

VISUALIZING DATA ON THE MODERN WEB

By [Robin Linderborg](#) / [@robinlinderborg](#)

OVERVIEW

- History
- Design principles
- Coding with D3.js
- The journalist perspective

SO, WHAT IS DATA?

"Data is a set of values [...]"

"Data becomes information by interpretation"

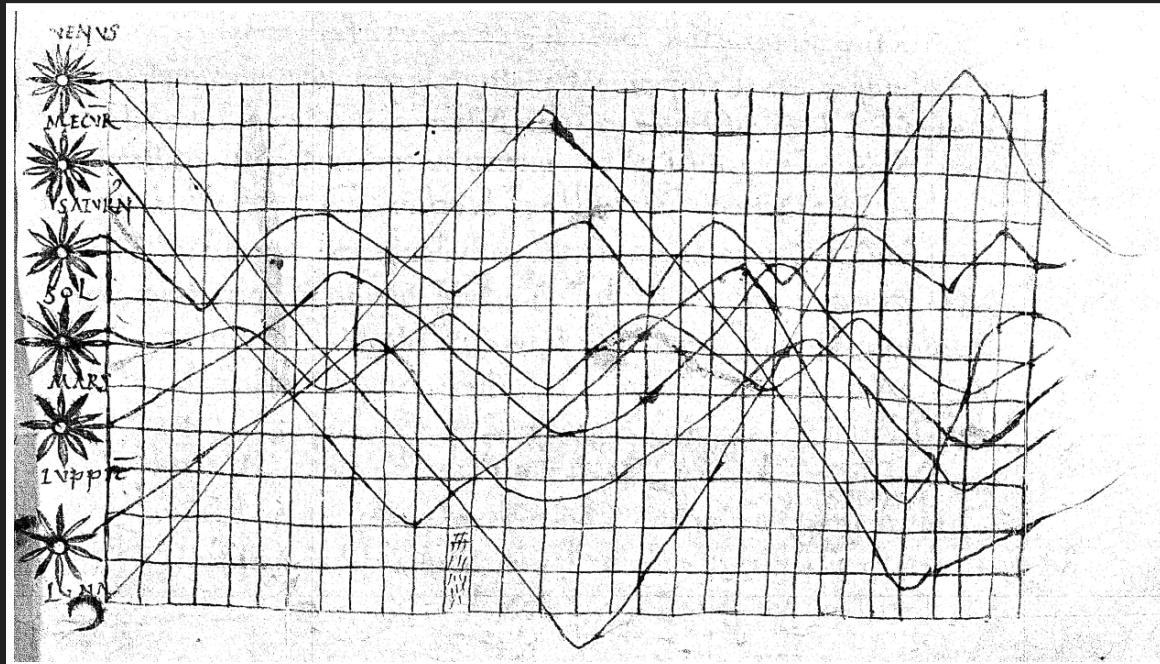
VISUAL ENCODING

(Or: Turning Boring Numbers Into Fun Shapes)

NAME	AGE
Robin	28
Anna	35
Nichlas	45
Johan	38
Claudia	60
Mary	50

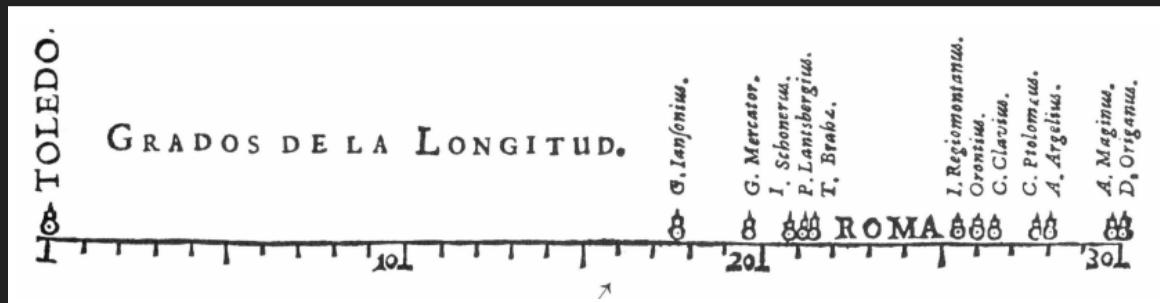
HISTORY

PRE-17TH CENTURY



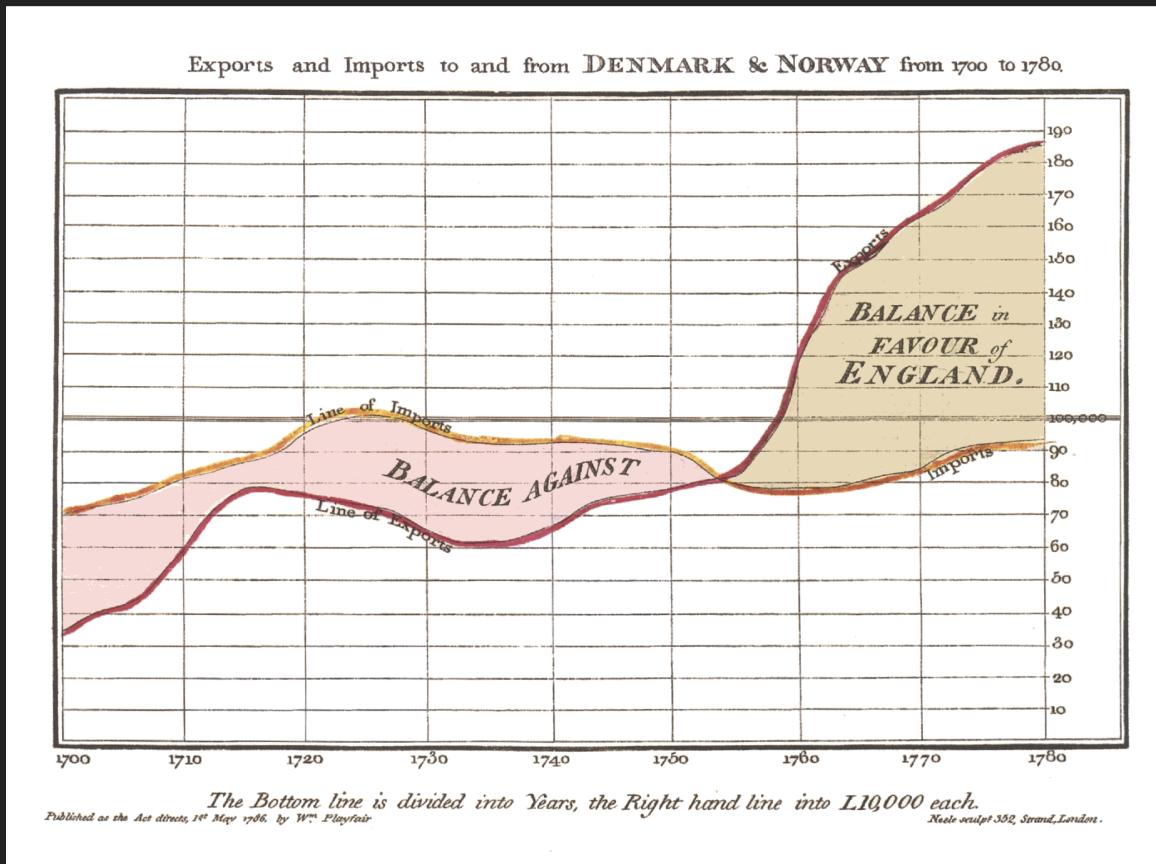
Graph of planetary movements, by unknown (10th century)

