	-9
Vehicle and mobile equipment mechanics and repairers	31	22	-9
Truck, delivery and tractor drivers	39	31	-8
Transportation occupations	14	7	-8

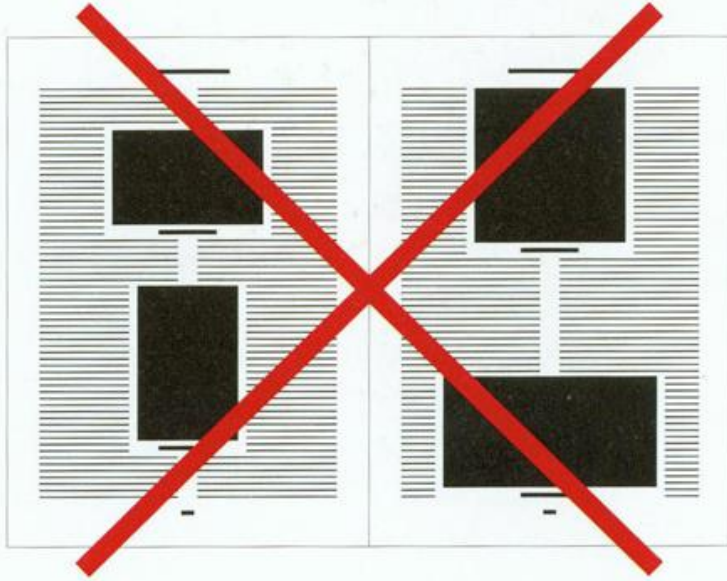
### Top 20 occupations that lost share

Occupation	1980	2012	Change
Machine operators and tenders, except precision	51	18	-33
Production supervisors or foremen	33	11	-23
Construction trades, except electricians	38	24	-15
Freight, stock and material handlers	25	11	-14
Assemblers of electrical equipment	15	6	-9
Precision metal working occupations	15	6	-9
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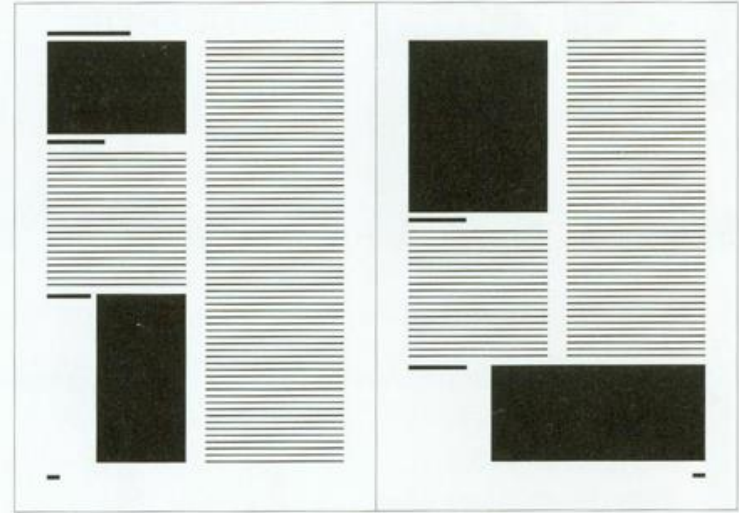
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Truck, delivery and tractor drivers	39	31	-8
Transportation occupations	14	7	-8

# VISUALS ANCHOR THE TEXT



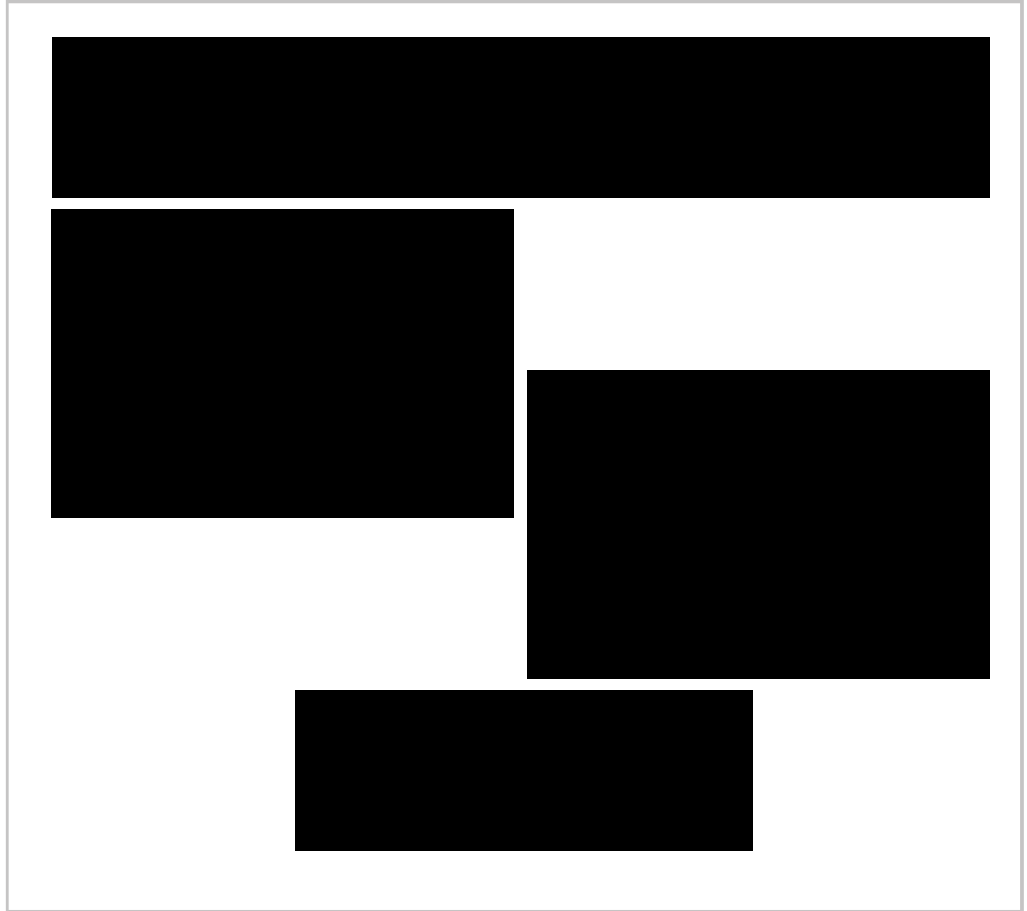
THE NEW TYPOGRAPHY  
Diagram, 1928  
(redrawn)  
Designer and author:  
Jan Tschichold



*Tschichold's diagram of good and bad magazine design advocates staggering images in relation to content instead of forcing text to wrap around blocks moored at the center of the page. Explaining this experiment, Tschichold wrote that his redesigned pages would be even more effective if the photographic halftones (called "blocks") were produced in fixed rather than arbitrary sizes.*

# POSITIVE AND NEGATIVE SPACE

YOU DON'T NEED TO  
USE ALL OF THE  
AVAILABLE SPACE



IN THEATRES THIS SUMMER

# MINIMALISM

IF YOU CAN DO IT WITH LESS, DO IT!

TRY TO SHOW **ONLY WHAT'S NECESSARY.**

USE DESIGN TO **COMMUNICATE**, NOT DECORATE.

# TYPOGRAPHY



ALMOST EVERY VISUALIZATION  
USES TEXT

...AND ALMOST EVERY VISUALIZATION  
CAN BENEFIT FROM GOOD USE OF  
TYPOGRAPHY

## THE BASICS

Serif

Sans Serif

# TYPE ON THE WEB

USED TO BE VERY  
LIMITED

Arial

**Arial Black**

**Comic Sans MS**

Courier New

Georgia

**Impact**

Times New Roman

Trebuchet MS

Verdana

# NOW...LOTS OF GREAT OPTIONS

Normal 400

Grumpy wizards make toxic brew for the evil Queen and Jack.

**Open Sans**, 10 Styles by [Steve Matteson](#)

---

Normal 400

Grumpy wizards make toxic brew for the evil Queen and Jack.

**Roboto**, 12 Styles by [Christian Robertson](#)

---

Normal 400

Grumpy wizards make toxic brew for the evil Queen and Jack.

**Lato**, 10 Styles by [Lukasz Dziedzic](#)

---

Normal 400

Grumpy wizards make toxic brew for the evil Queen and Jack.

**Slabo 27px**, 1 Style by John Hudson

---

Normal 400

Grumpy wizards make toxic brew for the evil Queen and Jack.

**Roboto Condensed**, 6 Styles by [Christian Robertson](#)

---

Normal 400

**Grumpy wizards make toxic brew for the evil Queen and Jack.**

Normal 400

Grumpy wizards make toxic brew for the evil Queen and Jack.

**Noto Sans**, 4 Styles by [Google](#)

---

Normal 400

Grumpy wizards make toxic brew for the evil Queen and Jack.

**PT Serif**, 4 Styles by [ParaType](#)

---

Normal 400

Grumpy wizards make toxic brew for the evil Queen and Jack.

**Alegreya Sans**, 14 Styles by [Juan Pablo del Peral](#)

---

Normal 400

Grumpy wizards make toxic brew for the evil Queen and Jack.

**Titillium Web**, 11 Styles by Multiple Designers

---

Normal 400

**Grumpy wizards make toxic brew for the evil Queen and Jack.**

**Passion One**, 3 Styles by [Fontstage](#)

---

Normal 400

Grumpy wizards make toxic brew for the evil Queen and Jack.

# NUMBERS

CHOOSE FONTS AND  
WEIGHTS TO MAXIMIZE  
LEGIBILITY AT THE SIZE  
THEY'LL BE DISPLAYED

For Numbers...

Din

0123456789

Helvetica Neue

0123456789

Myriad

0123456789

Gills Sans

0123456789

Tahoma

0123456789

Azuro

1 2 3 4 5 6 7 8 9 0

Lucida Sans

0123456789

# USE TWO TYPEFACES MAXIMUM

(OFTEN EVEN ONE IS ENOUGH.)

YOU CAN ALSO USE:

**WEIGHT**

COLOR

*Italics*

SIZE

# KEEP TYPE LARGE AND LEGIBLE

## 40-60pt (or Bigger) for Headlines

12-16 for body text, captions, and visualization text.

You should almost never use 10pt or smaller.  
(Even IN your visualizations.)

# TYPE AND CONTRAST

Be careful  
with small  
differences in  
luminosity.

What works  
on your display  
may not work  
in general.



# TYPE CAN SUGGEST



[Web](#) [Images](#) [Video](#) [News](#) [Maps](#) [more »](#)

Google Search

I'm Feeling Lucky

[Advertising Programs](#) - [Business Solutions](#) - [About Google](#)

[Make Google Your Homepage!](#)

©2007 Google

10 YEARS AGO



Google Search

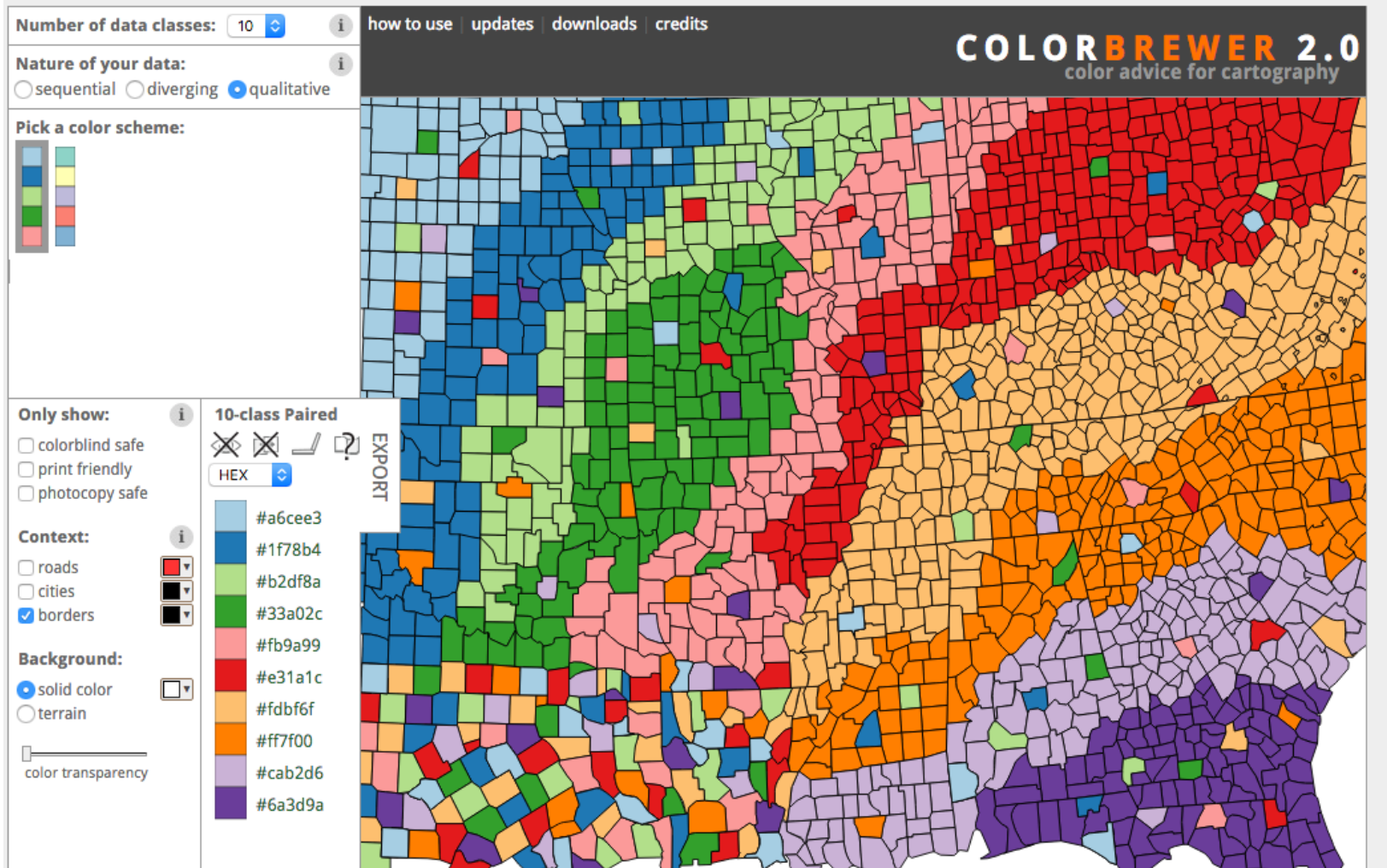
I'm Feeling Lucky

Google.ca offered in: [Français](#)

