an introduction to information graphics and data visualisation

max van kleek

INFO6005 – 12.02.2013

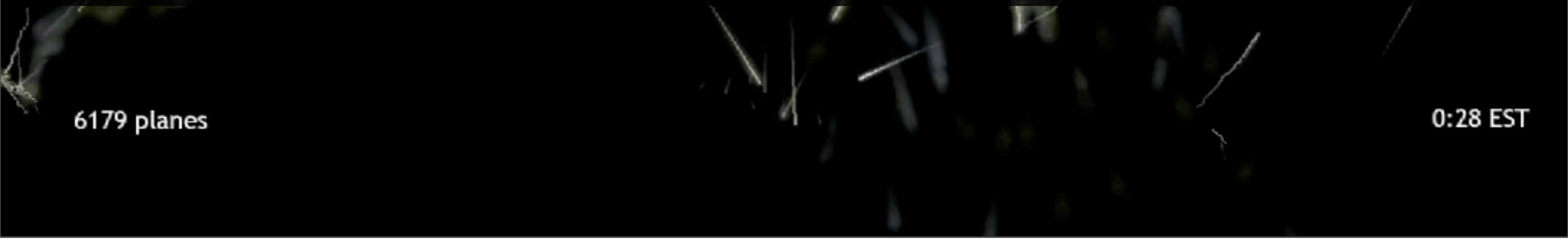
tuesday outline

biological basis of information design

visual dimensions and data dimensions

tasks

deception and bad infographics



friday outline

interacting with visualisations:
filtering, searching, selection

multidimensional data

toolkits: a D3 primer

key objectives

what are the goals of visualisation?

how do you choose a visual representation for data?

how do you evaluate a visualisation?

key objectives

aesthetics + engagement – is ‘pretty’ better?

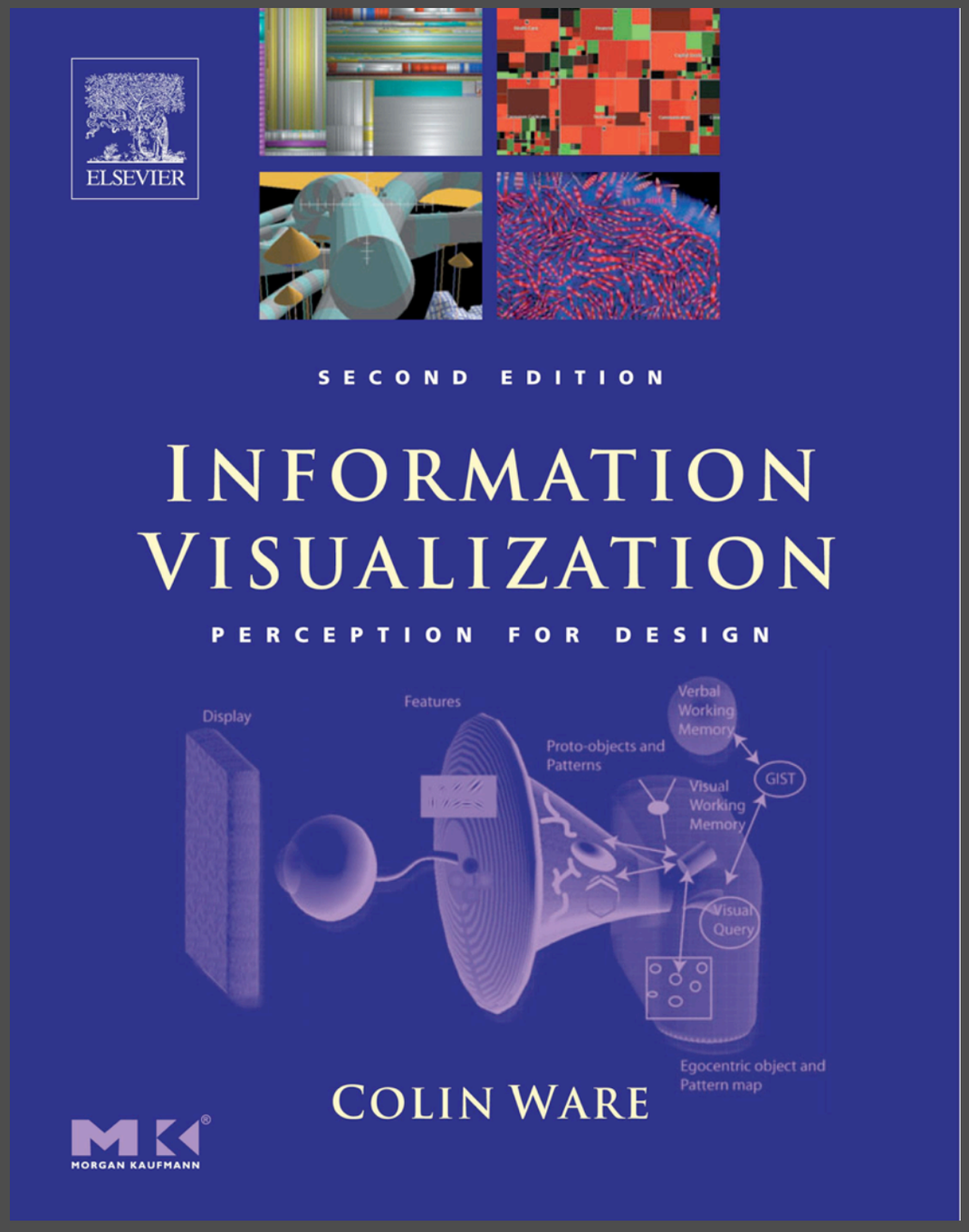
identifying distortion + deception

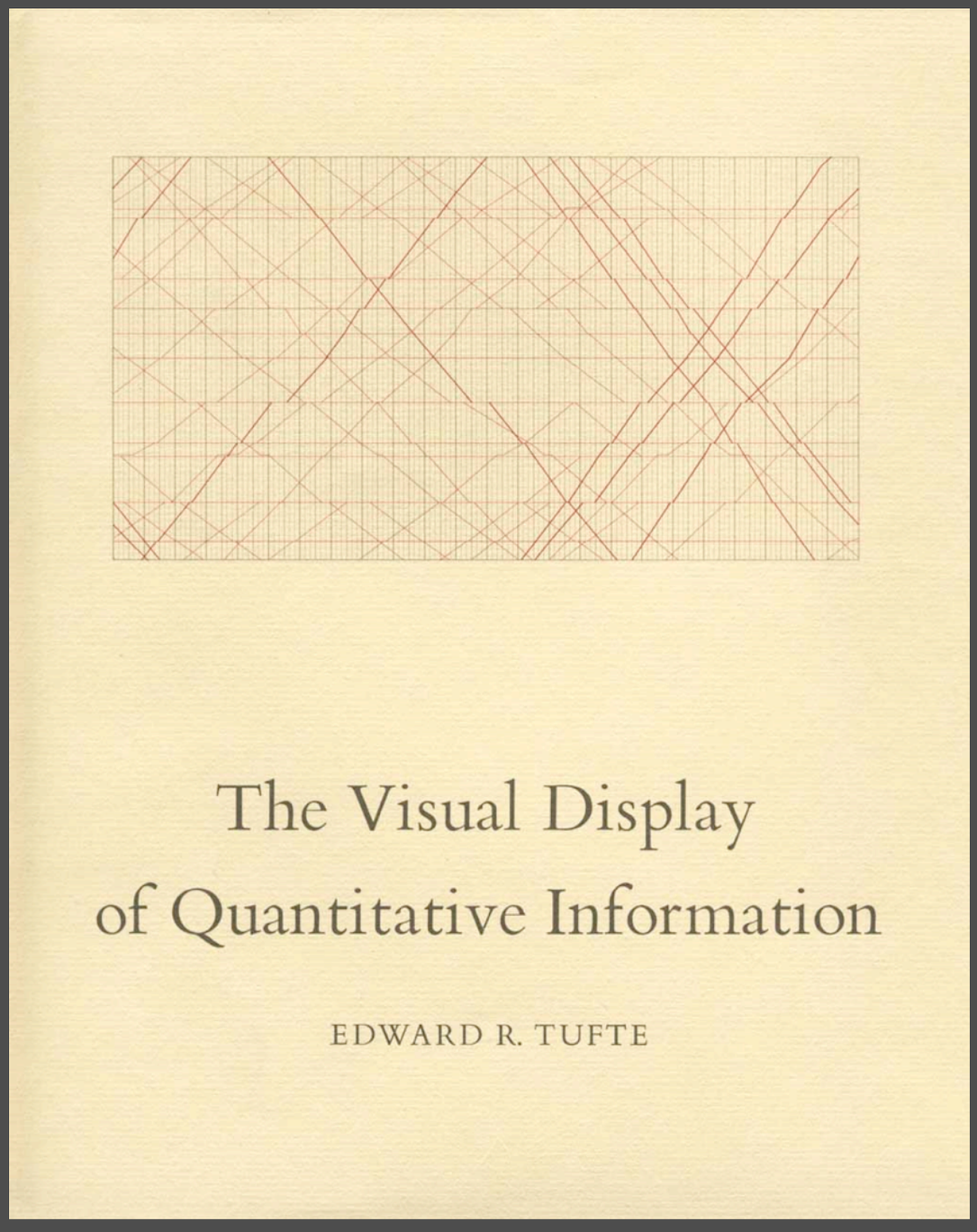
wielding power tools (excel / matlab / etc)

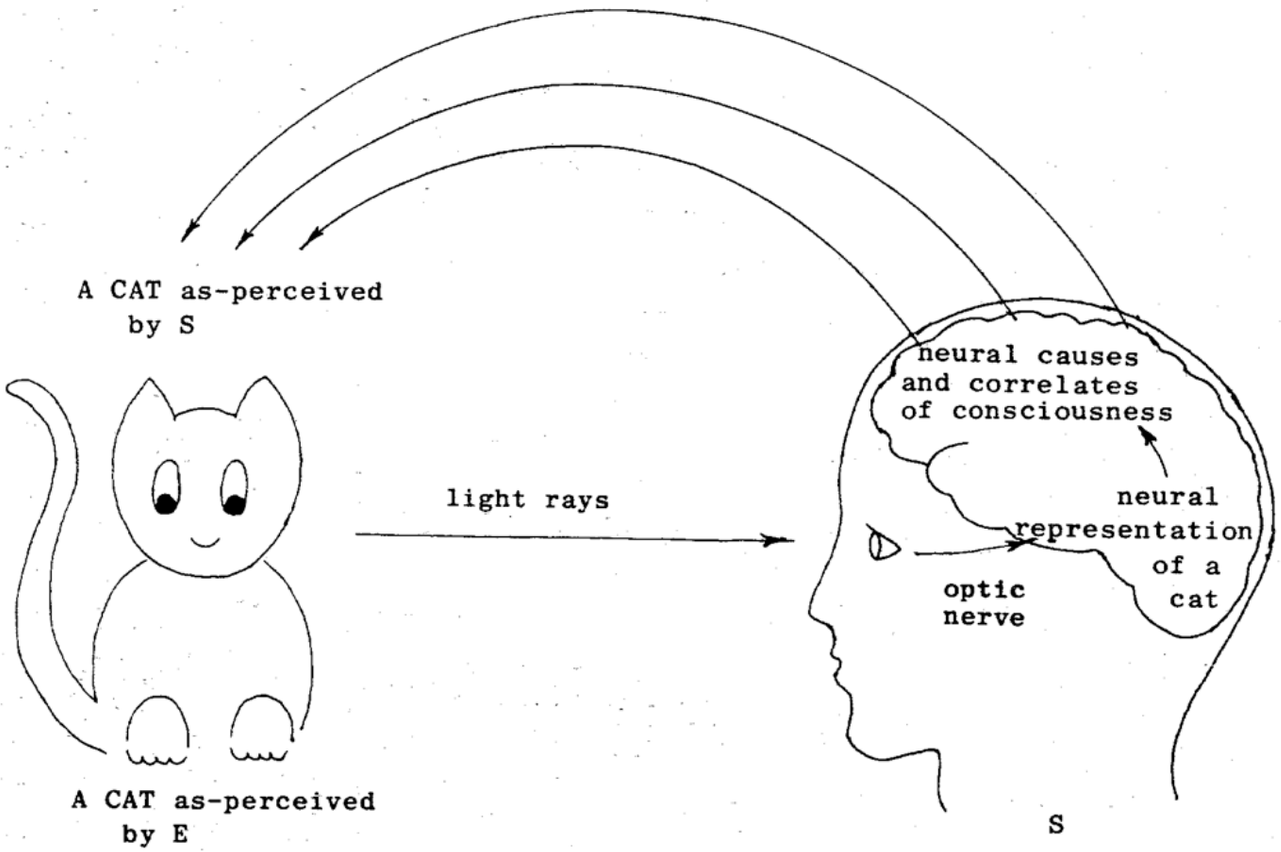
vs hacking bespoke approaches

minor objectives

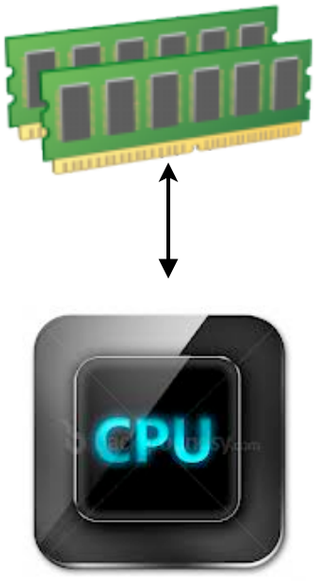
recommended texts

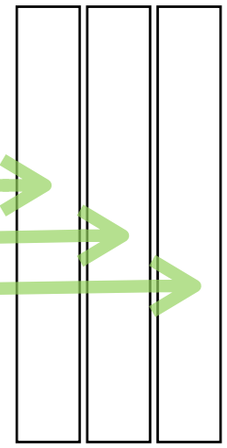




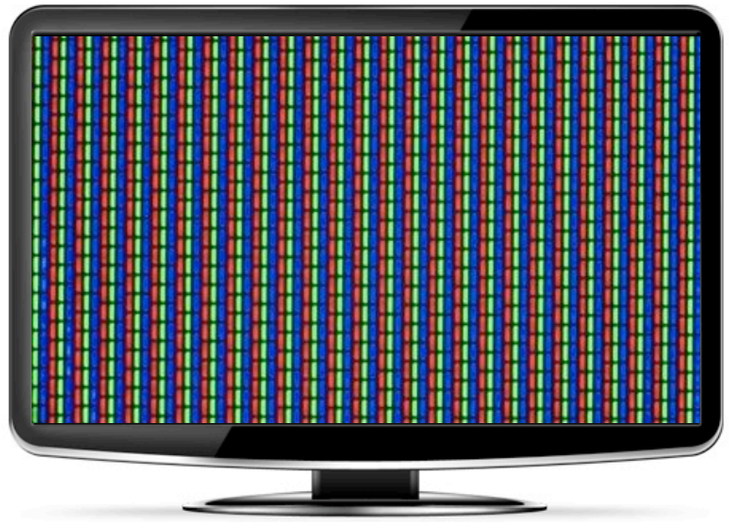


biological basis of information design

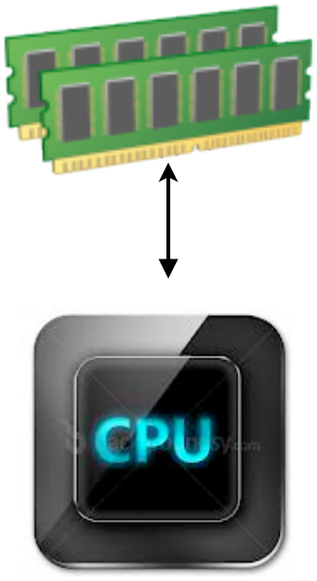


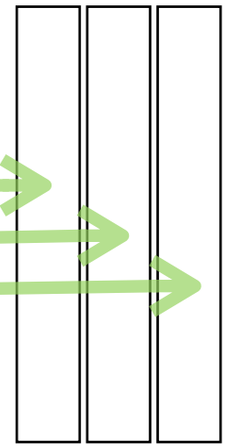


framebuffer(s)

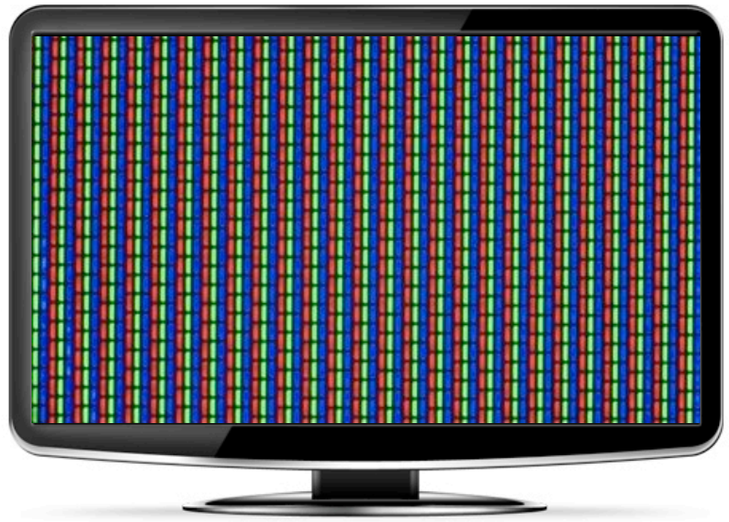


display



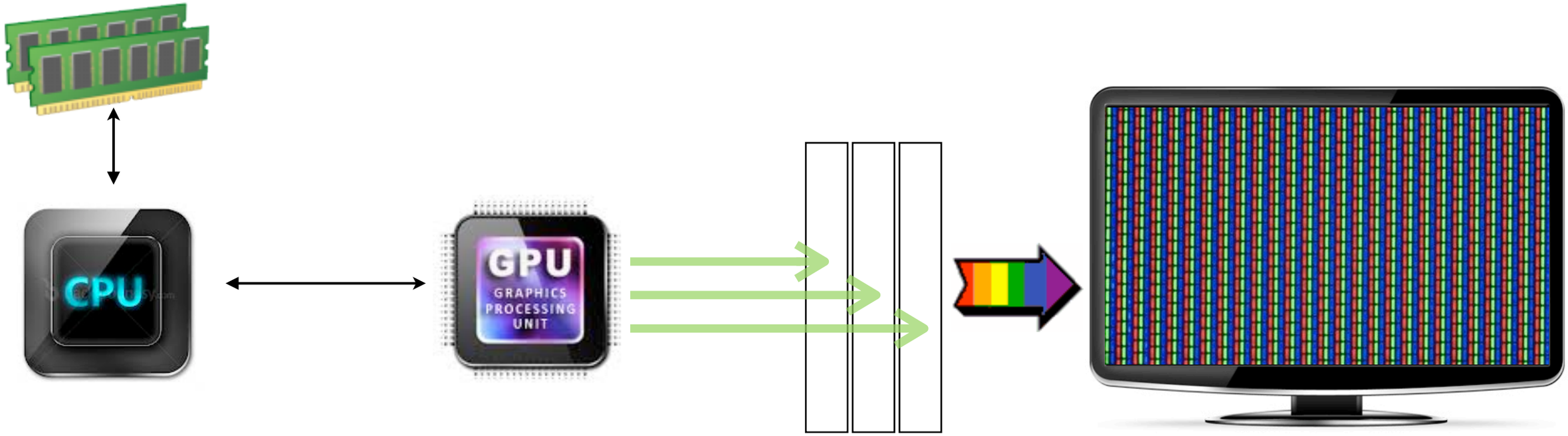


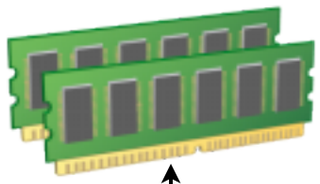
framebuffer(s)

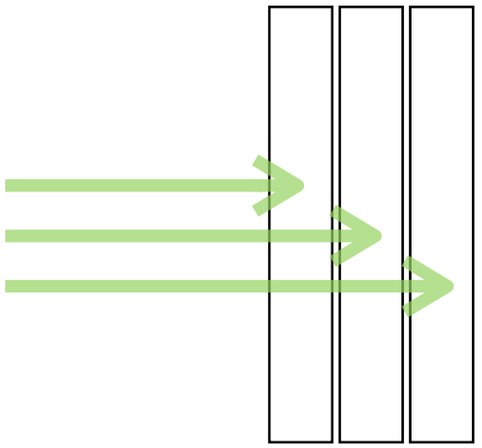


display

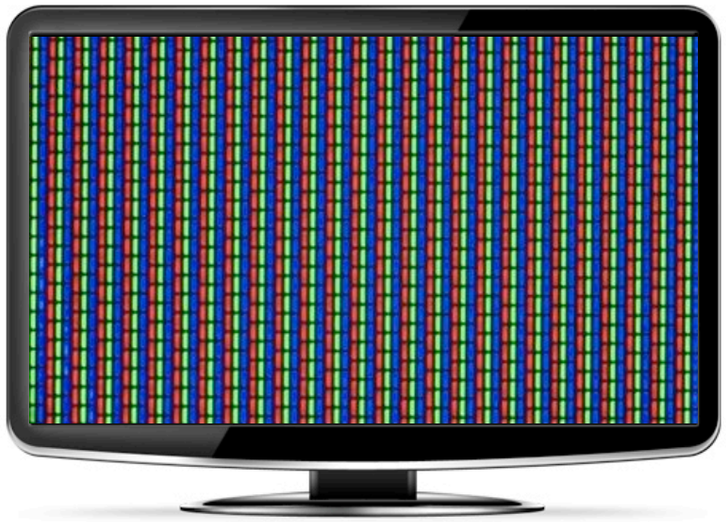
typical computer architecture


CPU
GPU
GRAPHICS
PROCESSING
UNIT
framebuffer(s)
display



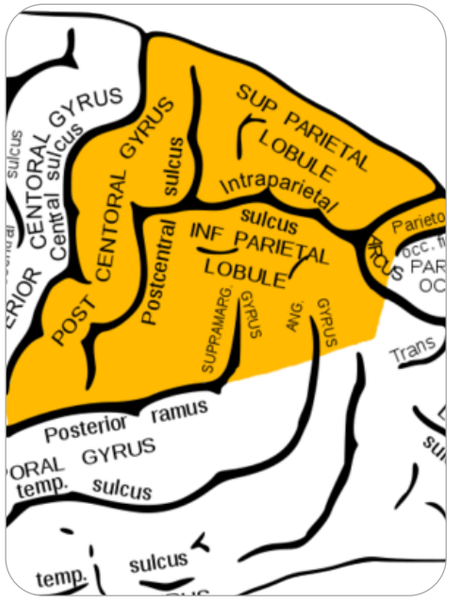


framebuffer(s)



