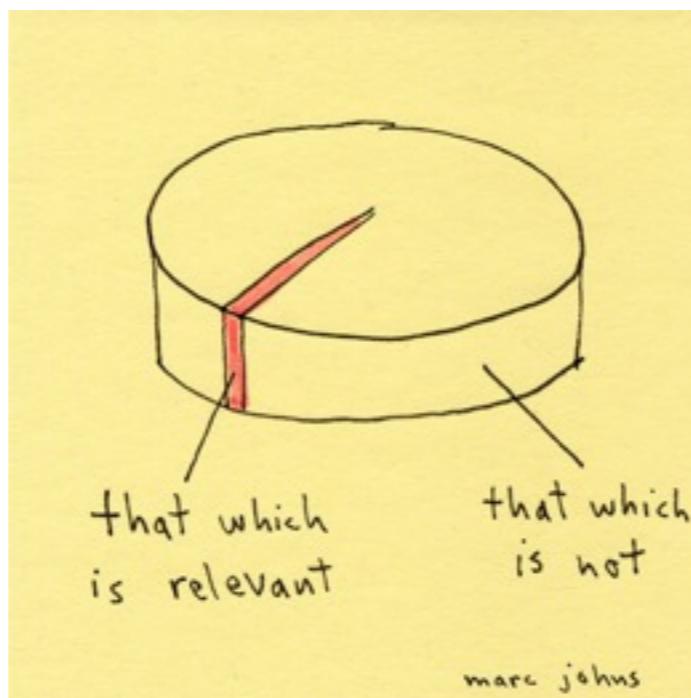


CSI 09 Data Science Visual Communication

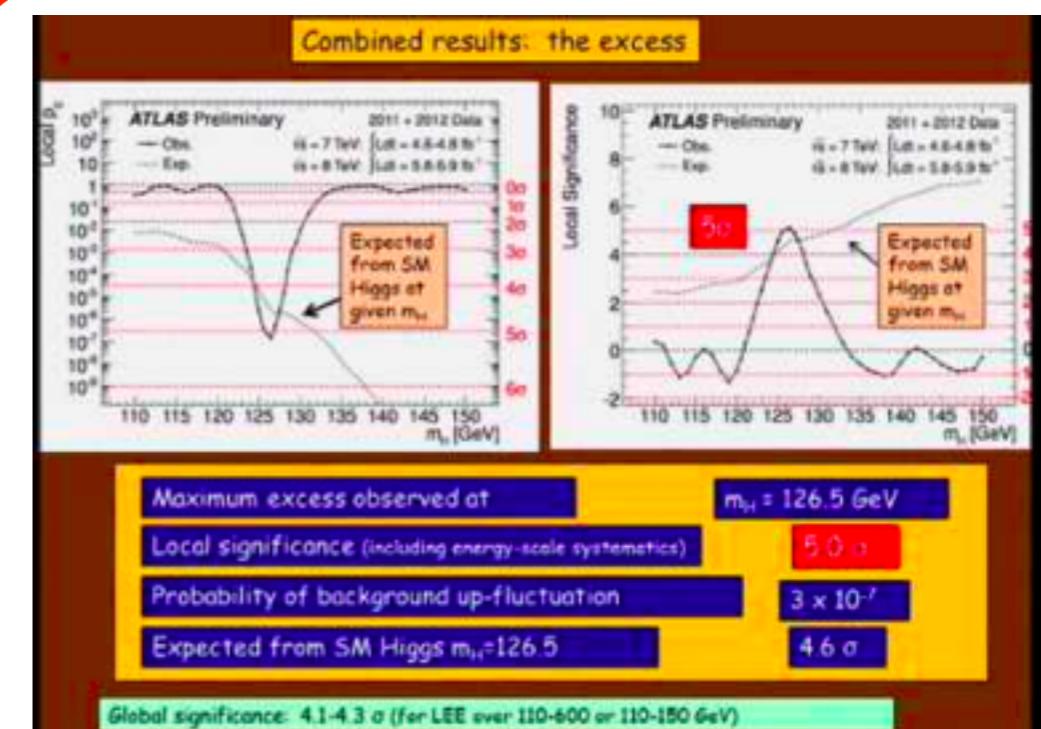
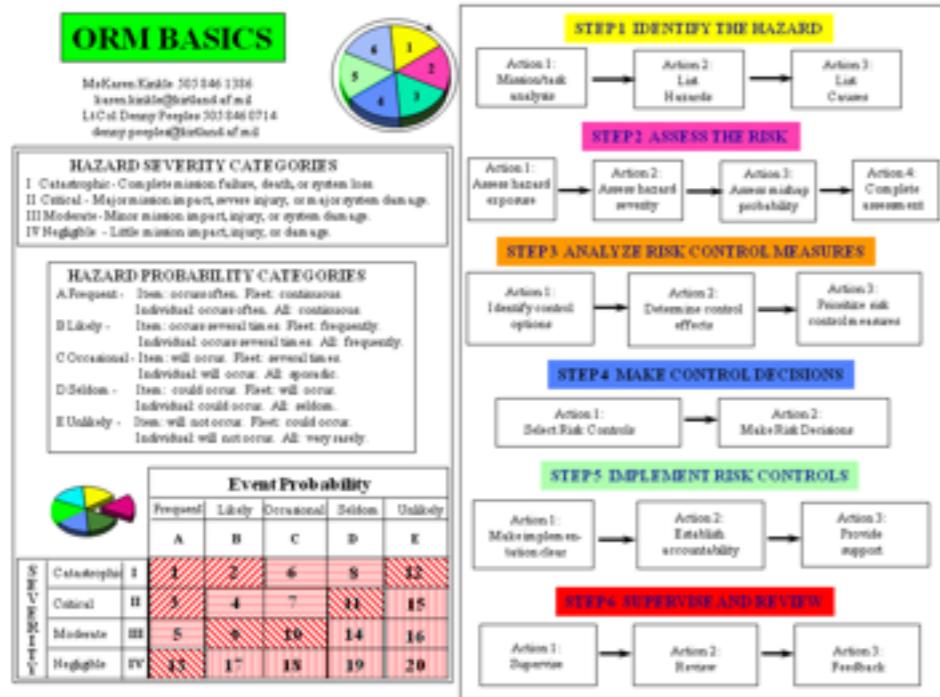
Hanspeter Pfister & Joe Blitzstein
pfister@seas.harvard.edu / blitzstein@stat.harvard.edu

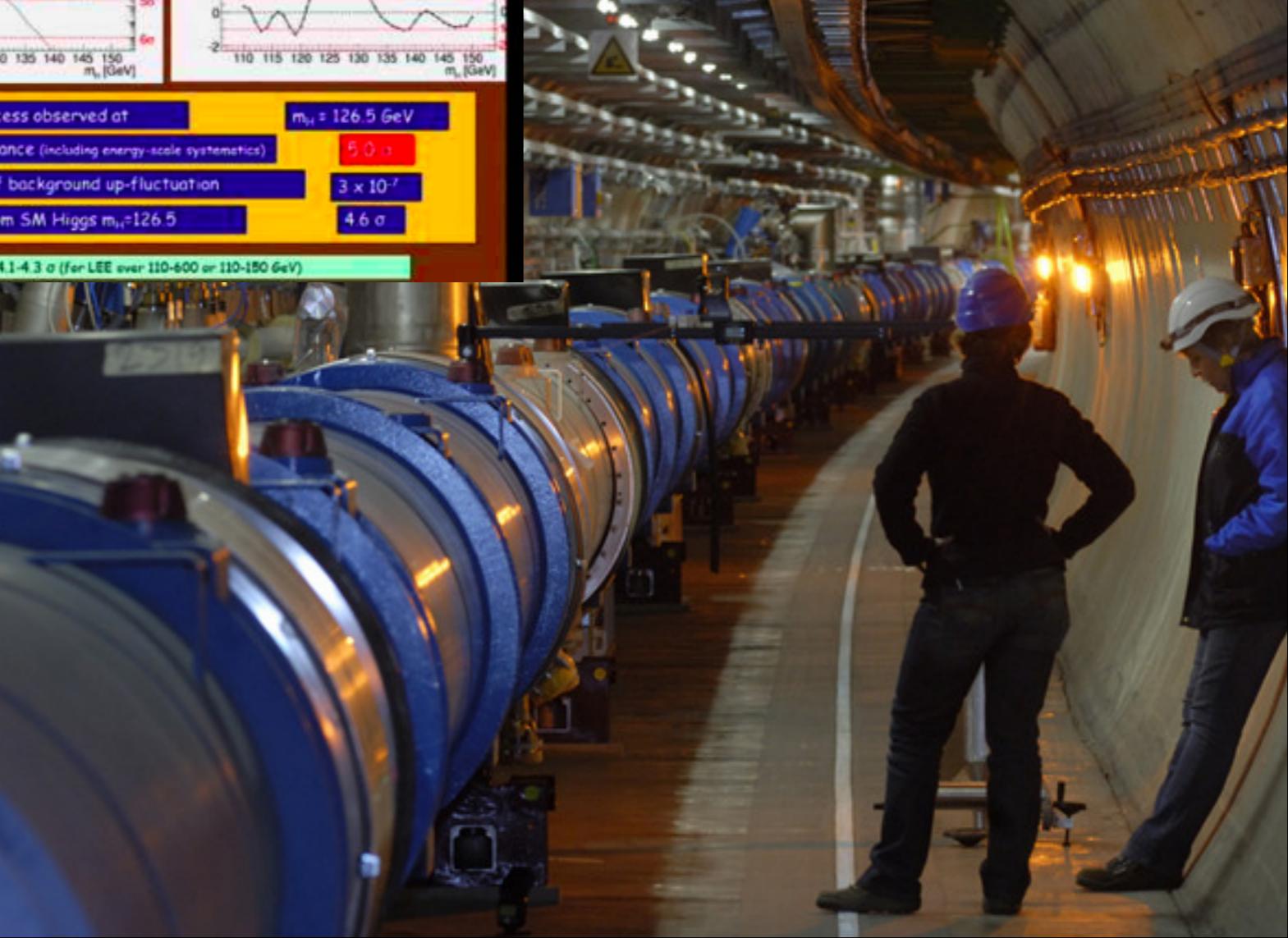
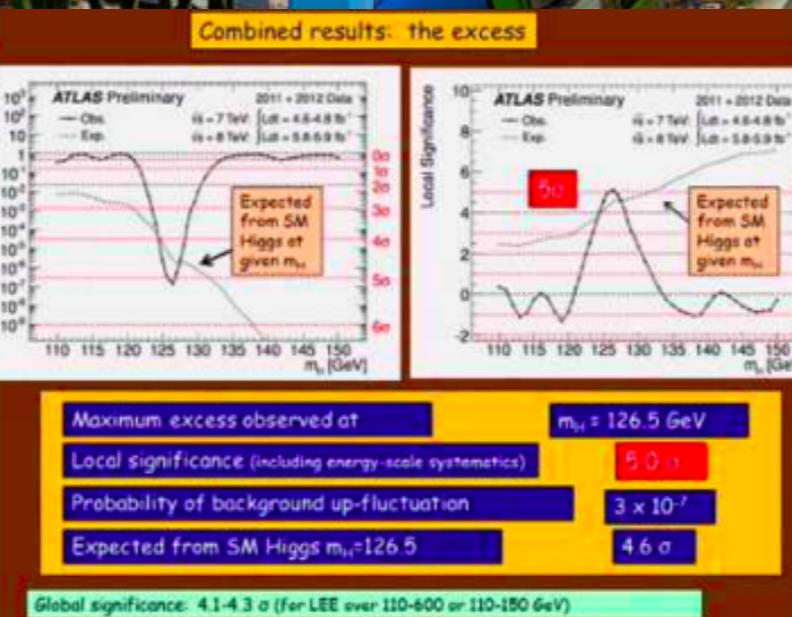
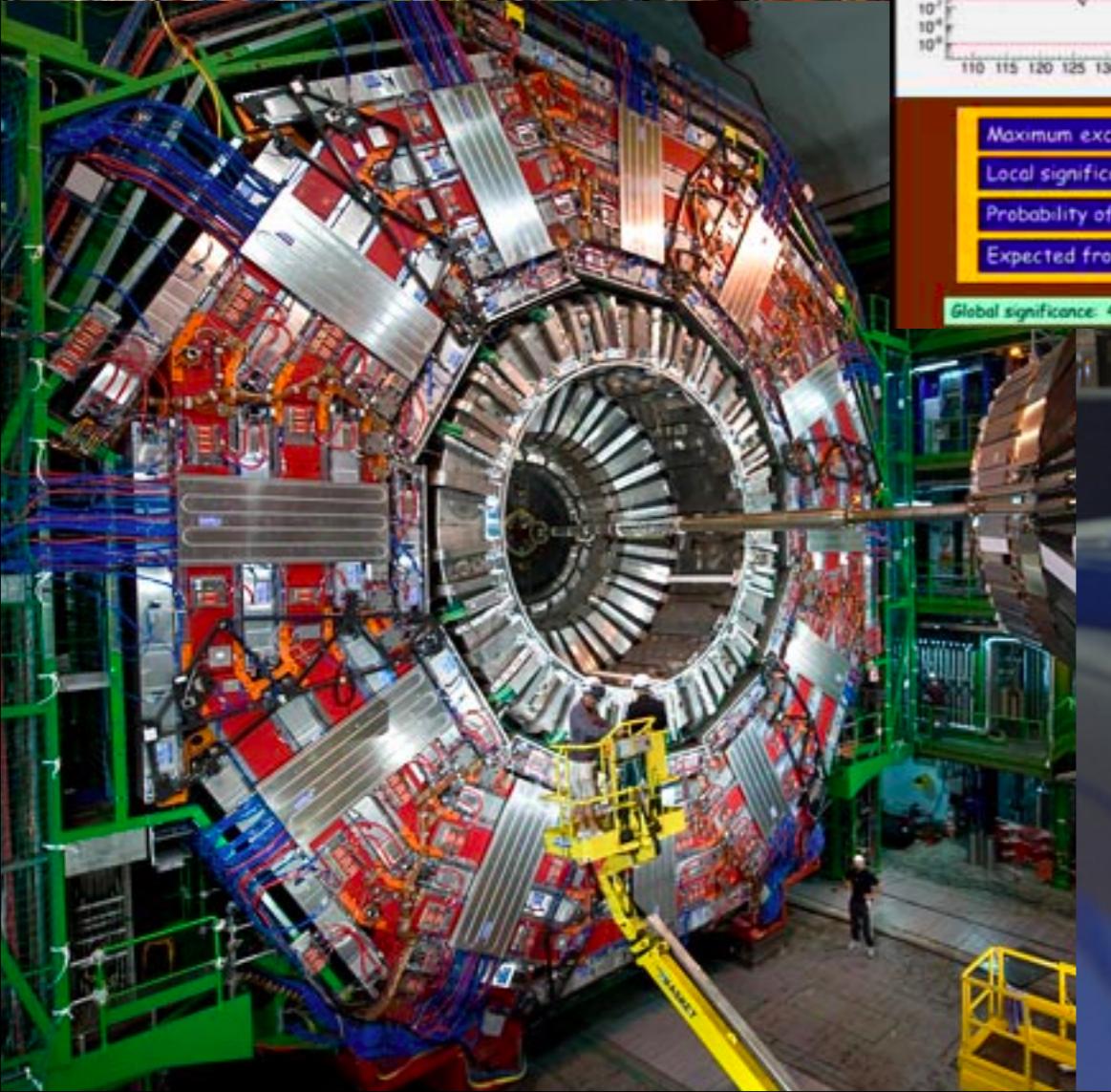
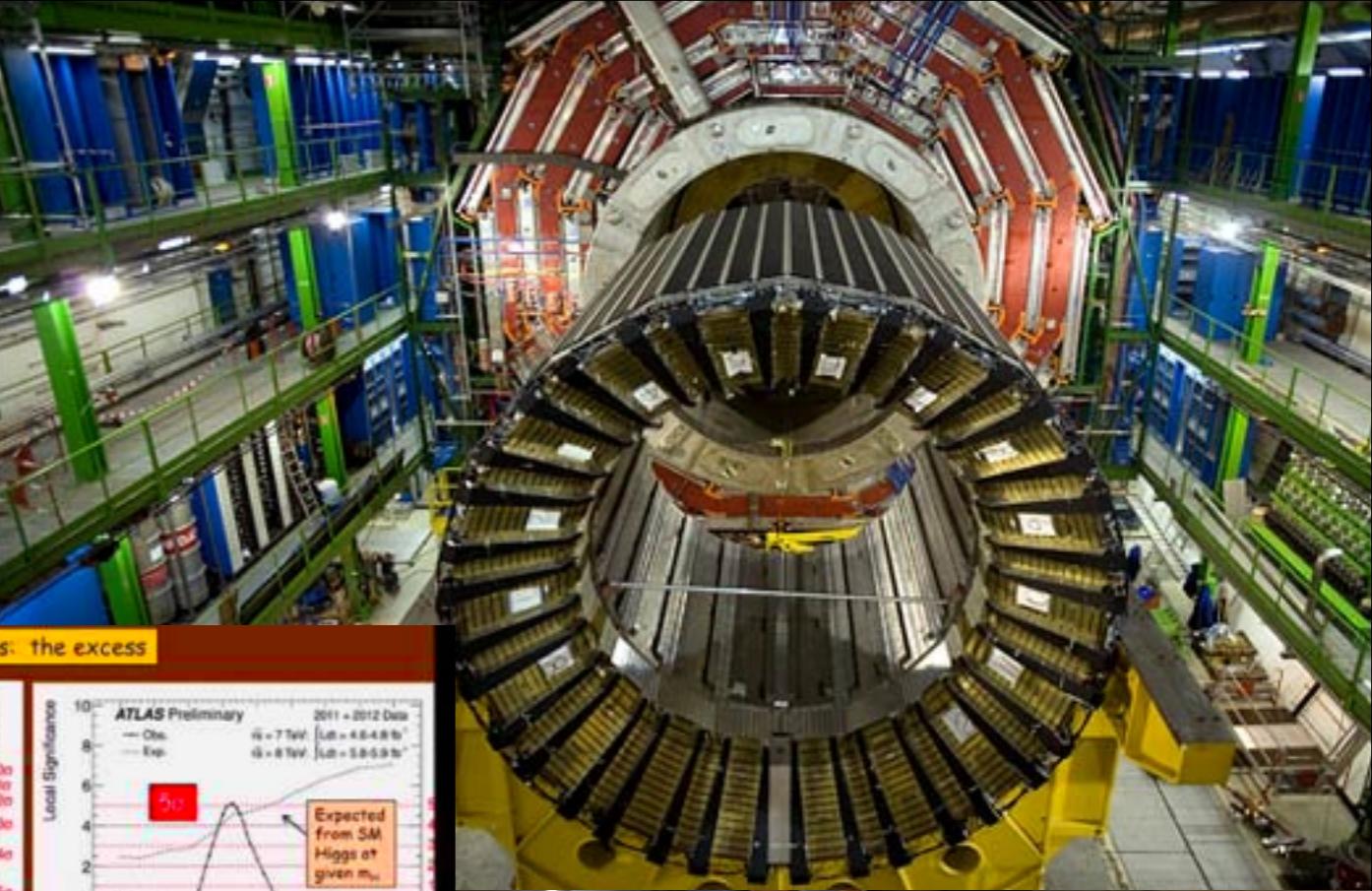
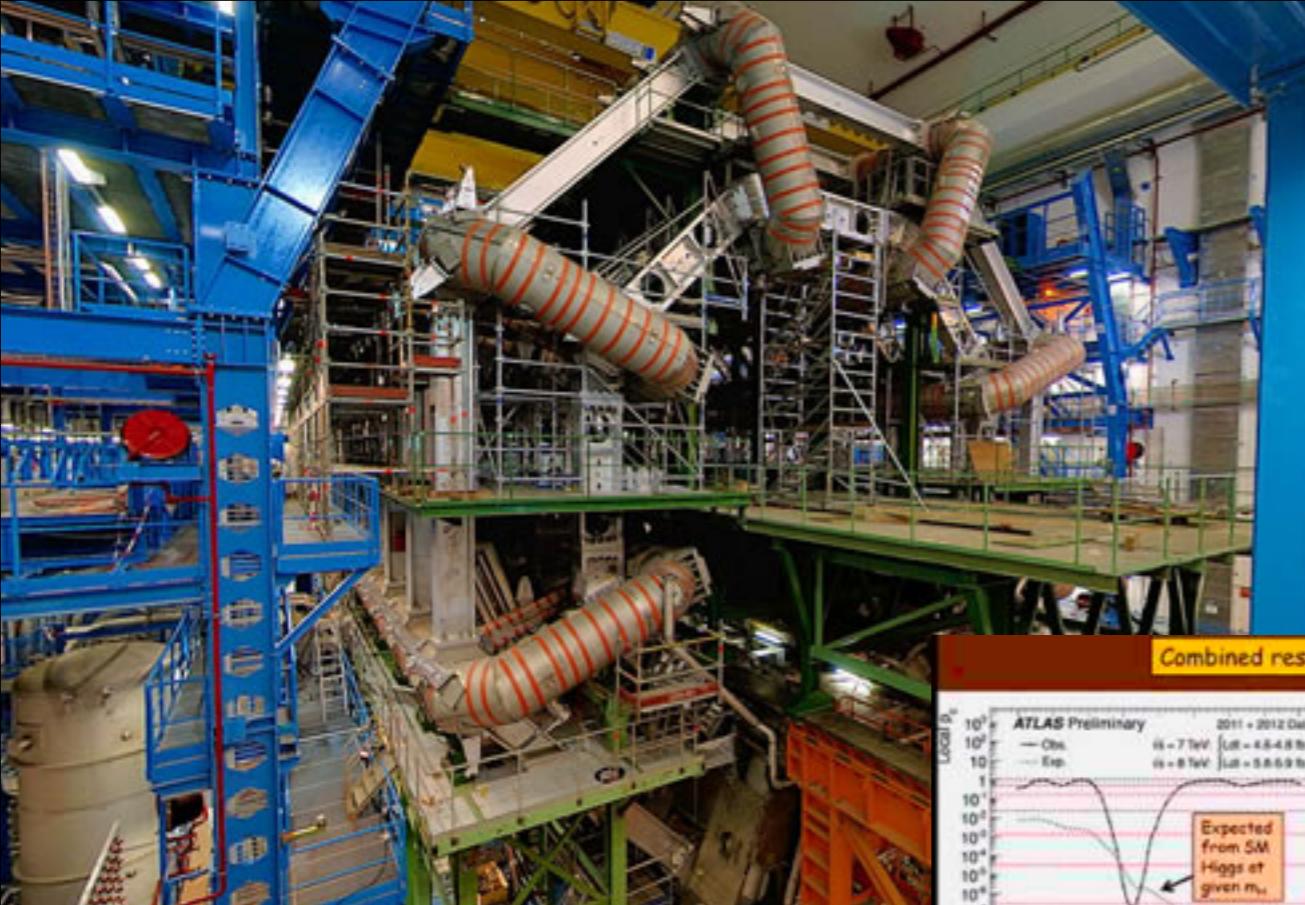


This Week

- HW5 due Friday, Nov 15. You should have started!
- Friday lab 10-11:30 am in MD G115
 - SVM, Neural Networks, and Hierarchical Clustering
- Final Project Proposals due Monday, Nov 11
 - Teams, interesting questions and data
 - Project scope and outline

Death by PowerPoint





The Image of the Scientist



Prof. Calculus, Tintin



Gyro Gearloose,
Duck Tales



Getafix (aka Miraculix),
Asterix & Obelix



Heinz Doofenshmirtz,
Phineas and Ferb

Effective Communication

Reasons to Communicate

I. Convey what you have learned in your project

Goal: Don't tell the audience what you did, tell the audience the most important things they should know, but probably do not.