1600-1699

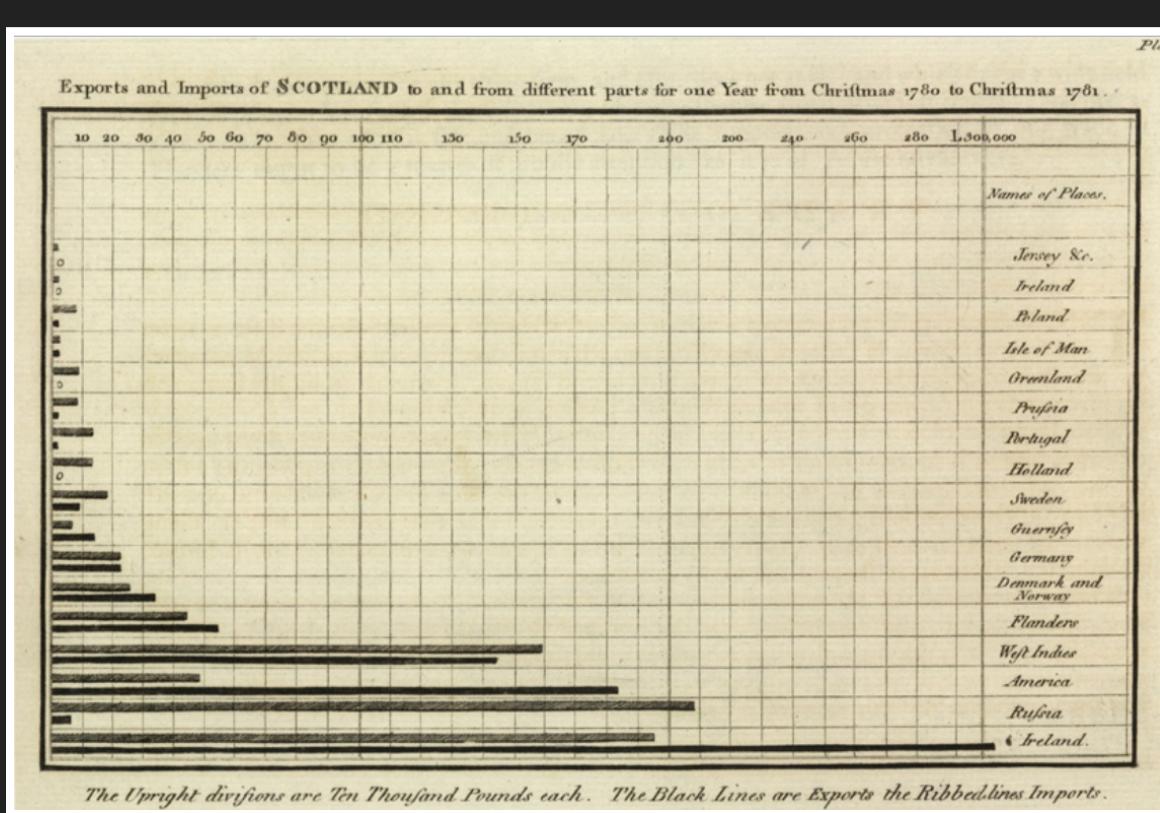


Distance from Rome to Toledo, by Michael Florent van
Langren (1644)

1700-1799

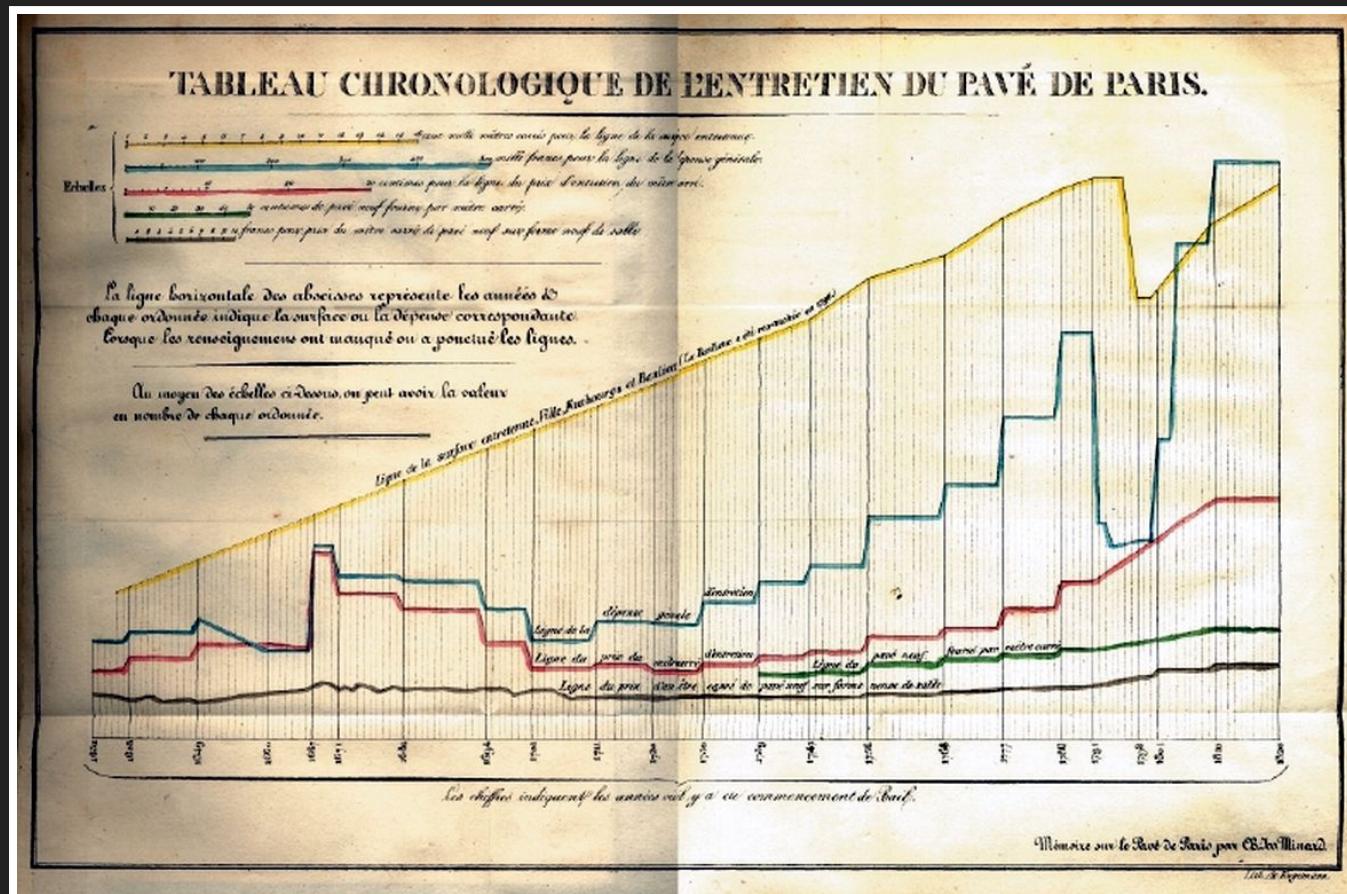


Exports and imports time series, by William Playfair (1786)



