

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”

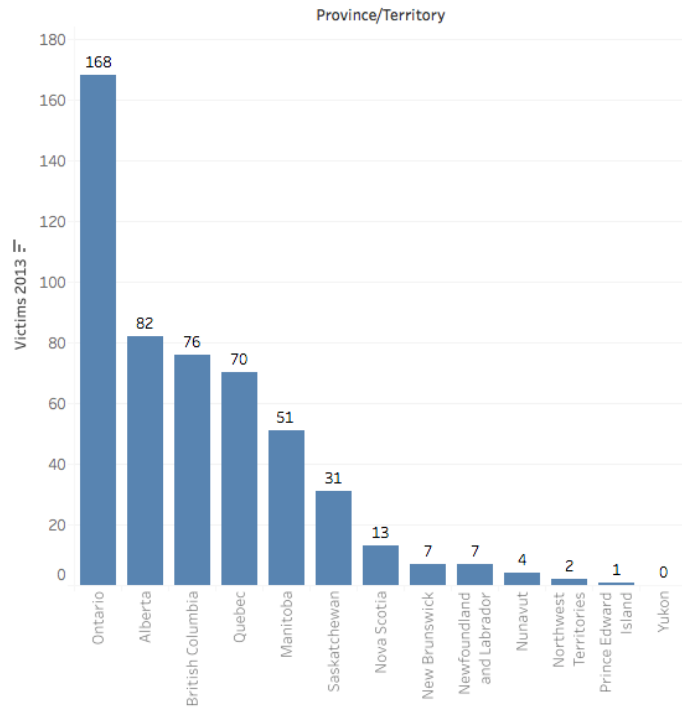
MAKING MEANINGFUL COMPARISONS

- **Normalized vs. Non-normalized Counts**
 - Murders / Capita
 - Failing grades / 100 Students
 - Etc.

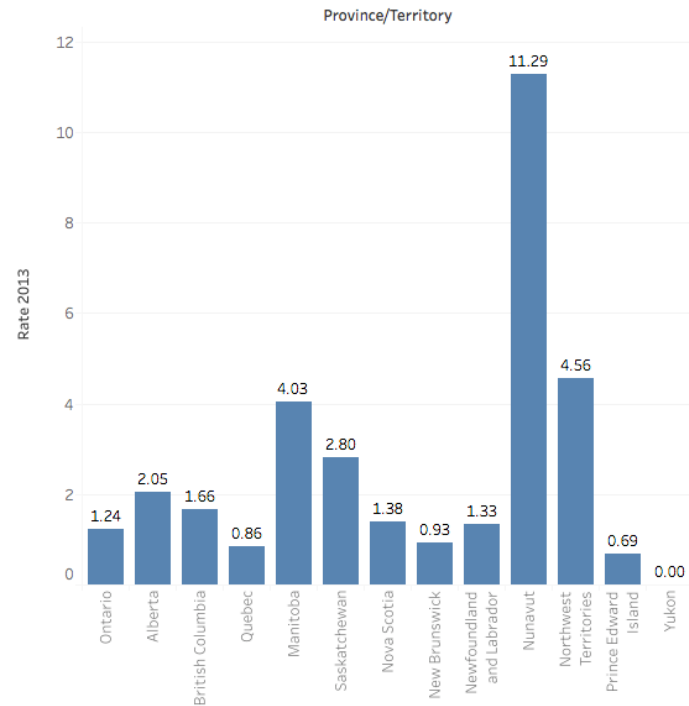
- **Counts vs. Distinct Counts**
 - # visits vs. # of customers

WHAT IS THE MOST DANGEROUS PROVINCE?

Victims by Province/Territory 2013



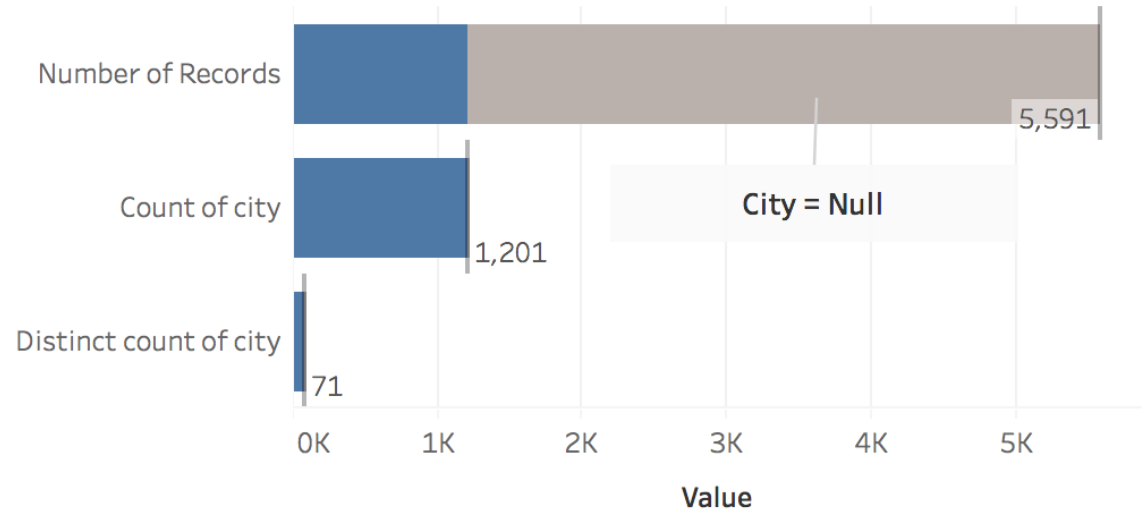
Victims per 100,000 residents by Province/Territory 2013



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

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- Assumptions about the meaning of correlations
- 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

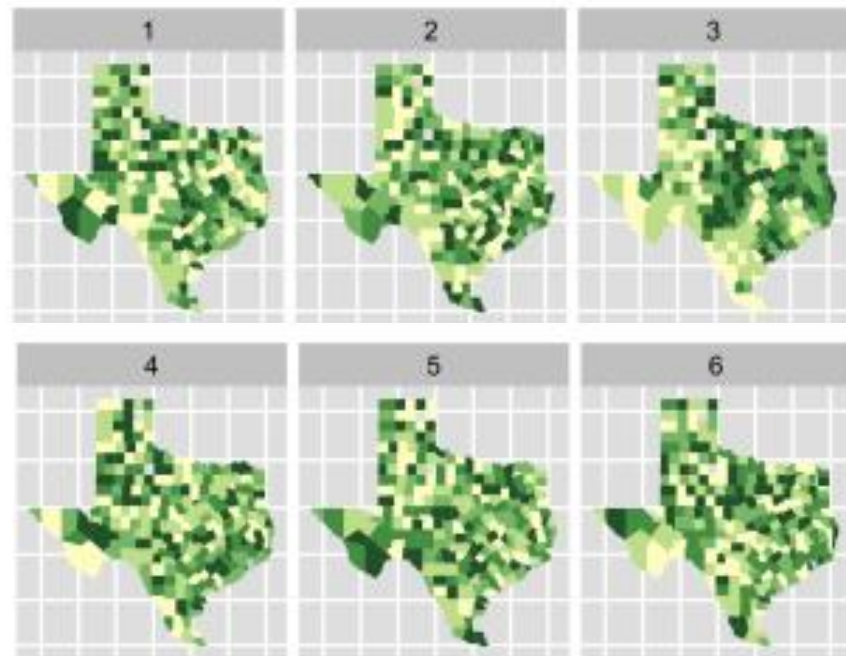
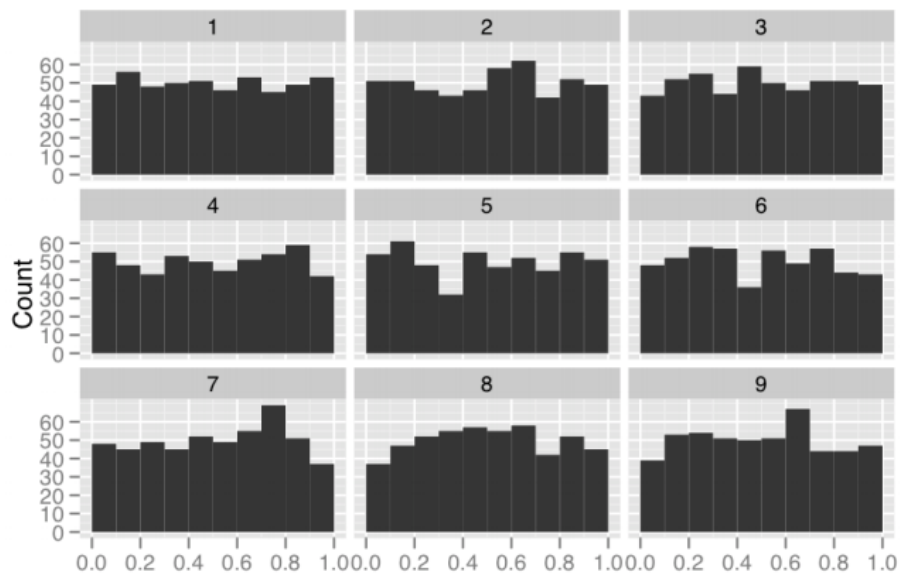
- Almost all data has noise, errors, and variability.
- We are great at seeing patterns – **even when we shouldn't.**



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



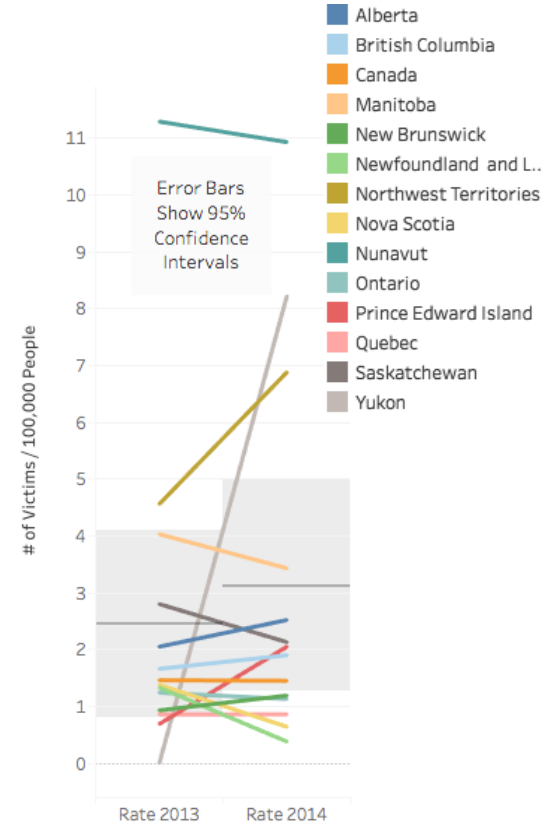
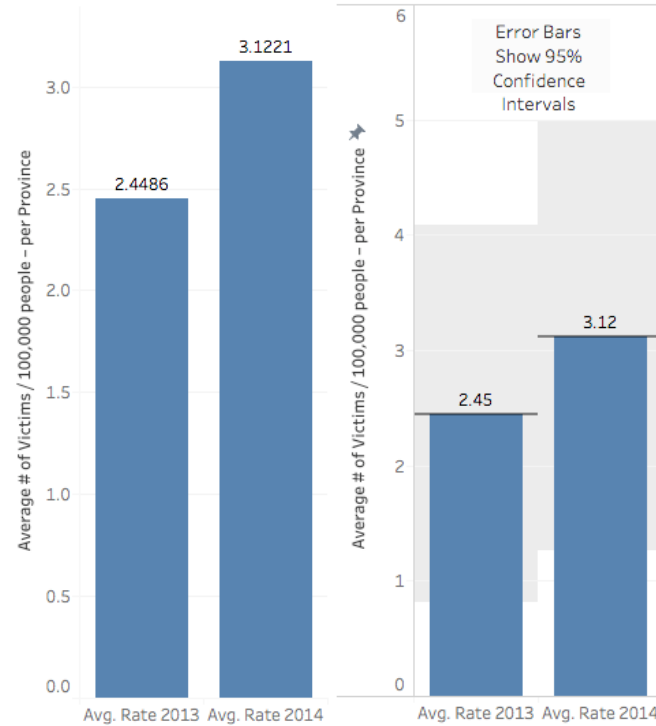
[Wickham et al. 2010](#)

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

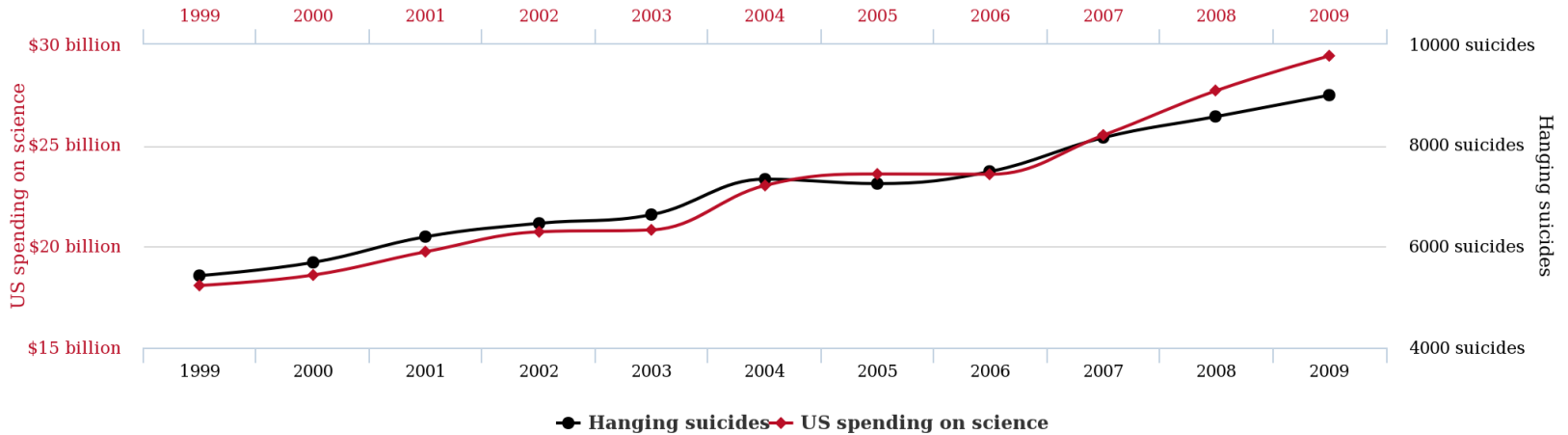
- Making meaningful comparisons
- Inferring trends and differences from noise
- Assumptions about the meaning of correlations
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CORRELATIONS

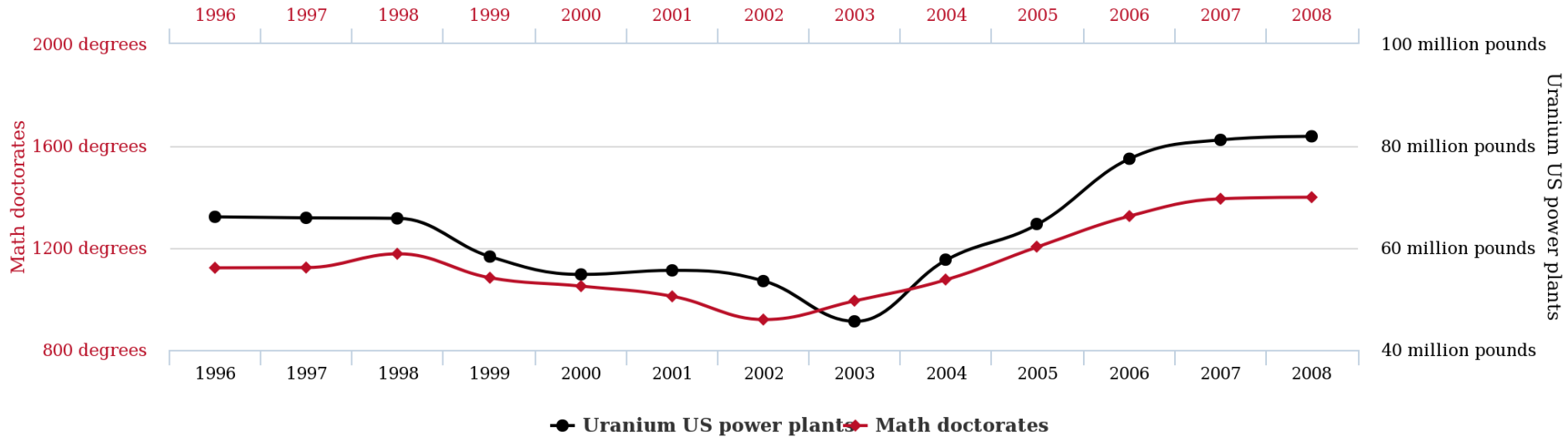
- Is there **really** a correlation?
- How **strong** is it?
- Is it **corroborated** by other data?
- Does it **make sense**?

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



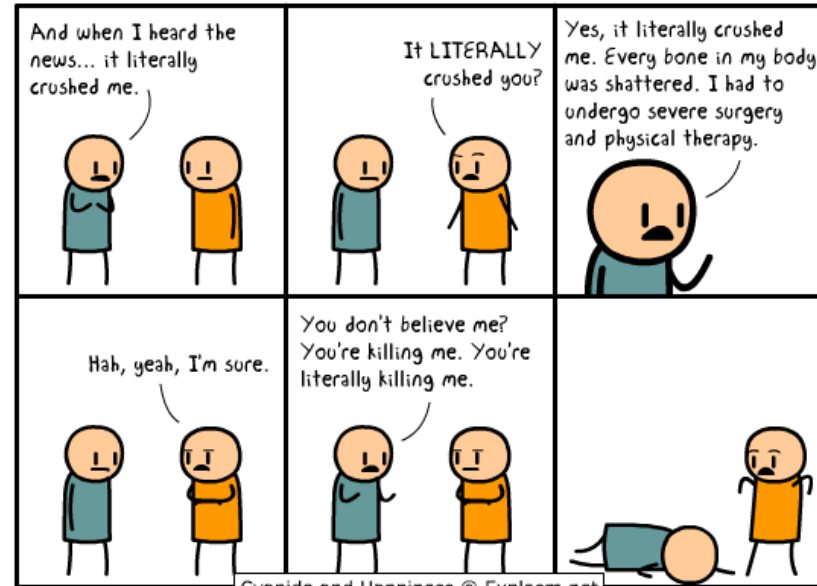
TRY THIS!

http://tylervigen.com/view_correlation

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- Assumptions about the meaning of correlations
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THE “LITERALLY” OF DATA ANALYSIS



“SIGNIFICANTLY...

DIFFERENT

HIGHER/LOWER

BIGGER/SMALLER

MORE/LESS

MORE IMPORTANT

ETC...

NEVER SAY THIS ...

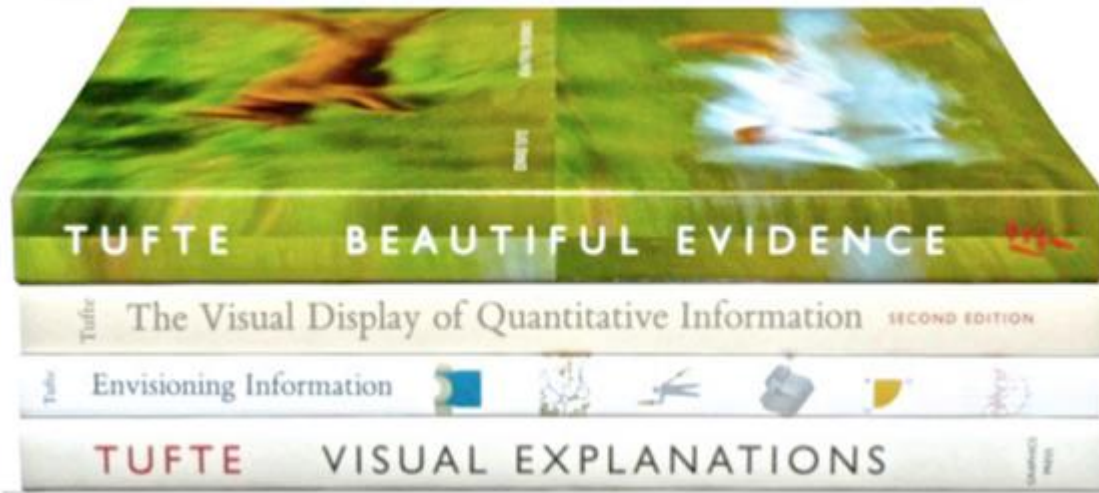
**UNLESS YOU’RE SURE THAT YOU
HAVE PERFORMED THE CORRECT
STATISTICAL SIGNIFICANCE TEST
AND CAN REPORT P-VALUES, EFFECT
SIZES, ETC.**

COMMUNICATING ASSUMPTIONS AND LIMITATIONS

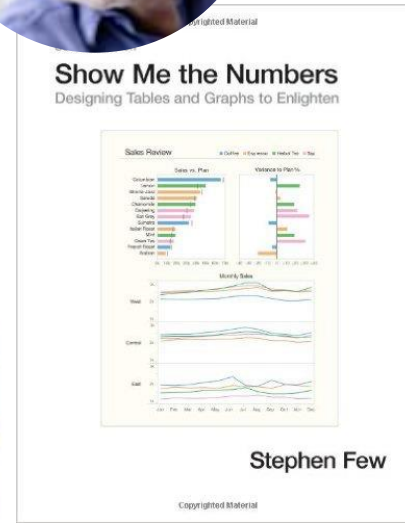
A good analysis must avoid overstating claims, and be honest about what you don't or can't know!



