

# Infographics: Visualizing Complex Data to Non-Experts

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Data Visualization and Mining  
WS 18/19

# Outline

**1 Motivation**

2 Background

3 Goals of Infographics

4 Design Principles

5 Application Fields

6 Conclusion

7 References

# Motivation

5		Percentage of women in occupational category		Median Earnings (dollars)						Women's earnings as a percentage of men's earnings	
6	Occupational Category			Total		Men		Women			
7		Estimate	MOE <sup>3</sup>	Estimate	MOE <sup>3</sup>	Estimate	MOE <sup>3</sup>	Estimate	MOE <sup>3</sup>	Estimate	MOE <sup>3</sup>
8	<b>Total</b>	43.1	0.1	45,860	66	50,741	54	40,675	54	80.2	0.1
9	<b>Management, Business, Science, and Arts Occupations</b>	49.0	0.1	65,004	161	76,692	155	55,474	144	72.3	0.1
10	<b>Management, Business, and Financial Occupations</b>	43.5	0.2	70,602	135	80,473	201	60,751	124	75.5	0.2
11	<b>Management Occupations</b>	38.8	0.2	73,688	473	81,829	235	62,254	175	76.1	0.3
12	Chief executives	23.8	0.6	130,266	1,910	141,108	1,375	103,564	4,259	73.4	3.1
13	General and operations managers	29.5	0.9	70,686	627	76,246	776	56,906	1,111	74.6	1.6
14	Legislators	46.8	8.7	65,592	5,454	67,233	12,792	63,788	10,085	94.9	23.5
15	Advertising and promotions managers	58.7	3.2	67,082	3,498	79,594	6,833	61,173	3,088	76.9	7.7
16	Marketing and sales managers	44.9	0.8	82,357	1,263	100,137	1,477	69,079	2,413	69.0	2.6
17	Public relations and fundraising managers	67.3	3.3	77,835	4,128	84,016	7,323	75,260	3,792	89.6	9.0
18	Administrative services managers	39.5	2.5	64,208	1,927	69,788	3,102	60,177	1,731	86.2	4.6
19	Computer and information systems managers	26.8	0.8	103,513	1,960	107,411	1,908	95,603	2,703	89.0	3.0
20	Financial managers	52.6	1.0	76,178	753	100,505	689	62,089	579	61.8	0.7
21	Compensation and benefits managers	75.1	4.5	71,605	4,679	93,895	15,621	70,251	5,258	(X)	(X)
22	Human resources managers	61.1	1.3	72,008	801	77,463	4,593	70,342	1,351	90.8	5.7
23	Training and development managers	52.0	4.6	72,153	4,805	82,392	7,206	64,686	5,535	78.5	9.6
24	Industrial production managers	20.0	1.3	76,077	1,099	77,262	1,807	70,073	4,005	90.7	5.6
25	Purchasing managers	47.9	1.6	76,501	1,625	82,307	2,505	70,023	2,812	85.1	4.3
26	Transportation, storage, and distribution managers	18.0	1.4	52,485	1,573	52,318	1,091	54,796	3,599	104.7	7.2
27	Farmers, ranchers, and other agricultural managers	11.2	0.6	41,404	525	42,190	737	30,405	1,257	72.1	3.2
28	Construction managers	7.8	0.6	71,331	693	71,907	803	62,218	3,121	86.5	4.4
29	Education administrators	62.3	0.5	70,748	476	80,380	827	64,509	1,589	80.3	2.1
30	Architectural and engineering managers	8.9	1.2	130,293	2,326	130,300	2,512	130,255	6,336	100.0	5.2
31	Food service managers	44.9	1.0	38,380	1,296	42,601	1,510	31,861	485	74.8	2.9
32	Funeral service managers	27.2	7.5	60,848	6,112	60,487	8,583	61,597	10,890	(X)	(X)
33	Gaming managers	34.6	6.5	55,674	5,819	56,664	8,926	52,872	6,227	93.3	18.4
34	Lodging managers	52.7	3.2	45,875	1,807	51,697	1,832	41,285	1,145	79.9	3.6
35	Medical and health services managers	71.0	0.9	71,739	750	87,311	3,047	66,855	876	76.6	2.9
36	Natural sciences managers	52.8	5.1	92,161	11,812	111,817	10,376	76,768	9,964	68.7	11.0
37	Postmasters and mail superintendents	45.6	3.4	71,429	948	72,401	3,138	67,745	4,019	93.6	6.9
38	Property, real estate, and community association managers	49.1	1.3	51,957	590	61,797	1,225	46,405	788	75.1	2.0
39	Social and community service managers	69.3	1.5	56,610	773	68,388	3,529	52,444	1,006	76.7	4.2

[1]

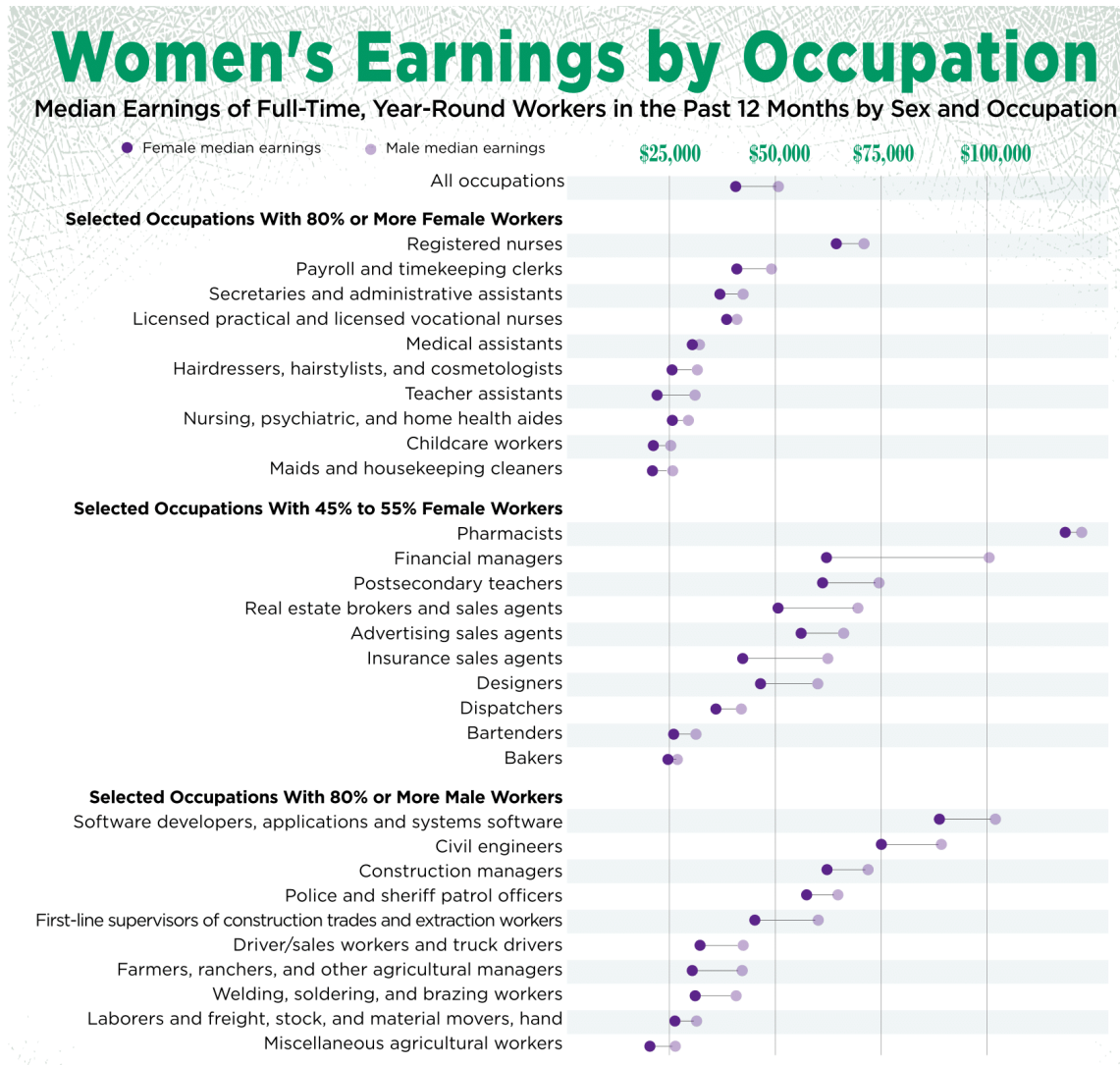
# Motivation

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18	Administrative services managers	<div>Median Earnings (dollars)</div> <table><tr><th colspan="2">Total</th><th colspan="2">Men</th><th colspan="2">Women</th></tr><tr><th>Estimate</th><th>MOE<sup>3</sup></th><th>Estimate</th><th>MOE<sup>3</sup></th><th>Estimate</th><th>MOE<sup>3</sup></th></tr><tr><td>60,848</td><td>6,112</td><td>60,487</td><td>8,583</td><td>61,597</td><td>10,890</td></tr></table>										Total		Men		Women		Estimate	MOE <sup>3</sup>	Estimate	MOE <sup>3</sup>	Estimate	MOE <sup>3</sup>	60,848	6,112	60,487	8,583	61,597	10,890
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[1]



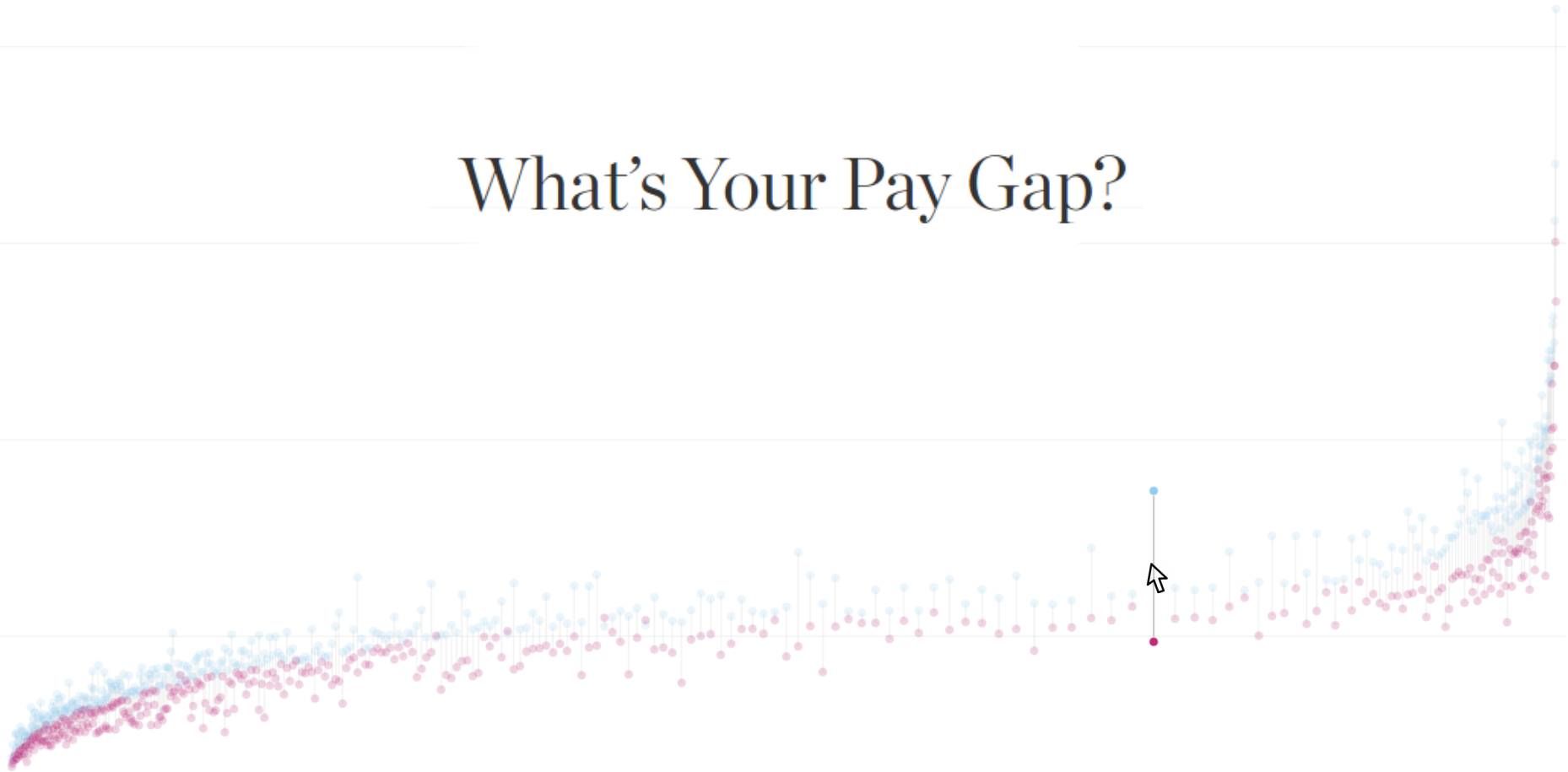
# Motivation



[2]

# Motivation

What's Your Pay Gap?



[3]