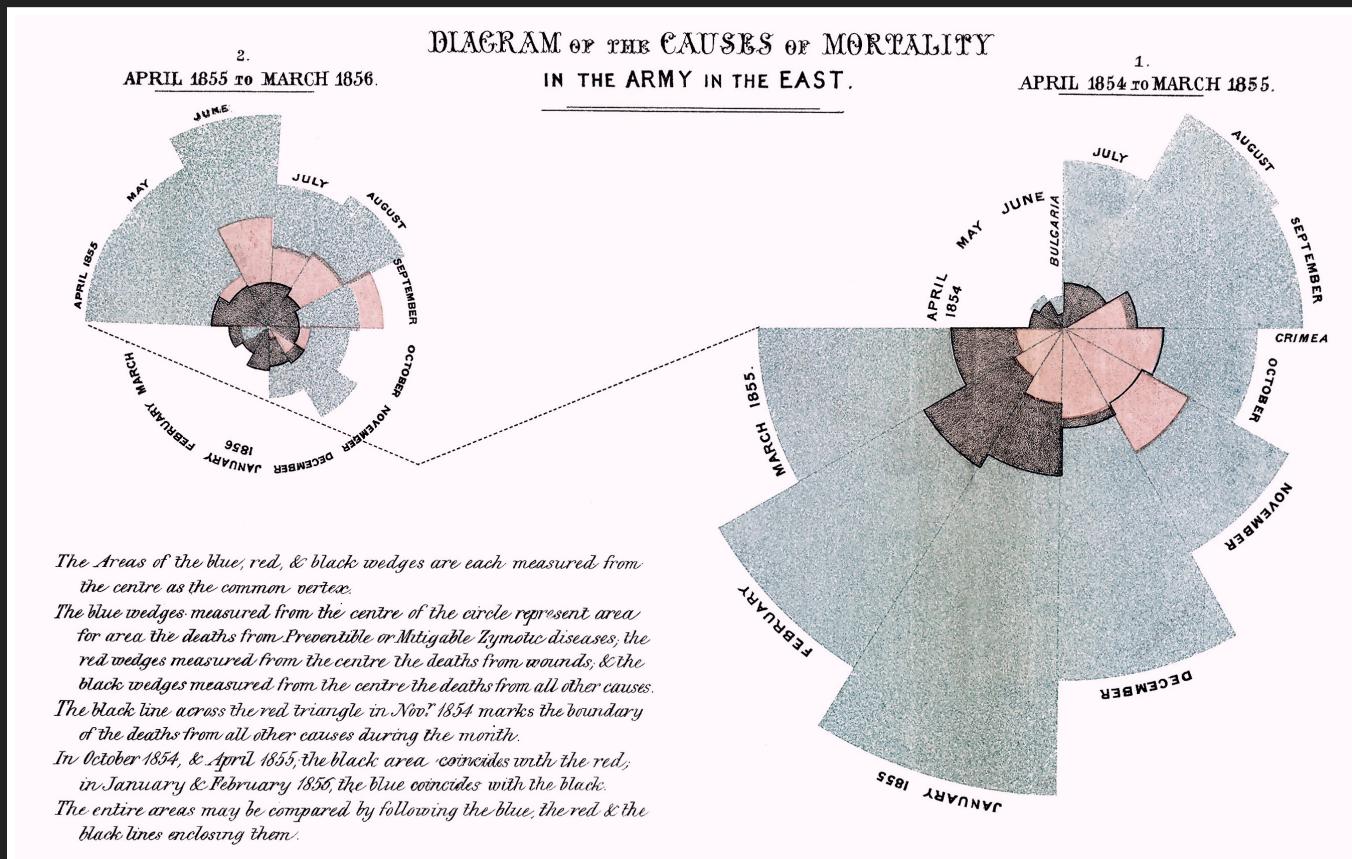
Exports and imports of Scotland, by William Playfair (1786)

1800-1850



Transport of cobblestones in Paris, by Charles Joseph Minard (1826)

1851-1900



Causes of mortality, by Florence Nightingale (1857)

Carte Figurative des pertes successives en hommes de l'Armée Française dans la campagne de Russie 1812-1813.

Dressée par M. Minard, Inspecteur Général des Ponts et Chaussées en retraite. Paris, le 20 Novembre 1869.

Les nombres d'hommes présents sont représentés par les largeurs des zones colorées à raison d'un millimètre pour dix mille hommes; ils sont de plus écrits en travers des zones. Le rouge désigne les hommes qui entrent en Russie, le noir ceux qui en sortent. _____ Les renseignements qui ont servi à dresser la carte ont été puisés dans les ouvrages de M.M. Chiens, de Séjur, de Fezensac, de Chambray et le journal inédit de Jacob, pharmacien de l'Armée depuis le 28 Octobre.

Pour mieux faire juger à l'oeil la diminution de l'armée, j'ai supposé que les corps du Prince Jérôme et du Maréchal Davout qui avaient été détachés sur Minsk et Mohilow et ont rejoint vers Orscha et Witebsk, avaient toujours marché avec l'armée.

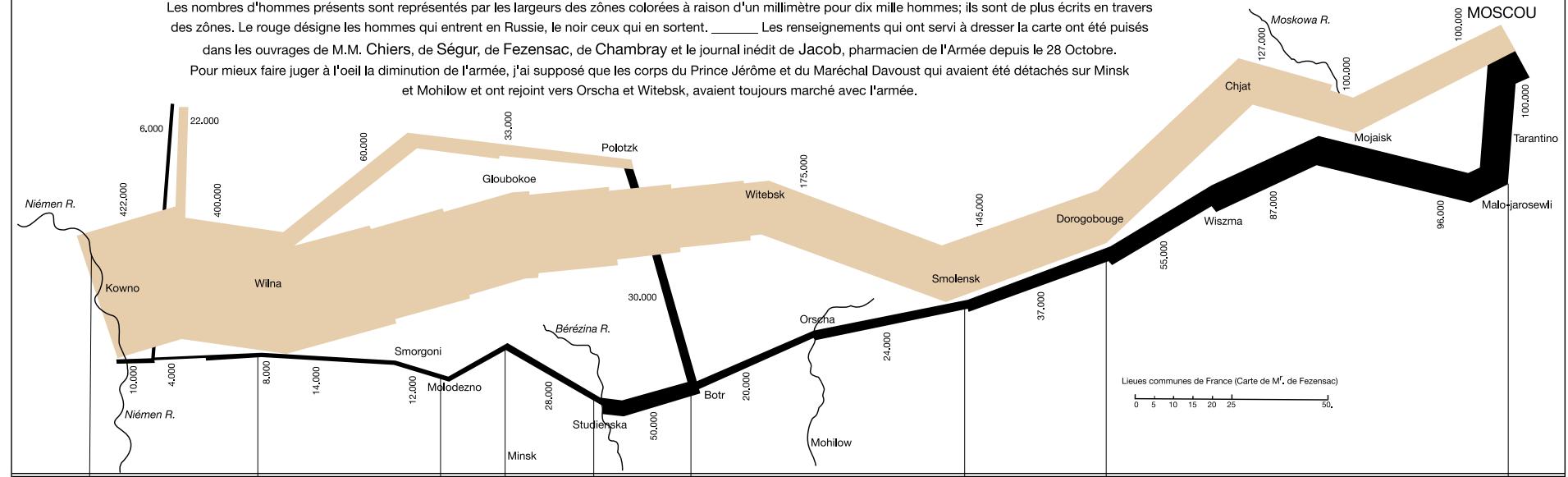
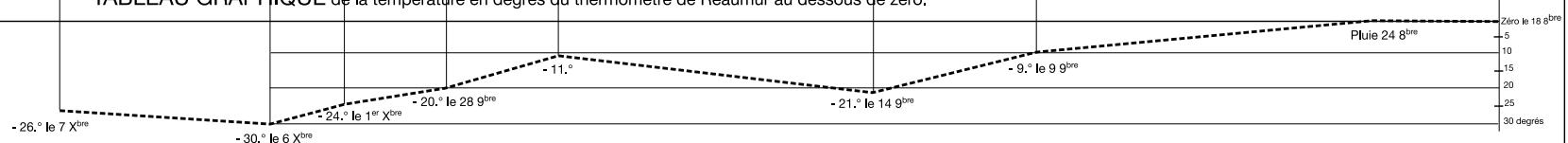


TABLEAU GRAPHIQUE de la température en degrés du thermomètre de Réaumur au dessous de zéro,

