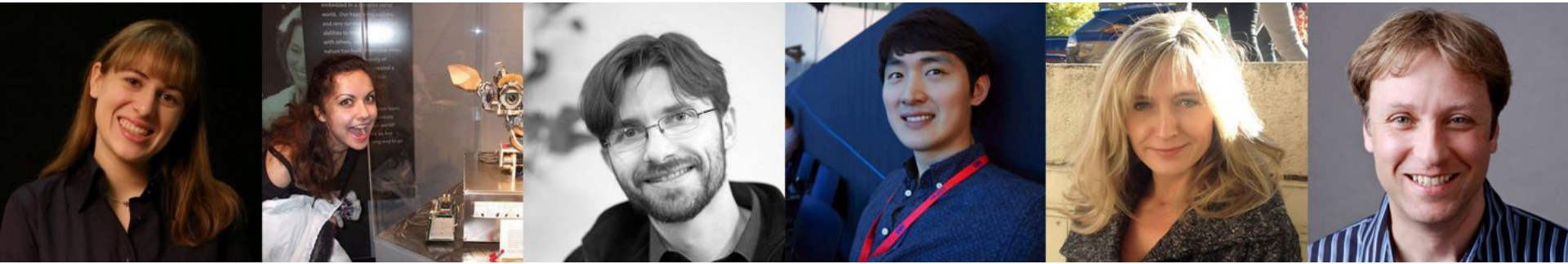
Beyond Memorability: Visualization Recognition and Recall

Borkin, M., Bylinskii, Z., Kim, N.W., Bainbridge C.M., Yeh, C.S., Borkin, D., Pfister, H., & Oliva, A.
IEEE Transactions on Visualization and Computer Graphics, 2015



Presented by Julieta Martinez

What makes an image memorable?

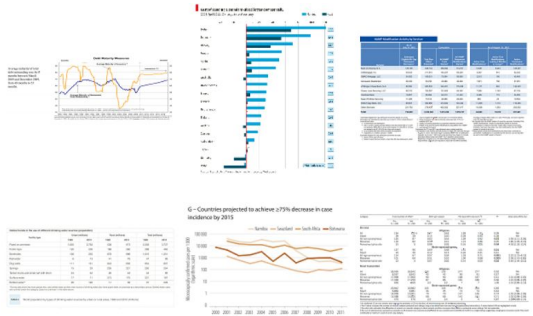
vs.

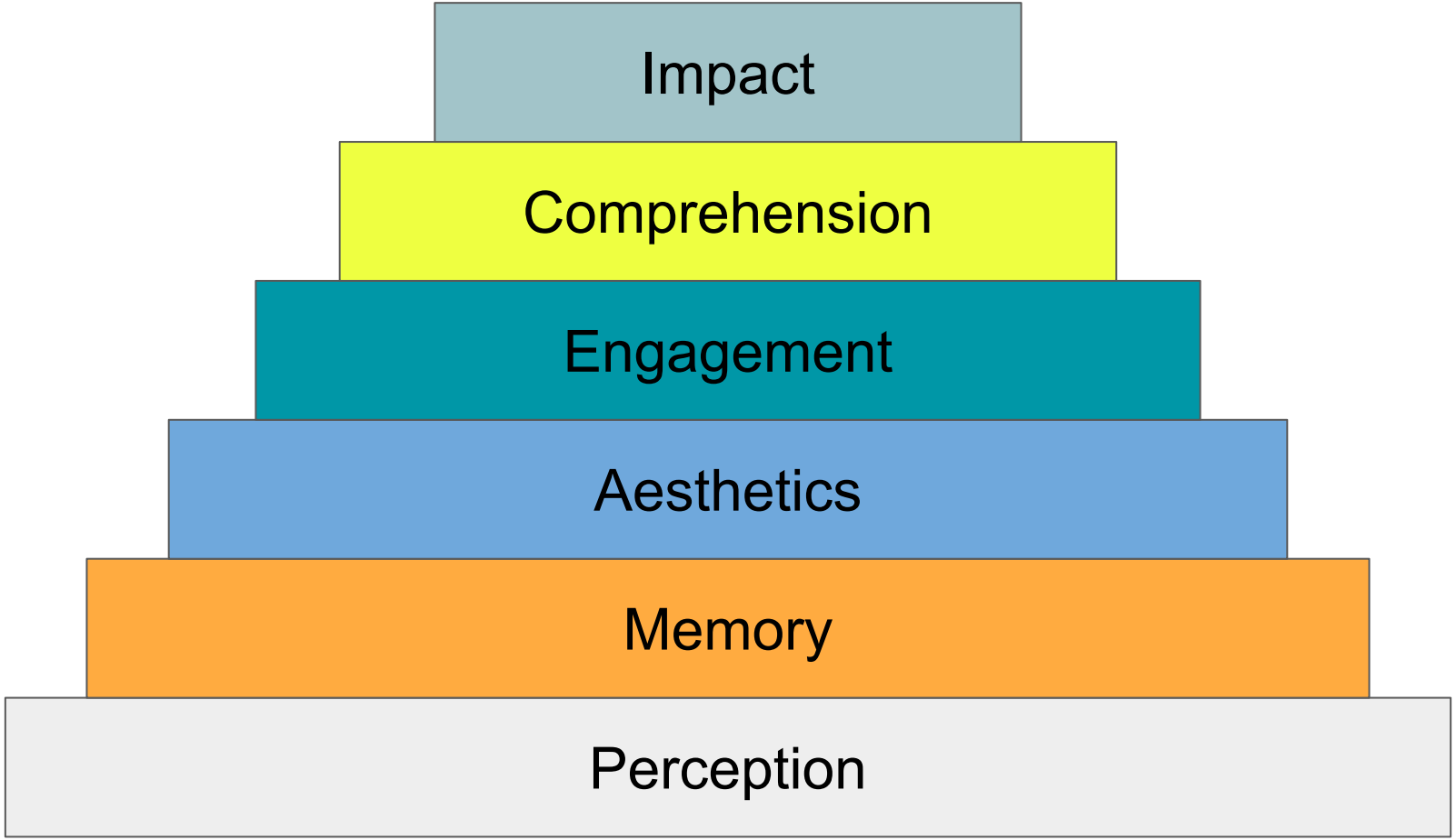
What makes a face memorable?

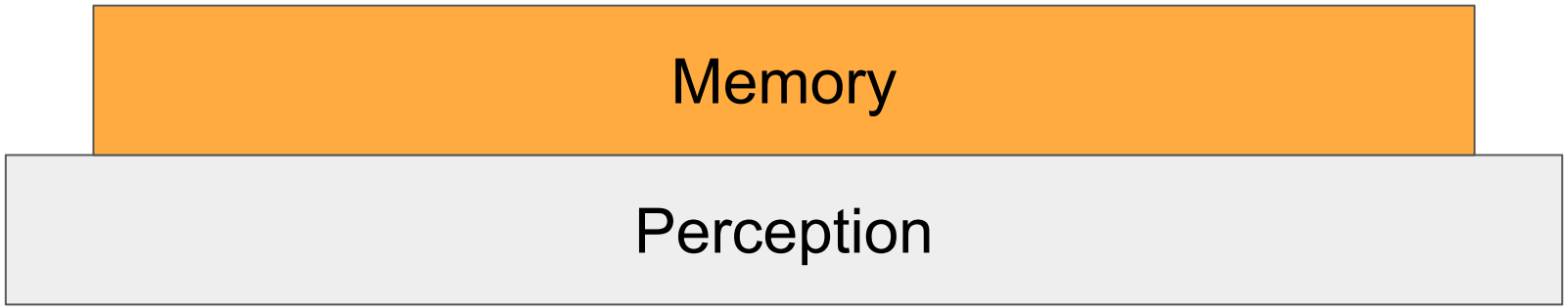
vs.

What makes a vis memorable?

vs.




Impact
Comprehension
Engagement
Aesthetics
Memory
Perception


Memory
Perception

What makes a visualization memorable?