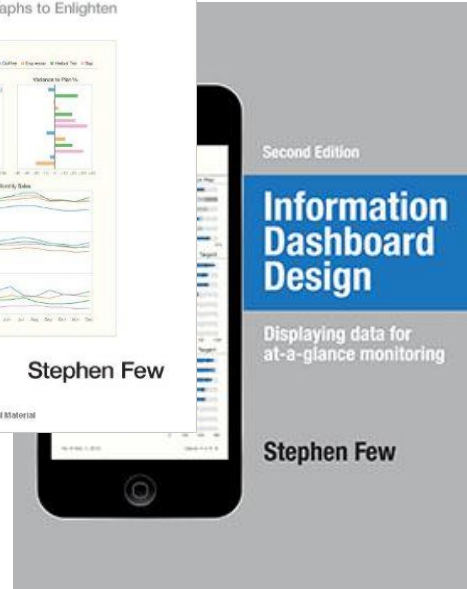
Edward Tufte



Stephen Few



Stephen Few



Stephen Few

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

TUFTE'S INTEGRITY PRINCIPLES

- 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)*



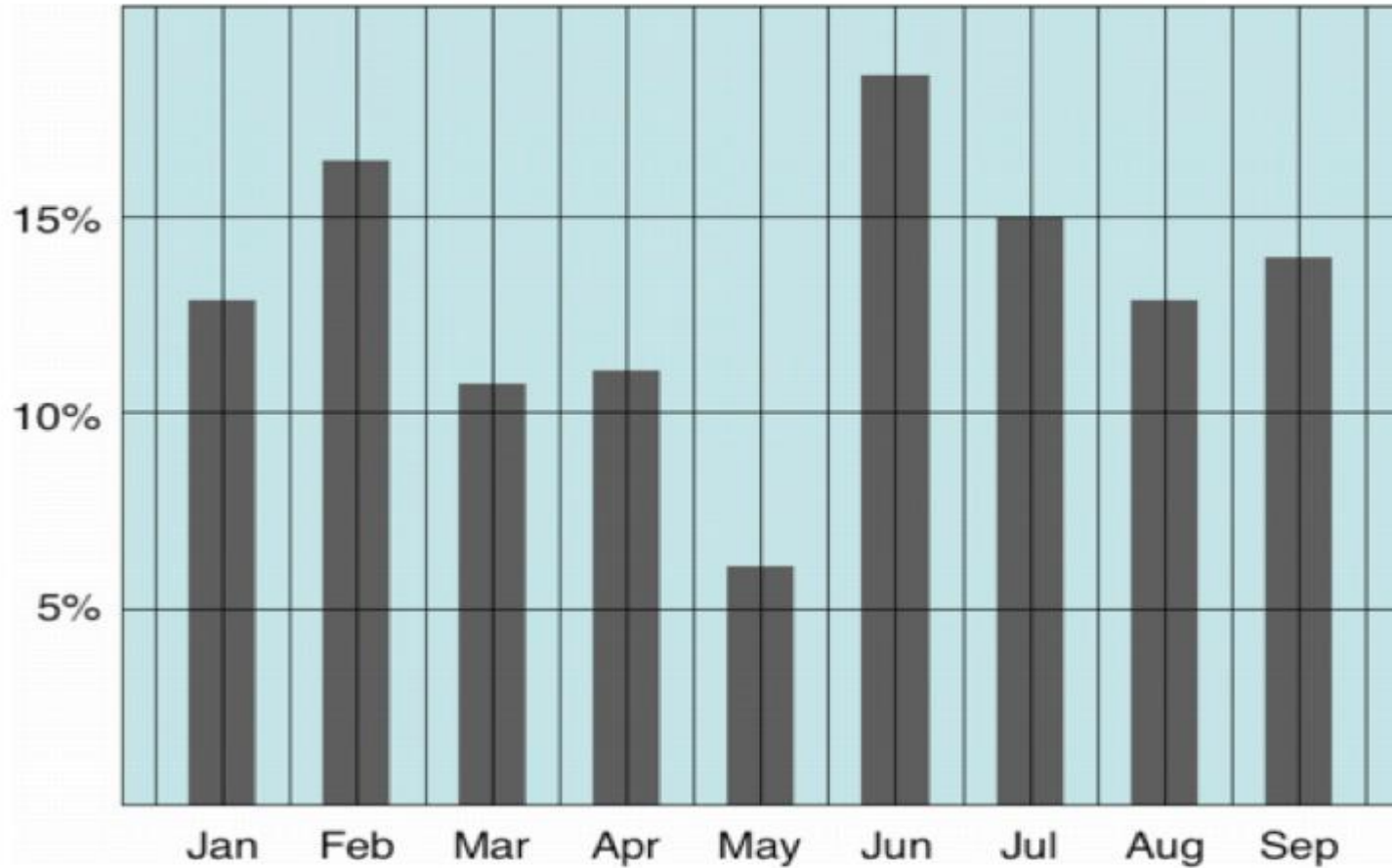
EDWARD TUFTE

DATA-INK RATIO

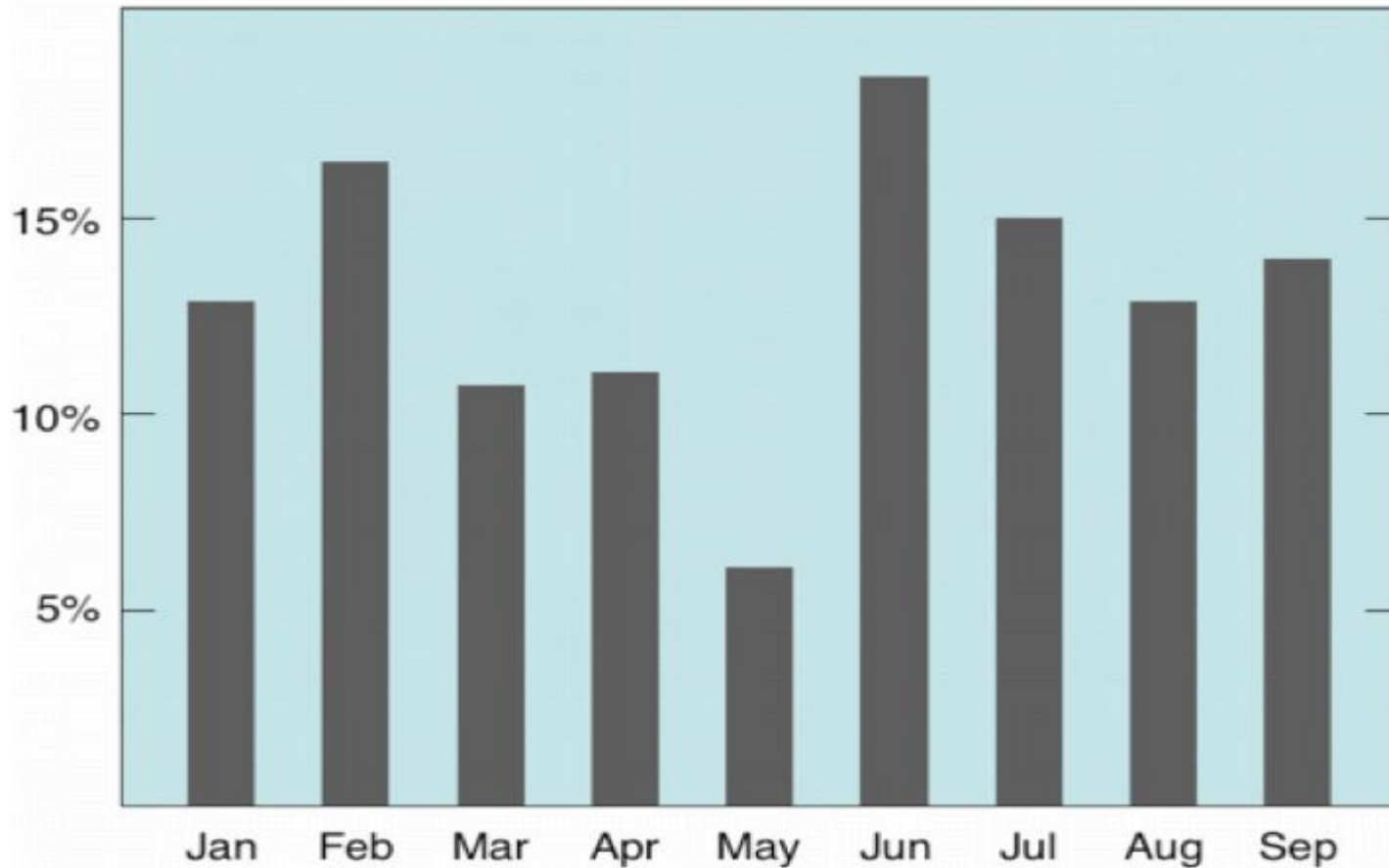
MAXIMIZE THE RATIO OF

$$\frac{\text{(INK USED TO SHOW DATA)}}{\text{(TOTAL INK USED)}}$$

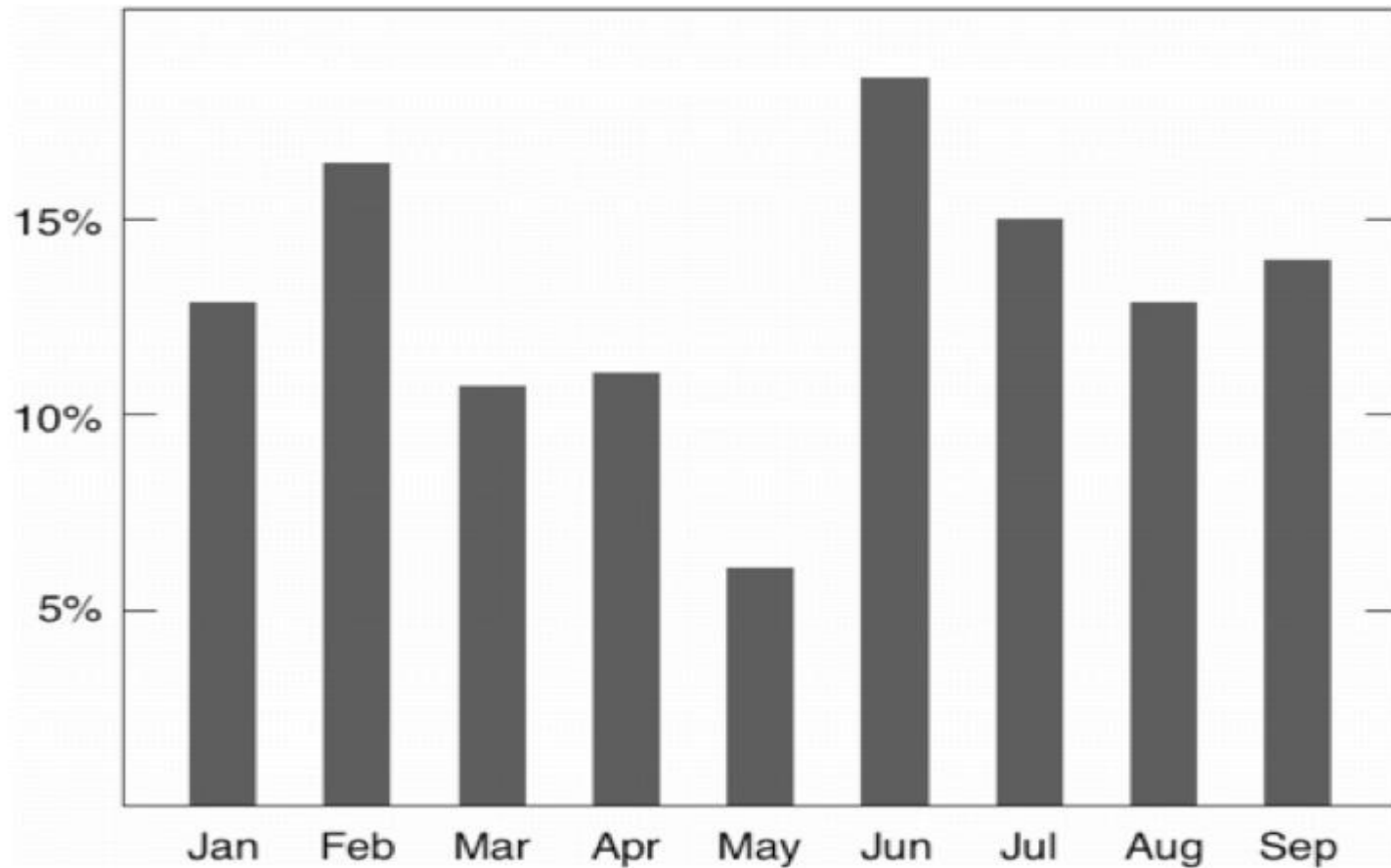
DATA-INK RATIO



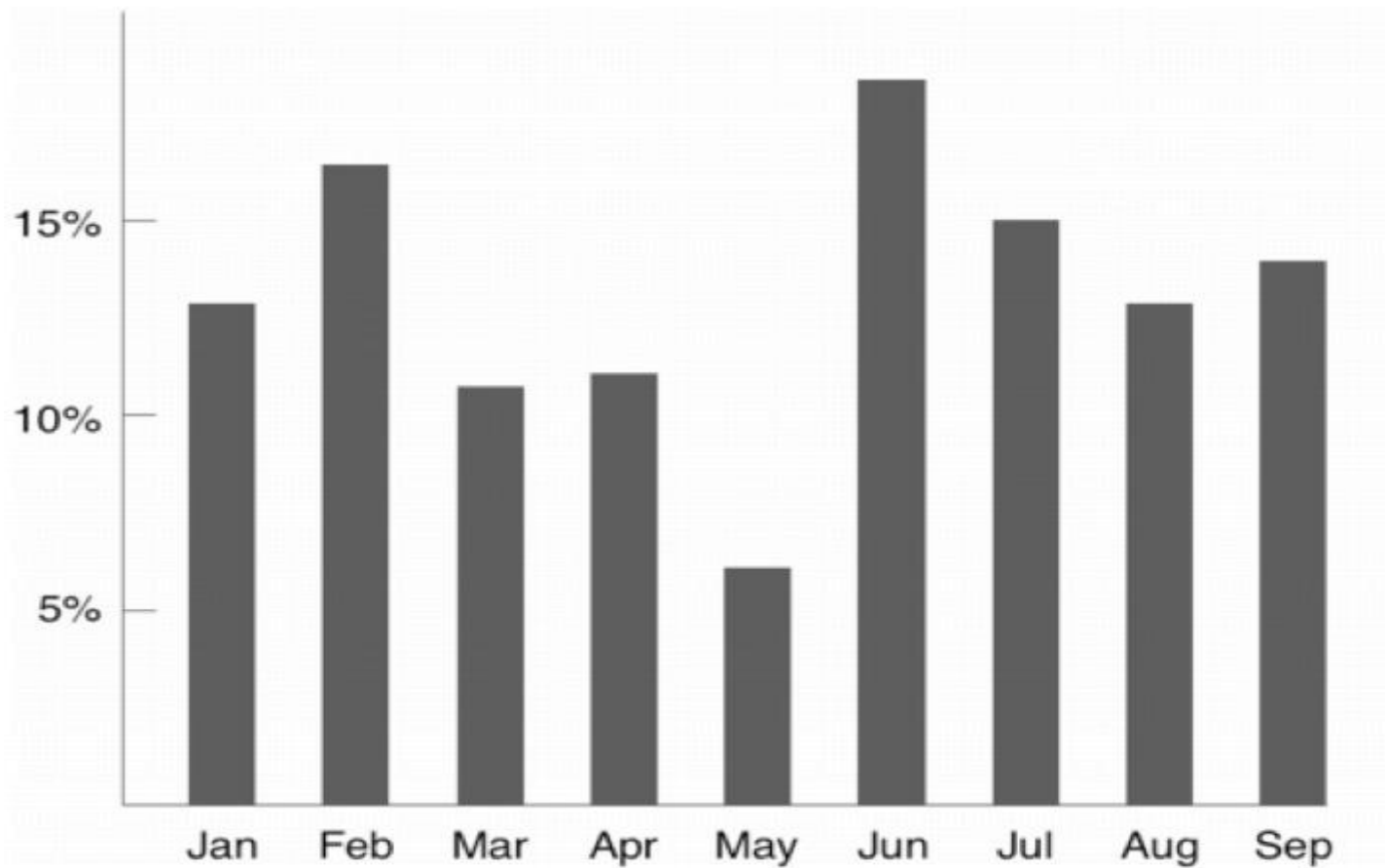
DATA-INK RATIO



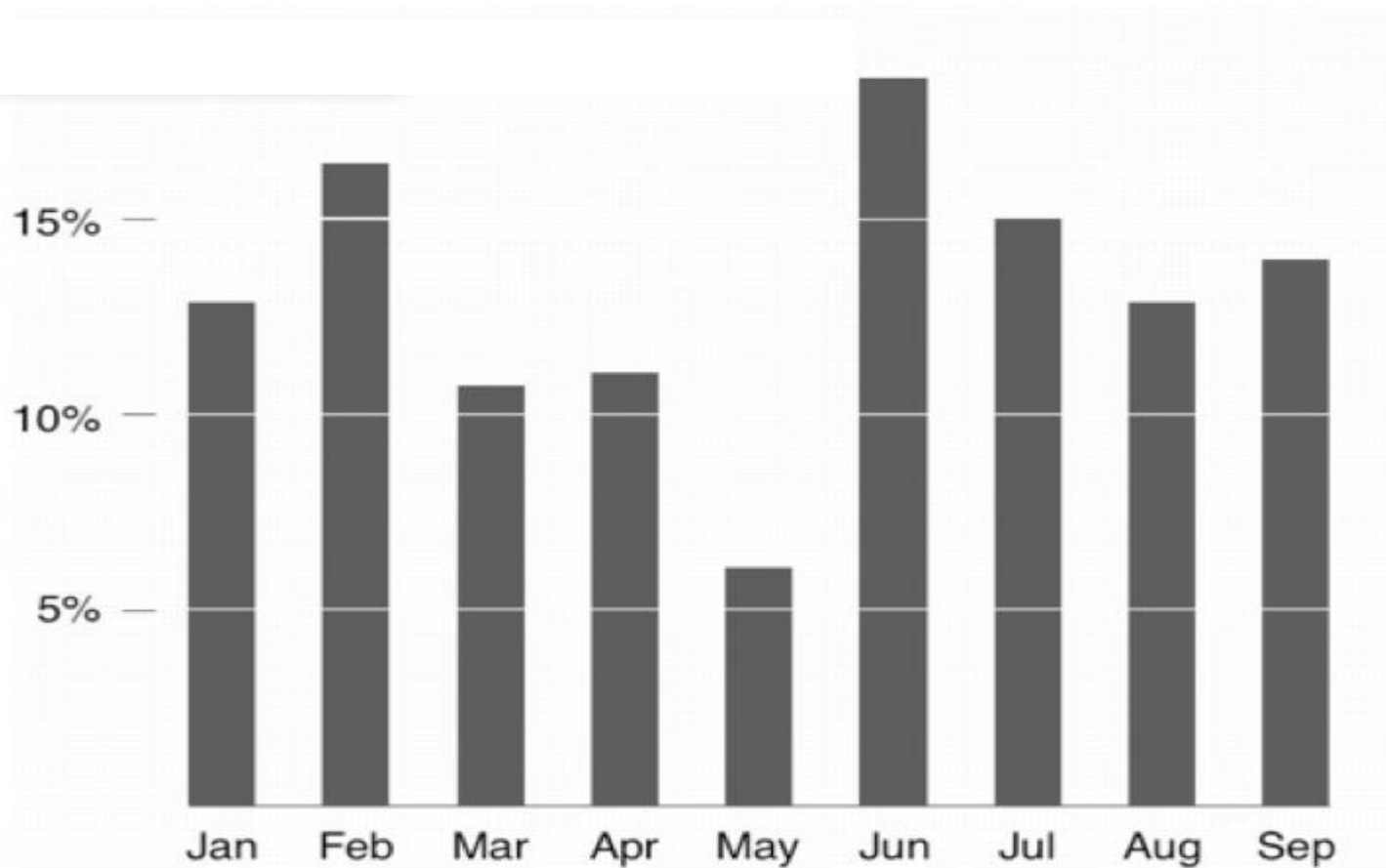
DATA-INK RATIO



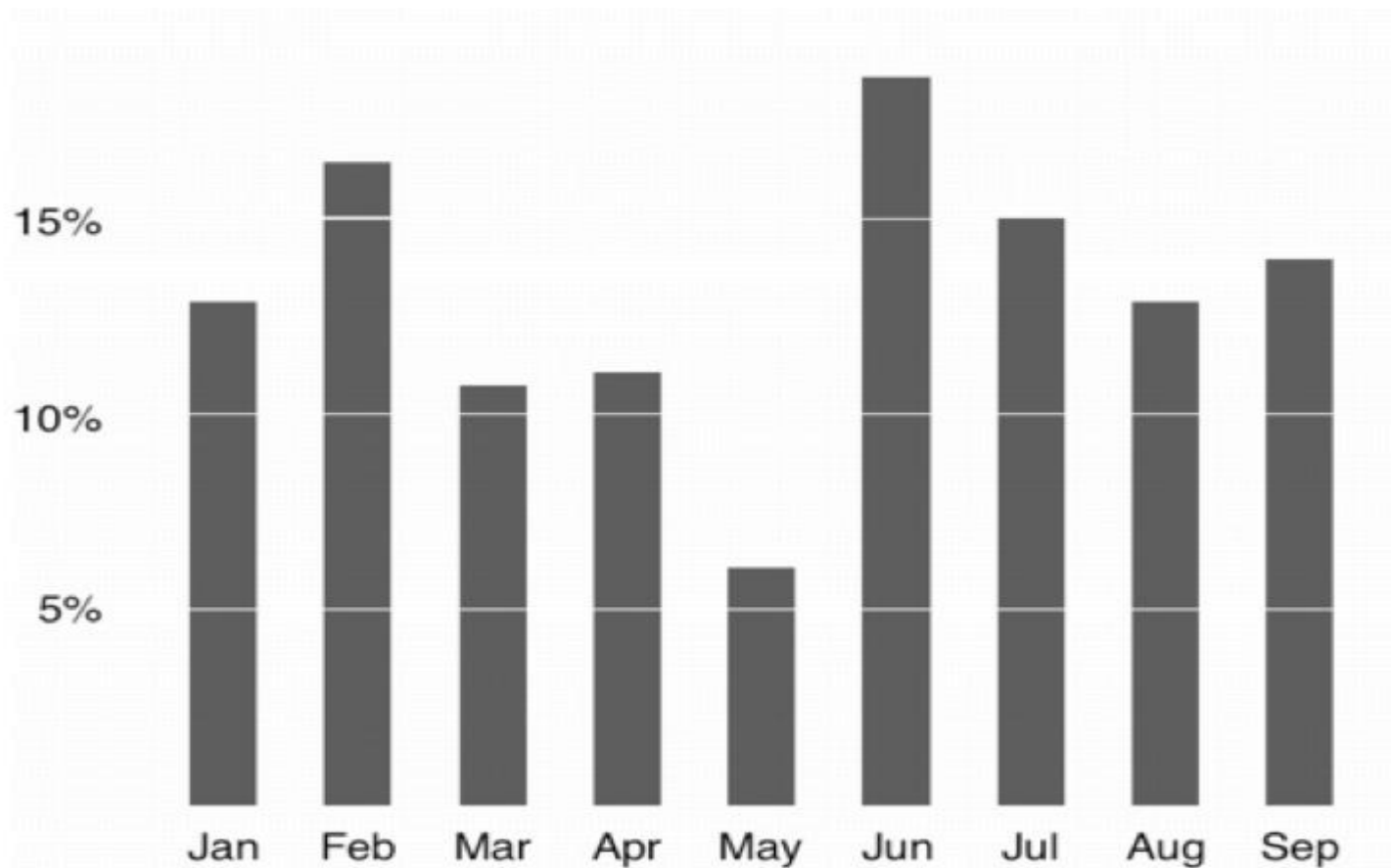
DATA-INK RATIO



DATA-INK RATIO



DATA-INK RATIO



MINIMIZE CHART JUNK

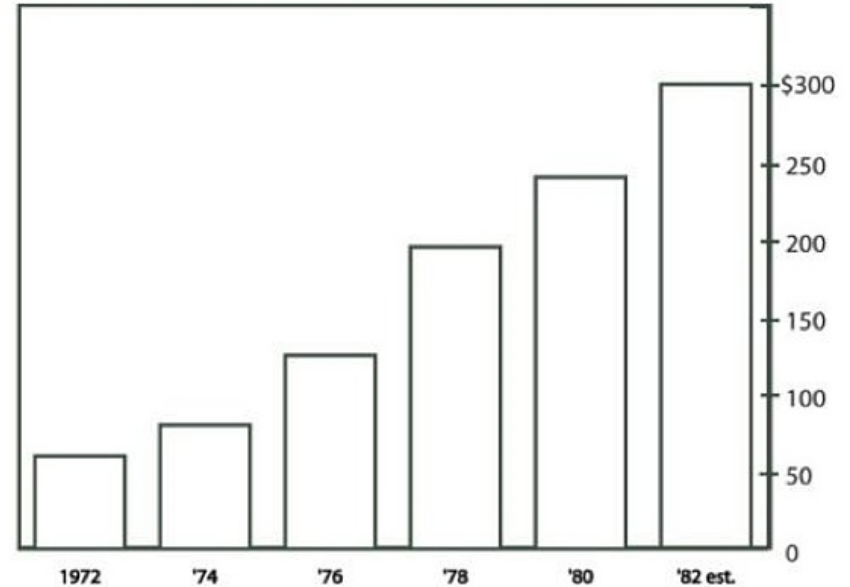
MONSTROUS COSTS

Total House and Senate campaign expenditures, in millions



MONSTROUS COSTS

Total House and Senate campaign expenditures, in millions



Wayne Lytle

The Dangers of
GLITZINESS
and other
Visualization Faux Pas

or... "What's Wrong with this Visualization?"

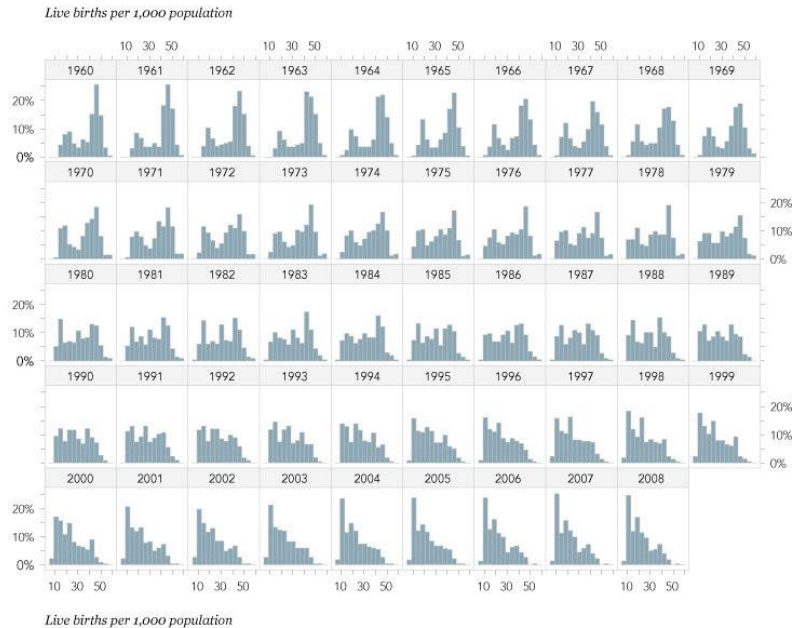
DATA DENSITY

MAXIMIZE THE RATIO OF:

$$\frac{\text{(NUMBER OF ENTRIES IN DATA)}}{\text{(AREA OF THE GRAPHIC)}}$$

DATA DENSITY – SHRINK THE GRAPHICS

Annual Worldwide Distributions of Live Births



“SMALL MULTIPLES”

DATA DENSITY – SHRINK THE GRAPHICS

GRAPHIC PROBLEMS POSED BY TIME SERIES

Scale in years

With a scale in years, a two-year total (figure 1) should be divided by 2 (figure 2). A total for six months should be multiplied by 2.

Pointed curves

For overly pointed curves (figure 3), the scale of the Q should be reduced; optimum angular perceptibility occurs at around 70 degrees (figure 4).

If the curve is not reducible (large and small variations), filled columns can be used (figure 5).

Flat curves

For overly flat curves (figure 6), the scale of the Q should be increased (figure 7).

Small variations

For small variations in relation to the total (figure 8), the total loses its importance, and the zero point can be eliminated (figure 9). The graphic can be interpreted as an acceleration if a precise study of the variations is necessary; here, we use a logarithmic scale (figure 10). (See also page 240.)

Large range

For a very large range between the extreme numbers (figure 11), we must either:

- (1) leave out the smallest variations;
- (2) be concerned only with relative differences (logarithmic scale), without knowing the absolute quantities;
- (3) select different parts (periods) within the ordered component and treat them on different scales above the common scale (figure 12).

Obvious periodicity

If there is obvious periodicity (figure 13), and the study involves a comparison of the phases of each cycle, it is preferable to break up the cycles in order to superimpose them (figure 14). A polar construction can be used, preferably in a spiral shape (figure 15), but we should not begin with too small a circle. As striking as it seems, it is less efficient than an orthogonal construction.

Annual curves

For annual curves of rainfall or temperature, if a cycle has two phases (figure 17), why depict only one (figure 16)?

A contrast

Unlike what we see in figure 18, the pertinent or "new" information must be separated from the background or "reference" information. The background involves: (a) the invariant, highlighted by a heading (Port St. Michel); (b) the highly visible identification of each component (tonnage and dates). The new information (the curve) must stand out from the background (figure 19).

Reference points

