

# Storytelling with Data

Nam Wook Kim

Mini-Courses – January @ GSAS  
2018

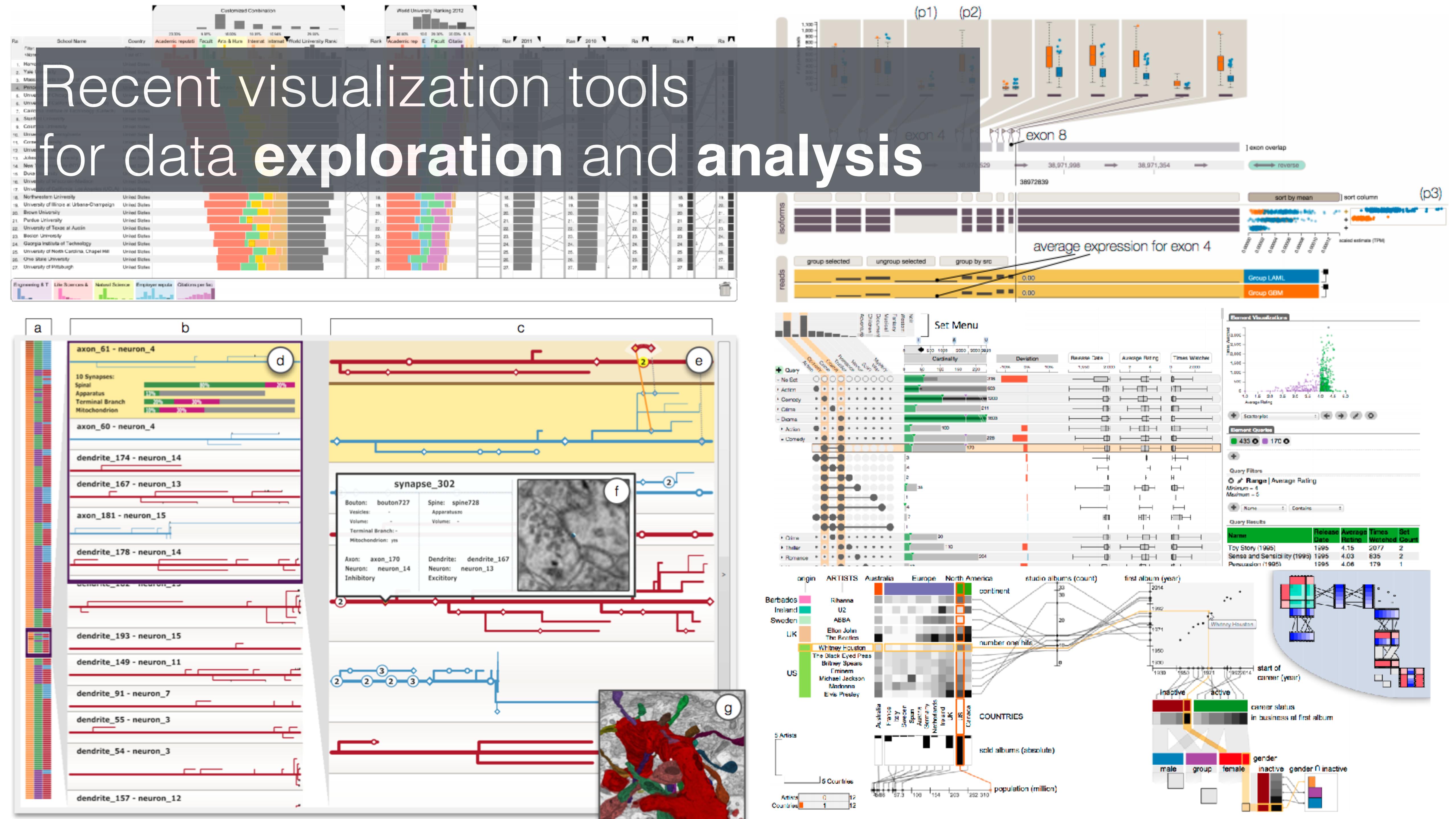
# Goal

From exploratory analysis  
to communication

# Topics

- Visualization for communication
- Data-Driven Storytelling
- Presentation & Storytelling in Tableau

# Recent visualization tools for data exploration and analysis



# Data → Explore → ?

---

- Data Centered
- Domain Experts
- Discovering Insights



# Need for communicating large, complex, and diverse data.

*Open Government*

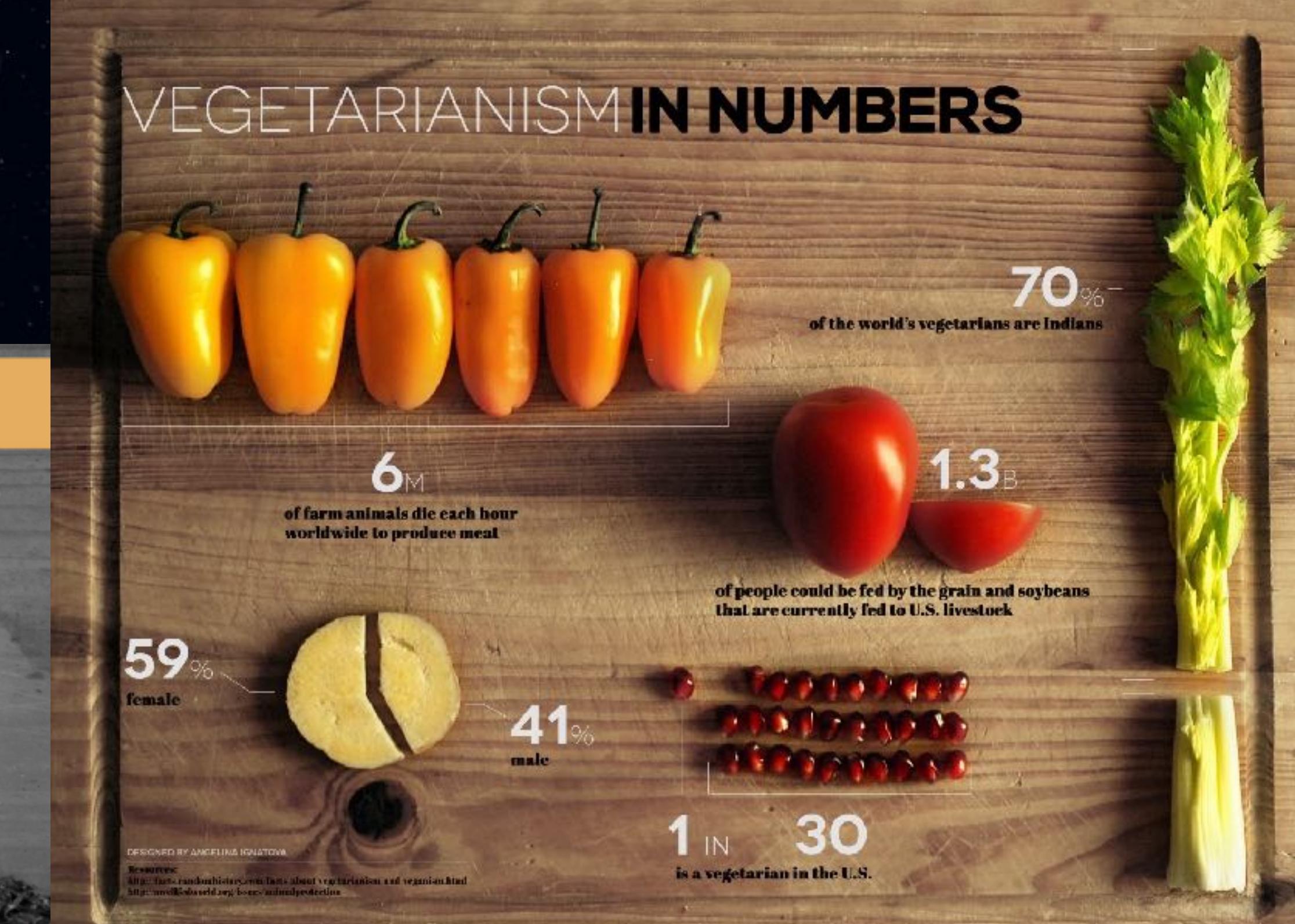
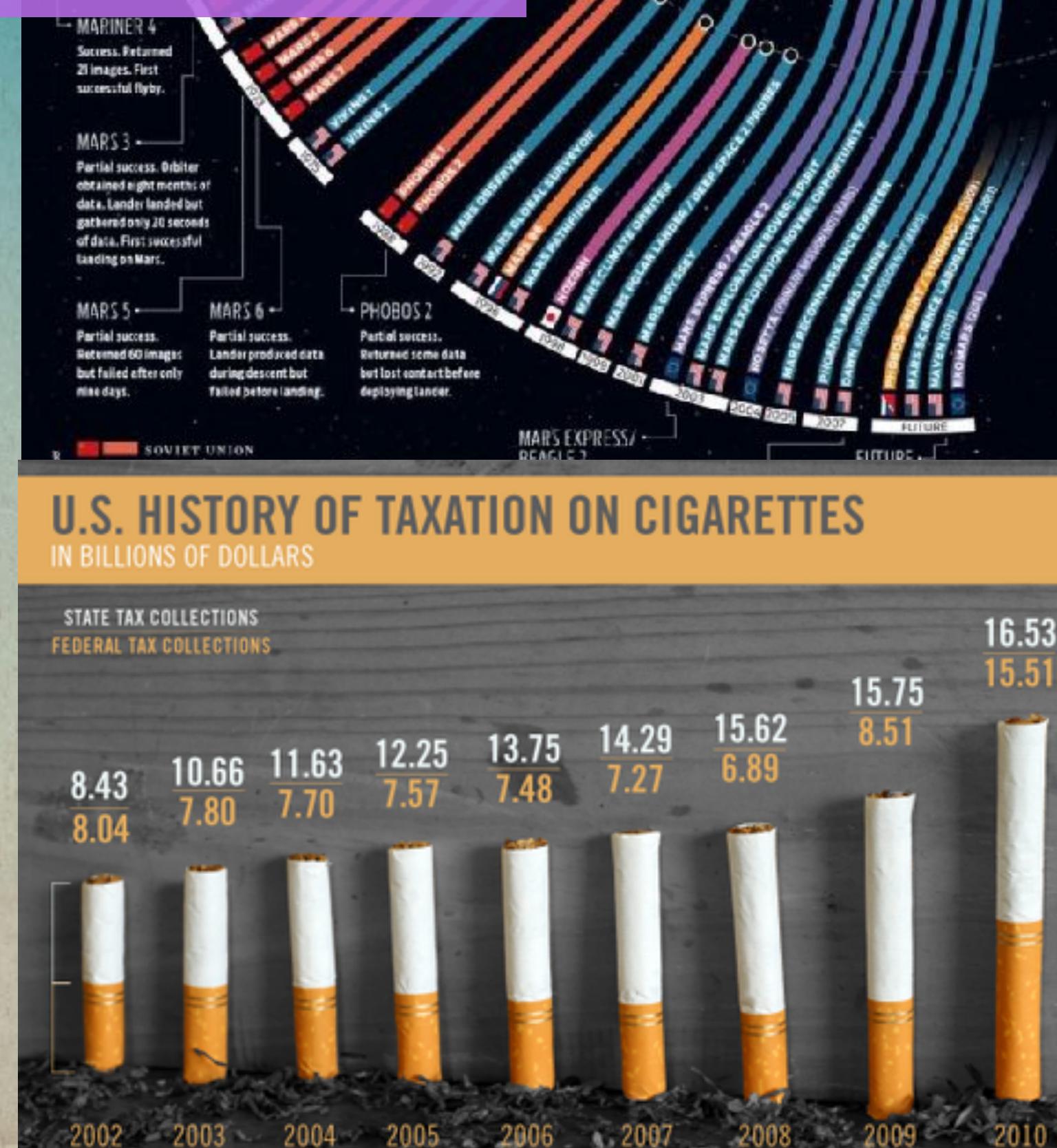
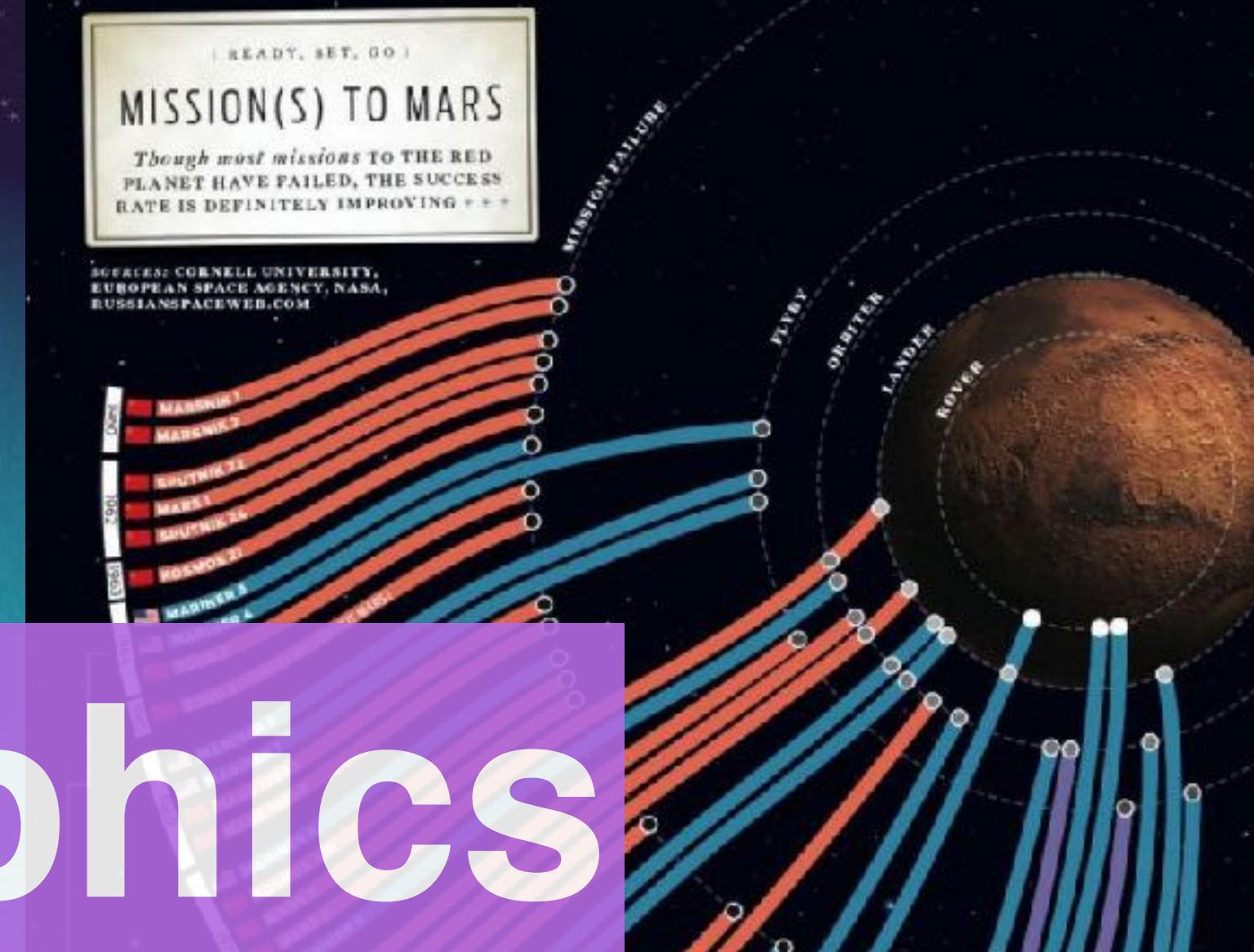
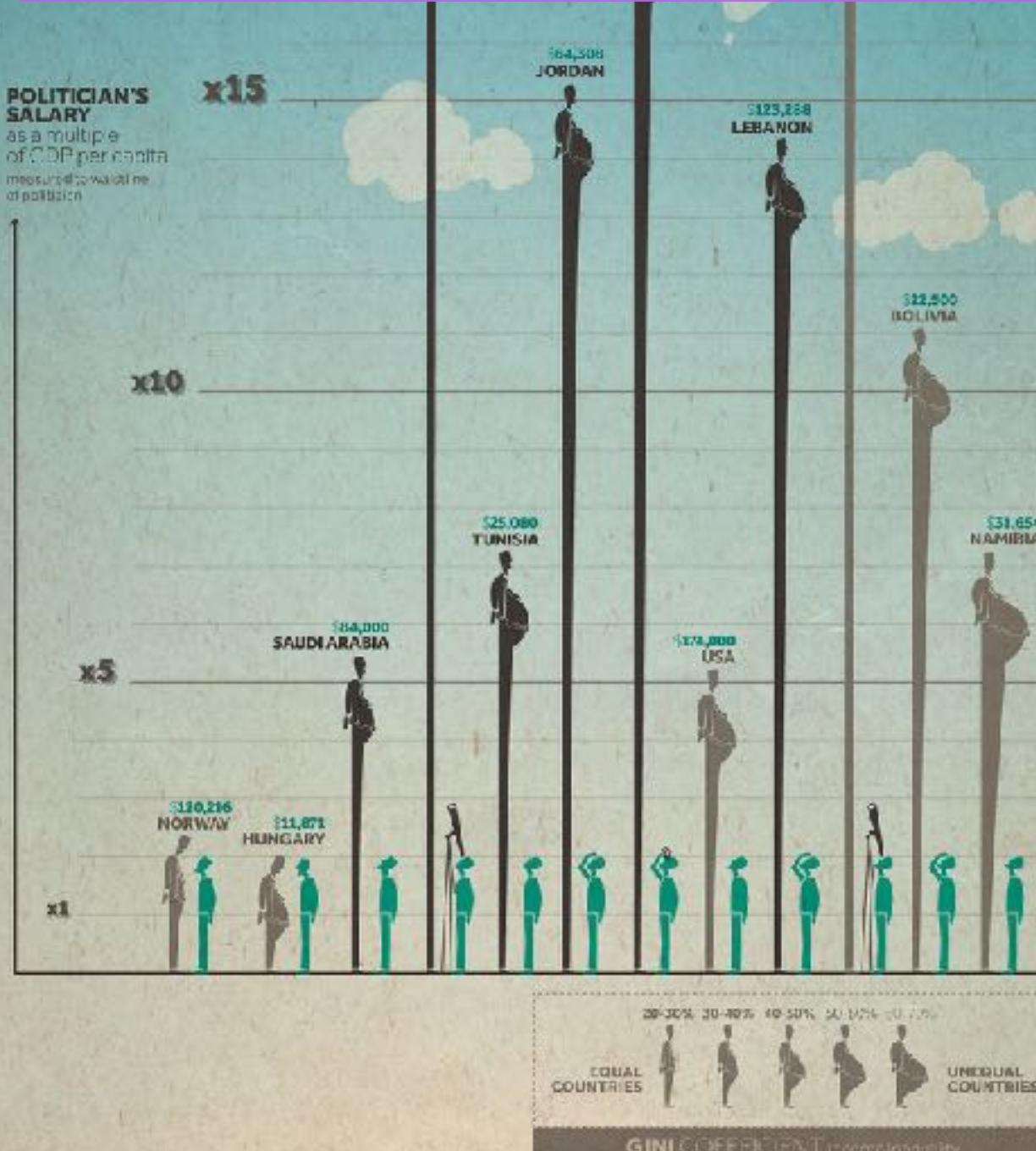
*Health & Medicine*

*Sensor & Devices*

*Social Media*



# Infographics





# Storytelling

Hans Rosling

Storytelling is the most powerful way  
to put ideas into the world today.

Robert McKee

cole nussbaumer knaflic

# storytelling with data

a data  
visualization  
guide for  
business  
professionals

WILEY

# How Far Is Europe Swinging to the Right?

By GREGORY ANGEL, ROAM PLATOR and BRYANT REILLY CALI - PUBLISHED December 5, 2016

Amid a migrant crisis, sluggish economic growth and growing disillusionment with the European Union, right-wing parties in a growing number of European countries have made electoral gains. The right-wing parties included below range across a wide policy spectrum, from populist and nationalist to far-right neofascist.

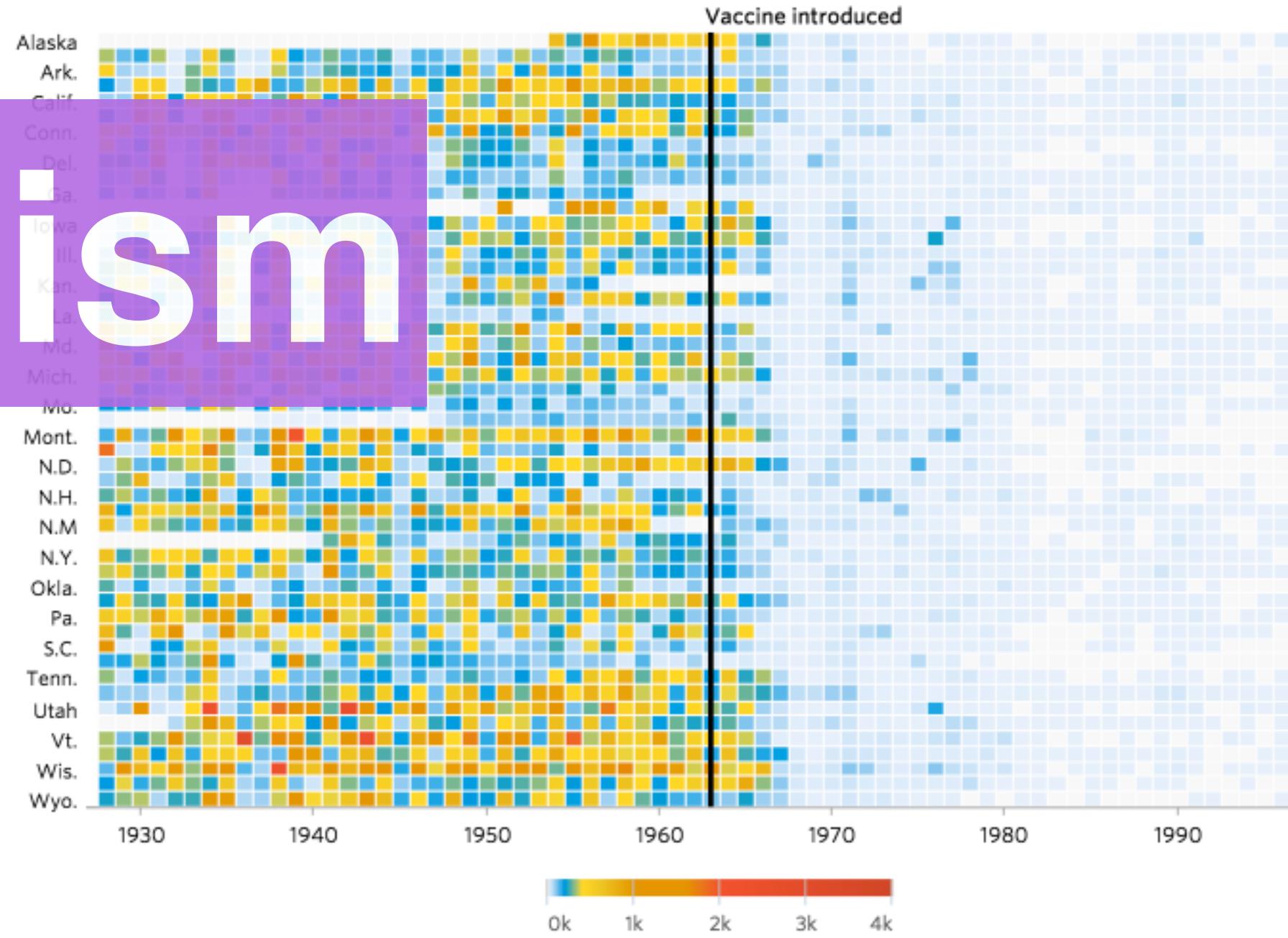
# Data Journalism

Party ideology in parliamentary elections\*

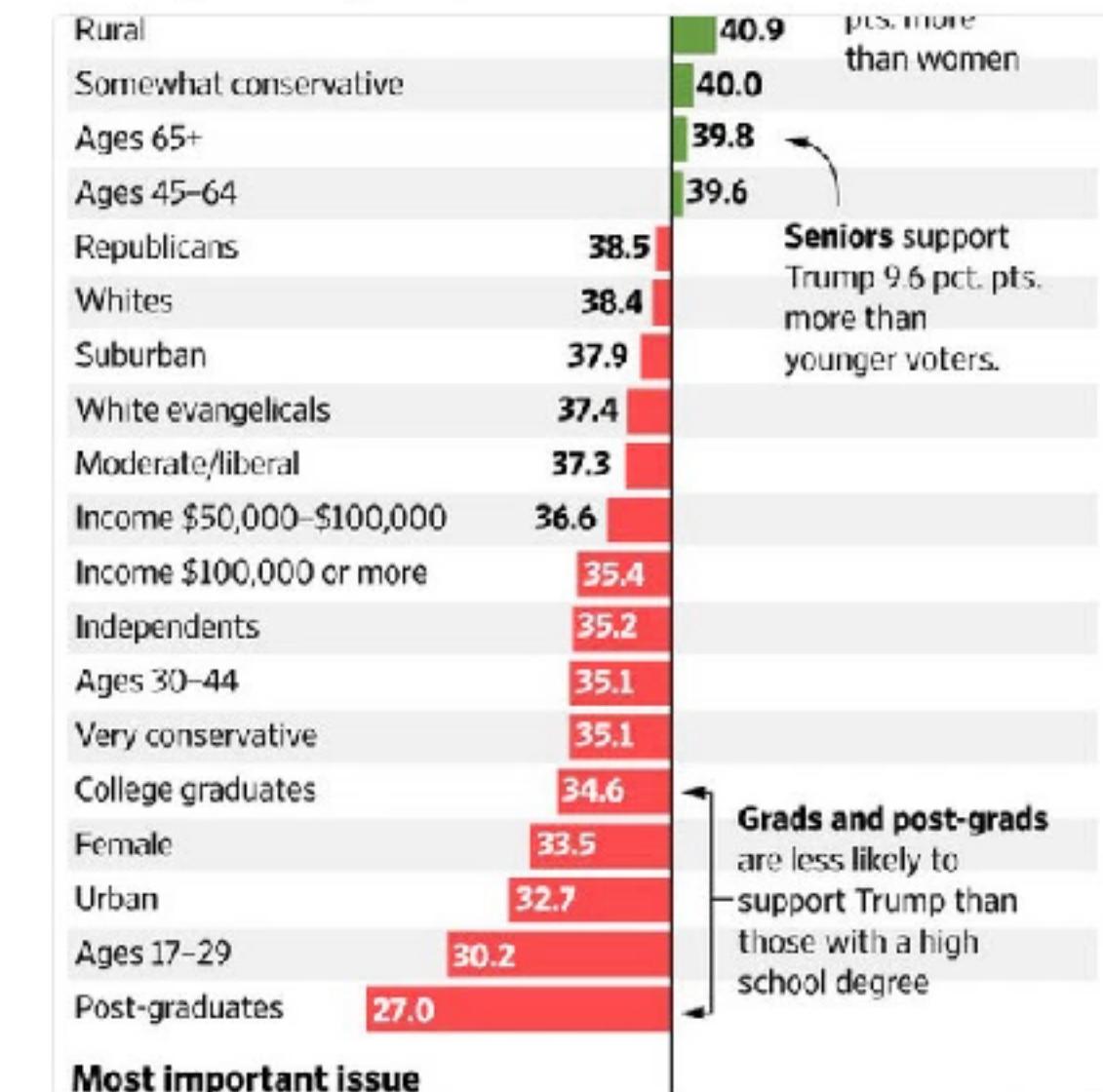
Center-left, center-right Other parties Right-wing and far-right



## Measles



## Inside the Trump coalition: How he performs among voter groups

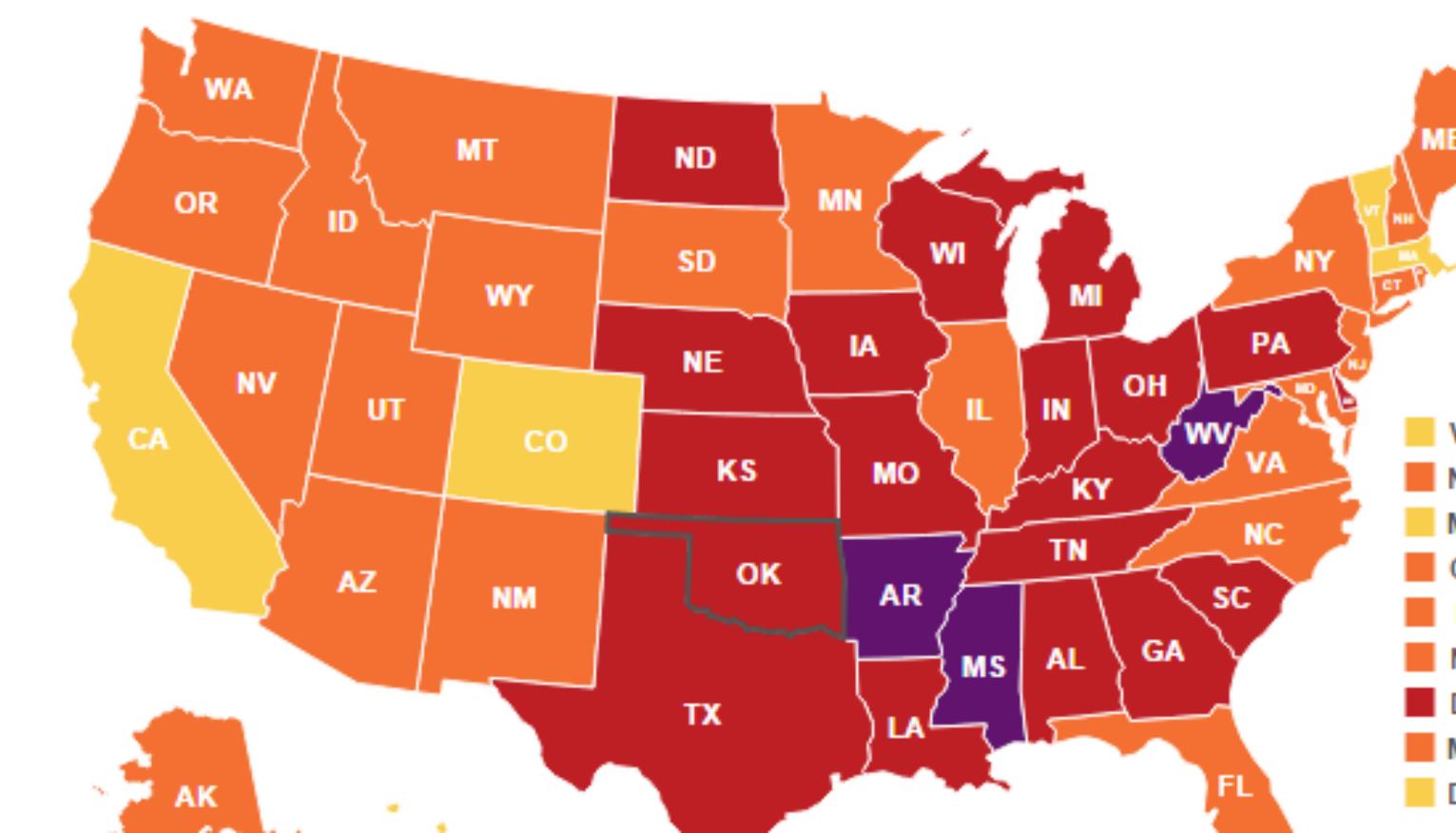


## Adult Obesity Rate by State, 2014

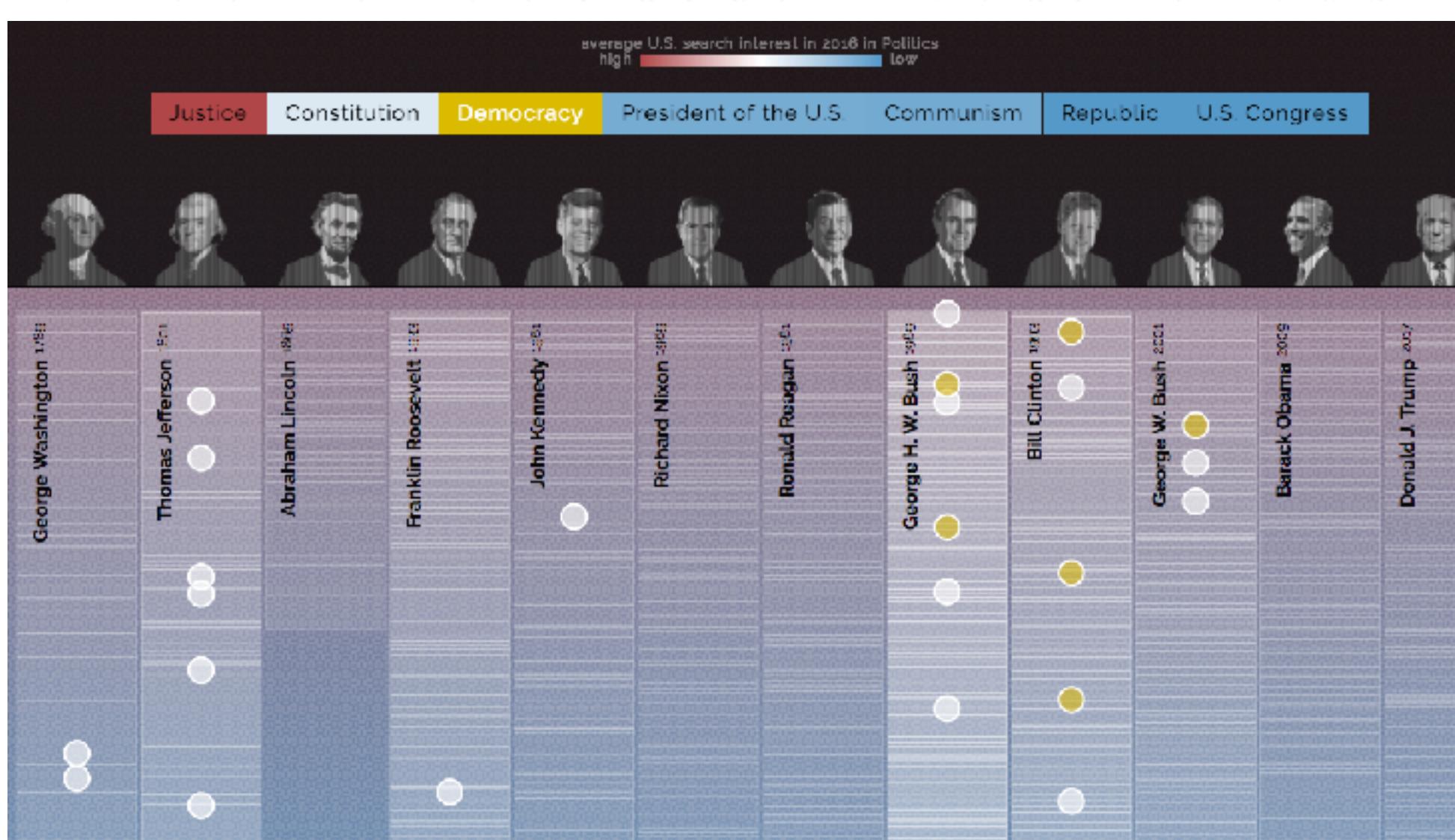
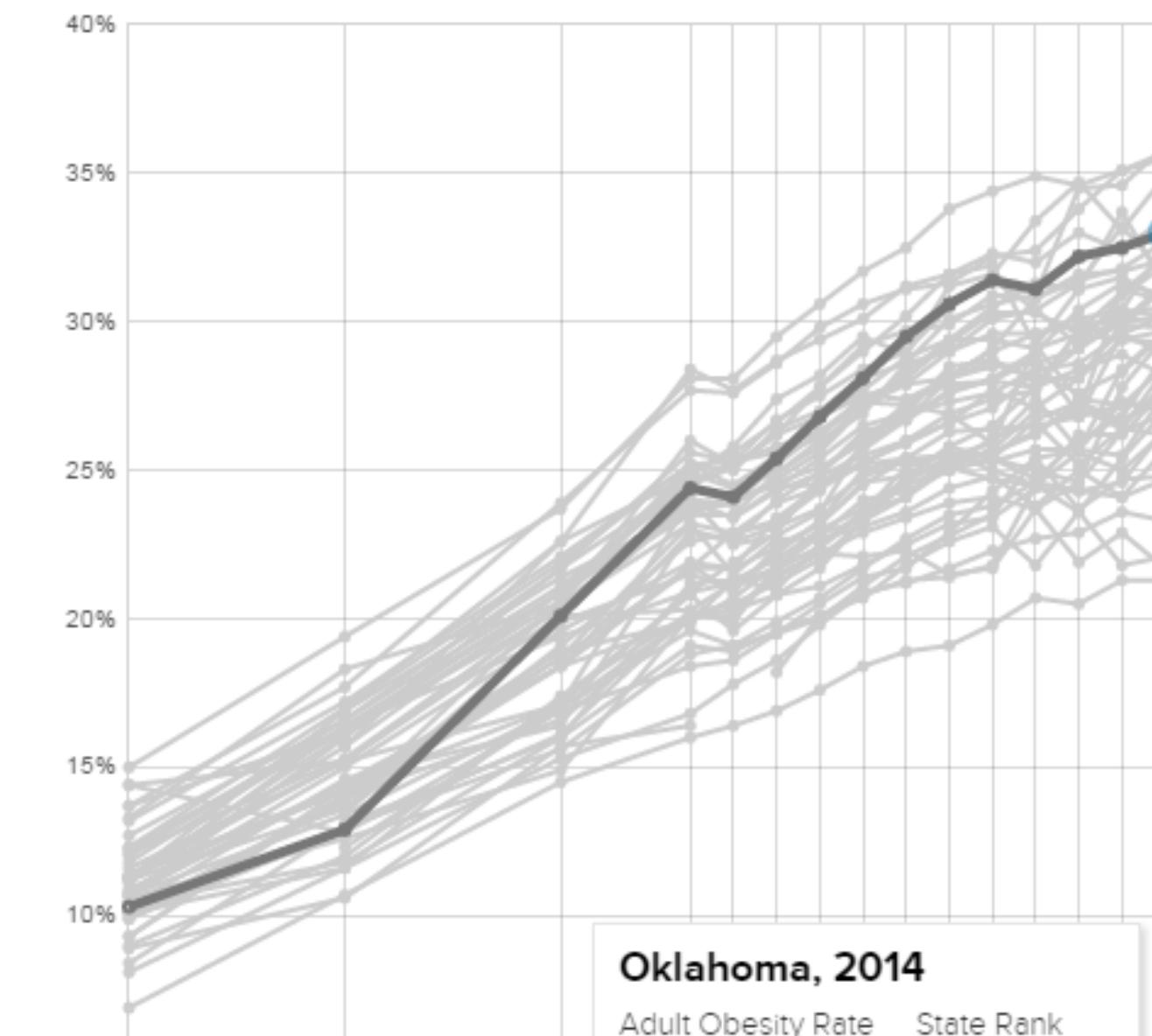
Select years with the slider to see historical data. Hover over states for more information. Click a state to lock the selection. Click again to unlock.

### Percent of obese adults (Body Mass Index of 30+)

0 - 9.9% 10 - 14.9% 15 - 19.9% 20 - 24.9% 25 - 29.9% 30 - 34.9% 35+%

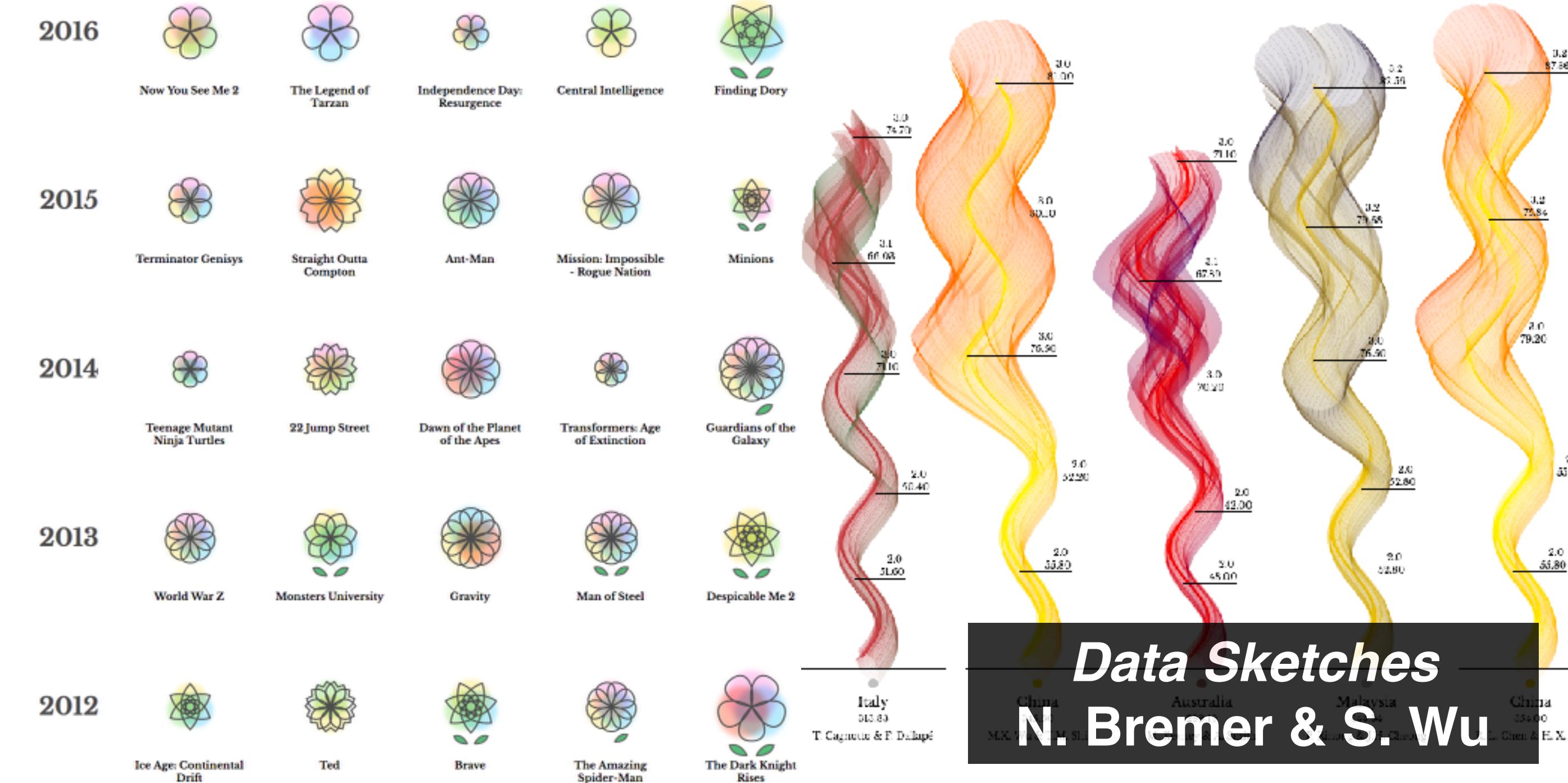
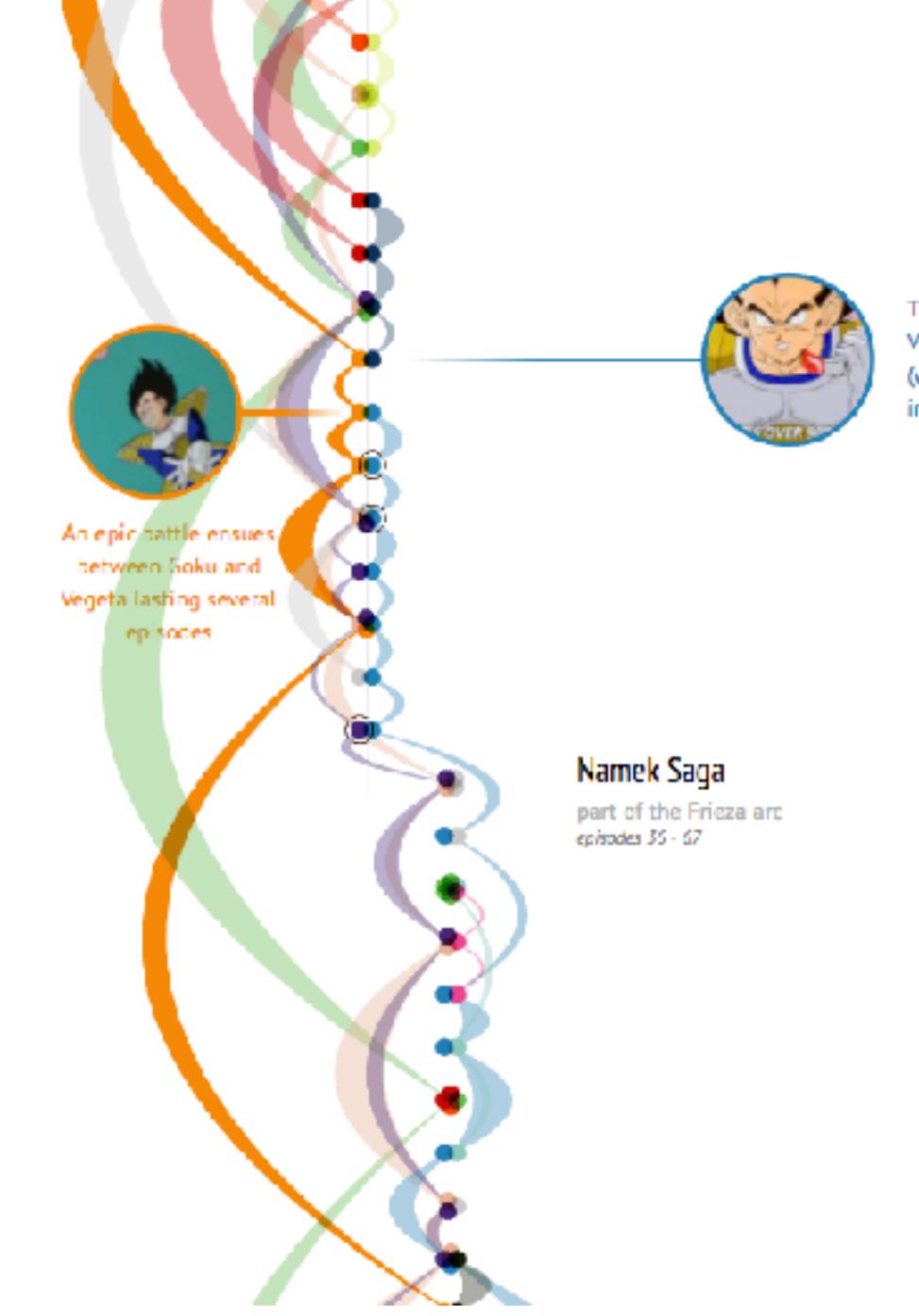
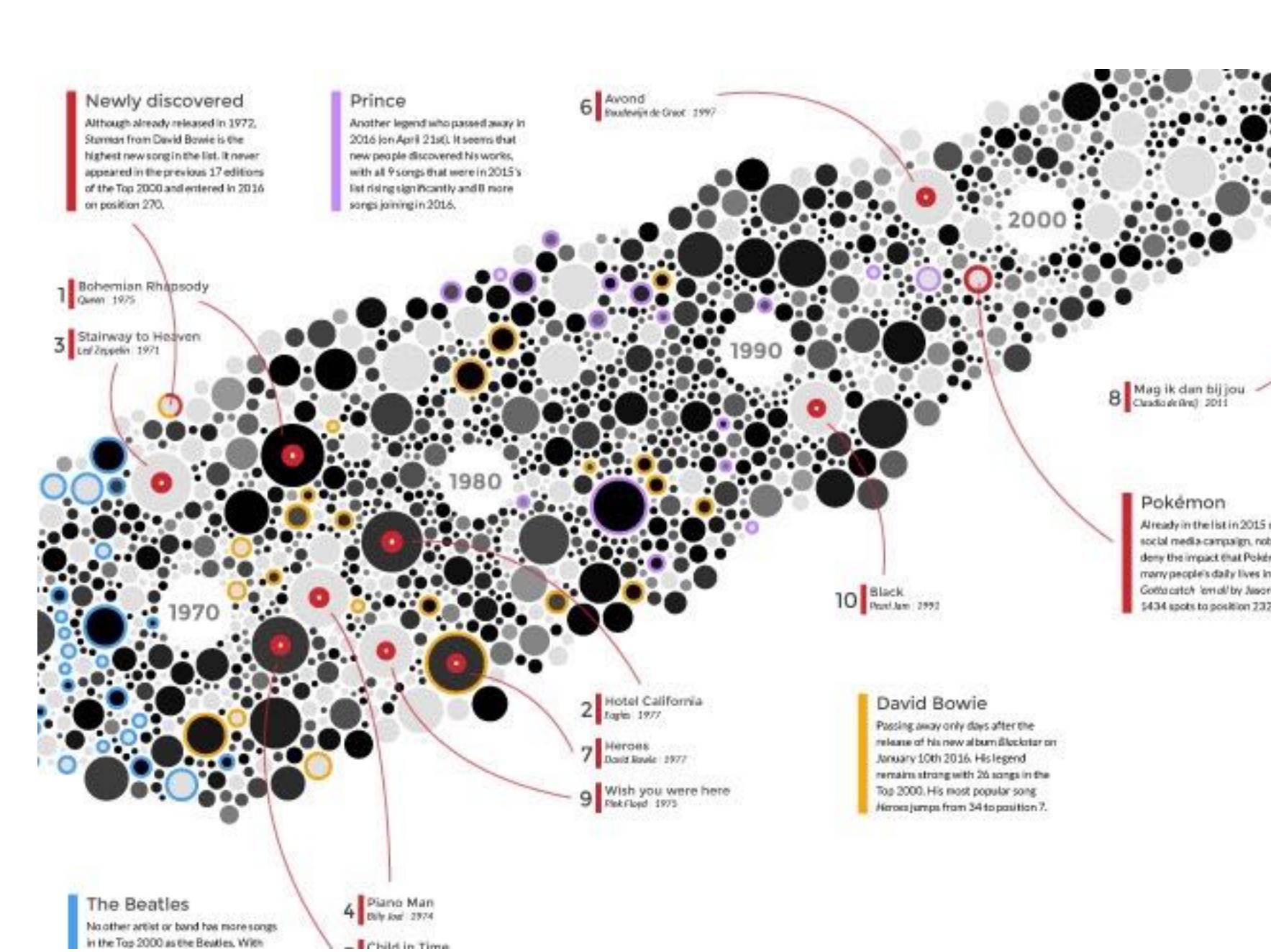
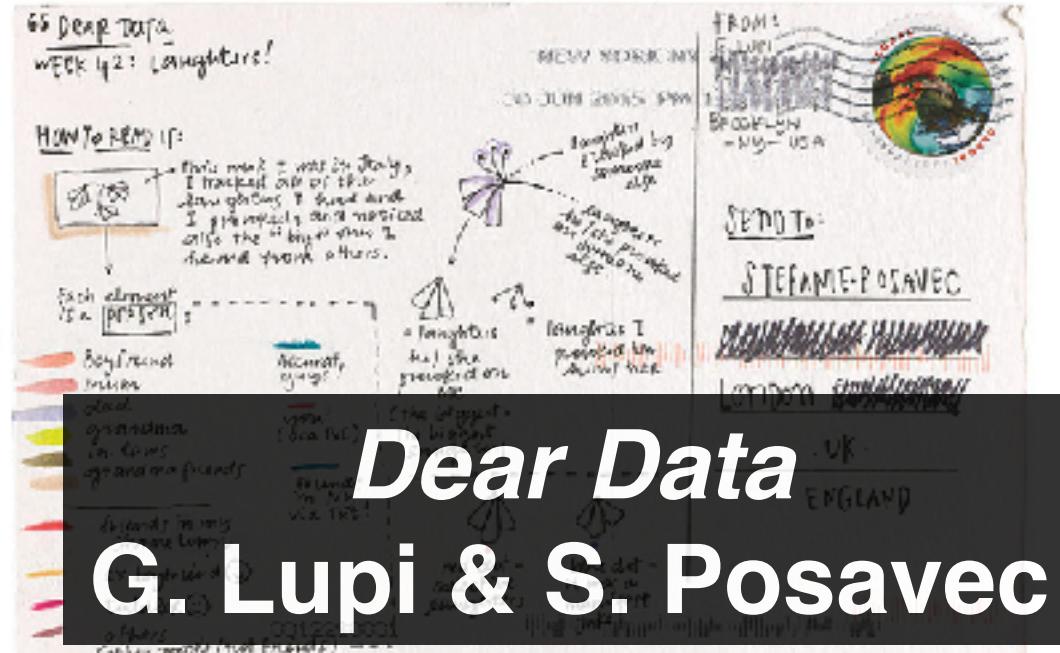
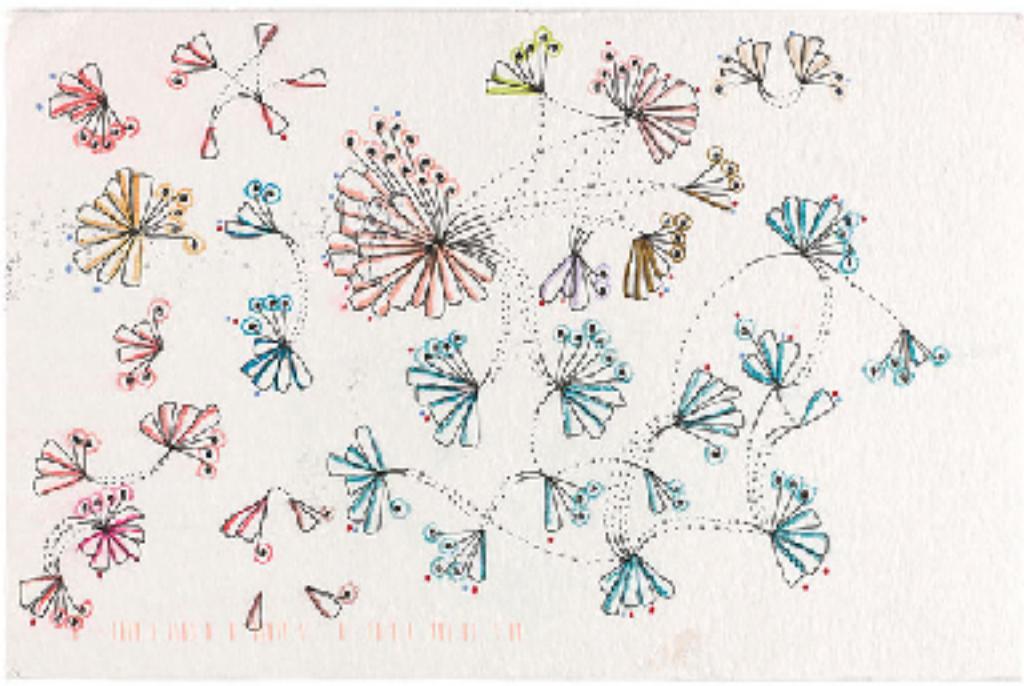
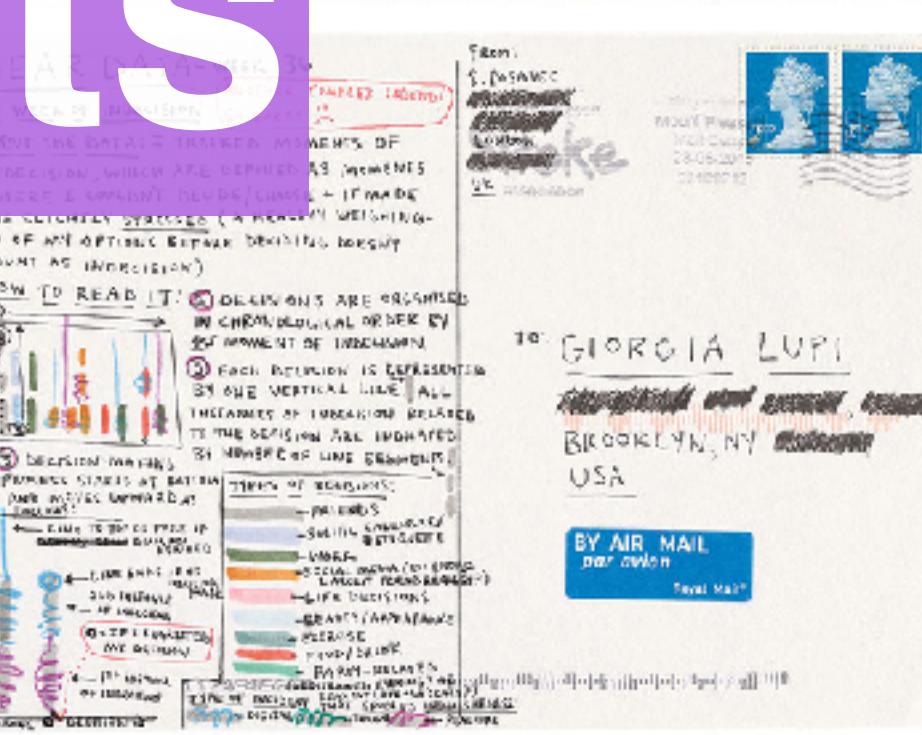
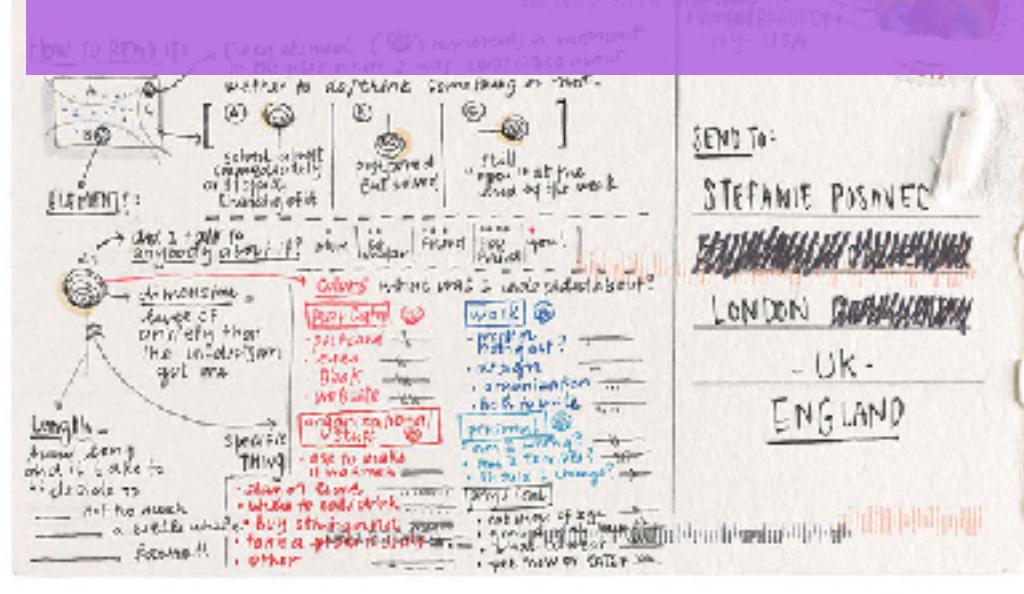


