Data-Driven Storytelling

The Human Factor

Benjamin Bach

March 2019

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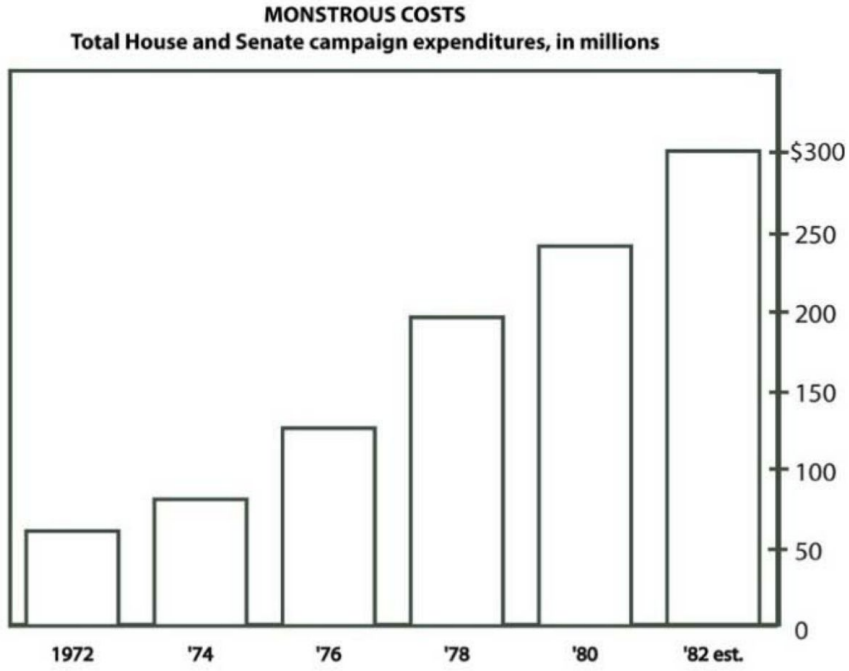
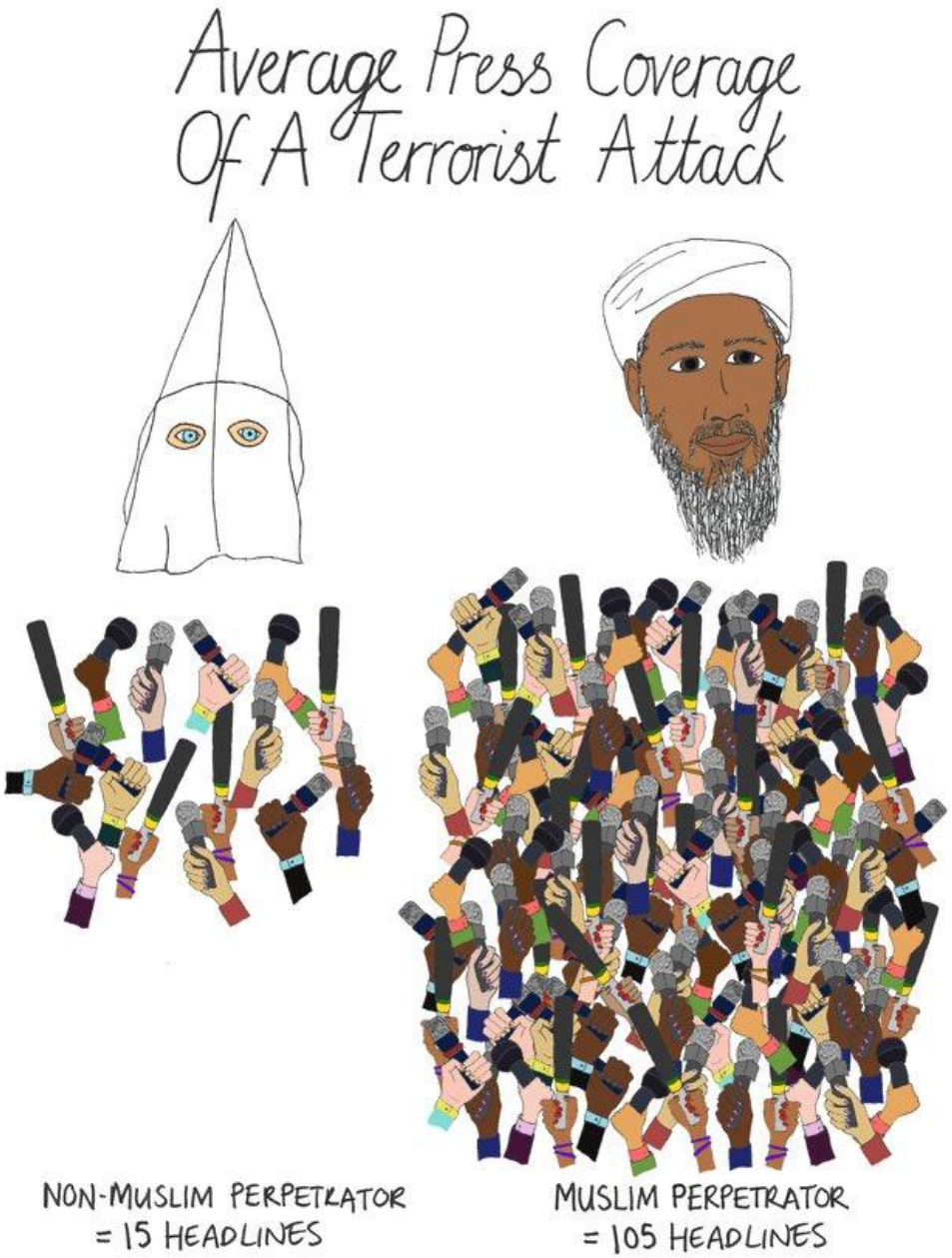
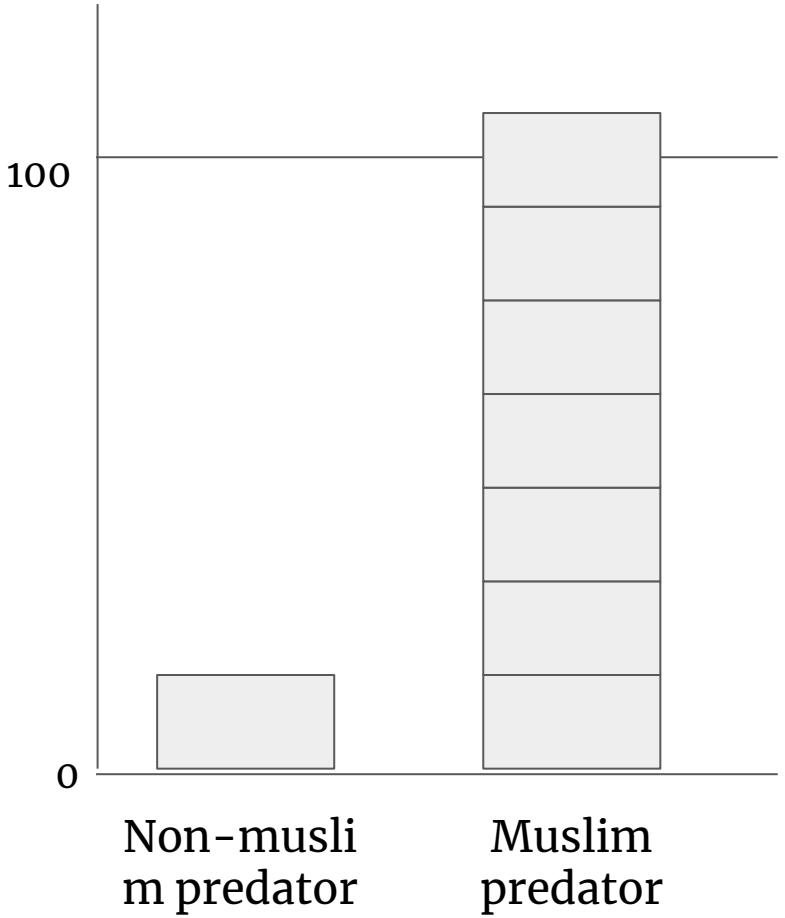
Embellishment







https://www.theguardian.com/us-news/2018/jul/20/muslim-terror-attacks-press-coverage-study

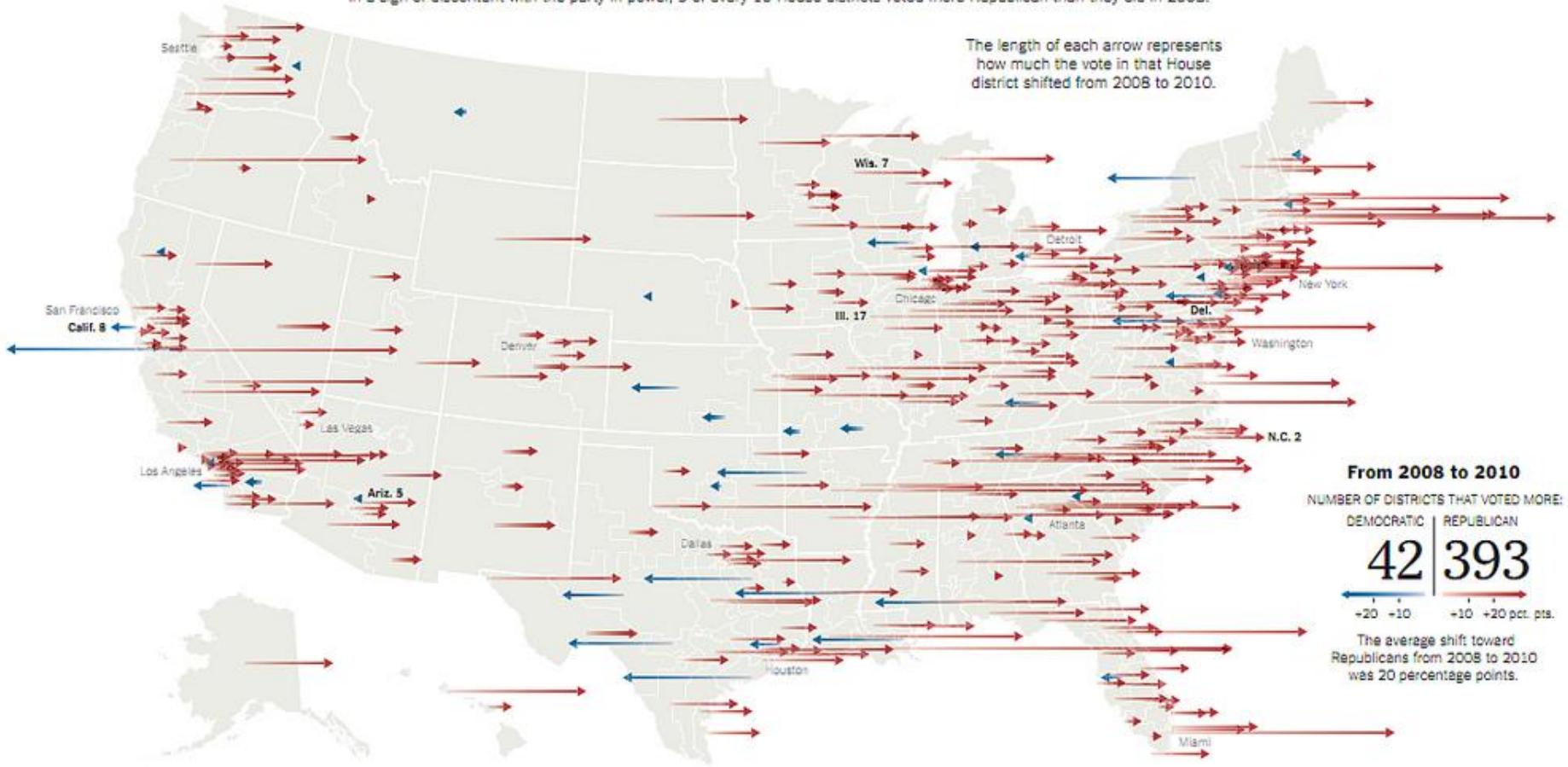
After the Vote

THURSDAY, NOVEMBER 4, 2010

The New York Times

Districts Across the Country Shift to the Right

In a sign of discontent with the party in power, 9 of every 10 House districts voted more Republican than they did in 2008.



While Republicans increased their share of the vote in **California 8**, Nancy Pelosi's lead still increased in the absence of a strong third-party candidate.

Arizona 5 shifted right about 20 points — enough to switch the seat to Republicans. David Schweikert defeated the Democrat he lost to in 2008.

The shift in **Wisconsin 7** was about average for an open race. Here, Sean P. Duffy, a Republican district attorney, won by 8 percentage points.

One of the largest shifts was in **Illinois 17**, where Republican Bobby Schilling, a pizza business owner, beat Phil Hare, a two-term Democratic incumbent.

Only a few districts voted more Democratic. In **Delaware**, the shift helped John Carney defeat Glen Urquhart for the seat held by Michael N. Castle since 1993.

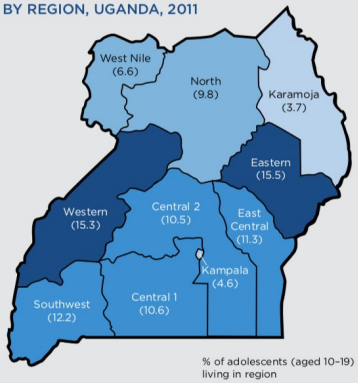
Renee Ellmers delivered one of the Republican Party's narrowest gains in **North Carolina 2**, a district that Democrats won by 36 percentage points in 2008.

Text +picture

physical, social, political, and economic structures of a region can place residents at varying risks for vulnerability. Areas susceptible to violence or natural disaster pose clear threats to individuals. An individual's environment also affects his or her development and behavioral choices. Resources available in the physical and social environments create the contexts within which decisions are made about health, education, and employment. Political and social environments also dictate whether resources are accessible to all adolescents. An examination of the residential distribution of adolescents provides a baseline for comparing geographical patterns of vulnerability. Within Uganda, by type of residence, the majority of adolescents (87 percent) live in rural versus urban areas. Figure 6 shows the distribution of adolescents aged 10 to 19 living in Uganda. Regional distributions show Karamoja contains only four percent of the adolescent population. Kampala with a much denser population contains 4.6 percent of the population. The Eastern and Western regions contain the largest proportions of the adolescent population.

FIGURE 6

PROPORTION OF ADOLESCENTS AGED 10-19 BY REGION, UGANDA, 2011



Source: DHS 2011.

Household factors influencing vulnerability

Household-level factors have direct impacts on the well-being of adolescents. Households are the primary setting where adolescents live and engage in activities. For this reason, the household environment and the people who live there have significant impacts on the lives of adolescents. Physical conditions of the home influence the health of residents. Family structures and demographic characteristics of household members affect the knowledge, decisions, behaviors and interactions in the environment of the adolescent.

Access to improved water sources and sanitation

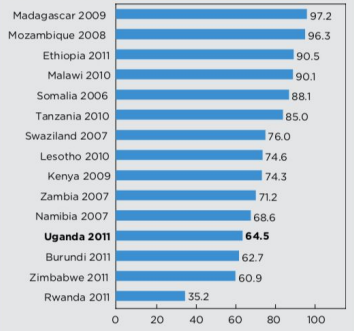
Unsafe water, inadequate sanitation, and poor hygiene are among the five leading risk factors responsible for one quarter of all deaths in the world (WHO 2009). Unsafe water supplies and inadequate sanitation in homes increase exposure to water-borne diseases and can cause diarrhea. Ensuring access to clean water sources and sanitation is key to maintaining hygiene and health. Improved water sources are those that either naturally protect water from contamination or are constructed to do so. These include piped water, public taps, standpipes, boreholes, tube wells, protected wells and springs, and rainwater collection. Improved sanitation includes constructs and systems that prevent fecal contamination. These include flush or pour toilets, ventilated pit latrines, pit latrines with slabs, and composting toilets (UNICEF 2013b).

Housing conditions across East and Southern Africa are largely in need of improvement, and lack of improved sanitation varies by country. In nearly all of East and Southern Africa, over half of adolescents either do not have improved sanitation or share facilities with other households. Conditions are worst in Madagascar and Mozambique where fewer than four percent of adolescents live in households with improved sanitation that is not shared (Figure 7). Rwanda has the lowest proportion of adolescents affected—35 percent—which is still unacceptably high. Lack of access to improved water sources affects lower proportions but is still a problem in the region. In five countries, fewer than half of adolescents have access to improved water sources (Figure 8). Water conditions are best in Namibia, where only 15 percent of adolescents have no access to improved water.

In Uganda, overall access to improved water and sanitation increased by a small but significant percentage between 2006 and 2011 (Figure 9). In 2006, 33 percent of adolescents had no access to improved water; in 2011, it is 30 percent. The proportion of adolescents without access to improved

FIGURE 7

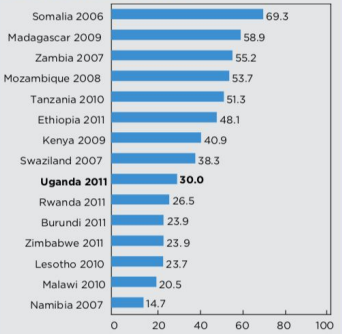
PERCENT OF ADOLESCENTS AGED 10-19 LIVING IN HOUSEHOLDS WITH NO IMPROVED OR WITH SHARED SANITATION, EAST AND SOUTHERN AFRICA



Source: DHS 2007-2011; MICS 2006-2008.

FIGURE 8

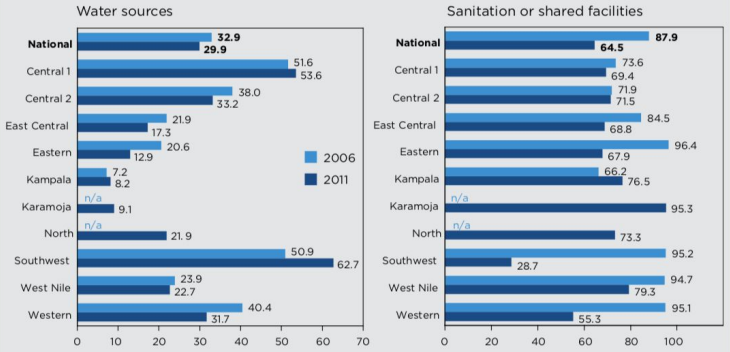
PERCENT OF ADOLESCENTS AGED 10-19 LIVING IN HOUSEHOLDS WITH NO IMPROVED WATER SOURCE, EAST AND SOUTHERN AFRICA



Source: DHS 2007-2011; MICS 2006-2008.

FIGURE 9

PERCENT OF ADOLESCENTS AGED 10-19 LIVING IN HOUSEHOLDS WITHOUT ACCESS TO IMPROVED WATER AND WITHOUT ACCESS TO IMPROVED OR WITH SHARED SANITATION, IN UGANDA, BY REGION, 2006 AND 2011



Source: DHS 2006 and 2011.
Note: Changes to the geographic boundaries were made to the North region in the 2011 DHS. The 2006 DHS North region is now divided into the North and Karamoja. For this reason, rates for 2006 are not shown for the North since it is not comparable and Karamoja was not identified in the previous survey.

Visualization for:

Exploration	Explanation
Data centered	Human centered
Lab context	In the wild
Insights	Messages
Expertise	*Novices**

Outline

- What is storytelling?
- When is storytelling necessary?
- How to create stories?
- Which story-formats exist?