2. Get feedback from others to advance your project

Goal: Put smart people in the best position to help you.

The (more or less) Five W's

- Who is your audience?
- What is the motivation behind your project?
 - What questions are you answering?
- What is the context of your project?
 - Data, related work, etc.
- Why should I care?
 - What are your major insights? Surprises? Impact?

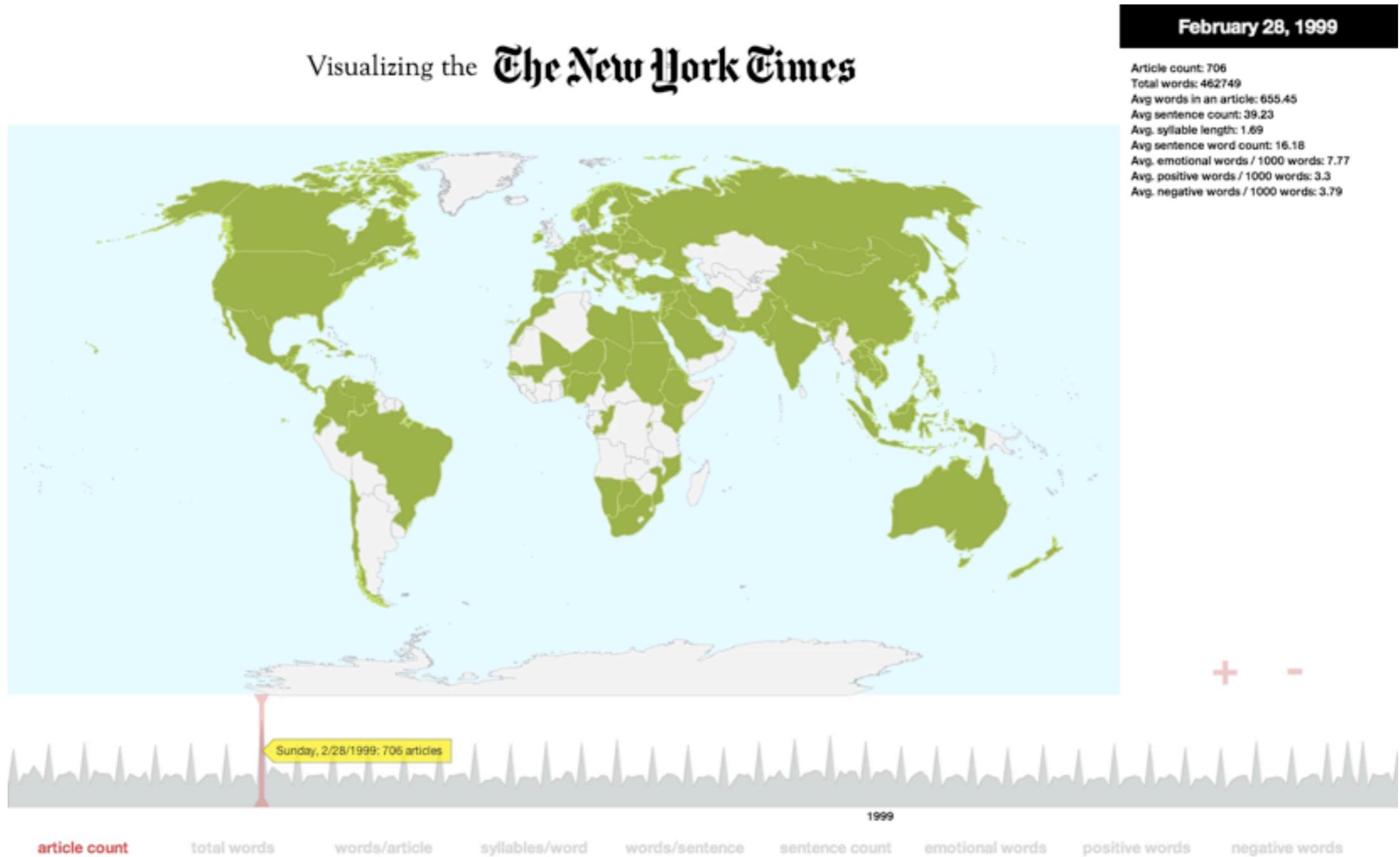
Know Your Audience

- Aim for your target audience to understand everything you say (otherwise why are you saying it?)
- This means you have to put yourself in your audience's shoes
- It is reasonable to target two audiences
 - The experts (e.g., instructors) that should understand everything
 - A broader audience (e.g., on the web) that might understand all but the most technical 20%

Don't Make Me Think!

- The audience does not want to burn mental effort about things you know and can just tell them
- Lead them by hand through the major steps of your story
- Audience does want to spend their energy thinking about:
 - The context of your project
 - Implications of your approach and findings
 - Potential problems with what you did (did you consider all edge cases?)

David Jacopille

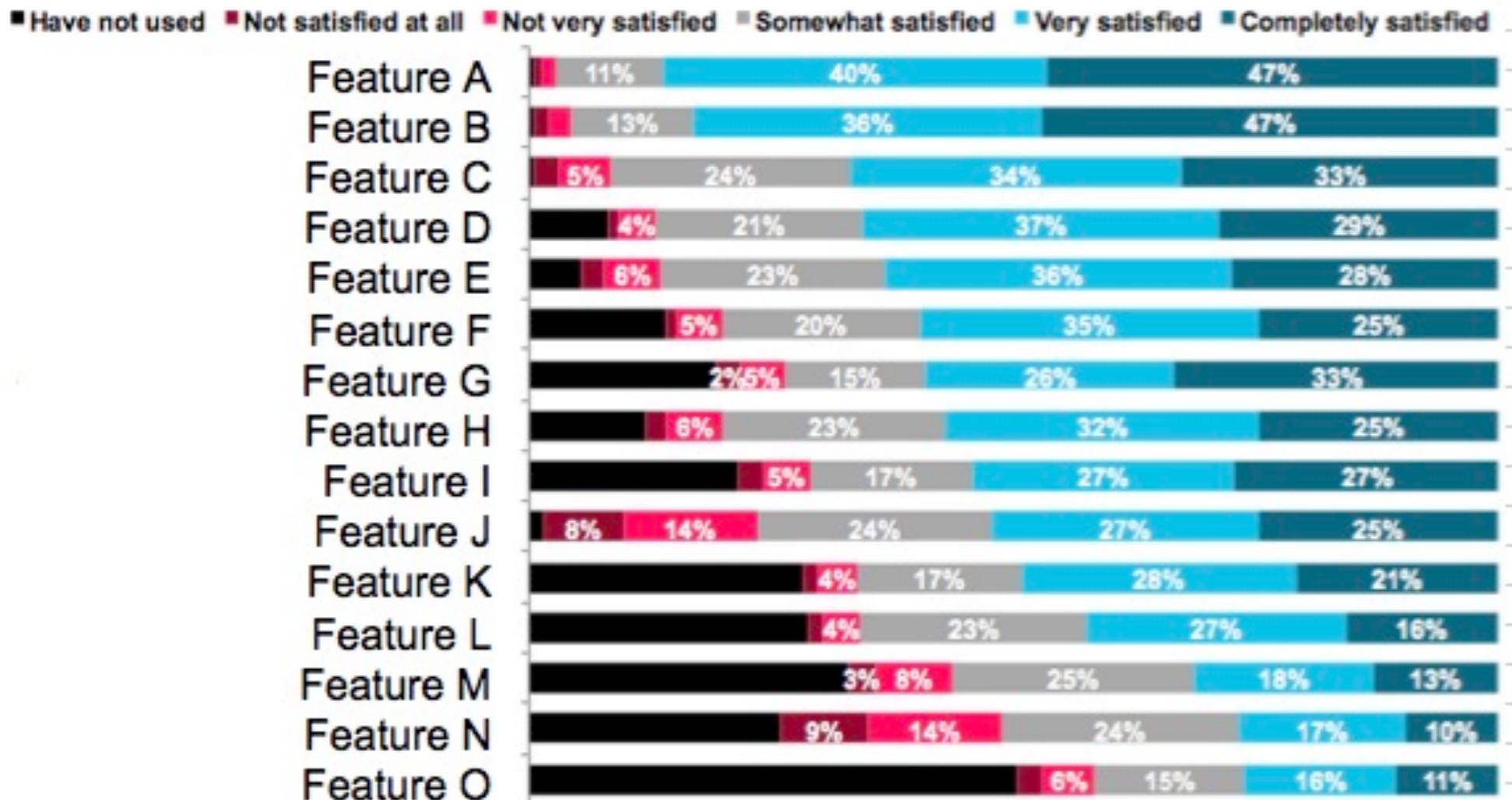


Framing

- Tell the audience: “Here is the right way to think about the problem I am trying to solve.”
- Catch the audience’s attention and frame the story in the introduction
- If done well, your solution will seem obvious given this framing. And that’s a good thing!

Don't Bury the Lead

How satisfied have you been with each of these features?

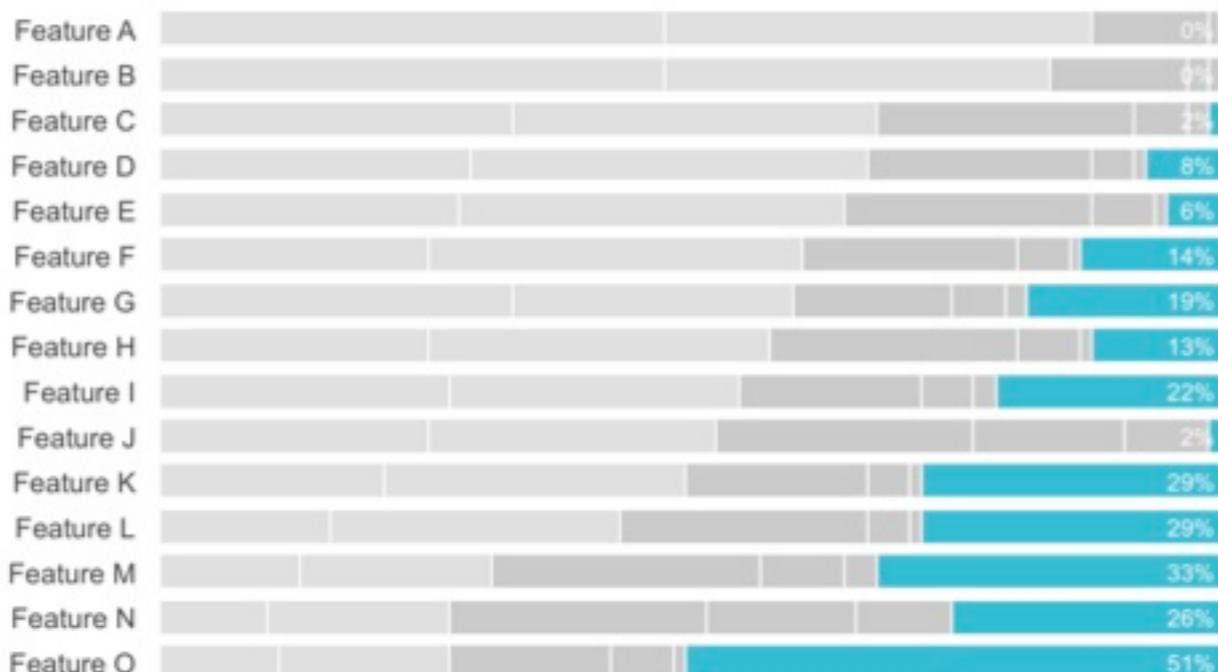


Don't Bury the Lead

User satisfaction varies greatly by feature

Product X User Satisfaction: Features

* Completely satisfied * Very satisfied * Somewhat satisfied * Not very satisfied * Not satisfied at all * Have not used



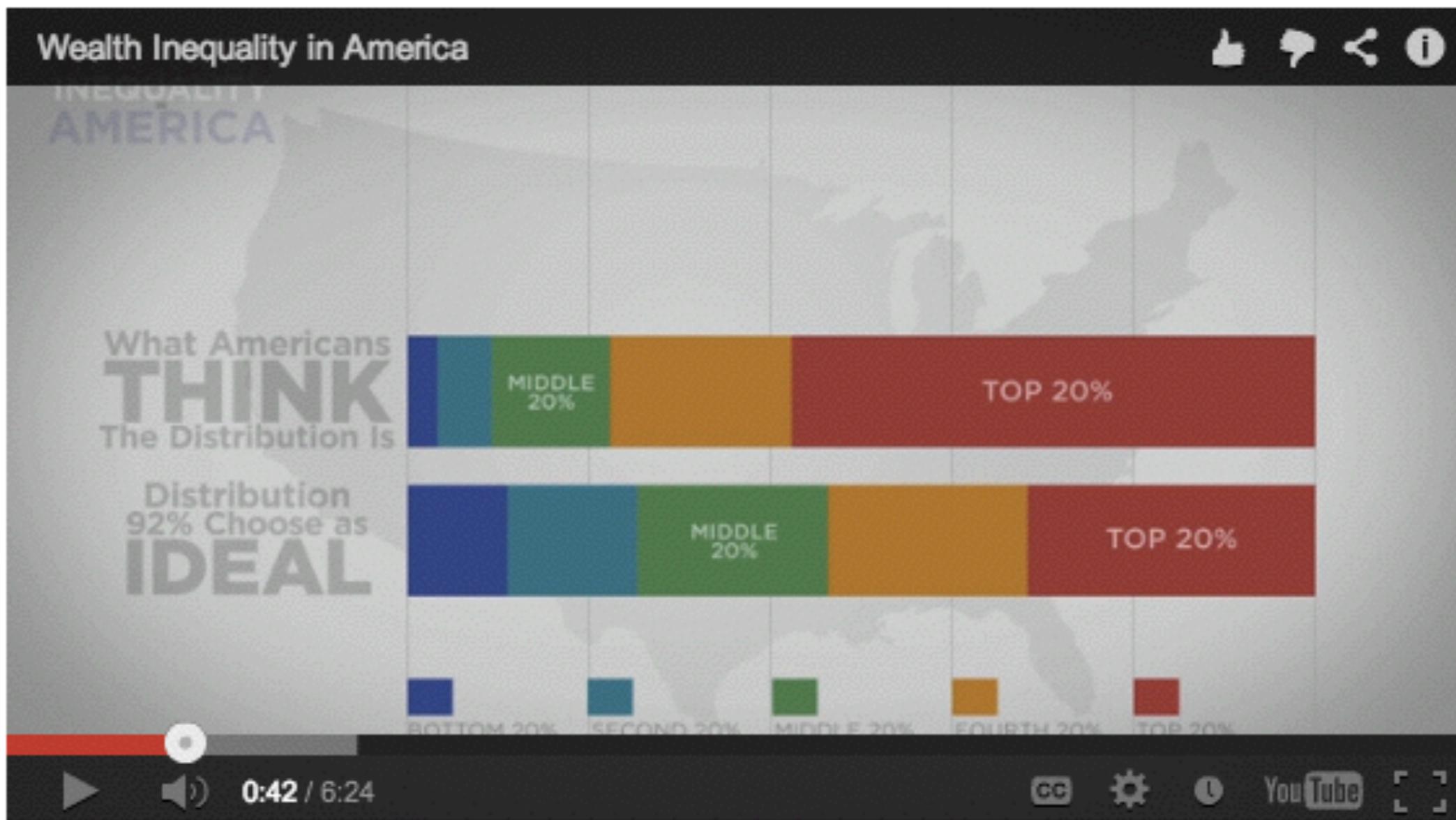
Feature O is least-used feature; what steps can we proactively take with existing users to increase use?

Unexpectedness

- Make the audience aware that there is something they didn't know they didn't know
- Use surprise to grab the audience's attention
- “You might think you know this, but here's a new angle on it”
- Curiosity happens when we feel a gap in our knowledge

Wealth Inequality in America

RANDY | MONDAY, MARCH 11, 2013 AT 8:08AM [PERMALINK](#)



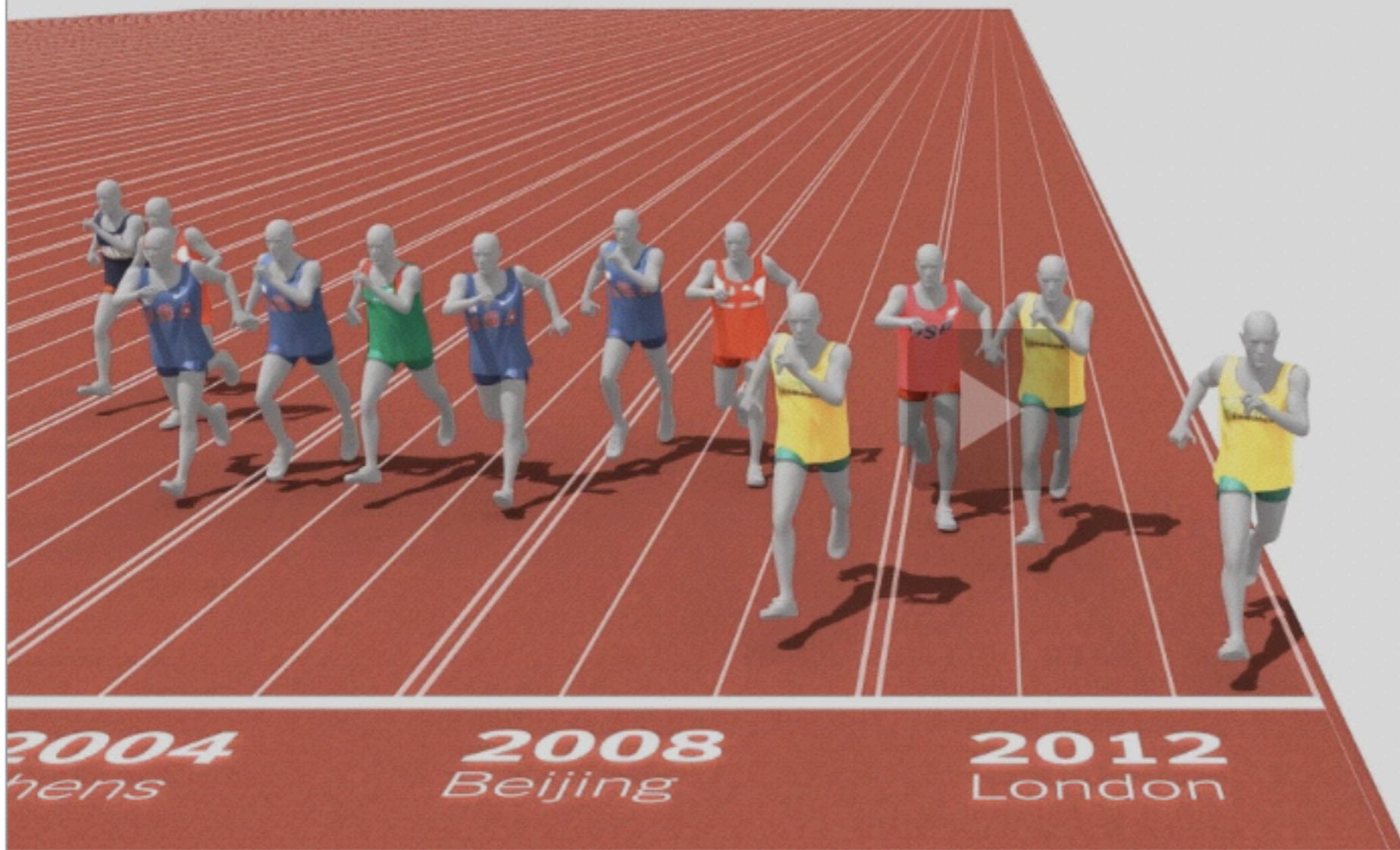
Inputs, Outputs, and Constraints

- Establish goals and assumptions early
- Given these input data, we wish to answer these questions
- We are working under the following constraints
 - Example: the data had these properties
 - Example: the analysis had to be easy to interpret
 - Example: our algorithm could only run on small data

Concreteness

- The *Curse of Knowledge* makes it hard to communicate with non-experts
- Decision paralysis sets in when we have too many choices
- Concreteness focuses the brain (e.g., write down as many white things as you can think of)

All the Medalists: Men's 100-Meter Sprint



Sources: "The Complete Book of the Olympics" by David Wallechinsky and Jaime Loucky, International Olympic Committee; Amateur Athletic Association; Photographs: Chang W. Lee/The New York Times, Getty Images, International Olympic Committee

[FACEBOOK](#) [TWITTER](#) [GOOGLE+](#) [E-MAIL](#) [SHARE](#)

End on a Positive Note!

- The future is bright!
- Lots of new work to do, here are some ideas!
- This is one part of something bigger!
- Don't stress problems with the work. It's boring and sort of a bummer for everyone involved.
- “Oh man, I guess they really haven’t done much”. “That was incremental.”

Simplicity

Simplicity

“A designer know he has achieved perfection not when there is nothing left to add, but when there is nothing left to take away.”

A. de Saint-Exupéry

Less is More

- KISS - Keep It Simple, Stupid!
- Every word, sentence, and graph matters
- Assess the value of why you are saying or showing something
- If you can't justify how it will help the listener, take it out

equipment, and to Dr. G. E. R. Deacon and the captain and officers of R.R.S. *Discovery II* for their part in making the observations.

¹ Young, F. B., Gerrard, H., and Jevons, W., *Phil. Mag.*, **40**, 149 (1920).

² Longast-Higgins, M. S., *Mon. Not. Roy. Astro. Soc., Geophys. Suppl.*, **5**, 283 (1949).

³ Von Arx, W. S., Woods Hole Papers in Phys. Oceanogr. Meteor., **11** (3) (1950).

⁴ Ekman, V. W., *Arkiv. Mat. Astron. Fysik. (Stockholm)*, **2**(11) (1906).

MOLECULAR STRUCTURE OF NUCLEIC ACIDS

A Structure for Deoxyribose Nucleic Acid

WE wish to suggest a structure for the salt of deoxyribose nucleic acid (D.N.A.). This structure has novel features which are of considerable biological interest.

A structure for nucleic acid has already been proposed by Pauling and Corey¹. They kindly made their manuscript available to us in advance of publication. Their model consists of three intertwined chains, with the phosphates near the fibre axis, and the bases on the outside. In our opinion, this structure is unsatisfactory for two reasons: (1) We believe that the material which gives the X-ray diagrams is the salt, not the free acid. Without the acidic hydrogen atoms it is not clear what forces would hold the structure together, especially as the negatively charged phosphates near the axis will repel each other. (2) Some of the van der Waals distances appear to be too small.