# Outline

1 Motivation

**2 Background**

3 Goals of Infographics

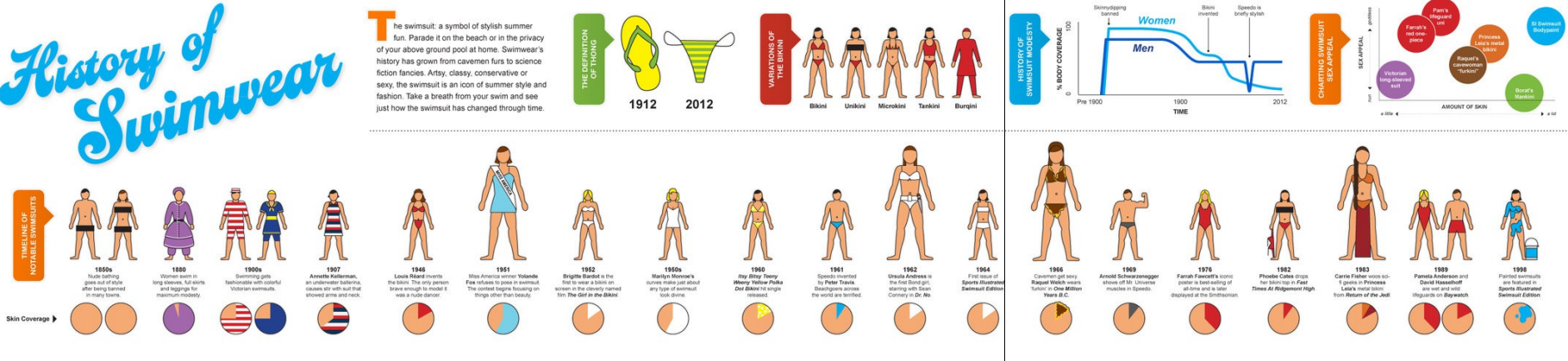
4 Design Principles

5 Application Fields

6 Conclusion

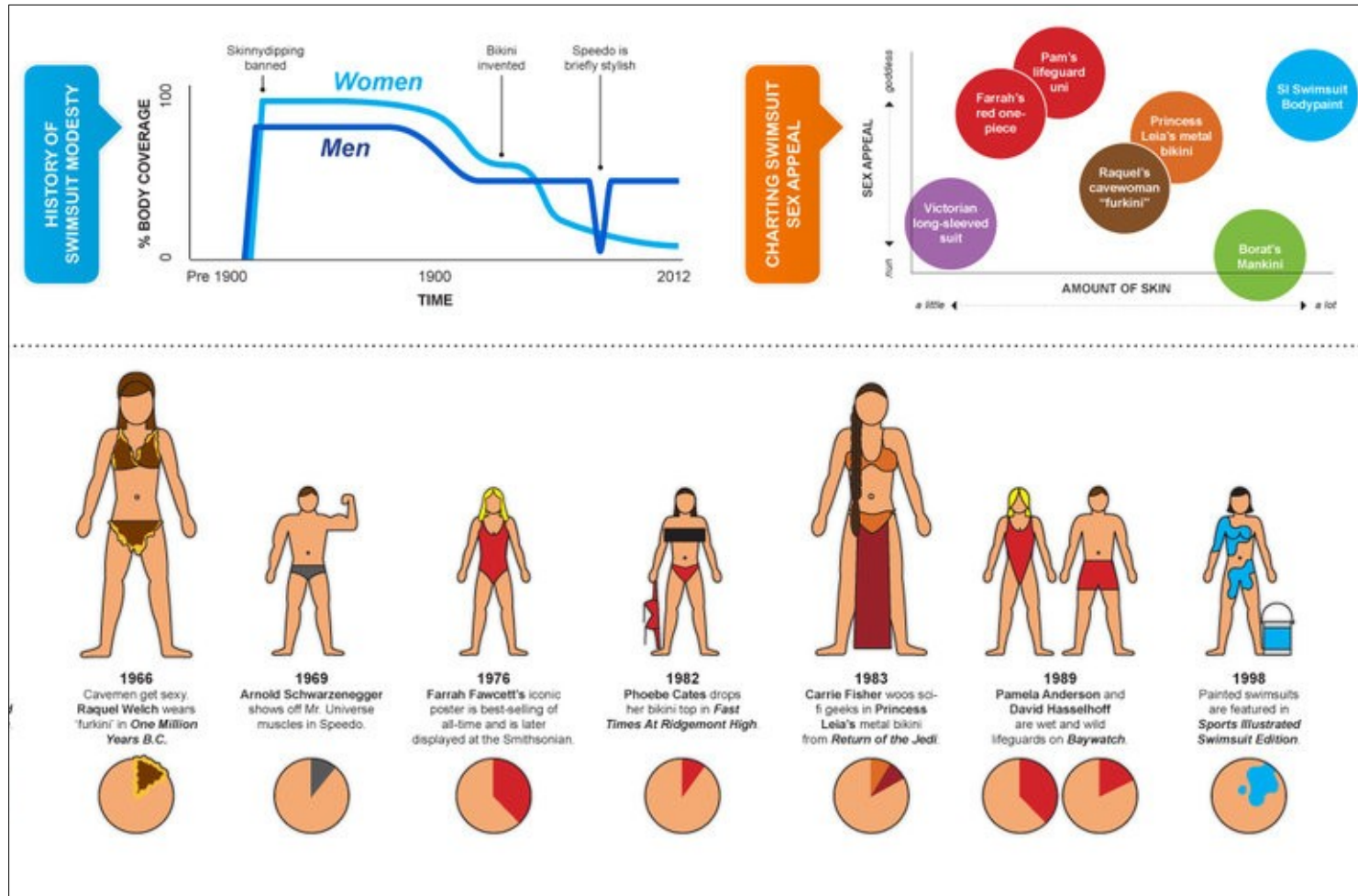
7 References

# Information graphics



- Narrative
- Statistical and artistic visualization
- Some text

# Background

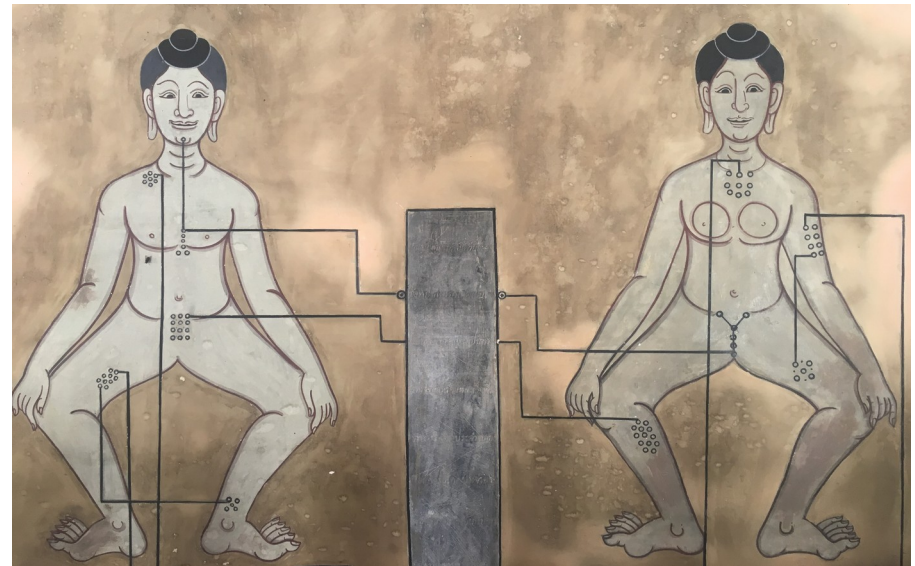




# Background – Information Overload



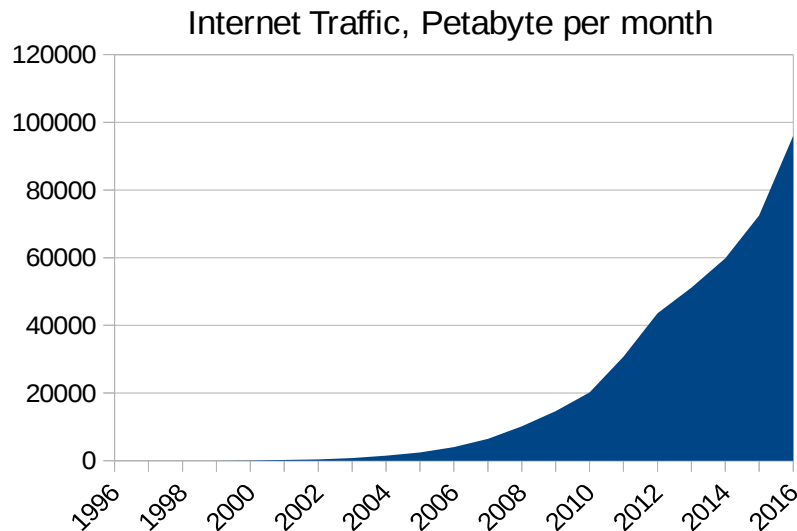
Rouffignac cave, France  
ca. 11000 B.C.



Wat Pho, Thailand  
ca. 1800 A.D.

[5][6]

# Background – Information Overload



Exposure to information:

**~ 34 GB/day/person**

Limit for conscious perception **~ 1 GB/day/person**

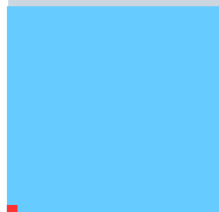
Reading 300 words/min  $\approx$  **0.0005 GB/day/person**

# Background – Information Overload

Exposed



Conscious



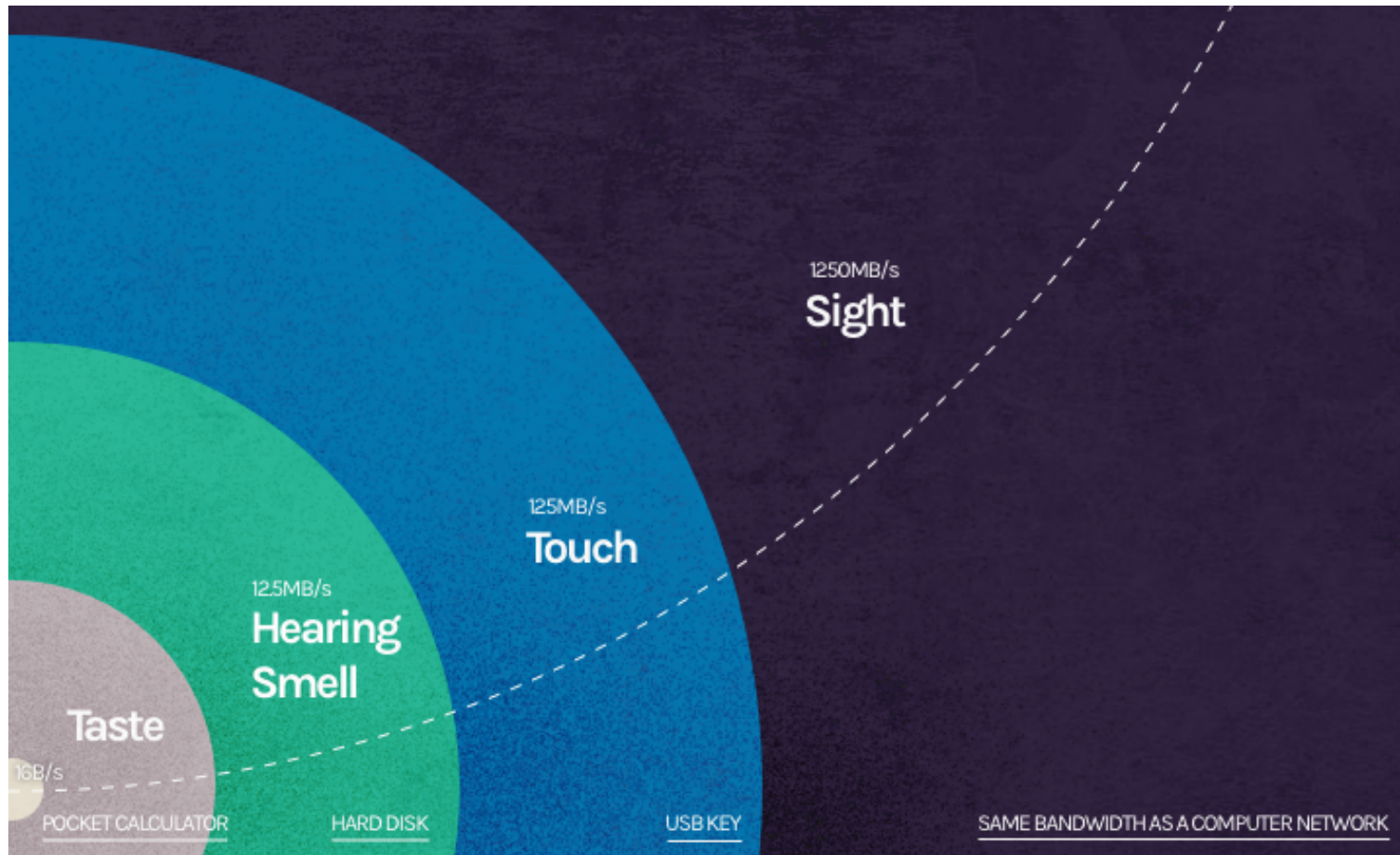
Reading



[6]



# Background - Perception



50%-80% processing of vision

[7]

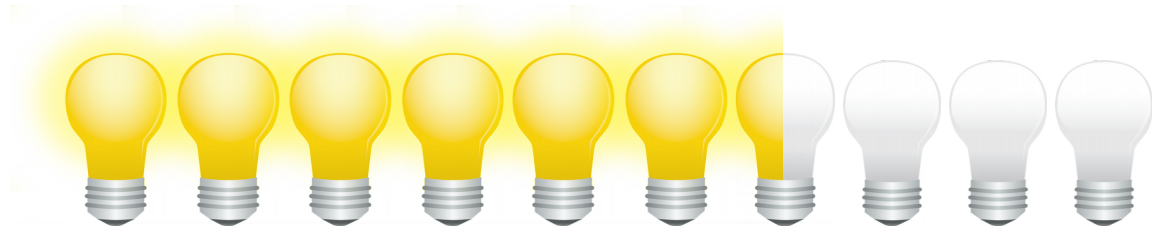
# Background - Perception

Picture Superiority Effect  
Memory retention after 3 days:

Text 10%



Text + picture 65%



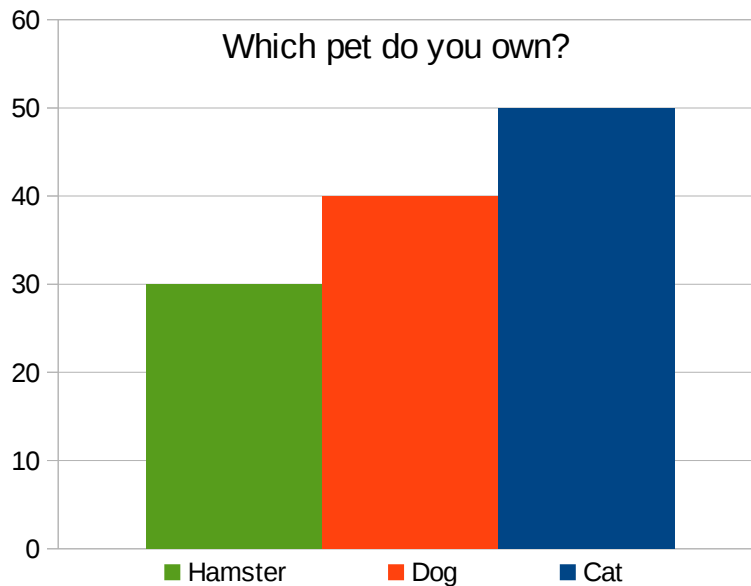
# Background – Storytelling

## Associative Thinking

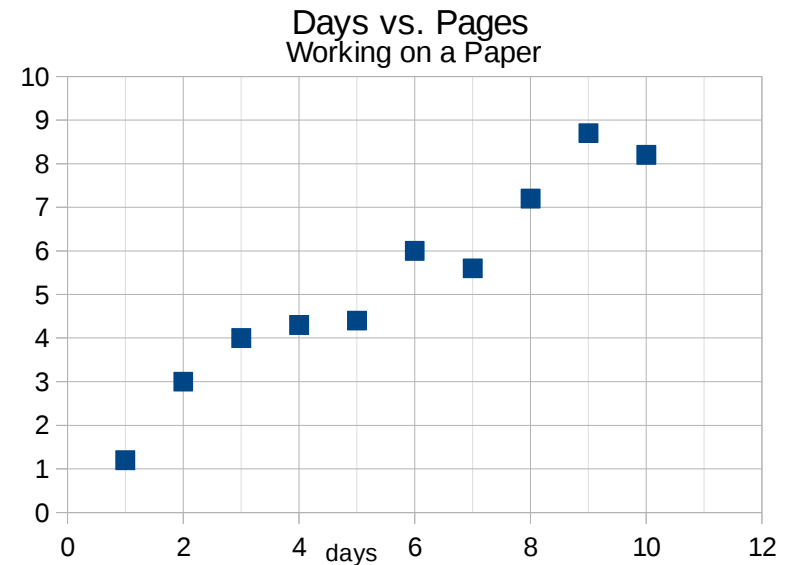
Name	Birthdate	Birthplace	Mother	Father
Lisa	13.04.1993	Berlin	Ada	James
Myself	21.07.1997	Berlin	Katrin	Jörg
Napoleon	15.08.1769	Corsica	Maria	Carlo