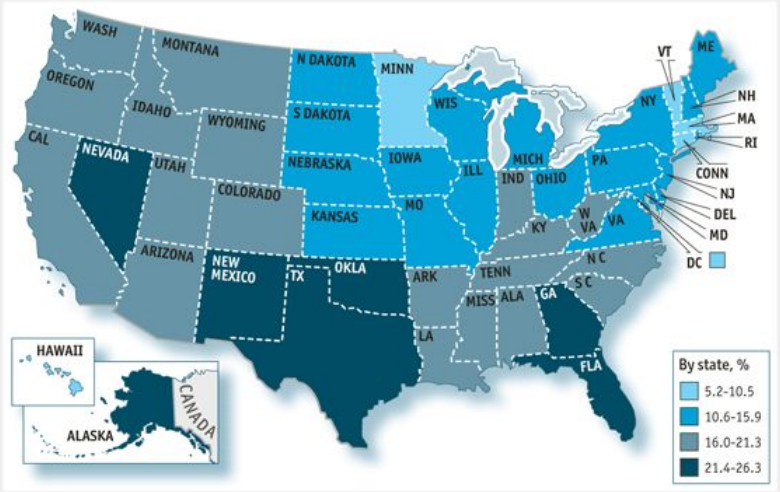
Let’s play a game

If you see a repeated visualization, clap

Seriously, get ready to clap

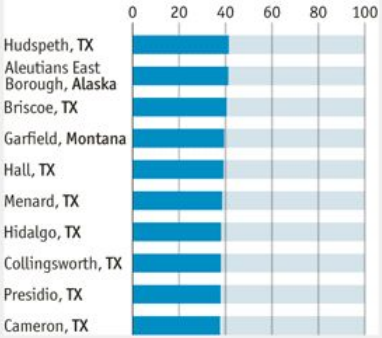
Population without health insurance

% of under 65s, 2010



By county

Highest levels of uninsured, %

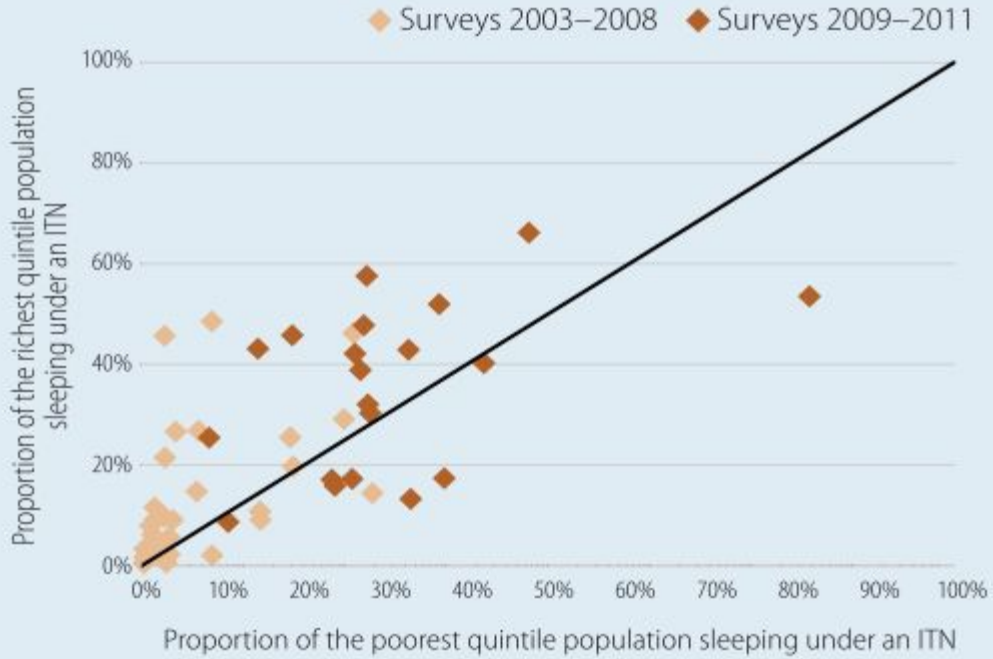


By county

Lowest levels of uninsured, %

Source: US Census Bureau

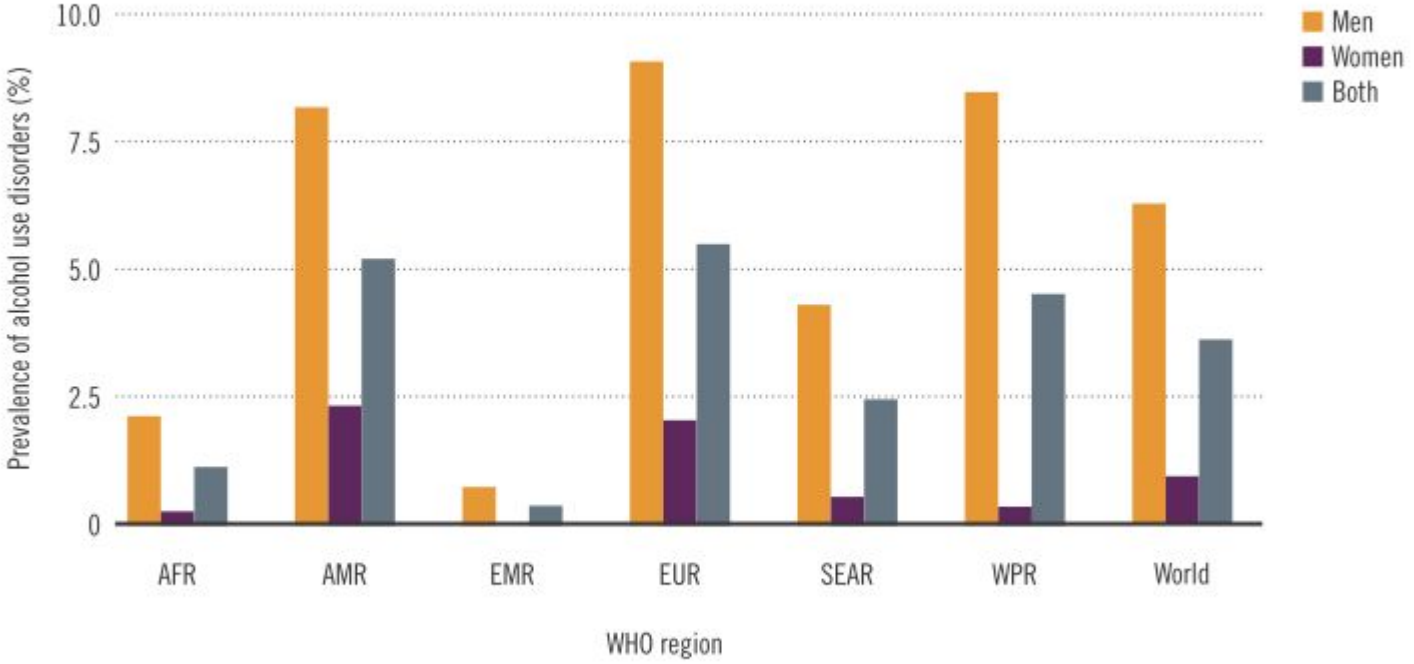
Figure Box 4.1b Proportion of the population sleeping under an ITN, by poorest and wealthiest quintiles and by older and more recent surveys



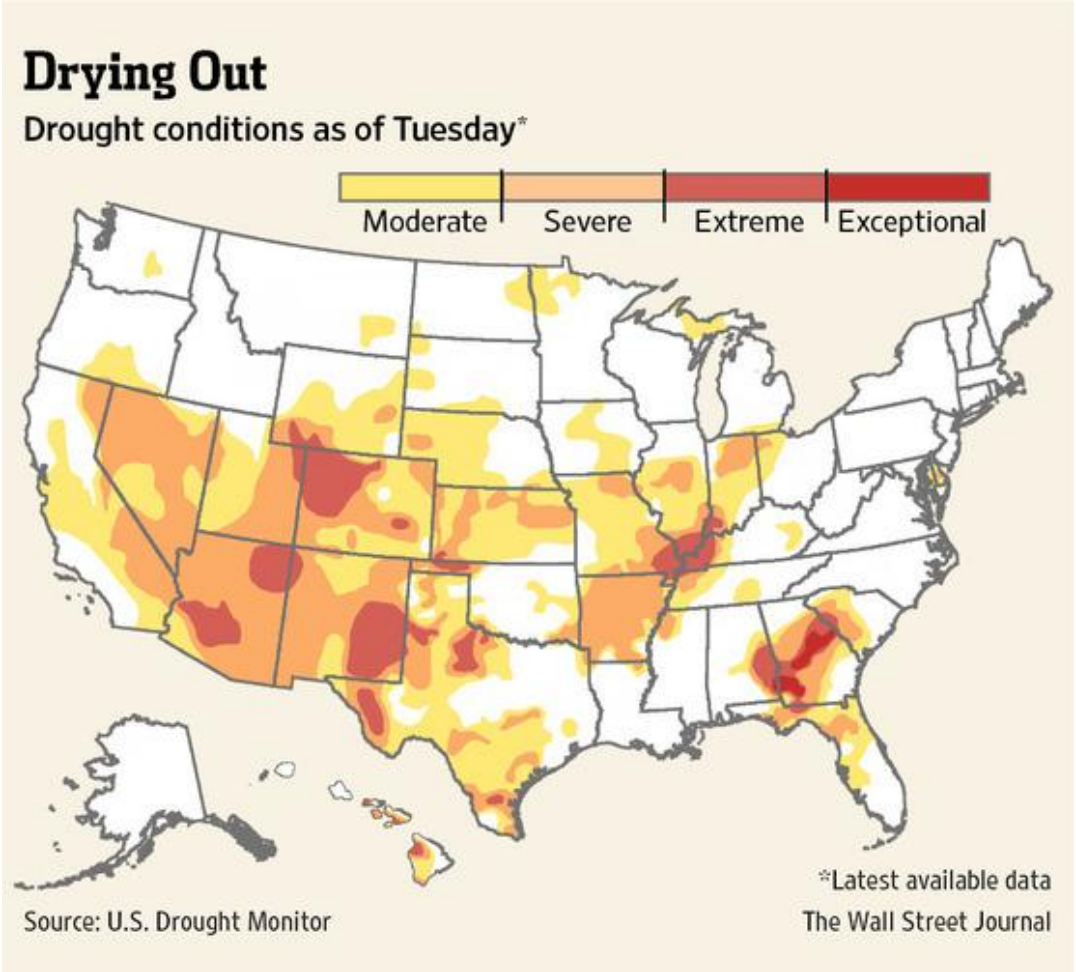
Source: *Household surveys*


Checking Out
Sales at grocers have been mixed and their stocks have soured
KROGER
FY SALES
$71† BILLION
SALES CHANGE FROM 2011 5%
AHOLD*
(Stop & Shop)
$22B
1%
$10B
12%
WHOLE FOODS
SAFEWAY*
$37B
6%
SUPERVALU
$36B
4%
DELHAIZE*
(Food Lion)
$19B
2%
A&P
$8B
8%
52-week stock performance
Kroger
-13%
Safeway
-33%
Supervalu
-70%
Ahold
-10%
Delhaize
-52%
Whole Foods
44%
A&P
-97%
Source: the companies
*U.S. operations; † Excludes fuel and convenience/jewelry stores
Graphic by Alberto Cervantes/The Wall Street Journal

Figure 10. Prevalence of alcohol use disorders by sex, WHO region and the world, 2004[a]



[a] Source: Rehm et al., 2009.


Drying Out
Drought conditions as of Tuesday*
Moderate
Severe
Extreme
Exceptional
*Latest available data
Source: U.S. Drought Monitor
The Wall Street Journal

Only one third of countries estimate that hygiene promotion programmes are scaled up in primary schools (Figure 7.3).

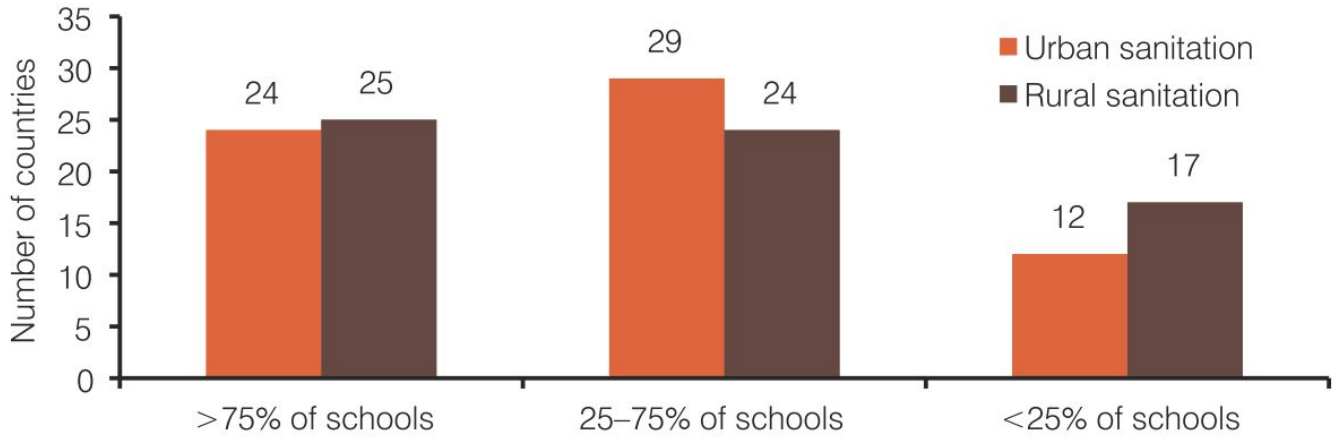


FIGURE 7.3 Are hygiene promotion programmes implemented in primary schools?

