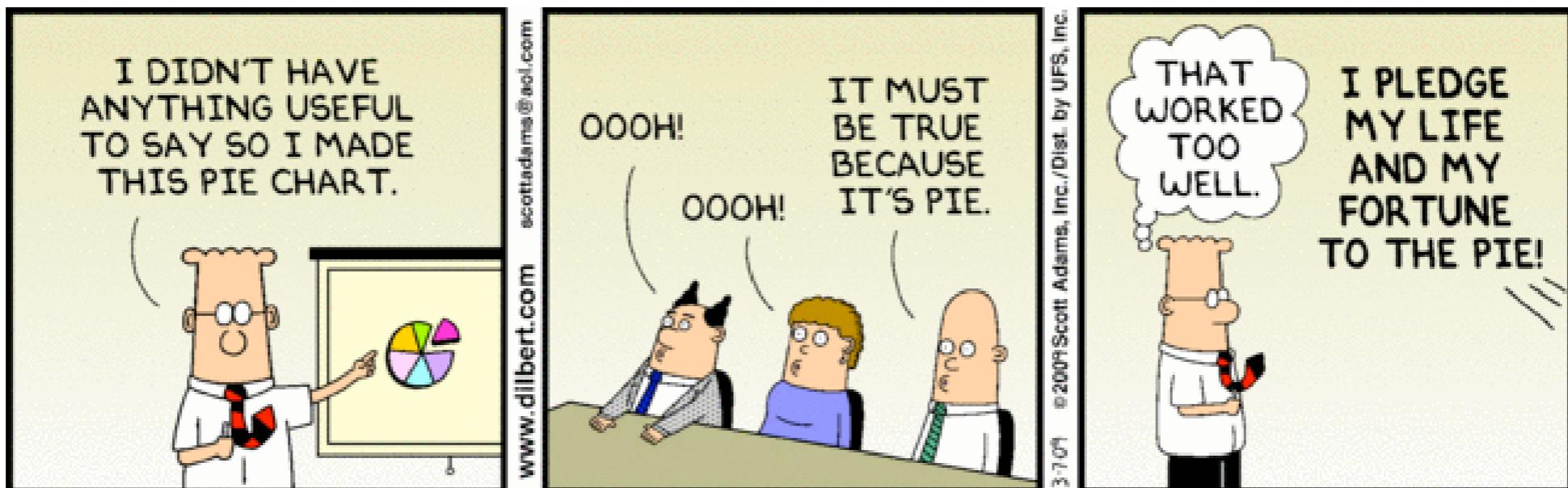


# CS 171: Visualization

## Data Models & Visual Variables

Alexander Lex  
[alex@seas.harvard.edu](mailto:alex@seas.harvard.edu)



# This Week

Friday lab:

D3: Loading Data, Selectors, Drawing with  
Data. – *Romain Vuillemot*

Readings:

D3: Chapters 5-8 / DFI: Chapter 1

# HW 1

Questions?

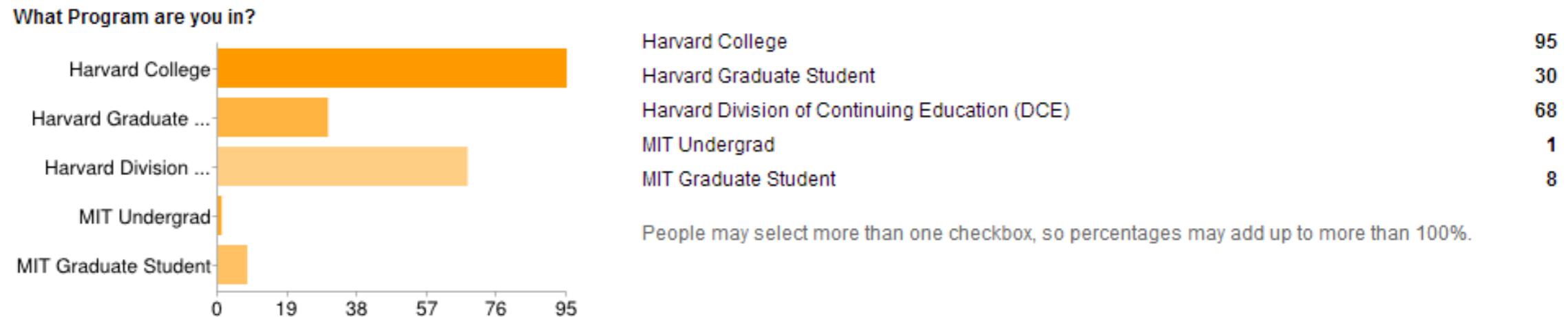
Write clean and general code!

Free to deviate from

Instructions.

# Survey Results

197 responses, 212 registered,  
125 College & other, 87 DCE

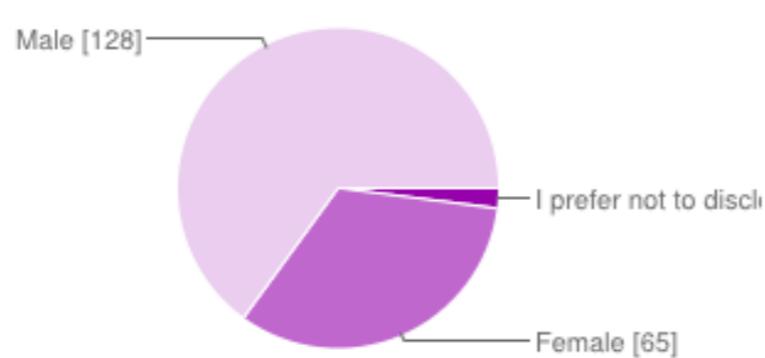


DCE:

While non-degree programs have an open enrollment policy, degree programs do require a formal Harvard University admissions process, and full tuition on a per-course basis. Admitted students have full access to Harvard's faculty, laboratories, library system and facilities.

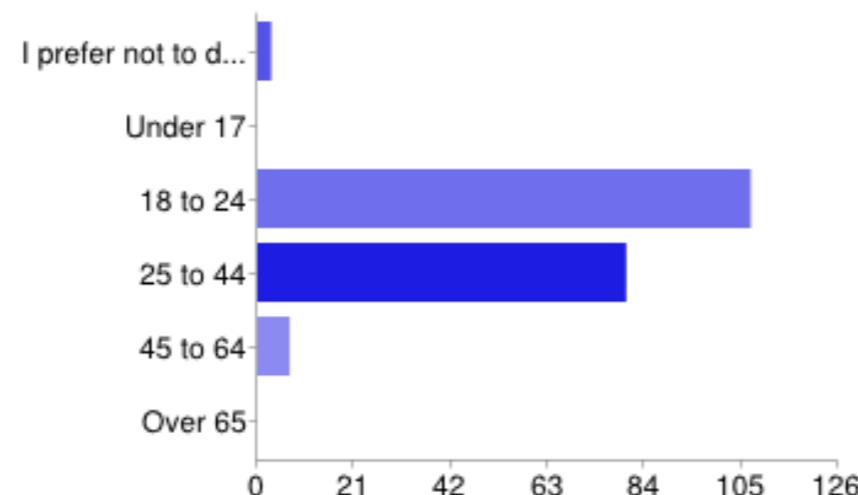
# Demographics

Gender



I prefer not to disclose	4	2%
Female	65	33%
Male	128	65%

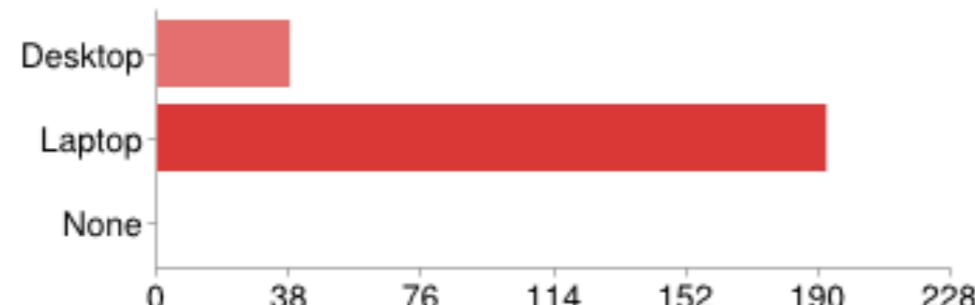
Age



I prefer not to disclose	3	2%
Under 17	0	0%
18 to 24	107	54%
25 to 44	80	41%
45 to 64	7	4%
Over 65	0	0%

# Computer / OS

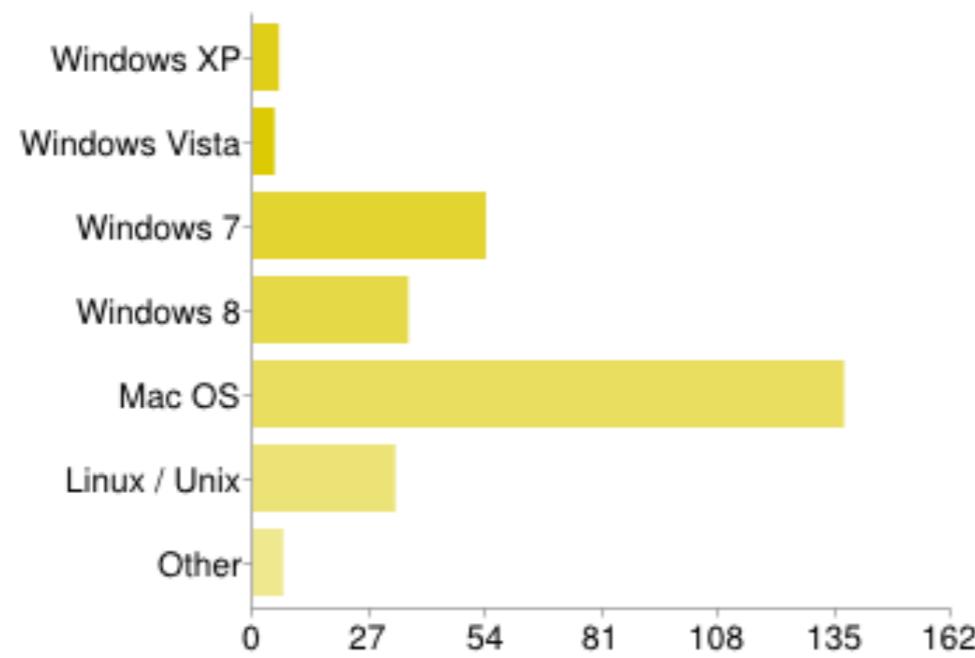
## What kind(s) of computer(s) do you own?



Desktop	38	19%
Laptop	192	97%
None	0	0%

People may select more than one checkbox, so percentages may add up to more than 100%.

## What operating system(s) do you run on your computer(s)?

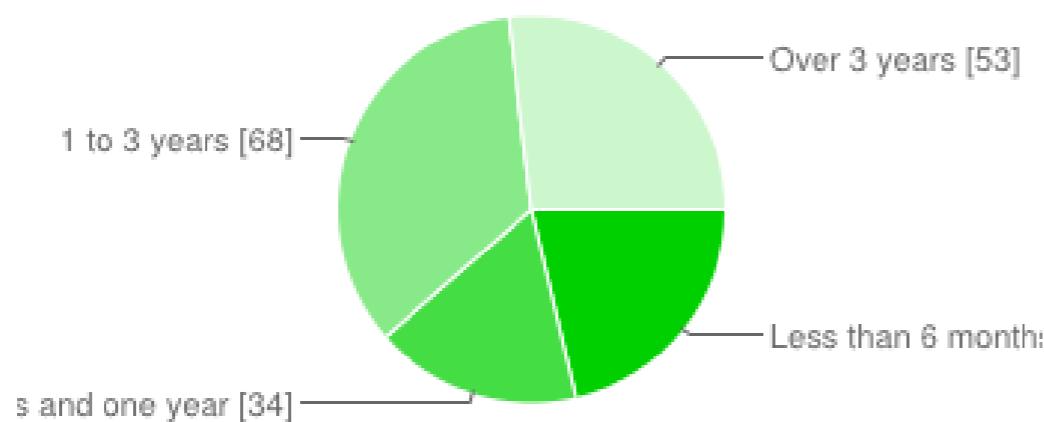


Windows XP	6	3%
Windows Vista	5	3%
Windows 7	54	27%
Windows 8	36	18%
Mac OS	137	70%
Linux / Unix	33	17%
Other	7	4%

People may select more than one checkbox, so percentages may add up to more than 100%.

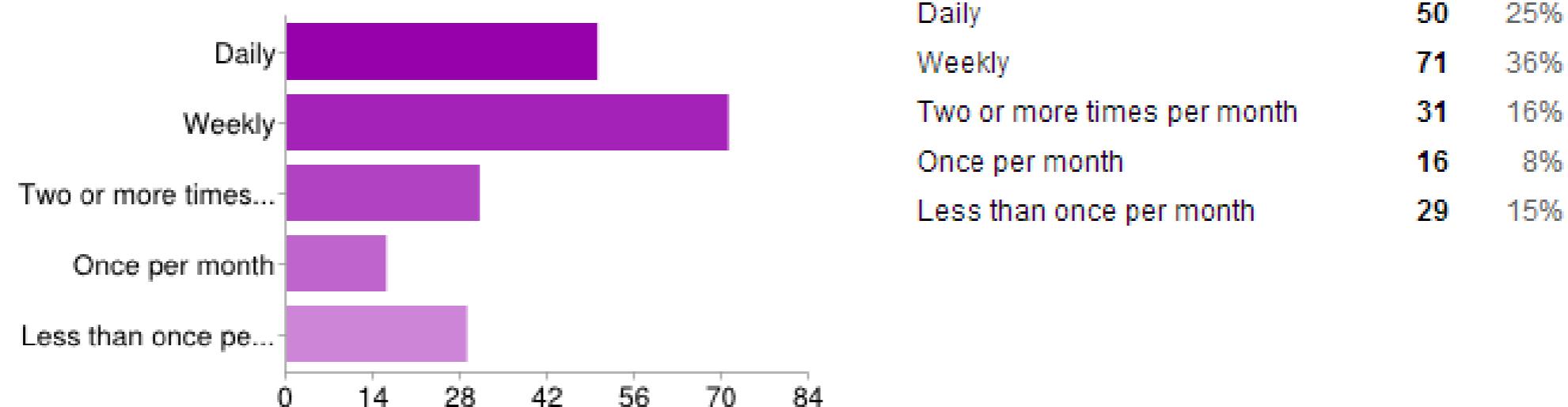
# Programming Skills

## How long have you been programming?



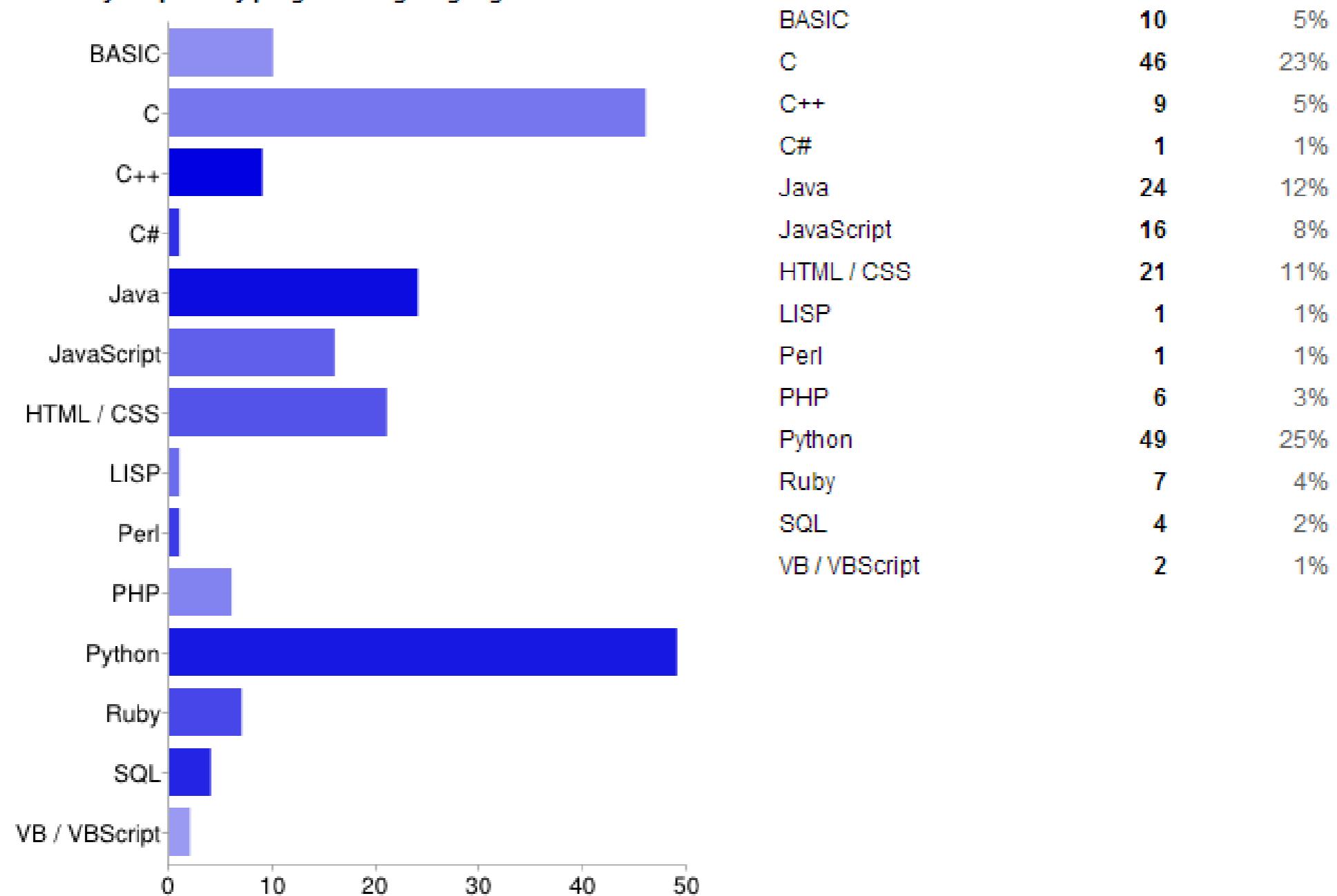
Less than 6 months	42	21%
Between 6 months and one year	34	17%
1 to 3 years	68	35%
Over 3 years	53	27%

## How often do you write code?



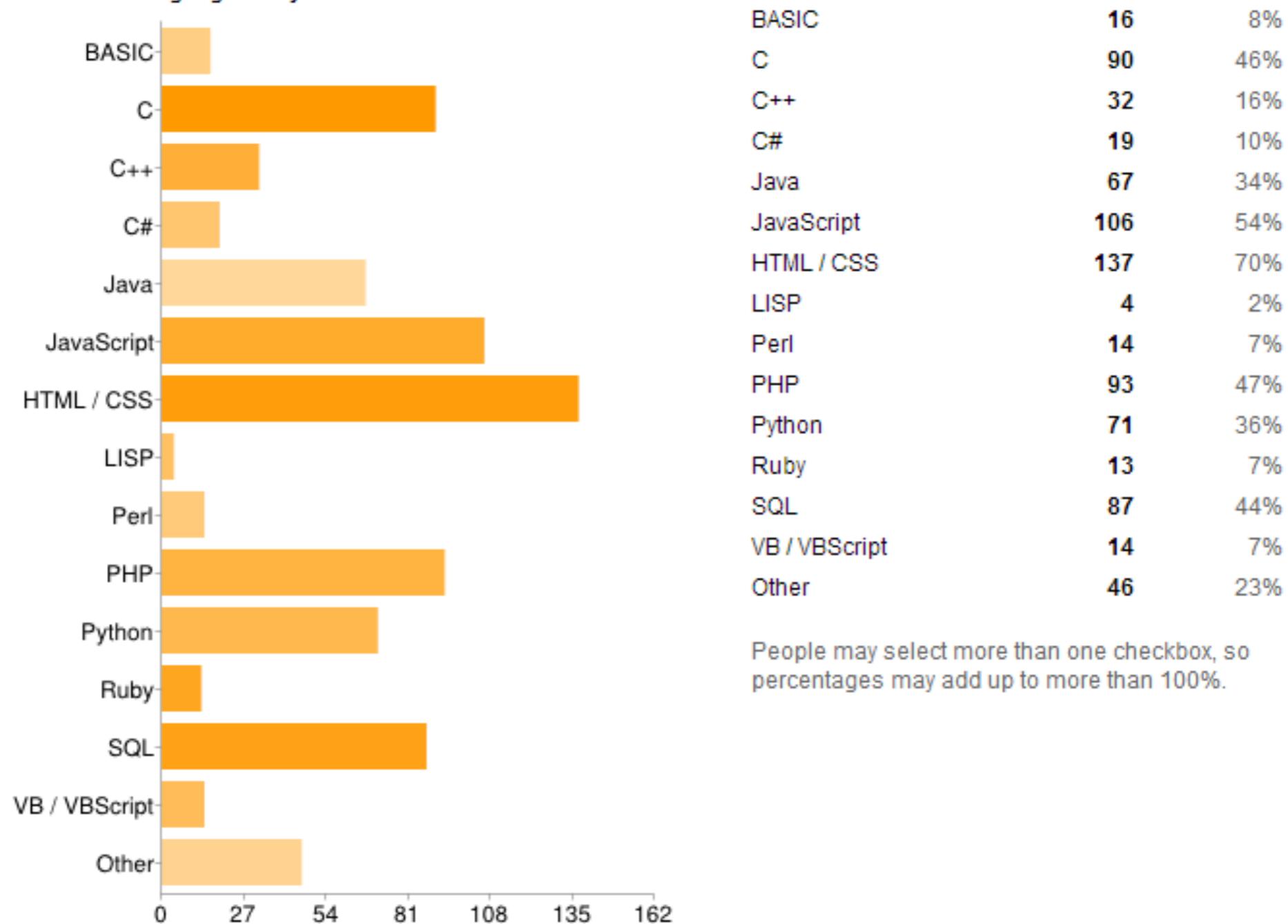
# Primary Language

What is your primary programming language?



