

Taming Treacherous Data | DHSI 2019

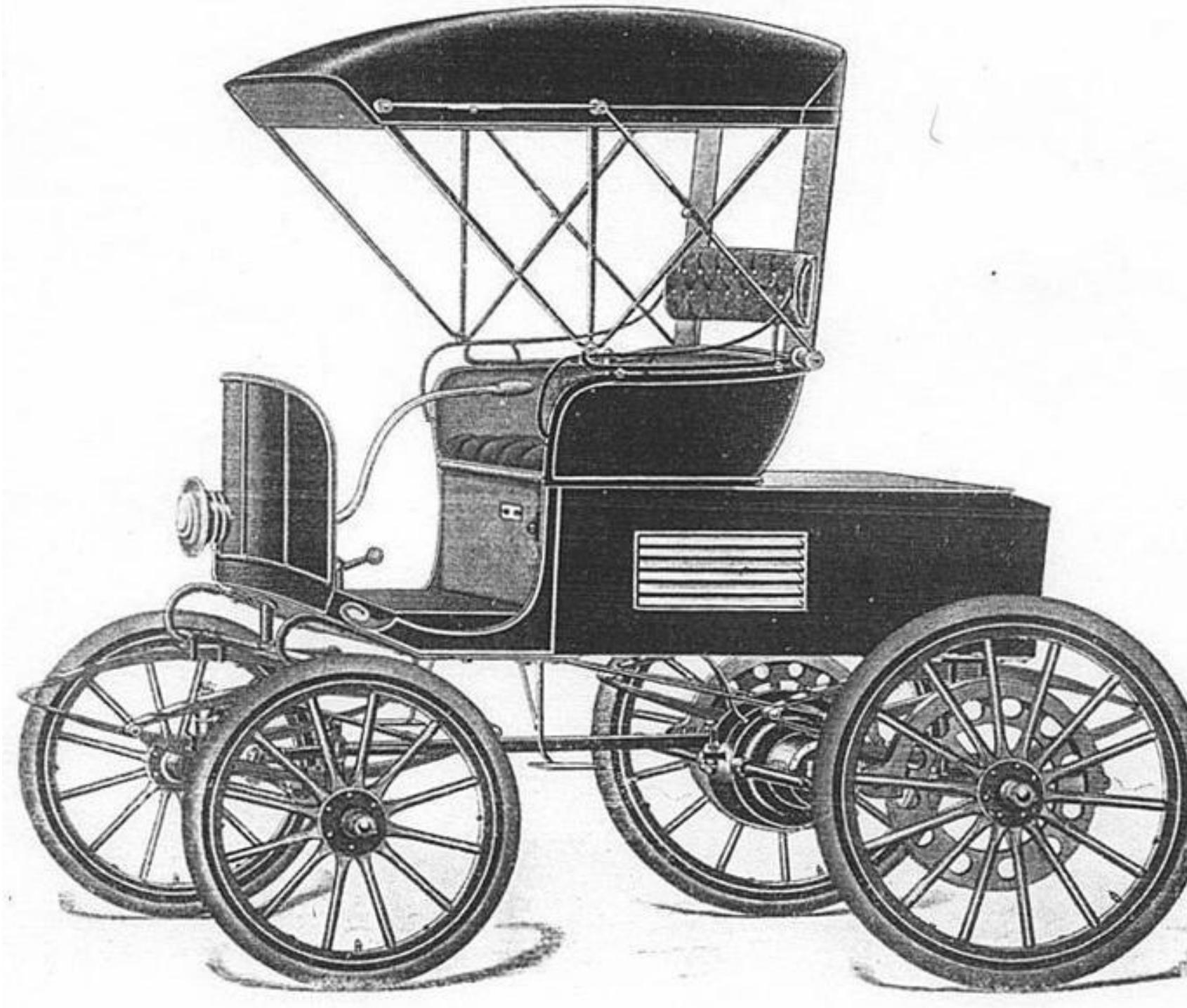
# Introduction to Data Visualization

## A FEW DEFINITIONS

The graphic design community mostly uses two terms for the visual displays of information: **infographics** and **information design**. In a nutshell, infographics stand for visual displays in which graphics (illustrations, symbols, maps, diagrams, etc) together with verbal language communicate information that would not be possible otherwise. Infographics can range from early scientific illustrations of the human body to modern representations of how the brain functions, from early route maps and train schedules to the emblematic London subway map. Journalism as well as technical and pedagogical books employ established practices that traditionally have used infographics to explain complex information and tell stories. From the familiar weather map to visual explanations of natural phenomena and recent facts, infographics help us better understand the news around us.

*Isabel Meirelles, “Design for Information”*

Information visualization is a set of technologies that use visual computing to **amplify human cognition** with abstract information. [ . . . ]



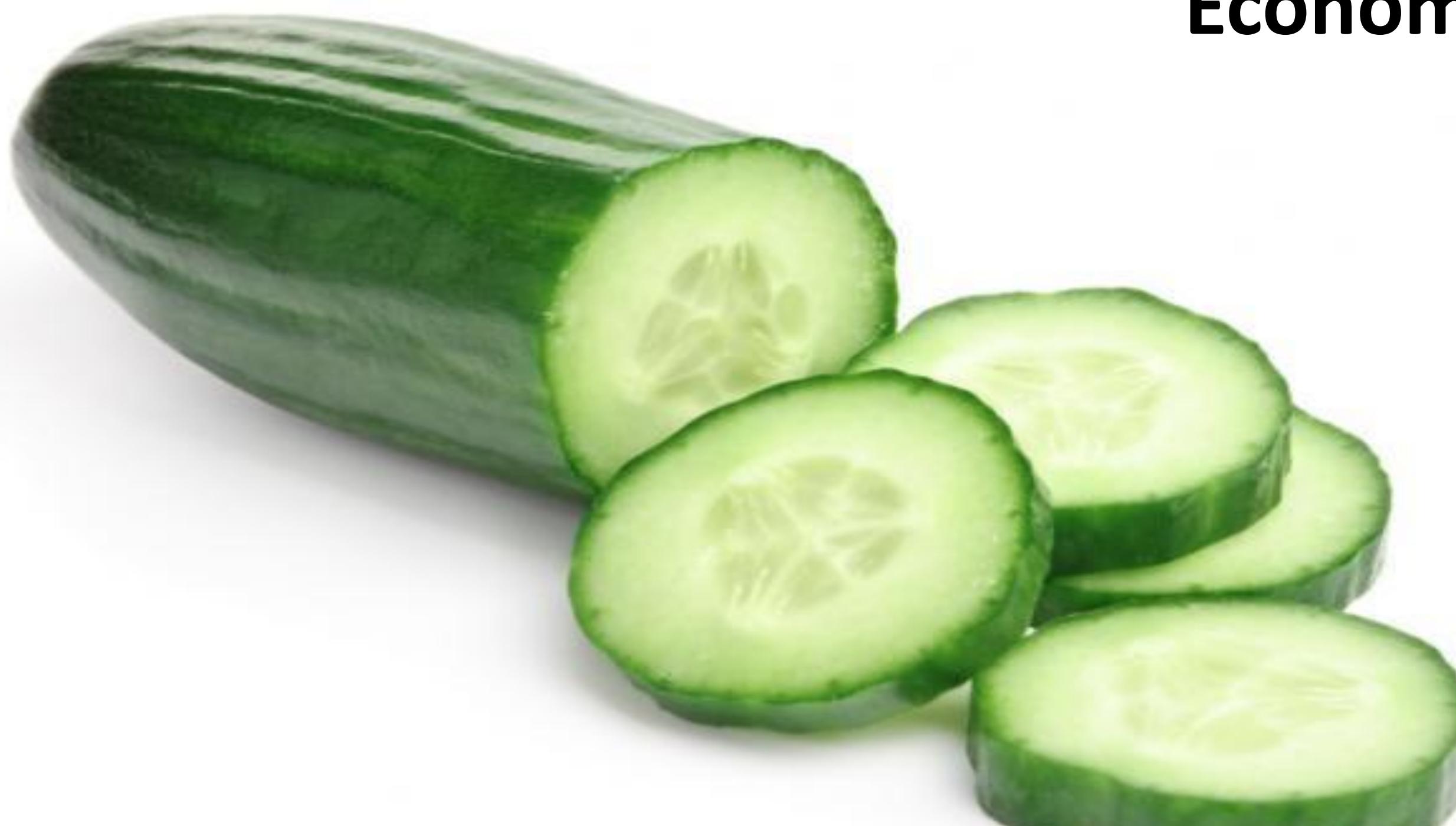
Information visualizations should *do for the mind what automobiles do for the feet.*

- Stuart Card, The Human-Computer Interaction Handbook, 539-542

Why Visualize  
Data?

“Getting information from a table  
is like extracting **sunbeams** from a  
**cucumber”**

*misquote of A. Farquar and H. Farquar,  
Economic and Industrial Delusions, 1891*



		QUANTITÉS produites.	PRIX.	VALEUR.
		tonnes.	fr. c.	fr.
Combustibles minéraux.	Houille . . . . .	15,854,445	16 40	259,647,648
	Anthracite et lignite . . .	1,238,168	13 »	16,133,563
	Tourbe . . . . .	295,827	11 70	3,454,464
Mines et minières	de fer. . . . .	2,574,227	6 80	17,432,562
	de plomb . . . . .	8,977	358 50	3,217,976
	de cuivre . . . . .	1,244	244 40	253,883
	de zinc . . . . .	1,665	56 50	94,050
Métallurgie de fer.	{ brute . . . . .	1,276,683	133 30	170,142,027
	Fonte { de 1 <sup>e</sup> fusion . . .	95,812	229 30	21,972,639
	{ de 2 <sup>e</sup> et 3 <sup>e</sup> fusions .	285,270	330 60	95,413,946
	Fer marchand, rails. . .	818,933	315 90	258,827,560
	Tôles et fers-blancs. . .	135,053	461 40	62,443,262
Production des métaux autres que le fer.	Aciers, rails . . . . .	198,413	421 »	83,643,261
	Plomb . . . . .	23,651	562 20	13,296,394
	Cuivre et laiton. . . . .	27,028	2,488 90	67,269,473
	Zinc . . . . .	40,530	665 30	26,965,500
	Argent . . . . .	220,000	»	10,054,880
	Or . . . . .	3,400,000	»	2,405,500
	Nickel . . . . .	8,000	»	204,000