Source: 2011 GLAAS country survey (66 country respondents)

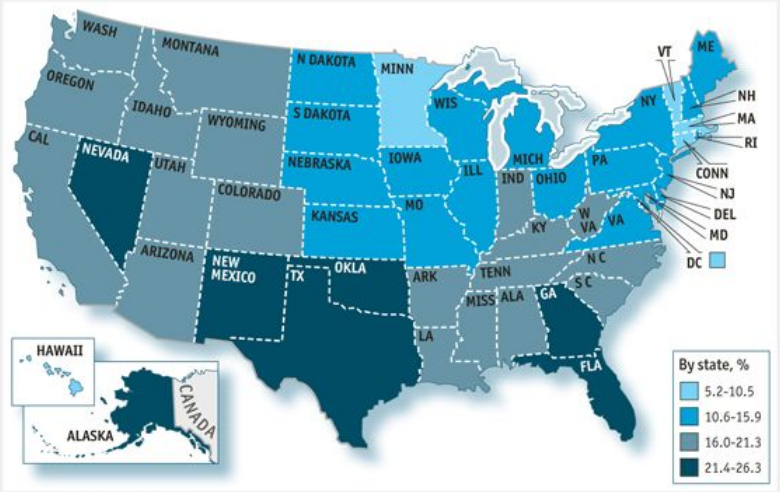

Checking Out | Sales at grocers have been mixed and their stocks have soured
KROGER
FY SALES
$71† BILLION
SALES CHANGE FROM 2011 5%
AHOLD* (Stop & Shop)
$22B
1%
$10B
12%
WHOLE FOODS
SAFEWAY*
$37B
6%
SUPERVALU
$36B
4%
DELHAIZE* (Food Lion)
$19B
2%
A&P
$8B
8%
52-week stock performance
Kroger
-13%
Safeway
-33%
Supervalu
-70%
Ahold
-10%
Delhaize
-52%
Whole Foods
44%
A&P
-97%
Source: the companies
*U.S. operations; † Excludes fuel and convenience/jewelry stores
Graphic by Alberto Cervantes/The Wall Street Journal


HOW WOULD YOU LIKE YOUR GRAPHIC DESIGN?
(YOU MAY PICK TWO)
FAST
CHEAP
GREAT
FREE
DIPPED IN UGLY SAUCE WITH HASTE AND CARELESSNESS
IMPOSSIBLE UTOPIA
YOU GET WHAT YOU PAY FOR
JUST IN TIME TO BE TOO LATE
TRASH
GO AWAY
TRY AGAIN


THE PART-TIME BARISTA
LOS ANGELES EDITION!
DEAD STARE
FORCED GRIN
INTELLECTUAL STUBBLE
TRIPLE ESPRESSO WITH ADDED RITALIN
EMPTY WALLET
SLIP-PROOF SHOES (ALSO SEX-PROOF)
BONUS ITEMS
COLLEGE DEGREE
TO BE USED AS TOILET PAPER WHEN MONEY IS TIGHT.
SCREENPLAY
A DELIGHTFUL INDIE ROMP THAT NO ONE WILL EVER READ.
LIFE BY TOM
CHEAP WINE
CONSUMED NIGHTLY IN AN ATTEMPT TO "MAKE SENSE OF IT ALL."
www.poorlydrawnlines.com

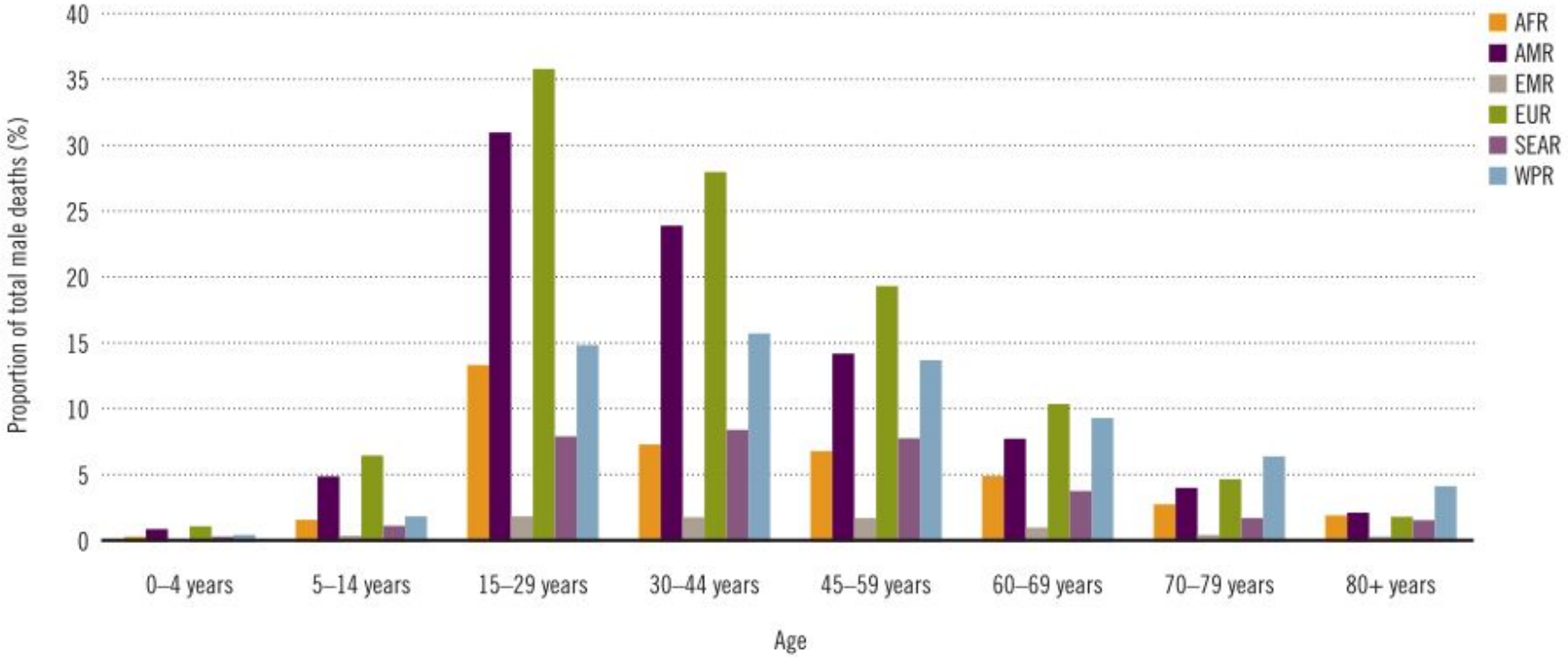
Population without health insurance

% of under 65s, 2010

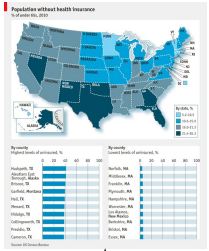


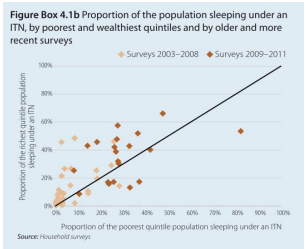
Source: US Census Bureau

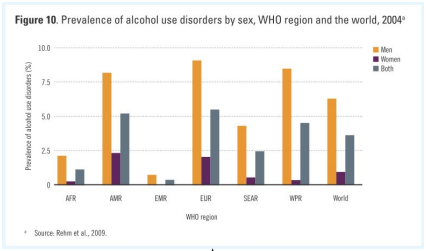
Figure 16. Proportion of alcohol-attributable male deaths (%) of all male deaths by age group and WHO region, 2004

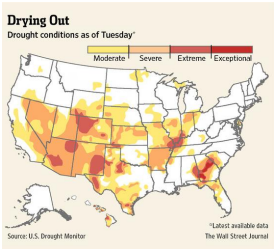


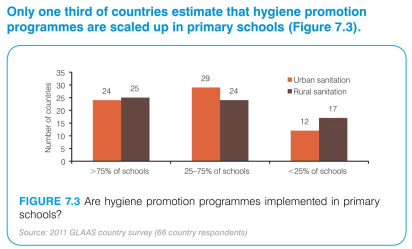
That’s it. Thanks!