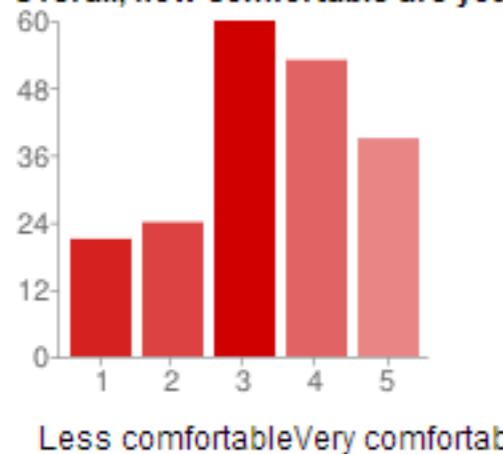
# Other Languages

What other languages do you know?



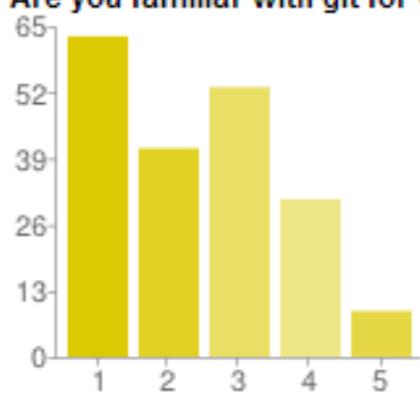
# Your Comfort Zone

Overall, how comfortable are you with programming?



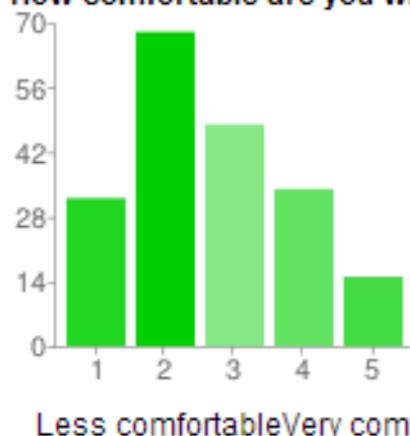
1 - Less comfortable	21	11%
2	24	12%
3	60	30%
4	53	27%
5 - Very comfortable	39	20%

Are you familiar with git for version control?



1 - What is git?	63	32%
2	41	21%
3	53	27%
4	31	16%
5 - I am the Master of rebasing!	9	5%

How comfortable are you with design?



1 - Less comfortable	32	16%
2	68	35%
3	48	24%
4	34	17%
5 - Very comfortable	15	8%

# Last Week

# Design Excellence

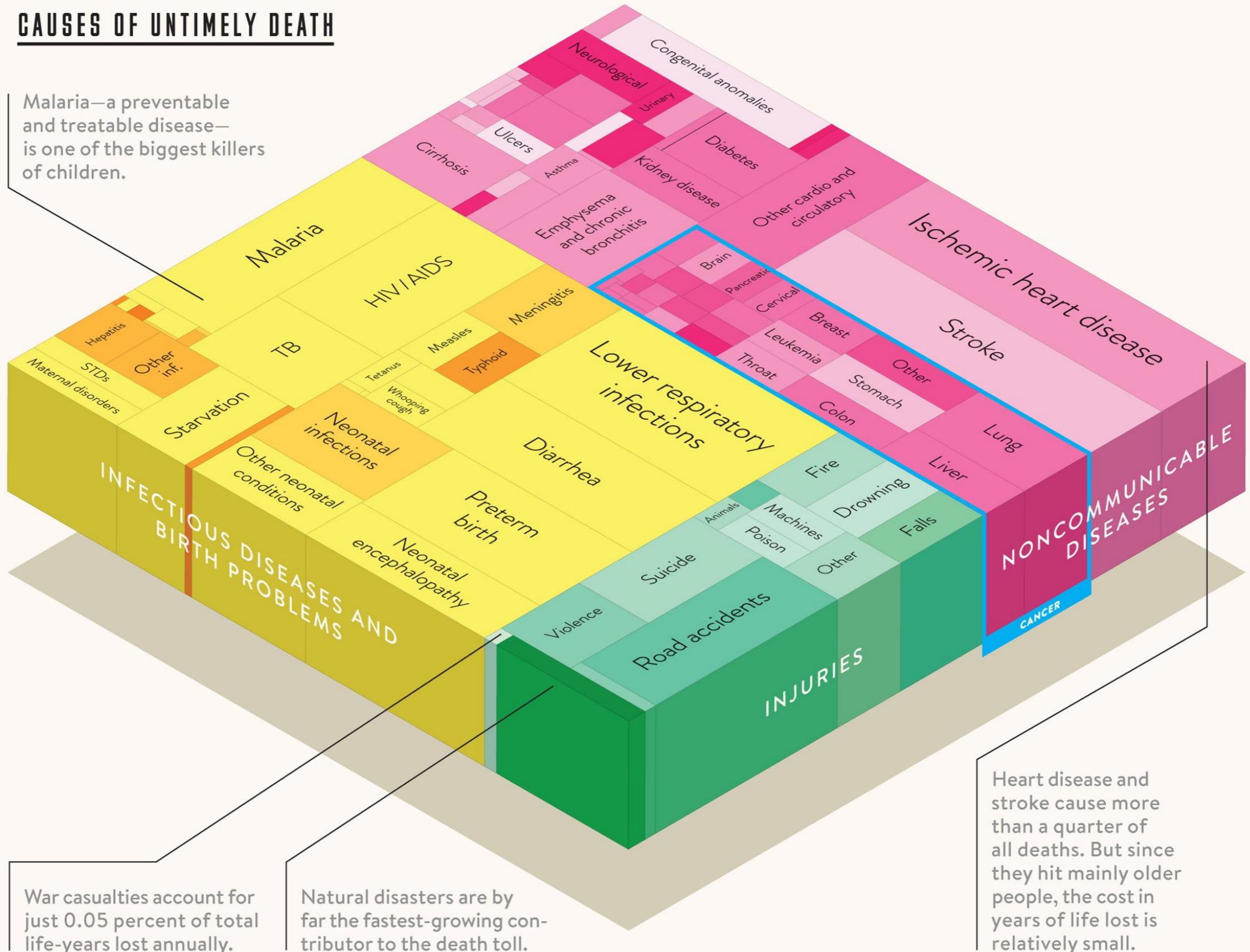
“Well-designed presentations of interesting data are a matter of substance, of statistics, and of design.”

E. Tufte

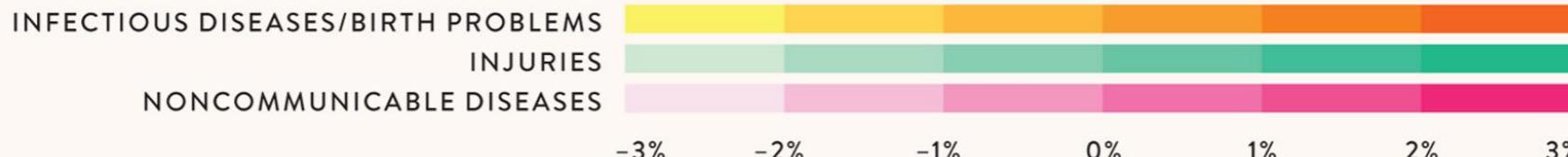


# CAUSES OF UNTIMELY DEATH

Malaria—a preventable and treatable disease—is one of the biggest killers of children.



ANNUAL % CHANGE (2005 TO 2010)



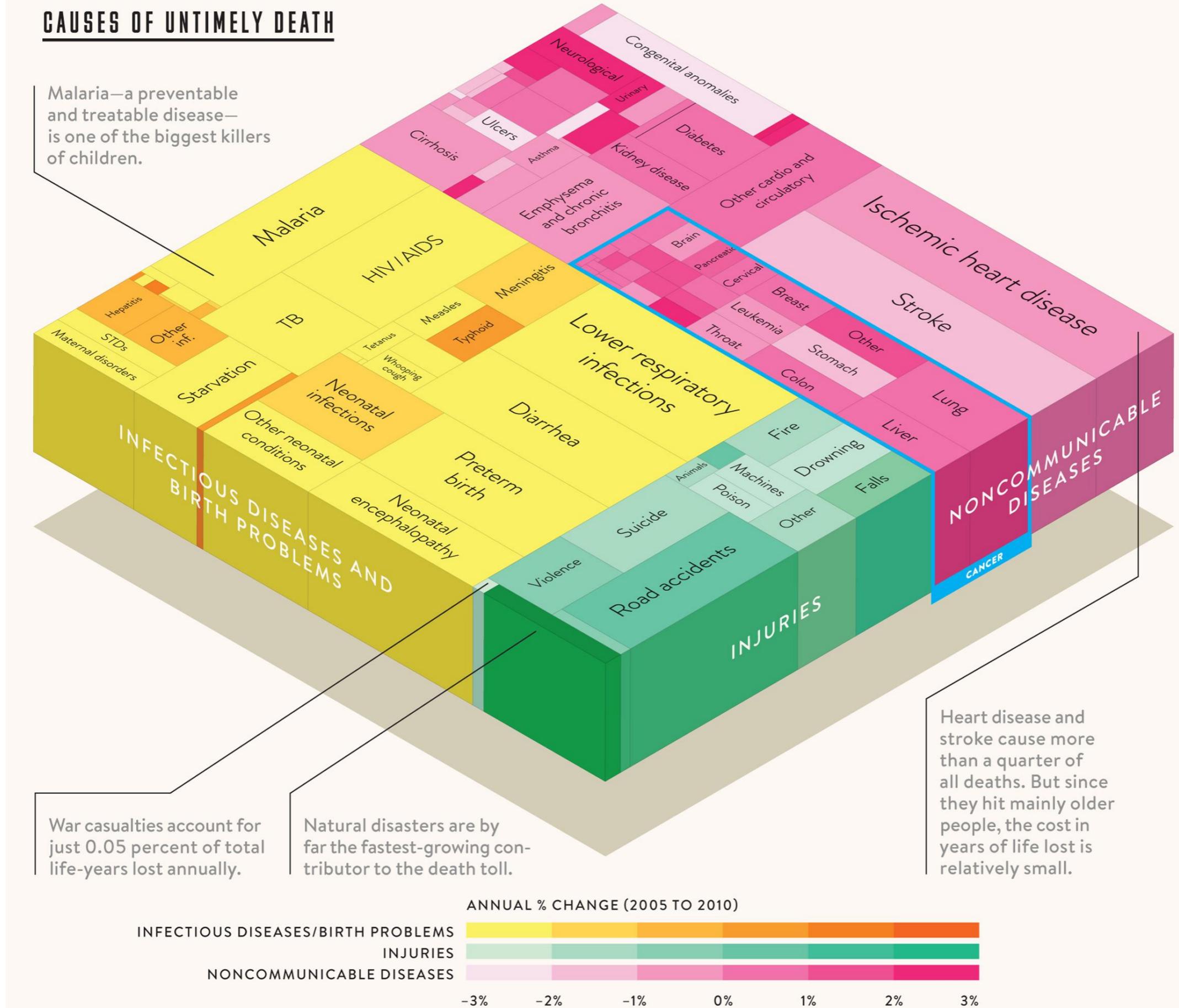
# Graph of the Year?

*"I love this graph because it shows that while the number of people dying from **communicable** diseases is still far too high, those **numbers continue to come down**. [...] But there remains much to do to **cut down the deaths in that yellow block** even more dramatically. We have the solutions. But we need to keep the up support where they're being deployed [...]"*

-Bill Gates

<http://goo.gl/W7ac3m>

## CAUSES OF UNTIMELY DEATH



# Data Model

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# SCIENCE

Vol. 103, No. 2684

Friday, June 7, 1946

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## On the Theory of Scales of Measurement

S. S. Stevens

*Director, Psycho-Acoustic Laboratory, Harvard University*

FOR SEVEN YEARS A COMMITTEE of the British Association for the Advancement of Science debated the problem of measurement. Appointed in 1932 to represent Section A (Mathematical and Physical Sciences) and Section J (Psychology), the committee was instructed to consider and report upon the possibility of "quantitative estimates of sensory events"—meaning simply: Is it possible to measure human sensation? Deliberation led only to disagreement, mainly about what is meant by the term measurement. An interim report in 1938 found one member complaining that his colleagues

by the formal (mathematical) properties of the scales. Furthermore—and this is of great concern to several of the sciences—the statistical manipulations that can legitimately be applied to empirical data depend upon the type of scale against which the data are ordered.

### A CLASSIFICATION OF SCALES OF MEASUREMENT

Paraphrasing N. R. Campbell (Final Report, p. 340), we may say that measurement, in the broadest sense, is defined as the assignment of numerals to objects or events according to rules. The fact that numerals can be assigned under different rules leads

Scale	Basic Empirical Operations	Mathematical Group Structure	Permissible Statistics (invariantive)
Nominal Categorical Qualitative	Determination of equality	<i>Permutation group</i> $x' = f(x)$ $f(x)$ means any one-to-one substitution	Number of cases Mode Contingency correlation
Ordinal	Determination of greater or less	<i>Isotonic group</i> $x' = f(x)$ $f(x)$ means any monotonic increasing function	Median Percentiles
Interval	Determination of equality of intervals or differences	<i>General linear group</i> $x' = ax + b$	Mean Standard deviation Rank-order correlation Product-moment correlation
Ratio	Determination of equality of ratios	<i>Similarity group</i> $x' = ax$	Coefficient of variation

# Data Types

## Nominal (Categorical) (N)

Are = or  $\neq$  to other values

Apples, Oranges, Bananas,...

## Ordinal (O)

Obey a  $<$  relationship

Small, medium, large

## Quantitative (Q)

Can do arithmetic on them

10 inches, 23 inches, etc.

# Quantitative Data Types

Q - Interval (no “true” zero)

Dates: Jan 19; Location: (Lat, Long)

Cannot compare directly. Temp in C & F

Only differences (i.e., intervals) can be compared

Q - Ratio (zero fixed)

Kelvin scale.  
 $10K * 2 == 20K$

Measurements: Length, Mass,

Origin is meaningful, can measure ratios & proportions

Like a geometric vector, origin is meaningful

Fahrenheit scale(Interval) vs Money scale(Ratio).

30원 - 10원 == 50원 - 30원,  $30F - 10F == 50F - 30F$

30원 - 10원 == 20원,  $30F - 10F != 20F$

10원 \* 2 == 20원,  $10F * 2 != 20F$

# Data Types

N - Nominal (labels)

Operations:  $=, \neq$

O - Ordinal (ordered)

Operations:  $=, \neq, >, <$

Q - Interval (location of zero arbitrary)

Operations:  $=, \neq, >, <, +, -$  (distance)

Q - Ratio (zero fixed)

Operations:  $=, \neq, >, <, +, -, \times, \div$  (proportions)

A	B	C	S	T	U
Order ID	Order Date	Order Priority	Product Container	Product Base Margin	Ship Date
3	10/14/06	5-Low	Large Box	0.8	10/21/06
6	2/21/08	4-Not Specified	Small Pack	0.55	2/22/08
32	7/16/07	2-High	Small Pack	0.79	7/17/07
32	7/16/07	2-High	Jumbo Box		7/17/07
32	7/16/07	2-High	Medium Box		7/18/07
32	7/16/07	2-High	Medium Box	0.65	7/18/07
35	10/23/07	4-Not Specified	Wrap Bag	0.52	10/24/07
35	10/23/07	4-Not Specified	Small Box	0.58	10/25/07
36	11/3/07	1-Urgent	Small Box	0.55	11/3/07
65	3/18/07	1-Urgent	Small Pack	0.49	3/19/07
66	1/20/05	5-Low	Wrap Bag	0.56	1/20/05
69	6/4/05	4-Not Specified	Small Pack	0.44	6/6/05
69	6/4/05	4-Not Specified	Wrap Bag	0.6	6/6/05
70	12/18/06	5-Low	Small Box	0.59	12/23/06
70	12/18/06	5-Low	Wrap Bag	0.82	12/23/06
96	4/17/05	2-High	Small Box	0.55	4/19/05
97	1/29/06	3-Medium	Small Box	0.38	1/30/06
129	11/19/08	5-Low	Small Box	0.37	11/28/08
130	5/8/08	2-High	Small Box	0.37	5/9/08
130	5/8/08	2-High	Medium Box	0.38	5/10/08
130	5/8/08	2-High	Small Box	0.6	5/11/08
132	6/11/06	3-Medium	Medium Box	0.6	6/12/06
132	6/11/06	3-Medium	Jumbo Box	0.69	6/14/06
134	5/1/08	4-Not Specified	Large Box	0.82	5/3/08
135	10/21/07	4-Not Specified	Small Pack	0.64	10/23/07
166	9/12/07	2-High	Small Box	0.55	9/14/07
193	8/8/06	1-Urgent	Medium Box	0.57	8/10/06
194	4/5/08	3-Medium	Wrap Bag	0.42	4/7/08

A	B	C	S	T	U
Order ID	Order Date	Order Priority	Product Container	Product Base Margin	Ship Date
3	10/14/06	5-Low	Large Box	0.8	10/21/06
6	2/21/08	4-Not Specified	Small Pack		2/22/08
32	7/16/07	2-High	Small Pack		7/17/07
32	7/16/07	2-High	Jumbo Box		7/17/07
32	7/16/07	2-High	Medium Box		7/18/07
32	7/16/07	2-High	Medium Box		7/18/07
35	10/23/07	4-Not Specified	Wrap Bag		10/24/07
35	10/23/07	4-Not Specified	Small Box	0.58	10/25/07
36	11/3/07	1-Urgent	Small Box	0.55	11/3/07
65	3/18/07	1-Urgent	Small Pack	0.49	3/19/07
66	1/20/05	5-Low	Wrap Bag	0.56	1/20/05
69	6/4/05	4-Not Specified	Small Pack	0.44	6/6/05
69	6/4/05	4-Not Specified	Wrap Bag	0.6	6/6/05
70	12/18/06	5-Low	Small Box	0.59	12/23/06
70	12/18/06	5-Low	Wrap Bag	0.82	12/23/06
96	4/17/05	2-High	Small Box	0.55	4/19/05
97	1/29/06	3-Medium	Small Box	0.38	1/30/06
129	11/19/08	5-Low	Small Box	0.37	11/28/08
130	5/8/08	2-High	Small Box	0.37	5/9/08
130	5/8/08	2-High	Medium Box	0.38	5/10/08
130	5/8/08	2-High	Small Box	0.6	5/11/08
132	6/11/06	3-Medium	Medium Box	0.6	6/12/06
132	6/11/06	3-Medium	Jumbo Box	0.69	6/14/06
134	5/1/08	4-Not Specified	Large Box	0.82	5/3/08
135	10/21/07	4-Not Specified	Small Pack	0.64	10/23/07
166	9/12/07	2-High	Small Box	0.55	9/14/07
193	8/8/06	1-Urgent	Medium Box	0.57	8/10/06
194	4/5/08	3-Medium	Wrap Bag	0.42	4/7/08