		QUANTITÉS produites.	PRIX.	VALEUR.
		tonnes.	fr. c.	fr.
Préparation et transformation des substances minérales	Porcelaine { ordinaire . .	»	» »	17,386,430
	{ opaque . . .	»	» »	15,238,350
	Faience. . . . .	»	» »	12,171,380

**PURPOSE 1**

**Visualization for analysis**

## LISTE N° 96 M

NOMS DES SOUSCRIPTEURS	QUALITES
Alexandre S. 1856.	Mari
Ch. Dubois	Br
H. Gougeau	Adjoint à
Gauthier	Cultiv
6. Brochard.	Cultiv
F. H. L. 1856	Pg
P. B. Luczecau	Cire
A. Haéronneau	44
Thibaut	6° en
D. Dart	Cultivo
J. P. Guérard	com
L. Pélanc	Br
J. P. Guérard	Br
J. P. Guérard	Br
Guérard	fr
Off. d. Courir.	Per
L. Caudelle	Per
Anonyme . . .	Per
charmeur père à Pielle	Per

— M. H. Veron-Magot, négociant en vins de Champagne à Avize, 10 fr. 05. — Collecte dans un banquet républicain à Chuny (Saône-et-Loire), 5 fr. 94. — Collecte dans la commune de Saponcourt (Haute-Saône), 9 fr. 90. — Collecte dans la commune de Beuliette (Haute-Saône), 7 fr. — MM. Deutz et Geidermann à Ay (Champagne), 25 fr. — Souscription du Régional de l'Oise (1<sup>re</sup> liste), 250 fr. — Association amicale des auditeurs diplômés des cours Bamberger, 19, rue Blanche (souscription des sociétaires), 25 fr. — Le conseil municipal de Lyon (vote dans la séance du 25 juillet), 1.500 fr. — La commune de Naverne (Haute-Saône) (souscription), 23 fr. 76. — L'école municipale Gotbert, 27 rue Château-Landon, 10 fr.



Geo-located donations plotted<sup>20</sup> within France using Gephi

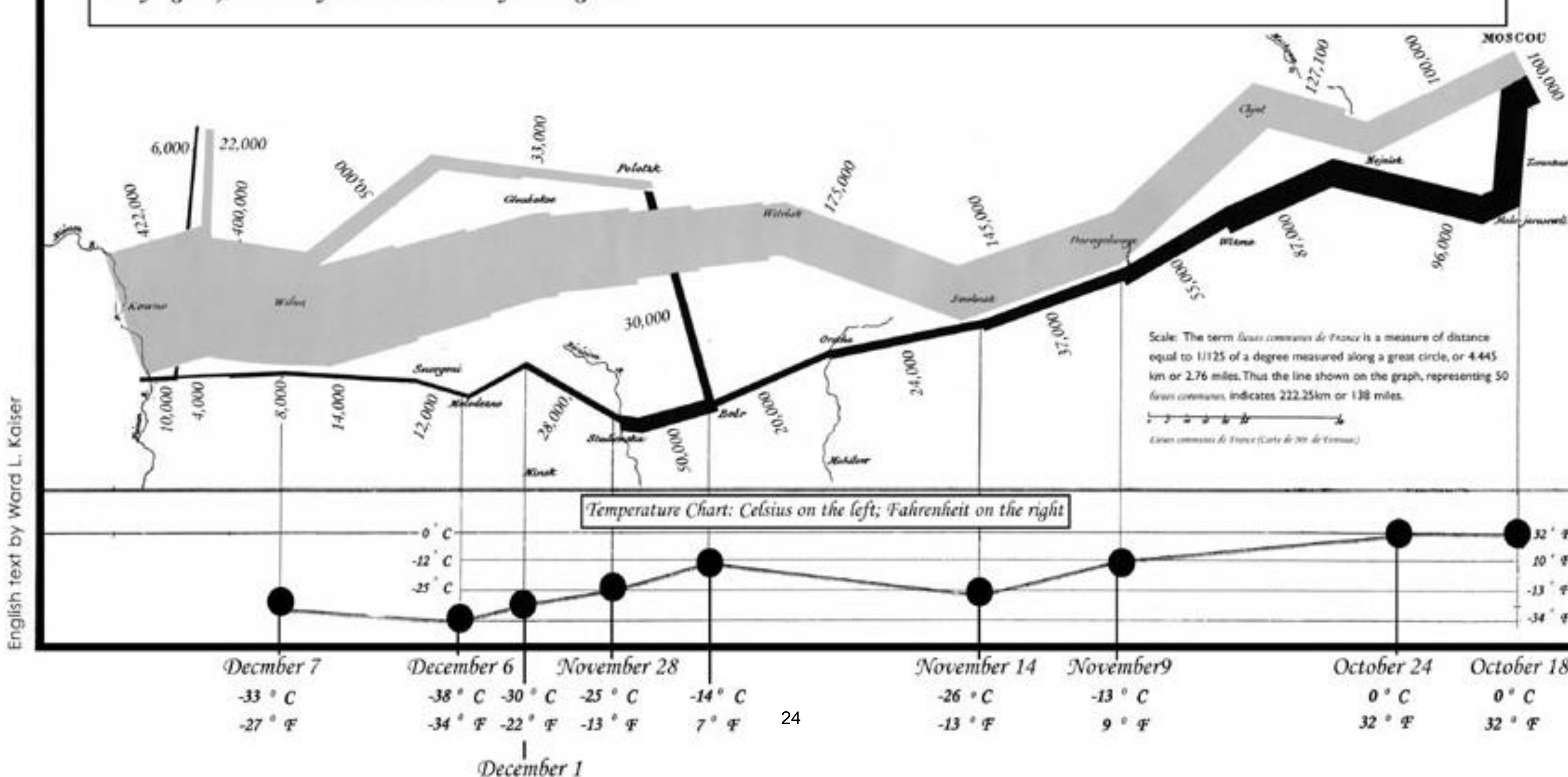
## PURPOSE 2

Visualization for  
sharing knowledge

*Map representing the losses over time of French army troops during the Russian campaign, 1812-1813.  
Constructed by Charles Joseph Minard, Inspector General of Public Works retired.*

Paris, 20 November 1869

*The number of men present at any given time is represented by the width of the grey line; one mm. indicates ten thousand men. Figures are also written besides the lines. Grey designates men moving into Russia; black, for those leaving. Sources for the data are the works of messrs. Thiers, Segur, Fezensac, Chambray and the unpublished diary of Jacob, who became an Army Pharmacist on 28 October. In order to visualize the army's losses more clearly, I have drawn this as if the units under prince Jerome and Marshall Davoust (temporarily separated from the main body to go to Minsk and Mikilow, which then joined up with the main army again), had stayed with the army throughout.*