Another three-chain structure has also been suggested by Fraser (in the press). In his model the phosphates are on the outside and the bases on the inside, linked together by hydrogen bonds. This structure as described is rather ill-defined, and for this reason we shall not comment on it.

We wish to put forward a radically different structure for the salt of deoxyribose nucleic acid. This structure has two helical chains each coiled round the same axis (see diagram). We have made the usual chemical assumptions, namely, that each chain consists of phosphate diester groups joining β -D-deoxyribofuranose residues with $3',5'$ linkages. The two chains (but not their bases) are related by a dyad perpendicular to the fibre axis. Both chains follow right-handed helices, but owing to the dyad the sequences of the atoms in the two chains run in opposite directions. Each chain loosely resembles Furberg's² model No. 1; that is, the bases are on the inside of the helix and the phosphates on the outside. The configuration of the sugar and the atoms near it is close to Furberg's 'standard configuration', the sugar being roughly perpendicular to the attached base. There

is a residue on each chain every 3·4 Å. in the z -direction. We have assumed an angle of 36° between adjacent residues in the same chain, so that the structure repeats after 10 residues on each chain, that is, after 34 Å. The distance of a phosphorus atom from the fibre axis is 10 Å. As the phosphates are on the outside, cations have easy access to them.

The structure is an open one, and its water content is rather high. At lower water contents we would expect the bases to tilt so that the structure could become more compact.

The novel feature of the structure is the manner in which the two chains are held together by the purine and pyrimidine bases. The planes of the bases are perpendicular to the fibre axis. They are joined together in pairs, a single base from one chain being hydrogen-bonded to a single base from the other chain, so that the two lie side by side with identical z -co-ordinates. One of the pair must be a purine and the other a pyrimidine for bonding to occur. The hydrogen bonds are made as follows: purine position 1 to pyrimidine position 1; purine position 6 to pyrimidine position 6.

If it is assumed that the bases only occur in the structure in the most plausible tautomeric forms (that is, with the keto rather than the enol configurations) it is found that only specific pairs of bases can bond together. These pairs are: adenine (purine) with thymine (pyrimidine), and guanine (purine) with cytosine (pyrimidine).

In other words, if an adenine forms one member of a pair, on either chain, then on these assumptions the other member must be thymine; similarly for guanine and cytosine. The sequence of bases on a single chain does not appear to be restricted in any way. However, if only specific pairs of bases can be formed, it follows that if the sequence of bases on one chain is given, then the sequence on the other chain is automatically determined.

It has been found experimentally^{3,4} that the ratio of the amounts of adenine to thymine, and the ratio of guanine to cytosine, are always very close to unity for deoxyribose nucleic acid.

It is probably impossible to build this structure with a ribose sugar in place of the deoxyribose, as the extra oxygen atom would make too close a van der Waals contact.

The previously published X-ray data^{5,6} on deoxyribose nucleic acid are insufficient for a rigorous test of our structure. So far as we can tell, it is roughly compatible with the experimental data, but it must be regarded as unproved until it has been checked against more exact results. Some of these are given in the following communications. We were not aware of the details of the results presented there when we devised our structure, which rests mainly though not entirely on published experimental data and stereochemical arguments.

It has not escaped our notice that the specific pairing we have postulated immediately suggests a possible copying mechanism for the genetic material.

Full details of the structure, including the conditions assumed in building it, together with a set of co-ordinates for the atoms, will be published elsewhere.

We are much indebted to Dr. Jerry Donohue for constant advice and criticism, especially on interatomic distances. We have also been stimulated by a knowledge of the general nature of the unpublished experimental results and ideas of Dr. M. H. F. Wilkins, Dr. R. E. Franklin and their co-workers at



This figure is purely diagrammatic. The two ribbons symbolize the two phosphate-sugar chains, and the horizontal rods the pairs of bases holding the chains together. The vertical line marks the fibre axis.

Not Effective...

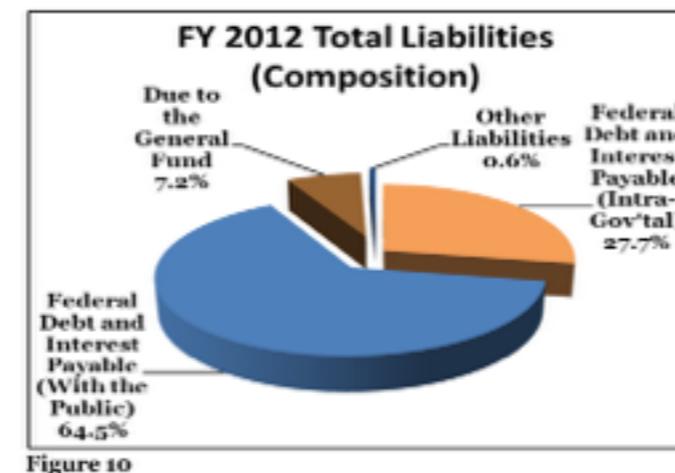
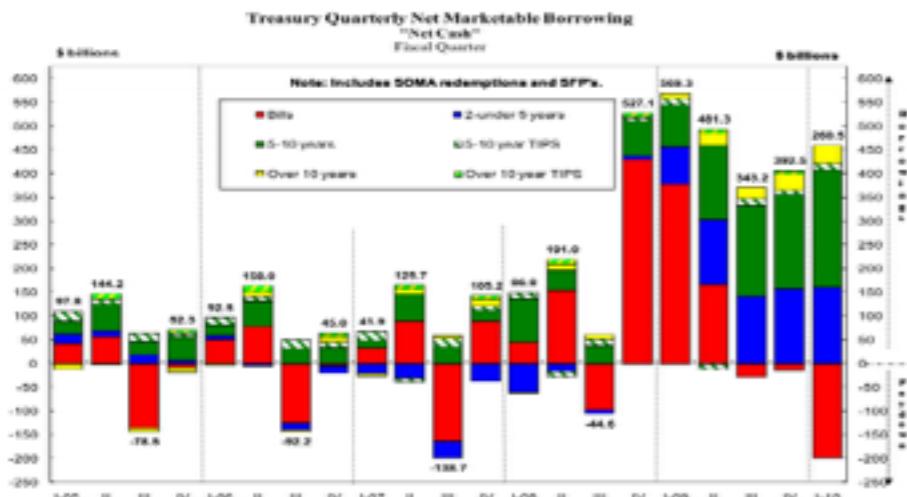
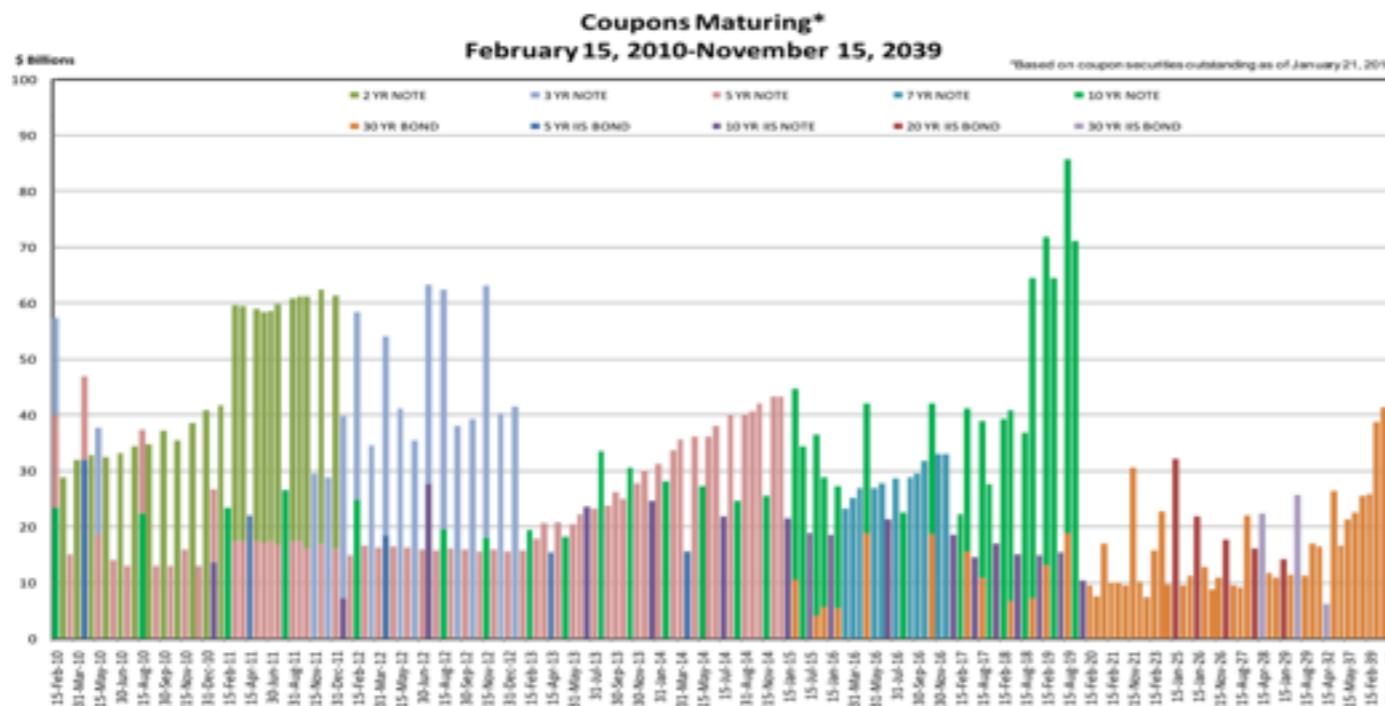
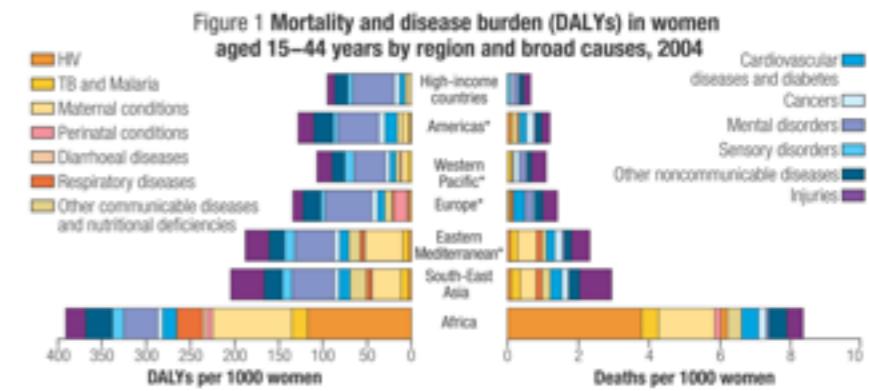


Figure 10



Much better...

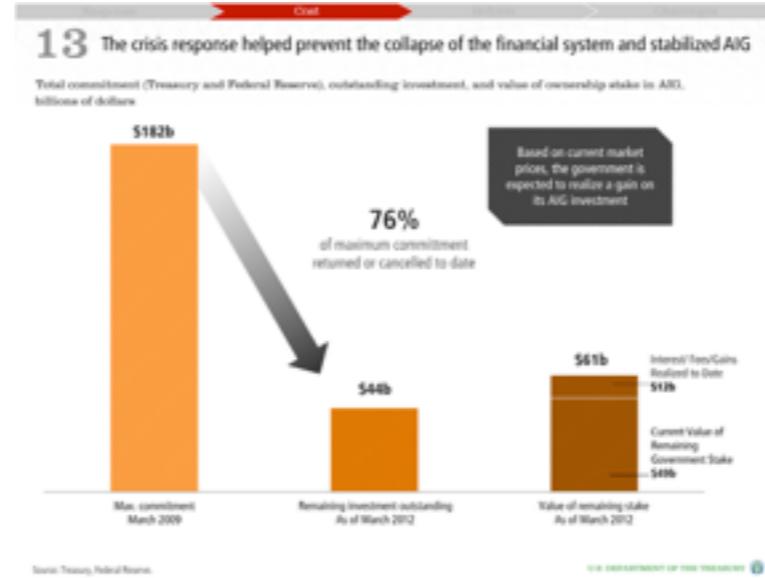
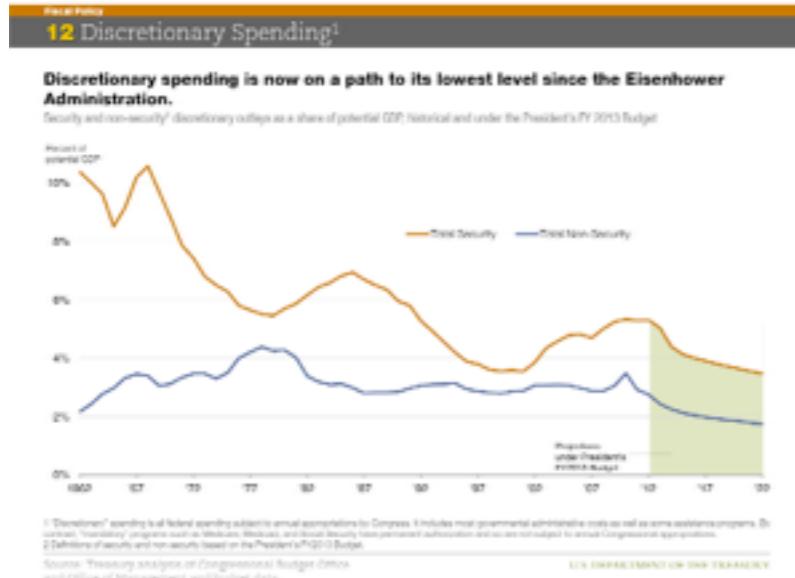
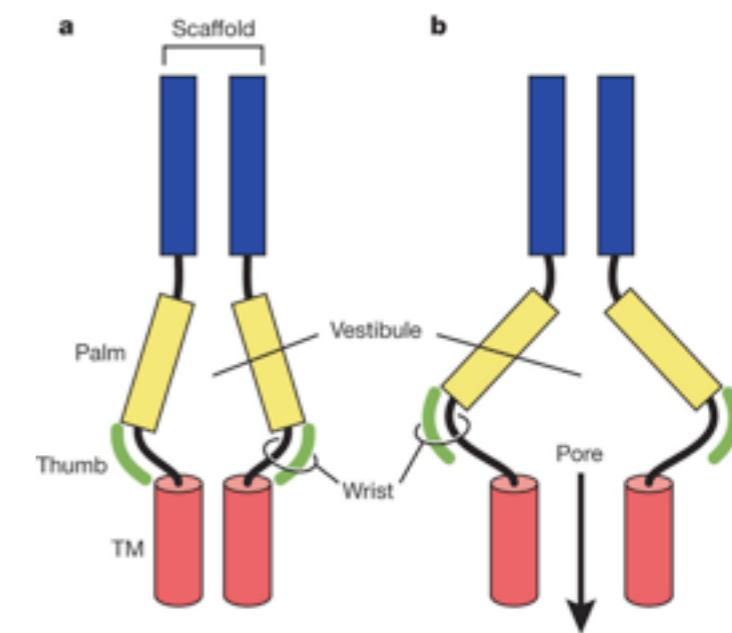
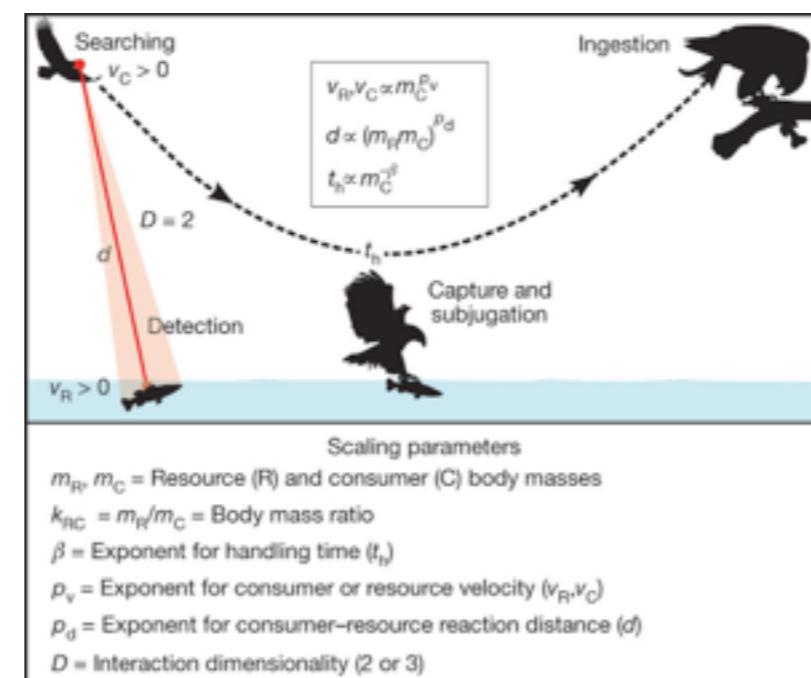
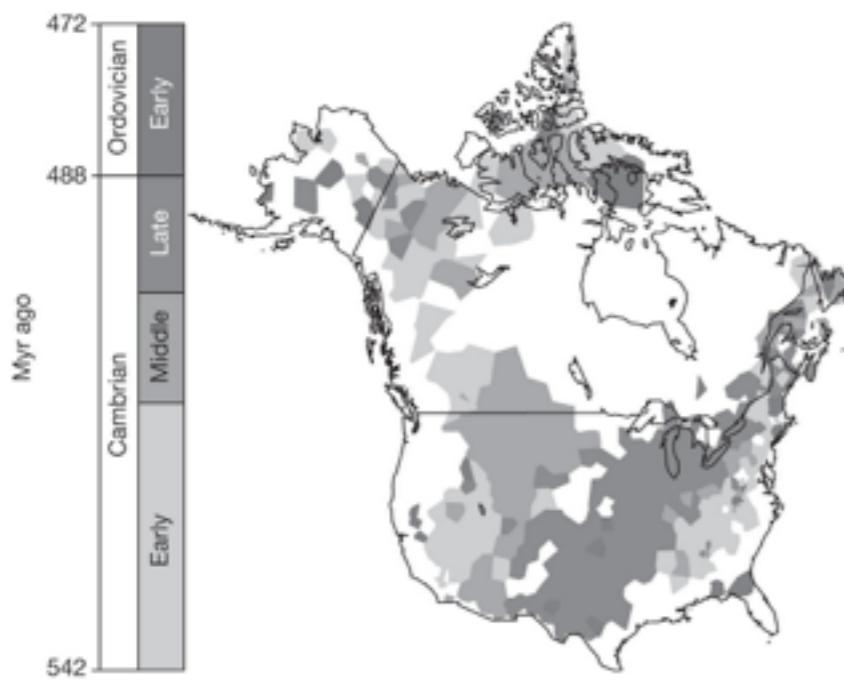
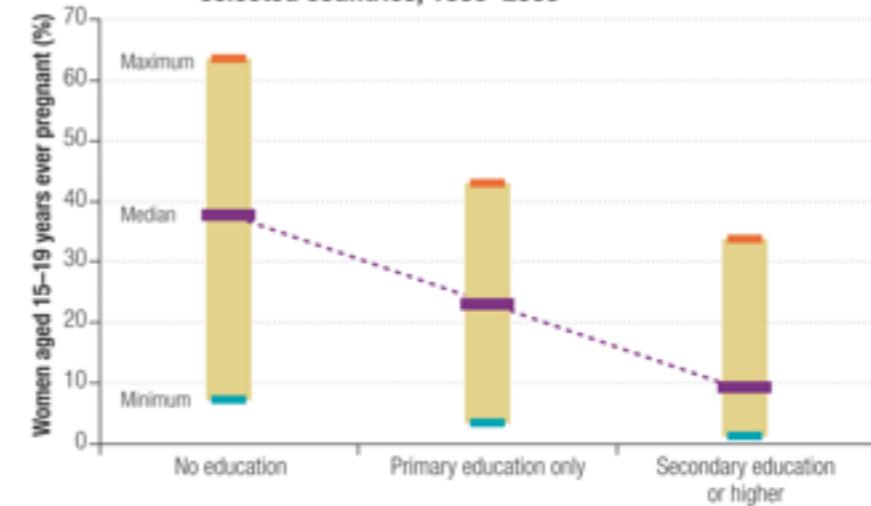


Figure 2 Adolescence pregnancy rates by educational level, selected countries, 1990–2005



Sources: US Treasury, WHO, Nature

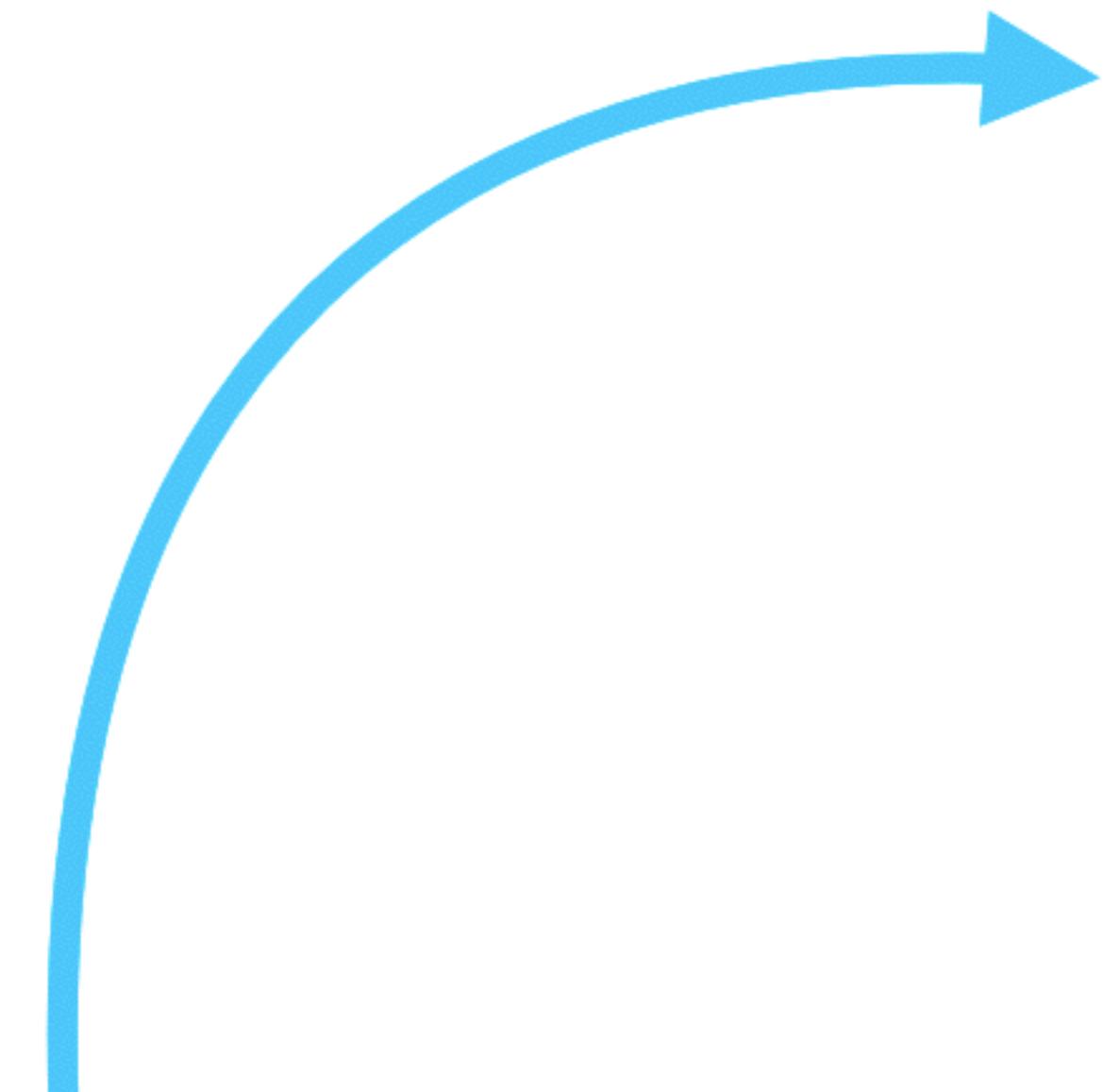
Visual Zen

DEAR NSA,

A quick work by Emiland De Cubber
@emilanddc - www.emiland.me

Visual Design

Use establishing shots.
Situate the viewer before diving in.