Storytelling

- Putting things in context
- Communication
- Order (of events)
- Memory
- Audience, author, storytelling,
- Story-telling
- Media

Data-driven Storytelling

- Provide **context**
  - Persons, collection, importance, questions, ...
- Explain **processes**
  - Transformation, selection, aggregation, ...
- Explain **insights**
  - Trends, outliers, groups, comparisons, ...
- Explain **visualizations**
- Talk to an **audience**
- **Conclude**
  - Take home message
- Chose **media**

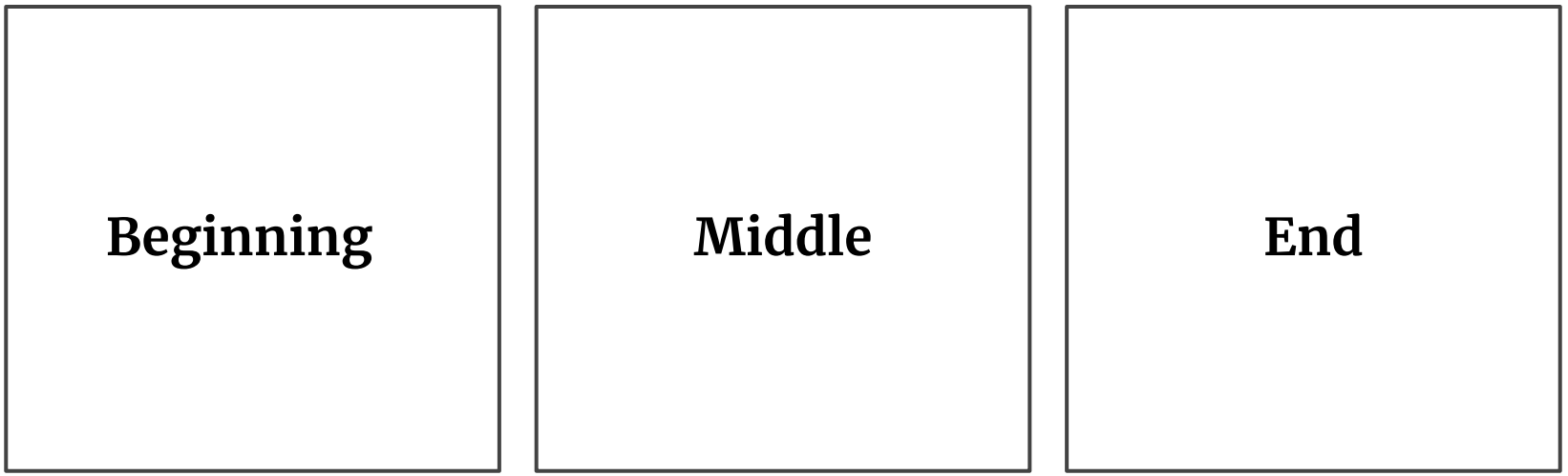
Story Structure

Story vs. Narrative

Story: All of the events in a narrative, those presented directly to an audience and those which might be inferred

Narrative: The 'telling' of a sequence of events which shape the events, characters, arrangement of time, etc. in very particular ways so as to invite particular positions towards the story on the part of the audience."

Structure

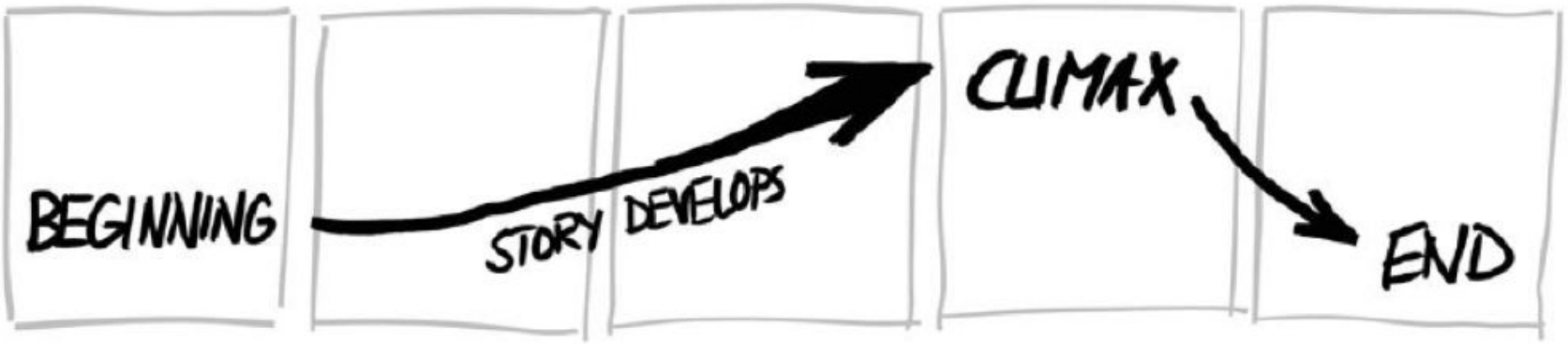


Introduction
Context
Problems
…

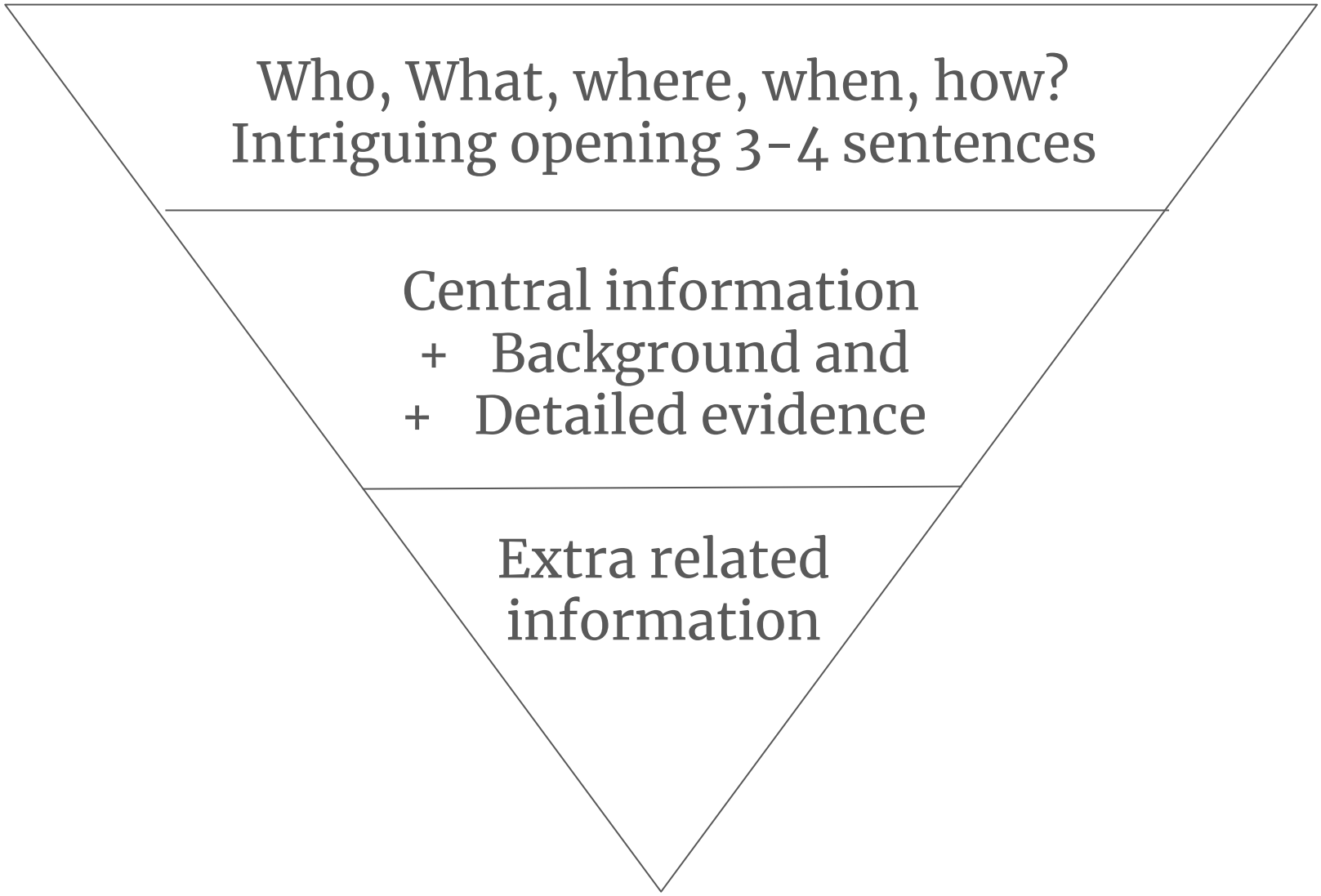
Events, facts,
Relations, surprise
insights
…

Conclusion,
Resolution,
Take-home
Call-to-action,
…

Story structure: Drama



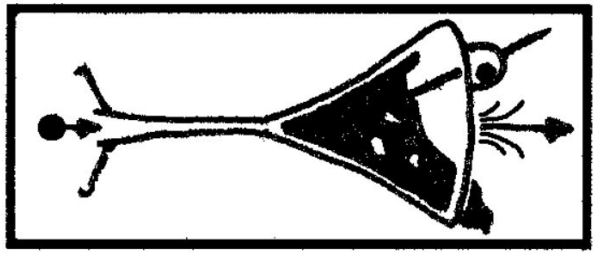
Story structure: Journalism



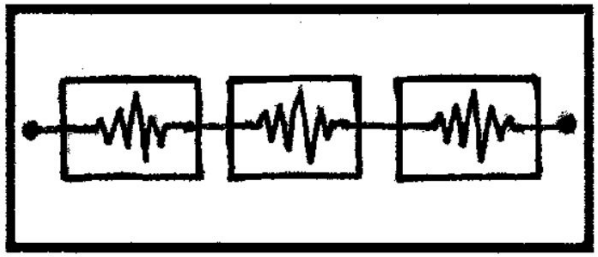
(Interactive) Narrative Structures

Author driven	⟷	**Reader driven**
Linear ordering		No ordering
Heavy messaging		No messaging
No interactivity		Free interactivity

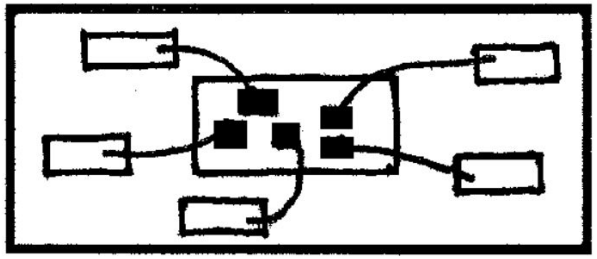
Narrative Structures



Martini-glass Structure
Guidance first, then exploration

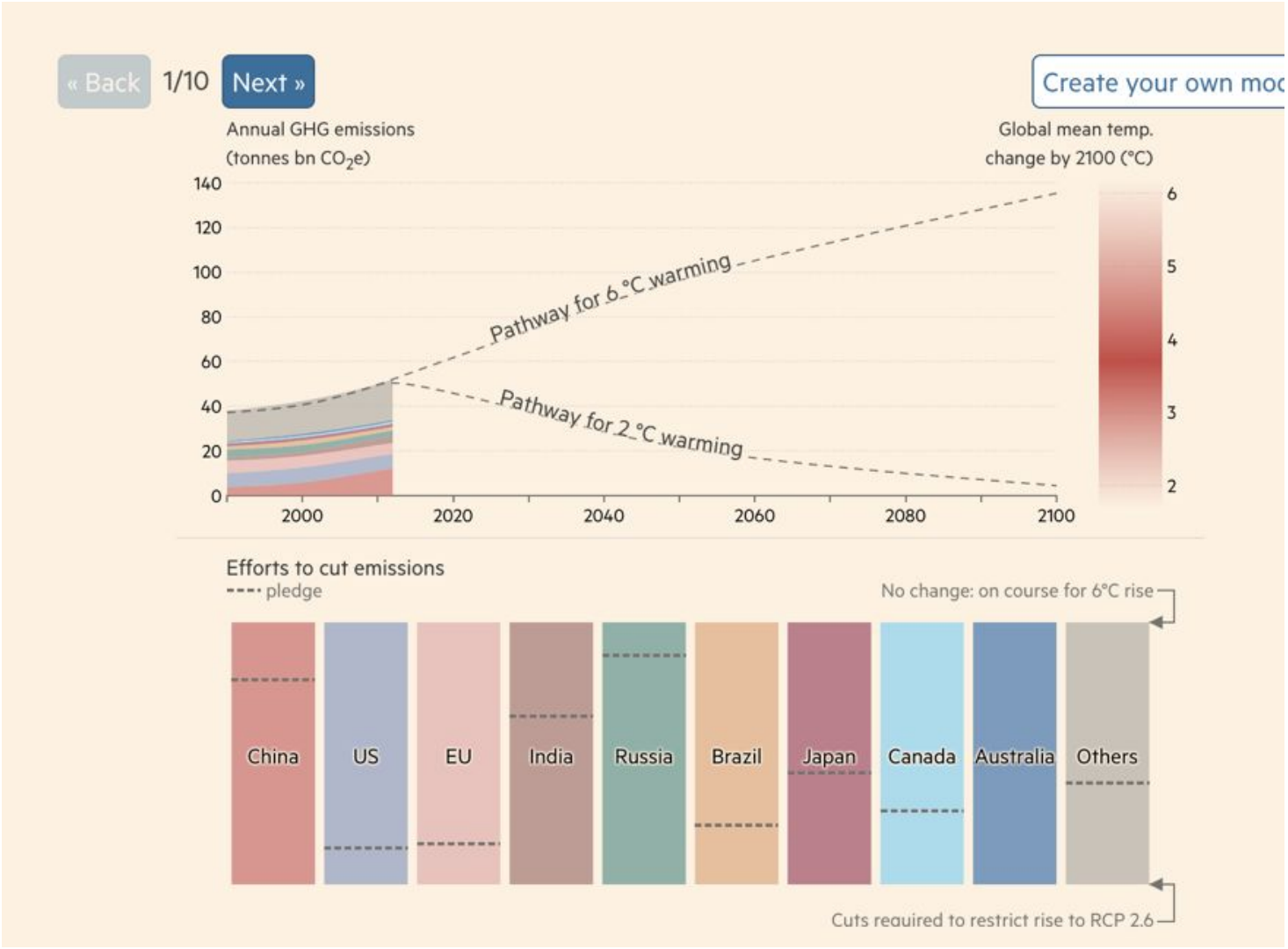


Interactive slideshow
Overall structure
+ local exploration



Drill-down story
Largely reader driven

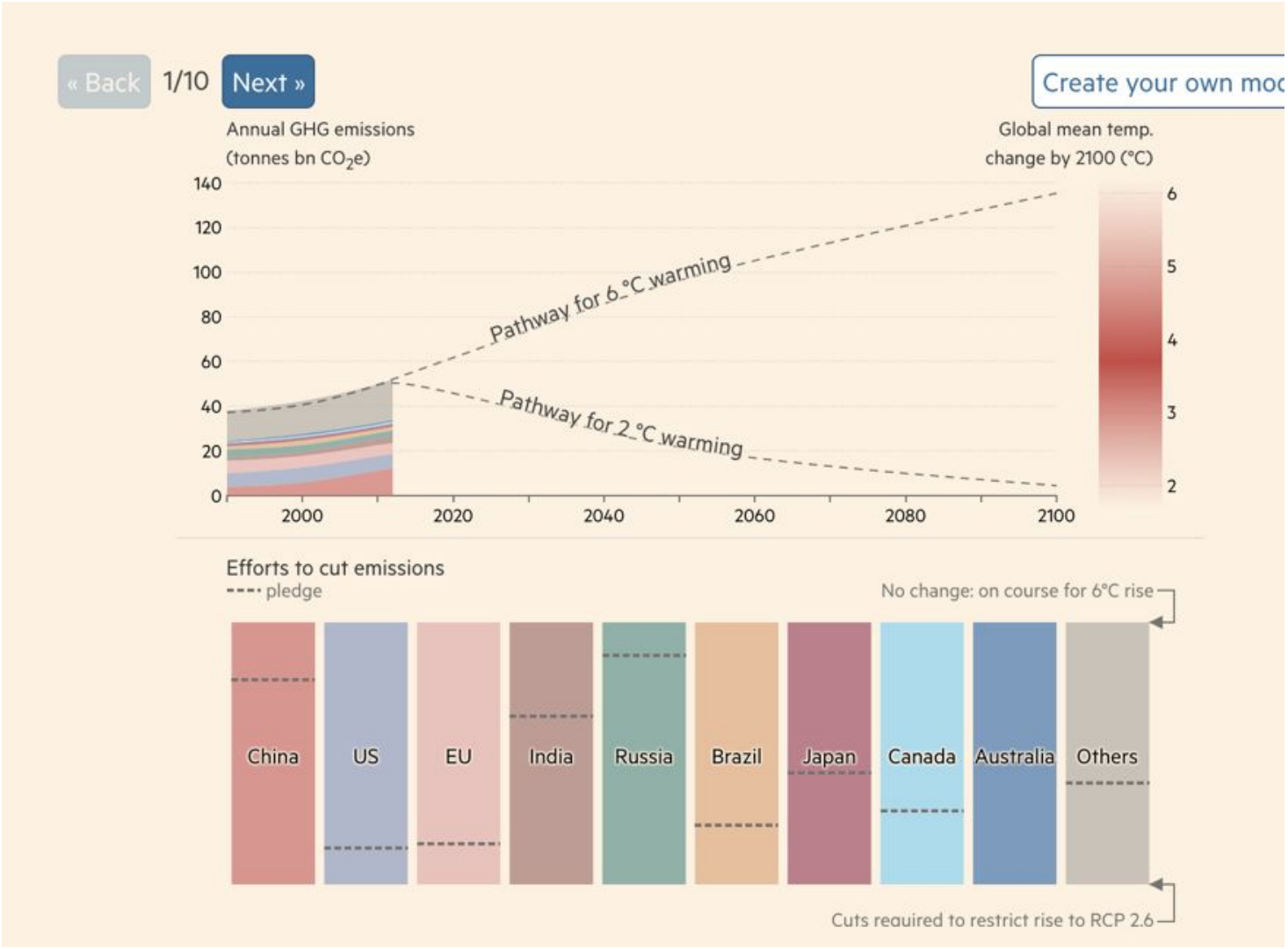
Interactive Slide show



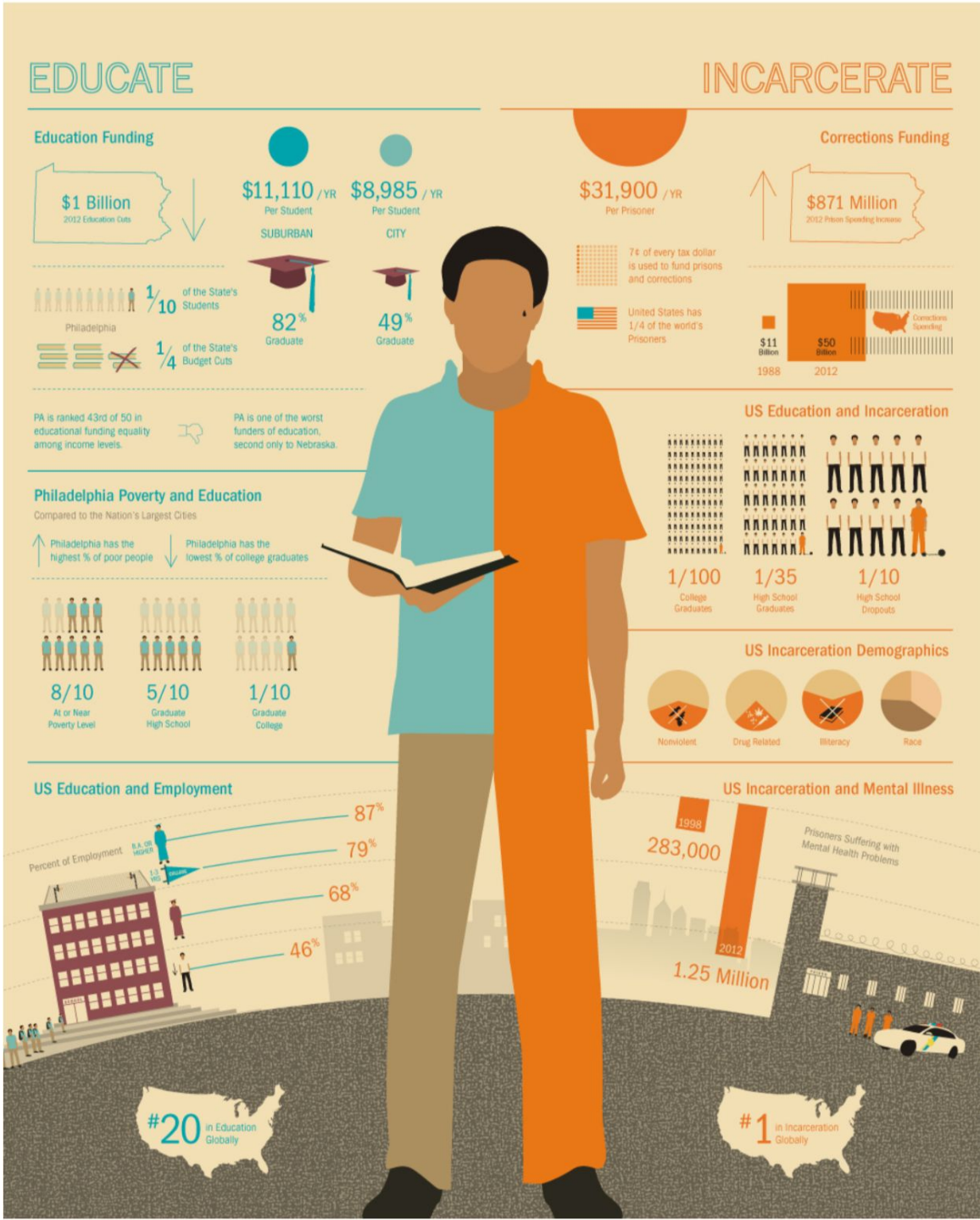
https://ig.ft.com/sites/climate-change-calculator/