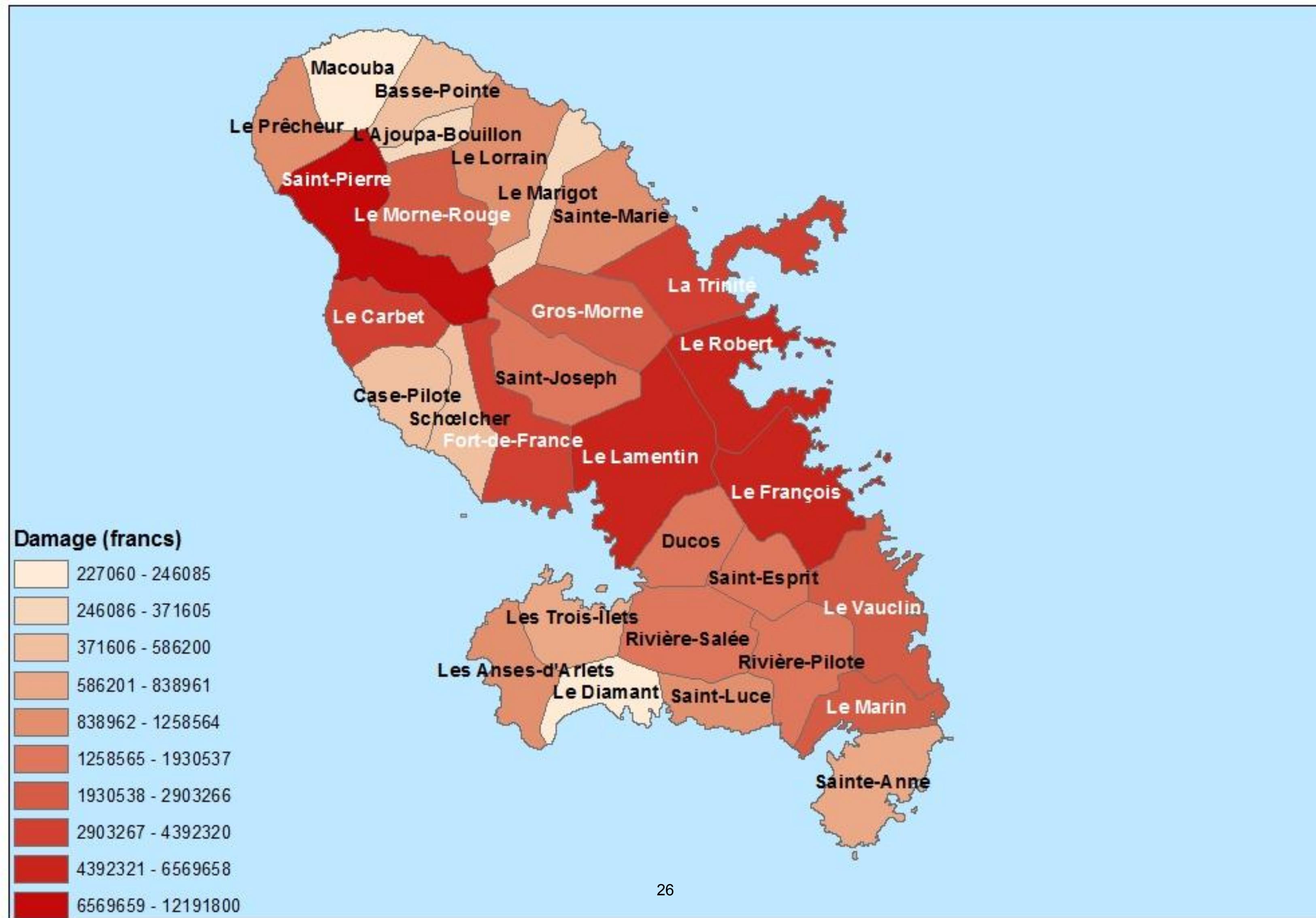


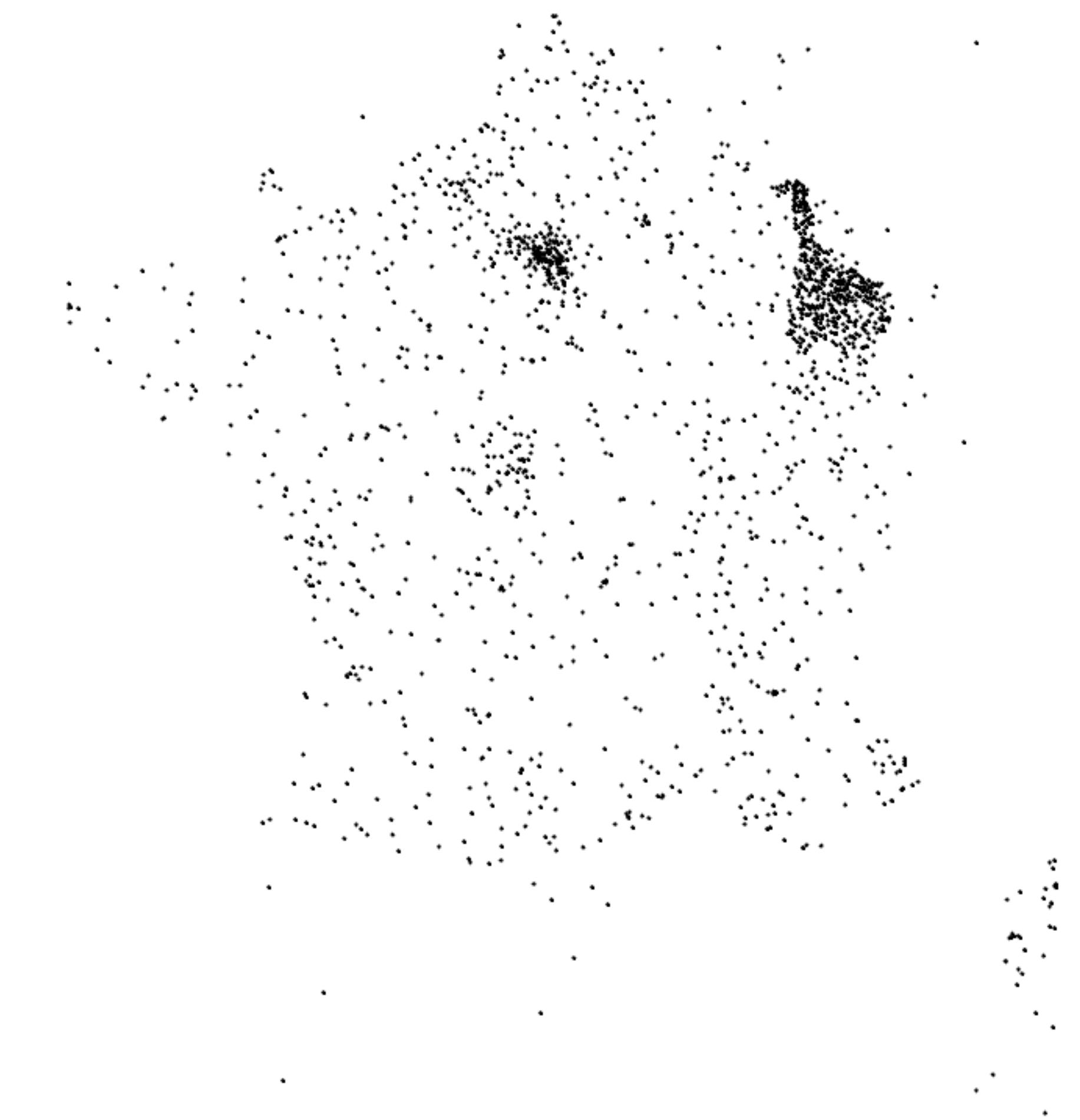
COMMUNE	FRANCS
<b>Saint Pierre</b>	12,191,800
<b>Lamentin</b>	6,569,658
<b>Le Francois</b>	5,665,200
<b>Le Robert</b>	5,407,100
<b>Fort-de-France</b>	4,392,320
<b>La Trinite</b>	4,166,756
<b>Gros-Morne</b>	2,903,266
<b>Marin</b>	2,658,720
<b>Vauclin</b>	2,386,000
<b>Morne-Rouge</b>	2,357,000

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**Damage by Commune (Top 10)**  
Martinique, 1891 Hurricane

## Total Damage by Commune (1891 Hurricane)





Geo-located donations plotted<sup>27</sup> within France using Gephi

**OTHER PURPOSES**

**Art**

**Decoration**

**Personal expression**

**NOT COVERED HERE**

# Vocabulary of Forms

# Lines

# The Long-term Future of Hits from 2013

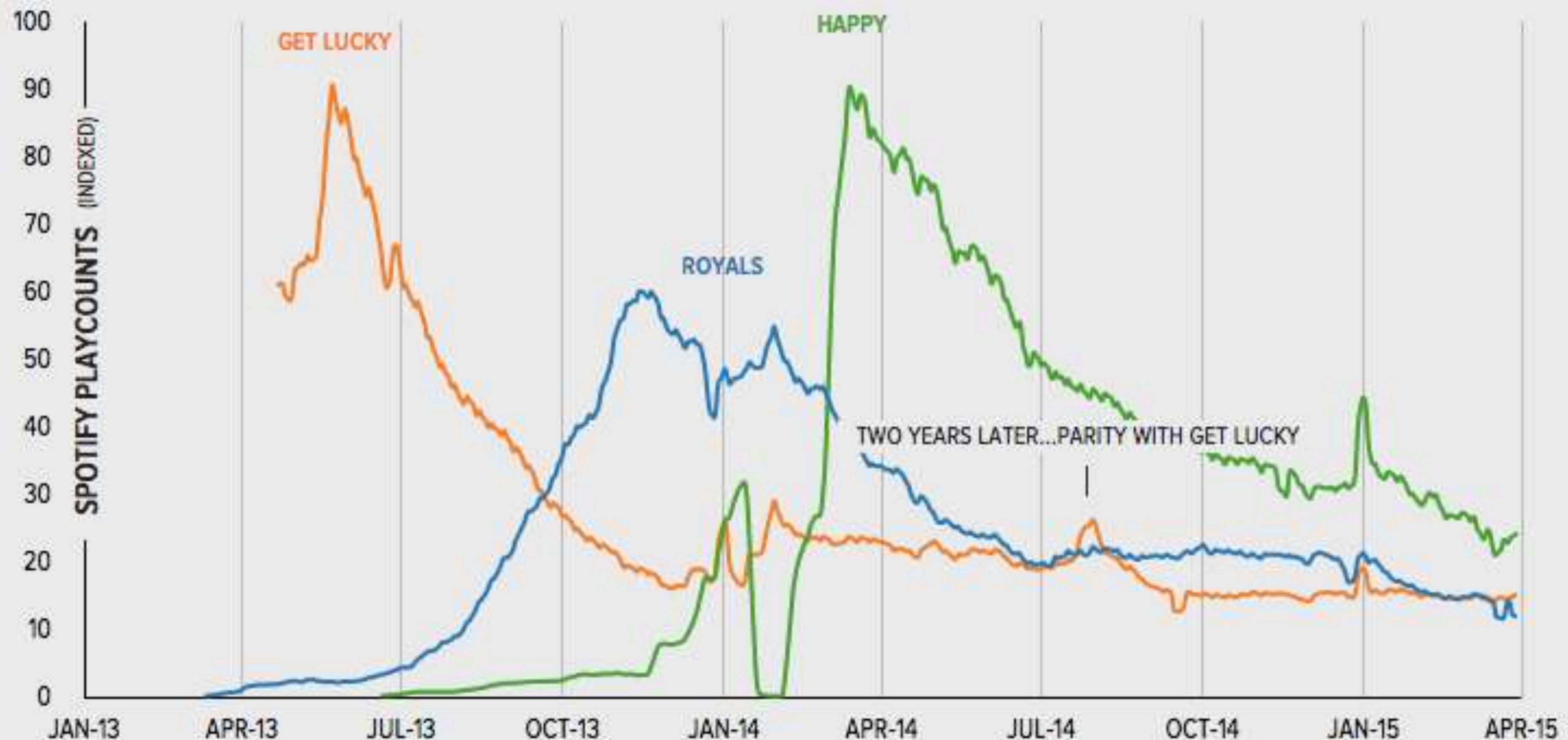
## GROWTH, DECAY-RATE OF 2013-RELEASED TRACKS ON SPOTIFY

TRACKS WERE OFFICIALLY RELEASED IN 2013.

FIND A TRACK:

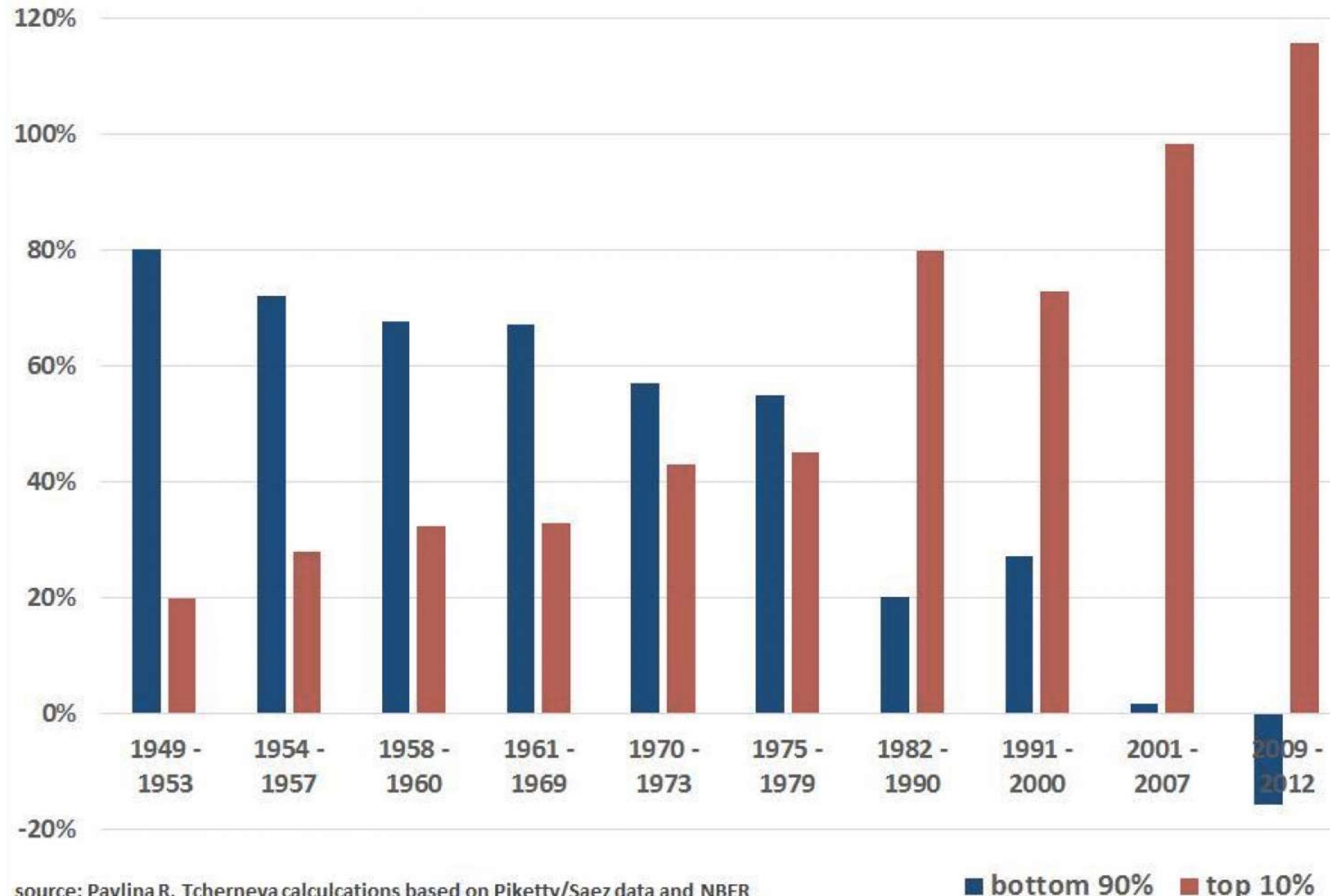
Clear All

- Lorde - Royals
- Daft Punk - Get Lucky...
- OneRepublic - Counting...
- Lana Del Rey - Young a...
- Avicii - Wake me up...
- Robin Thicke - Blurred...
- Pink - Just Give Me a ...
- Calvin Harris - I Need...
- Justin Timberlake - Mi...
- Bastille - Pompeii...
- Bruno Mars - When I Wa...
- Miley Cyrus - We Can't...

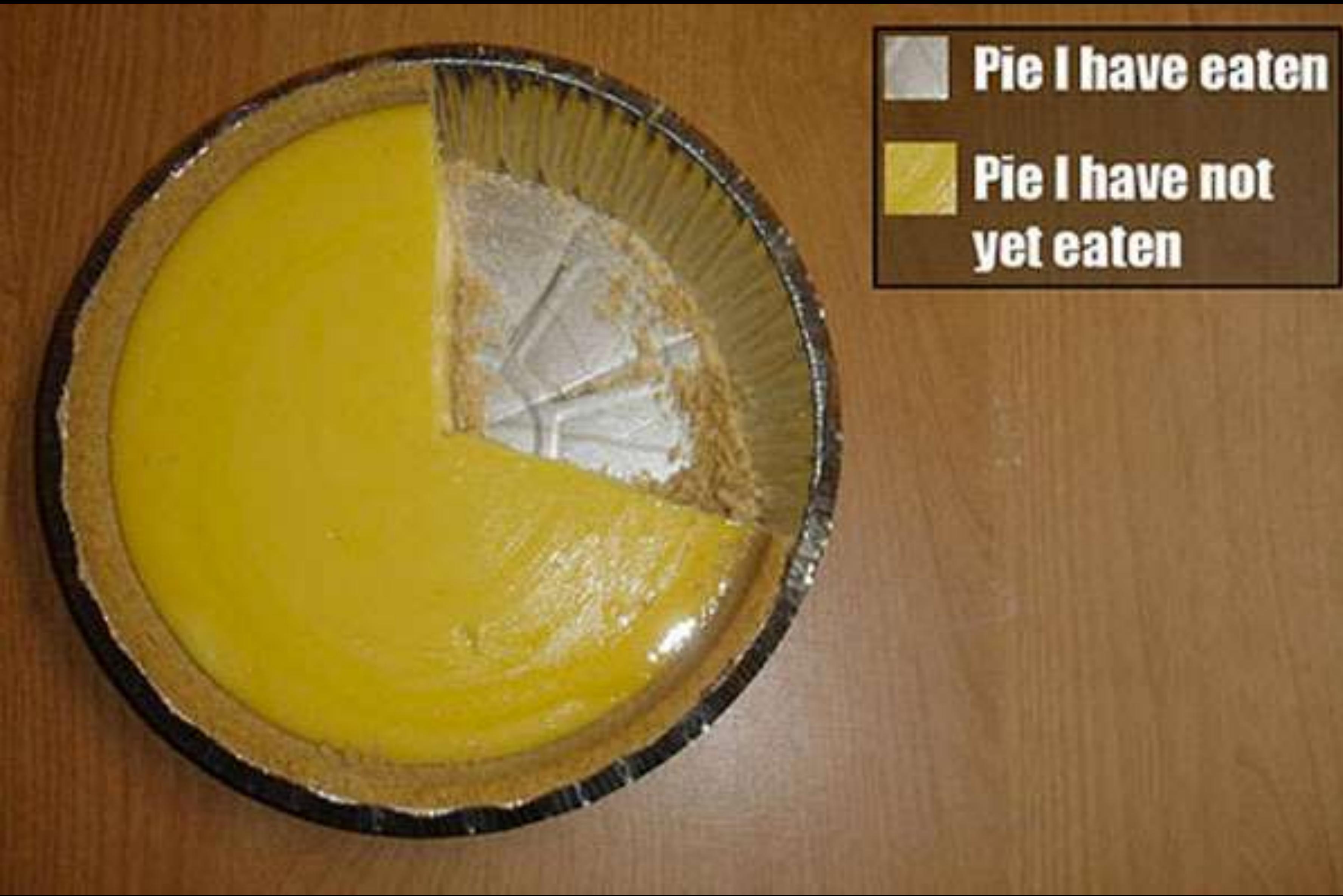


# Bars

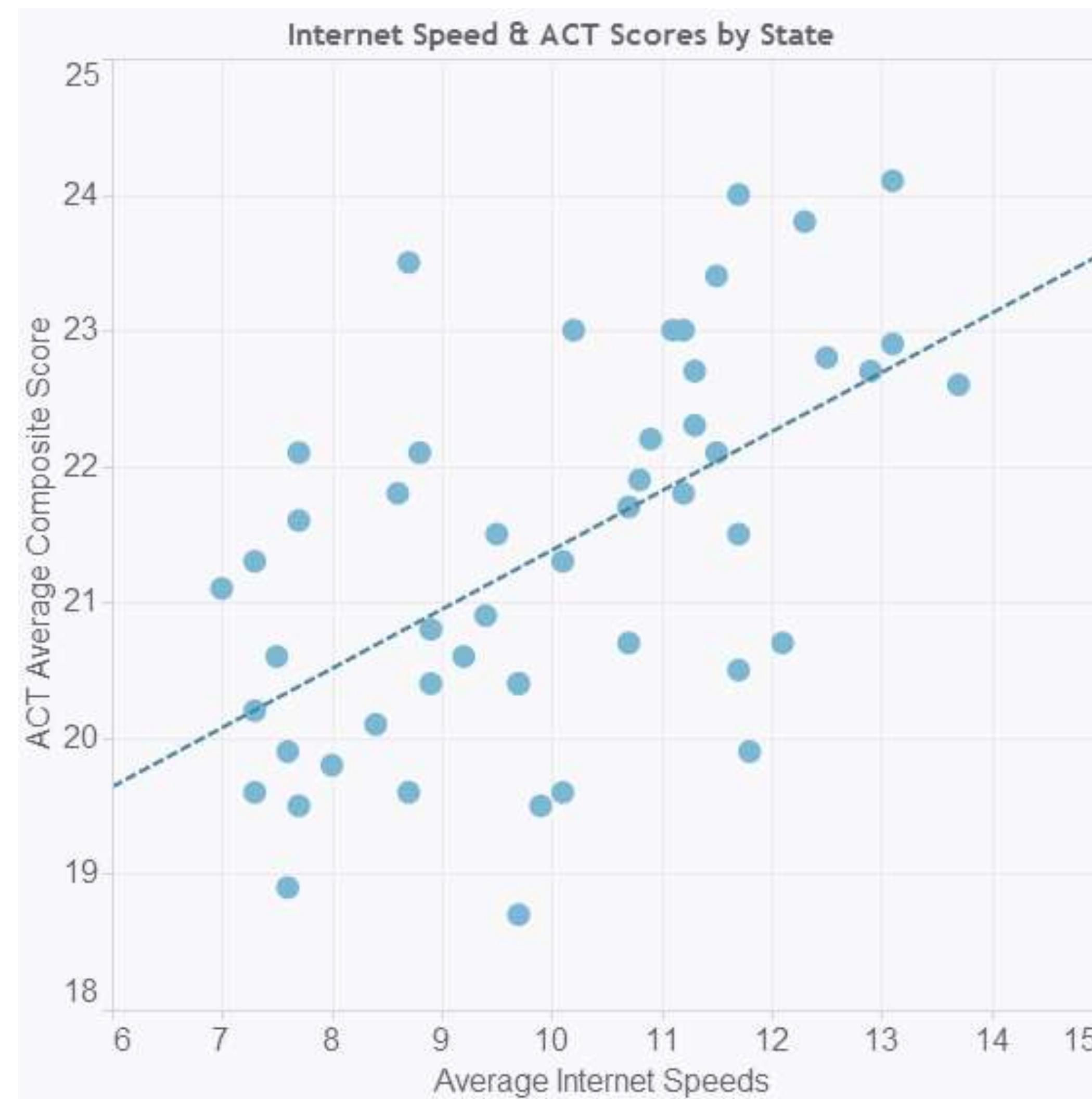
## Distribution of Average Income Growth During Expansions