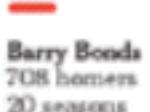
755



Steroids or Not, the Pursuit Is On

Babe Ruth is taking aim at the career home run record. He needs only six more to tie Babe Ruth and 47 to equal Hank Aaron.

Lines are cumulative home runs.



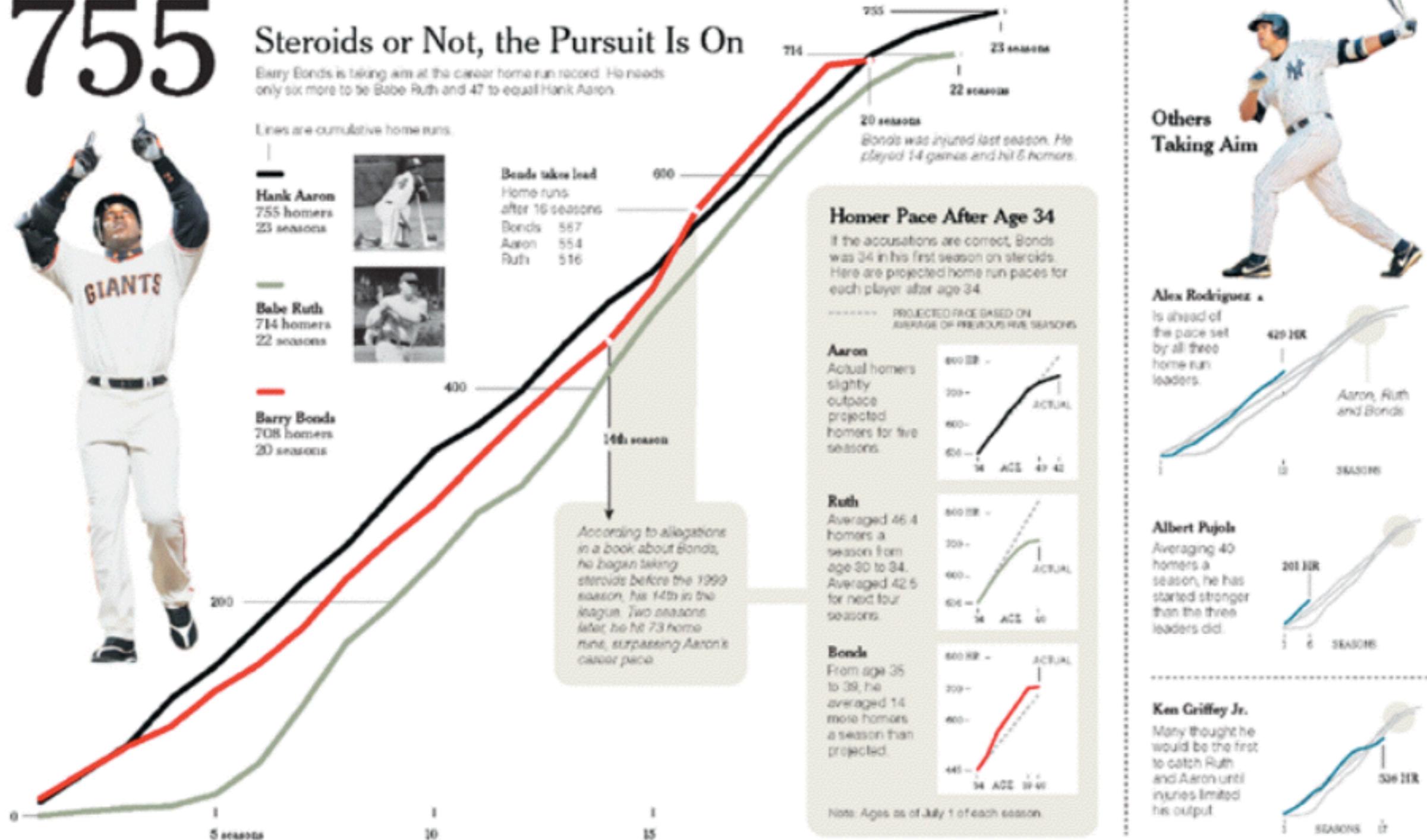
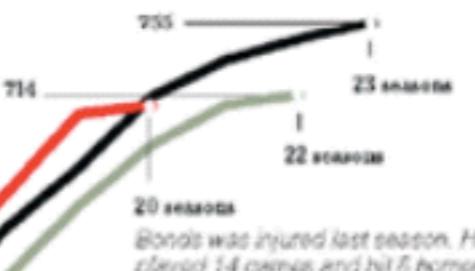
Bonds takes lead
Home runs:
after 16 seasons

Bonds	587
Aaron	554
Ruth	516

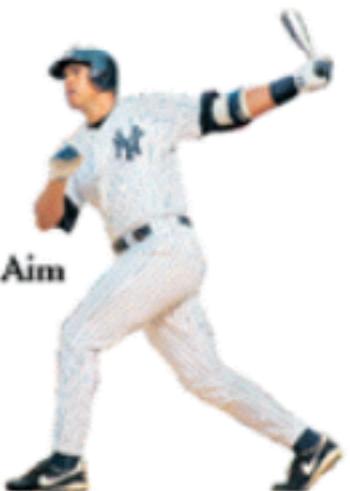
600

14th season

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

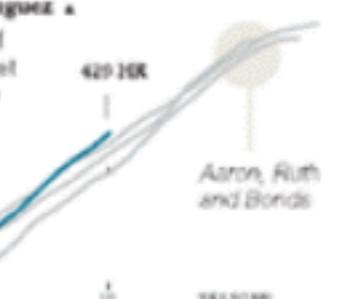


Others Taking Aim



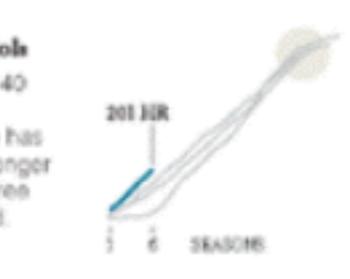
Alex Rodriguez

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



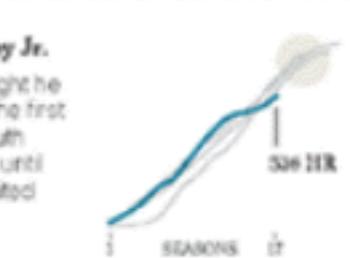
Albert Pujols

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



Ken Griffey Jr.

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

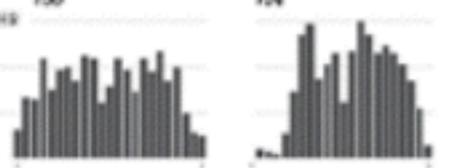


Differing Paths to the Top of the Charts

The top seven players on the career home run list, along with a look at Griffey (12th), Rodriguez (37th) and Pujols (56th/257th).

Hank Aaron

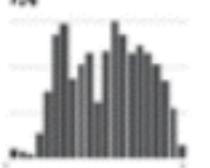
755



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

Babe Ruth

714



Hit only 20 over first five seasons.

Barry Bonds

708



Averaged 52 from 2000 to 2004.

Willie Mays

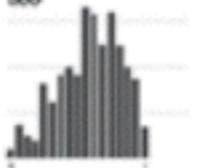
660



No one hit more than 1950-69.

Sunny Sosa

588



Three 60-homer seasons is record.

Frank Robinson

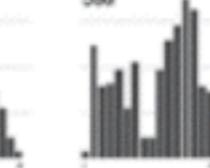
586



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

Mark McGwire

583



First to hit 70 in a season.

Ken Griffey Jr.

536



Only McGwire had more in the 90's.

Alex Rodriguez

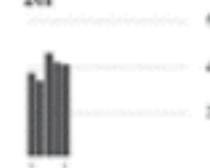
429



Youngest to reach 400 homers.

Albert Pujols

261



Second most ever in first five seasons.

Source: The Sporting News and New York Times

E. Segel

755

Steroids or Not, the Pursuit Is On

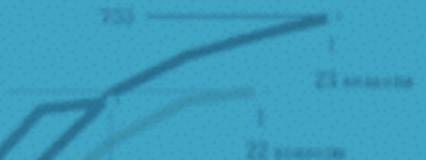
Every Bonds is being won at the career home run record. His record is only six more to tie Babe Ruth and 47 to equal Hank Aaron.

It's a remarkable home run



BEGINNING

According to accusations in a book about steroids, he began using steroids before the 1993 season. He hit 143 in the league two seasons after his 67 in home runs, surpassing Aaron's career pace.



20 seasons
Bonds was accused last season. He already had 147 games and 146 homers.

Homer Pace After Age 34

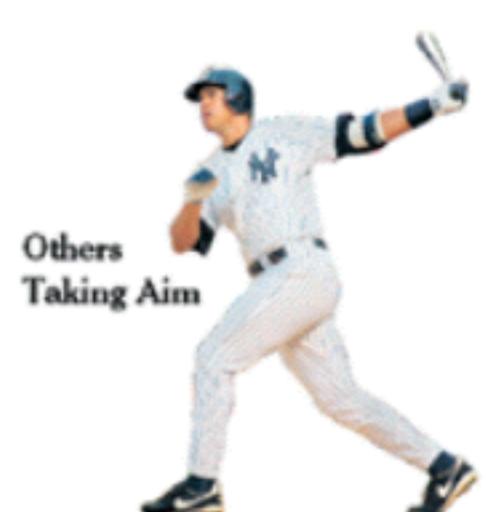
If the accusations are correct, Bonds was 24 in his first season on steroids. Here are projected home run paces for each player after age 34.

Accusations raised the number of previous five seasons



Note: Ages as of July 1 of each season

Others Taking Aim



Alex Rodriguez

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

Albert Pujols

Averaging 40 homers a season from age 20 to 34, he has started stronger than the three leaders did.

Ken Griffey Jr.

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

Differing Paths to the Top of the Charts

The top seven players on the career home run list, along with a look at Griffey (128), Rodriguez (378) and Pujols (led 2578).



755

Steroids or Not, the Pursuit Is On

Every Bonds hit seems like the closer home run is scored. He needs only six more to tie Babe Ruth and 47 to equal Hank Aaron.

Line shows cumulative home runs

Hank Aaron
755 home runs
23 seasons



Babe Ruth
714 home runs
22 seasons



Barry Bonds
709 home runs
20 seasons



BEGINNING

According to accusations in a grand jury about steroids, he began hitting records before the 1990 season. The 400 in the major leagues was passed when he hit 70 home runs, surpassing Aaron's career pace.



Homer Pace After Age 34

If the accusations are correct, Bonds was 26 in his first season on steroids. Here are projected home run paths for each player after age 34.

Legend: — Actual home runs
— Projected home runs

Aaron
Actual home runs: 755
Surface projected home runs for his 20 seasons:
714 (age 22), 753 (age 42)

Ruth
Averaged 46.4 home runs a season from age 30 to 34.
Averaged 42.5 for next four seasons:
709 (age 22), 714 (age 42)

Bonds
From age 35 to 39, he averaged 51.4 more home runs a season than projected:
709 (age 22), 714 (age 42)

Note: Ages as of July 1 of each season

Others Taking Aim

Alex Rodriguez
429 home runs
22 seasons

By about 2008, he'll have 429 home runs.

MIDDLE

Albert Pujols
Averaging 40 home runs 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.
However, he's limited by age.

Alex Rodriguez

429

22 seasons

Youngest to reach 400 homers.

Second most ever in first five seasons.

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 (led 257th).

Hank Aaron

755

Home runs by season

1954-74

1975-76

1977-78

1979-80

1981-82

1983-84

1985-86

1987-88

1989-90

1991-92

1993-94

1995-96

1997-98

1999-2000

Babe Ruth

714

Home runs by season

1914-24

1925-26

1927-28

1929-30

1931-32

1933-34

1935-36

1937-38

1939-40

1941-42

1943-44

1945-46

1947-48

1949-50

1951-52

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2057-2058

2058-2059

2059-2060

2060-2061

2061-2062

2062-2063

2063-2064

2064-2065

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2068-2069

2069-2070

2070-2071

2071-2072

2072-2073

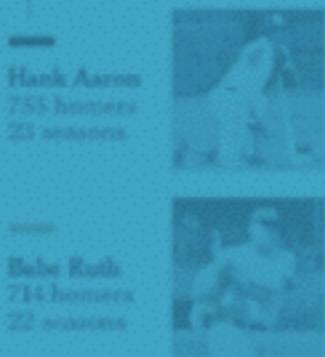
2073-2074

755

Steroids or Not, the Pursuit Is On

Barry Bonds is racing with the greatest home run record. Perhaps only six more to tie Babe Ruth and 47 to break Hank Aaron.

It's been a cumulative race since 1970.



BEGINNING

According to Allegations in a book about steroids, no player living averaged before the 1990 season, like Bonds did, 567 home runs over 20 seasons, taking his 167.3 home runs, surpassing Aaron's current total.



Bonds was accused last season. His 2005 total is 746 home runs.

Homer Pace After Age 34

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

PROJECTED BASED ON AVERAGE OF PREVIOUS SEASONS



Note: Ages as of July 5 of each season

Others Taking Aim

Alex Rodriguez
is ahead of
the pace set
by Ruth.
Aaron is
slowing down.

MIDDLE

Albert Pujols
averaging 49
home runs a
season, he has
scored stronger
than the three
leaders did.

Ken Griffey Jr.
Many thought he
would be the first
to match Ruth
and Aaron until
he was 37 and
then stopped.

END

Barry Bonds
708
Babe Ruth
714
Hank Aaron
755
Albert Pujols
201
Alex Rodriguez
429
Ken Griffey Jr.
606
Mark McGwire
566
Frank Robinson
566
Willie Mays
669
Sandy Koufax
386
Mike Schmidt
544
Ron Santo
530
Tom Seaver
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Mike Piazza
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Tim Raines
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Ozzie Smith
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Differing Paths to the Top of the Charts



END

Messaging

**Consistent
visual
frameworks.**
Keep things
tidy.

The Social Network



Black Swan



The King's Speech



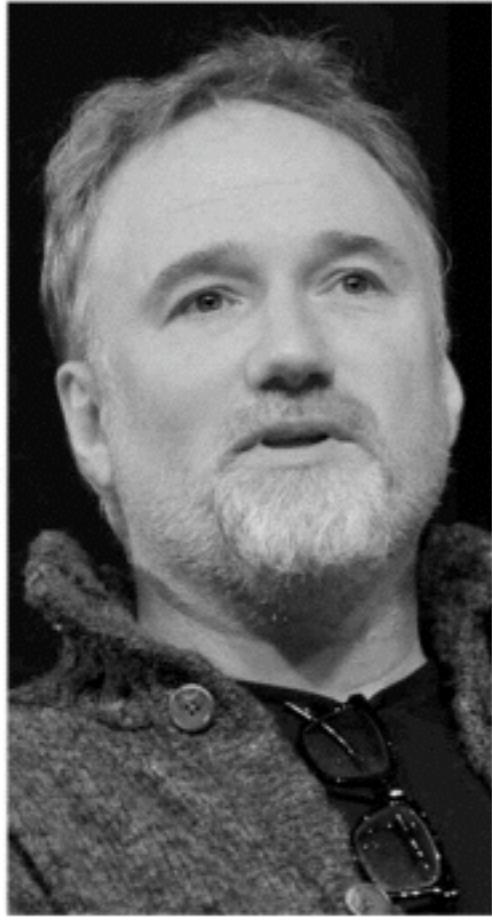
The Fighter



127 Hours



The Kids Are All Right



Guardian Review Observer Review Interview Interview Trailer More

8 nominations

Many people have the Golden Globes winner down as the film to rain on the king's parade. Its slick script and well-pitched performances impressed critics and picking a film about the internet may help Academy members feel like they have their fingers on the pulse

IMAGES: GETTY IMAGES, ALLSTAR/COLUMBIA PICTURES

Dodd-Frank One Year Later: The Key Players

When Dodd-Frank was signed into law a year ago, the lobbying in Congress moved to the regulatory agencies. Now financial firms are arguing with regulators and each other over the language of hundreds of rules that will determine how much Dodd-Frank will change the system.

[Explore the key players >](#)



Photos from Bloomberg, U.S. Chamber of Commerce, U.S. Securities and Exchange Commission

Source: Bloomberg reporting

Bloomberg
GOVERNMENT



Toy Story 3



The Social Network



True Grit



Inception



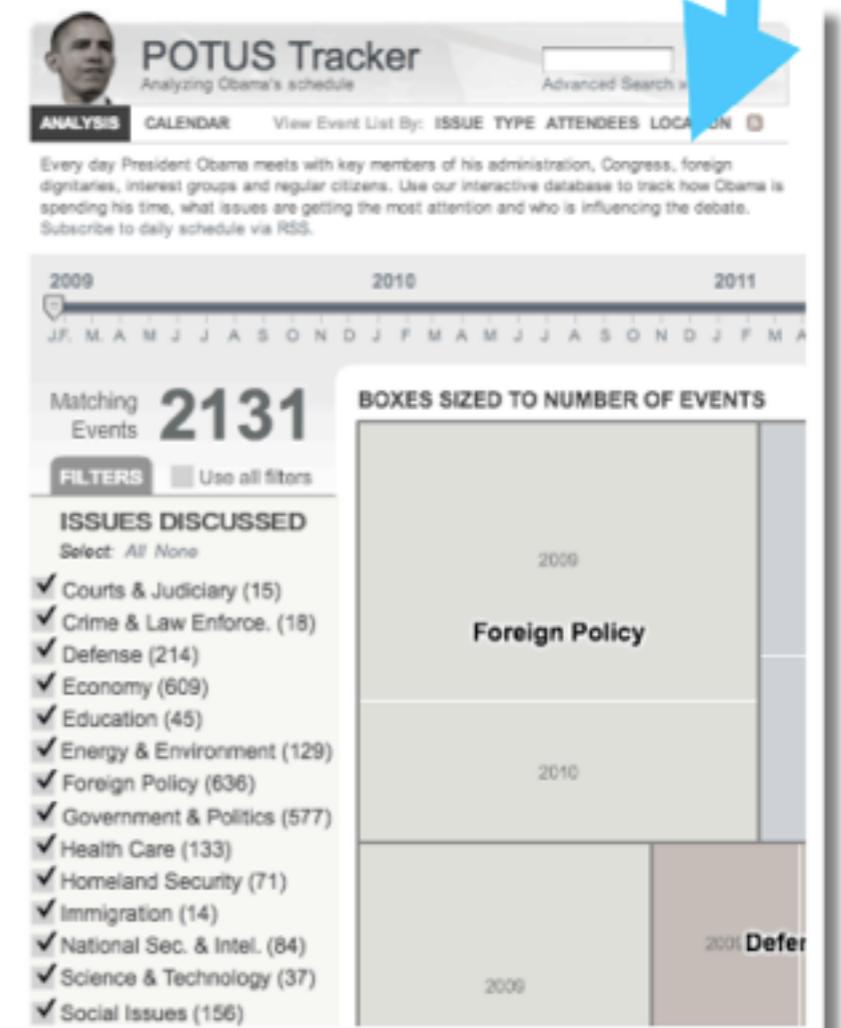
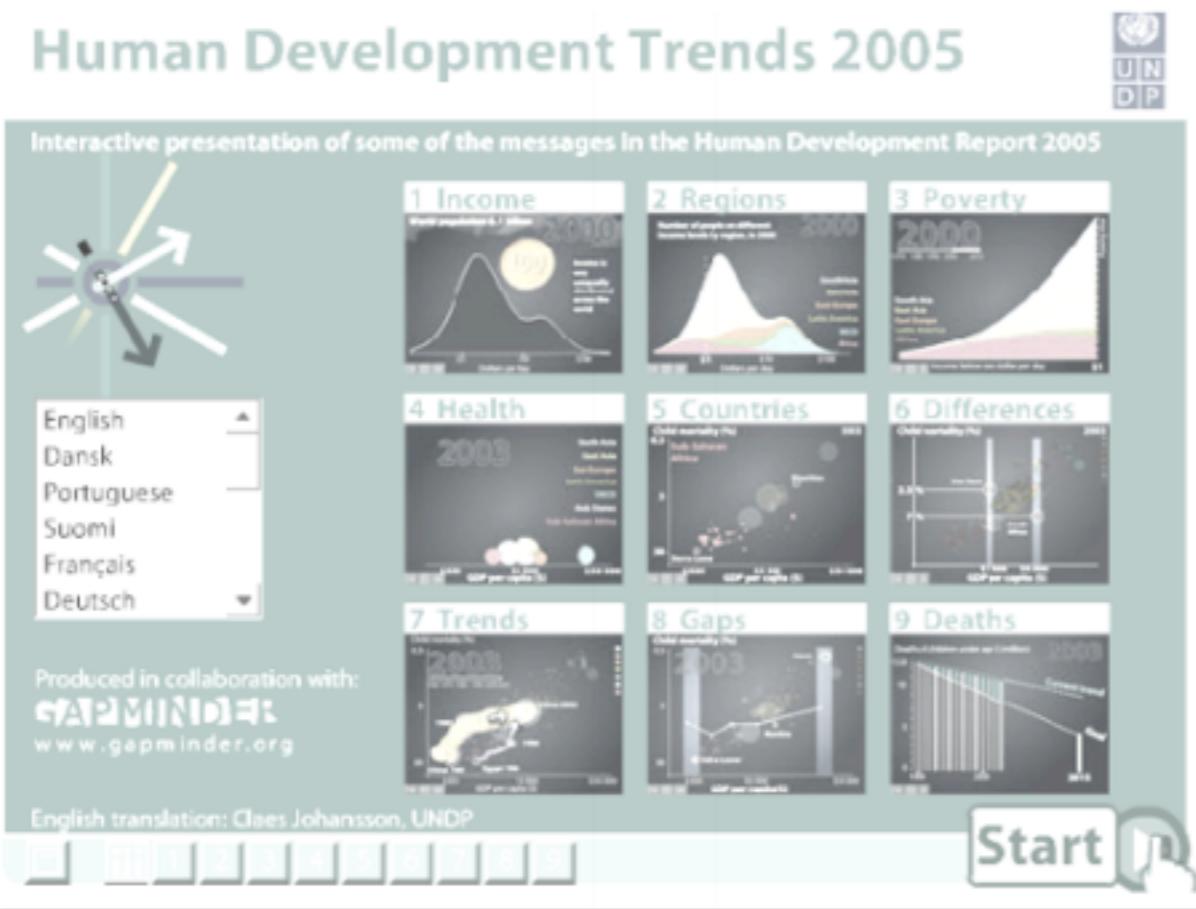
Winter's Bone

Make it clear where to start.
Don't let readers defect.