## Adult obesity rates, 1990 to 2014





# Data Arts



# Data → Explore → Communicate

---

- Data Centered
  - Domain Experts
  - Discovering Insights
- Human Centered
  - General Audience
  - Conveying Messages

# New Challenges

What is beyond data exploration?

What is a communication-oriented visualization?

How can we better support communication of data?

How can we tell compelling stories with data?

“

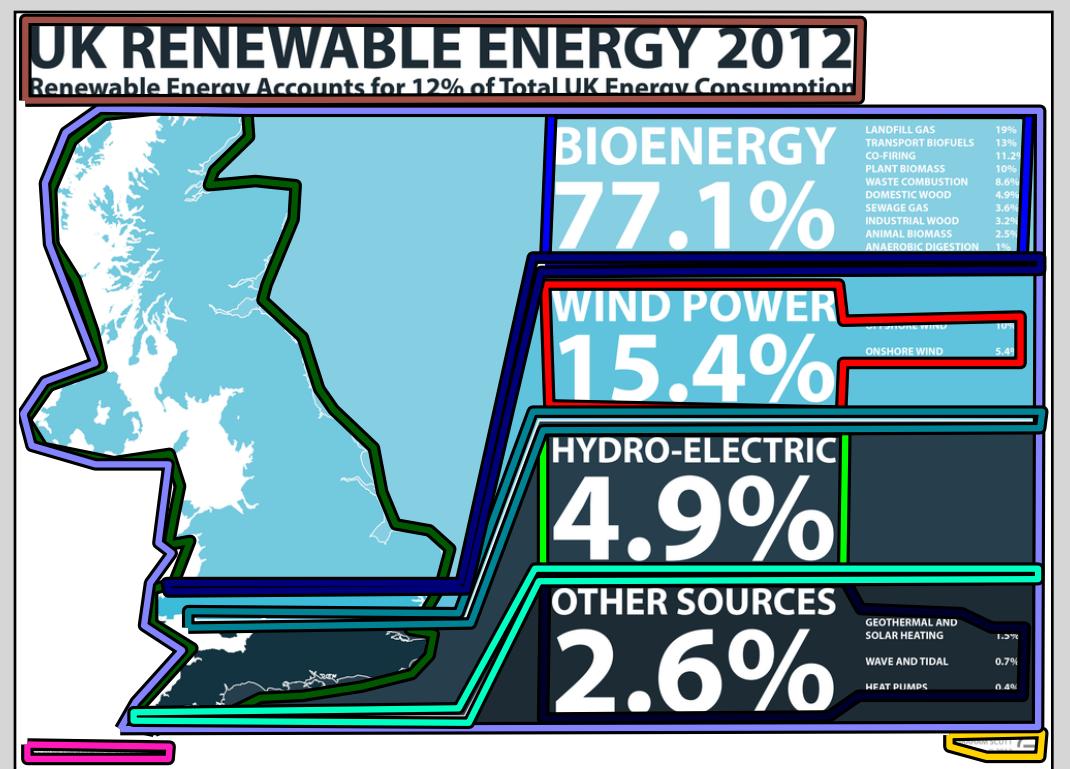
Presentation—specifically, its **use of elements from storytelling**—is the next logical step in visualization research and should be a focus of at least **equal importance** with **exploration and analysis**

— Kosara & Mackinlay 2013

Research:

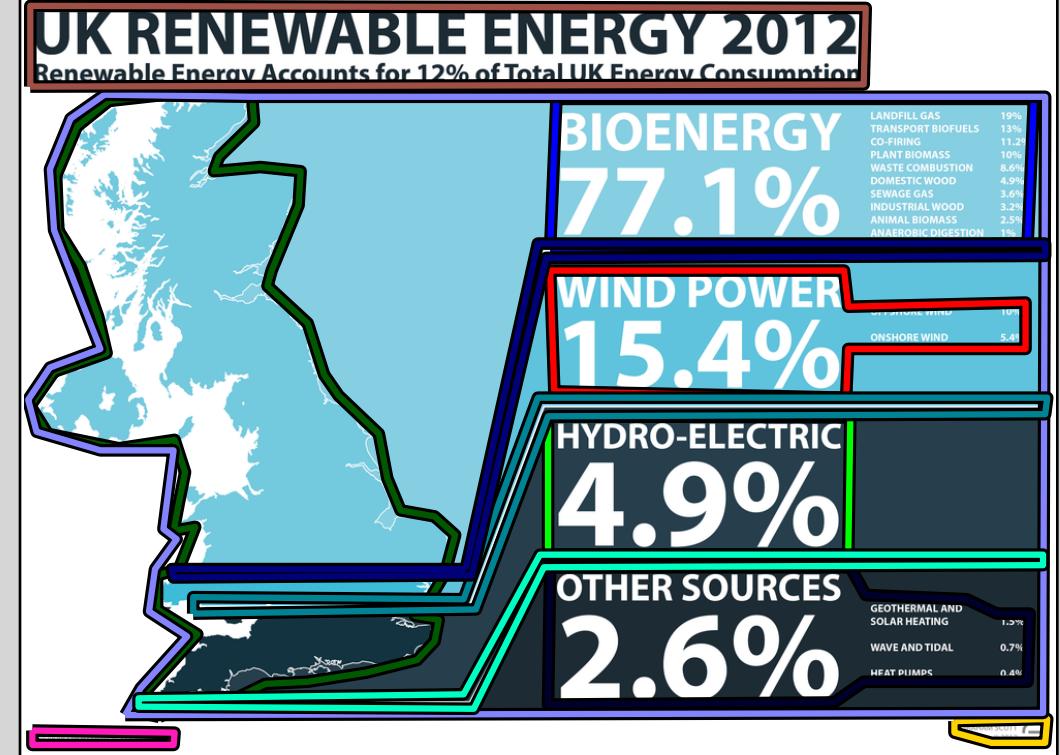
What makes a visualization **communicative**?

# LABELED VISUALIZATION DATABASE

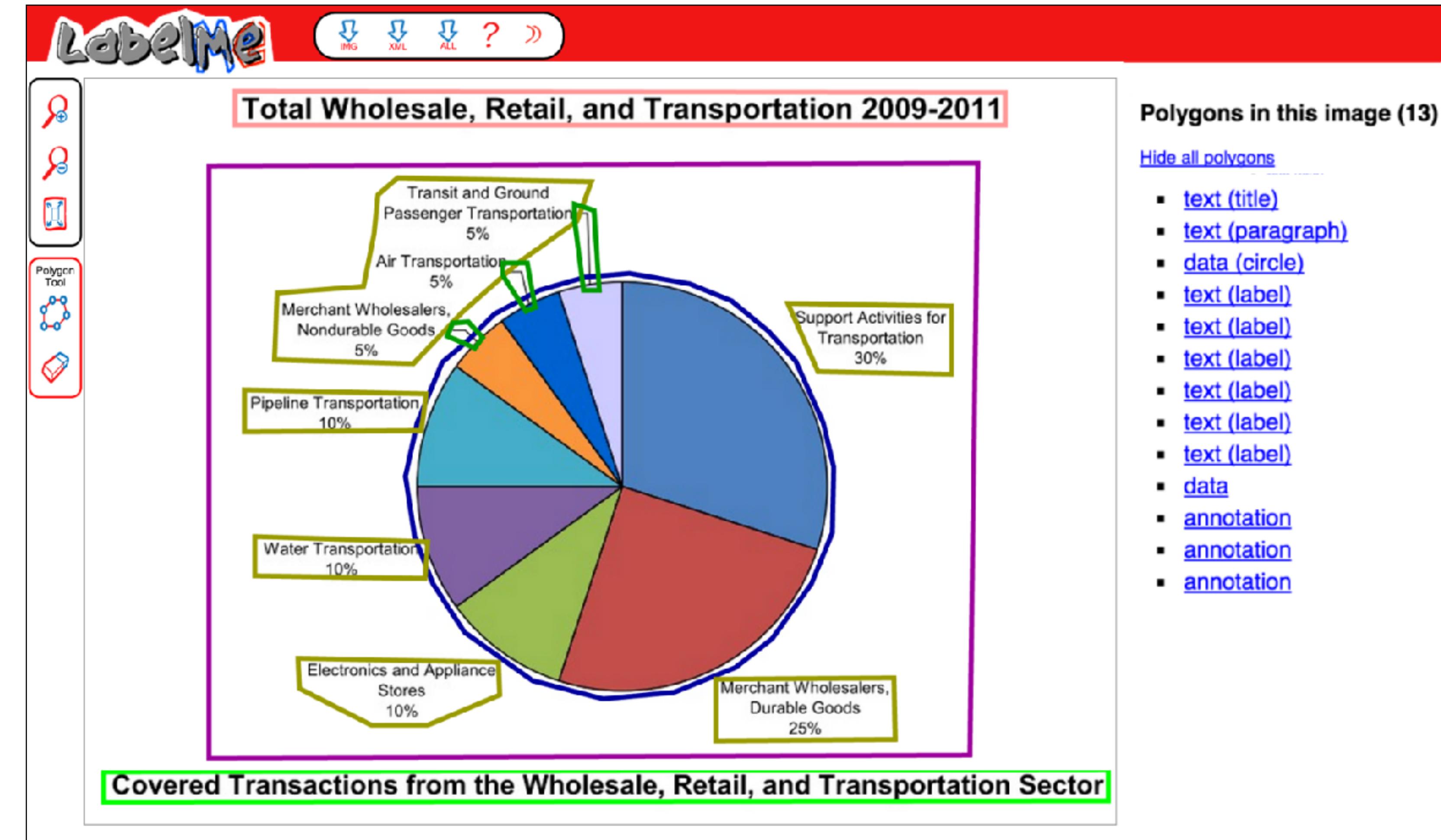


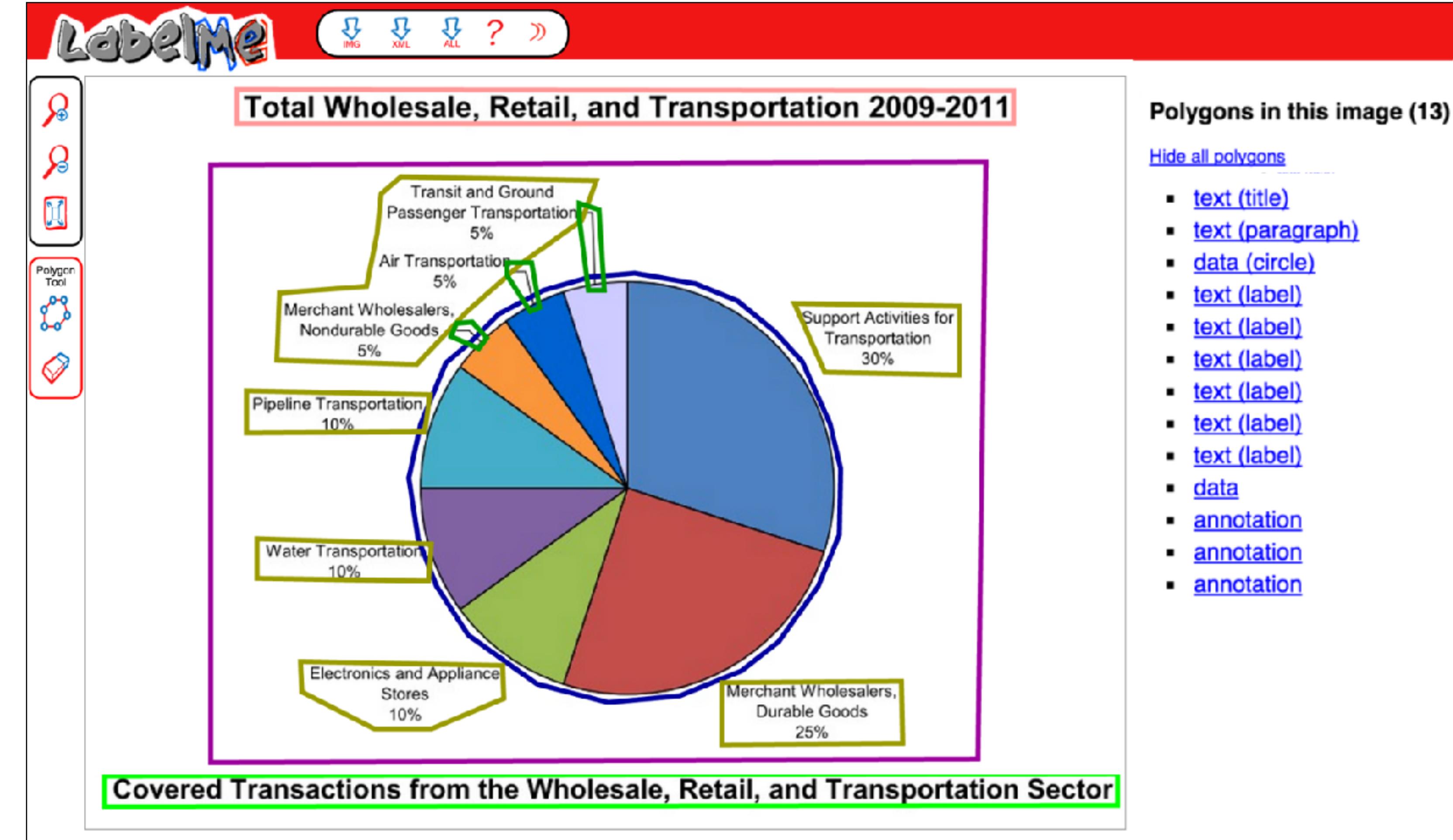
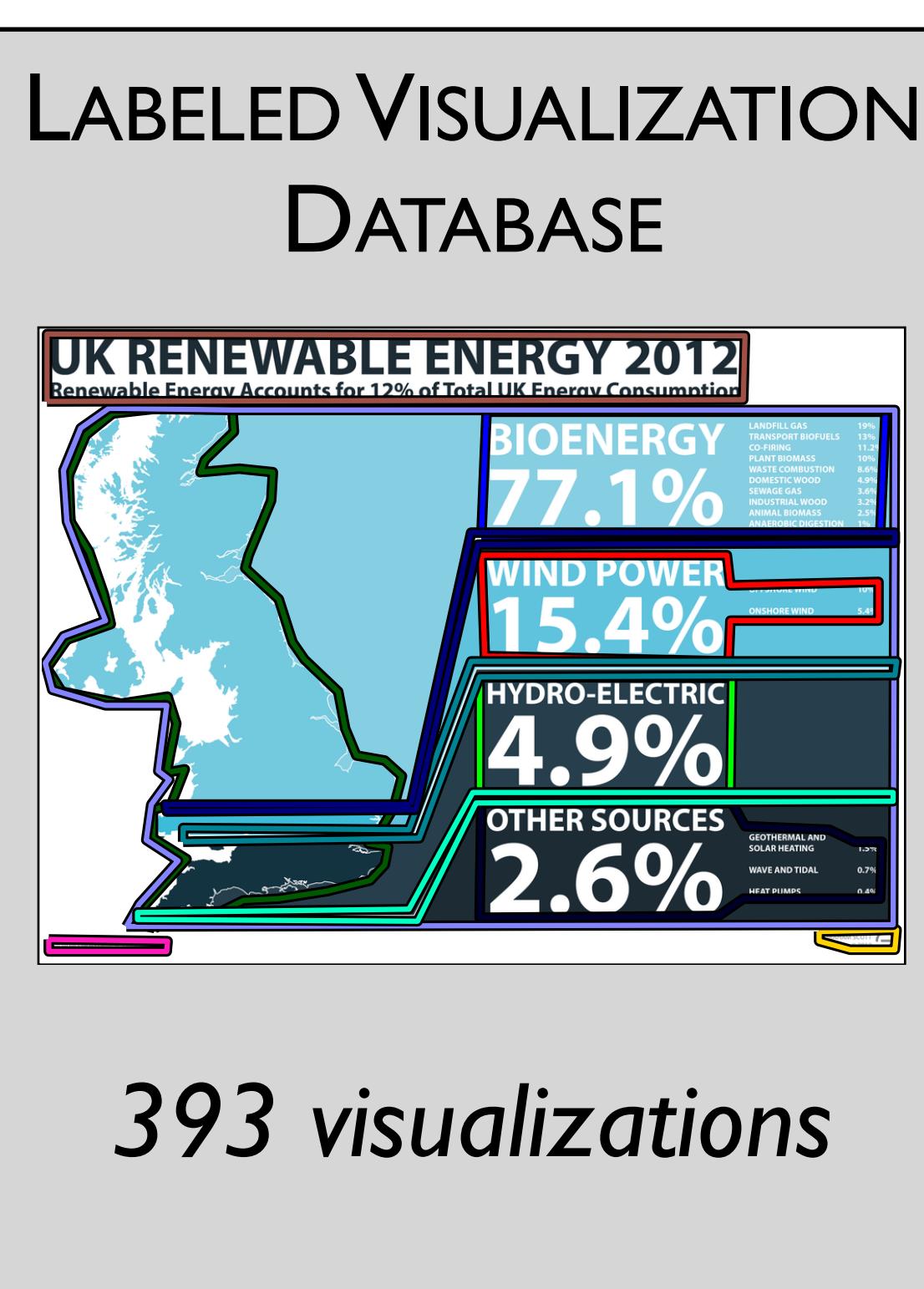
393 visualizations

# LABELED VISUALIZATION DATABASE



393 visualizations

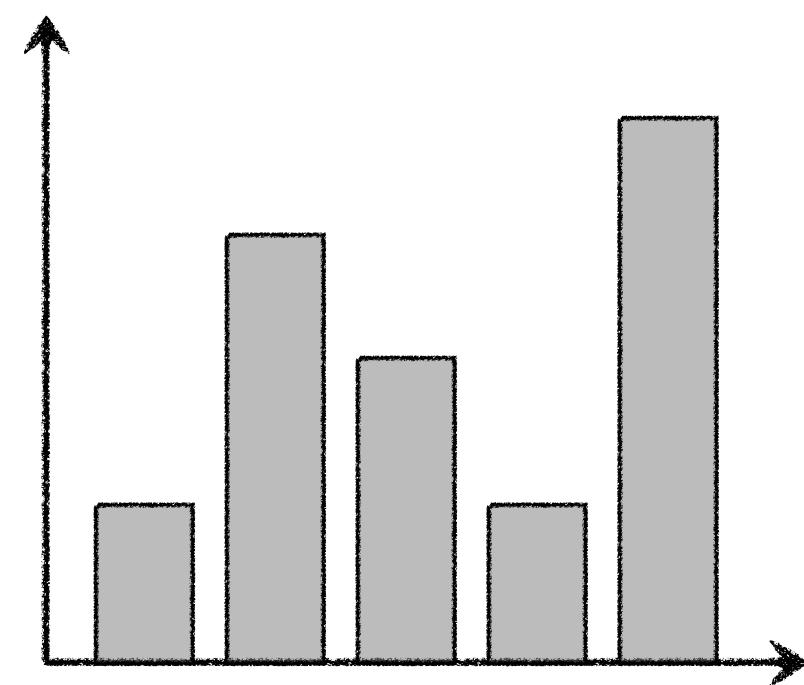




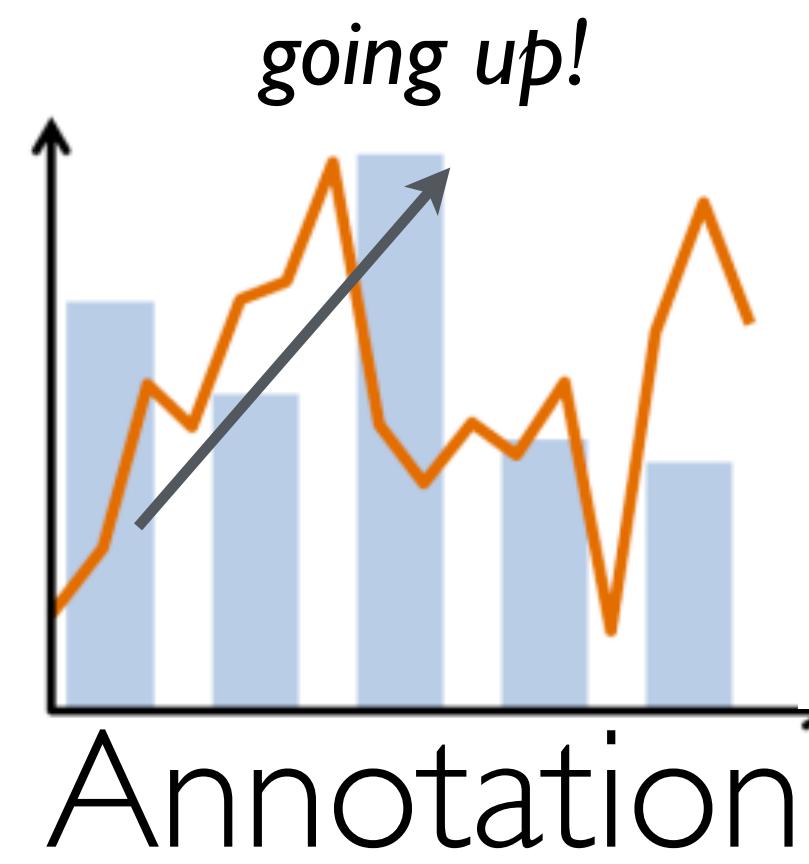
+

Data-Ink Ratio and Visual Density  
Human Recognizable Objects  
Data and Message Redundancy

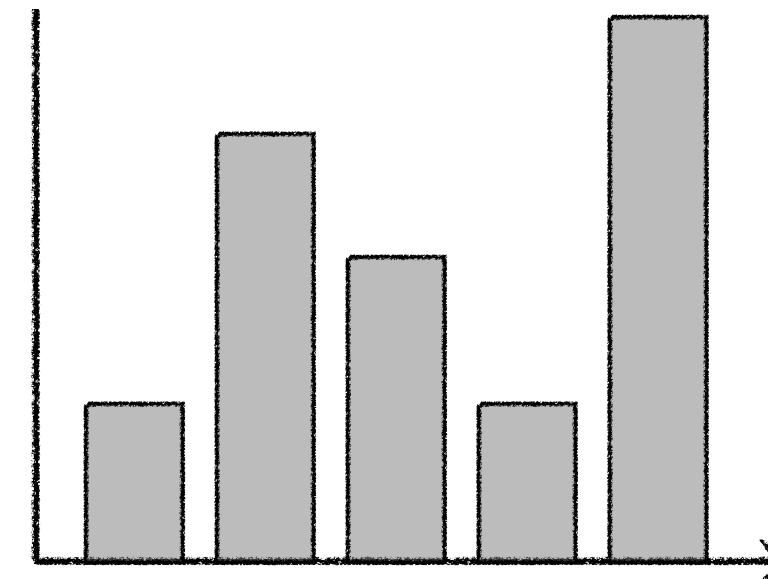
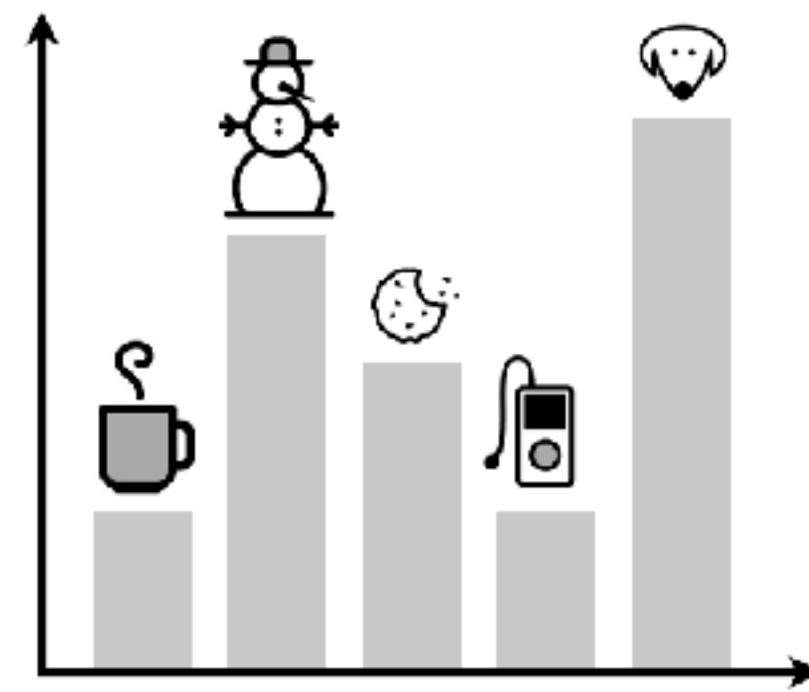
# Examples of Redundant Encoding



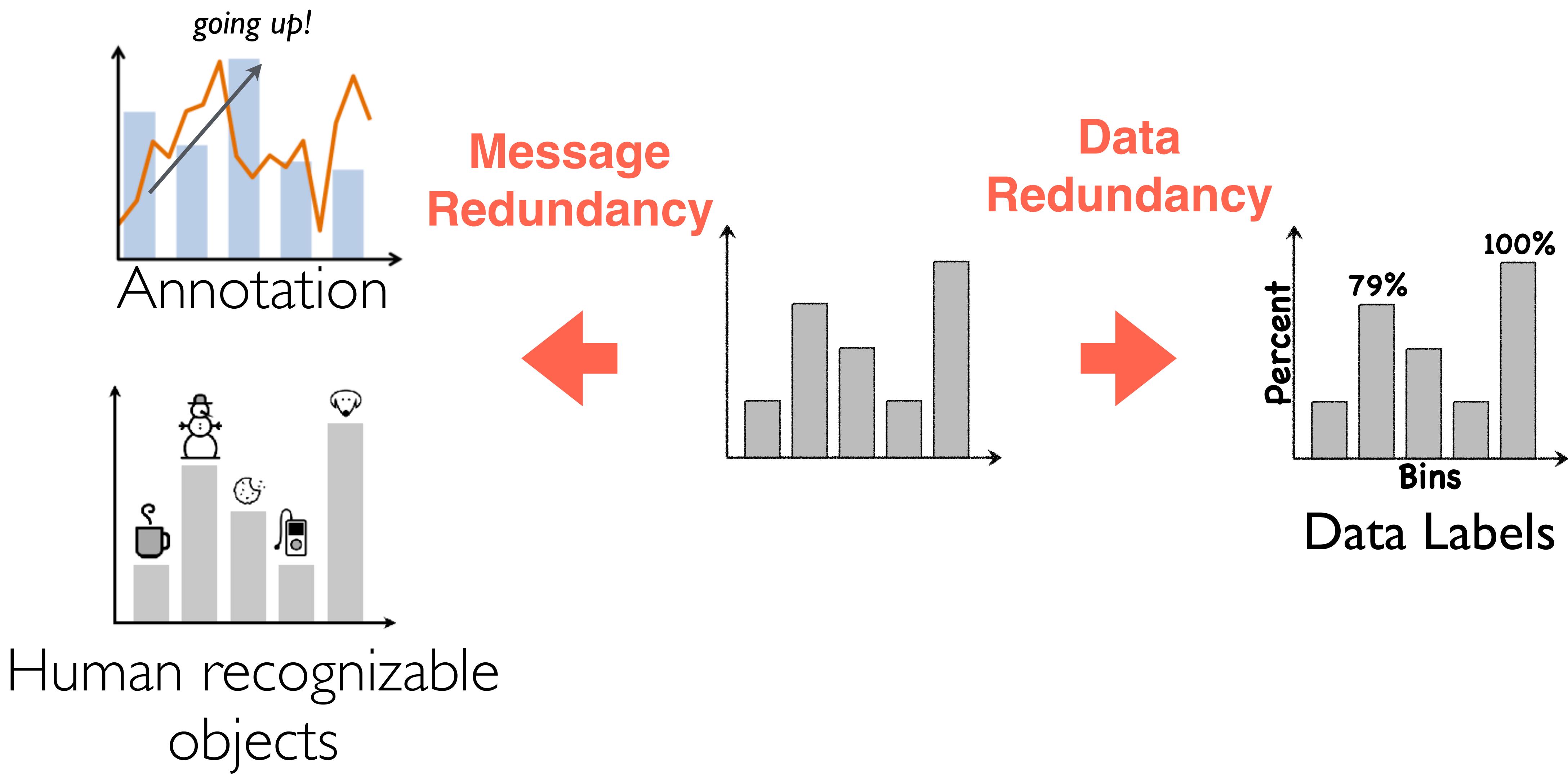
# Examples of Redundant Encoding



Message  
Redundancy

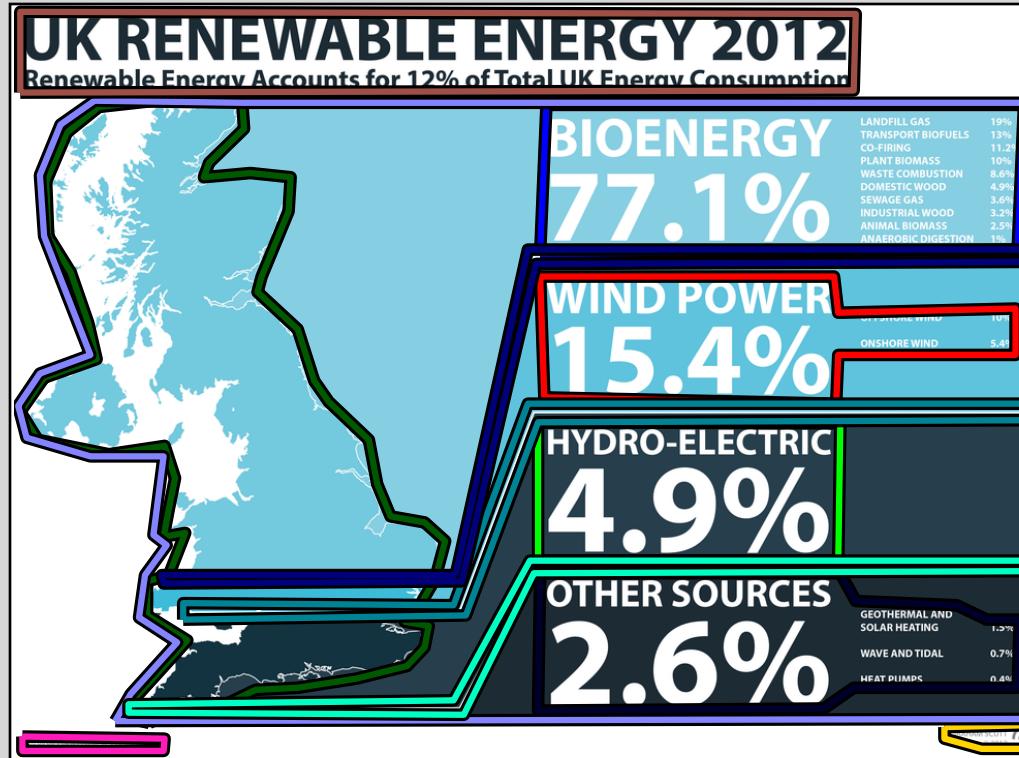


# Examples of Redundant Encoding



# Experiment Procedure

## LABELED VISUALIZATION DATABASE

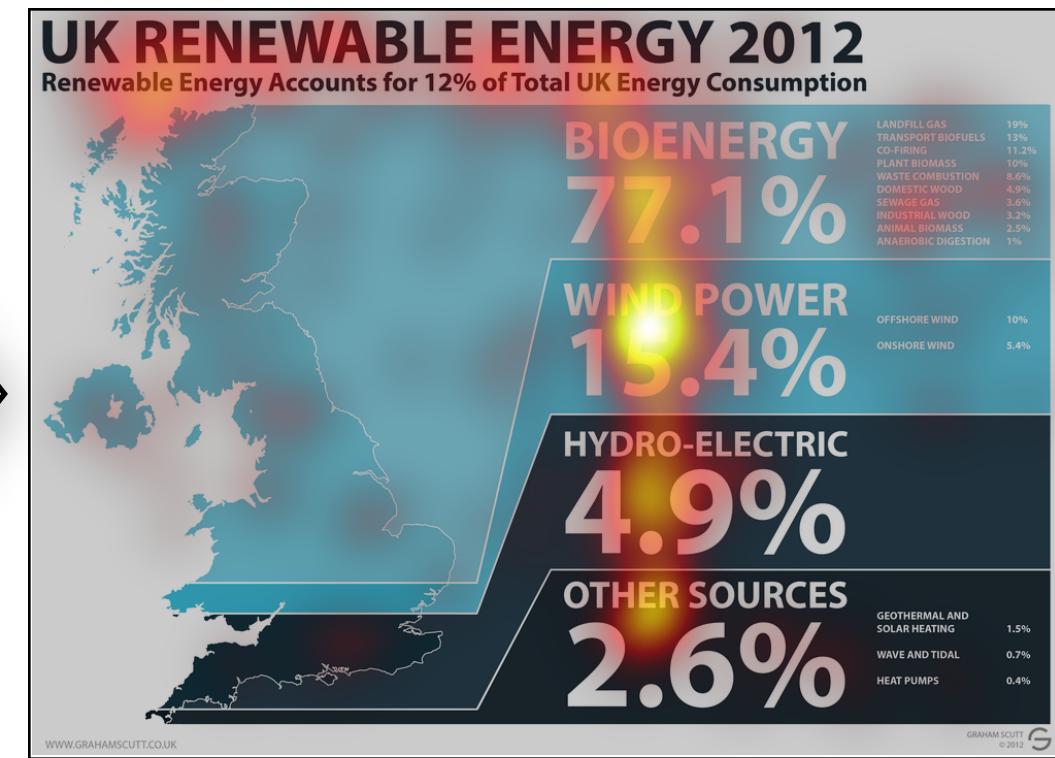


393 visualizations

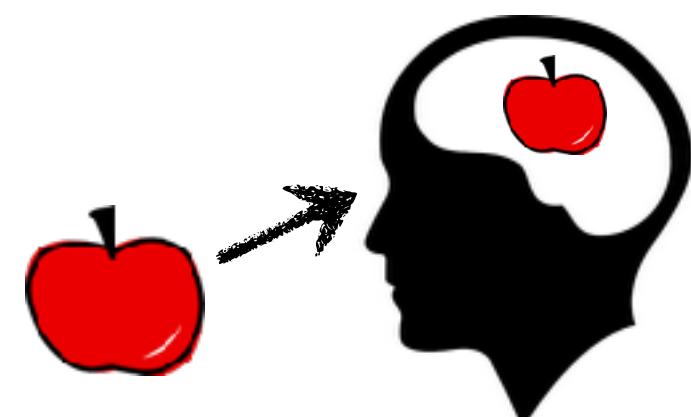
33 PARTICIPANTS

## “ENCODING”

10 seconds / image

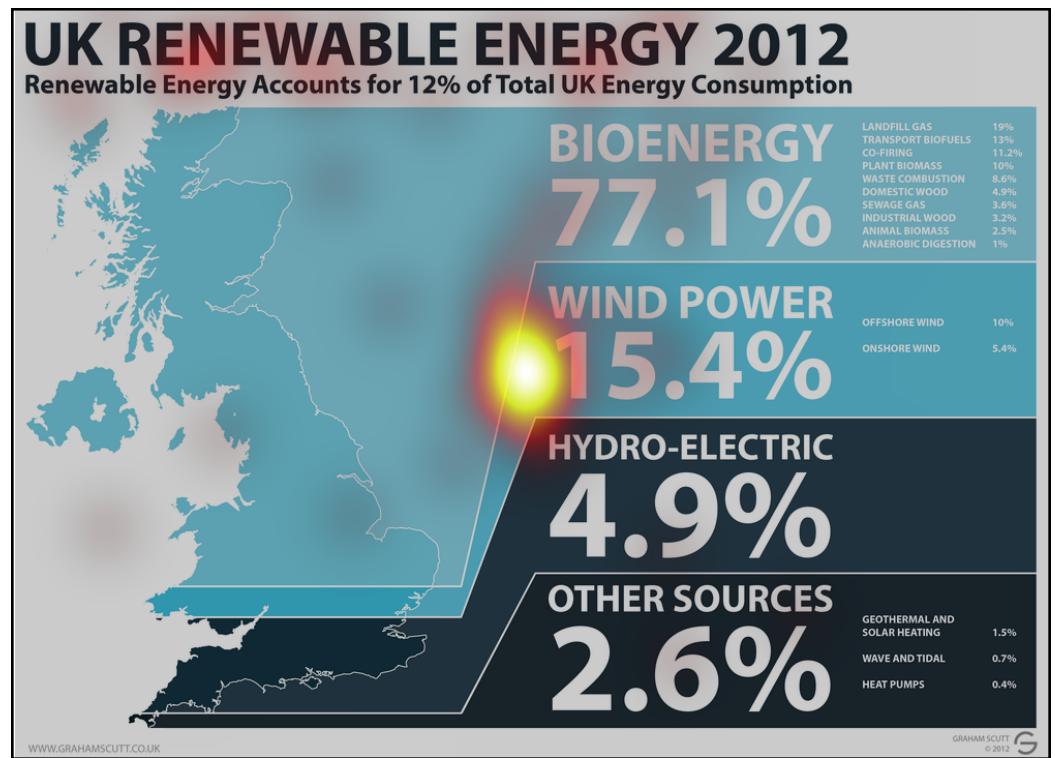


EYE-TRACKING DATA

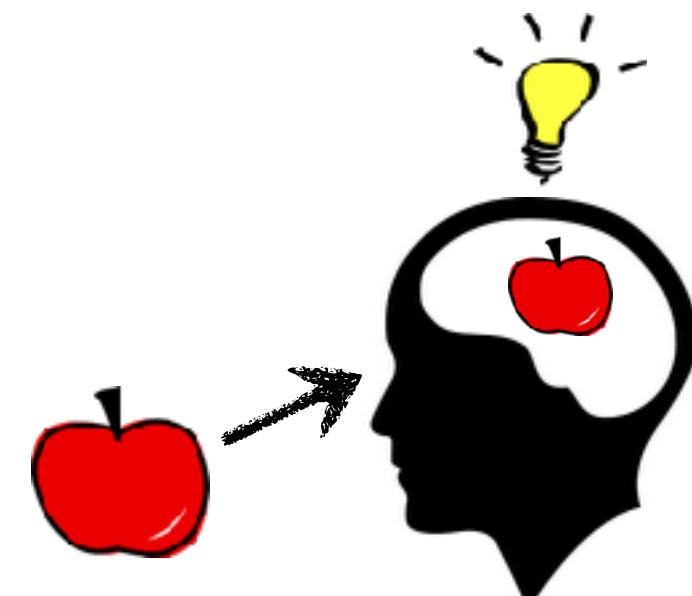


## “RECOGNITION”

2 seconds / image

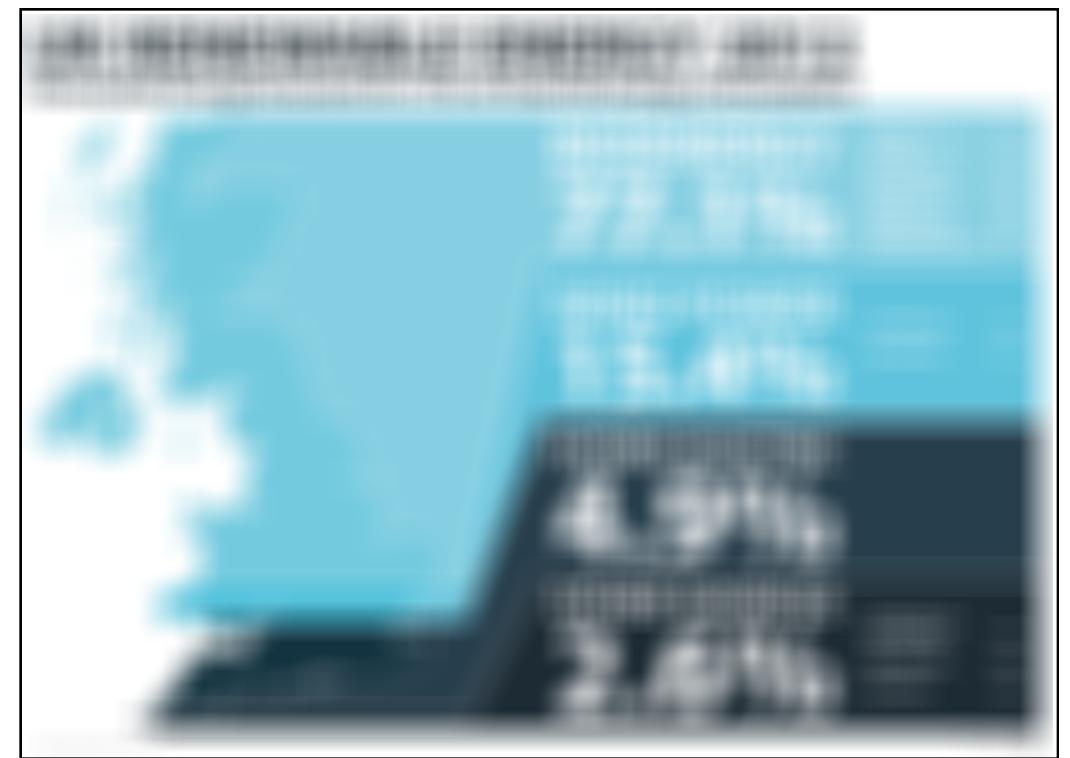


EYE-TRACKING DATA

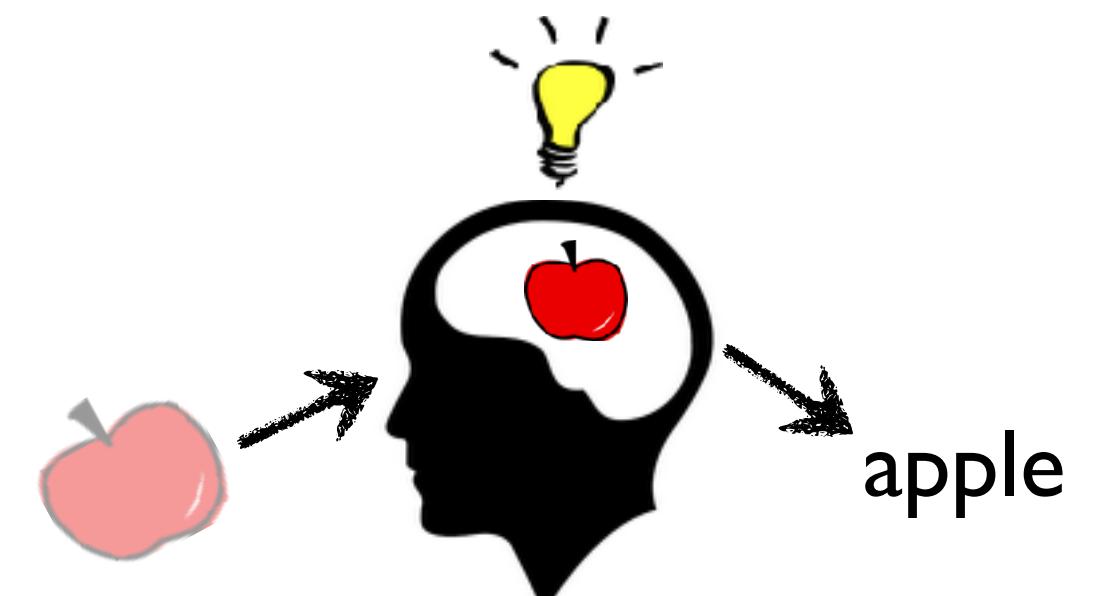


## “RECALL”

20 minutes



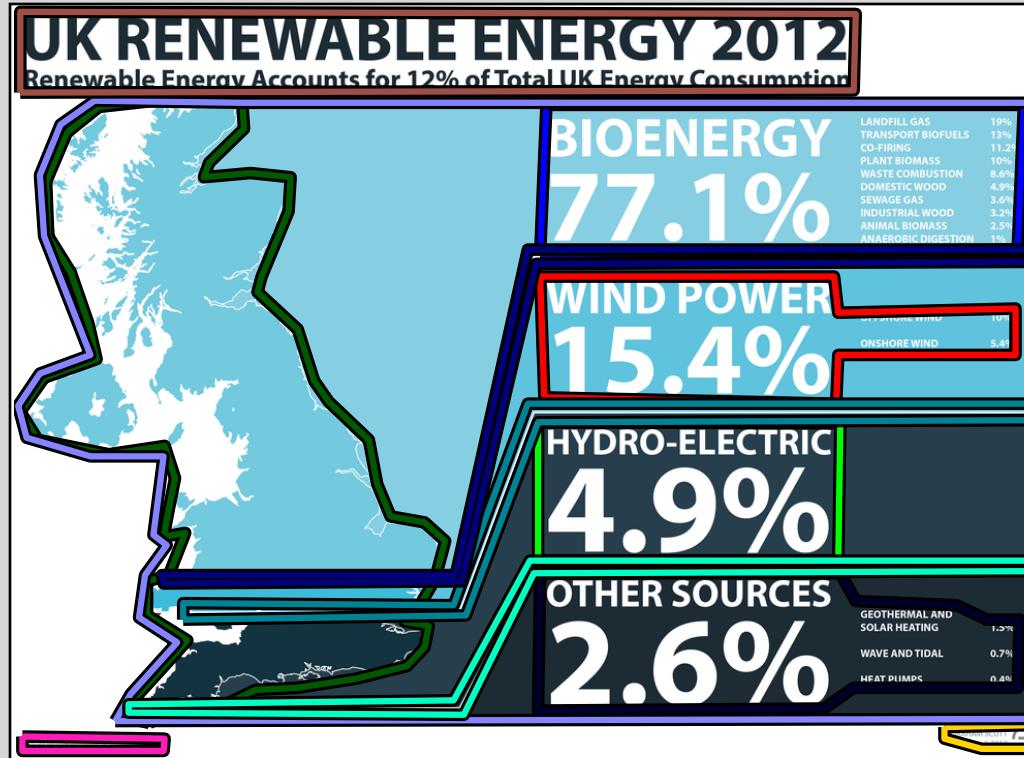
TEXT DESCRIPTIONS



~60 minutes

# Experiment Procedure

LABELED VISUALIZATION  
DATABASE

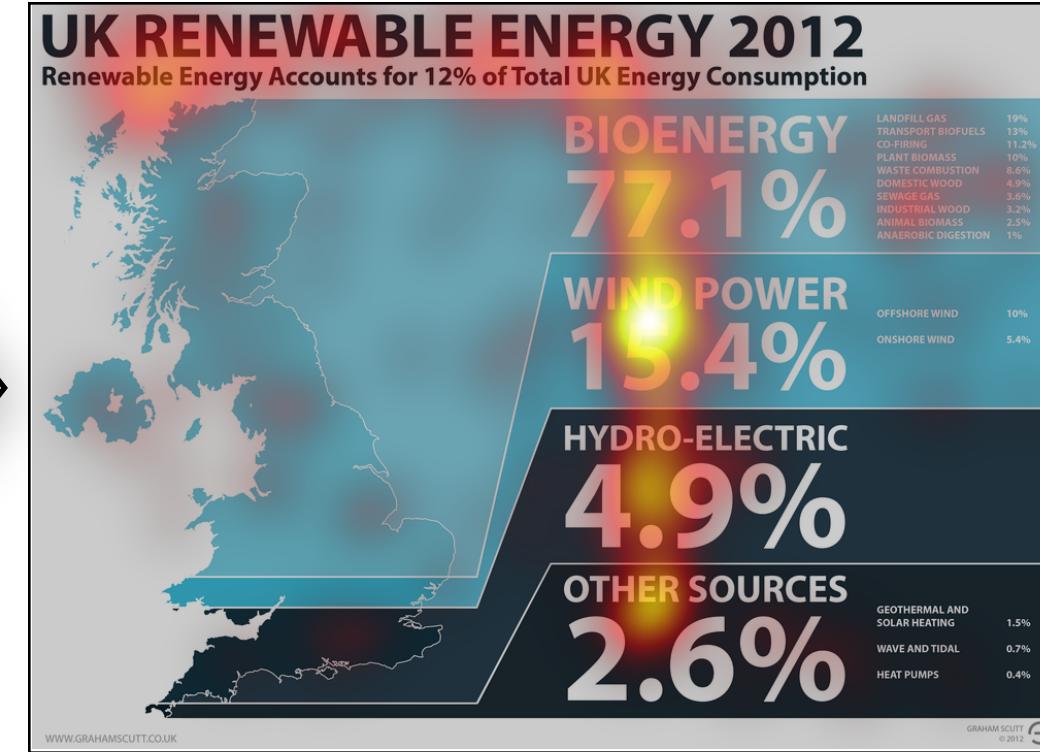


393 visualizations

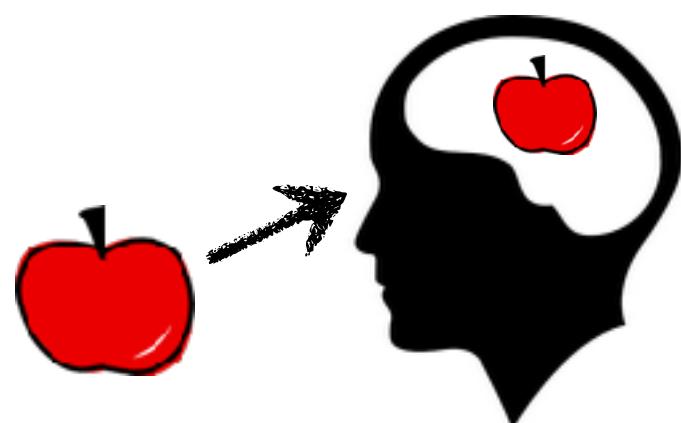
33 PARTICIPANTS

“ENCODING”