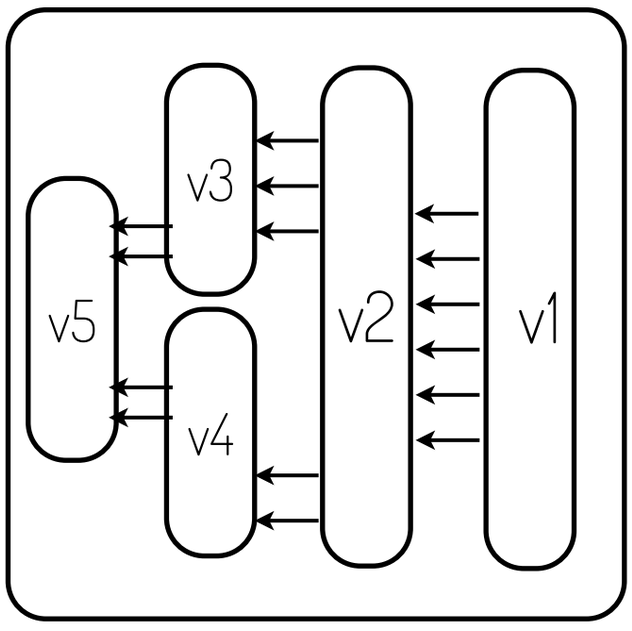
display

parietal lobe + frontal cortex

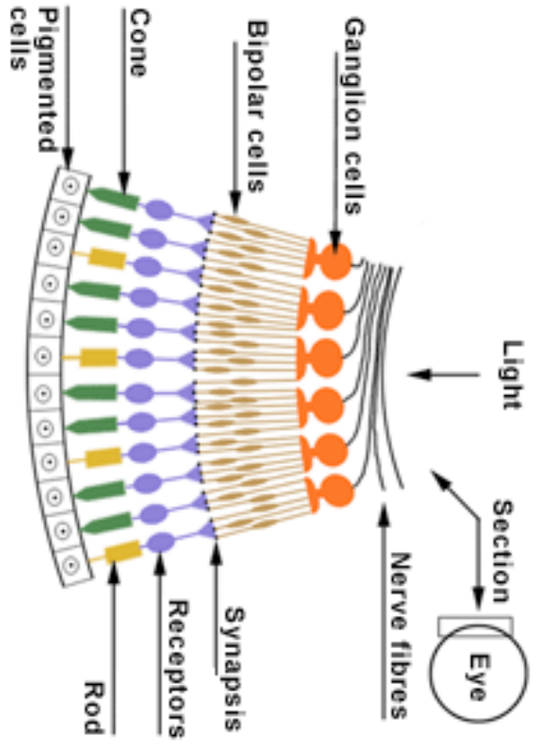


spatial orientation
focus of attention
eye control,
perceptual fusion

occipital lobe

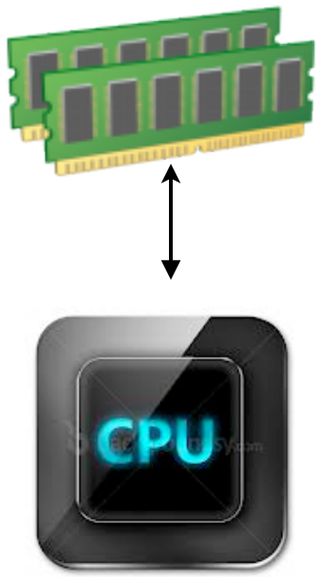


visual cortex
(pattern detection)



retina
(sensing)

eye / iris / fovea



serial / deliberative processing

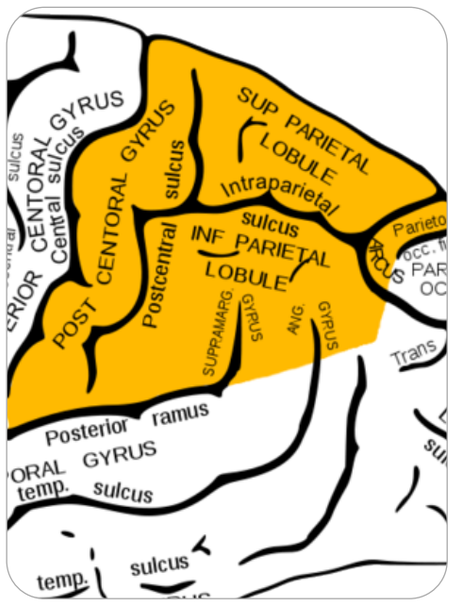
"attention-focused"

access to long term memory

highly parallel

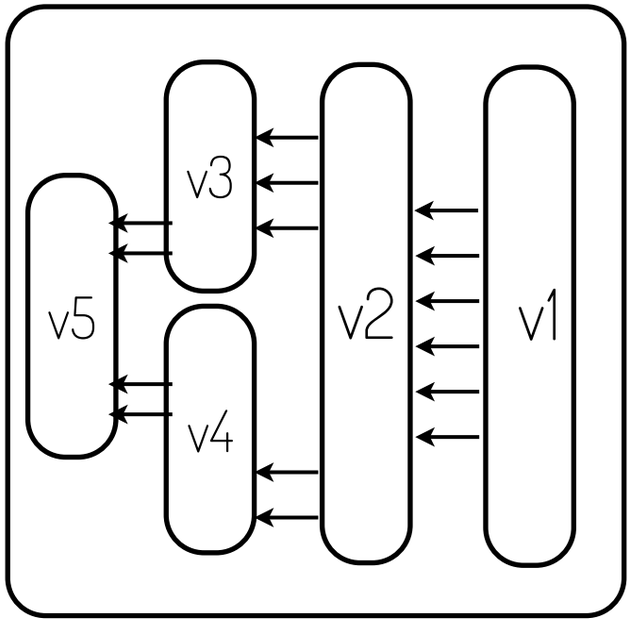
visual processing routines optimised for purpose

parietal lobe + frontal cortex



spatial orientation
focus of attention
eye control,
perceptual fusion

occipital lobe



visual cortex
(pattern detection)

frontal lobe

planning
thinking
deliberation
action

parietal lobe

spatial reasoning
perceptual fusion

V5

dorsal stream
"where/how"
pathways

language
semiotics

V3

V2

V1

occipital lobe

V4

ventral stream
"what" pathway

John Snow, 1854
London Cholera Outbreak

The Story of London's Most Terrifying Epidemic – and How it Changed Science, Cities and the Modern World.

John Snow, 1854
London Cholera Outbreak

"There was one significant anomaly - none of the monks in the adjacent monastery contracted cholera. Investigation showed that this was not an anomaly, but further evidence, for they drank only beer, which they brewed themselves."

The Story of London's Most Terrifying Epidemic – and How it Changed Science, Cities and the Modern World.

Sepal length	Sepal width	Petal length	Petal width	Species
5.1	3.5	1.4	0.2	*I. setosa*
4.9	3	1.4	0.2	*I. setosa*
4.7	3.2	1.3	0.2	*I. setosa*
4.6	3.1	1.5	0.2	*I. setosa*
5	3.6	1.4	0.2	*I. setosa*
5.4	3.9	1.7	0.4	*I. setosa*
4.6	3.4	1.4	0.3	*I. setosa*
5	3.4	1.5	0.2	*I. setosa*
4.4	2.9	1.4	0.2	*I. setosa*
4.9	3.1	1.5	0.1	*I. setosa*
5.4	3.7	1.5	0.2	*I. setosa*
4.8	3.4	1.6	0.2	*I. setosa*
4.8	3	1.4	0.1	*I. setosa*
4.3	3	1.1	0.1	*I. setosa*
5.8	4	1.2	0.2	*I. setosa*
5.7	4.4	1.5	0.4	*I. setosa*
5.4	3.9	1.3	0.4	*I. setosa*
5.1	3.5	1.4	0.3	*I. setosa*
5.7	3.8	1.7	0.3	*I. setosa*
5.1	3.8	1.5	0.3	*I. setosa*
5.4	3.4	1.7	0.2	*I. setosa*
5.1	3.7	1.5	0.4	*I. setosa*
4.6	3.6	1	0.2	*I. setosa*
5.1	3.3	1.7	0.5	*I. setosa*
4.8	3.4	1.9	0.2	*I. setosa*
5	3	1.6	0.2	*I. setosa*
5	3.4	1.6	0.4	*I. setosa*
5.2	3.5	1.5	0.2	*I. setosa*
5.2	3.4	1.4	0.2	*I. setosa*
4.7	3.2	1.6	0.2	*I. setosa*
4.8	3.1	1.6	0.2	*I. setosa*

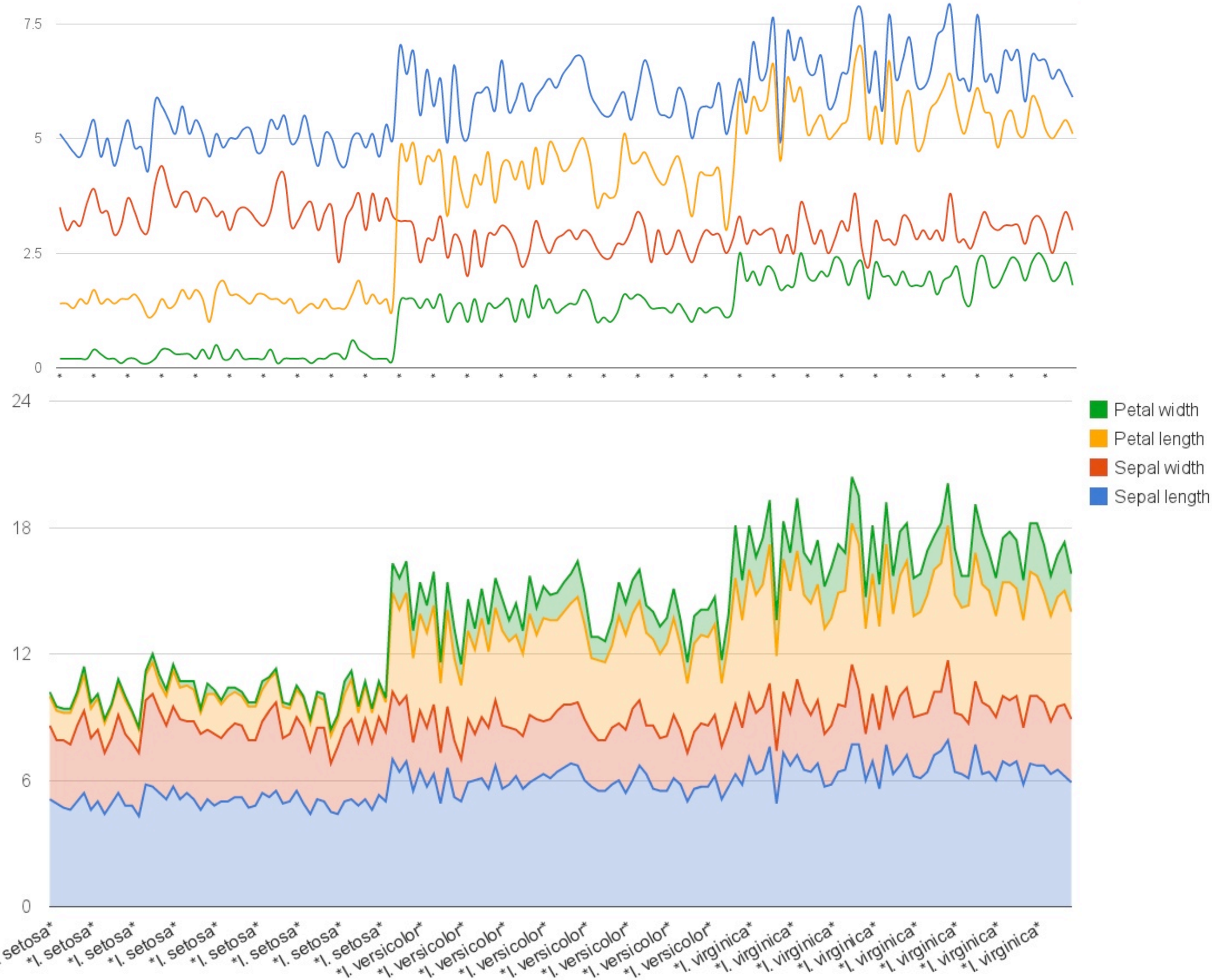
Sepal length	Sepal width	Petal length	Petal width	Species
5.4	3.4	1.5	0.4	*I. setosa*
5.2	4.1	1.5	0.1	*I. setosa*
5.5	4.2	1.4	0.2	*I. setosa*
4.9	3.1	1.5	0.2	*I. setosa*
5	3.2	1.2	0.2	*I. setosa*
5.5	3.5	1.3	0.2	*I. setosa*
4.9	3.6	1.4	0.1	*I. setosa*
4.4	3	1.3	0.2	*I. setosa*
5.1	3.4	1.5	0.2	*I. setosa*
5	3.5	1.3	0.3	*I. setosa*
4.5	2.3	1.3	0.3	*I. setosa*
4.4	3.2	1.3	0.2	*I. setosa*
5	3.5	1.6	0.6	*I. setosa*
5.1	3.8	1.9	0.4	*I. setosa*
4.8	3	1.4	0.3	*I. setosa*
5.1	3.8	1.6	0.2	*I. setosa*
4.6	3.2	1.4	0.2	*I. setosa*
5.3	3.7	1.5	0.2	*I. setosa*
5	3.3	1.4	0.2	*I. setosa*
7	3.2	4.7	1.4	*I. versicolor*
6.4	3.2	4.5	1.5	*I. versicolor*
6.9	3.1	4.9	1.5	*I. versicolor*
5.5	2.3	4	1.3	*I. versicolor*
6.5	2.8	4.6	1.5	*I. versicolor*
5.7	2.8	4.5	1.3	*I. versicolor*
6.3	3.3	4.7	1.6	*I. versicolor*
4.9	2.4	3.3	1	*I. versicolor*
6.6	2.9	4.6	1.3	*I. versicolor*
5.2	2.7	3.9	1.4	*I. versicolor*
5	2	3.5	1	*I. versicolor*
5.9	3	4.2	1.5	*I. versicolor*

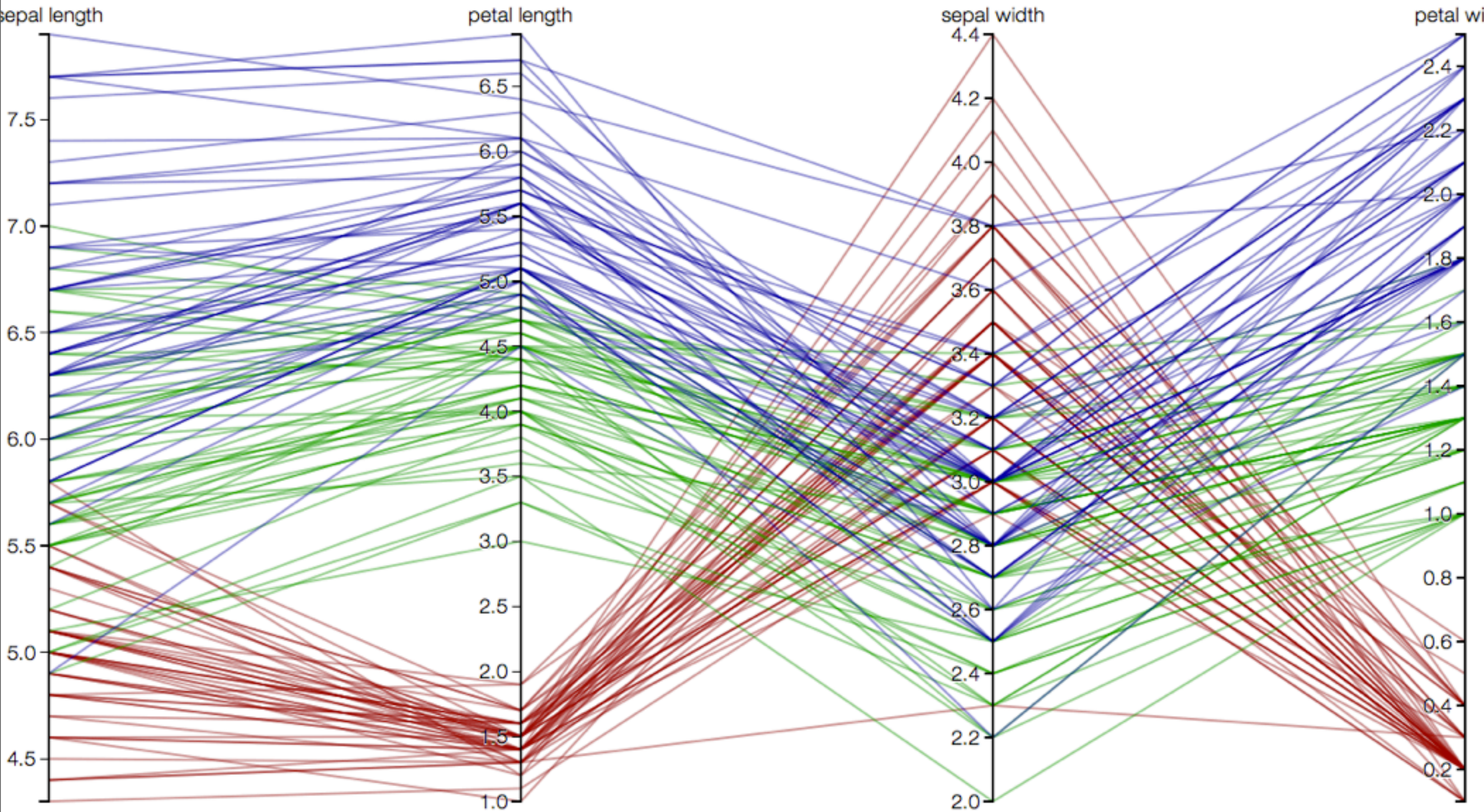
Sepal length	Sepal width	Petal length	Petal width	Species
5.4	3.4	1.5	0.4	*I. setosa*
5.2	4.1	1.5	0.1	*I. setosa*
5.5	4.2	1.4	0.2	*I. setosa*
4.9	3.1	1.5	0.2	*I. setosa*
5	3.2	1.2	0.2	*I. setosa*
5.5	3.5	1.3	0.2	*I. setosa*
4.9	3.6	1.4	0.1	*I. setosa*
4.4	3	1.3	0.2	*I. setosa*
5.1	3.4	1.5	0.2	*I. setosa*
5	3.5	1.3	0.3	*I. setosa*
4.5	2.3	1.3	0.3	*I. setosa*
4.4	3.2	1.3	0.2	*I. setosa*
5	3.5	1.6	0.6	*I. setosa*
5.1	3.8	1.9	0.4	*I. setosa*
4.8	3	1.4	0.3	*I. setosa*
5.1	3.8	1.6	0.2	*I. setosa*
4.6	3.2	1.4	0.2	*I. setosa*
5.3	3.7	1.5	0.2	*I. setosa*
5	3.3	1.4	0.2	*I. setosa*
7	3.2	4.7	1.4	*I. versicolor*
6.4	3.2	4.5	1.5	*I. versicolor*
6.9	3.1	4.9	1.5	*I. versicolor*
5.5	2.3	4	1.3	*I. versicolor*
6.5	2.8	4.6	1.5	*I. versicolor*
5.7	2.8	4.5	1.3	*I. versicolor*
6.3	3.3	4.7	1.6	*I. versicolor*
4.9	2.4	3.3	1	*I. versicolor*
6.6	2.9	4.6	1.3	*I. versicolor*
5.2	2.7	3.9	1.4	*I. versicolor*
5	2	3.5	1	*I. versicolor*
5.9	3	4.2	1.5	*I. versicolor*

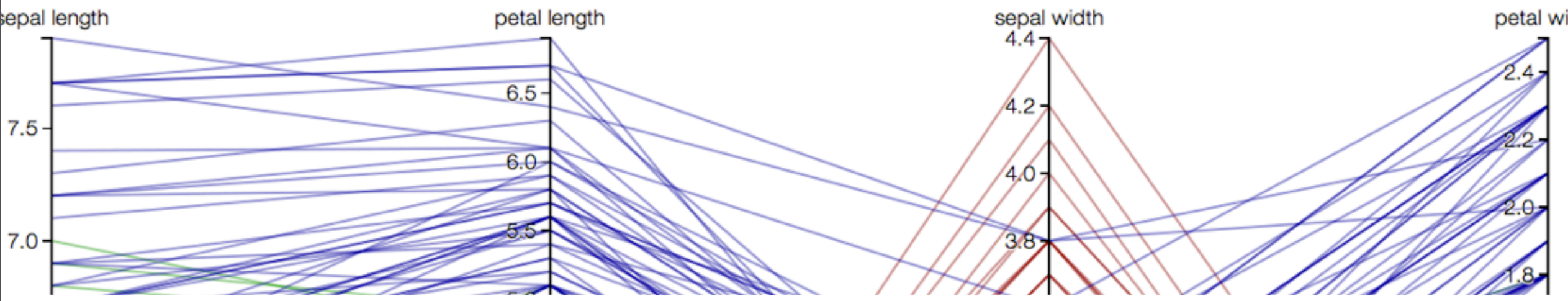
Sepal length	Sepal width	Petal length	Petal width	Species
5.1	3.5	1.4	0.2	*I. setosa*
4.9	3	1.4	0.2	*I. setosa*
4.7	3.2	1.3	0.2	*I. setosa*
4.6	3.1	1.5	0.2	*I. setosa*
5	3.6	1.4	0.2	*I. setosa*
5.4	3.9	1.7	0.4	*I. setosa*
4.6	3.4	1.4	0.3	*I. setosa*
5	3.4	1.5	0.2	*I. setosa*
4.4	2.9	1.4	0.2	*I. setosa*
4.9	3.1	1.5	0.1	*I. setosa*
5.4	3.7	1.5	0.2	*I. setosa*
4.8	3.4	1.6	0.2	*I. setosa*
4.8	3	1.4	0.1	*I. setosa*
4.3	3	1.1	0.1	*I. setosa*
5.8	4	1.2	0.2	*I. setosa*
5.7	4.4	1.5	0.4	*I. setosa*
5.4	3.9	1.3	0.4	*I. setosa*
5.1	3.5	1.4	0.3	*I. setosa*
5.7	3.8	1.7	0.3	*I. setosa*
5.1	3.8	1.5	0.3	*I. setosa*
5.4	3.4	1.7	0.2	*I. setosa*
5.1	3.7	1.5	0.4	*I. setosa*
4.6	3.6	1	0.2	*I. setosa*
5.1	3.3	1.7	0.5	*I. setosa*
4.8	3.4	1.9	0.2	*I. setosa*
5	3	1.6	0.2	*I. setosa*
5	3.4	1.6	0.4	*I. setosa*
5.2	3.5	1.5	0.2	*I. setosa*
5.2	3.4	1.4	0.2	*I. setosa*
4.7	3.2	1.6	0.2	*I. setosa*
4.8	3.1	1.6	0.2	*I. setosa*