Martini-glass Structure

https://ig.ft.com/sites/climate-change-calculator/

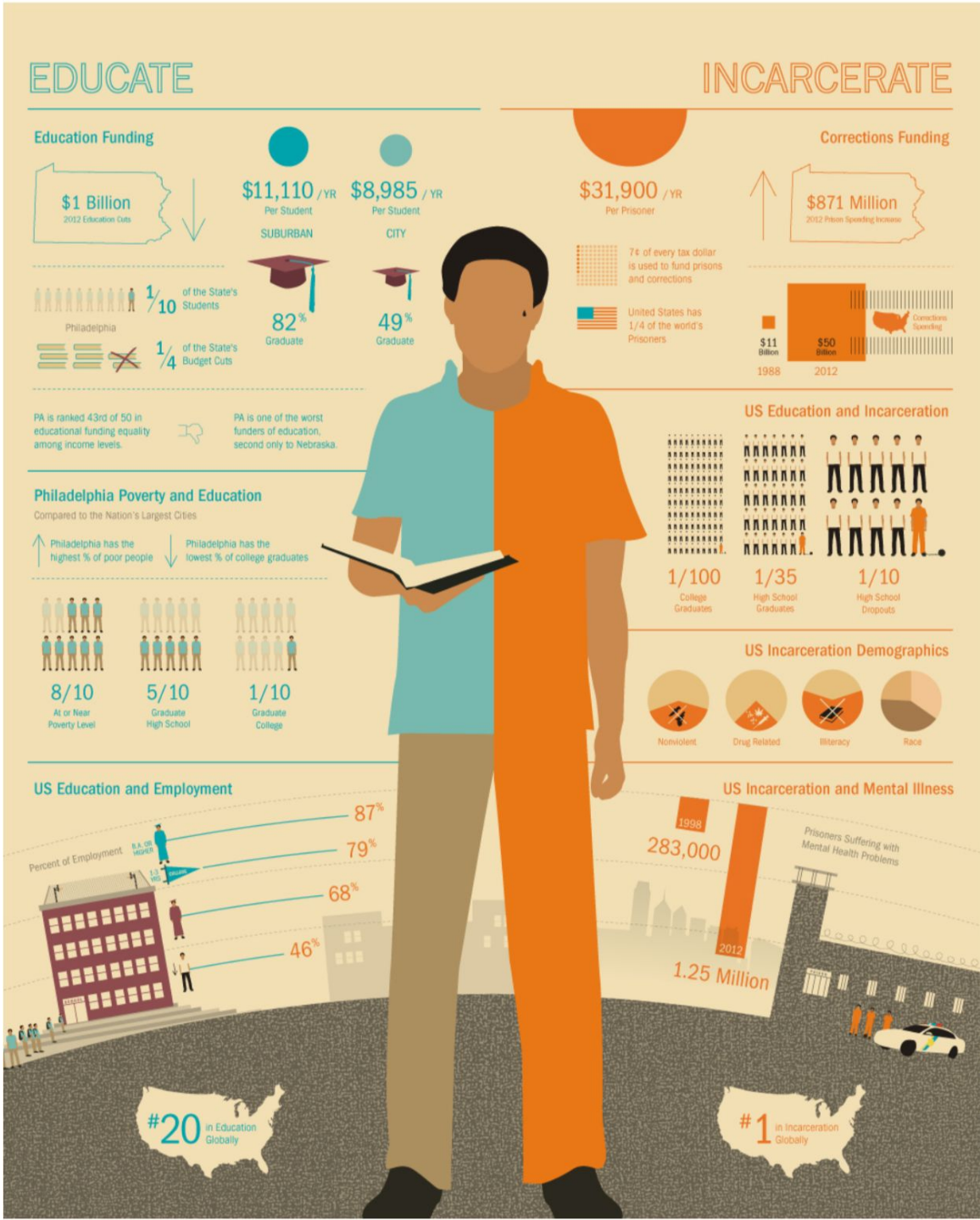


Drill-down story



Narrative Design Patterns

Contrast

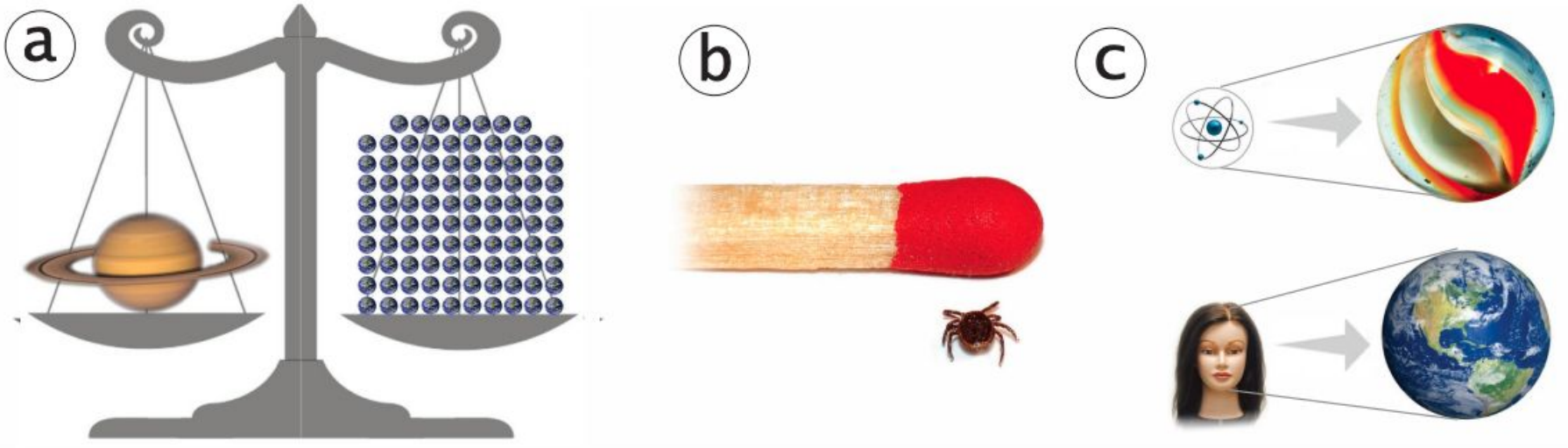

EDUCATE
INCARCERATE
Education Funding
$1 Billion
2012 Education Cuts
$11,110 / YR
Per Student
SUBURBAN
$8,985 / YR
Per Student
CITY
1/10 of the State's Students
Philadelphia
1/4 of the State's Budget Cuts
82% Graduate
49% Graduate
PA is ranked 43rd of 50 in educational funding equality among income levels.
PA is one of the worst funders of education, second only to Nebraska.
Philadelphia Poverty and Education
Compared to the Nation's Largest Cities
Philadelphia has the highest % of poor people
Philadelphia has the lowest % of college graduates
8/10 At or Near Poverty Level
5/10 Graduate High School
1/10 Graduate College
US Education and Employment
Percent of Employment
87%
79%
68%
46%
#20 in Education Globally
Corrections Funding
$31,900 / YR
Per Prisoner
$871 Million
2012 Prison Spending Increase
7¢ of every tax dollar is used to fund prisons and corrections
United States has 1/4 of the world's Prisoners
$11 Billion
1988
$50 Billion
2012
Corrections Spending
US Education and Incarceration
1/100 College Graduates
1/35 High School Graduates
1/10 High School Dropouts
US Incarceration Demographics
Nonviolent
Drug Related
Illiteracy
Race
US Incarceration and Mental Illness
1998
283,000
2012
1.25 Million
Prisoners Suffering with Mental Health Problems
#1 in Incarceration Globally

Concretize (ISOTYPE)

Scales

https://www.youtube.com/watch?v=XqUwr-Nkq9g

Scales



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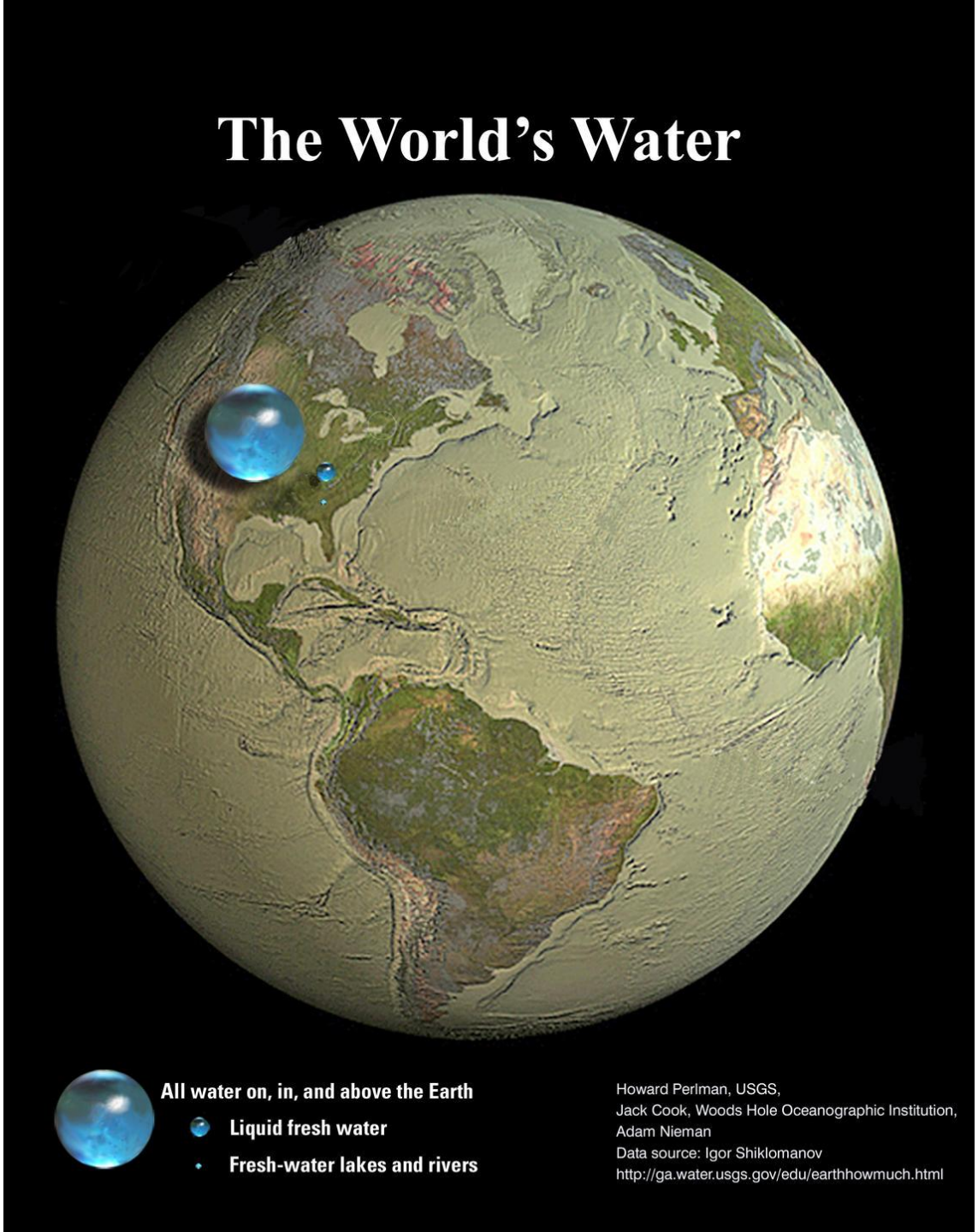
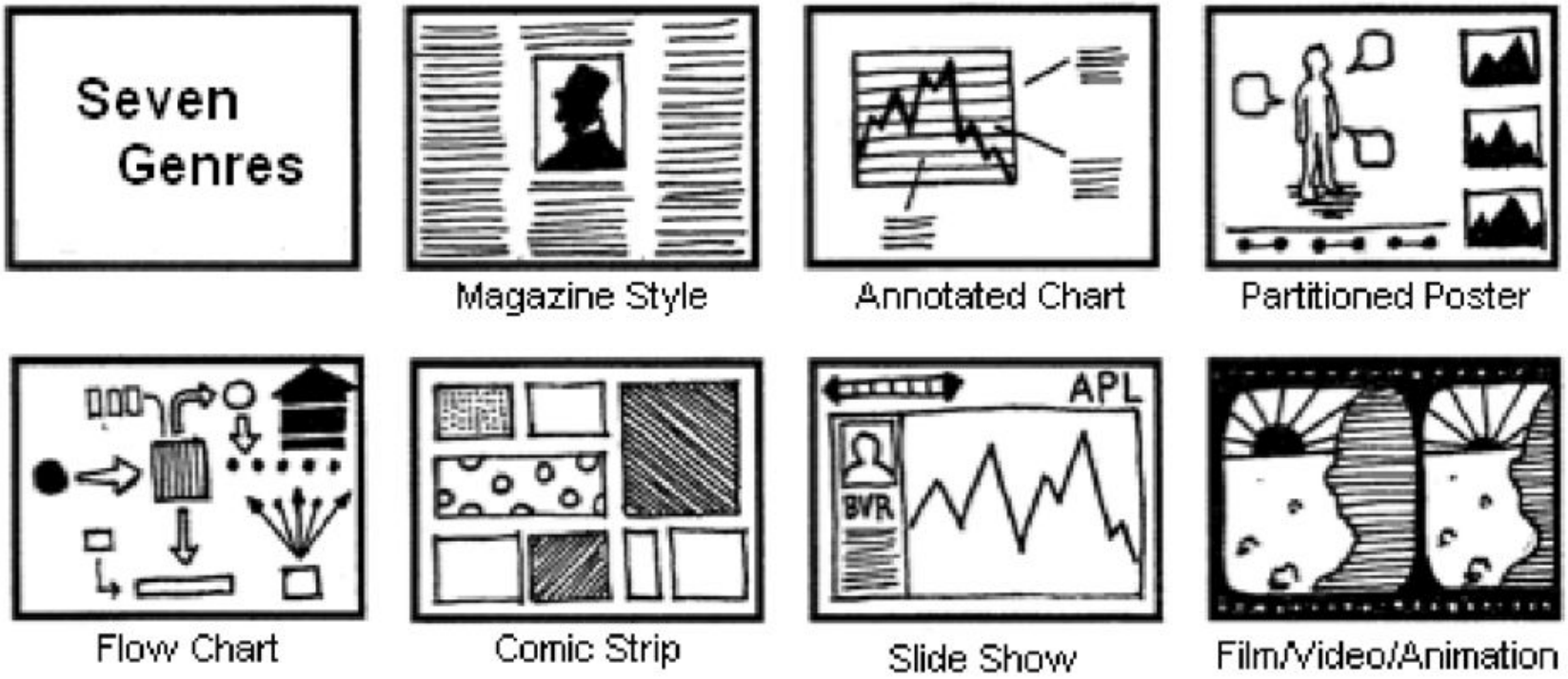

The World's Water
All water on, in, and above the Earth
Liquid fresh water
Fresh-water lakes and rivers
Howard Perlman, USGS,
Jack Cook, Woods Hole Oceanographic Institution,
Adam Nieman
Data source: Igor Shiklomanov
http://ga.water.usgs.gov/edu/earthhowmuch.html

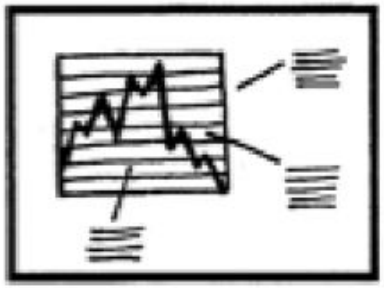
Storytelling Genres



Segel, E., & Heer, J. (2010). Narrative visualization: Telling stories with data. *IEEE transactions on visualization and computer graphics*, *16*(6), 1139-1148.

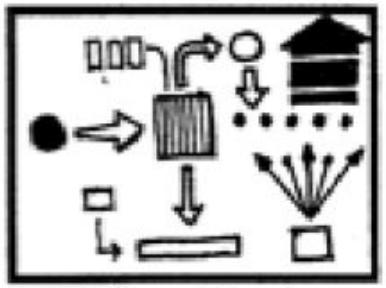
Seven Genres

Magazine Style

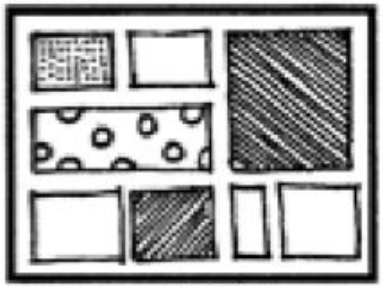


Annotated Chart

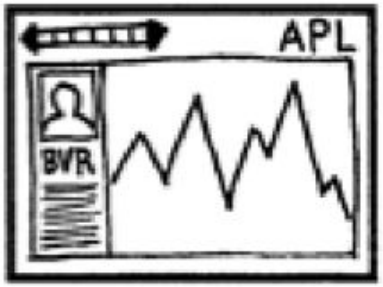
Partitioned Poster



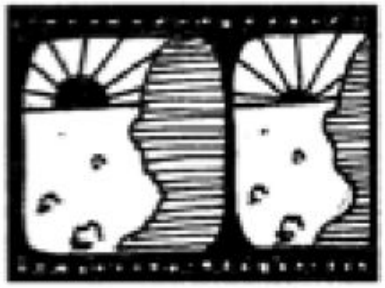
Flow Chart



Comic Strip



Slide Show



Film/Video/Animation

Magazine Style

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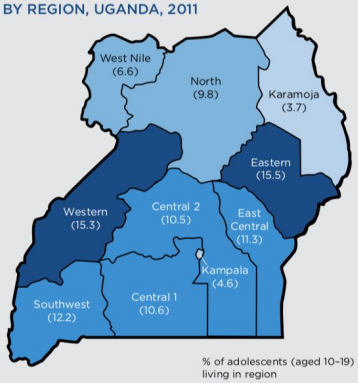

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Access to improved water sources and sanitation

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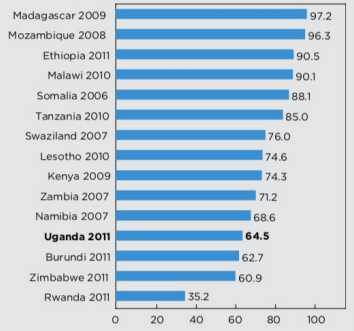

Source: DHS 2007-2011; MICS 2006-2008.