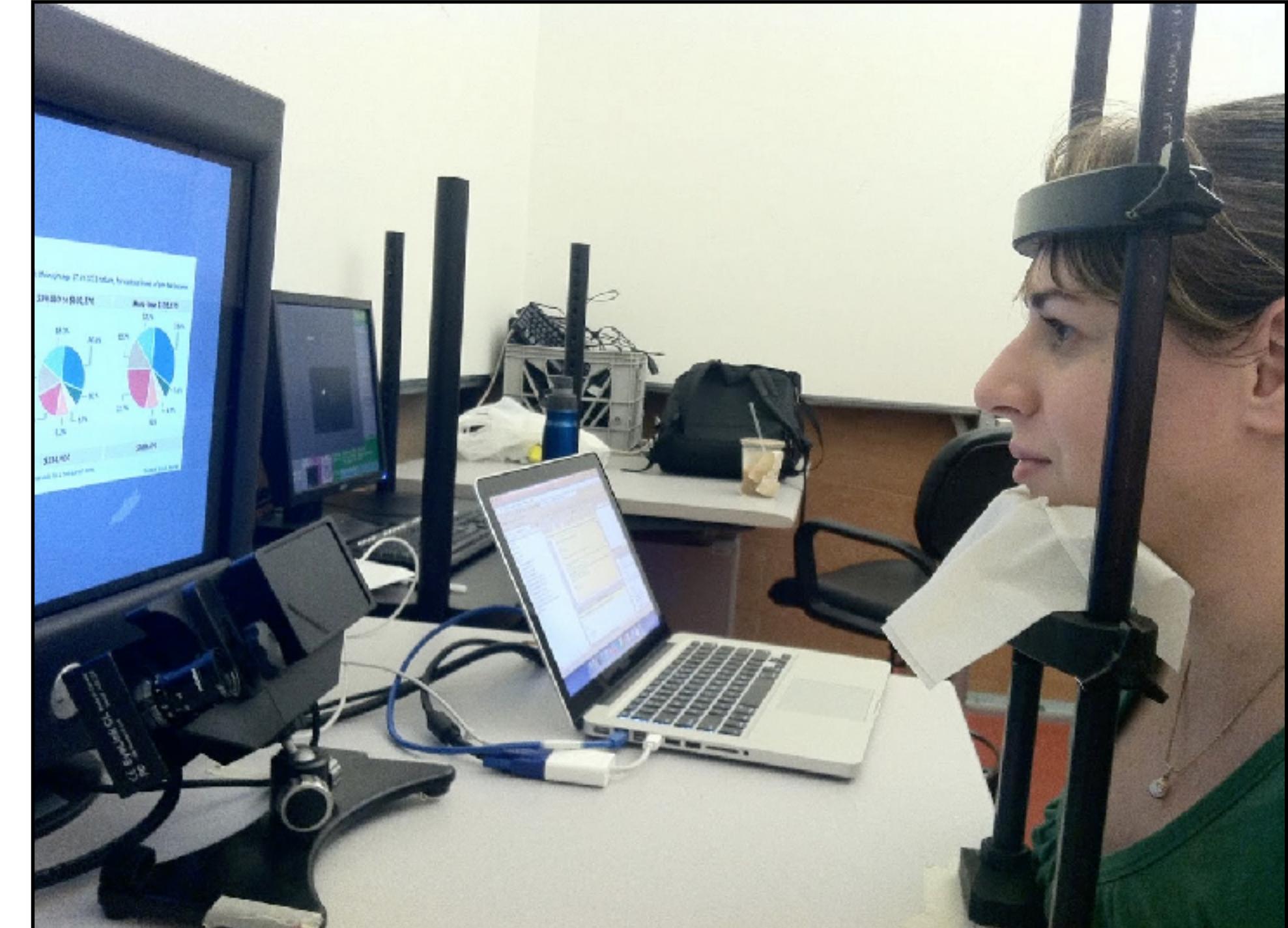
10 seconds / image



EYE-TRACKING DATA

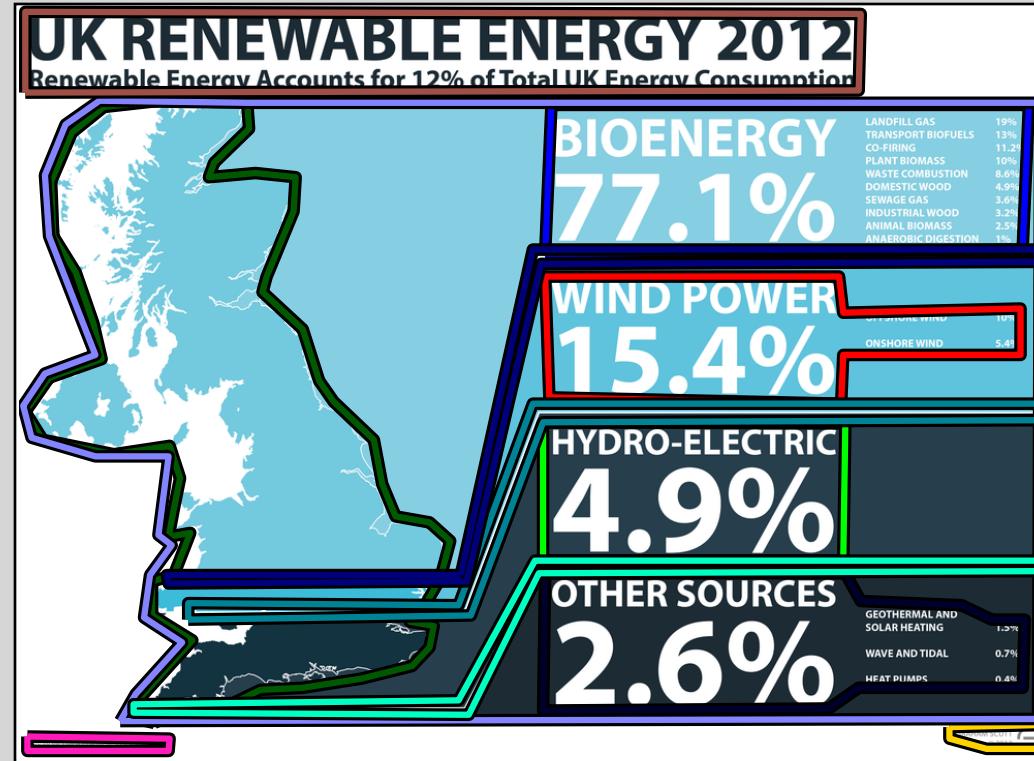


20 minutes



# Experiment Procedure

LABELED VISUALIZATION  
DATABASE

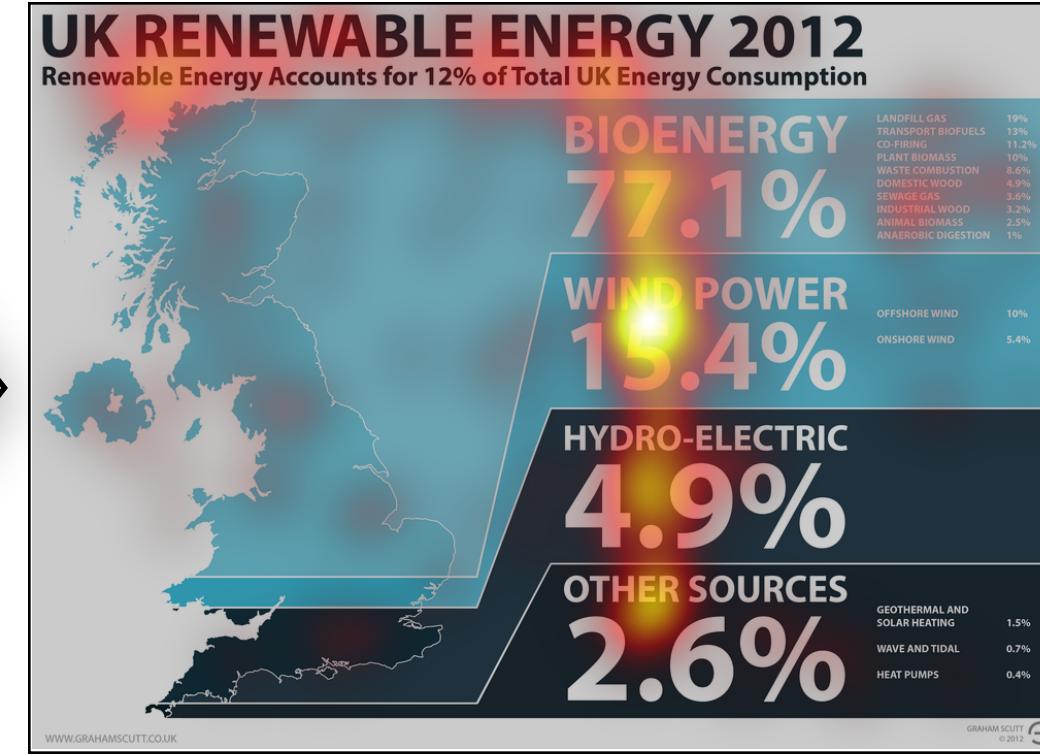


393 visualizations

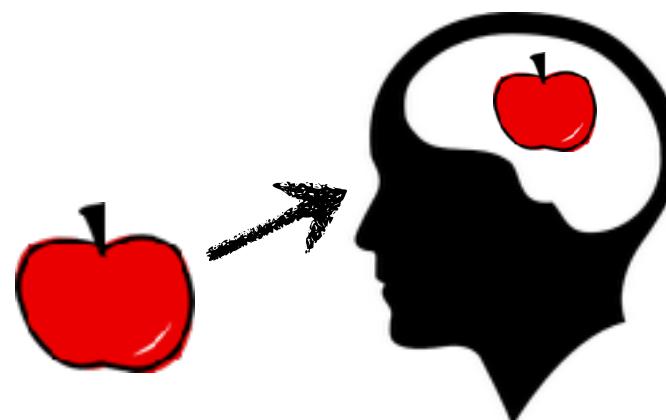
33 PARTICIPANTS

“ENCODING”

10 seconds / image

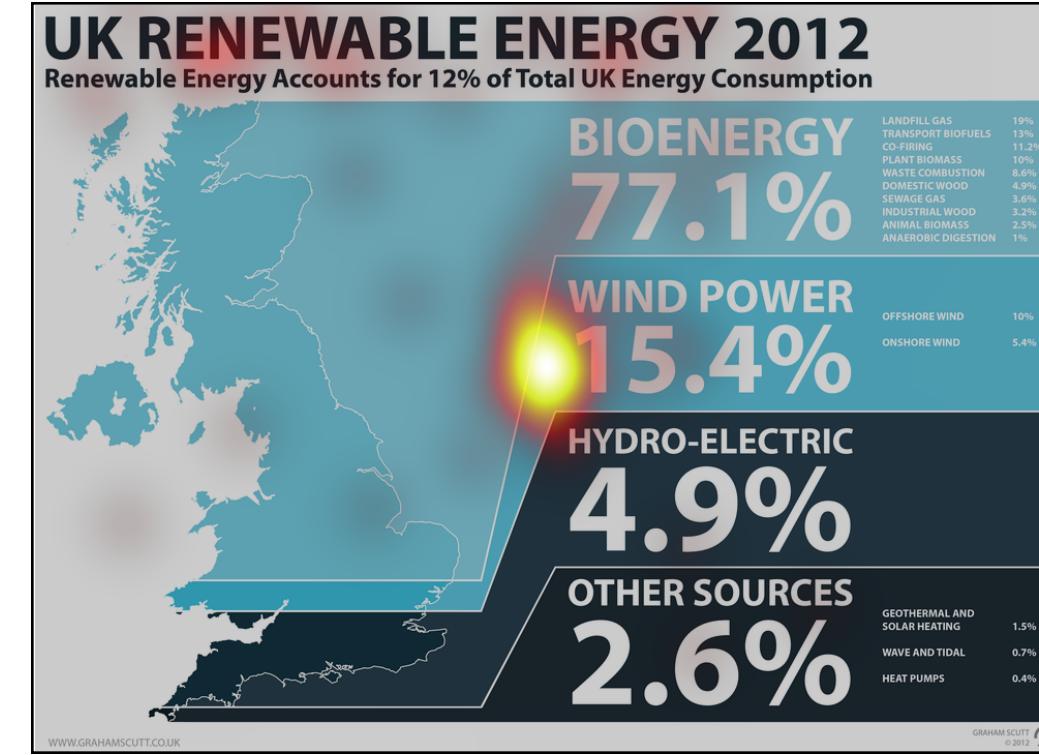


EYE-TRACKING DATA

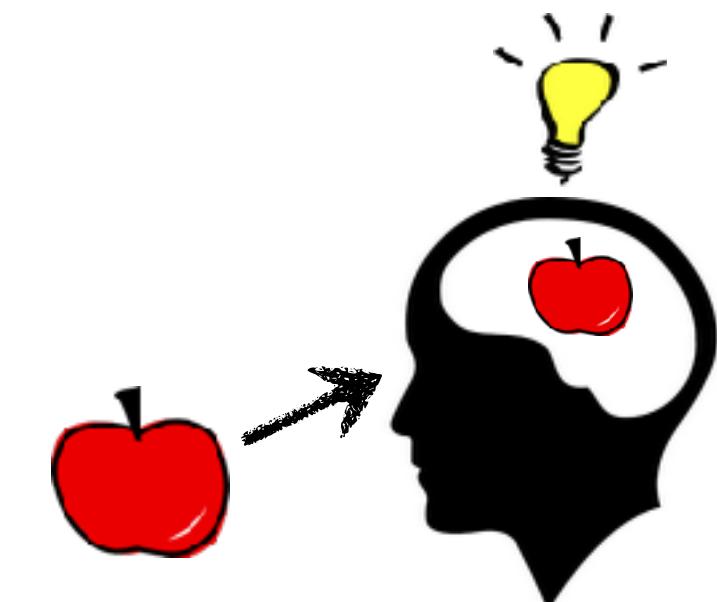


“RECOGNITION”

2 seconds / image



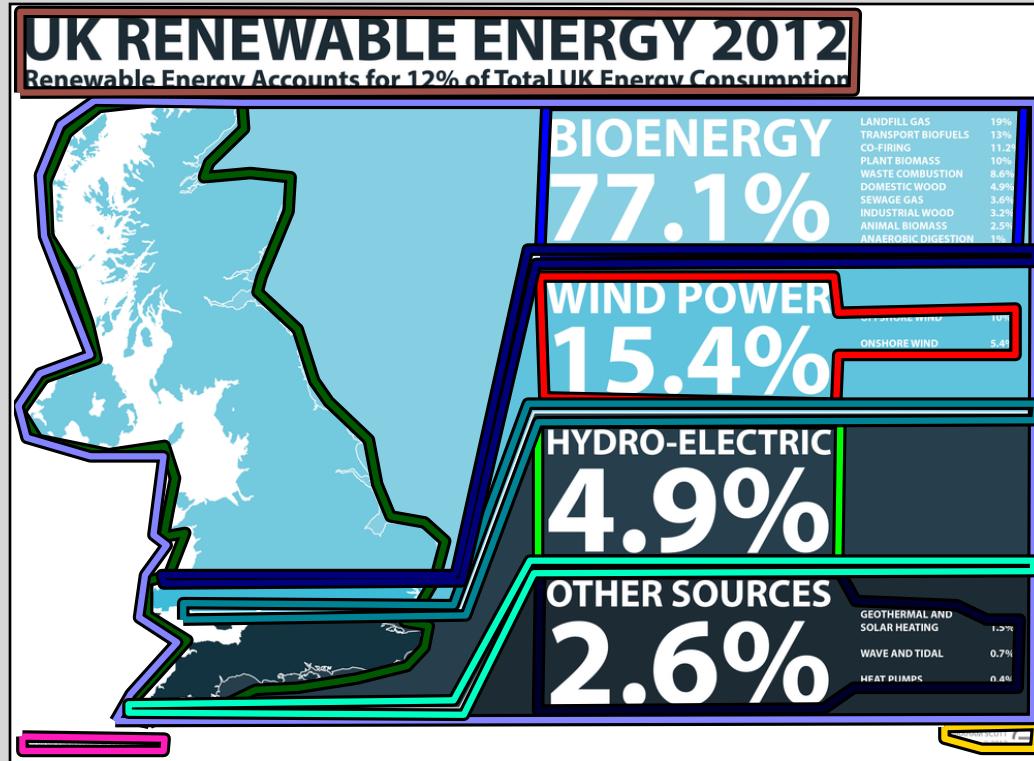
EYE-TRACKING DATA



10 minutes

# Experiment Procedure

## LABELED VISUALIZATION DATABASE

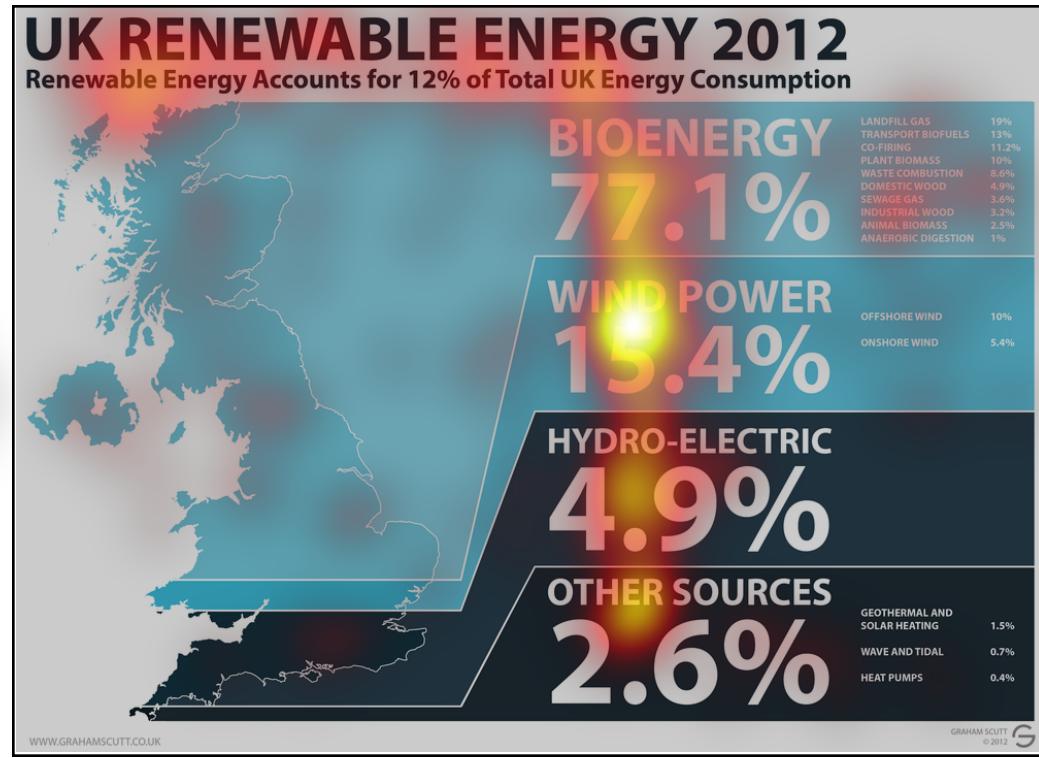


393 visualizations

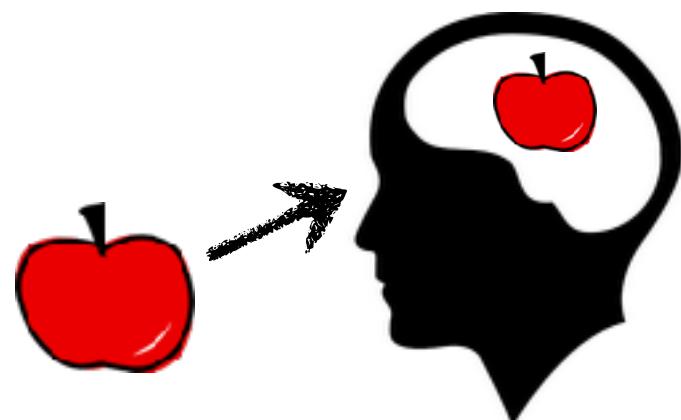
33 PARTICIPANTS

## “ENCODING”

10 seconds / image

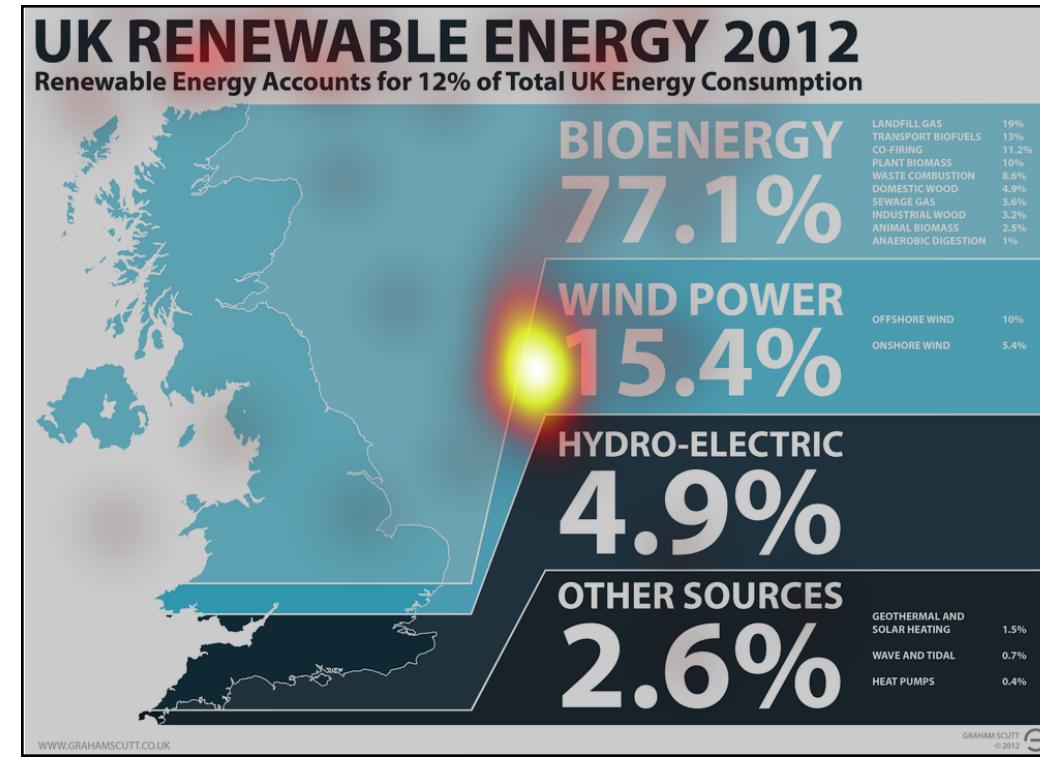


EYE-TRACKING DATA

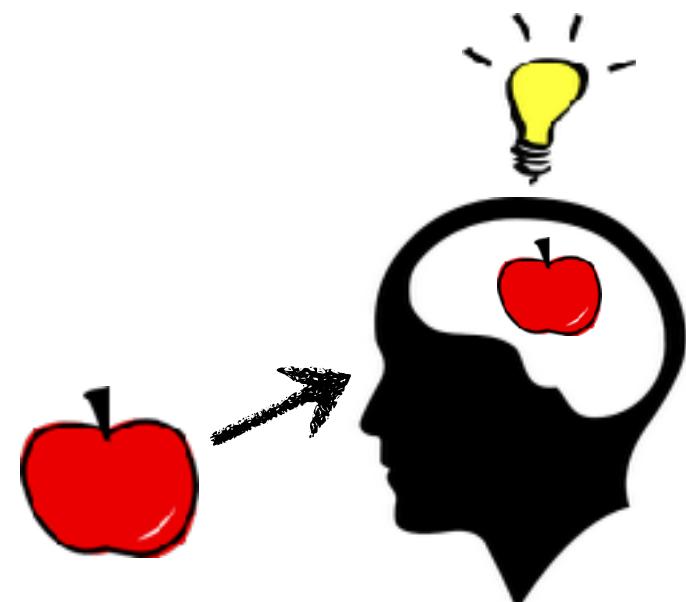


## “RECOGNITION”

2 seconds / image

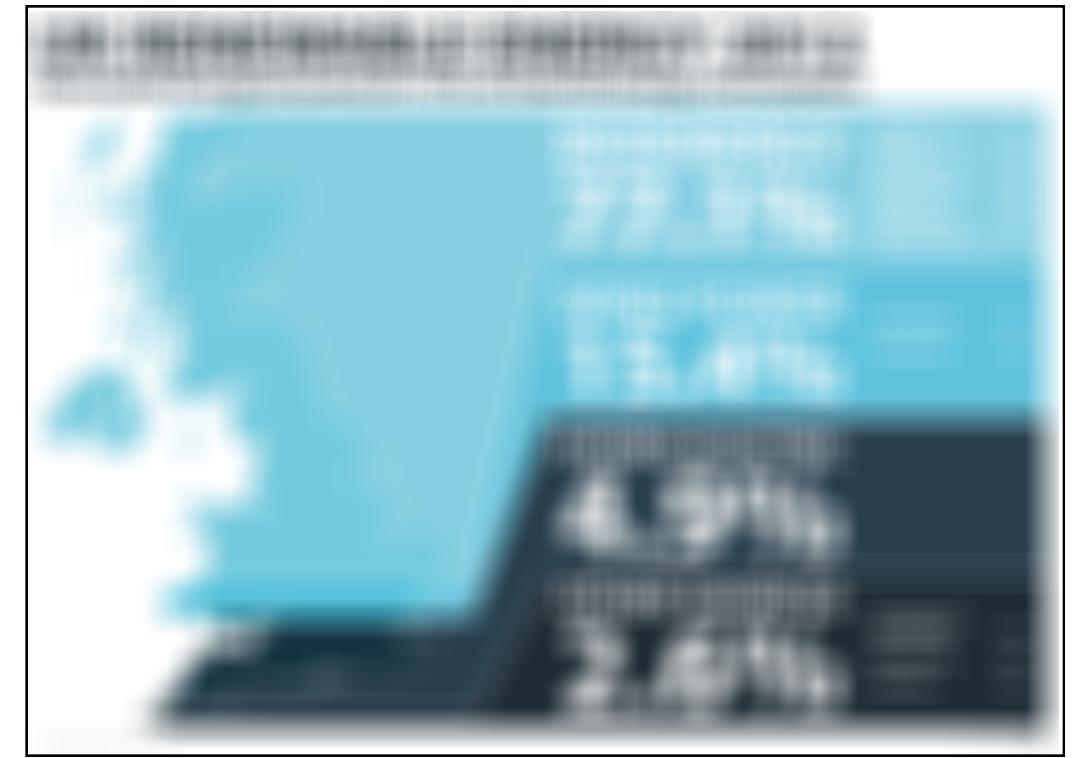


EYE-TRACKING DATA

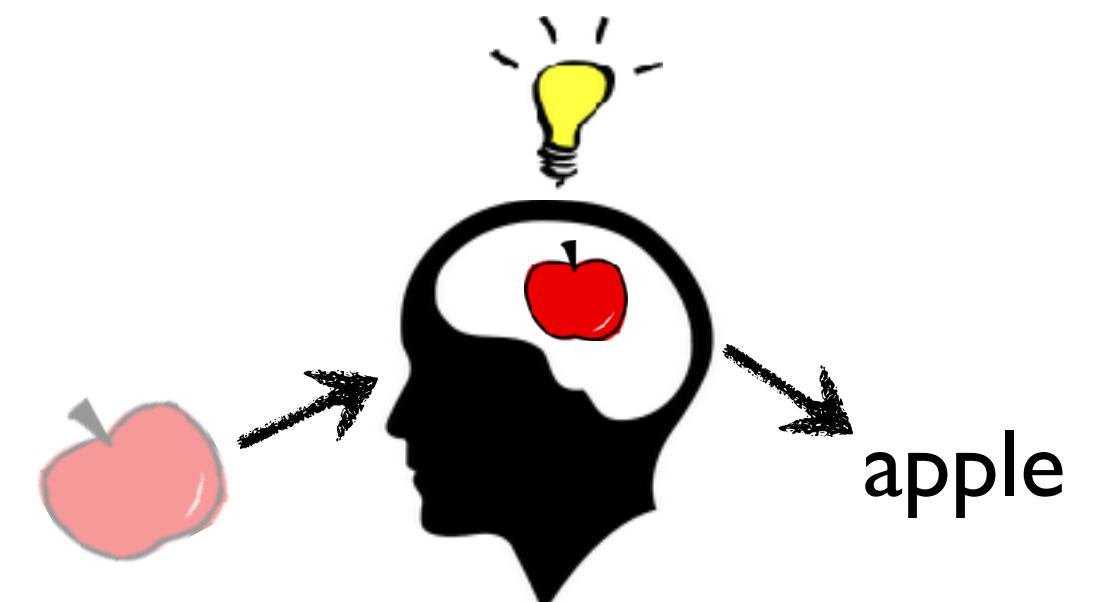


## “RECALL”

20 minutes

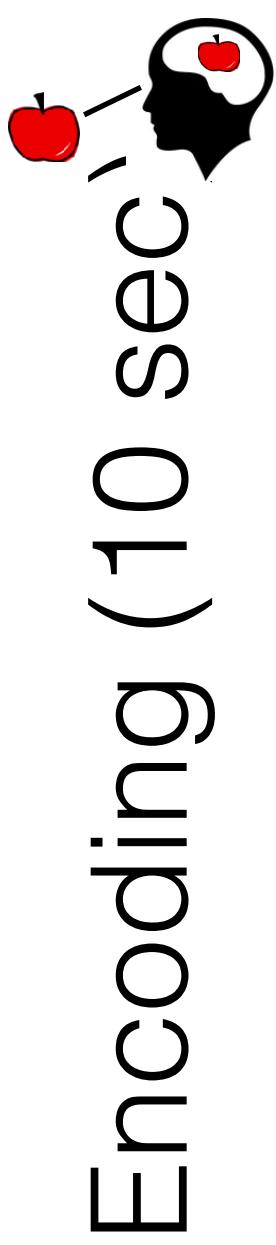


TEXT DESCRIPTIONS

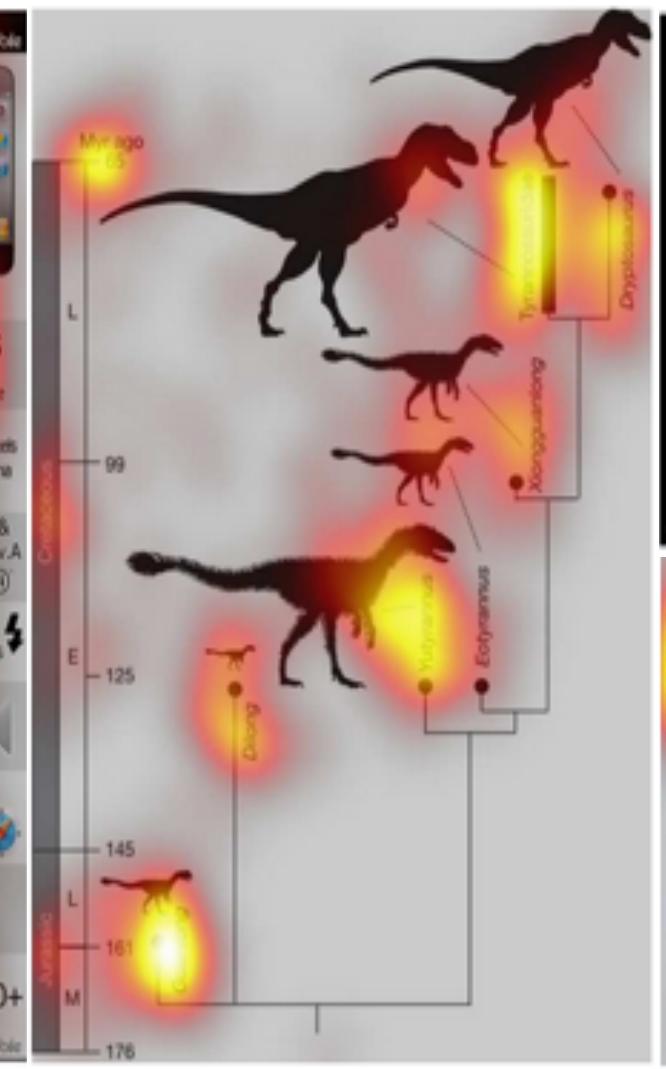
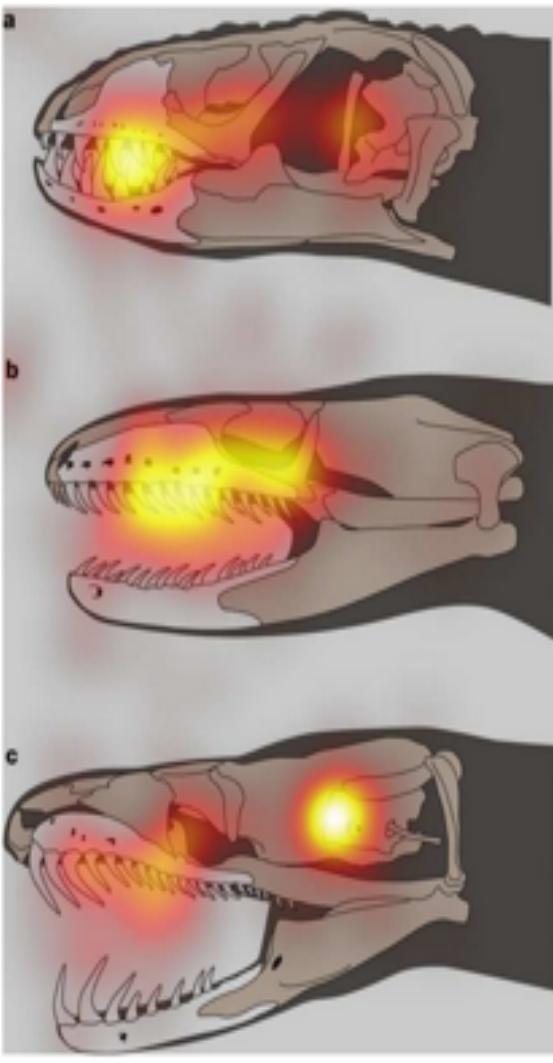


20 minutes

# Results



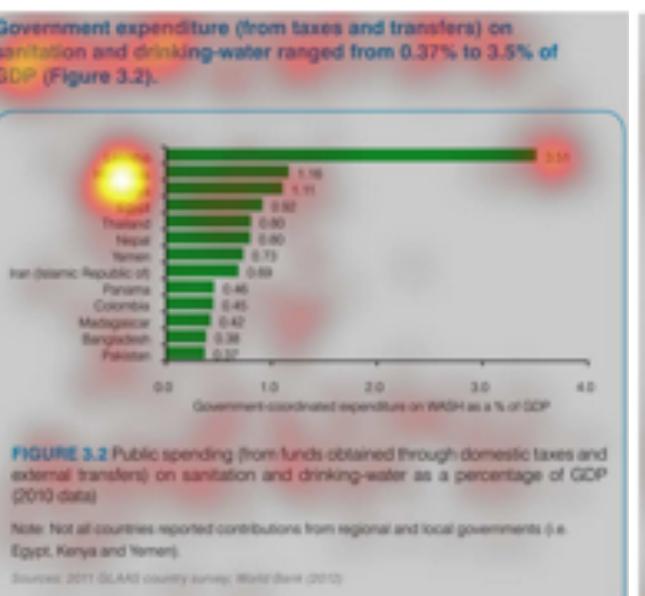
# Most Memorable



Summary data from respondent countries indicate that median government expenditure on sanitation and drinking-water is one third of that for health and one sixth of that for education (Table 1.4).

Country	Government expenditure on health (% of GDP)	Government expenditure on education (% of GDP)	Government expenditure on sanitation and drinking-water (% of GDP)
<b>Azerbaijan</b>	3.1	2.4 <sup>a</sup>	0.4
<b>Bangladesh</b>	5.4	4.7	0.5
<b>China</b>	1.9	3.8 <sup>b</sup>	0.9
<b>India</b>	4.6	—	1.2
<b>Iran (Islamic Republic of)</b>	1.3	—	0.2
<b>Kenya<sup>c</sup></b>	2.3	4.7	0.7
<b>Lao PDR</b>	2.1	6.9 <sup>d</sup>	1.5
<b>Lesotho</b>	8.4	—	3.5
<b>Madagascar</b>	2.7	3.2	0.4
<b>Nepal</b>	1.7	4.7	0.8
<b>Panama</b>	6.1	3.8 <sup>e</sup>	0.5
<b>Thailand</b>	3.7	4.7	0.8
<b>Venezuela<sup>f</sup></b>	1.4	—	0.7
<b>Minimum</b>	1.1	3.2	0.2
<b>Maximum</b>	8.4	16.0	3.5
<b>Median</b>	2.3	5.5	0.7

Sources: 2017 QLAAS country survey; UNESCO (2012); WHO (2012); World Bank (2012)



www.ijerph.com



## Waterfall of Estimated Eligible Homeowners Eligible for HAMP Modification Program

Not all 60+ day delinquent loans are currently eligible for HAMP. Other characteristics may preclude homeowner eligibility. Based on the estimates, of the 4.1 million homeowners who are currently 60+ days delinquent, about 700,000 homeowners are eligible for HAMP. As this represents a point-in-time snapshot of the delinquency population and estimated HAMP eligibility, we expect that as homeowners become seriously delinquent between now and the end of 2013, some of those homeowners will also be eligible for HAMP.

The waterfall chart illustrates the cumulative reduction in the number of estimated eligible HAMP borrowers as various homeowner characteristics are considered. The total population starts at 4.1 million and is broken down into categories that disqualify borrowers from HAMP. The final count of estimated HAMP-eligible borrowers is 0.7 million.