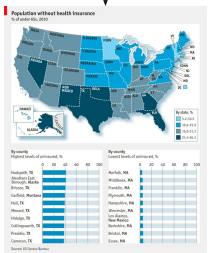


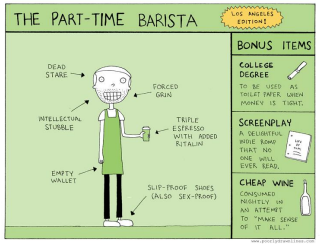


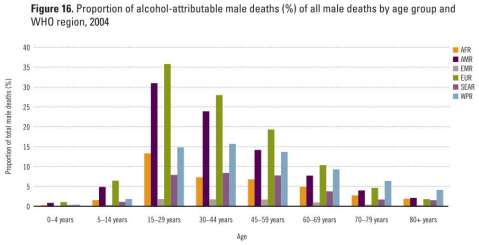
memory check

attention check

likely to be a false positive

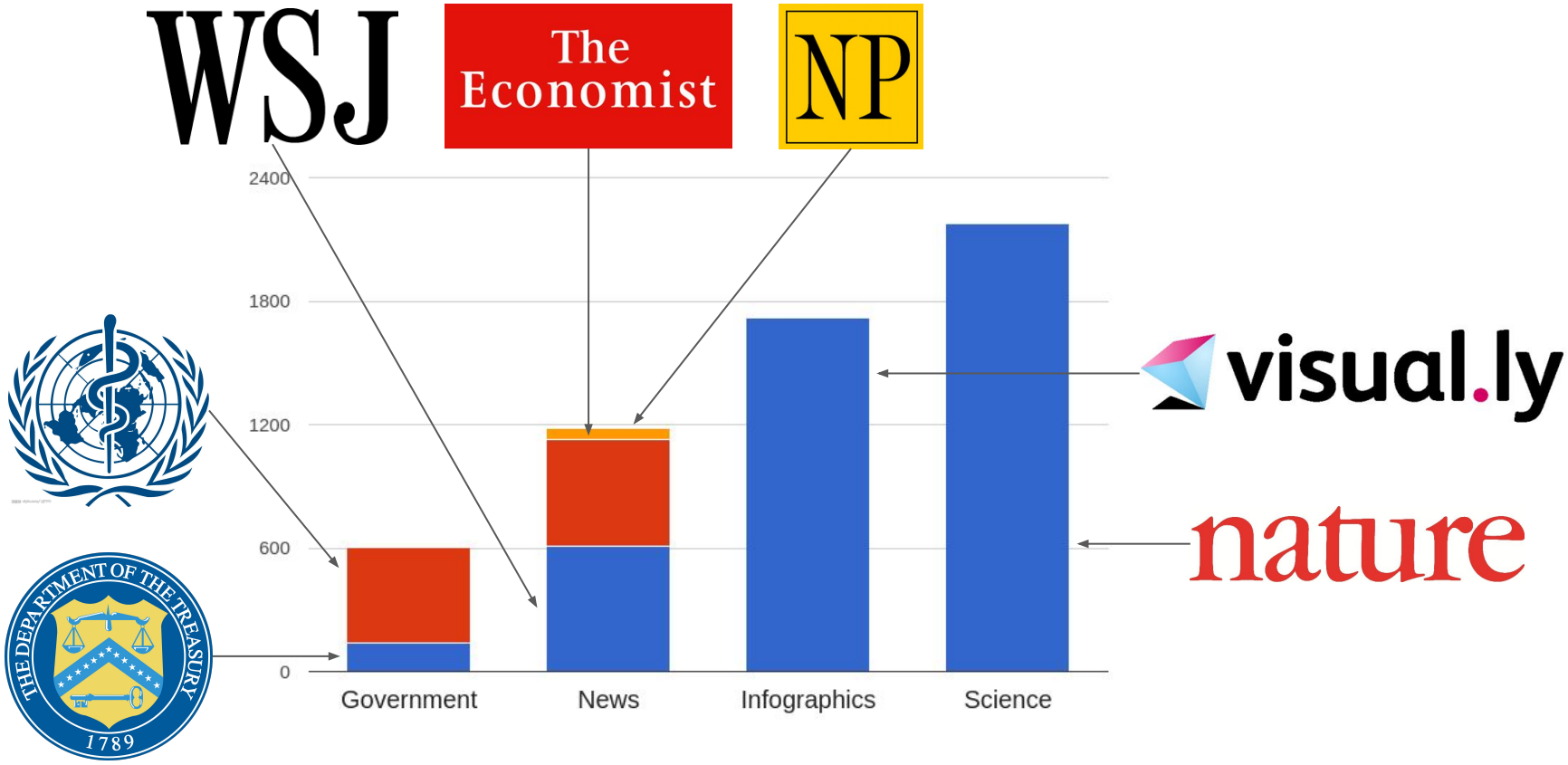




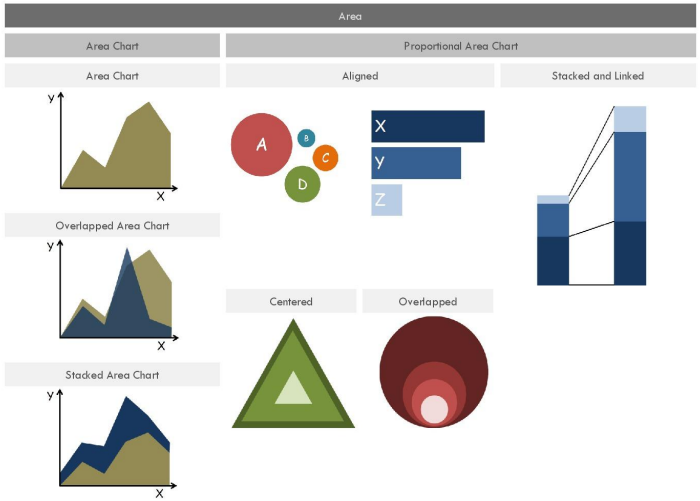


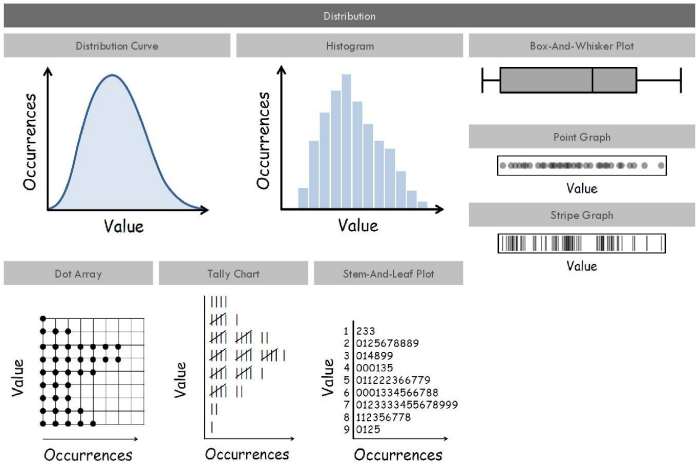
Data

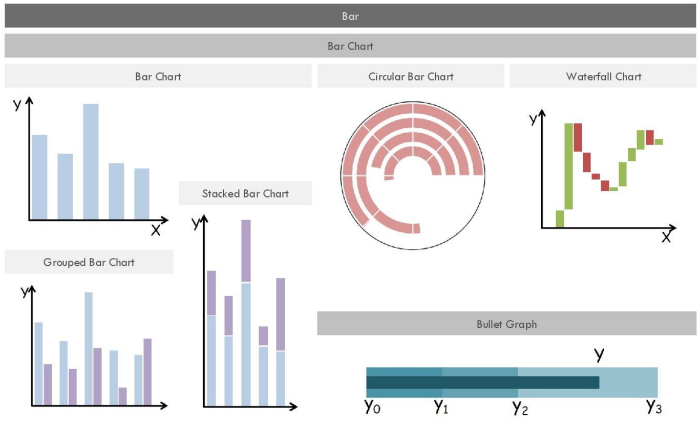

Government
Infographic
News
Science

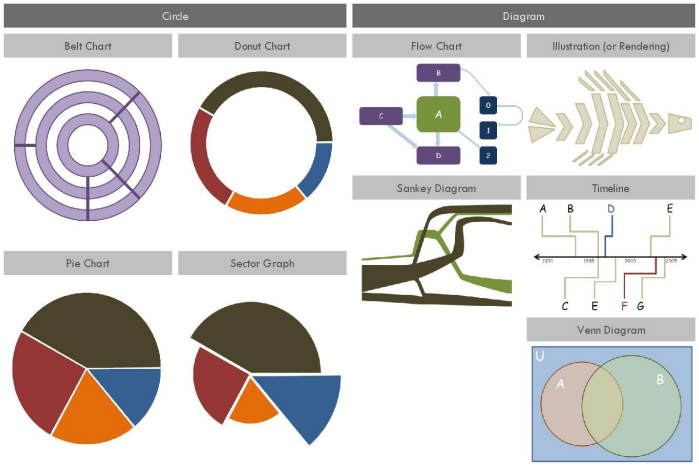

WSJ
The Economist
NP
2400
1800
1200
600
0
Government
News
Infographics
Science
visual.ly
nature
THE DEPARTMENT OF THE TREASURY
1789

“These particular web sites were chosen because each contained a large number of static visualizations that could be automatically scraped without requiring a large manual clean-up effort.”


Area
Area Chart
Proportional Area Chart
Area Chart
Aligned
Stacked and Linked
Overlapped Area Chart
Centered
Overlapped
Stacked Area Chart

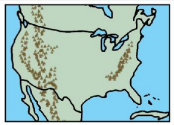

Distribution
Distribution Curve
Histogram
Box-And-Whisker Plot
Occurrences
Value
Point Graph
Stripe Graph
Dot Array
Tally Chart
Stem-And-Leaf Plot


Bar
Bar Chart
Bar Chart
Circular Bar Chart
Waterfall Chart
Stacked Bar Chart
Grouped Bar Chart
Bullet Graph


Circle
Diagram
Belt Chart
Donut Chart
Flow Chart
Illustration (or Rendering)
Sankey Diagram
Timeline
Pie Chart
Sector Graph
Venn Diagram

Map

Geographic Map

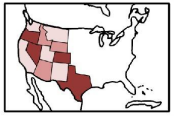


Flow Map

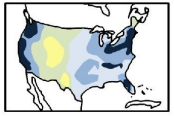
Street Map

Statistical Map

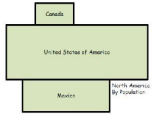
Choropleth Map



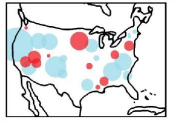
Contour Map (Isopleth)



Distorted Map (Cartogram)



Statistical Plot Map

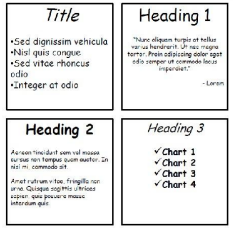


Table

Table

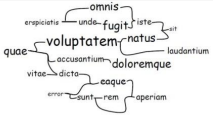
ABC	1234	X45
Category	543.2109	7%
Group	45.67	45%
Unit	9876	98%
Class	123.78	12%

Text Chart

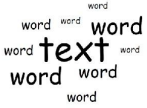


Text Based

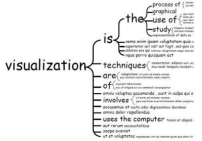
Phrase Net



Word Cloud



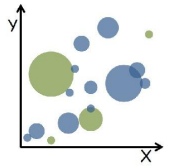
Word Tree



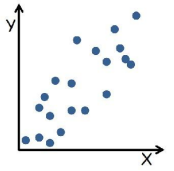
Point

Scatter Plot

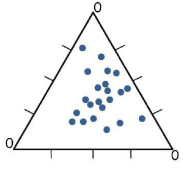
Bubble Chart



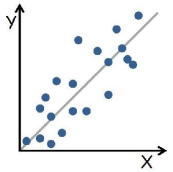
Scatter Plot



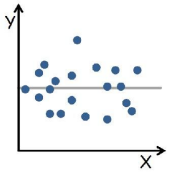
Trilinear Scatter Plot



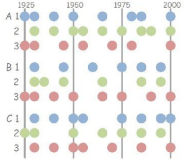
Trend Line



Residual Graph



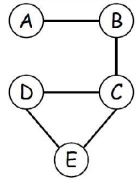
Dot Plot



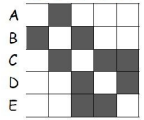
Tree and Network (Graph)