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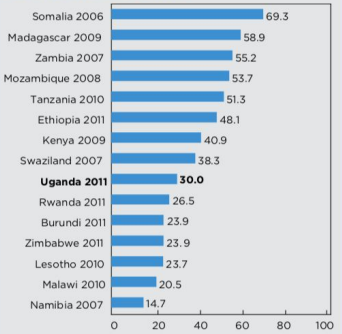

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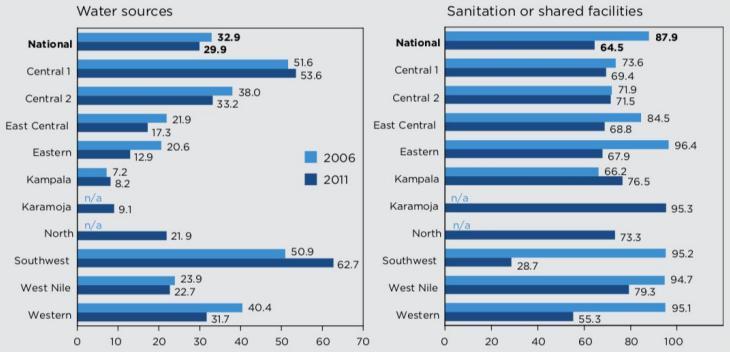

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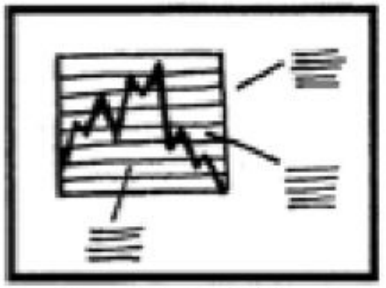


Add word or phrase +

← Words favored by Democrats

Number of mentions per 25,000 spoken words by Democrats and Republicans

Words favored by Republicans →

Obama 175 - 66
Families 66 - 54
Jobs 88 - 80
Health 38 - 9
Forward 33 - 6
Choice 22 - 15
Tax 39 - 32
Hope 17 - 19
American dream 17 - 20
Small business 14 - 27
Success 20 - 44
Better 21 - 44
Freedom 8 - 21
Government 13 - 66
Workers 19 - 4
Education 33 - 10
Seniors 11 - 3
Military 12 - 5
Energy 20 - 13
Science 2 - 1
Fight 39 - 11
Vote 29 - 11
Invest 22 - 7
Middle class 47 - 7
Auto 18 - 1
Medicare 26 - 7
Women 69 - 26
Economy 53 - 41
War 19 - 9
Biden 11 - 6
Immigration 10 - 10
Oil / Gas 11 - 10
Ryan 25 - 31
God 22 - 35
Leadership 32 - 53
Romney 92 - 109
Debt 13 - 21
Business 35 - 86
Faith 6 - 11
Obamacare 4 - 11
Fail 7 - 17
Spending 7 - 16
Flag 1 - 4
Church 1 - 9
Regulation 2 - 14
Unemployment 1 - 17
Job creators 1 - 5
Red tape 0 - 3
Veteran 16 - 2
Wall Street 5 - 1
Bin Laden 5 - 0
Fair 13 - 1
Medicaid 2 - 0
Arithmetic 3 - 0
Equal pay 6 - 0
Level playing field 2 - 0
Millionaire 7 - 0
Marry 6 - 8

AUTO Democrats credited President Obama with the recovery of the auto industry after the 2009 bailout, while Republicans left the topic unmentioned.

WOMEN Democrats used the word much more frequently, primarily in reference to women's health and equal pay.

BUSINESS Republicans were more likely to talk about businesses, emphasizing Mr. Romney's private-sector experience and plans to improve the economy.

UNEMPLOYMENT Many Republican speakers brought up the still-high unemployment rate and the number of Americans who remain jobless, while Democrats largely avoided the topic.

Partitioned Poster (Infographic)

Partitioned Poster

https://www.visualcinnamon.com/portfolio/baby-spike

GRAPHIC SCIENCE

The Baby Spike

Births peak on weekdays during daytime work hours

Two generations ago babies were born pretty much spontaneously, around the clock. But today in the U.S., about half of all births are cesarean sections prescheduled by Mom or deliveries induced by doctors concerned about the mother's or baby's health. These medical procedures have skewed the days of the week, and hours of the day, during which those little bundles of joy arrive.

The procedures dominate because more than 98 percent of infants are born in a hospital, despite what seems to be the rising popularity of home births. Far more babies now arrive on weekdays than on weekends, most between 8 A.M. and 6 P.M. "We can't schedule spontaneous labor, obviously," says Neel Shah, a physician and professor at Harvard Medical School. "But we can schedule delivery."

—Mark Fischetti and Zan Armstrong

Babies Born by Minute

The Average 7.3 babies born per minute

Eat First
More births of all types occur right after lunch

Day Shift
Births peak around 8 A.M., then rise again between noon and 1 P.M. Hospitals typically have more doctors and nurses on hand during the morning and fewer later in the day.

Boom
The morning peak is driven by planned C-sections

Babies Born by Hour

The Average 447 babies born per hour

Fewest Births
Sunday night between 2 and 3 A.M.

Early Riser
More babies than average are born on weekdays during daylight hours. Fewer are born on weekends or at night, primarily because fewer hospital staffers are on duty, so women tend not to schedule their delivery then. Despite folklore, a full moon has no effect.

Midday Special
On a typical Tuesday, 770 babies are born from noon to 1 P.M.

Babies Born by Week

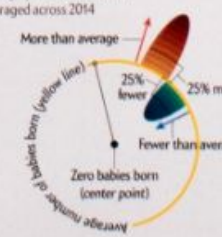
The Average 77,000 babies born per week

No, Thanks
Moms do not schedule C-sections around Thanksgiving

Happy Holidays
Babies seem to arrive nine months after Christmas and New Year's Eve

Summer Son
Evidently, more people have sex during colder months, leading to more births nine months later from July through October, and less sex during warmer months.

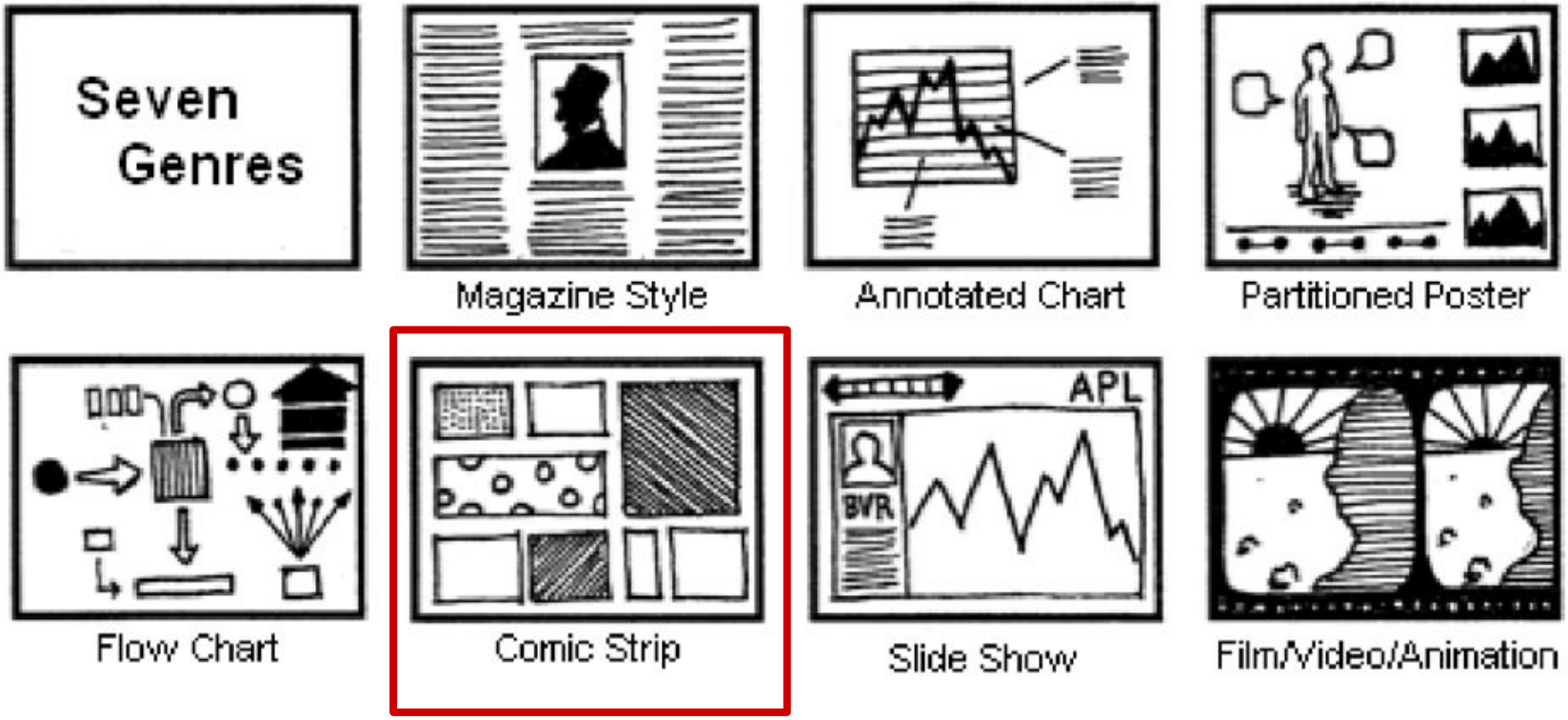
Each graph shows U.S. data averaged across 2014



SOURCES: FIVETHIRTYEIGHT, FROM DATA SUPPLIED BY U.S. SOCIAL SECURITY ADMINISTRATION [and] CENTERS FOR DISEASE CONTROL AND PREVENTION [annual and hour data]

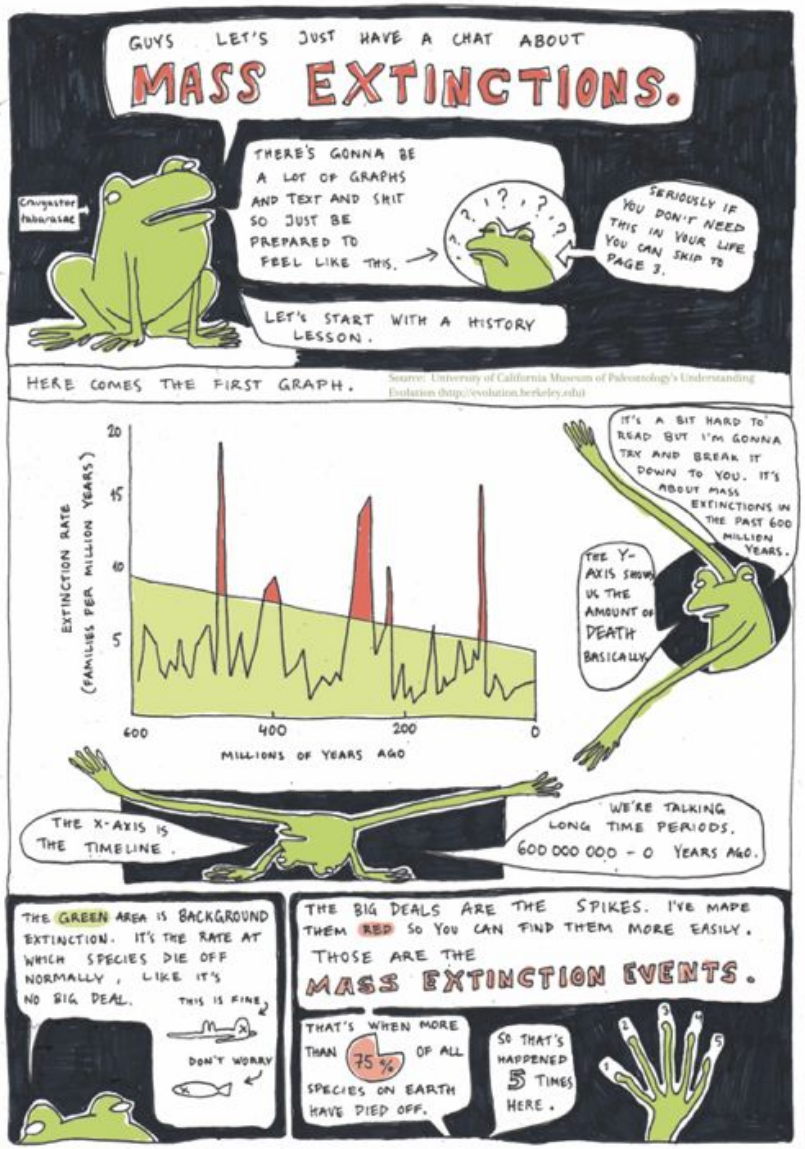
Graphic by Nadieh Bremer and Zan Armstrong

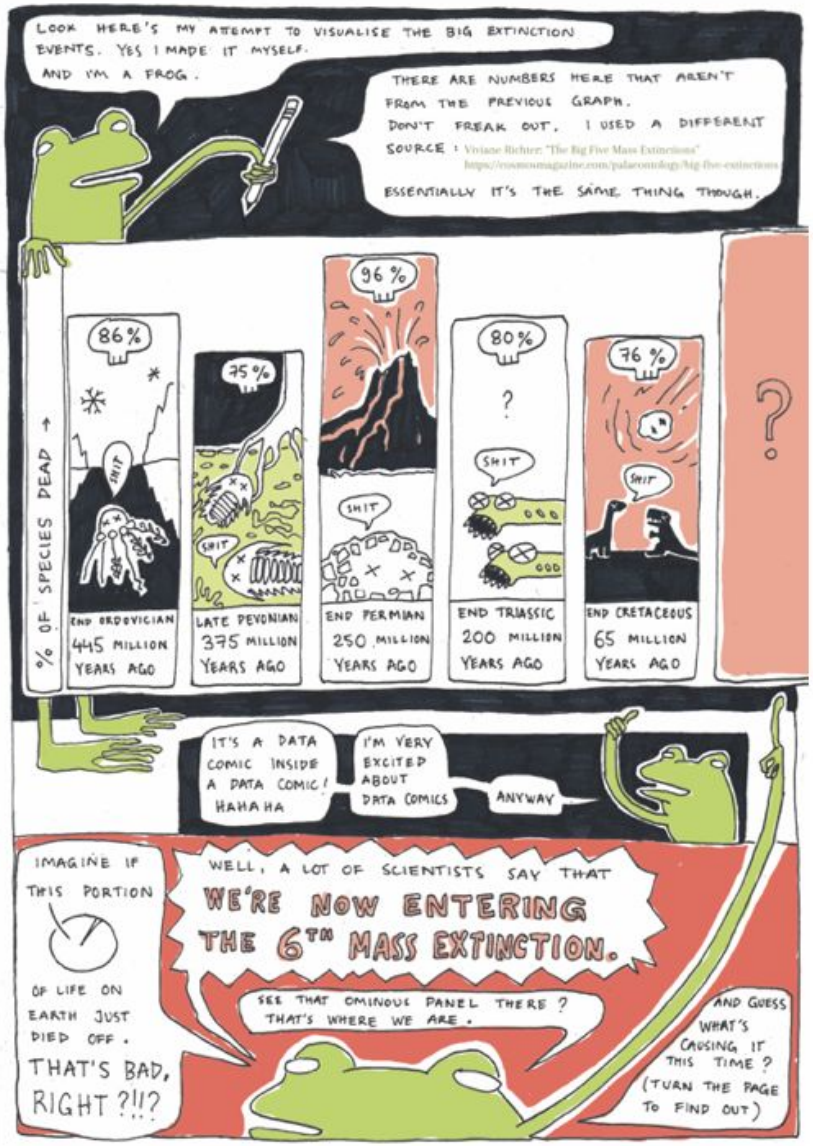
Data Comics

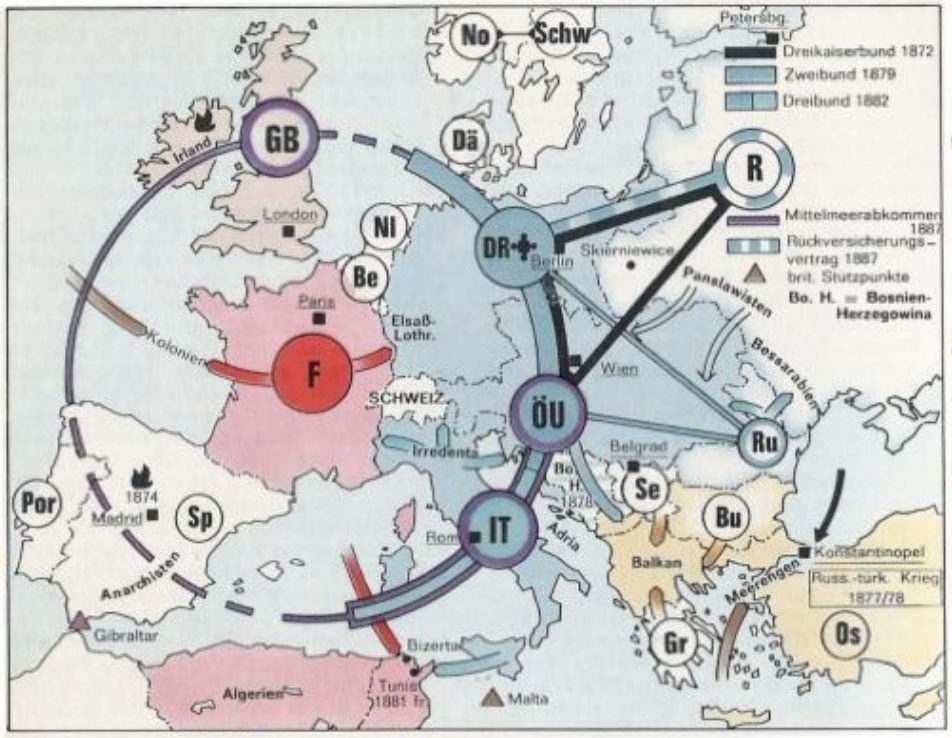


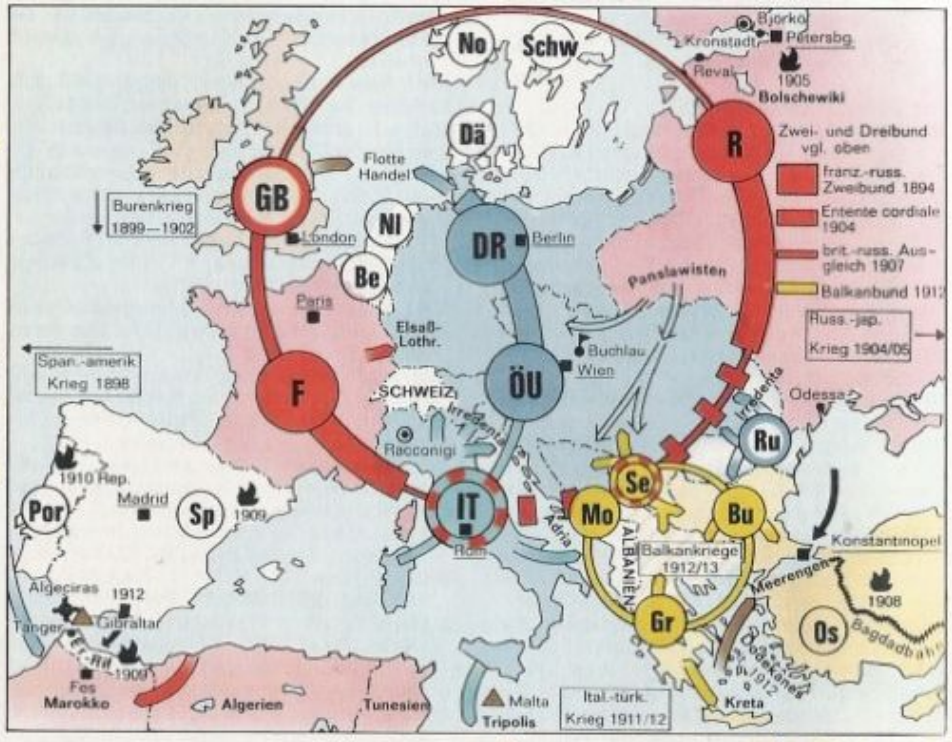
Bach, Benjamin, Nathalie Henry Riche, Sheelagh Carpendale, and Hanspeter Pfister. "The emerging genre of data comics." *IEEE computer graphics and applications* 37, no. 3 (2017): 6-13.