It is impossible to utilize a graphic such as figure 20, except in a general manner. There is confusion concerning the position of the points, and no potential comparison is possible, as it is in figure 21.

Precision reading

A precision reading (utilization on the elementary level, as in figure 24) is difficult in figure 22, which results in a poor reading of the order of the points, and in figure 23, where there is ambiguity concerning the position of the points. On the other hand, figure 22 does favor overall vision (correlation).

Null boxes

Curves accommodate null boxes poorly (figure 25). Columns (figure 26) are preferable.

Unknown boxes

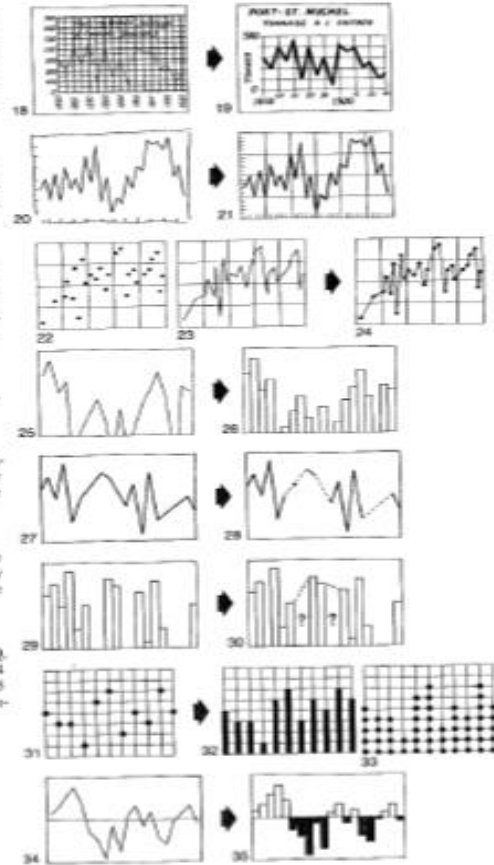
The drawing must indicate the unknowns of the information in an unambiguous way (figures 28 and 30). The reader might interpret figure 27 as a change in the structure of the curve and figure 29 as involving null values.

Very small quantities

Except in seeking a correlation (quite improbable here) the number of ships entering into a port is represented better by figure 33 than by figures 31 or 32. The reader can perceive the numerical values at first glance.

Positive-negative variation

This is in fact a problem involving three components O, Q, \neq (+, -), and it must be visually treated as such. Figure 34 can be improved by utilizing a retinal variable (as figure 35 a value difference: black-white) to differentiate the \neq component and thus highlight positive-negative variation.



DATA DENSITY – SHRINK THE GRAPHICS

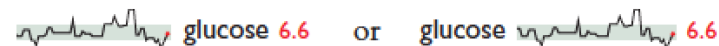
Placed in the relevant context, a single number gains meaning. Thus the most recent measurement of glucose should be compared with earlier measurements for the patient. This data-line shows the path of the last 80 readings of glucose:



Lacking a scale of measurement, this free-floating line is dequantified. At least we do know the value of the line's right-most data point, which corresponds to the most recent value of glucose, the number recorded at far right. Both representations of the most recent reading are tied together with a color accent:



Some useful context is provided by showing the *normal range* of glucose, here as a gray band. Compared to normal limits, readings above the band horizon are elevated, those below reduced:



SPARKLINES

Science fiction

From Wikipedia, the free encyclopedia

For other uses, see [Science fiction \(disambiguation\)](#).

33k visits in last 30 days

Science fiction is a genre of [fiction](#) dealing with imaginative content such as [futuristic](#) settings, futuristic [science](#) and [technology](#), [space travel](#), [time travel](#), [parallel universes](#), and [extraterrestrial life](#). It often explores the potential consequences

SPARKLINES

EASTERN EUROPE

Soviet cult and pragmatism in Transnistria

Experts worry that the next "Crimea" could be the breakaway region of Transnistria

Many locals there don't share that fear, and if the last referendum holds, a large majority would welcome a Russian annexation.



SPARKLINES

Gonzalo Higuaín slides
a cross in from the right



and Ronaldo,
at the front post, shoots
off target.

HOW TO COMMUNICATE DATA HONESTLY TO AN AUDIENCE

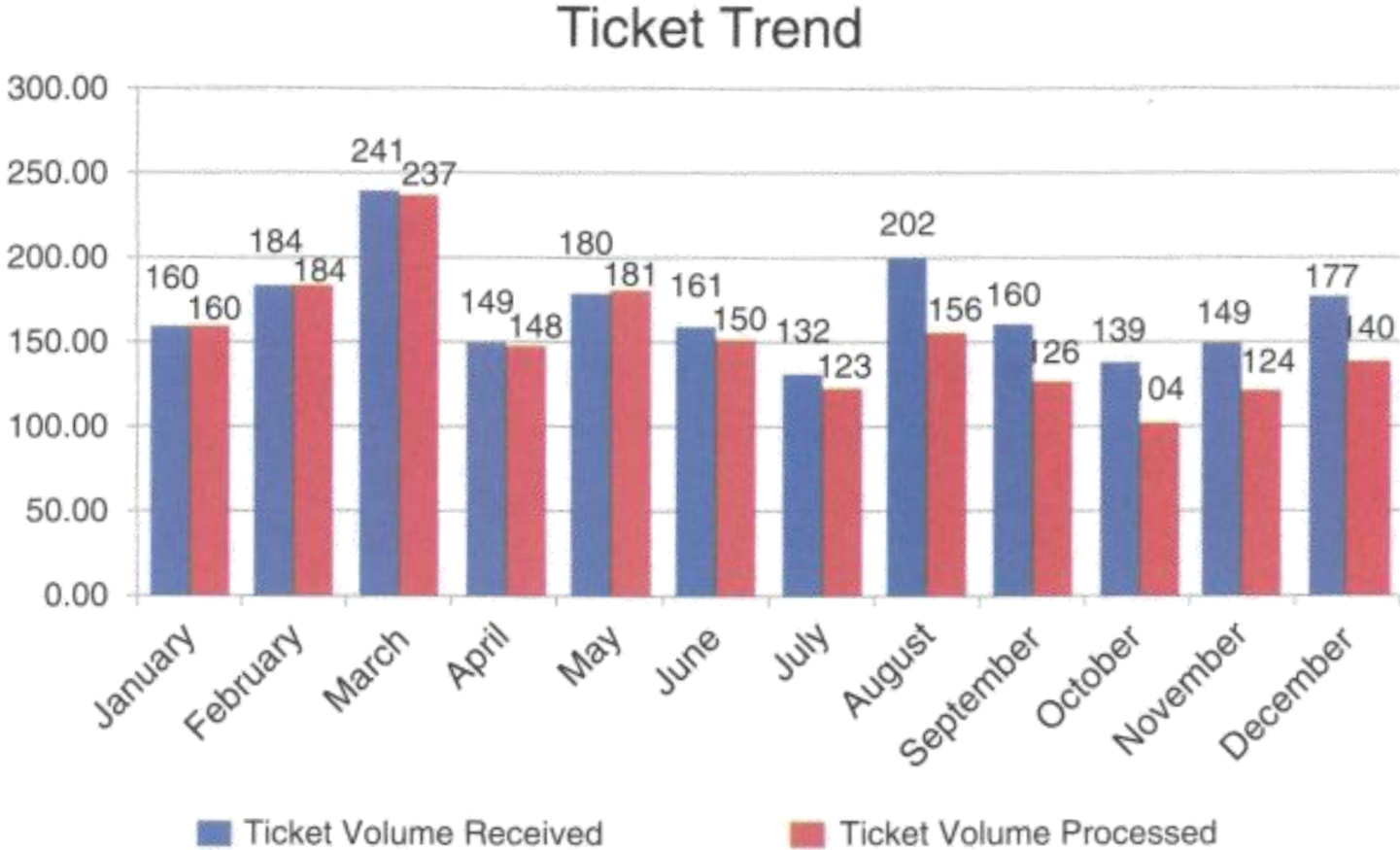
(W. Willett)

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

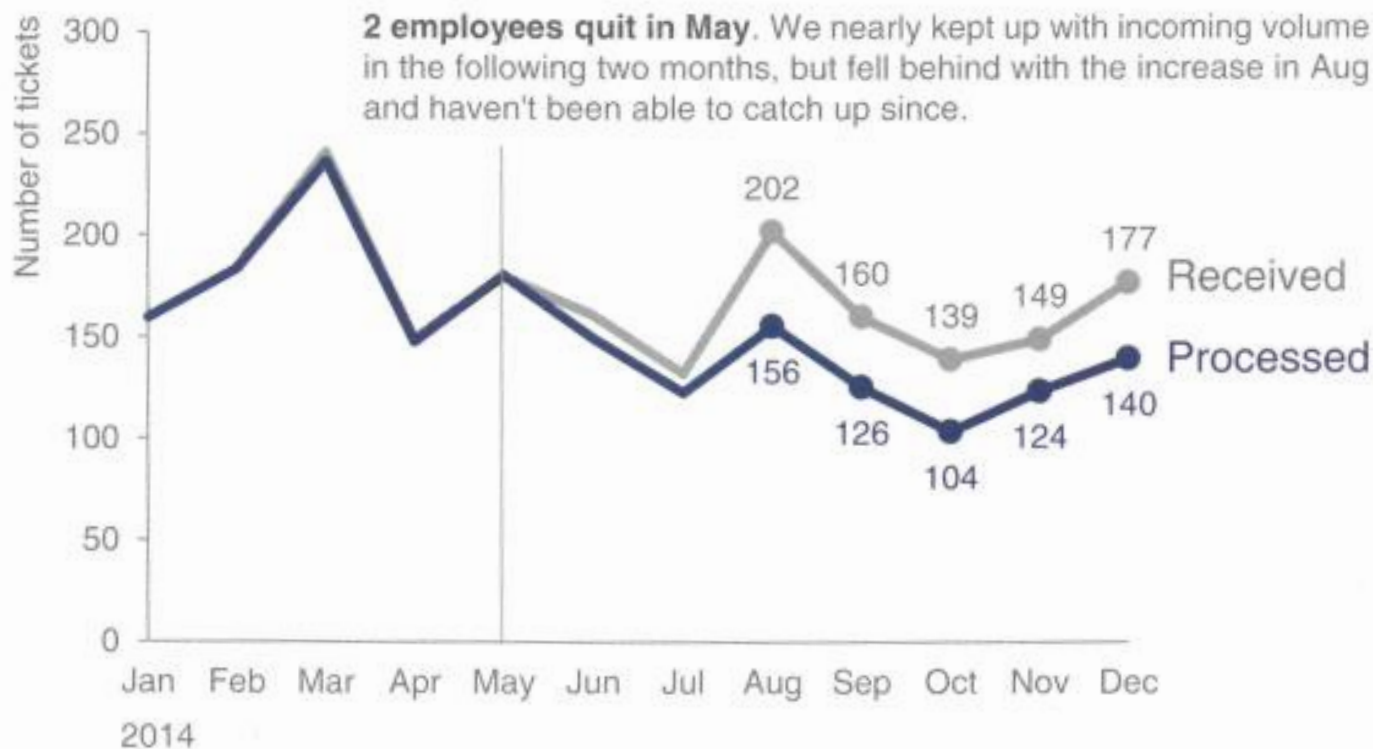
The chart was designed to argue for the hire of more two employees



Please approve the hire of 2 FTEs

to backfill those who quit in the past year

Ticket volume over time

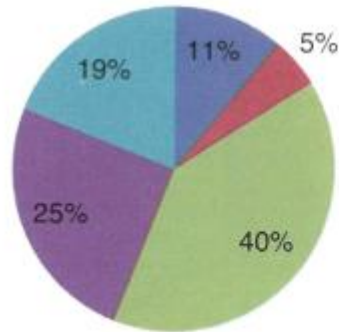


EXAMPLE - EXERCISE

Survey Results

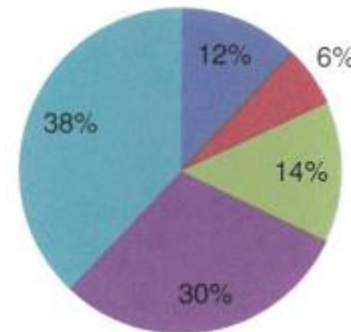
PRE: How do you feel about doing science?