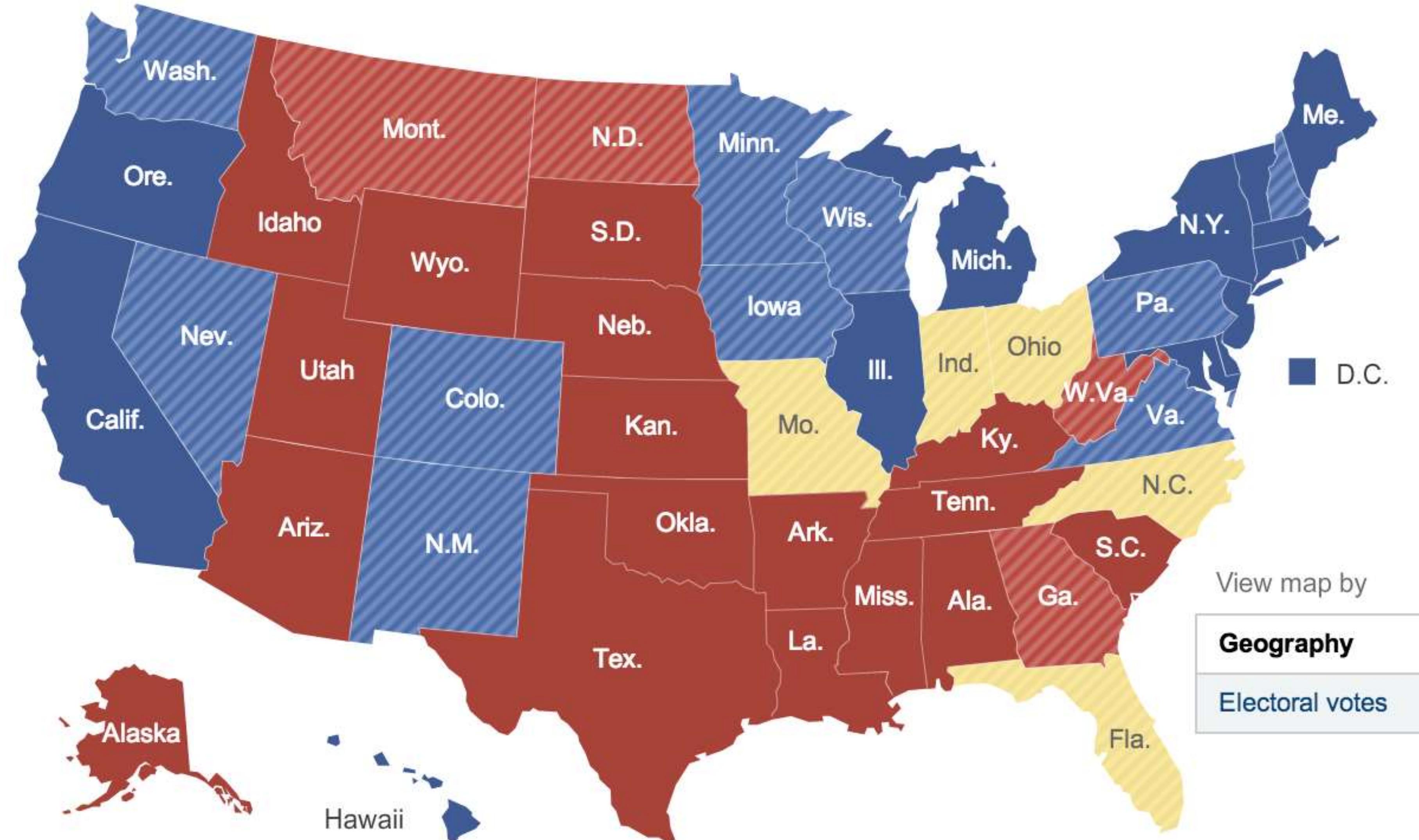
# Pies

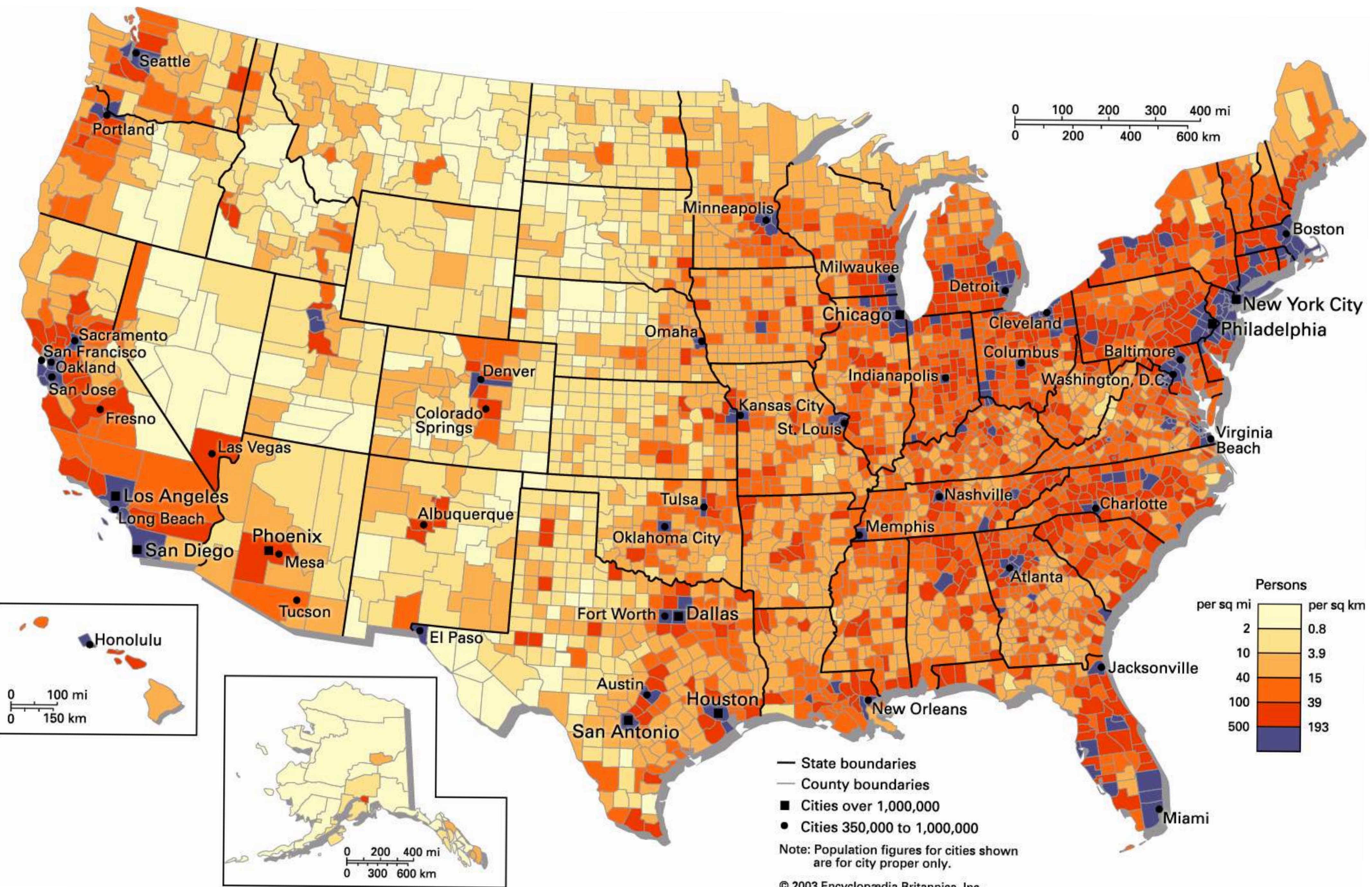


# Scatterplots



# Choropleth





# Small Multiples





# Perception

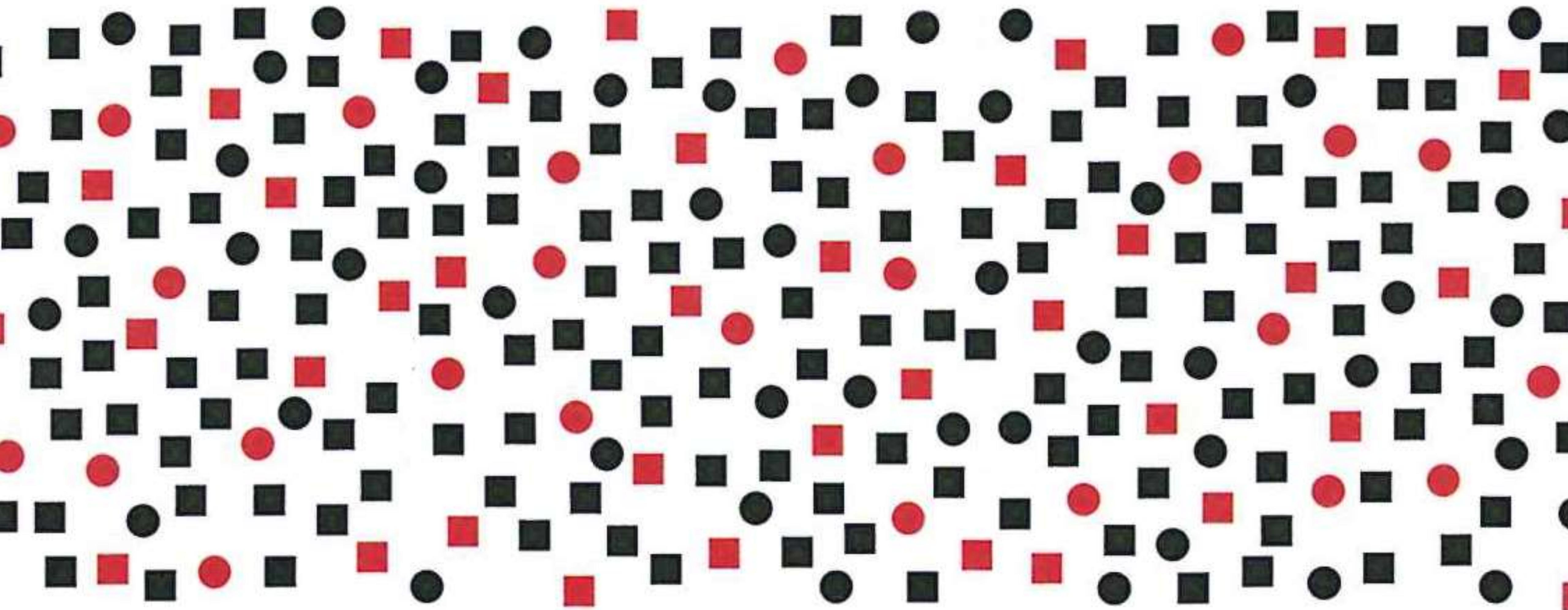
# Chunking

18596746321475030608030504090  
70502769843010215346748950213  
06057204020503090845064201040  
70204070835061305080239245798