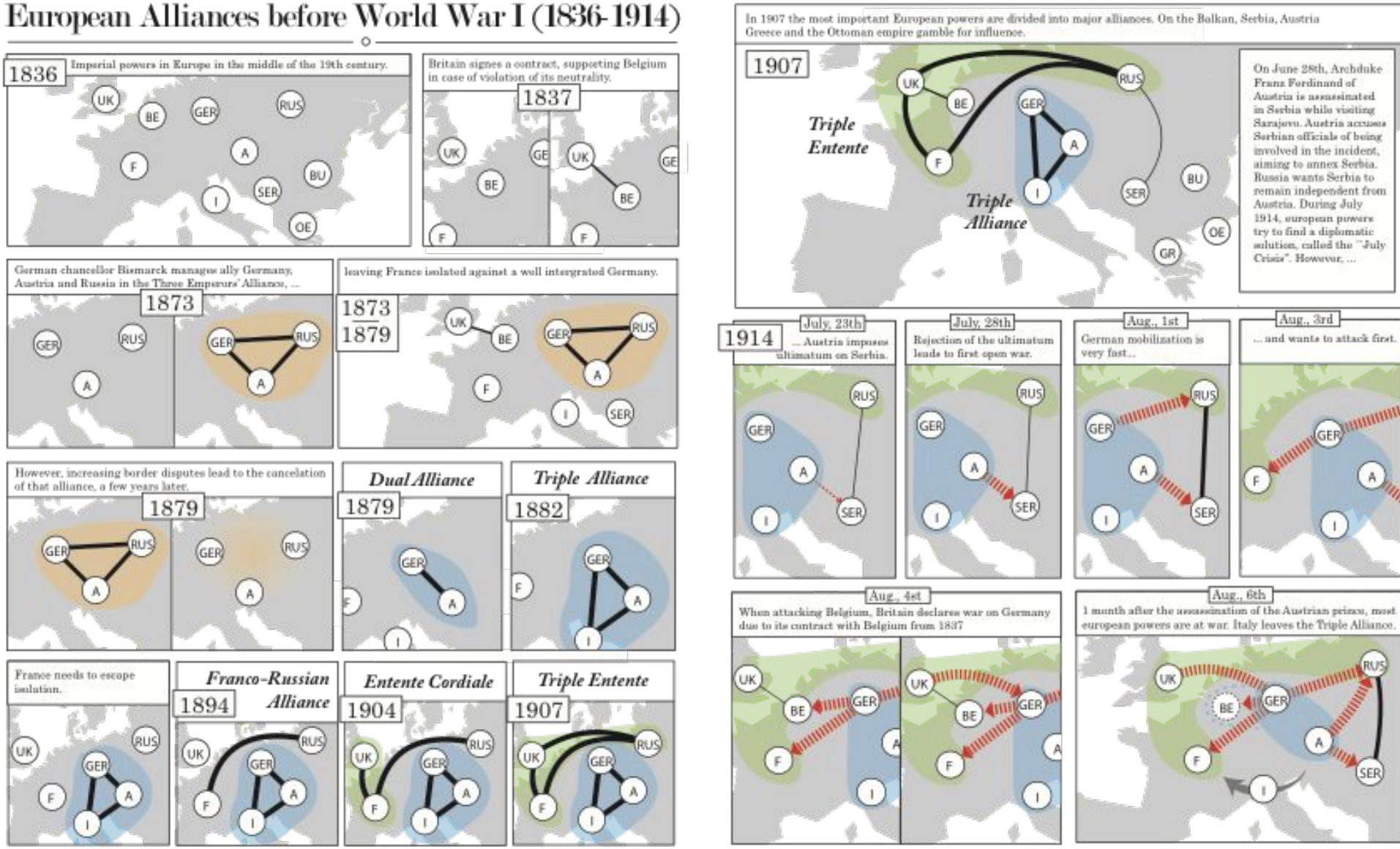
Data Comics (http://datacomics.net)






No
Schw
Petersbg
Dreikaiserbund 1872
Zweibund 1879
Dreibund 1882
GB
Irland
Dä
R
London
Nl
Be
DR
Berlin
Skierniewice
Mittelmeerabkommen 1887
Rückversicherungs-vertrag 1887
brit. Stützpunkte
Bo. H. = Bosnien-Herzegowina
Paris
Elsaß-Lothr.
Panslawisten
Kolonien
F
Wien
Bessarabien
SCHWEIZ
ÖU
Irredenta
Belgrad
Ru
Por
1874
Madrid
Sp
Se
Bu
IT
Rom
Adria
Konstantinopel
Anarchisten
Balkan
Meerengen
Russ.-turk. Krieg 1877/78
Gibraltar
Bizerta
Gr
Os
Algerien
Tunis
1881 fr.
Malta


No
Schw
Björko
Kronstadt
Petersbg.
Reval
1905
Bolschewiki
Dä
R
Zwei- und Dreibund vgl. oben
Flotte
Handel
GB
Burenkrieg 1899—1902
franz.-russ. Zweibund 1894
Entente cordiale 1904
London
Nl
DR
Berlin
brit.-russ. Ausgleich 1907
Balkanbund 1912
Be
Panslawisten
Paris
Russ.-jap. Krieg 1904/05
Elsaß-Lothr.
Buchlau
Wien
Span.-amerik. Krieg 1898
F
ÖU
SCHWEIZ
Irredenta
Odessa
Racconigi
Ru
1910 Rep.
Se
Por
Madrid
Sp
1909
IT
Mo
Bu
Adria
ALBANIEN
Balkankriege 1912/13
Rom
Konstantinopel
Algeciras
1912
Meerengen
1908
Gr
Os
Tanger
Gibraltar
Bagdadbahn
Fes
1909
Marokko
Algerien
Tunesien
Malta
Tripolis
Ital.-türk. Krieg 1911/12
Kreta

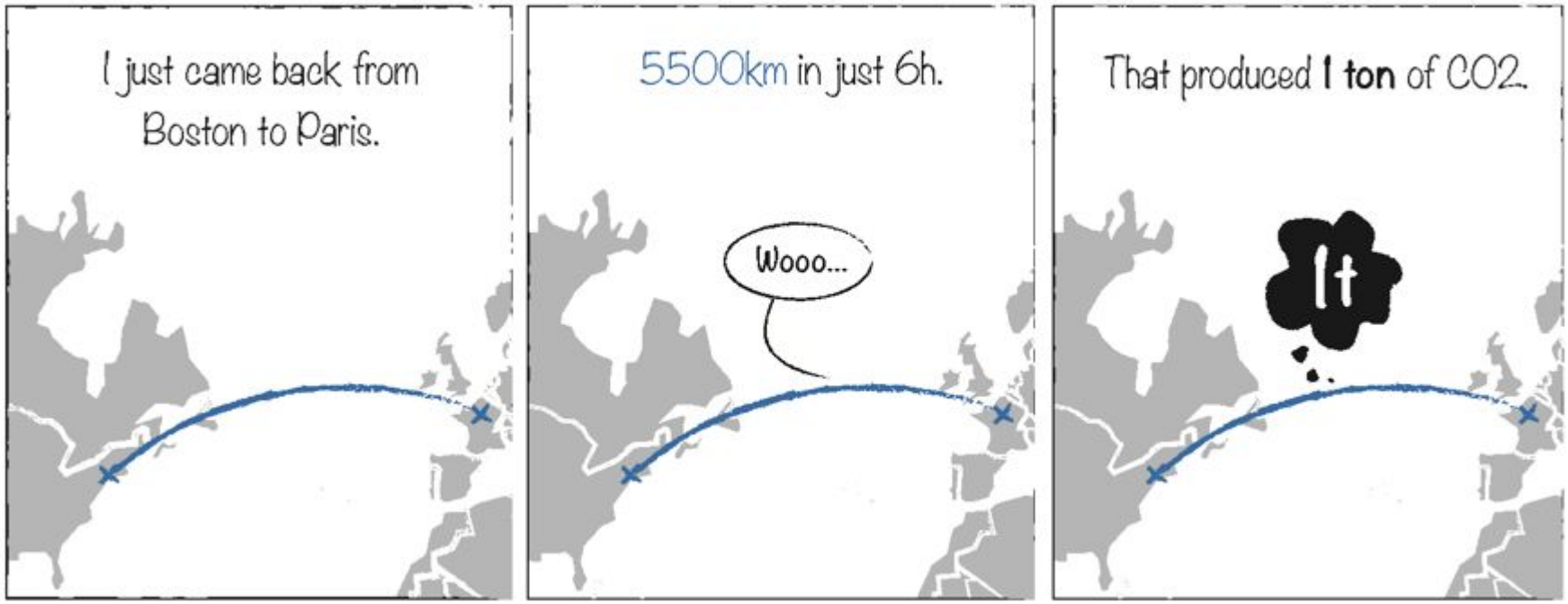


Bach, B., Kerracher, N., Hall, K. W., Carpendale, S., Kennedy, J., & Henry Riche, N. (2016, May). Telling stories about dynamic networks with graph comics. In *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems* (pp. 3670-3682). ACM.

Data Comics

Bach, Benjamin, Nathalie Henry Riche, Sheelagh Carpendale, and Hanspeter Pfister. "The emerging genre of data comics." *IEEE computer graphics and applications* 37, no. 3 (2017): 6-13.

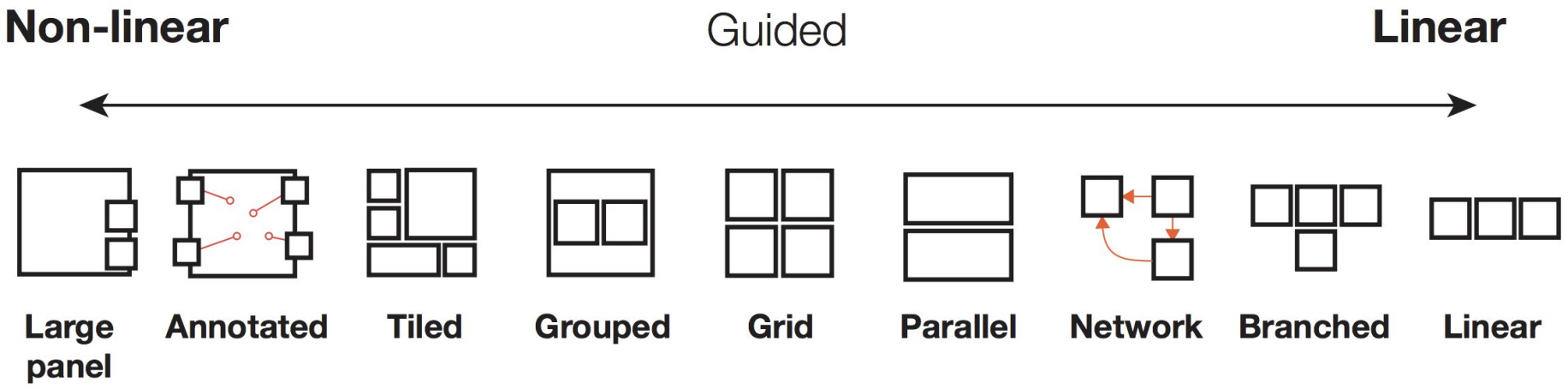
Data Comics


I just came back from Boston to Paris.
5500km in just 6h.
Wooo...
That produced 1 ton of CO2.
!!

Data Comics

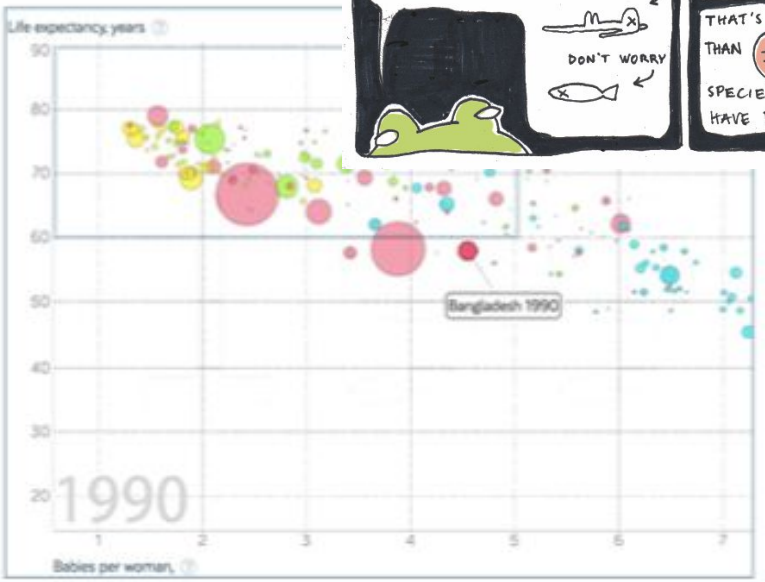
1. Familiarity
2. Easy access
3. Textual + graphical content
4. Open or closed sequence

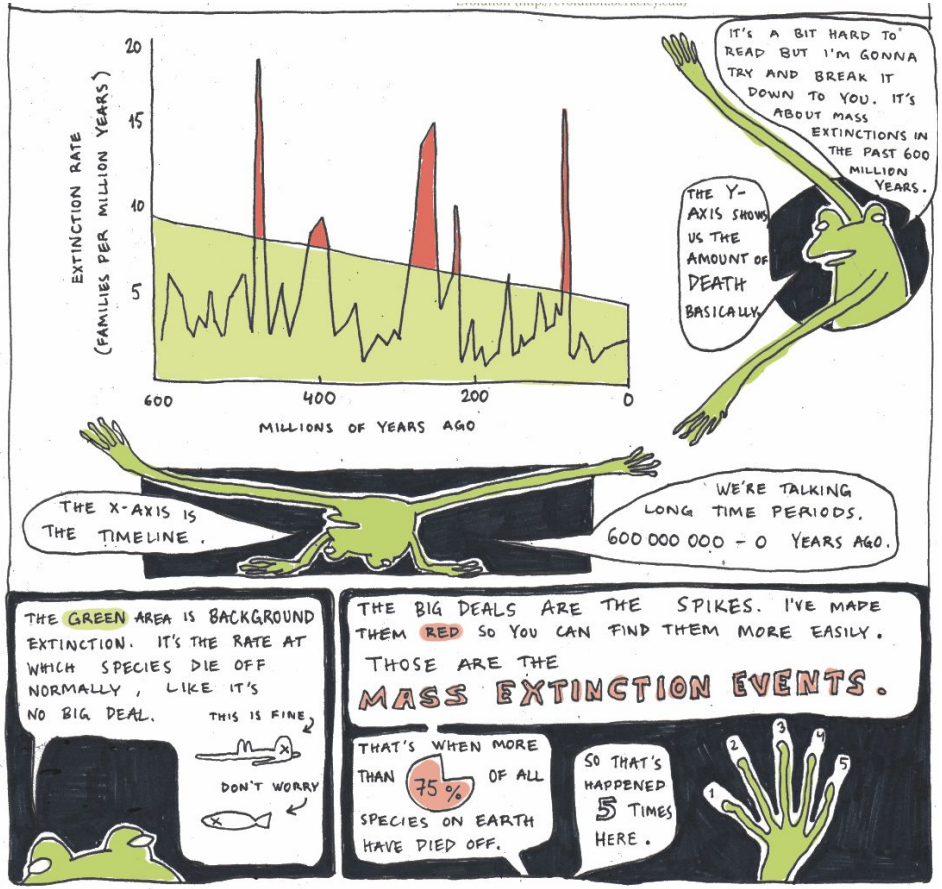
Sequence



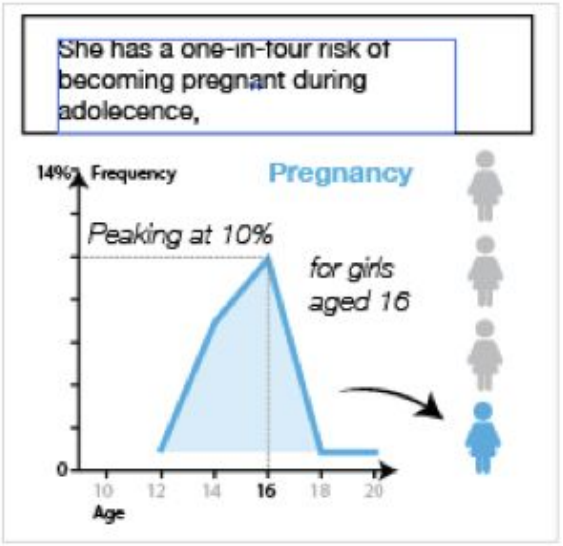
Bach, B., Wang, Z., Farinella, M., Murray-Rust, D., & Henry Riche, N. (2018, April). Design patterns for data comics. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems* (p. 38). ACM.