■ 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

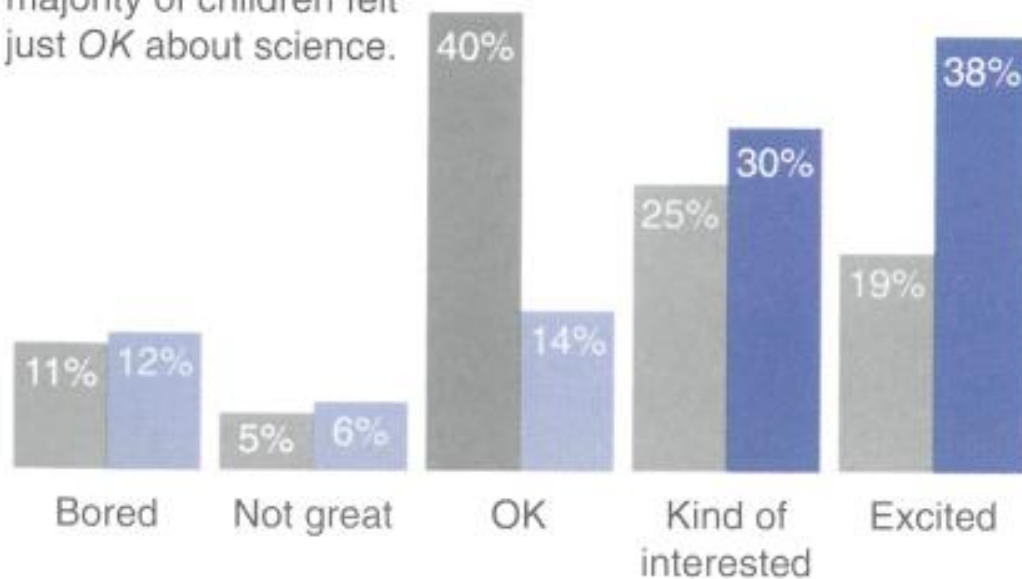
QUESTIONS ON YOUR

- 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

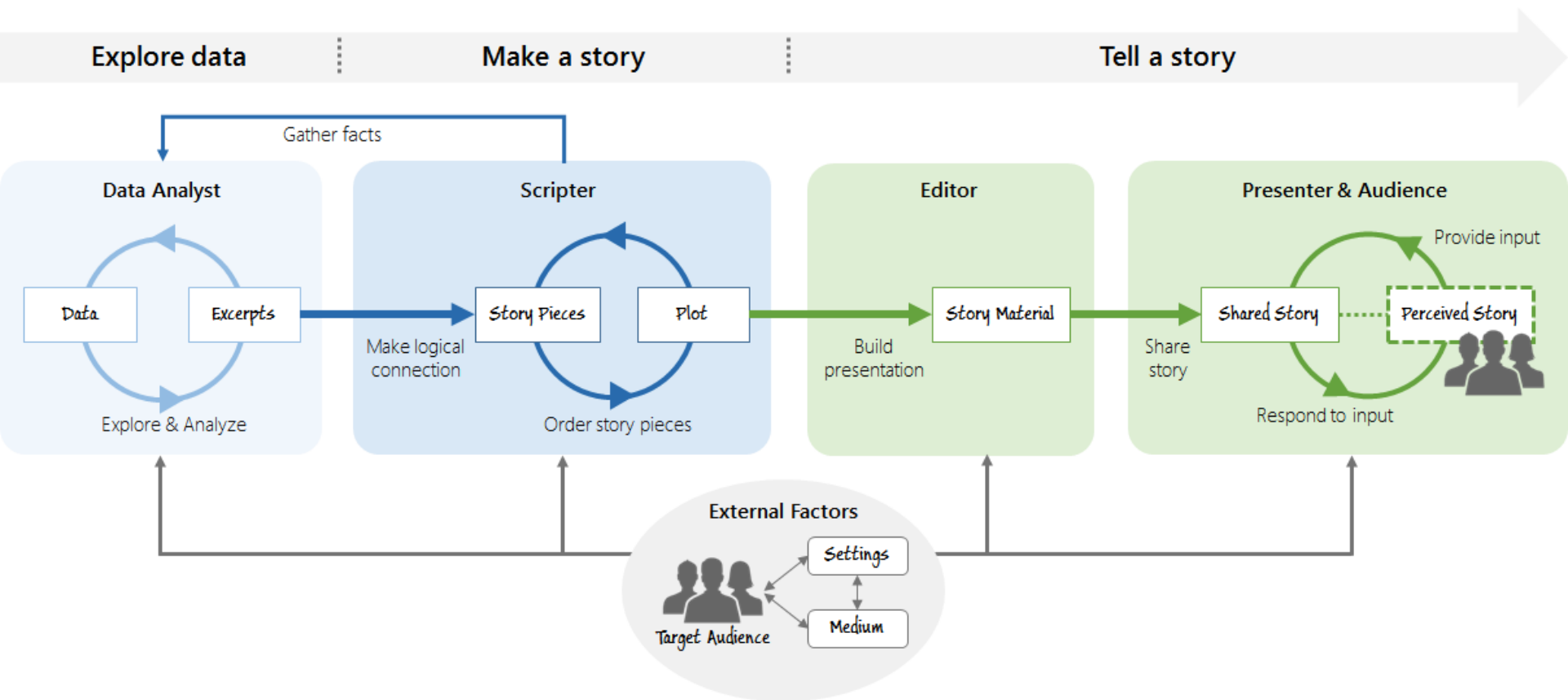
IN A SINGLE SENTENCE

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



Merito 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 KITT 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 KITT EATON

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



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2. [U.S. Says It May Not Need Apple's Help to Unlock iPhone](#)
3. [Amazon Leans on Government in Its Quest to Be a Delivery Powerhouse](#)
4. [CrowdSignals Aims to Create a Marketplace for Smartphone Sensor Data](#)
5. [Bits: Flinging Emojis, Twitch Chatters Revel as Julia Child Cooks](#)
6. [Apple vs. the F.B.I.: How the Case Could Play Out](#)
7. [Breaking Down Apple's iPhone Fight With the U.S. Government](#)
8. [Apple's New iPhones Say: Small Is Beautiful, Too](#)
9. [Judge in Apple Case Seen as Unfazed by Stress, Even a Plane Crash](#)
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U.S.

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

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.

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 15 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

BRAIN SIZE

2.5-16 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

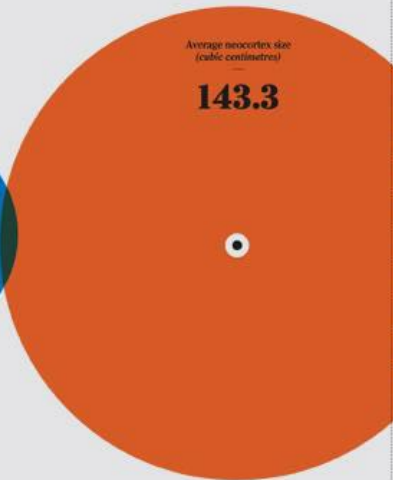
Average group size

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

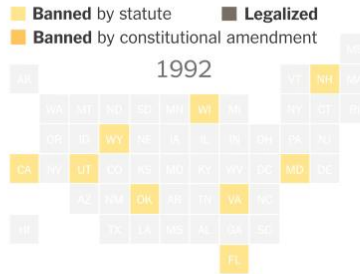


... as a lion fish



... and a flatfish

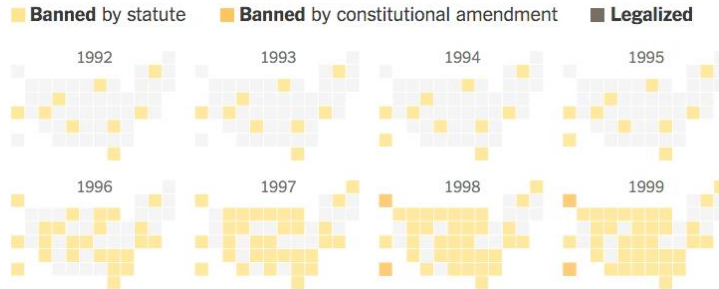




Gay Marriage State by State: From a Few States to the Whole Nation

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

IL | GLOBAL REPORT - NEL DETAGLIO

LA FACCELLA DELLA RAPIDITÀ

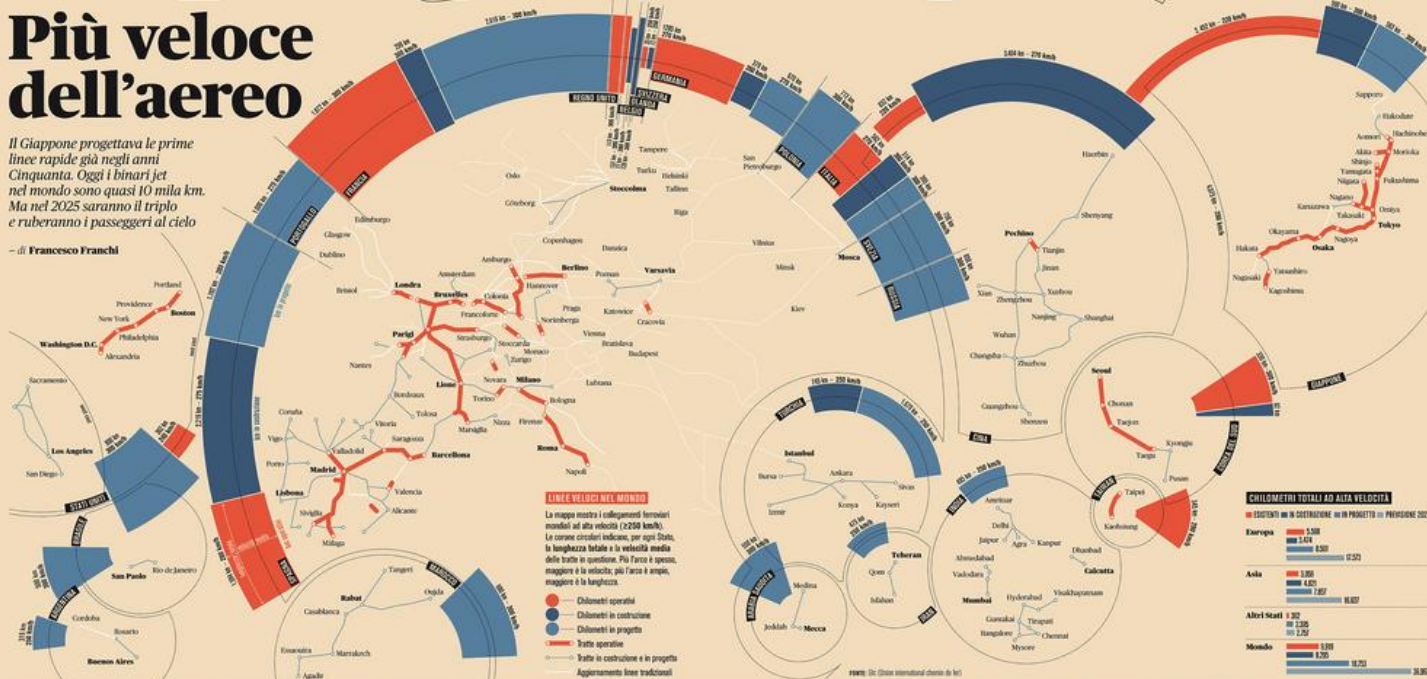
Alcuni esempi di treni ad alta velocità attualmente operativi. Per ciascuno è indicato il Paese, il nome, l'anno di entrata in servizio e la velocità massima.



Più veloce dell'aereo

Il Giappone progettava le prime linee rapide già negli anni Cinquanta. Oggi i binari jet nel mondo sono quasi 10 mila km. Ma nel 2025 saranno il triplo e ruberanno i passeggeri al cielo

di Francesco Franchi



CHILOMETRI TOTALI AD ALTA VELOCITÀ

in STAZIONI ANNI DI SERVIZIO IN PROGETTO IN PRESSIONE 2025

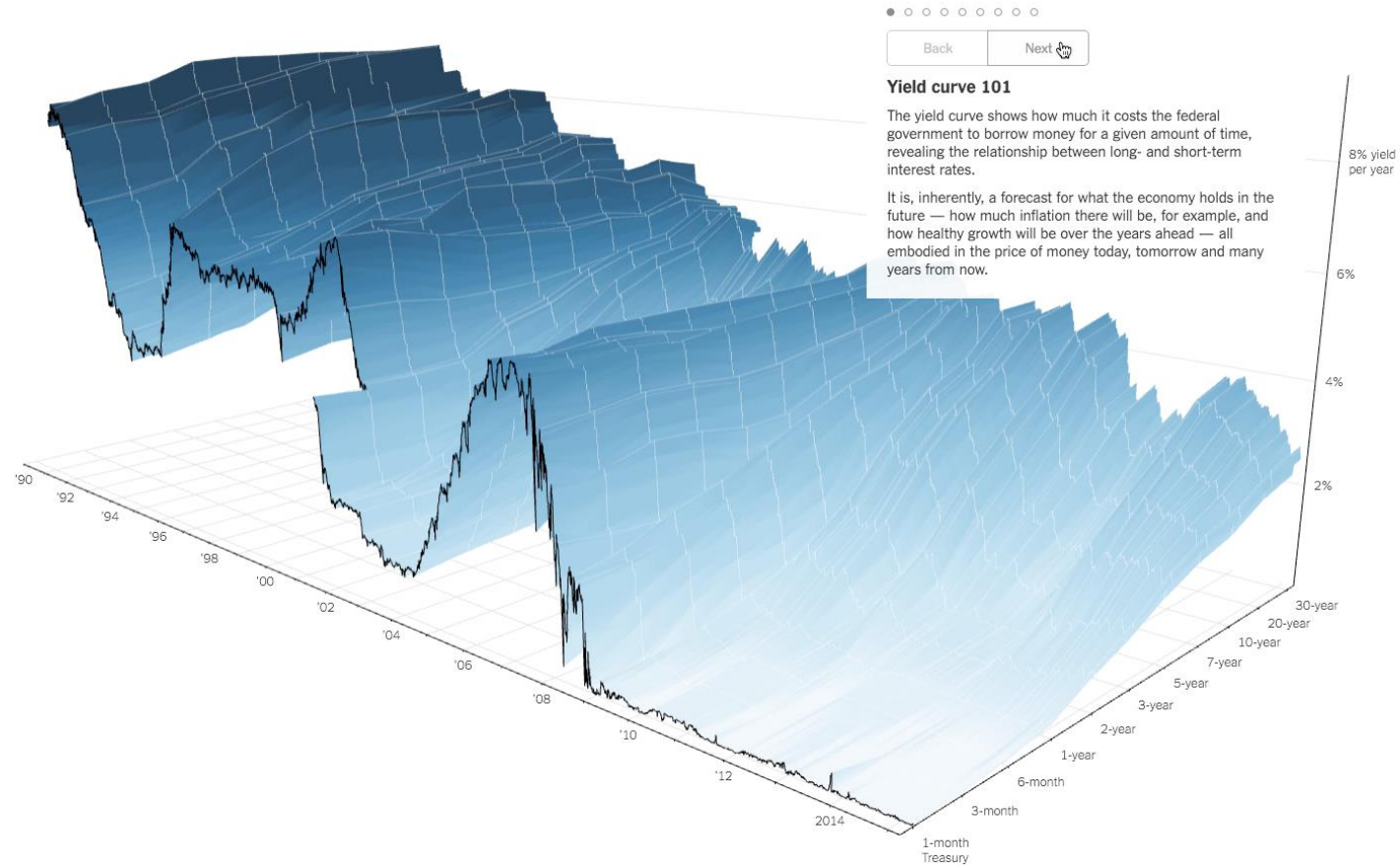
Regione	Operativa	In costruzione	In progetto
Europa	5.500	1.640	1.500
Asia	1.900	4.400	1.000
Altri Stati	200	1.000	1.200
Mondo	8.100	7.040	3.700

1956 Il Giappone progetta una linea veloce (250 km/h) tra Tokyo e Osaka. Viene inaugurata nel 1959
 1970 Iniziano i lavori per la Deltaline tra Roma e Firenze. L'intera tratta è ultimata nel 1992
 1976 La Stet francese lancia il progetto di linea veloce Parigi-Lione. Essa è funzionale nel 1991
 1991 Prima InterCityExpress in Germania: Hannover-Würzburg e Mannheim-Chiaranda
 1992 Diventa operativa la linea tra Madrid e Siviglia; prima tratta dell'alta velocità in Spagna
 1999 In Giappone il treno Maglev (a levitazione magnetica) tocca in un test la velocità record di 502 km/h
 2000 Negli Usa inizia a funzionare il collegamento veloce tra New York, Washington e Boston
 2008 La Cina inaugura la linea Pechino-Tianjin: 120 km in 20 minuti. In Italia apre la TAV Milano-Bologna

38 % il finanziamento degli investimenti cinesi per l'alta velocità nel primo semestre 2008

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

By GREGOR AISCH and AMANDA COX MARCH 18, 2015



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.

Tour Programs

The Flatiron District September 17
New York's first skyscraper and the industrial buildings of the early 20th Century

Lower Manhattan September 24
Explore the concrete canyons that rose up on the site of New Amsterdam

Midtown October 5
The corporate megaliths of the 1970s and 1980s

Sign up now! Space is limited.
\$125 per three-hour tour. Purchase the package of three for \$275

Call the office of Continuing Education at NYU:
212.555.2259 or visit us on the Web at
www.nyu.edu/arch/walk.html
One academic credit
Tours are open to the public

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Tour Programs

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

September 24 **Lower Manhattan**
Explore the concrete canyons that rose up on the site of old New Amsterdam

October 5 **Midtown**
The corporate megaliths of the 1970s and 1980s

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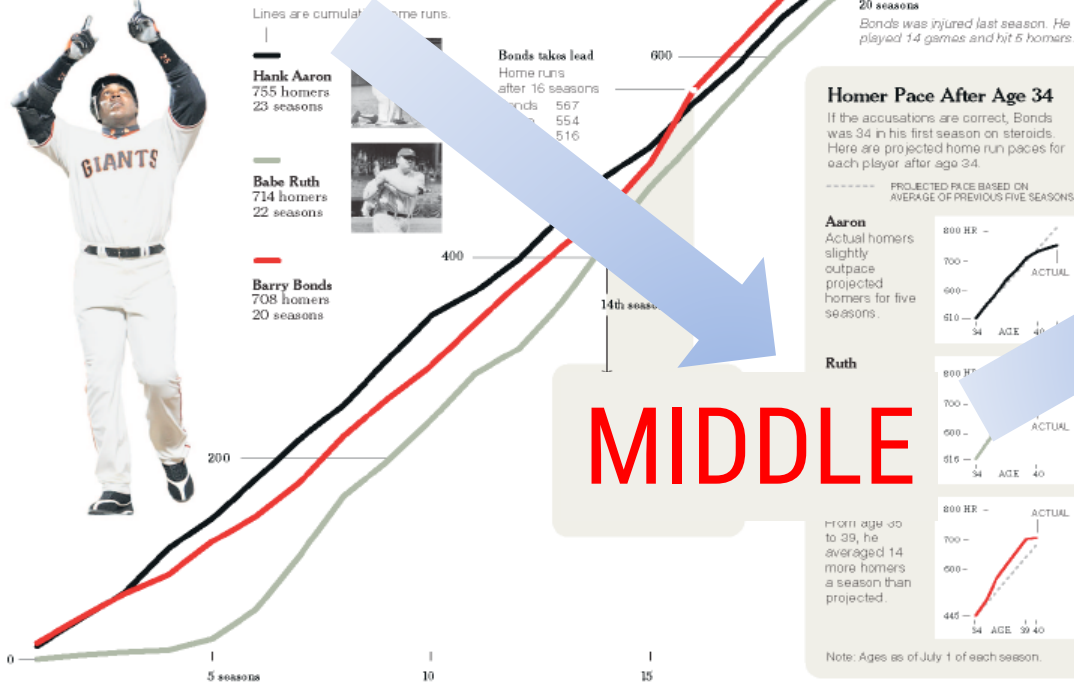
WE TEND TO SCAN TOP TO BOTTOM
THEN LEFT TO RIGHT

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.

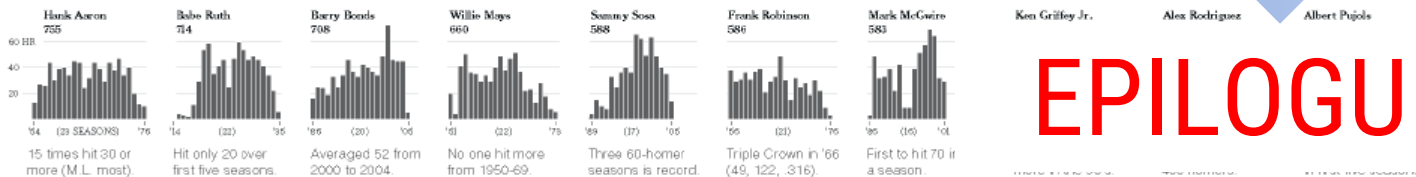
Ken Griffey Jr.

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).

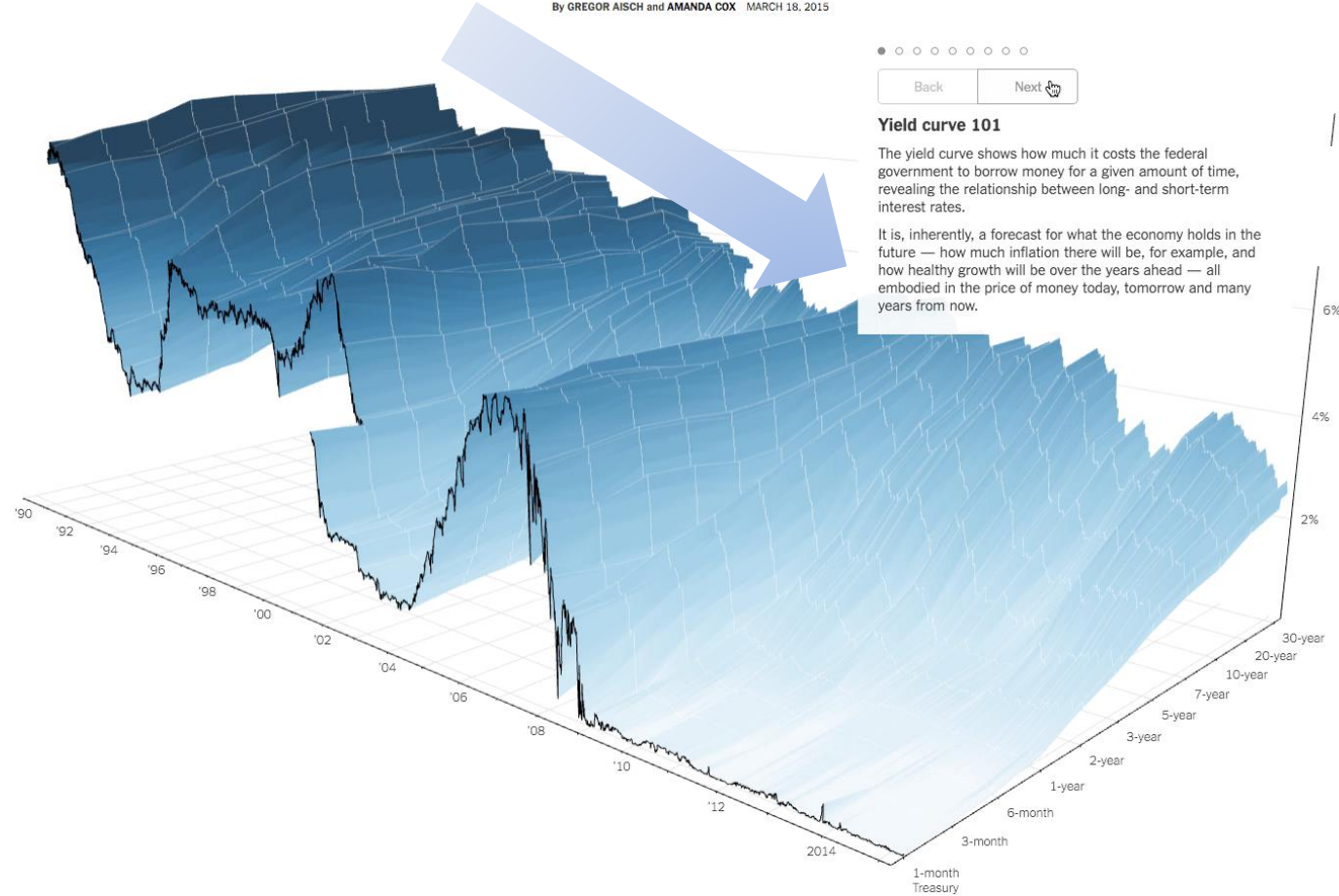


EPILOGUE

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



-
-
-
-
-
-
-
-

[Back](#) [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.