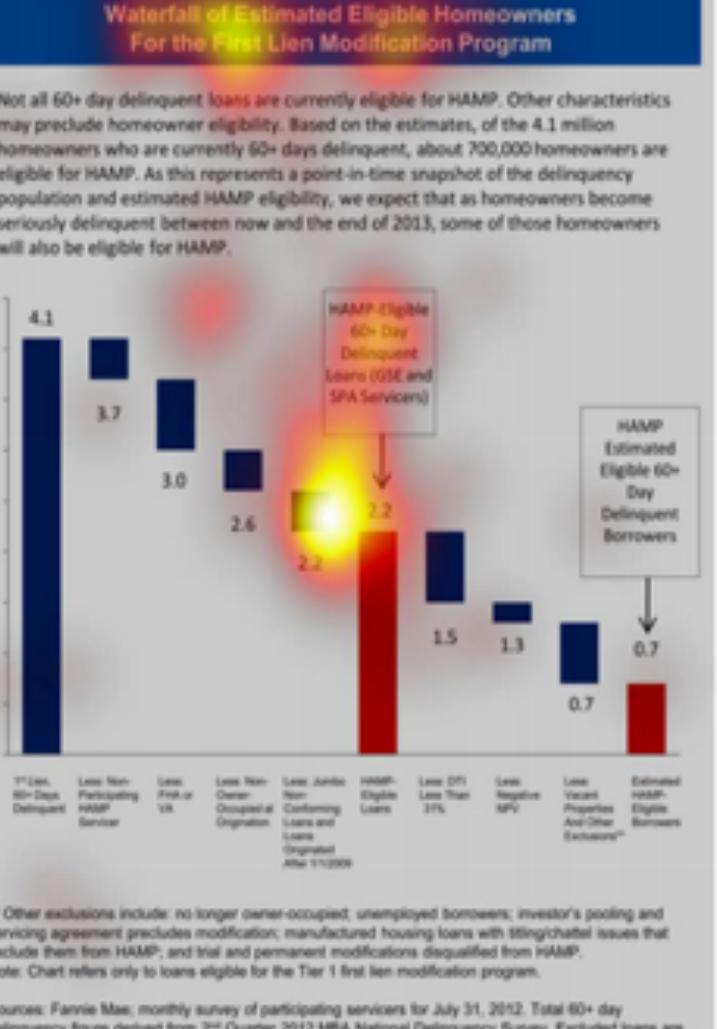
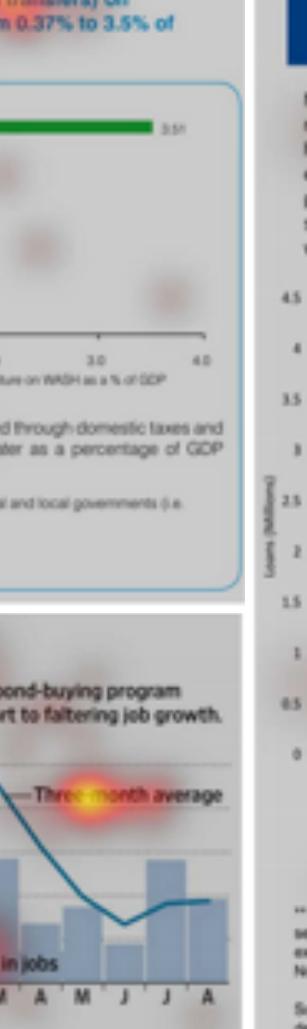
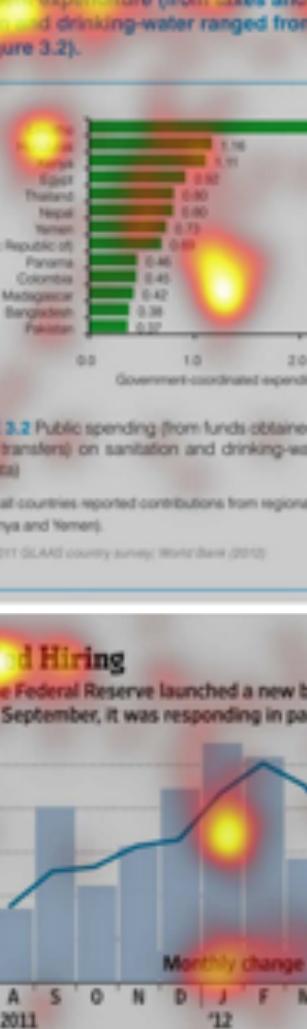
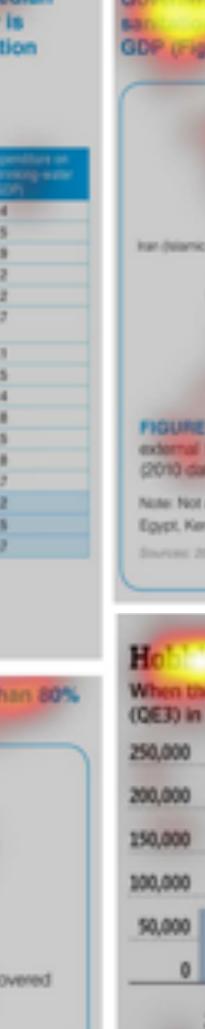
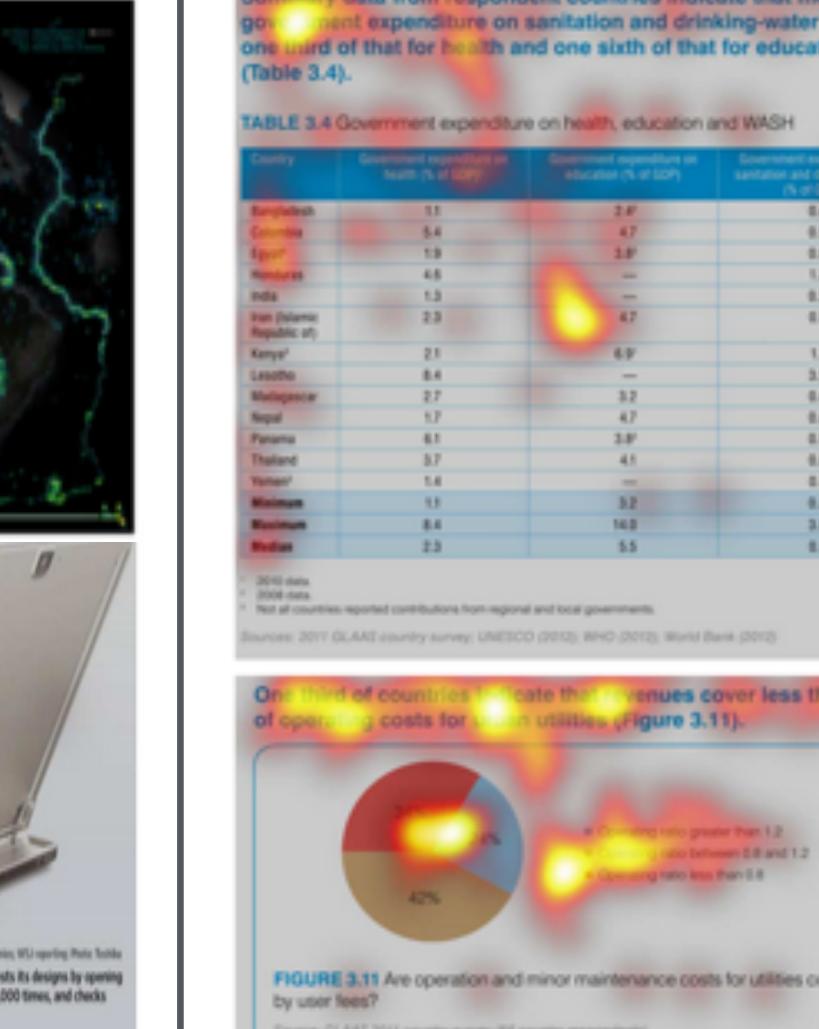
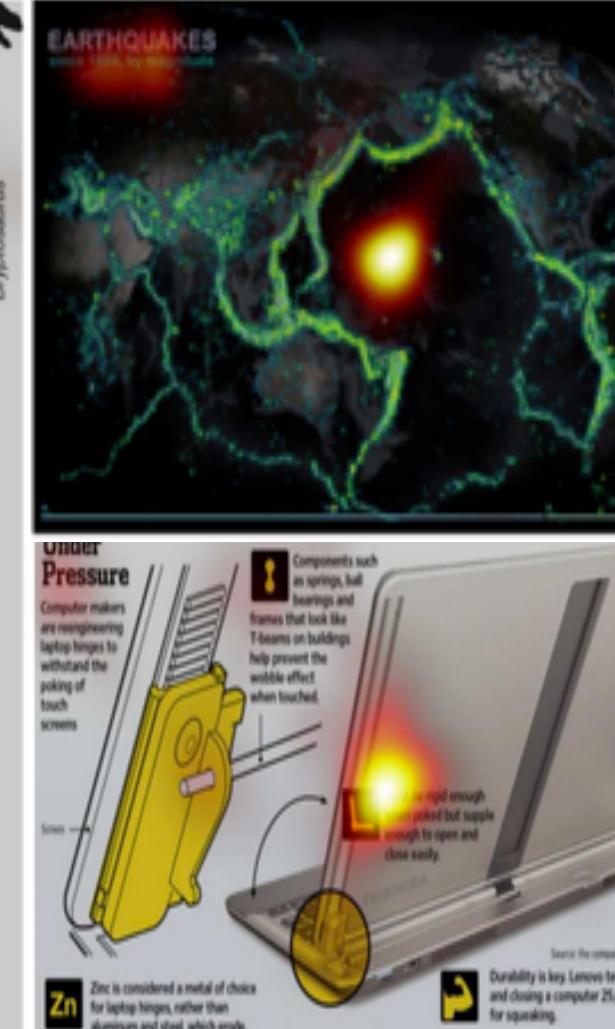
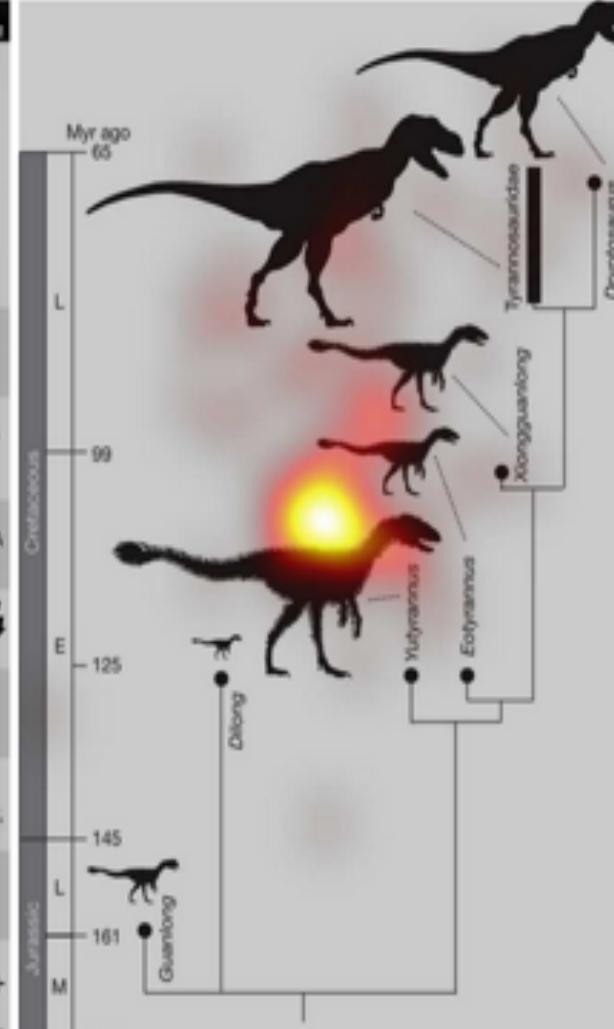
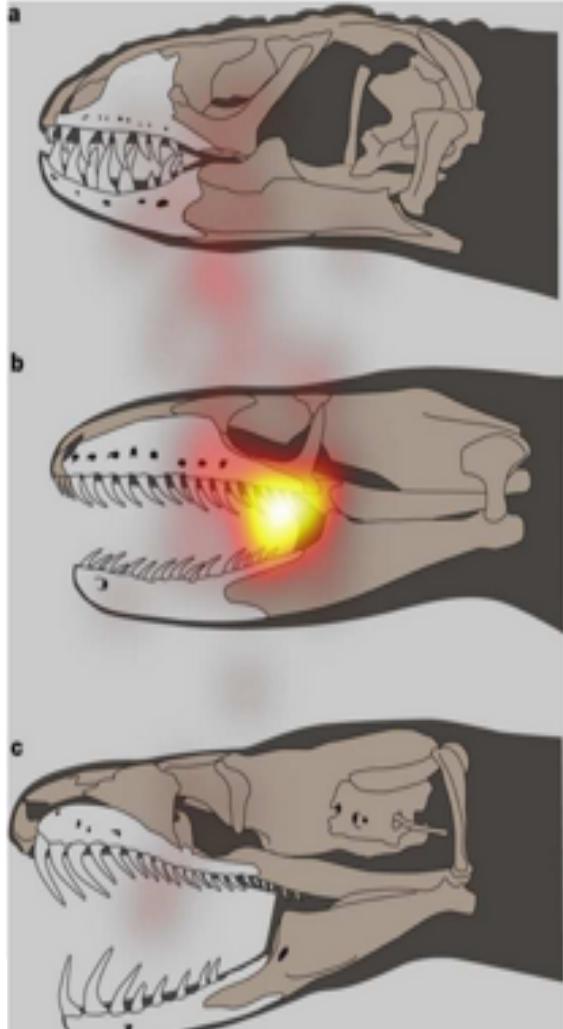
Characteristic	Value	Count
Tier 1 Lien, 60+ Day Delinquent	4.1	4.1 million
Less Non-Participating HAMP Service	-0.4	-0.4 million
Less First or VR	-0.3	-0.3 million
Less Non-Owner Occupied at Origination	-0.1	-0.1 million
Less Jumbo Non-Conforming Loans and Loans Originated After 11/1/09	-0.4	-0.4 million
HAMP-Eligible Loans	2.2	2.2 million
Less DTI Less Than 37%	-0.7	-0.7 million
Less Negative NPV	-0.2	-0.2 million
Less Vacant Properties And Other Exclusions**	-0.4	-0.4 million
Estimated HAMP-Eligible Borrowers	0.7	0.7 million

\*\* Other exclusions include: no longer owner-occupied; unemployed borrowers; investor's pooling and servicing agreement precludes modification; manufactured housing loans with titling/chain of title issues that exclude them from HAMP; and trial and permanent modifications disqualified from HAMP.  
Note: Chart refers only to loans eligible for the Tier 1 first lien modification program.

Sources: Fannie Mae; monthly survey of participating servicers for July 31, 2012. Total 60+ day delinquencies. Excludes distressed loans. Data as of December 2012. HAMP: National Delinquency Survey. Excluded loans are loans that do not meet the definition of a HAMP-eligible loan.

## Recognition

Encoding (10 sec)

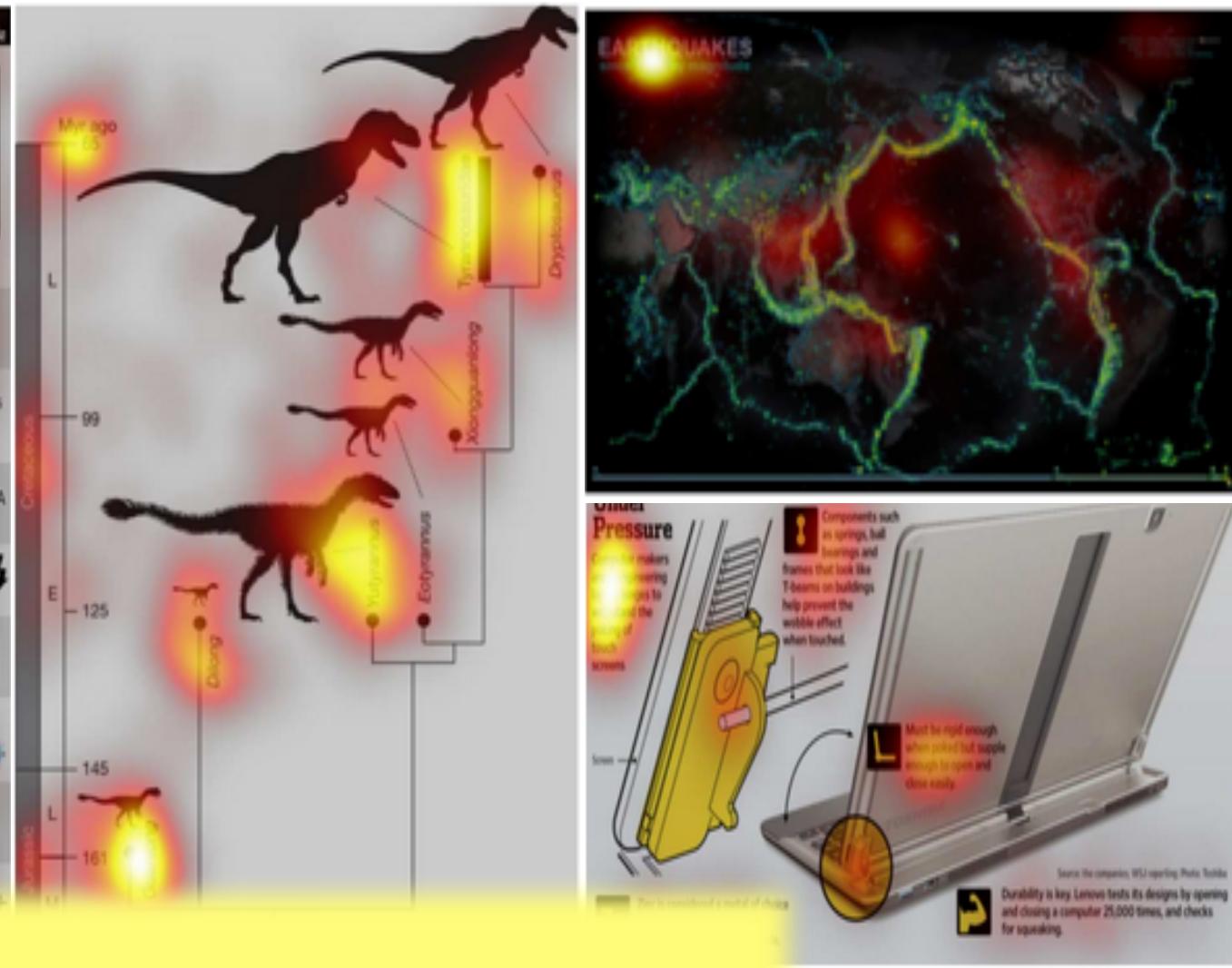
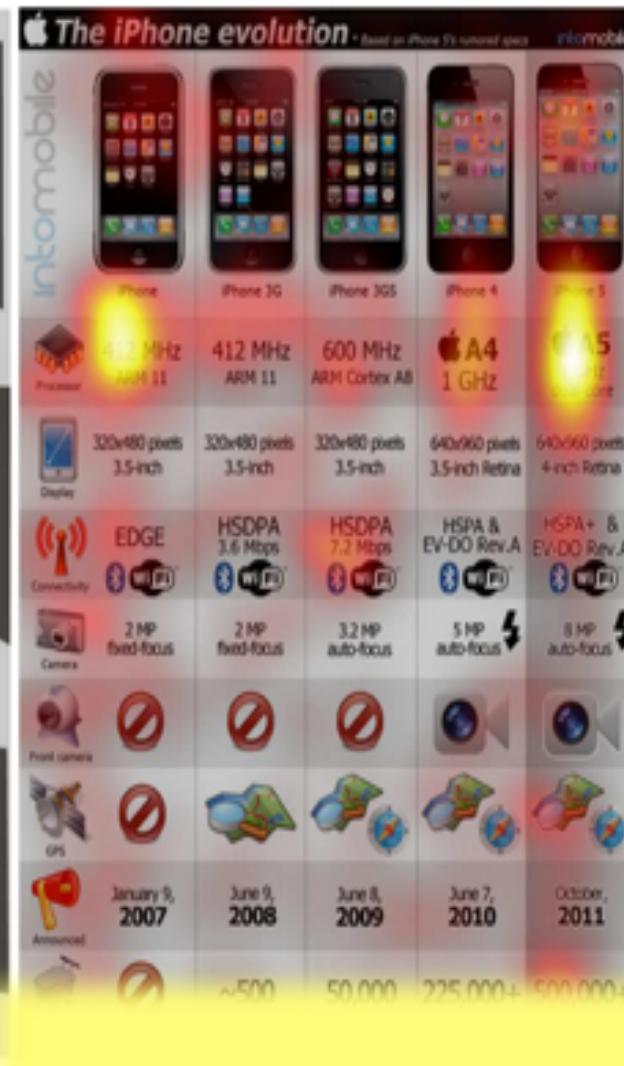
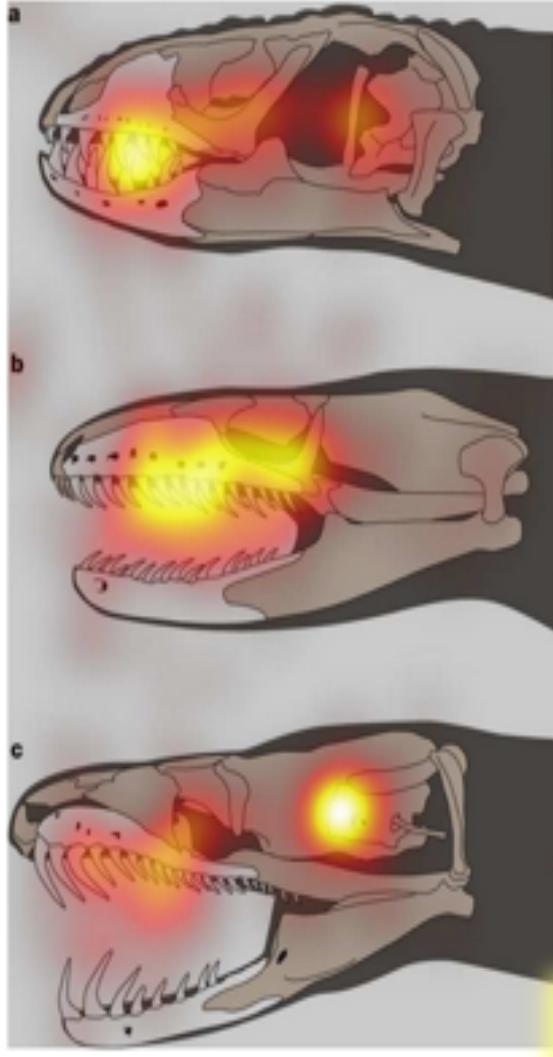


## Most Memorable

## Least Memorable



Encoding (10 sec)



Summary data from respondent countries indicate that median government expenditure on sanitation and drinking-water is one-third of that for health and one sixth of that for education (Table 3.4).			
Country	Government expenditure on health (% of GDP)	Government expenditure on education (% of GDP)	Government expenditure on sanitation and drinking-water (% of GDP)
Burkina Faso	1.1	2.4	0.4
Bulgaria	5.4	4.7	0.5
Egypt	1.9	3.8	0.8
Honduras	4.6	—	1.2
India	1.3	—	0.2
Iran (Islamic Republic of)	2.3	4.7	0.7
Kenya*	2.1	6.9	1.1
Lao PDR	0.4	—	0.1
Mongolia	2.7	3.2	0.4
Nepal	1.7	4.7	0.8
Panama	6.1	3.8	0.5
Thailand	3.7	4.1	0.8
Venezuela	1.4	—	0.7
Malta	1.7	3.2	0.2
Benin	0.4	14.8	3.5
Madagascar	0.36	—	0.2
Bangladesh	0.37	—	0.2
Maldives	2.3	5.5	0.7

Government expenditure (from taxes and transfers) on sanitation and drinking-water ranged from 0.37% to 3.5% of GDP (Figure 3.2).			
Country	Government expenditure on WASH as a % of GDP	Government expenditure on health as a % of GDP	Government expenditure on education as a % of GDP
Burkina Faso	0.37	1.18	3.4
Bulgaria	0.41	1.11	3.5
Egypt	0.39	0.80	3.5
Honduras	0.40	1.11	3.5
India	0.37	1.11	3.5
Iran (Islamic Republic of)	0.37	1.11	3.5
Kenya*	0.37	1.11	3.5
Lao PDR	0.40	1.11	3.5
Mongolia	0.37	1.11	3.5
Nepal	0.37	1.11	3.5
Panama	0.40	1.11	3.5
Thailand	0.37	1.11	3.5
Venezuela	0.37	1.11	3.5
Malta	0.37	1.11	3.5
Benin	0.40	1.11	3.5
Madagascar	0.37	1.11	3.5
Bangladesh	0.37	1.11	3.5
Maldives	0.37	1.11	3.5
Maldives	0.37	1.11	3.5

FIGURE 3.2 Public spending (from funds obtained through domestic taxes and external transfers) on sanitation and drinking-water as a percentage of GDP (2010 data)

Note: Not all countries reported contributions from regional and local governments (i.e. Egypt, Kenya and Yemen).

Sources: 2011 GLAAS country survey; World Bank (2012)

\* 2010 data.

\*\* 2009 data.

† Not all countries reported contributions from regional and local governments.

Sources: 2011 GLAAS country survey; UNESCO (2012); WHO (2012); World Bank (2012)

‡ 2010 data.

§ 2008 data.

\*\* Not all countries reported contributions from regional and local governments.

Sources: 2011 GLAAS country survey; UNESCO (2012); WHO (2012); World Bank (2012)

\*\* 2010 data.

† 2009 data.

‡ Not all countries reported contributions from regional and local governments.

Sources: 2011 GLAAS country survey; UNESCO (2012); WHO (2012); World Bank (2012)

\*\* 2010 data.

† 2009 data.

‡ Not all countries reported contributions from regional and local governments.

Sources: 2011 GLAAS country survey; UNESCO (2012); WHO (2012); World Bank (2012)

\*\* 2010 data.

† 2009 data.

‡ Not all countries reported contributions from regional and local governments.

Sources: 2011 GLAAS country survey; UNESCO (2012); WHO (2012); World Bank (2012)

\*\* 2010 data.

† 2009 data.

‡ Not all countries reported contributions from regional and local governments.

Sources: 2011 GLAAS country survey; UNESCO (2012); WHO (2012); World Bank (2012)

\*\* 2010 data.

† 2009 data.

‡ Not all countries reported contributions from regional and local governments.

Sources: 2011 GLAAS country survey; UNESCO (2012); WHO (2012); World Bank (2012)

\*\* 2010 data.

† 2009 data.

‡ Not all countries reported contributions from regional and local governments.

Sources: 2011 GLAAS country survey; UNESCO (2012); WHO (2012); World Bank (2012)

\*\* 2010 data.

† 2009 data.

‡ Not all countries reported contributions from regional and local governments.

Sources: 2011 GLAAS country survey; UNESCO (2012); WHO (2012); World Bank (2012)

\*\* 2010 data.

† 2009 data.

‡ Not all countries reported contributions from regional and local governments.

Sources: 2011 GLAAS country survey; UNESCO (2012); WHO (2012); World Bank (2012)

\*\* 2010 data.

† 2009 data.

‡ Not all countries reported contributions from regional and local governments.

Sources: 2011 GLAAS country survey; UNESCO (2012); WHO (2012); World Bank (2012)

\*\* 2010 data.

† 2009 data.

‡ Not all countries reported contributions from regional and local governments.

Sources: 2011 GLAAS country survey; UNESCO (2012); WHO (2012); World Bank (2012)

\*\* 2010 data.

† 2009 data.

‡ Not all countries reported contributions from regional and local governments.

Sources: 2011 GLAAS country survey; UNESCO (2012); WHO (2012); World Bank (2012)

\*\* 2010 data.

† 2009 data.

‡ Not all countries reported contributions from regional and local governments.

Sources: 2011 GLAAS country survey; UNESCO (2012); WHO (2012); World Bank (2012)

\*\* 2010 data.

† 2009 data.

‡ Not all countries reported contributions from regional and local governments.

Sources: 2011 GLAAS country survey; UNESCO (2012); WHO (2012); World Bank (2012)

\*\* 2010 data.

† 2009 data.

‡ Not all countries reported contributions from regional and local governments.

Sources: 2011 GLAAS country survey; UNESCO (2012); WHO (2012); World Bank (2012)

\*\* 2010 data.

† 2009 data.

‡ Not all countries reported contributions from regional and local governments.

Sources: 2011 GLAAS country survey; UNESCO (2012); WHO (2012); World Bank (2012)

\*\* 2010 data.

† 2009 data.

‡ Not all countries reported contributions from regional and local governments.

Sources: 2011 GLAAS country survey; UNESCO (2012); WHO (2012); World Bank (2012)

\*\* 2010 data.

† 2009 data.

‡ Not all countries reported contributions from regional and local governments.

Sources: 2011 GLAAS country survey; UNESCO (2012); WHO (2012); World Bank (2012)

\*\* 2010 data.

† 2009 data.

‡ Not all countries reported contributions from regional and local governments.

Sources: 2011 GLAAS country survey; UNESCO (2012); WHO (2012); World Bank (2012)

\*\* 2010 data.

† 2009 data.

‡ Not all countries reported contributions from regional and local governments.

Sources: 2011 GLAAS country survey; UNESCO (2012); WHO (2012); World Bank (2012)

\*\* 2010 data.

† 2009 data.

‡ Not all countries reported contributions from regional and local governments.

Sources: 2011 GLAAS country survey; UNESCO (2012); WHO (2012); World Bank (2012)

\*\* 2010 data.

† 2009 data.

‡ Not all countries reported contributions from regional and local governments.

Sources: 2011 GLAAS country survey; UNESCO (2012); WHO (2012); World Bank (2012)

\*\* 2010 data.

† 2009 data.

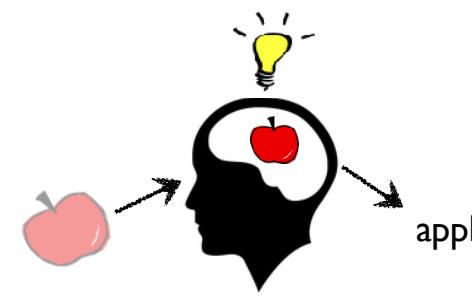
‡ Not all countries reported contributions from regional and local governments.

Sources: 2011 GLAAS country survey; UNESCO (2012); WHO (2012); World Bank (2012)

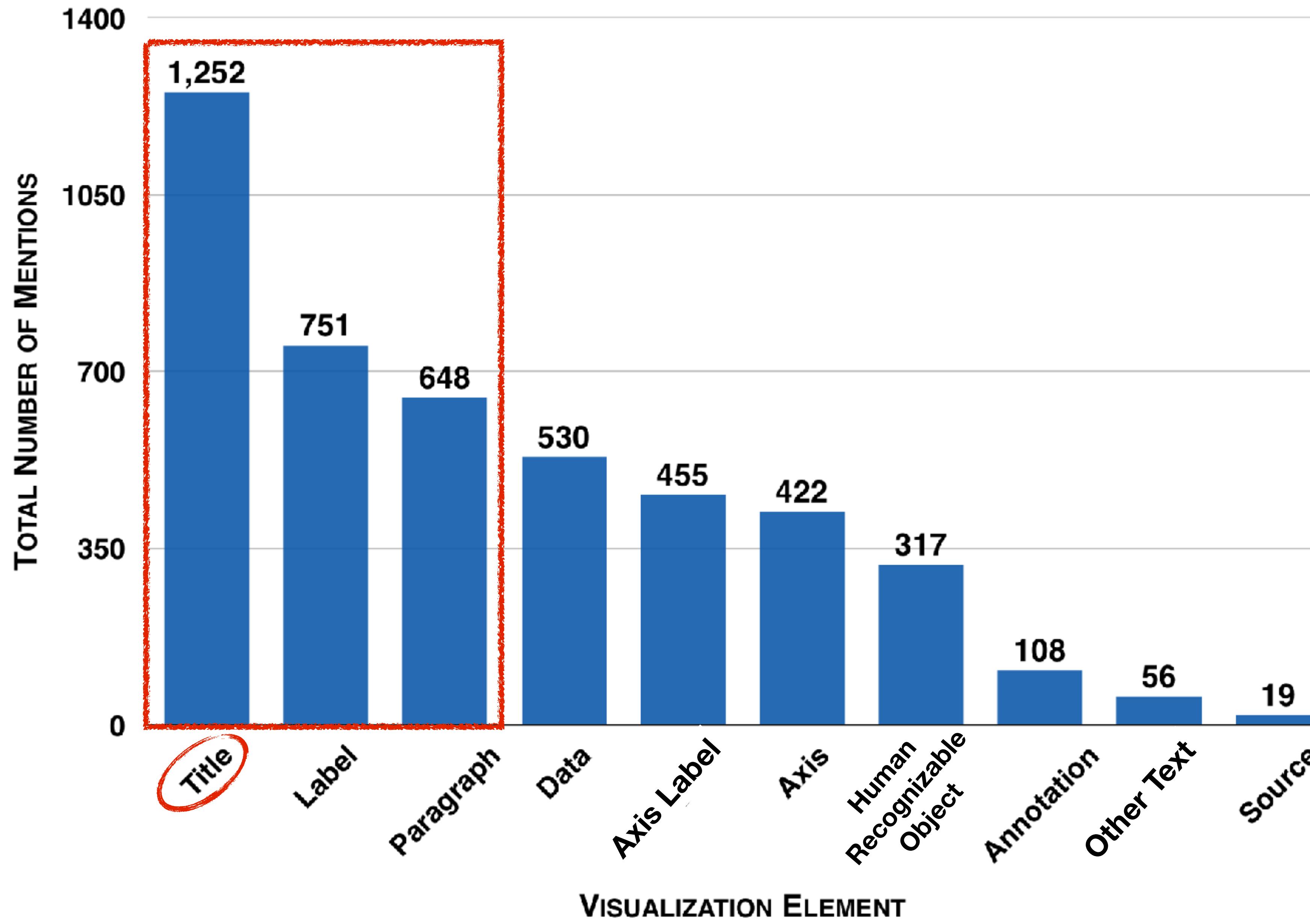
\*\* 2010 data.

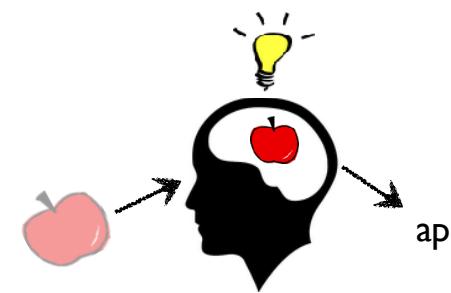
† 2009 data.

‡ Not all countries reported contributions from regional and local governments.

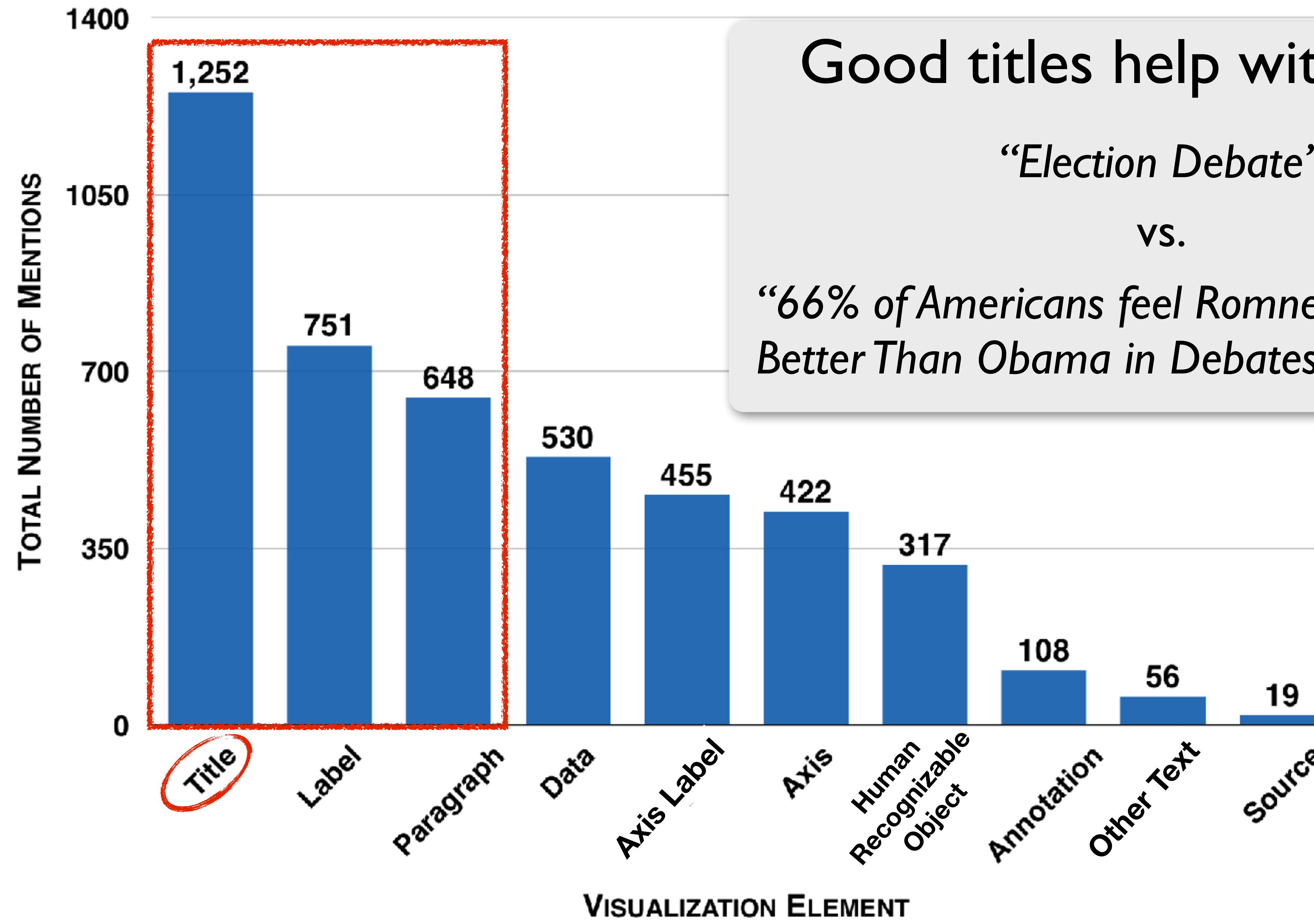


# RECALL





# RECALL



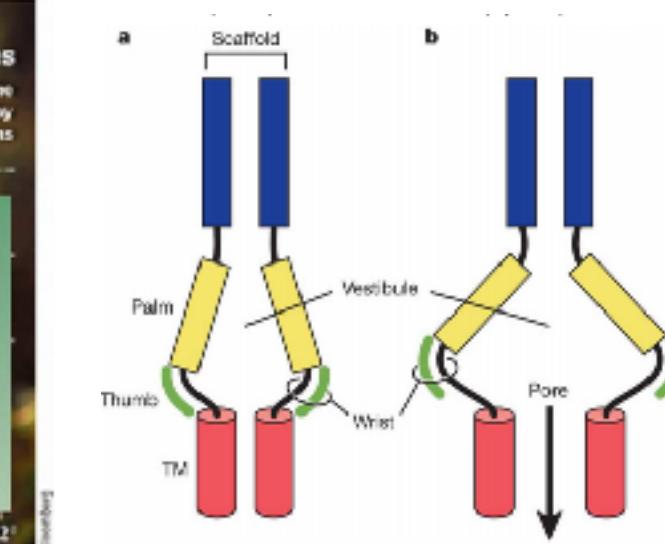
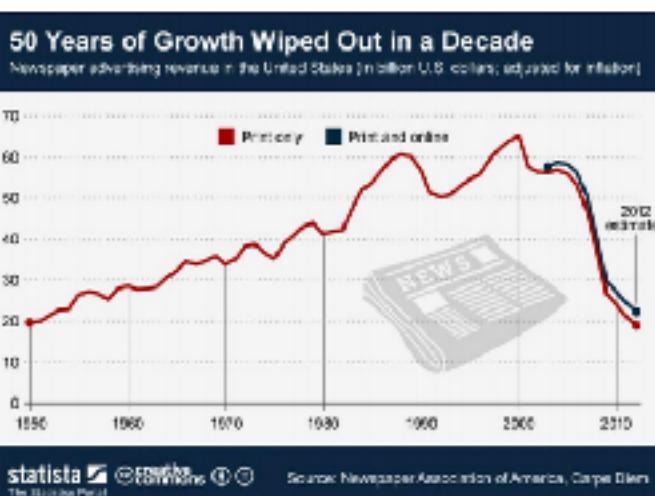
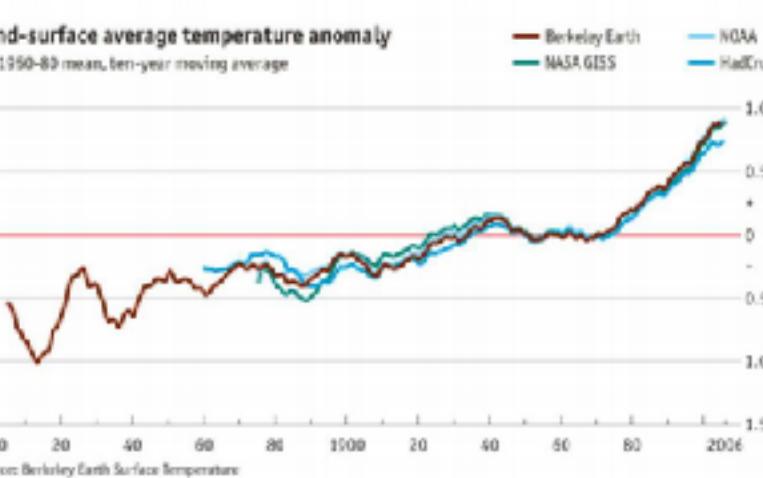
Good titles help with recall!

*“Election Debate”*

vs.

*“66% of Americans feel Romney Performed Better Than Obama in Debates”*

# Low Quality Description



**Figure 6.2: Policy shifts and interventions to enable wetland practices to accommodate notions of ecosystem services and human health**

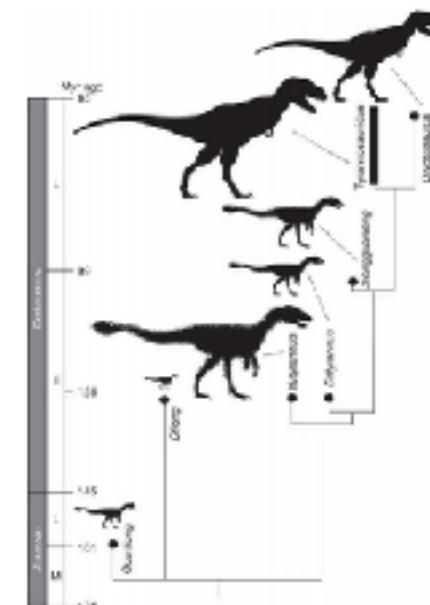
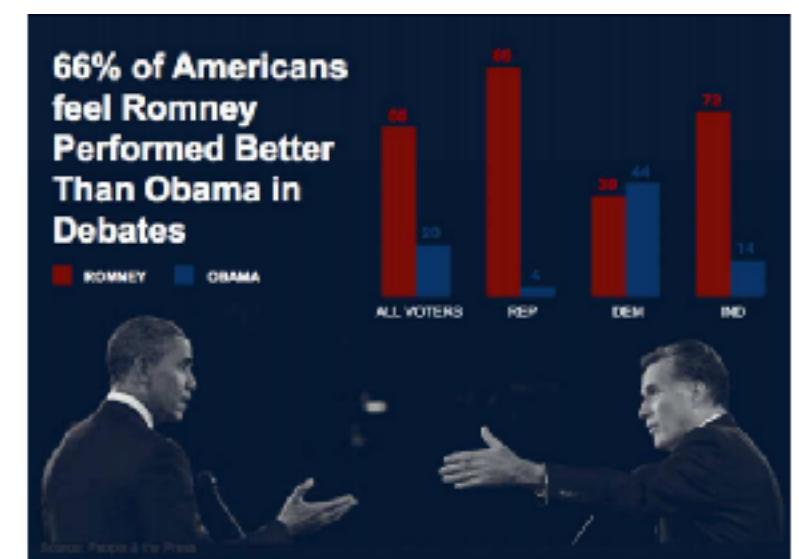
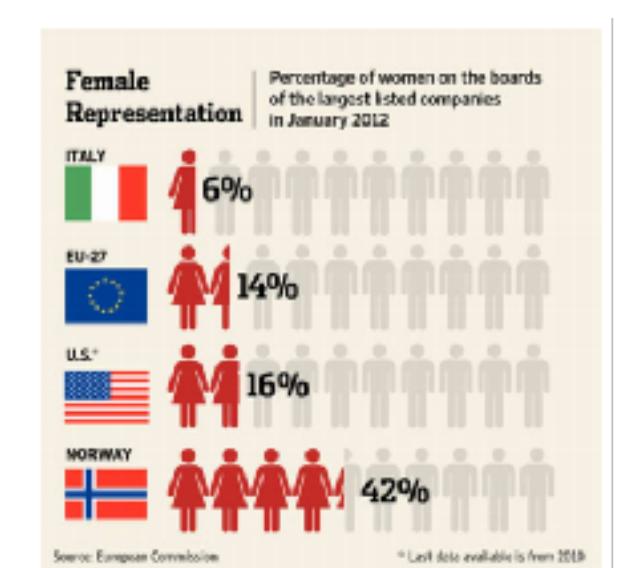
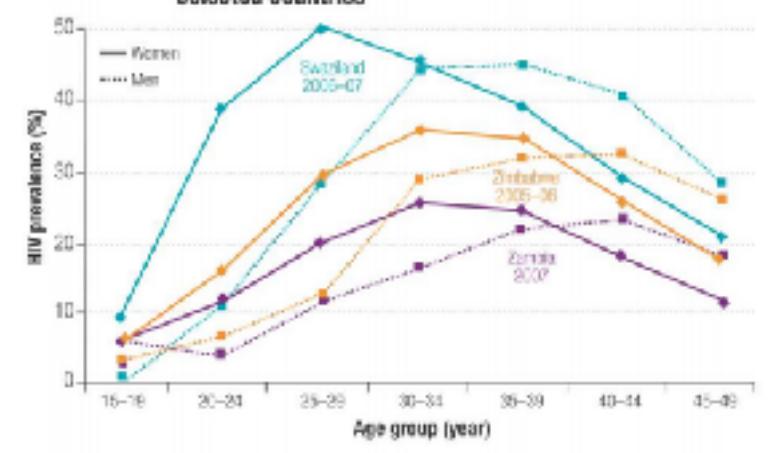
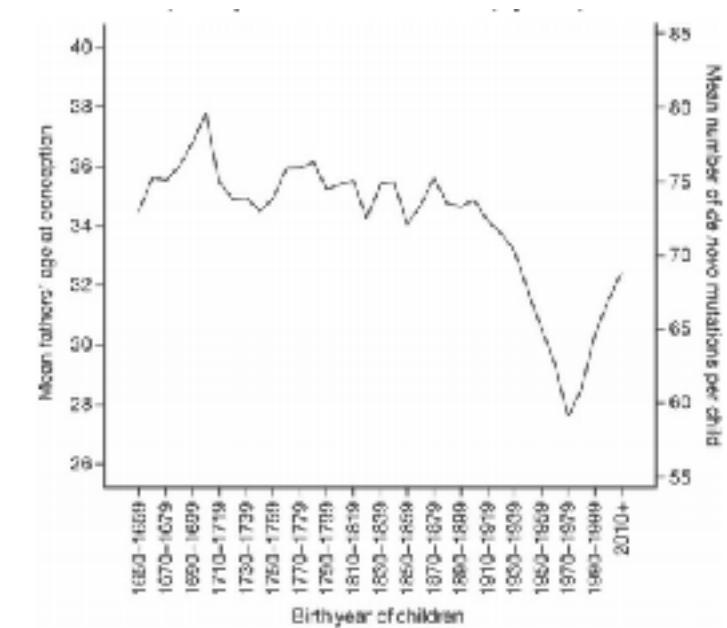
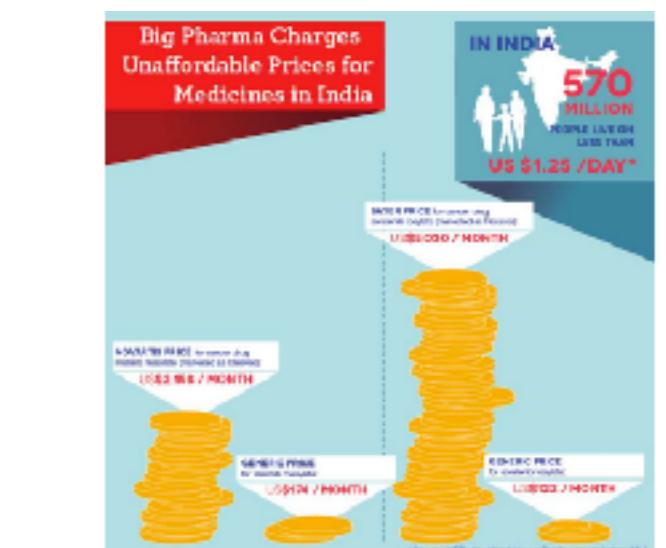
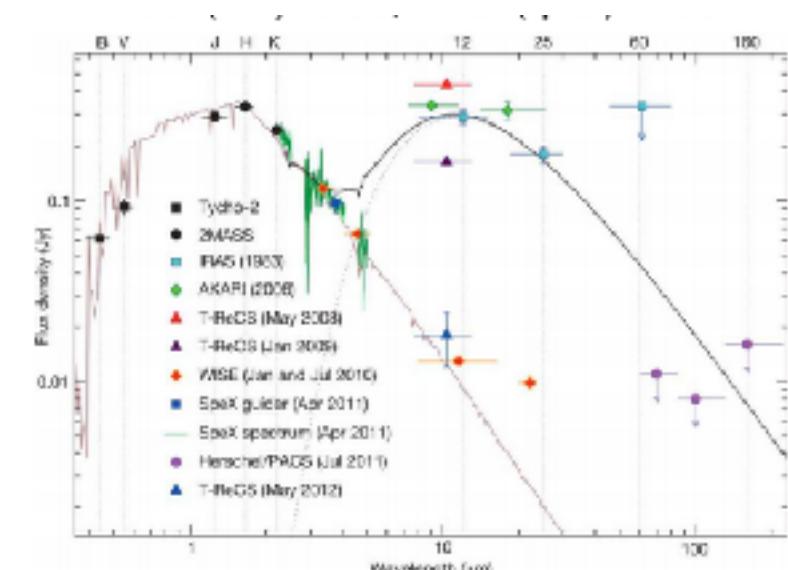


Figure 7 HIV prevalence in women and men by age group, selected countries

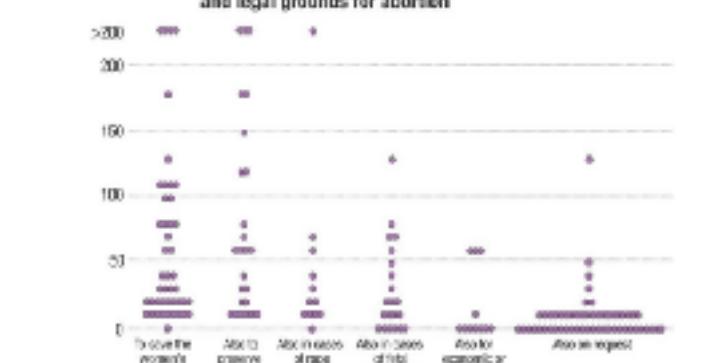


<sup>14</sup> Source: Demographic and Health Surveys in selected countries, 2006-2007.