Attribute  
aka Feature

A	B	C	S	T	U
Order ID	Order Date	Order Priority	Product Container	Product Base Margin	Ship Date
3	10/14/06	5-Low	Large Box	0.8	10/21/06
6	2/21/08	4-Not Specified	Small Pack		2/22/08
32	7/16/07	2-High	Small Pack		7/17/07
32	7/16/07	2-High	Jumbo Box	0.72	7/17/07
32	7/16/07	2-High	Medium Box	0.6	7/18/07
32	7/16/07	2-High	Medium Box	0.65	7/18/07
35	10/23/07	4-Not Specified	Wrap Bag	0.52	10/24/07
35	10/23/07	4-Not Specified	Small Box	0.58	10/25/07
36	11/3/07	1-Urgent	Small Box	0.55	11/3/07
65	3/18/07	1-Urgent	Small Pack	0.49	3/19/07
66	1/20/05	5-Low	Wrap Bag	0.56	1/20/05
69	6/4/05	4-Not Specified	Small Pack	0.44	6/6/05
69	6/4/05	4-Not Specified	Wrap Bag	0.6	6/6/05
70	12/18/06	5-Low	Small Box	0.59	12/23/06
70	12/18/06	5-Low	Wrap Bag	0.82	12/23/06
96	4/17/05	2-High	Small Box	0.55	4/19/05
97	1/29/06	3-Medium	Small Box	0.38	1/30/06
129	11/19/08	5-Low	Small Box	0.37	11/28/08
130	5/8/08	2-High	Small Box	0.37	5/9/08
130	5/8/08	2-High	Medium Box	0.38	5/10/08
130	5/8/08	2-High	Small Box	0.6	5/11/08
132	6/11/06	3-Medium	Medium Box	0.6	6/12/06
132	6/11/06	3-Medium	Jumbo Box	0.69	6/14/06
134	5/1/08	4-Not Specified	Large Box	0.82	5/3/08
135	10/21/07	4-Not Specified	Small Pack	0.64	10/23/07
166	9/12/07	2-High	Small Box	0.55	9/14/07
193	8/8/06	1-Urgent	Medium Box	0.57	8/10/06
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32	7/16/07	2-High	Small Pack	0.79	7/17/07
32	7/16/07	2-High	Jumbo Box	0.72	7/17/07
32	7/16/07	2-High	Medium Box	0.6	7/18/07
32	7/16/07	2-High	Medium Box	0.65	7/18/07
35	10/23/07	4-Not Specified	Wrap Bag	0.52	10/24/07
35	10/23/07	4-Not Specified	Small Box	0.58	10/25/07
36	11/3/07	1-Urgent	Small Box	0.55	11/3/07
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69	6/4/05	4-Not Specified	Small Pack	0.44	6/6/05
69	6/4/05	4-Not Specified		0.6	6/6/05
70	12/18/06	5-Low		0.59	12/23/06
70	12/18/06	5-Low		0.82	12/23/06
96	4/17/05	2-High		0.55	4/19/05
97	1/29/06	3-Medium		0.38	1/30/06
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130	5/8/08	2-High	Medium Box	0.38	5/10/08
130	5/8/08	2-High	Small Box	0.6	5/11/08
132	6/11/06	3-Medium	Medium Box	0.6	6/12/06
132	6/11/06	3-Medium	Jumbo Box	0.69	6/14/06
134	5/1/08	4-Not Specified	Large Box	0.82	5/3/08
135	10/21/07	4-Not Specified	Small Pack	0.64	10/23/07
166	9/12/07	2-High	Small Box	0.55	9/14/07
193	8/8/06	1-Urgent	Medium Box	0.57	8/10/06
194	4/5/08	3-Medium	Wrap Bag	0.42	4/7/08

1 = Quantitative  
 2 = Nominal  
 3 = Ordinal

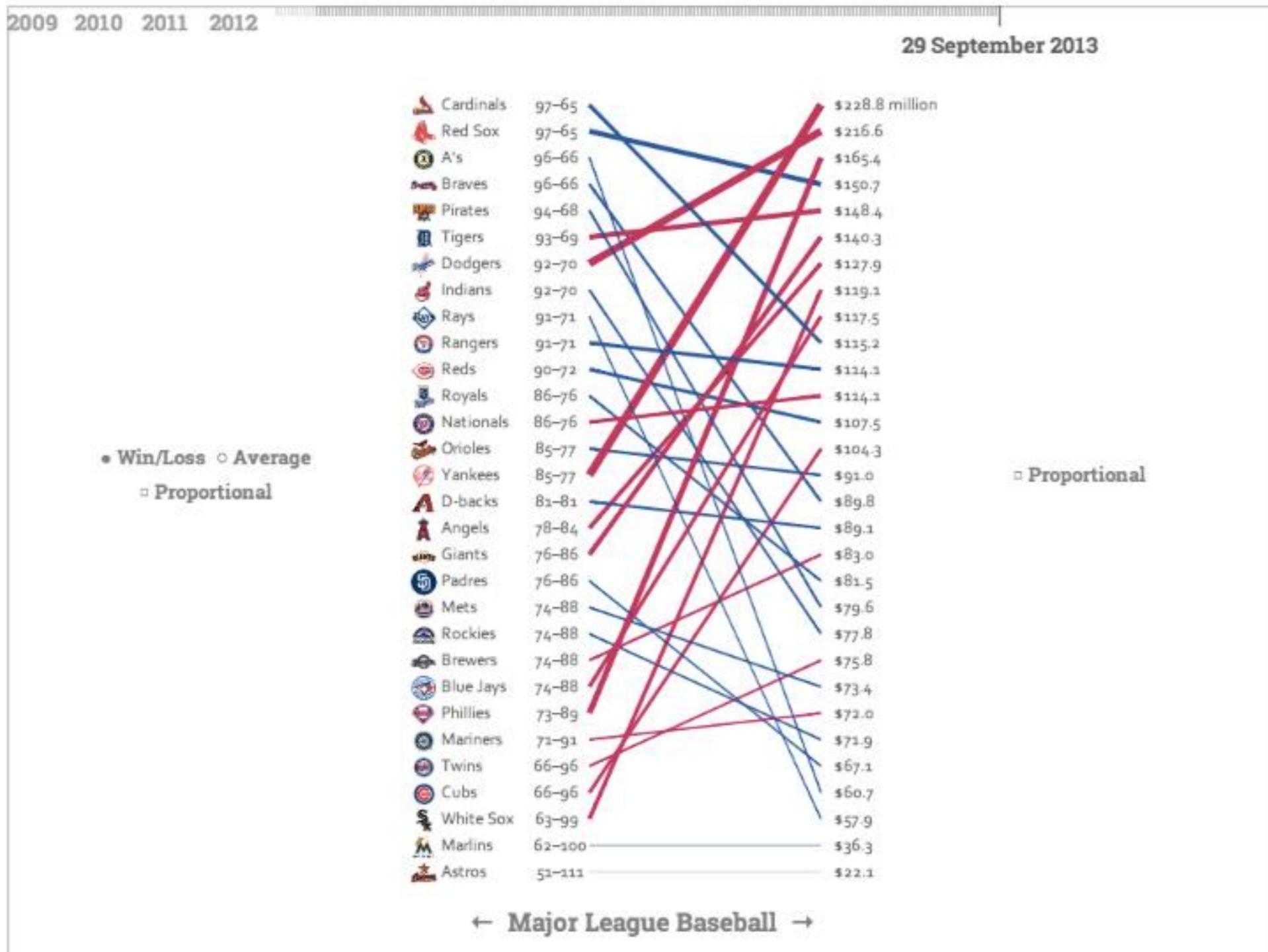
A	B	C	S	T	U
Order ID	Order Date	Order Priority	Product Container	Product Base Margin	Ship Date
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70	12/18/06	5-Low		0.82	12/23/06
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97	1/29/06	3-Medium		0.38	1/30/06
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130	5/8/08	2-High	Medium Box	0.38	5/10/08
130	5/8/08	2-High	Small Box	0.6	5/11/08
132	6/11/06	3-Medium	Medium Box	0.6	6/12/06
132	6/11/06	3-Medium	Jumbo Box	0.69	6/14/06
134	5/1/08	4-Not Specified	Large Box	0.82	5/3/08
135	10/21/07	4-Not Specified	Small Pack	0.64	10/23/07
166	9/12/07	2-High	Small Box	0.55	9/14/07
193	8/8/06	1-Urgent	Medium Box	0.57	8/10/06
194	4/5/08	3-Medium	Wrap Bag	0.42	4/7/08
194	4/5/08	3-Medium	Wrap Bag	0.84	4/7/08

1 = Quantitative  
2 = Nominal  
3 = Ordinal

# Entities, Relationships, and Attributes

- Entities: The things we are studying
  - a person, a business transaction, an instrument reading
- Relationships: Connections between entities
  - parent / child, store / customer, geographically adjacent
- Attribute: a property of an entity or relationship
  - person: height, weight, address, DOB, SSN, ...
  - parent / child: lives / does not live
  - instrument reading: temperature, pressure, ...

# Example



<http://fathom.info/salaryper/>

Ben Fry

# Data vs. Conceptual Model

- Data Model: Low-level description of the data  
Set with operations, e.g., floats with +, -, /, \*
- Conceptual Model: Mental construction  
Includes semantics, supports reasoning

Data	Conceptual
1D floats	temperature
3D vector of floats	space

# Data vs. Conceptual Model

- From data model...  
32.5, 54.0, -17.3, ... (floats)
- using conceptual model...  
Temperature
- to data type  
Continuous to 4 significant figures (Q)  
Hot, warm, cold (O)  
Burned vs. Not burned (N)

# Visual Variables

# Jacques Bertin

- French cartographer [1918-2010]
- Semiology of Graphics [1967]
- Theoretical principles for visual encodings



# Bertin's Visual Variables

## Channels

Position

Size

(Grey)Value

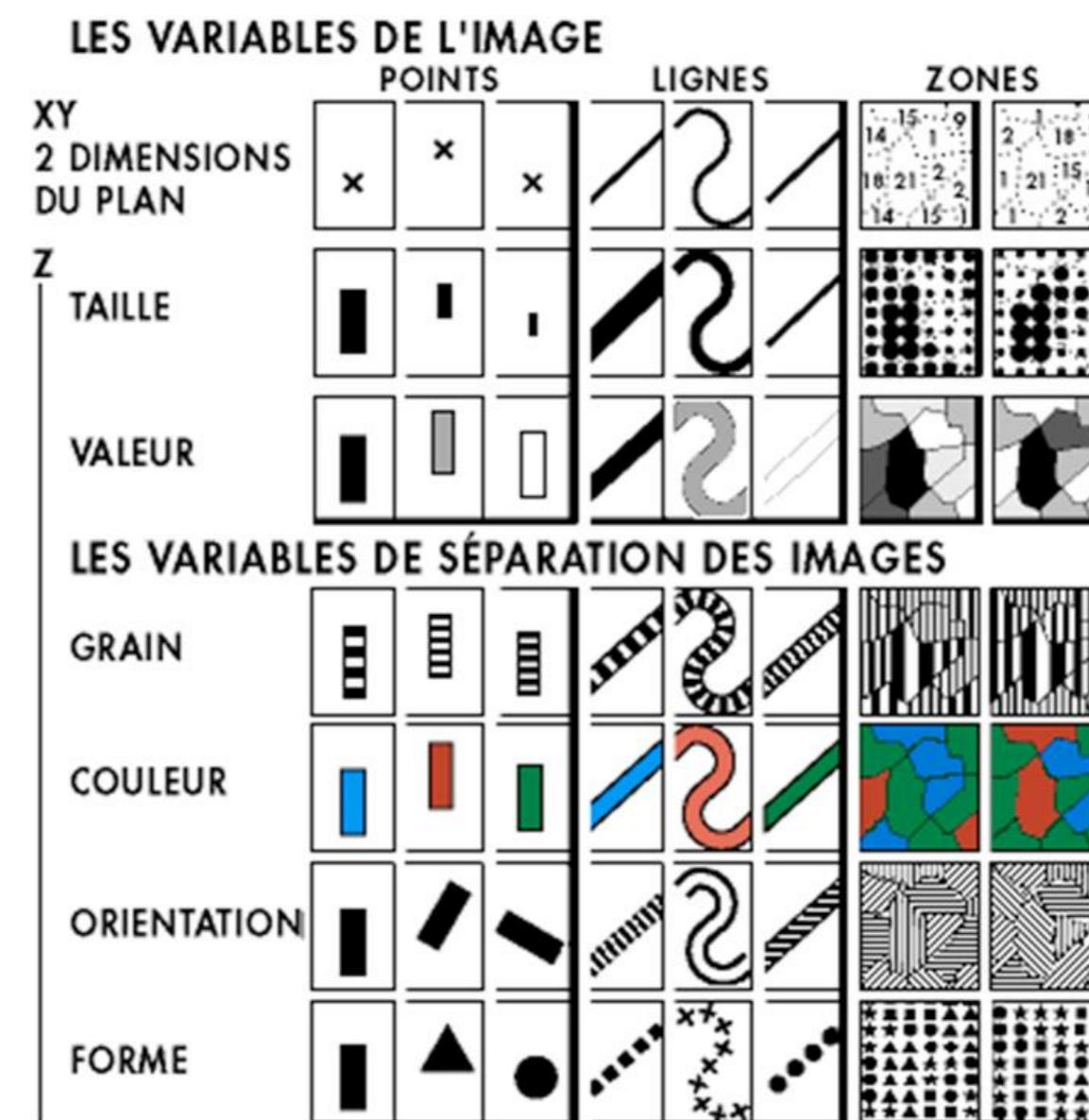
Texture

Color

Orientation

Shape

Marks Points Lines Areas



# Characteristics of Visual Variables

## Selective

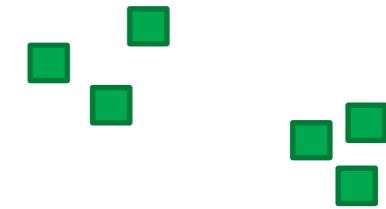
Is a mark distinct from other marks?



Can we make out the difference between two marks?

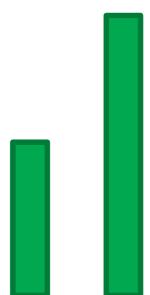
## Associative

Does it support grouping?



## Quantitative

Can we quantify the difference between two marks?



# Characteristics of Visual Variables

Order

Can we see a change in order?



Length

How many unique marks can we make?

# Position

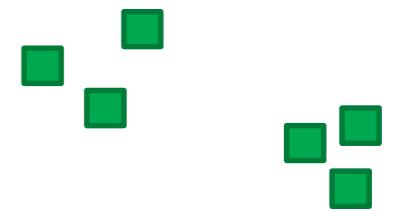
Strongest visual variable

Suitable for all data types

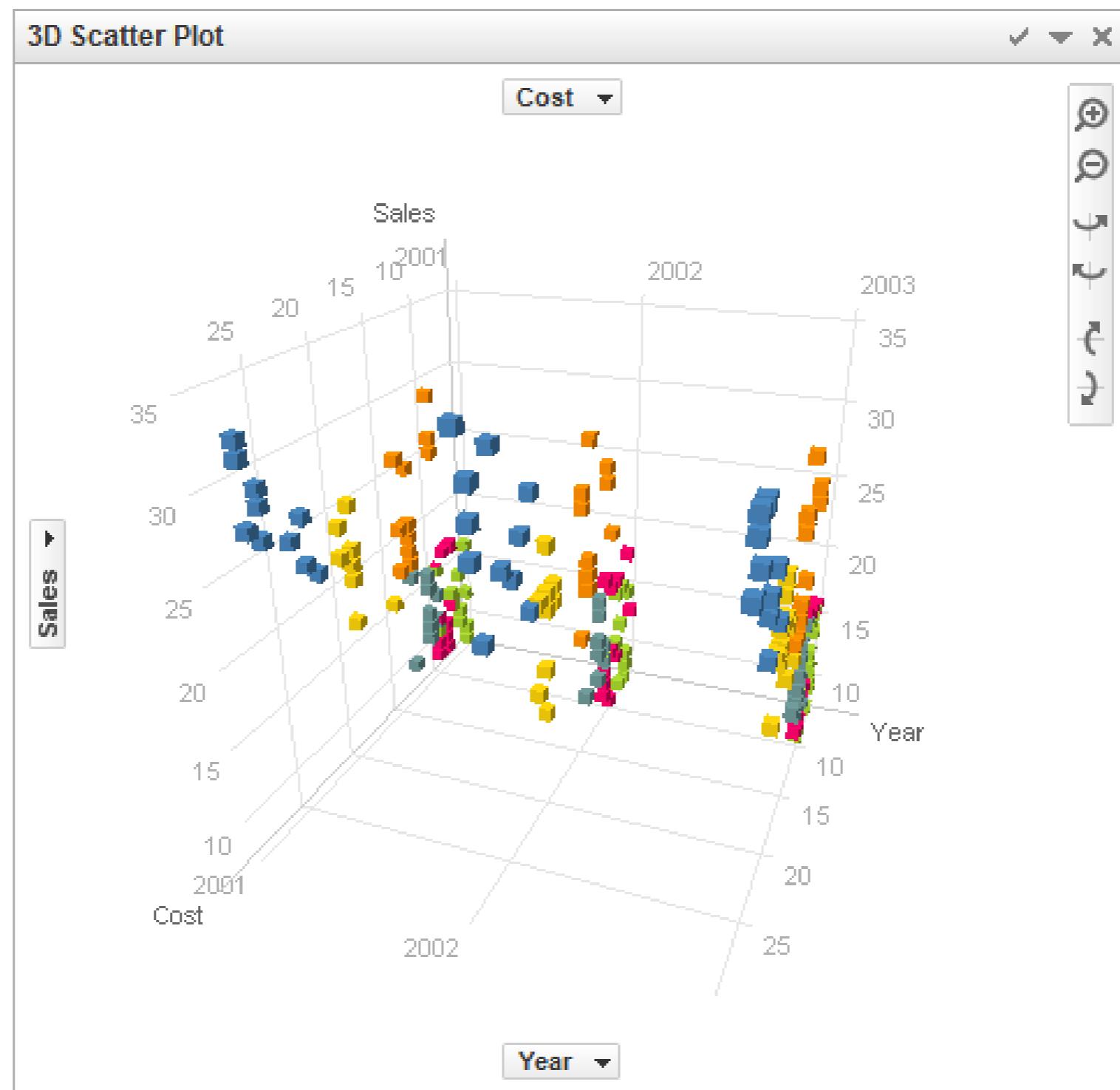
Problems:

Sometimes not available

Cluttering



# Position in 3D?

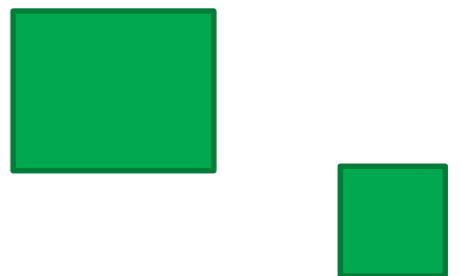


[Spotfire]

# Size & Length

Good visual variable

Easy to see whether one is bigger



Grouping works

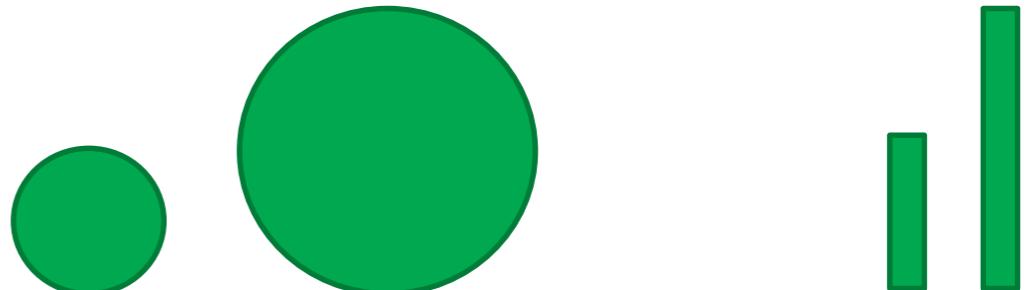
Judging differences

Good for aligned bars (position)



OK for changes in length

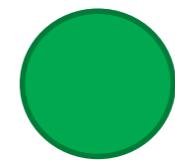
Bad for changes in area



# Shape

Great to recognize many classes.

No grouping, ordering.



# Value

Good for quantitative data when length & size are used.

Not very many shades recognizable

Supports grouping

Is preattentive (stands out) if sufficiently different



# Color

Good for qualitative data

Limited number of classes!