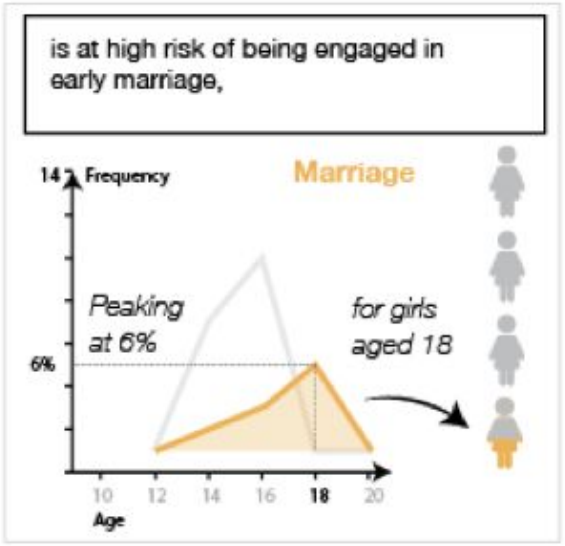
Visual Explanation

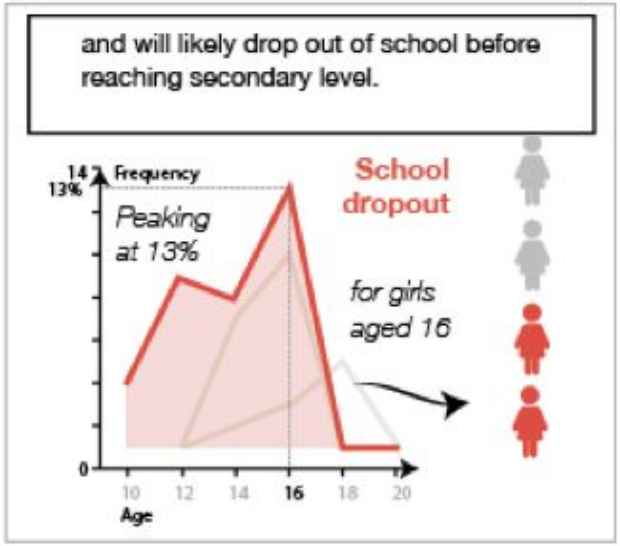


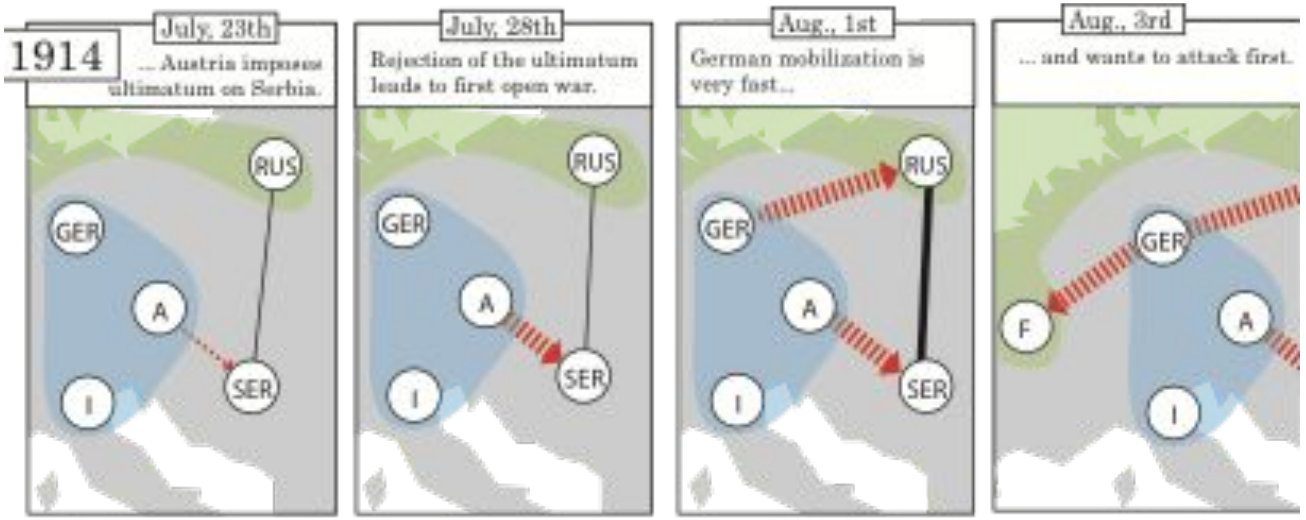


Consistency

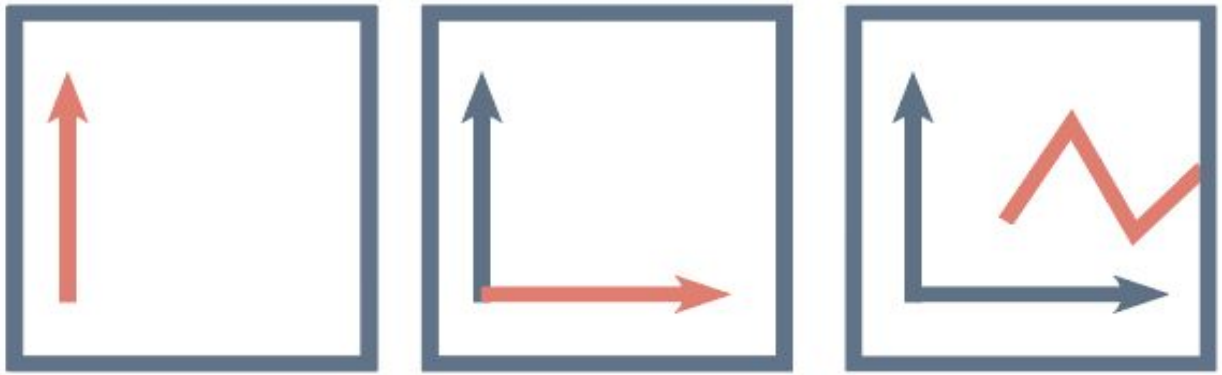








Build up pattern

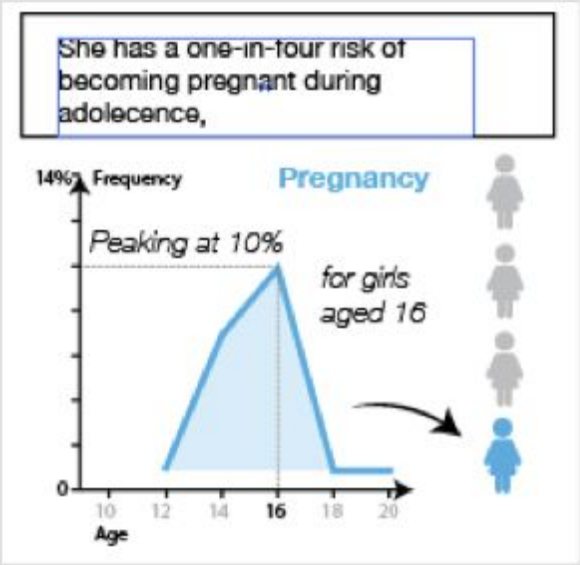


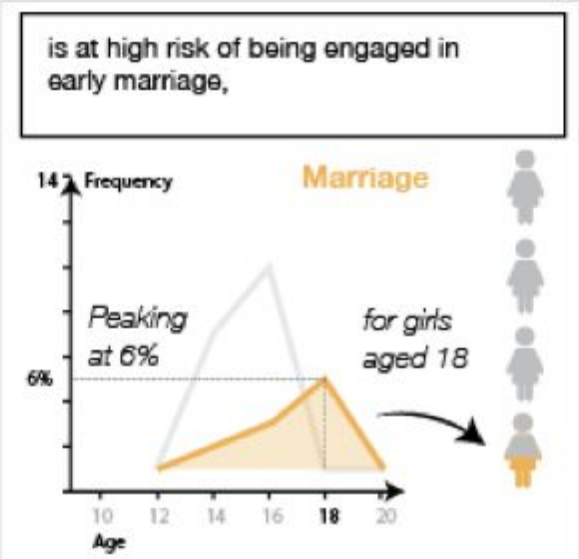
Zoom pattern

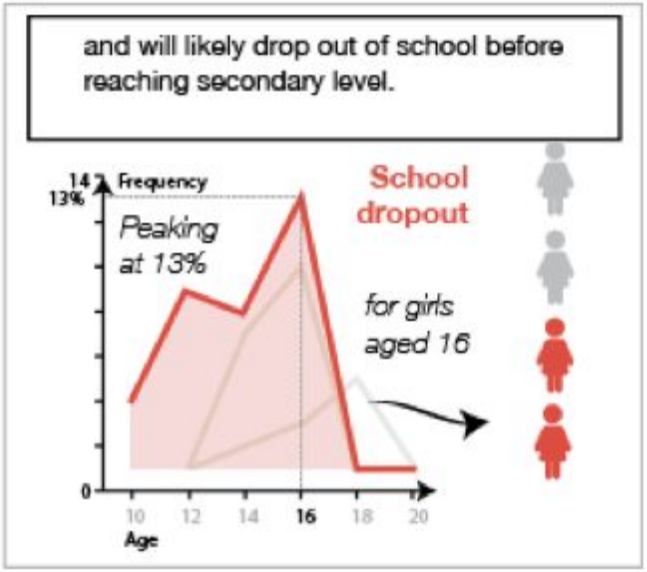
Zoom

down from 127 in 2010

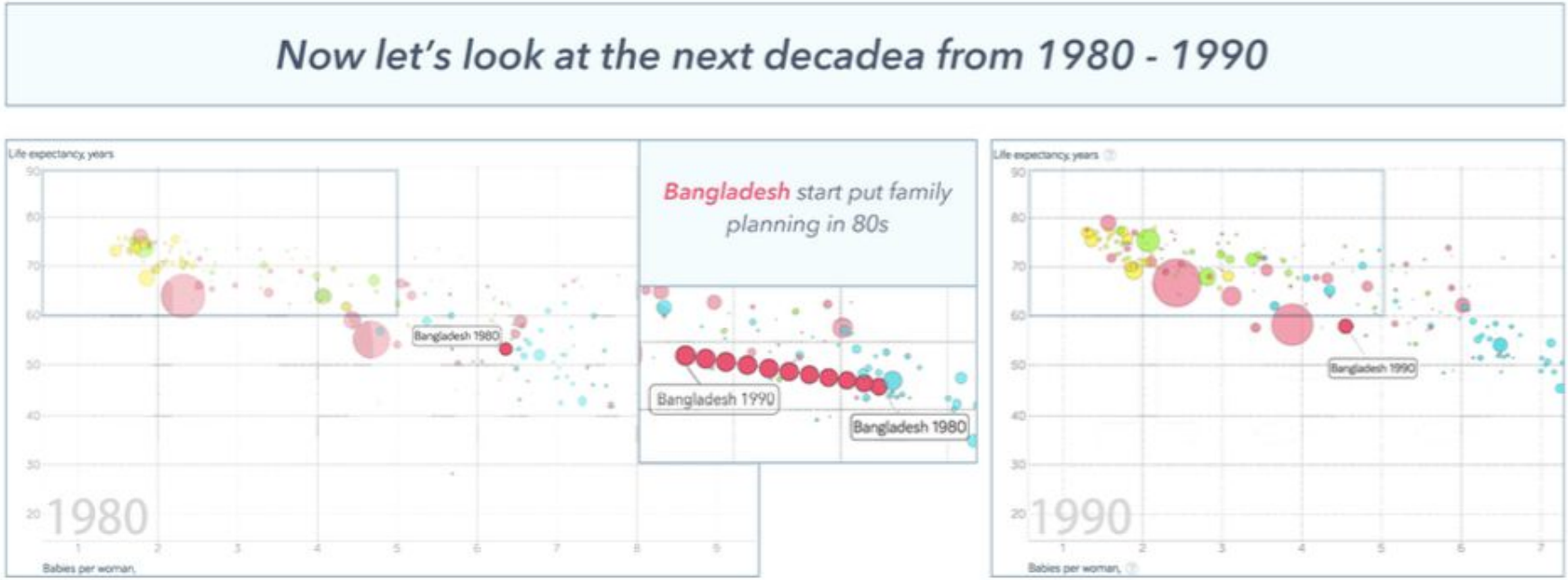
Facetts pattern



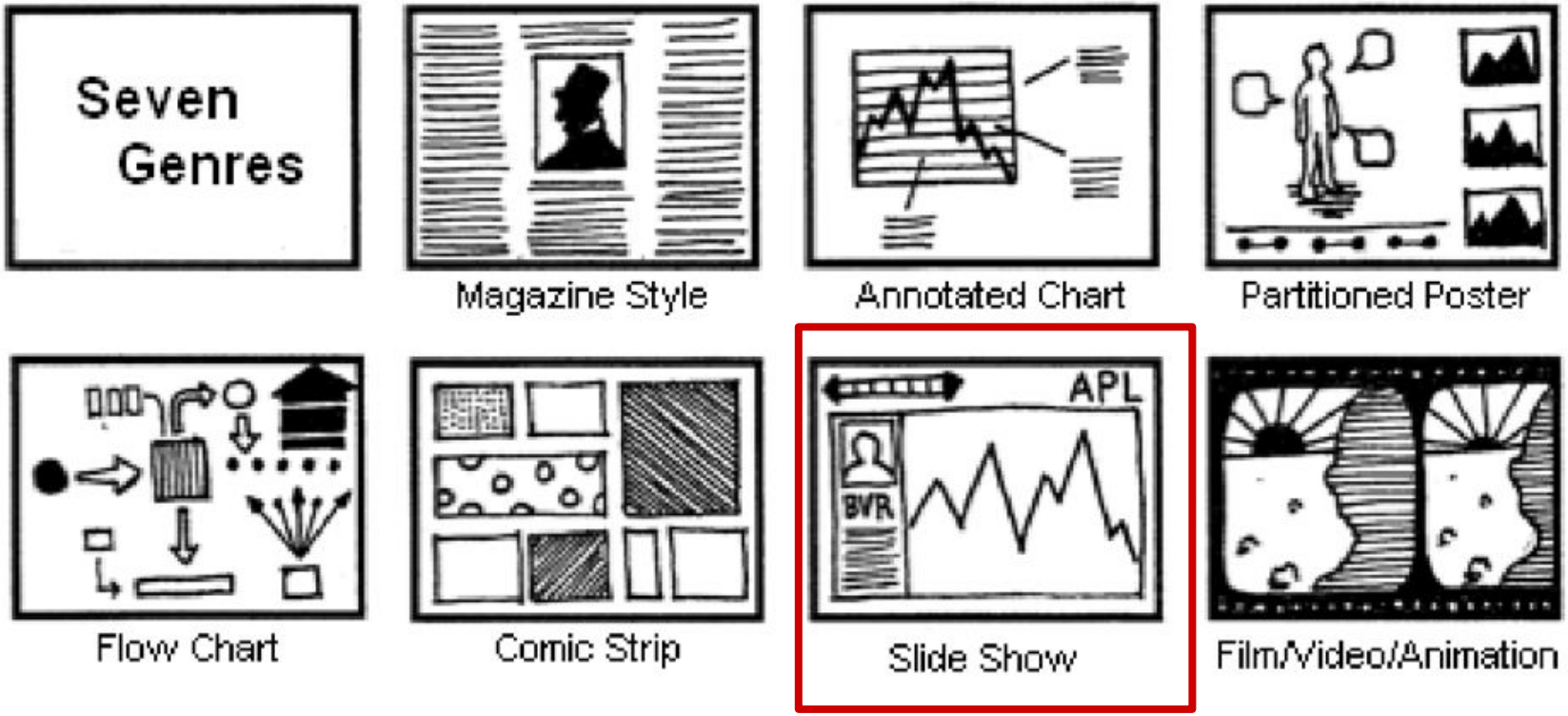




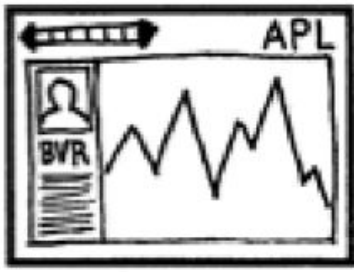
Transition pattern



Slide Shows


Seven Genres
Magazine Style
Annotated Chart
Partitioned Poster
Flow Chart
Comic Strip
APL
BVR
Slide Show
Film/Video/Animation

Slideshow



https://ig.ft.com/sites/climate-change-calculator/

« Back 1/10 Next »

Create your own mod

Annual GHG emissions
(tonnes bn CO_2e)

Global mean temp.
change by 2100 (°C)

140
120
100
80
60
40
20
0

Pathway for 6 °C warming

Pathway for 2 °C warming

6
5
4
3
2

2000 2020 2040 2060 2080 2100

Efforts to cut emissions

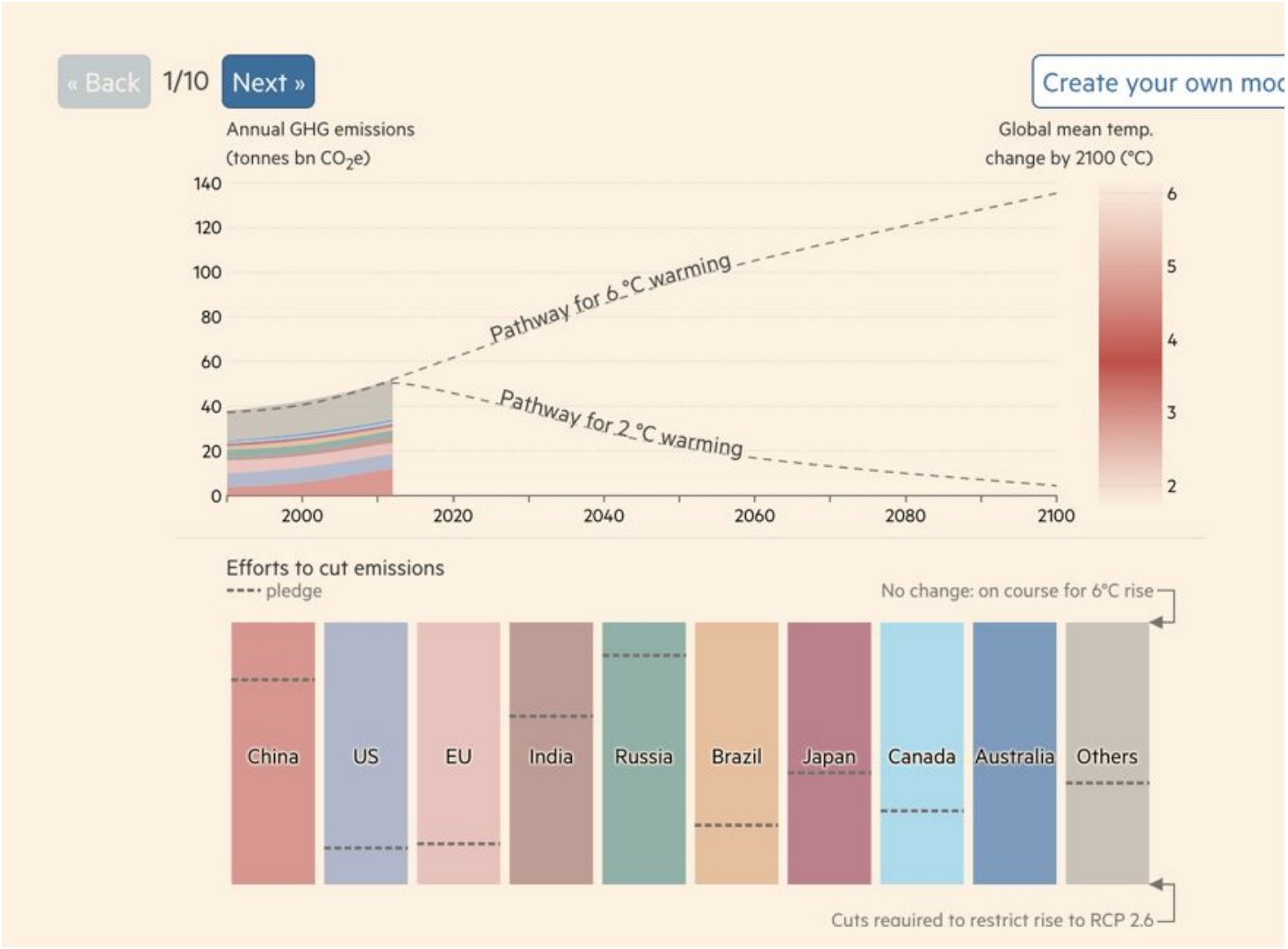
pledge

No change: on course for 6°C rise

China US EU India Russia Brazil Japan Canada Australia Others

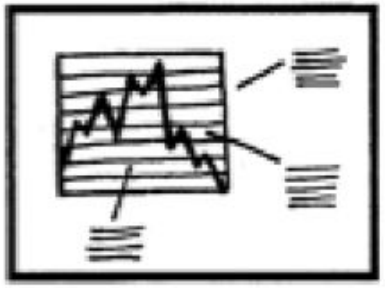
Cuts required to restrict rise to RCP 2.6