# **HIGH QUALITY DESCRIPTION**



**Figure 4. Distribution of countries by numbers of deaths attributable to unsafe abortion per 100 000 live births and legal grounds for abortion.**



Each dot represents one country.  
Source: [www.oecd-ilibrary.org](http://www.oecd-ilibrary.org)

# MEMORABLE

# Low Quality Description

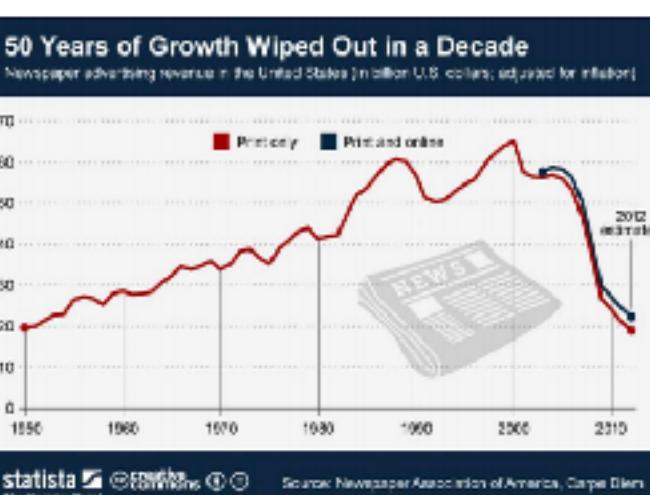
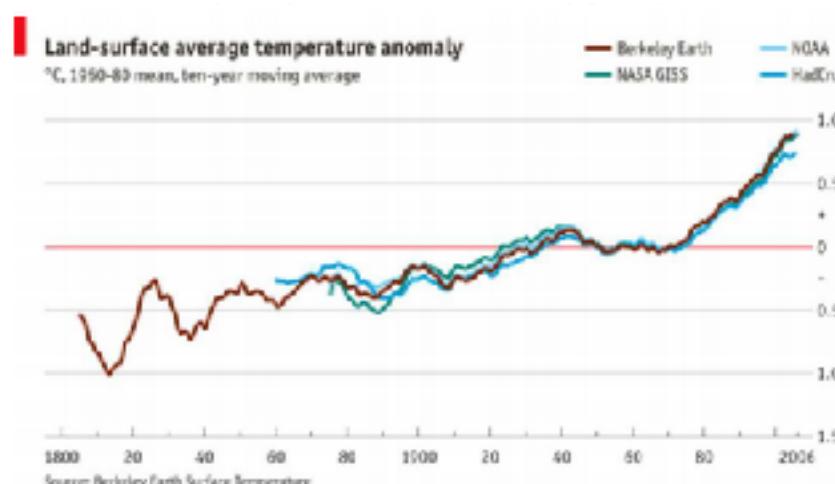
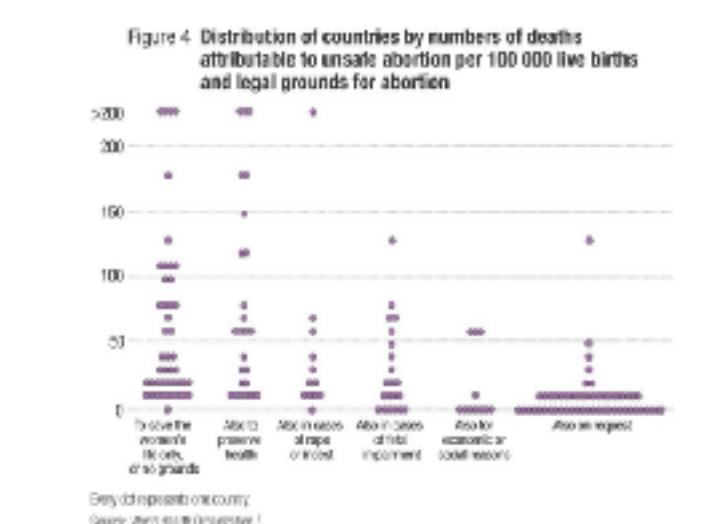
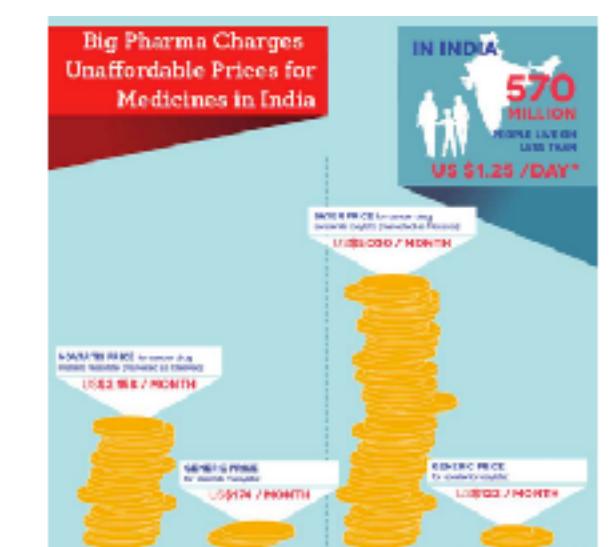
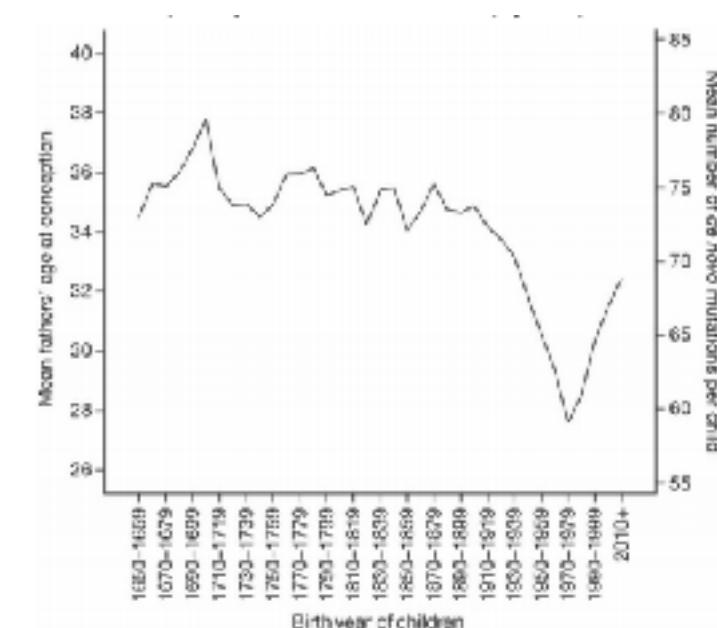
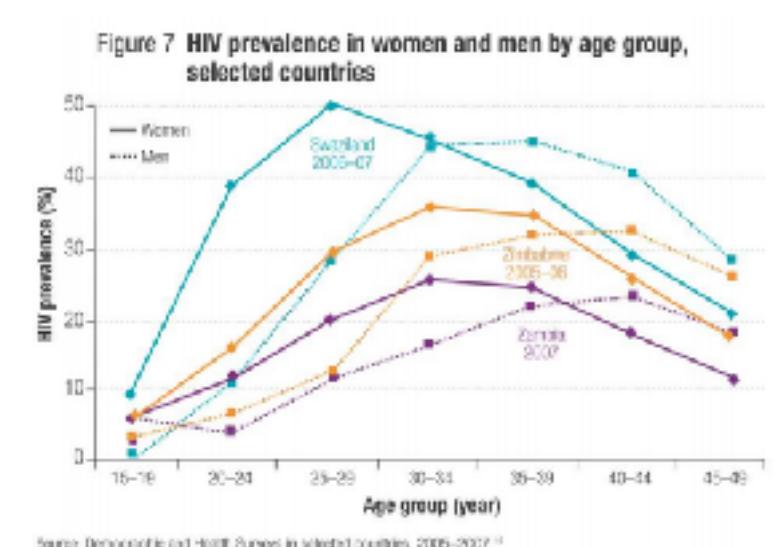
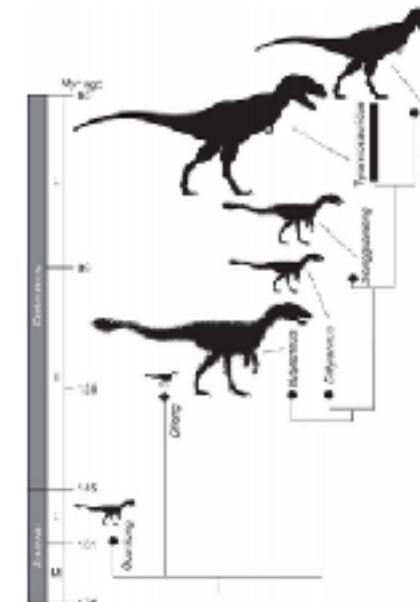
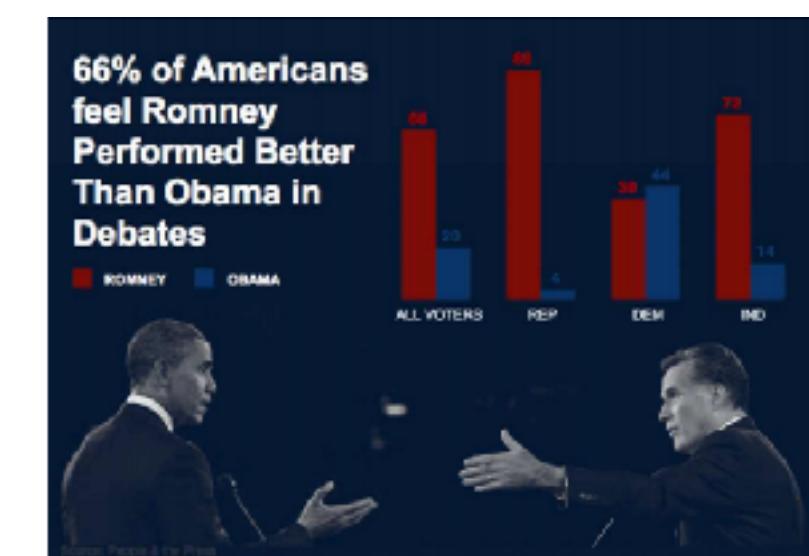
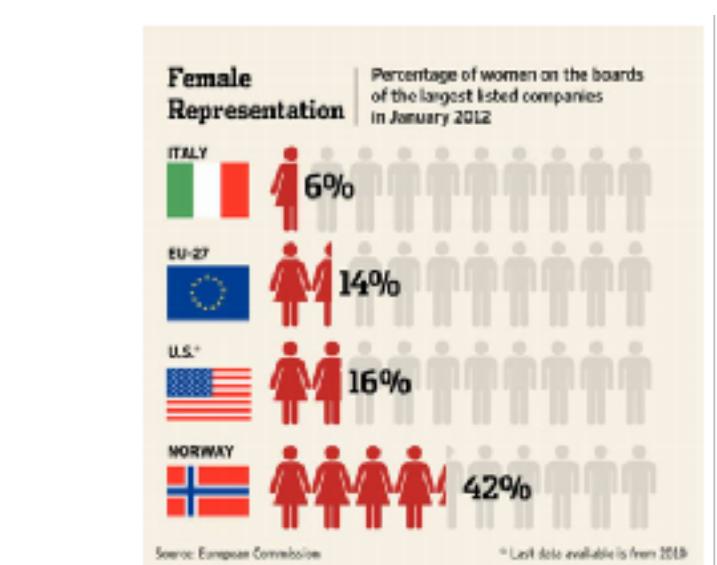
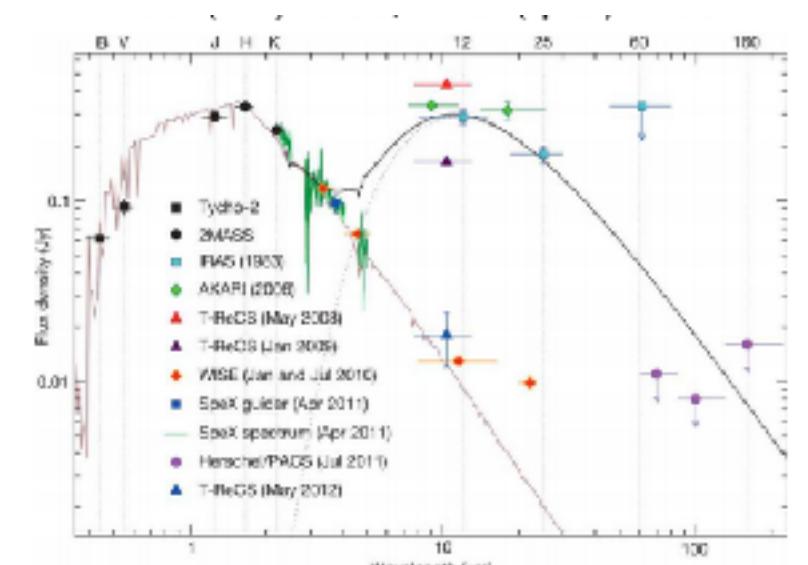


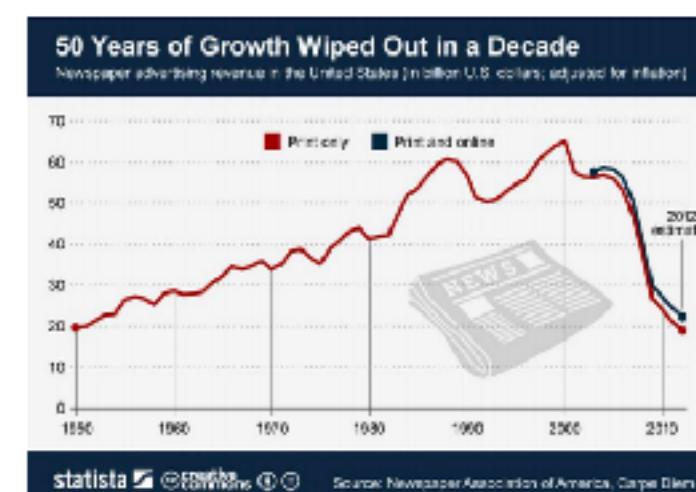
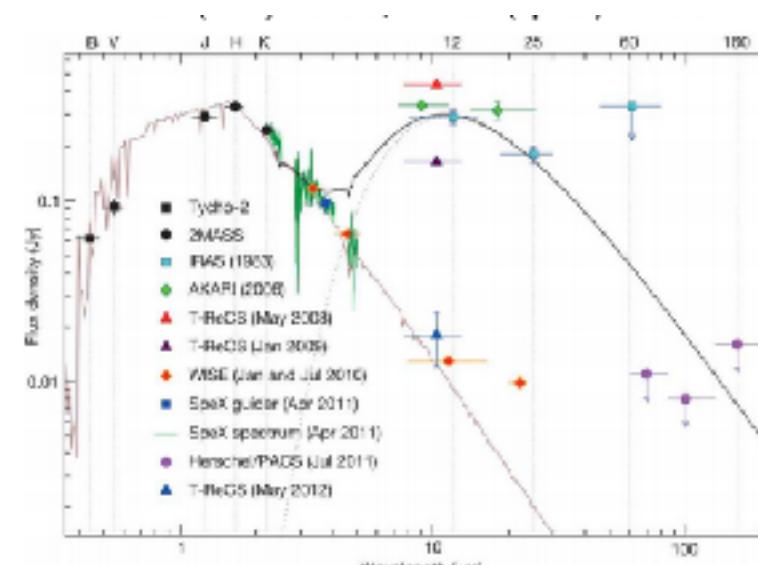
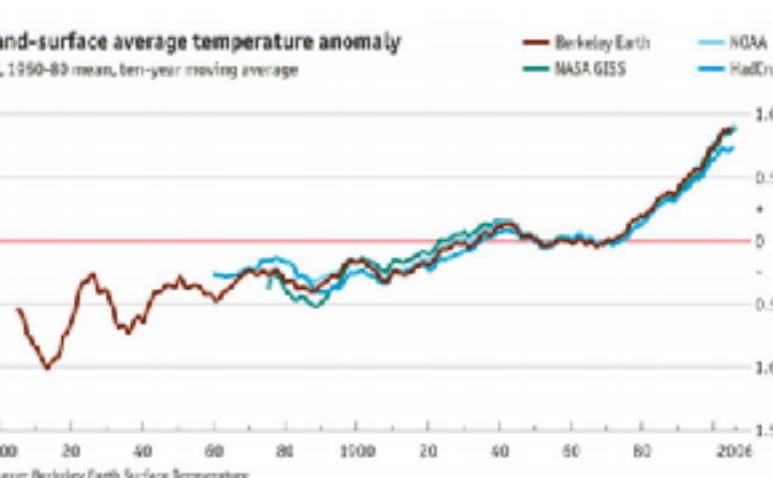
Figure 6.2: Policy shifts and interventions to enable wetland practices to accommodate notions of ecosystem services and



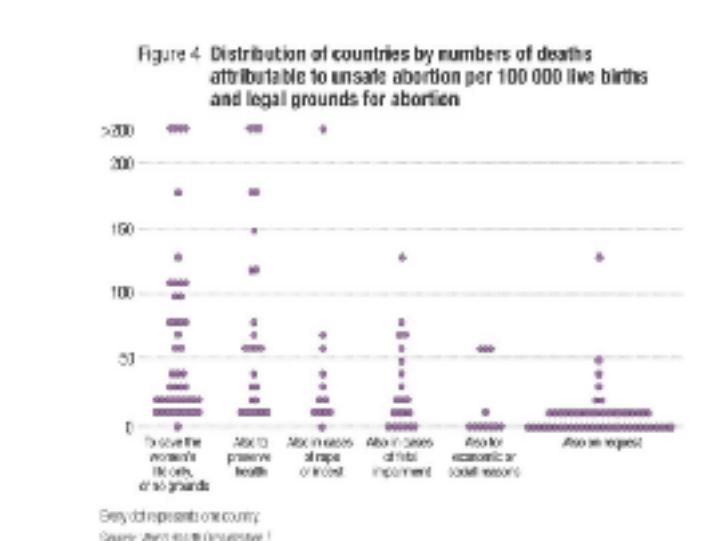
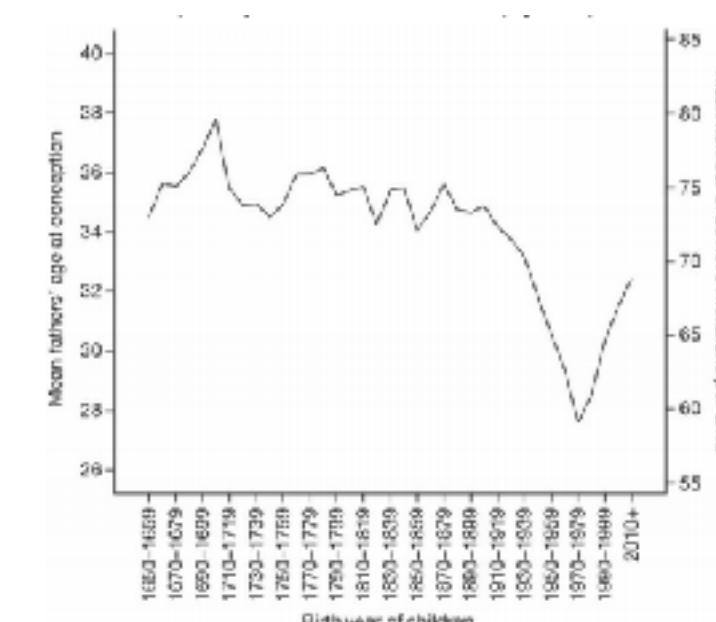
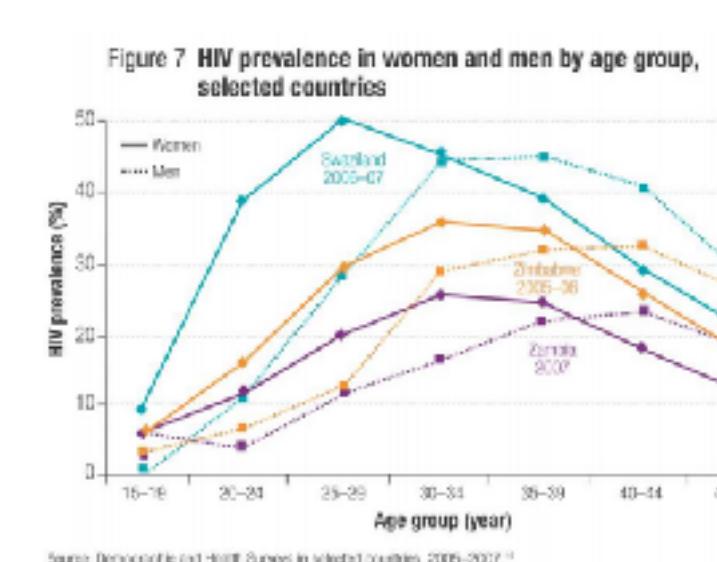
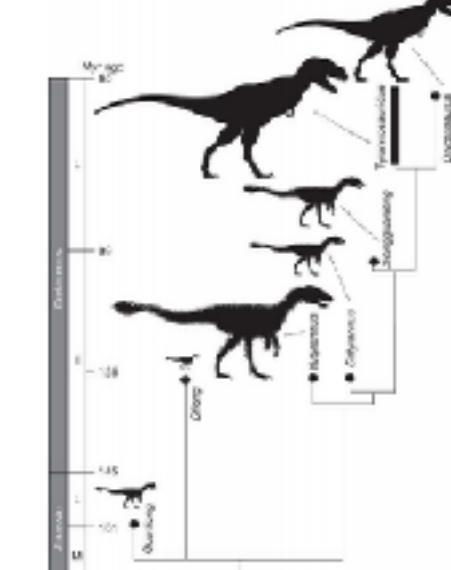
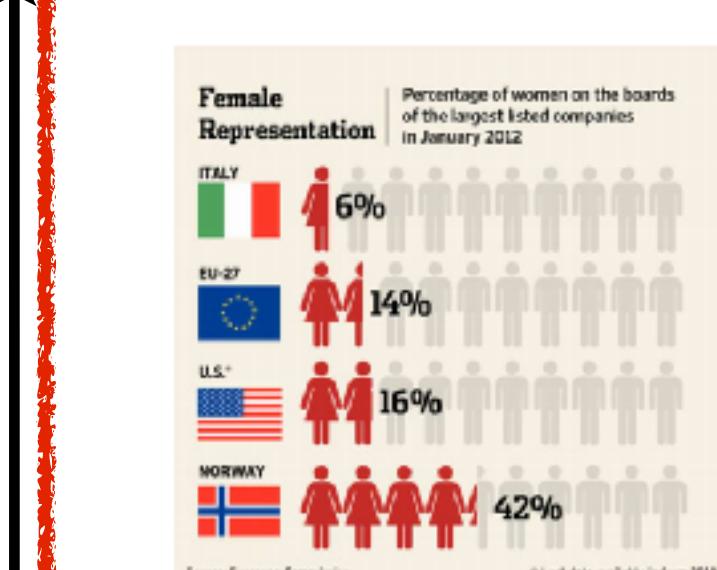
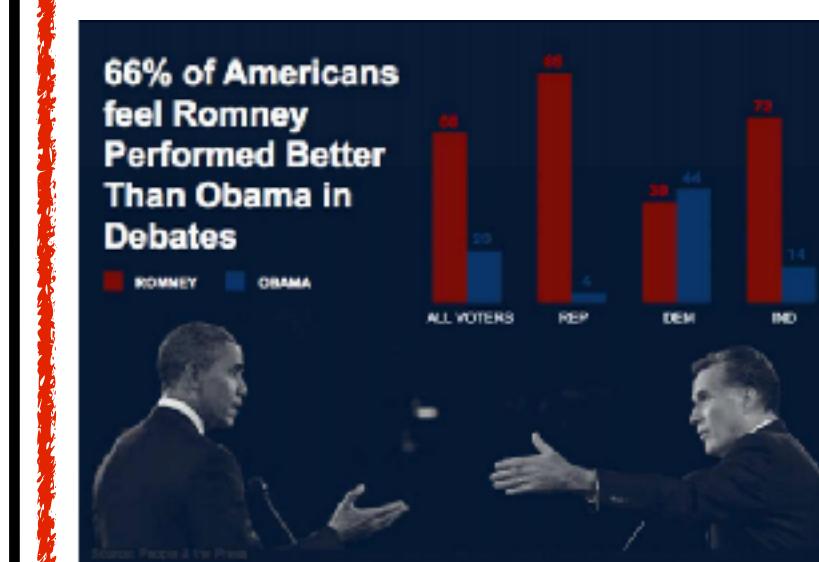
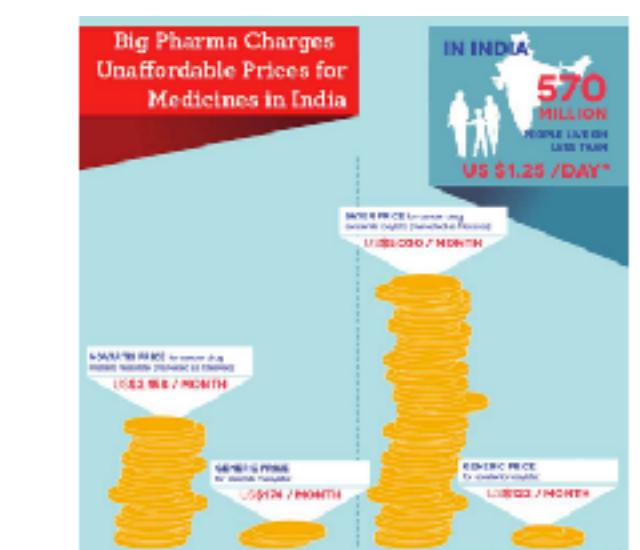
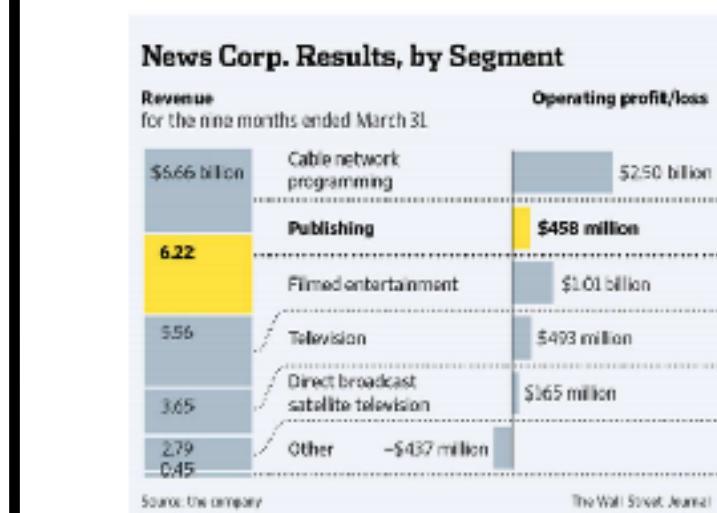
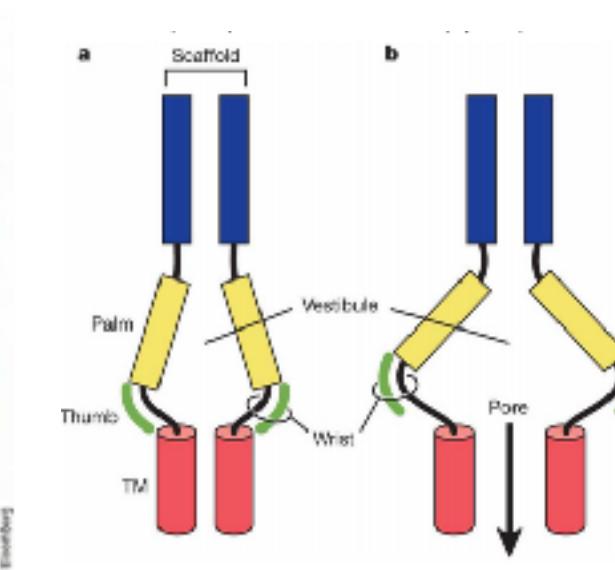
# MEMORABLE

# “Effective”

# LOW QUALITY DESCRIPTION



**Figure 6.2: Policy shifts and interventions to enable wetland practices to accommodate notions of ecosystem services and**



# FORGETTABLE

# Visual Associations

# Semantic Associations

# Message redundancy

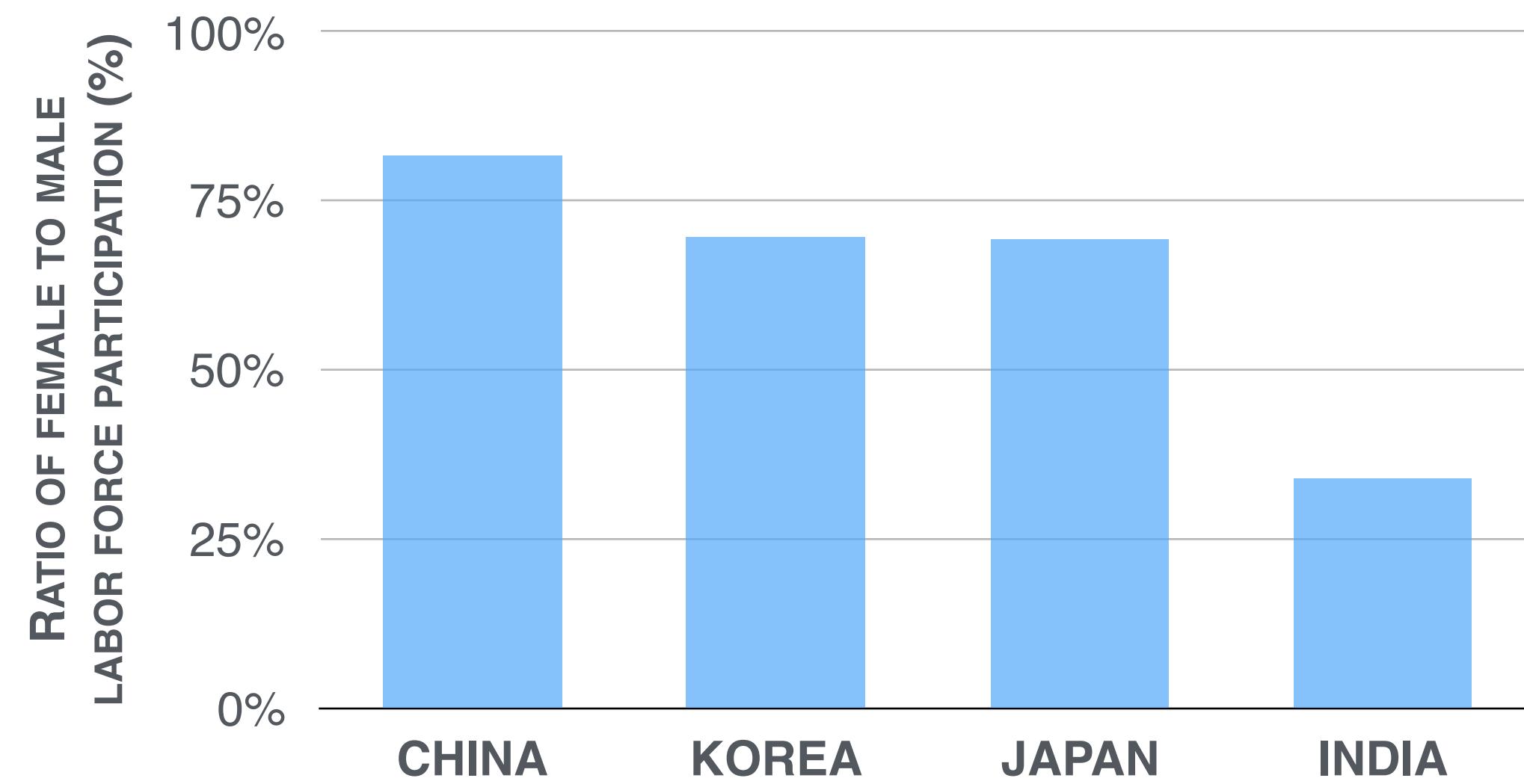
# Data redundancy

# **Titles/annotations**

# HIGH QUALITY DESCRIPTION

# Examples

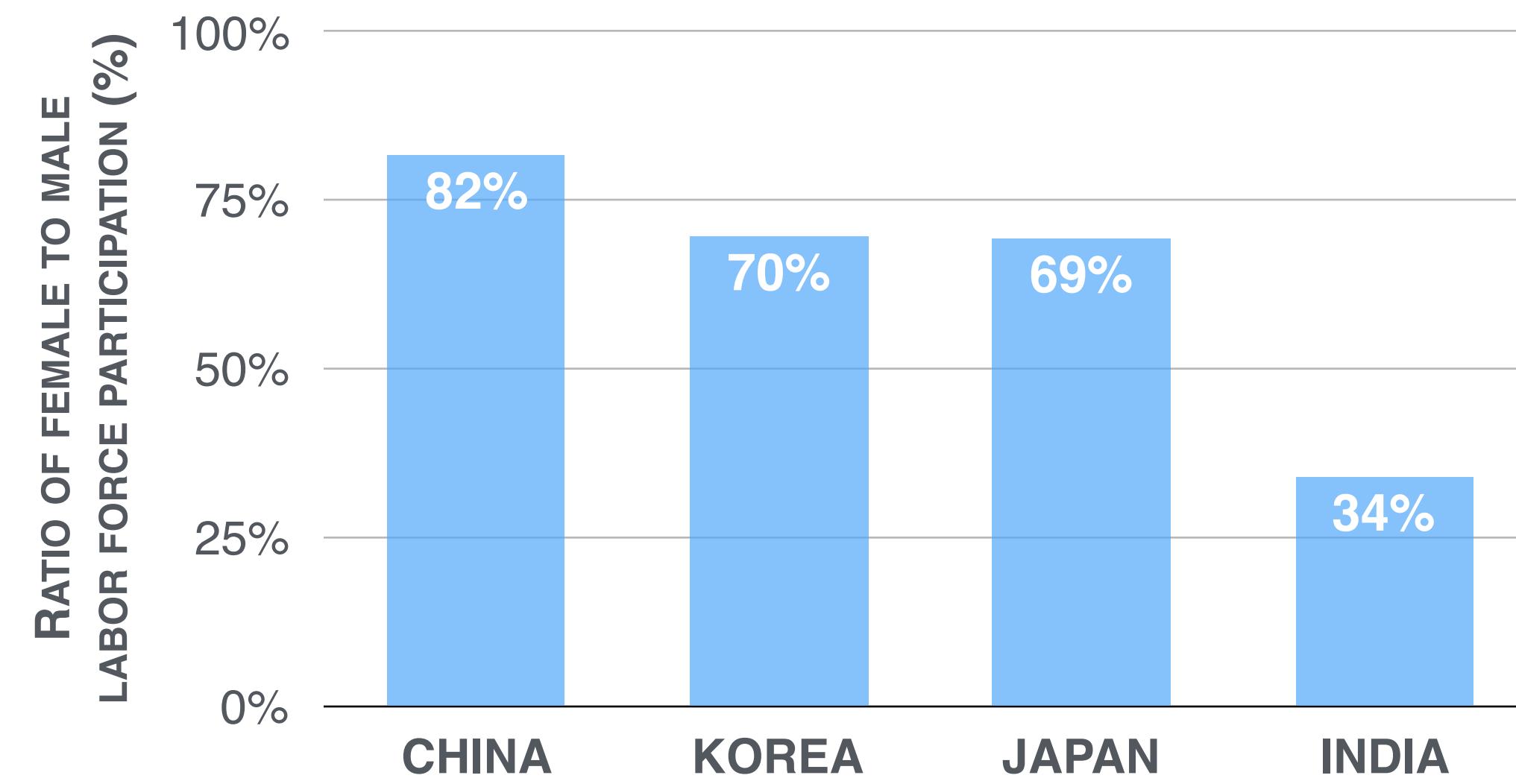
## GENDER EQUALITY IN LABOR FORCE PARTICIPATION



Source: Gender Statistics 2013, World Bank

**ORIGINAL**

## GENDER EQUALITY IN LABOR FORCE PARTICIPATION

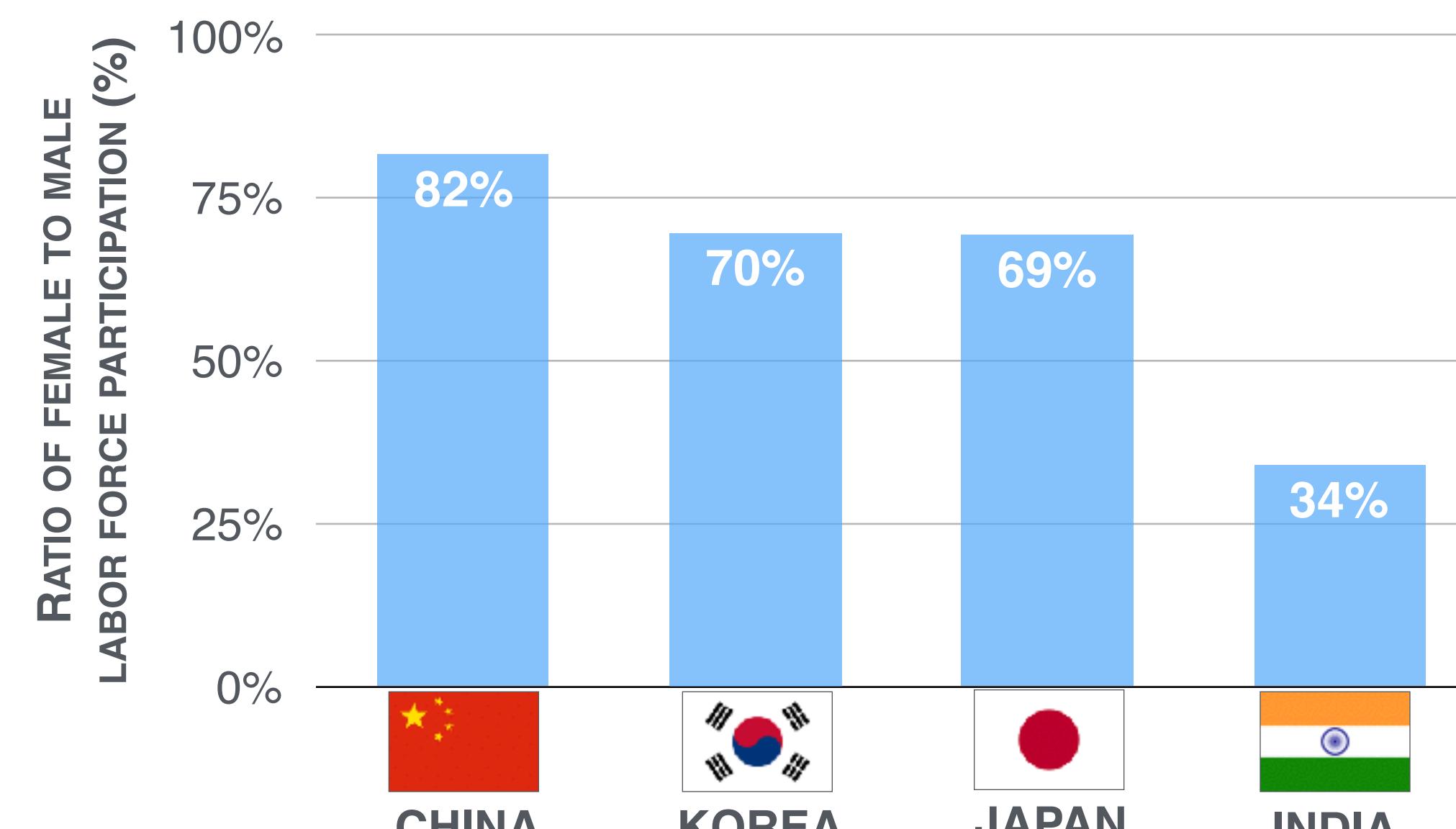


Source: Gender Statistics 2013, World Bank

## DATA REDUNDANCY

## GENDER EQUALITY IN LABOR FORCE PARTICIPATION

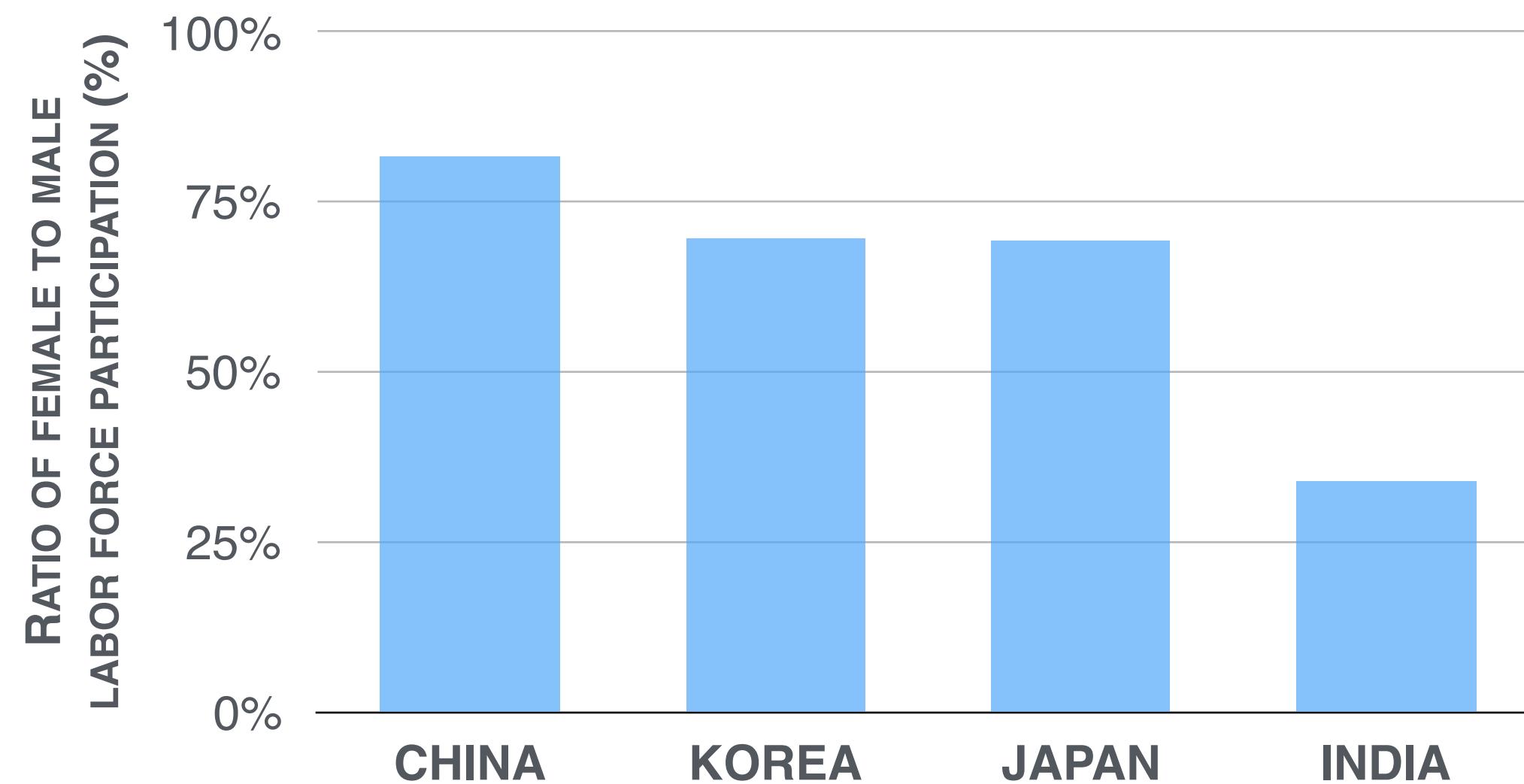
CHINA LEADS IN FEMALE LABOR FORCE PARTICIPATION WHEREAS INDIA LAGS SIGNIFICANTLY BEHIND AMONG OTHER ASIAN-PACIFIC COUNTRIES IN 2013.



Source: Gender Statistics 2013, World Bank

## DATA & MESSAGE REDUNDANCY

## GENDER EQUALITY IN LABOR FORCE PARTICIPATION

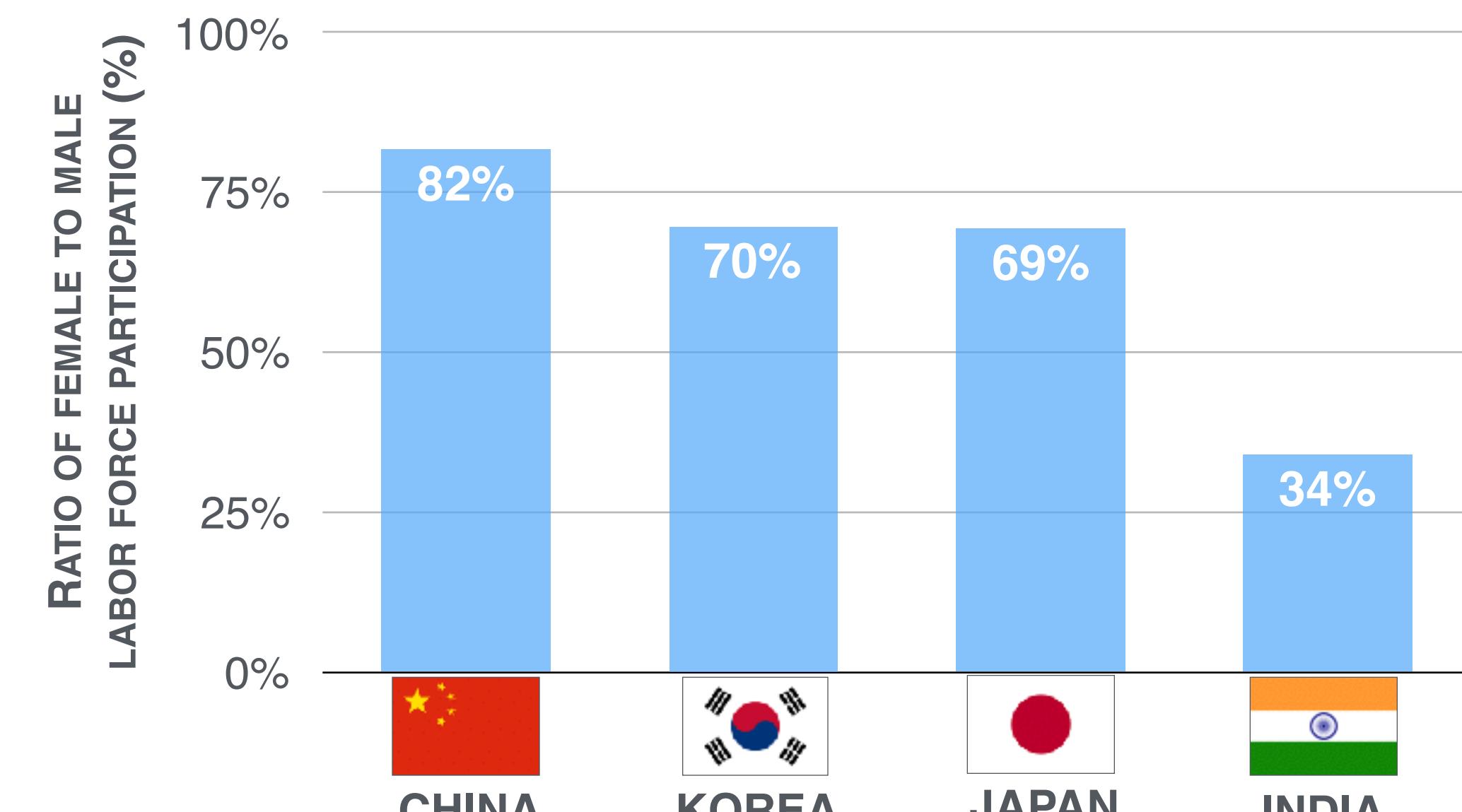


Source: Gender Statistics 2013, World Bank

ORIGINAL

## GENDER EQUALITY IN LABOR FORCE PARTICIPATION

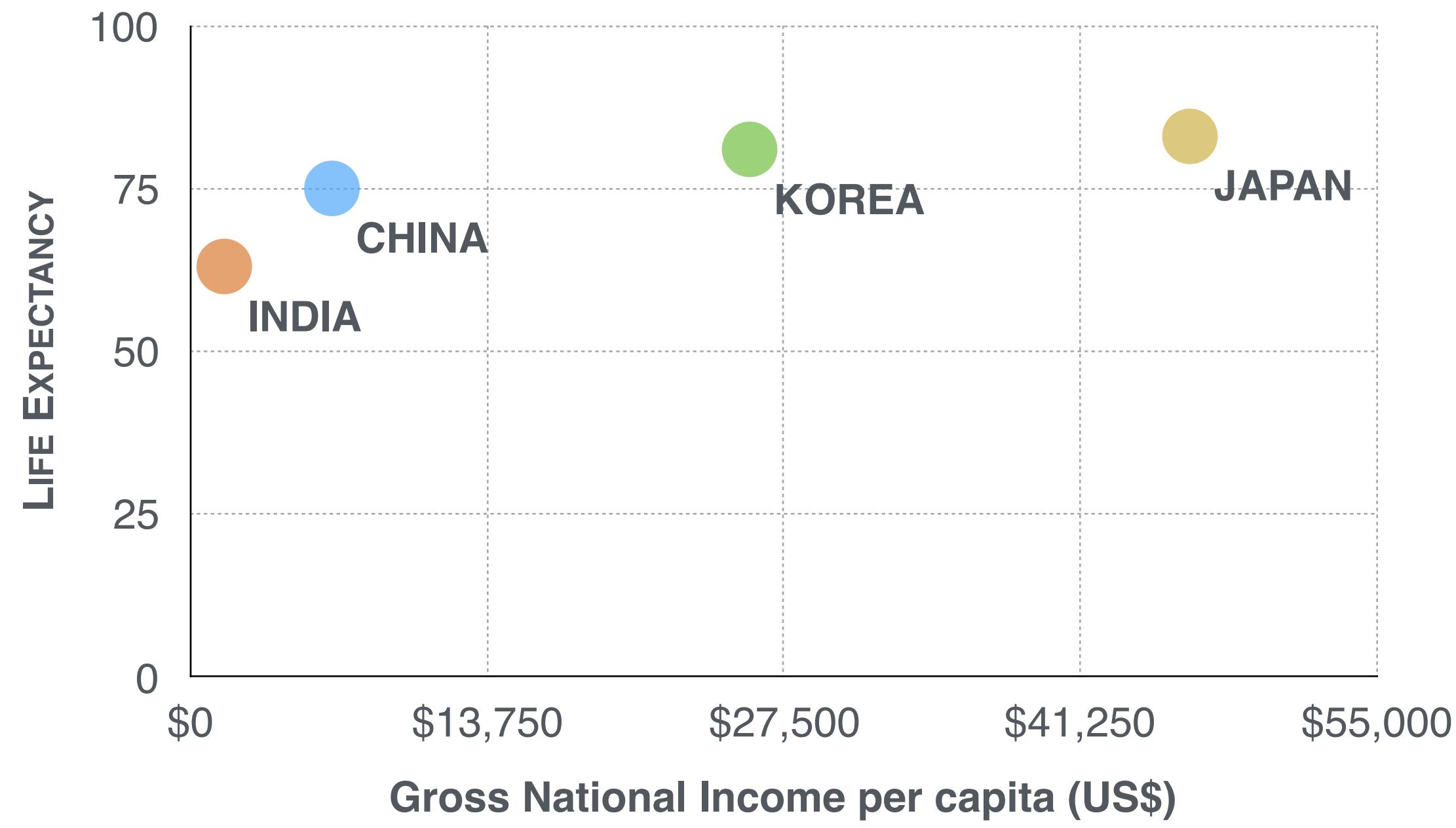
CHINA LEADS IN FEMALE LABOR FORCE PARTICIPATION WHEREAS INDIA LAGS SIGNIFICANTLY BEHIND AMONG OTHER ASIAN-PACIFIC COUNTRIES IN 2013.



Source: Gender Statistics 2013, World Bank

DATA & MESSAGE REDUNDANCY

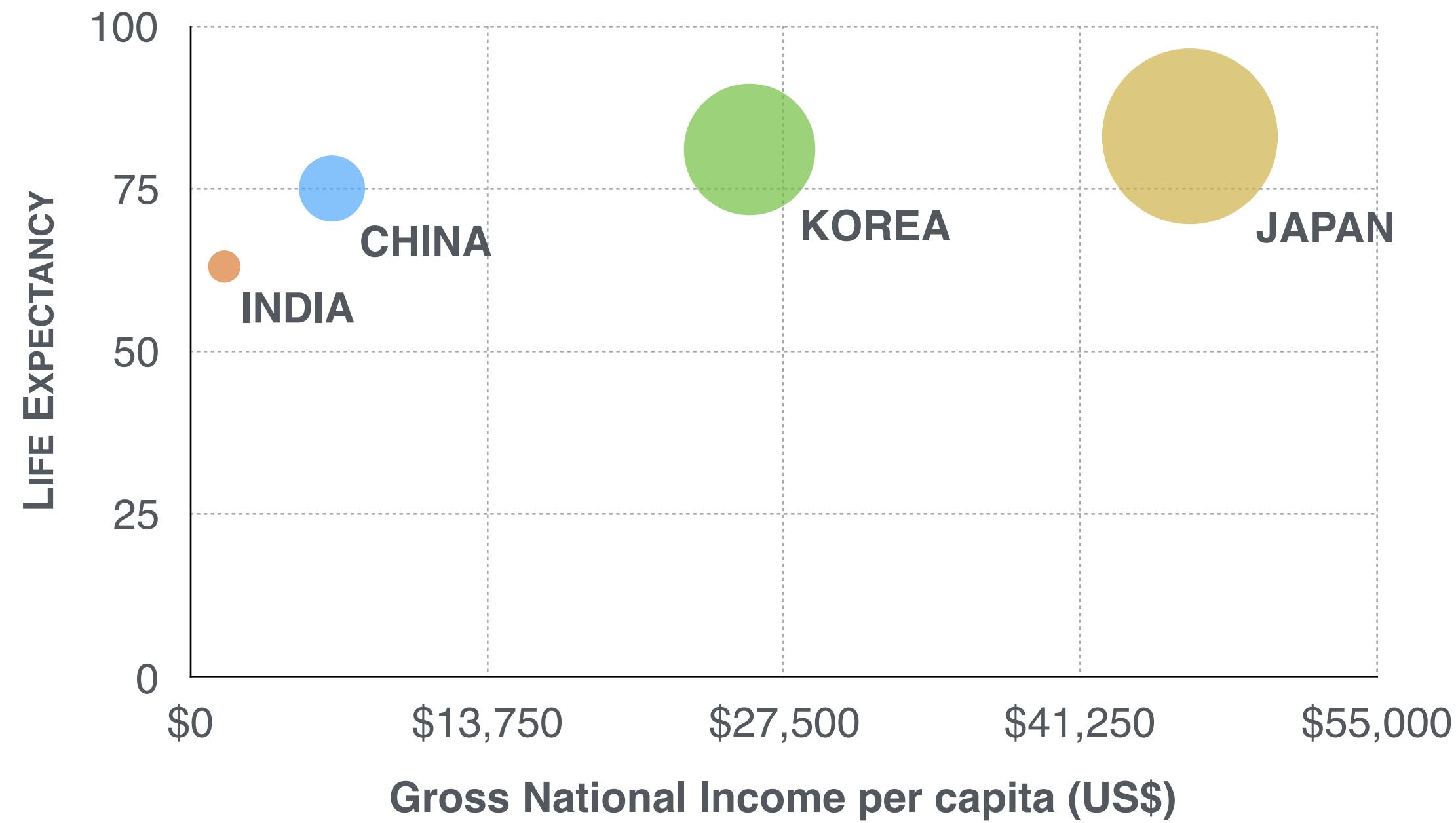
## LIFE EXPECTANCY VS ECONOMIC GROWTH



Source: World Bank national accounts data, and  
OECD National Accounts data files (2013).

**ORIGINAL**

## LIFE EXPECTANCY VS ECONOMIC GROWTH

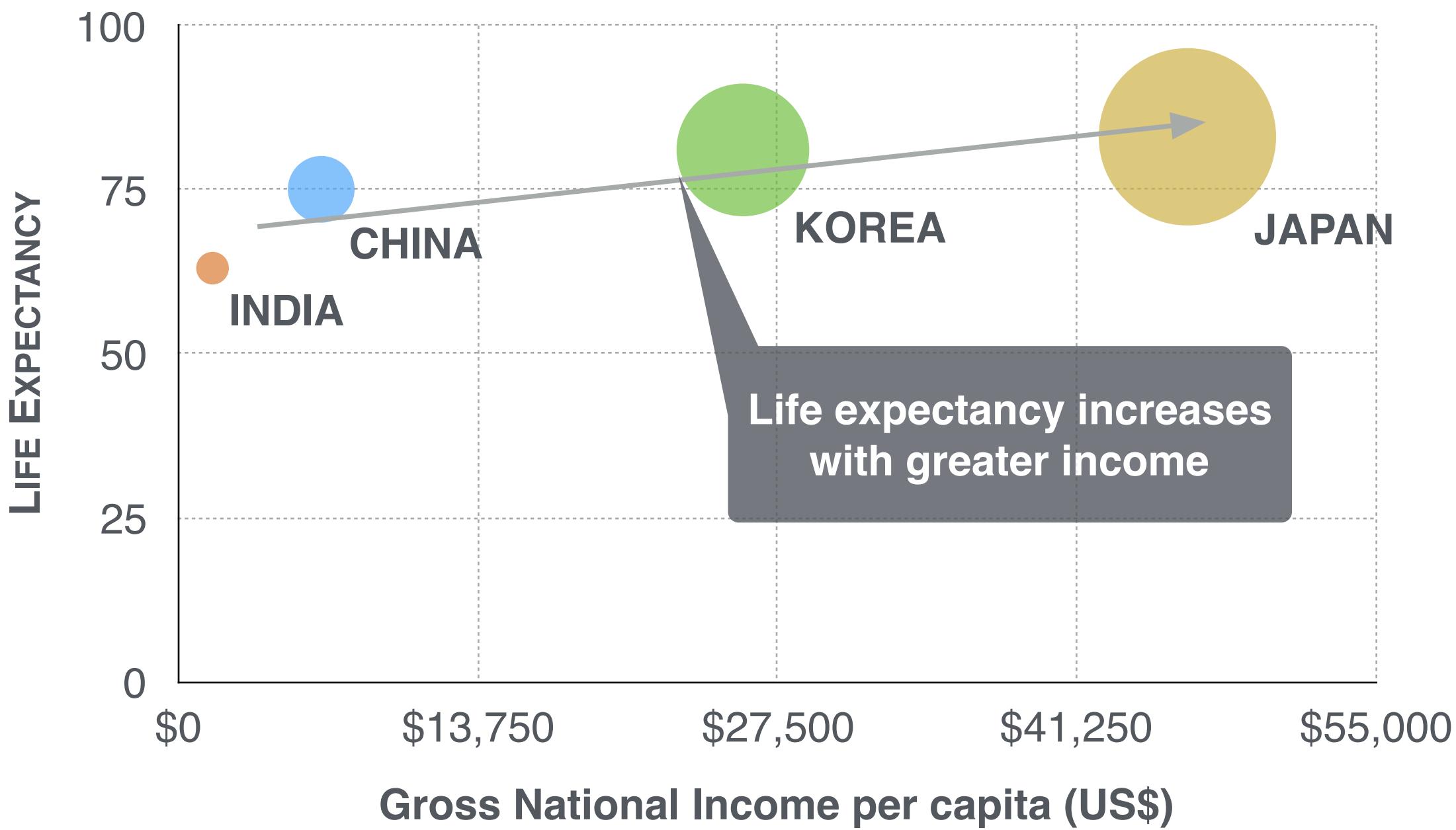


Source: World Bank national accounts data, and  
OECD National Accounts data files (2013).