TODAY  
(CUES CAN BE SUBTLE)

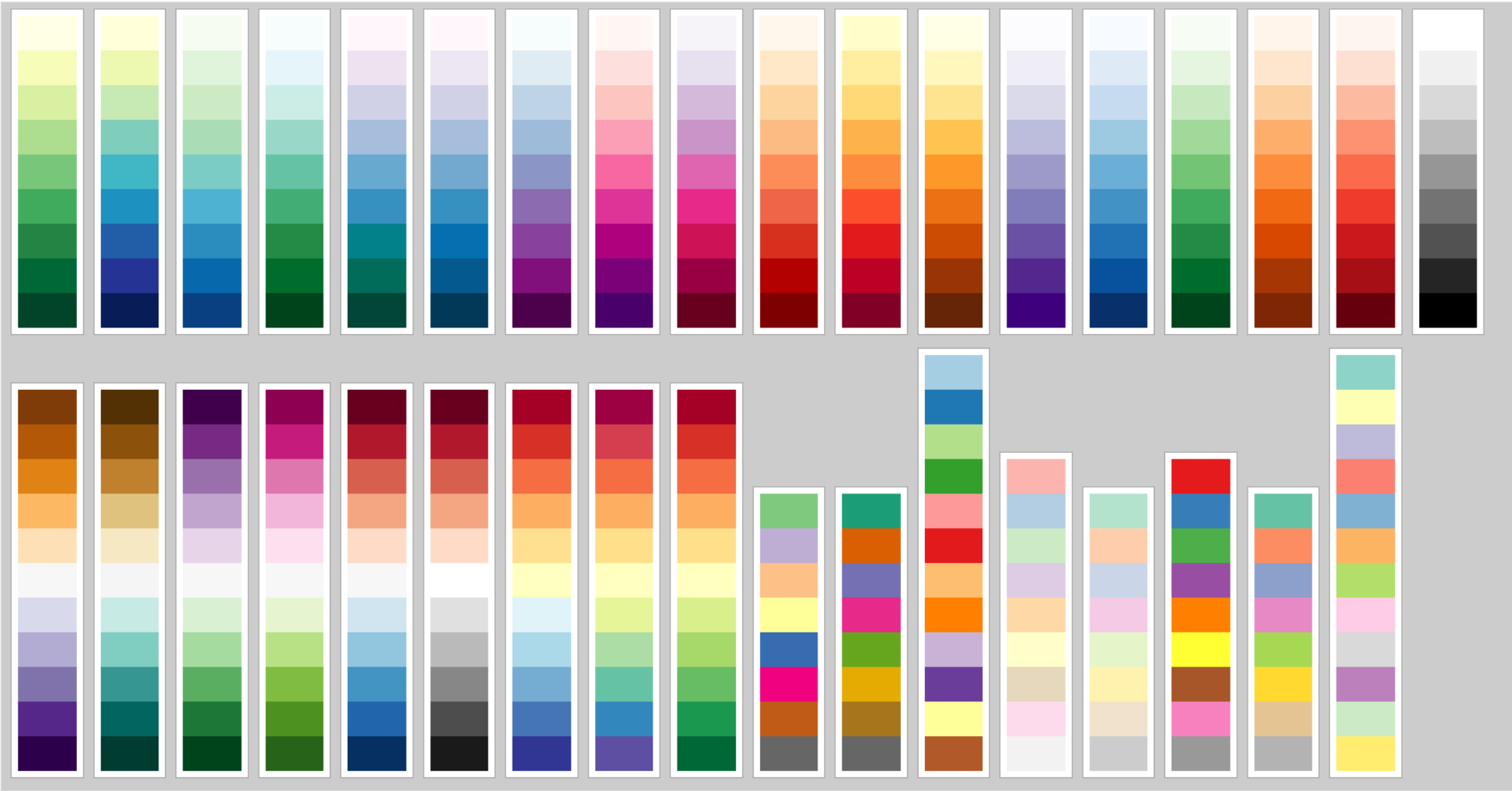
# COLOR

( WE'VE SEEN THIS BEFORE.)



USE COLORBREWER!

# Every ColorBrewer Scale



# **SYMBOLS AND ICONOGRAPHY**

# SEMIOTICS (THE STUDY OF SIGNS)



**SIGNIFIED**  
A THING OR IDEA



**SIGNIFIER**  
A REPRESENTATION  
OF THE THING OR IDEA  
(A WORD, PICTURE, SOUND, ETC.)

warmth  
heat  
danger  
etc.

**SENSE**  
THE UNDERSTANDING A  
VIEWER GETS FROM  
SEEING THE SIGNIFIED  
(OR THE SIGNIFIER!)

# TYPES OF SIGNS



printer-sif on  
impression-sif.ad  
.inria.fr

## ICON

PHYSICALLY  
RESEMBLES  
WHAT IT STANDS  
FOR



## INDEX

IMPLIES / POINTS TO  
SOMETHING  
(CORRELATION)



## SYMBOL

POINTS TO  
SOMETHING

RELATIONSHIP HAS  
TO BE LEARNED

# USING SIGNS TO ILLUSTRATE AND PROMPT RECOGNITION

## World's most contagious falsehoods

virulence of idea  
(google hits)

New BODY FOOD HISTORY LAW MIND NATURE RELIGION SCIENCE SPORT Reset



### The Vomitorium

Not a room Romans used for Bacchanalian binges, but the name for the entrance to a stadium.



### Different tongue parts

There are no different sections for each taste: bitter, sour, salty, sweet & umami (savory/meaty).



### Electric fan @ night

Big myth in South Korea that this is deadly. Very unlikely to harm you. Unless you put the fan in the bed.



### Steep Learning Curve

Actually means a skill that is easy and quick to learn. Think about it. The curve just goes up and up.



### Sharks = no cancer

Oh yes they do get cancer. Particularly skin cancer.



### Black holes

Not really 'holes' but hugely dense objects with massive gravitational pull.



### Wake sleepwalkers?

They'll be really confused, but it's okay. They're more likely to hurt themselves if they're not awoken.



### Chemical Imbalance

Simplistic. Thank pharma for the idea that major depression is caused by an imbalance of neurotransmitters like serotonin.



### Napoleon was short

A tall tale. At 5'7", he was actually above average height for a Frenchman of the time.



### The 5 Second Rule

Amount of bacteria transferred to fallen food depends on how contaminated the floor is, not how long the food stays there.



### Bulls hate red

Bulls are colour-blind. They actually react to motions of the bull fighter's cloth as a perceived threat.



### Great Wall of China

Not visible from space. Myth. Now stop saying it!



### Missing persons reports

Police don't demand a 24-hour period before



### Bananas grow on trees

Actually grow on massive herbs that resemble trees. Bet



### Oil stops stuck pasta

Nope. But it can stop the water foaming



### A gene for...

Genes code for proteins, so there are actually no genes

DAVID  
MCCANDLESS  
[LINK](#)



# Best in Show

The ultimate data-dog

INTELLIGENCE

dumb clever

SIZE

sml med lrg

TYPE

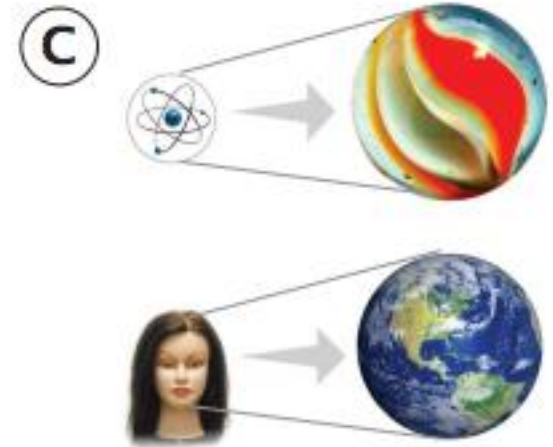
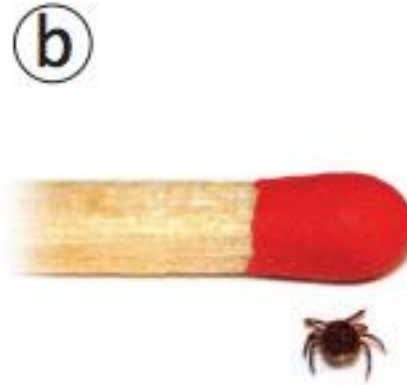
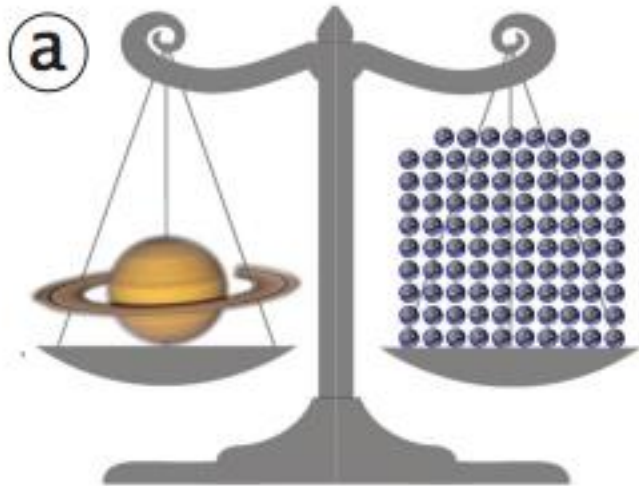
Herding Hound Non-sporting Sporting Terrier Toy Working

public popularity



our data score

# USING SIGNS TO MAKE DATA RELATABLE



USING CONCRETE SCALES

CHEVALIER ET AL. 2013 [LINK](#)



BUYING POWER

Here are 120 million  
Monopoly pieces, roughly  
one for every household  
in the United States.

## Mainly in Finance and Energy



### **Finance** 64

Majority in hedge funds, private equity or venture capital.



### **Energy and natural resources** 17

Mostly oil and gas.



### **Real estate and construction** 15



### **Media and entertainment** 12

Hollywood moguls like Steven Spielberg, J.J. Abrams and Jeffrey Katzenberg.



### **Health** 12

Woody Johnson, owner of the New York Jets, whose family founded Johnson & Johnson.



### **Technology** 10



### **Transportation** 9

Trucking, autos, cruise ships.



### **Retail and manufacturing** 6



### **Food, beverage, agriculture** 5

Includes citrus, poultry and sugar magnates.



### **Insurance** 3



### **Other/unknown** 5



## DEATH IN SYRIA

By KAREN YOURISH, K.K. REBECCA LAI and DEREK WATKINS

SEPT. 14, 2015

More than **200,000** people  
have been killed in the four-and-a-half-year Syrian civil war.

# The death toll in the Gaza-Israel conflict

By Lazaro Gamio and Richard Johnson, [Updated: Aug 7, 2014](#)

Statistics on death tolls during active conflict are often difficult to track accurately. A note on our sourcing:

For death toll numbers from within Gaza, we receive daily or sometimes twice daily updates from the head of the Information Management Unit in the United Nations Office for the Coordination of Humanitarian Affairs in the Occupied Palestinian Territories field office in the West Bank. The field office gets updates from multiple sources within Gaza, including U.N. agencies and the Palestinian Medical Authorities. They then create and continually update a spreadsheet of all available data. These numbers are often not complete, but represent the best available data and do tend to clarify over time. Israel [disputes the numbers](#) provided by the United Nations, saying that a large number of those killed, particularly males over 18, were armed terrorists and not civilians.

For death toll numbers of Israeli soldiers, we rely on Israel Defense Forces press releases and their [Twitter account](#). For Israeli civilian deaths, we rely on news reports and our reporters in Israel and Gaza. These numbers are similarly tentative initially but clarify over time.

**Related articles:** Reporters grapple with politics, erratic sources in reporting Israeli/Gaza death toll (Washington Post) | Caution needed with Gaza casualty figures (BBC) | Civilian or Not? New Fight in Tallying the Dead From the Gaza Conflict (New York Times)

1,958 Deaths up to **Aug. 6**



65 were Israeli soldiers.



3 were Israeli civilians.



217 were armed Palestinian militants. Of those, 2 were children.



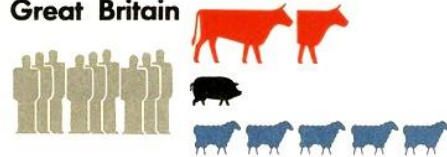
1396 were Palestinian civilians. Of those, 222 were women and 418 were children.