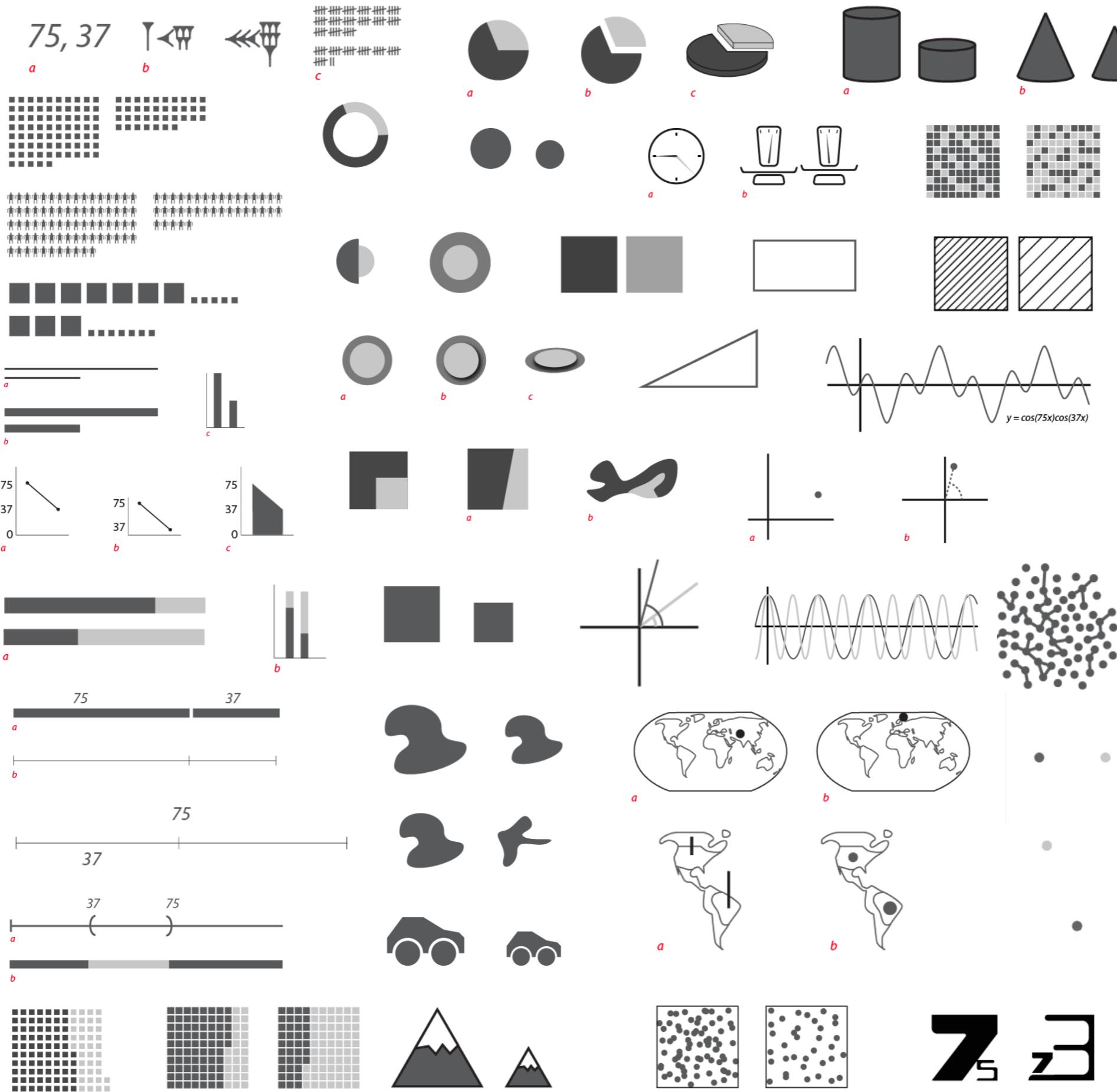
Not good for quantitative data!

Is preattentive if sufficiently different.

Lots of pitfalls! Be careful!

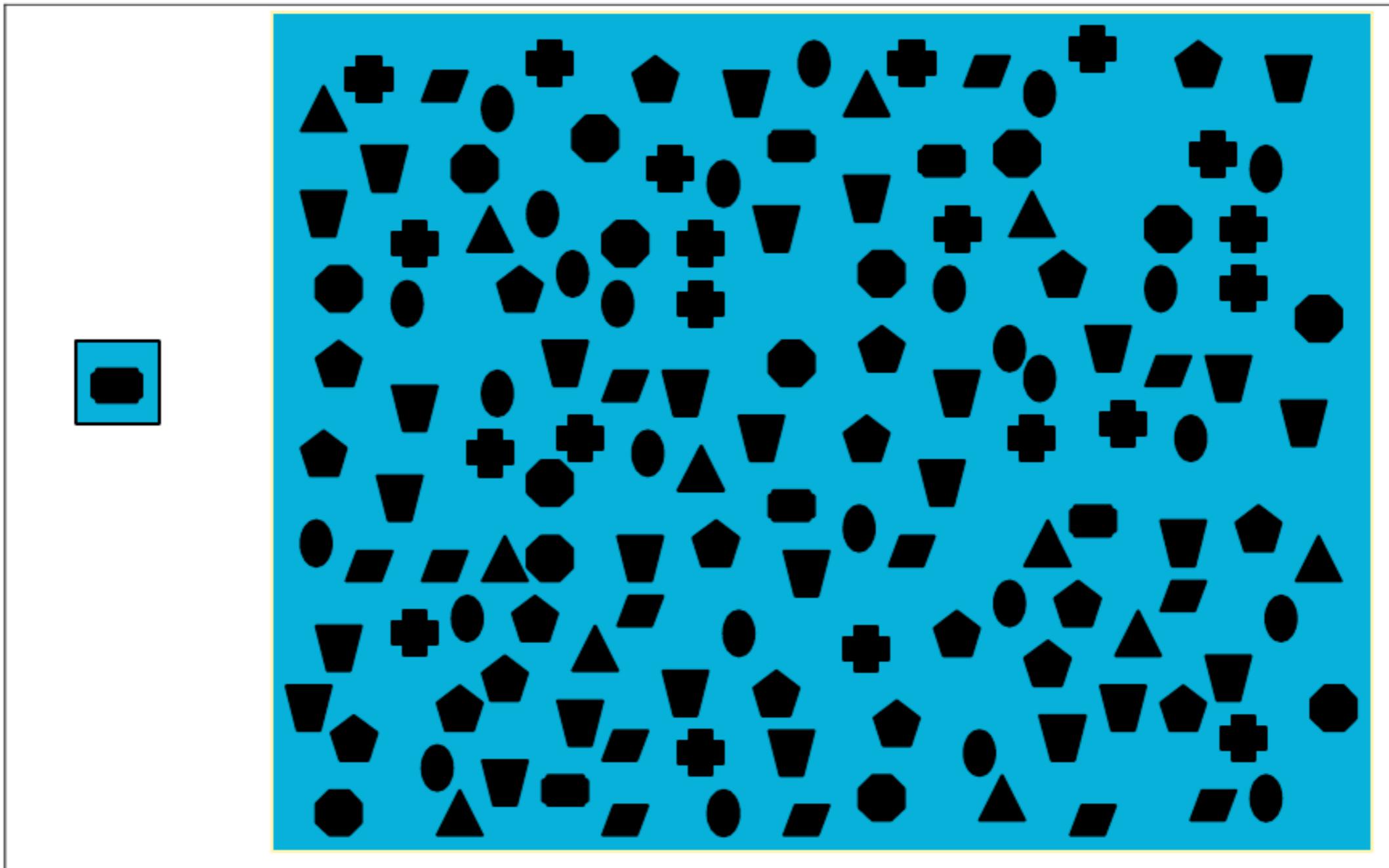


# <http://blog.visual.ly/45-ways-to-communicate-two-quantities/>



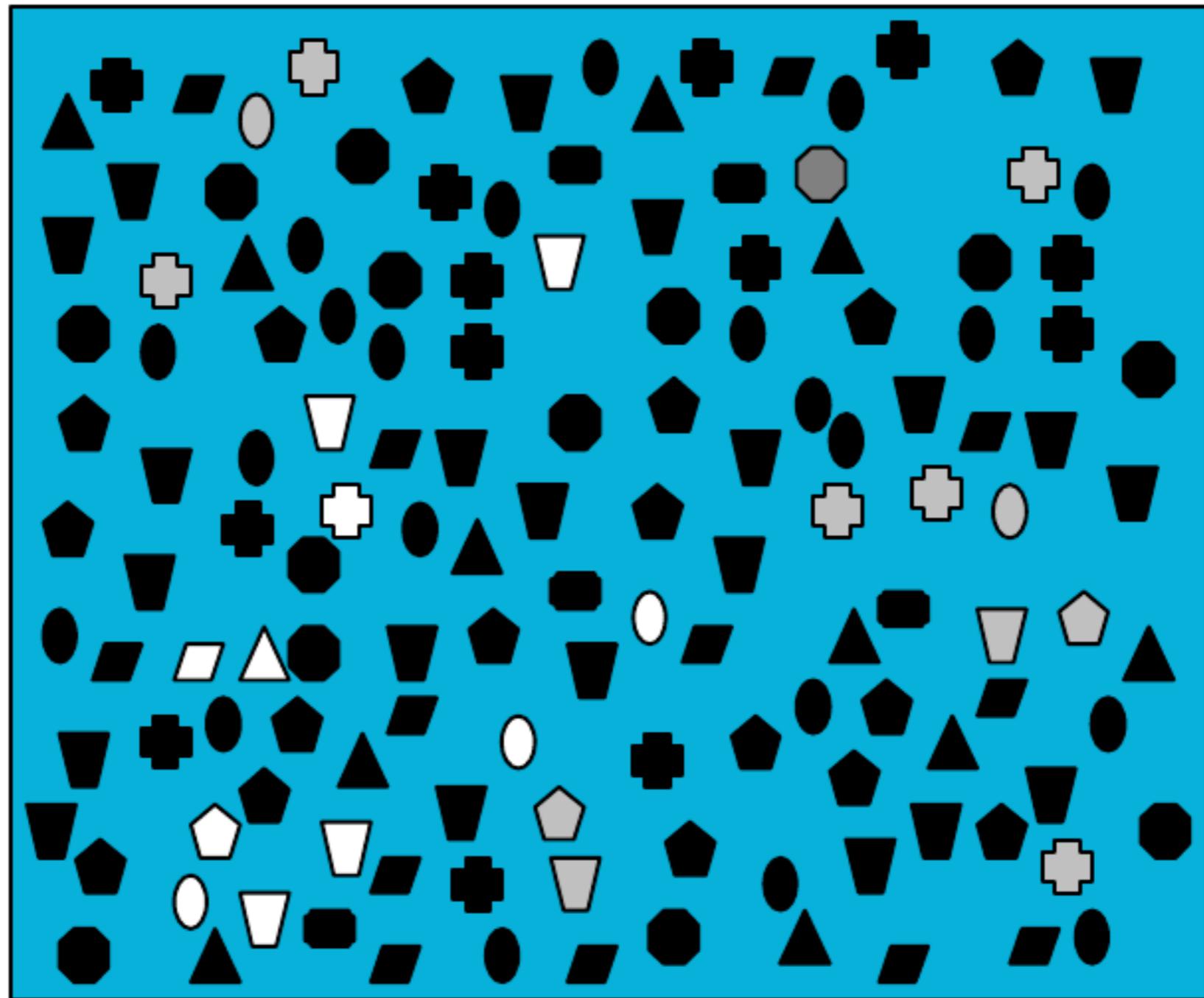
# Graphical Perception

# Select a shape?



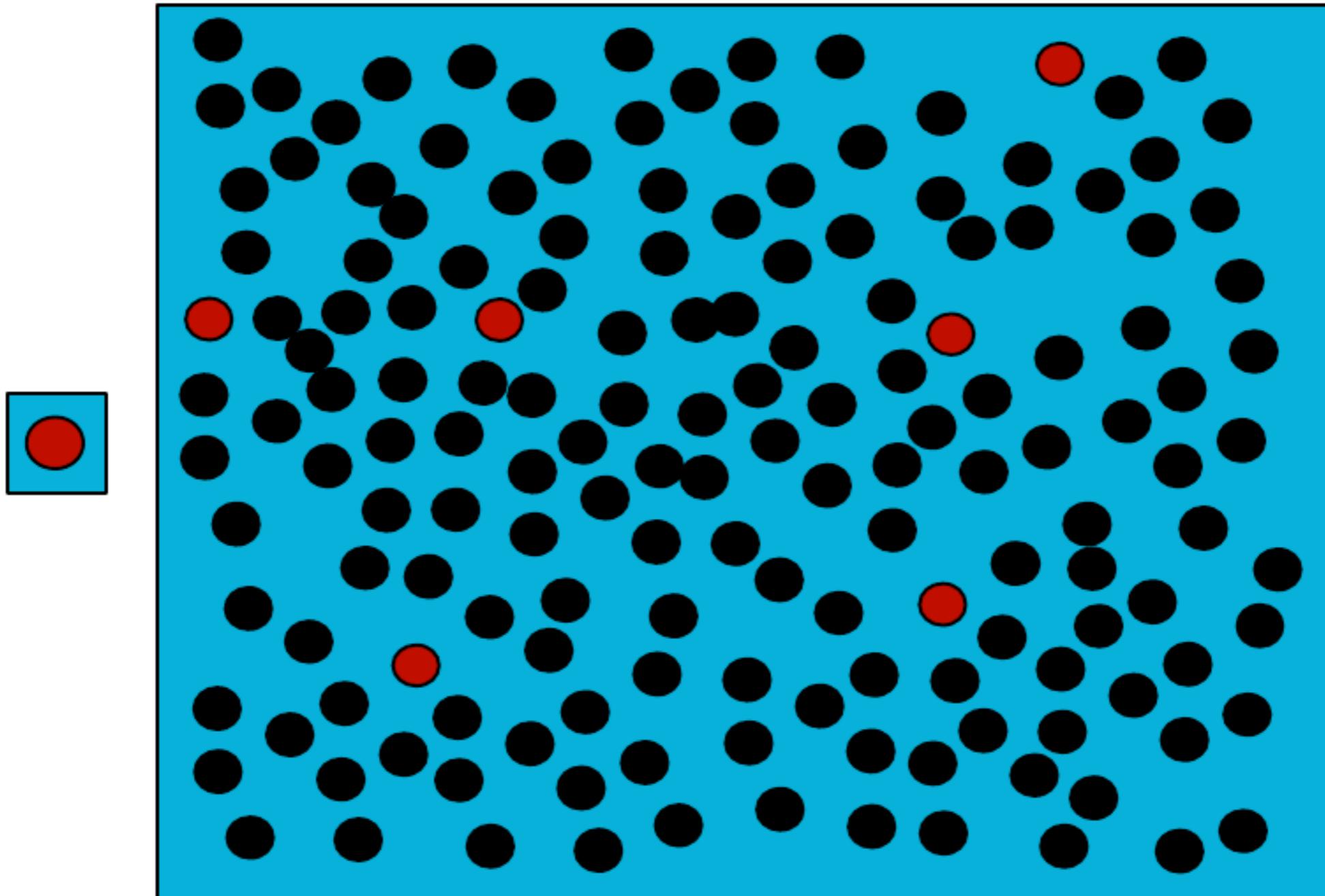
[Carpendale]

# Select a Value?



[Carpendale]

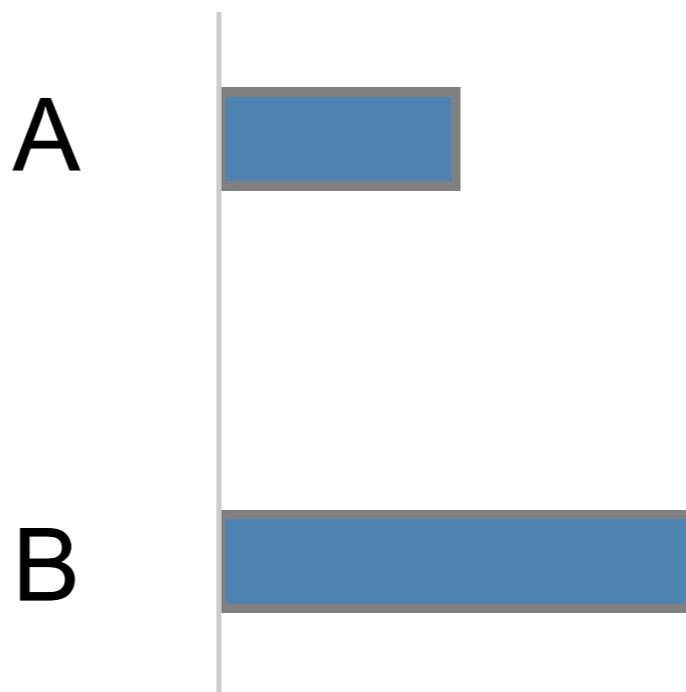
# Select Color?



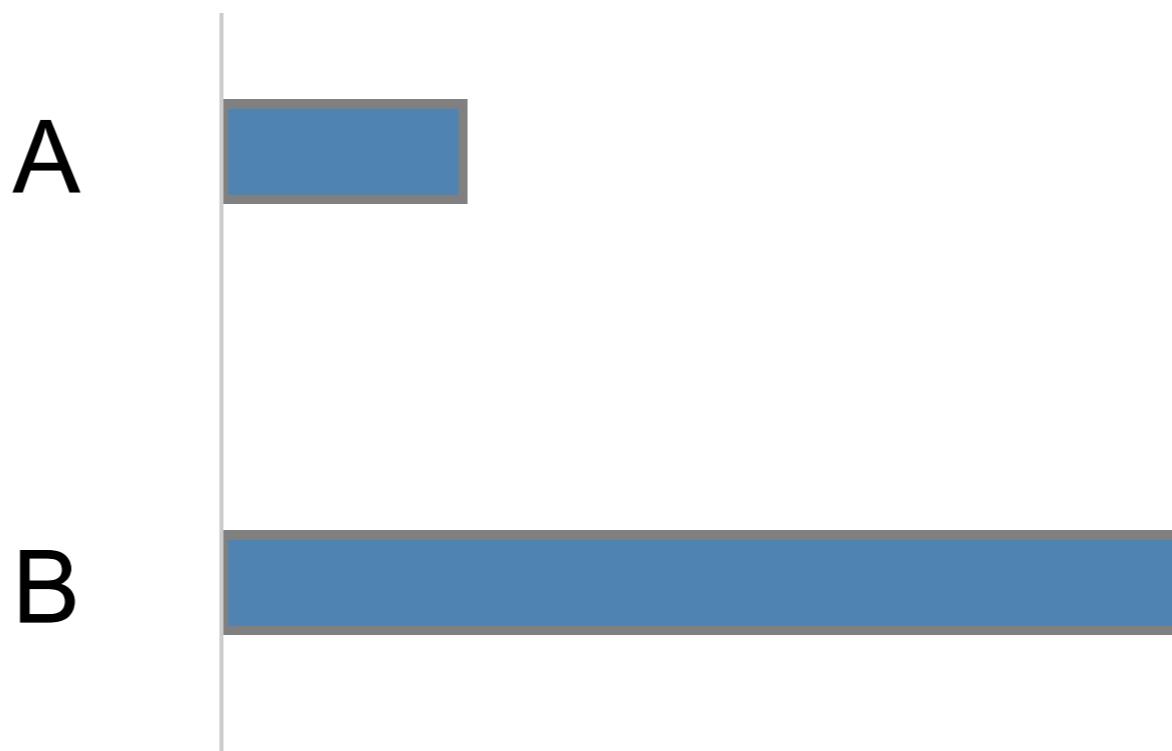
Unfair Comparison?