NEXT

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

The classic multi-colored Google logo with a trademark symbol.

[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

The Google logo with the word "Canada" in blue text below it.

Google Search

I'm Feeling Lucky

Google.ca offered in: [Français](#)

TODAY
(CUES CAN BE SUBTLE)

COLOR

(WE'VE SEEN THIS BEFORE.)

Number of data classes: 10



[how to use](#) | [updates](#) | [downloads](#) | [credits](#)

COLORBREWER 2.0

color advice for cartography

Nature of your data:



sequential diverging qualitative

Pick a color scheme:



Only show:



- colorblind safe
- print friendly
- photocopy safe

Context:



- roads
- cities
- borders

Background:



- solid color
- terrain

color transparency

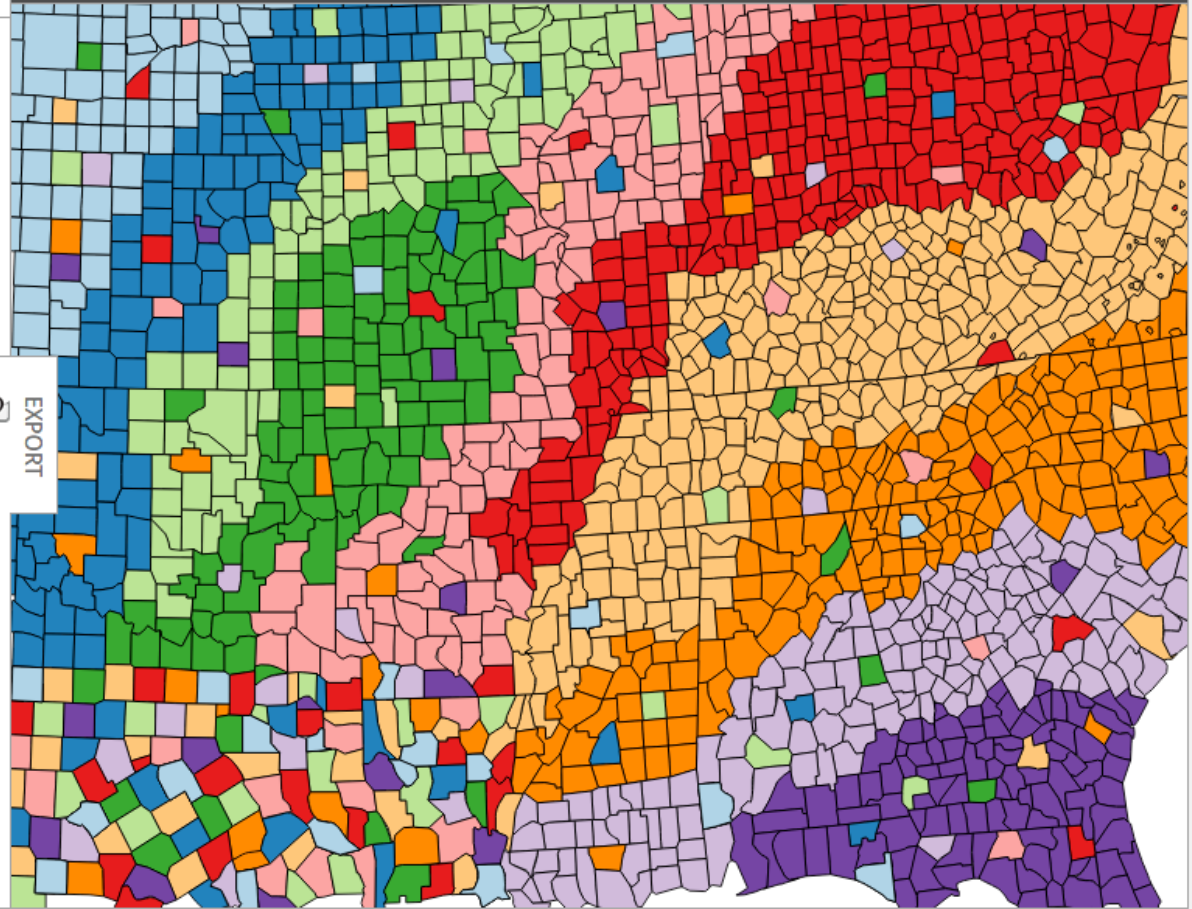
10-class Paired



EXPORT

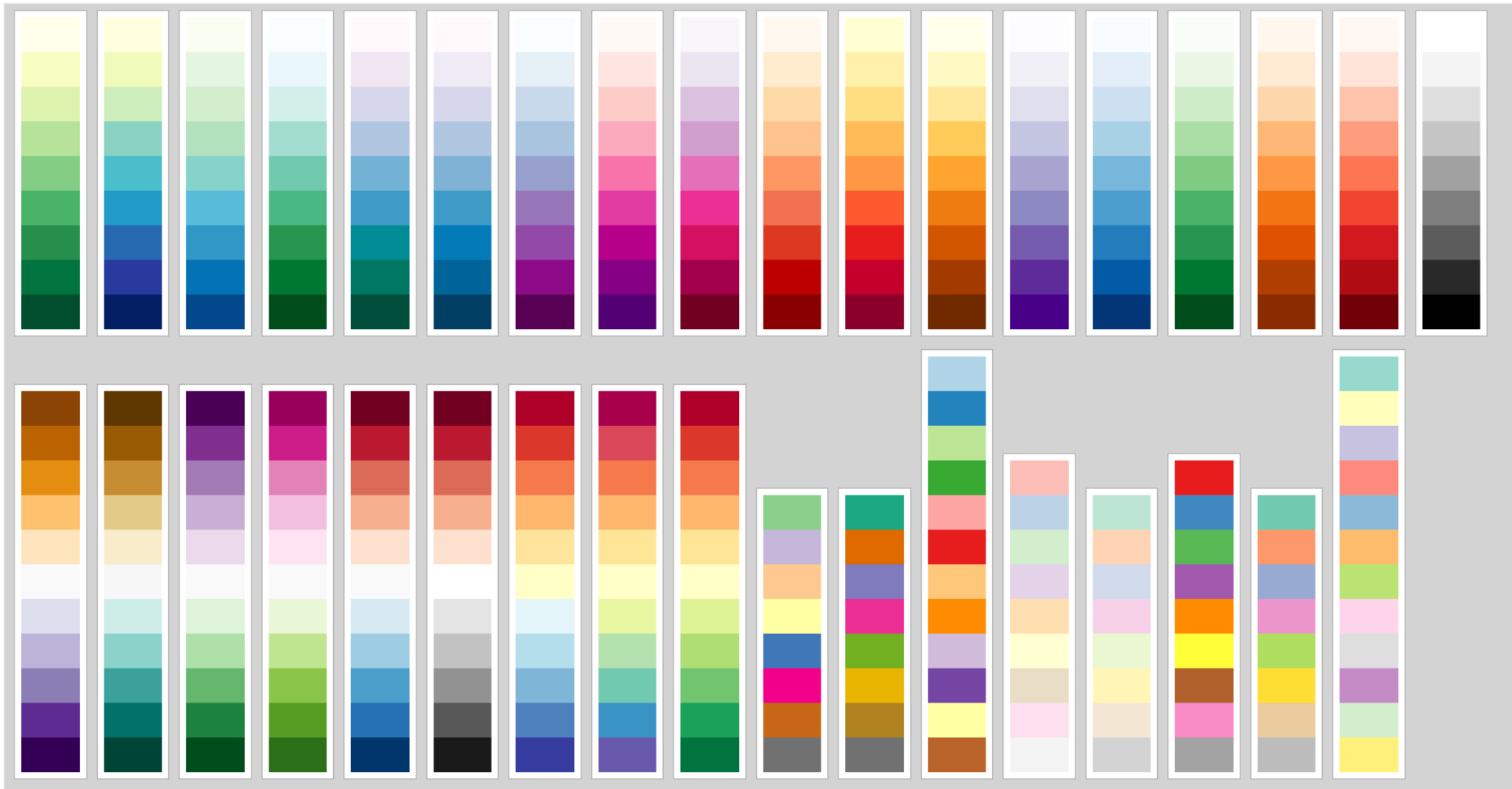
HEX

- #a6cee3
- #1f78b4
- #b2df8a
- #33a02c
- #fb9a99
- #e31a1c
- #fdbf6f
- #ff7f00
- #cab2d6
- #6a3d9a



USE [COLORBREWER!](#)

Every ColorBrewer Scale



SYMBOLS AND ICONOGRAPHY

SEMIOTICS (THE STUDY OF SIGNS)



SIGNIFIED
A THING OR IDEA

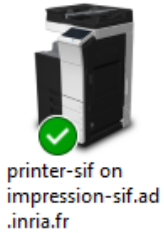


SIGNIFIER
A REPRESENTATION
OF THE THING OR IDEA
(A WORD, PICTURE, SOUND, ETC.)

warmth
heat
danger
etc.

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

TYPES OF SIGNS



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 57", 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

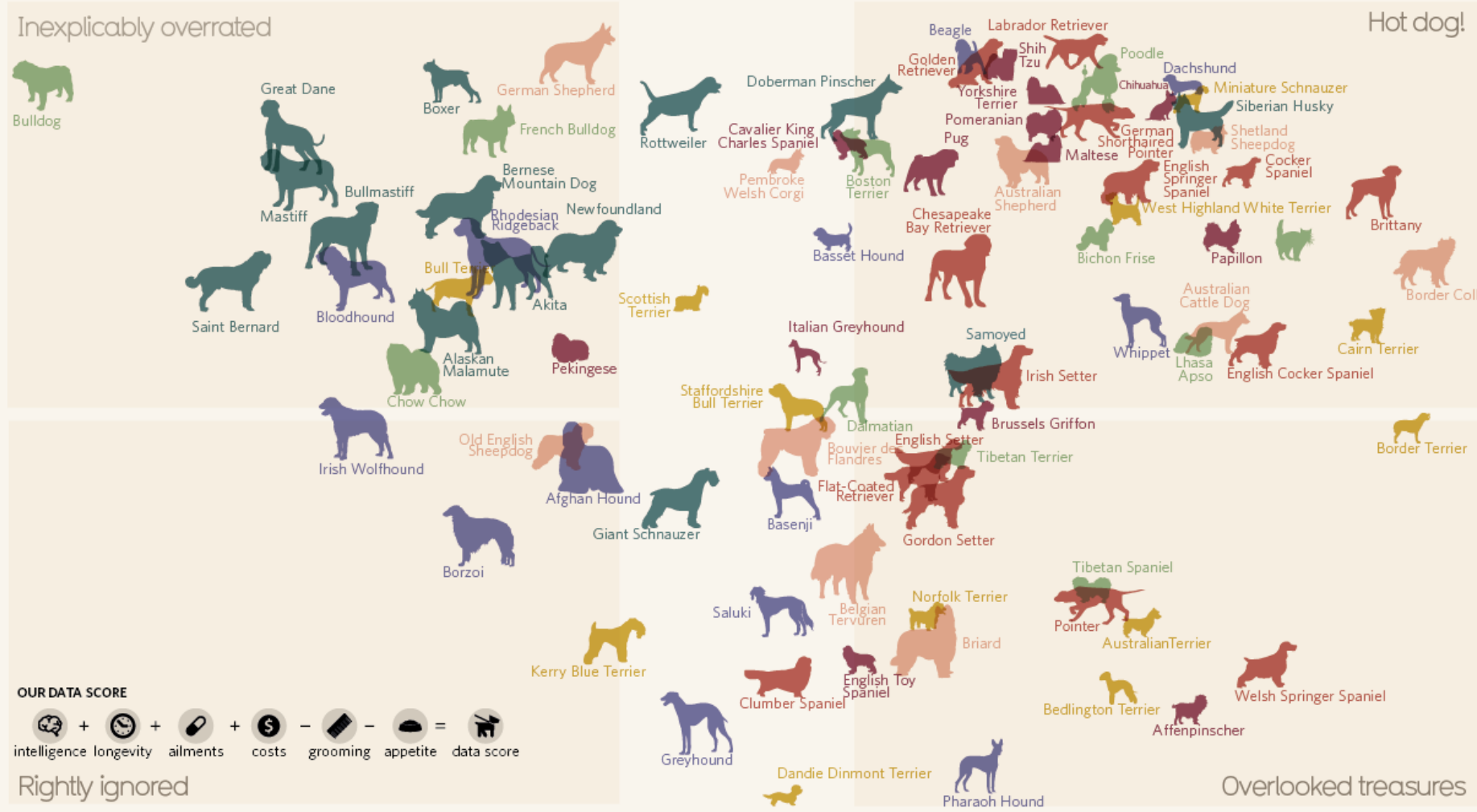
The ultimate data-dog

INTELLIGENCE **SIZE** **TYPE**

dumb clever sml med lrg

Herding Hound Non-sporting Sporting Terrier Toy Working

public popularity



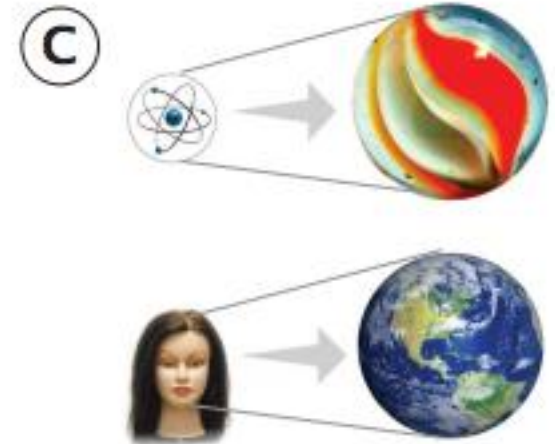
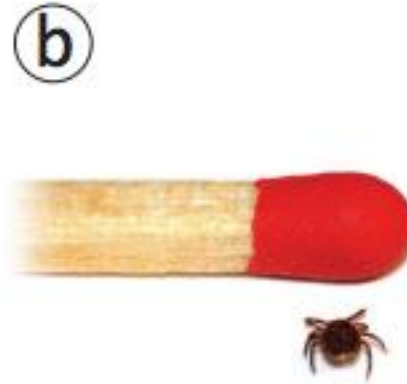
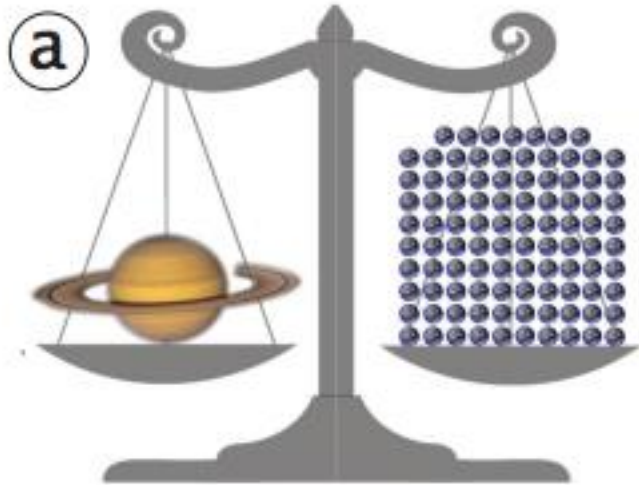
OUR DATA SCORE

+
 +
 +
 -
 -
 =

intelligence longevity ailments costs grooming appetite data score

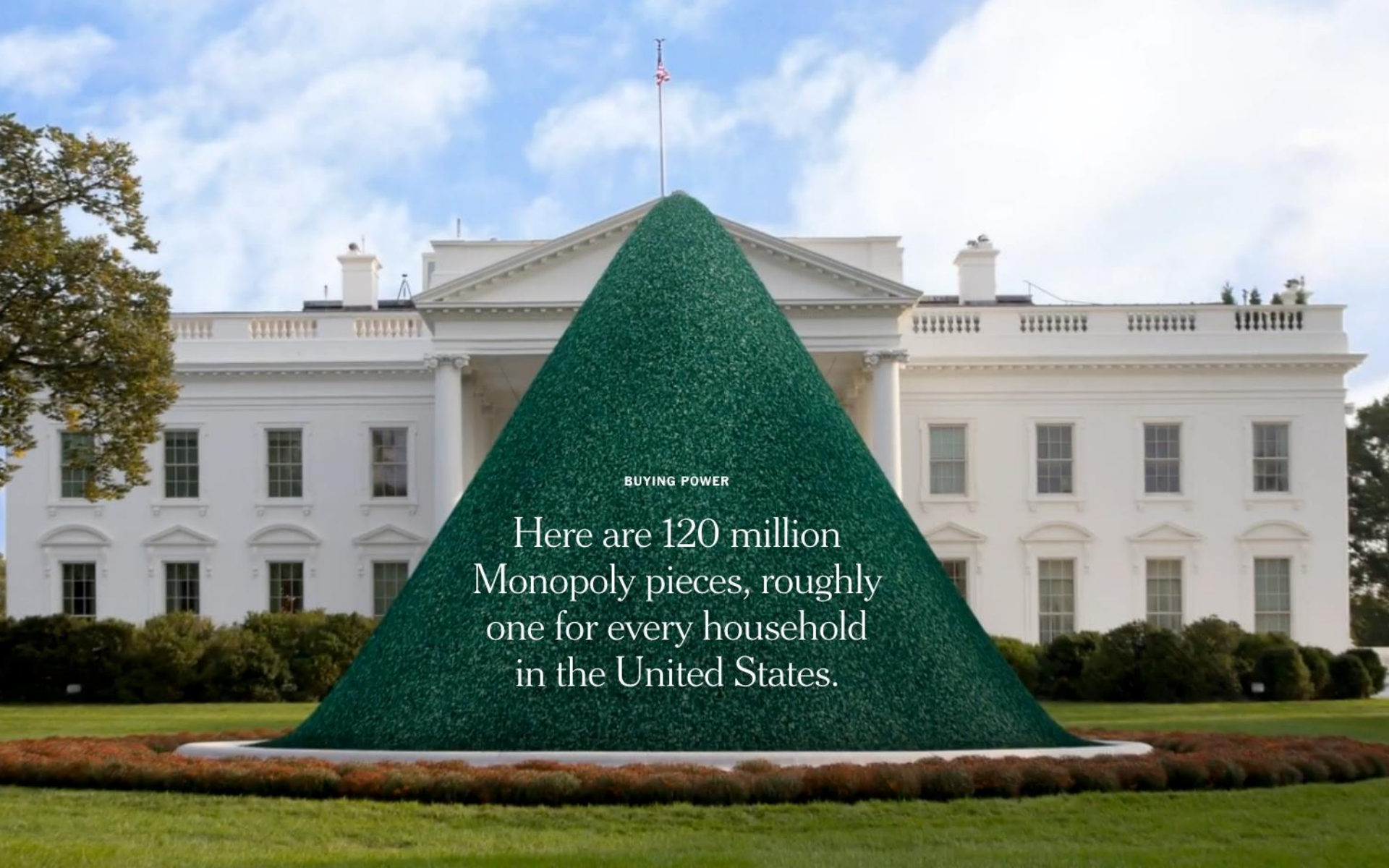
our data score

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.



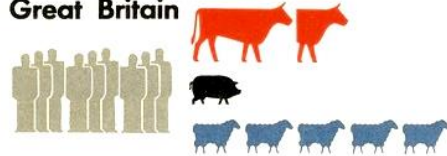
1396 were Palestinian civilians. Of those, 222 were women and 418 were children.