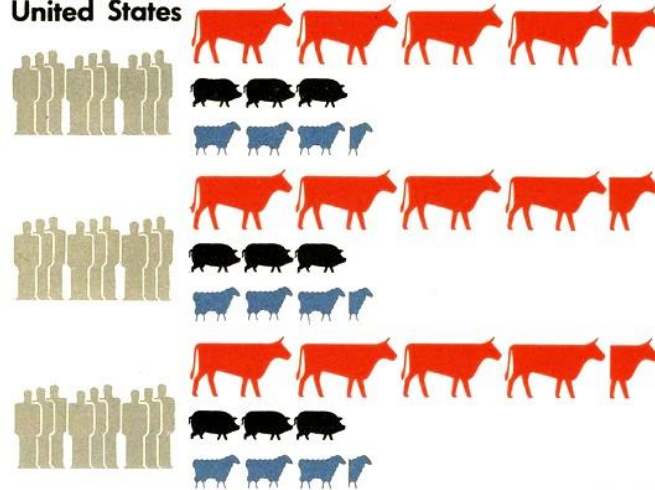
# ISOTYPE VISUALIZATION

## Population and Live Stock

### Great Britain



### United States

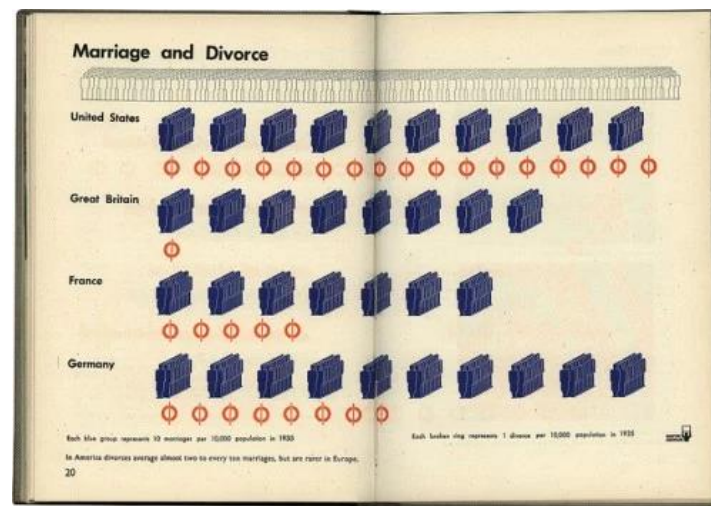
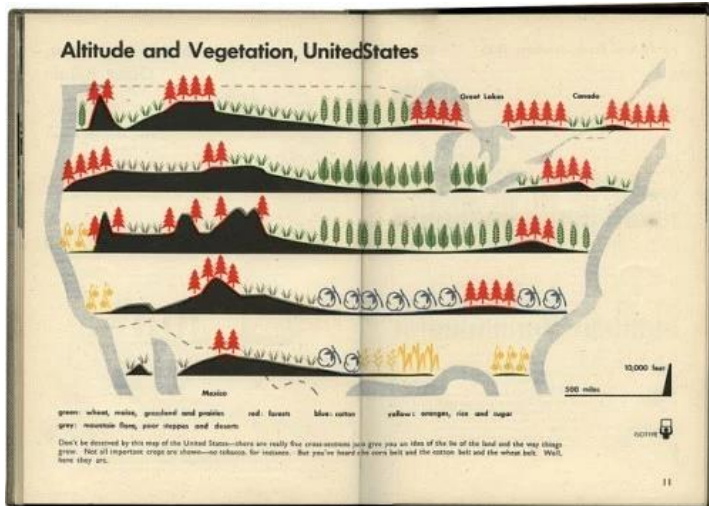
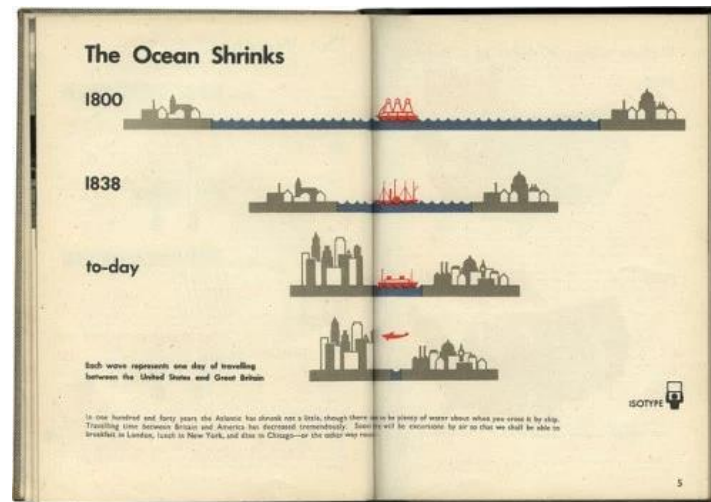
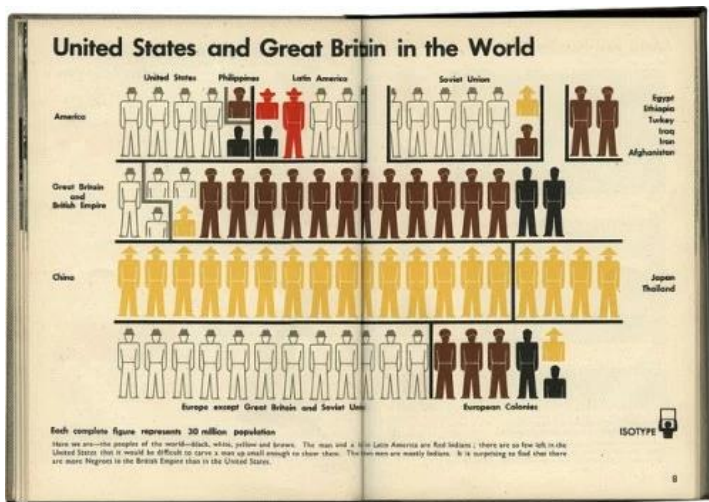


Each grey figure represents 5 million population  
Each complete red symbol represents 5 million cattle  
Each complete black symbol represents 5 million pigs  
Each complete blue symbol represents 5 million sheep

Average for 1935 - 1939

OTTO & MARIE NEURATH 1948





OTTO & MARIE NEURATH 1948 [MORE EXAMPLES](#)



# ISOTYPE Visualization – Working Memory, Performance, and Engagement with Pictographs

Steve Haroz  
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Steven L. Franconeri  
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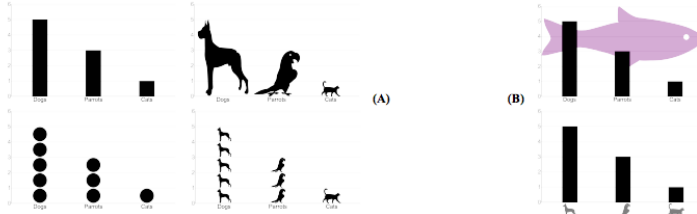


Fig. 1. Pictographic charts have been used for decades. (A) Which chart above most effectively conveys information? Which data is easiest to remember during a demanding task? Which is most engaging? (B) How integrated must a pictograph be to benefit the user? Do purely decorative background images offer the same benefits as simple axis labels? Or must they be used to convey data?

## ABSTRACT

Although the infographic and design communities have used simple pictographic representations for decades, it is still unclear whether they can make visualizations more effective. Using simple charts, we tested how pictographic representations impact (1) memory for information just viewed, as well as under the load of additional information, (2) speed of finding information, and (3) engagement and preference in seeking out these visualizations. We find that superfluous images can distract. But we find no user costs – and some intriguing benefits – when pictographs are used to represent the data.

## Author Keywords

Visualization; Psychophysics; Working Memory; User Performance; Pictograph; Embellishment; ISOTYPE

## INTRODUCTION

The International System Of Typographic Picture Education (ISOTYPE) uses simple pictographic elements to convey many types of information, including numerical data. Otto and Marie Neurath defined the term in the 1920s [21], though this type of chart was first described by Willard Brinton in

1914 [6]. Together with Gerd Arntz, the Neuraths created many ISOTYPE designs over several decades [1].

The goal was a universally understandable system for communicating quantities of commercial, social, or economic information (e.g., automobile production or number of children born per year). Symbols, each representing a fixed quantity, were stacked to provide an intuitive representation of a total amount (Fig. 2). Gerd Arntz's pictographs – simplified icons with minimal color – are highly recognizable and are still used in signs, traffic icons, and warning labels.

While the design community has largely embraced the simple style of ISOTYPE for pictographic embellishments [7, 17], the visualization and HCI communities tend to regard pictographs as 'chart junk' – a distraction from the data itself [24]. Here we examine how ISOTYPE-style embellishment affects viewer memory, speed, and engagement within simple visualizations.

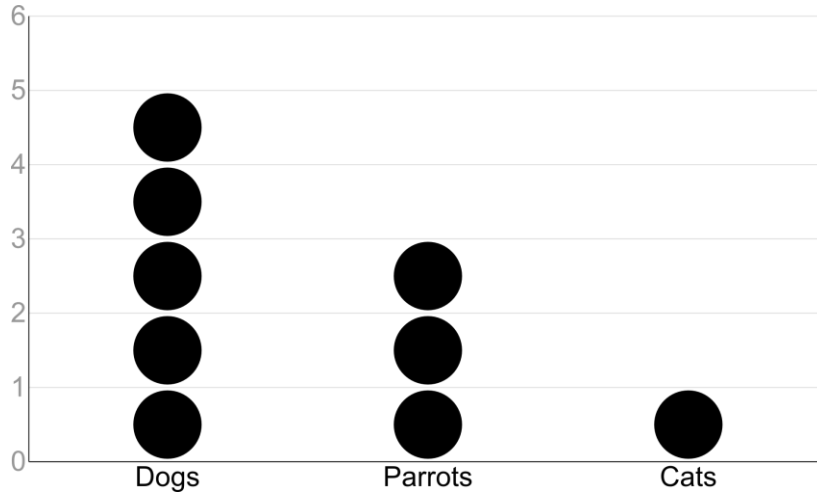
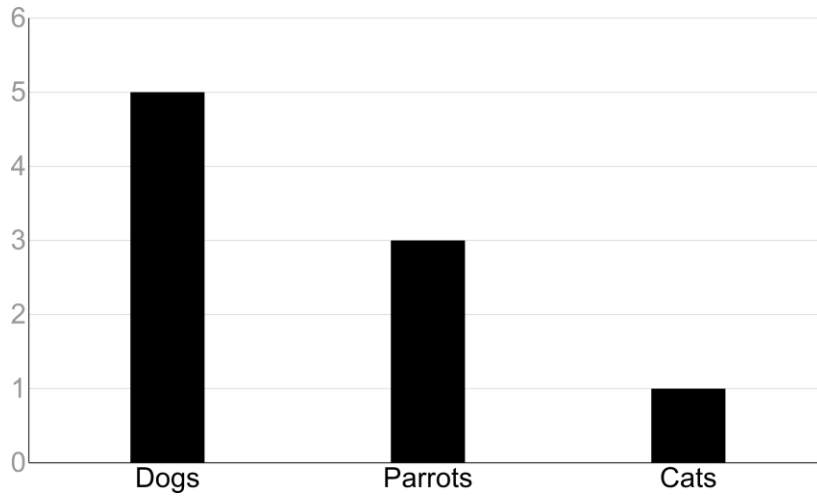
Recent work suggests that extraneous pictographic information can indeed improve the effectiveness of visualizations. Bateman et al. found that visualizations that integrate data with illustrations yielded better memory of the data compared to minimalistic outlines of bar charts [2]. Borkin et al. found a related result – that people can better recall having seen a visualization that includes pictures [4], though it is not clear if they would better recall the data, per se. When images and clip-art are embedded in the visualization's data representation, Borgo et al. found occasional impact to work-

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ACM 978-1-4503-3145-6/15/04...\$15.00  
<http://dx.doi.org/10.1145/2702123.2702275>

# STACKED ICONS CAN:

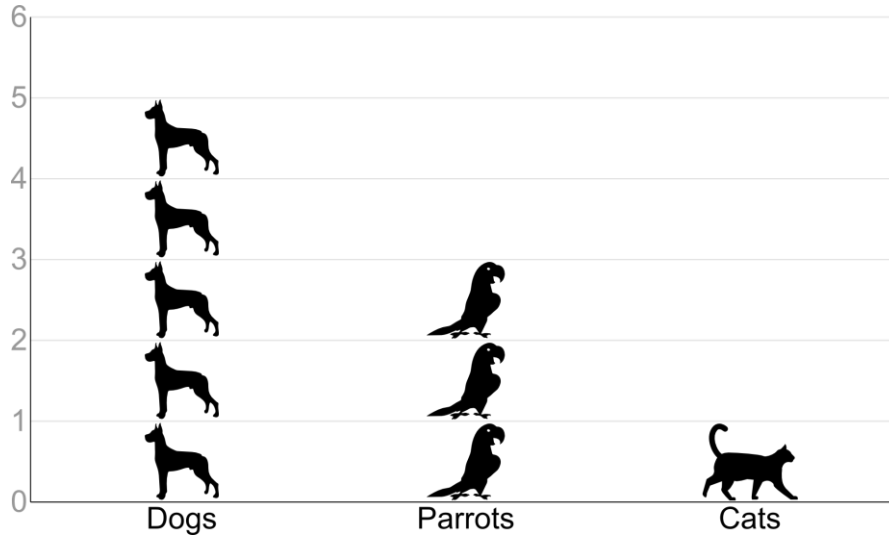
HAROZ ET AL. 2015 [LINK](#)

STACKED ICONS CAN:  
ENCODE DATA AS BOTH  
LENGTH AND QUANTITY



STACKED ICONS CAN:  
ENCODE DATA AS BOTH  
LENGTH AND QUANTITY

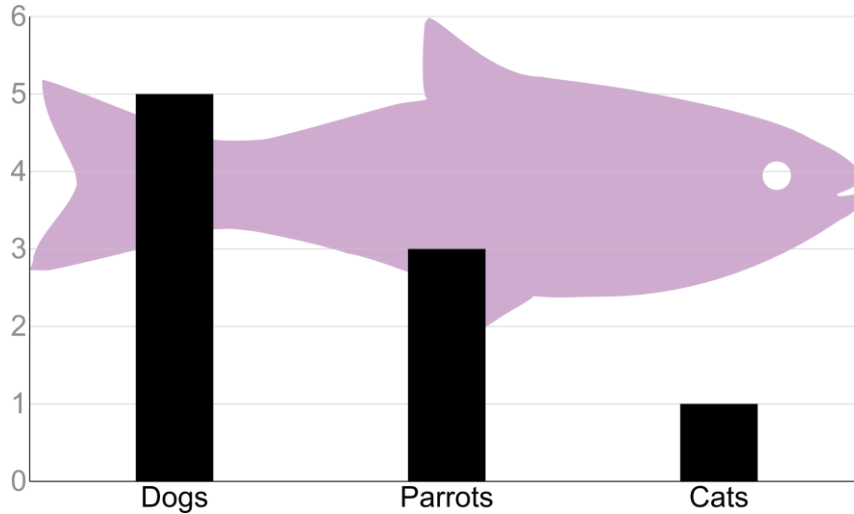
(WHERE THIS WORKS)  
ICONS CAN SUPPORT  
MEMORY & ENGAGEMENT



STACKED ICONS CAN:  
ENCODE DATA AS BOTH  
LENGTH AND QUANTITY

(WHERE THIS WORKS)  
ICONS SUPPORT MEMORY  
& ENGAGEMENT

**BUT!** OTHER IMAGES ARE  
DISTRACTING



# HOW TO USE DATA TO TELL A STORY?

(THERE ARE MANY, MANY CHOICES TO MAKE.)