[Carpendale]

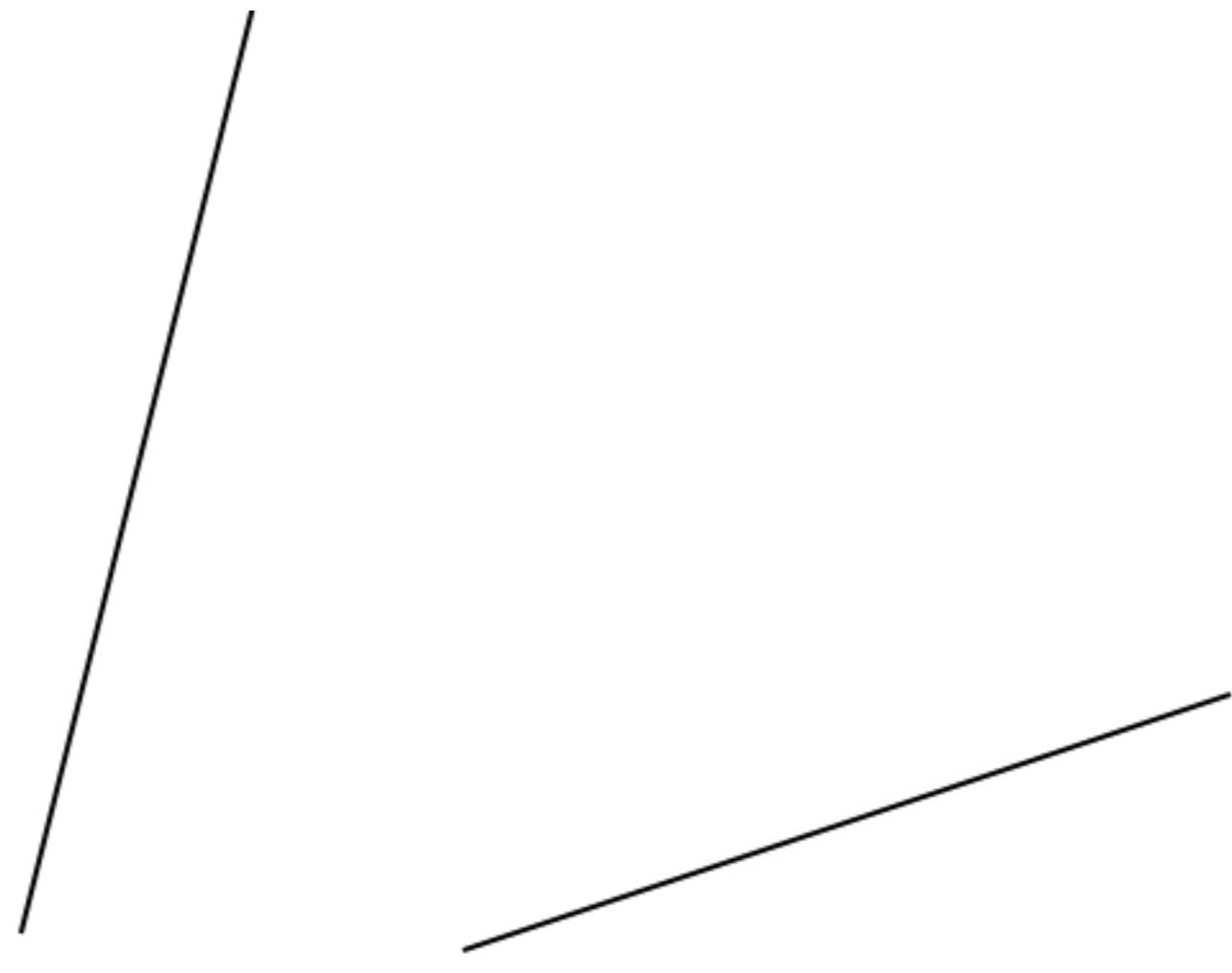
# How much longer?



# How much longer?



# How much steeper?

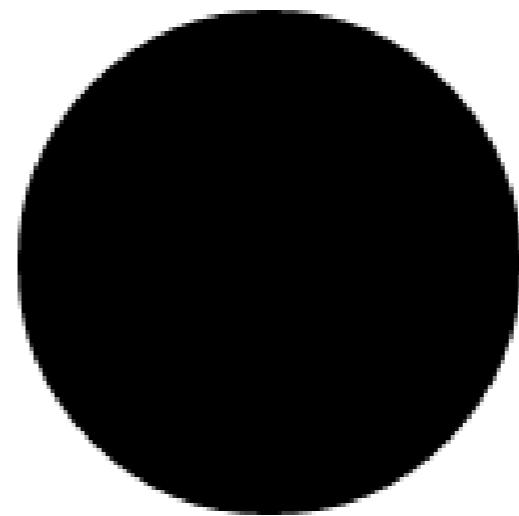
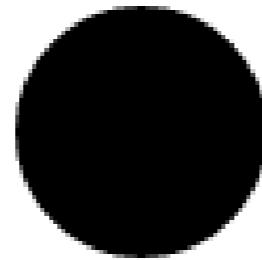


A

B

$4x$

# How much larger?

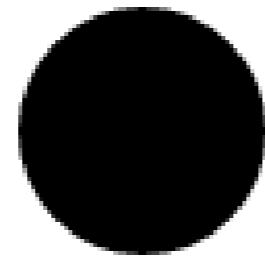


A

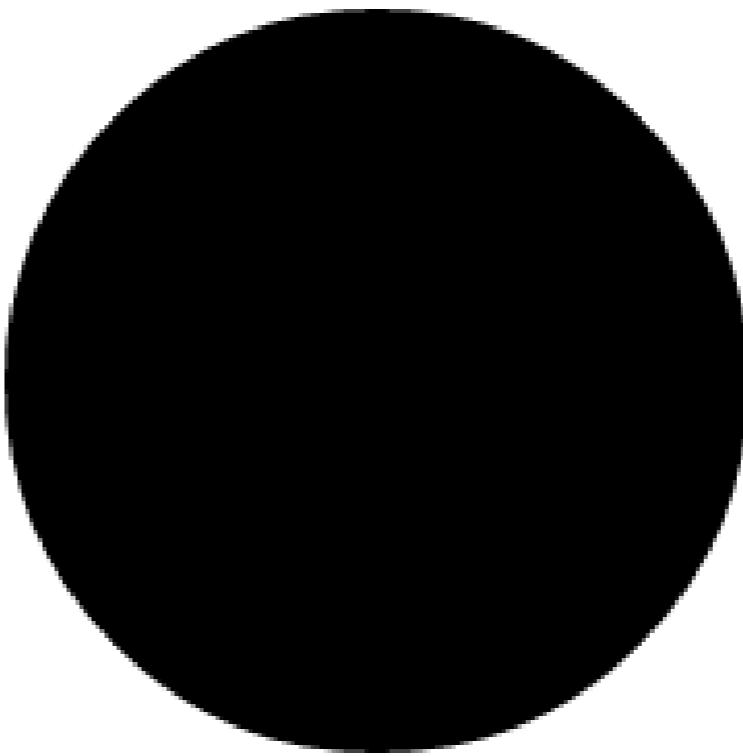
B

2x

# How much larger?



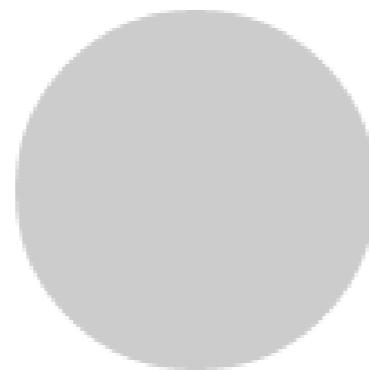
A



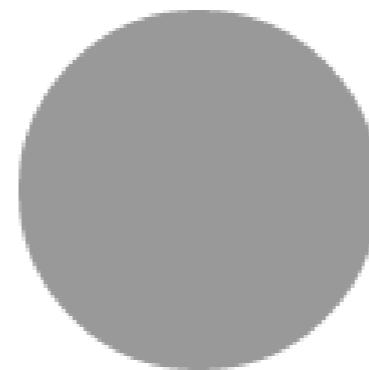
B

3x

# How much darker?



A



B

Opacity: A = 0.2 / B = 0.4 ->

But: non-linearities of the human visual system

# Position, Length & Angle

## The eyeballing game

Adjust to make a parallelogram



Accurate to 5.0 units

Next

Your inaccuracy by category:

Parallelogram	5.0	---	---
Midpoint	---	---	---
Bisect angle	---	---	---
Triangle center	---	---	---
Circle center	---	---	---
Right angle	---	---	---
Convergence	---	---	---

Average error: 5.00 (lower is better)

Time taken: 3.3

Best of last 500 score and time: [\(more\)](#)

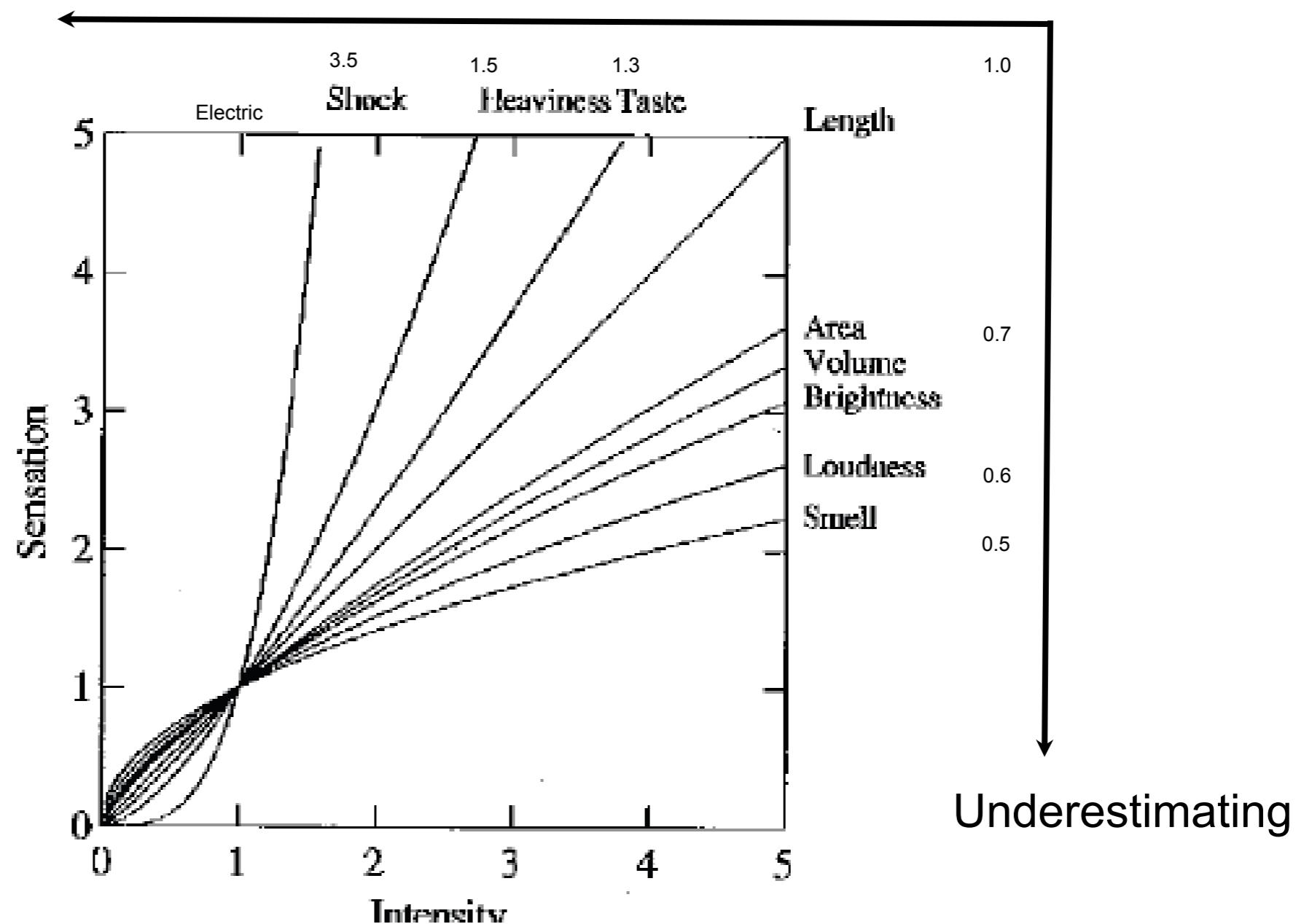
1.32	250 s	Harabubakken sparkakar kl
1.36	81 s	± rides saddle horn
1.39	110 s	have both-can f myself±
1.46	93 s	± is one kinky dude
1.50	95 s	no NT...sample my taco? ±
1.55	114 s	
1.57	113 s	
1.65	85 s	± "come on funny feeling"
1.70	71 s	JSA
1.75	89 s	JSA

Best on this computer score and time:

# Steven's Power Law, 1961

$$S = kI^p$$

Overestimating



# Bertin, 1967

	Nominal	Ordinal	Quantitative
Position	✓	✓	✓
Size	✓	✓	~
(Grey)Value	✓	✓	~
Texture	✓	~	✗
Color	✓	✗	✗
Orientation	✓	✗	✗
Shape	✓	✗	✗

✓ = Good

~ = OK

✗ = Bad

# Cleveland / McGill, 1984

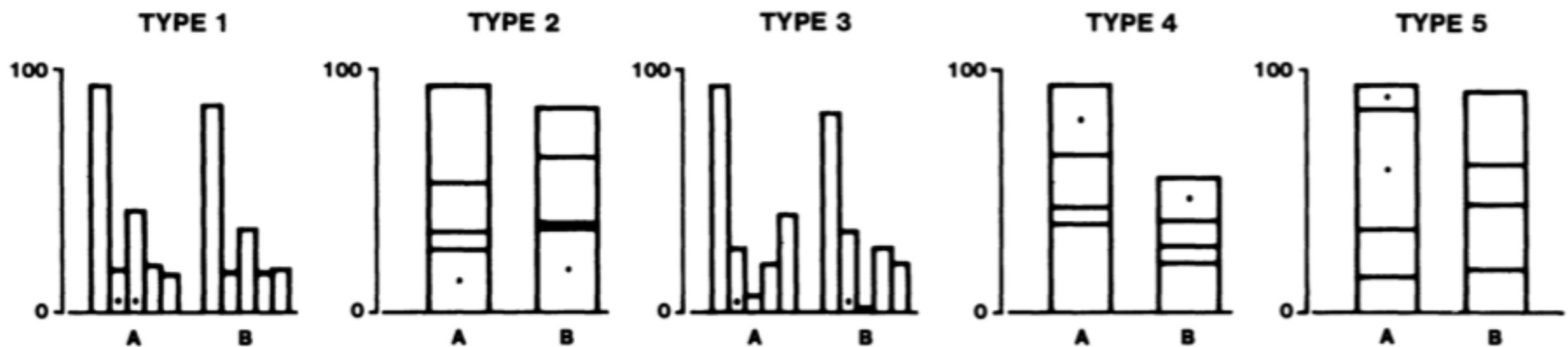


Figure 4. Graphs from position-length experiment.

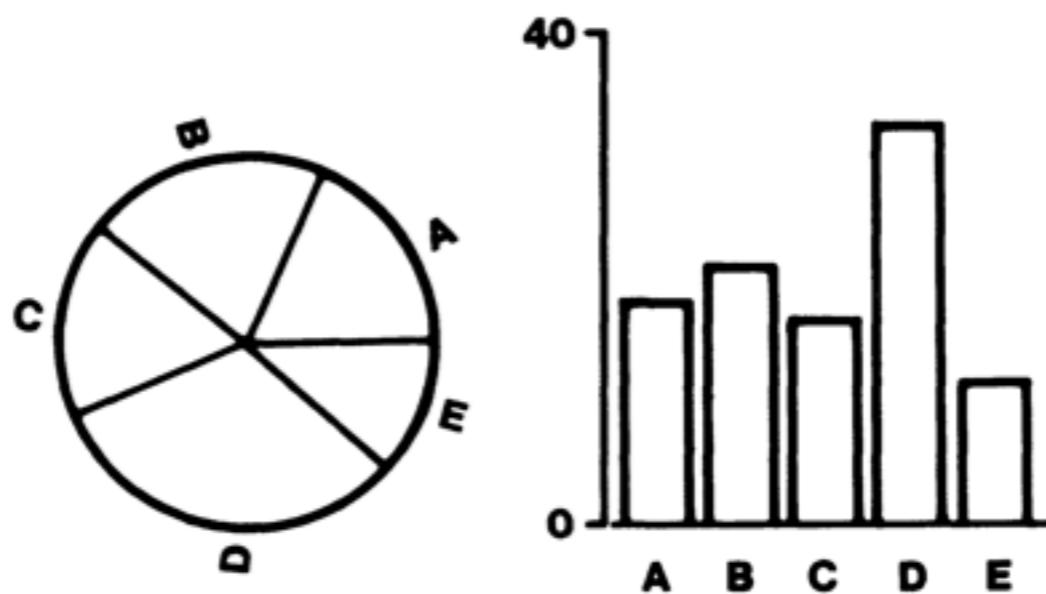


Figure 3. Graphs from position-angle experiment.

# Cleveland / McGill, 1984

Position judgments > length >> angle

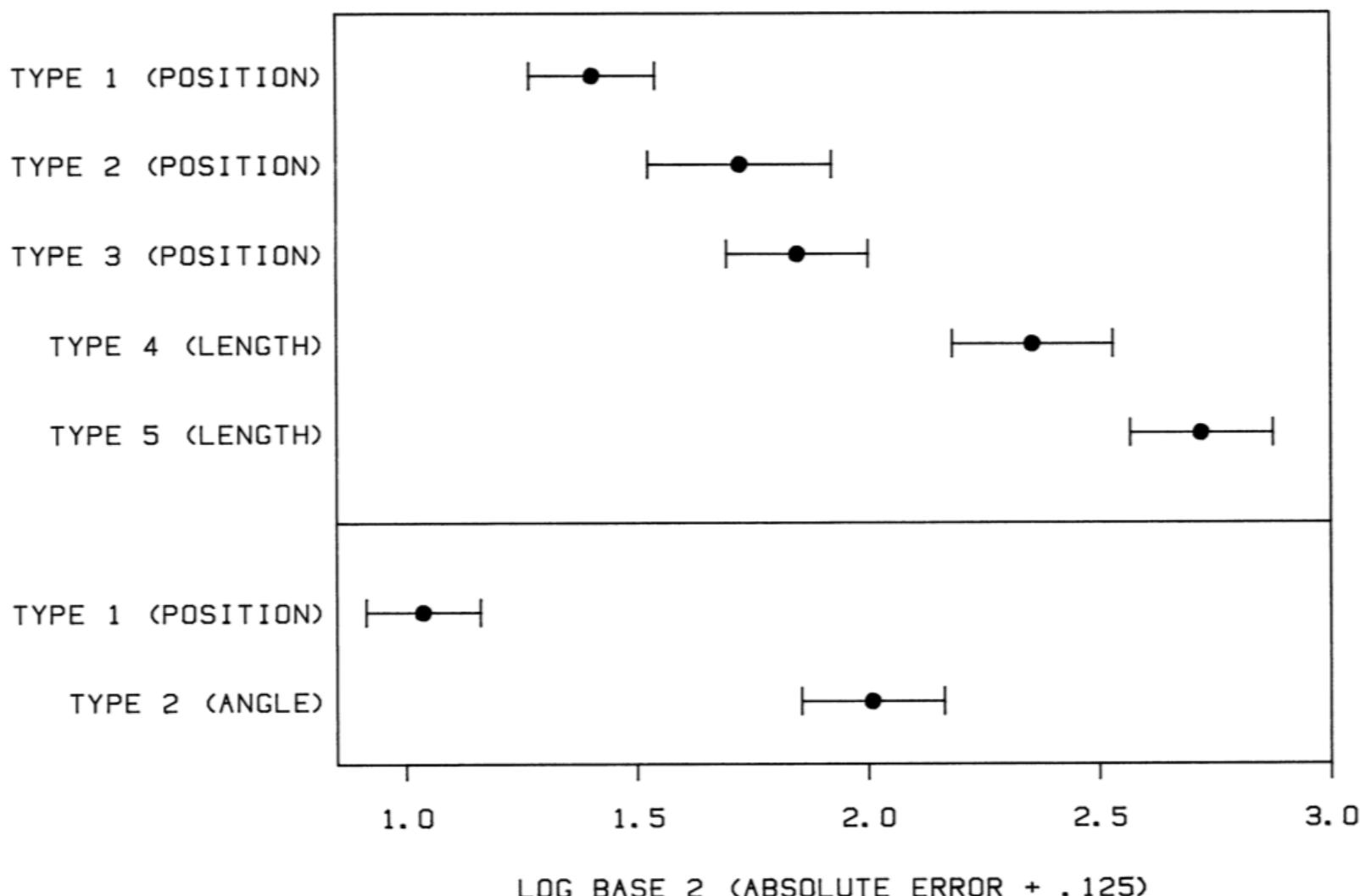
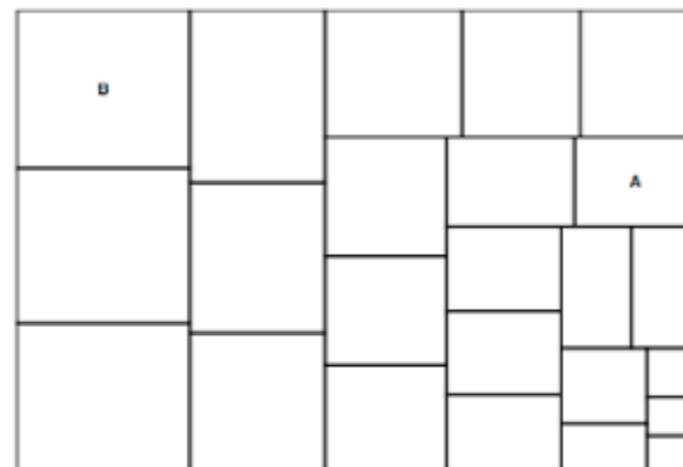
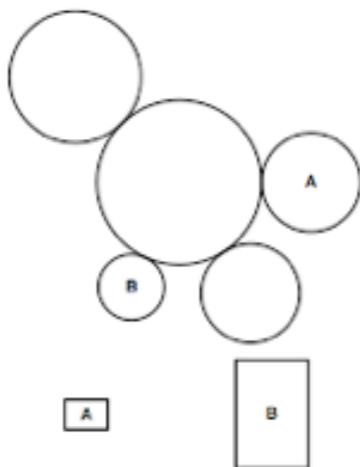
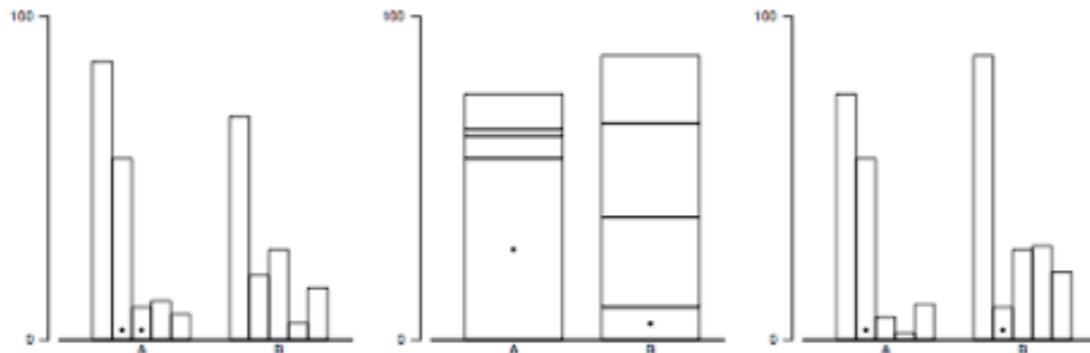


Figure 16. Log absolute error means and 95% confidence intervals for judgment types in position-length experiment (top) and position-angle experiment (bottom).