18596746321475030608030504090  
70502769843010215346748950213  
06057204020503090845064201040  
70204070835061305080239245798

18596746321475030608030504090  
70502769843010215346748950213  
06057204020503090845064201040  
70204070835061305080239245798

18596746321475030608030504090  
70502769843010215346748950213  
06057204020503090845064201040  
70204070835061305080239245798



Mirielles, Ware

# Serial position effects

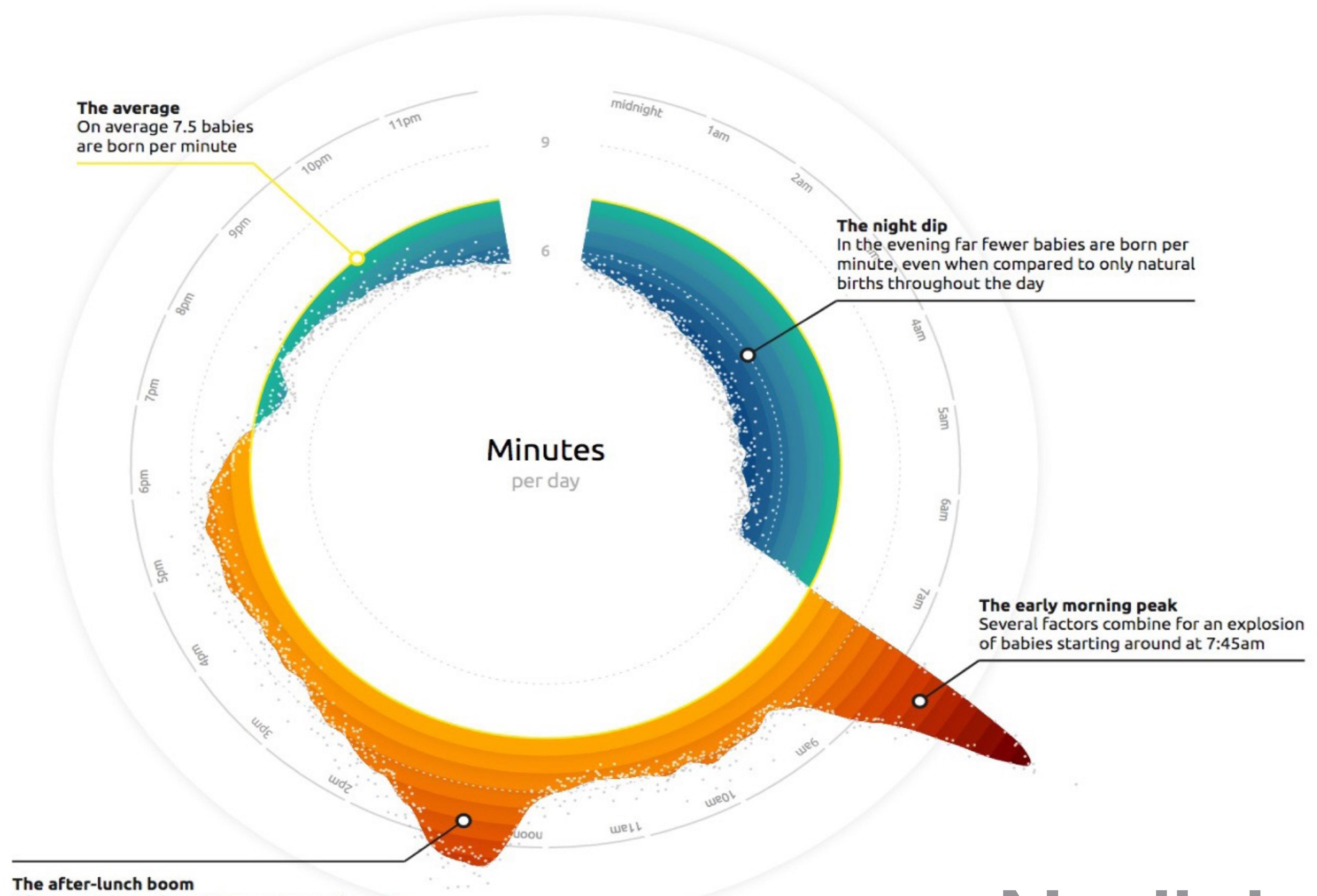
Items at the beginning and end of a list are  
more likely to be remembered

DATES	POLLSTER	GRADE	SAMPLE	WEIGHT	APPROVE	DISAPPROVE	ADJUSTED
• FEB. 4-5	YouGov	B	1,000 A	0.25	40%	52%	41% 54%
• FEB. 3-5	Rasmussen Reports/Pulse Opinion Research	C+	1,500 LV	0.95	48%	51%	43% 52%
• FEB. 2-5	YouGov	B	1,500 A	0.34	40%	52%	41% 54%
• FEB. 2-5	Harris Interactive	C+	3,004 RV	0.61	44%	56%	40% 55%
• FEB. 3-4	YouGov	B	1,000 A	0.23	37%	54%	38% 56%

FiveThirtyEight

# Priming

Activating concepts in memory (usually with color) influences decision making



Nadieh Bremer

# Communication Strategies

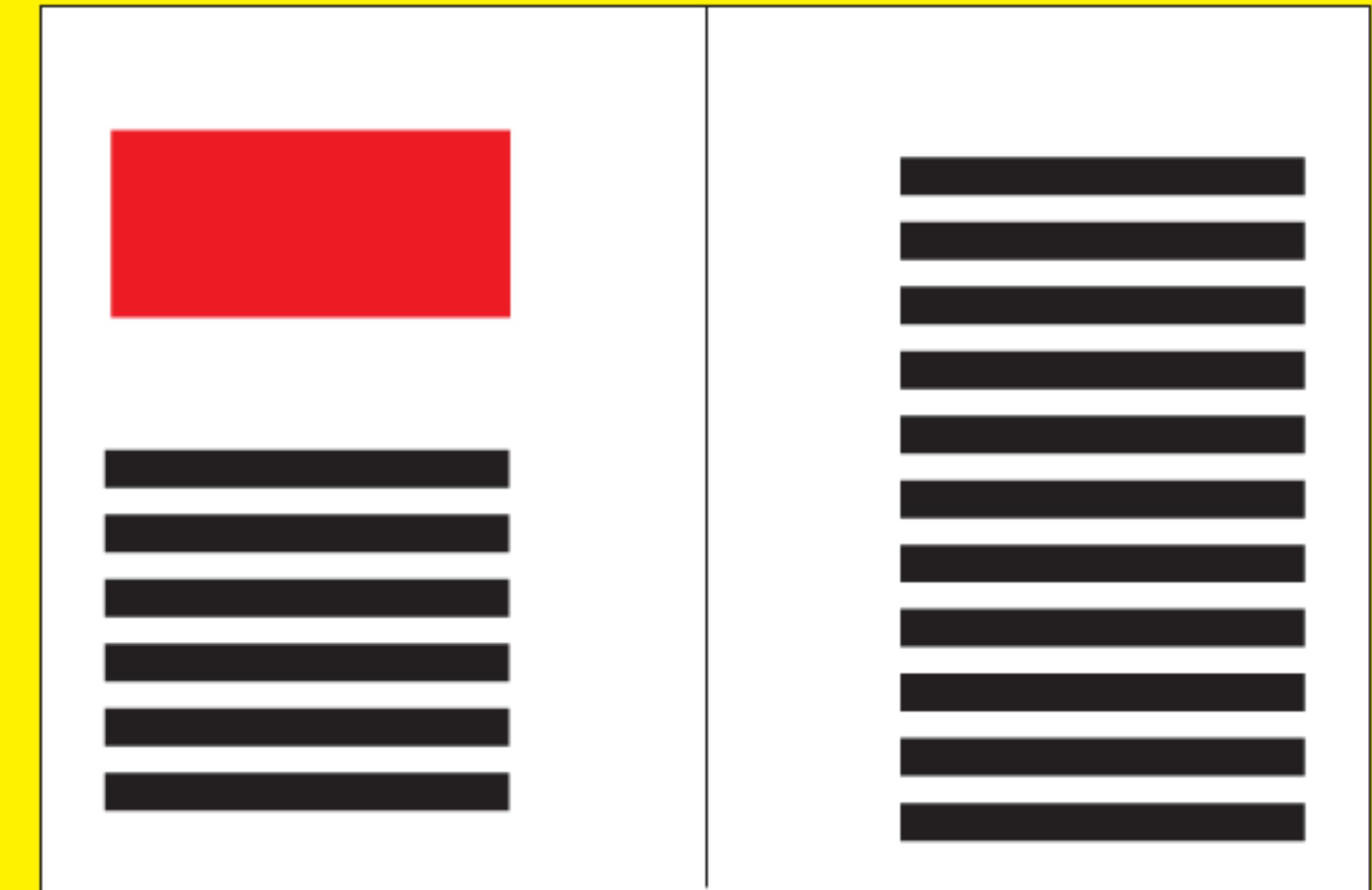
# Visual hierarchy

Organizing information so  
the most important details are read first



### Position and size

Positioning an element in the entry hotspot, while also altering its size and introducing spacing, establishes its dominance in the hierarchy.