Britain's "broken society"

## Through a glass darkly

**Crime, family break-up, drunks and drugs: the Conservatives—and apparently plenty of voters—think that Britain has a “broken society”. Does the claim stand up?**

IT IS hard to believe that such appalling crimes could have been committed by anyone so young. Two boys in the north of England were subjected to a sadistic attack that caused parents across the country to shudder. The anguish of the children was awful enough. But in a grotesque twist, their tormentor was also a child, not yet even a teenager. The attacks had been carried out “solely for the pleasure and excitement” of it, the judge in the case said. What has society come to when such evil is done in those so young?

That was in 1968. Mary Bell, the daughter of a Tyneside prostitute and supposedly the victim of repeated abuse herself, became Britain's most famous child-killer when, just 11 years old, she was convicted of strangling two young boys. Now, a similar case is causing people to wonder again whether society has gone to the dogs. Two brothers from the South Yorkshire village of Edlington, aged ten and 11, were convicted on January 22nd of torturing and sexually abusing two younger boys in an ordeal that left one of them close to death.

The case was highlighted by David Cameron, the leader of the opposition, who on the day the boys were sentenced launched a chapter of his Conservative Party's election manifesto dedicated to dealing with what he calls Britain's “bro-

ken society”. The Edlington case was not “just some isolated incident of evil”, Mr Cameron said. Connecting it to four other infamous examples of callous brutality, he declared that it raised “deep questions about what is going wrong in our society”. Britain is experiencing a social recession to match the economic one, he reckons.

### Those good old days in full

Was Mary Bell's Britain better than today's version? An increasing number of people seem to think so. Opinion pollsters around the world find that people are usually gloomy about the future, perhaps because it is inherently more uncertain than the past. But Britons are getting even more downbeat. When Labour came to power in 1997, 40% of the population thought the country was becoming a worse place to live in. By 2007 that had risen to 60%. A year on, and a year into Gordon Brown's spell as prime minister, the malcontents numbered 71%—and that was before the financial crash. There has been a “surge of nostalgia” for the good old days, says Ben Page, head of Ipsos-Mori, a polling firm.

Chief among people's worries is their security. Under Labour, fear of crime climbed until by 2007 it had become the issue that pollsters identified as the main complaint among voters. (Since then wor-

Also in this section

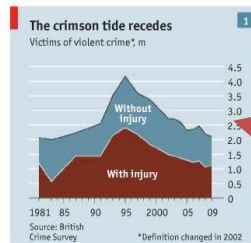
64 Bagehot: Electoral reform

More articles about Britain are available to subscribers at

[economist.com/britain](http://economist.com/britain)

ries about the economy have eclipsed all else.) The heightened fears are a puzzle to criminologists, who point out that over the past 35 years Britain has experienced a steady, deep fall in crime. The statistics are notoriously hard to interpret, but according to the British Crime Survey, the Home Office's most reliable measure though still far from perfect, crime overall has dropped by 45% since its peak in 1995. A big chunk of that fall is owing to reductions in vehicle theft and domestic burglary, for which alarm manufacturers and increased householder vigilance probably deserve as much credit as the police. But violent crime has fallen too. It is now almost half what it was in 1995, and no higher than in 1981 (see chart 1).

Looking more carefully, the big fall in brutality has been in domestic violence, which has dropped by a staggering 70%. (No one is sure why; the best guess is that an improving economy has kept men out of the house and given women enough money to escape if they need to.) Violence ▶



SMALL  
SUPPORT  
AFTERTHOUGHT  
BORING?



**[ BUT ]**

WHAT DOES  
IT MEAN?

Published: February 2, 2010

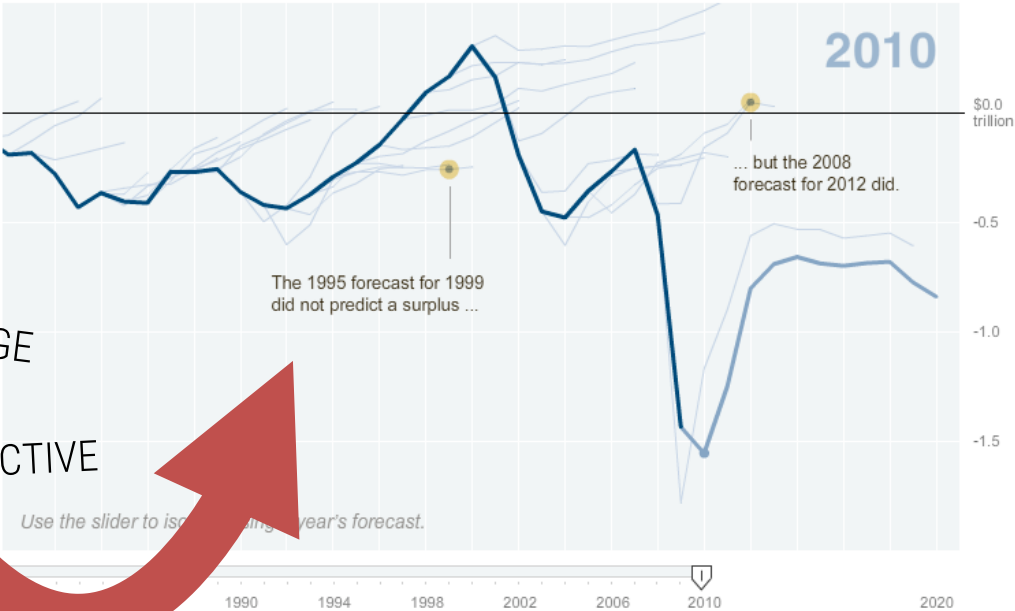
# Budget Forecasts, Compared With Reality

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

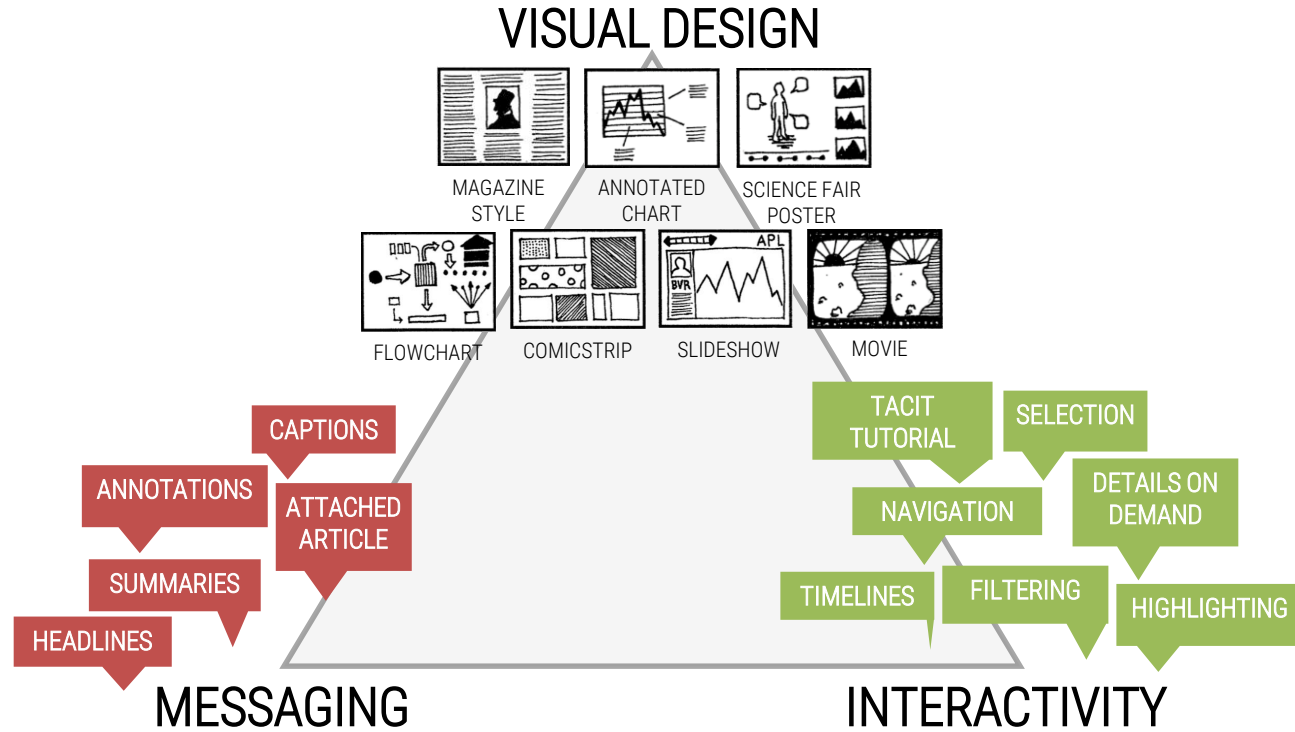
Today, with a better understanding of the severity of the economic downturn, the deficit situation is much more dire.

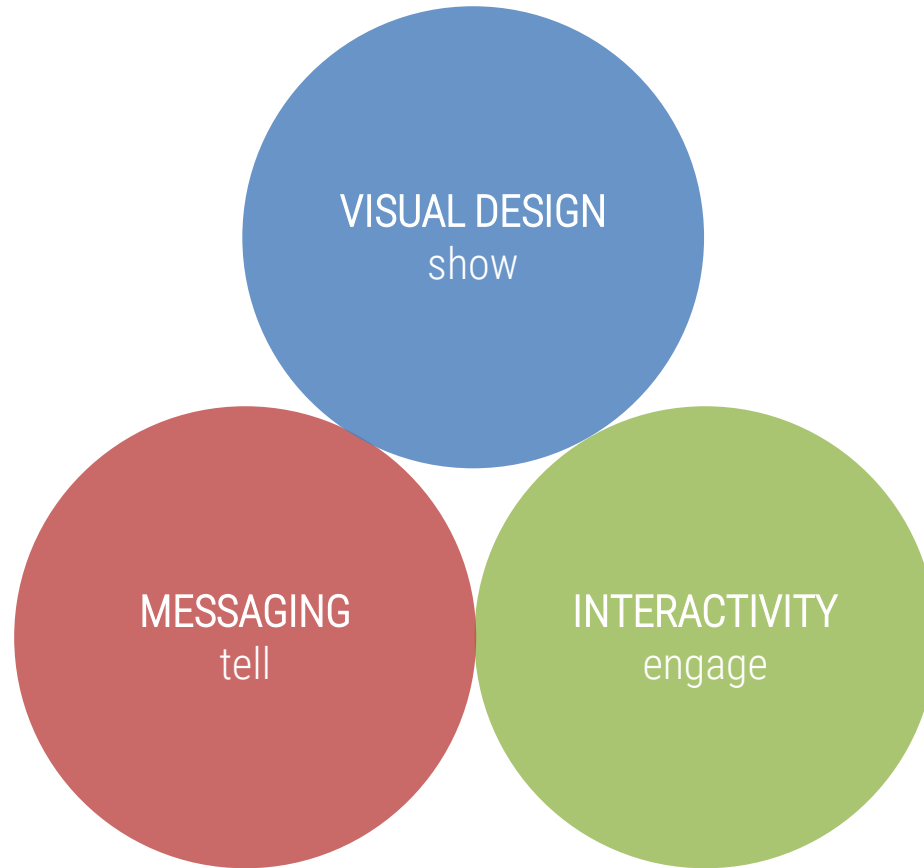


CENTER STAGE  
STANDALONE  
INTERACTIVE  
GUIDED









**VISUAL DESIGN**  
show

**MESSAGING**  
tell

**INTERACTIVITY**  
engage

## Taking the Corners

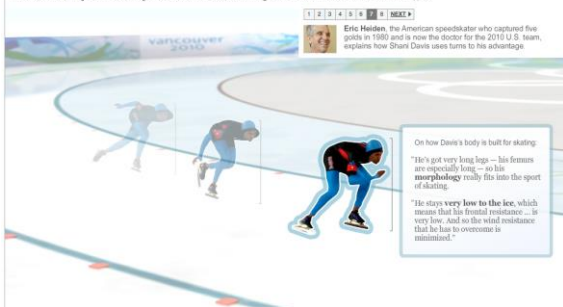
A look at the technique of American speedskater Shani Davis, who won gold in the 1,000 meters and silver in the 1,500.



By Graham Roberts, Bedel Sapet and Michael W. Schmitt | [Send Feedback](#)

## Taking the Corners

A look at the technique of American speedskater Shani Davis, who won gold in the 1,000 meters and silver in the 1,500.

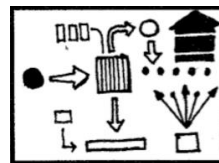


## Taking the Corners

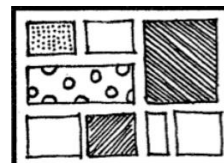
A look at the technique of American speedskater Shani Davis, who won gold in the 1,000 meters and silver in the 1,500



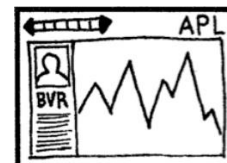
THE MORE LINEAR, THE MORE  
LIKE A TRADITIONAL STORY.  
WITH A BEGINNING, MIDDLE,  
AND END.