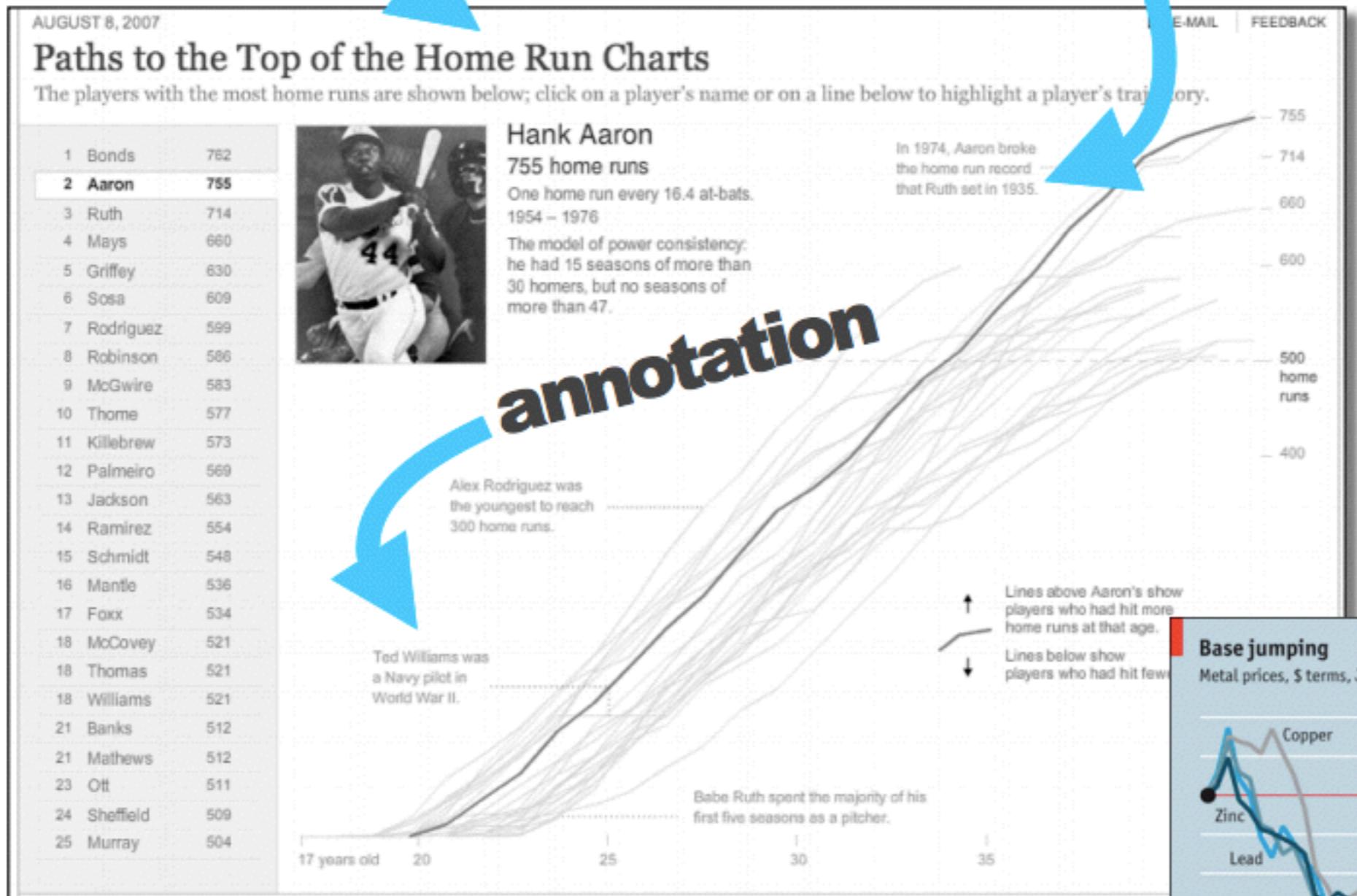
where?

Human Development Trends 2005



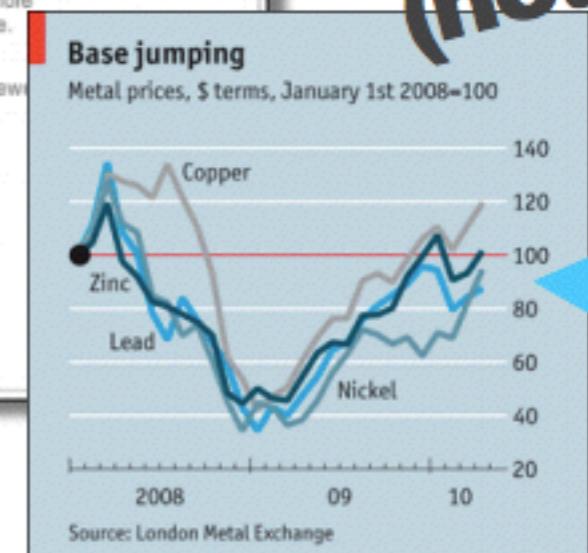
headline

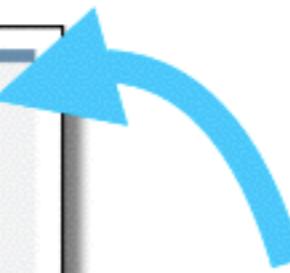
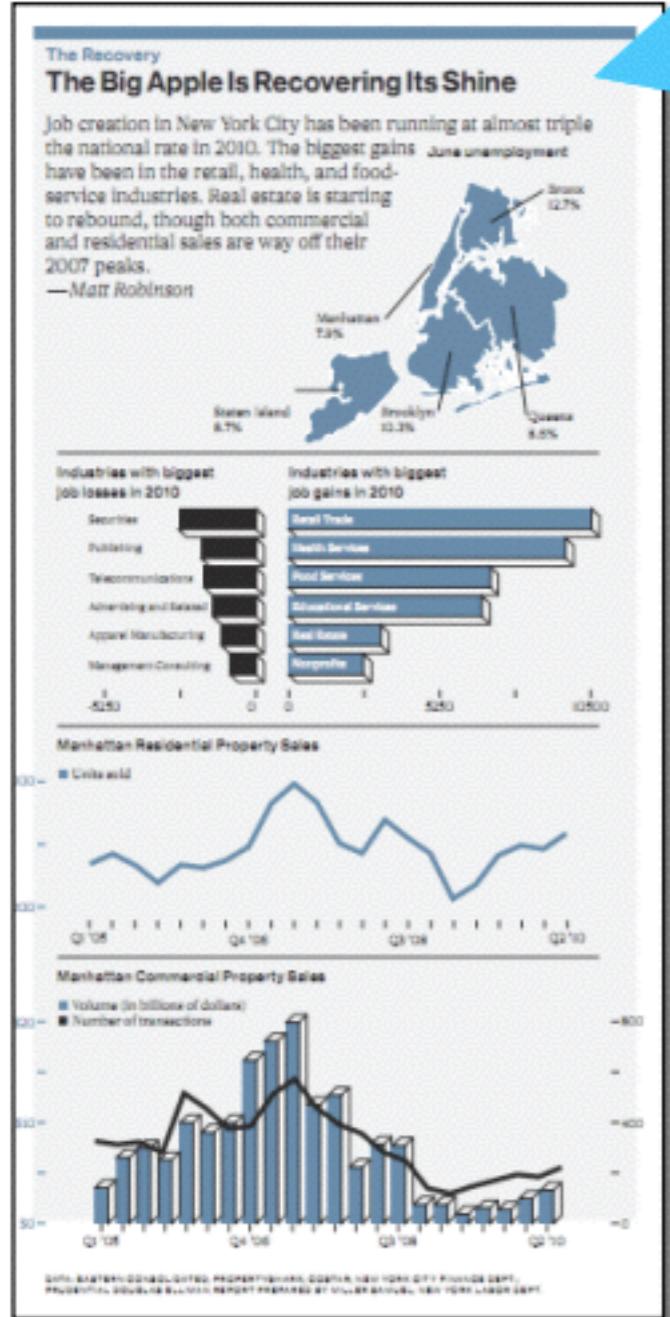
caption



Use headlines,
captions, &
annotations.

Quickly draw
attention to
what's
important.





isolated

Weave text into the graphic—not just at the beginning.

Text and graphics work better together than apart.

quite significantly to work than traditional metrics. To make this work more economical, visualizations need to stories that are either persistent or viral in order to generate traffic. **Persistent stories** cover "fertile themes" that maintain relevance over time (economics, food, crisis, food economics, the housing market).

Connect the text to the relevant graphics.

See Fig. 5

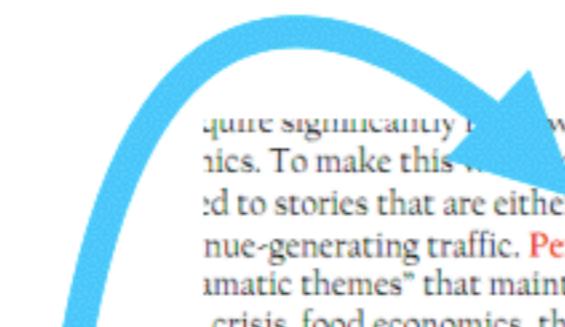
ology, personalities, or sensational news. To get the buck, produce visualizations for editorial content that is persistent or viral.

1.5 million women sued **Wal-Mart** for discriminatory pay & promotion practices, using mostly statistics to make their case.

Women filled 70% of hourly jobs...

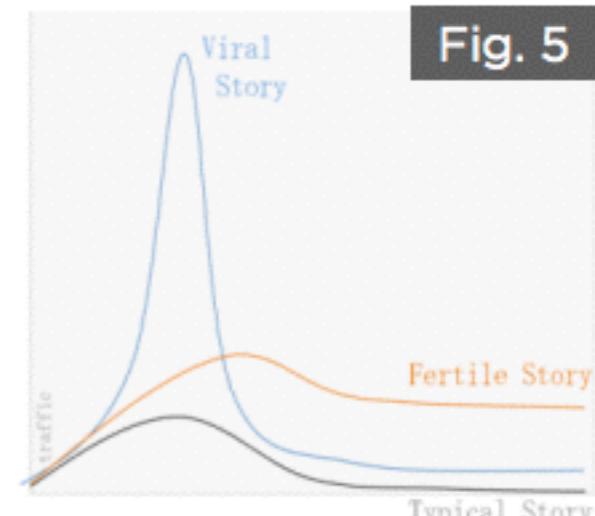
...but only 33% of management.

integrated

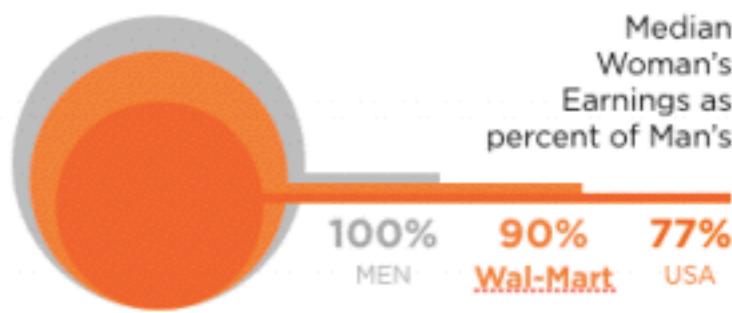


June 20, 2011

"fattens and elongates" ready fatter and longer than these visualizations several months and heavy traffic. These stories tend



But **Wal-Mart's** numbers showed their women fared better than elsewhere in the country.



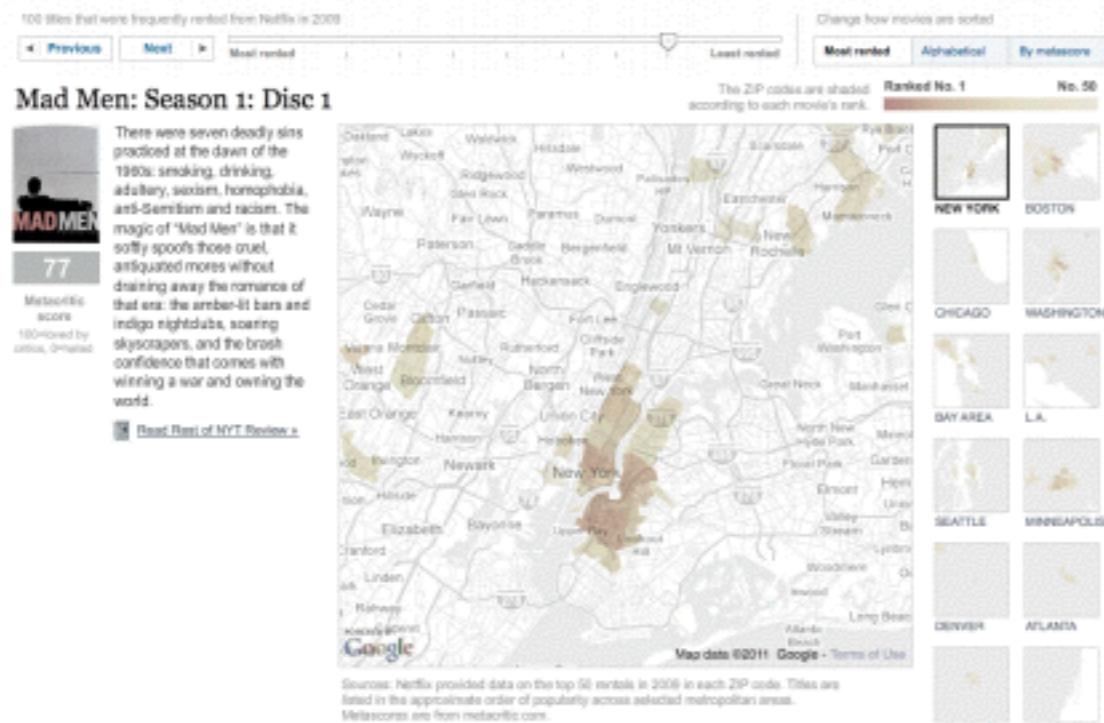
OurView The Supreme Court was **right**.

E. Segel

Published: January 8, 2010

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 editorially interesting view.
Default views can be boring.
Curate the experience from the beginning.

Make data relatable. Put numbers and facts in context.
250 thousand square miles means nothing.
It's the size of Texas!

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

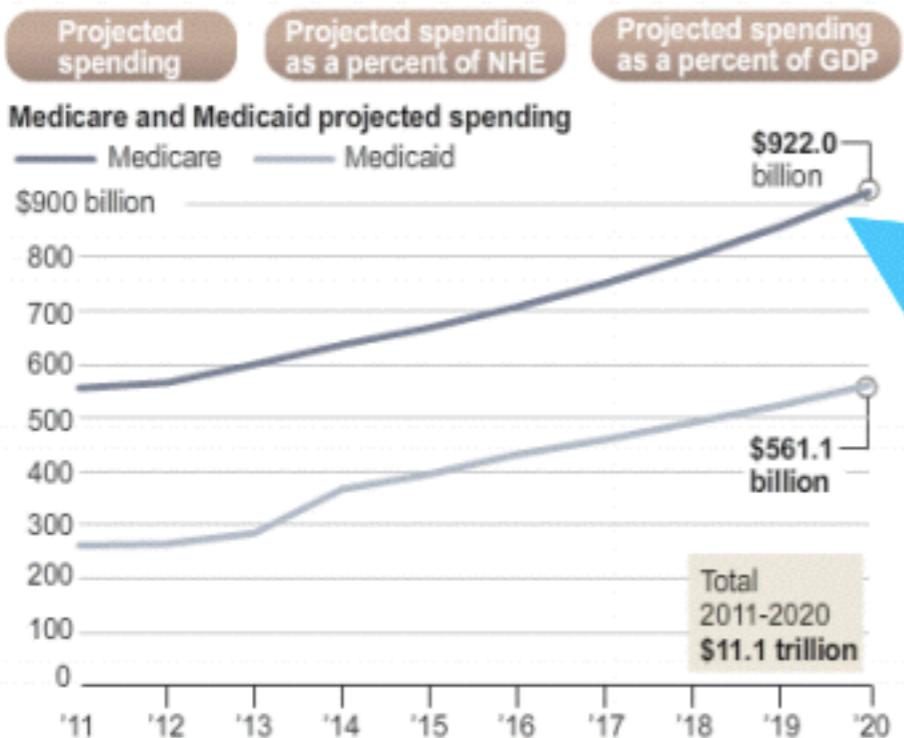
Aug 16, 2010

Mind your precision.
Significant digits, tickmarks, and labels suggest what deserves attention.

BGOV INTERACTIVE

Medicare and Medicaid Spending Show No Signs of Slowing Down

Centers for Medicare and Medicaid Services projects increases in spending compared to gross domestic product and national health expenditures.



Sources: Centers for Medicare and Medicaid Services, Bloomberg Government

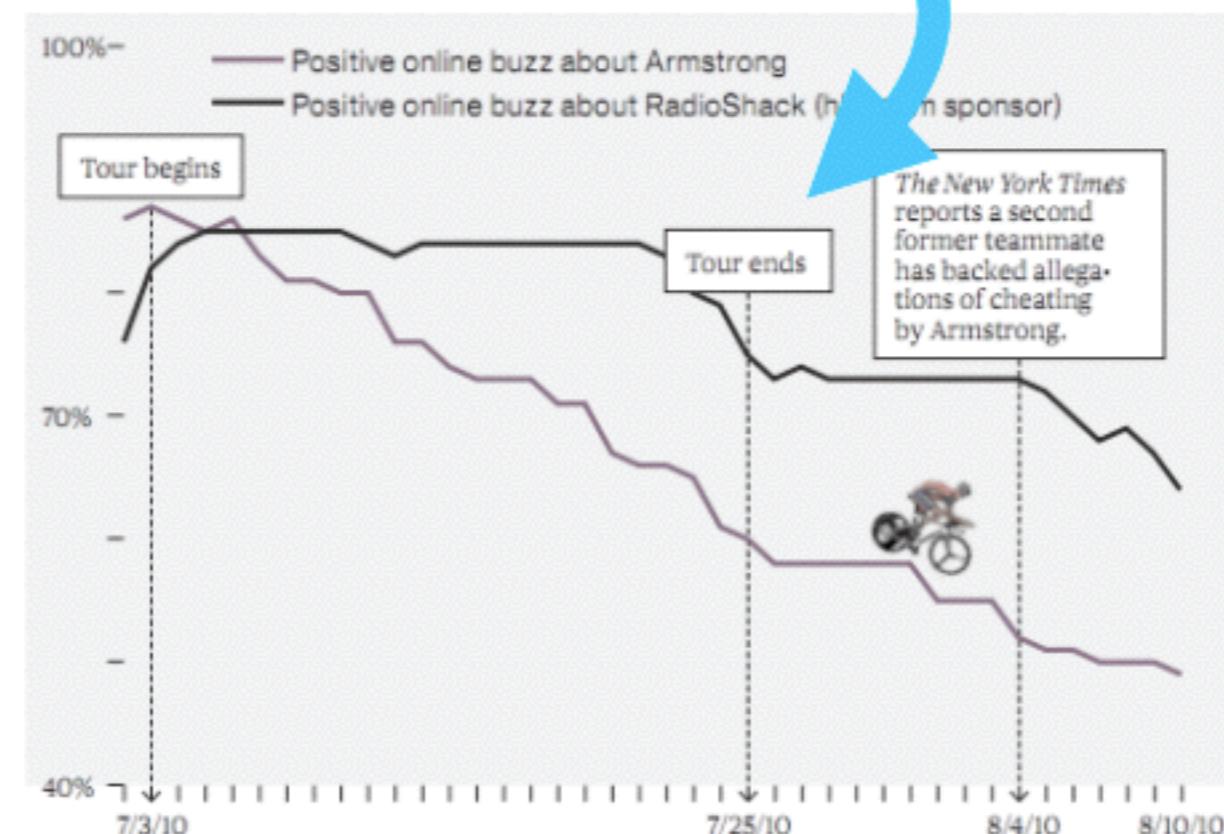
Graphic: Adrienne Lewis
BGOVgraphics@bloomberg.com

too precise

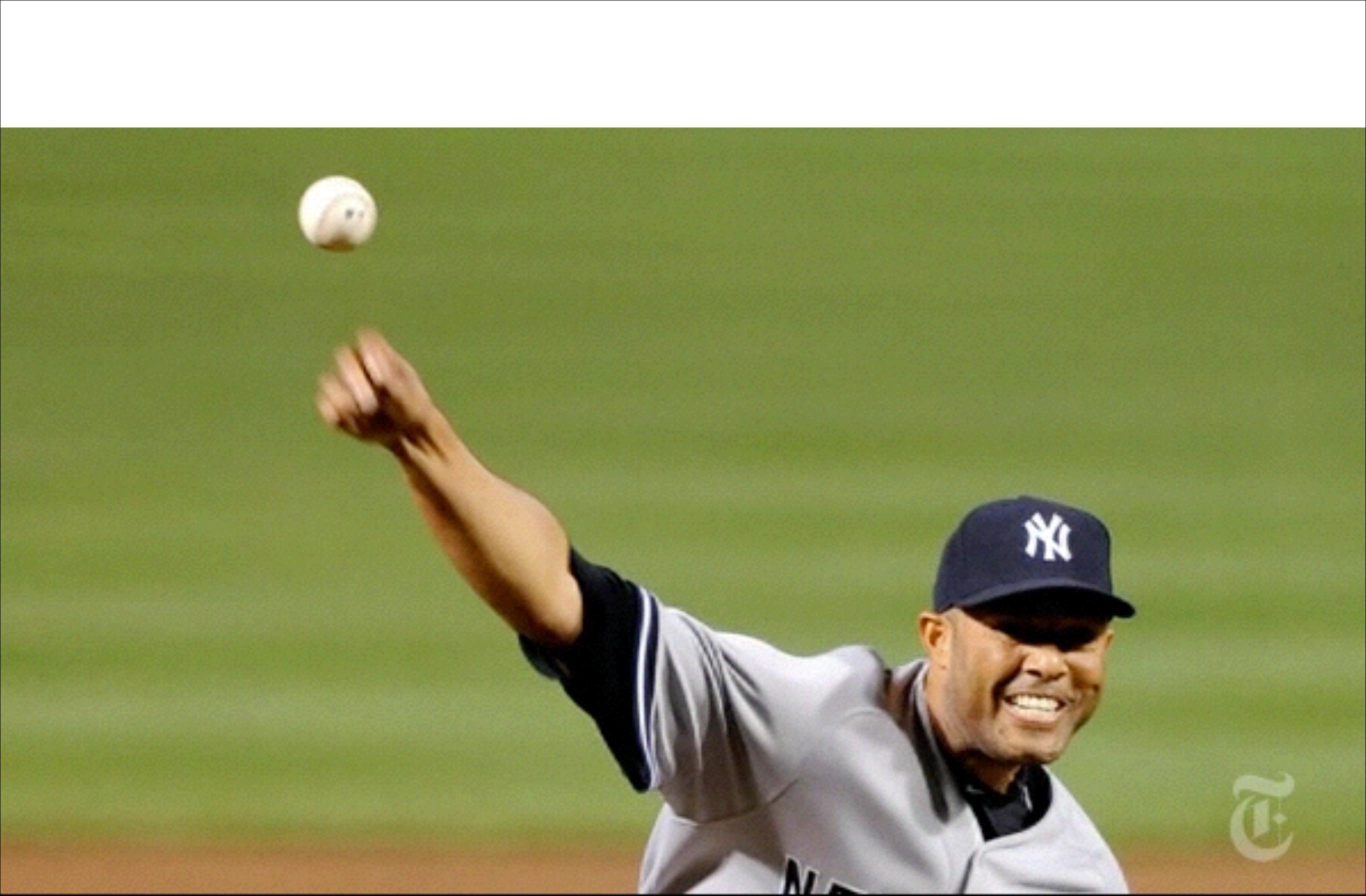
Representative	District	Fiscal 2010 contract spending
Mike Coffman	Colo. 6	\$3.26 billion
Doug Lamborn	Colo. 5	2.98 billion
Rob Bishop	Utah 1	2.76 billion
Kenny Marchant	Texas 24	2.58 billion
Jeff Duncan	S.C. 3	2.40 billion
Sandy Adams	Fla. 24	2.36 billion
Lamar Smith	Texas 21	1.65 billion
Steve Scalise	La. 1	1.49 billion
Jeff Landry	La. 3	1.47 billion
Roscoe Bartlett	Md. 6	1.44 billion
John Carter	Texas 31	1.42 billion

fine

thoughtful



Visual Storytelling



New York Times

Visual Storytelling

Narrative Visualization: Telling Stories with Data

Edward Segel and Jeffrey Heer

Abstract—Data visualization is regularly promoted for its ability to reveal stories within data, yet these “data stories” differ in important ways from traditional forms of storytelling. Storytellers, especially online journalists, have increasingly been integrating visualizations into their narratives, in some cases allowing the visualization to function in place of a written story. In this paper, we systematically review the design space of this emerging class of visualizations. Drawing on case studies from news media to visualization research, we identify distinct genres of narrative visualization. We characterize these design differences, together with interactivity and messaging, in terms of the balance between the narrative flow intended by the author (imposed by graphical elements and the interface) and story discovery on the part of the reader (often through interactive exploration). Our framework suggests design strategies for narrative visualization, including promising under-explored approaches to journalistic storytelling and educational media.