# Heer & Bostock, 2010

## Crowdsourcing Graphical Perception: Using Mechanical Turk to Assess Visualization Design

Jeffrey Heer, Michael Bostock

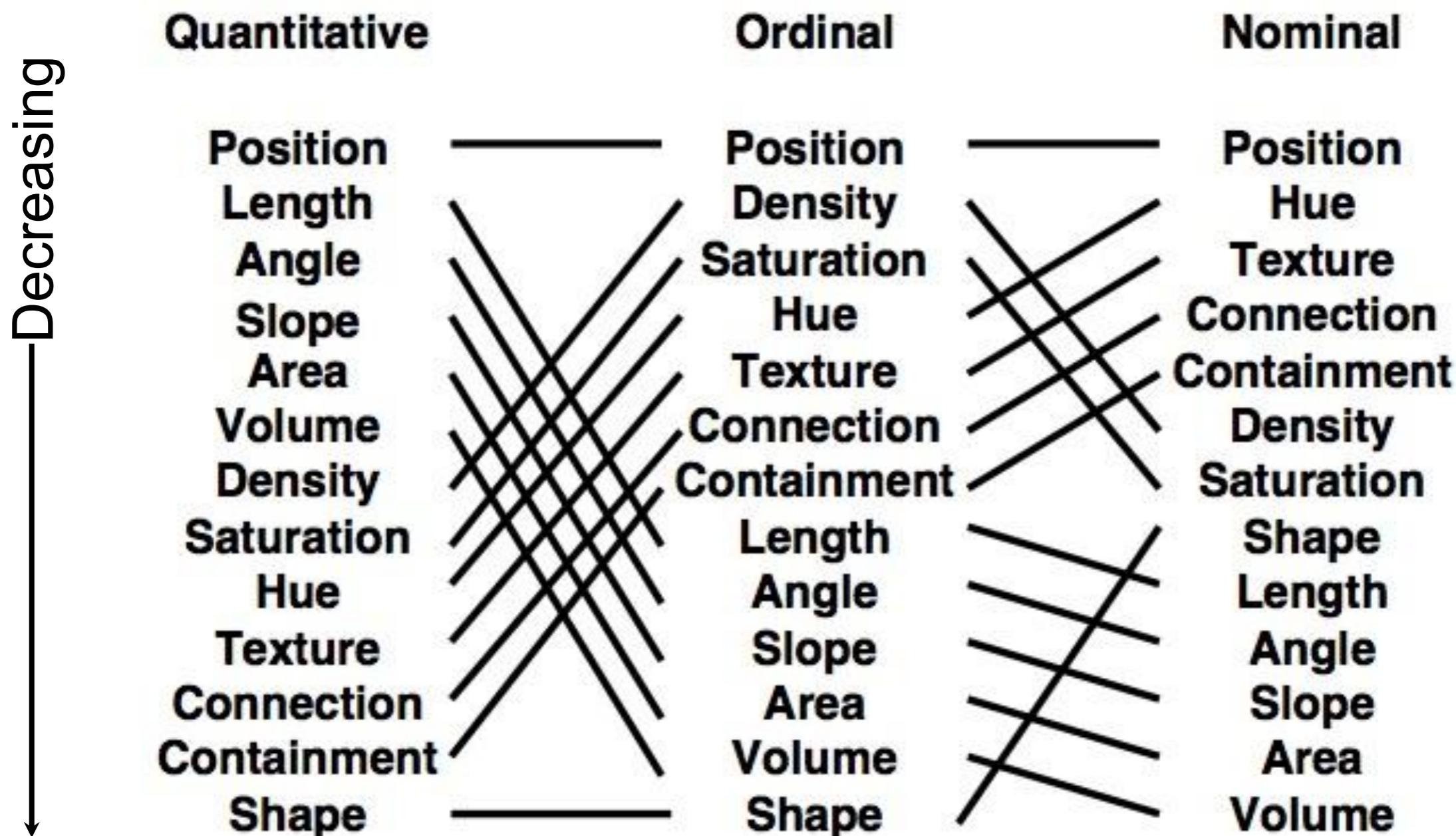


Experimental stimuli in which participants were asked to estimate what percentage the smaller value was of the larger.

### ABSTRACT

Understanding perception is critical to effective visualization design. With its low cost and scalability, crowdsourcing presents an attractive option for evaluating the large design space of visualizations; however, it first requires validation. In this paper, we assess the viability of Amazon's Mechanical Turk as a platform for graphical perception experiments.

# Jock Mackinlay, 1986



# Effective Visualizations

Most  
Efficien

t

Least  
Efficien

t

Position



Length



Slope



Angle

Area



Intensity



Color



Shape

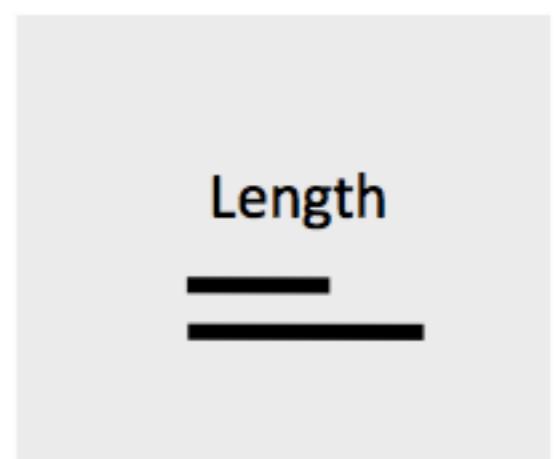
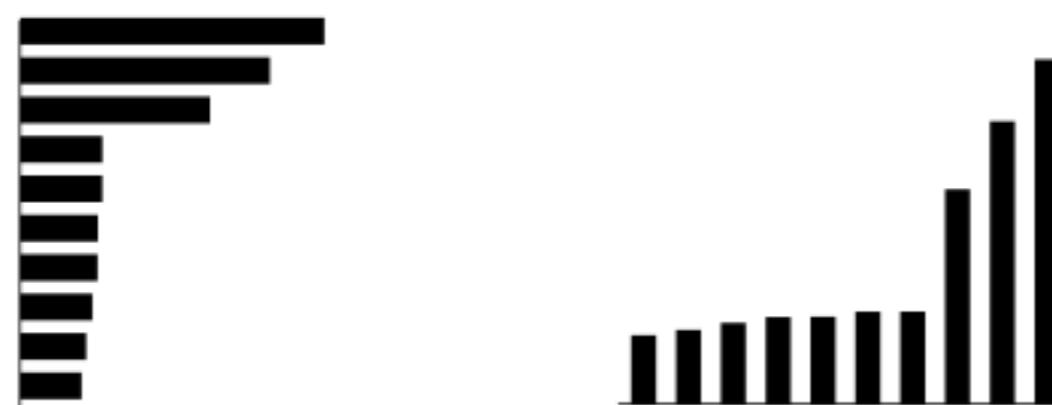
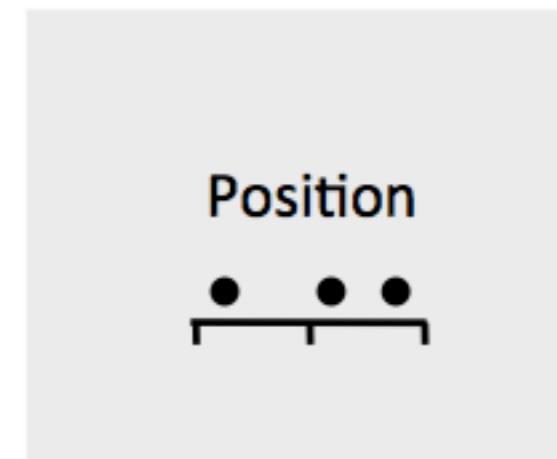
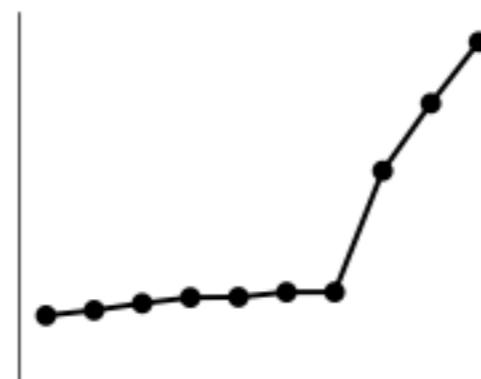


Quantitative

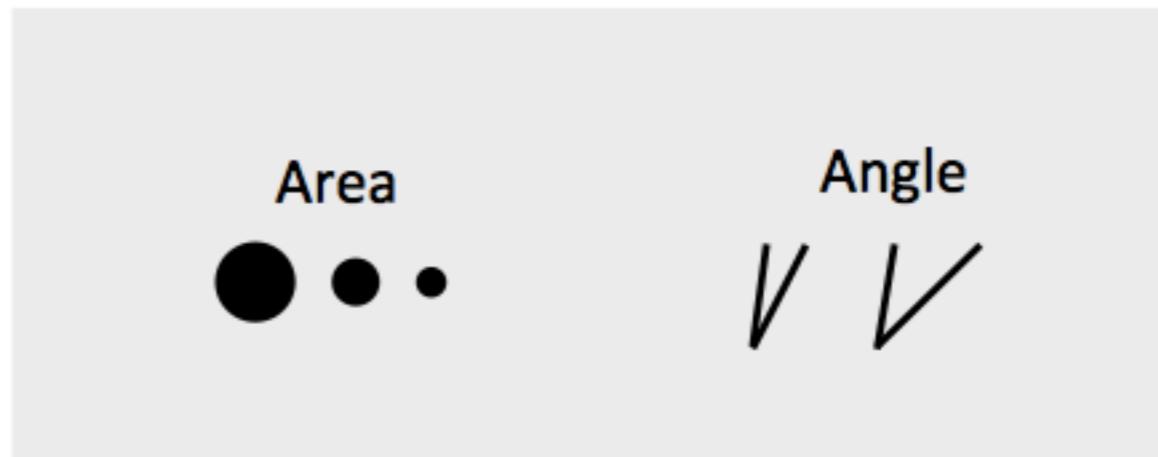
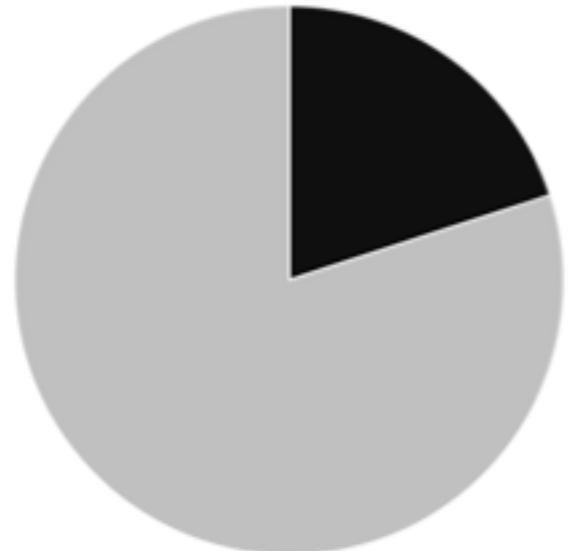
Ordinal

Nominal

# Most Effective



# Less Effective



# Least Effective

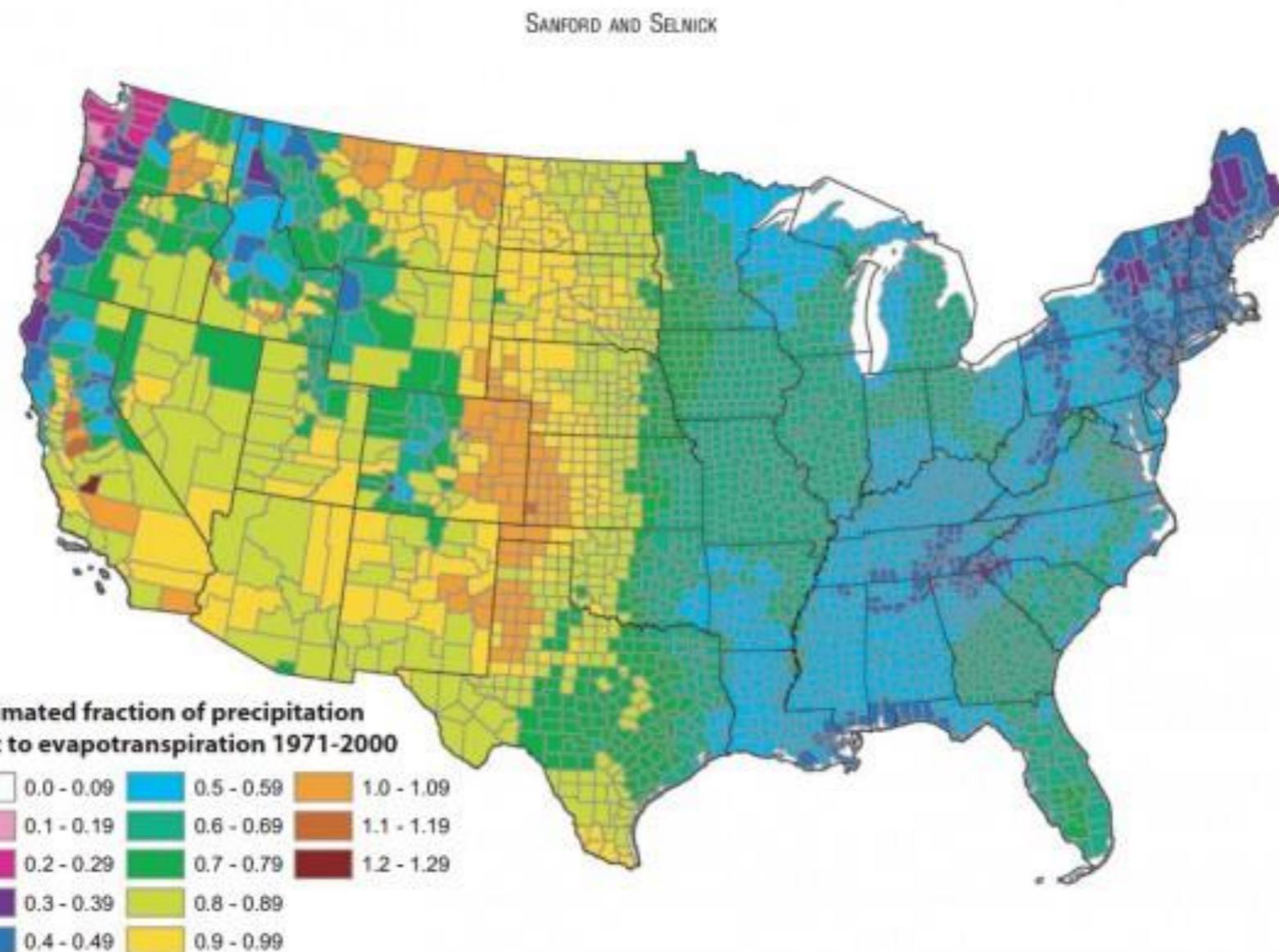
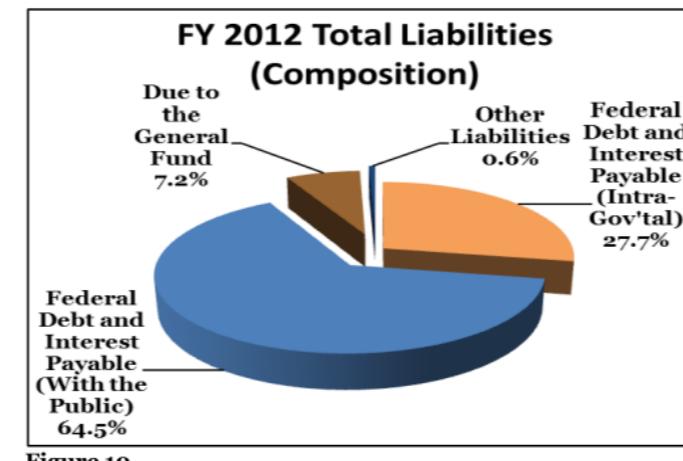
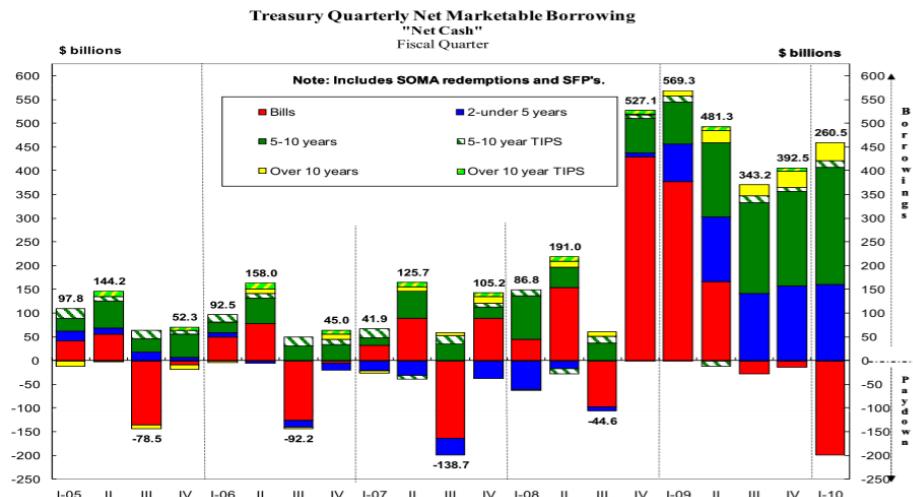
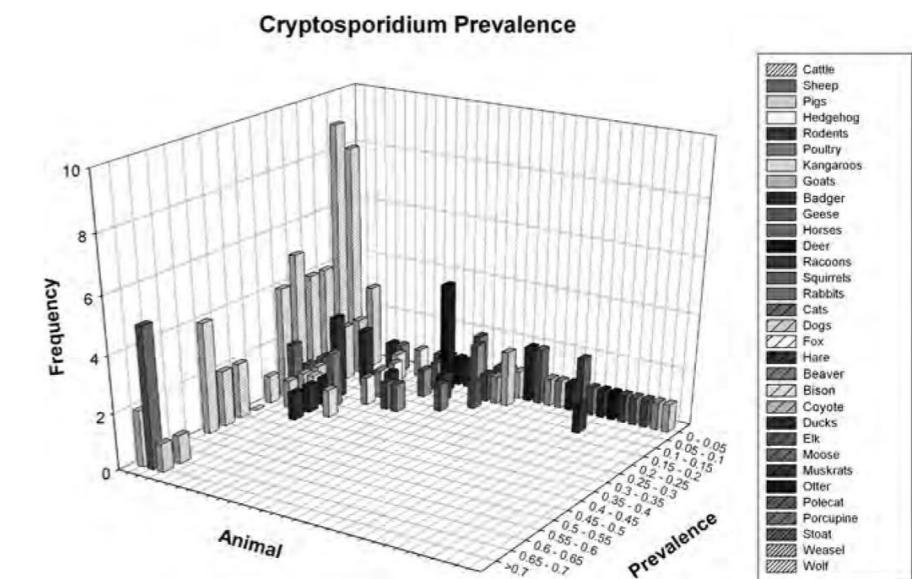
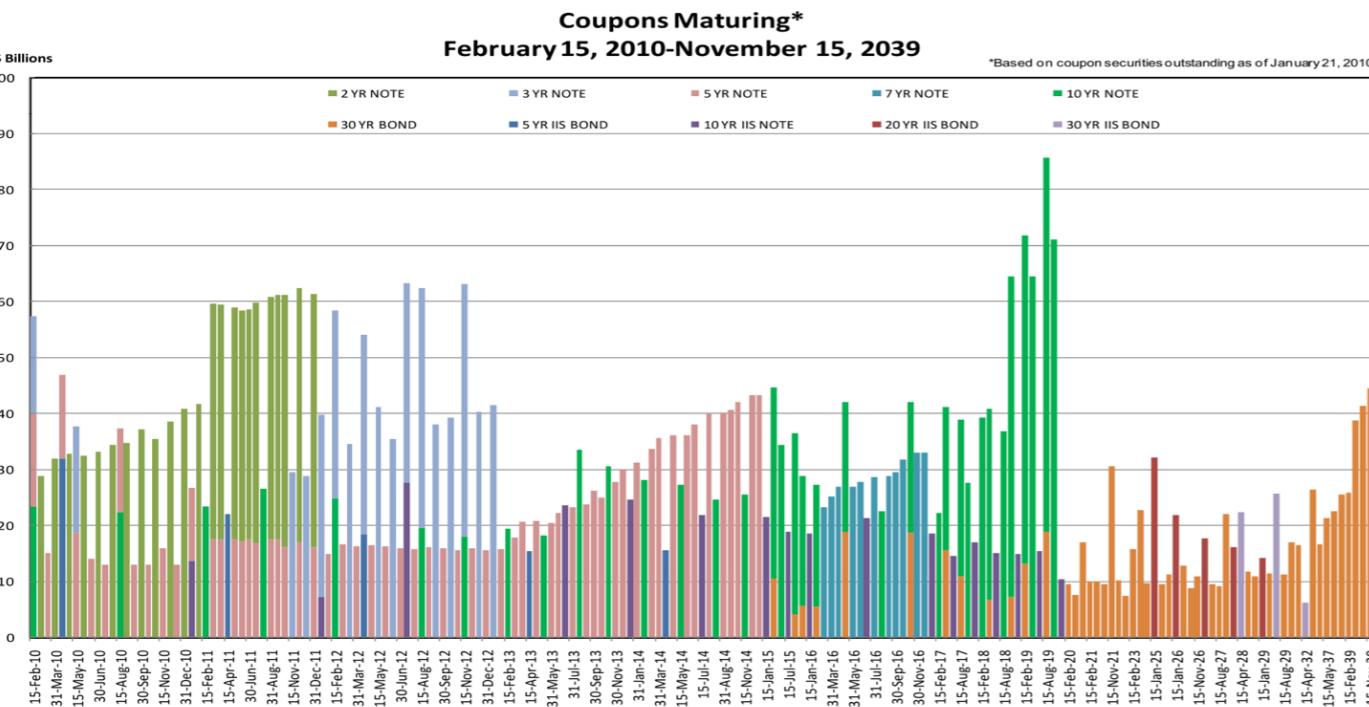