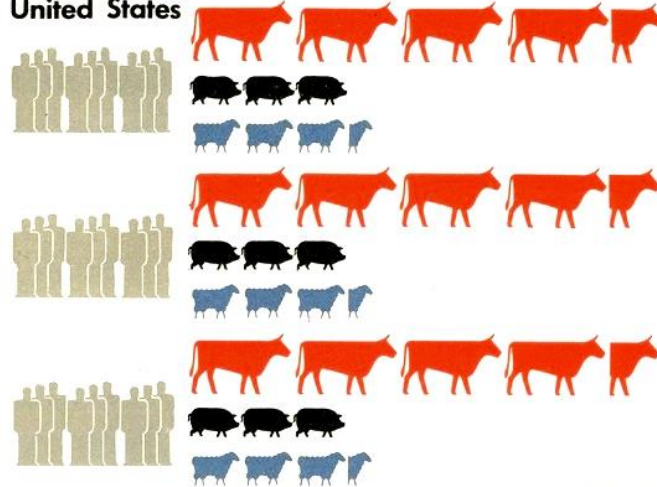
ISOTYPE VISUALIZATION

Population and Live Stock

Great Britain

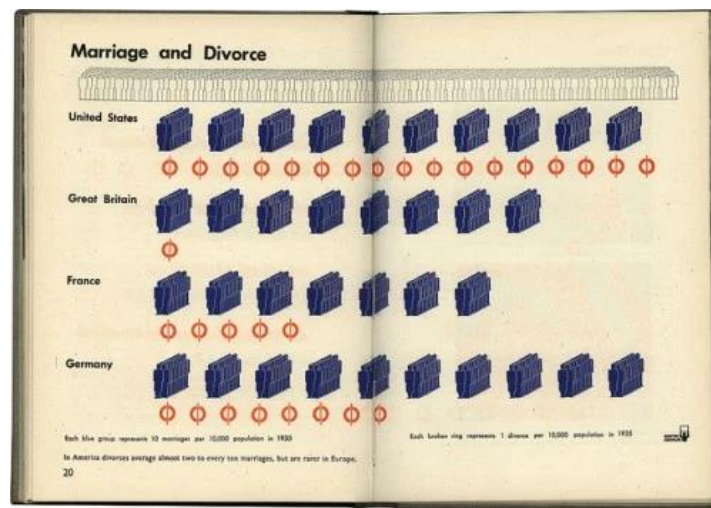
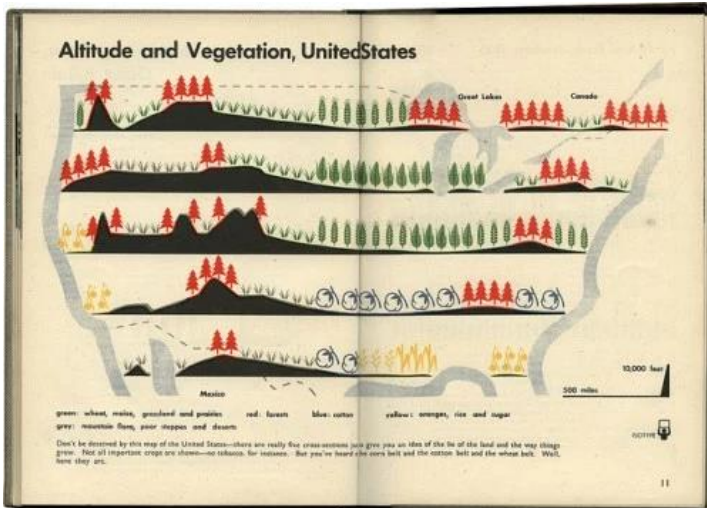
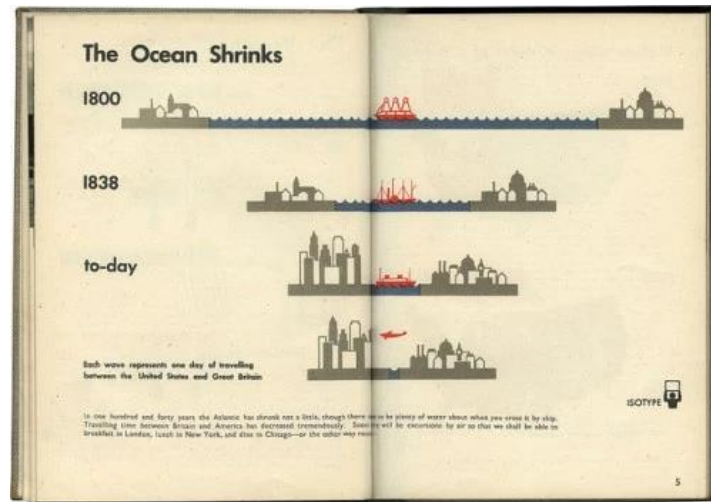
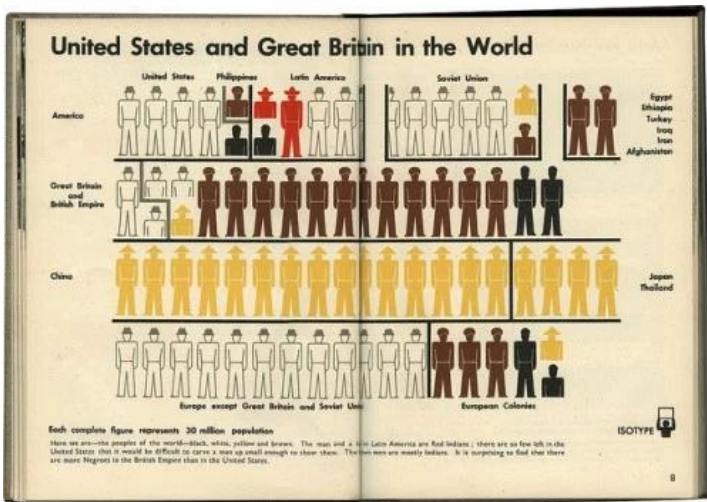


United States



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 [MORE EXAMPLES](#)

STACKED ICONS CAN:

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

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Robert Kosara
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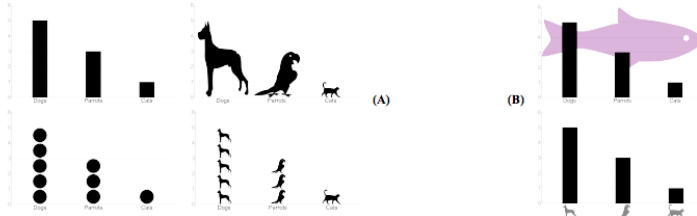


Fig. 1. Pictographic charts have been used for decades. (A) Which chart above most effectively conveys information? Which data is easiest to remember during a demanding task? Which is most engaging? (B) How integrated must a pictograph be to benefit the user? Do purely decorative background images offer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

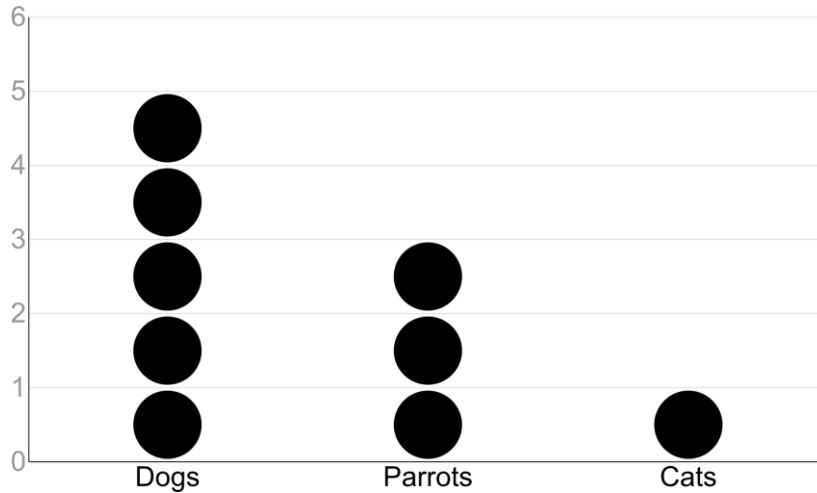
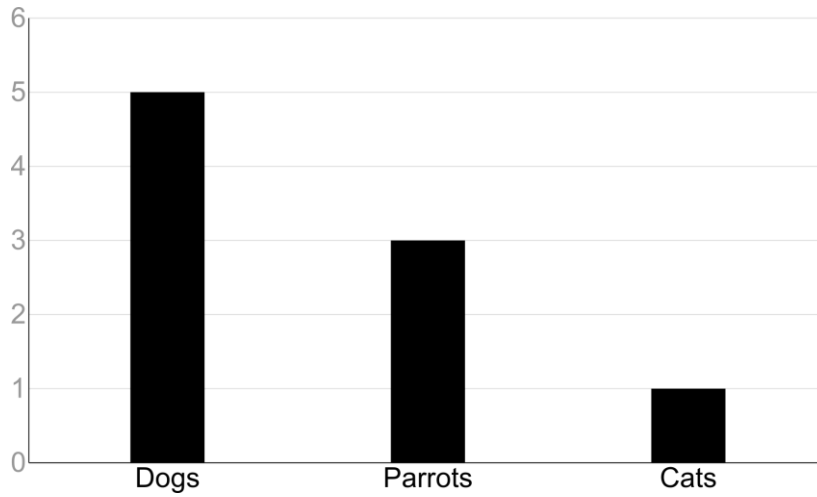
The goal was a universally understandable system for communicating quantities of commercial, social, or economic information (e.g., automobile production or number of children born per year). Symbols, each representing a fixed quantity, were stacked to provide an intuitive representation of a total amount (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-

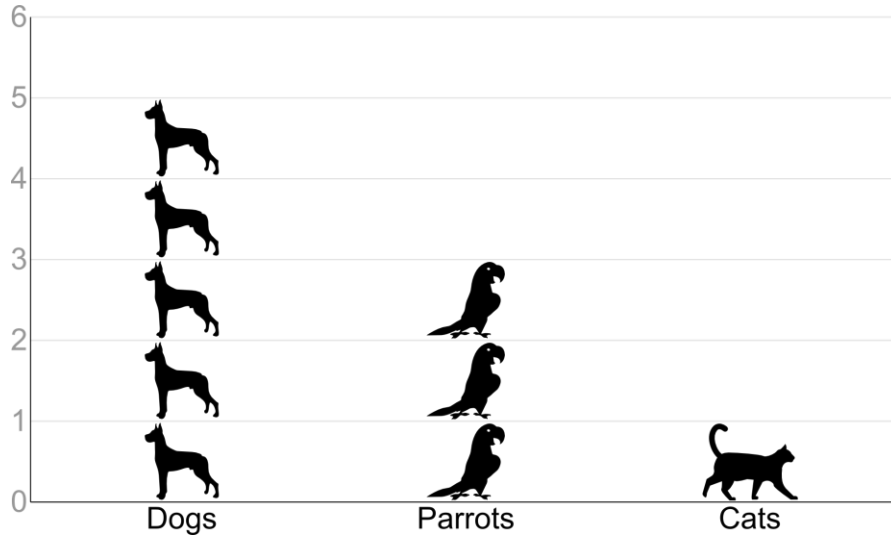
Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for components of this work owned by others than ACM must be honored. Abstracting with credit is permitted. To copy otherwise, or republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee. Request permissions from Permissions@acm.org.
CHI 2015, April 18 – 23 2015, Seoul, Republic of Korea.
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ACM 978-1-4503-3145-6/15/04...\$12.00
<http://dx.doi.org/10.1145/2702123.2702275>

STACKED ICONS CAN:
ENCODE DATA AS BOTH
LENGTH AND QUANTITY



STACKED ICONS CAN:
ENCODE DATA AS BOTH
LENGTH AND QUANTITY

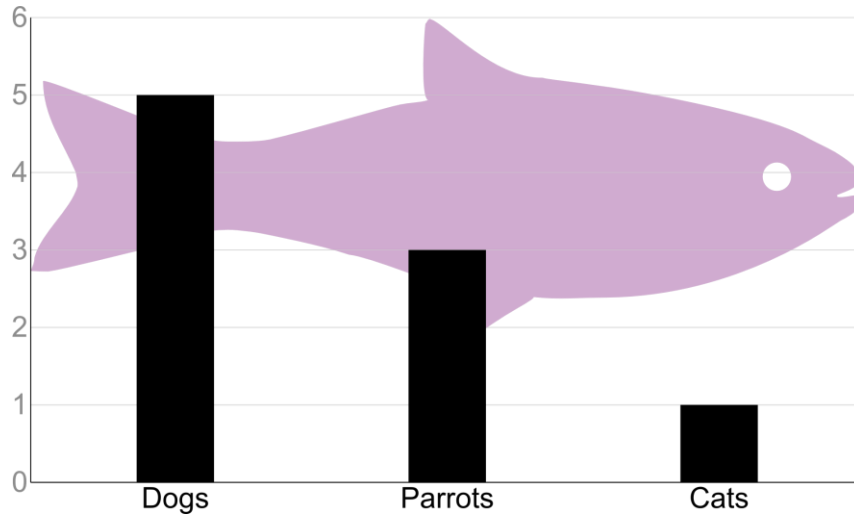
(WHERE THIS WORKS)
ICONS CAN SUPPORT
MEMORY & ENGAGEMENT



STACKED ICONS CAN:
ENCODE DATA AS BOTH
LENGTH AND QUANTITY

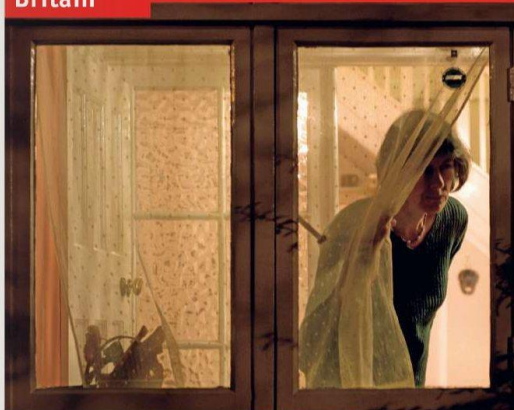
(WHERE THIS WORKS)
ICONS SUPPORT MEMORY
& ENGAGEMENT

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 found 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-

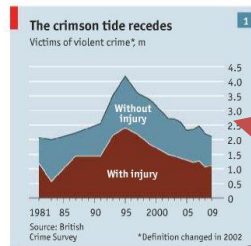
Also in this section

64 **Bagehot: Electoral reform**

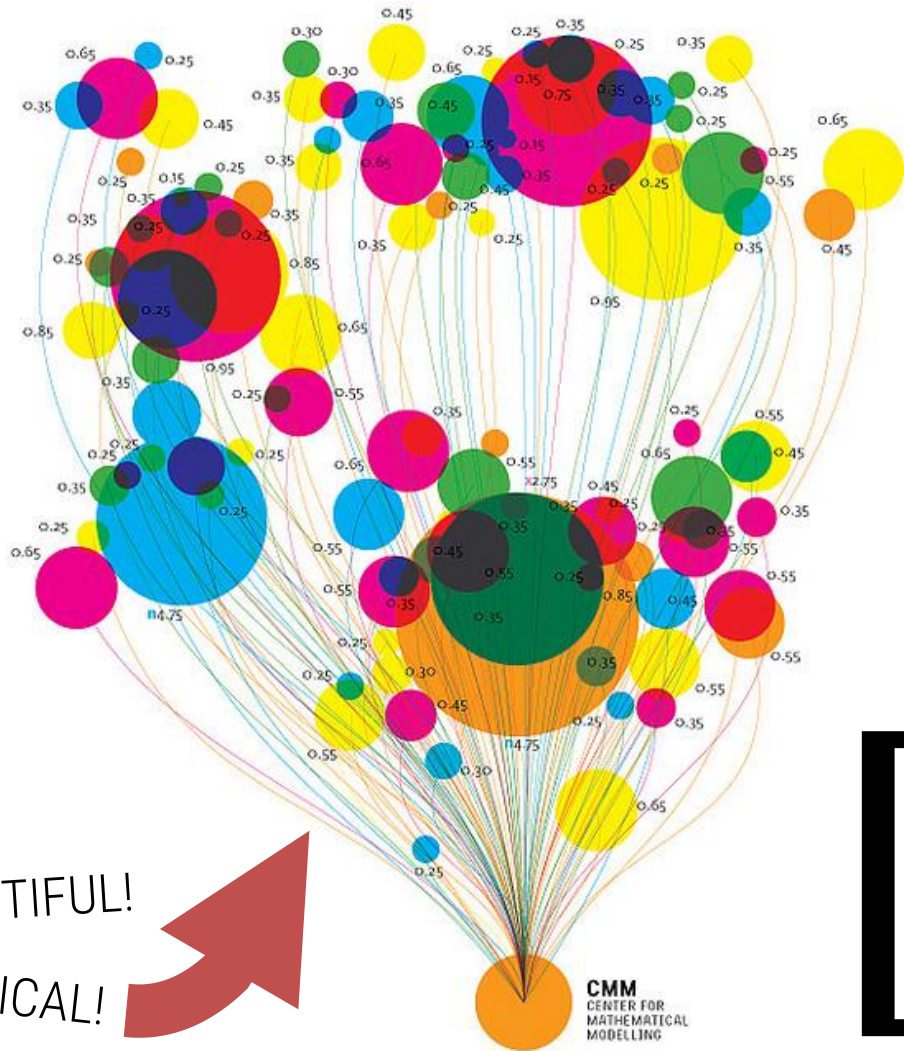
More articles about Britain are available to subscribers at economist.com/britain

ries about the economy have eclipsed all else.) The heightened fears are a puzzle to criminologists, who point out that over the past 15 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).

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?



EXCITING!
BEAUTIFUL!
TECHNICAL!



[BUT]
WHAT DOES
IT MEAN?

Published: February 2, 2010

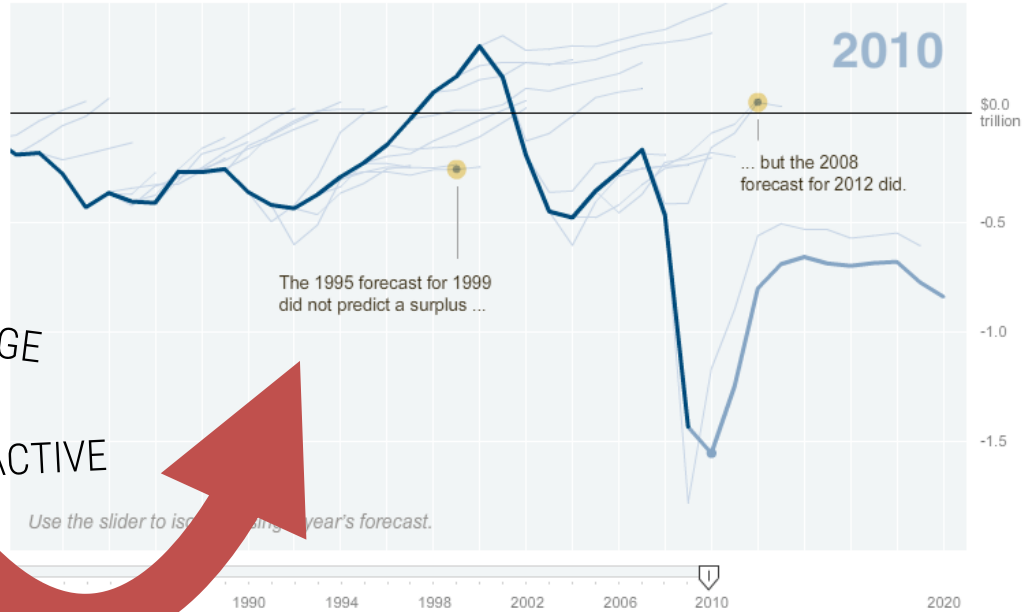
Budget Forecasts, Compared With Reality

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

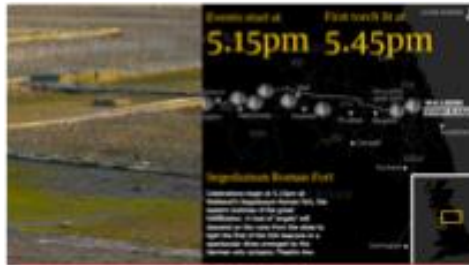
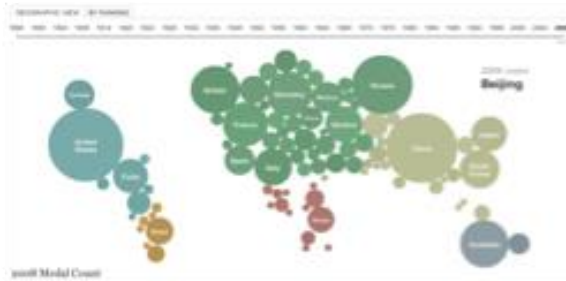
Today, with a better understanding of the severity of the economic downturn, the deficit situation is much more dire.



CENTER STAGE
STANDALONE
INTERACTIVE
GUIDED



Use the slider to isolate any year's forecast.



58

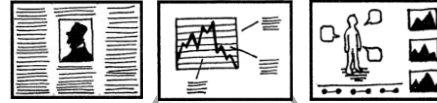
CASE STUDIES

70% JOURNALISM
 20% BUSINESS
 10% RESEARCH

EDWARD SEGEL &
 JEFFREY HEER 2010



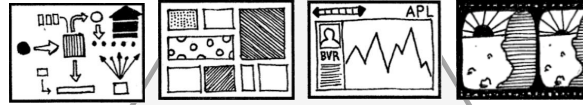
VISUAL DESIGN



MAGAZINE
STYLE

ANNOTATED
CHART

SCIENCE FAIR
POSTER

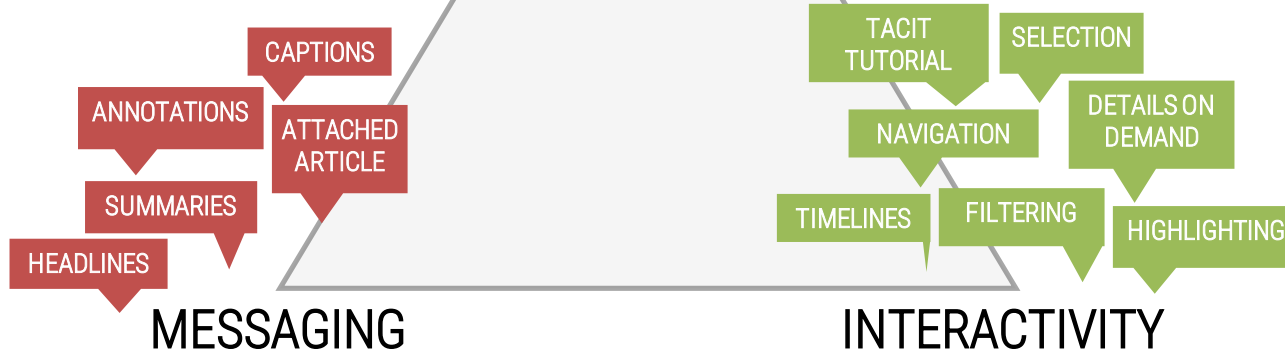


FLOWCHART

COMICSTRIP

SLIDESHOW

MOVIE



VISUAL DESIGN
show

MESSAGING
tell

INTERACTIVITY
engage

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.

1 2 3 4 5 6 7 8 **NEXT**



Eric Heiden, the American speedskater who captured five golds in 1980 and is now the doctor for the 2010 U.S. team, explains how Shani Davis uses turns to his advantage.