Tree and Network (Graph)

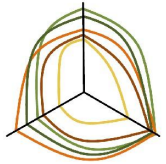
Graph



Matrix Representation

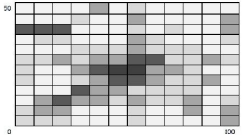


Hive Graph

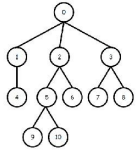


Grid / Matrix

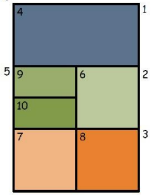
Heat Map



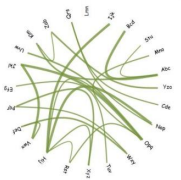
Tree



Treemap



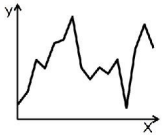
Hierarchical Edge Bundling



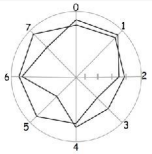
Line

Line Graph

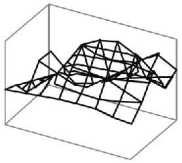
Line Graph



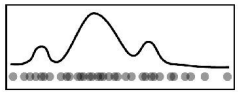
Circular Line Graph



Surface Graph

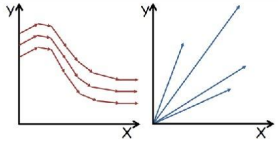


Density Plot

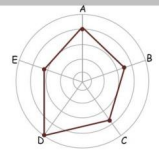


Surface Graph

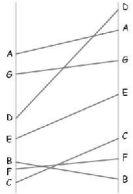
Vector Graph



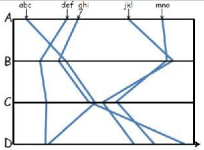
Star Plot



Slopegraph



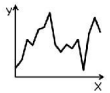
Parallel Coordinates



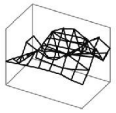
Properties

Dimensionality

2D

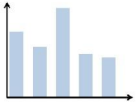


3D



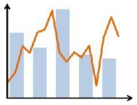
Multiplicity

Single

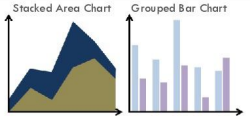


Multiple

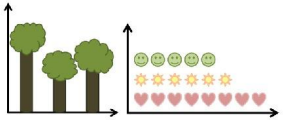
Combination



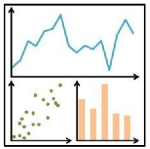
Grouped



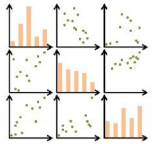
Pictorial



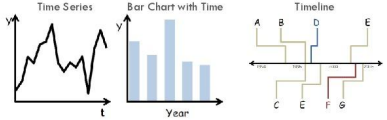
Multipanel

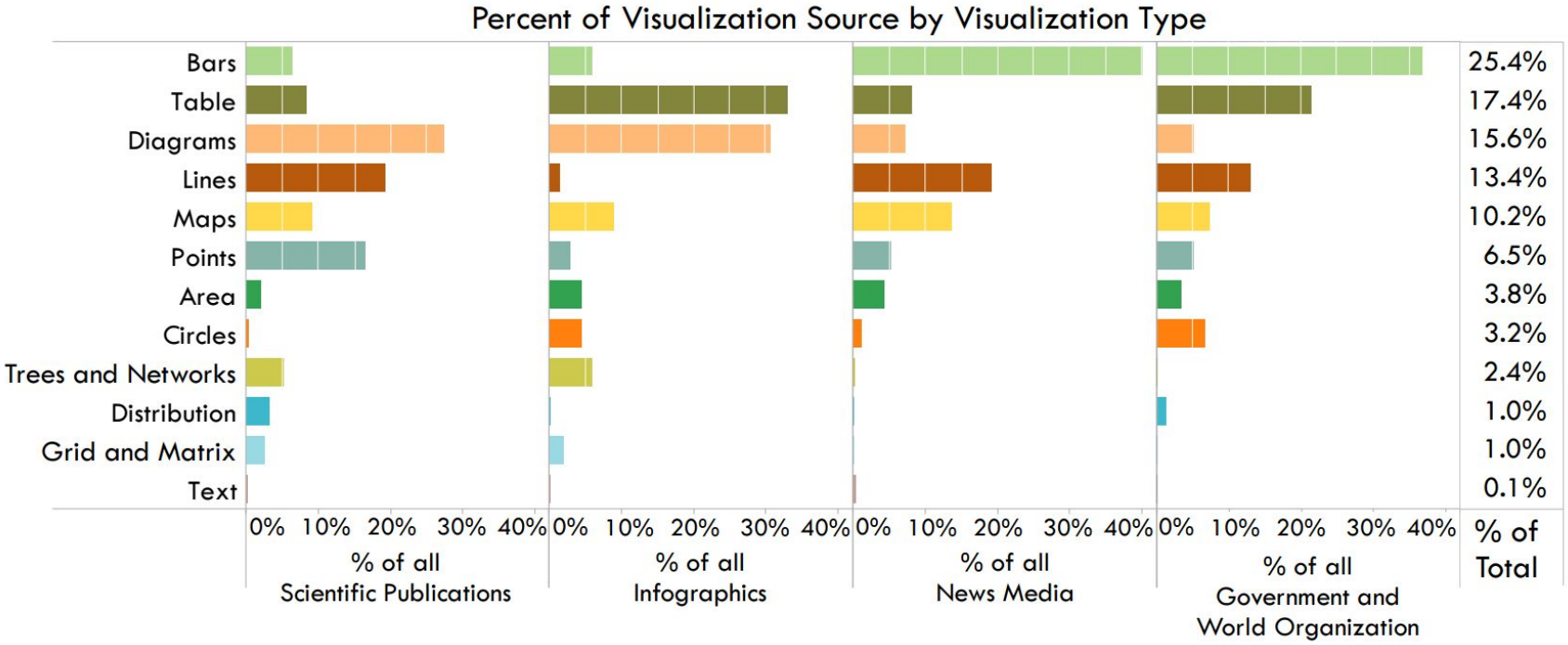


Small Multiples

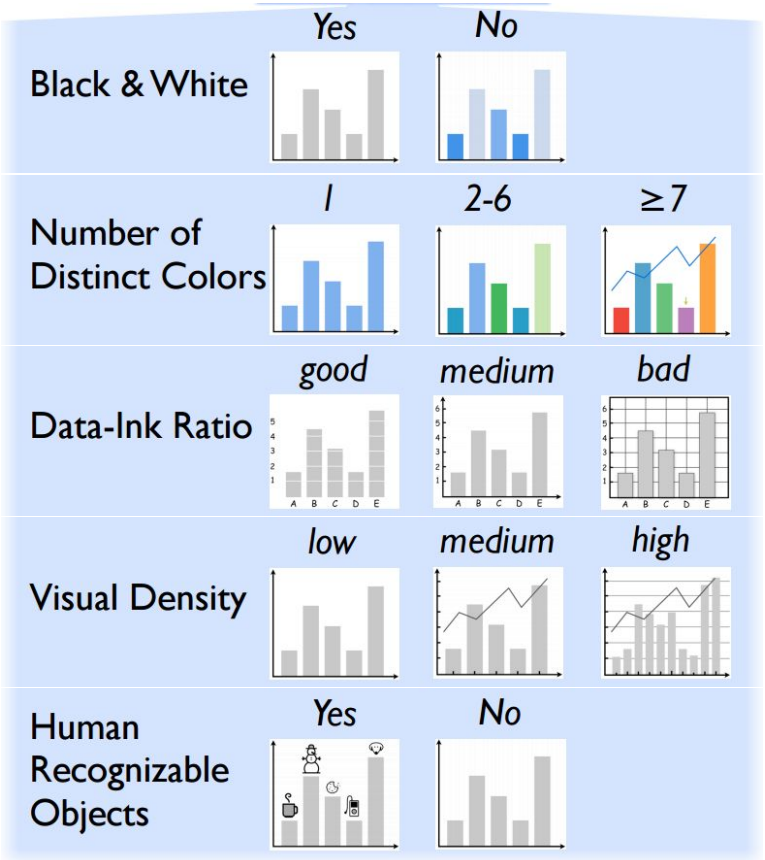


Time Component

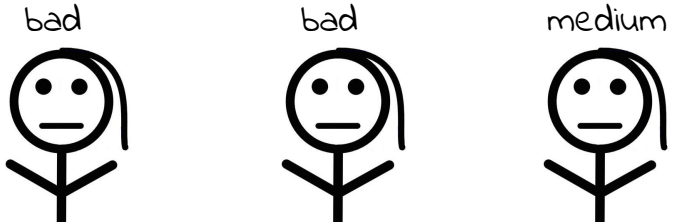




"The annotations were done by ten Harvard University undergraduates who had completed the Harvard introductory visualization course"

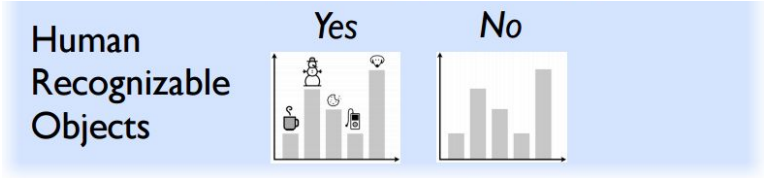


data-ink ratio? = bad

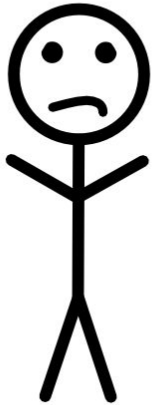


Results

A visualization is memorable if…

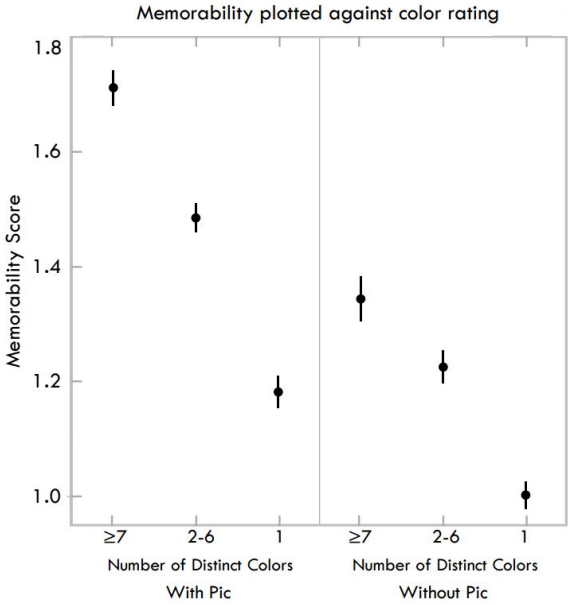


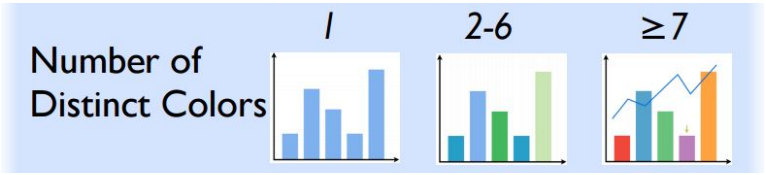
… it has a pictogram (M=1.93 vs. M=1.14)