Index Terms—Narrative visualization, storytelling, design methods, case study, journalism, social data analysis.

1 INTRODUCTION

In recent years, many have turned to data visualization. New York Times, Washington Post, and other news organizations have integrated dynamic graphics into their journalism. Reporters use interactive visualizations to tell stories about global health and economic trends. A recent feature in The Economist highlights the potential of data and notes that visualization is “the new computer science, statistics, and economics.”

Static visualizations have traditionally been used usually in the form of diagrams or infographics, often accompanied by text. In this format, the visualization typically provides supporting evidence for a particular claim or argument. A new class of visualizations attempts to combine the strengths of both graphics and text. Storytellers, especially online journalists, are integrating complex visualizations into their narratives.

Crafting successful “data stories” requires skills like those familiar to narrative writers: knowledge of computer engineering, data science, and communication, as well as an understanding of how people process information.

collection to include visualizations that contained clear sequences of narrative events, a diversity of visualization genres (e.g., flow charts, slide shows), and a range of interaction strategies (e.g., filtering, timelines). Using these criteria, we sampled from our initial larger pool of examples to arrive at the resulting 58 items featured in Fig. 7. However, we do not claim that our sample is exhaustive, as we did not canvas other potential sources such as video games or e-learning tools.

The table uses dark blue and a plus-sign (+) to indicate the presence of a particular feature; light blue and a minus-sign (-) indicate that an example does not use that feature. In some cases a cell is colored grey to indicate that a design feature is precluded by the medium rather than omitted by explicit design choices. For instance, we did not analyze visualizations on printed paper with respect to interactivity or animation. That said, some workarounds to medium limitations are possible: comics can use a multi-panel series of increasing close-ups to convey the same effect as camera zoom [20], and static visualizations might employ a choose-your-own-adventure format to allow viewers to determine their own path through the content.

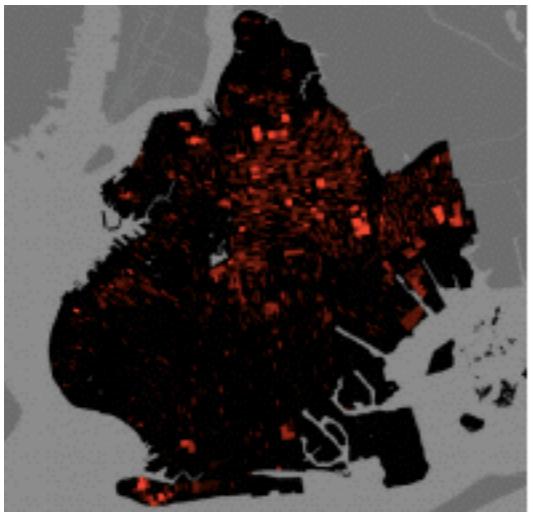
We arrived at our categories after much iterative organization (e.g.,



Fig. 8. Genres of Narrative Visualization.

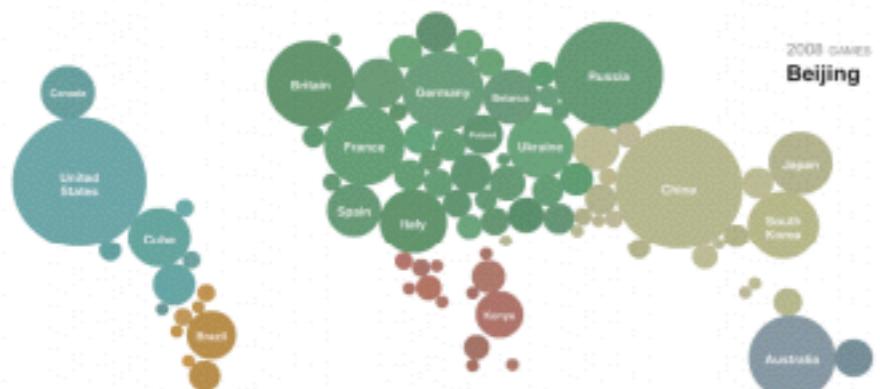
The first pattern can be observed by the clusters of dark blue in the ordering section, suggesting clear differences between how visualizations guide the viewer through their content (Figure 7(1)). These clusters correspond to narrative formats such as slide shows, comic strips, annotated graphs, and others. We use these ordering types to identify distinct genres of visual narratives in Section 4.3.

The second pattern highlights the consistency in interaction design

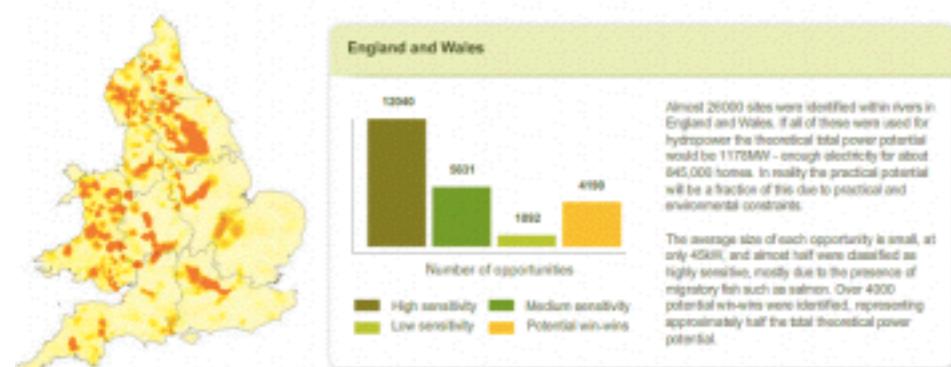
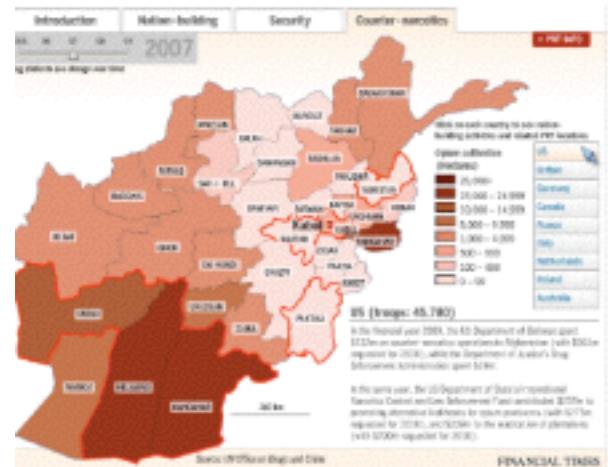


GEOGRAPHIC VIEW BY RANKING

1996 1998 1994 1992 1990 1988 1986 1984 1982 1980 1978 1976 1974 1972 1970 1968 1966 1964 1962 1960 1958 1956 1954 1952 1950 1948 1946 1944 1942 1940 1938 1936 1934 1932 1930 1928 1926 1924 1922 1920 1918 1916 1914 1912 1910 1908 1906 1904 1902 1900 1998 1996



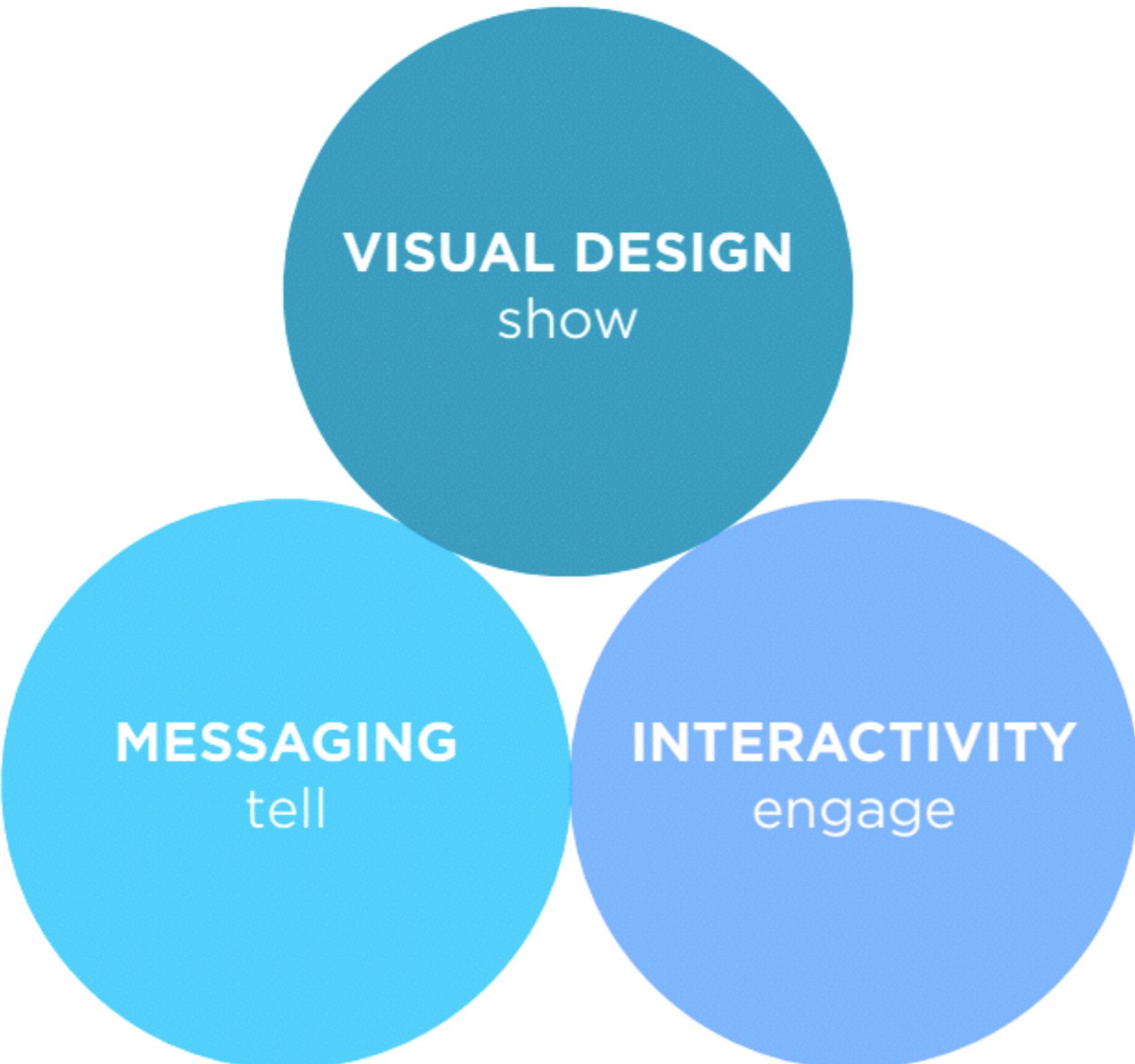
2008 Medal Count



58

CASE STUDIES

70% Journalism
20% Business
10% Research



VISUAL DESIGN
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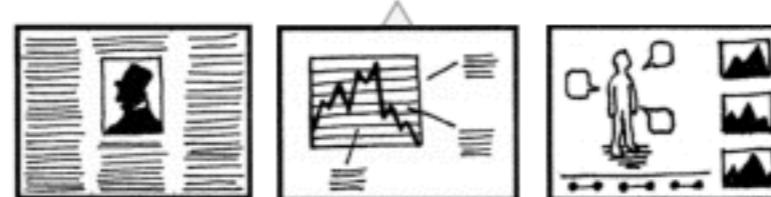
MESSAGING

tell

INTERACTIVITY

engage

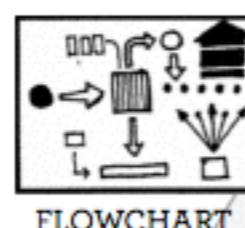
Visual Design



MAGAZINE
STYLE

ANNOTATED
CHART

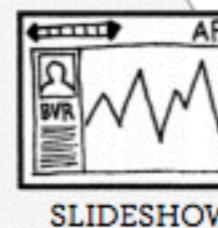
SCIENCE FAIR
POSTER



FLOWCHART



COMICSTRIP



SLIDESHOW



MOVIE

7 Genres

Duo-Specific

Captions

Annotations

Attached Article

Summaries

Interpret

Headlines

Tacit Tutorial

Selection

Navigation

Details on Demand

Timelines

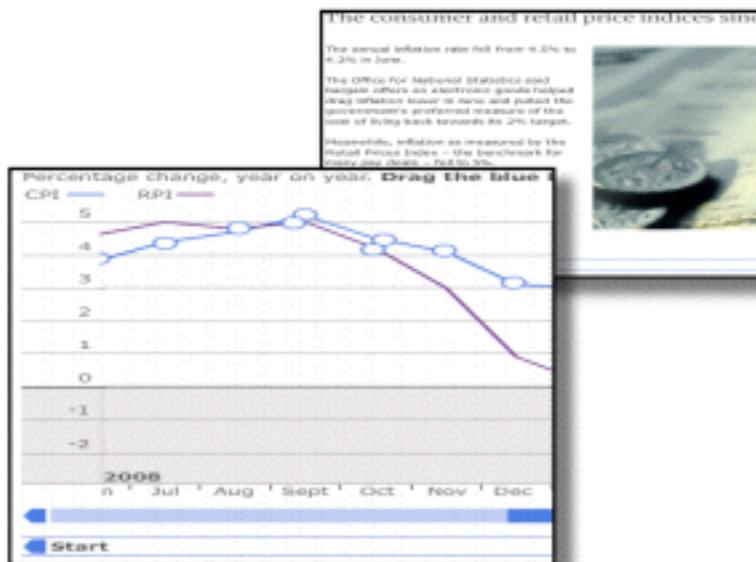
Filtering

Highlighting

Messaging

Interactivity

Genres + Interactivity + Messaging = DESIGN SPACE



martini
glass

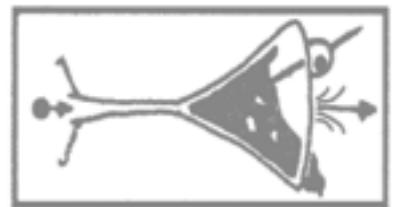


interactive
slideshow



drill-down
story

The Martini Glass



Fathom

Interactive Slideshow



Published: February 2, 2010

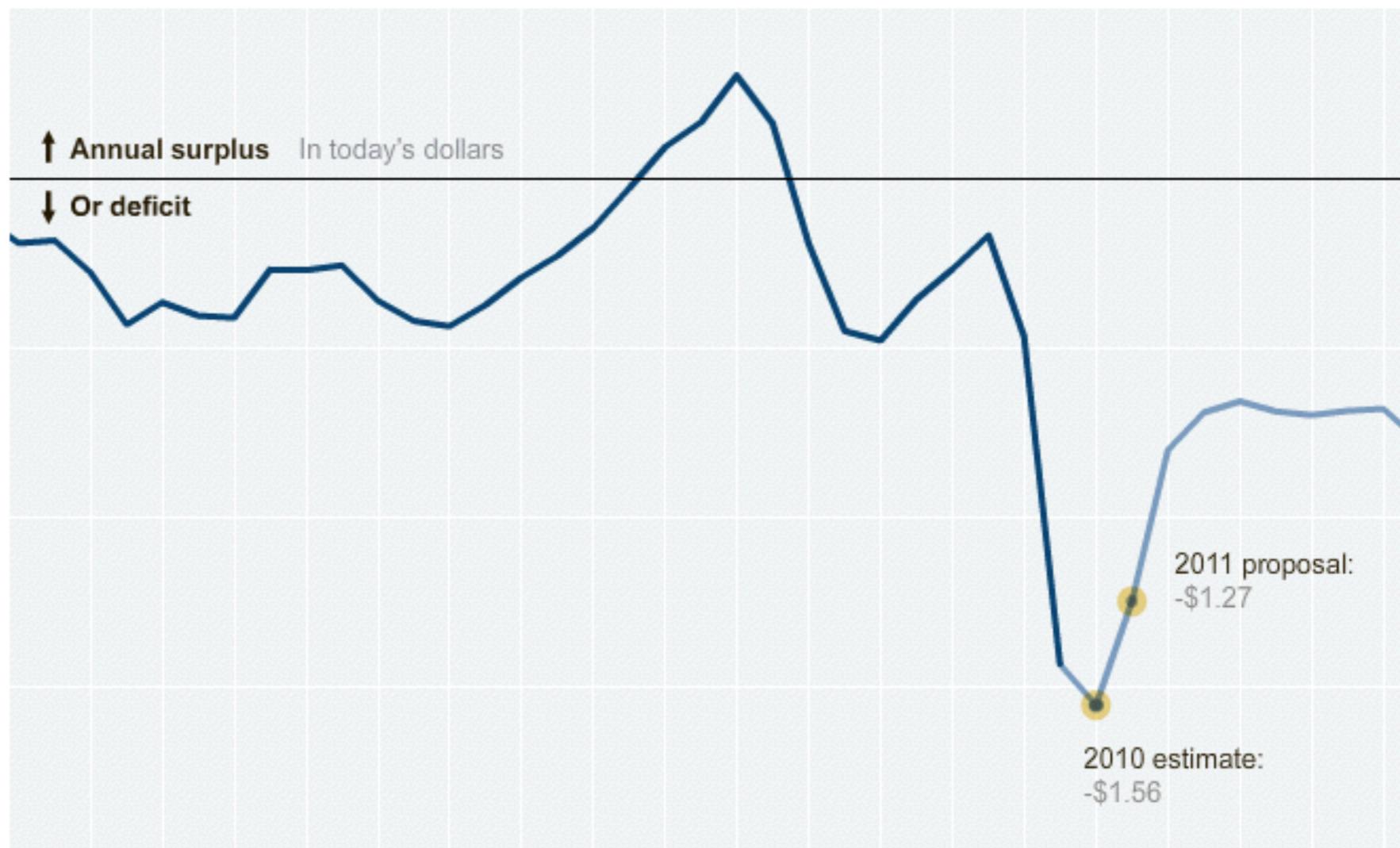
Budget Forecasts, Compared With Reality

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

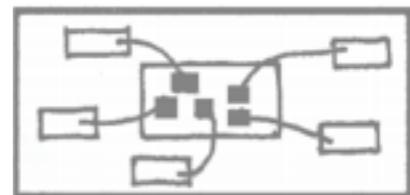
1 2 3 4 5 6 **NEXT ▶**

Falling short

President Obama's budget proposal estimates a deficit of \$1.6 trillion for the current fiscal year and \$1.3 trillion in 2011.



Drill Down Story



On the Map: Five Major North Korean Prison Camps

North Korea has operated political prison camps for more than 50 years, twice as long as the Gulag in the former Soviet Union. People suspected of opposing the government are forced to do slave labor in the camps, which hold an estimated 200,000 prisoners. North Korea's government says the camps don't exist, but high-resolution satellite images show otherwise.

Click on the map markers below for more information on each site.

RELATED

- Article: On the Diplomatic Back Burner
- Google Earth: North Korea Uncovered

Now Viewing: Overview Up Close: Camp 15

Major Prison Camps

The existence of five main camps has been confirmed by survivors, escapees and former guards. Most prisoners work 12-hour days, making military uniforms, felling trees or tilling fields until they die of malnutrition-related illnesses, usually before the age of 50. North Korea allows no outsiders into the remote, mountainous camps.

Learn more about five major prison camps at right, or take a closer look at life in Camp 15.