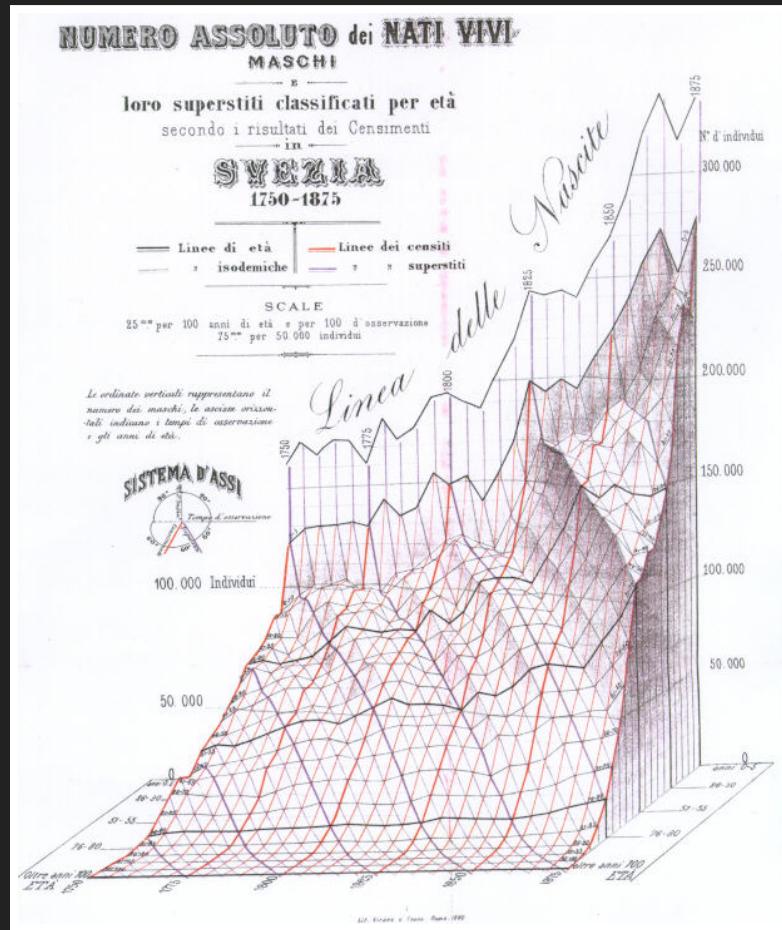
Les Cosaques passent au galop
le Niémen gelé.



[Vectorization CC-BY-SA martingrandjean.ch 2014]

Imp. Lith. Regnier et Dourdet.

Napoleonic troops during the Russian campaign, by Charles Joseph Minard (1869)

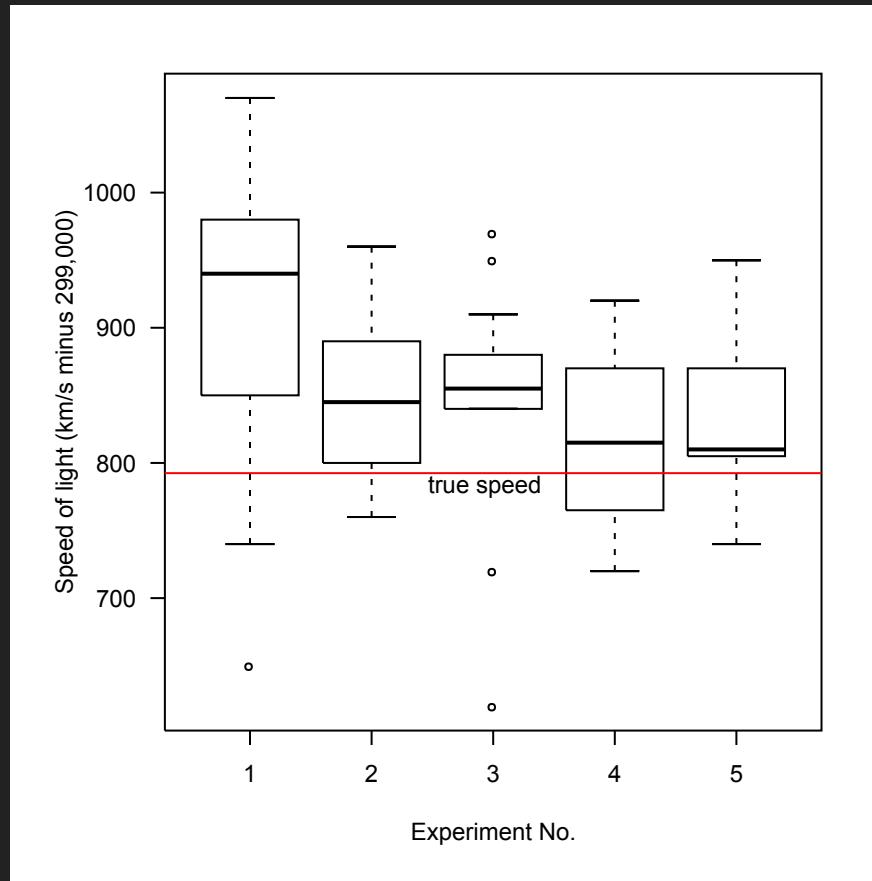


3D population pyramid modeled on actual data, by Luigi Perozzo (1879)

1900-1950

"The Dark Ages"

1950-1994



Boxplot diagram and others invented, by John W. Tukey

ENTER THE WEB

HTML

CSS

JS

```
<p>Hello World!</p>
```

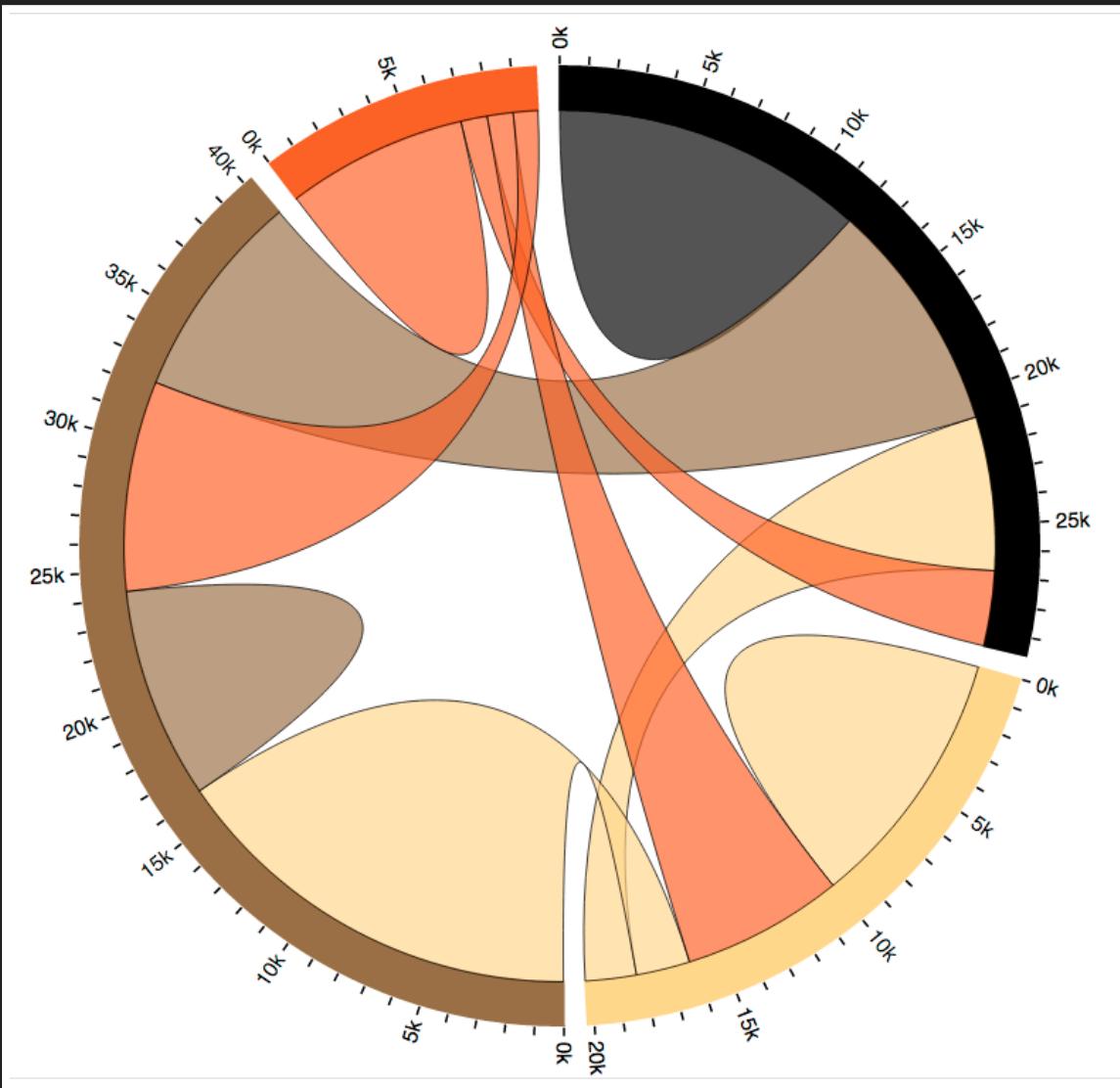
```
p {  
    color: red;  
}
```

```
alert('Hi!');
```