On Davis's mechanics:
"After you push out to the side, you want to make sure you don't use a lot of effort and energy to bring that foot back underneath you.
"The higher you raise it up off the ice, the more energy you have to expend. So you want to make sure that foot stays close to the ice without really scraping the ice, cause scraping the ice will also slow you down."

By Graham Roberts, Beate Sagel and Michael W. Schmidt | 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.

1 2 3 4 5 6 7 8 **NEXT**



Eric Heiden, the American speedskater who captured five golds in 1980 and is now the doctor for the 2010 U.S. team, explains how Shani Davis uses turns to his advantage.

On how Davis's body is built for skating:
"He's got very long legs -- his femurs are especially long -- so his morphology really fits into the sport of skating.
"He stays very low to the ice, which means that his frontal resistance -- is very low. And so the wind resistance that he has to overcome is minimized."

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.

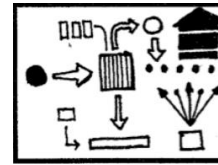
1 2 3 4 5 6 7 8 **NEXT**



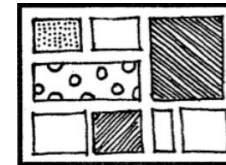
Eric Heiden, the American speedskater who captured five golds in 1980 and is now the doctor for the 2010 U.S. team, explains how Shani Davis uses turns to his advantage.

On building speed into the straightaway:
"If you watch Shani when he first enters the turn, his first few strokes the tempo is a little bit slower than when he leaves the turn.
"And by the end of the turn his tempo has increased so that he can maximize the ability to gain speed out of the turns... As you watch as he enters the straightaway very often -- he continues with his turn strokes long into the straightaway."

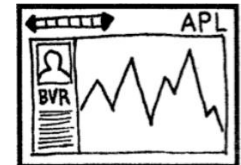
THE MORE LINEAR, THE MORE LIKE A TRADITIONAL STORY. WITH A BEGINNING, MIDDLE, AND END.



FLOWCHART

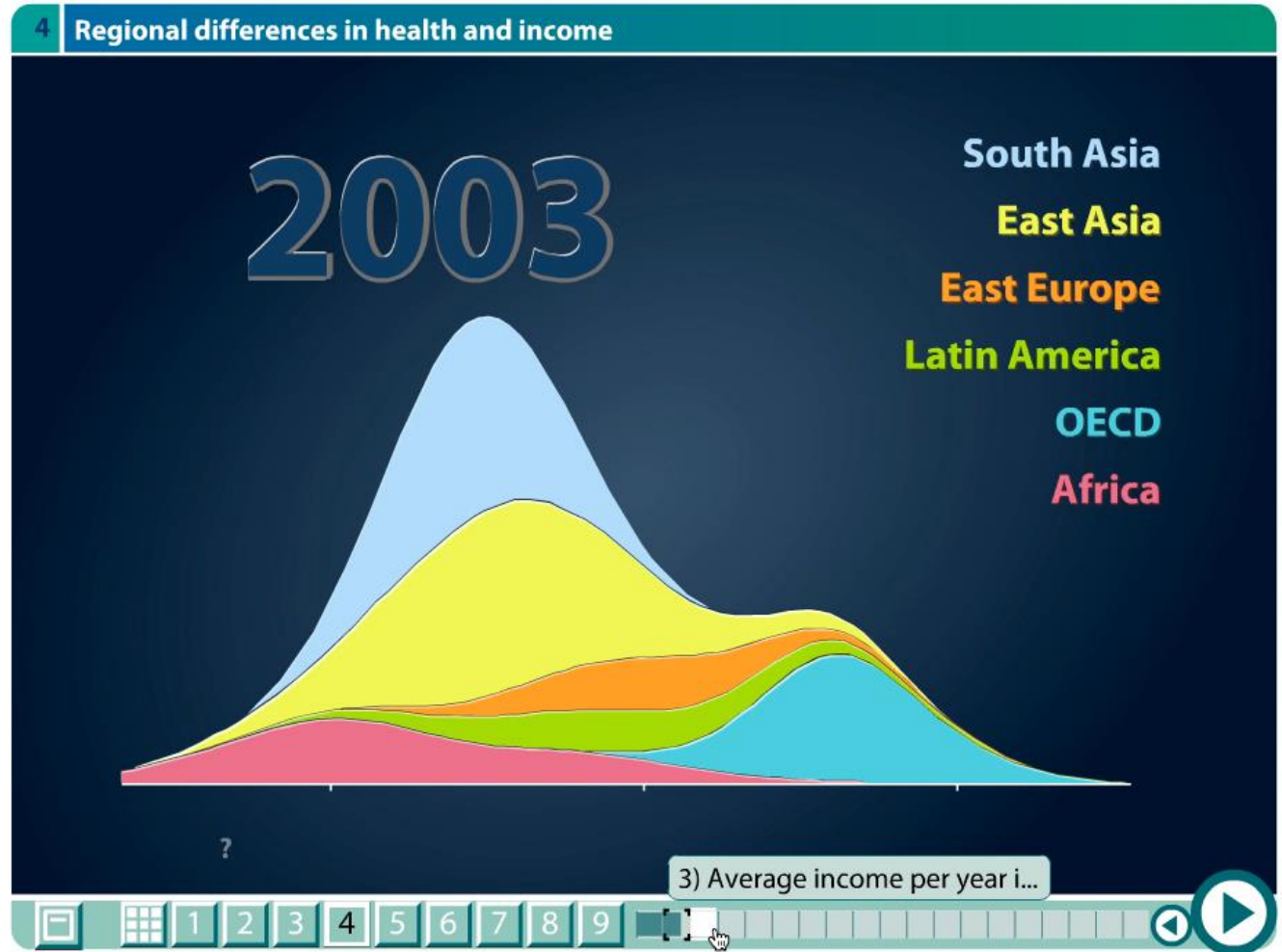


COMICSTRIP



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)

1836 Imperial powers in Europe in the middle of the 19th century.

1837 Britain signs a contract, supporting Belgium in case of violation of its neutrality.

1873 German chancellor Bismarck manages ally Germany, Austria and Russia in the **Three Emperors' Alliance**, ...

... leaving France isolated against a well integrated Germany.

1873 **1879**

However, increasing border disputes lead to the cancellation of that alliance, a few years later.

1879 **Dual Alliance**

1882 **Triple Alliance**

France needs to escape isolation.

1894 **Franco-Russian Alliance**

1904 **Entente Cordiale**

1907 **Triple Entente**

In 1907 the most important European powers are divided into major alliances. On the Balkan, Serbia, Austria Greece and the Ottoman empire gamble for influence.

1907

Triple Entente

Triple Alliance

On June 28th, Archduke Franz Ferdinand of Austria is assassinated in Serbia while visiting Sarajevo. Austria accuses Serbian officials of being involved in the incident, aiming to annex Serbia. Russia wants Serbia to remain independent from Austria. During July 1914, european powers try to find a diplomatic solution, called the "July Crisis". However, ...

1914

July 23th ... Austria imposes ultimatum on Serbia.

July 28th Rejection of the ultimatum leads to first open war.

Aug., 1st German mobilization is very fast...

Aug., 3rd ... and wants to attack first.

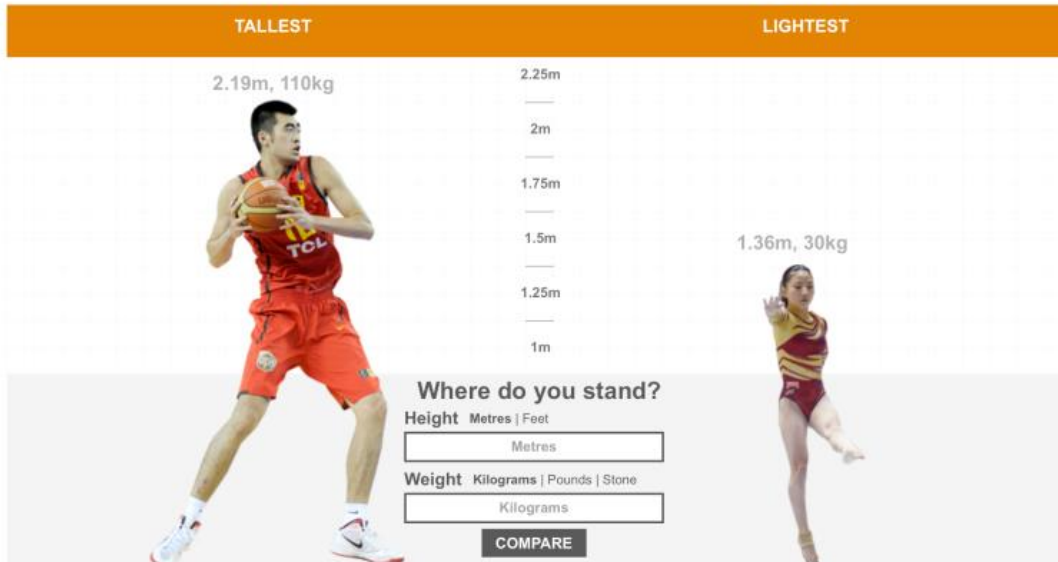
Aug., 4th When attacking Belgium, Britain declares war on Germany due to its contract with Belgium from 1837

Aug., 6th 1 month after the assassination of the Austrian prince, most european powers are at war. Italy leaves the Triple Alliance.

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?



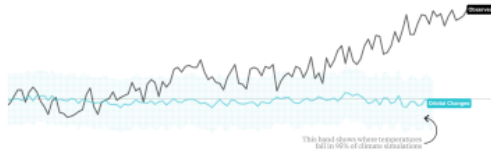
HELPS ANCHOR
VIEWER IN THE PIECE.
MAKES DATA MORE
PERSONALLY
RELEVANT.

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

Again, and again...

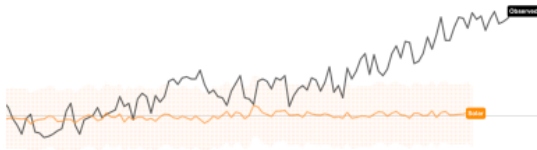
Is It the Earth's Orbit?

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.



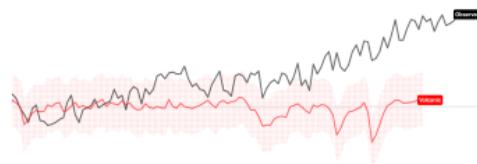
Is It the Sun?

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



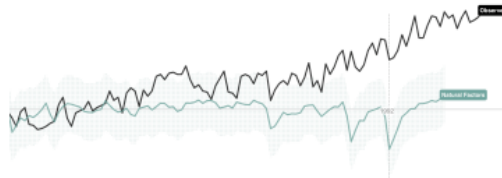
Is It Volcanoes?

The data suggest no. Human industry emits about 100 times more CO₂ 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.

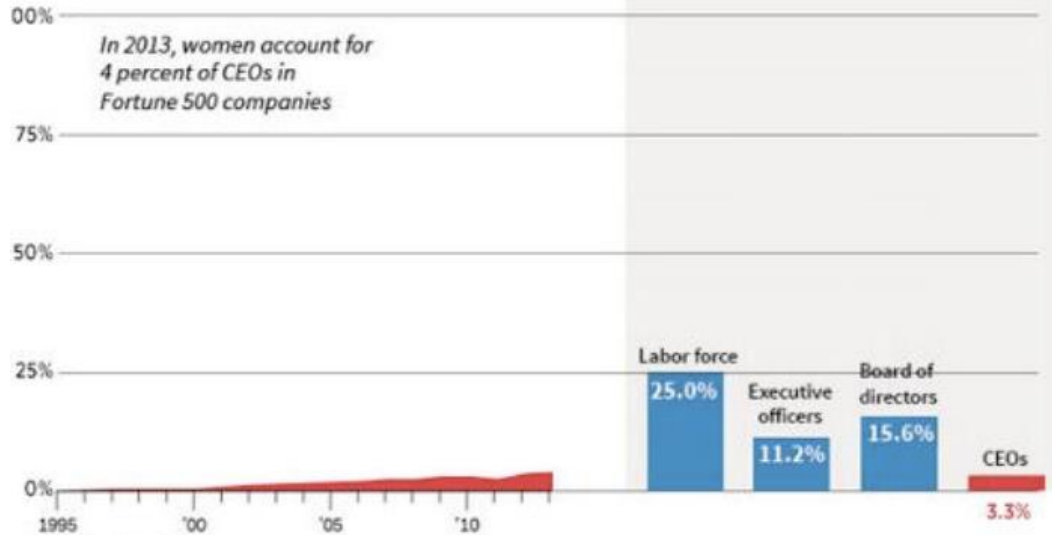
2016 LYN BARTRAM, BENJAMIN BACH, JEREMY
BOY, PAULO CIUCCARELLI, STEVEN DRUCKER,
YURI ENGELHARDT, ULRIKE KOEPPEN, MORITZ
STEFANER, BARBARA TVERSKY, & JO WOOD.

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



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.



VISUAL DESIGN
show

MESSAGING
tell

INTERACTIVITY
engage

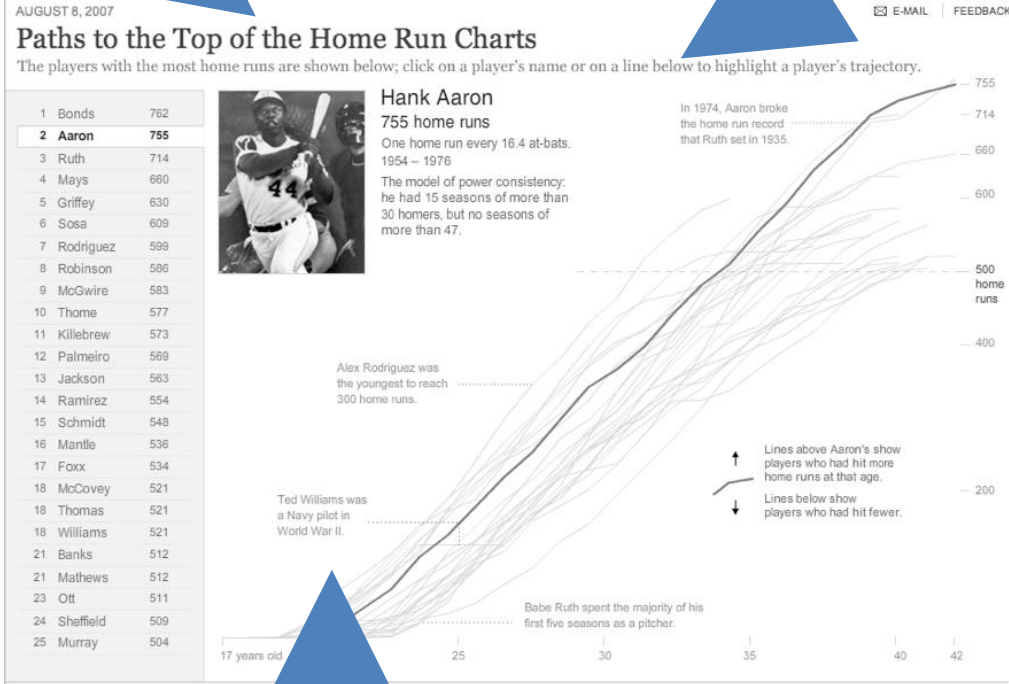
HEADLINE



CAPTION



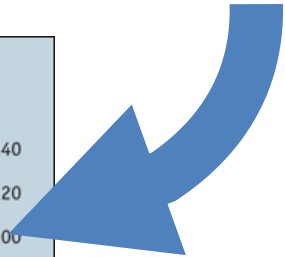
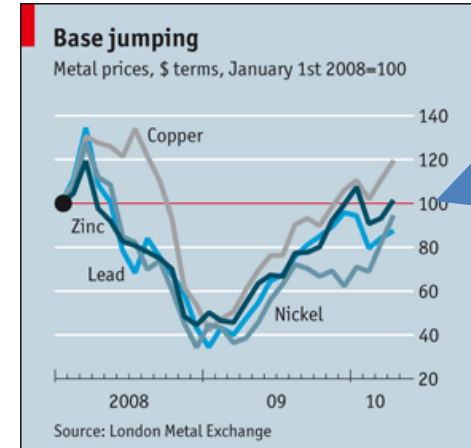
USE HEADLINES, CAPTIONS, & ANNOTATIONS QUICKLY DRAW ATTENTION TO WHAT'S IMPORTANT.



ANNOTATION

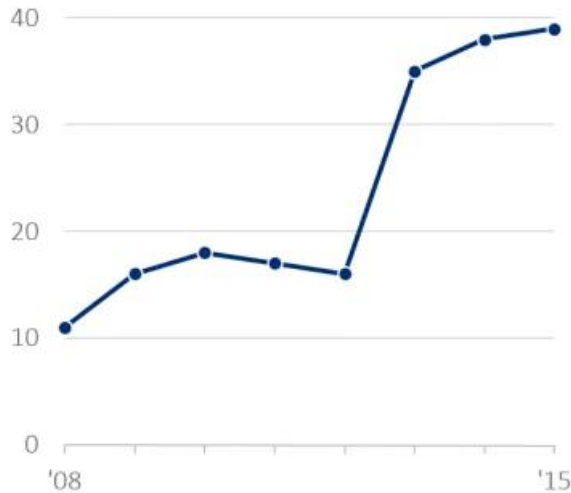


MARK FOR EMPHASIS



DESCRIPTIVE TITLES AND ANNOTATIONS CAN BE THE DIFFERENCE BETWEEN A CHART AND A STORY

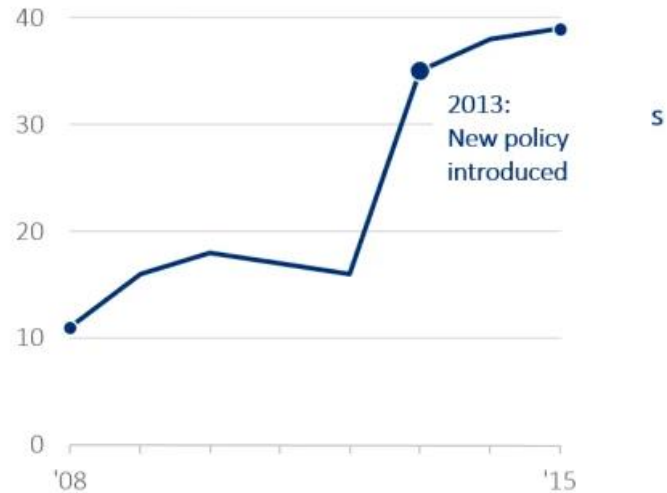
Number of studies funded each year



or

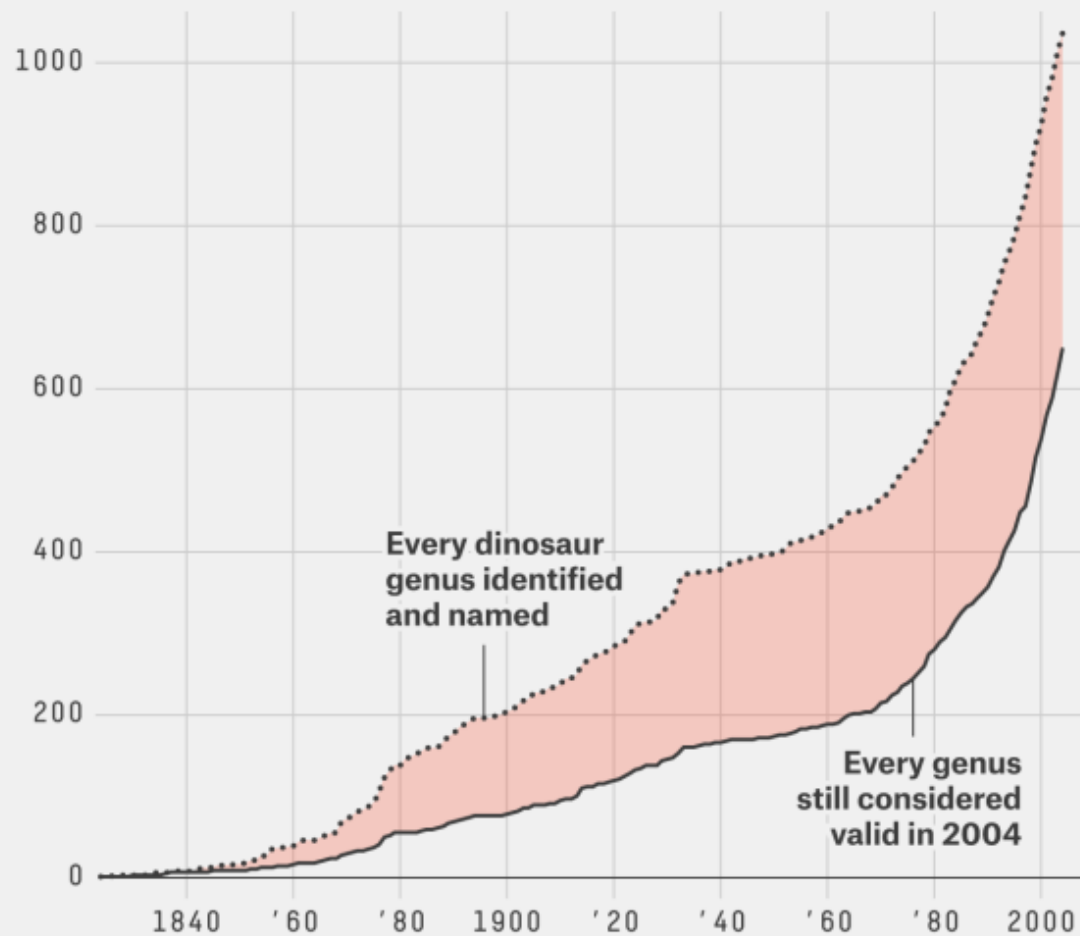
We're funding more studies each year

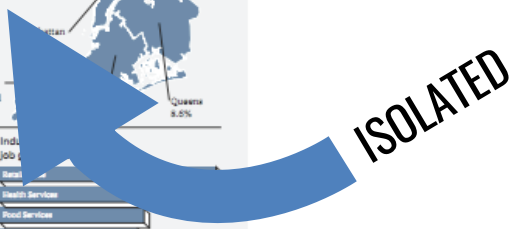
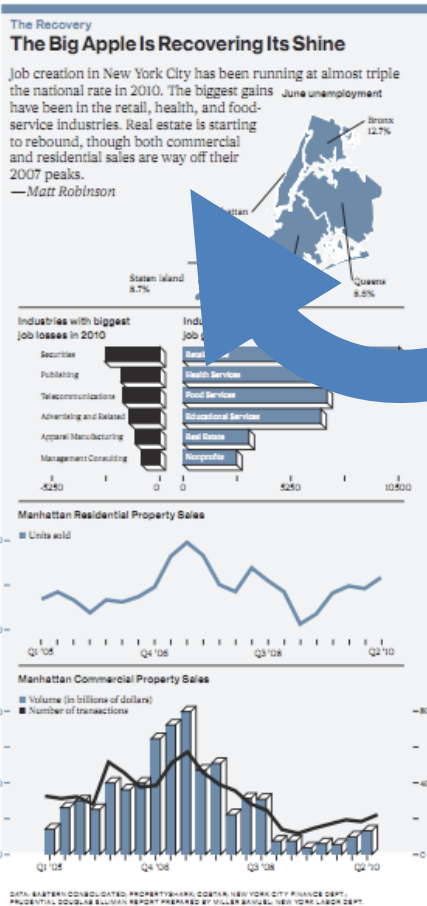
Beginning in 2013, we set aside new funding to measure the effectiveness of our initiatives – and we evaluated 39 of our programs in 2015 alone.