# Background – Chart Types

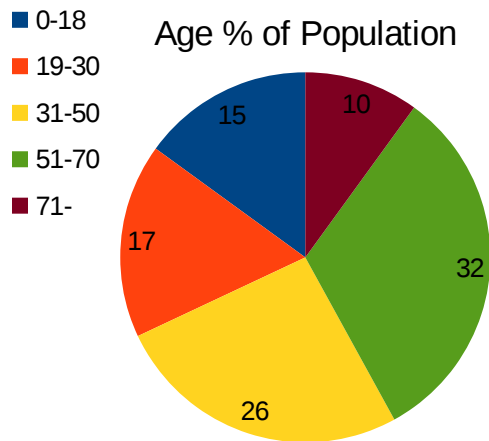


Bar Chart

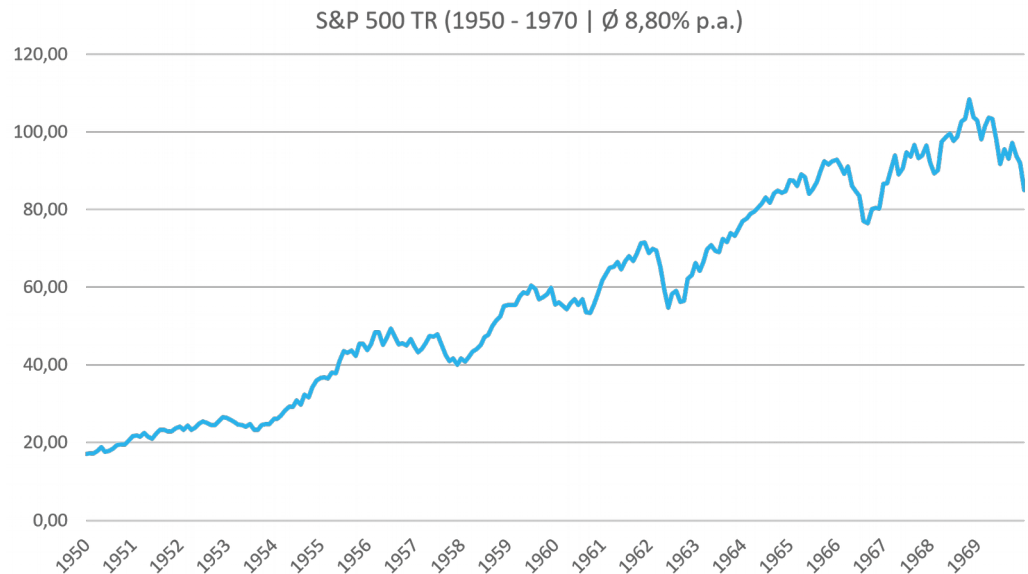


Scatter Plot

# Background – Chart Types



Pie Chart



Line Chart

# Background – Chart Types



Treemap



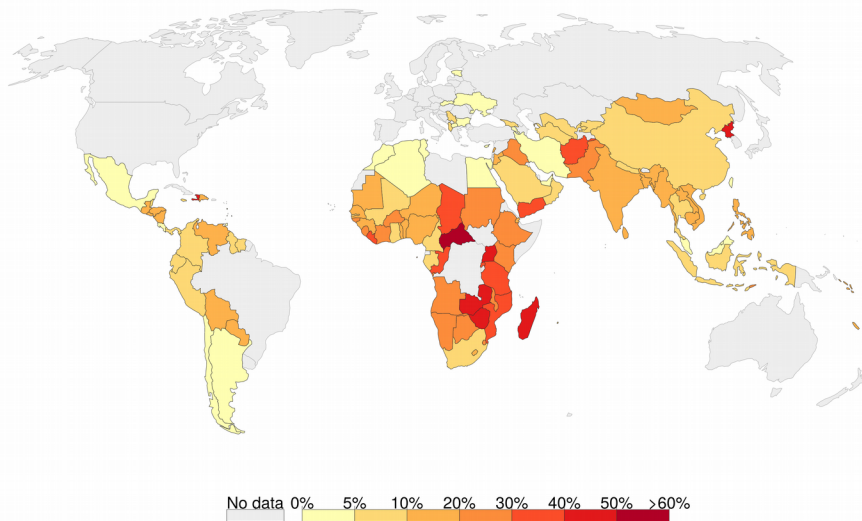
Network Graph

[10][11]



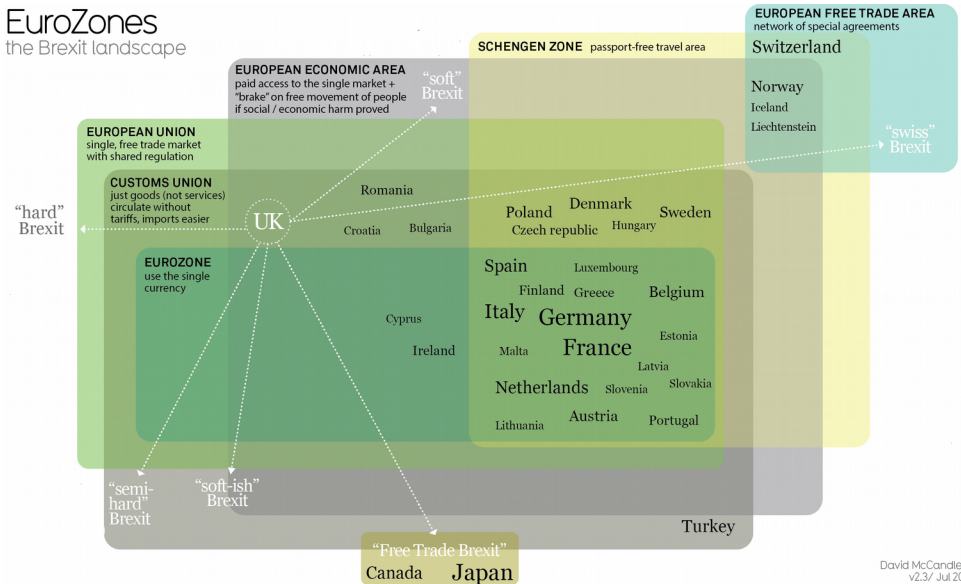
# Background – Chart Types

**Share of people who are undernourished, 2016**  
The estimated share of the population who are undernourished (have an energy intake below minimum requirements).



Map

**EuroZones**  
the Brexit landscape



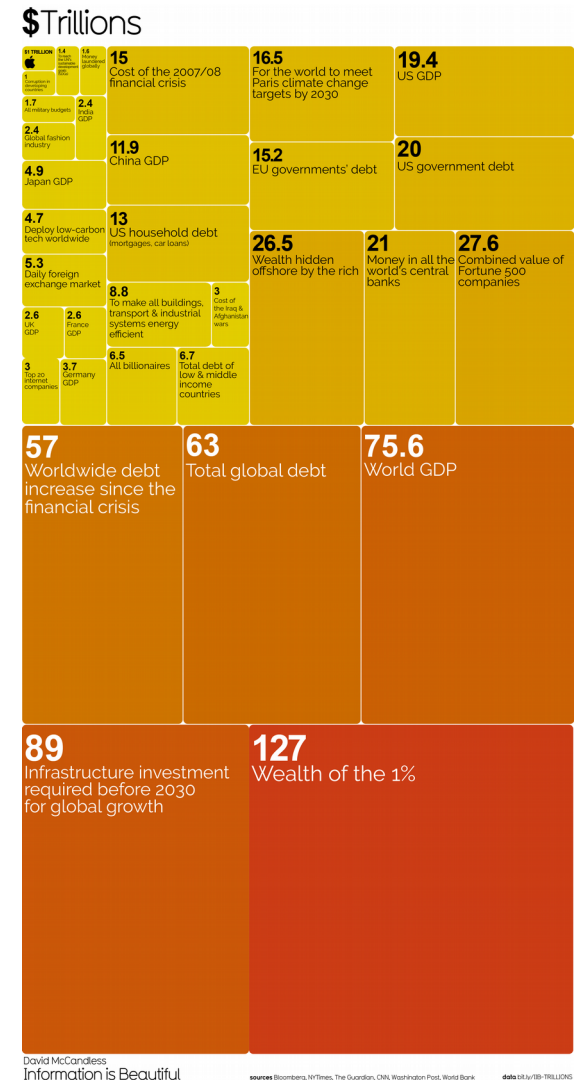
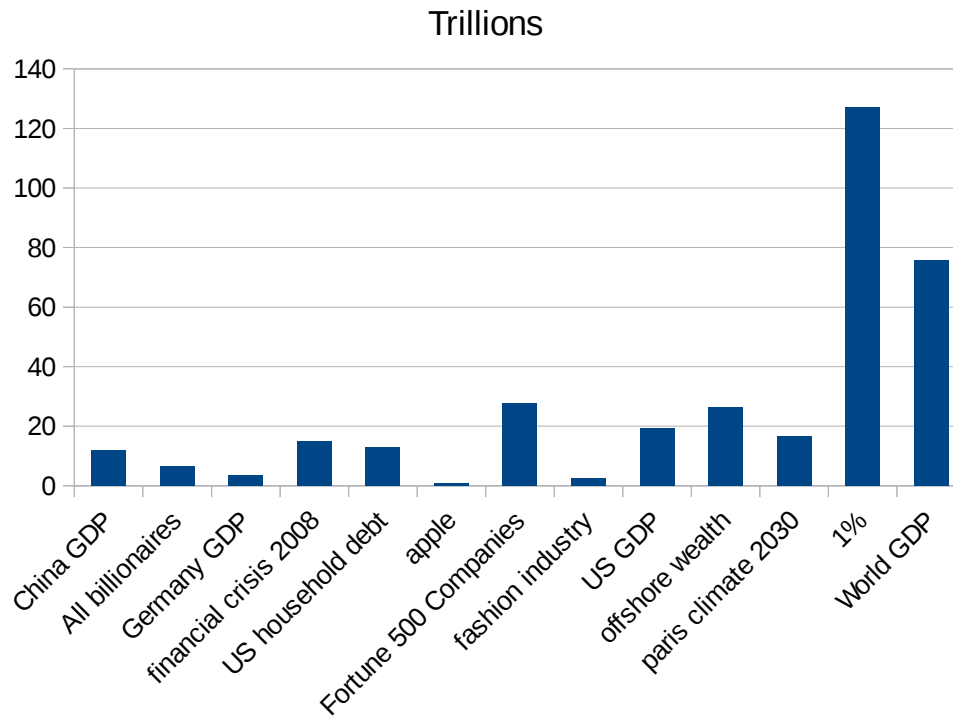
Venn Diagram

David McCandless  
v2.3 / Jul 2018  
sources: Bloomberg, IMF, Gov.uk, EU  
InformationIsBeautiful.net

[12][13]

# Background – Chart Types

Not every chart fits every data set  
1st Example:





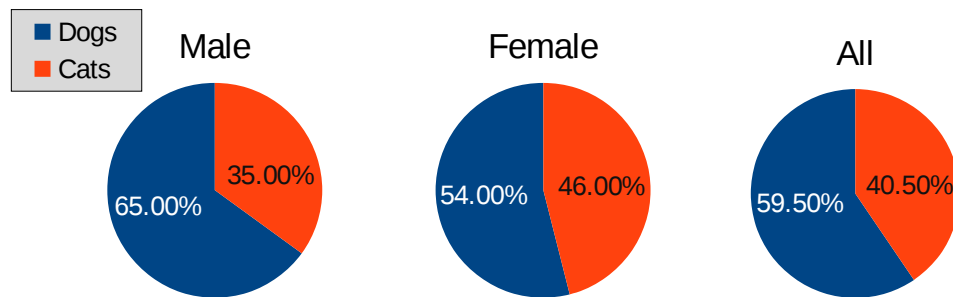
# Background – Chart Types

2nd Example: Do you prefer cats or dogs?

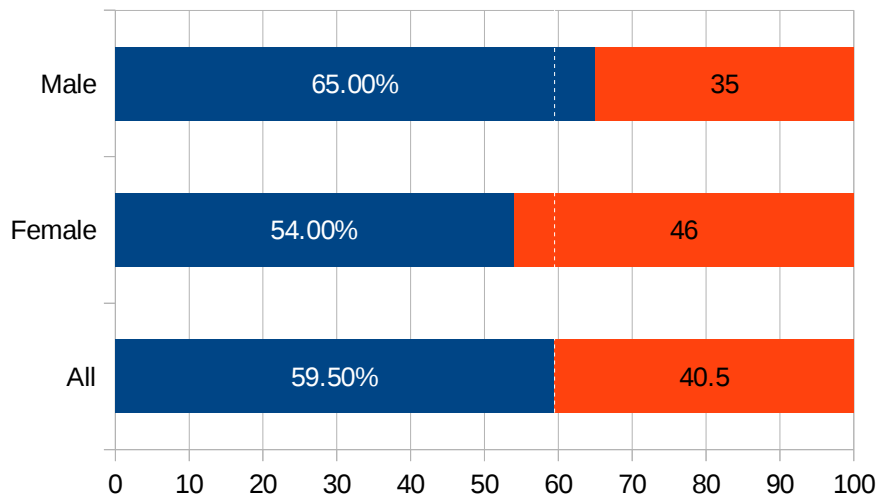
	Male	Female	All
Dogs	65%	54%	59.5%
Cats	35%	46%	40.5%

# Background – Chart Types

## 2nd Example: Do you prefer cats or dogs?



VS.



[6]

# Outline

- 1 Motivation
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- 3 Goals of Infographics**
- 4 Design Principles
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# Goals

comprehension
entertainment
retention



advertise

change opinion

educate

## Goals – Edward R. Tufte

- make large or complex data sets coherent
- don't distract from information
- encourage to compare data
- show several levels of detail
- serve clear purpose

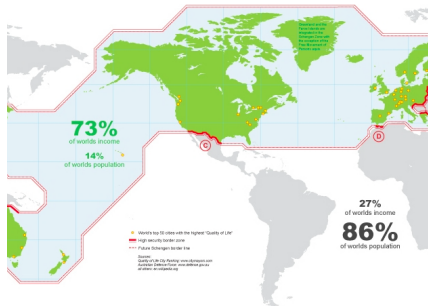
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# Design Principles – Storytelling



# Design Principles – Interactivity



static



clickable



video

zooming



animated



interactive

What's Your Pay Gap?



[14][15][16][17][18][3]

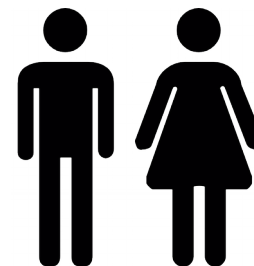
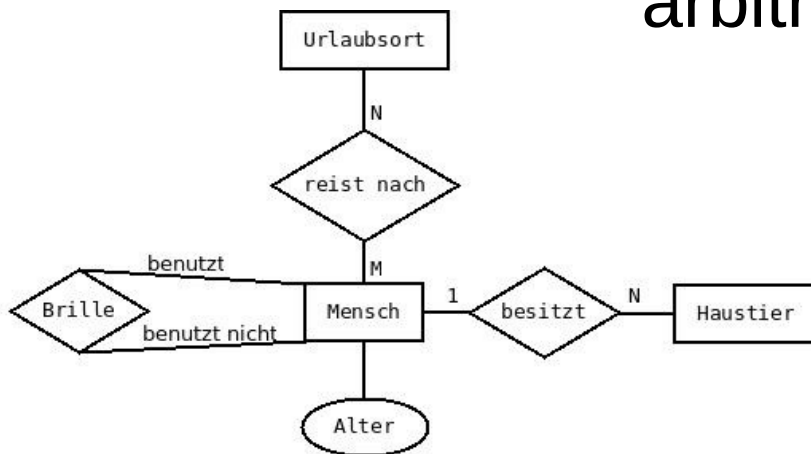


# Design Principles – Sensory vs. Arbitrary



sensory: intuitive, without learning

arbitrary: needs to be learned



[19][6][20]

# Background – less is more

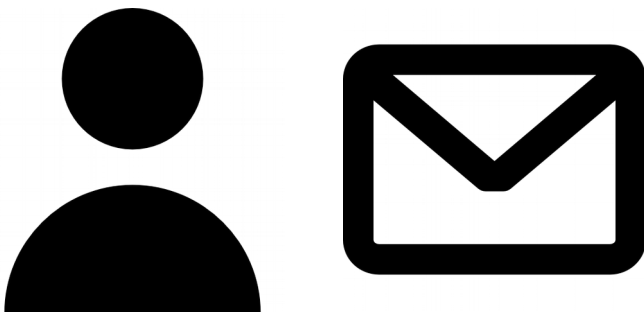
Isotypes (1924)



Defying

- Educational background
- Language
- Culture

Today



[21][22][23]