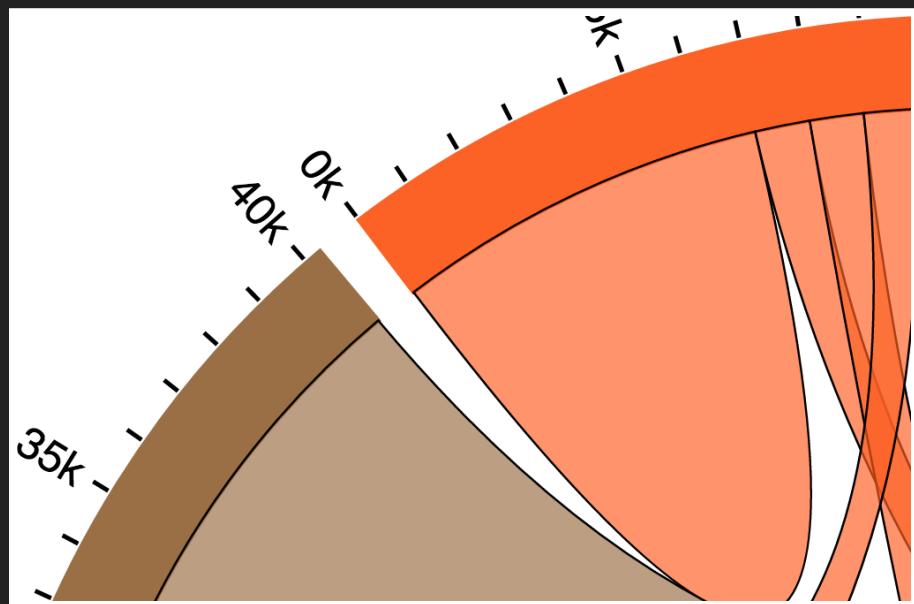
PROPRIETARY SOFTWARE

- Flare
- Tableau
- Silverlight

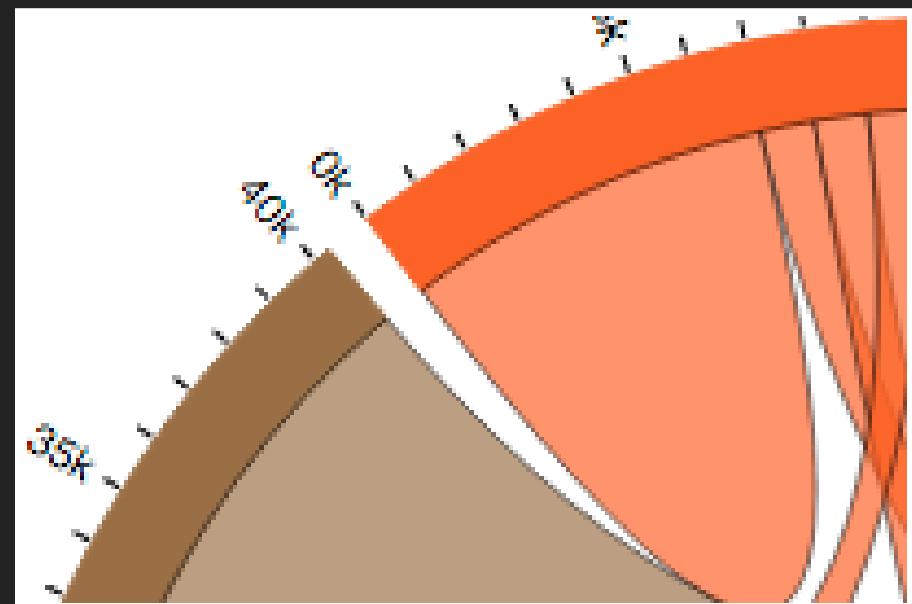
SCALABLE VECTOR GRAPHICS

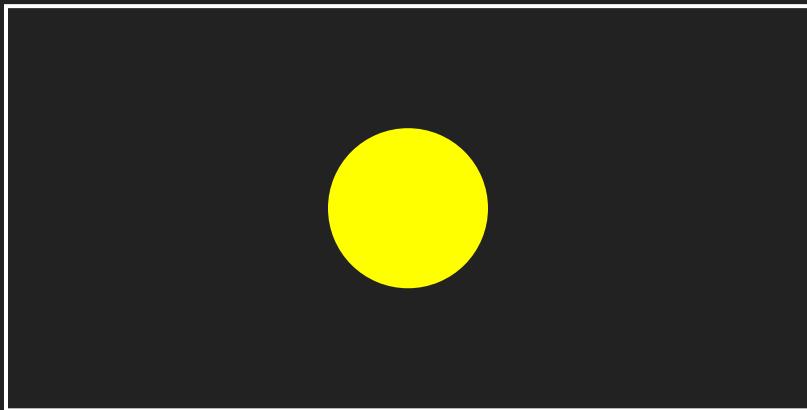


SVG

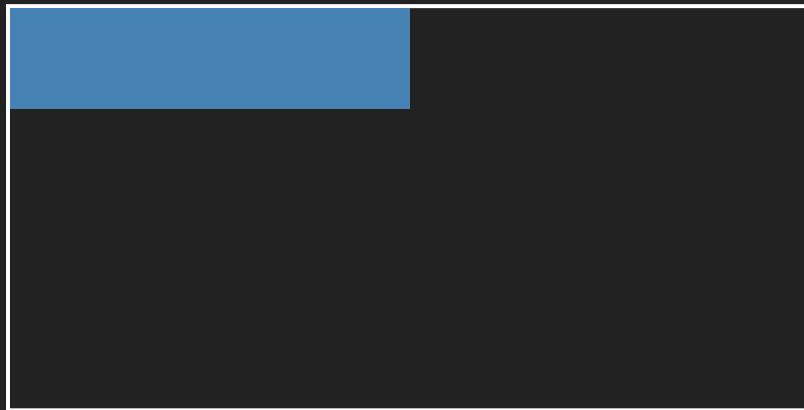


RASTER





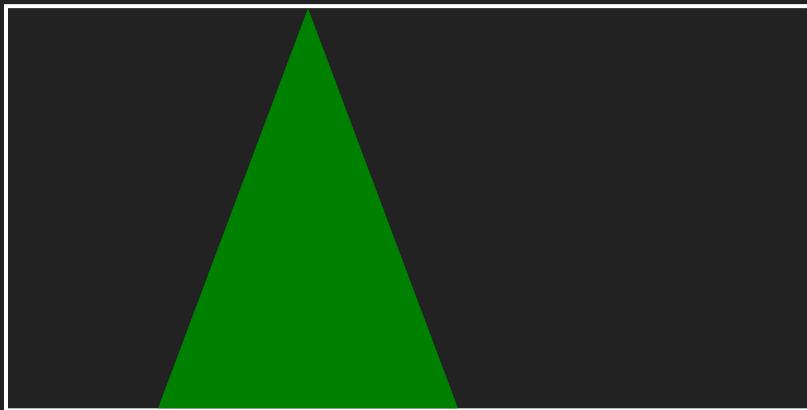
```
<svg width="400" height="200">
  <circle cx="200" cy="100" r="40" fill="yellow" />
</svg>
```



```
<svg width="400" height="200">
  <rect width="200" height="50" x="0" y="0" fill="steelblue" />
</svg>
```



```
<svg width="400" height="200">
  <line x1="0" y1="0" x2="200" y2="200" stroke="red" stroke-width="2">
</svg>
```



```
<svg width="400" height="200">
  <path d="M150 0 L75 200 L225 200 Z" fill="green" />
</svg>
```