Sepal length	Sepal width	Petal length	Petal width	Species
5.4	3.4	1.5	0.4	*I. setosa*
5.2	4.1	1.5	0.1	*I. setosa*
5.5	4.2	1.4	0.2	*I. setosa*
4.9	3.1	1.5	0.2	*I. setosa*
5	3.2	1.2	0.2	*I. setosa*
5.5	3.5	1.3	0.2	*I. setosa*
4.9	3.6	1.4	0.1	*I. setosa*
4.4	3	1.3	0.2	*I. setosa*
5.1	3.4	1.5	0.2	*I. setosa*
5	3.5	1.3	0.3	*I. setosa*
4.5	2.3	1.3	0.3	*I. setosa*
4.4	3.2	1.3	0.2	*I. setosa*
5	3.5	1.6	0.6	*I. setosa*
5.1	3.8	1.9	0.4	*I. setosa*
4.8	3	1.4	0.3	*I. setosa*
5.1	3.8	1.6	0.2	*I. setosa*
4.6	3.2	1.4	0.2	*I. setosa*
5.3	3.7	1.5	0.2	*I. setosa*
5	3.3	1.4	0.2	*I. setosa*
7	3.2	4.7	1.4	*I. versicolor*
6.4	3.2	4.5	1.5	*I. versicolor*
6.9	3.1	4.9	1.5	*I. versicolor*
5.5	2.3	4	1.3	*I. versicolor*
6.5	2.8	4.6	1.5	*I. versicolor*
5.7	2.8	4.5	1.3	*I. versicolor*
6.3	3.3	4.7	1.6	*I. versicolor*
4.9	2.4	3.3	1	*I. versicolor*
6.6	2.9	4.6	1.3	*I. versicolor*
5.2	2.7	3.9	1.4	*I. versicolor*
5	2	3.5	1	*I. versicolor*
5.9	3	4.2	1.5	*I. versicolor*

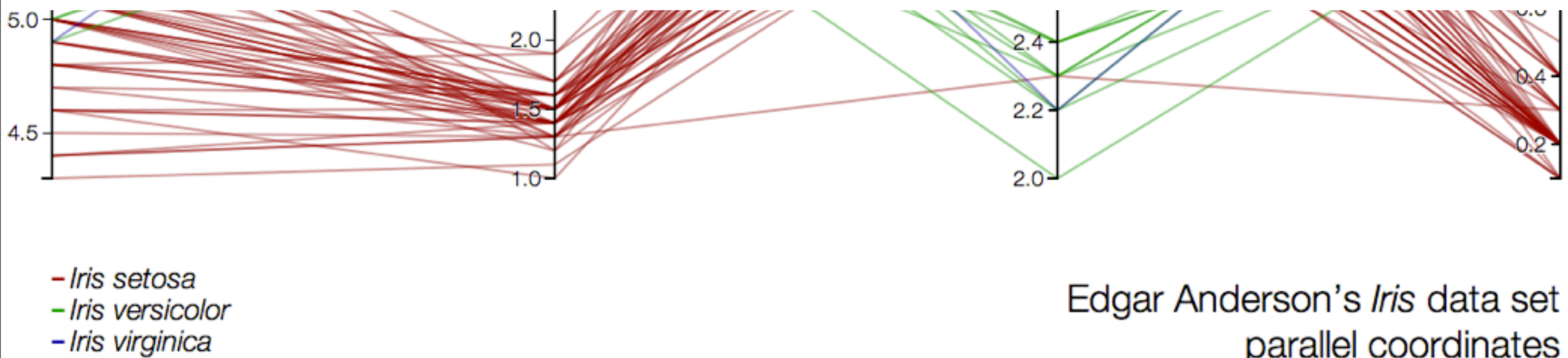
Sepal length	Sepal width	Petal length	Petal width	Species
5.4	3.4	1.5	0.4	*I. setosa*
5.2	4.1	1.5	0.1	*I. setosa*
5.5	4.2	1.4	0.2	*I. setosa*
4.9	3.1	1.5	0.2	*I. setosa*
5	3.2	1.2	0.2	*I. setosa*
5.5	3.5	1.3	0.2	*I. setosa*
4.9	3.6	1.4	0.1	*I. setosa*
4.4	3	1.3	0.2	*I. setosa*
5.1	3.4	1.5	0.2	*I. setosa*
5	3.5	1.3	0.3	*I. setosa*
4.5	2.3	1.3	0.3	*I. setosa*
4.4	3.2	1.3	0.2	*I. setosa*
5	3.5	1.6	0.6	*I. setosa*
5.1	3.8	1.9	0.4	*I. setosa*
4.8	3	1.4	0.3	*I. setosa*
5.1	3.8	1.6	0.2	*I. setosa*
4.6	3.2	1.4	0.2	*I. setosa*
5.3	3.7	1.5	0.2	*I. setosa*
5	3.3	1.4	0.2	*I. setosa*
7	3.2	4.7	1.4	*I. versicolor*
6.4	3.2	4.5	1.5	*I. versicolor*
6.9	3.1	4.9	1.5	*I. versicolor*
5.5	2.3	4	1.3	*I. versicolor*
6.5	2.8	4.6	1.5	*I. versicolor*
5.7	2.8	4.5	1.3	*I. versicolor*
6.3	3.3	4.7	1.6	*I. versicolor*
4.9	2.4	3.3	1	*I. versicolor*
6.6	2.9	4.6	1.3	*I. versicolor*
5.2	2.7	3.9	1.4	*I. versicolor*
5	2	3.5	1	*I. versicolor*
5.9	3	4.2	1.5	*I. versicolor*


7.5
5
2.5
0
24
Petal width
Petal length
Sepal width
Sepal length
18
12
6
0
I. setosa
I. versicolor
I. virginica

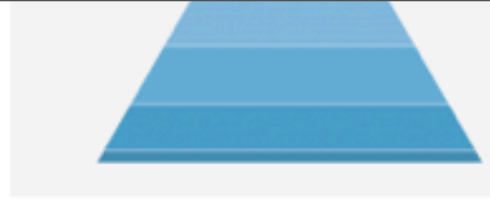

sepal length
7.5
7.0
6.5
6.0
5.5
5.0
4.5
petal length
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
sepal width
4.4
4.2
4.0
3.8
3.6
3.4
3.2
3.0
2.8
2.6
2.4
2.2
2.0
petal width
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
Iris setosa
Iris versicolor
Iris virginica
Edgar Anderson's Iris data set
parallel coordinates

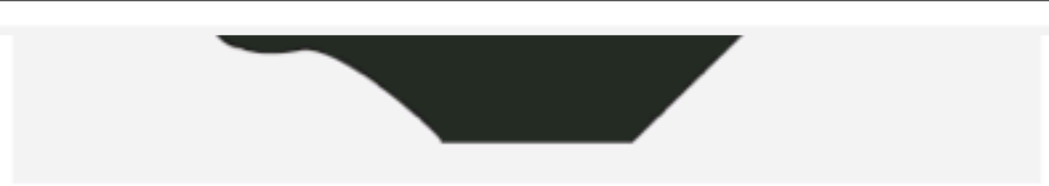


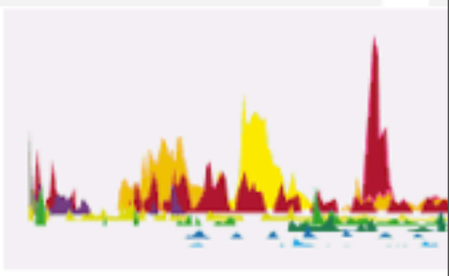
so how do we come up with these visual representations and which do we choose for a dataset?

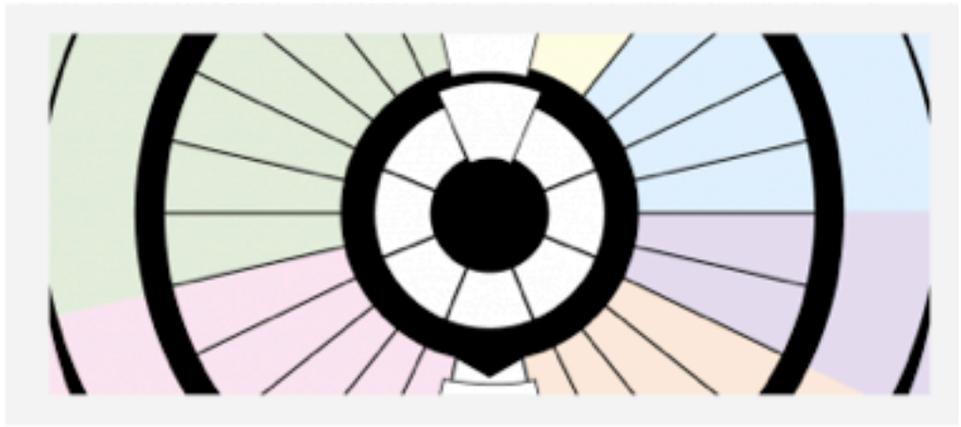


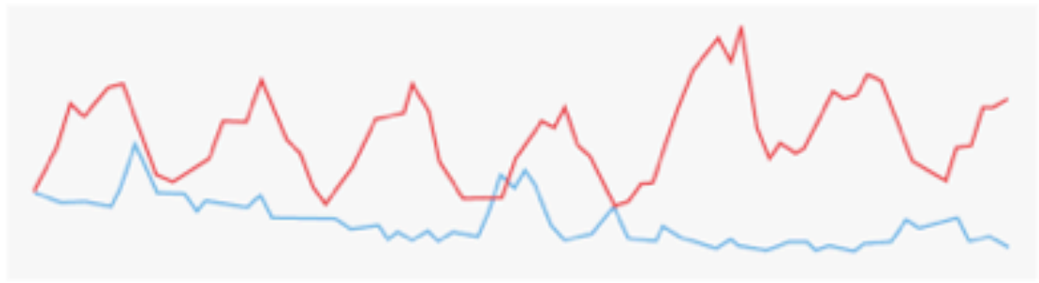
Edgar Anderson's *Iris* data set
parallel coordinates

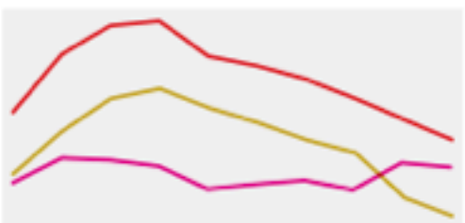












Visual and Data Dimensions

so you have a dataset...

$\{x_1, x_2, x_3, x_4, \ldots\}$ x_1

so you have a dataset...

{x1, x2, x3, x4, ... }	*x1*
{1, 200, 5, 6, ... }	integral
{1.0, 2.0, 1.2, 4, ... }	fixed point
{'a', 'b', '12c', 'd' ...}	alpha(-numeric)
{20%, 30%, 1%, 5% ...}	fractions of a population
{🍐,🍎,🥝,🍍,🍍 ...}	categorical
{f(🍐,🍎),g(🍎,🥝),q(🥝,🍍) ...}	relational

so you have a dataset...

{x1, x2, x3, x4, ... }	*x1*
{1, 200, 5, 6, ... }	integral
{1.0, 2.0, 1.2, 4, ... }	fixed point
{'a', 'b', '12c', 'd' ...}	alpha(-numeric)
{20%, 30%, 1%, 5% ...}	fractions of a population
{🍐,🍎,🥝,🍍,🍍 ...}	categorical
{f(🍐,🍎),g(🍎,🥝),q(🥝,🍍) ...}	relational

<u>objective</u> - help the user to understand :
relationships among the elements of the set

so you have a dataset...

$$x = \{\vec{x_1}, \vec{x_2}, \vec{x_3}, \vec{x_4}, \ldots\}$$

$$x = \begin{bmatrix} x_1 & x_2 & x_3 \\ y_1, & y_2, & y_3 \ldots \\ t_1 & t_2 & t_3 \end{bmatrix}$$



it's probably multivariate

if these are observations of the [same] of object(s) over time
"time series"

if these are observations of different things at a single point in time
"population"

if these are observations of different things at a different points in time
"observations"

so you have a dataset...

it's probably multivariate

$$x = \{\vec{x1}, \vec{x2}, \vec{x3}, \vec{x4}, \dots\}$$

$$x = \begin{bmatrix} x1 & x2 & x3 \\ y1 & y2 & y3 \dots \\ t1 & t2 & t3 \end{bmatrix}$$



if these are observations of the (same) of object(s) over time
"time series"

if these are observations of different things at a single point in time
"population"

if these are observations of different things at a different points in time
"observations"

<u>objective</u> - help the user to understand :

1. elements - specifically relationships among dimensions (through a large number of examples)
2. relationships - among different elements

data dimension types

visual dimension type

integral

fixed point

alpha(-numeric)

fractions of a population

categorical

relational

...

data dimension types

integral

fixed point

alpha(-numeric)

fractions of a population

categorical

relational

...

visual dimension type

position — relative location, centrality

data dimension types	*visual dimension type*	
	position	relative location centrality
integral	shape	
fixed point		
alpha(-numeric)		
fractions of a population		
categorical		
relational		
...		

data dimension types

integral

fixed point

alpha(-numeric)

fractions of a population

categorical

relational

...

visual dimension type

position	relative location centrality
shape	
colour	saturation opacity

data dimension types

integral

fixed point

alpha(-numeric)

fractions of a population

categorical

relational

...

visual dimension type

position	relative location centrality
shape	
colour	saturation opacity
size	width height

data dimension types

integral

fixed point

alpha(-numeric)

fractions of a population

categorical

relational

...

visual dimension type

position — relative location, centrality

shape

colour — saturation, opacity

size — width, height

orientation

data dimension types

integral

fixed point

alpha(-numeric)

fractions of a population

categorical

relational

...

visual dimension type

position	relative location centrality
shape	
colour	saturation opacity
size	width height
orientation	
stroke	colour pattern, thickness

data dimension types

integral

fixed point

alpha(-numeric)

fractions of a population

categorical

relational

...

visual dimension type

position — relative location, centrality

shape

colour — saturation, opacity

size — width, height

orientation

stroke — colour, pattern, thickness

opacity

data dimension types

integral

fixed point

alpha(-numeric)

fractions of a population

categorical

relational

...

visual dimension type

position — relative location, centrality

shape

colour — saturation, opacity

size — width, height

orientation

stroke — colour, pattern, thickness

opacity

texture

data dimension types

integral

fixed point

alpha(-numeric)

fractions of a population

categorical

relational

...

visual dimension type

position — relative location, centrality

shape

colour — saturation, opacity

size — width, height

orientation

stroke — colour, pattern, thickness

opacity

texture

movement

data dimension types

integral

fixed point

alpha(-numeric)

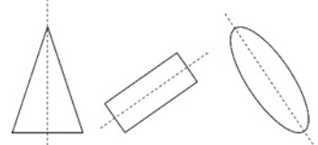
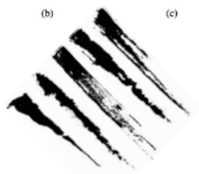
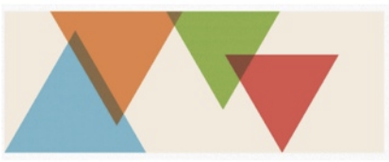
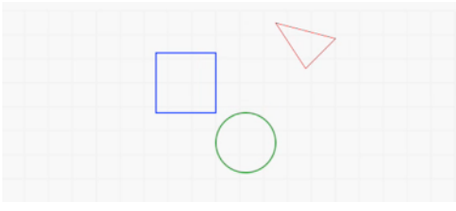
fractions of a population

categorical

relational

...

visual dimension type

position	relative location centrality	
shape		
colour	saturation opacity	
size	width height	
orientation		
stroke	colour pattern, thickness	
opacity		
texture		
movement		
juxtaposition		

data dimension types

integral

fixed point

alpha(-numeric)

fractions of a population

categorical

relational

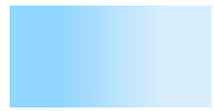
...

visual dimension type

position — relative location, centrality

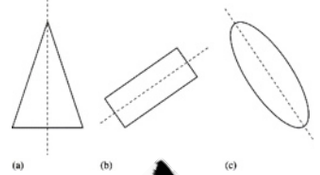
shape

colour — saturation, opacity

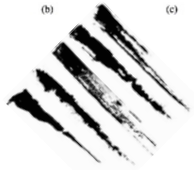


size — width, height

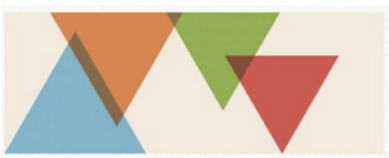
orientation



stroke — colour, pattern, thickness

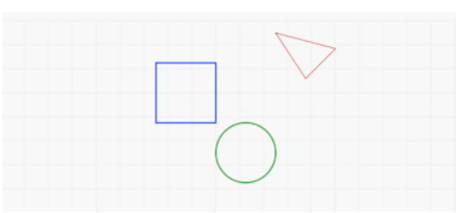


opacity



texture

movement



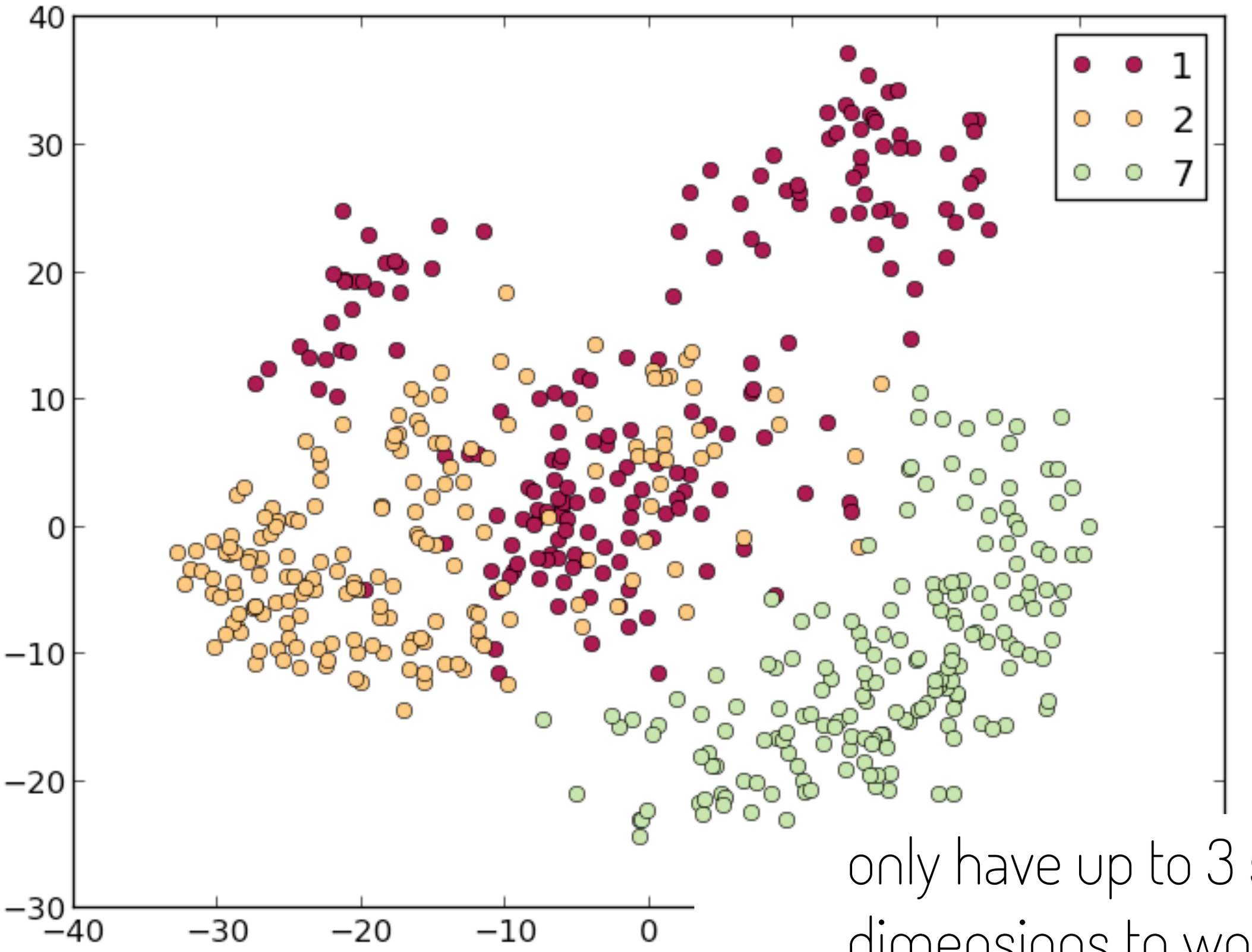
juxtaposition

position

position

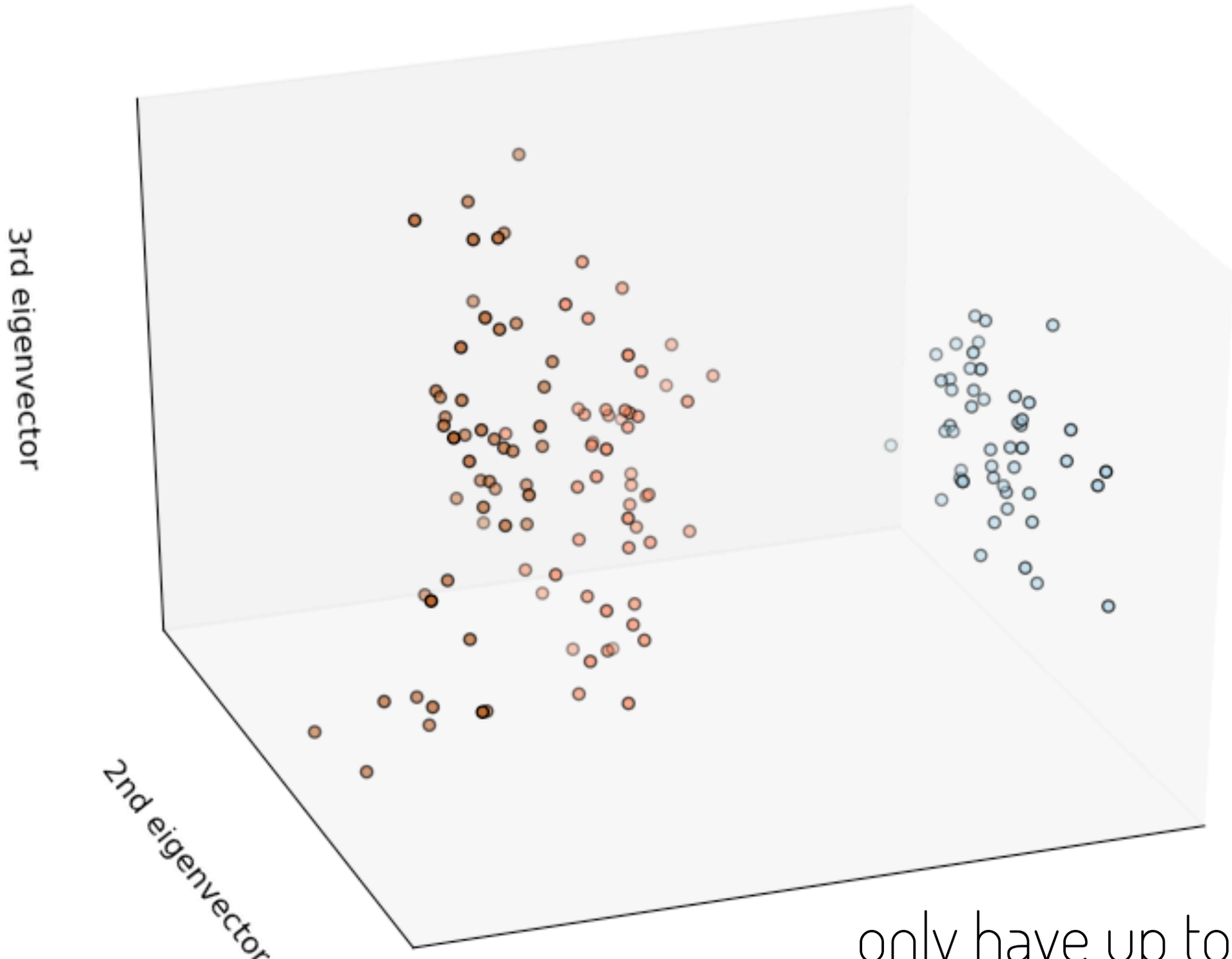
linear mapping of values
logarithmic..
bin and count..