### FLOWCHART

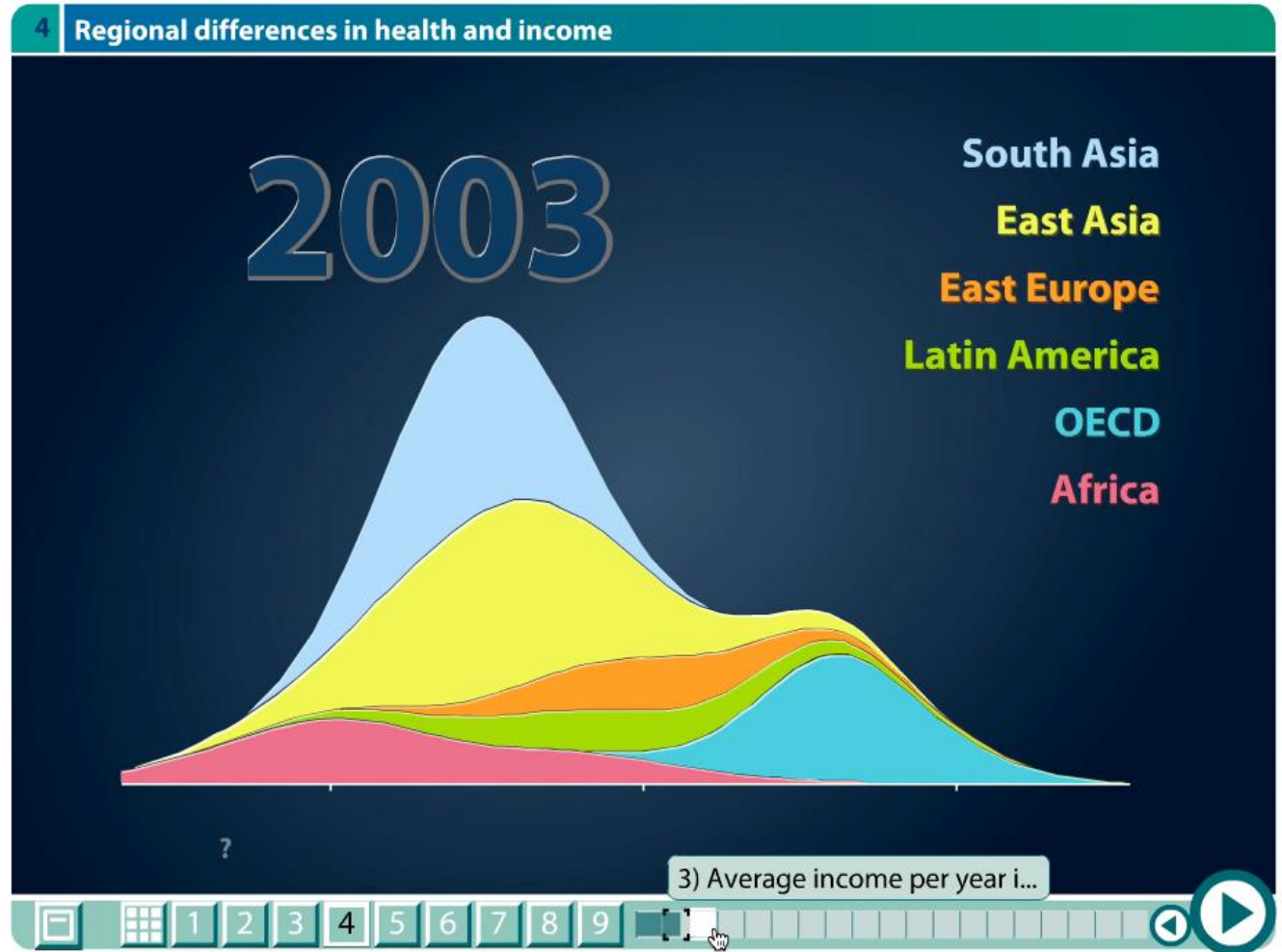


COMICSTRIP



SLIDESHOW

USE STAGING AND  
ANIMATION FOR  
COMPLICATED  
TRANSITIONS  
TO AVOID  
CONFUSING  
READERS

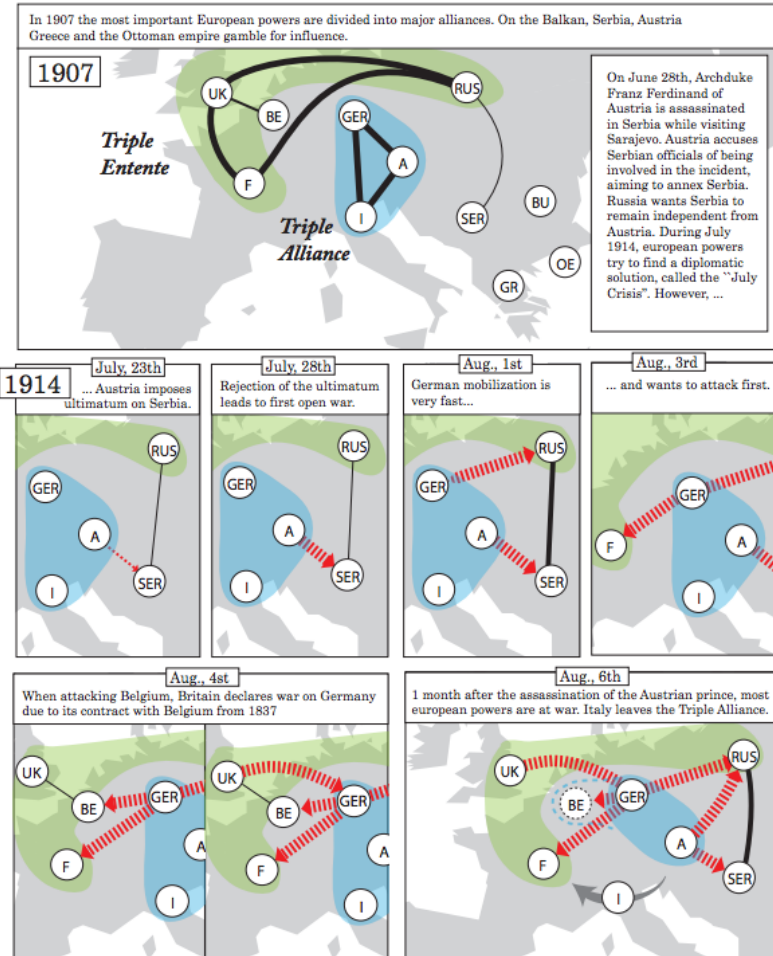
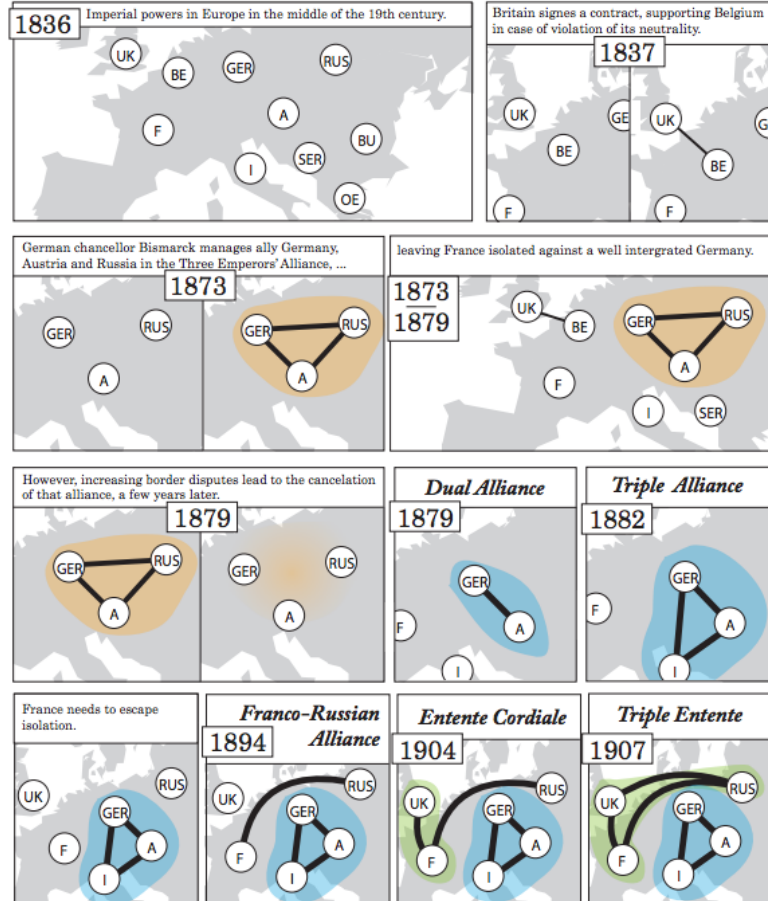


# USE ESTABLISHING SHOTS

## SITUATE THE VIEWER BEFORE DIVING IN.



# European Alliances before World War I (1836-1914)





# Users find themselves

## Your Olympic athlete body match

Olympic athletes come in all shapes and sizes, from the lithe limbs of Japan's Asuka Teramoto to the gargantuan frame of China's Zhaoxu Zhang. But how do you measure up in comparison? Try our app below and find out. Why not then share your results with your friends?

TALLEST

LIGHTEST

2.19m, 110kg

2.25m

2m

1.75m

1.5m

1.25m

1m

1.36m, 30kg

Where do you stand?

Height Metres | Feet

Metres

Weight Kilograms | Pounds | Stone

Kilograms

COMPARE

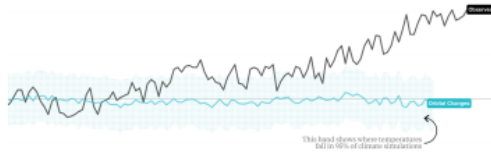
HELPS ANCHOR  
VIEWER IN THE PIECE.  
MAKES DATA MORE  
PERSONALLY  
RELEVANT.

2016 LYN BARTRAM, BENJAMIN BACH, JEREMY  
BOY, PAULO CIUCCARELLI, STEVEN DRUCKER,  
YURI ENGELHARDT, ULRIKE KOEPPEN, MORITZ  
STEFANER, BARBARA TVERSKY, & JO WOOD.

# Again, and again...

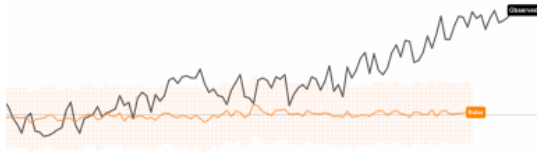
## Is It the Earth's Orbit?

The Earth wobbles on its axis, and its tilt and orbit change over many thousands of years, pushing the climate into and out of ice ages. Yet the influence of orbital changes on the planet's temperature over 125 years has been negligible.



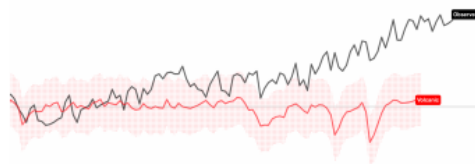
## Is It the Sun?

The sun's temperature varies over decades and centuries. These changes have had little effect on the Earth's overall climate.



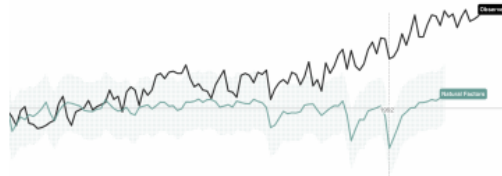
## Is It Volcanoes?

The data suggest no. Human industry emits about 100 times more CO<sub>2</sub> than volcanic activity, and eruptions release sulfate chemicals that can actually cool the atmosphere for a year or two.



## Is it All Three of These Things Combined?

If it were, then the response to natural factors should match the observed temperature. Adding the natural factors together just doesn't add up.



SHOW SAME PHENOMENON  
OVER AND OVER, CHANGING  
ONLY ONE VARIABLE.

RHYTHM STRENGTHENS  
THE NARRATIVE.  
REPEATED  
DISAPPOINTMENT SETS UP  
THE FINAL REVEAL.

2016 LYN BARTRAM, BENJAMIN BACH, JEREMY BOY, PAULO CIUCCARELLI, STEVEN DRUCKER, YURI ENGELHARDT, ULRIKE KOEPPEN, MORITZ STEFANER, BARBARA TVERSKY, & JO WOOD.

# Break conventions

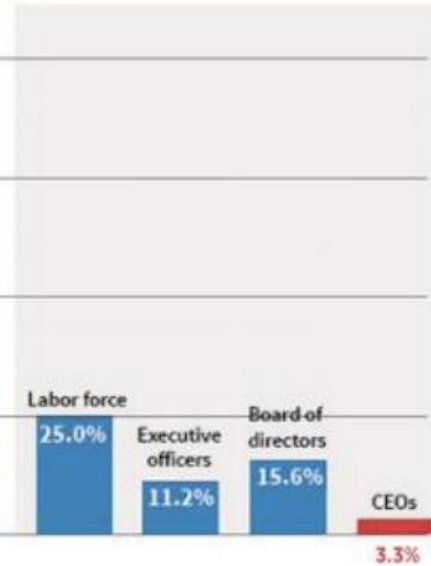
## The glass ceiling persists

General Motors named Mary Barra as its next CEO, replacing Dan Akerson. Here's a look at how women are faring in their advancement to the top of Fortune 500 companies and the durable goods sector.