PURE WEB TECHNOLOGY

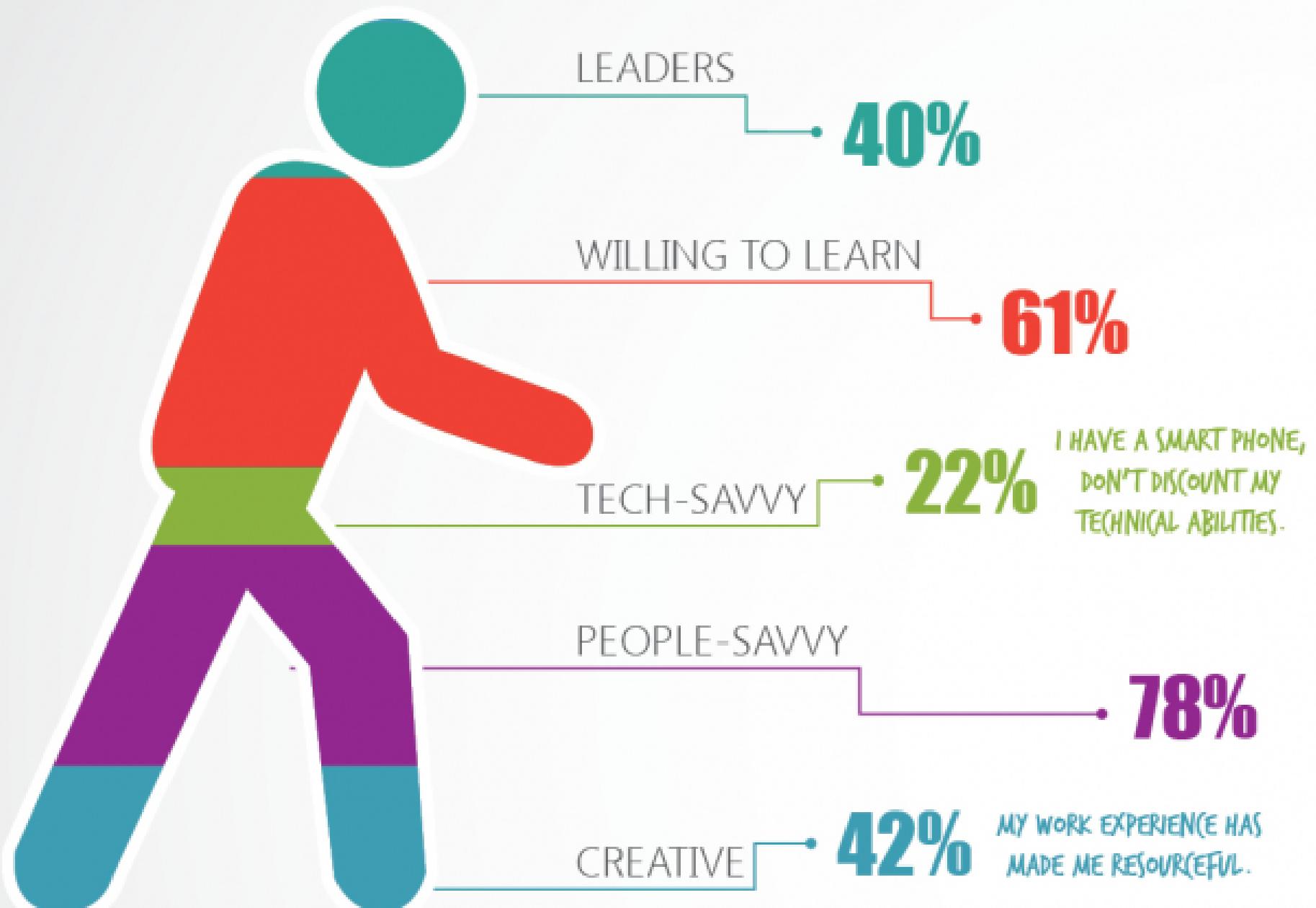
- Raphael.js (2008)
- Protovis.js (2009)
- **D3.js (2011)**

ANYONE CAN DO IT!



made on imgur

HOW BABY BOOMERS DESCRIBE THEMSELVES



Americans' Desire to Have Children

Have
children

Want to have
children

Regret not
having children

Do not want
children

■ 1990 73%
■ 2003 72%
■ 2013 74%

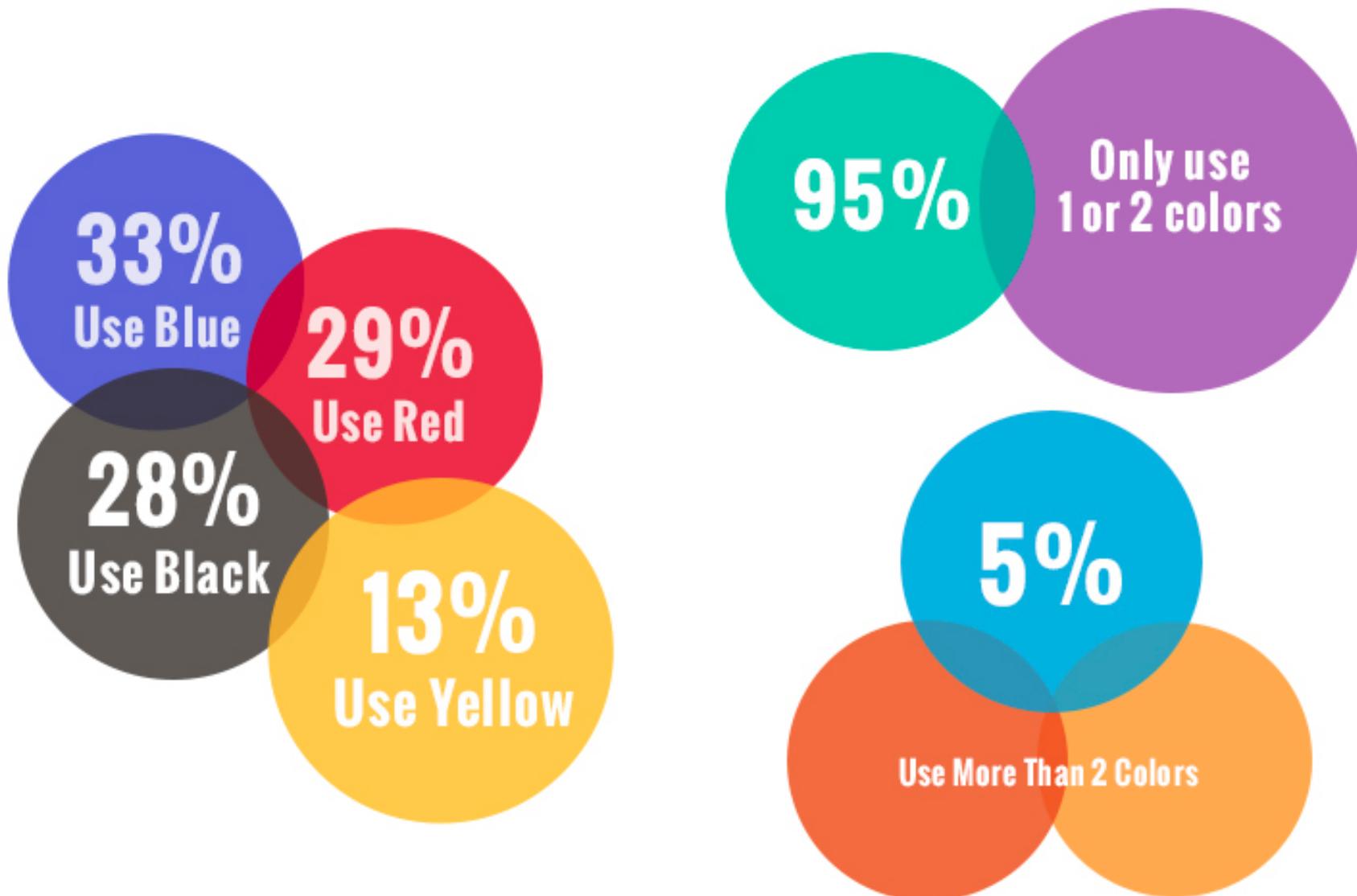
■ 1990 17%
■ 2003 16%
■ 2013 16%

■ 1990 3%
■ 2003 6%
■ 2013 3%

■ 1990 4%
■ 2003 4%
■ 2013 5%

COLOR TRENDS

THE MOST-USED COLORS OF THE WORLD'S TOP BRANDS



JOB LOSS BY QUARTER



FOX NEWS
.com

SOURCE: BLS

AMERICA'S
NEWSROOM

N FAIRFAX, VA... BYRD WAS ADMITTED TO THE HC

S&P ▼ 3.08

HOW TO DO IT RIGHT

*In data visualization, the number one rule of thumb to bear in mind is: **Function first, suave second.** Your visualization may look really slick, but if it's not communicating the information you're encoding [...] then it's just so much visual noise—a pretty picture to put on the wall.*