# Design Principles – Preattentive Processing

Orientation



Curved/straight



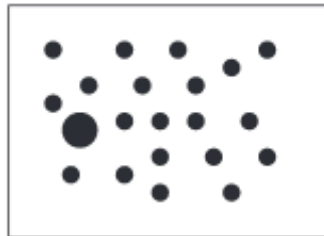
Shape



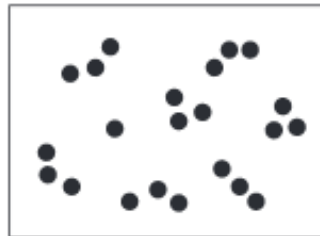
Shape



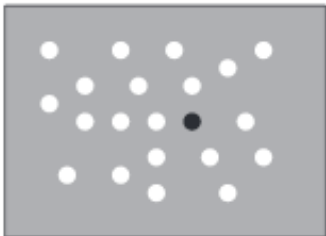
Size



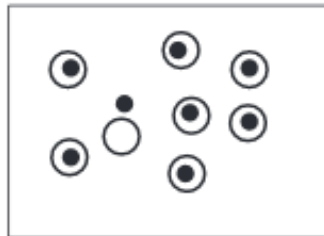
Number



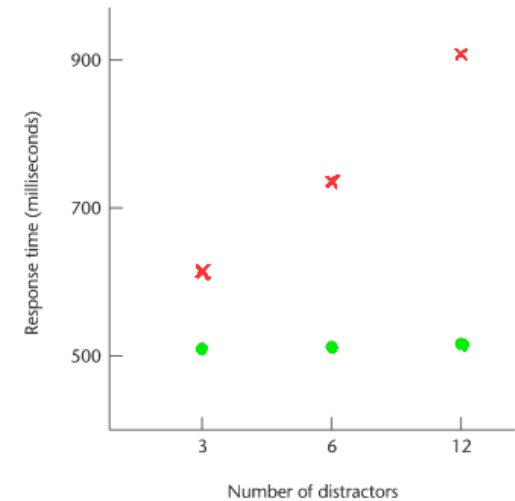
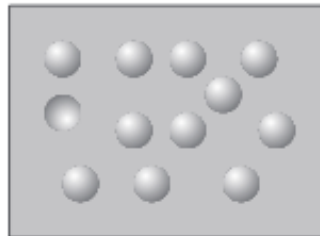
Gray/value



Enclosure



Convexity/concavity



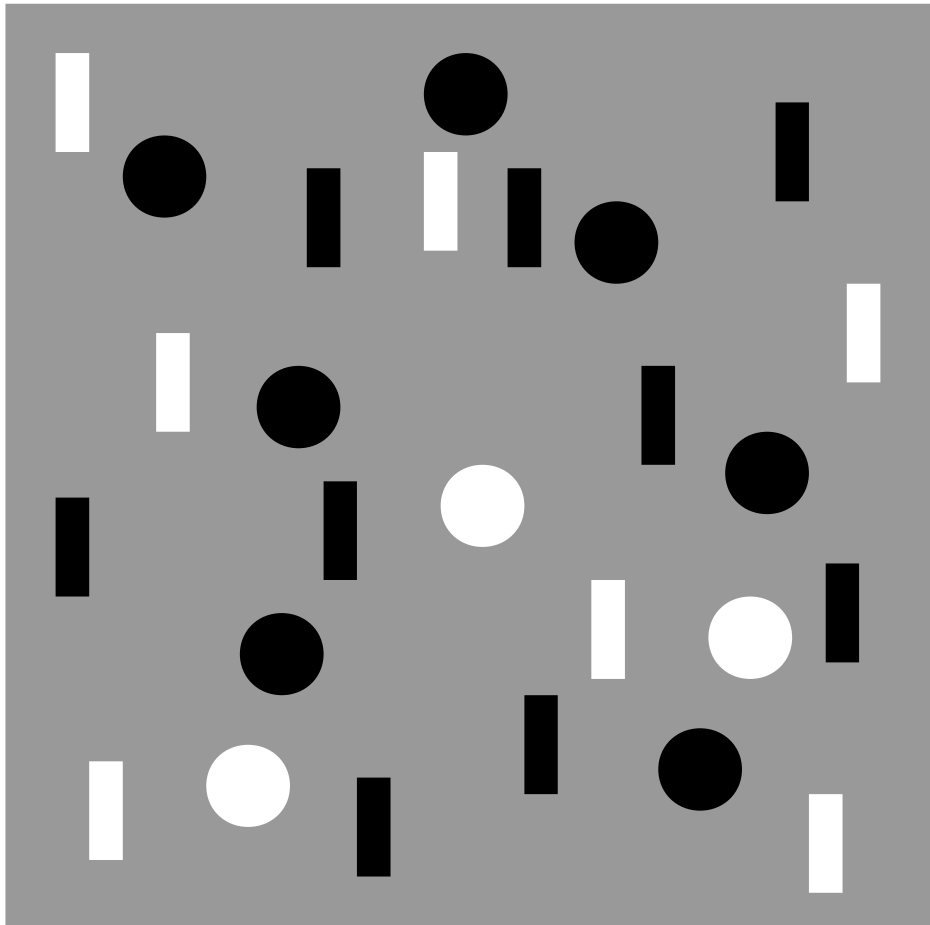
# Design Principles – Preattentive Processing



Conjunction of features:

Color and shape

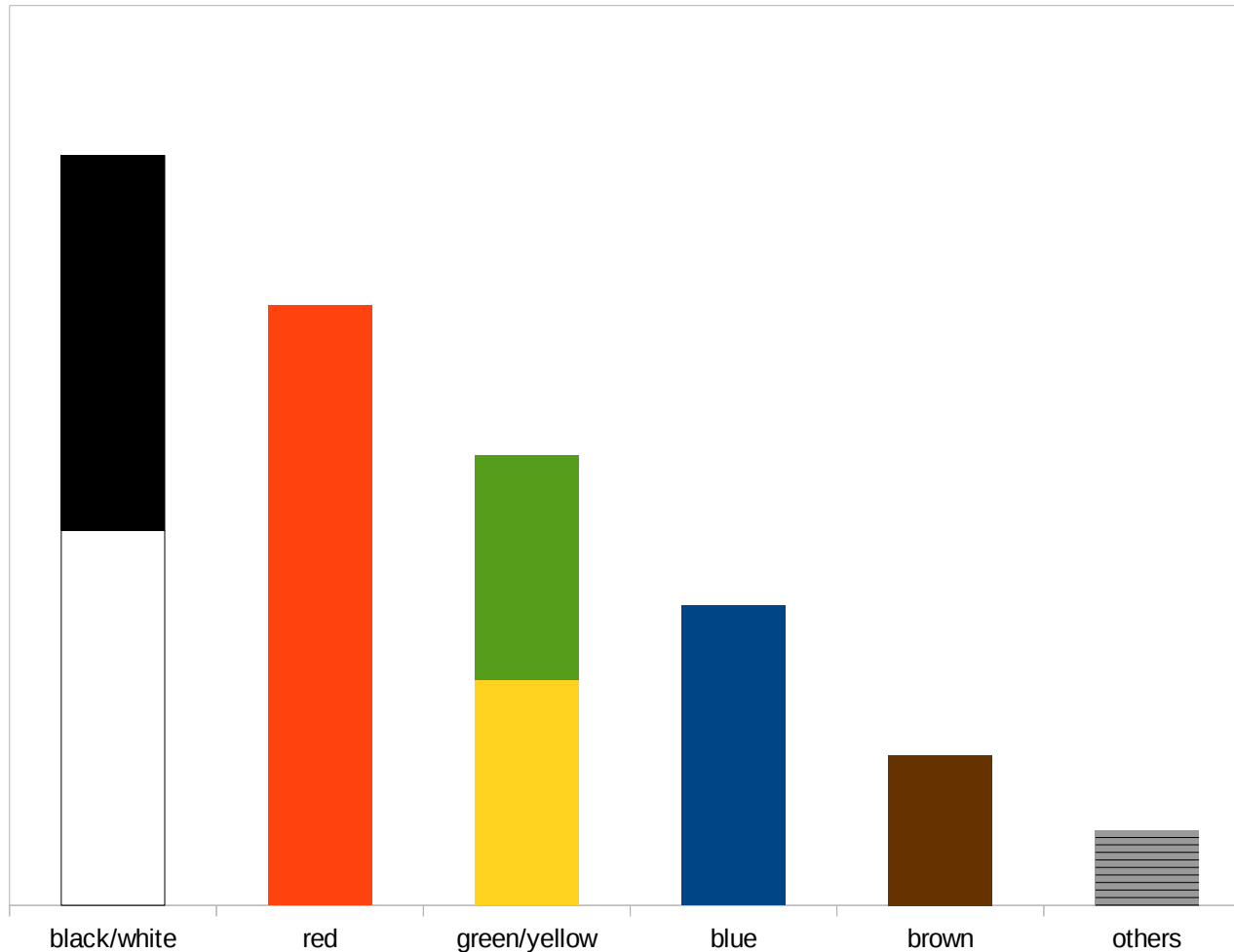
# Design Principles – Preattentive Processing



Conjunction of features:

Polarity and shape

# Design Principles – Colors



$6 \pm 1$  colors

[6]

# Design Principles – Gestalt Theory

*„Das Ganze ist etwas anderes  
als die Summe seiner Teile“*

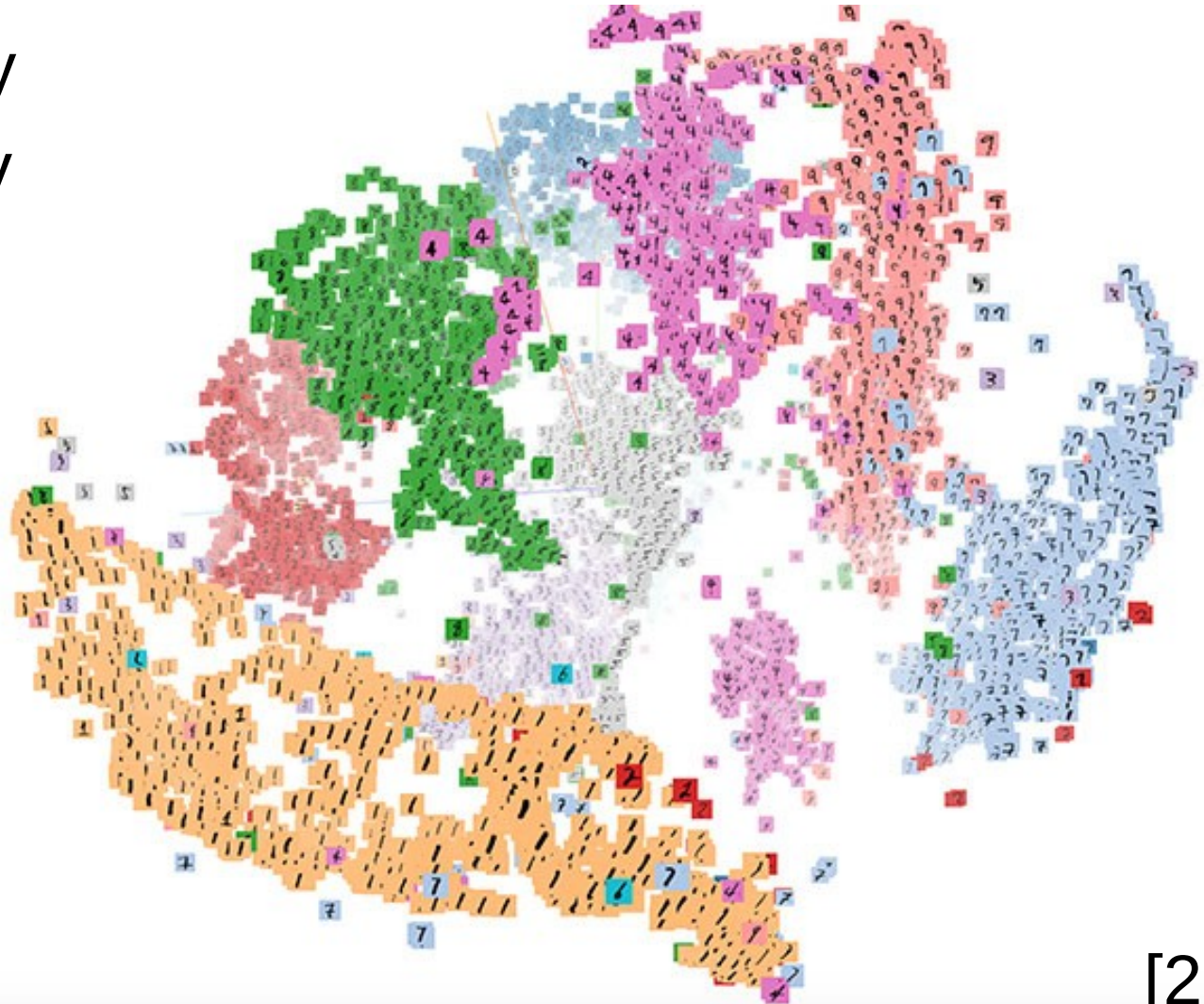
– Wolfgang Metzger

The whole is different than  
just the sum of its parts

# Design Principles – Gestalt Theory

Law of Proximity

Law of Similarity

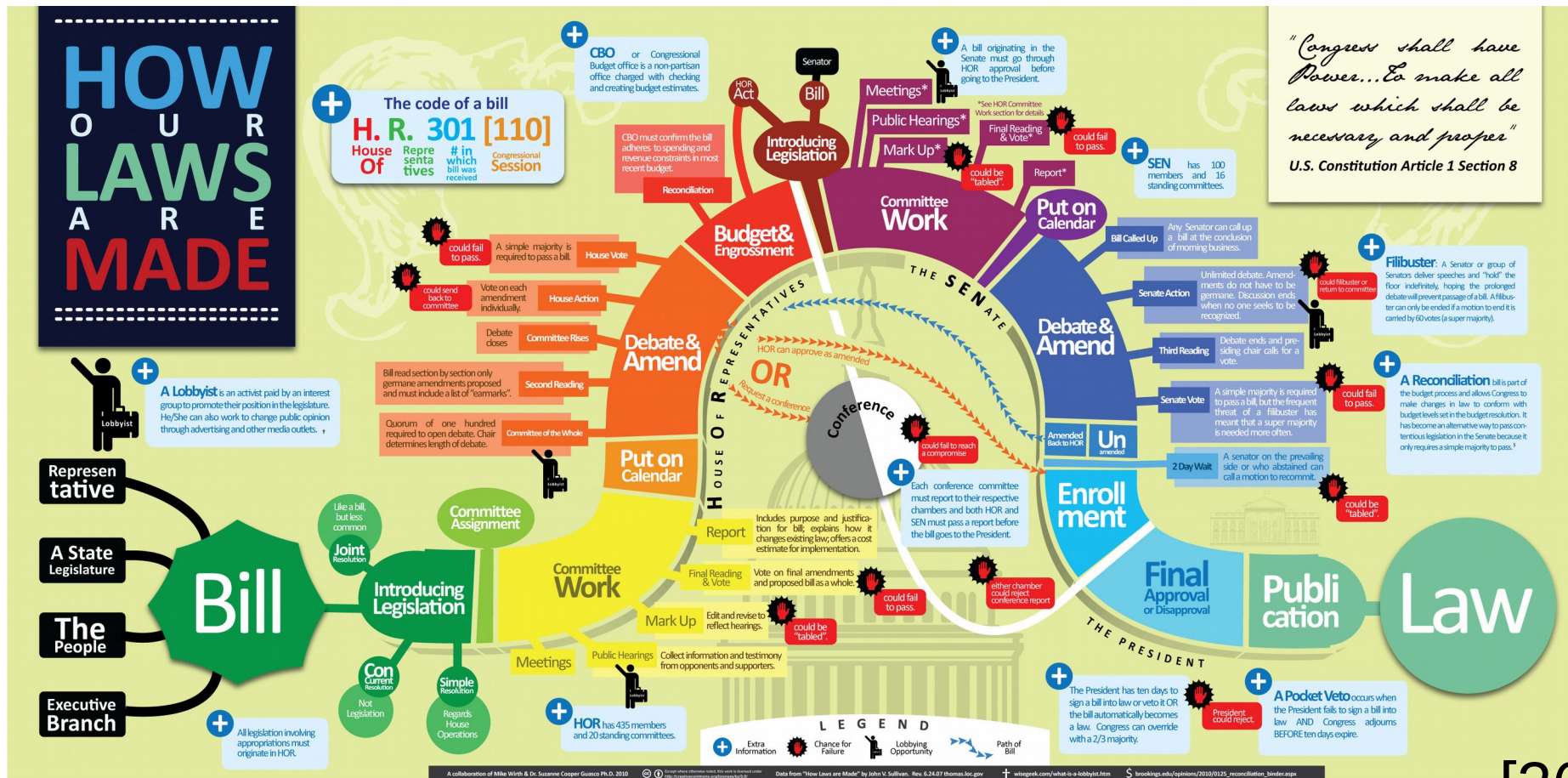


[25]