**Women CEOs in Fortune 500 companies**  
Percent



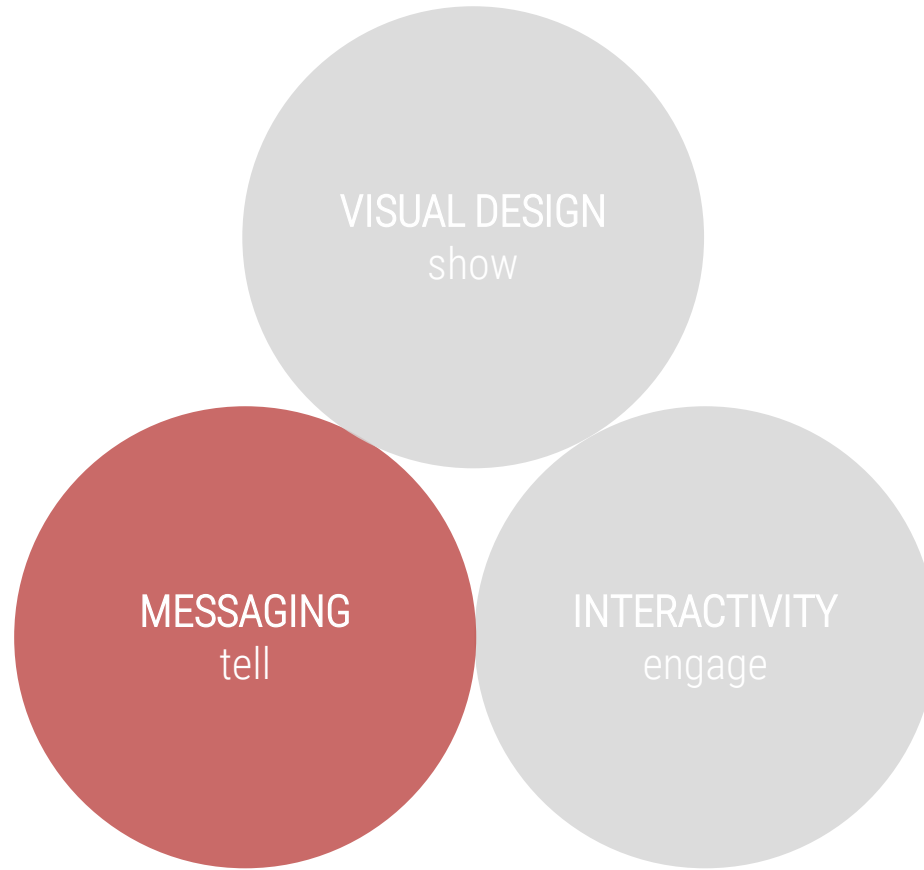
**Women in durable goods manufacturing**  
Percent



PURPOSEFULLY BREAK  
CONVENTIONS OF  
CHART DESIGN.

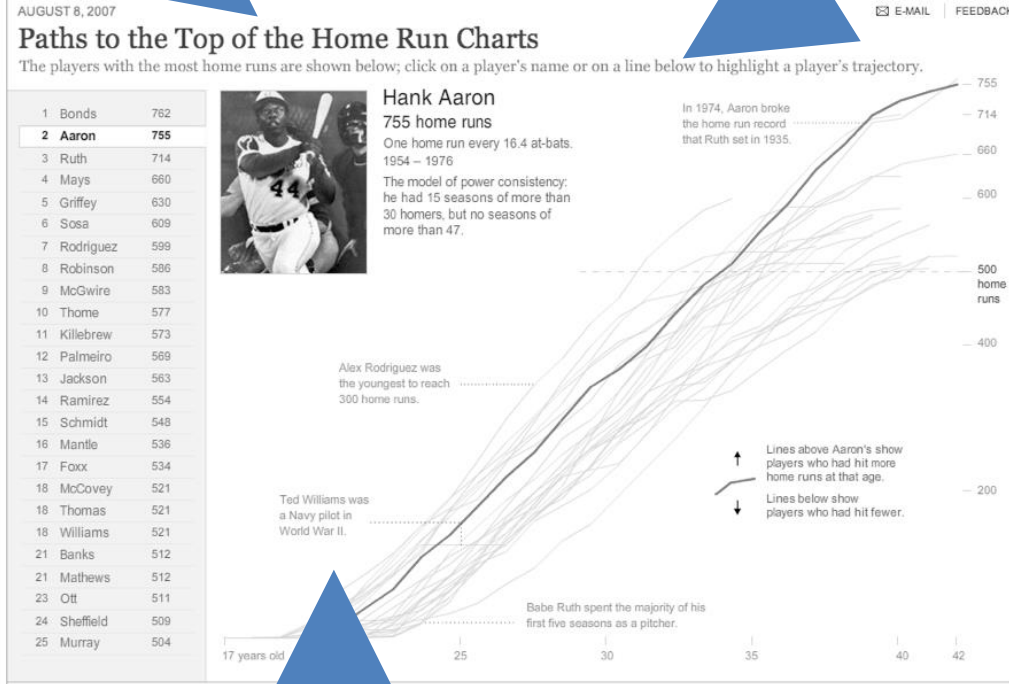
BREAKING  
EXPECTATIONS CAN  
BE USED TO  
UNDERLINE  
PARTICULAR  
INTERPRETATIONS.

2016 LYN BARTRAM, BENJAMIN BACH, JEREMY  
BOY, PAULO CIUCCARELLI, STEVEN DRUCKER,  
YURI ENGELHARDT, ULRIKE KOEPPEN, MORITZ  
STEFANER, BARBARA TVERSKY, & JO WOOD.



HEADLINE

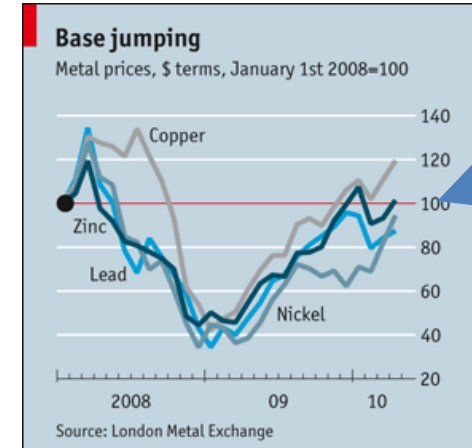
CAPTION



ANNOTATION

USE HEADLINES, CAPTIONS,  
& ANNOTATIONS  
QUICKLY DRAW ATTENTION  
TO WHAT'S IMPORTANT.

MARK FOR EMPHASIS

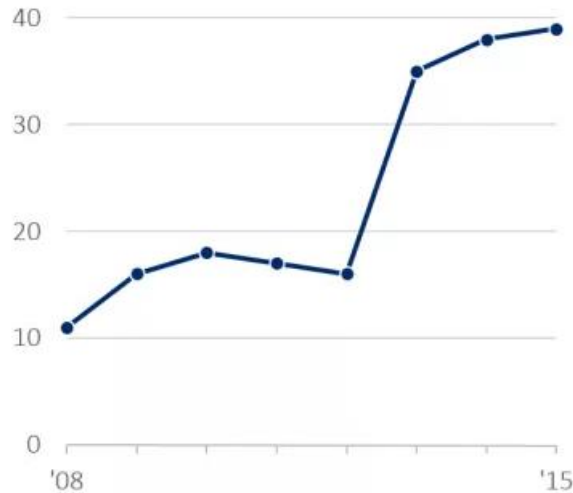


# DESCRIPTIVE TITLES AND ANNOTATIONS

## CAN BE THE DIFFERENCE BETWEEN

## A CHART AND A STORY

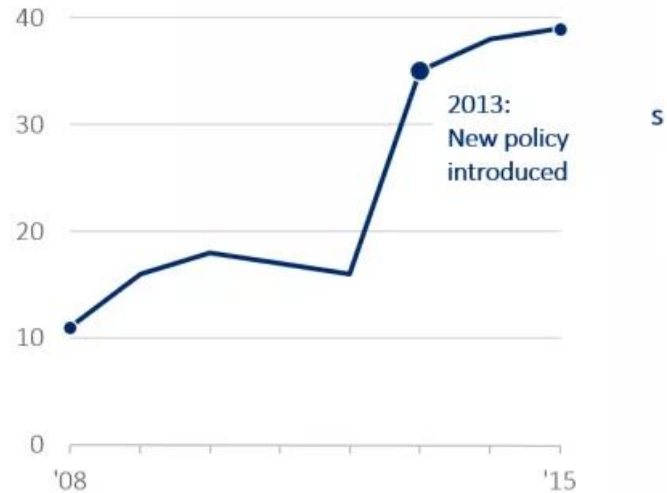
Number of studies funded each year



or

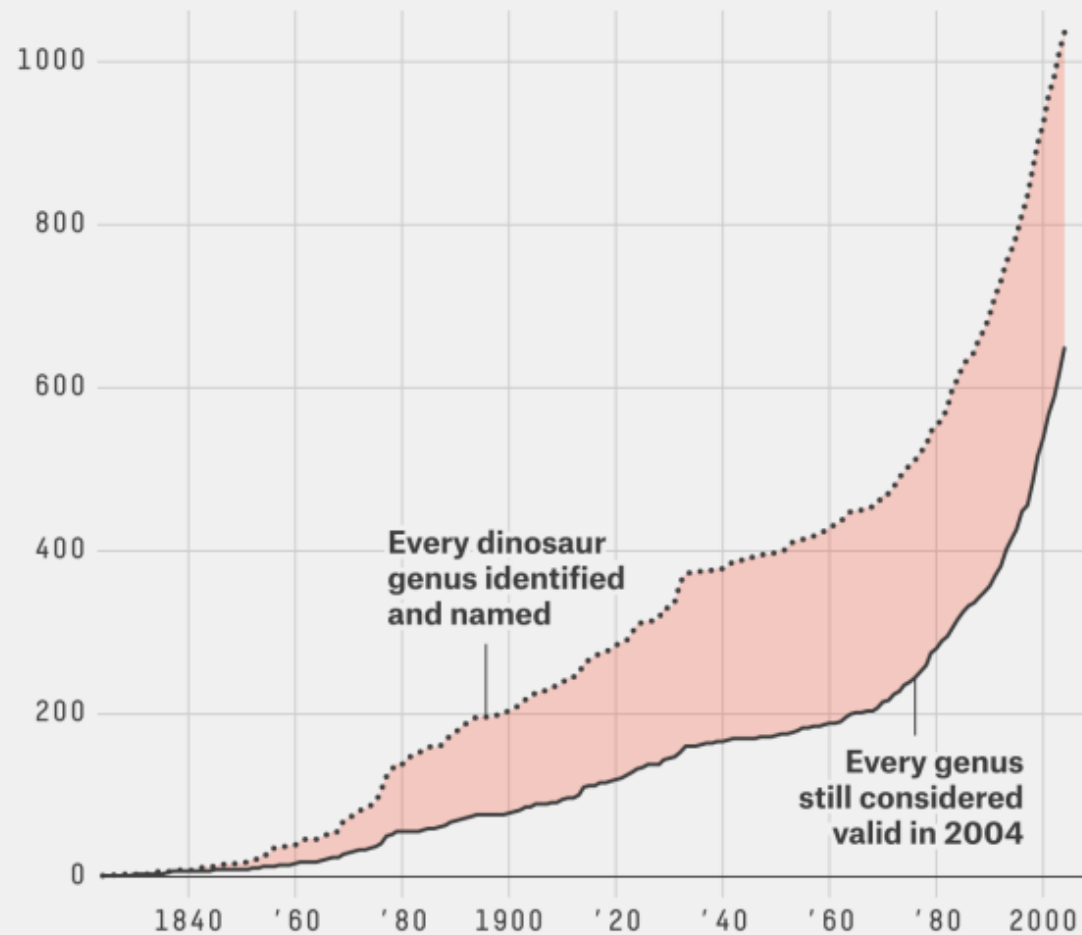
We're funding more studies each year

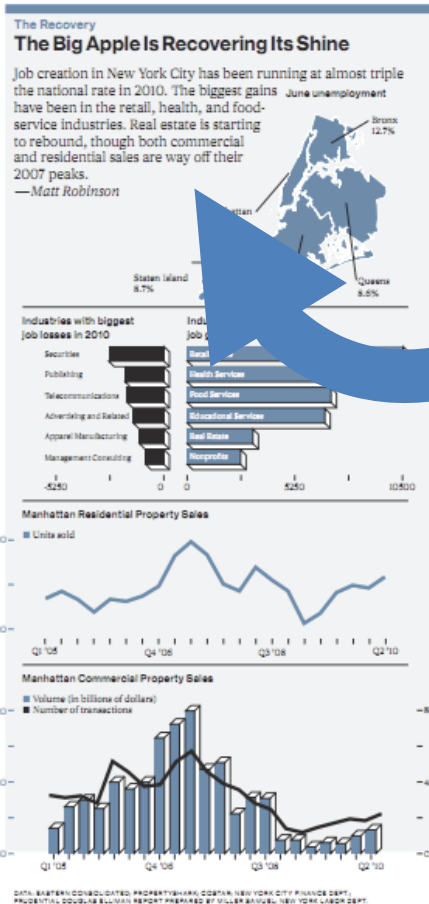
Beginning in 2013, we set aside new funding to measure the effectiveness of our initiatives – and we evaluated 39 of our programs in 2015 alone.



## Dinosaurs named, then unnamed

By 2004, about 37 percent of every dinosaur genus ever identified and named had had its genus status revoked





ISOLATED

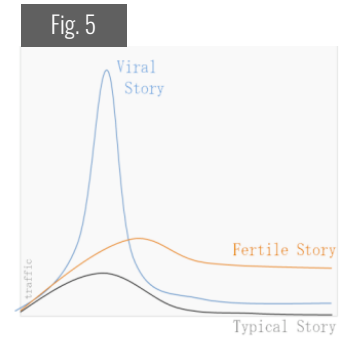
WEAVE TEXT INTO THE GRAPHIC,  
 NOT JUST AT THE BEGINNING.

TEXT AND GRAPHICS WORK  
 BETTER TOGETHER THAN  
 APART.

CONNECT THE  
 TEXT TO  
 RELEVANT  
 GRAPHICS  
 “SEE FIG. 5”



...ity more work than traditional  
 this work economical, visualizations  
 nat are either *persistent* or *viral* in order  
 ing traffic. **Persistent stories** cover  
 ;” that maintain relevance over time  
 onomics, the housing market).  
 sistent themes “fattens and elongates”  
 is (which are already fatter and longer  
 g this slow-burn, these visualizations  
 of stories over several months and  
 .l stories achieve heavy traffic  
 icks of popularity. These stories tend  
 alities, or sensational news. To get the  
 ze visualizations for editorial content





[ELECTION 2016](#)
[Primary forecasts](#)
[Delegates](#)
[National polls](#)
[Endorsements](#)
[Facebook map](#)




























## The Endorsement Primary

In presidential primaries, endorsements have been among the best predictors of which candidates will succeed and which will fail. So we're keeping track.