position



only have up to 3 spatial dimensions to work with

position



only have up to 3 spatial dimensions to work with

orientation

orientation

range-limited

orientation

range-limited

orientation

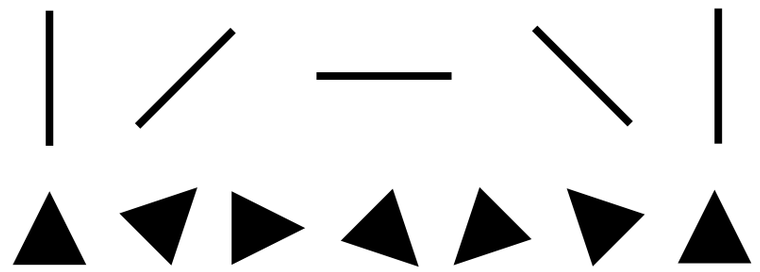
range-limited

symmetry properties of the geometry

orientation

range-limited

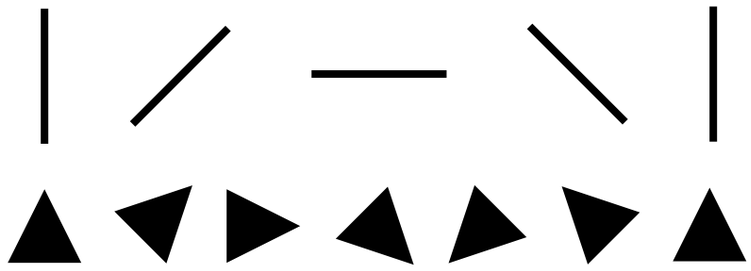
symmetry properties of the geometry



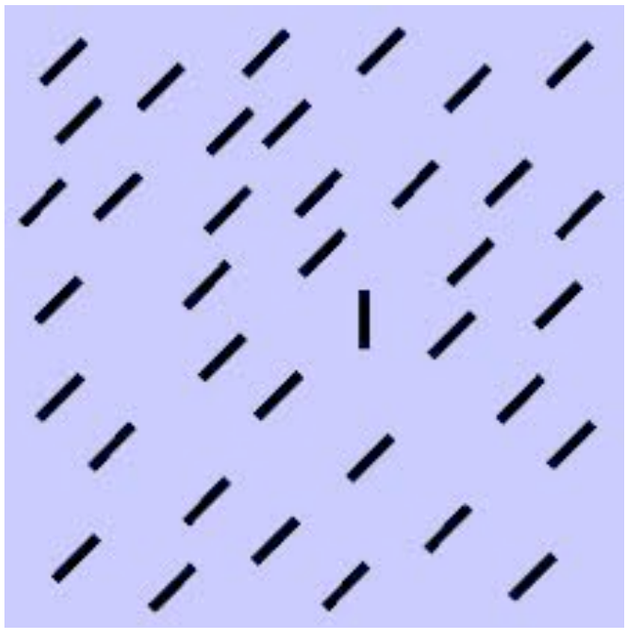
orientation

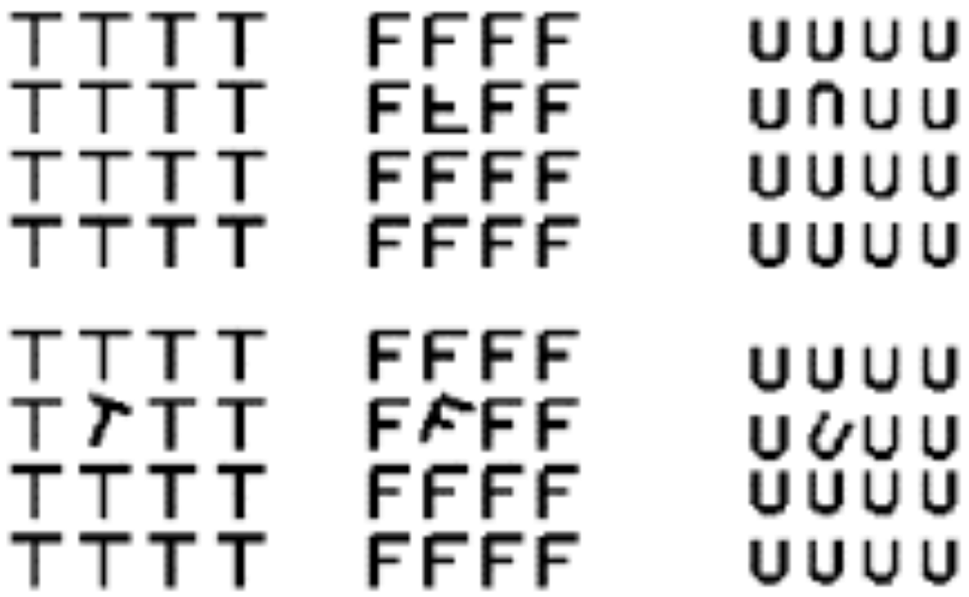
range-limited

symmetry properties of the geometry



pop-out

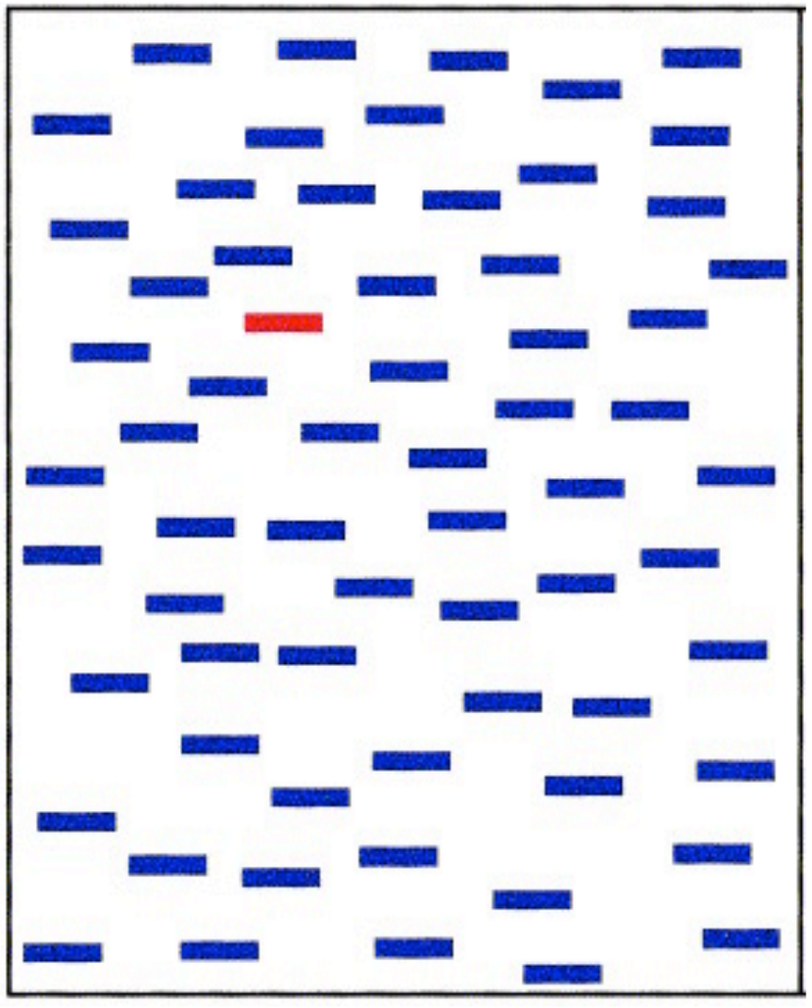




orientation

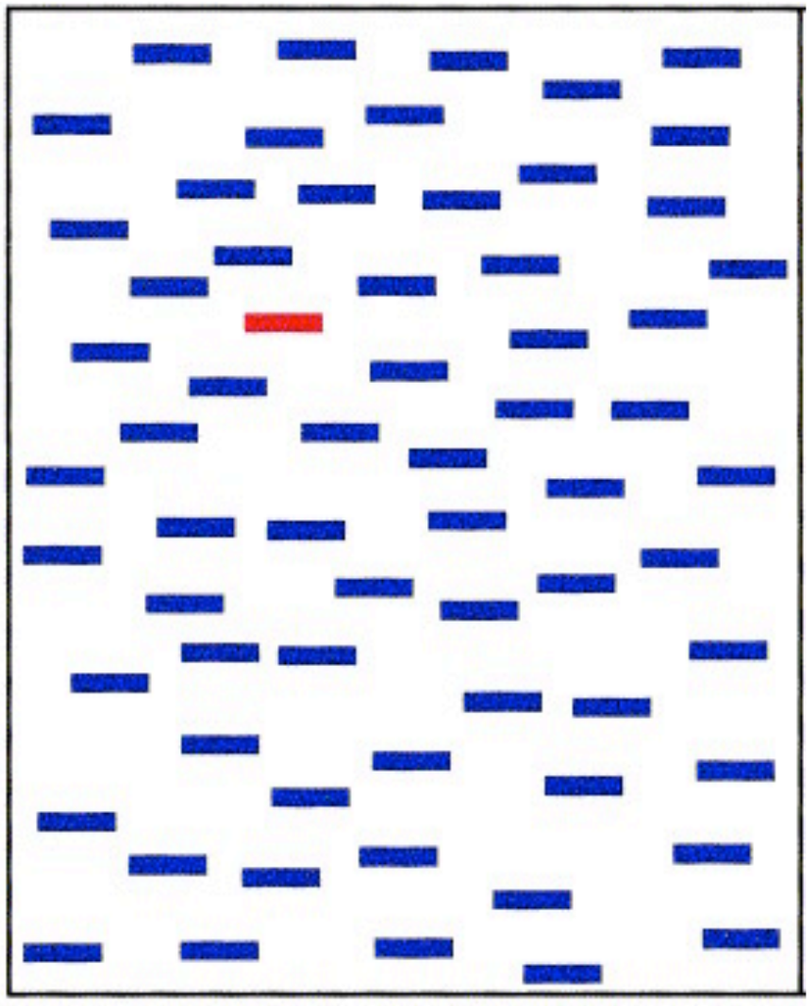
popouts using multiple dimensions

orientation
popouts using multiple dimensions

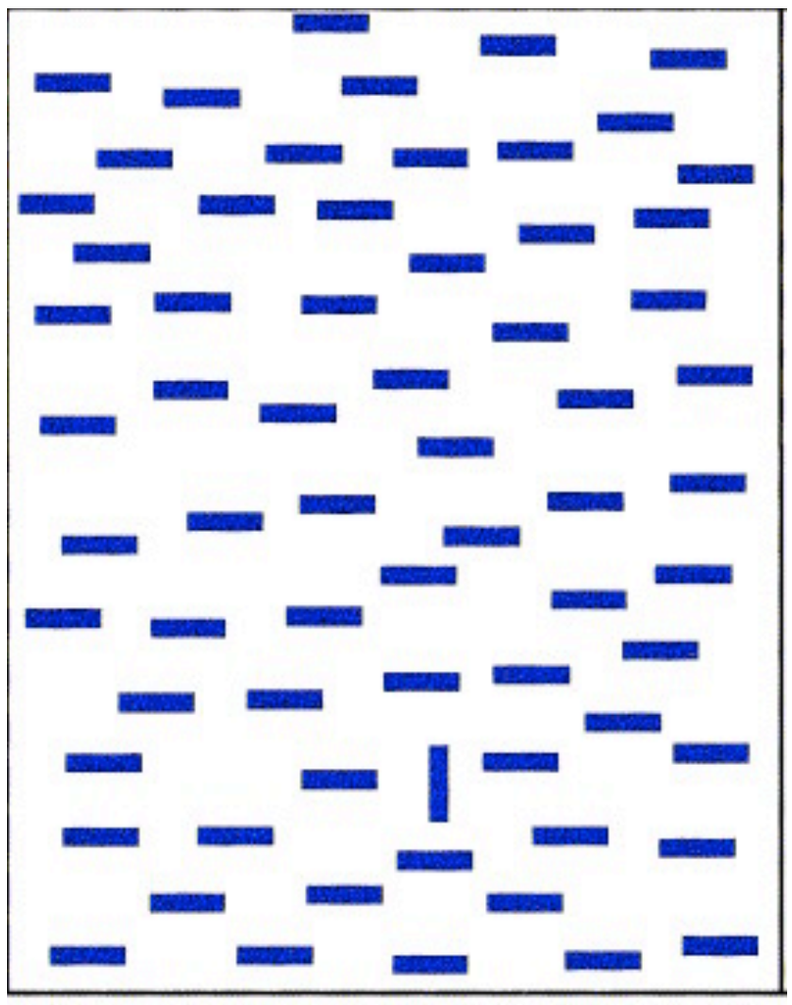


1D colour

orientation
popouts using multiple dimensions

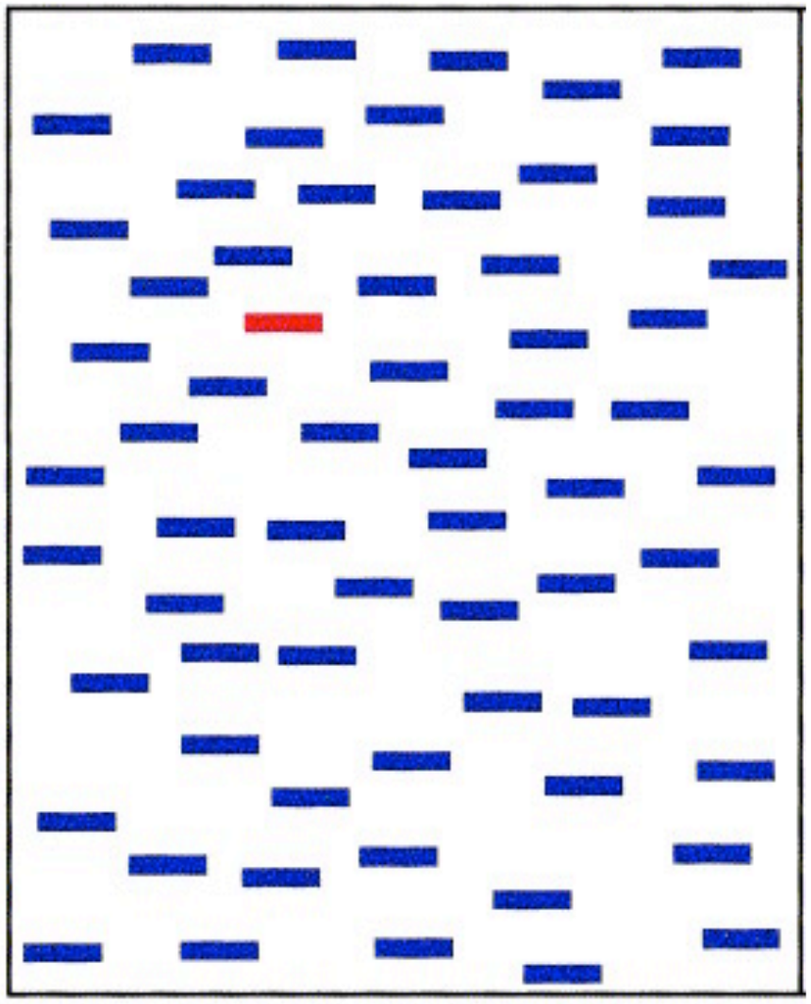


1D colour

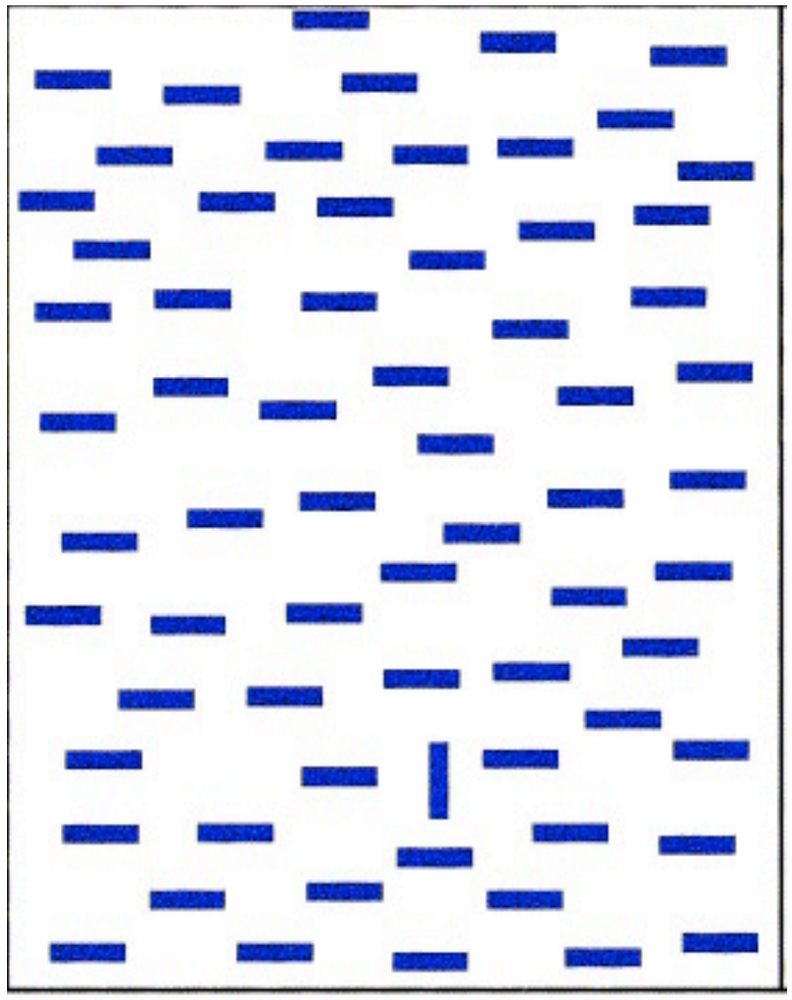


1D orientation

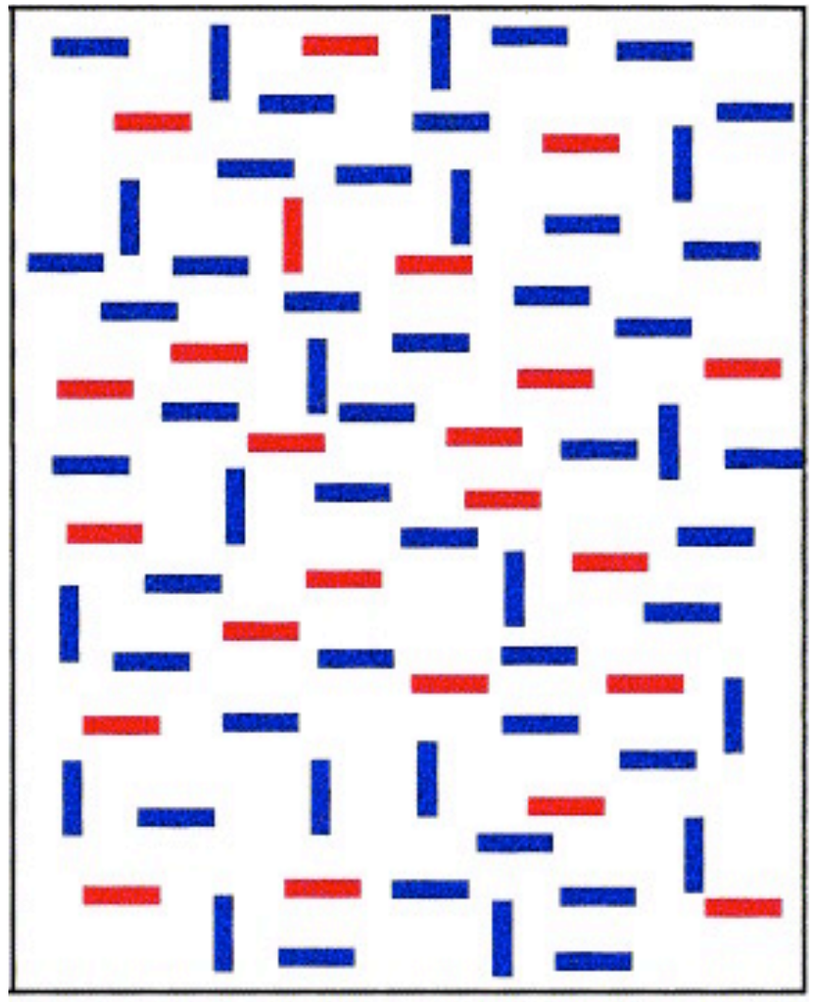
orientation
popouts using multiple dimensions