– Noah Iliinsky

CHOICES, CHOICES, CHOICES

TYPE OF DATA VS VISUAL PROPERTY

Type of data Example

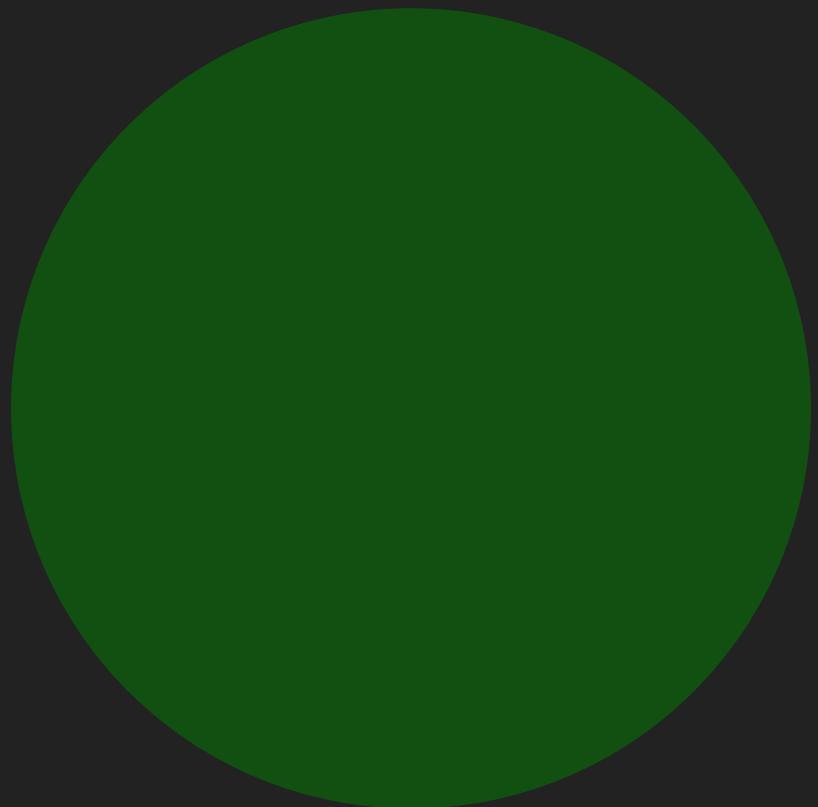
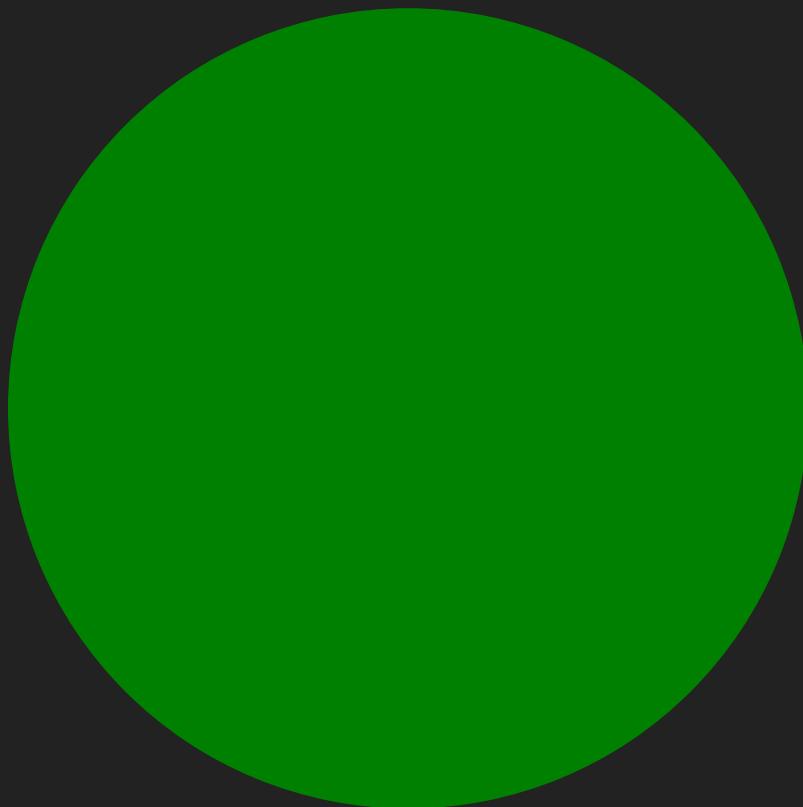
Quantitative 1, 2, 5, 8

Categorical Beer, coffee, tea

Ordinal Low, medium, high

Relational Social network

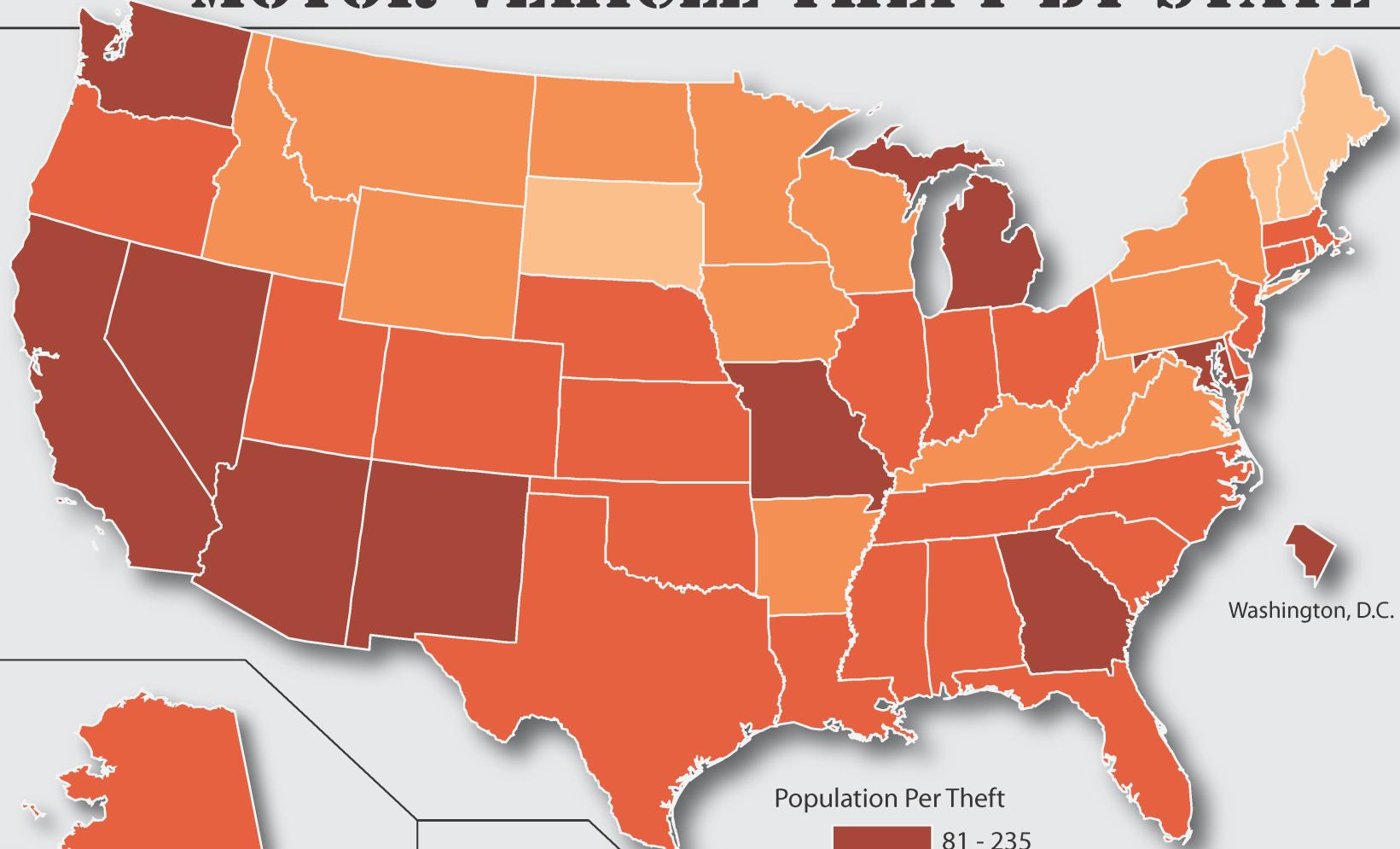
"Color is one of the least accurate encoding channels for comparing quantitative data"