Scale varies in this perspective.
Distances from Pyongyang: 120 miles to Seoul, 427 miles to Vladivostok

SOURCES: North Korea Uncovered; Korean Bar Association ("2008 White Paper on Human Rights in North Korea"); "The Hidden Gulag," David Hawk, U.S. Committee for Human Rights in North Korea; Joshua Stanton, One Free Korea; interviews with former prisoners and guards; Satellite Images: Google Earth; GRAPHIC: Kat Downs, Blaine Harden, Liz Heron, Laris Karklis and Francine Uenuma - The Washington Post

THE DEFENSE OF THE NEIGHBORS

An overview of the armed forces of countries around Brazil

Brazil has the strongest armed forces in South America in absolute terms—

ARMED FORCES

(Thousands of people)

Brazil	367.9
Colombia	254.2
Venezuela	115.0
Peru	114.0
Argentina	76.0
Chile	65.0
Ecuador	57.1
Bolivia	46.1

DEFENSE BUDGET

(Billions of US\$ a year)

Brazil	21.6
Colombia	7.1
Chile	4.6
Venezuela	2.6
Argentina	2.1
Peru	1.2
Ecuador	0.9
Bolivia	0.2

POPULATION

(Millions of people)

Brazil	190.0
Colombia	44.2
Argentina	40.3
Peru	28.6
Venezuela	26.0
Chile	16.3
Ecuador	13.7
Bolivia	9.1

—but not in relative terms

ARMED FORCES EMPLOYEES PER 1,000 PEOPLE

Colombia 5.8

Bolivia 5.1

Venezuela 4.4

Ecuador 4.2

Chile 4.0

Peru 4.0

Brazil 1.9

Argentina 1.9

PER CAPITA SPENDING IN ARMED FORCES (in US dollars a year)

Chile 282.2

Colombia 161.5

Brazil 113.7

Venezuela 100.0

Ecuador 61.2

Argentina 50.9

Peru 41.9

Bolivia 17.6

MONEY SPENT ON EACH ARMED FORCES EMPLOYEE (in US dollars a year)

Chile 70.8

Brazil 58.7

Colombia 28.1

Argentina 27.0

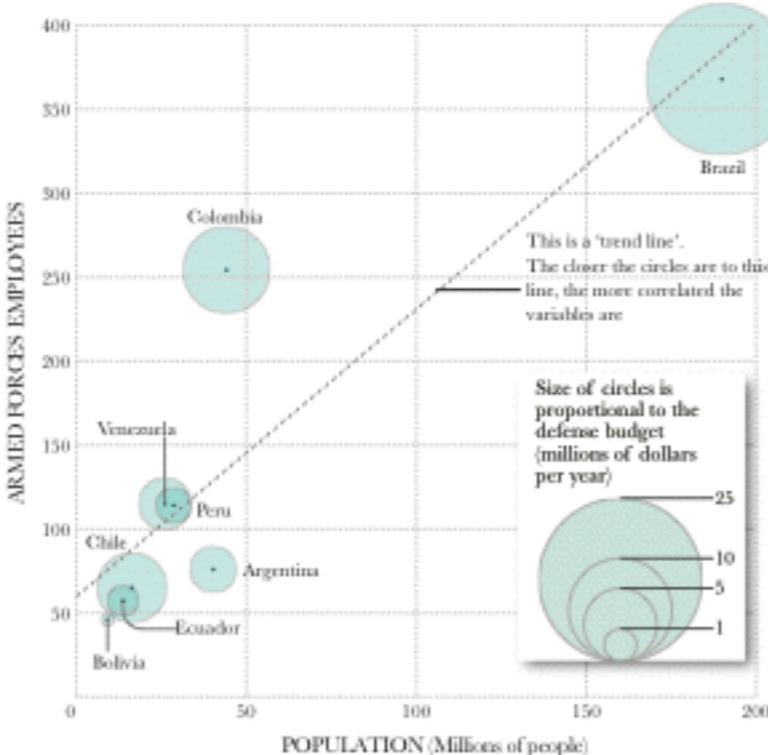
Venezuela 22.6

Ecuador 16.1

Peru 10.5

Bolivia 3.5

A different look at the data



Future investments

COLOMBIA
will improve its armed forces in the next few years. It will invest \$30 billion dollars to buy Brazilian fighters, Russian tanks, and Spanish propelled rockets.

ECUADOR
will not make significant investments in the near future

PERU
will invest in an upgrade of its air force

CHILE
will buy several AS332 planes and Leopard tanks

VENEZUELA
will keep buying Russian vehicles, such as Su-30 fighters and armored gunships. It will also buy several Kilo class submarines.

BRASIL
will finish building a 250 Leopard tank force, and keep modernizing its F-5 fighters. It will also buy an undisclosed number of combat planes

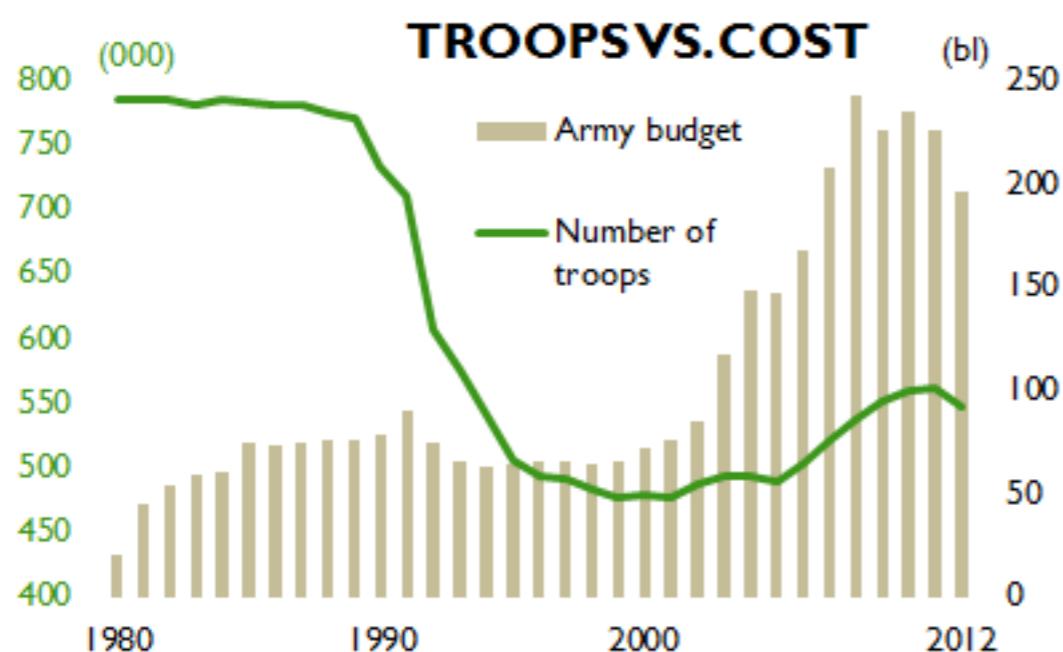
BOLIVIA
will not make significant investments in the near future

ARGENTINA
has announced that it will modernize its fleet of tanks and fighters

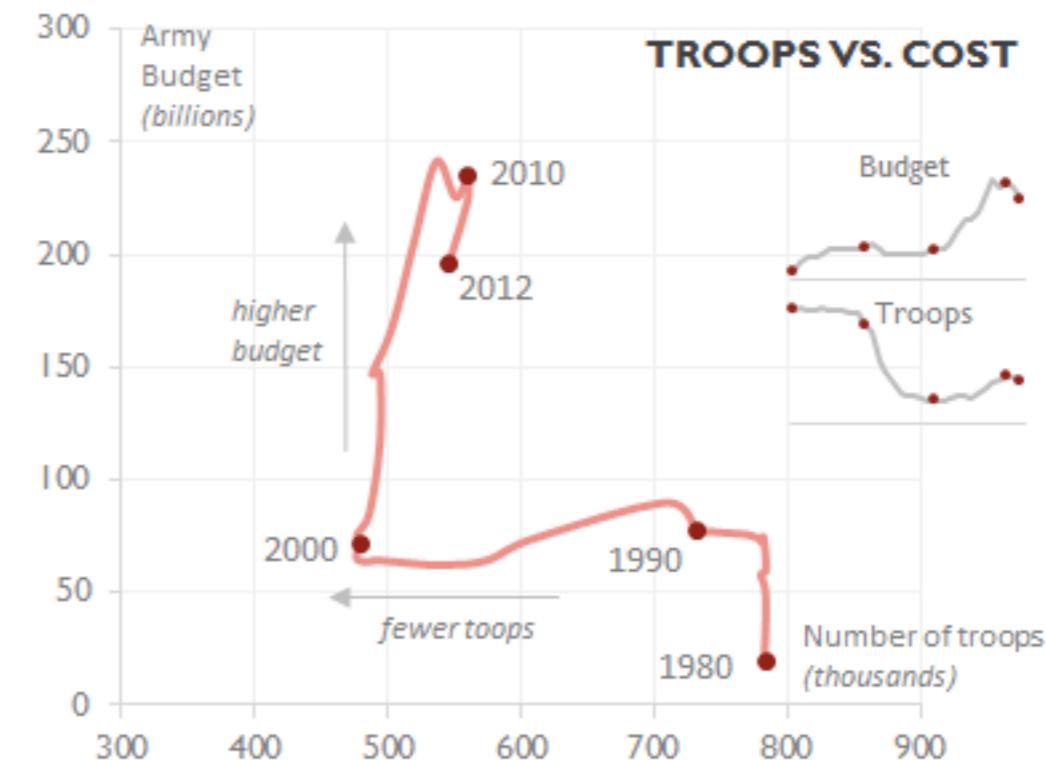
Alberto Cairo

Connected Scatterplots

Time Magazine



Redesign



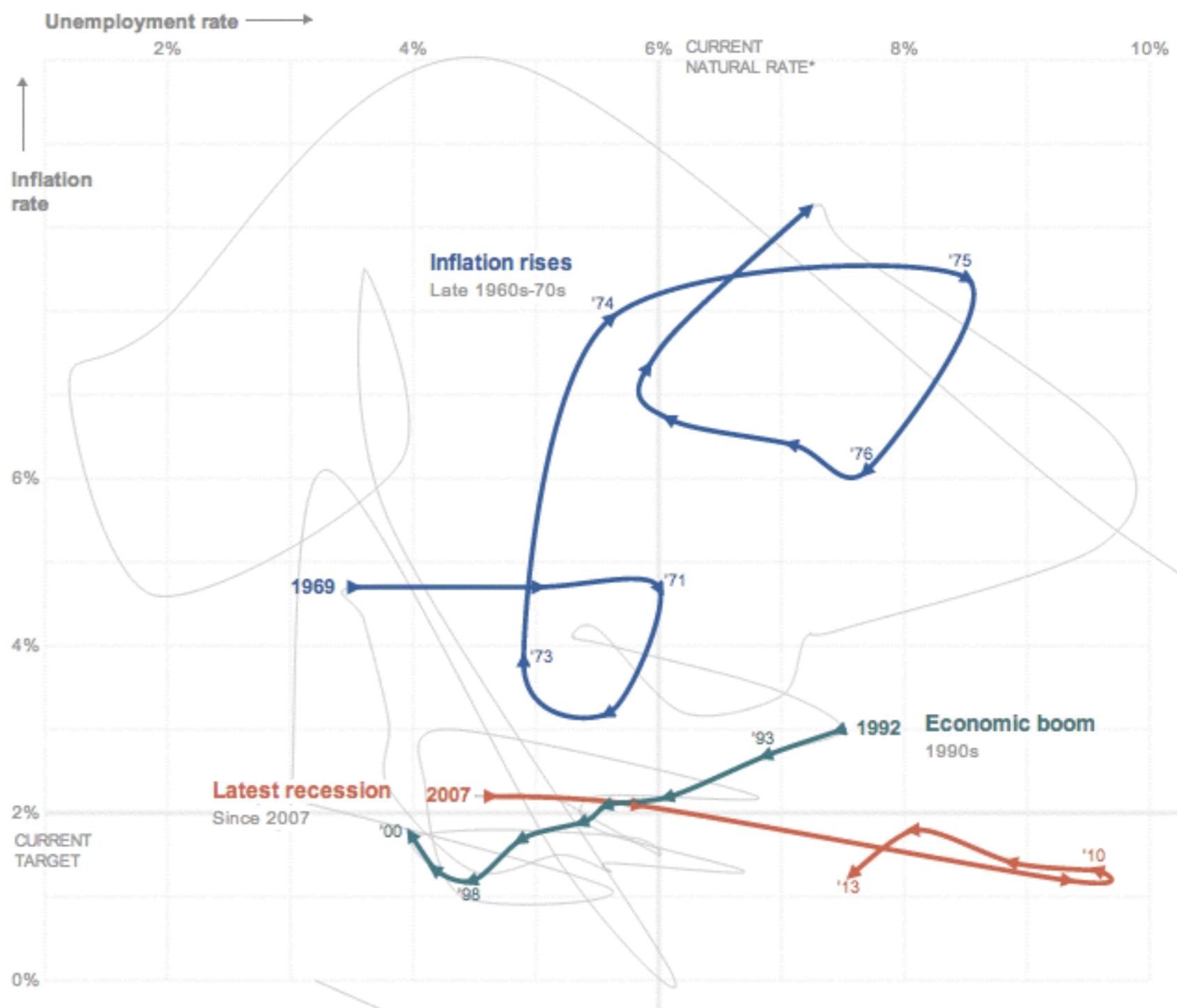
Janet L. Yellen, on the Economy's Twists and Turns

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

Inflation and unemployment

The Federal Reserve is said to have a “dual mandate”: keeping inflation in check and the unemployment rate low. These measures, which tend to change cyclically and in concert with each other, are charted for every year since the Great Depression.

In speeches and in meetings, Ms. Yellen, the nominee for the next Fed leader, has commented on the Fed's actions during significant periods, providing a window into her views and priorities.



*The natural rate of unemployment is defined as the lowest sustainable level of unemployment over the long term. If the rate is pushed any lower than the natural level, wages and prices would rise.

When the Brazilian Economy Improves, Inequality Doesn't Drop

The graphic below shows the correlation between Brazilian GDP (horizontal axis) and inequality (vertical axis) between 1981 and 2010. The position of the points, each representing a year, depends on how high GDP and inequality were. You can notice, for instance, that the economy grew between 1986 and 1989 because the line tends to move to the right, but inequality also grew, as the point representing 1989 is much higher than the ones before. You can also see that, during Lula da Silva's government, the economy expanded almost as much as during the terms of the other presidents who preceded him combined.

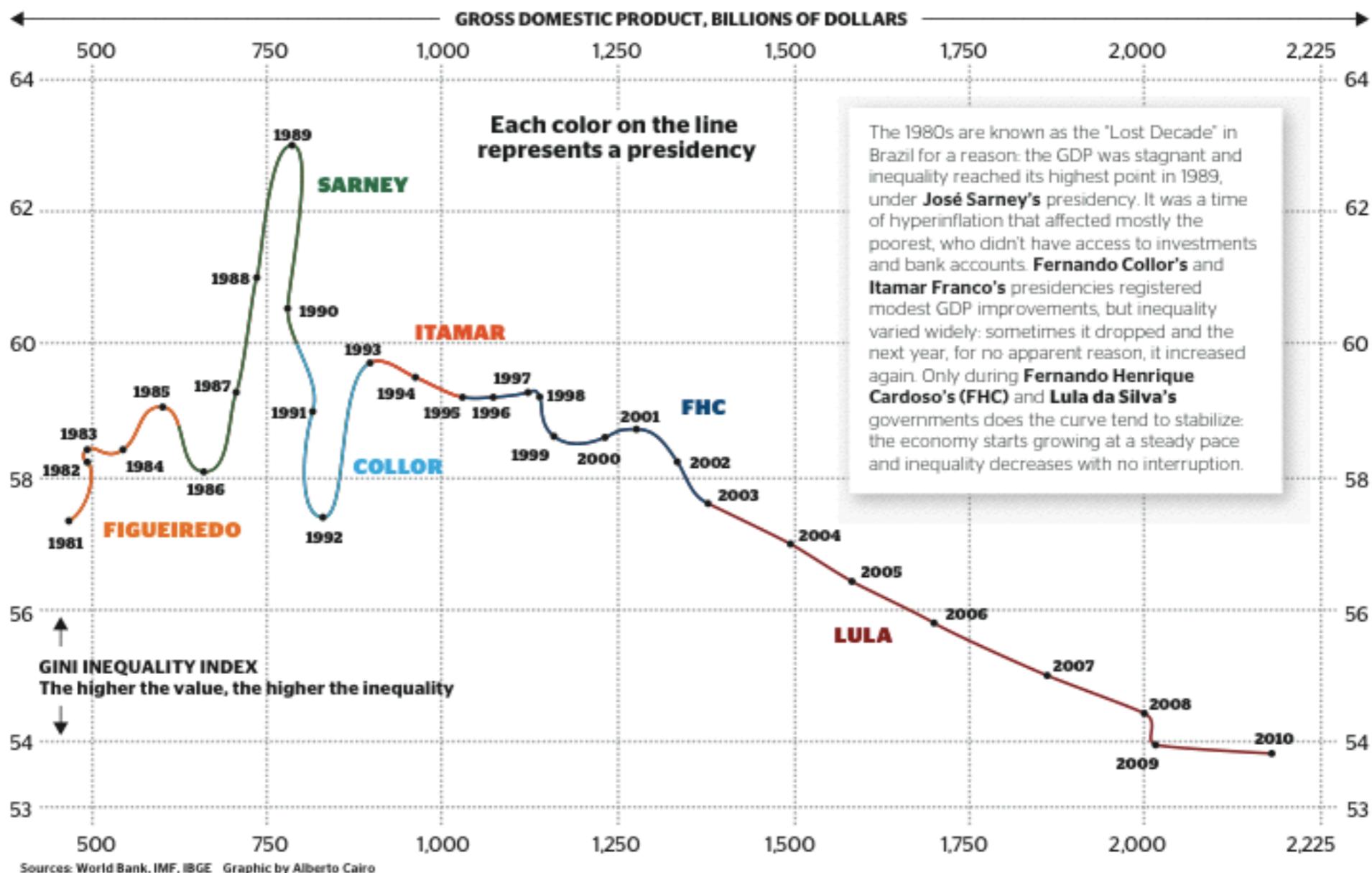


Figure 3 Época magazine. The co-variation of inequality and economic growth (Translated from Portuguese.) Reproduced with permission.

Examples

WHERE THERE'S SMOKE—THERE'S CANCER

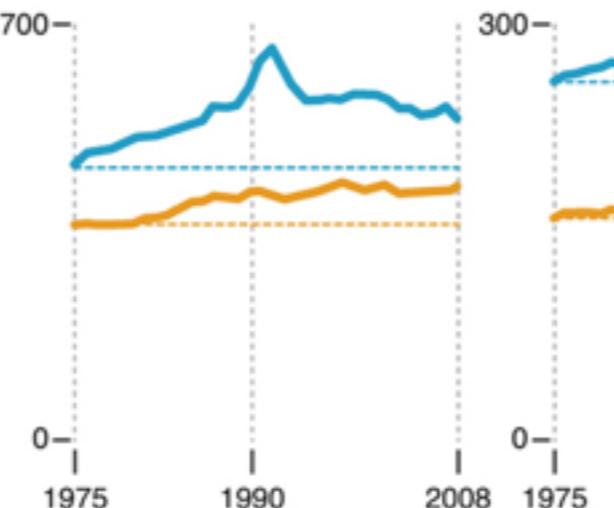
Cancer rates are up, but mortality is down. New diagnostics and treatments are responsible for part of this trend. But the greatest single contributing factor is the decline in smoking—rates are at their lowest level in 50 years.

Men Women

1 Increased incidence

An aging population contributes to rising incidence of cancer.

Cancer incidence rates (per 100,000)

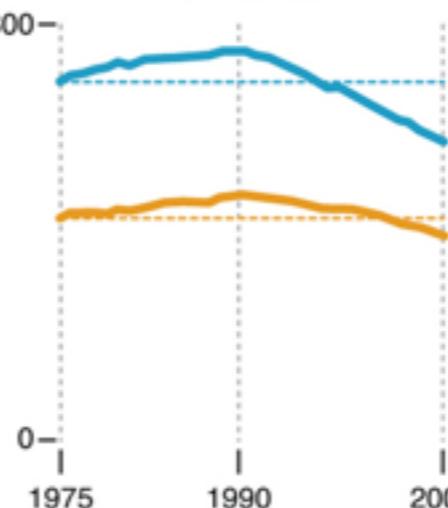


2 Fewer deaths

Cancer deaths have been dropping since 1991, especially in males.

Cancer death rates (per 100,000)

OVERALL

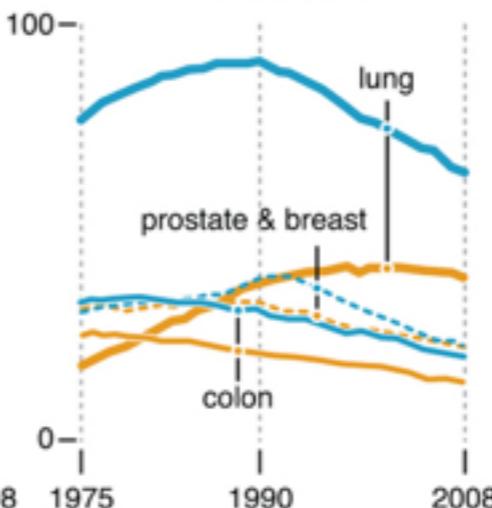


3 Decline of lung cancer

Drop in lung cancer deaths in males is the primary reason why death rates are down.

Cancer death rates (per 100,000)

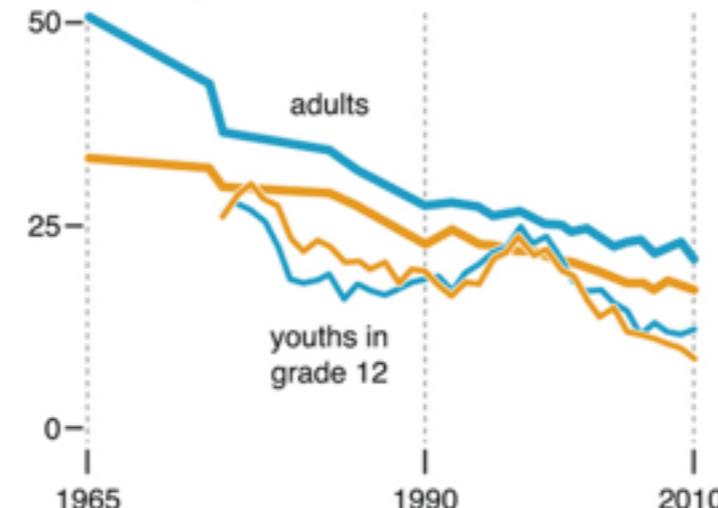
BY CANCER



4 Decline in smoking

Since the 1964 first Surgeon General's report, smoking rates have been dropping. By 2010, the rate among males was down to 20%, from 50% at its peak. Among youths, rates have been on an even steeper decline since 1997.

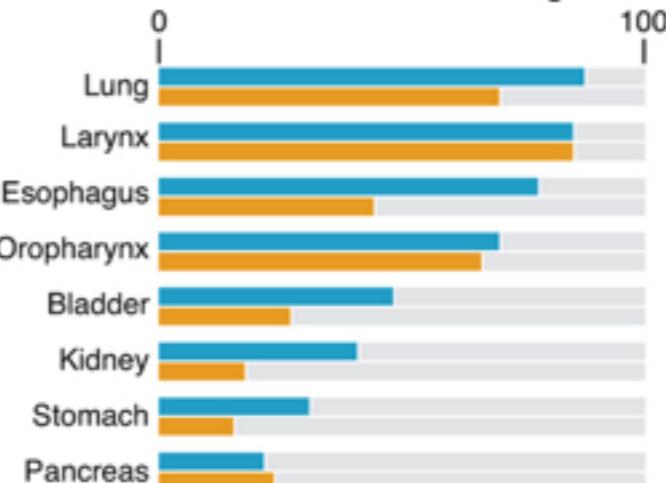
Smoking prevalence (%)



5 Impact of smoking on cancer deaths

Smoking is a major risk factor for many types of cancer and significant contributor to cancer-related deaths. It remains the single largest preventable cause of disease and premature death in the US.