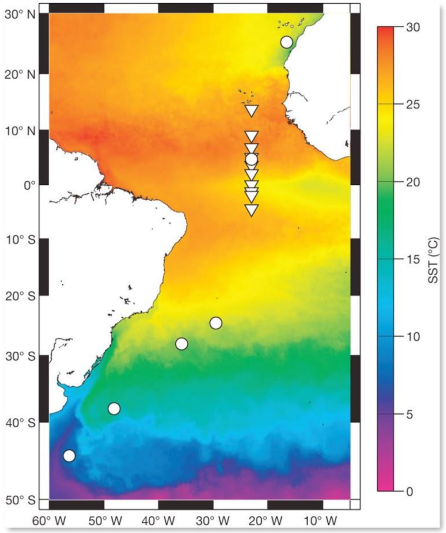


Thus, all results are presented with and without pictograms

… it is colorful







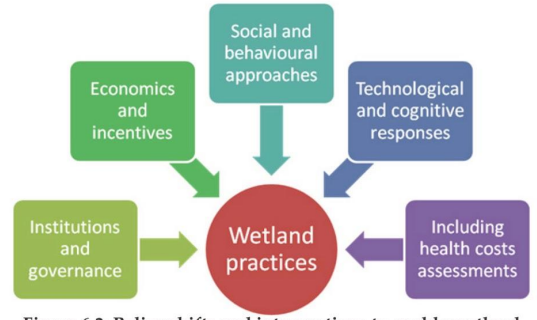
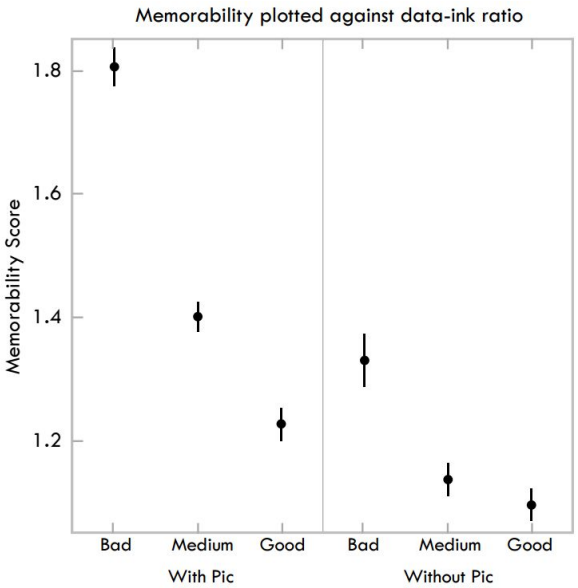
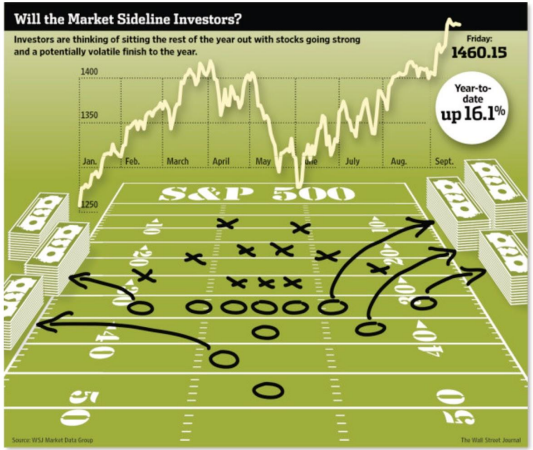
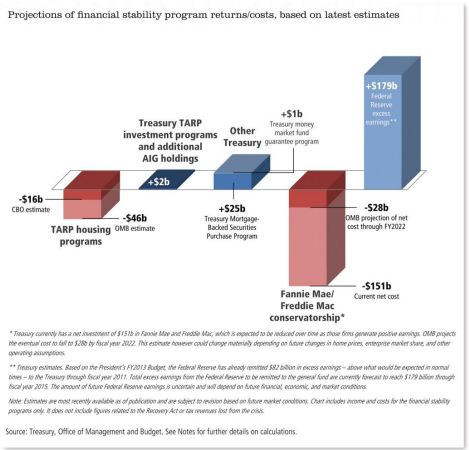


Figure 6.2: Policy shifts and interventions to enable wetland practices to accommodate notions of ecosystem services and human health

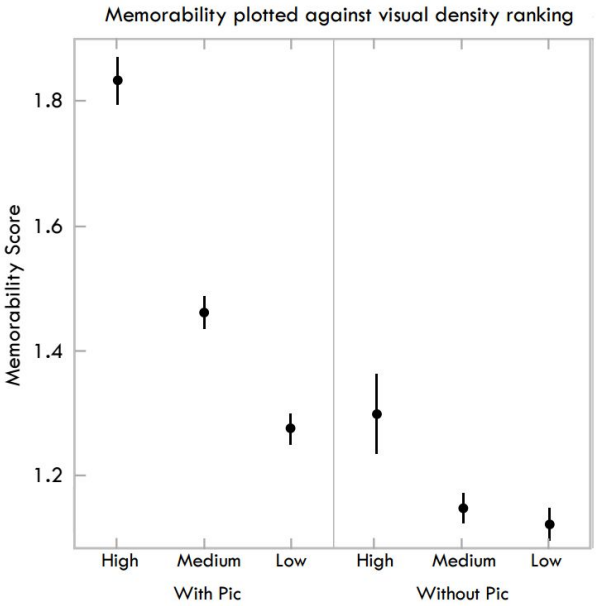
… it has *low* data-ink ratio

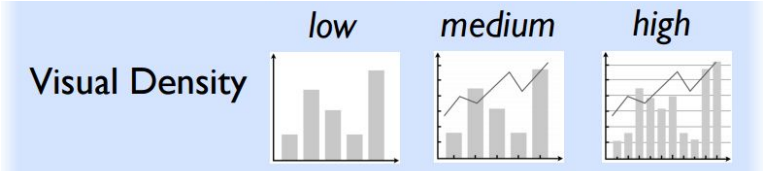


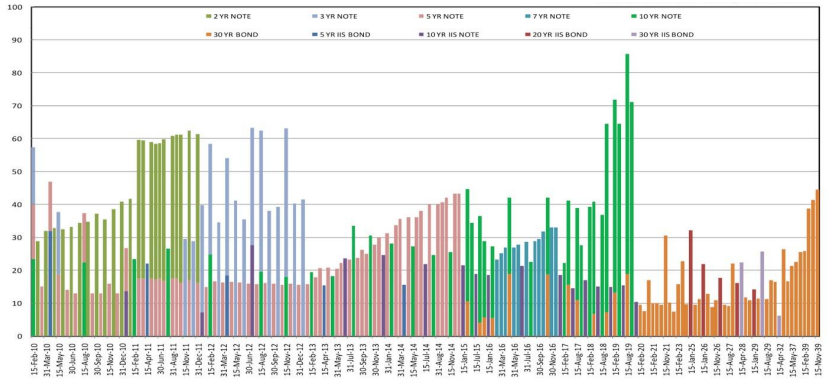




… it is visually dense



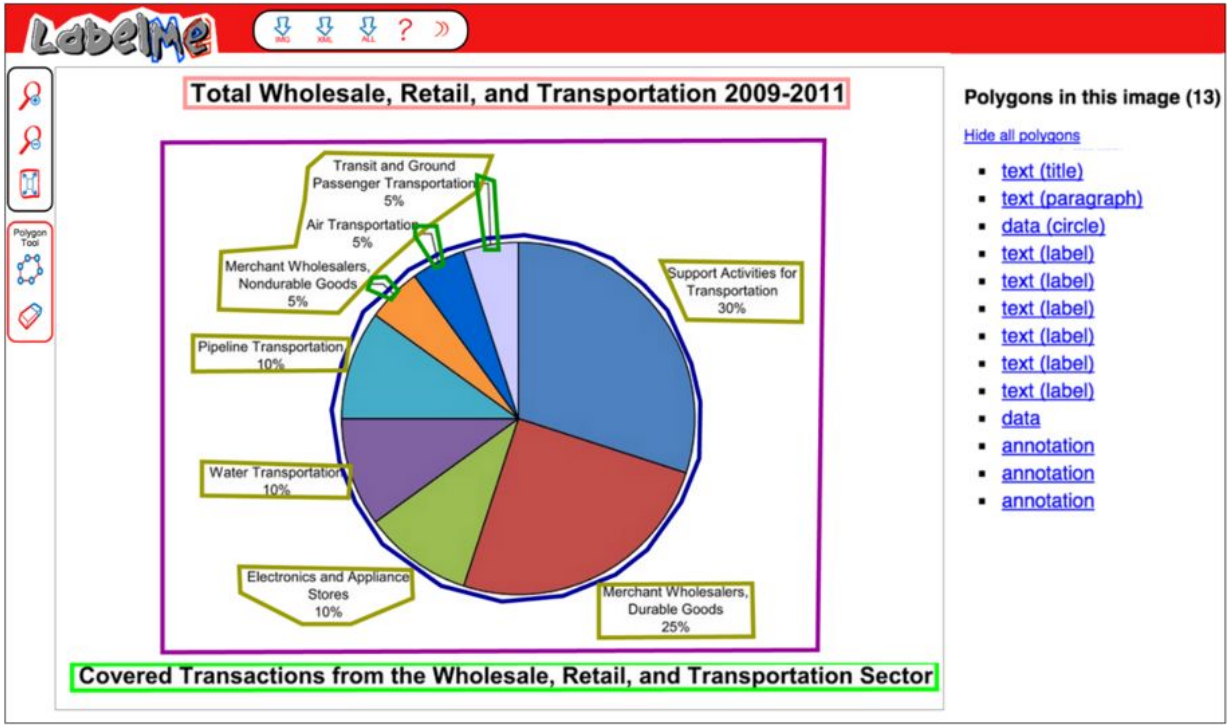


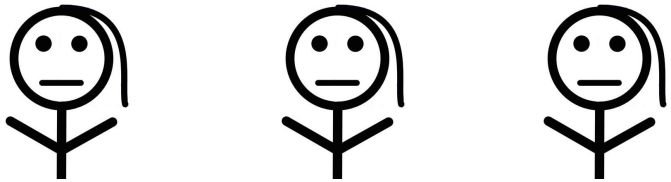


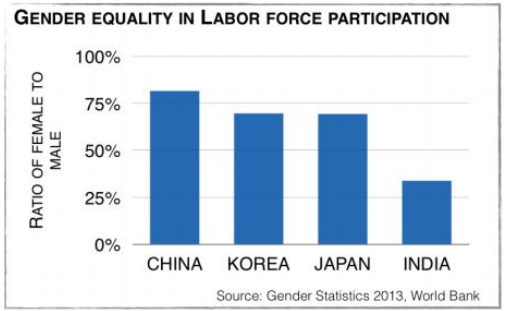
Some questions remain

- What visual elements do people use to
  - store into memory?
  - retrieve from memory?
- Does giving more time make a difference?
- What do people remember?