BETTER REPRESENTED WITH LENGTH



MOTOR VEHICLE THEFT BY STATE

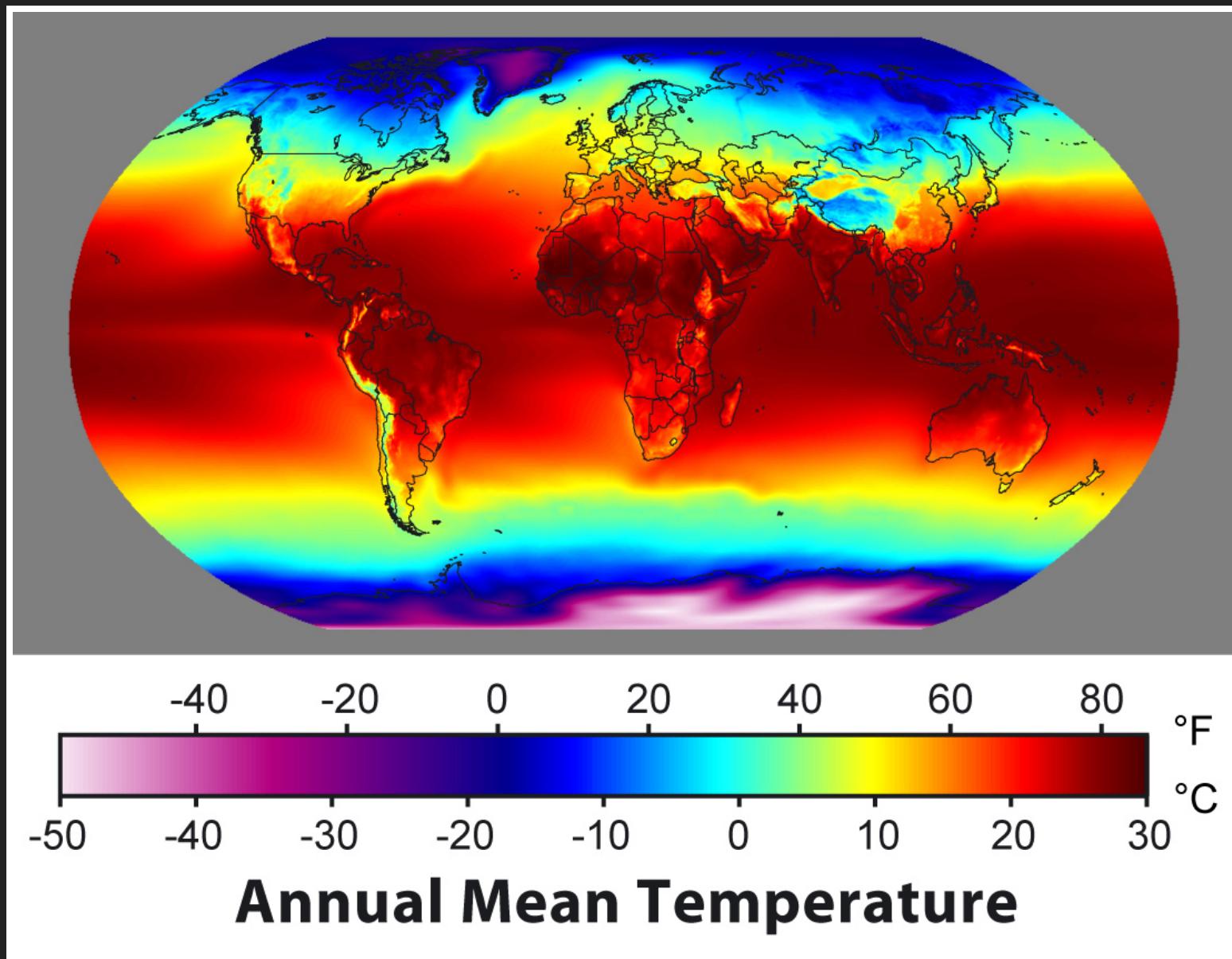


Cartography by Jacob Jensvold

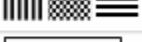
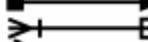
*Alaska, Hawaii, & Washington, D.C.
not to scale or in correct geographic
position

Bureau of Justice and Statistics - 2006

COLORS CONVEY MEANING (SOMETIMES)



Properties and Best Uses of Visual Encodings

<u>Example</u>	<u>Encoding</u>	<u>Ordered</u>	<u>Useful values</u>	<u>Quantitative</u>	<u>Ordinal</u>	<u>Categorical</u>	<u>Relational</u>
	position, placement	yes	infinite	Good	Good	Good	Good
1, 2, 3; A, B, C	text labels	optional (alphabetical or numbered)	infinite	Good	Good	Good	Good
	length	yes	many	Good	Good		
	size, area	yes	many	Good	Good		
	angle	yes	medium/few	Good	Good		
	pattern density	yes	few	Good	Good		
	weight, boldness	yes	few		Good		
	saturation, brightness	yes	few		Good		
	color	no	few (< 20)			Good	
	shape, icon	no	medium			Good	
	pattern texture	no	medium			Good	
	enclosure, connection	no	infinite			Good	Good
	line pattern	no	few				Good
	line endings	no	few				Good
	line weight	yes	few		Good		



DESIGNING MAPS

- Is location information meaningful?
- Is location information *the most important* relationship?
- How relevant is geographic detail?

EXTERNAL EYES

- Evaluation requires an external perspective
- Conduct ad hoc user tests

GOOD DESIGN: SUMMARY

- Keep it simple
- Focus on the message
- Use the defaults
- Beauty doesn't hurt

D3.JS

"D3.js is a JavaScript library for manipulating documents based on data."

```
var paragraphs = document.getElementsByTagName("p");
for (var i = 0; i < paragraphs.length; i++) {
  var paragraph = paragraphs.item(i);
  paragraph.style.setProperty("color", "pink", null);
}
```

```
d3.selectAll("p").style("color", "pink");
```

BINDING DATA

```
d3.selectAll("p")
  .data([4, 8, 15, 16, 23, 42])
  .style("font-size", function(d) { return d + "px"; });
```

Hi there!

I'm a paragraph

Hey, I'm also a paragraph!

Me too!

Same here!

Guys, we're all paragraphs...

THE ENTER SELECTION

Data value HTML element

5	Paragraph
11	Paragraph
21	Paragraph
7	Paragraph
14	Paragraph
15	
29	

THE EXIT SELECTION

Data value	HTML element
5	Paragraph
11	Paragraph
21	Paragraph
7	Paragraph
14	Paragraph
	Paragraph
	Paragraph

DEMO TIME

DATAVIZ FOR JOURNALISTS

INTUITIVE, SIMPLE AND ENGAGING

REUSABLE CHARTS AND TOOLS

MOBILE FRIENDLY

A STATIC FUTURE?

THANK YOU!