Dinosaurs named, then unnamed

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





ISOLATED

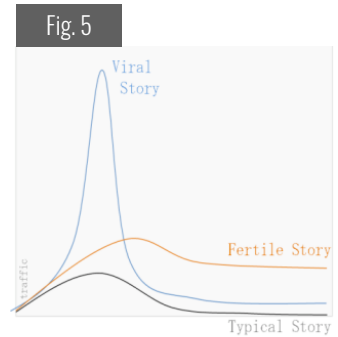
WEAVE TEXT INTO THE GRAPHIC,
 NOT JUST AT THE BEGINNING.

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
 that are either *persistent* or *viral* in order
 ing traffic. **Persistent stories** cover
 3" that maintain relevance over time
 economics, 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
 re visualizations for editorial content



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





















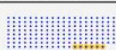






The Endorsement Primary

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.

Mille Cymru

9. Beetroot soup and a chocolate milkshake at Pete's Eats in Llanberis. Hummers 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 Y 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.

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.

Lake Vyrnwy

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-lycra civvies. A sense of foreboding and onion soup pervades the village hall.

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 Penrhyndaudraeth. A slight tail wind helps speed me on my way.

11. Get the beginnings of the bonk, so munch through two Snickers flapjacks (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 audaxes over the years.

Dolgellau

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

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

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.

16. MattH catches me on the descent. We end up riding the rest of the MC together. Your company is much appreciated.



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 \(135\)](#)

100 titles that were frequently rented from Netflix in 2009

Change how movies are sorted

[Previous](#)
[Next](#)
[Most rented](#)
[Least rented](#)
[Most rented](#)
[Alphabetical](#)
[By metascore](#)

Mad Men: Season 1: Disc 1

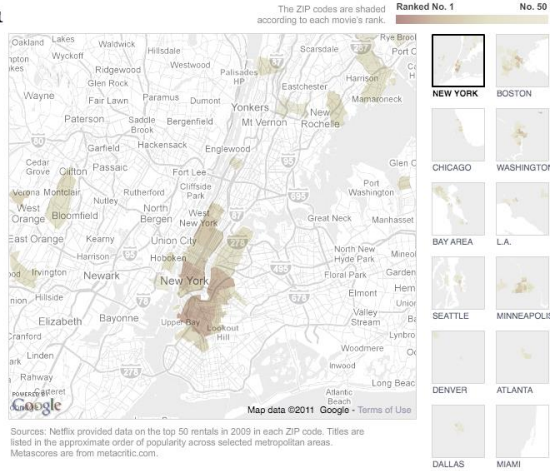


77 Metascore

100-loved by critics, 0-hated

There were seven deadly sins practiced at the dawn of the 1960s: smoking, drinking, adultery, sexism, homophobia, anti-Semitism and racism. The magic of *Mad Men* is that it softly spoofs those cruel, antiquated mores without draining away the romance of that era: the amber-lit bars and indigo nightclubs, soaring skyscrapers, and the brash confidence that comes with winning a war and owning the world.

[Read Rest of NYT Review >](#)



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.

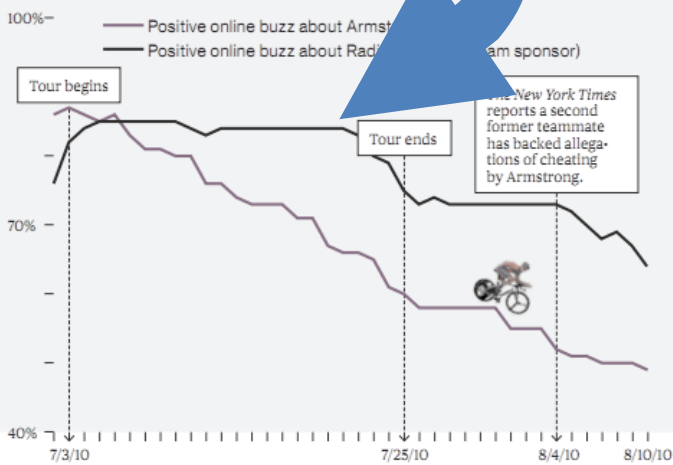
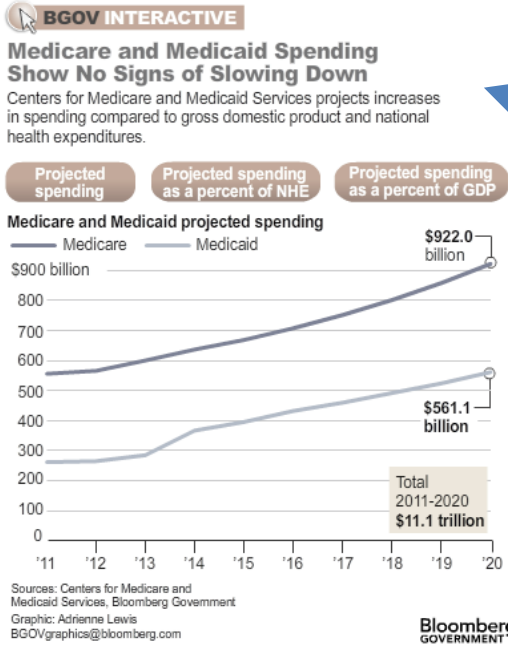
SIGNIFICANT DIGITS, TICK MARKS, AND LABELS SUGGEST WHAT DESERVES ATTENTION.

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	1.47 billion
John Carter	Texas 31	1.47 billion

TOO PRECISE

THOUGHTFUL

FINE



USE EMBELLISHMENTS SPARINGLY & CAREFULLY.

STYLISED VISUALS CAN
BE ENGAGING BUT ARE
HARD

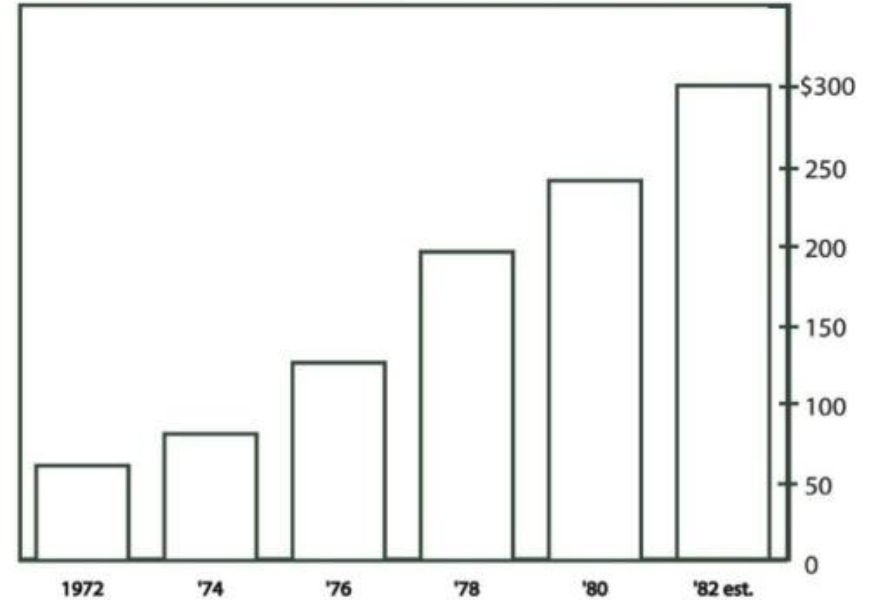
TO GET RIGHT.

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.**

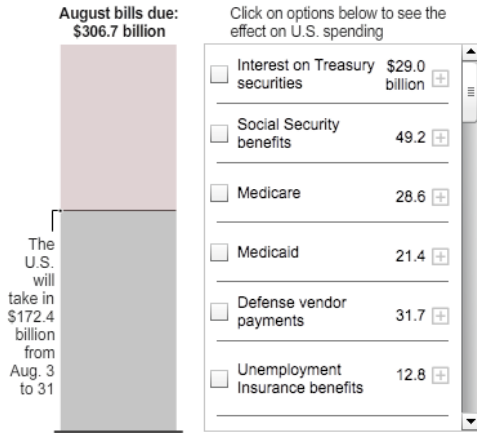
VISUAL DESIGN
show

MESSAGING
tell

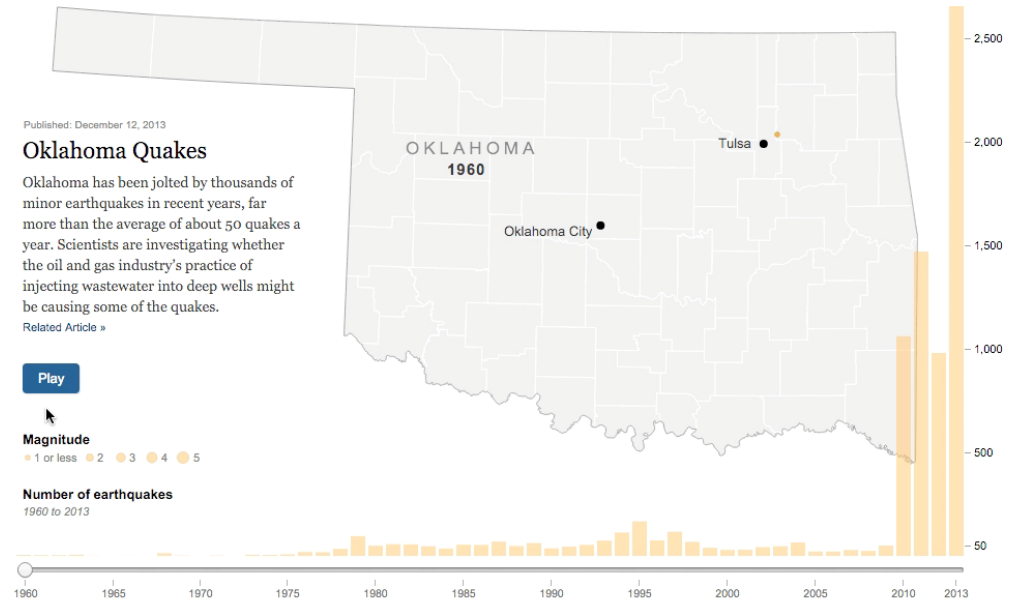
INTERACTIVITY
engage

INTERACTIVE FEATURES SHOULD SUGGEST INTERACTIVITY. AVOID A CLICK-AND-SEEK EXPERIENCE.

FAMILIAR WIDGETS



VISUAL FEEDBACK ON PAGE LOAD OR PLAY



By JONATHAN CORUM

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

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

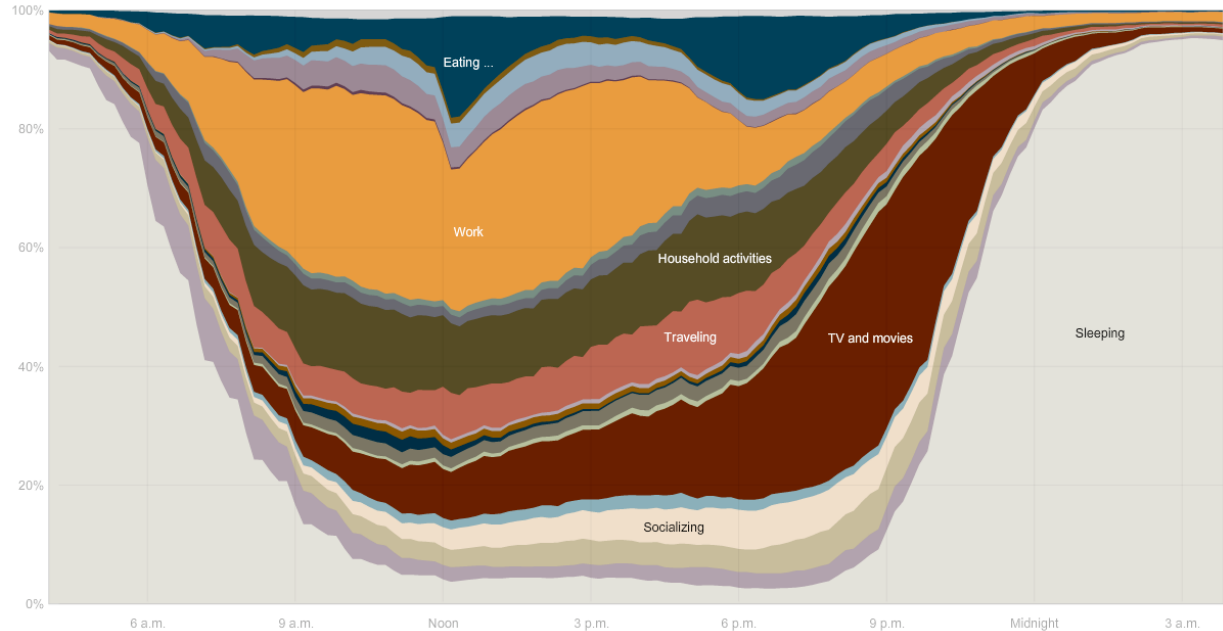
How Different Groups Spend Their Day

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

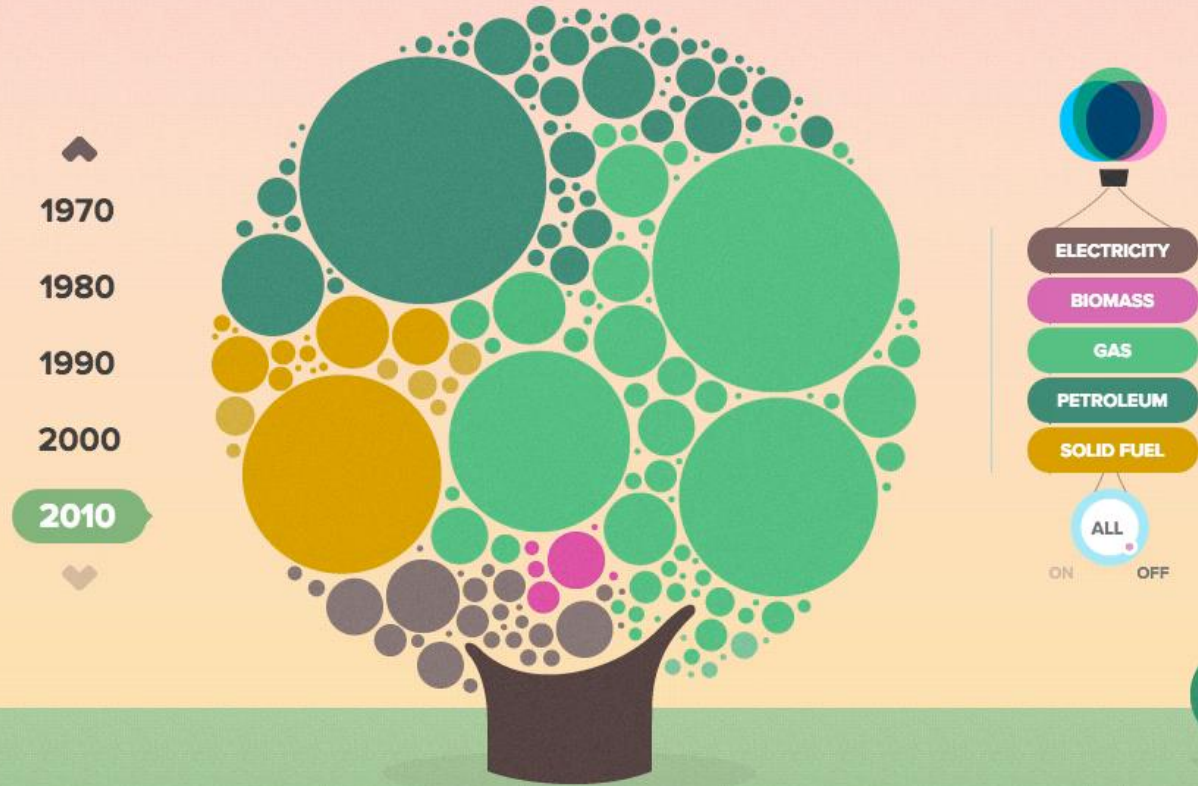
Sleeping, eating, working and watching television take up about two-thirds of the average day.

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

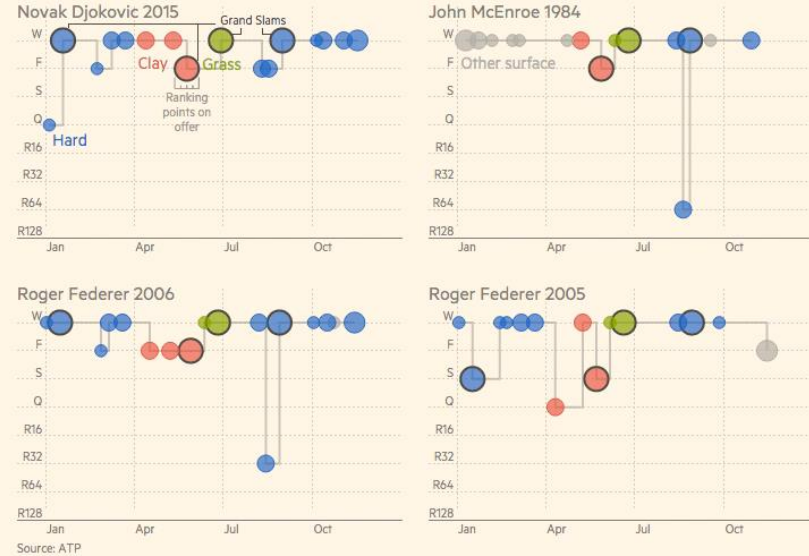
Final energy is energy supplied that is available to the consumer to be converted into useful energy (e.g. electricity at the wall outlet).

“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.

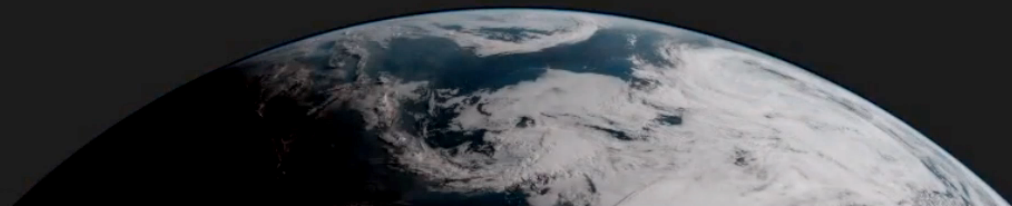
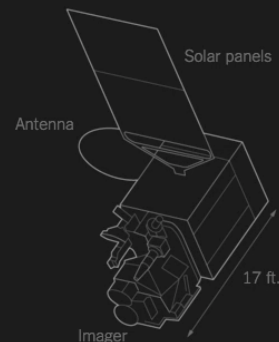
CLICKING IS A DECISION
SCROLLING IS A CONTINUATION

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.



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/>

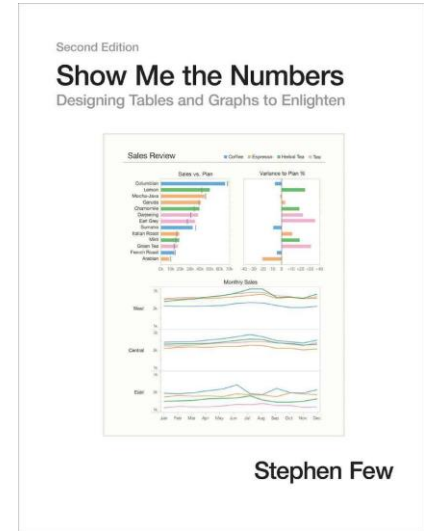
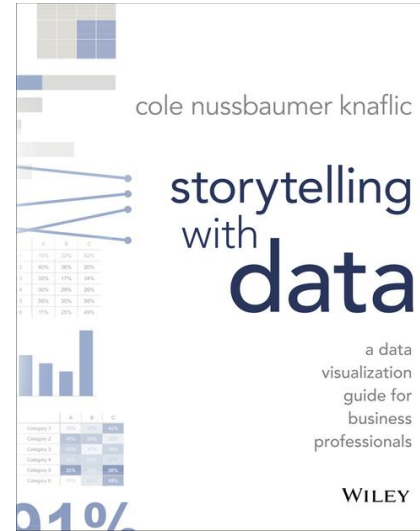


QUESTIONS?

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...