FIGURE 13. Estimated Mean Annual Ratio of Actual Evapotranspiration (ET) to Precipitation ( $P$ ) for the Conterminous U.S. for the Period 1971-2000. Estimates are based on the regression equation in Table 1 that includes land cover. Calculations of  $ET/P$  were made first at the 800-m resolution of the PRISM climate data. The mean values for the counties (shown) were then calculated by averaging the 800-m values within each county. Areas with fractions  $>1$  are agricultural counties that either import surface water or mine deep groundwater.

# *Not Effective...*



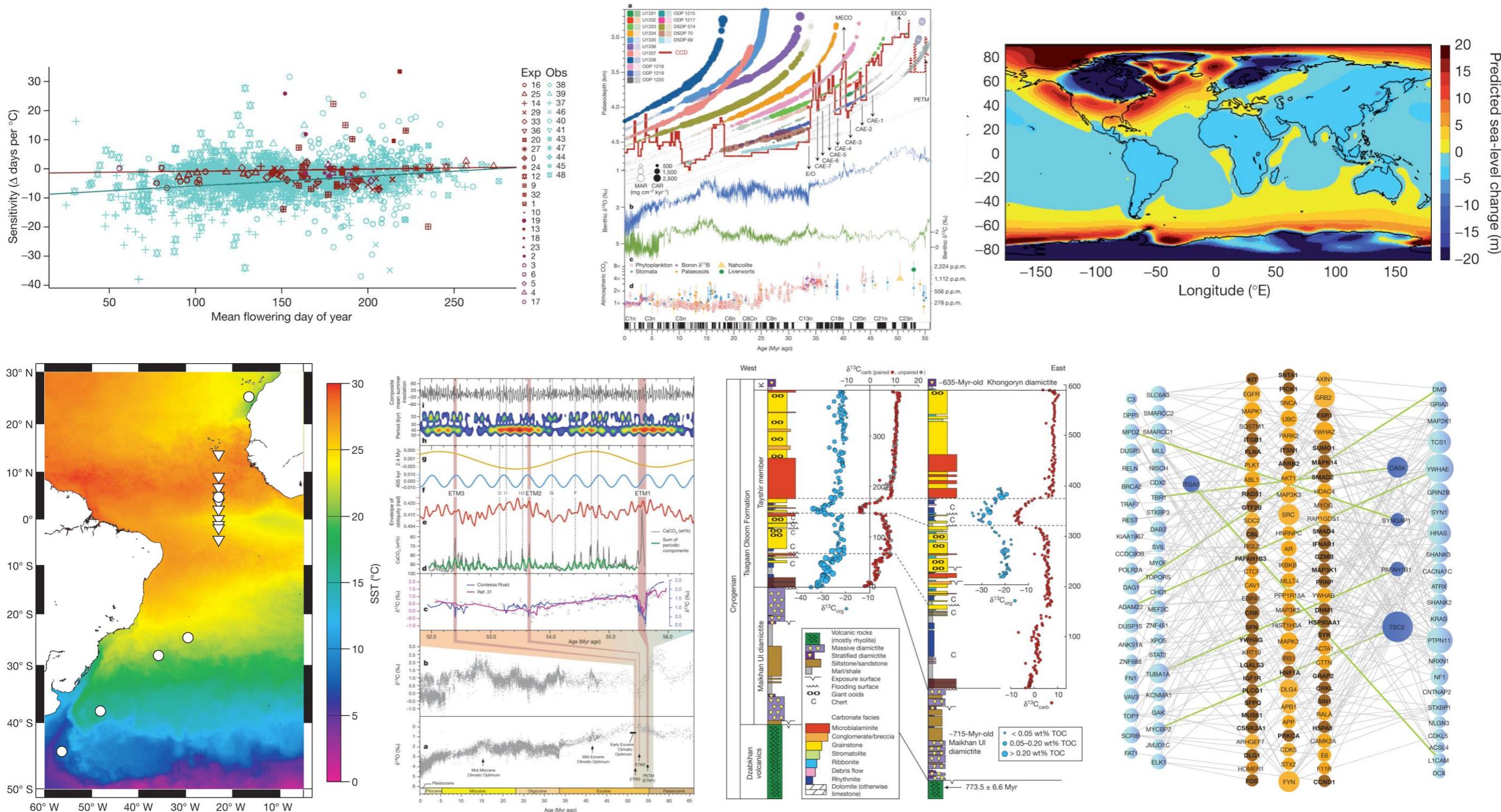
**Figure 1C**



**Figure 5.2** Mean prevalence rates of *Cryptosporidium* oocysts by animal species.

Sources: US Treasury and WHO reports

# Also not effective...



Source: Nature



## National Weather Service Forecast Office

# Boston, MA

[Home](#)[News](#)[Organiza](#)

Local forecast by  
"City, St" or zip code

Current Hazards  
Southern New England  
Severe Weather  
Tropical/Hurricane  
Hazardous Outlooks  
Send Us Your Report

Recent Conditions  
Observations  
Hourly Roundups  
Rivers & Lakes AHPS  
U.S. & World Cities  
Summaries  
Satellite Images  
Hydrologic Observations  
Marine  
Record Breaking  
Storm Totals - Info  
Storm Damage

Radar Imagery  
Taunton, MA  
New England  
Northeast Sector Mosaic  
Nationwide Mosaic

Forecasts  
Activity Planner  
New England  
Extended Outlooks  
River-Flood-Drought  
Graphical Table  
Graphical 2D  
Digital Forecast  
Database (NDFD)  
Detailed Point  
Forecast  
Aviation  
Fire Weather  
Discussions

A Public Information Statement has recently been issued. [Map of Storm Totals](#)

## Storm Total Snow Forecast

### Storm Total Snow Forecast

[Click to see WINTER WEATHER MESSAGE](#)

Probability 2 Inches of Snow

None < 1 1-2 2-4 4-6 6-8 8-10 10-14 14-18 18-24 24-30 > 30

Click for Amounts  
to NE

Click for Amounts  
to N & W

Click for  
Amounts  
to W & N

Click for Amounts  
to SW

Storm Total Snow Forecast (in): Ending at 01 am Thu Feb 06 2014



NOAA / National Weather Service

Graphic last modified: Tuesday, 04th February, 2014 @ 4:31PM



Probability 2 Inches of Snow



Probability 4 Inches of Snow



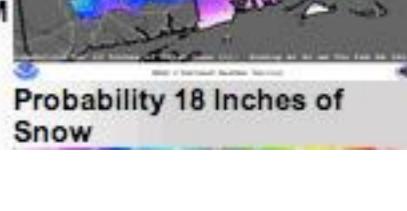
Probability 6 Inches of Snow



Probability 8 Inches of Snow



Probability 12 Inches of Snow



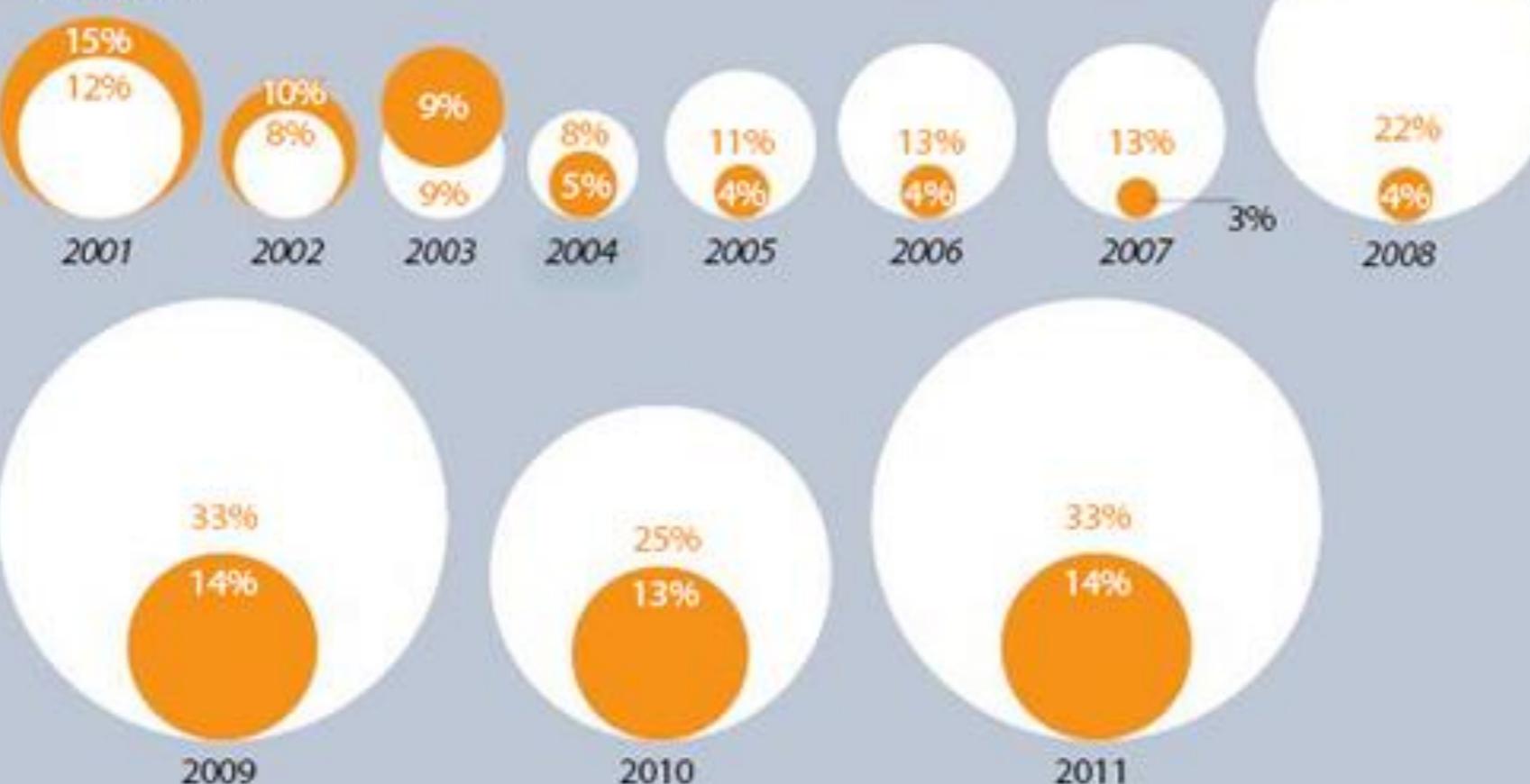
Probability 18 Inches of Snow

## Most important issues

What do you think is the most important problem facing New Zealand today?