## DATA REDUNDANCY

## LIFE EXPECTANCY VS ECONOMIC GROWTH

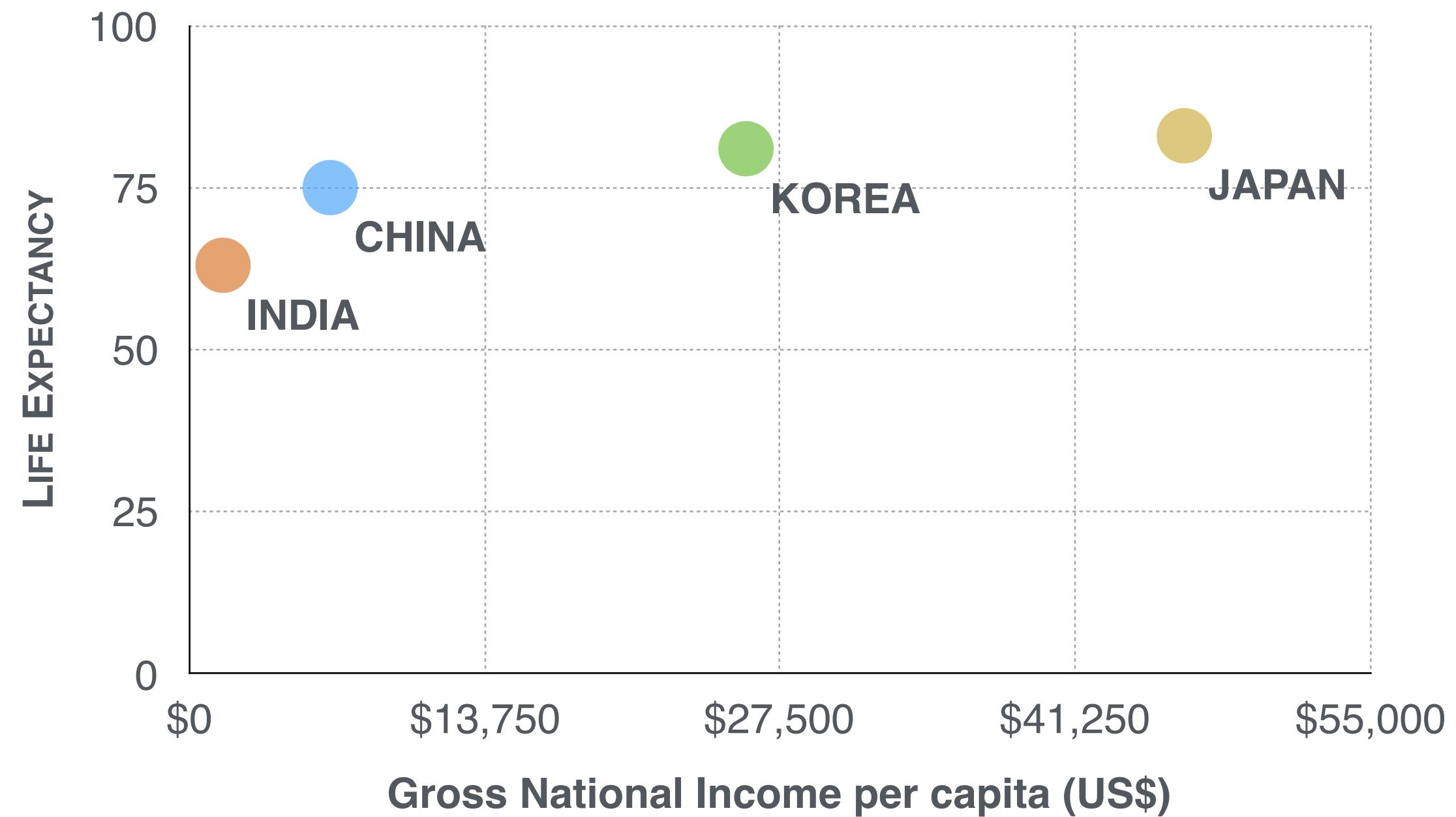
RELATION BETWEEN LIFE EXPECTANCY AND GROSS NATIONAL INCOME OF ASIAN-PACIFIC COUNTRIES IN 2013



Source: World Bank national accounts data, and  
OECD National Accounts data files (2013).

## DATA & MESSAGE REDUNDANCY

## LIFE EXPECTANCY VS ECONOMIC GROWTH

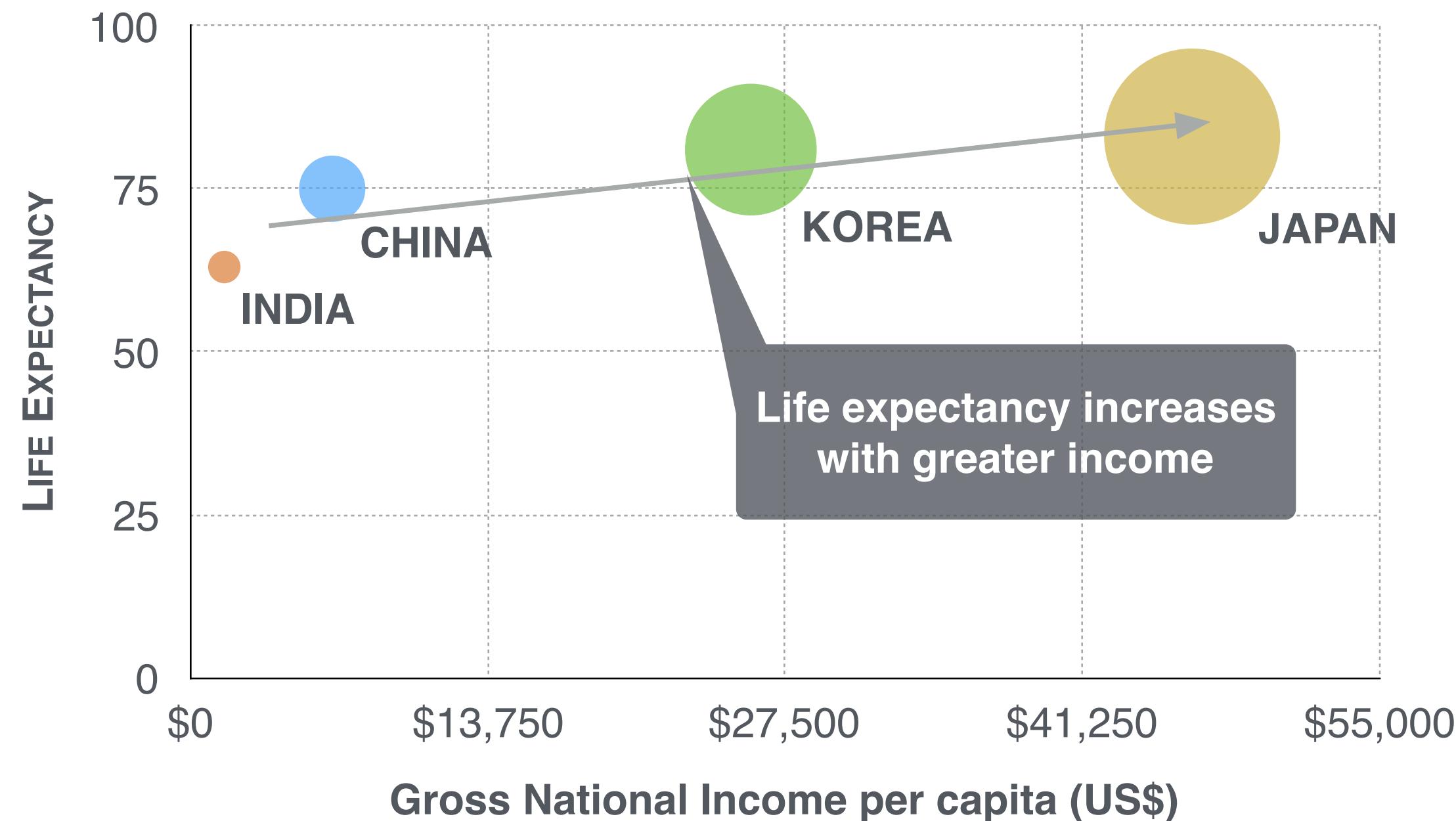


Source: World Bank national accounts data, and  
OECD National Accounts data files (2013).

ORIGINAL

## LIFE EXPECTANCY VS ECONOMIC GROWTH

RELATION BETWEEN LIFE EXPECTANCY AND GROSS NATIONAL INCOME OF ASIAN-PACIFIC COUNTRIES IN 2013

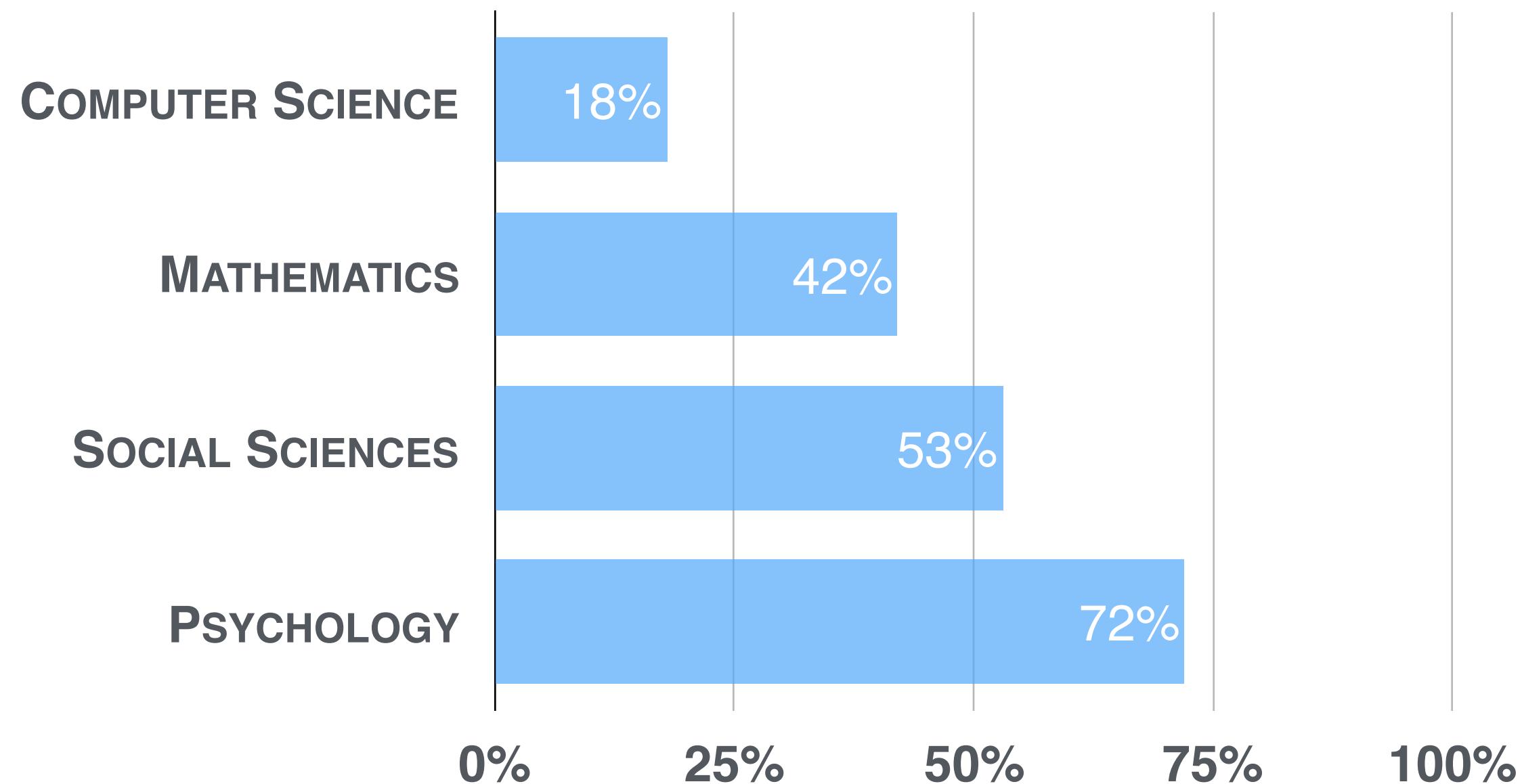


Source: World Bank national accounts data, and  
OECD National Accounts data files (2013).

DATA & MESSAGE REDUNDANCY

## VERY FEW WOMEN ARE STUDYING COMPUTER SCIENCE

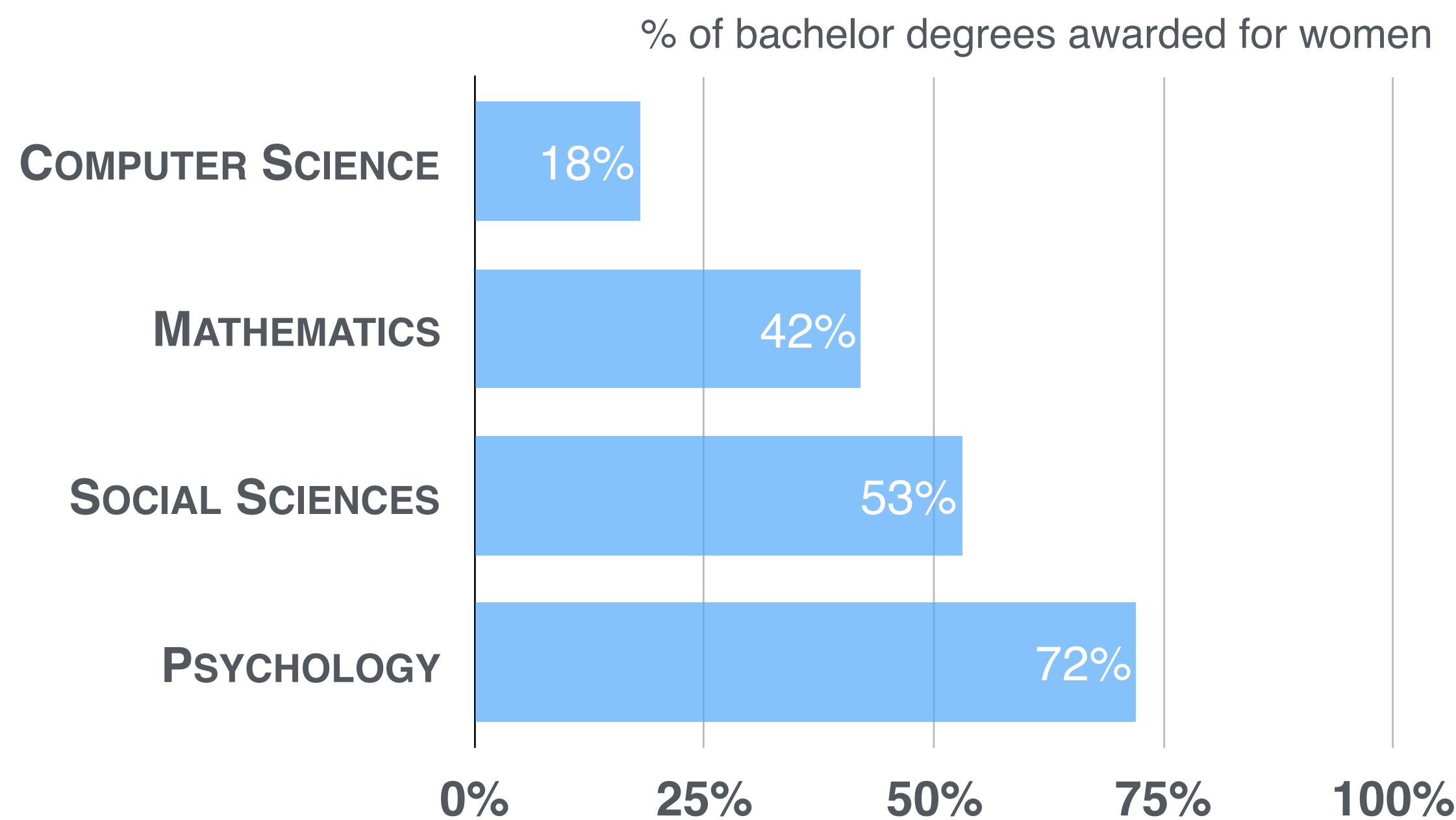
% of bachelor degrees awarded for women



Source: National Student Clearinghouse Research Center (2014).

## WITHOUT PICTOGRAM

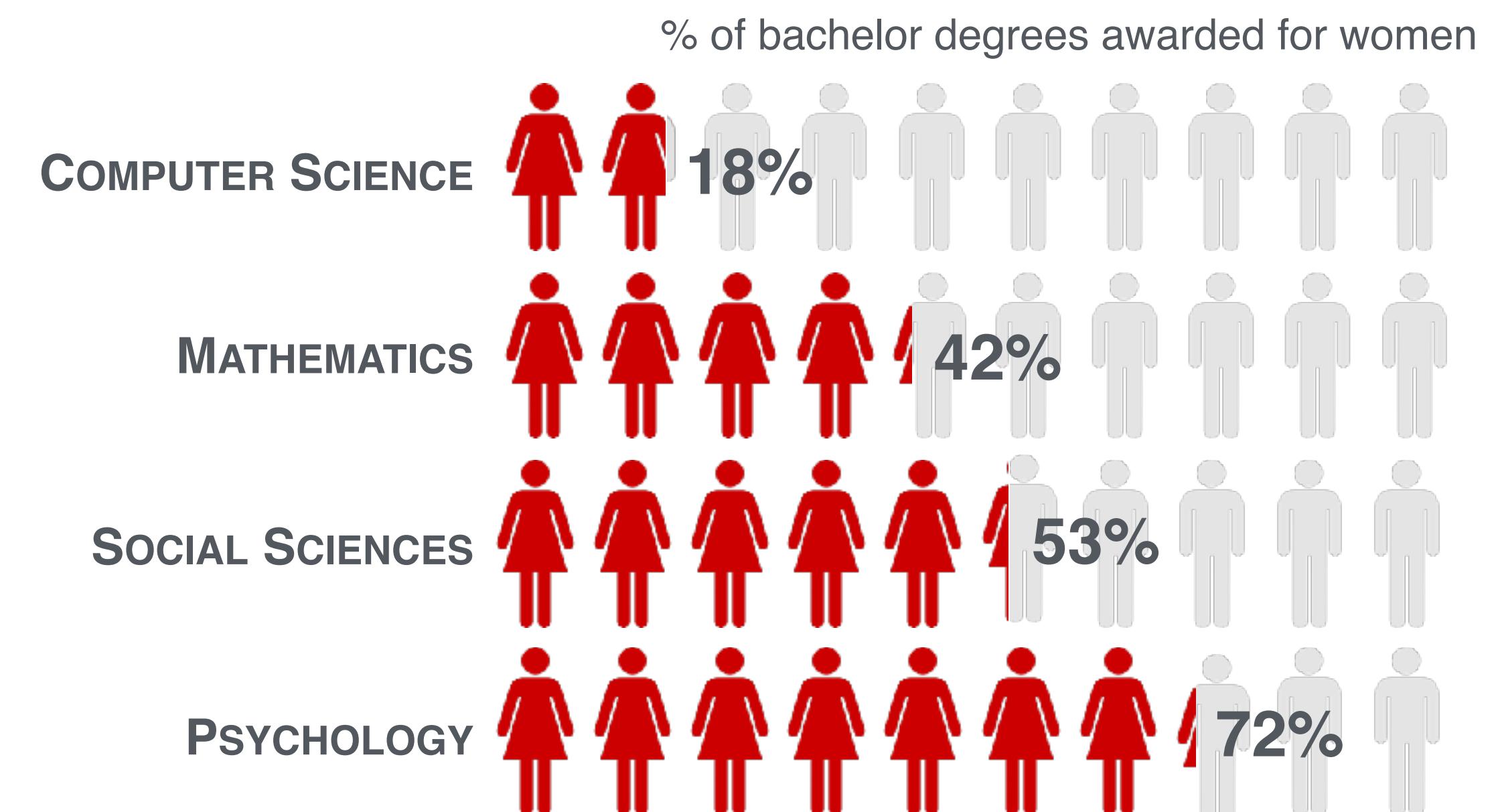
## VERY FEW WOMEN ARE STUDYING COMPUTER SCIENCE



Source: National Student Clearinghouse Research Center (2014).

**WITHOUT PICTOGRAM**

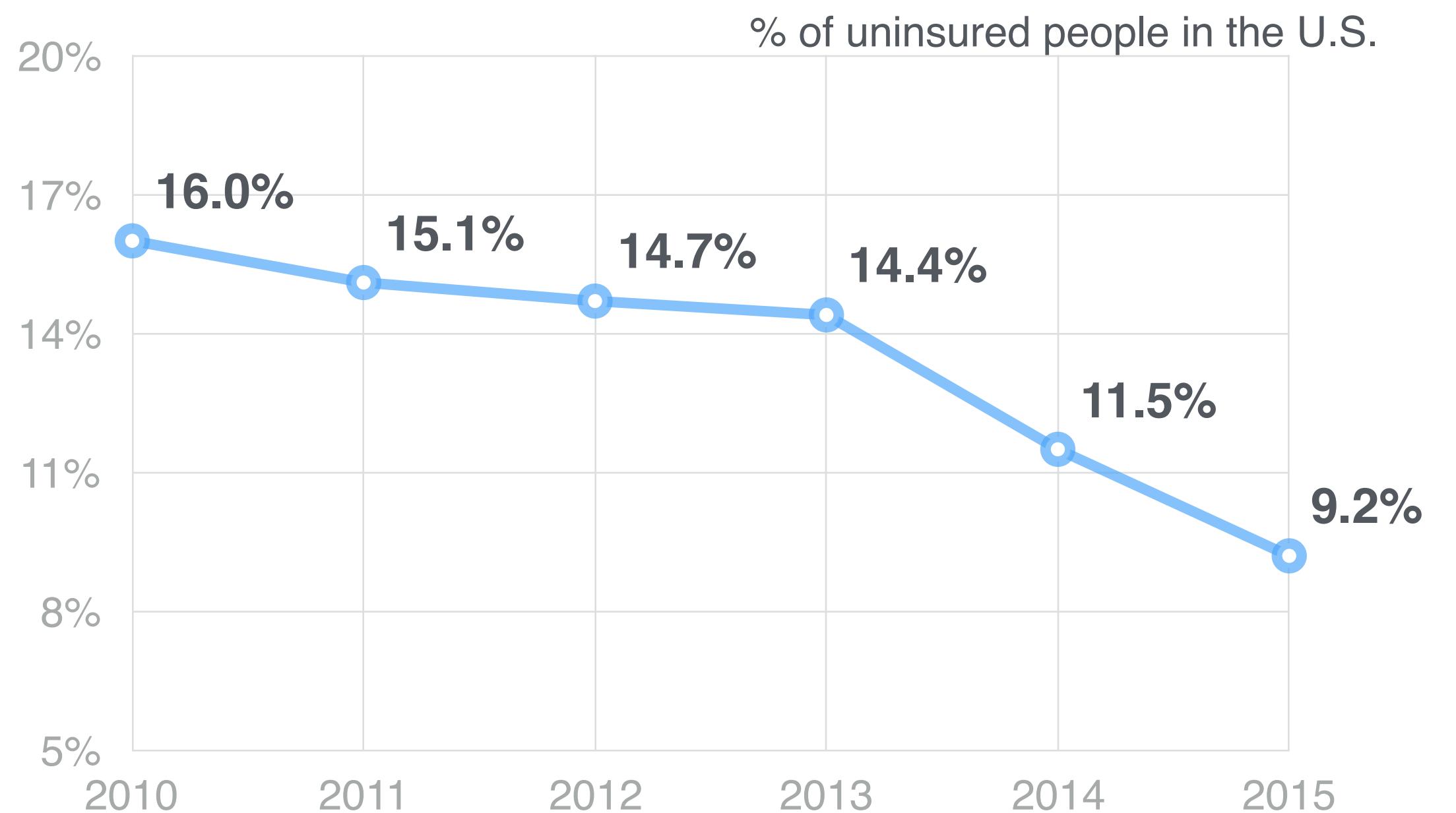
## VERY FEW WOMEN ARE STUDYING COMPUTER SCIENCE



Source: National Student Clearinghouse Research Center (2014).

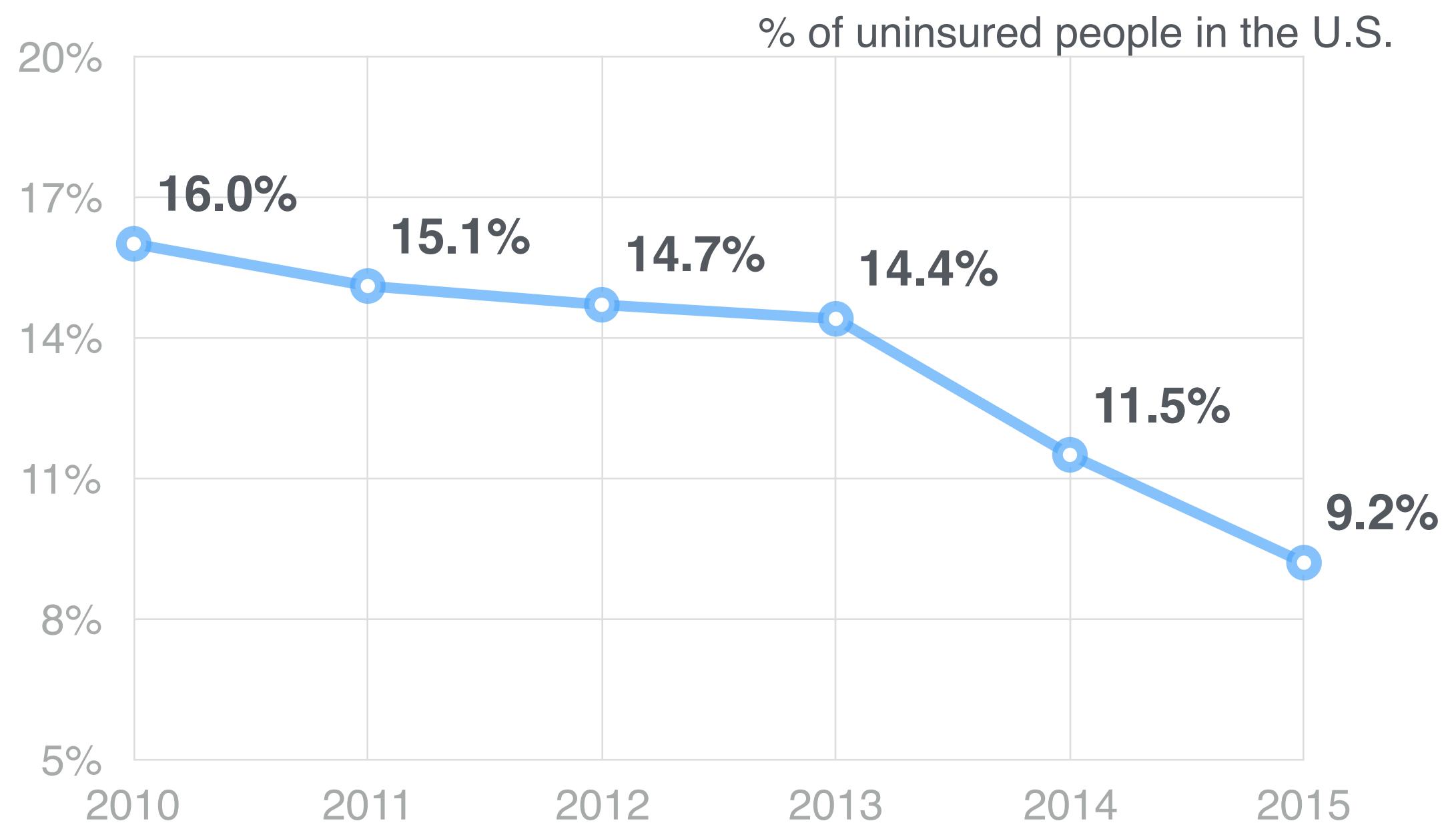
**WITH PICTOGRAM**

## PERCENTAGE OF UNINSURED AMERICANS



**BAD TITLE**

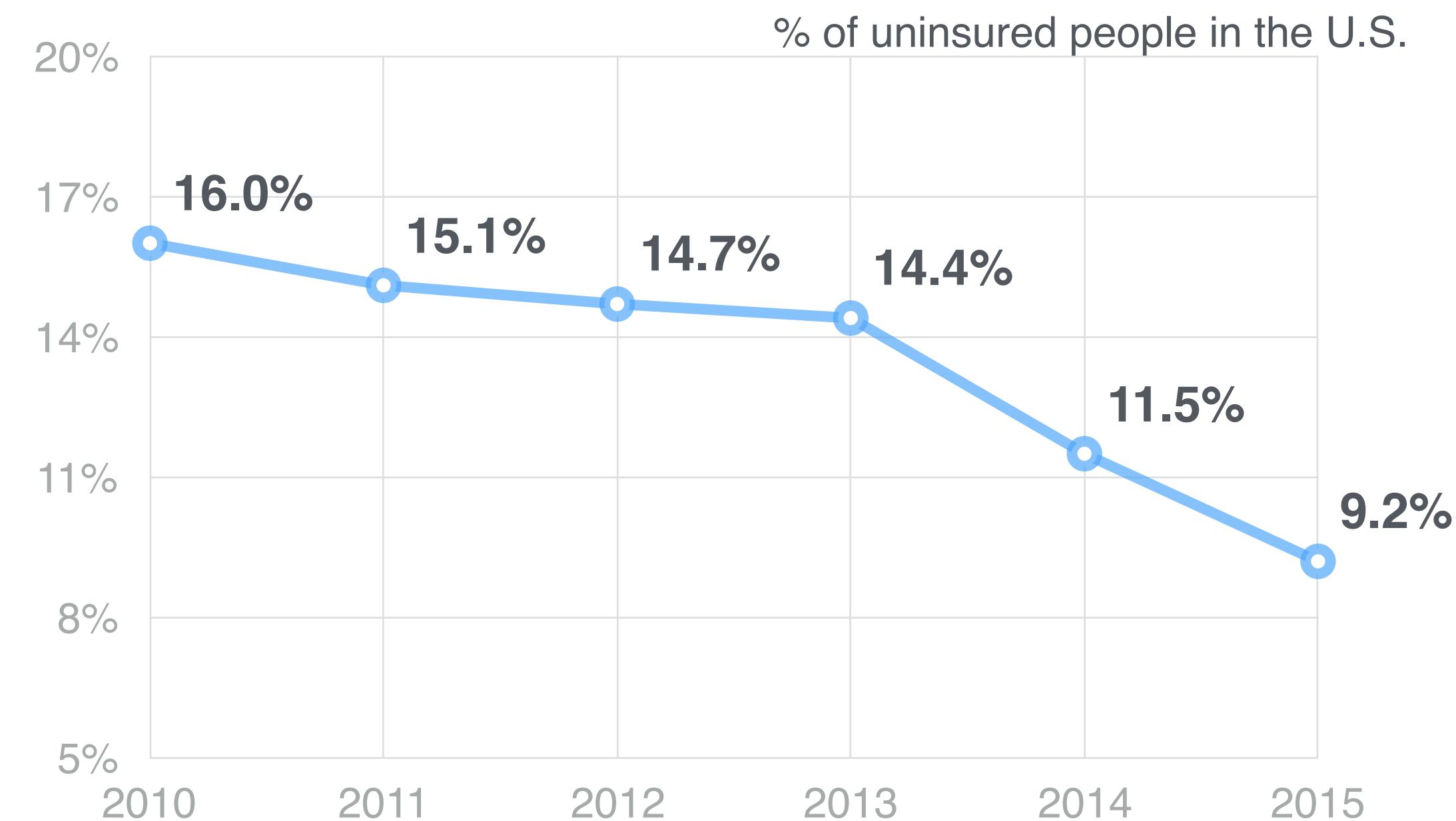
## PERCENTAGE OF UNINSURED AMERICANS



Source: CDC/NCHS, National Health Interview Survey, 2010–2015

**BAD TITLE**

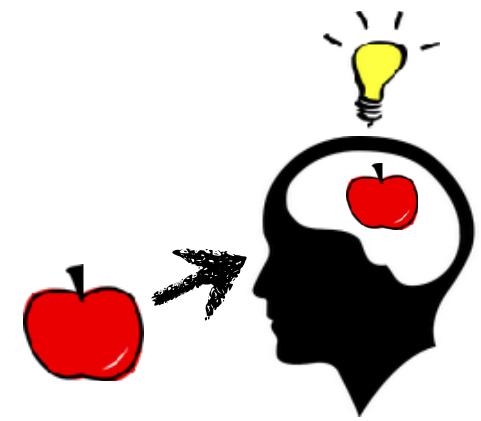
## AMERICA'S UNINSURED RATE DIPS BELOW 10%



Source: CDC/NCHS, National Health Interview Survey, 2010–2015

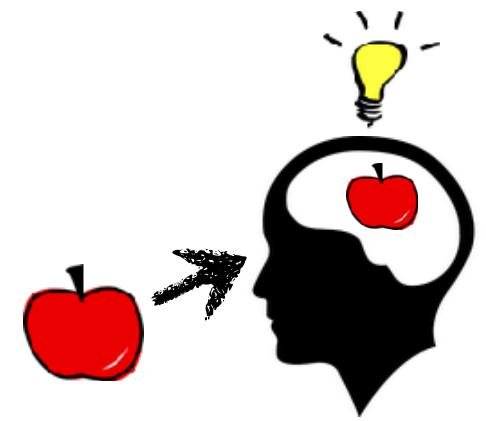
**GOOD TITLE**

# Summary

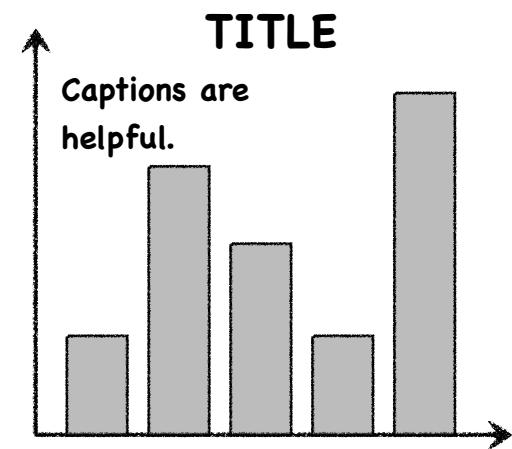


Visualizations that are memorable “at-a-glance” have memorable content.

# Summary

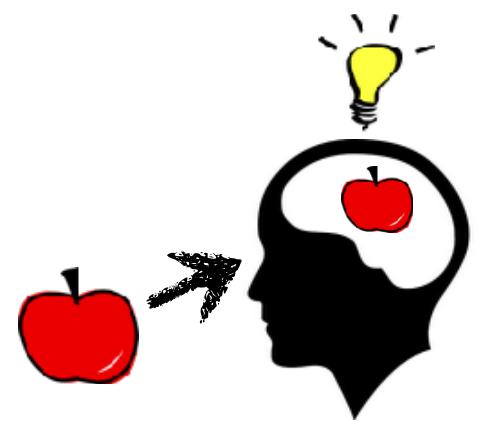


Visualizations that are memorable “at-a-glance” have memorable content.

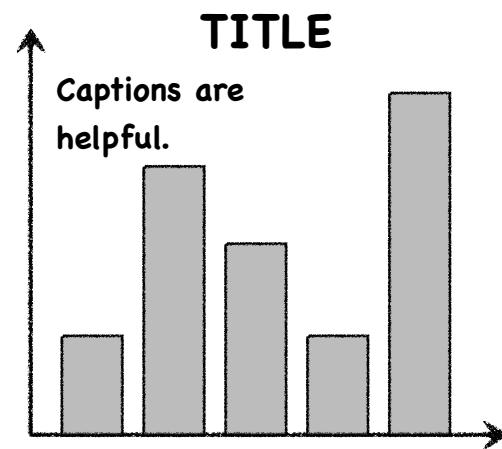


Titles and text are key elements in a visualization and help recall the message.

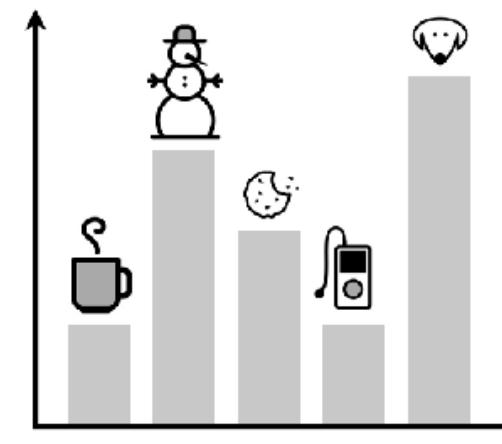
# Summary



Visualizations that are memorable “at-a-glance” have memorable content.

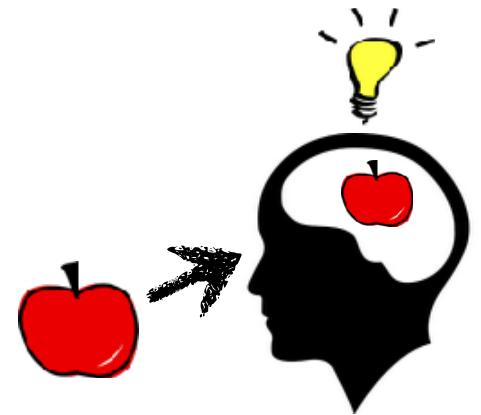


Titles and text are key elements in a visualization and help recall the message.

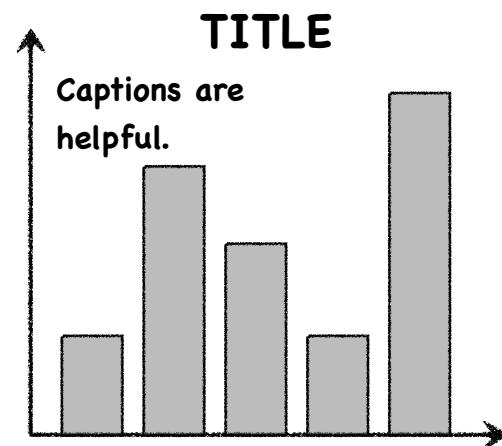


Human recognizable objects (e.g., pictograms) can help with the recognition or recall of a visualization.

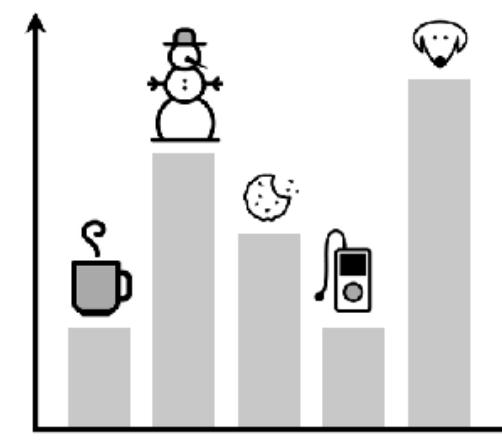
# Summary



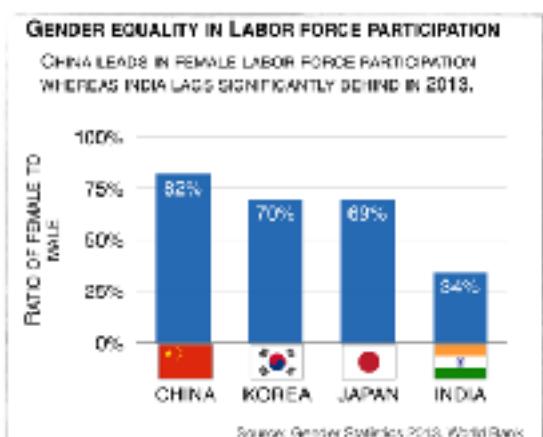
Visualizations that are memorable “at-a-glance” have memorable content.



Titles and text are key elements in a visualization and help recall the message.



Human recognizable objects (e.g., pictograms) can help with the recognition or recall of a visualization.

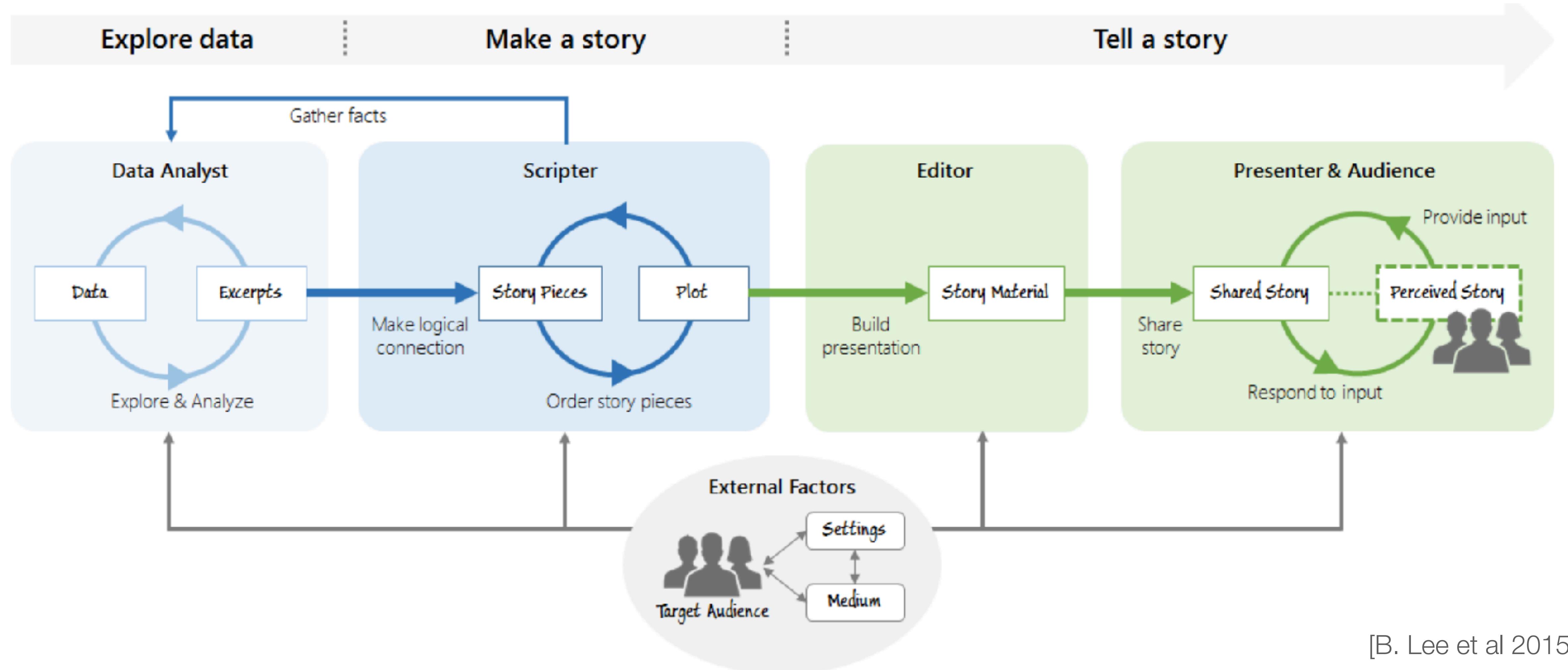


Redundancy helps with visualization recall and understanding.

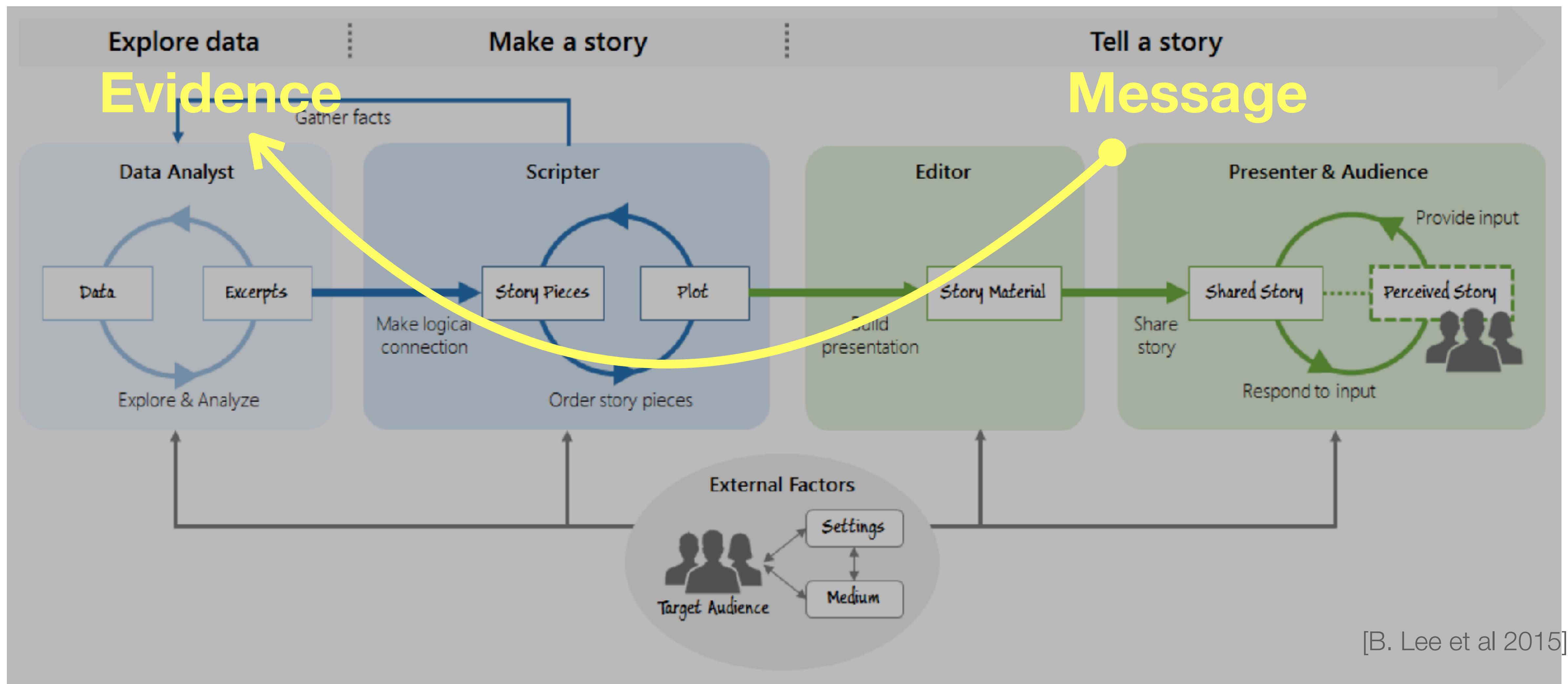
A single picture cannot tell compelling stories

# Data-Driven Storytelling

# Storytelling process: transforming data into visually shared stories.



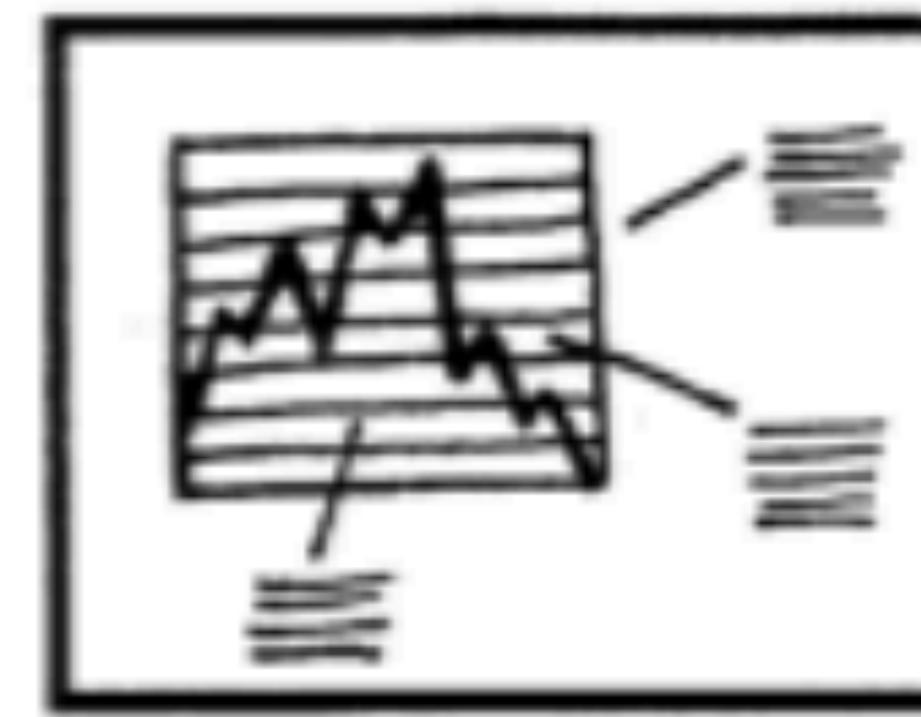
# In reality...