By [AARON BYCOFFE](#)

UPDATED 11:27 A.M. EST | MAR 3



CANDIDATE	REPRESENTATIVES 1 POINT EACH	SENATORS 5 POINTS EACH	GOVERNORS 10 POINTS EACH	TOTAL POINTS
 Marco Rubio				 168
 Ted Cruz				 34
 John Kasich				 31
 Donald Trump				 29
CANDIDATE	REPRESENTATIVES 1 POINT EACH	SENATORS 5 POINTS EACH	GOVERNORS 10 POINTS EACH	TOTAL POINTS
 Hillary Clinton				 478
 Bernie Sanders				 5

Before any votes are cast, presidential candidates compete for the support of influential members of their party, especially elected officials like U.S. representatives, senators and governors. During the period

# REMOVE DETAIL TO CREATE SPACE FOR THE STORY.

9. Beetroot soup and a chocolate milkshake at Pete's Eats in Llanberis. Hammers remarks that to have willingly chosen the beetroot must mean my body has developed an immunity to it. There is talk in the cafe from veterans of the Snowdon and Coasts of taking the long way round to avoid a gratuitous climb out of town. I decide to take the official route and am rewarded with stunning views of Snowdon and coasts.

## Llanberis

8. Magnificent views of Snowdon as we begin the steady climb from Betws T Coed to Pen-y-pass. Sun is out, little wind to bother us. The last part of the climb overlaps with the Brian Chapman route, but feels much easier today with fresher legs and benign weather.

7. Have run out of water and am feeling increasingly thirsty. Fill water bottles up in mountain stream. More eco-friendly than Evian.

6. The climb up above Ffestiniog starts to feel increasingly remote. In this weather it's beautiful, surrounded by the higher peaks of Snowdonia. In poor weather this could be a bit of a brute.

10. Interesting to ride a bit more of the Brian Chapman here, but earlier in the day with better weather and fresher legs. A novelty not to get minor hassle from drunken locals in Penrhynedeudraeth. A slight tail wind helps speed me on my way.

11. Get the beginnings of the bonk, so munch through two Snickers flatjacks (very good on the bike comfort eating) and a Magnum with views of holiday folk on the beach.

12. Barmouth bridge as delightful as ever. Man at toll booth very careful to make sure I have my ticket. I wonder how much they've made in tolls from the various Brian Chapmans and other audaxers over the years.

## Dolgellau

14. Civilised food stop and in Dolgellau. Apparently about 'half the field' have already controlled here.

13. Decide to take the road rather than NCN route to Dolgellau. Relief not to have to climb up to Kings YHA.

15. Great to climb Cross Foxes and descend Dinas Mawddwy on gears for a change. Seems easier than at 5am on day two of the Brian Chapman. A novelty to experience overheating on this climb. Could do with less traffic though.

## Lake Vyrnwy

5. Climbing proper begins up to Bwlch y Groes. Highest point on the ride, but not the hardest climbing. We ascend the "easy" way. At the t-junction near the top, get precipitous views of the 25% climb to our left that thankfully we avoid.

4. Wonderful wooded road along the banks of Lake Vyrnwy. Not a car (or cyclist) in sight.

3. Climbing begins in earnest through stunning landscape. Unexpected surprise to see the magnificent dam at Lake Vyrnwy - and then to cycle over it. The first control does generous beans on toast - the first of about ten. I'll get through on this long weekend.

2. Welsh place names seem to arrive remarkably quickly. The pace is quite fast, with a fairly organised peloton and turns at the front. This is a new part of the country for cycling for me. The good weather, clear, dry, little wind, brings out the best in the landscape.

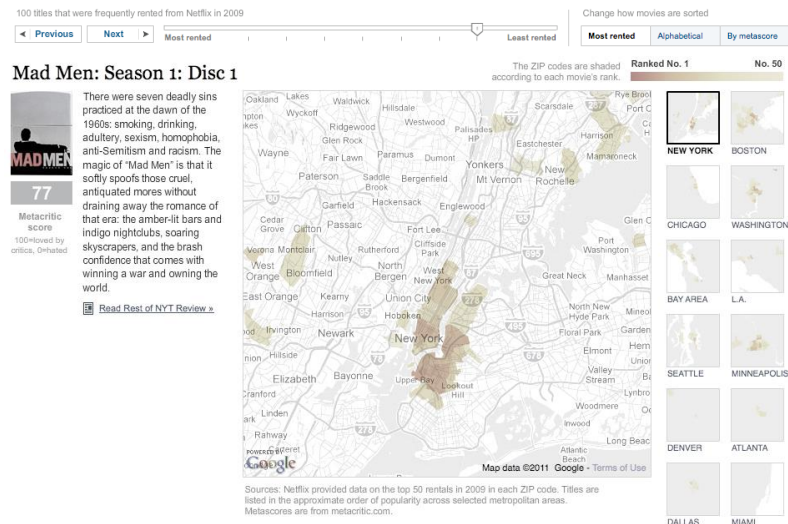
## Upton Magna

1. Arrived Thursday evening for a pre-ride meal. Fellow audaxers looking intimidatingly fit in their non-lyca civvies. A sense of foreboding and onion soup pervades the village hall.



## A Peek Into Netflix Queues

Examine Netflix rental patterns, neighborhood by neighborhood, in a dozen cities. Some titles with distinct patterns are [Mad Men](#), [Obsessed](#) and [Last Chance Harvey](#). [Comments \(135\)](#)



START WITH AN INTERESTING VIEW.  
CURATE THE EXPERIENCE  
FROM THE BEGINNING.

MAKE DATA RELATABLE & PUT  
NUMBERS AND FACTS IN CONTEXT.  
260 THOUSAND SQUARE MILES?  
"IT'S THE SIZE OF FRANCE!"

## Wetlands Destruction



Coastal marshes absorb fertilizer runoff from farms and buffer civilization from Gulf storms.

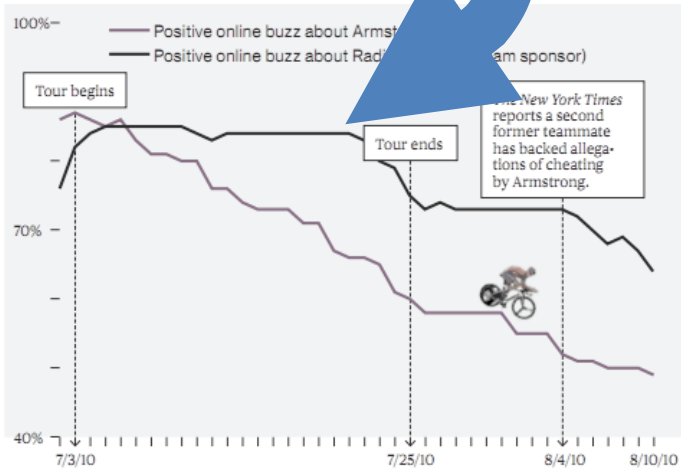
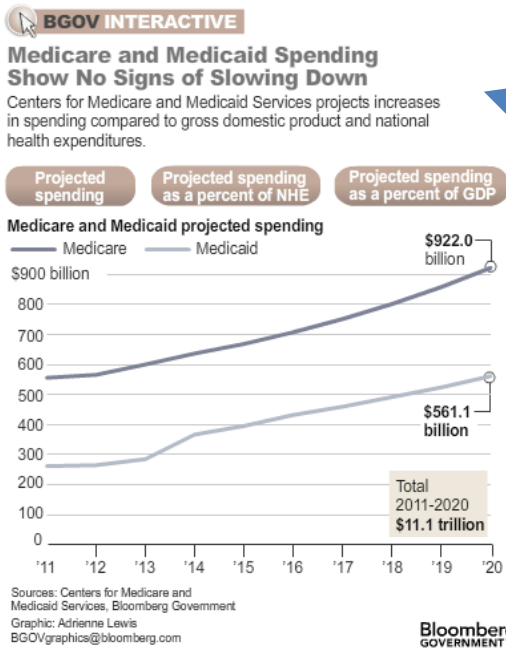
Losses in coastal watersheds, 1998 to 2004

Great Lakes	20,000	acres
Atlantic	110,000	acres

# MIND YOUR PRECISION.

SIGNIFICANT DIGITS, TICK MARKS, AND LABELS SUGGEST WHAT DESERVES ATTENTION.

Representative	District	Fiscal 2010 contract spending
Mike Coffman	Colo. 6	\$3.26 billion
Doug Lamborn	Colo. 5	2.98 billion
Rob Bishop	Utah 1	2.76 billion
Kenny Marchant	Texas 24	2.58 billion
Jeff Duncan	S.C. 3	2.40 billion
Sandy Adams	Fla. 24	2.36 billion
Lamar Smith	Texas 21	1.65 billion
Steve Scalise	La. 1	1.49 billion
Jeff Landry	La. 3	1.47 billion
Roscoe Bartlett	Md. 6	1 billion
John Carter	Texas 31	1 billion



USE EMBELLISHMENTS  
SPARINGLY & CAREFULLY.

STYLISTED VISUALS CAN  
BE ENGAGING BUT ARE  
HARD

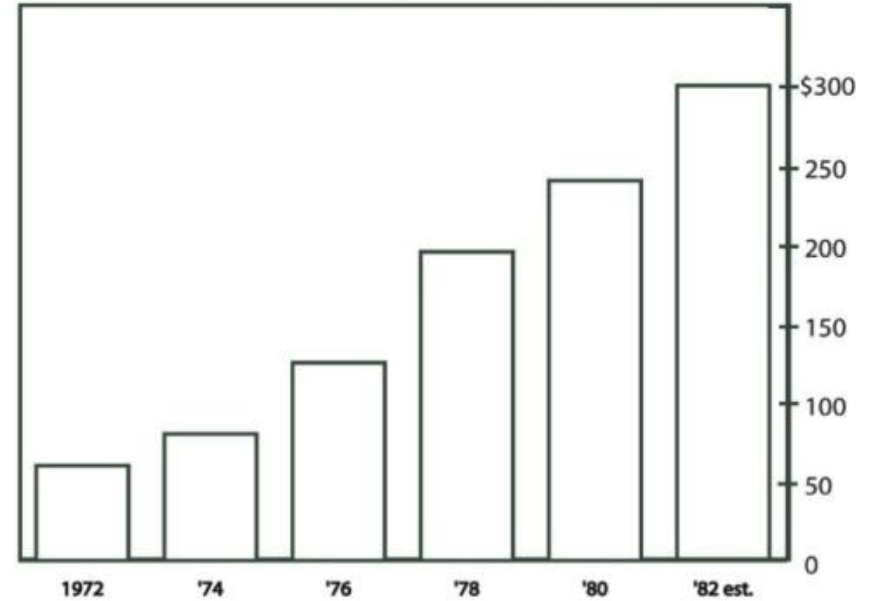
TO GET RIGHT.

### MONSTROUS COSTS

Total House and Senate  
campaign expenditures,  
in millions



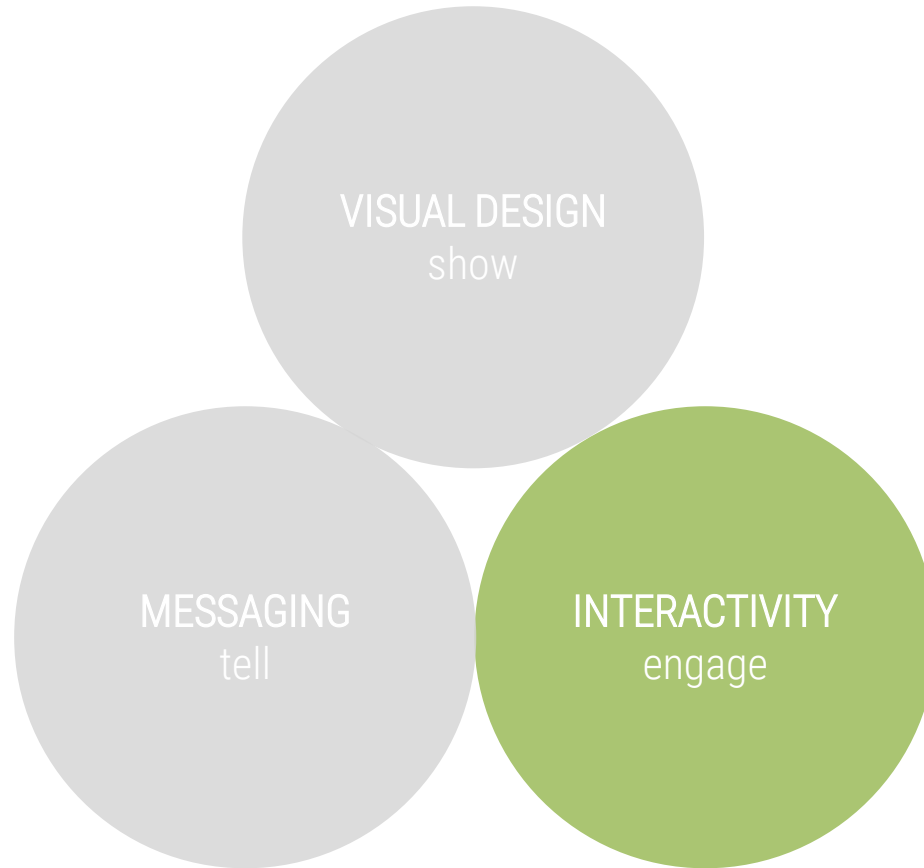
MONSTROUS COSTS  
Total House and Senate campaign expenditures, in millions



NIGEL HOLMES



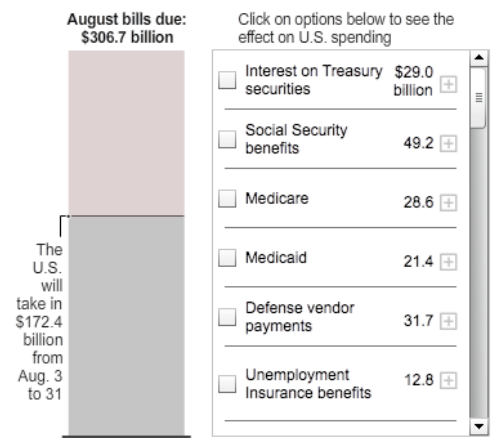
IT'S IMPORTANT TO REALLY  
UNDERSTAND THE RULES OF  
GOOD VISUAL COMMUNICATION  
BEFORE YOU TRY TO BREAK  
THEM.