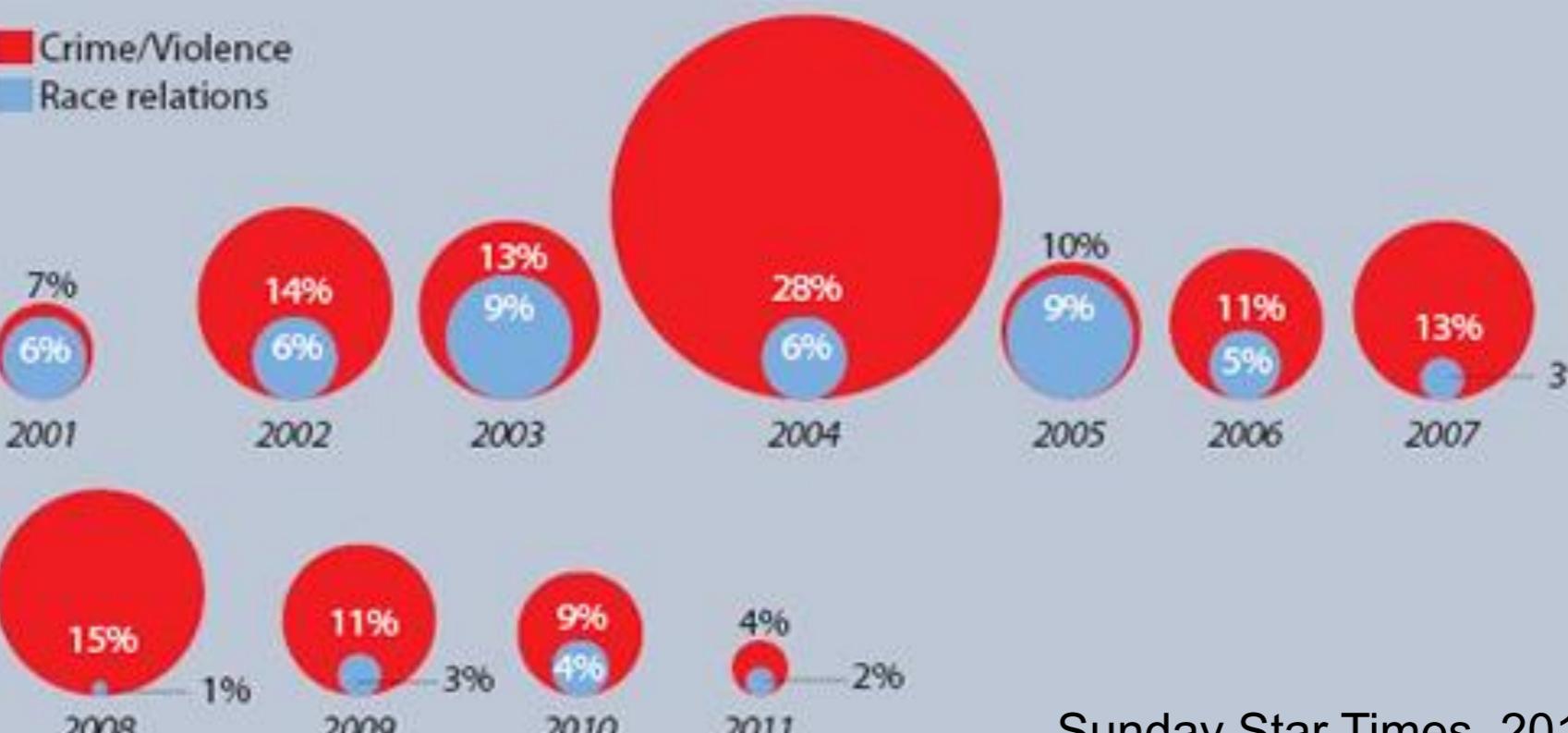
■ Unemployment/Jobs

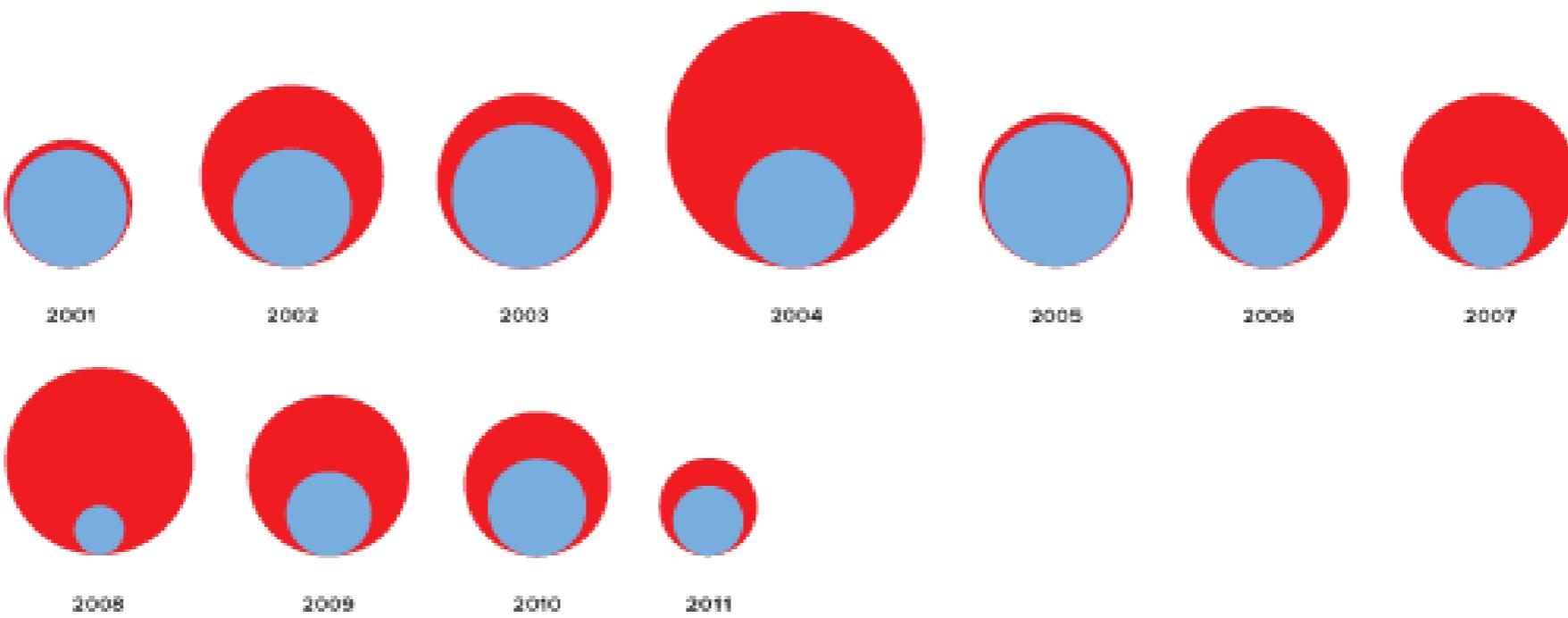
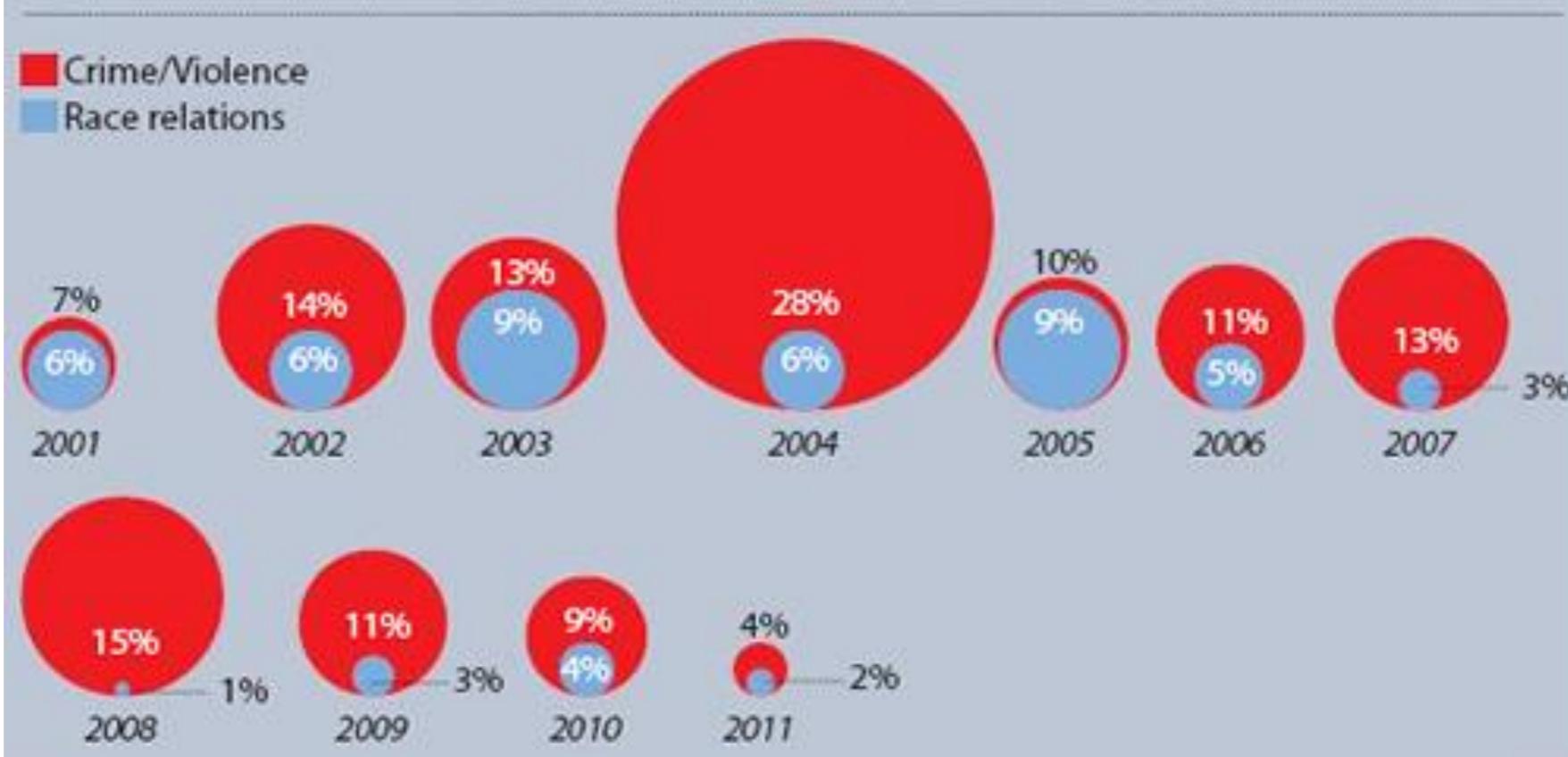
■ Economy

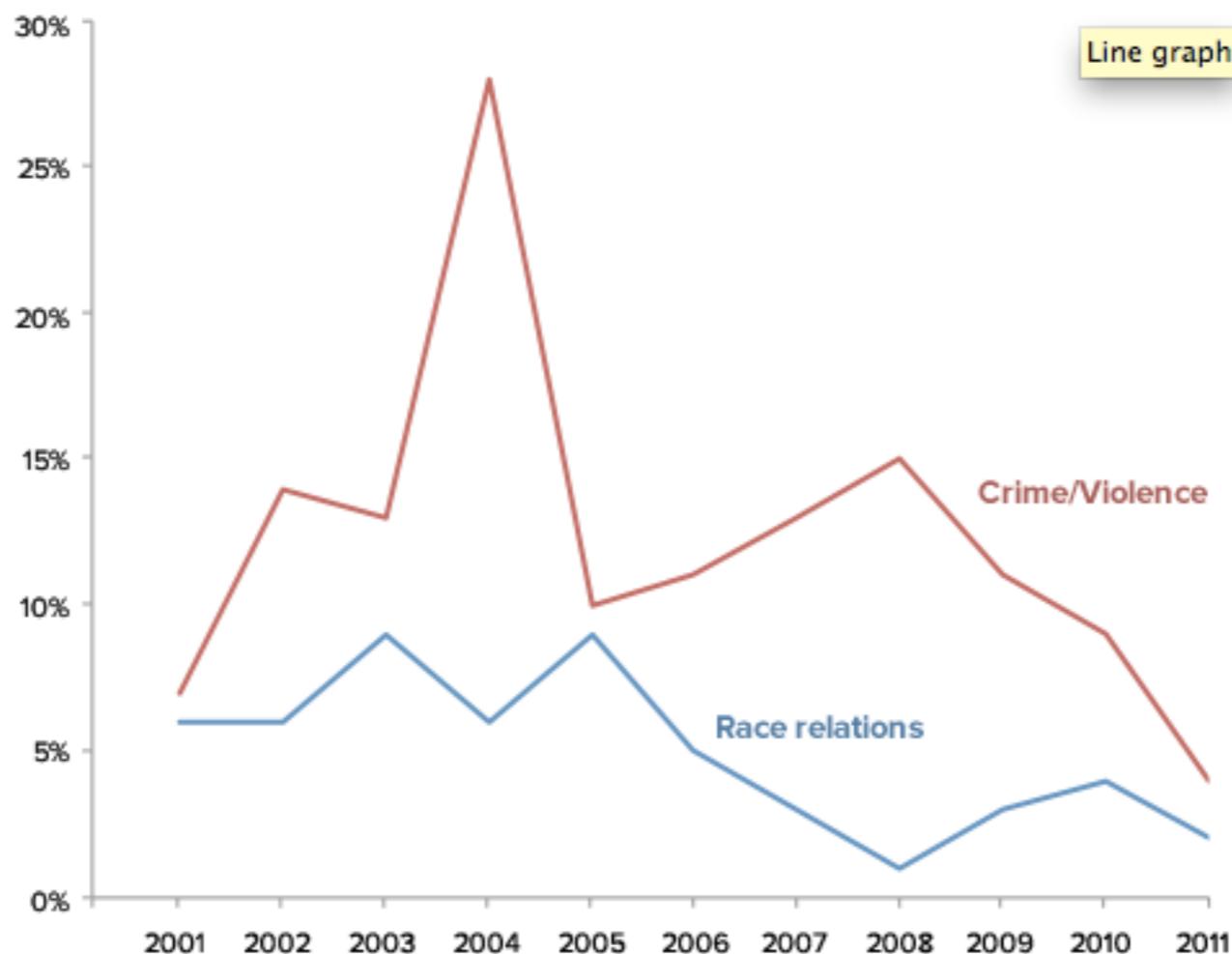
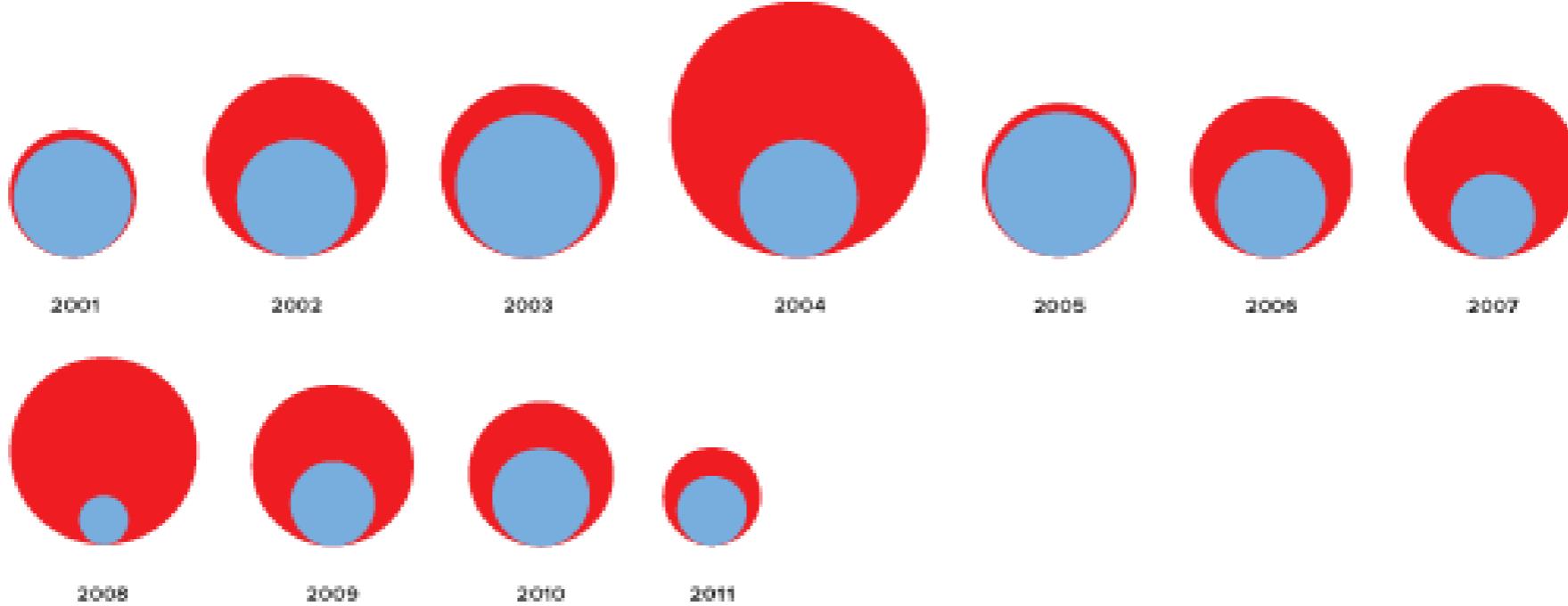


■ Crime/Violence

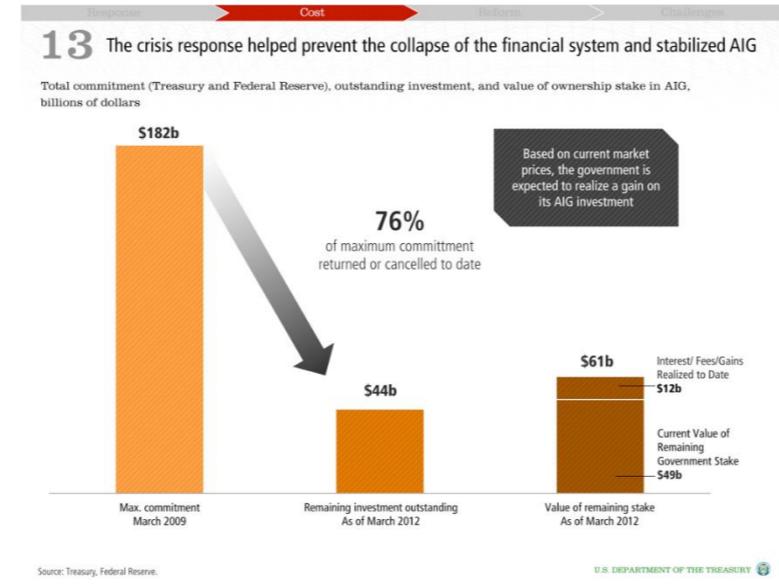
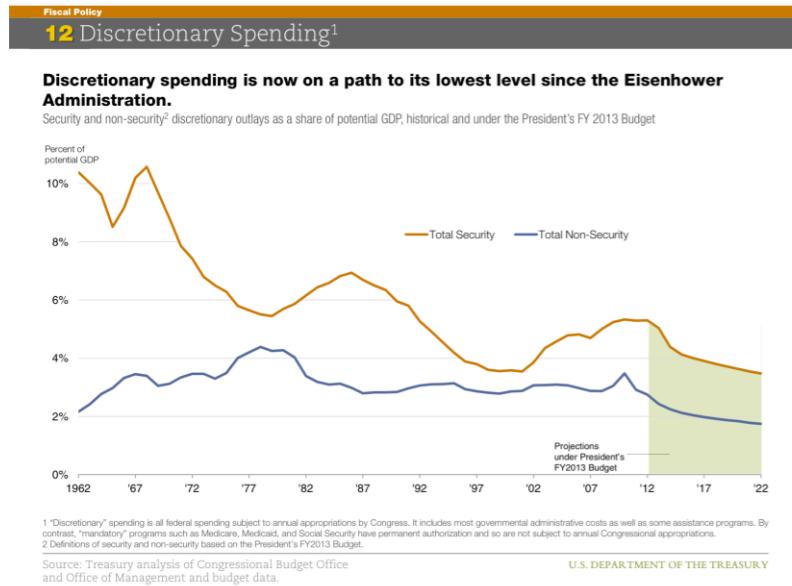
■ Race relations



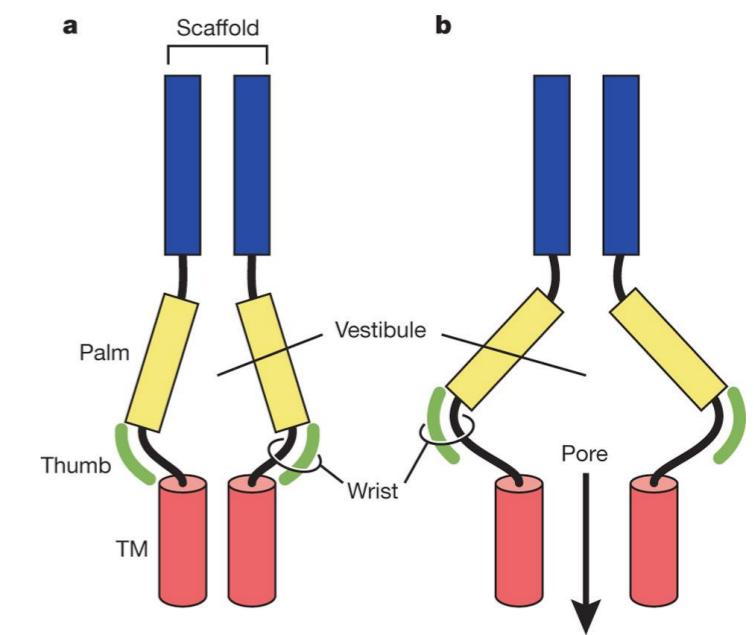
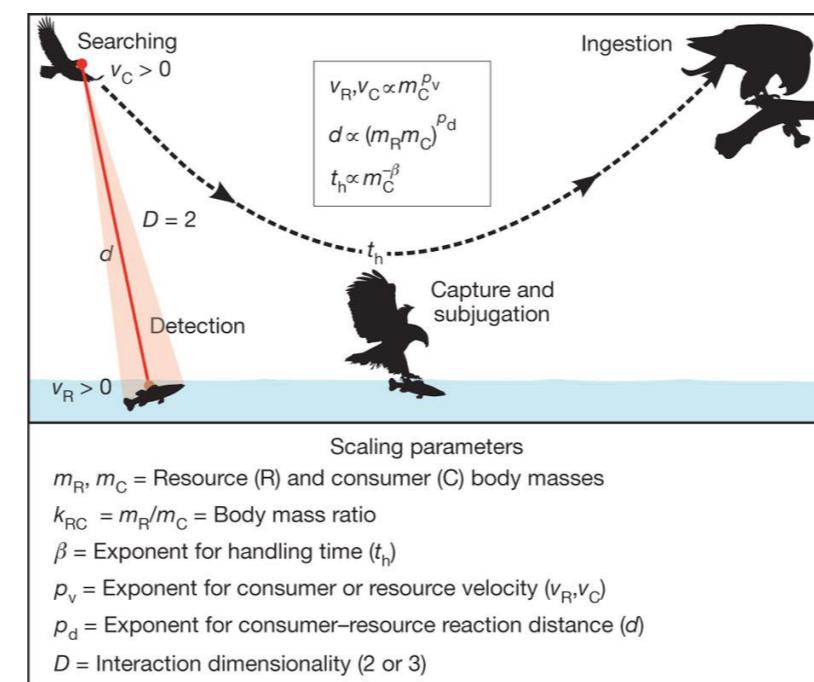
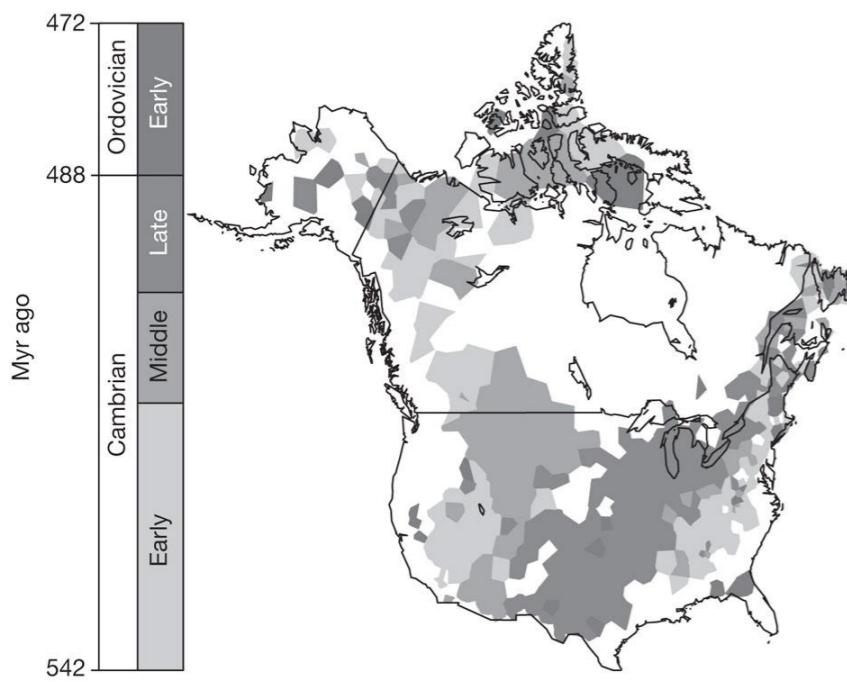
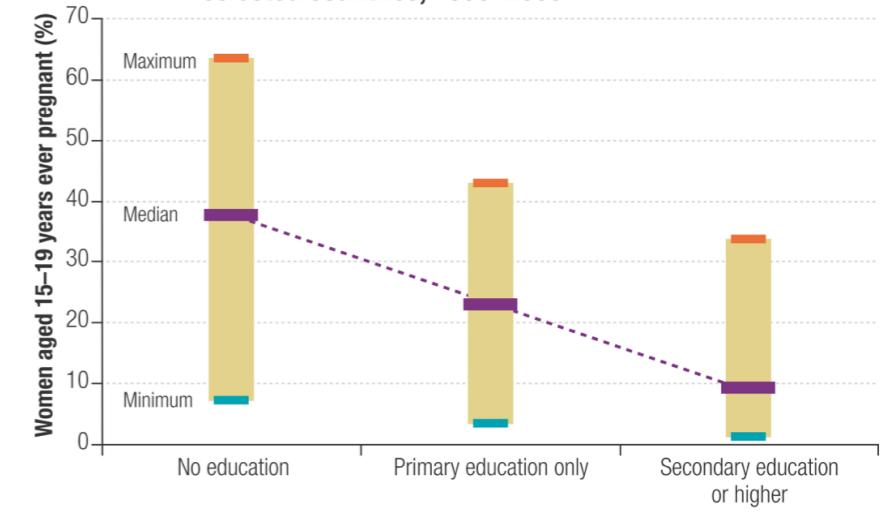




# Much better...



**Figure 2 Adolescence pregnancy rates by educational level, selected countries, 1990–2005**



Sources: US Treasury, WHO, Nature