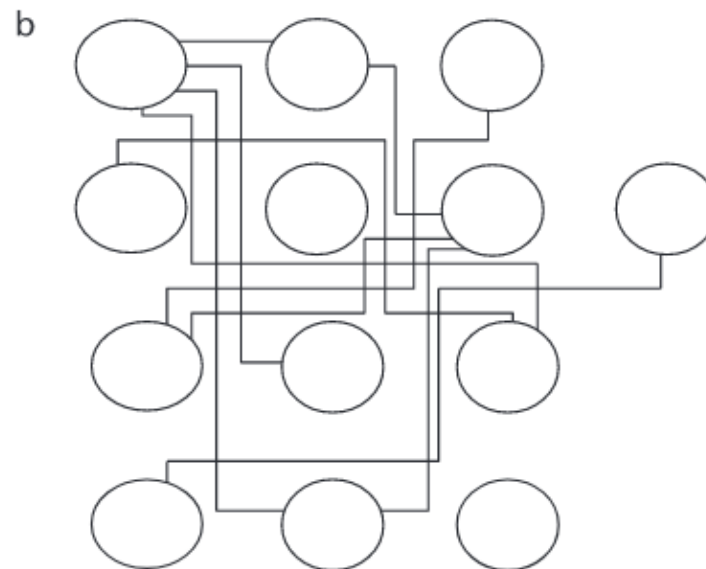
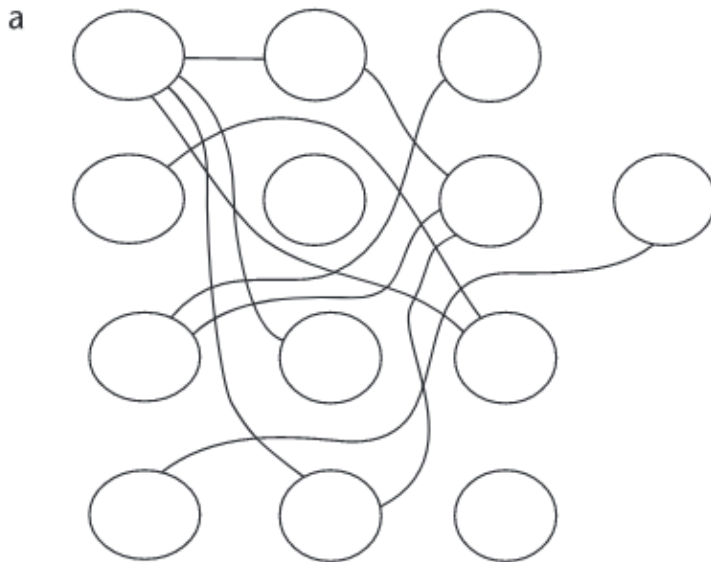
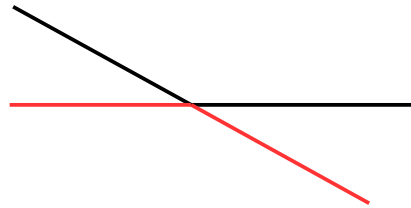
# Design Principles – Gestalt Theory

## Law of Connectedness



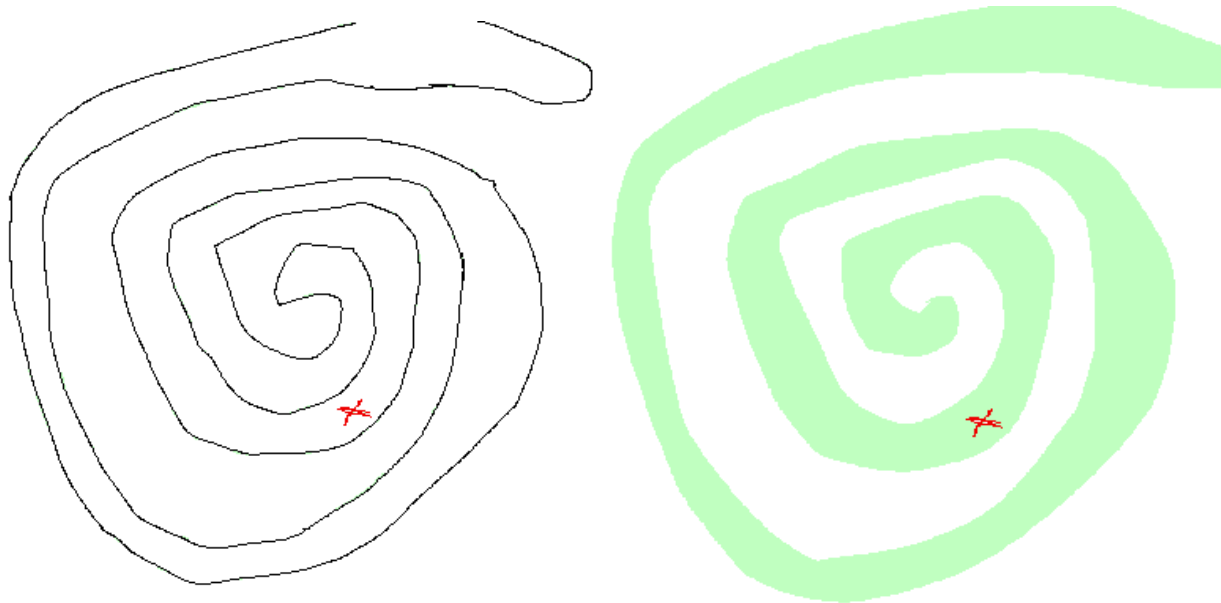
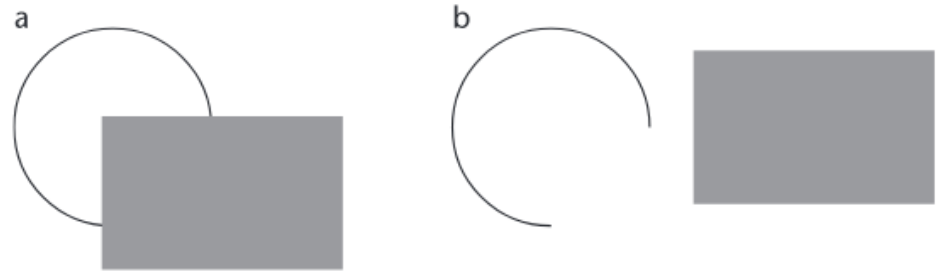
# Design Principles – Gestalt Theory

## Law of Continuity



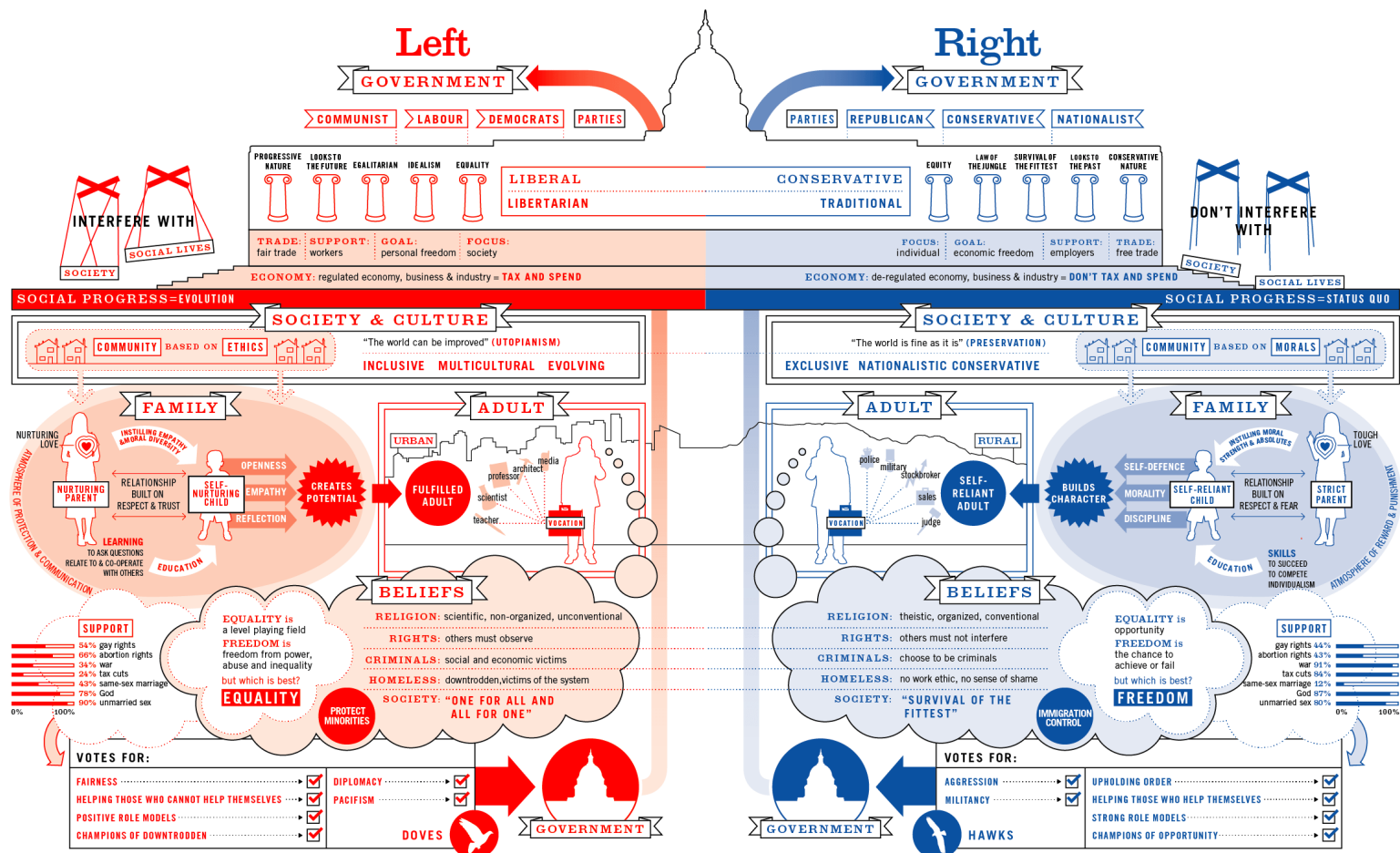
# Design Principles – Gestalt Theory

## Law of Closure and Common Region



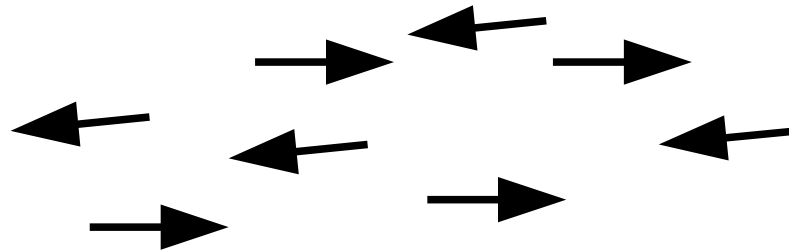
# Design Principles – Gestalt Theory

## Law of Symmetry

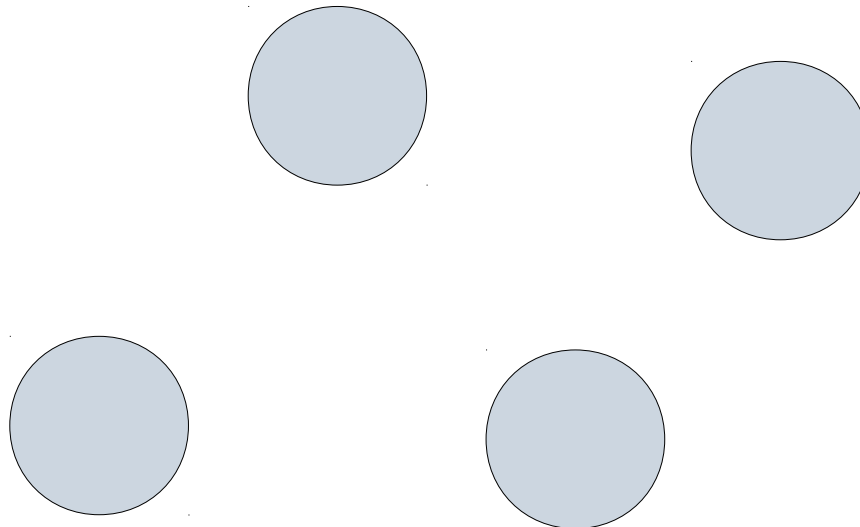


# Design Principles – Gestalt Theory

Law of Same Fate:

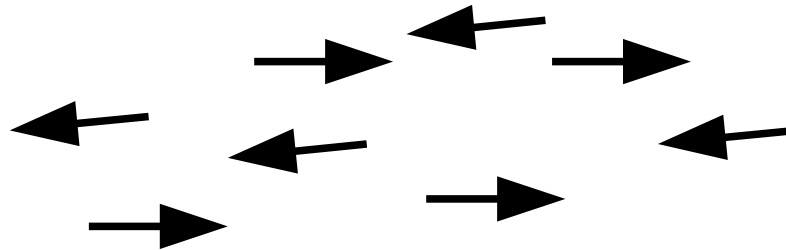


Law of Simultaneity

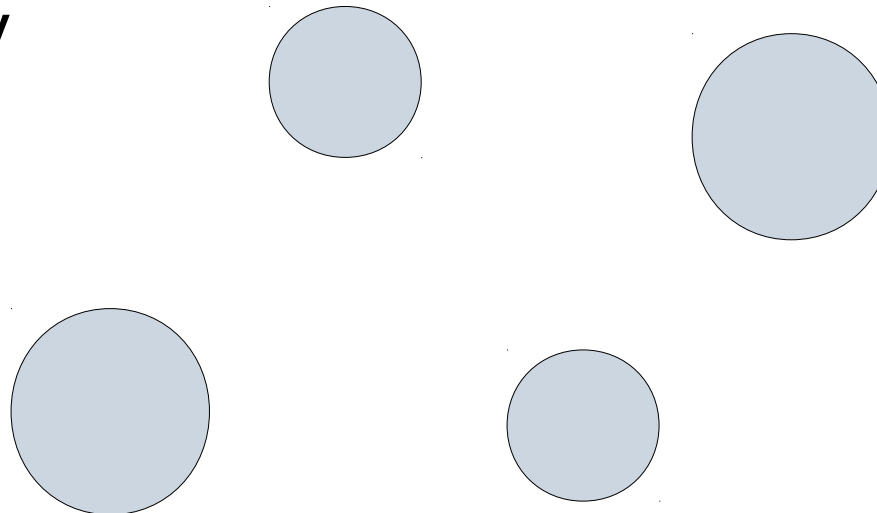


# Design Principles – Gestalt Theory

Law of Same Fate:

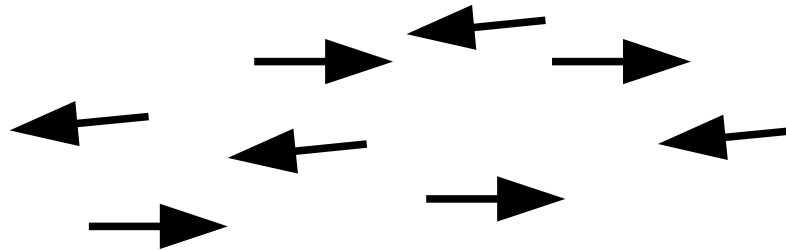


Law of Simultaneity

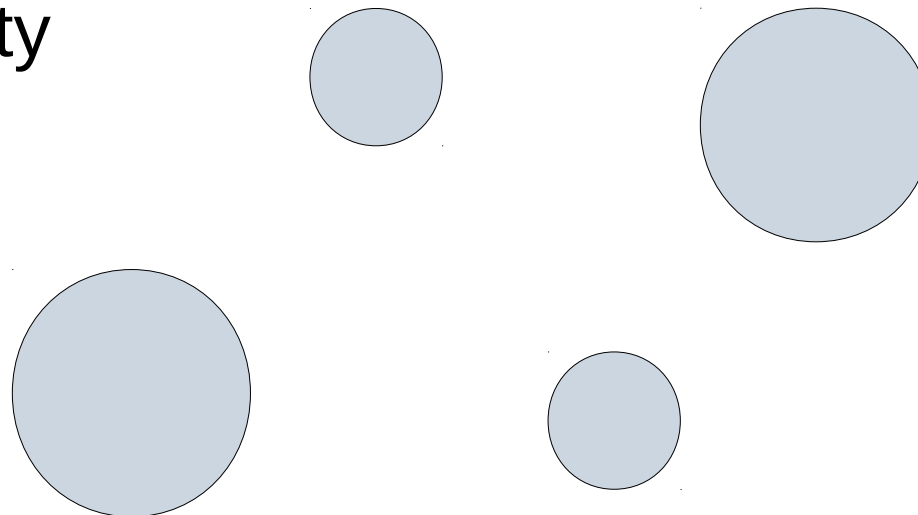


# Design Principles – Gestalt Theory

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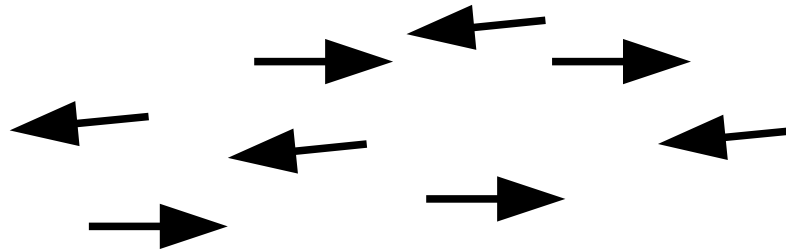


Law of Simultaneity

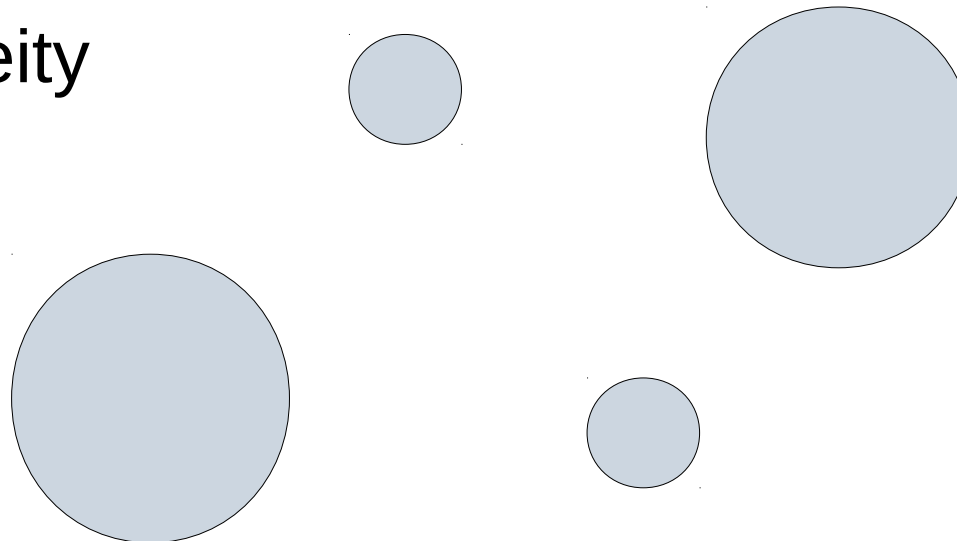


# Design Principles – Gestalt Theory

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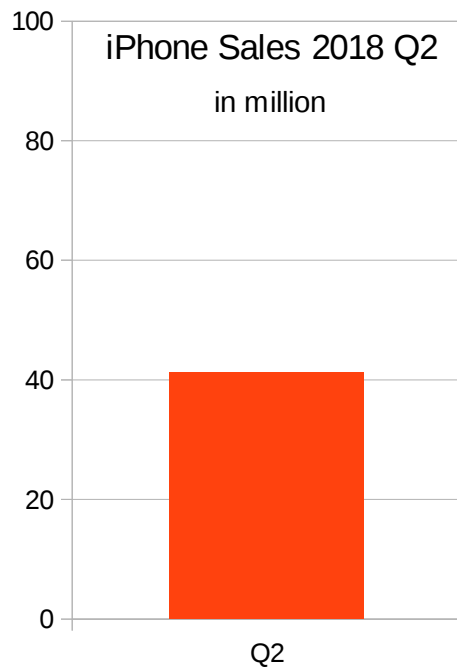


Law of Simultaneity

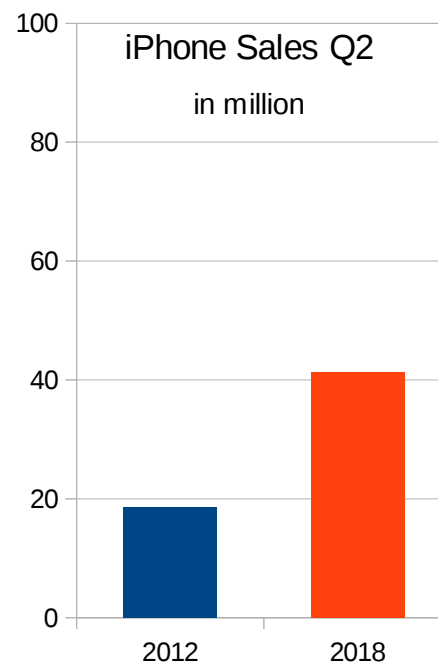
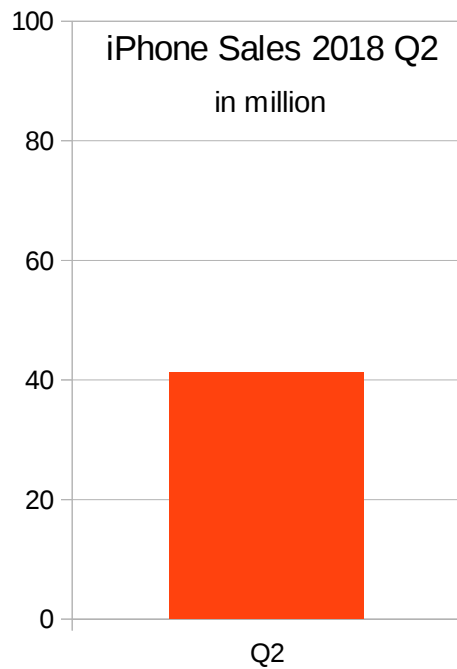




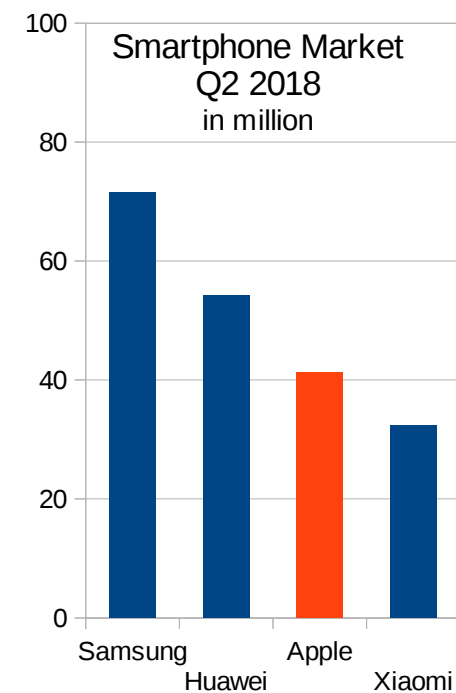
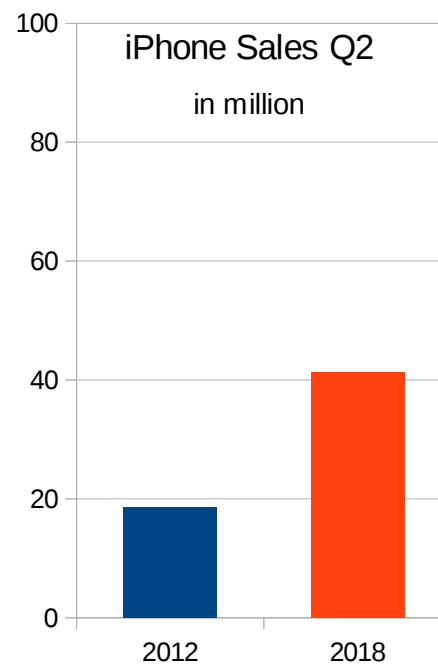
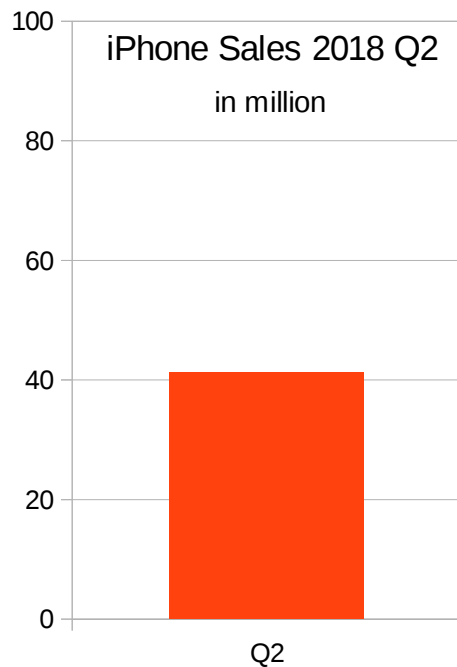
# Design Principles – Context



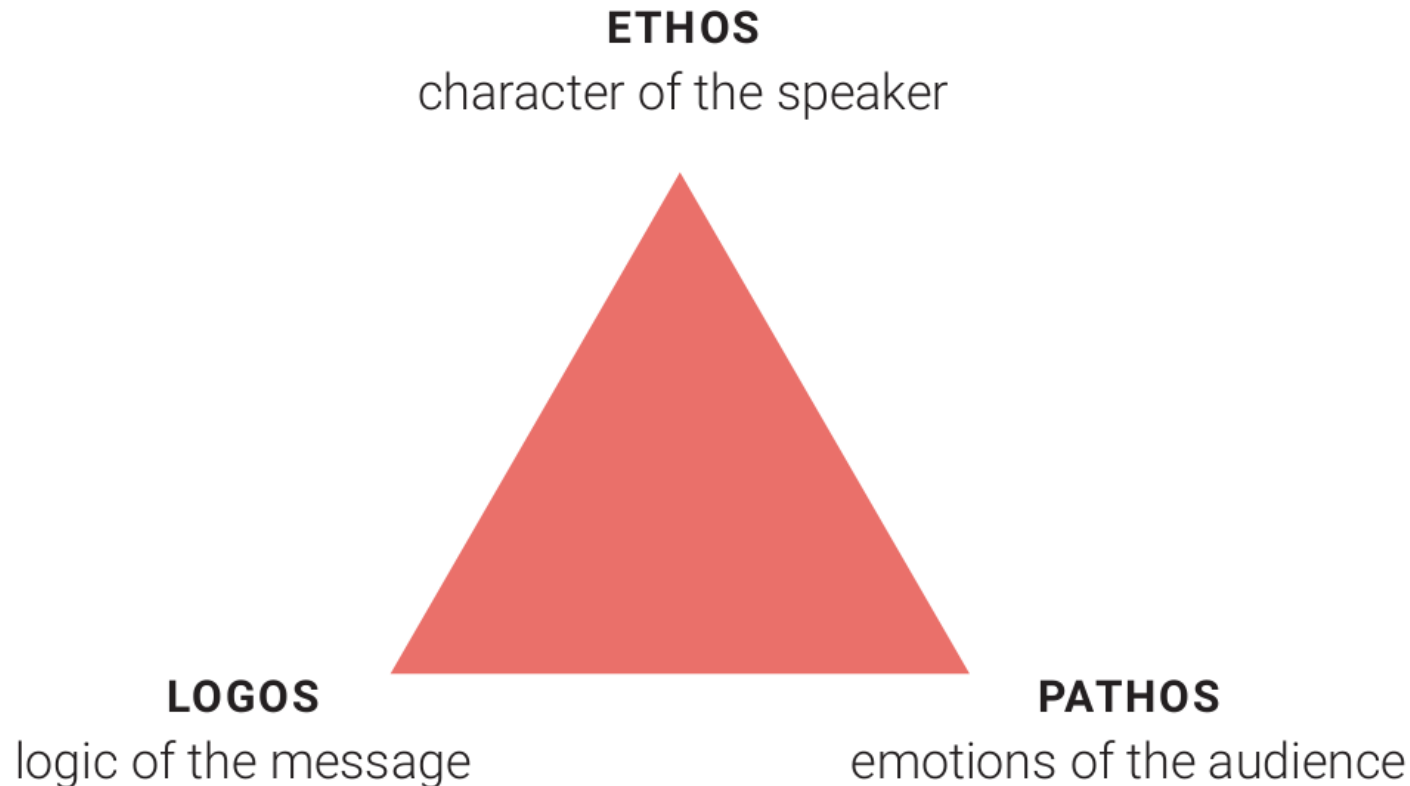
# Design Principles – Context



# Design Principles – Context



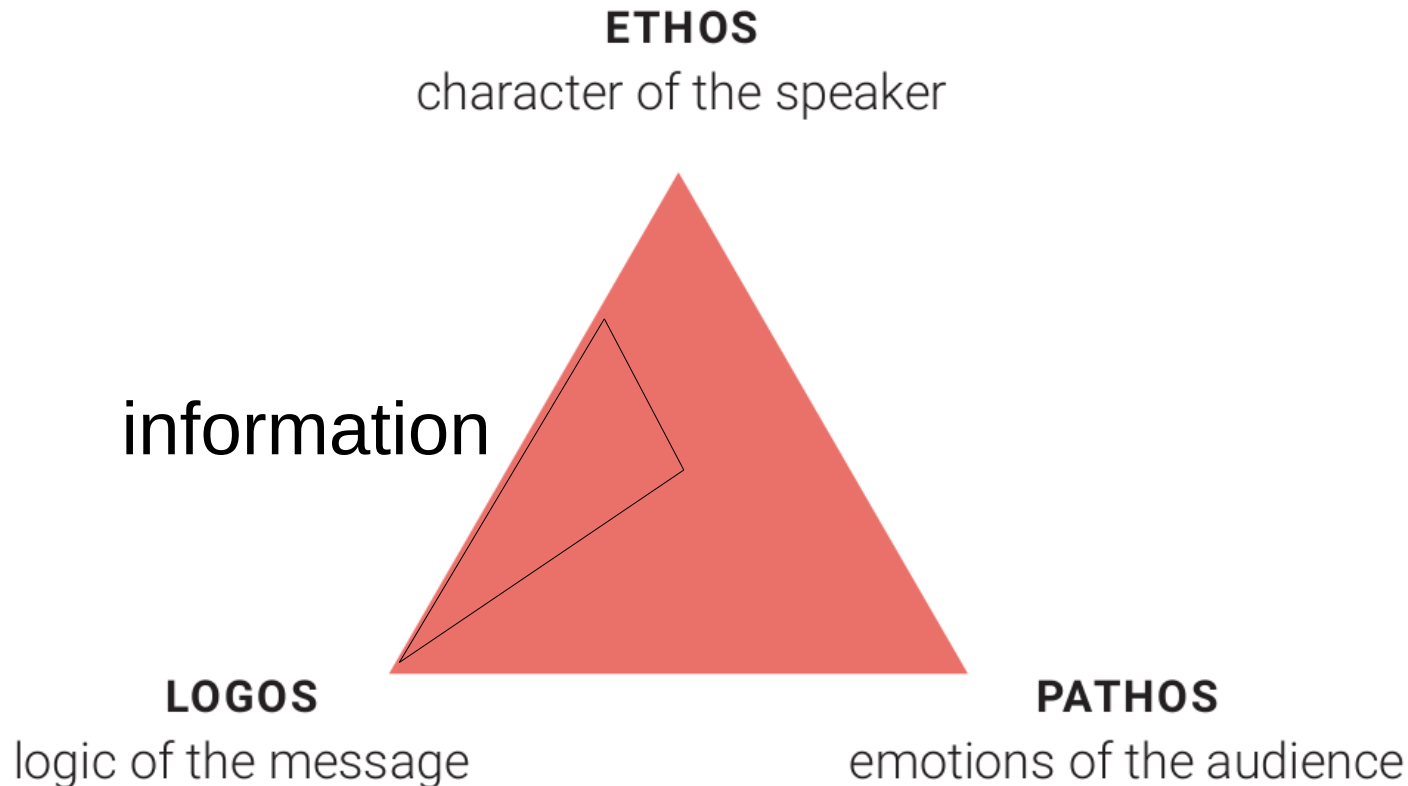
# Design Principles – Affectivity



Aristoteles Rethorical Argument

[28]