1D colour

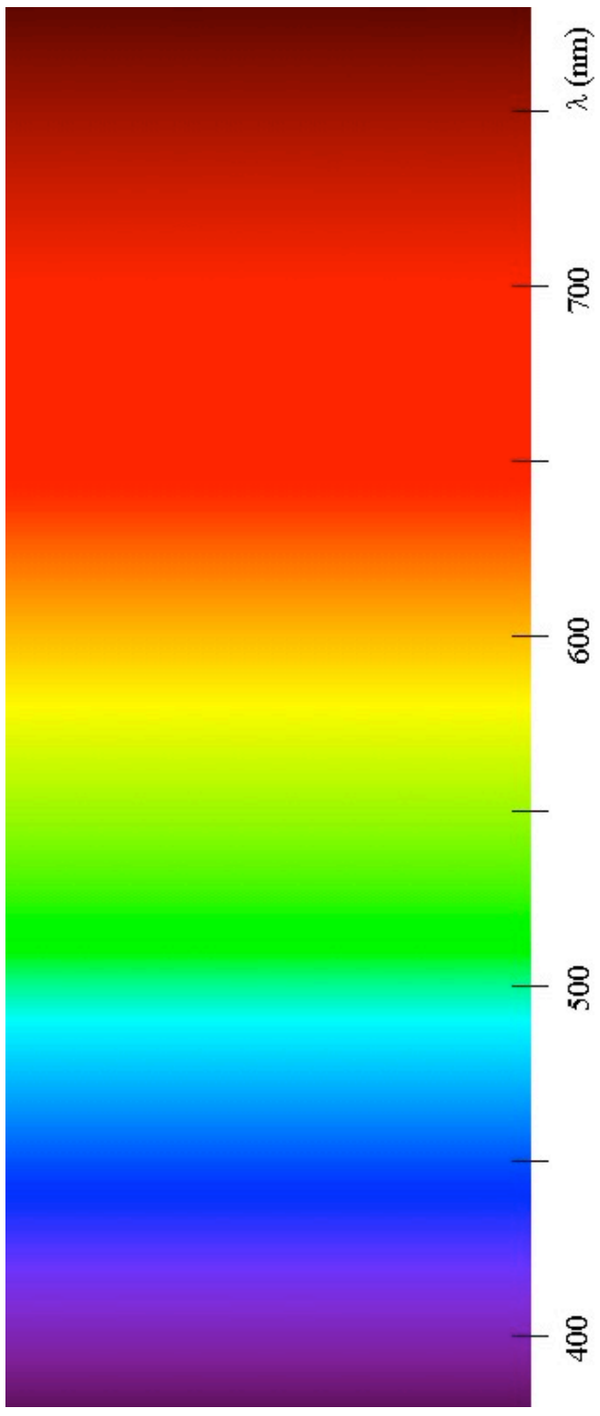


1D orientation

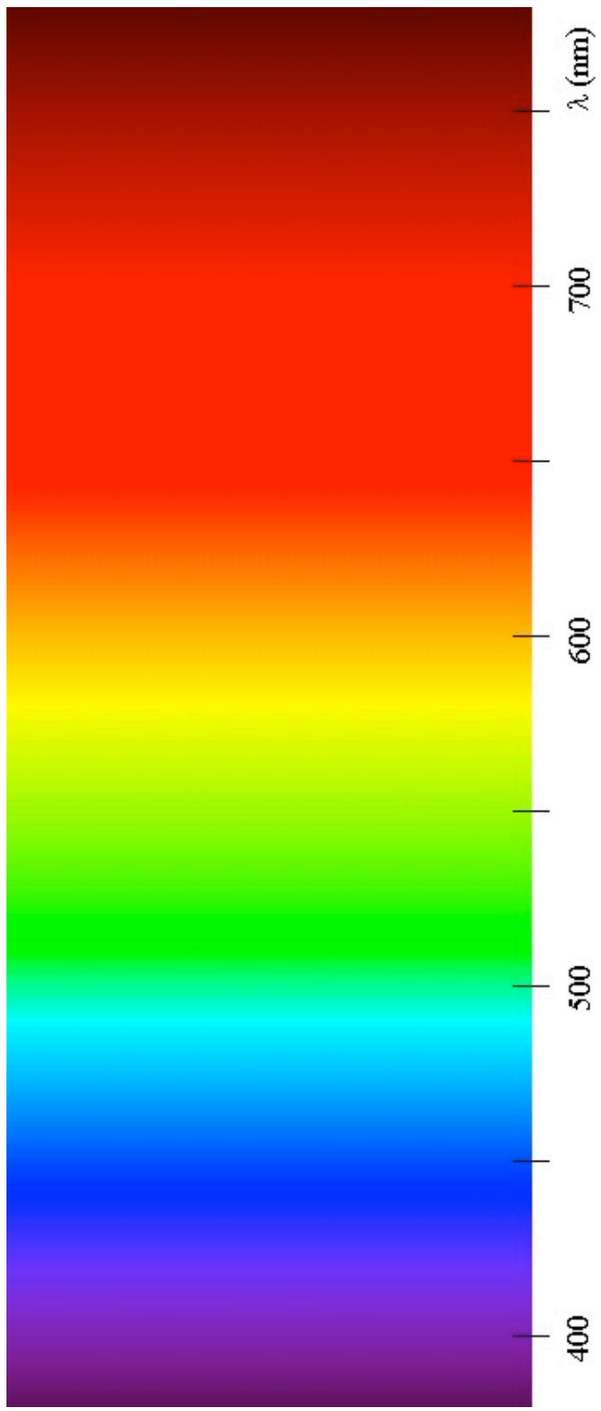


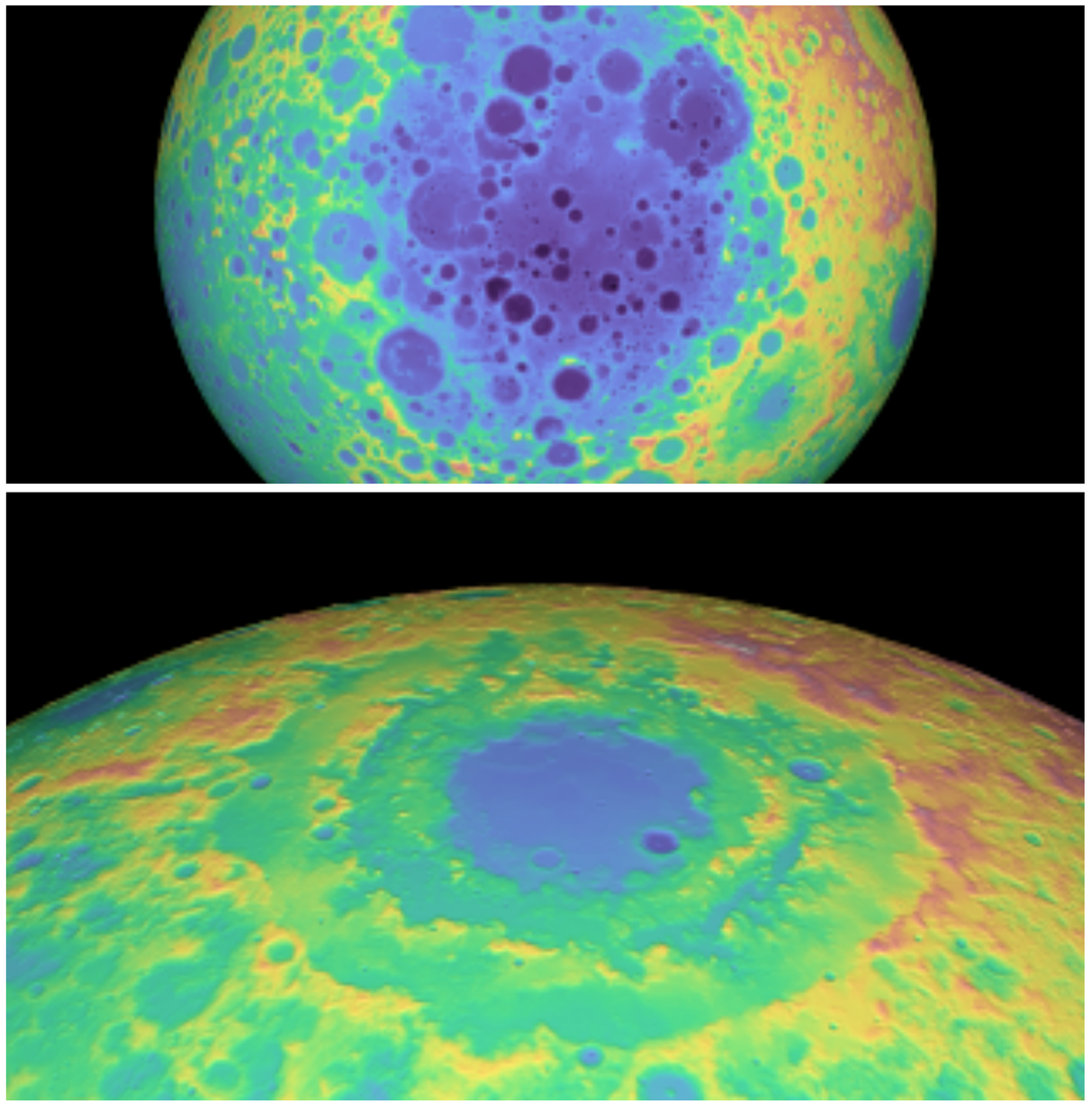
2D color/
orientation

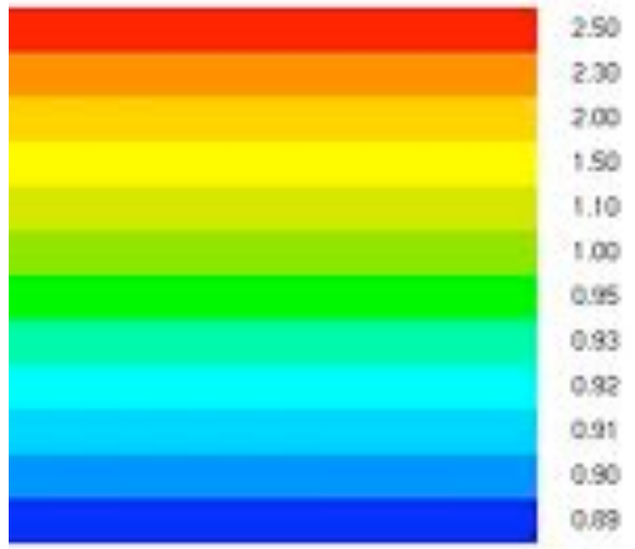
Using colour for continuous values

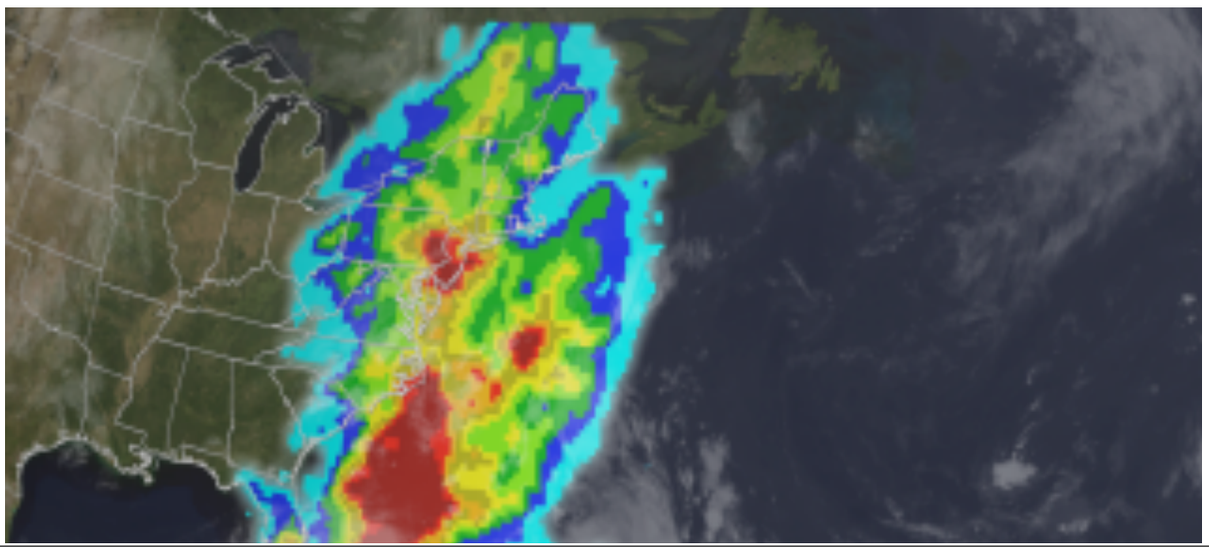


Using colour for continuous values

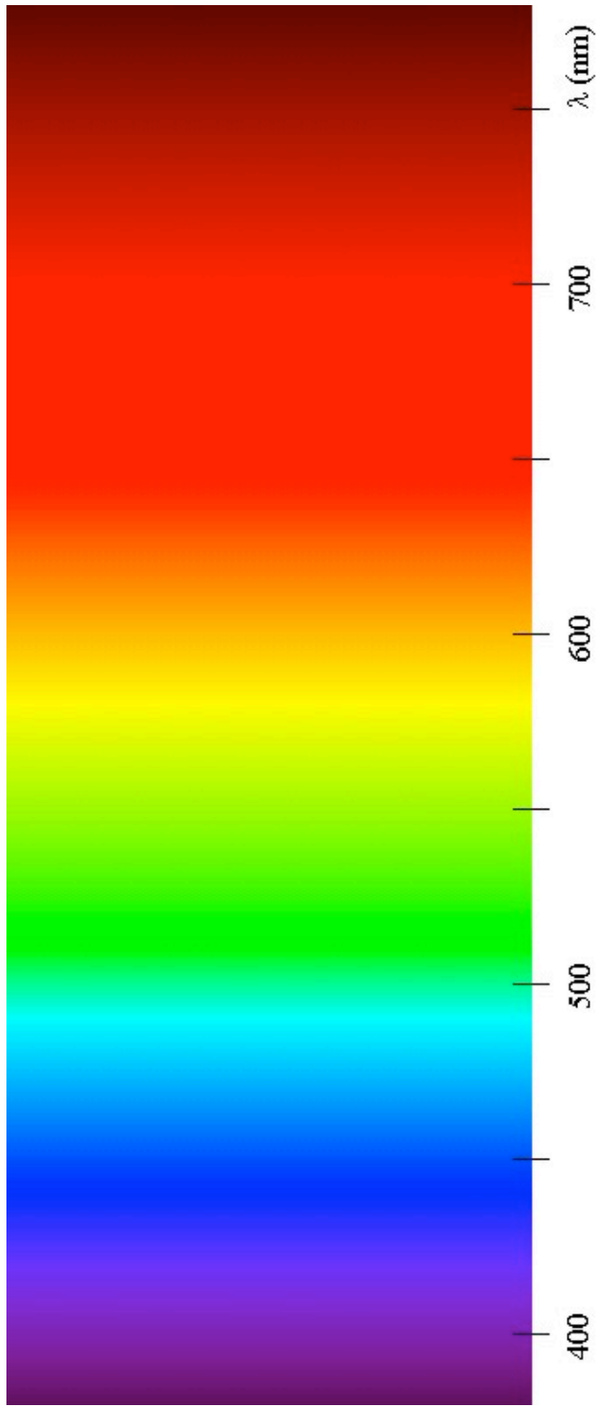


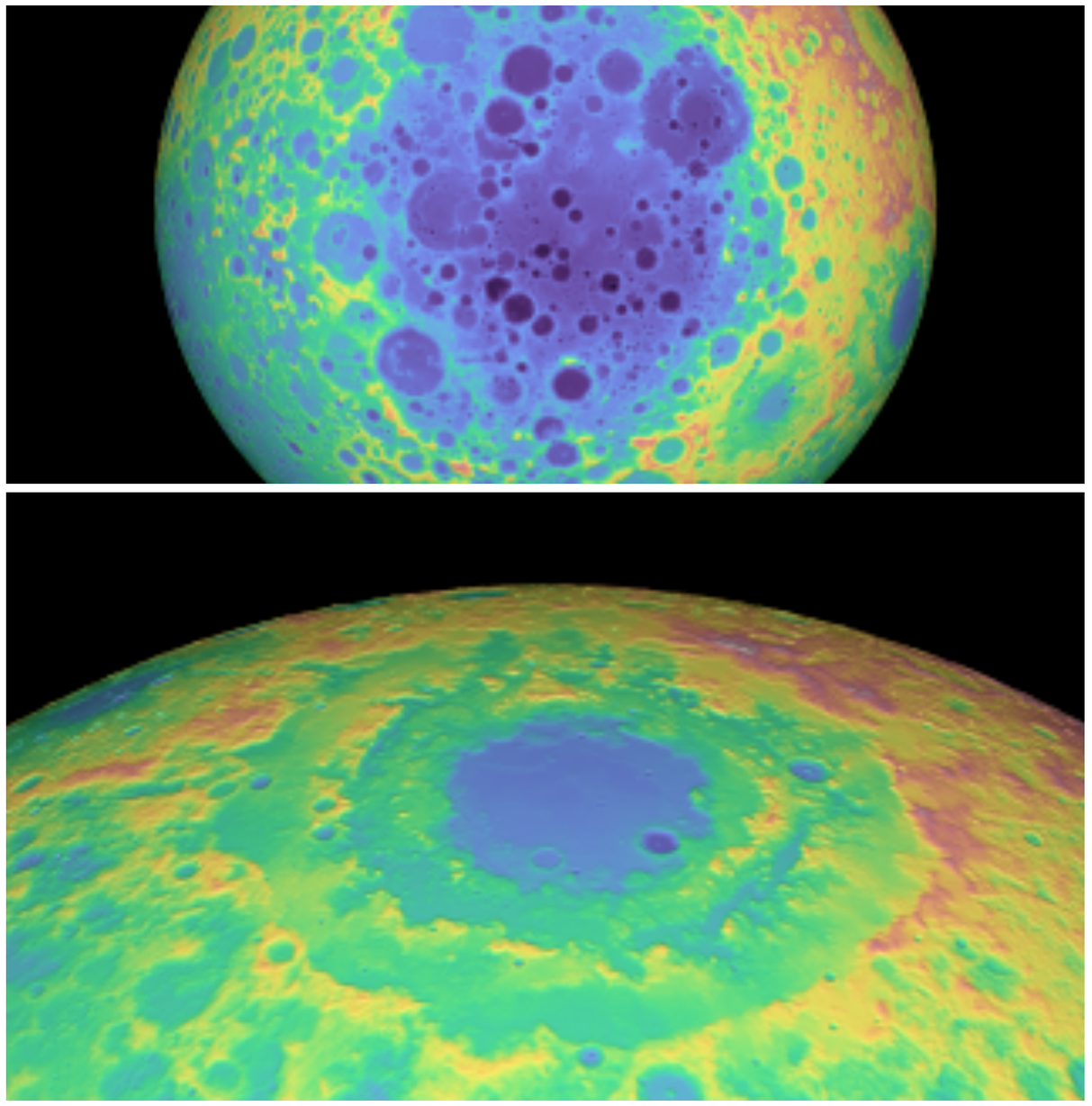


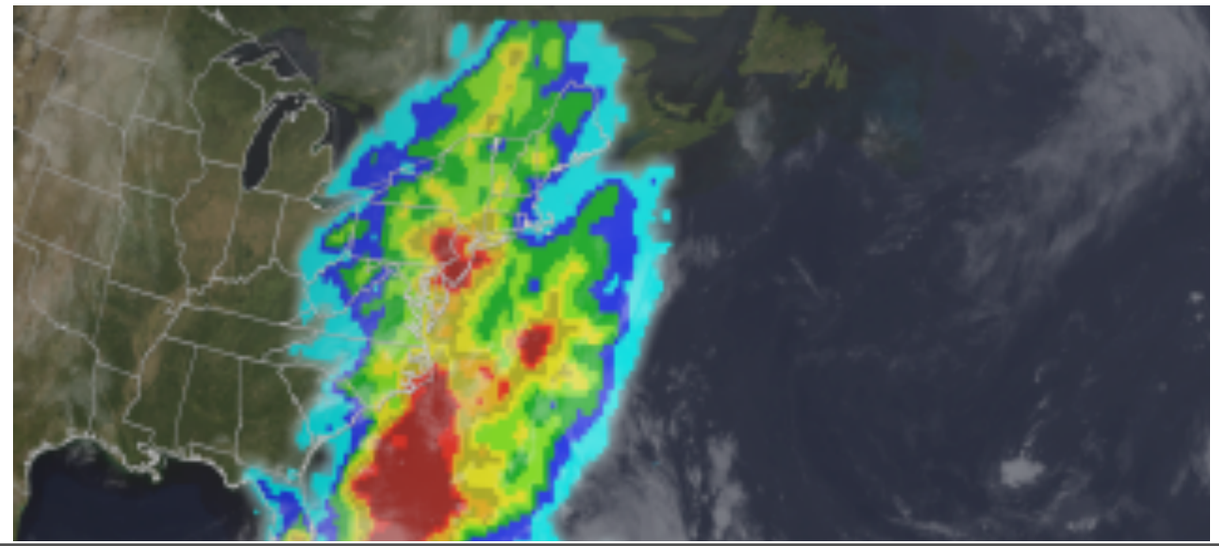


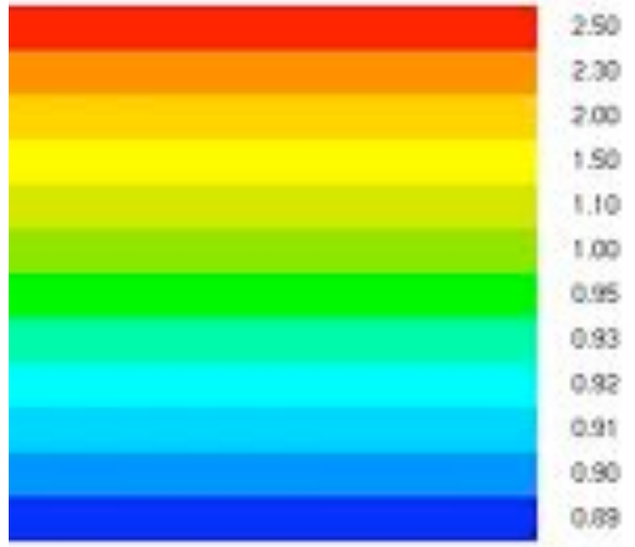


Using colour for continuous values









Using colour for continuous values

problem 1: No natural ordering

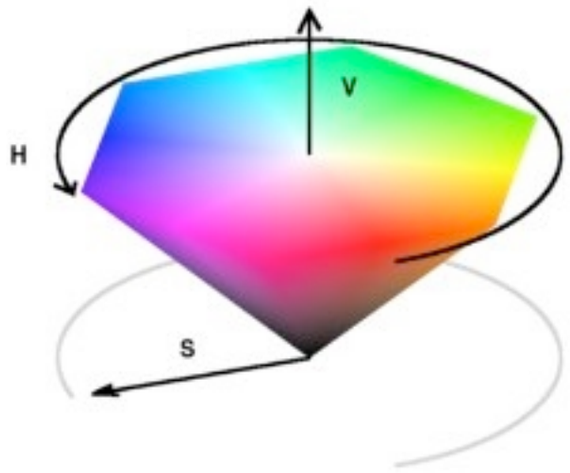
Using colour for continuous values

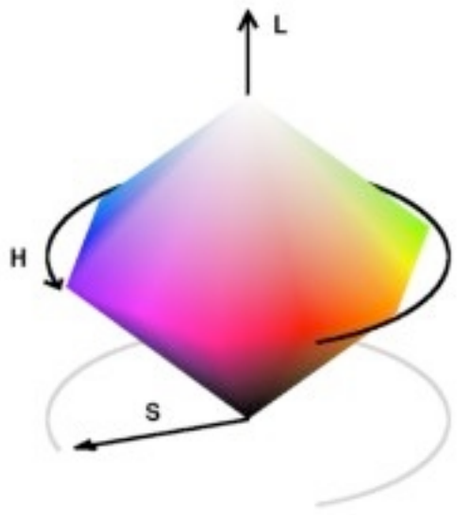
problem 1: No natural ordering

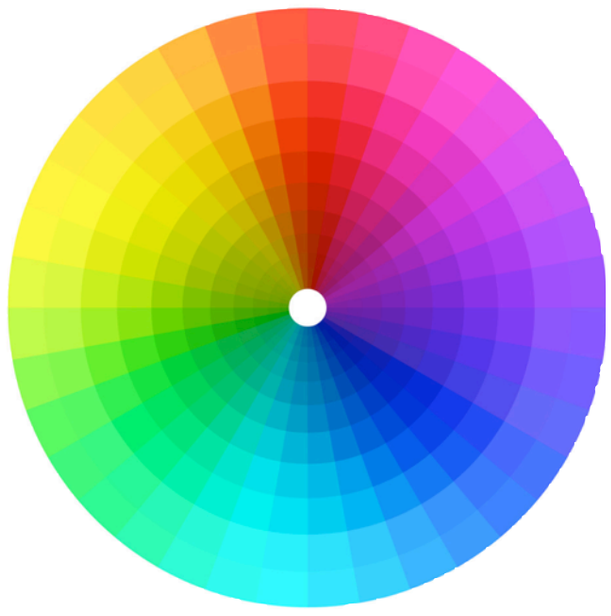