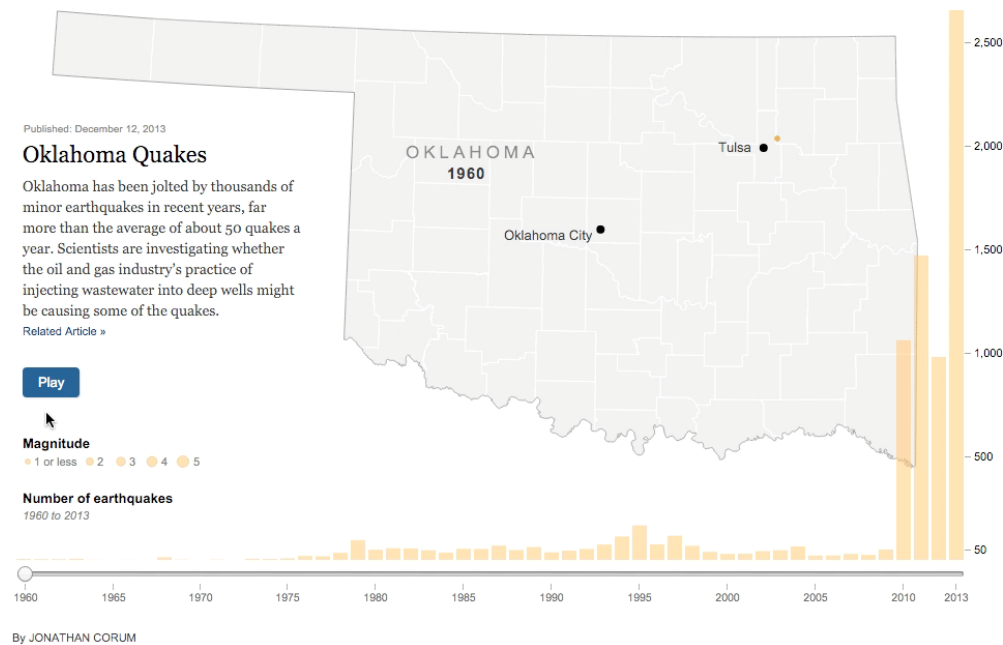
# INTERACTIVE FEATURES SHOULD SUGGEST INTERACTIVITY.

## AVOID A CLICK-AND-SEEK EXPERIENCE.

### FAMILIAR WIDGETS



### VISUAL FEEDBACK ON PAGE LOAD OR PLAY





INCLUDE EASY WAYS  
TO GO BACK / RESET  
LINEAR NAVIGATION  
CAN SIMPLIFY THIS.

RESTRICT  
INTERACTION  
TO KEY DIMENSIONS.  
THE MORE  
INTERACTIVITY, THE  
LESS STORY.

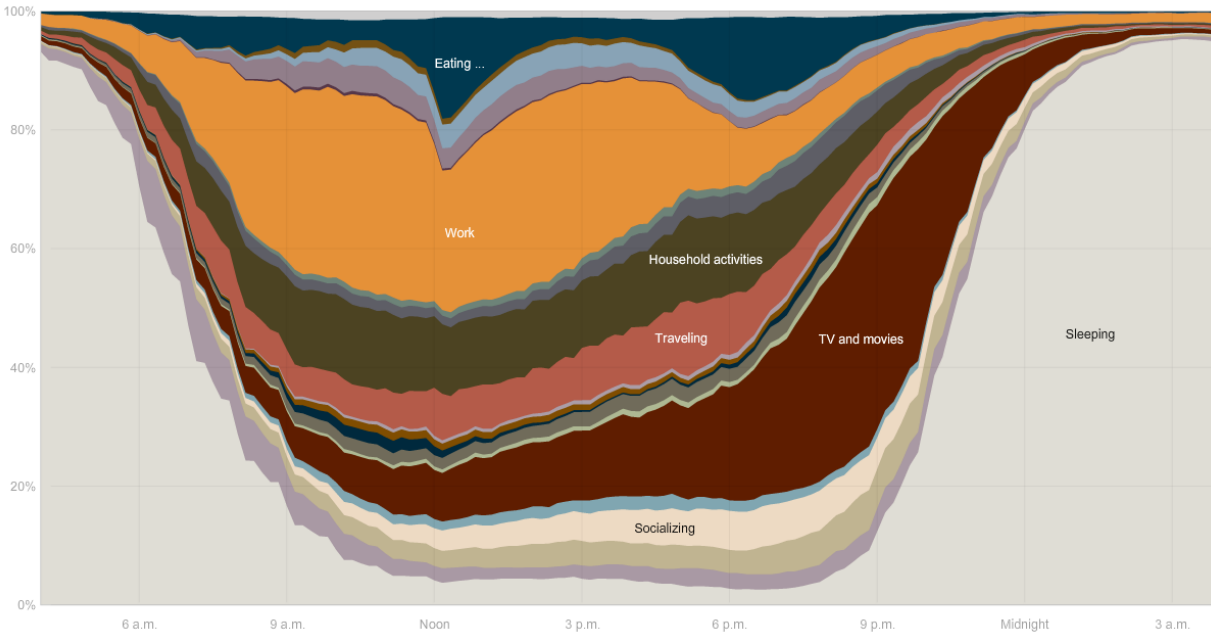
# How Different Groups Spend Their Day

The American Time Use Survey asks thousands of American residents to recall every minute of a day. Here is how people over age 15 spent their time in 2008. [Related article](#)

## Everyone

Sleeping, eating, working and watching television take up about two-thirds of the average day.

Everyone	Employed	White	Age 15-24	H.S. grads	No children
Men	Unemployed	Black	Age 25-64	Bachelor's	One child
Women	Not in lab...	Hispanic	Age 65+	Advanced	Two+ children



USE MOTION &  
OTHER CUES  
TO SUGGEST  
INTERACTION

## TOTAL **PRIMARY** ENERGY CONSUMPTION *By* FUEL



## TOTAL **FINAL** ENERGY CONSUMPTION *By* FUEL

Final energy is energy supplied that is available to the consumer to be converted into useful energy (e.g. electricity at the wall outlet).

# Suggested Interactivity

				Slcue1	Slcue2	Slcue3	Slcue4	Slcue5	Slcue6	Slcue7	Slcue8	Slcue9	Slcue10	Slcue11	Slcue12	Slcue13	Slcue14	Slcue15	Slcue16	Slcue17	Slcue18	Slcue19	Slcue20	Slcue21	Slcue22	Slcue23	Slcue24	Slcue25	Slcue26	Slcue27	Slcue28	Slcue29	Slcue30	Slcue31	Slcue32	Slcue33	Slcue34	Slcue35	Slcue36	Slcue37	Slcue38	Slcue39	Slcue40	Slcue41	Slcue42	Slcue43	Slcue44	Slcue45																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
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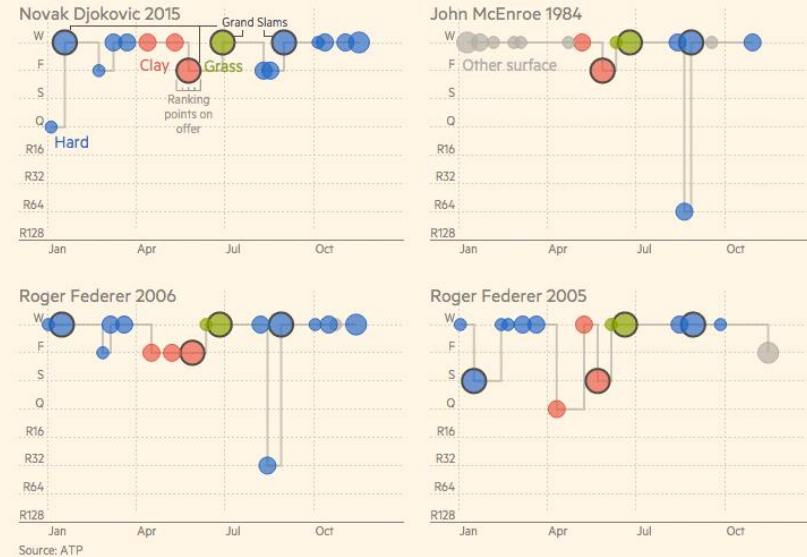
JEREMY BOY ET AL. 2015

LOTS OF INTERACTIVE EXAMPLES AT [http://peopleviz.gforge.inria.fr/trunk/Sl\\_cues/](http://peopleviz.gforge.inria.fr/trunk/Sl_cues/)

“SCROLLJACKING”  
HIJACKING IN-BROWSER  
SCROLLING TO ADVANCE A  
LINEAR NARRATIVE.

SMOOTH AND LINEAR  
EASY FORWARD/BACK  
MORE BROWSABLE THAN VIDEO  
CROSS-PLATFORM  
CAN BREAK THE SCROLLBAR

## Djokovic's 2015 was the greatest ever men's tennis season



John Burn-Murdoch • January 27, 2016



If Novak Djokovic wins the Australian Open title this weekend, he will in doing so extend the most impressive streak ever in men's tennis.

When the current world number one won the Qatar Open earlier this month, it marked the 16th consecutive tournament he had entered in which he reached the final -- a run stretching back exactly one year to a quarter-final defeat at the same event.

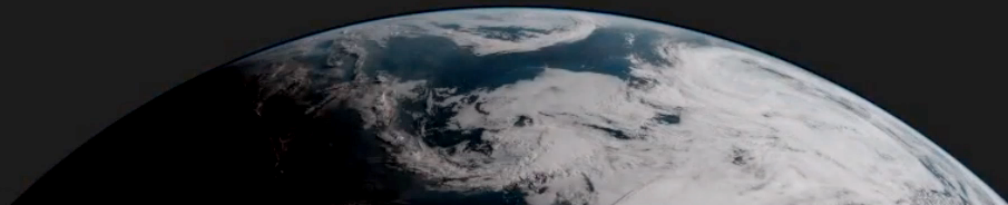
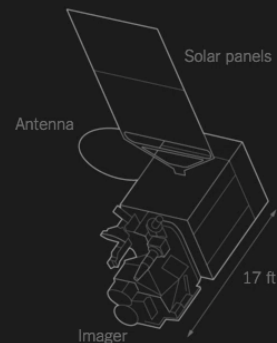
CLICKING IS A DECISION  
**SCROLLING IS A CONTINUATION**

JOSHUA PORTER

# Japan's New Satellite Captures an Image of Earth Every 10 Minutes

By DEREK WATKINS JULY 10, 2015

A sense of perspective is unavoidable from 22,000 miles out. Looking down at Earth from that distance — almost three times farther than the diameter of the planet itself — allows a view of the globe as a massive organic system, pulsing with continuous movement. Below, images from the Himawari-8 weather satellite's first official day paint a living portrait of the western Pacific, with Typhoons Chan-hom and Nangka spinning slowly westward.



## What's Really Warming the World?

By Eric Roston  and Blacki Migliozi  | June 24, 2015

Skeptics of manmade climate change offer various natural causes to explain why the Earth has warmed 1.4 degrees Fahrenheit since 1880. But can these account for the planet's rising temperature? Scroll down to see how much different factors, both natural and industrial, contribute to global warming, based on findings from NASA's Goddard Institute for Space Studies.

Hotter  
+2°F  
1880-1910  
Average  
-2°F  
Colder



# Scroll Events

Detecting The Scroll



*“Data journalism is not graphics and visualizations. **It's about telling the story in the best way possible.** Sometimes that will be a visualization ...But sometimes it's a news story. Sometimes, just publishing the number is enough.”*

SIMON ROGERS, THE GUARDIAN // 2011

*“I think people have begun to forget  
how powerful human stories are,  
exchanging their sense of empathy for  
a fetishistic fascination with data...  
The human stuff is the main stuff, and  
the data should enrich it.”*

JONATHAN HARRIS // 2008



The Fallen of World War II

from Neil Halloran

<http://www.fallen.io/ww2/>

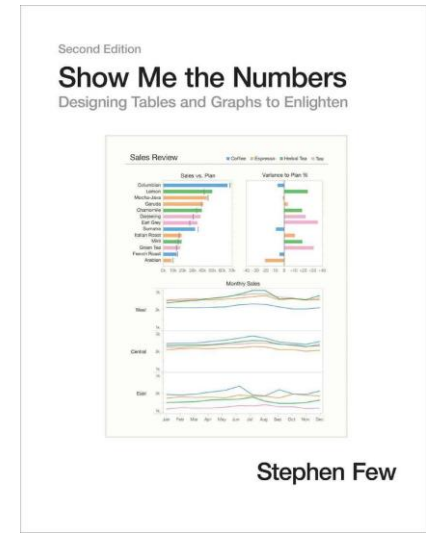
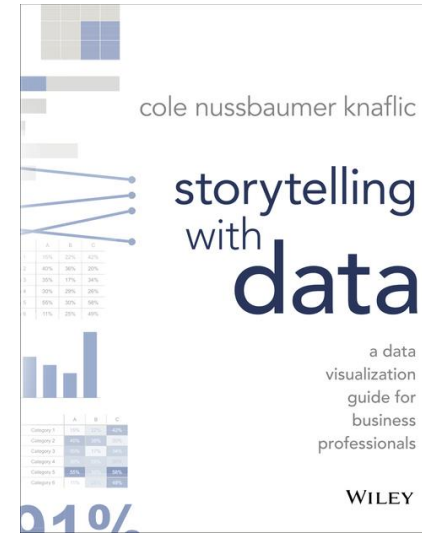


**QUESTIONS?**

# ACKNOWLEDGEMENTS

Slides in were inspired and adapted from

- slides by Wesley Willett (University of Calgary)
- content of the books on the right



# RECAP

- MAXIMIZE THE DATA-INK RATIO
- AVOID CHART JUNK (*SOMETIMES*)
- LAYER INFORMATION
- MAXIMIZE THE DATA DENSITY
  - *SHRINK THE GRAPHICS*
  - *MAXIMIZE THE AMOUNT OF DATA SHOWN (SOMETIMES)*



**EDWARD TUFTE**

# DESIGN PRINCIPLES

MANY MORE EXIST...