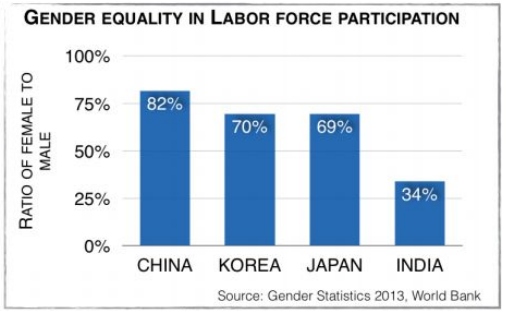
- Same data
- More labels
- Less participants (33)
- More time
- + Eye tracking
- + Word descriptions


LabelMe
Polygon Tool
Total Wholesale, Retail, and Transportation 2009-2011
Transit and Ground Passenger Transportation 5%
Air Transportation 5%
Merchant Wholesalers, Nondurable Goods 5%
Pipeline Transportation 10%
Water Transportation 10%
Electronics and Appliance Stores 10%
Support Activities for Transportation 30%
Merchant Wholesalers, Durable Goods 25%
Covered Transactions from the Wholesale, Retail, and Transportation Sector
Polygons in this image (13)
Hide all polygons
text (title)
text (paragraph)
data (circle)
text (label)
text (label)
text (label)
text (label)
text (label)
text (label)
data
annotation
annotation
annotation

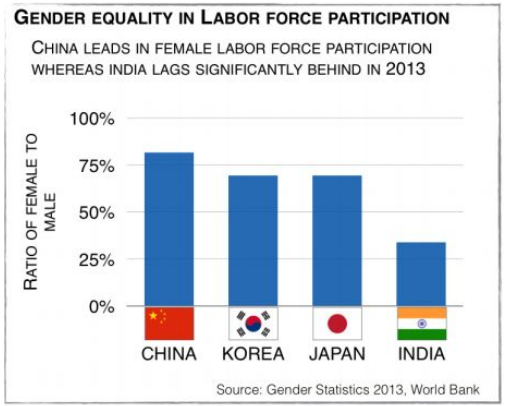




ORIGINAL

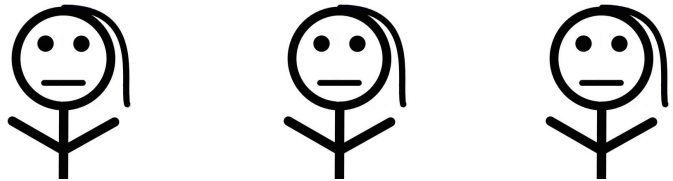


DATA REDUNDANCY

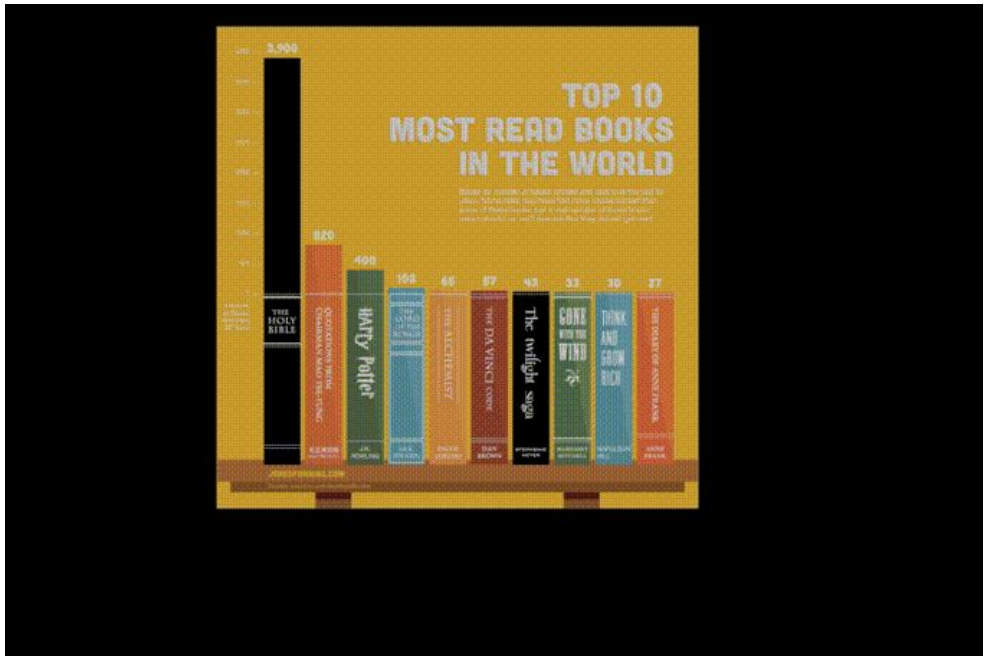


MESSAGE REDUNDANCY

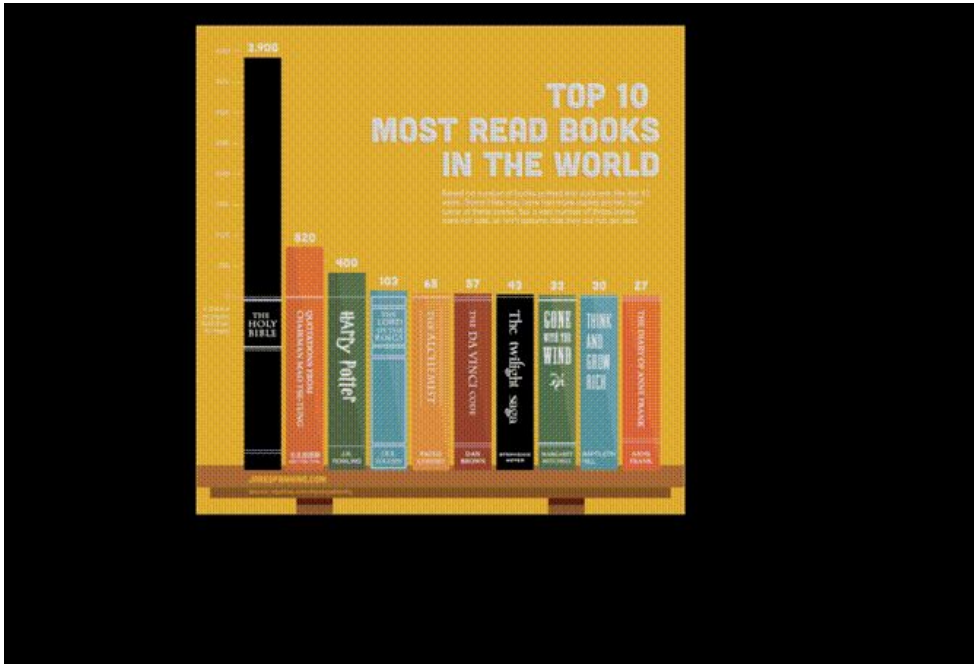
DATA & MESSAGE REDUNDANCY



Step 1: Encode

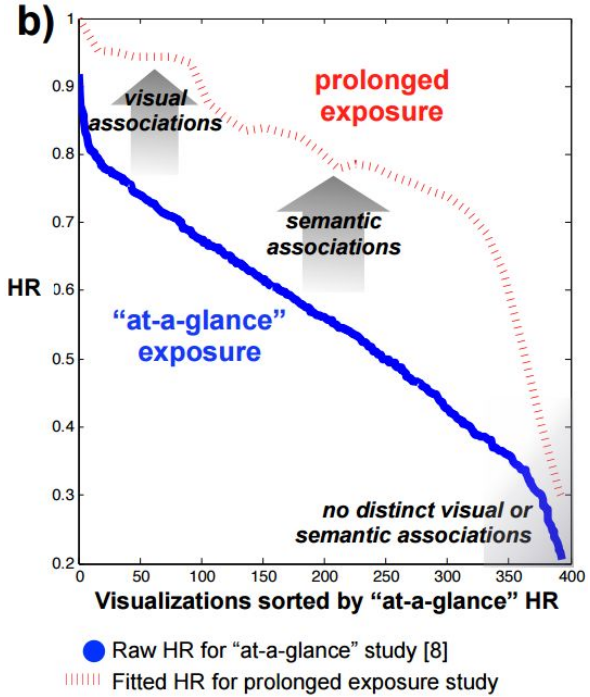


Step 2: Recognize



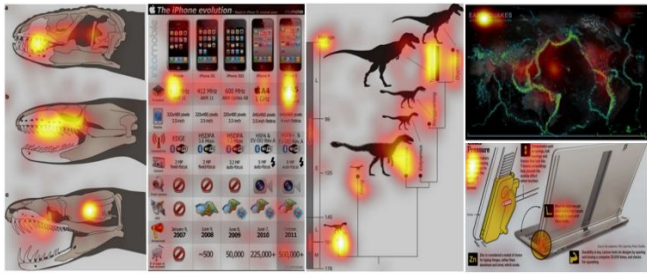
Step 3: recall

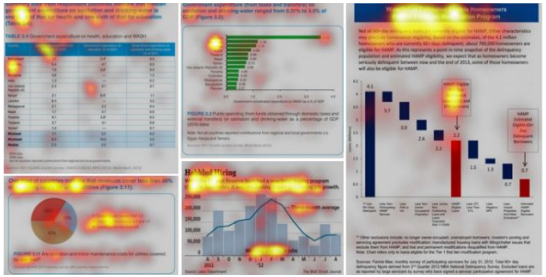
Does giving more time make a difference?