## Seven Genres



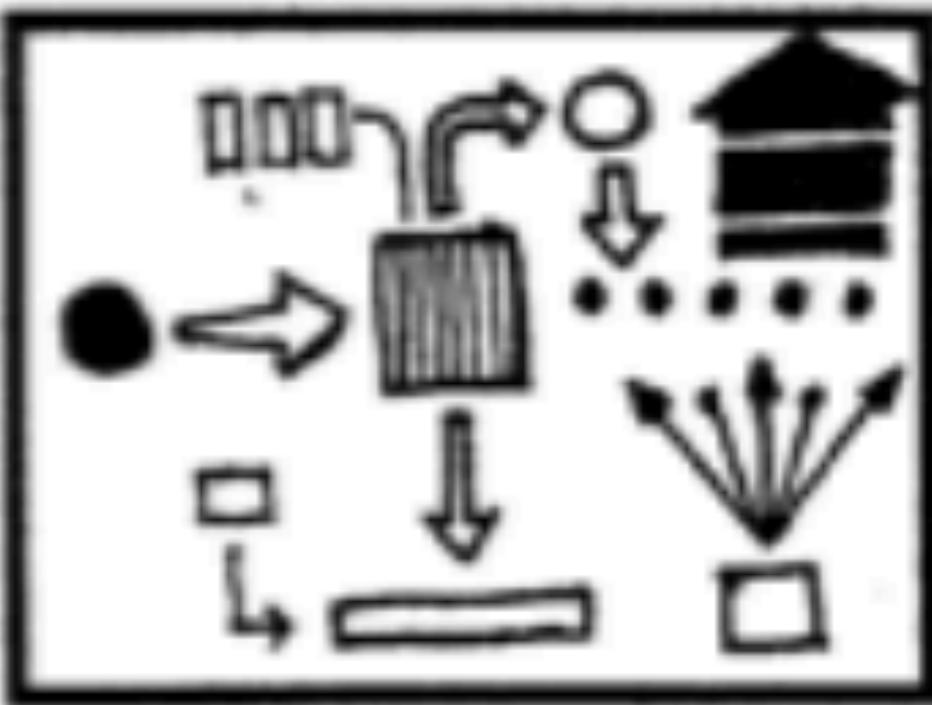
Magazine Style



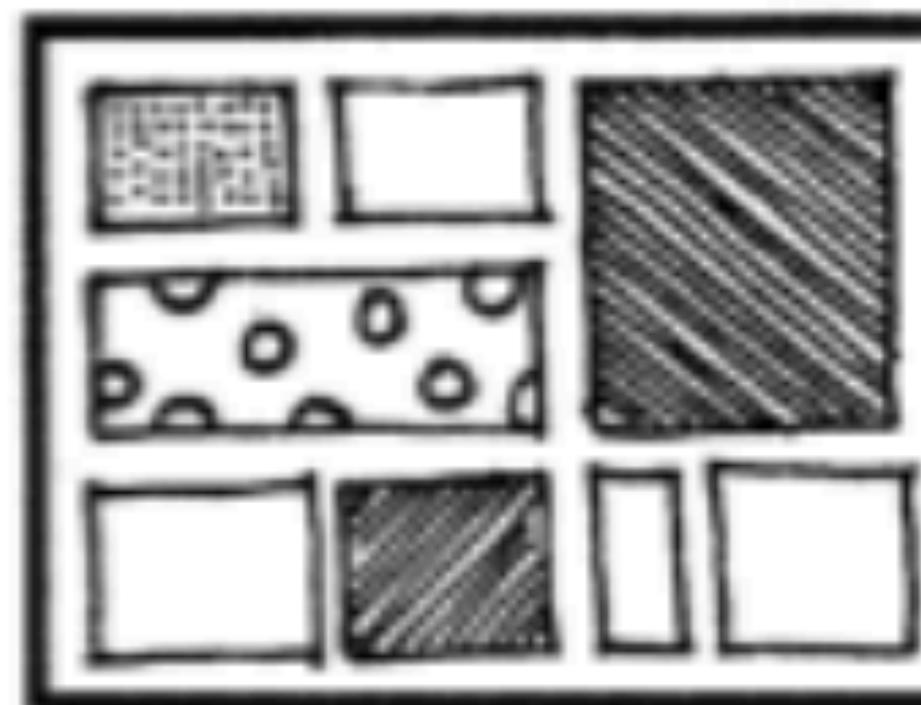
Annotated Chart



Partitioned Poster



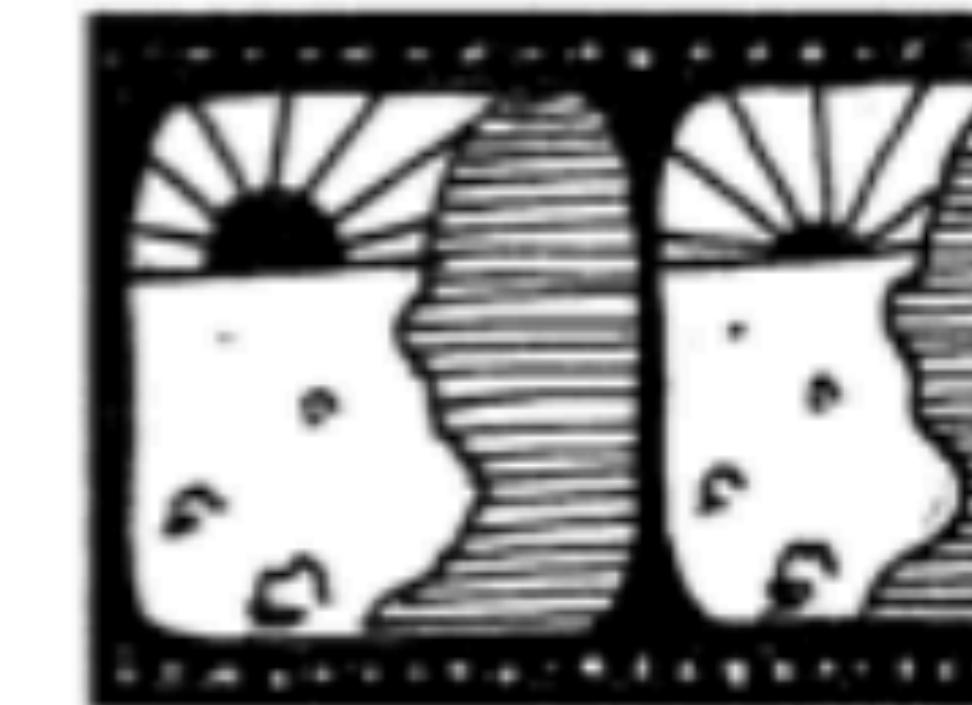
Flow Chart



Comic Strip



Slide Show



Film/Video/Animation

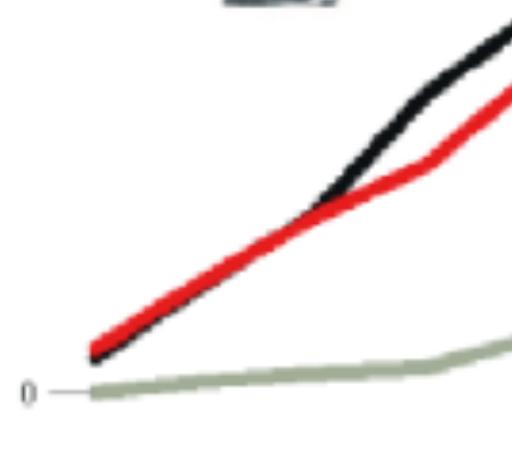
Mostly combined...

[Segel & Heer 2010]

# Examples

# Magazine

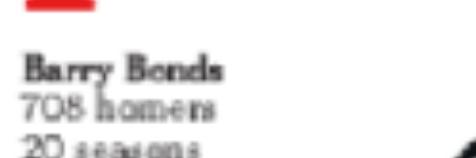
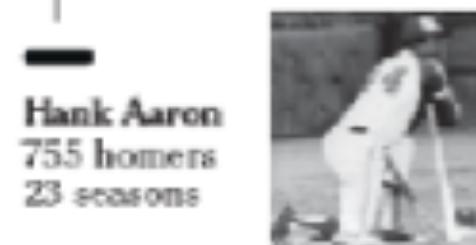
# 755



## Steroids or Not, the Pursuit Is On

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

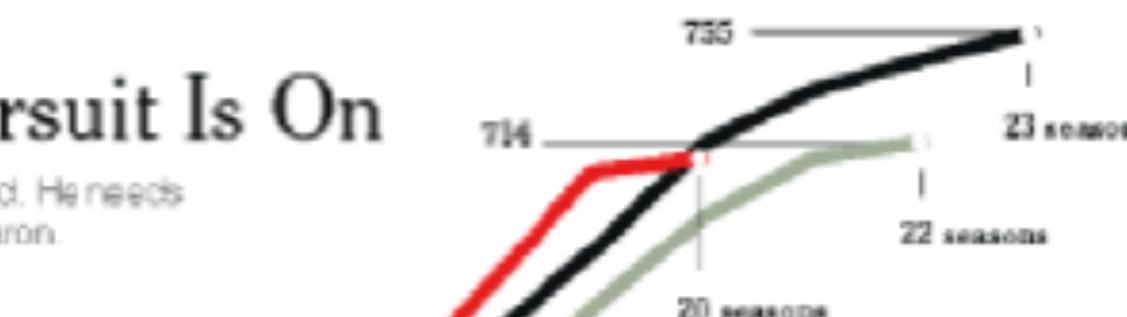
Lines are cumulative home runs.



Bonds takes lead.

Home runs after 16 seasons

Bonds 567  
Aaron 554  
Ruth 516

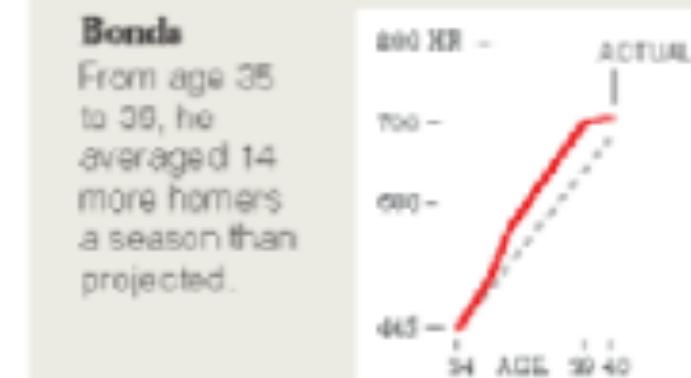
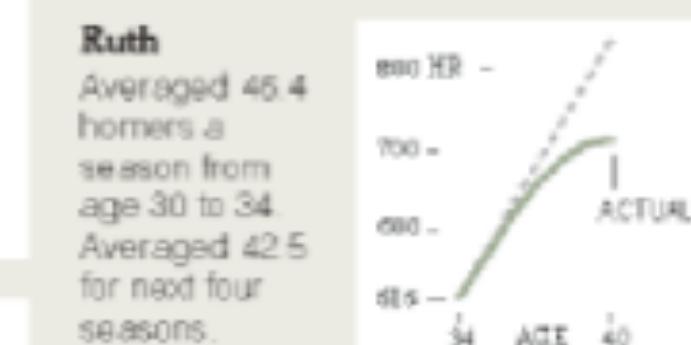


Bonds was injured last season. He played 14 games and hit 5 homers.

### Homer Pace After Age 34

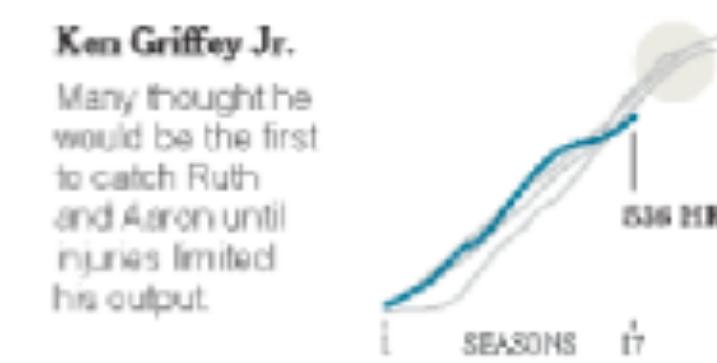
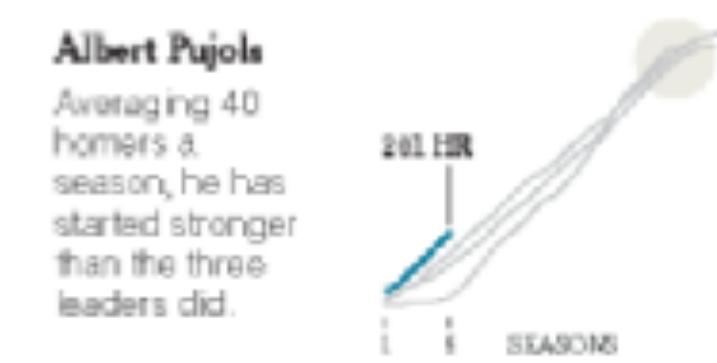
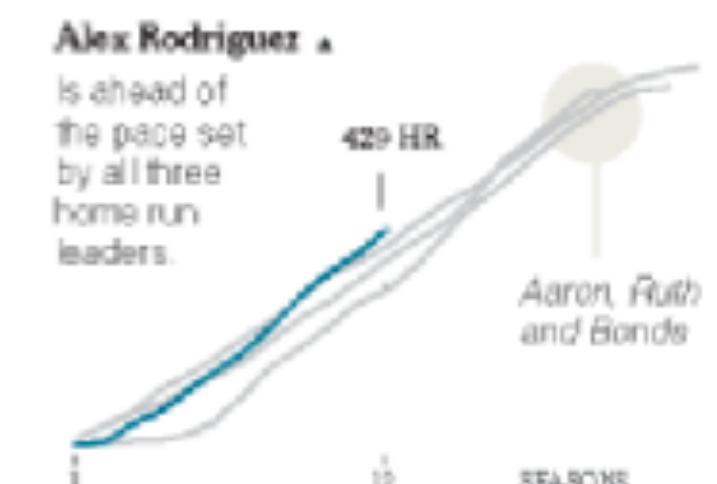
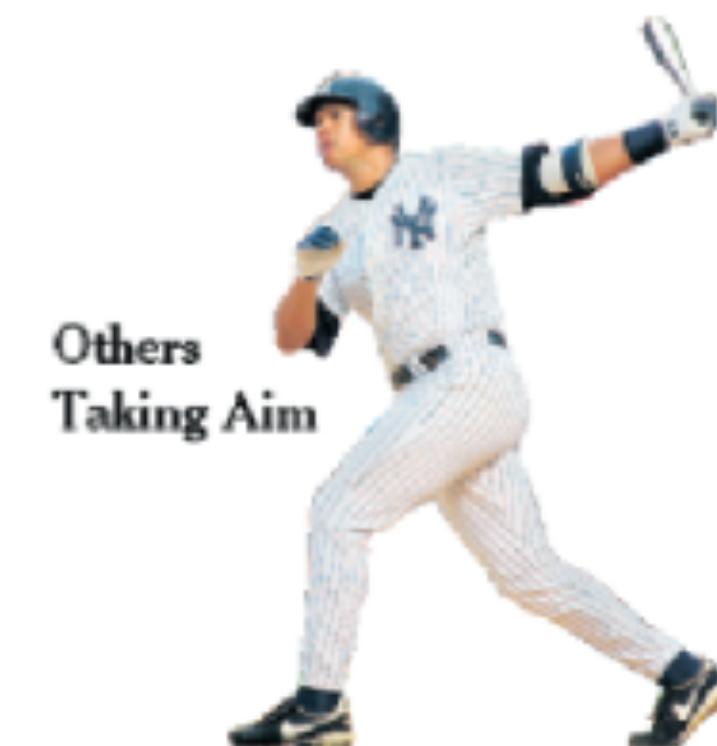
If the accusations are correct, Bonds was 34 in his first season on steroids. Here are projected home run paces for each player after age 34.

— PROJECTED PACE BASED ON AVERAGE OF PREVIOUS FIVE SEASONS



Note: Ages as of July 1 of each season.

### Others Taking Aim



### Differing Paths to the Top of the Charts

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

**Hank Aaron**



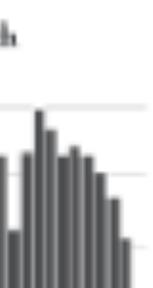
15 times hit 30 or more (M.L. most).

**Babe Ruth**



Hit only 20 over first five seasons.

**Barry Bonds**



Averaged 52 from 2000 to 2004.

**Willie Mays**



No one hit more from 1950-69.

**Sammy Sosa**



Three 60-home run seasons is record.

**Frank Robinson**



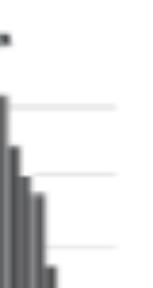
Triple Crown in '66 (49, 122, 316).

**Mark McGwire**



First to a season.

**Ken Griffey Jr.**



536 HR

**Alex Rodriguez**



429 HR

**Albert Pujols**



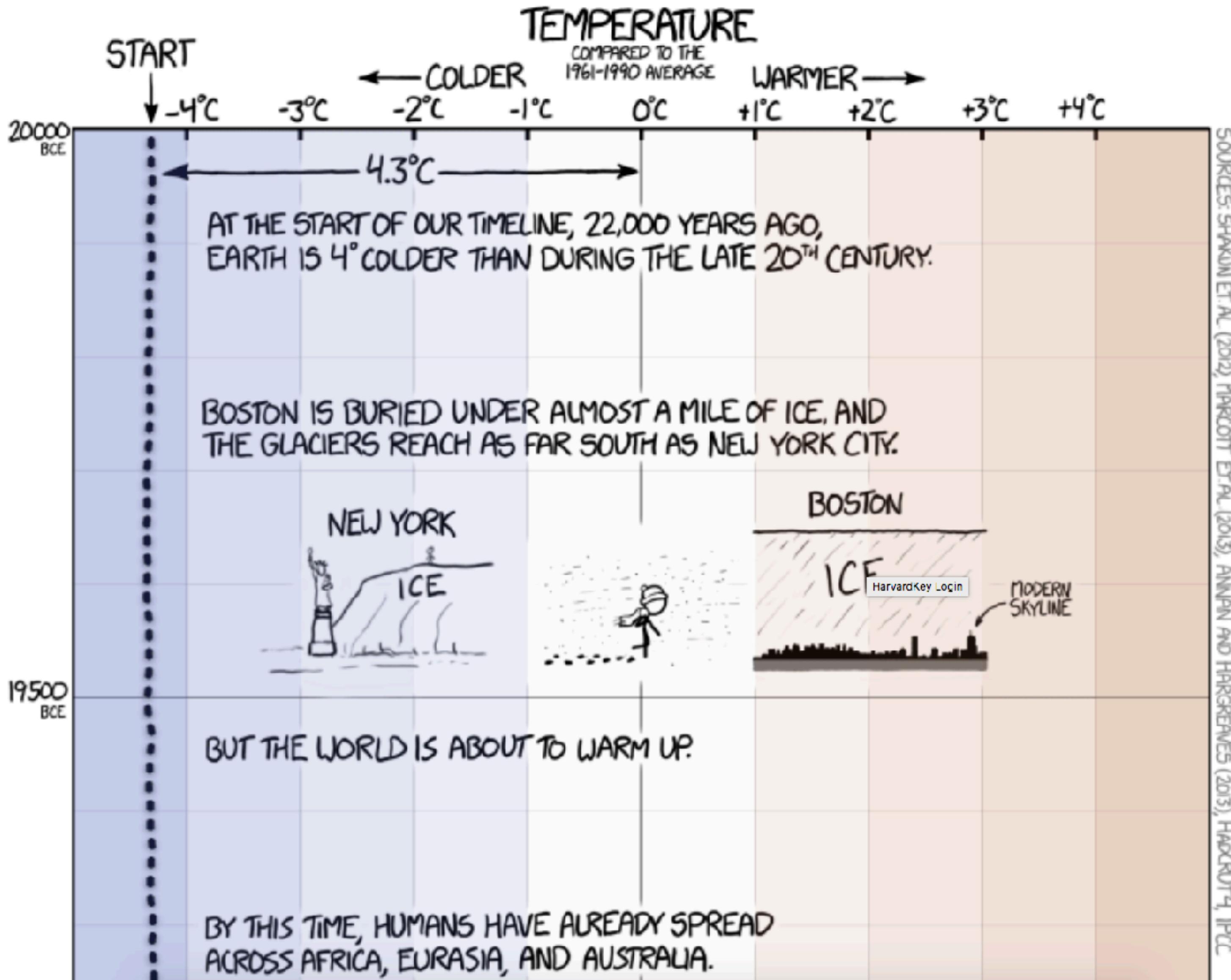
281 HR

New York Times 2006

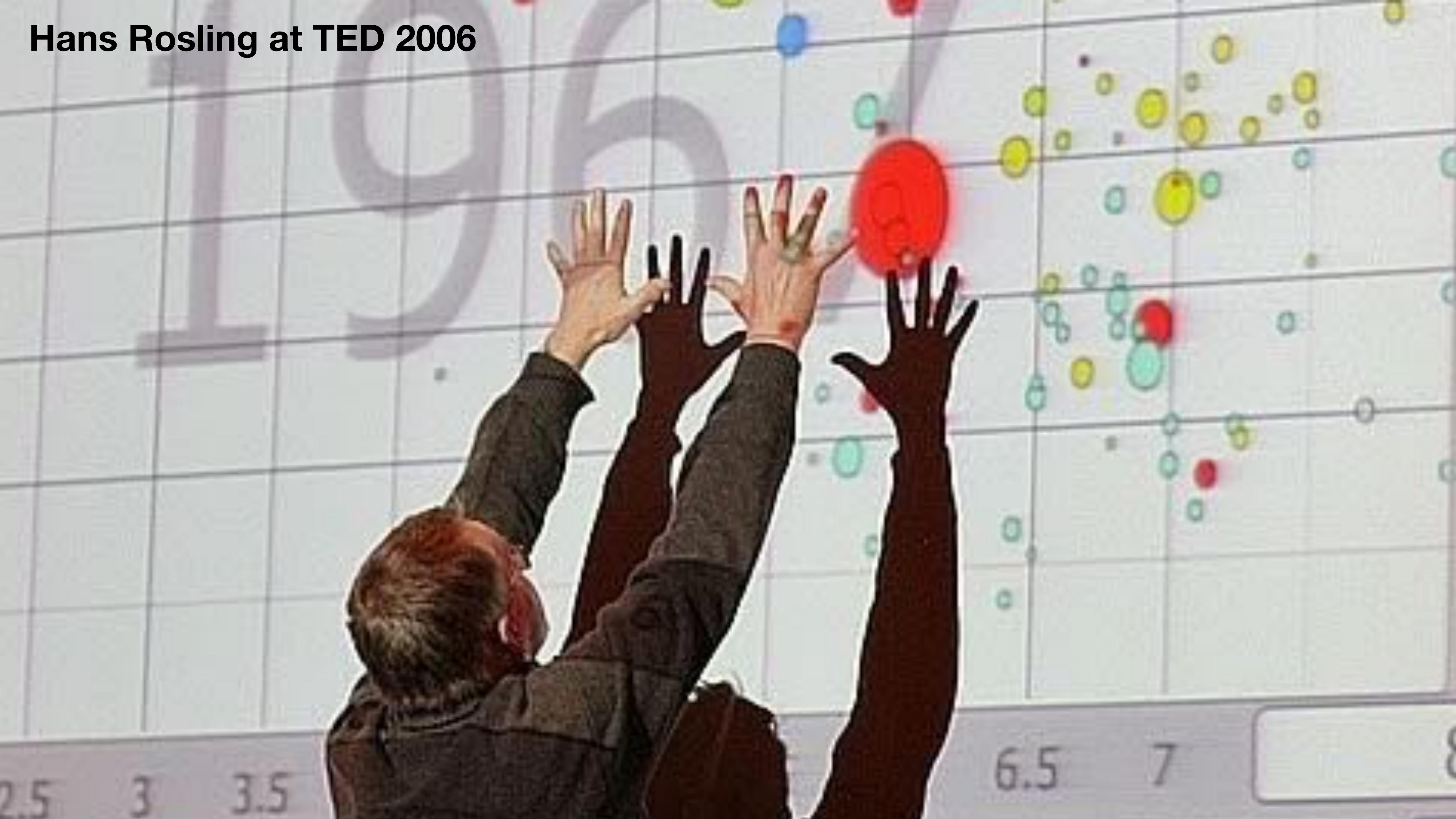
# Comics

## A TIMELINE OF EARTH'S AVERAGE TEMPERATURE SINCE THE LAST ICE AGE GLACIATION

WHEN PEOPLE SAY "THE CLIMATE HAS CHANGED BEFORE," THESE ARE THE KINDS OF CHANGES THEY'RE TALKING ABOUT.

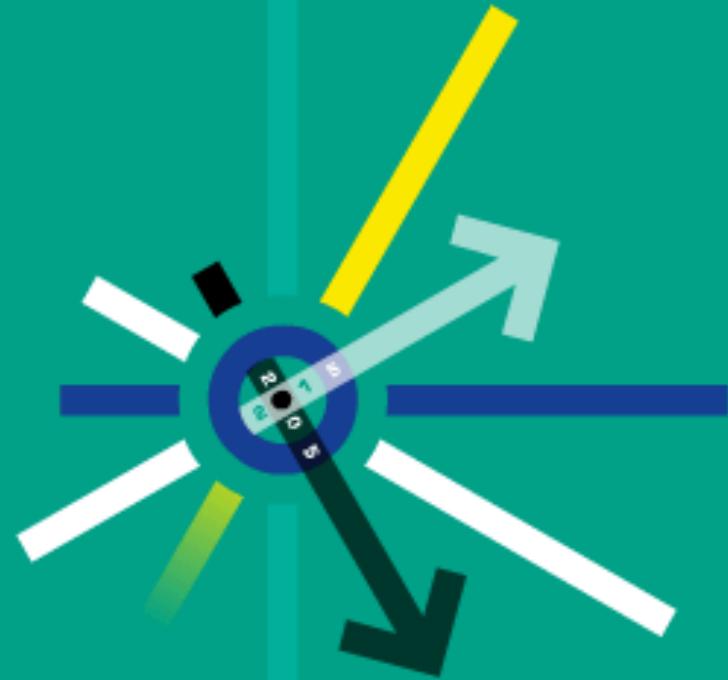


Hans Rosling at TED 2006



# Human Development Trends 2005

Interactive presentation of some of the messages in the Human Development Report 2005



English

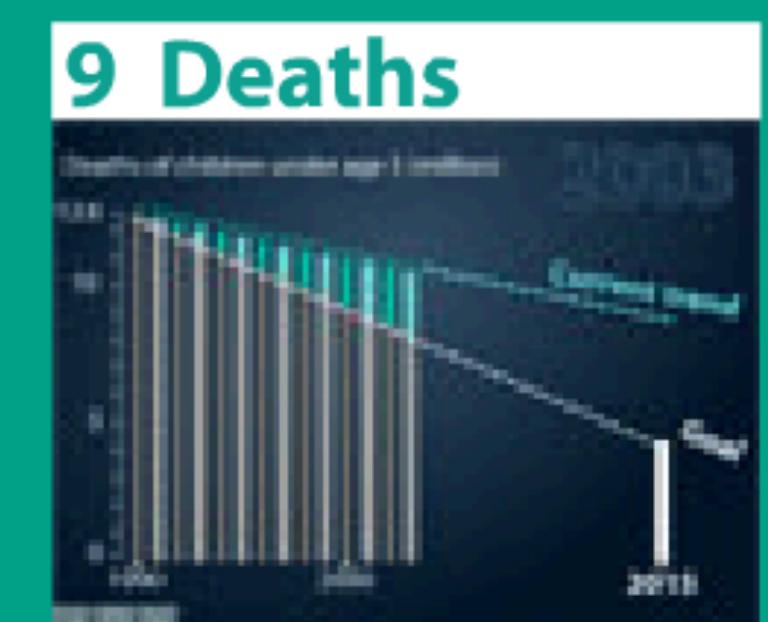
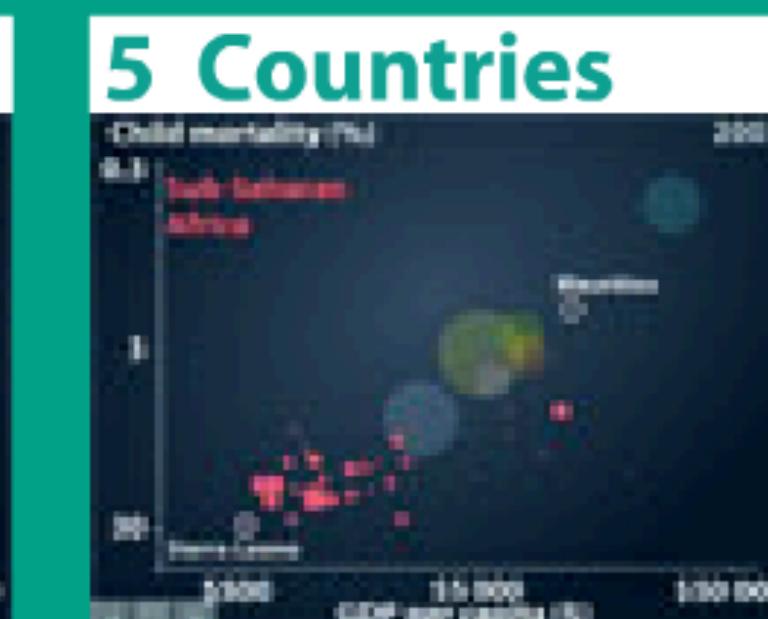
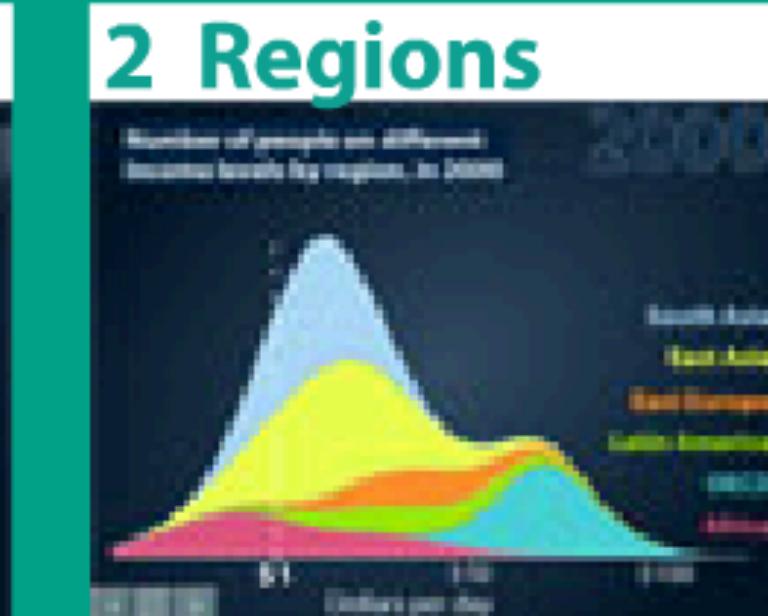
Dansk

Portuguese

Suomi

Français

Deutsch



Produced in collaboration with:

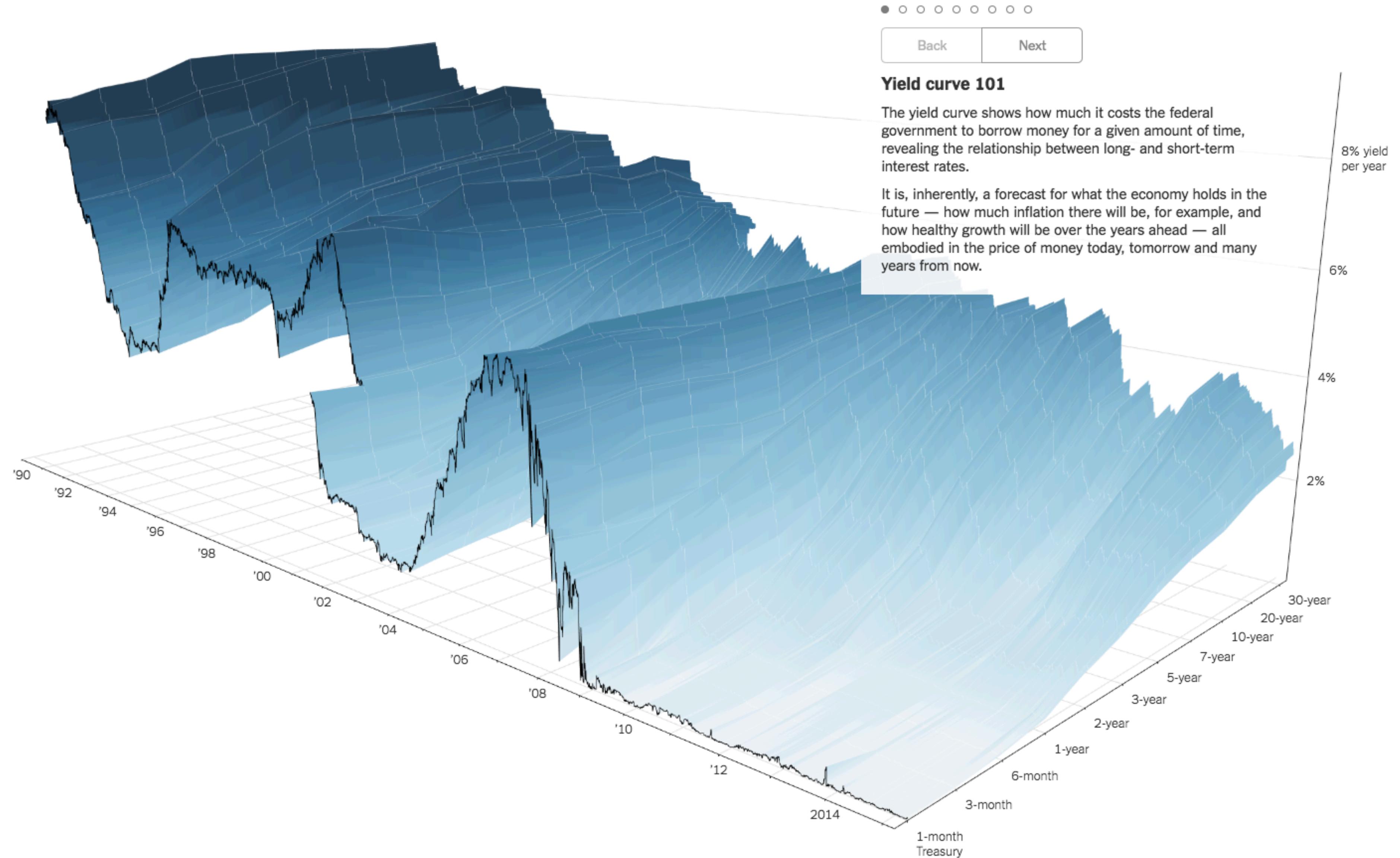
**GAPMINDER**

[www.gapminder.org](http://www.gapminder.org)

English translation: Claes Johansson, UNDP

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

By GREGOR AISCH and AMANDA COX MARCH 18, 2015



# Budget Forecasts, Compared With Reality

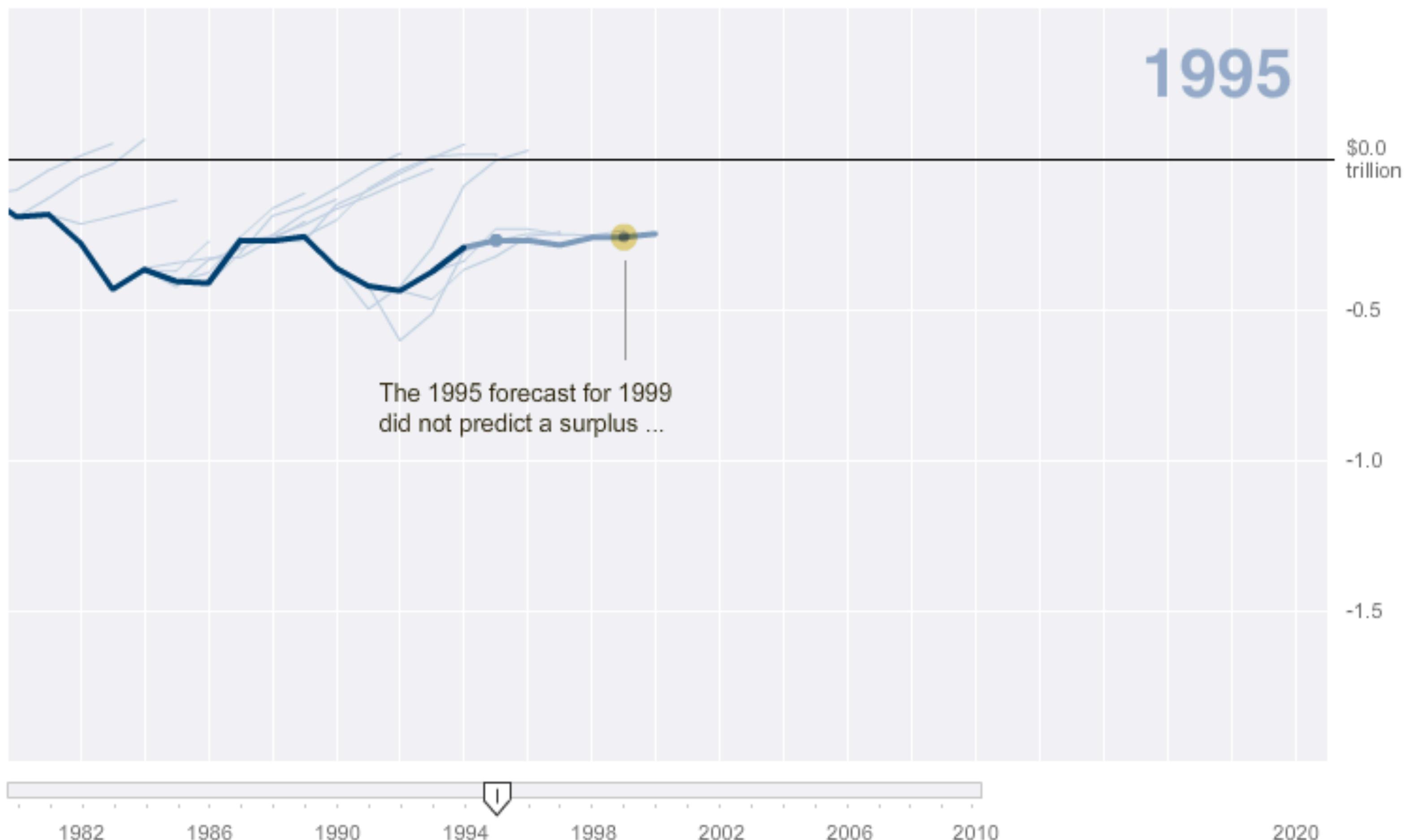
Just two years ago, surpluses were predicted by 2012. How accurate have past White House budget forecasts been?

1 2 3 4 5 6 NEXT ►

## Past forecasts

Even that may be an understatement. In the last 30 years, about 80 percent of four-year deficit forecasts have been too optimistic.

The early Clinton budgets — which failed to predict the surpluses that were generated, in part, by a stock market bubble — are the only major exception.



By AMANDA COX | Send Feedback

Source: Office of Management and Budget

TWITTER

LINKEDIN

SHARE

U.S. GUN DEATHS IN

2013 2010

OCTOBER

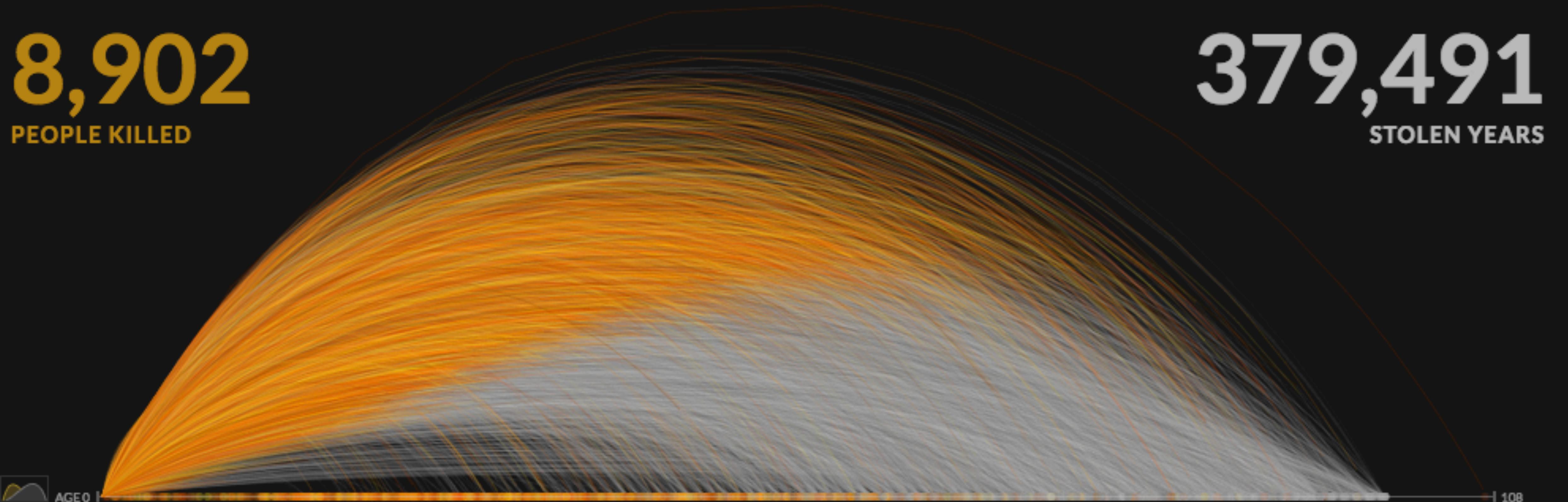
**8,902**  
PEOPLE KILLED

**379,491**  
STOLEN YEARS



AGE 0

108



THE  
**Fallen**  
OF  
World War II



## Seven Genres



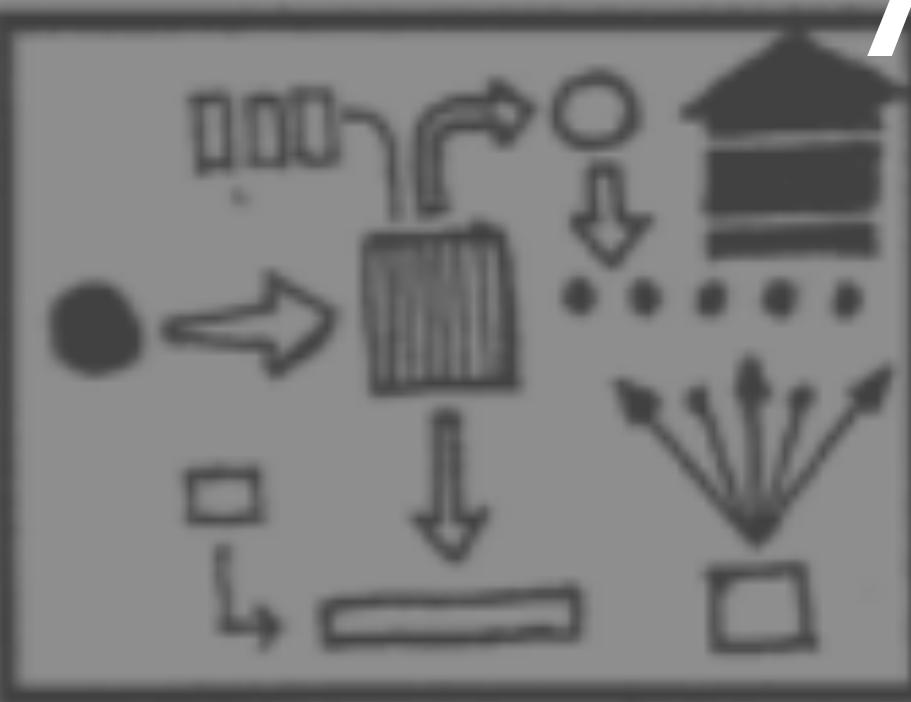
Magazine Style



Annotated Chart



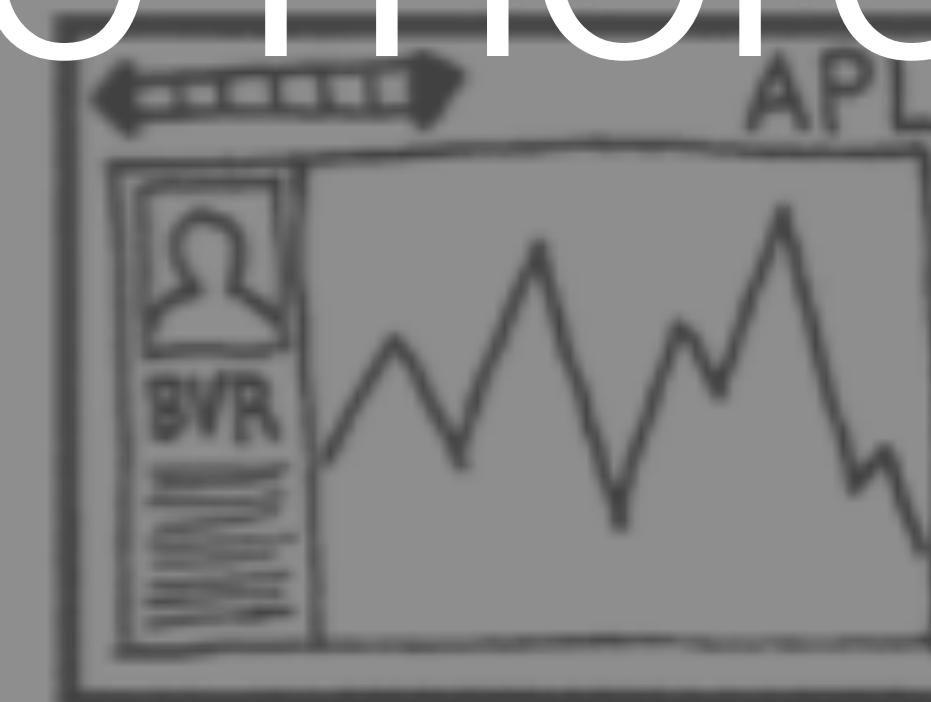
Partitioned Poster



Flow Chart



Comic Strip



Slide Show



Film/Vide/Animation

# Are there more?

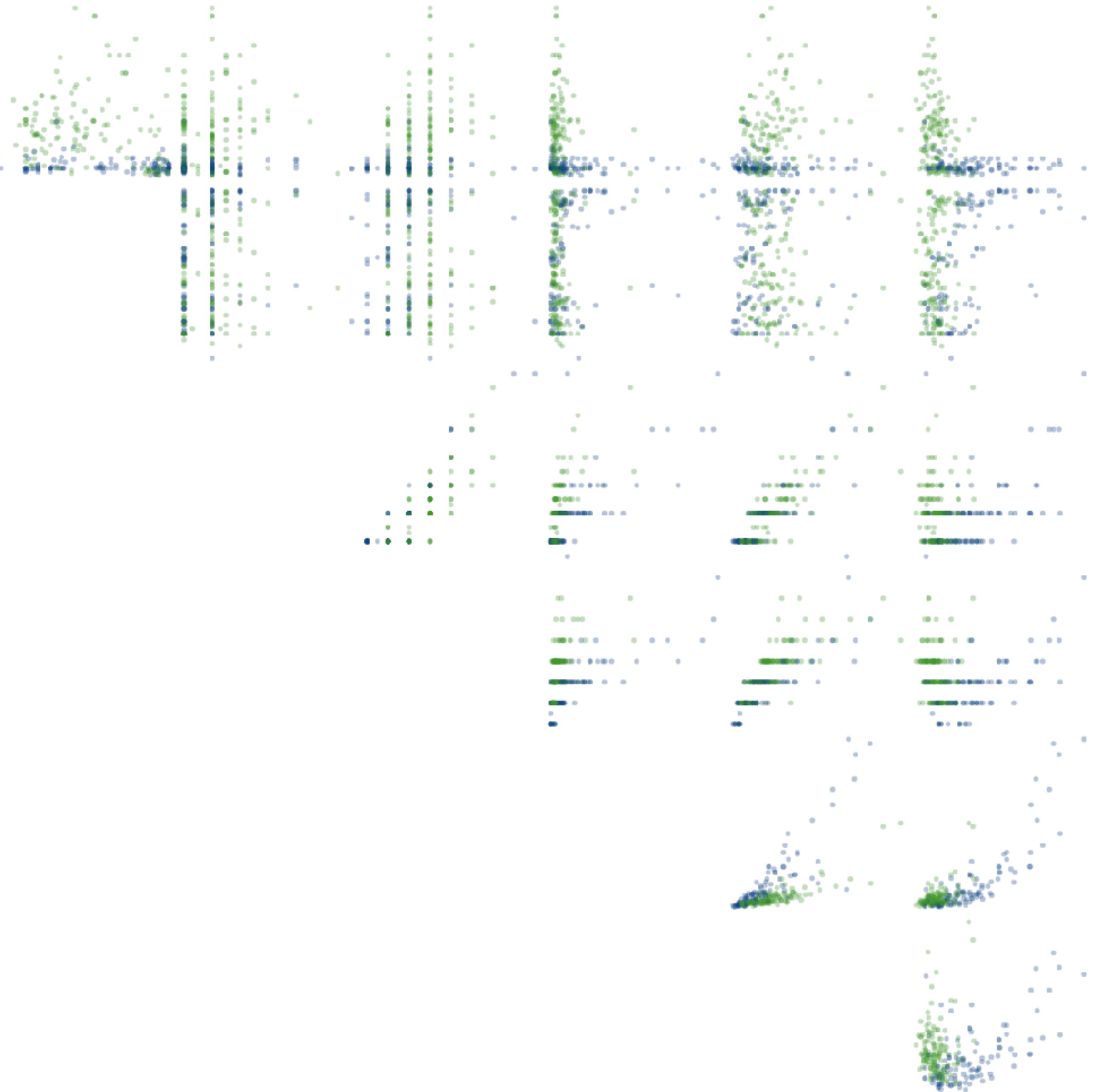
# A visual introduction to machine learning

English ▾

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

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

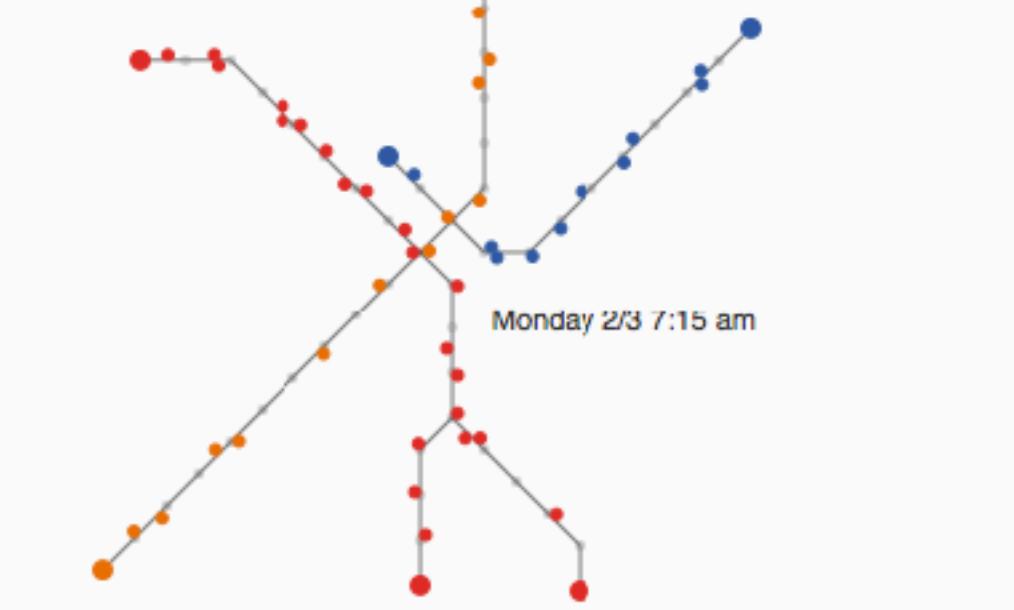
**SCROLL**



# Visualizing MBTA Data

An interactive exploration of Boston's subway system

Mike Barry and Brian Card - June 10, 2014



Star 676 Share 6.9K Tweet G+ Share

Boston's Massachusetts Bay Transit Authority (MBTA) operates the 4th busiest subway system in the U.S. after New York, Washington, and Chicago. If you live in or around the city you have probably ridden on it. The MBTA recently began publishing substantial amount of subway data through its public APIs. They provide the full schedule in General Transit Feed Specification (GTFS) format which powers Google's transit directions. They also publish realtime train locations for the Red, Orange, Blue, and Green lines. The following visualizations use data captured from these feeds for the entire month of February, 2014. [Green Line data became available](#) in October, 2014 so is not shown here. Also, working with the MBTA, we were able to acquire per-minute entry and exit counts at each station measured at the turnstiles used for payment.