Interactive

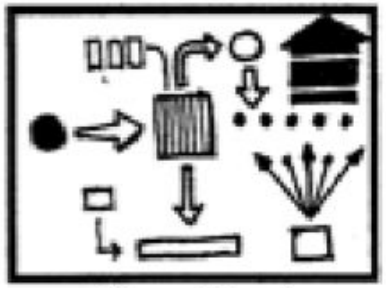


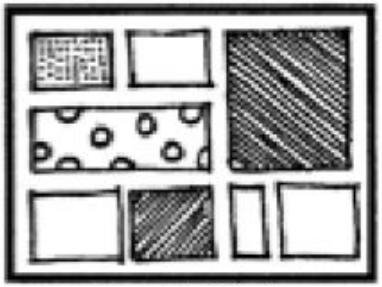
Data Videos

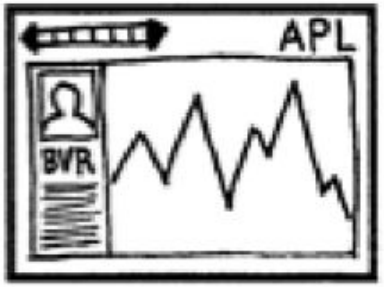

Magazine Style


Annotated Chart

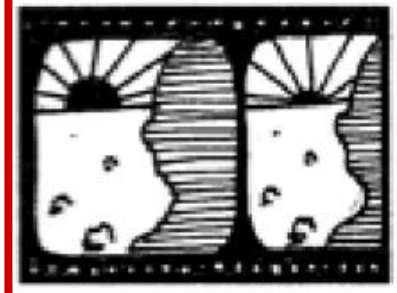

Partitioned Poster


Flow Chart

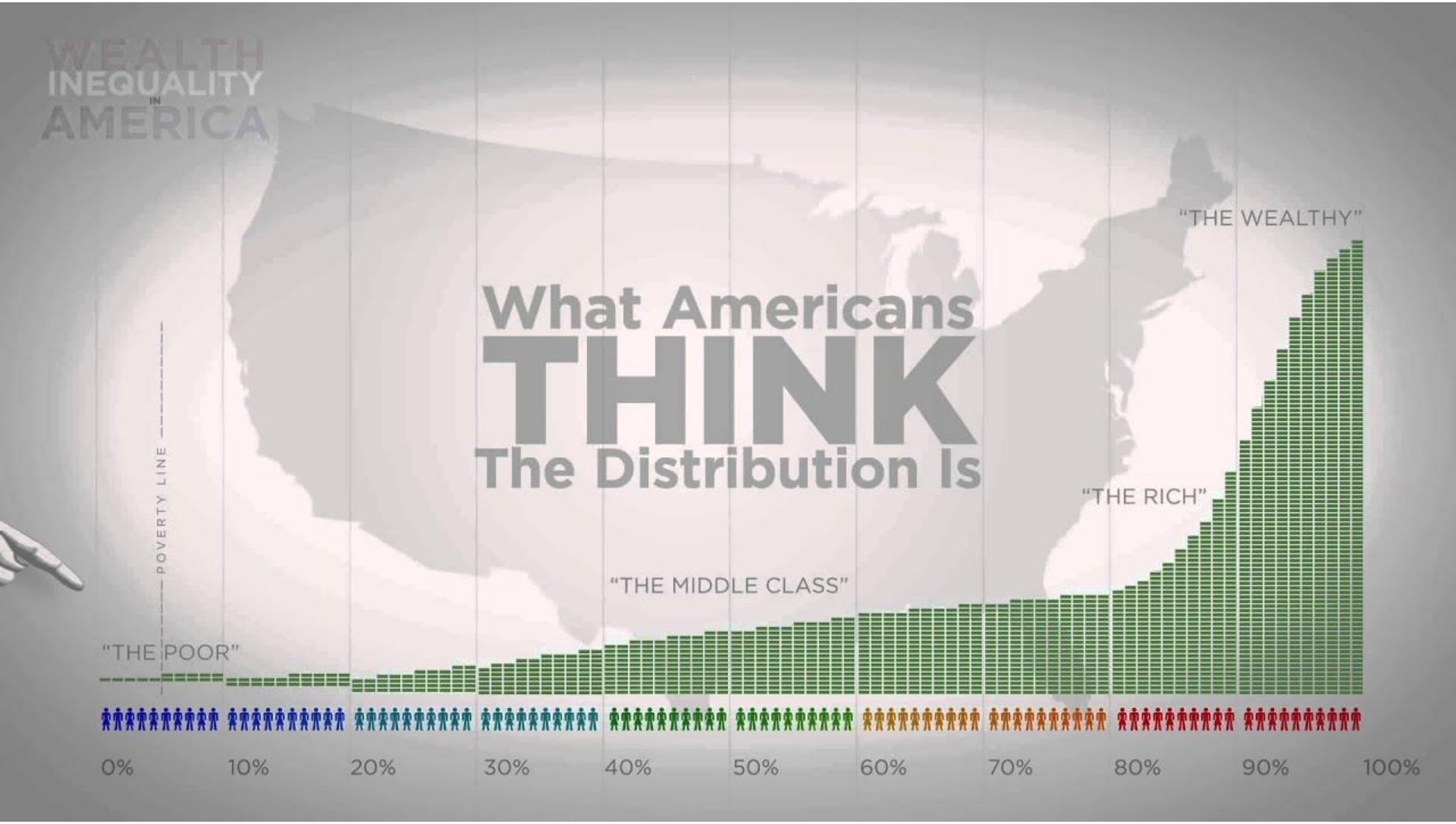

Comic Strip



Slide Show

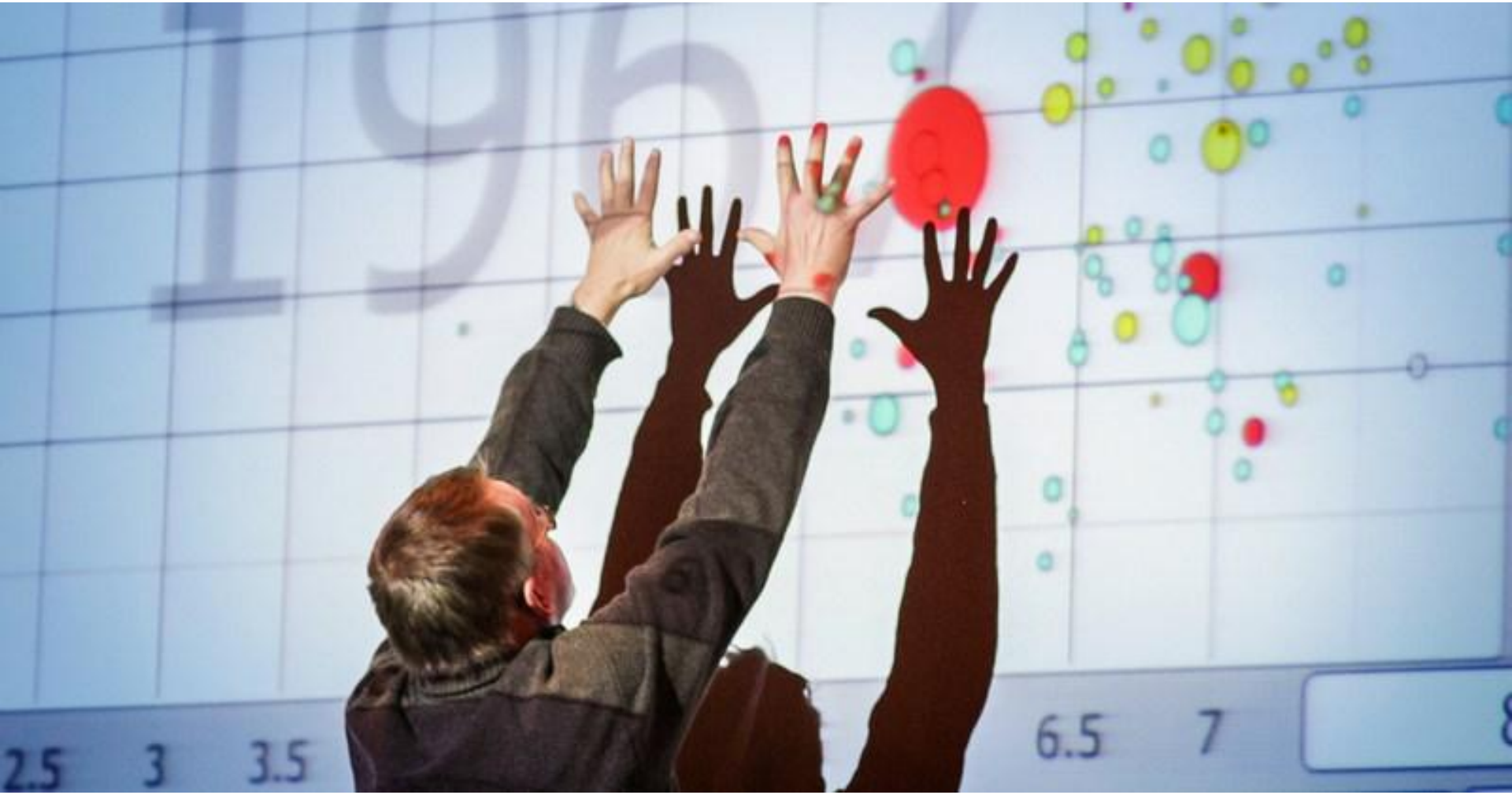

Film/Video/Animation

Data Videos



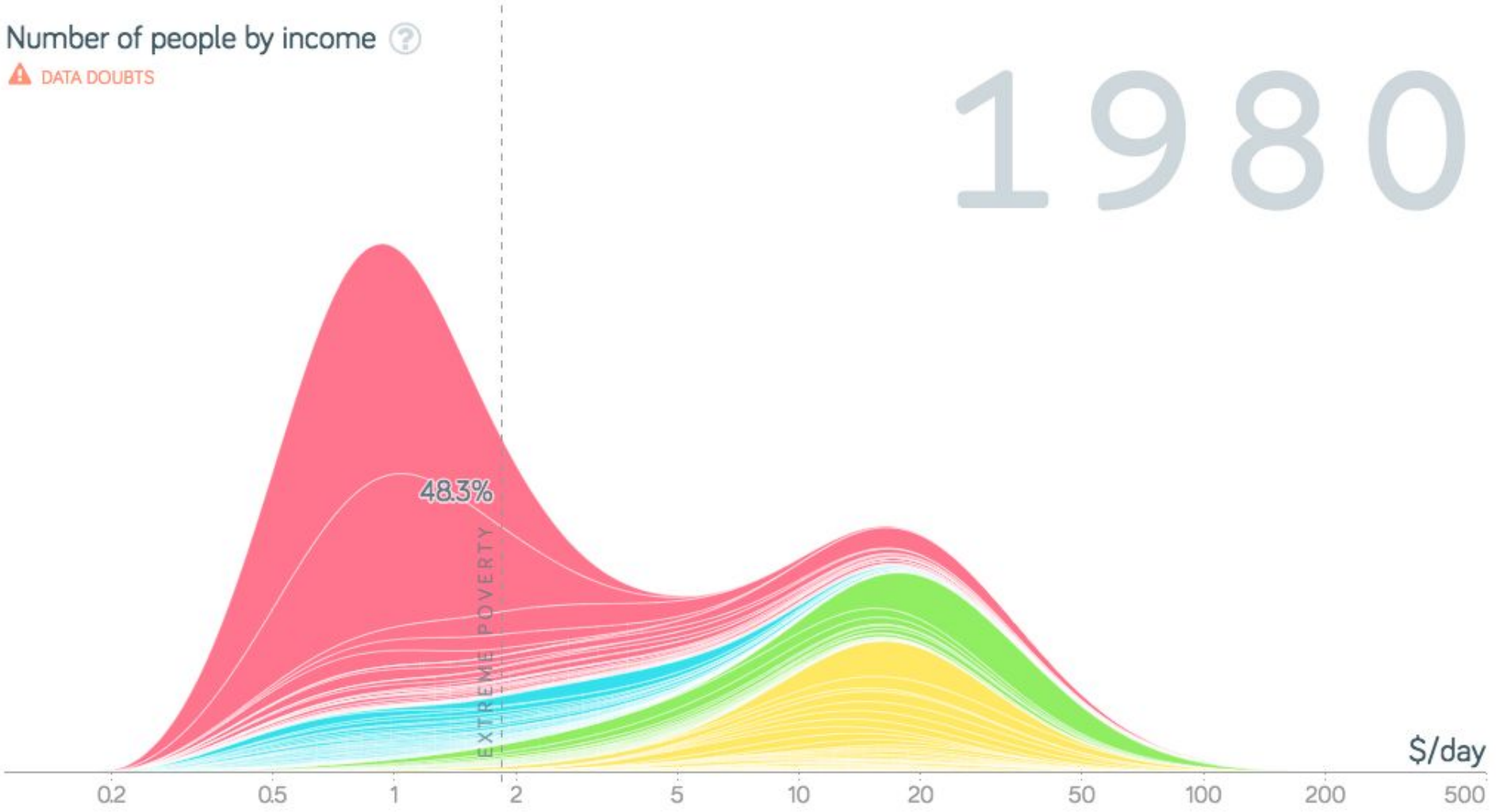
https://www.youtube.com/watch?v=QPKKQnijnsM

Life Presentations

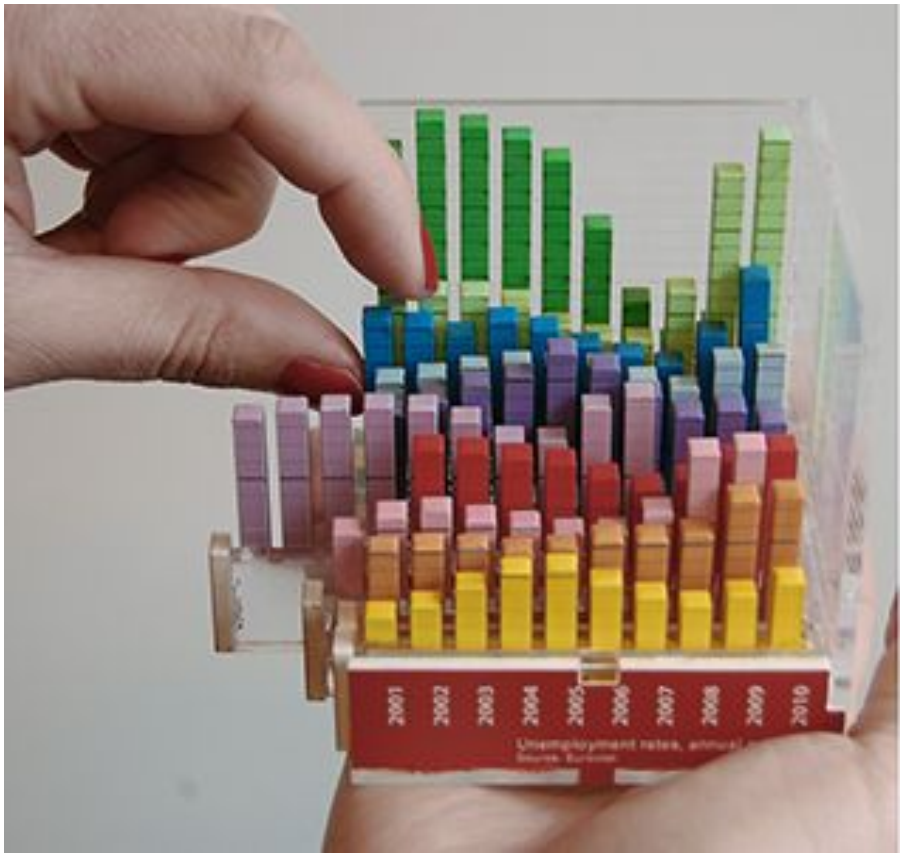


https://www.ted.com/talks/hans_rosling_shows_the_best_stats_you_ve_ever_seen?language=en

Animations


Number of people by income
DATA DOUBTS
1980
48.3%
EXTREME POVERTY
$/day
0.2
0.5
1
2
5
10
20
50
100
200
500

Data Physicalizations



A data physicalization (or simply physicalization) is a physical artifact whose geometry or material properties encode data

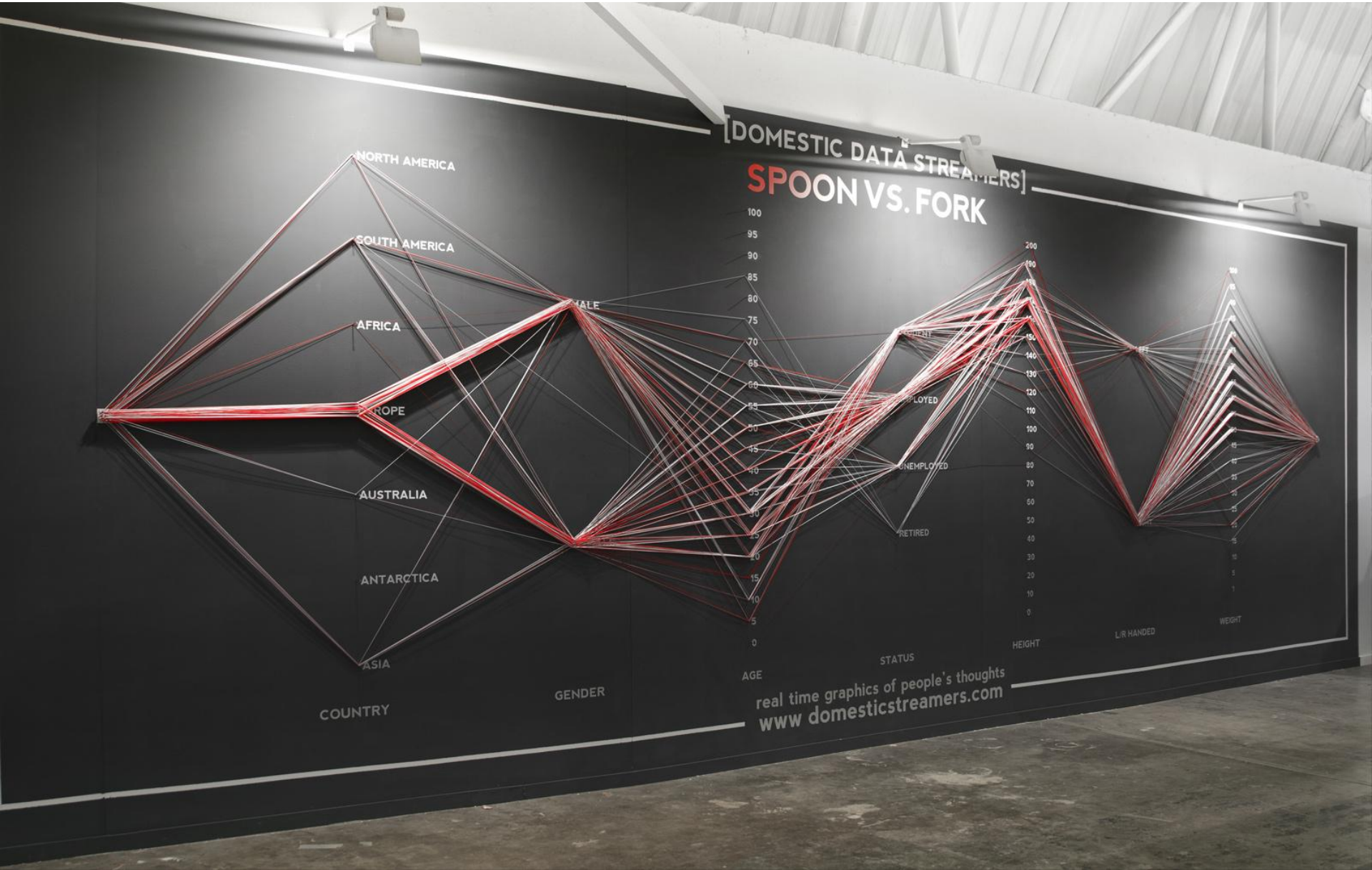
Jansen, Y., Dragicevic, P., Isenberg, P., Alexander, J., Karnik, A., Kildal, J., ... & Hornbæk, K. (2015, April). Opportunities and challenges for data physicalization. In *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems* (pp. 3227-3236). ACM.

Advantages of Physicalizations

- Active perception
- Depth perception
- Haptic senses
- Playfullnes and cognition
- Data in the real world

Physical (http://dataphys.org/list)

Physical


[DOMESTIC DATA STREAMERS]
SPOON VS. FORK
NORTH AMERICA
SOUTH AMERICA
AFRICA
ROPE
AUSTRALIA
ANTARCTICA
ASIA
COUNTRY
GENDER
AGE
STATUS
RETIRED
HEIGHT
L/R HANDED
WEIGHT
real time graphics of people's thoughts
www domesticstreamers.com


LONDON
MEXICO CITY
MEXICO CITY

1957
1971
1984
1993
AREAL


Rethink Your Drink
Dole
pure apple juice
NESTEA
Coca-Cola
Five Alive
Coca-Cola
SUPER BIG GULP
Water 0 tsp.
Milk (250 mL) 3 tsp.
Dole Sparkler (355 mL) 4 tsp.
Apple Juice (200 mL) 6 tsp.
Chocolate Milk (250 mL) 7 tsp.
Iced Tea (500 mL) 11 tsp.
Coca Cola (355 mL) 11 tsp.
Crush Grape (355 mL) 12 tsp.
Five Alive (450 mL) 13 tsp.
Coca Cola (591 mL) 18 tsp.
Super Big Gulp (44oz) 32 tsp.

DataPhys List (*http://dataphys.org/list*)

List of Physical Visualizations

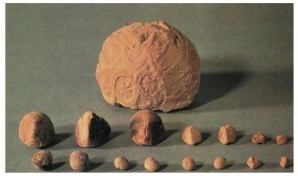
and Related Artifacts

This is a chronological list of physical visualizations and related artifacts, maintained by Pierre Dragicevic and Yvonne Jansen. Thanks to our contributors. Feel free to post a general comment or if you know of another interesting physical visualization, please **submit it**!

This list currently has 327 entries. See recent additions. You can also get notified of new entries through Twitter.

Gallery view | Passive physical visualizations (190) | Active physical visualizations (35) | Physical models (33) | Measuring instruments (11) | Interactive installations (7) | Enabling technologies (23) | Other (6) | Uncertain (22)

5500 BC – Mesopotamian Clay Tokens



The earliest data visualizations were likely physical: built by arranging stones or pebbles, and later, clay tokens. According to an eminent archaeologist (Schmandt-Besserat, 1999): "Whereas words consist of immaterial sounds, the tokens were concrete, solid, tangible artifacts, which could be handled, arranged and rearranged at will. For instance, the tokens could be ordered in special columns according to types of merchandise, entries and expenditures; donors [...]