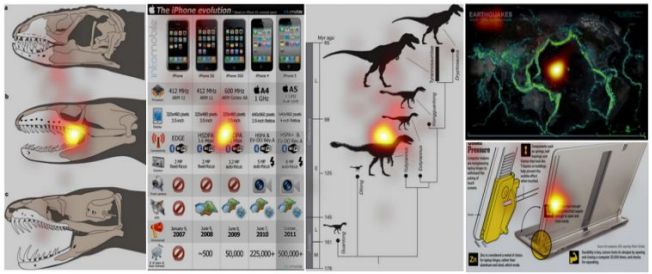
What do people look at?

Encoding





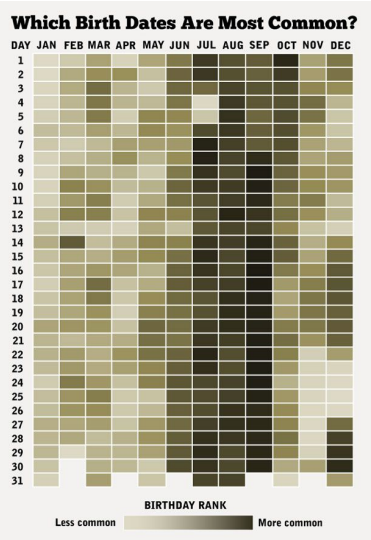
Recognition



Most recognizable

Least recognizable

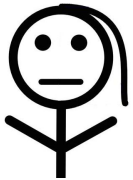
Evaluating recall

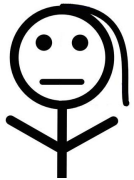


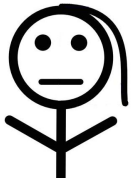
“Percent of people born on each day of the year. X-axis is month Y-axis is day. Most popular birthdays are in late summer and early fall.”

“this was a chart of most common birthdays. the darker the color the more common the birthday. september was the darkest month”

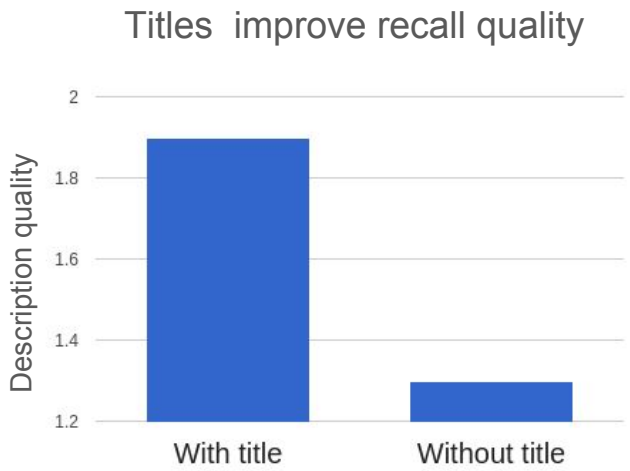
- Quality was rated from 0 to 3
  - 0 → incorrect or incoherent
  - 3 → visualization topic, what data or information is presented in the visualization, the main message of the visualization, and one additional specific detail about the visualization



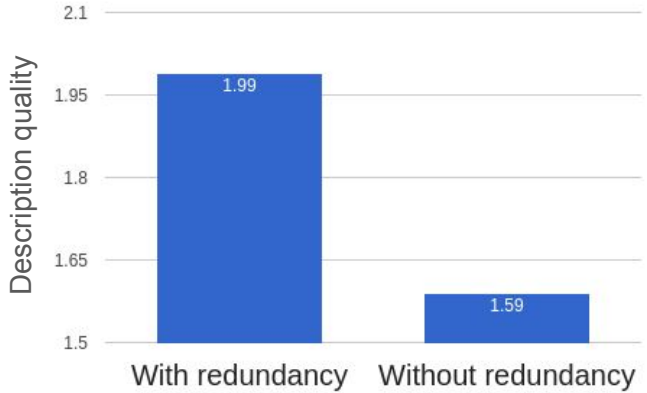




Titles help!



So does redundancy!



Strengths and weaknesses

Strengths

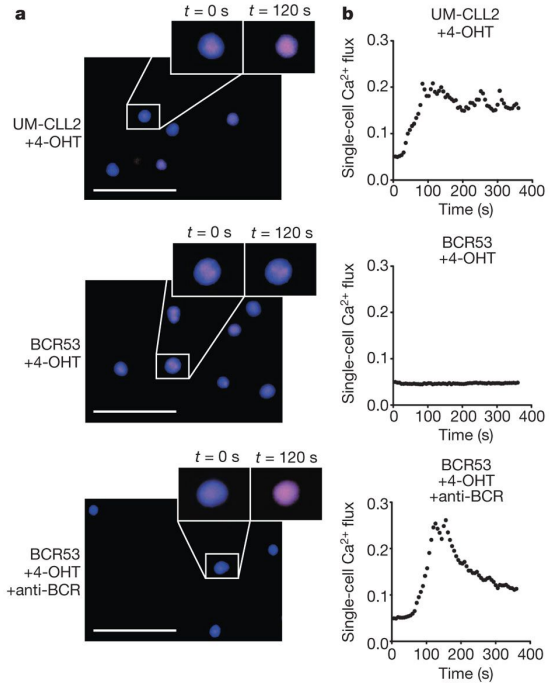
- First dataset of its kind
- High quality, transparent research. All the data is available online.
- Props for collecting verbal descriptions of visualizations → machine learning (:

a group of people sitting around a table with laptops
`logprob: -5.85`

a man flying a kite in a field
`logprob: -6.13`

Weaknesses

- Data is very skewed
- Who would think tables are memorable?
- Infographics != infovis
- Maybe scientific visualizations are inherently harder to understand



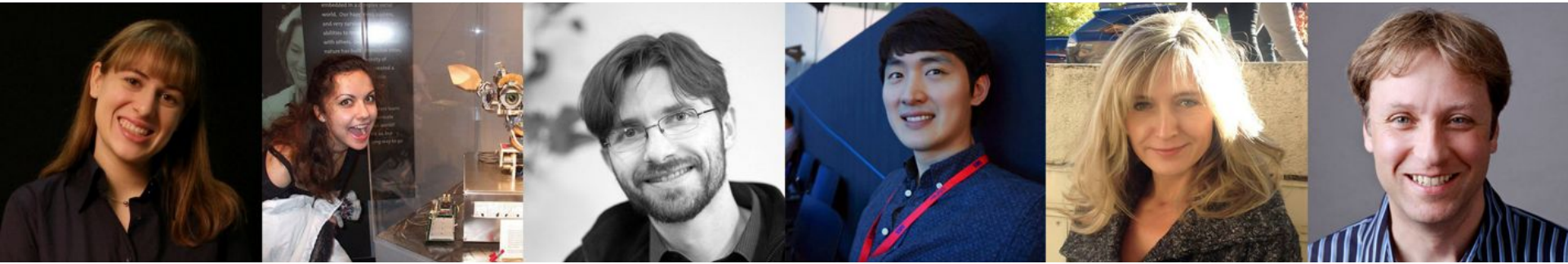
HAMP Activity by State

State	Active Trials	Permanent Modifications	State Total[1]	% of U.S. HAMP Activity	State	Active Trials	Permanent Modifications	State Total[1]	% of U.S. HAMP Activity
AK	40	366	406	0.0%	MT	72	951	1,023	0.1%
AL	383	4,549	4,932	0.6%	NC	1,238	14,764	16,002	1.8%
AR	142	1,774	1,916	0.2%	ND	6	123	129	0.0%
AZ	1,640	33,869	35,509	4.0%	NE	111	1,103	1,214	0.1%
CA	14,822	212,769	227,591	25.4%	NH	310	3,679	3,989	0.4%
CO	841	11,635	12,476	1.4%	NJ	2,500	26,693	29,193	3.3%
CT	976	10,471	11,447	1.3%	NM	283	2,708	2,991	0.3%
DC	119	1,445	1,564	0.2%	NV	1,097	19,222	20,319	2.3%
DE	196	2,427	2,623	0.3%	NY	4,523	40,725	45,248	5.0%
FL	8,232	100,435	108,667	12.1%	OH	1,507	17,348	18,855	2.1%
GA	2,322	29,931	32,253	3.6%	OK	183	1,905	2,088	0.2%
HI	302	3,155	3,457	0.4%	OR	758	9,134	9,892	1.1%
IA	145	1,979	2,124	0.2%	PA	1,548	16,703	18,251	2.0%
ID	211	3,175	3,386	0.4%	RI	281	4,059	4,340	0.5%
IL	3,332	43,459	46,791	5.2%	SC	617	7,522	8,139	0.9%
IN	639	7,683	8,322	0.9%	SD	22	292	314	0.0%
KS	171	1,920	2,091	0.2%	TN	759	8,270	9,029	1.0%
KY	270	2,988	3,258	0.4%	TX	2,043	22,094	24,137	2.7%
LA	427	4,567	4,994	0.6%	UT	390	7,659	8,049	0.9%
MA	1,810	19,880	21,690	2.4%	VA	1,473	19,652	21,125	2.4%
MD	2,022	26,277	28,299	3.2%	VT	66	696	762	0.1%
ME	224	2,275	2,499	0.3%	WA	1,483	17,208	18,691	2.1%
MI	1,558	25,531	27,089	3.0%	WI	673	7,788	8,461	0.9%
MN	846	13,291	14,137	1.6%	WV	92	1,097	1,189	0.1%
MO	732	8,104	8,836	1.0%	WY	29	400	429	0.0%
MS	211	2,886	3,097	0.3%	Other[2]	186	3,025	3,211	0.4%

[1] Total reflects active trials and active permanent modifications.
[2] Includes Guam, Puerto Rico and the U.S. Virgin Islands.

Beyond Memorability: Visualization Recognition and Recall

Borkin, M., Bylinskii, Z., Kim, N.W., Bainbridge C.M., Yeh, C.S., Borkin, D., Pfister, H., & Oliva, A.
IEEE Transactions on Visualization and Computer Graphics, 2015



Presented by Julieta Martinez