Using colour for continuous values

problem 1: No natural ordering

Using colour for continuous values





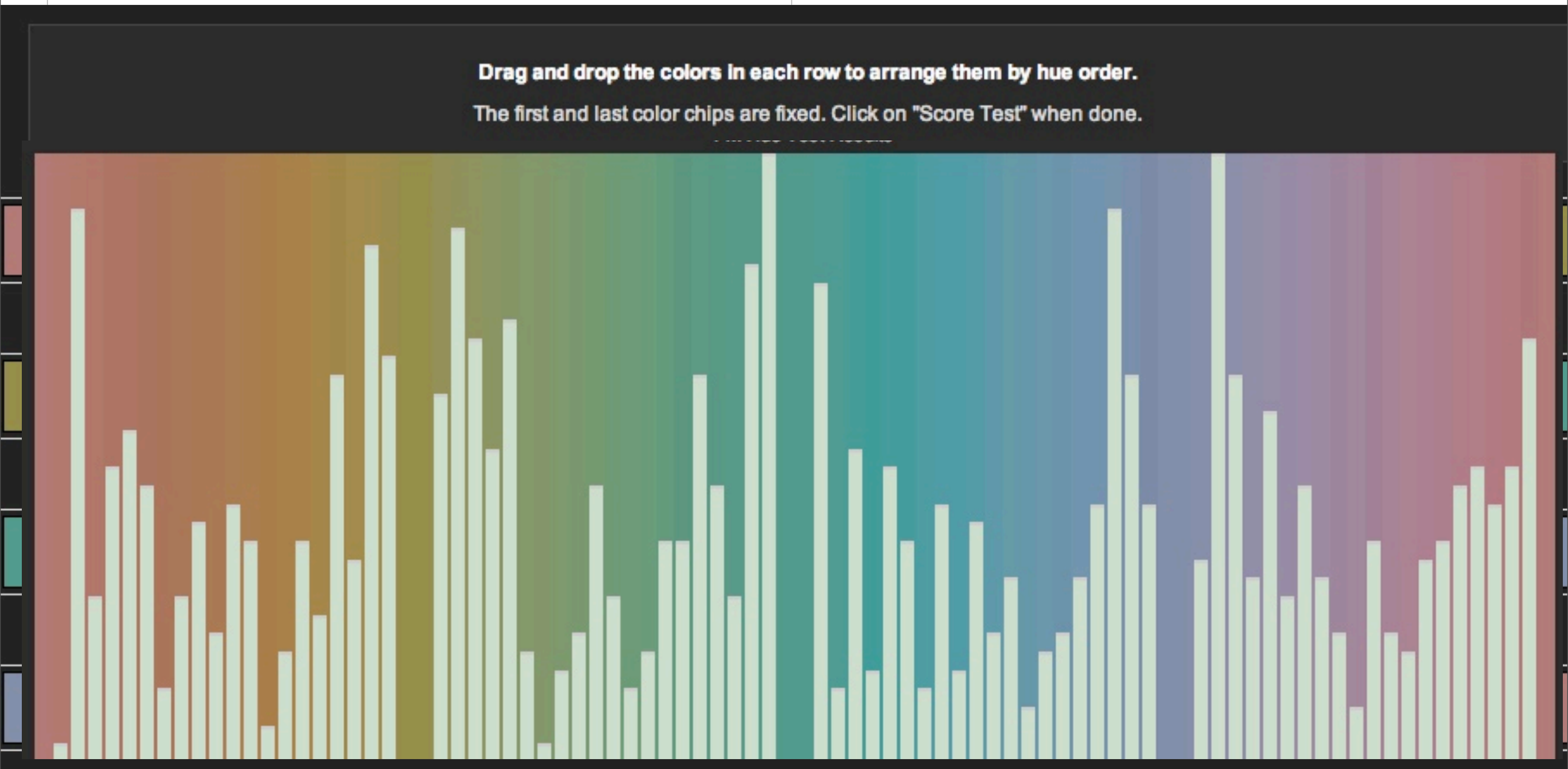


problem 1: No natural ordering

Using colour for continuous values

problem 1: No natural ordering

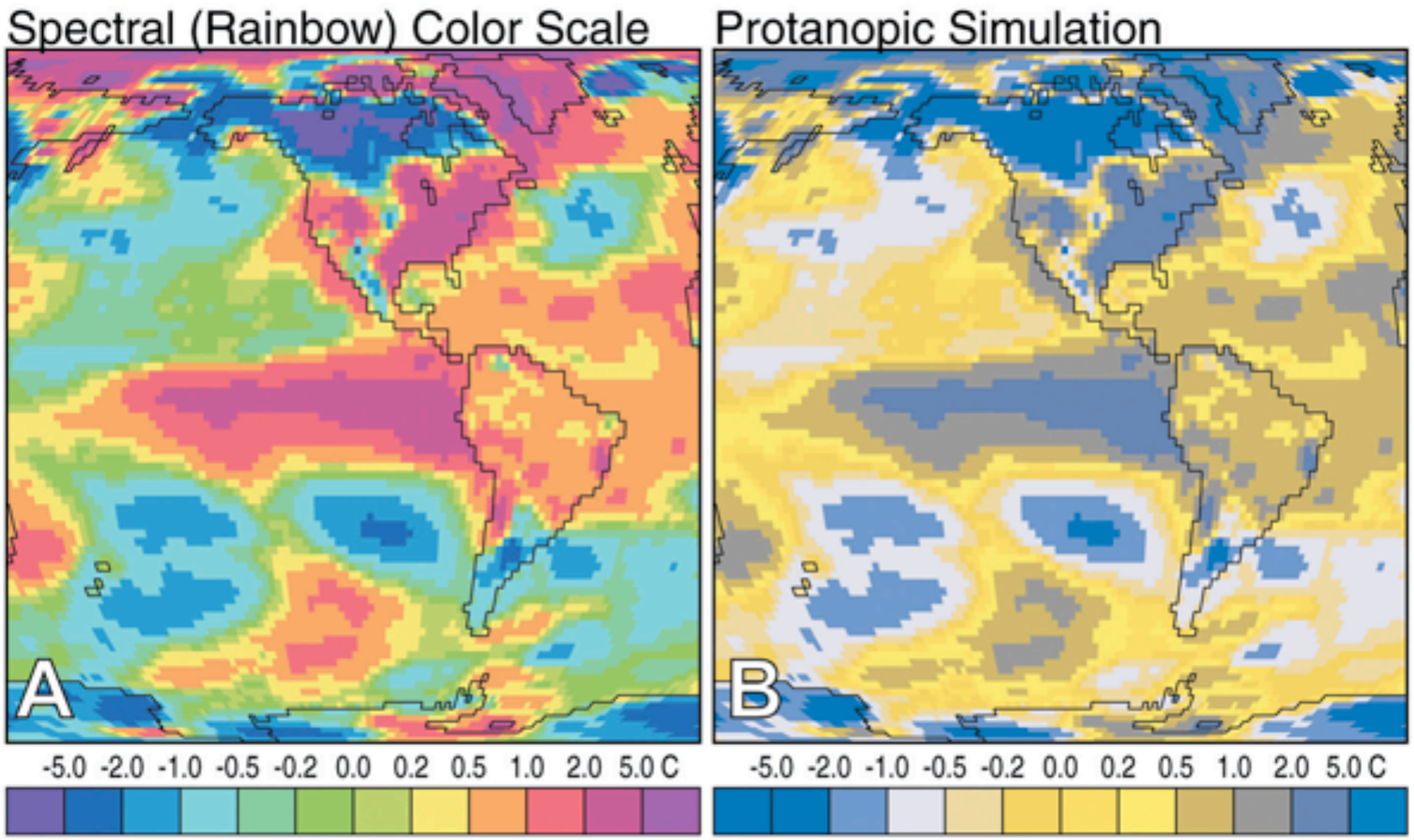
Using colour for continuous values



http://www.colormunki.com/game/huetest_kiosk

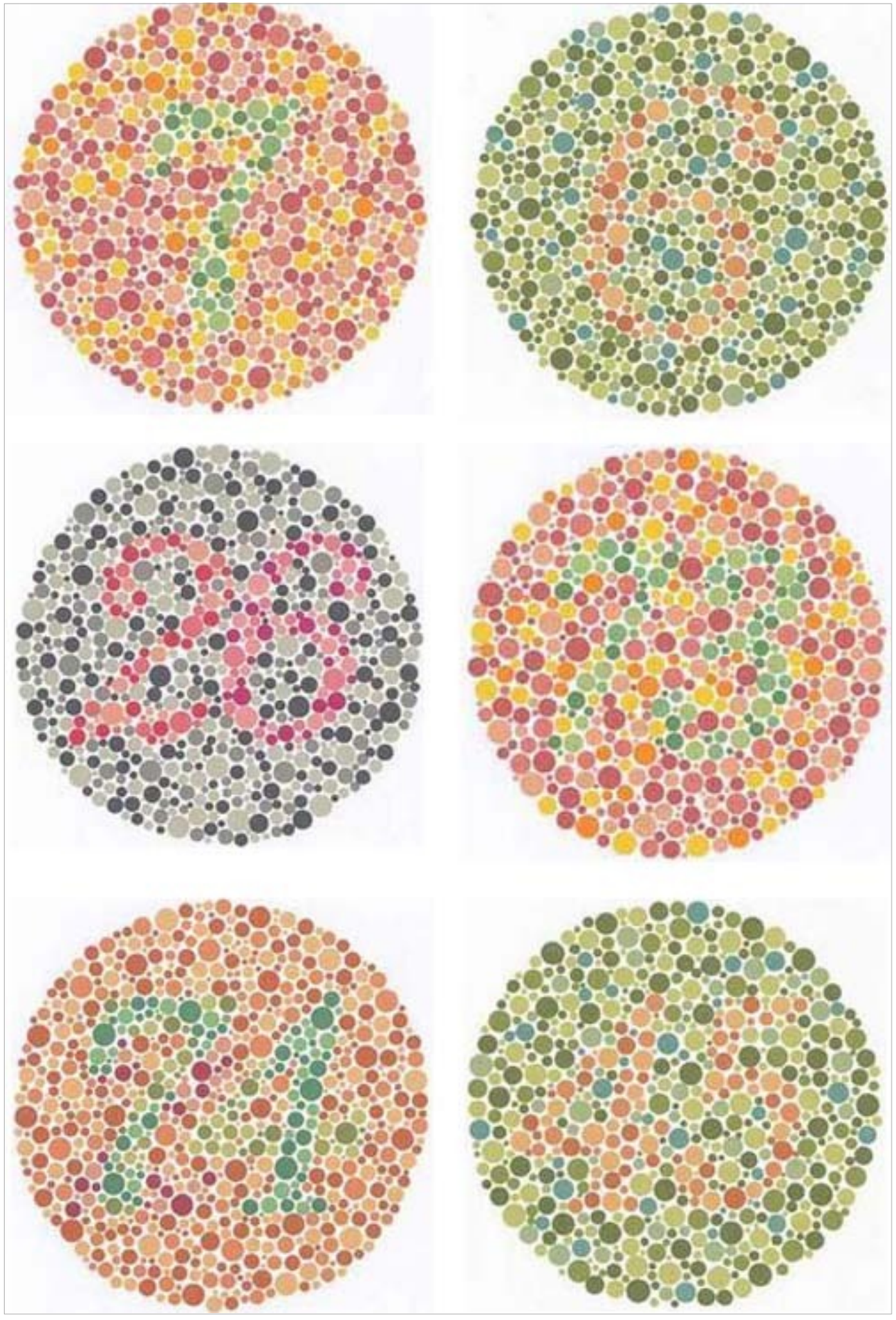
problem 1: No natural ordering

Using colour for continuous values

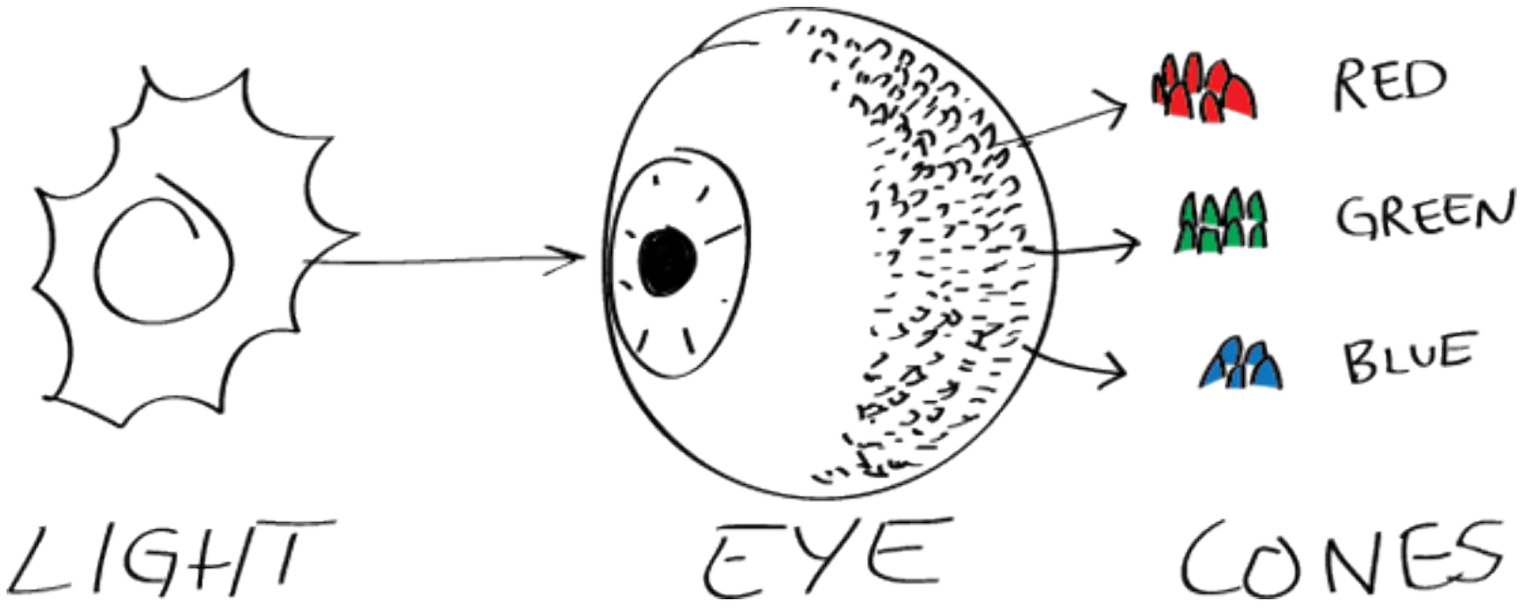


Protanopia affects 8% of males, 0.5% females of Northern European ancestry

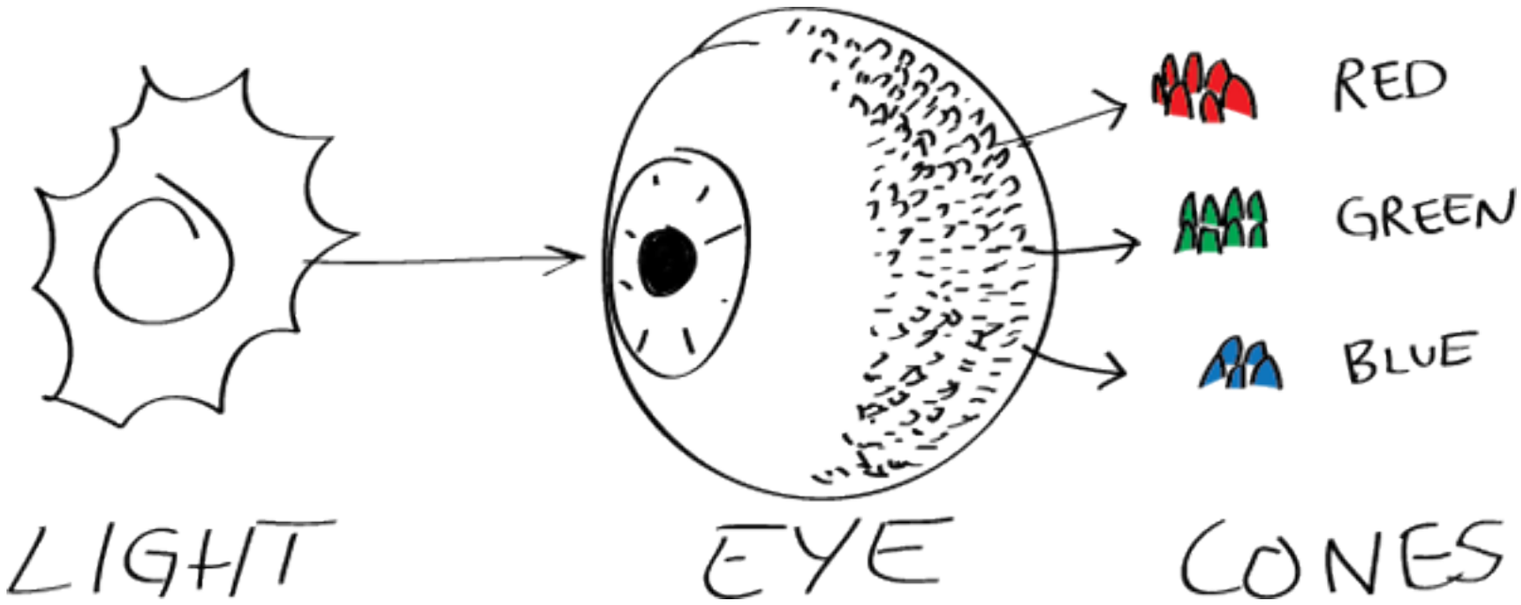
problem 2: colour sensitivity



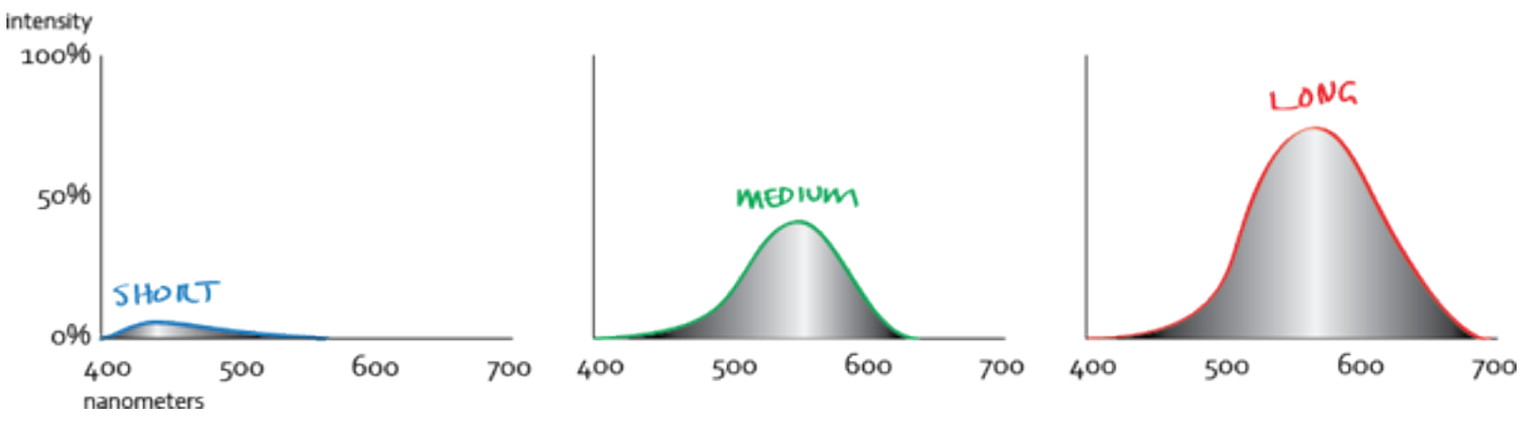
Using colour for continuous values
problem 3: yellow is special