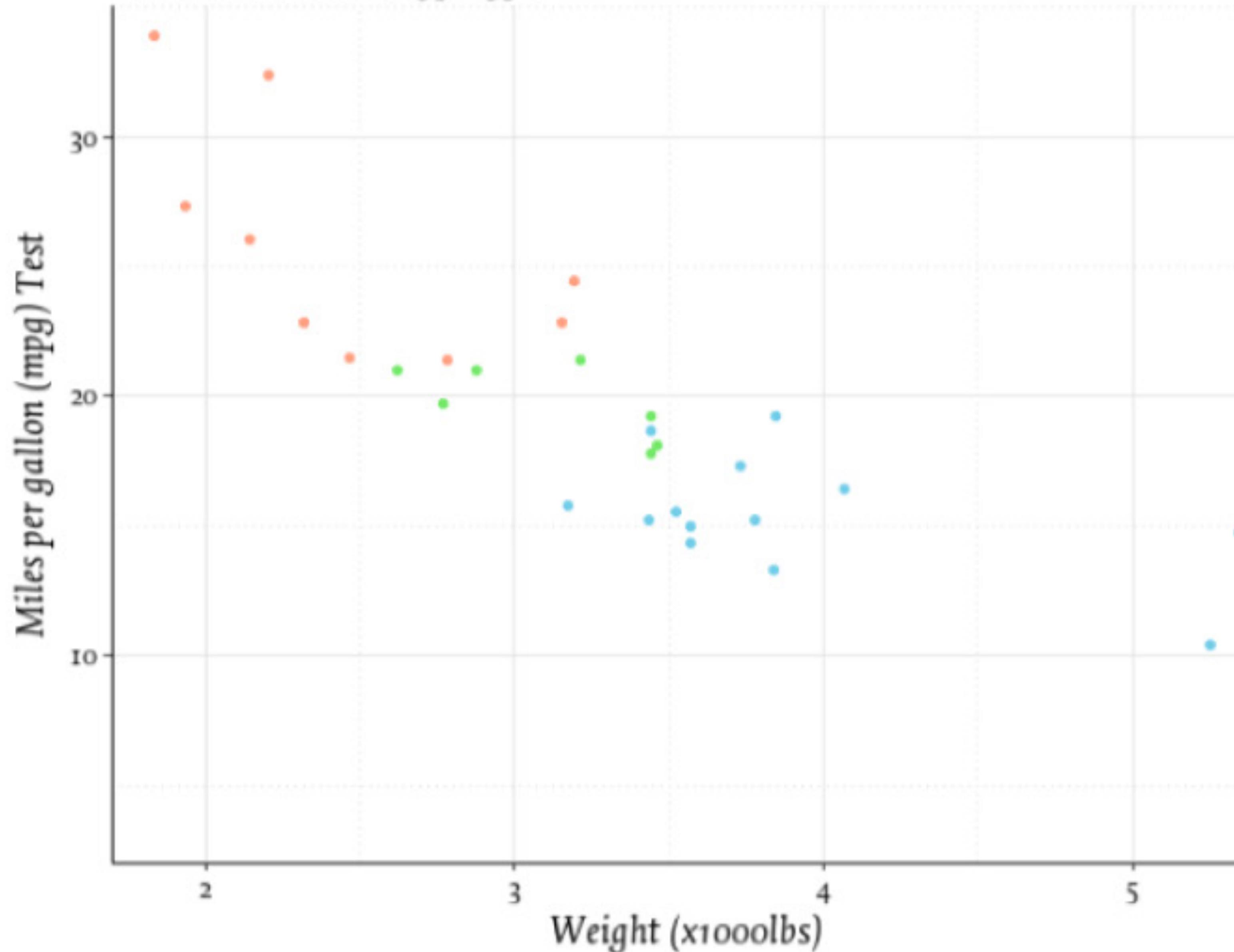


### Position, size and emphasis

A final technique is to add extra emphasis to an element to cement its position at the top of the hierarchy – as seen in the use of colour above.

# Weight vs Horsepower of Cars

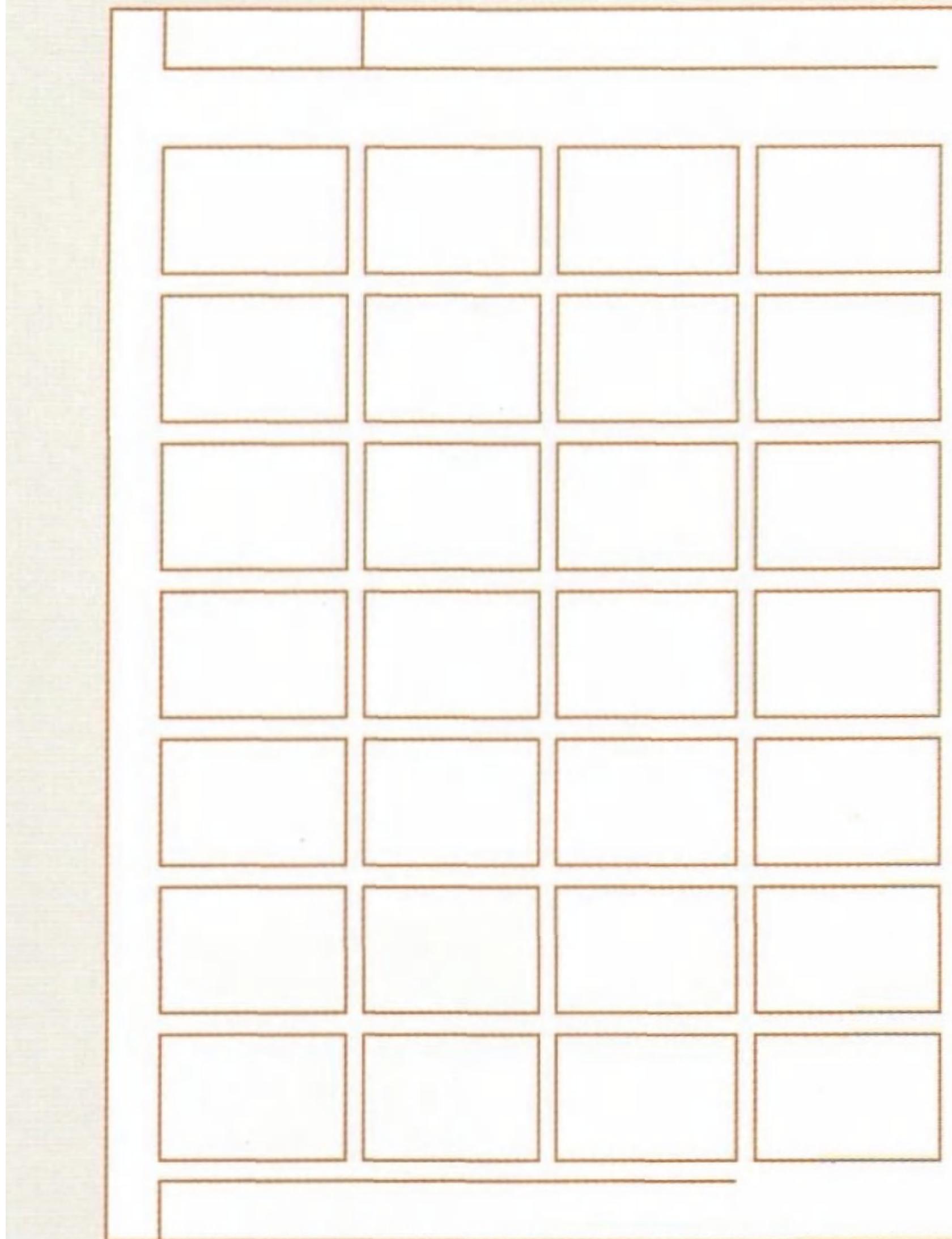
Models built between 1952-1992



# Visual consistency

Repeated use of positions, sizes, and colors

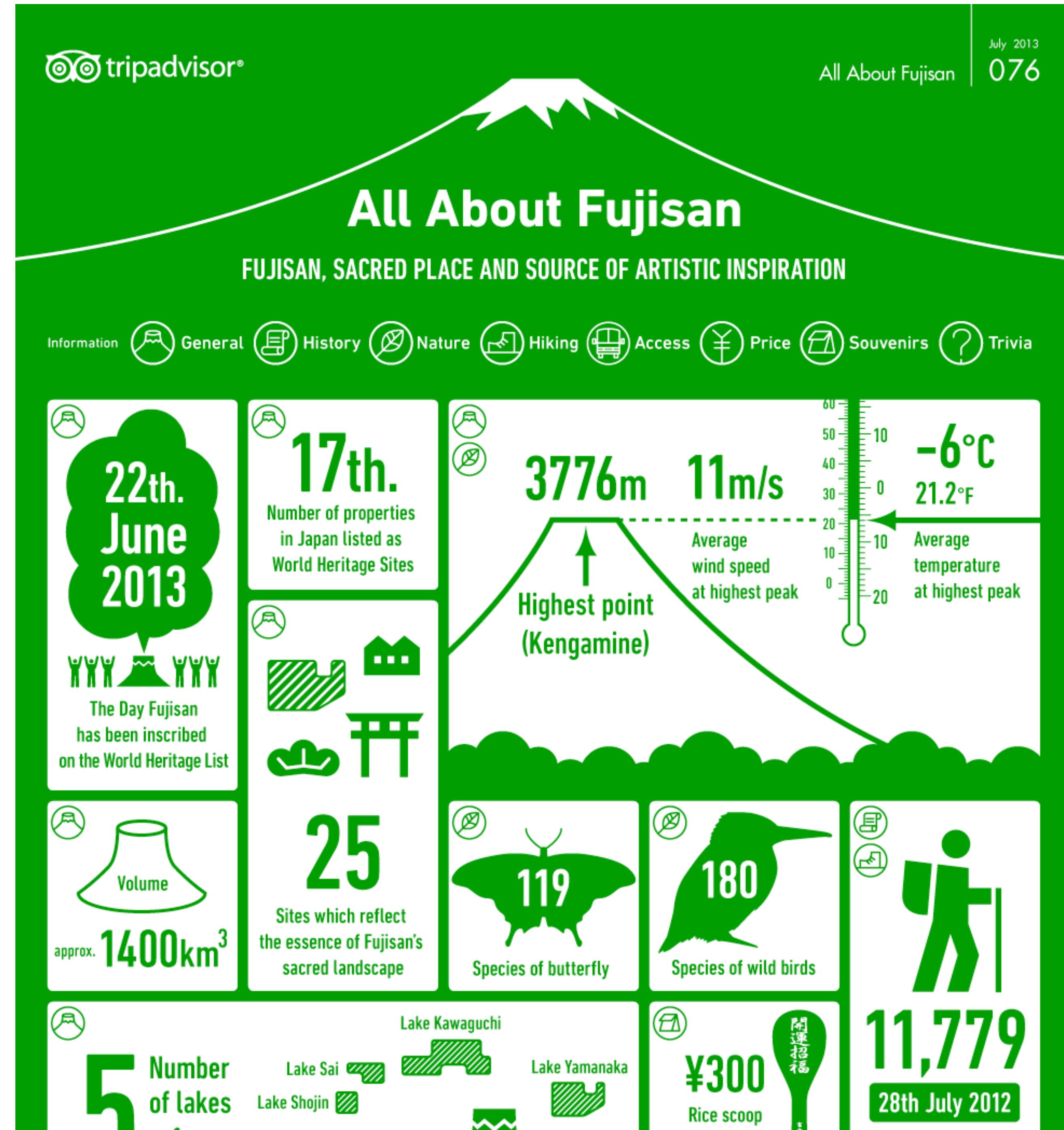
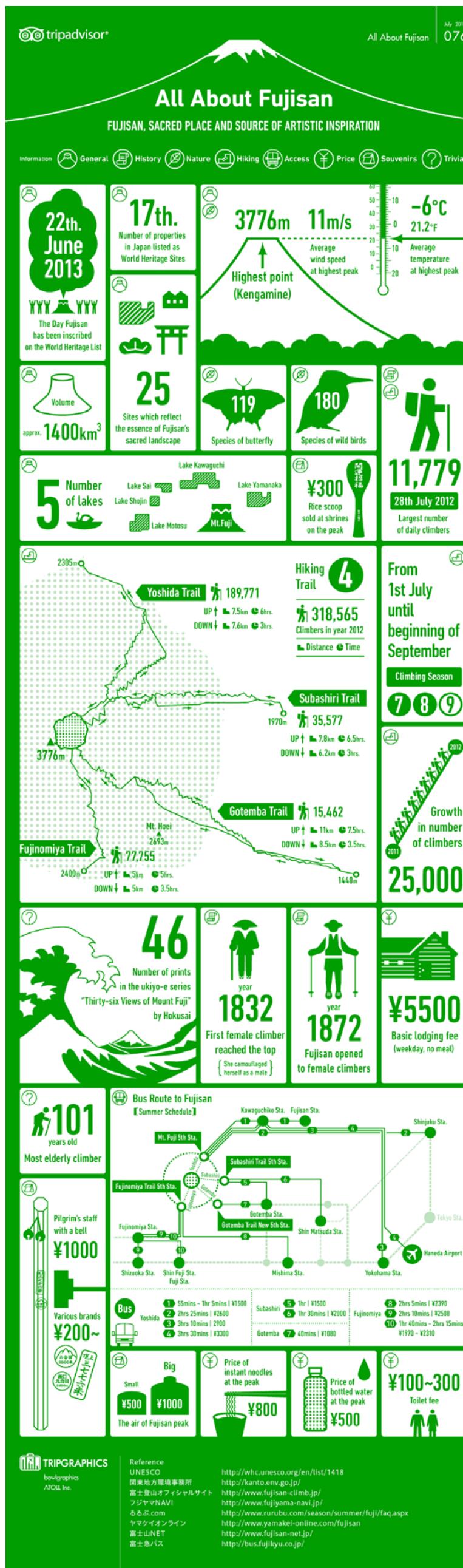
makes information easier to understand