Percentage of cancer deaths attributable to smoking



U.S. GUN DEATHS IN

2013 2010

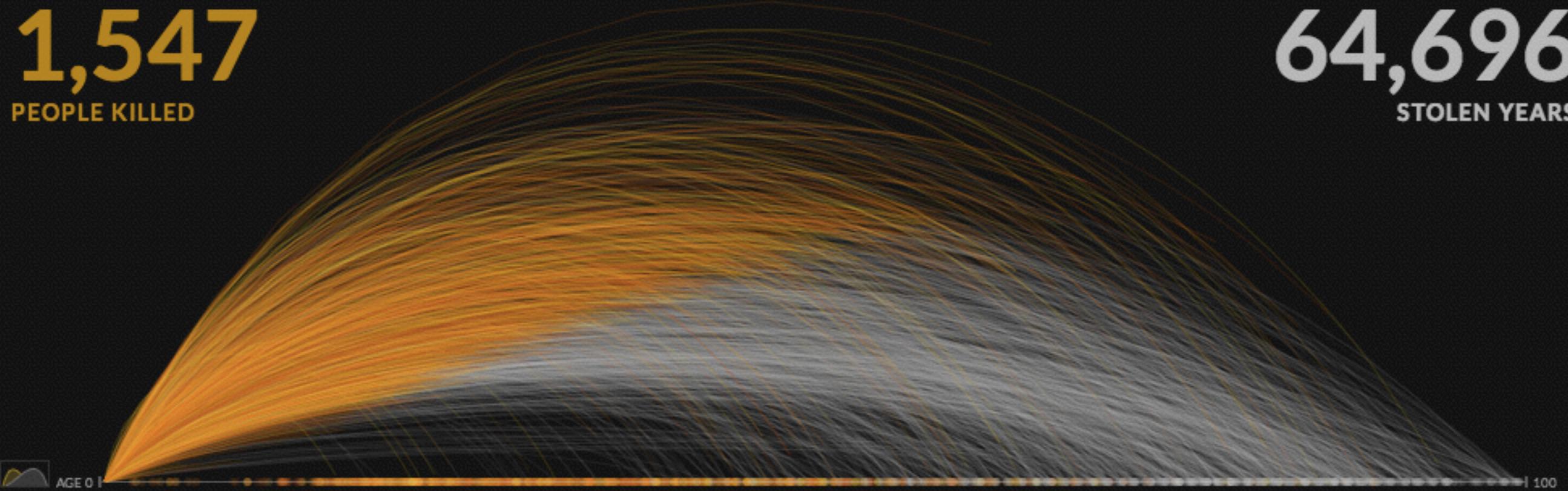
FEBRUARY

1,547

PEOPLE KILLED

64,696

STOLEN YEARS



SEX

AGE GROUP

REGION

TIME

A public service provided by

PERISCOPIC

Sources and Methods



Out of Sight, Out of Mind.

ATTACKS VICTIMS NEWS INFO

PAKISTAN

ESTIMATED TOTAL FATALITIES 3115

SHARE

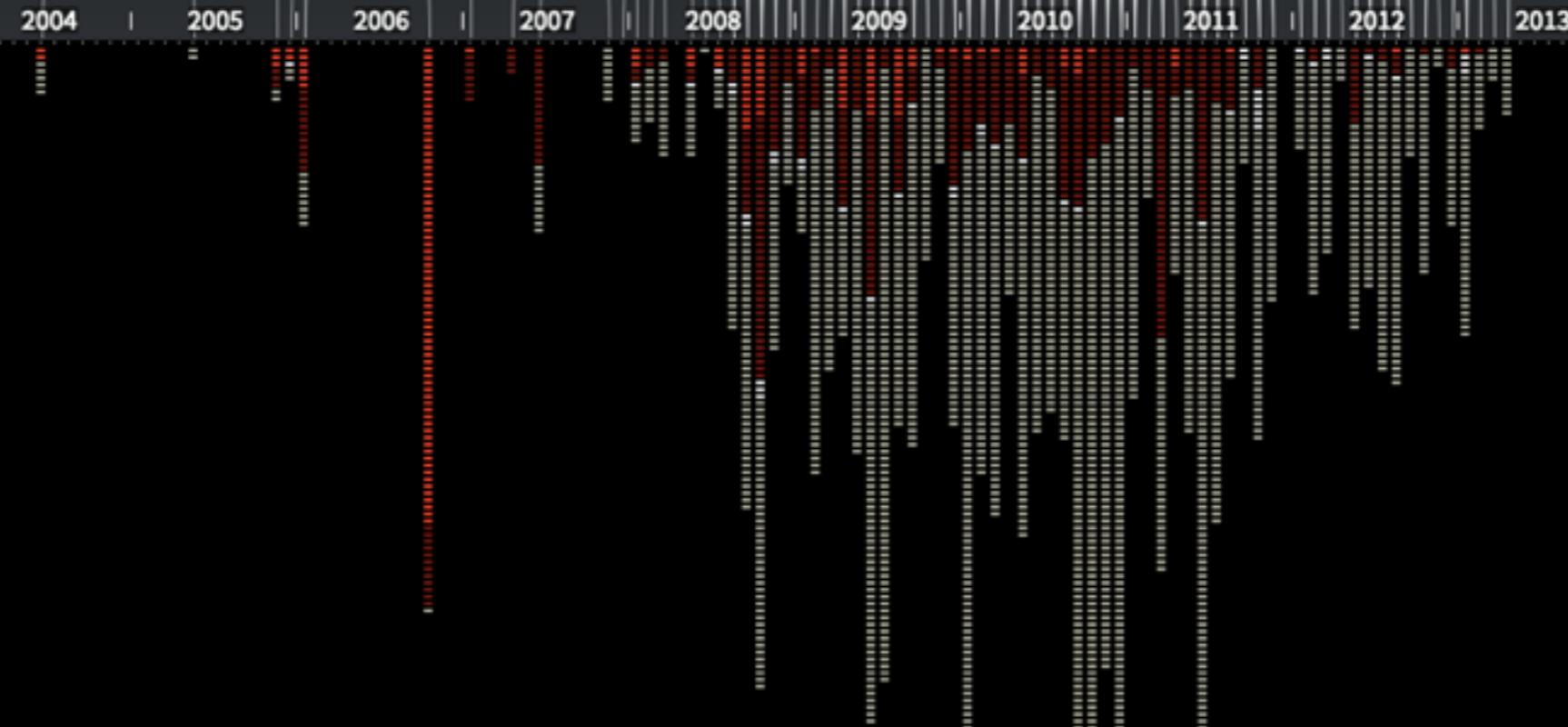
CHILDREN
175 5.6%

CIVILIAN
535 17.2%

OTHER
2358 75.7%

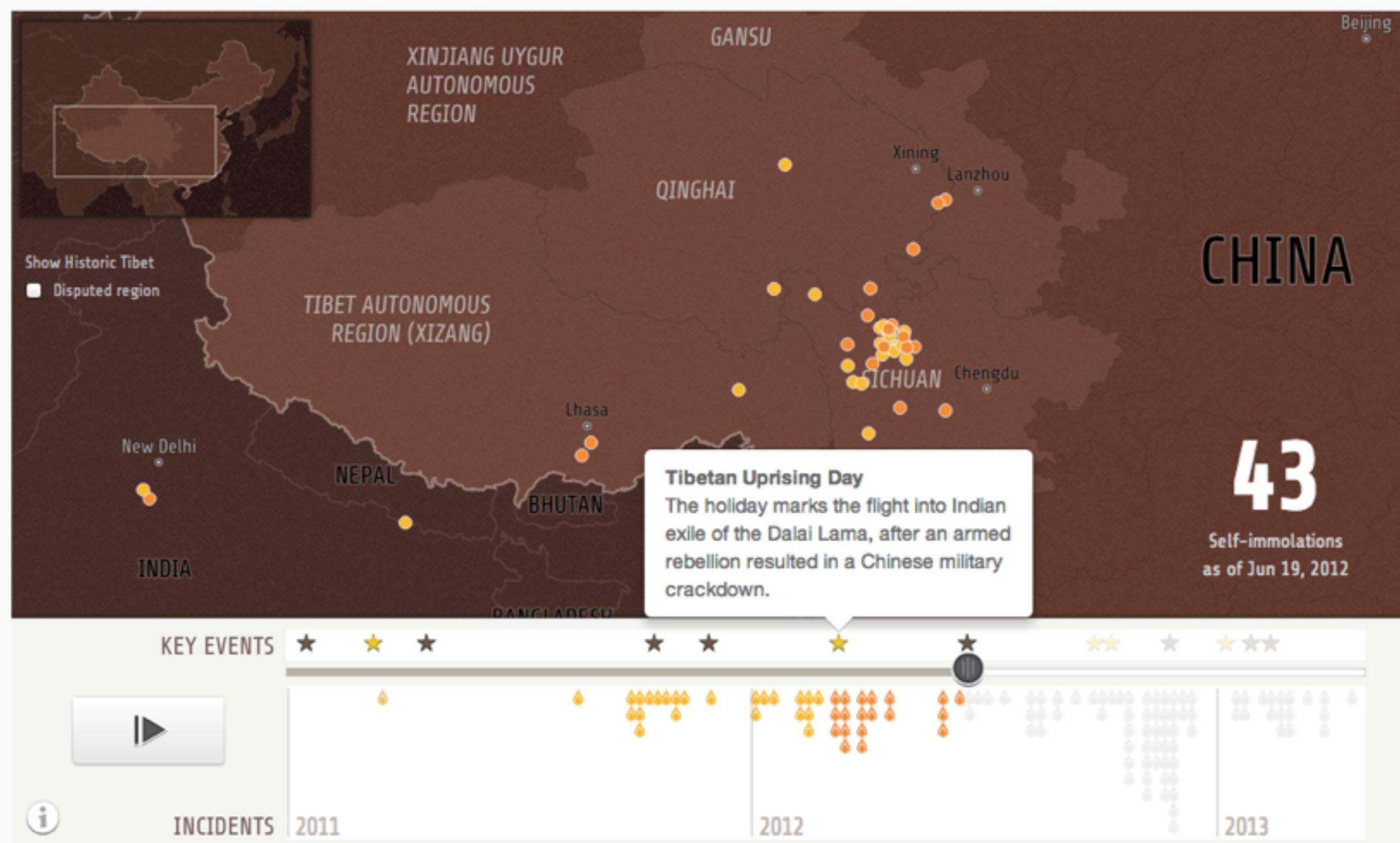
HIGH PROFILE
1.5% **47**

Last drone strike on Apr 17, 2013 with 5 fatalities



SELF-IMMOLATIONS IN TIBET (MARCH 2013)

Al Jazeera English asked Halftone to create an interactive visualization to mark the 54th anniversary of the Tibetan Uprising against Chinese oppression. This map shows the increasing number of self-immolation incidences in the past years, which recently exceeded 100 people.



Snow Fall

The Avalanche at Tunnel Creek

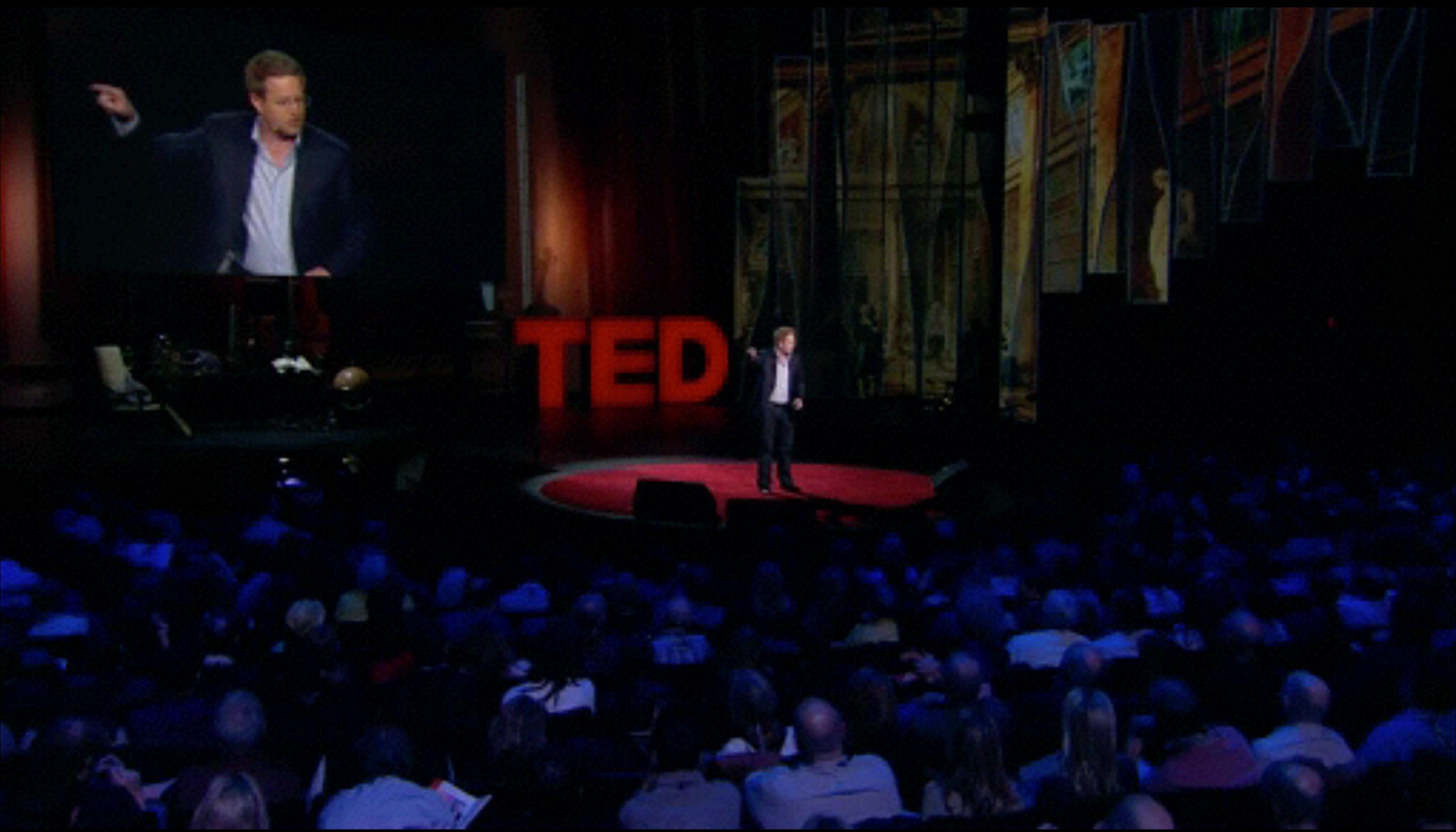
By JOHN BRANCH



The snow burst through the trees with no warning but a last-second whoosh of sound, a two-story wall of white and Chris Rudolph's piercing cry: "Avalanche! Elyse!"

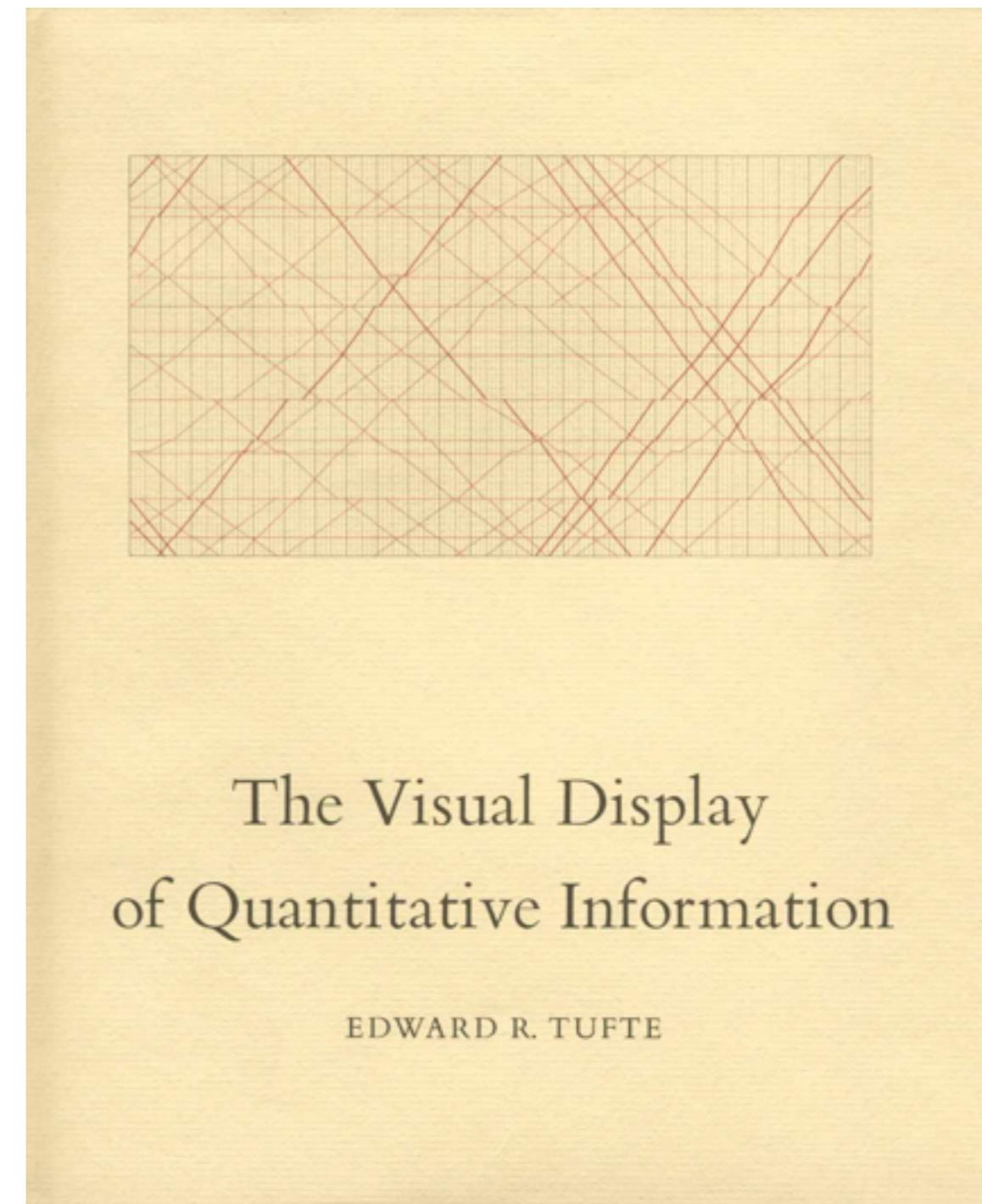
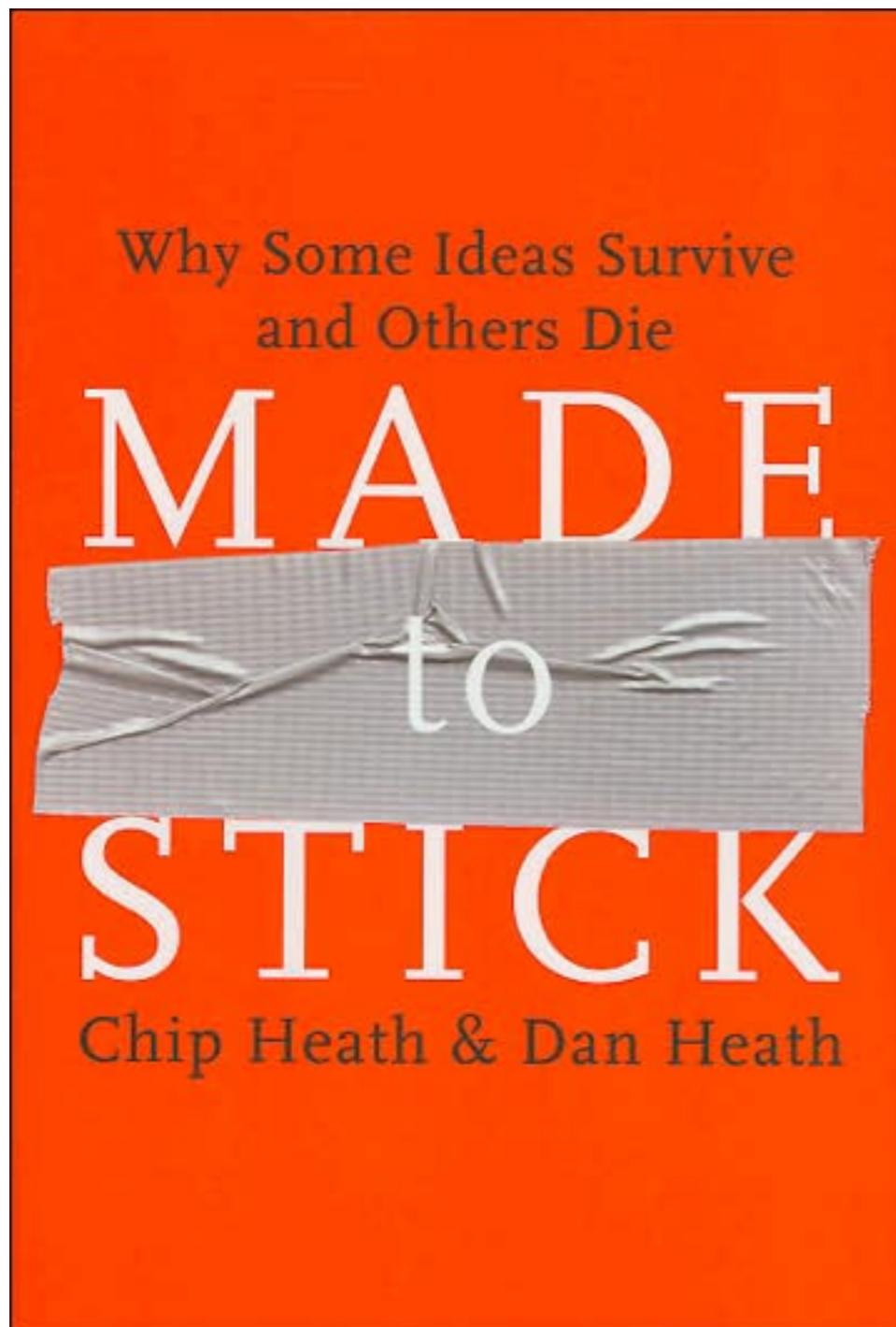
PEOPLE HAVE BEGUN TO FORGET HOW
POWERFUL HUMAN STORIES ARE,
EXCHANGING THEIR SENSE OF EMPATHY FOR
A FETISHISTIC FASCINATION WITH DATA...
THE HUMAN STUFF IS THE MAIN STUFF,
AND THE DATA SHOULD ENRICH IT.

JONATHAN HARRIS // 2008



Andrew Stanton, Pixar

Further Reading



Further Reading