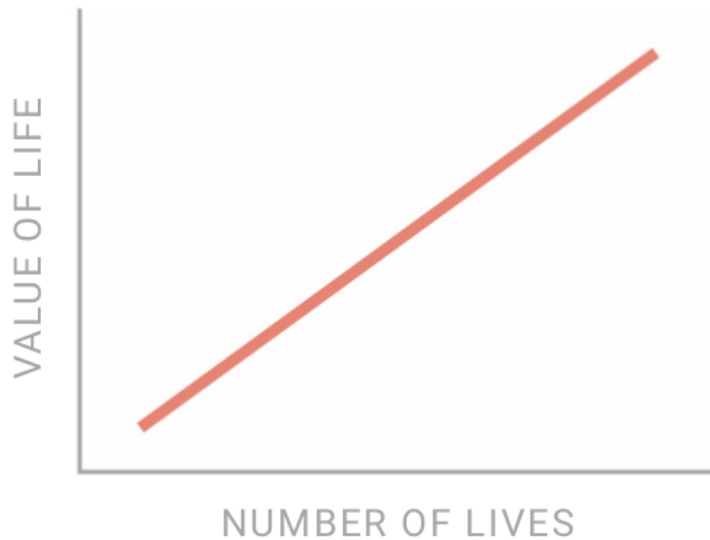
# Design Principles – Affectivity



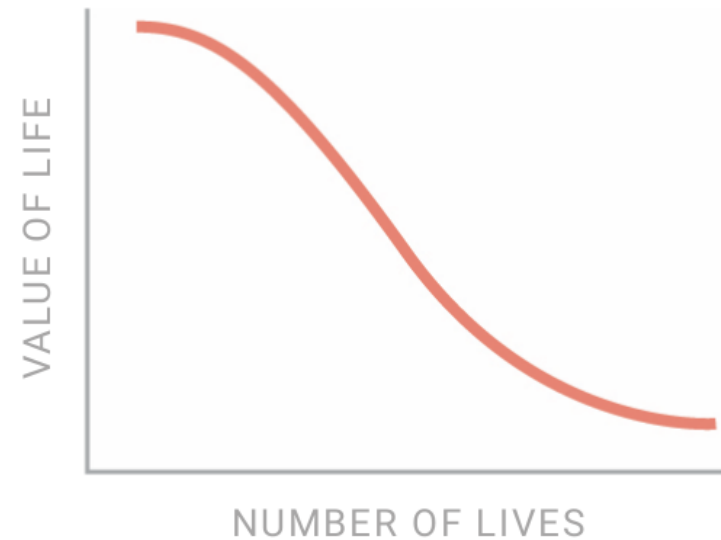
Aristoteles Rethorical Argument

[28]

# Design Principles – Affectivity



expectation



reality

# Design Principles – Affectivity

## Humanize



# Design Principles – Affectivity

## Personalize – Interests

### The Jobless Rate for People Like You

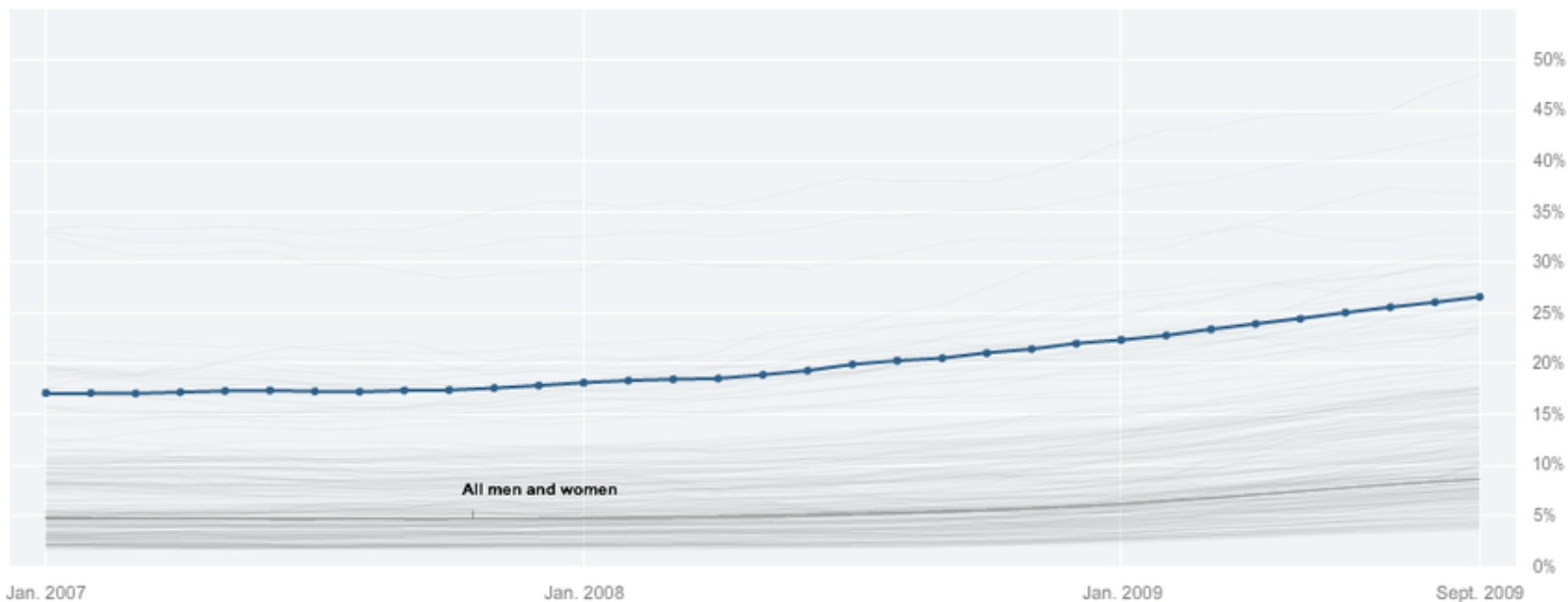
Not all groups have felt the recession equally.



UNEMPLOYMENT RATE,  
12 MONTH AVG. ENDING SEPT. '09

**26.6%**

For all men and women ages 15 to 24  
without a high school degree

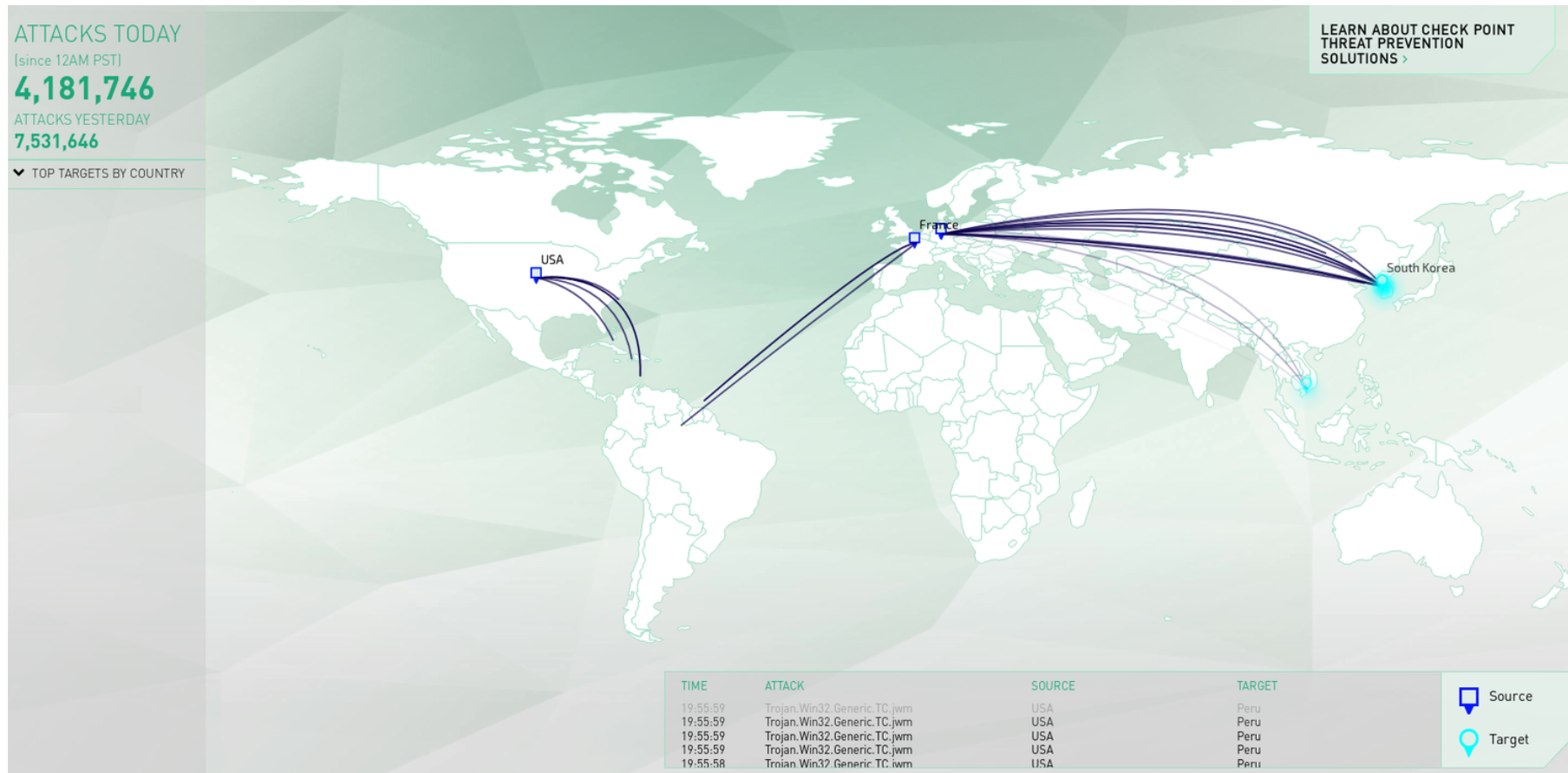


[30]



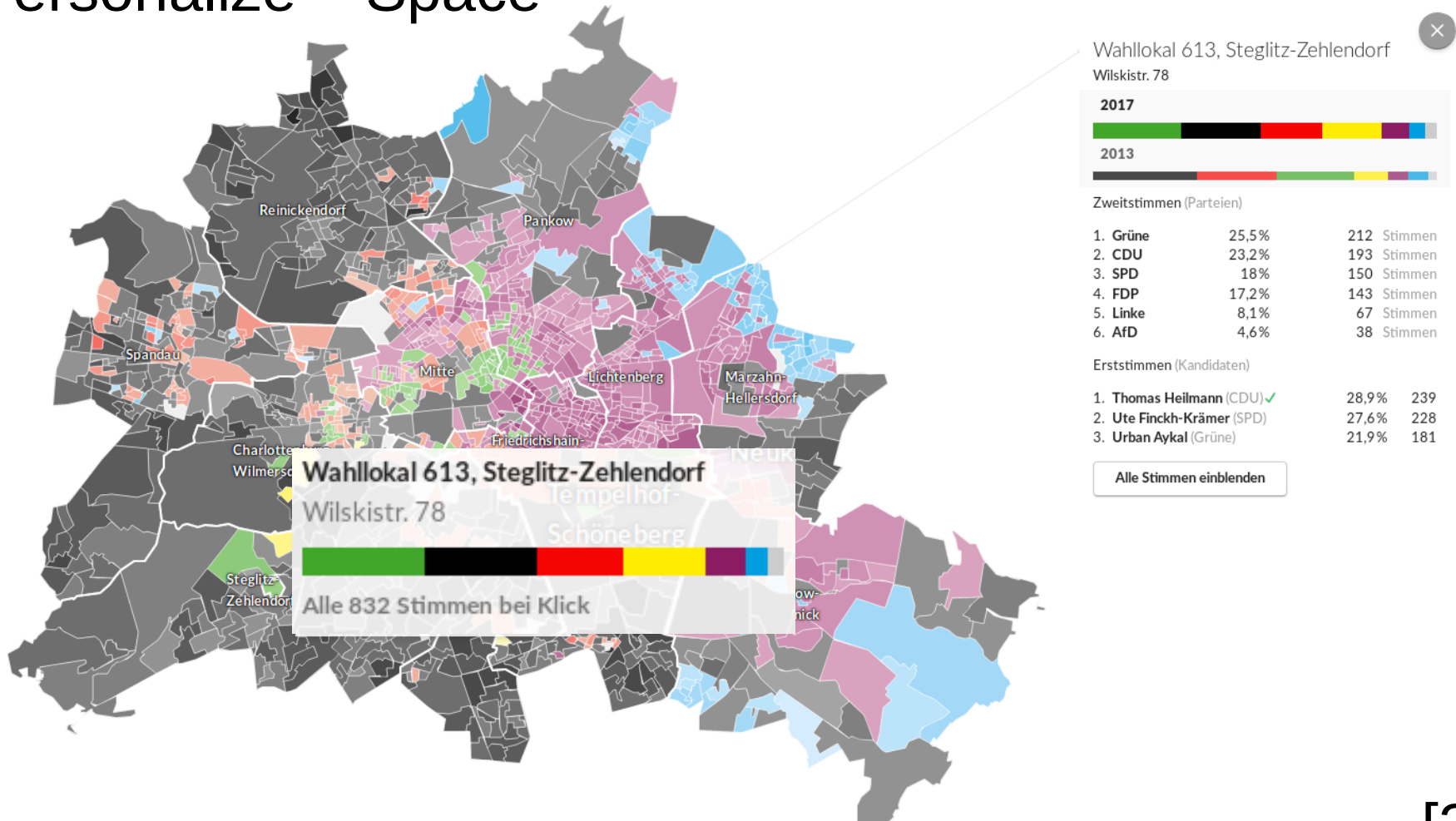
# Design Principles – Affectivity

## Personalize – Time



# Design Principles – Affectivity

## Personalize – Space



# Design Principles – Applied

- 1 Outline story
  - 2 Define target group
  - 3 Prepare data
- } interchangeable
- 
- 4 Visualize data
  - 5 Arrange and design

# Outline

- 1 Motivation
- 2 Background
- 3 Goals of Infographics
- 4 Design Principles
- 5 Application Fields**
- 6 Conclusion
- 7 References

# Application Fields

- Advertising
- Politics
- Education
- Resumes
- Within companies
- ...