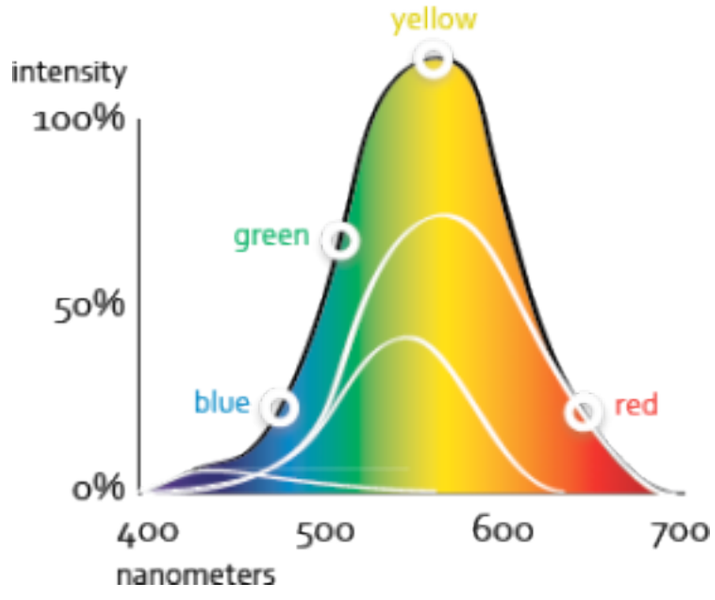
Using colour for continuous values
problem 3: yellow is special



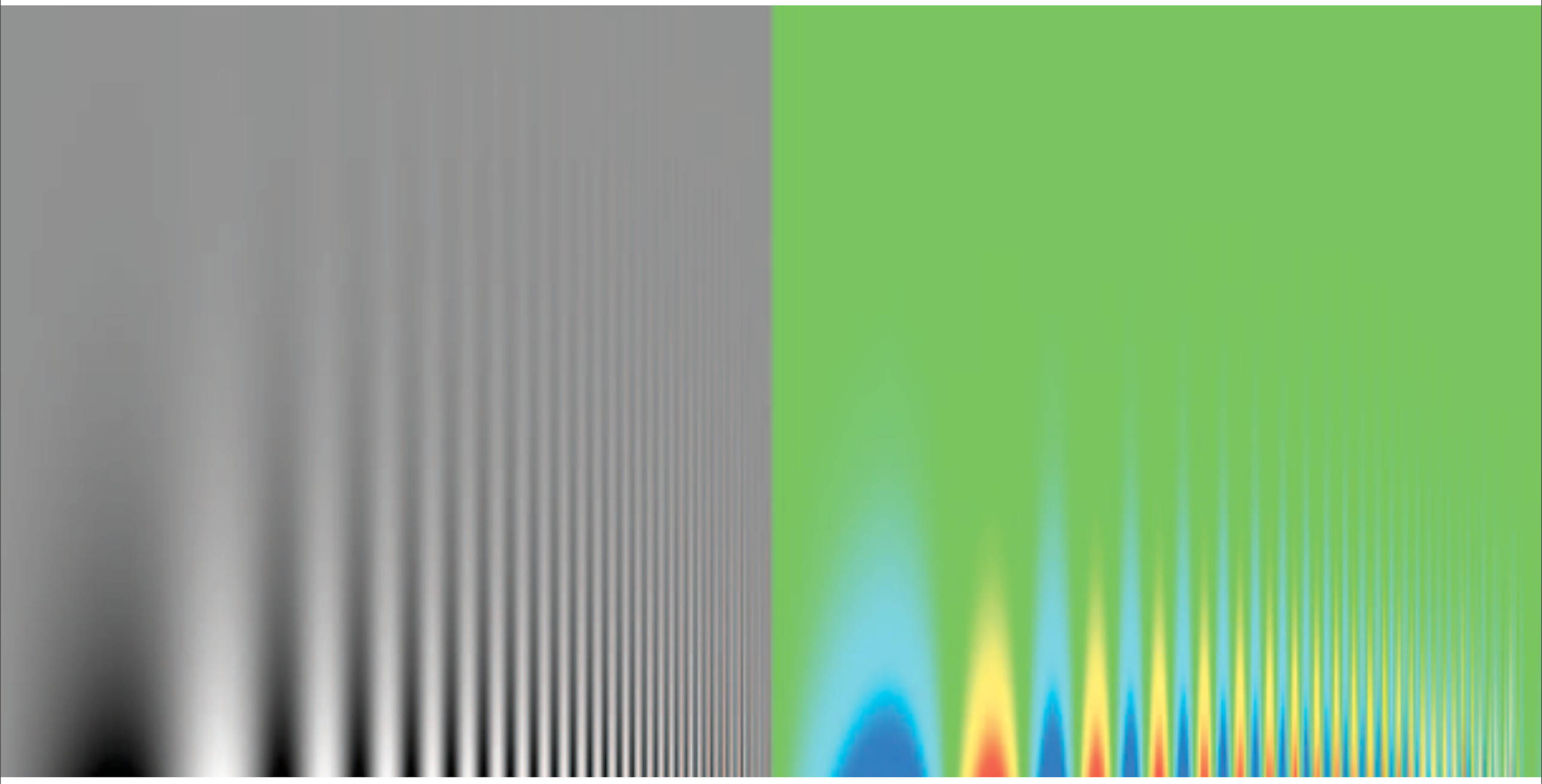
RELATIVE SENSITIVITY TO LIGHT WAVELENGTHS



PUTTING IT ALL TOGETHER

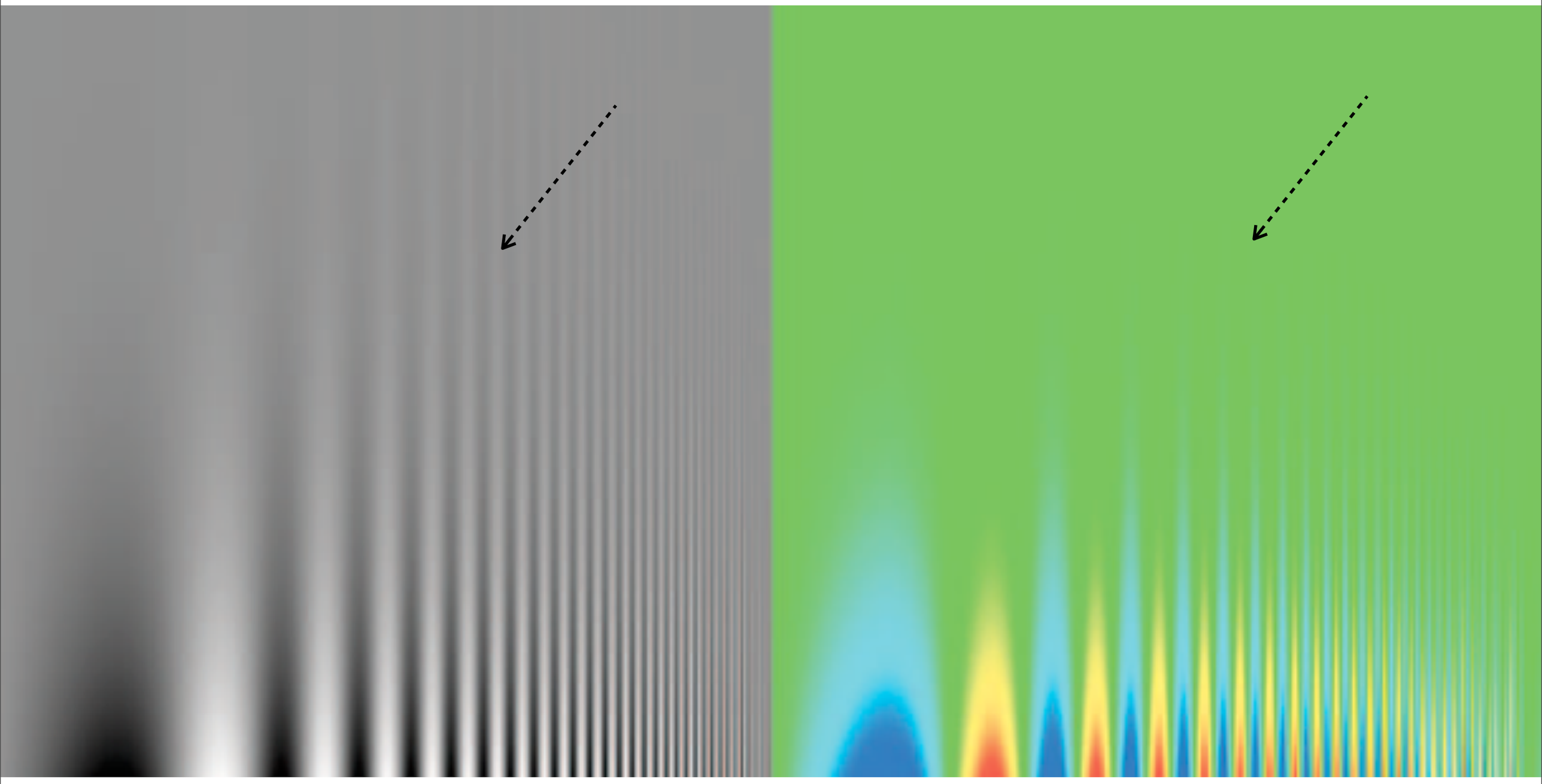


Using colour for continuous values
problem 4: Details: overemphasised or obscured



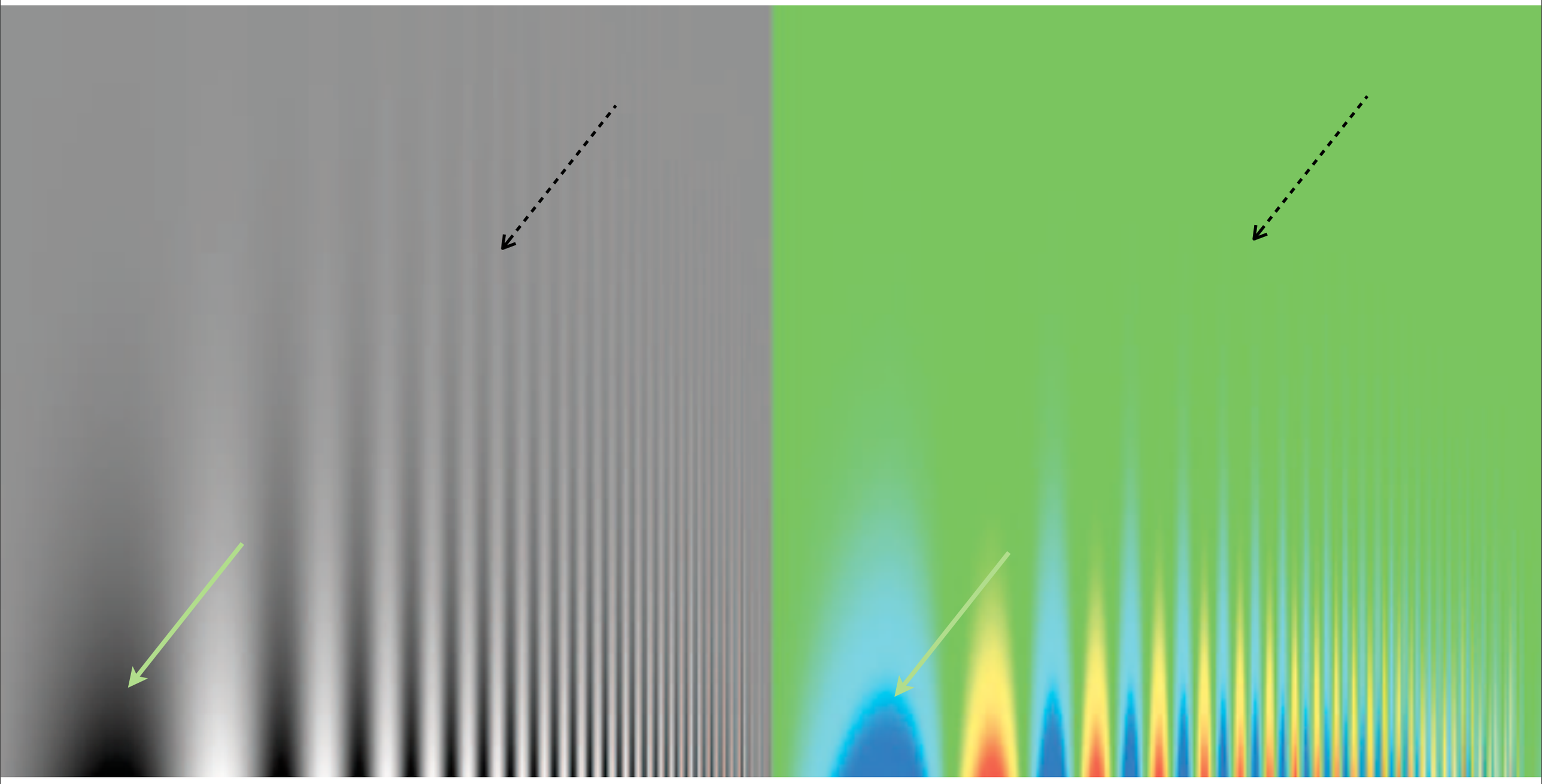
hue ‘borders’ overemphasise small changes, hue ‘middles’ blend potentially important details

Using colour for continuous values
problem 4: Details: overemphasised or obscured



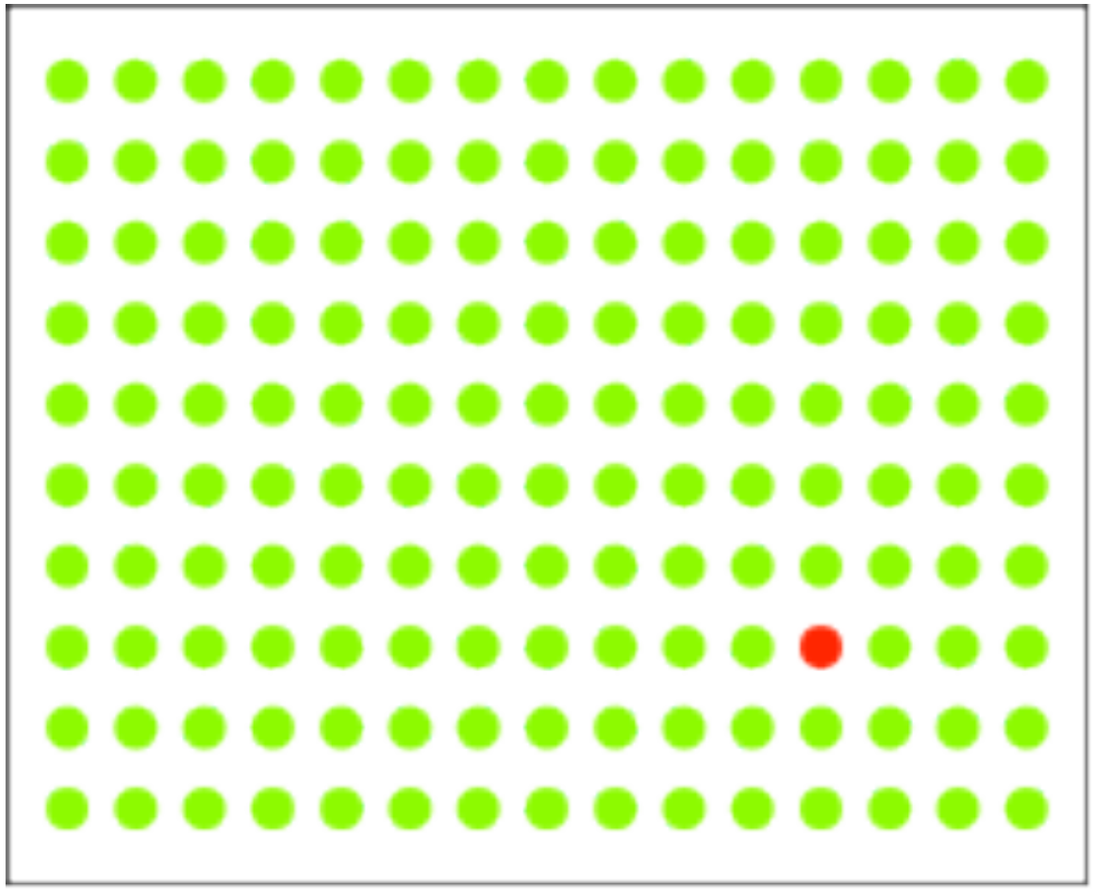
hue ‘borders’ overemphasise small changes, hue ‘middles’ blend potentially important details

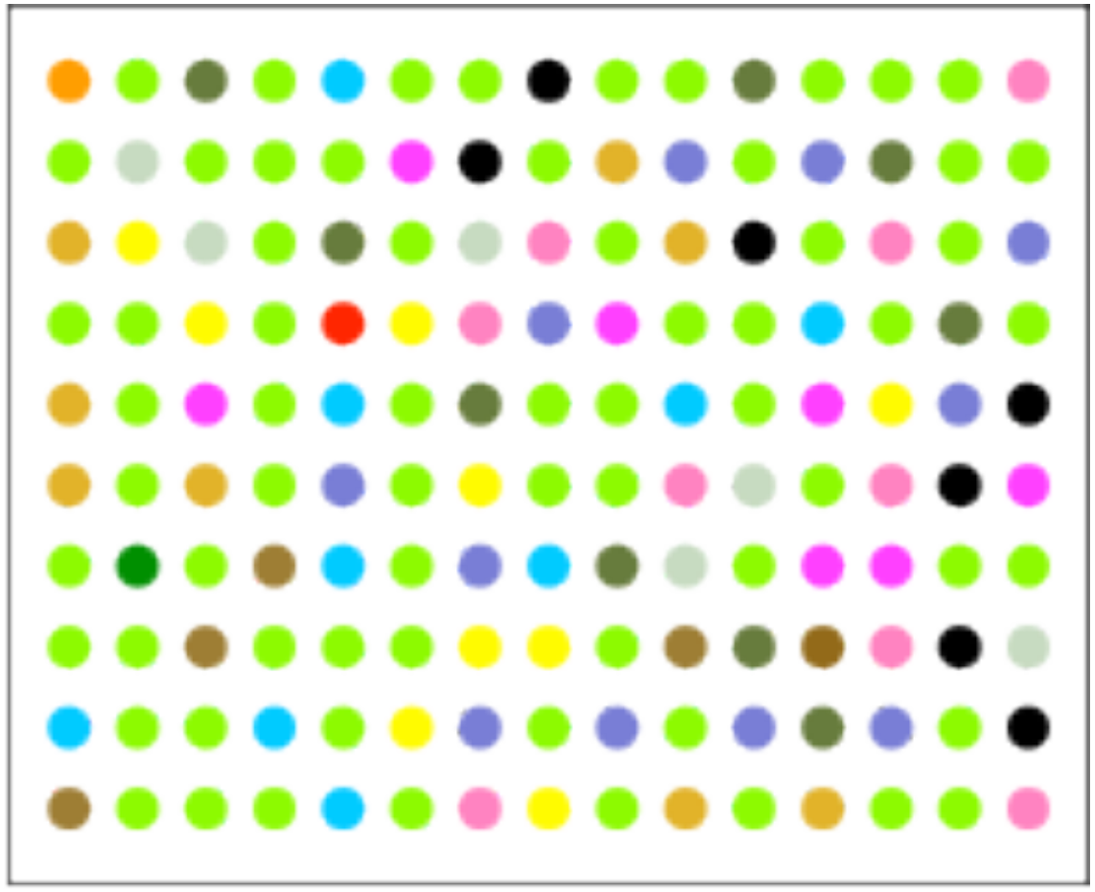
Using colour for continuous values
problem 4: Details: overemphasised or obscured