Added by **Pierre Dragicevic**. Category: **Passive physical visualization**. Tags: anthropology, archaeology, clay tokens, mesopotamians, rearrangeable

---

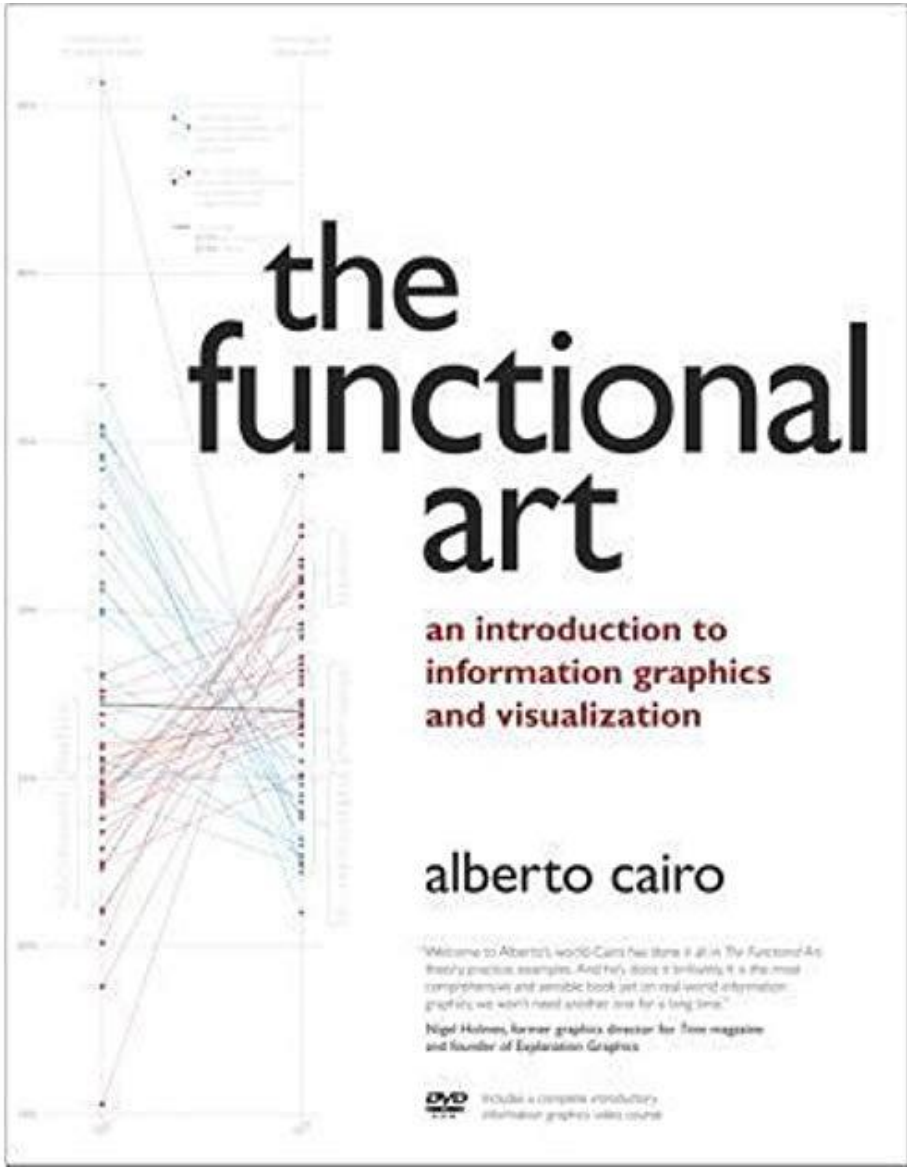
2600 BC – Inca Quipus

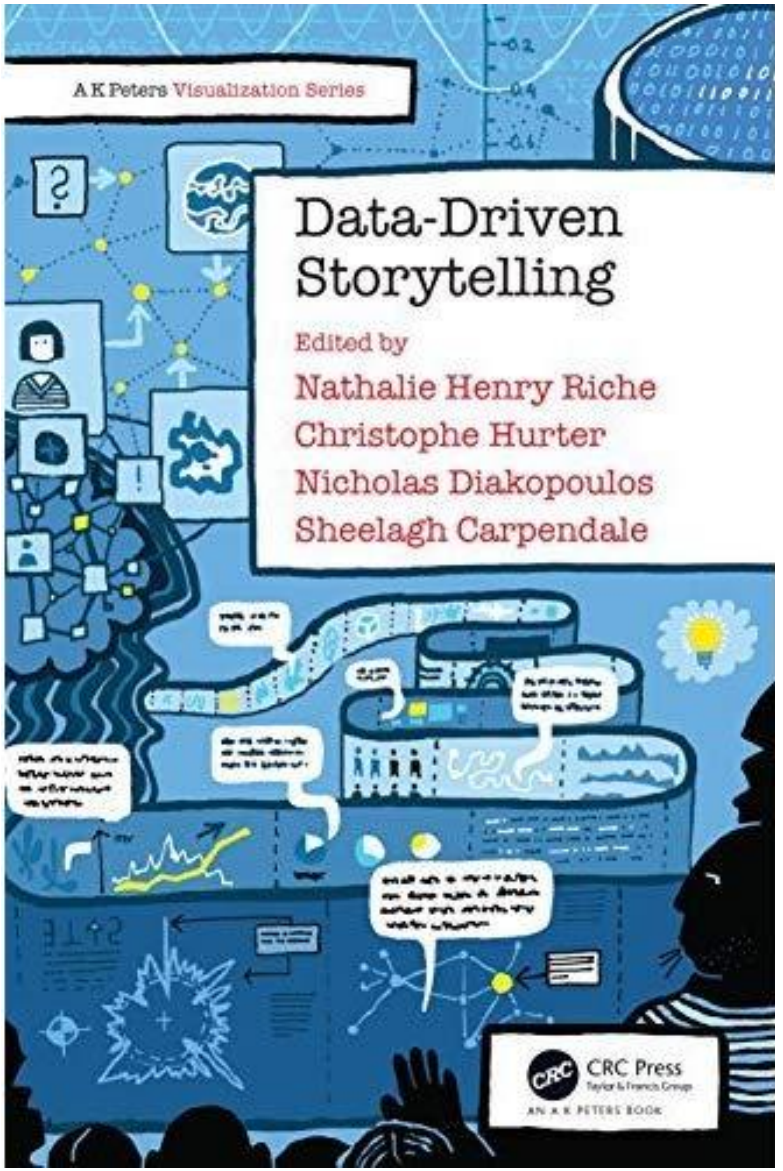
Quipus were complex assemblies of knotted ropes that were used in South America as a data storage device and played an important role in the Inca administration. Only a handful of specialists could use and decipher them. Their meaning mostly remains a mystery but it seems that color, relative position of knots, knot types and rope length were used to encode categorical and quantitative [...]

Summary

- Storytelling for communication and engagement
- Story structures can be complex
- Form follows messages
- Know your audience
- Multiple storytelling genres

Book recommendations





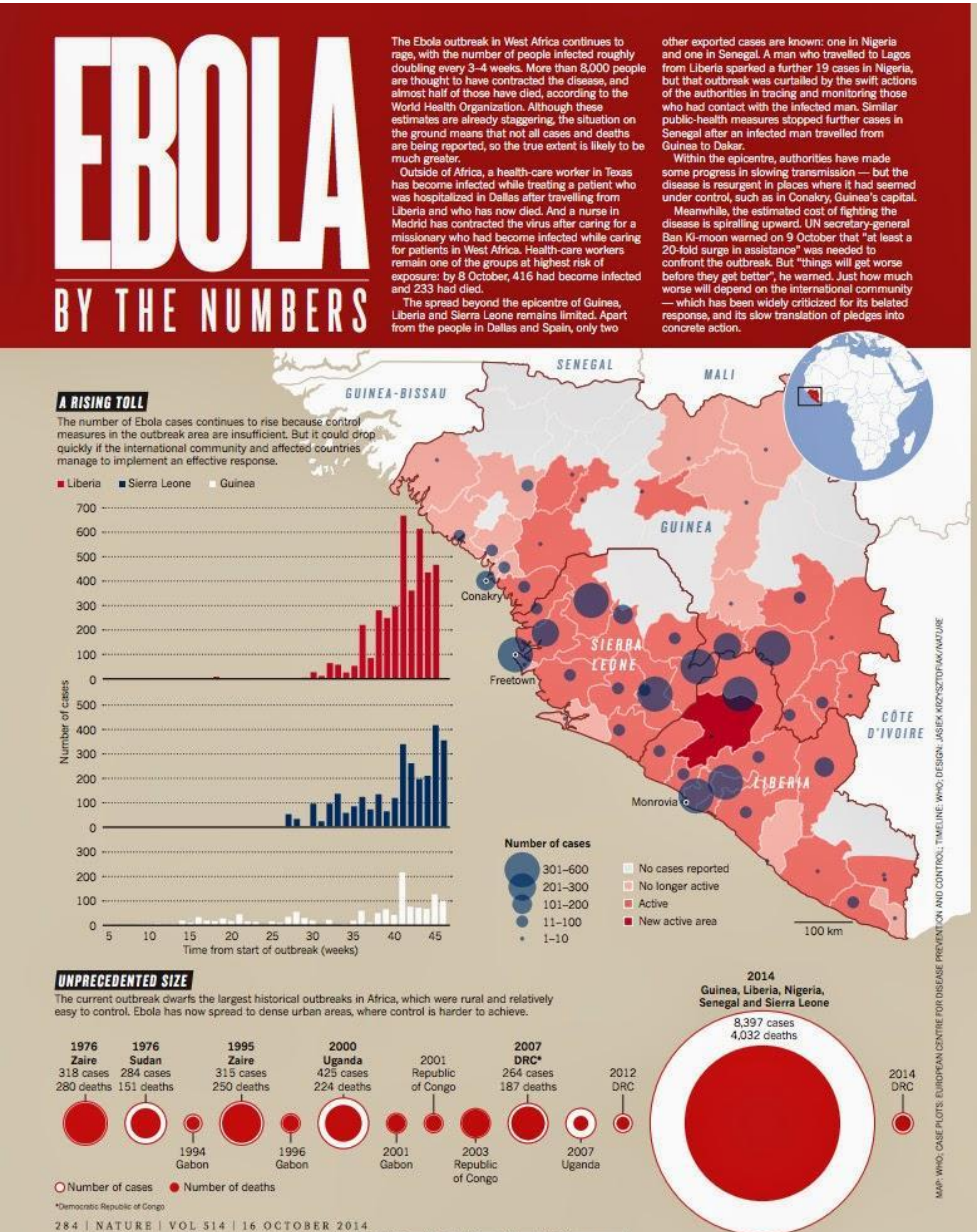
Assignment

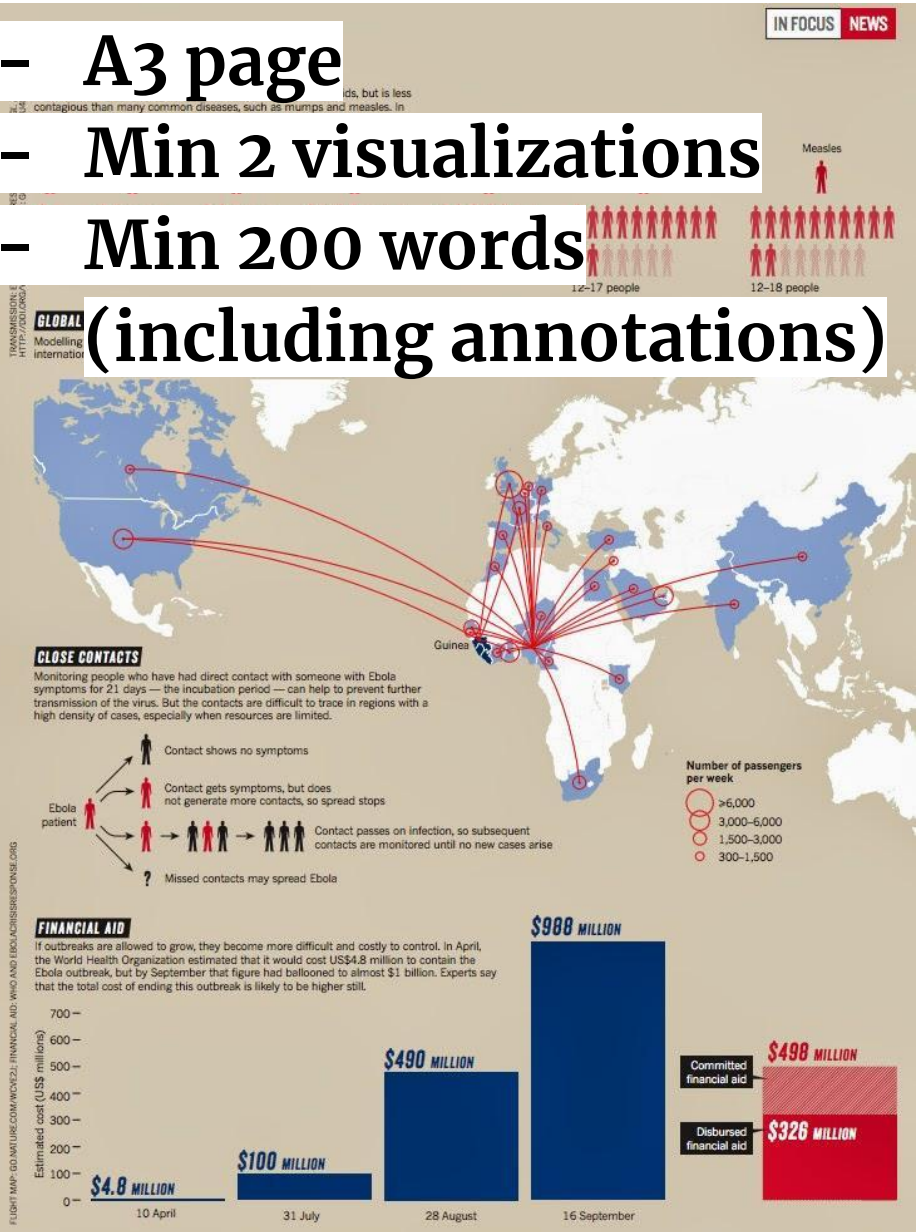
Tutorial: your story

- Who is your **audience**?
- What is your **data**?
- Why is this **important**?
- What is the **story** that you are going to tell?
- What **effect** are you hoping to have?
- How are you communicating to them? (**Format**)

a) Infographic

- A3 page
- Min 2 visualizations
- Min 200 words (including annotations)

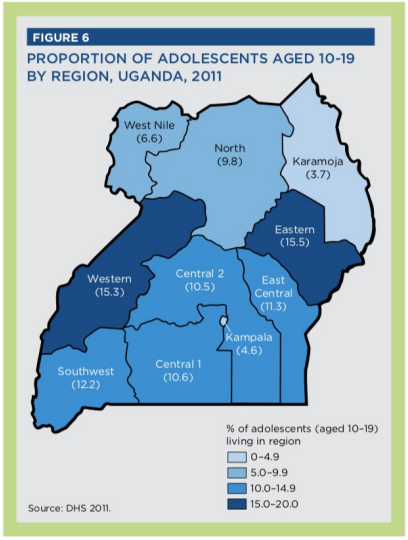




b) Report

- Min 2 visualizations
- Min 200 words (including annotations)

physical, social, political, and economic structures of a region can place residents at varying risks for vulnerability. Areas susceptible to violence or natural disaster pose clear threats to individuals. An individual's environment also affects his or her development and behavioral choices. Resources available in the physical and social environments create the contexts within which decisions are made about health, education, and employment. Political and social environments also dictate whether resources are accessible to all adolescents. An examination of the residential distribution of adolescents provides a baseline for comparing geographical patterns of vulnerability. Within Uganda, by type of residence, the majority of adolescents (87 percent) live in rural versus urban areas. Figure 6 shows the distribution of adolescents aged 10 to 19 living in Uganda. Regional distributions show Karamoja contains only four percent of the adolescent population. Kampala with a much denser population contains 4.6 percent of the population. The Eastern and Western regions contain the largest proportions of the adolescent population.



Household factors influencing vulnerability

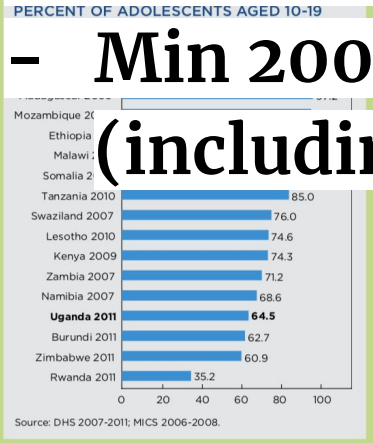
Household-level factors have direct impacts on the well-being of adolescents. Households are the primary setting where adolescents live and engage in activities. For this reason, the household environment and the people who live there have significant impacts on the lives of adolescents. Physical conditions of the home influence the health of residents. Family structures and demographic characteristics of household members affect the knowledge, decisions, behaviors and interactions in the environment of the adolescent.

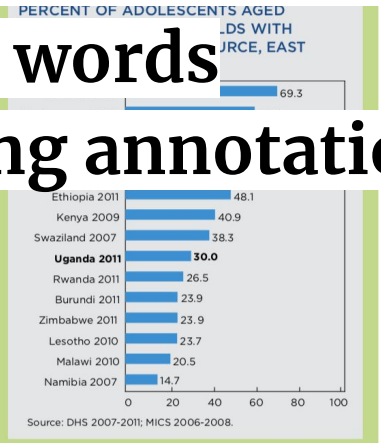
Access to improved water sources and sanitation

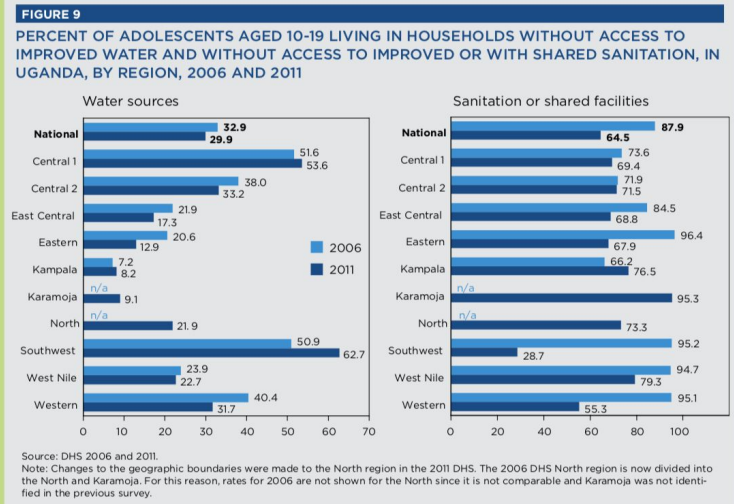
Unsafe water, inadequate sanitation, and poor hygiene are among the five leading risk factors responsible for one quarter of all deaths in the world (WHO 2009). Unsafe water supplies and inadequate sanitation in homes increase exposure to water-borne diseases and can cause diarrhea. Ensuring access to clean water sources and sanitation is key to maintaining hygiene and health. Improved water sources are those that either naturally protect water from contamination or are constructed to do so. These include piped water, public taps, standpipes, boreholes, tube wells, protected wells and springs, and rainwater collection. Improved sanitation includes constructs and systems that prevent fecal contamination. These include flush or pour toilets, ventilated pit latrines, pit latrines with slabs, and composting toilets (UNICEF 2013b).

Housing conditions across East and Southern Africa are largely in need of improvement, and lack of improved sanitation varies by country. In nearly all of East and Southern Africa, over half of adolescents either do not have improved sanitation or share facilities with other households. Conditions are worst in Madagascar and Mozambique where fewer than four percent of adolescents live in households with improved sanitation that is not shared (Figure 7). Rwanda has the lowest proportion of adolescents affected—35 percent—which is still unacceptably high. Lack of access to improved water sources affects lower proportions but is still a problem in the region. In five countries, fewer than half of adolescents have access to improved water sources (Figure 8). Water conditions are best in Namibia, where only 15 percent of adolescents have no access to improved water.

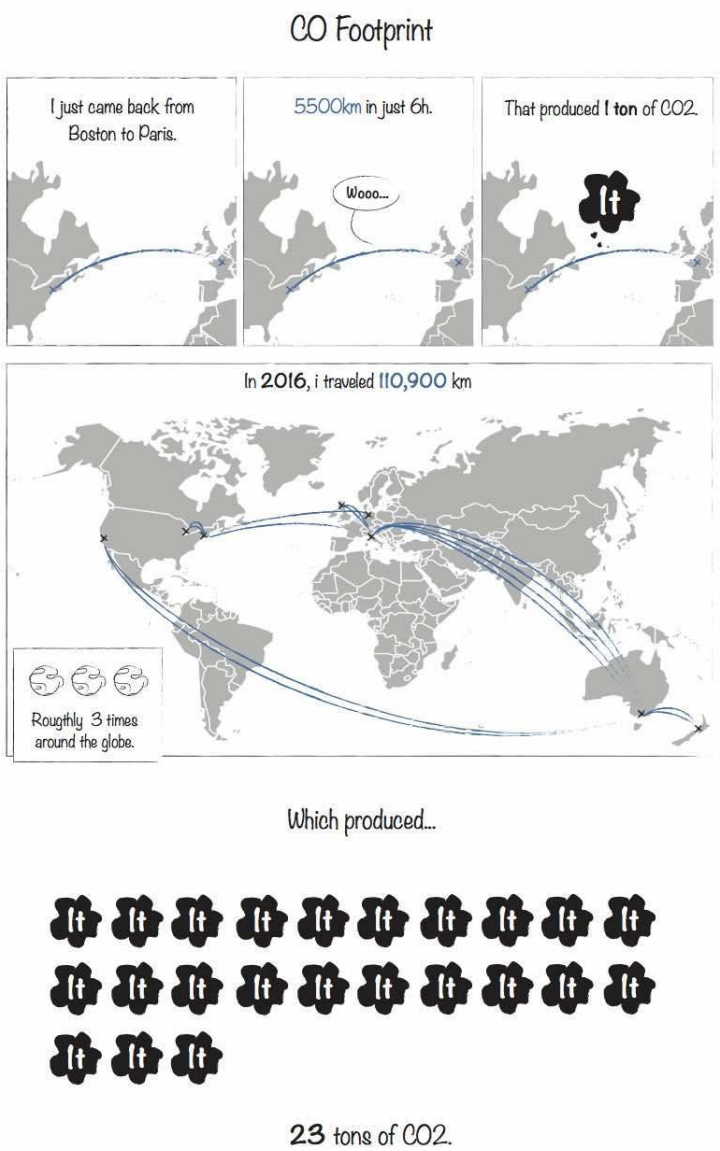
In Uganda, overall access to improved water and sanitation increased by a small but significant percentage between 2006 and 2011 (Figure 9). In 2006, 33 percent of adolescents had no access to improved water; in 2011, it is 30 percent. The proportion of adolescents without access to improved







Data Comic (*http://datacomics.net*)



- A4 page
- Min 2 visualizations
- Min 5 panels