# Application Fields



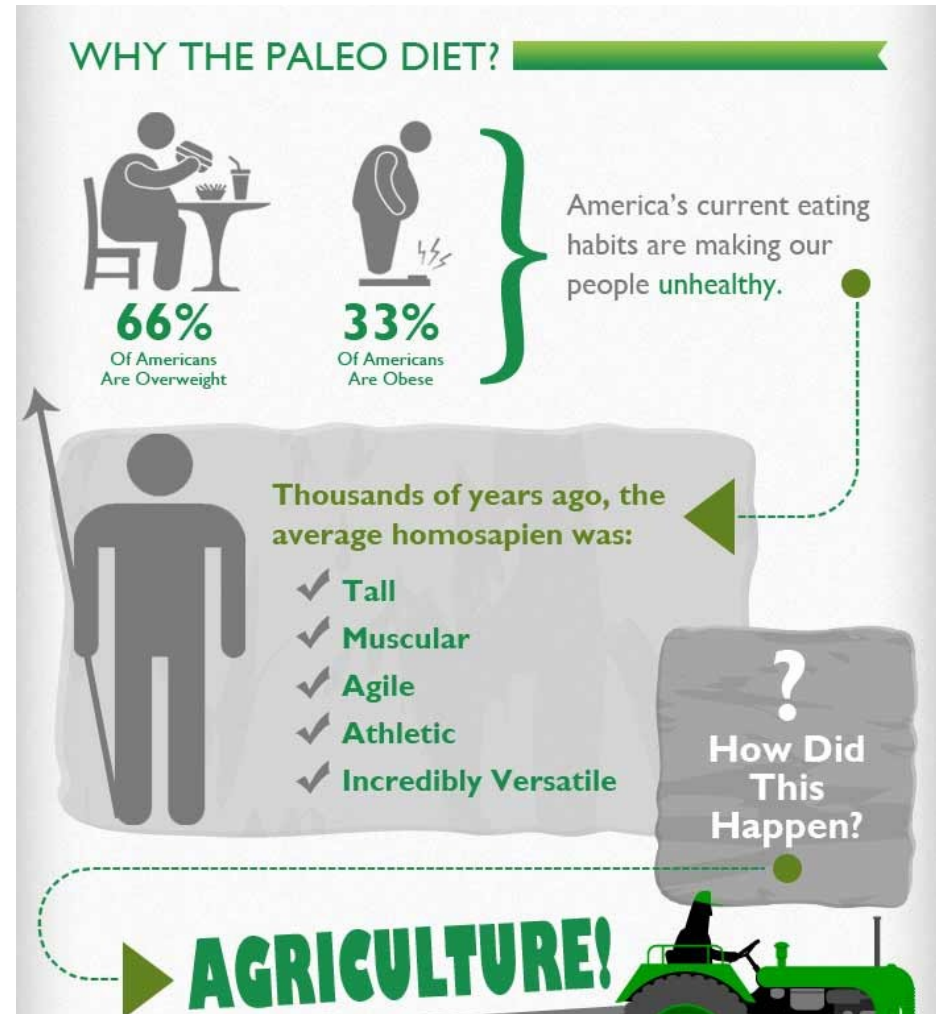
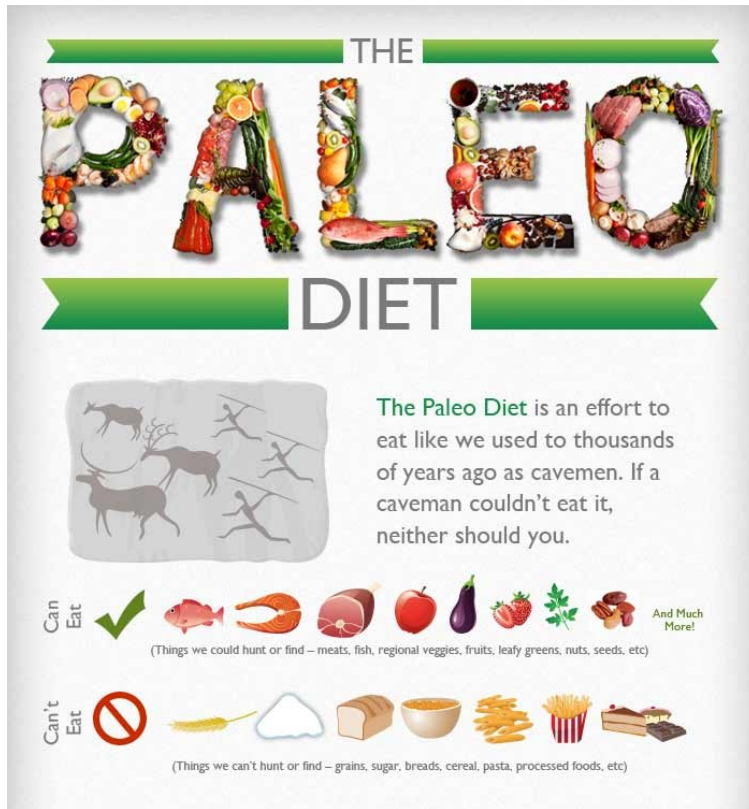
...

As advertisement



[33]

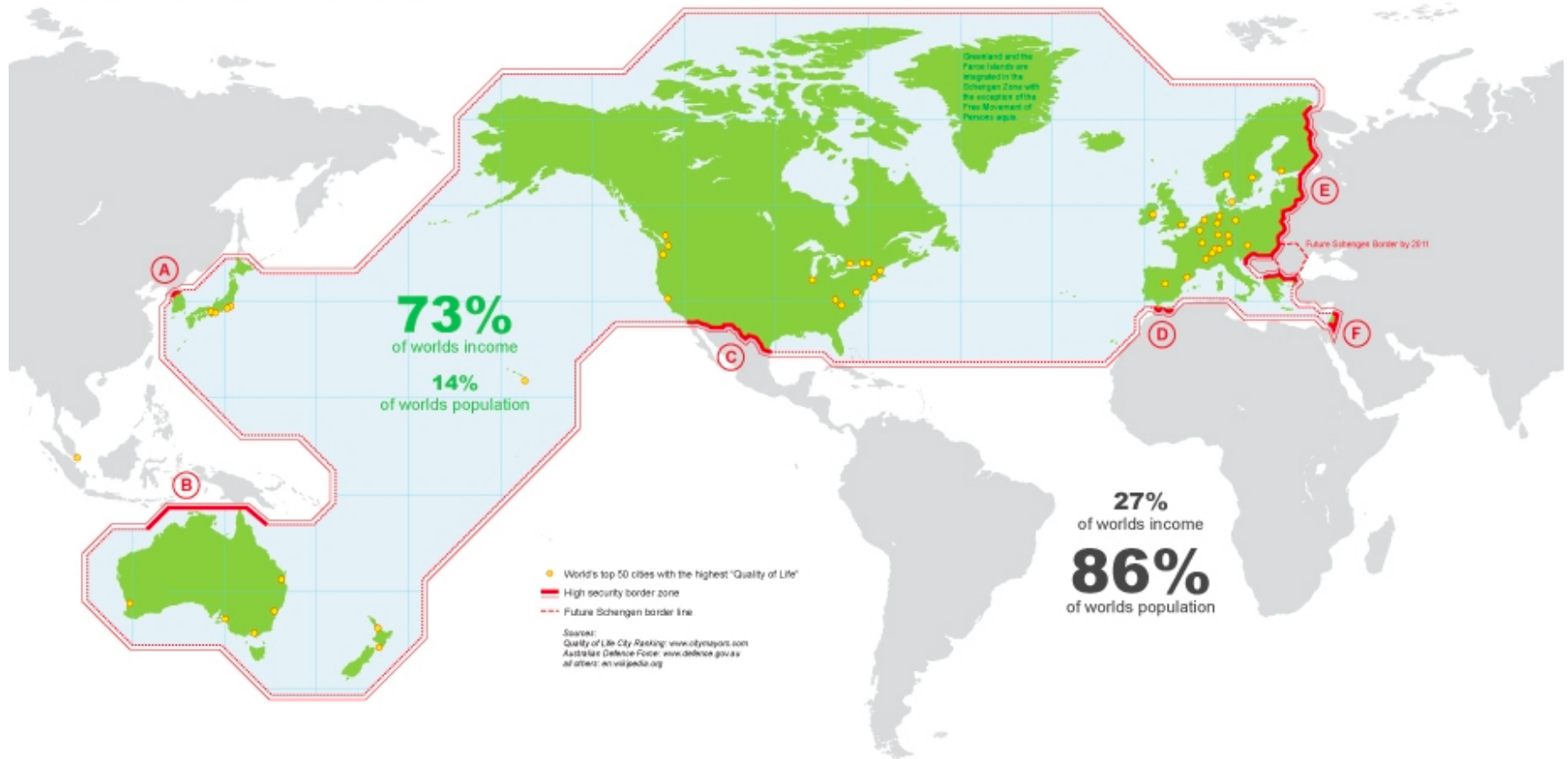
# Application Fields





# Application Fields

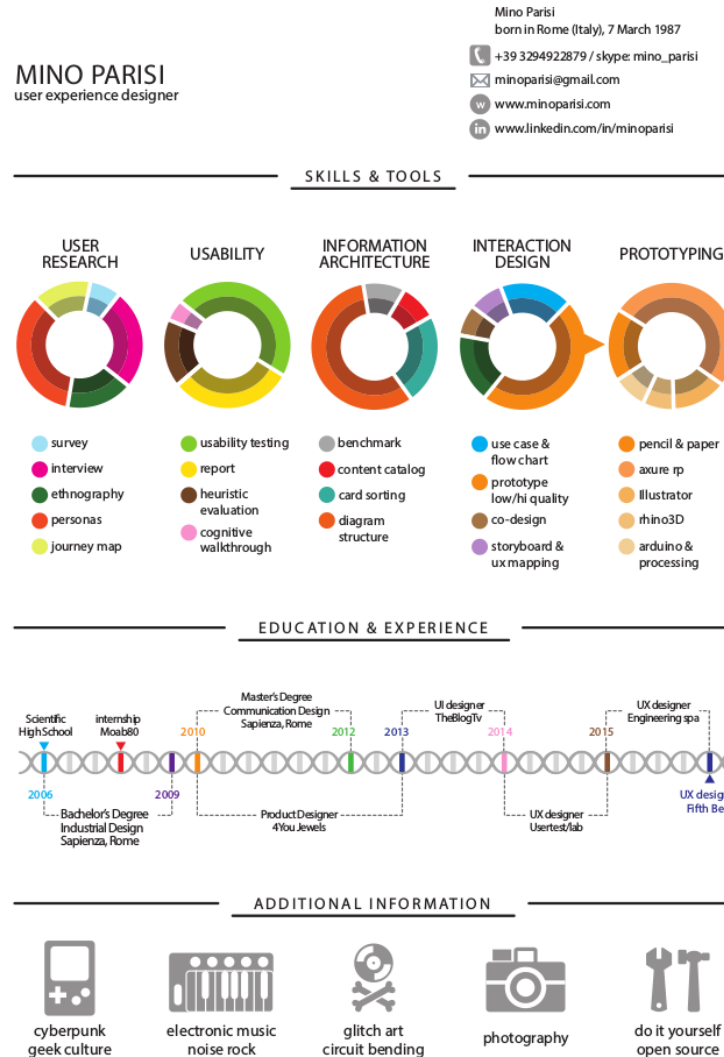
## Walled World



In politics, to educate



# Application Fields

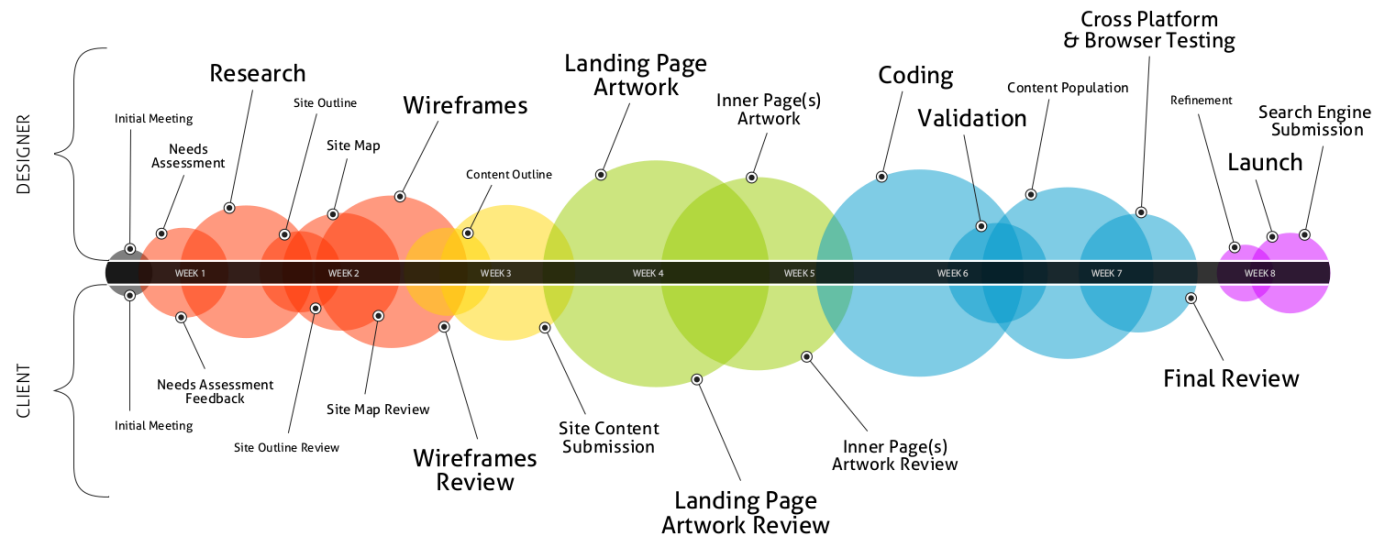


For resumes

# Application Fields

## A Website Designed

MILESTONES, INVOLVEMENT, IMPORTANCE & TIMELINE



A Website Designed was created by John Furness of Simple Square. © 2011 - All rights reserved.

## Inside of companies

# Outline

- 1 Motivation
- 2 Background
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- 5 Application Fields
- 6 Conclusion**
- 7 References

# Conclusion

Make Data Understandable to Everyone:

- take human perception into account
- make relevant to viewer
- not simplify but minimalize

# Conclusion

Information

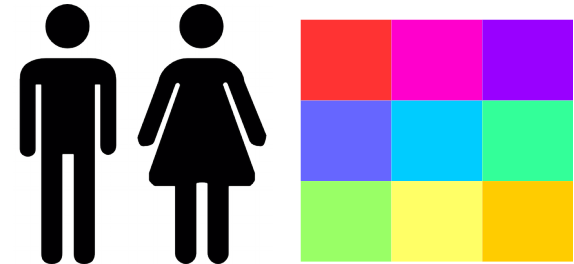


Individual  
Understanding

## Conclusion – Outlook

- Use for experts → data science

- More inclusive, less stereotyping



- Prevent abuse → don't „lie with statistics“

[20][6]

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**Information is Beautiful**, David McCandless, 2009

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# THANK YOU

# QUESTIONS

# ?



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