# Visual conventions

Follow visual standards of the

format you are creating

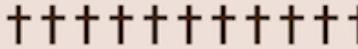


## A SIP OF SODA: HOW SOFT DRINKS IMPACT YOUR HEALTH

### ASTHMA

Sodium benzoate, found in sodas, is used as a preservative (microbial control) in foods. Sodium preservatives add sodium to the diet and reduce the availability of potassium. Some reported reactions to sodium benzoate include recurring urticaria (rash), asthma, and eczema.

Each day 11 Americans die from asthma



The annual cost of asthma to the healthcare system is estimated to be nearly \$18 billion



### KIDNEY ISSUES

Colas contain high levels of phosphoric acid, which has been linked to kidney stones and other renal problems.

You are more likely to get kidney stones if you are:



### SUGAR OVERLOAD

Twenty minutes after drinking a soda, your blood sugar spikes, causing an insulin burst. Your liver responds to this by turning any sugar into fat.

Forty minutes later, caffeine absorption is complete. Your pupils dilate; your blood pressure rises; as a response, your liver dumps more sugar into your bloodstream. The adenosine receptors in your brain are now blocked, preventing drowsiness.

45 minutes later, your body ups your dopamine production, stimulating the pleasure centers of your brain. This is physically the same way heroin works, by the way.

### OBESITY

The relationship between soft drink consumption and body weight is so strong that researchers calculate that for each additional soda consumed, the risk of obesity increases 1.6 times.

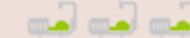
70% of cardiovascular disease is related to obesity



42% of breast and colon cancer is diagnosed in obese individuals



30% of gall bladder surgery is related to obesity



### DISSOLVES TOOTH ENAMEL

Sugar and acid in soft drinks easily dissolve tooth enamel. When tooth decay reaches the nerve, the root, and the area at the base of the tooth, the tooth may die and, if left untreated, an abscess can develop.

### HEART DISEASE

Most soft drinks contain high fructose corn syrup, a sweetener that's recently come under considerable scrutiny. High fructose corn syrup has been associated with an increased risk of metabolic syndrome, a condition associated with an elevated risk of both diabetes and heart disease.

In 2006, more than one in every four deaths were caused by heart disease.



### REPRODUCTIVE ISSUES

Soft drink cans are coated with a resin that contains BPA (bisphenol-A). This is the same cancer causing chemical found in plastic baby bottles, water bottles, and plastic containers that wreaks havoc on the endocrine system, potentially causing premature puberty and reproductive abnormalities.

99.9% of plastic bottles contain BPA.

### OSTEOPOROSIS

Soft drinks contain phosphoric acid and a high phosphate diet has been associated with bone breakdown and an increased risk of osteoporosis. When phosphorus is excreted in the urine, it takes calcium with it, depriving the bones and the rest of the body of this important mineral.

Eighty percent of those affected by osteoporosis are women. Twenty percent are men.

### INCREASED RISK OF DIABETES

Those who drink more soda have an 80% increased risk of developing Type 2 diabetes.

Approximately 1 in 10 health care dollars is spent on diabetes



term  
**LIFE**  
insurance

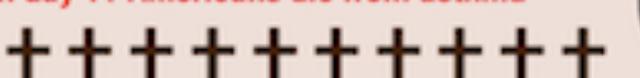
Sources: AssociatedContent.com | Waterforlifeusa.com | Ionizers.org | NYTimes.com | Helium.com | AAFA.org | KidneyFund.org | CDC.gov | Nutrition.Suite101.com | AmericanHeart.org | Chetday.com | NOF.org | Information provided by TermLifeInsurance.org

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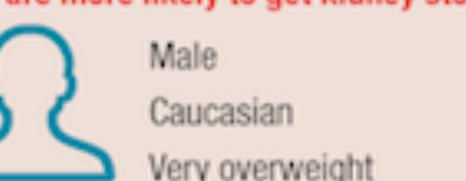
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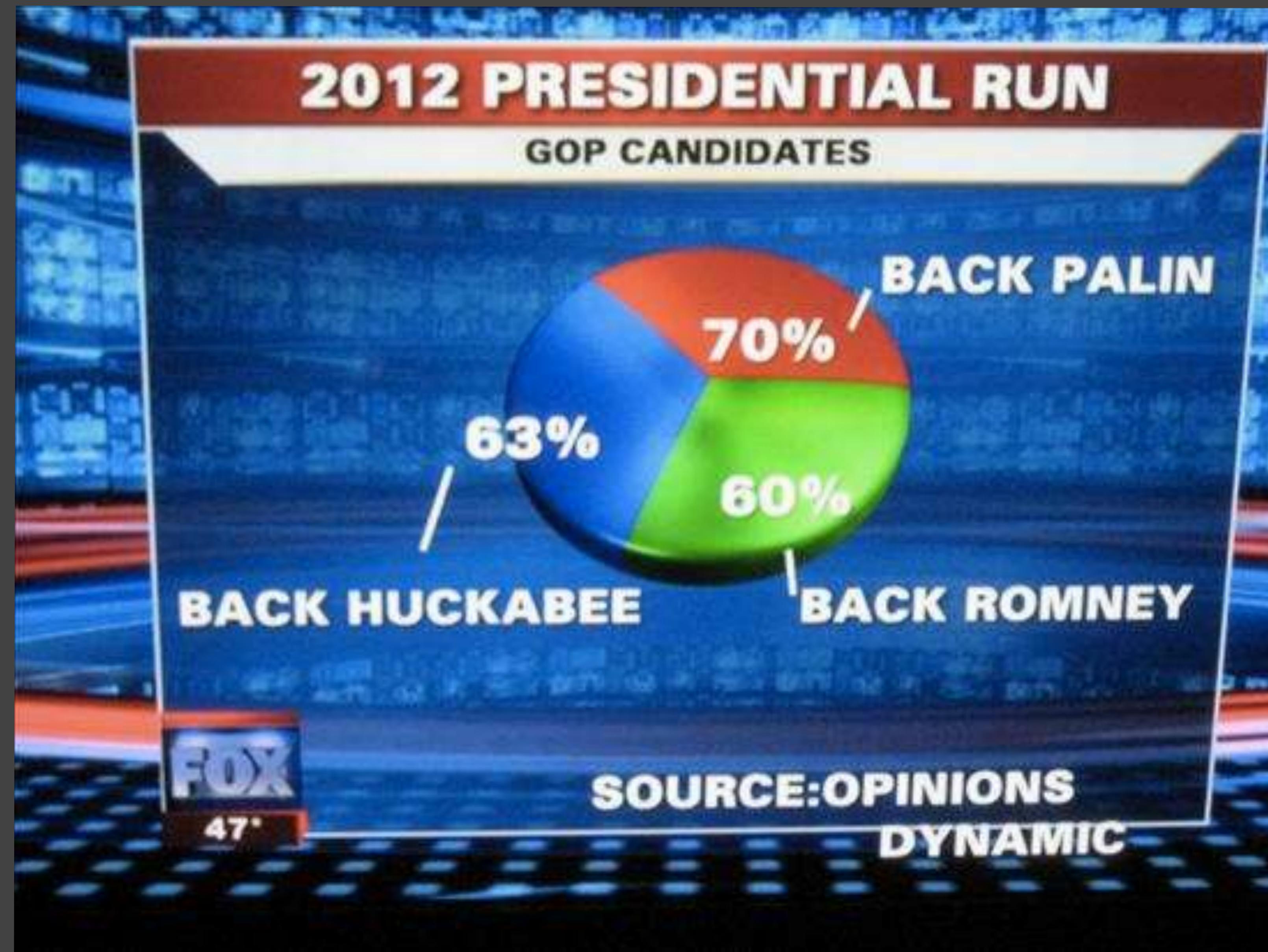
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# Proportional ink

Visualized data points do not take more ink  
proportionally than the numbers  
they represent



# Simplicity

As few visual details as necessary

Less colors, less lines, less effects