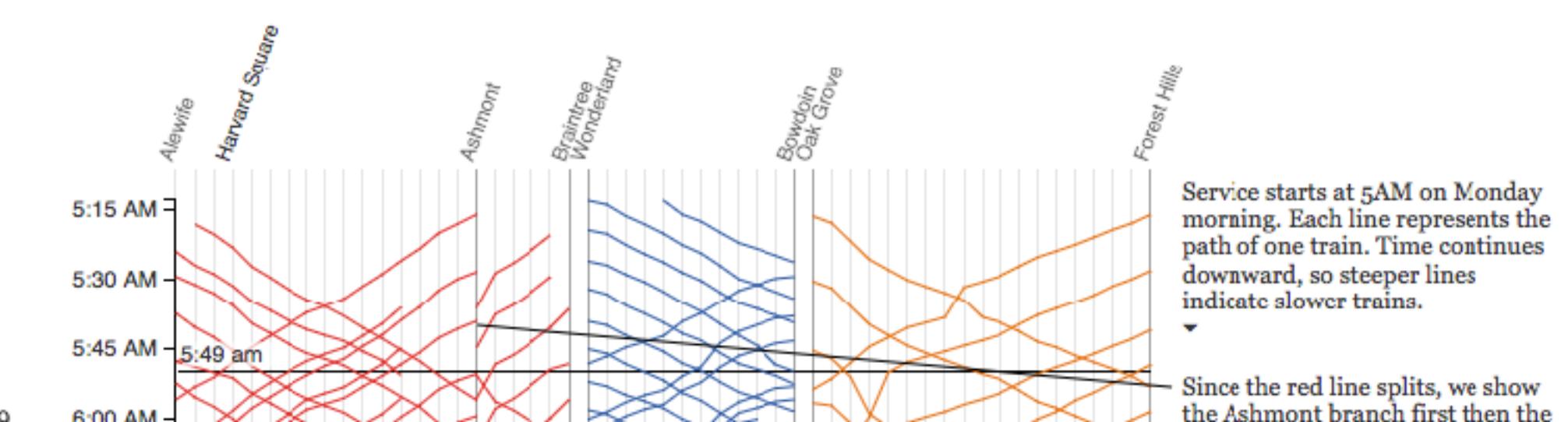
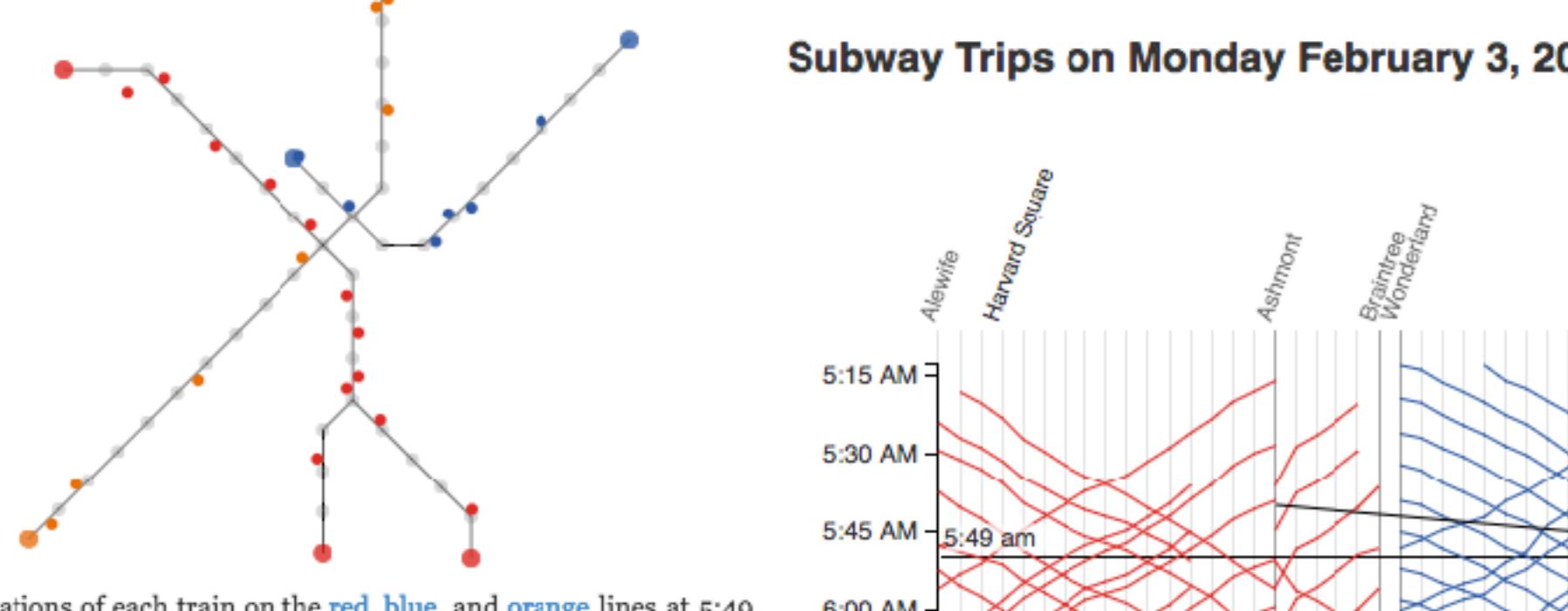
We attempt to present this information to help people in Boston better understand the trains, how people use the trains, and how the people and trains interact with each other.

## The Trains

In a typical weekday, trains make approximately 1150 trips on the red, orange, and blue lines starting at 5AM and continuing through 1AM the next morning. On Saturdays trains make 870 trips and on Sundays they make 760.

To better understand how the trains operate on a typical day, below are all trips that trains took on the red, orange, and blue lines on Monday February 3 2014. Each vertical line represents a station, and time extends from top to bottom. Steeper lines indicate slower trains. This visualization was first used by Étienne-Jules Marey to visualize train schedules and is typically called a "Marey Diagram."

	Average Number of Trips per Day		
	Weekdays	Saturdays	Sundays
Red	450	350	300
Orange	320	260	220
Blue	380	260	240
Total	1150	870	760

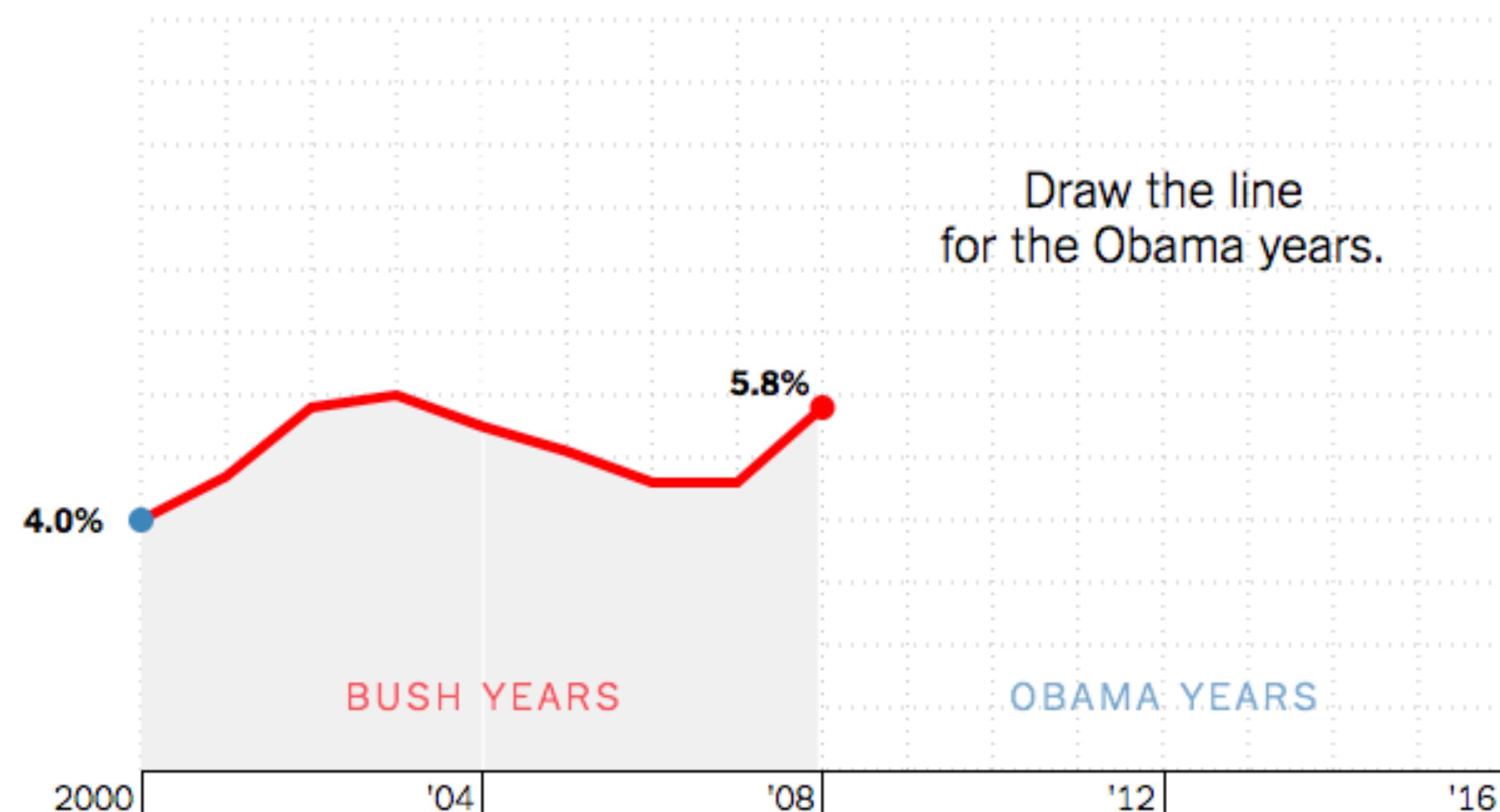


# You Draw It: What Got Better or Worse During Obama's Presidency

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

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

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



Show me how I did.

# Salubrious Nation: a game-y look at U.S. health

?



Level (1 / 8)

Adult Smoking  
(Percentage rate)

Guess the health parameters for **Santa Rosa, FL**.

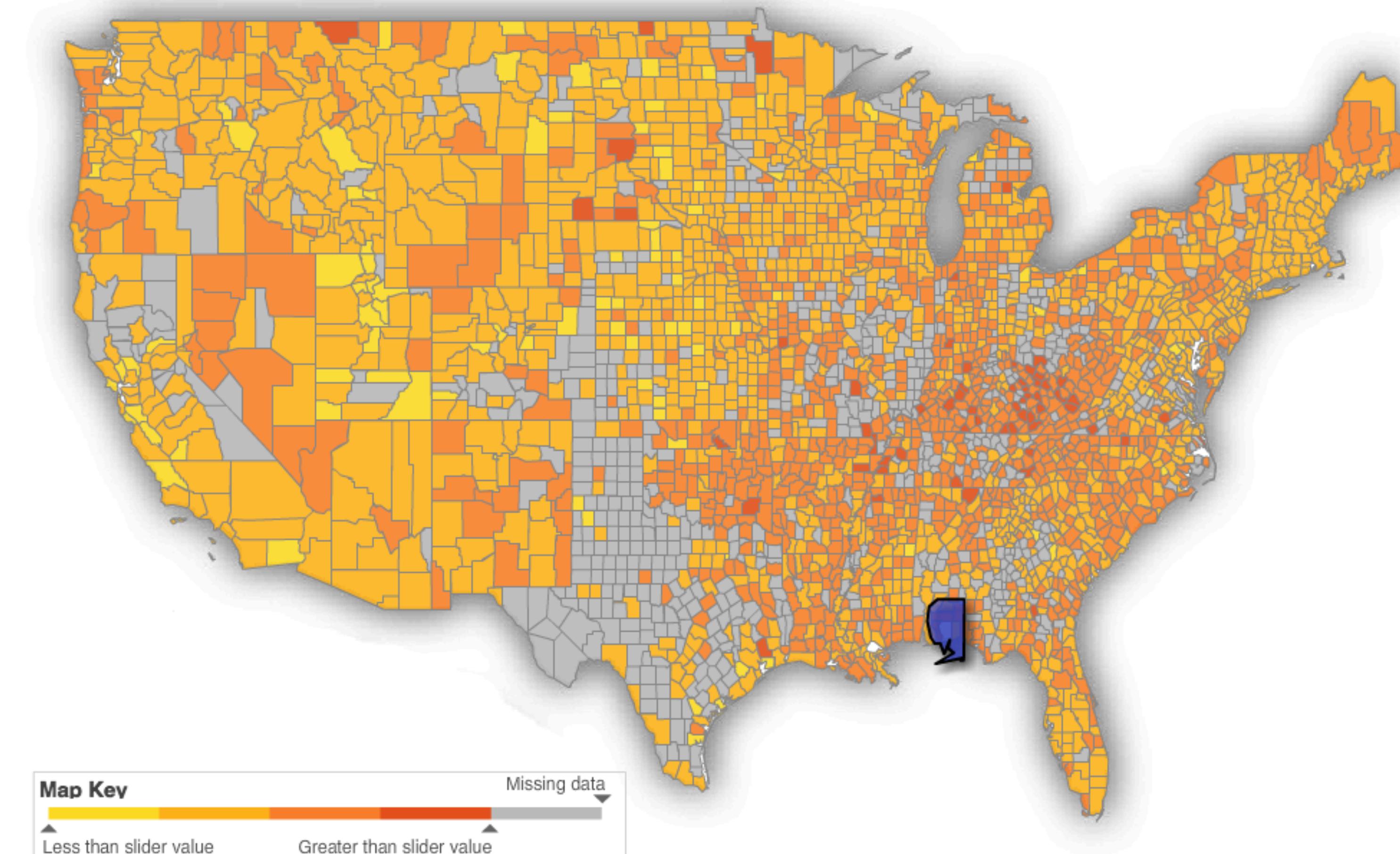
Hover your mouse over a county for demographic hints.

Guess:

Submit

Your Score: 0

High Score: 86





digital **dreams**

X 547  
Y 320 $\circ$

0 minutes  
49 seconds

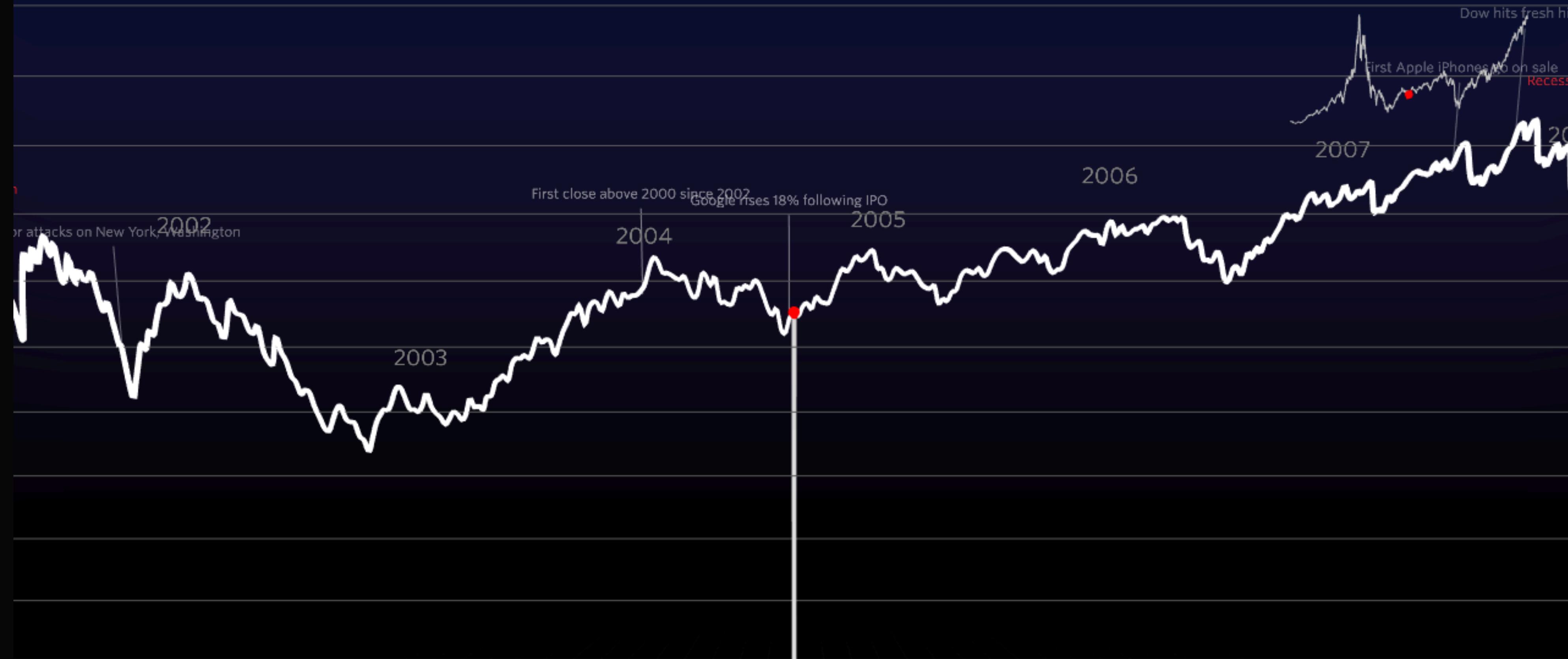
O

O

Aug. 27, 2004

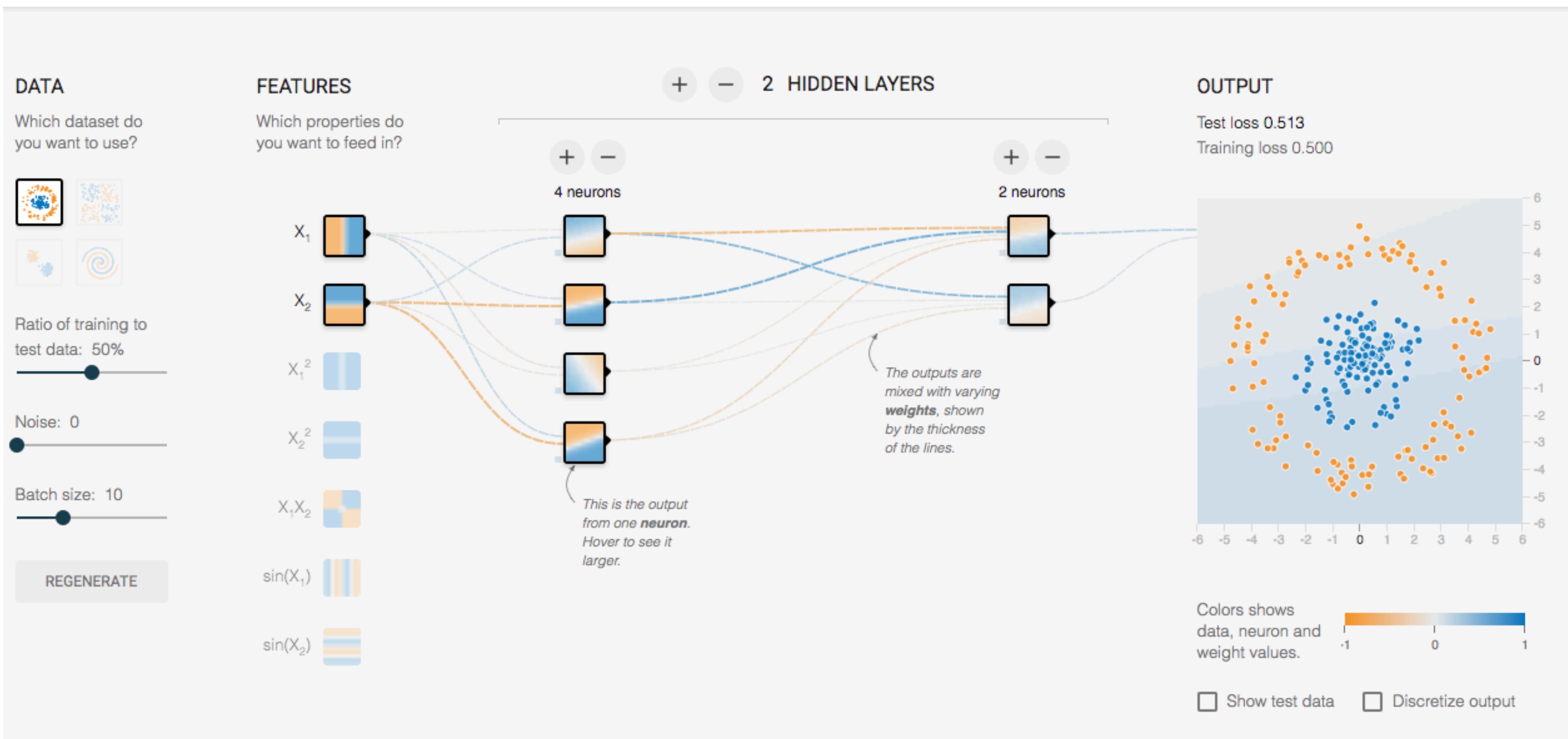
**1862.09**

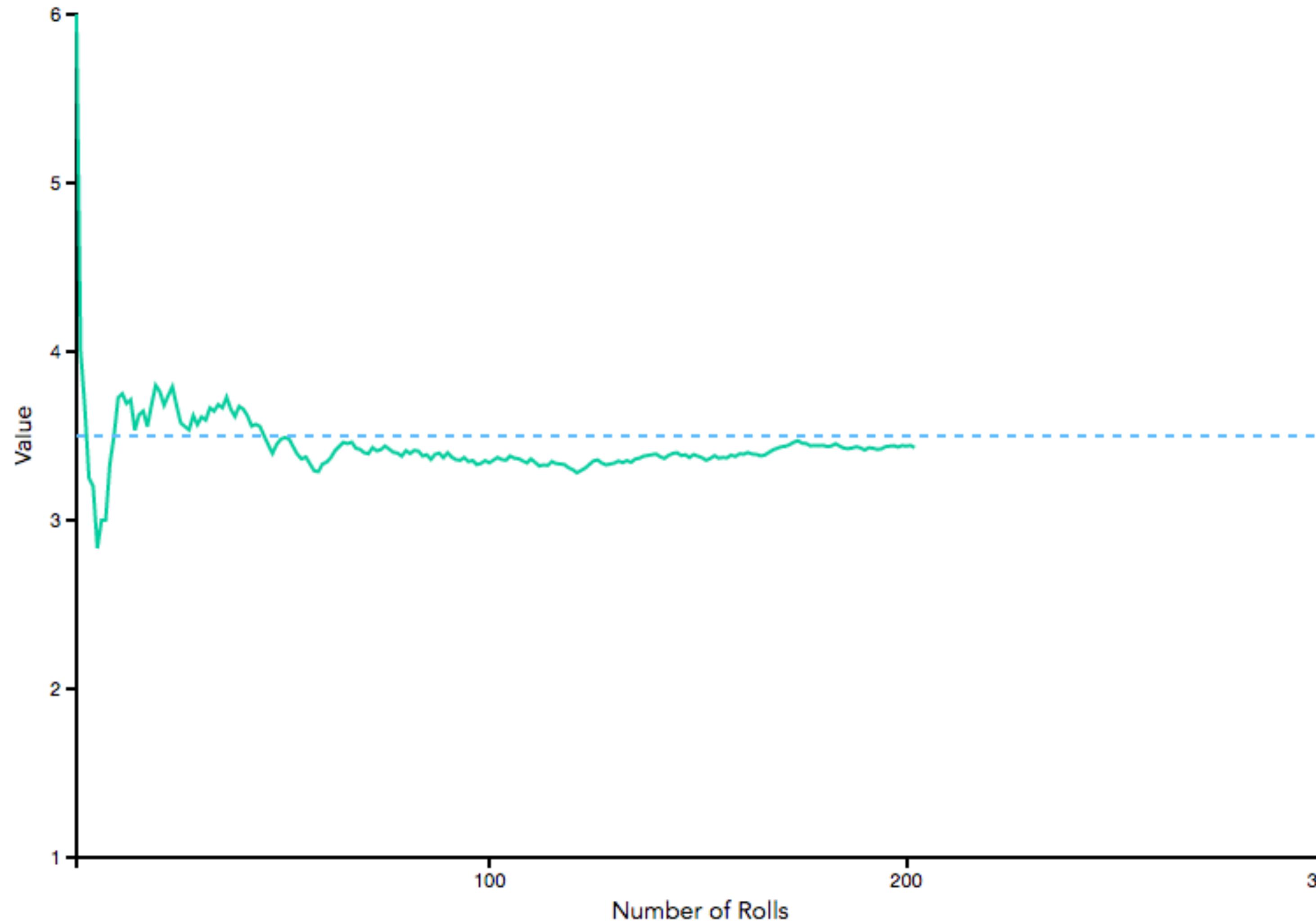
26.90 P/E ratio



START RIDE

			Epoch 000,000	Learning rate 0.03	Activation Tanh	Regularization None	Regularization rate 0	Problem type Classification
--	--	--	------------------	-----------------------	--------------------	------------------------	--------------------------	--------------------------------





## Expectation



The expectation is a statistic that attempts to summarize the average of a random experiment. It can be interpreted as the long term average outcome of repeating the experiment many times. Mathematically, it is defined as the probability weighted sum of all outcomes in the sample space, denoted,

$$E[X] = \sum_{x \in \Omega} xP(x)$$

Consider the random experiment of rolling a fair die and watch as the running average converges to the expectation of 3.5.



Roll the Die

Roll 100 times

Make the die unfair by adjusting the blue bars below and observe how this changes the expectation.



# EXPLORABLE EXPLANATIONS

Lion cubs play-fight to learn hunting skills. Rats play to learn social & emotional skills. Monkeys play to learn cognitive skills, to practice problem-solving and creativity.

And yet, in the last century, we humans have convinced ourselves that play is useless, and learning is *supposed* to be boring. Gosh, no wonder we're all so miserable.

Welcome to **Explorable Explanations**, a hub for learning through play! We're a disorganized "movement" of artists, coders & educators who want to *reunite play and learning*.

Let's get started! Check out these **3 random Explorables**:



★ **Fireflies** biology

a small, serene simulation of self-synchronization

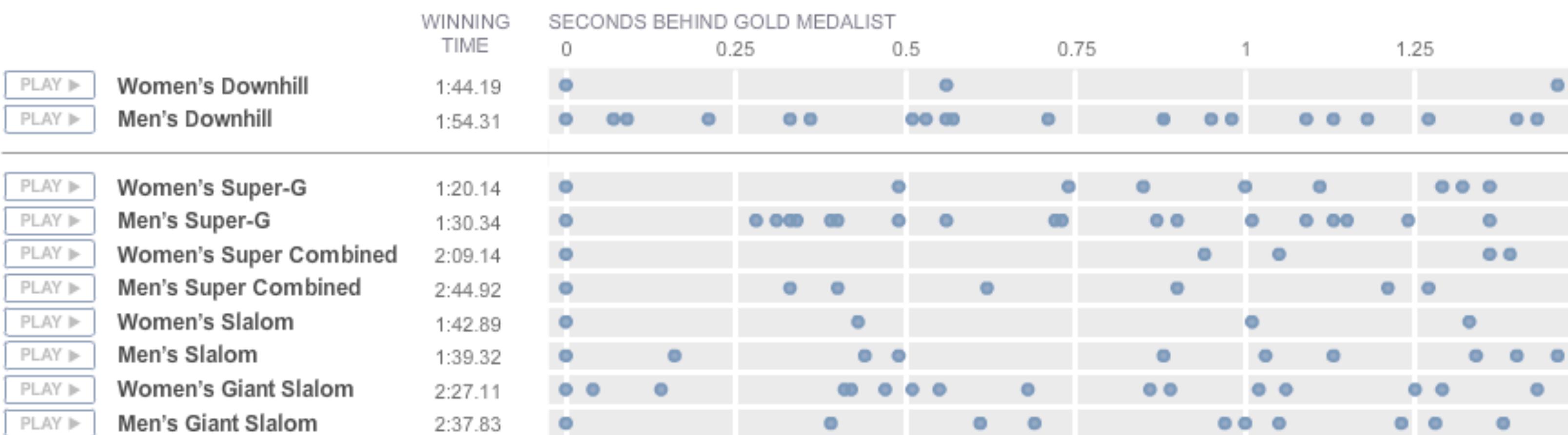
## Fractions of a Second: An Olympic Musical

At the Olympics, the blink of an eye can be all that separates the gold medalist from the 10th-place finisher. In some events, this is obvious. But in others, with athletes racing one by one, the closeness of the race is harder to perceive. Listen to the differences below.



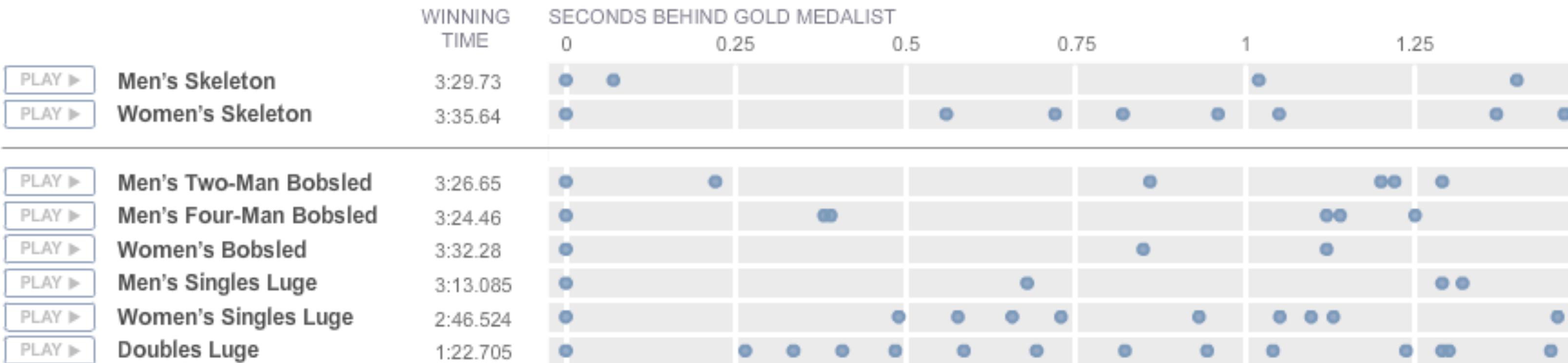
### Alpine skiing

The women's downhill course was extremely tiring, and, because it was more challenging than the men's course, it ended up separating the skiers by much larger margins. This pattern appears in the two speed events: the downhill and the super-G.



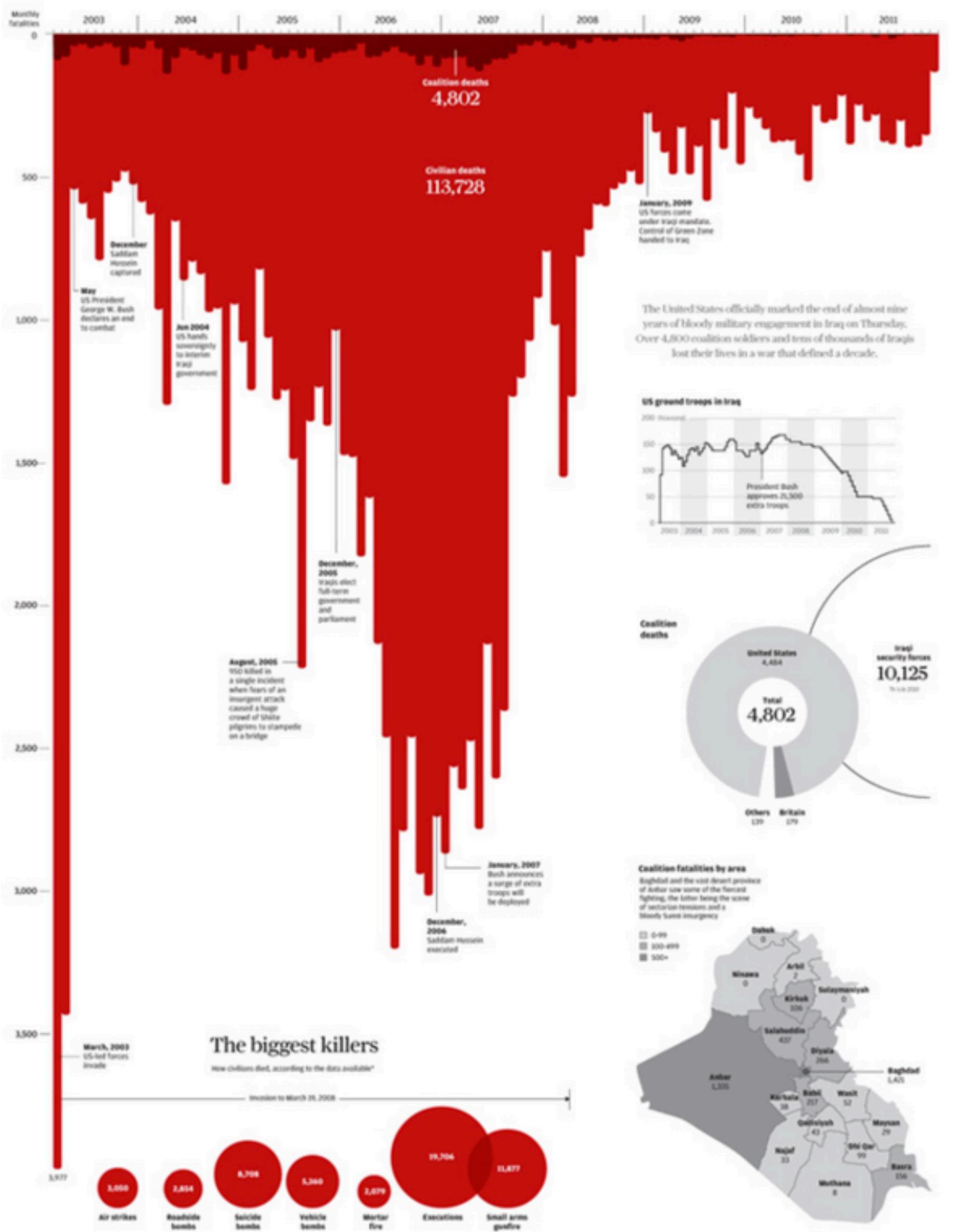
### Skeleton, Bobsled and Luge

In percentage terms, the men's skeleton had one of the tightest finishes in Vancouver, with only .07 of a second separating the top two finishers across a three-and-a-half-minute run. But the difficult track produced speeds higher than expected, and many sliding events had relatively large gaps between gold and silver.



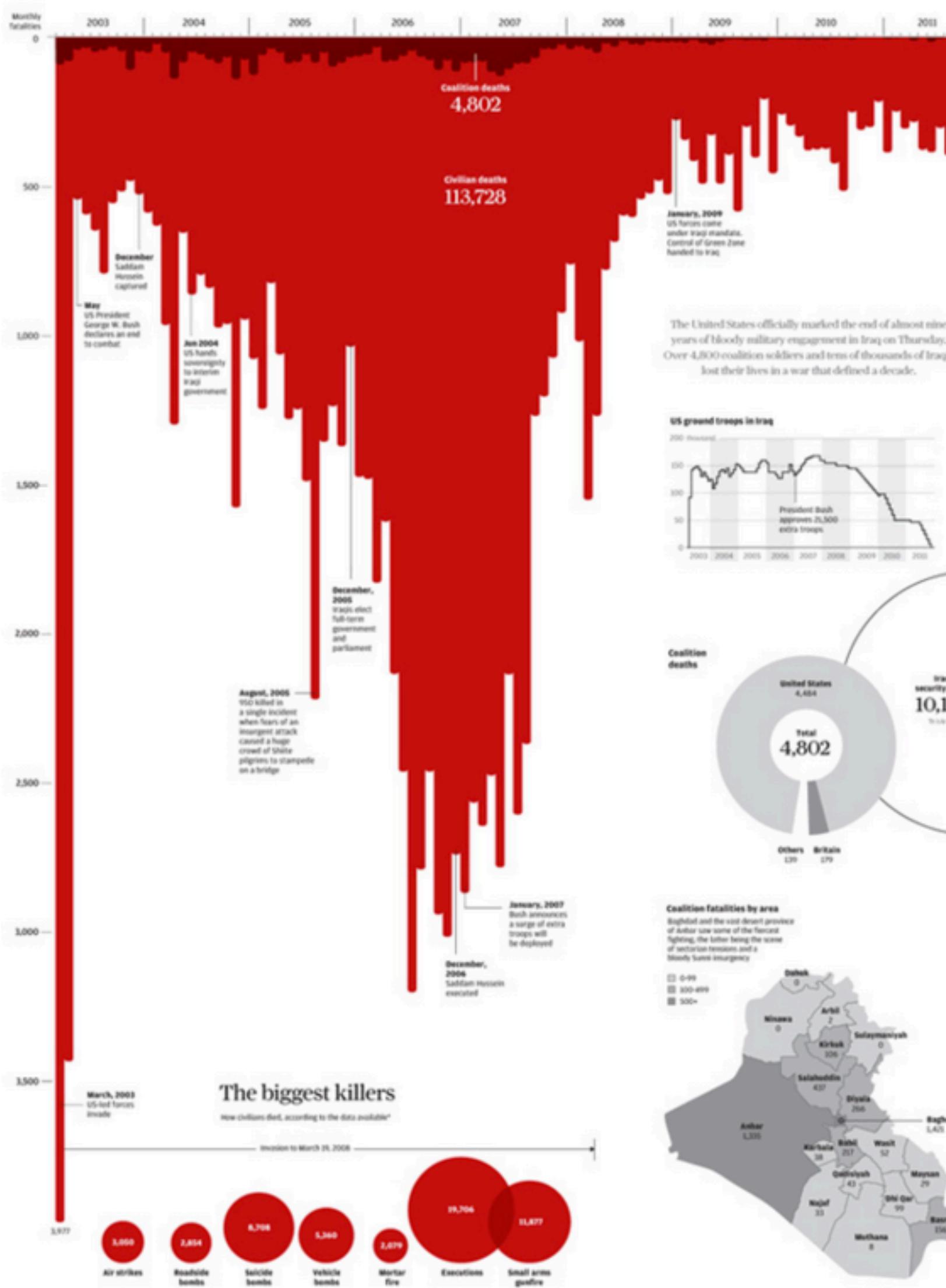
Storytelling, Double-edged Sword?

# Iraq's bloody toll



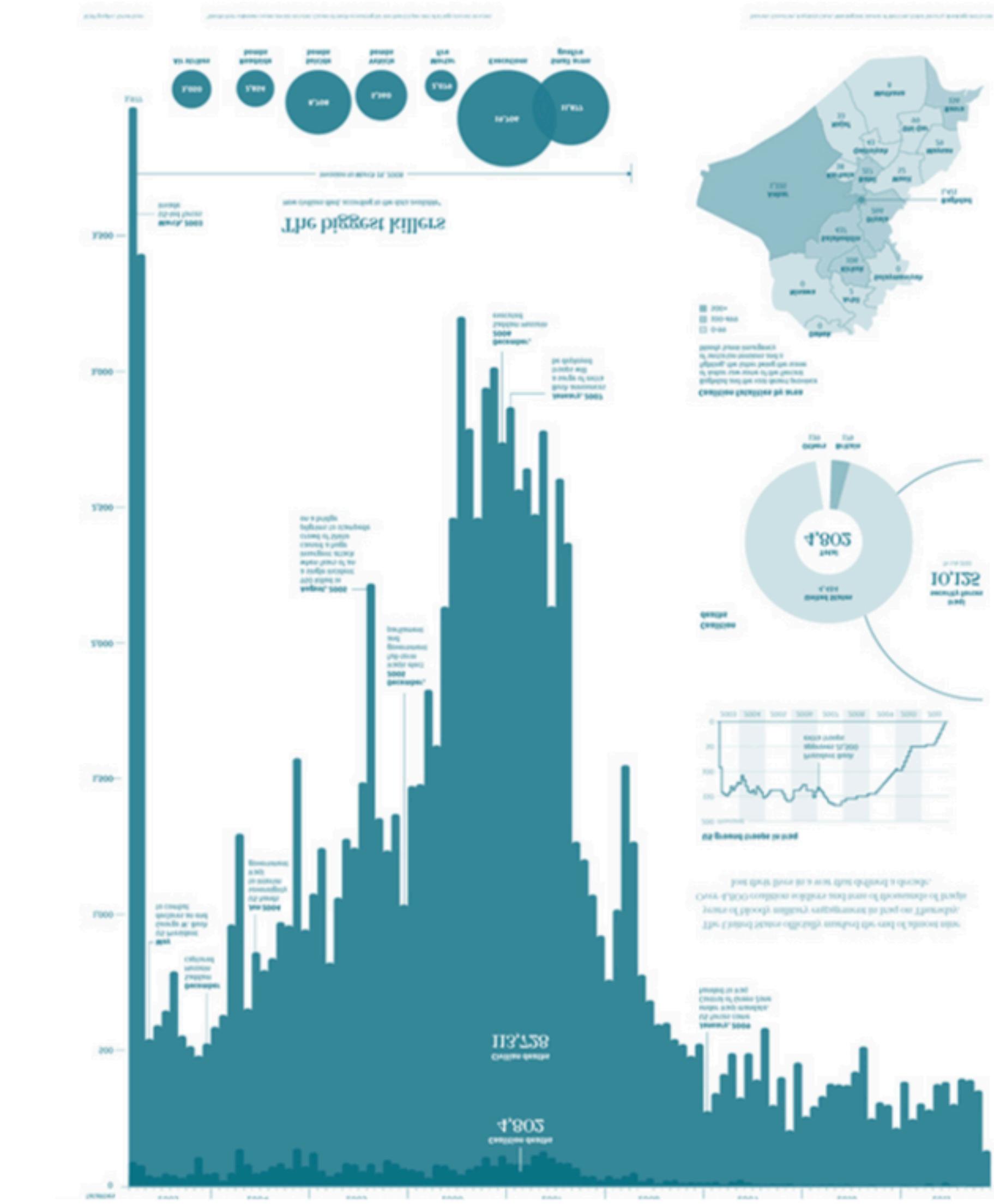
[South China Morning Post 2011]

# Iraq's bloody toll

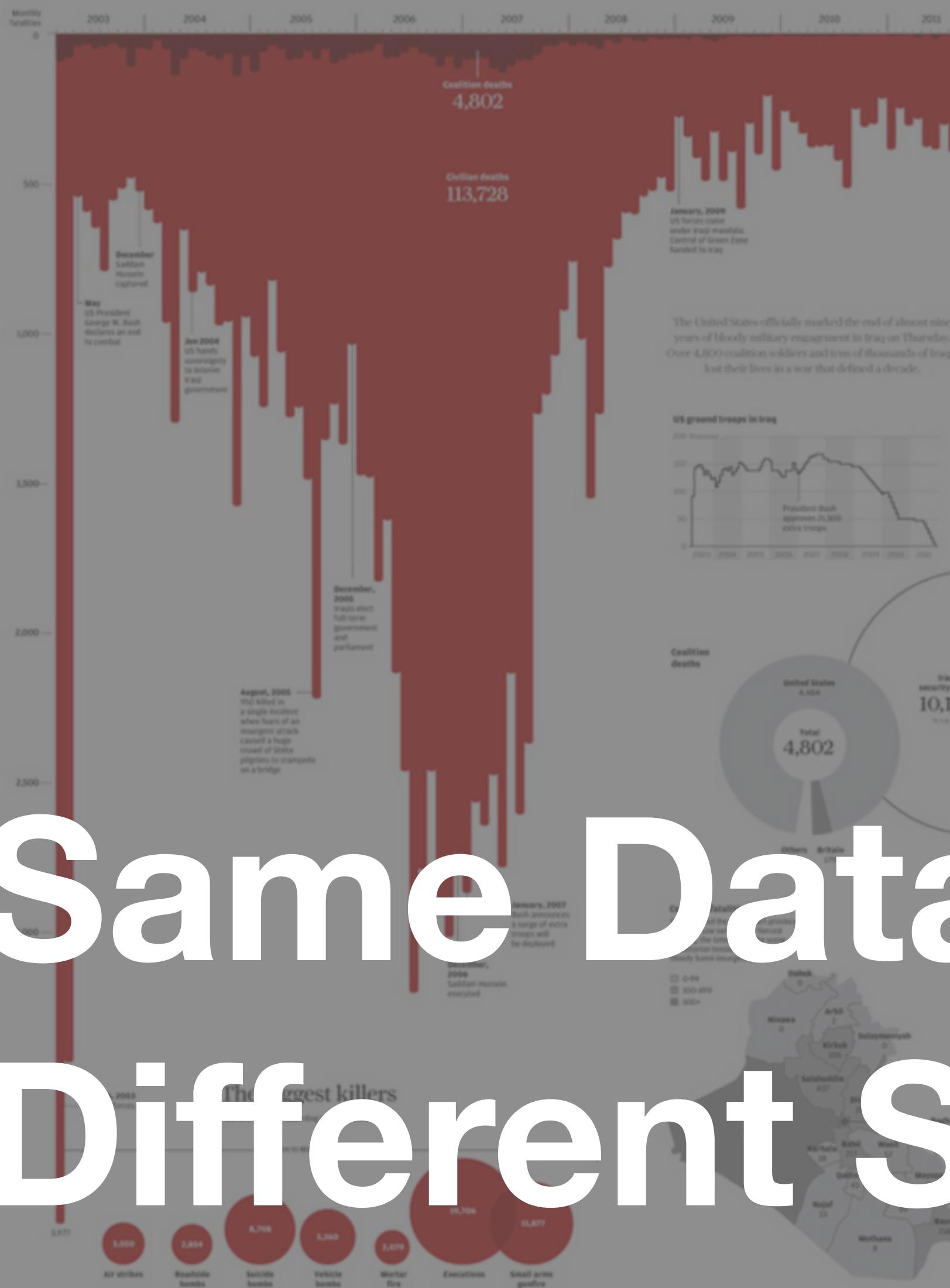


[South China Morning Post 2011]

# Iraq: Deaths on the decline



## Iraq's bloody toll



# Iraq: Deaths on the decline



# Same Data, Different Stories

[South China Morning Post 2011]

# Flipped upside down...

# Presentation & Storytelling in Tableau

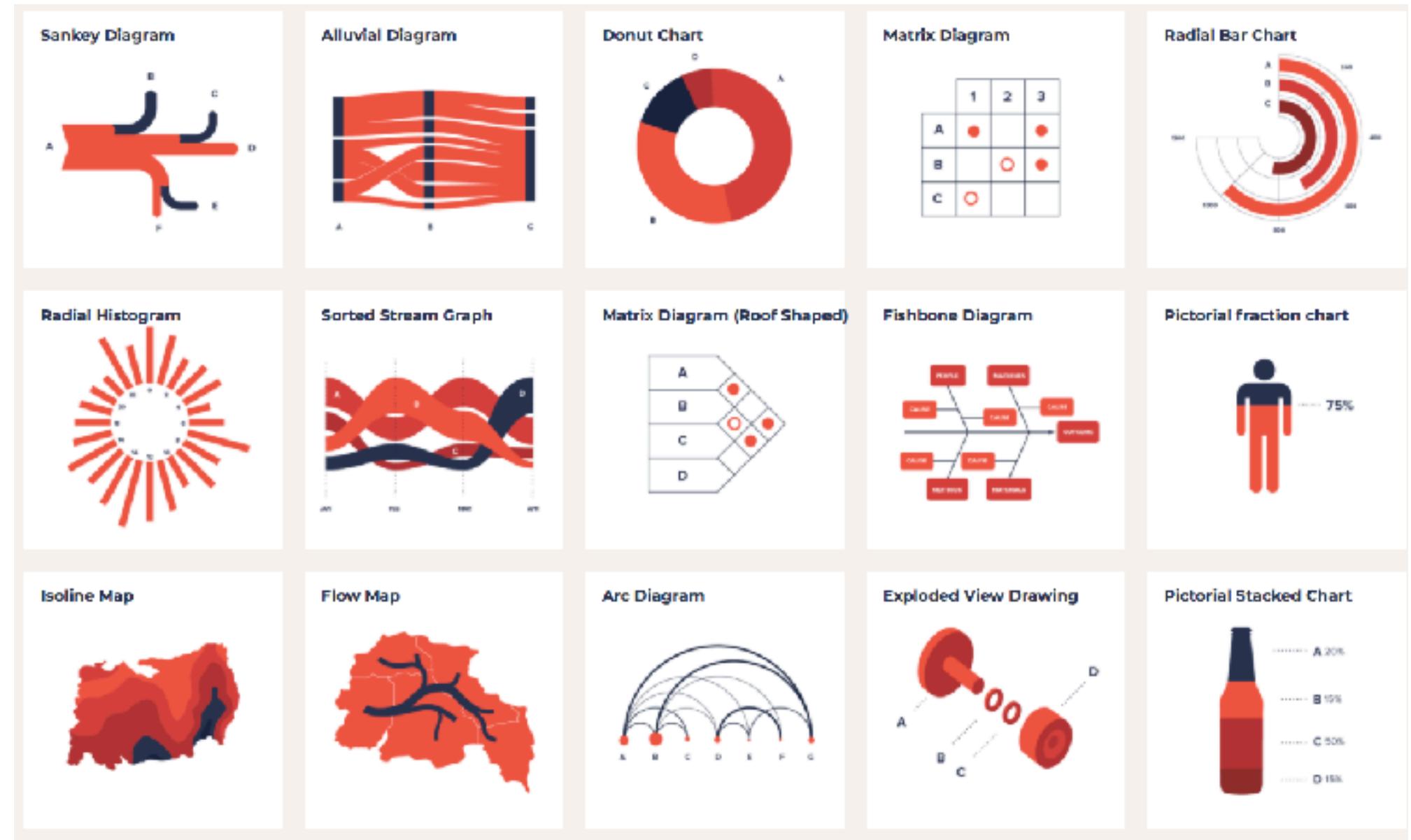
# Dashboard

# Annotation

# Story Points

# Next

## Advanced visualizations



10 min break