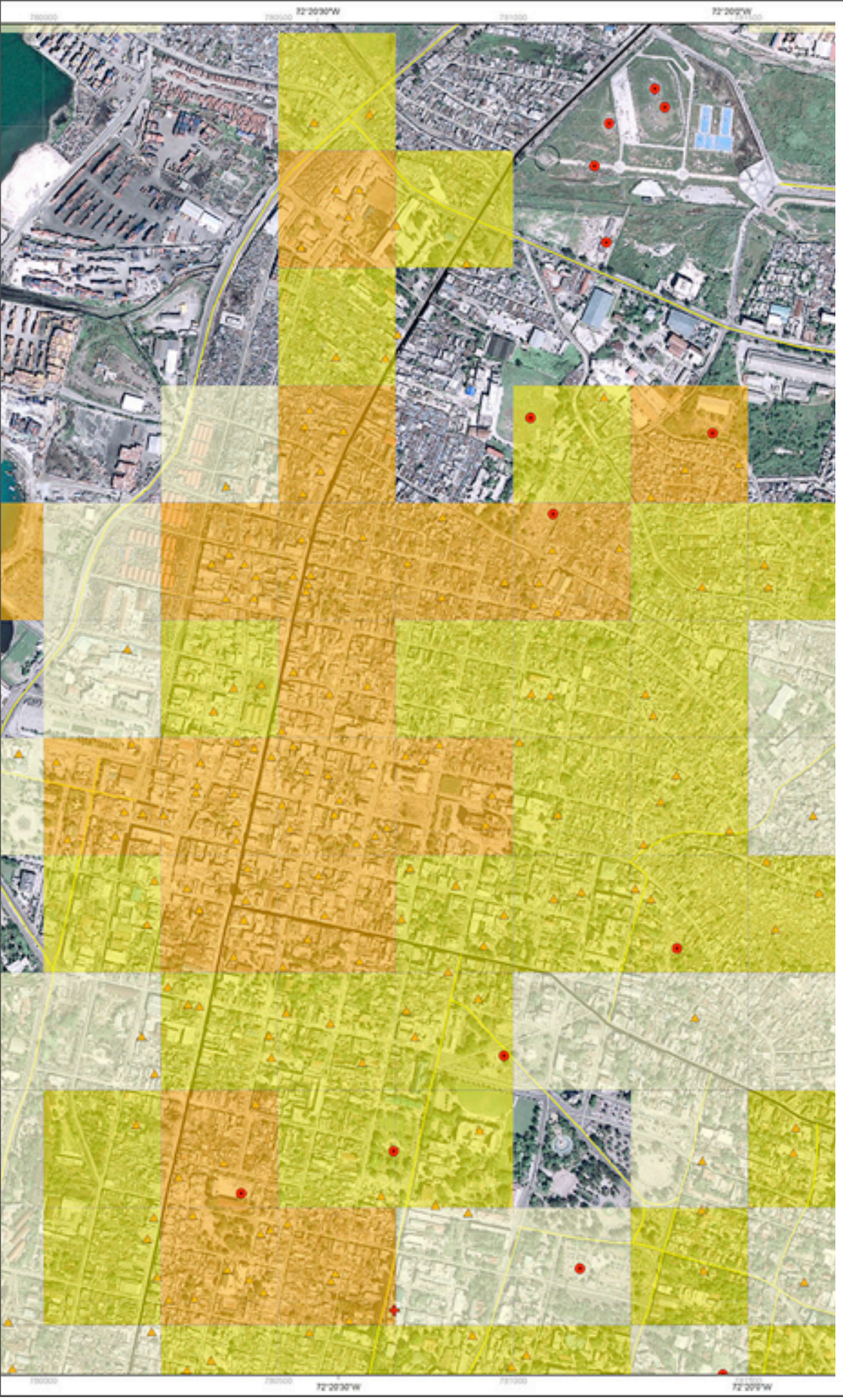


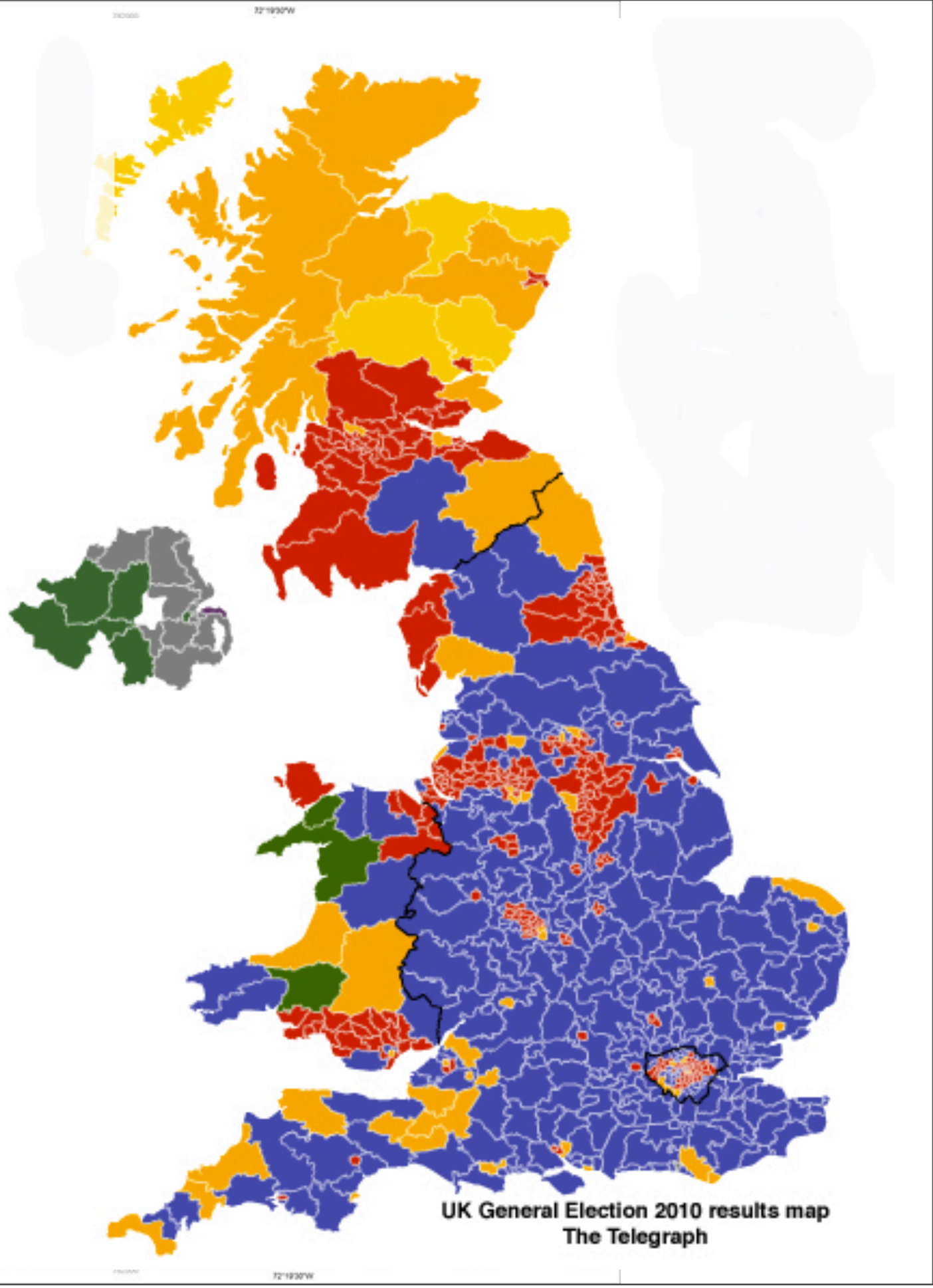
hue ‘borders’ overemphasise small changes, hue ‘middles’ blend potentially important details

Using colour for continuous values
problem 5: pop out can drown out

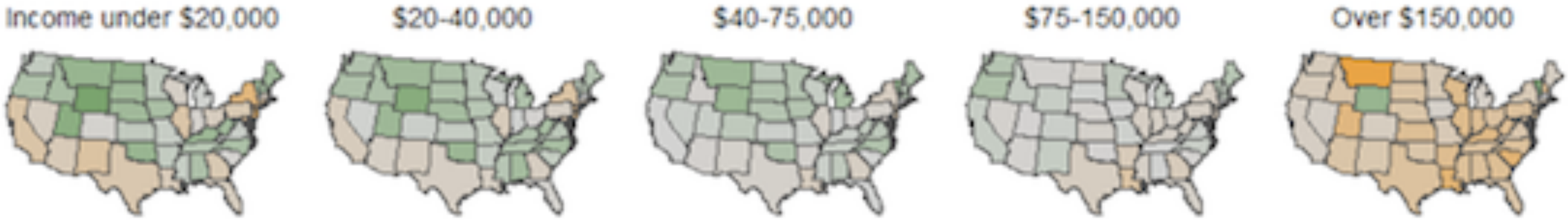


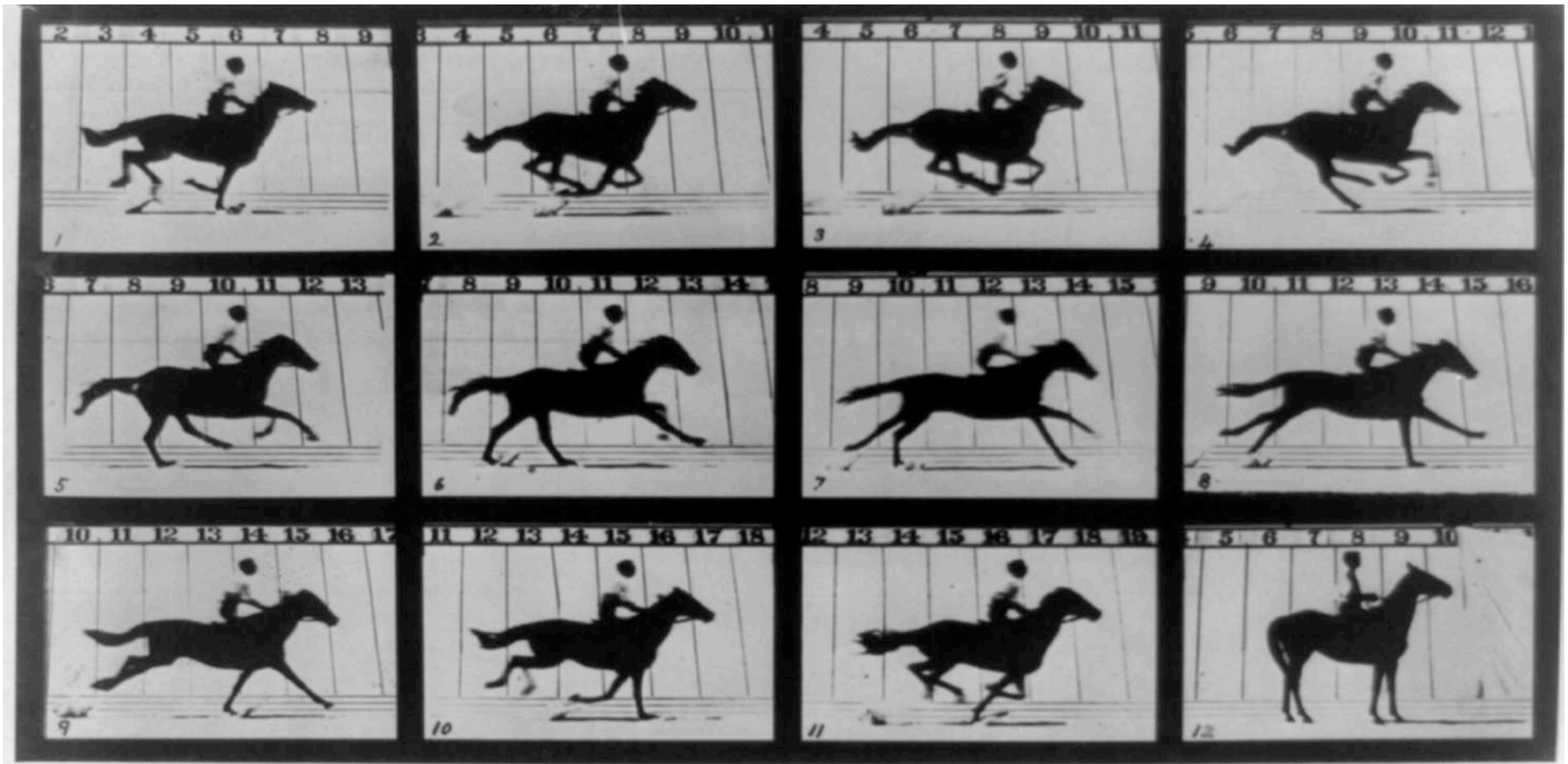





UK General Election 2010 results map
The Telegraph

juxtaposition: small multiples





The 892 unique ways to partition a 3×4 grid

The 892 unique ways to partition a 3×4 grid

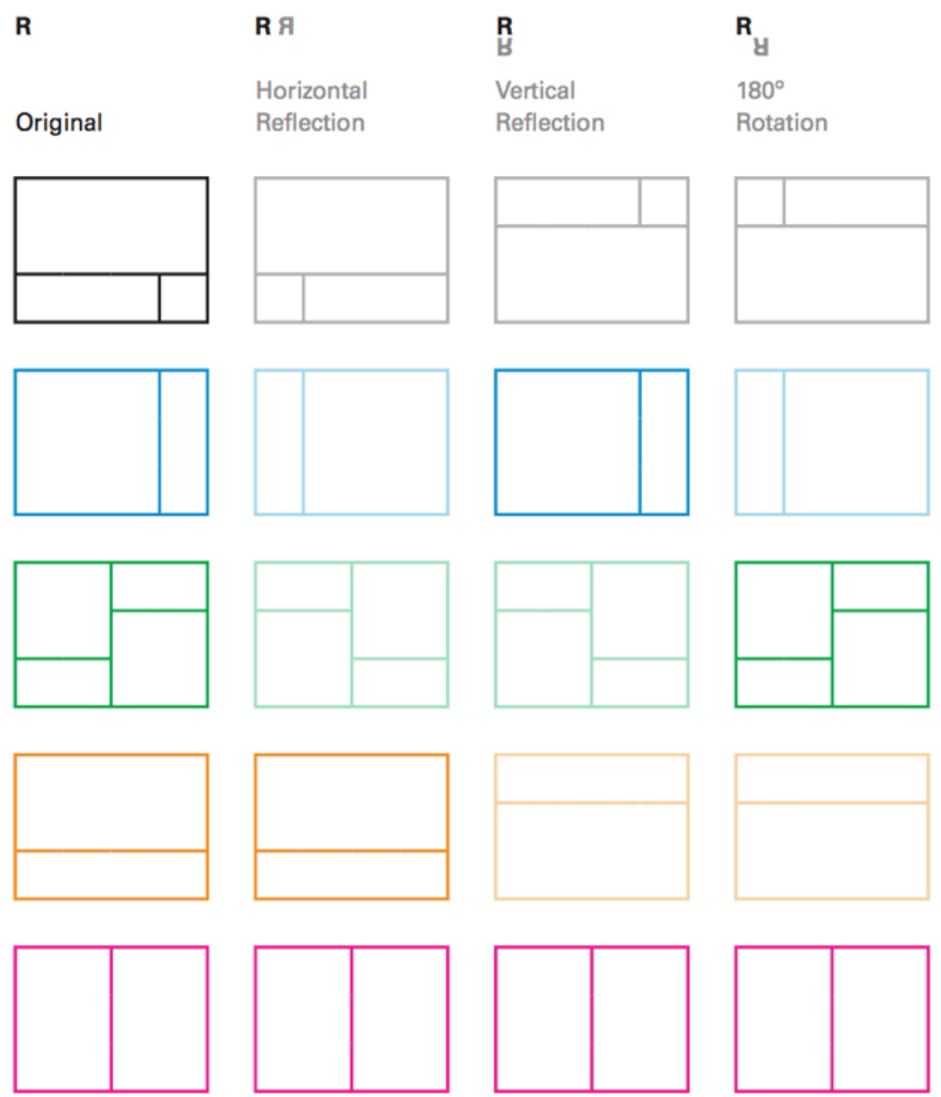
703 × Black
Asymmetric
Changed by horizontal reflection, vertical reflection, and 180° rotation.

61 × Blue
Top-bottom symmetry
Changed by horizontal reflection and 180° rotation.

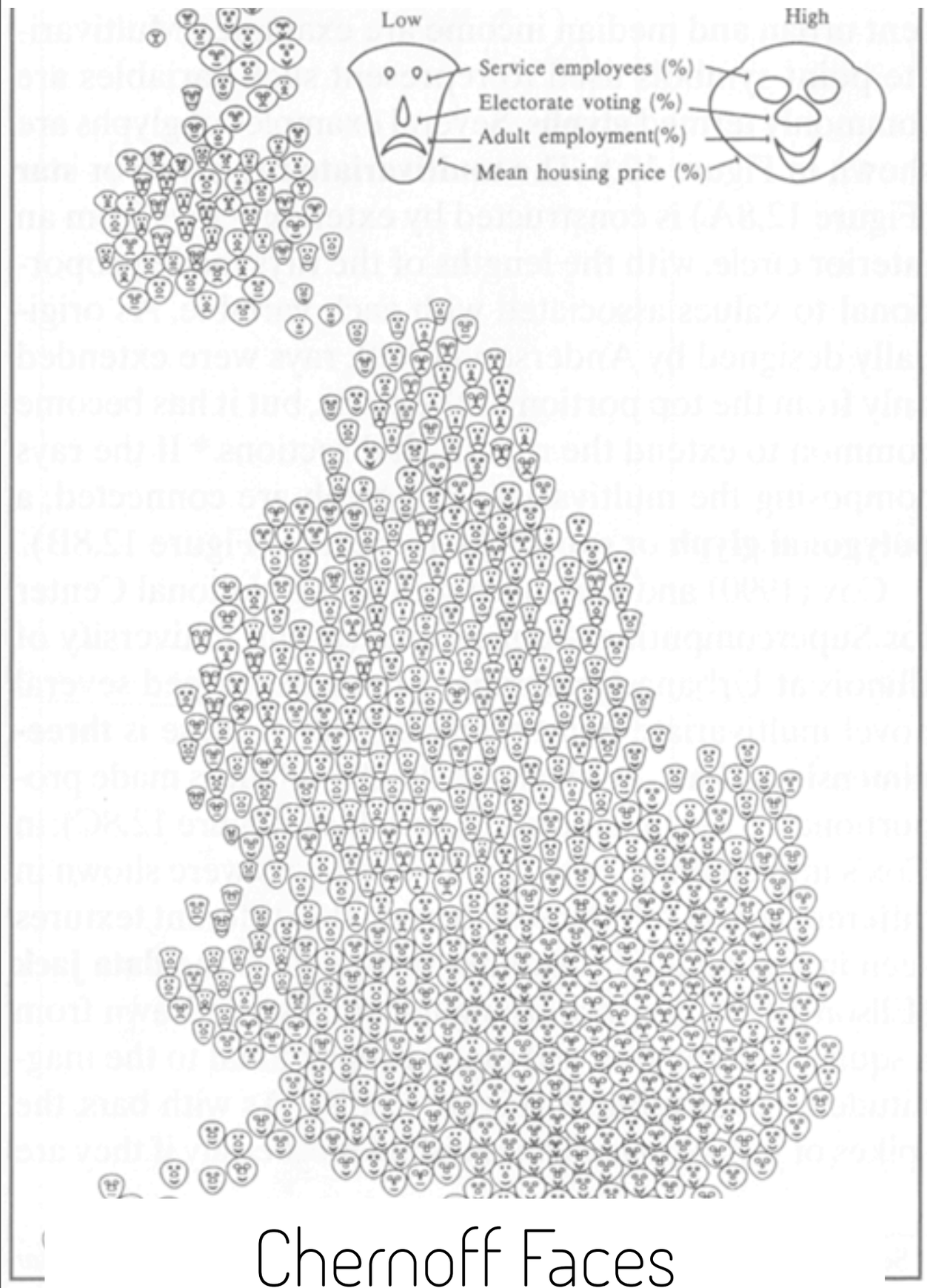
26 × Green
Rotational symmetry
Changed by horizontal and vertical reflection.

76 × Orange
Left-right symmetry
Changed by vertical reflection and 180° rotation.

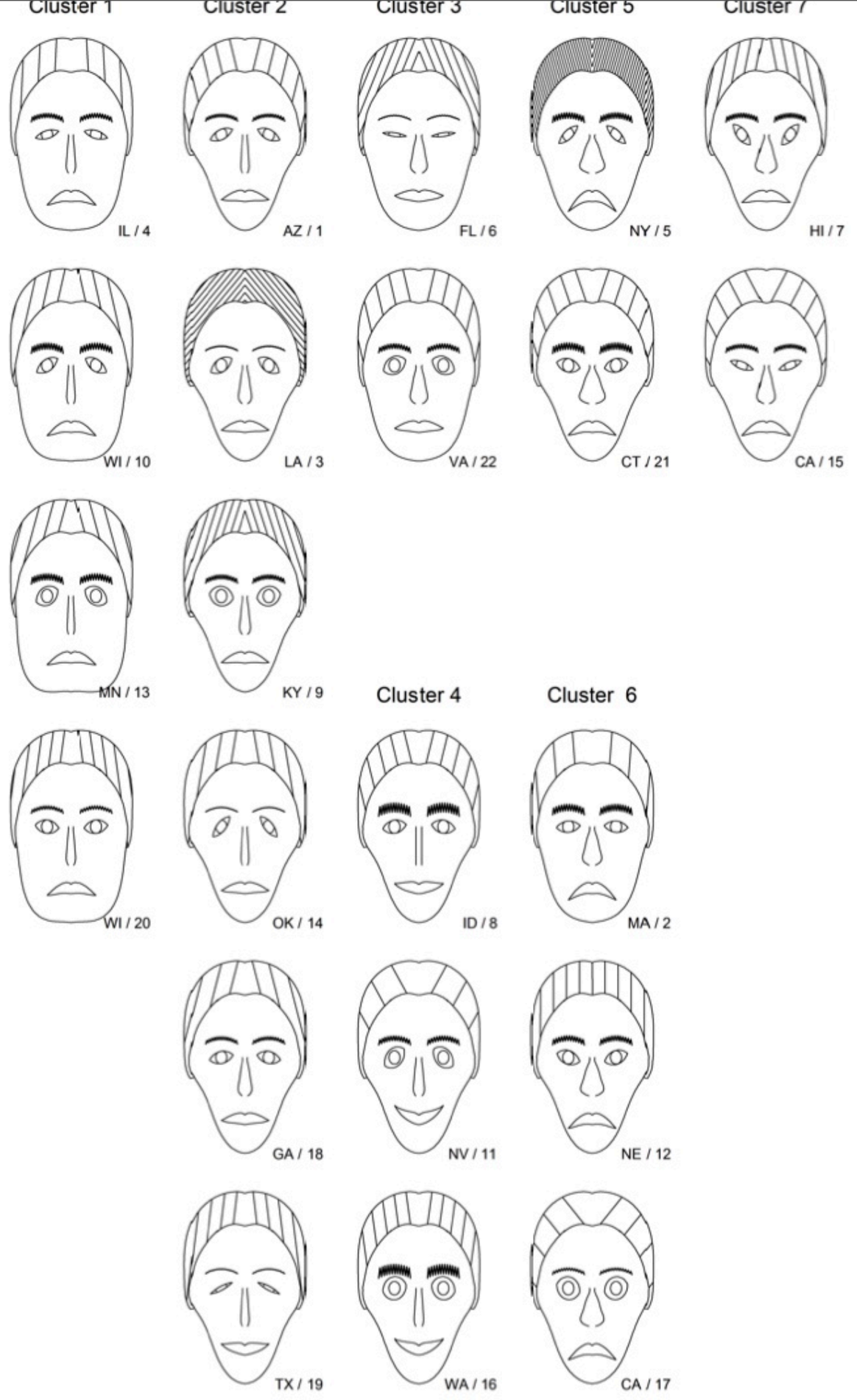
26 × Magenta
All three symmetries combined
Unchanged by horizontal reflection, vertical reflection, or 180° rotation.



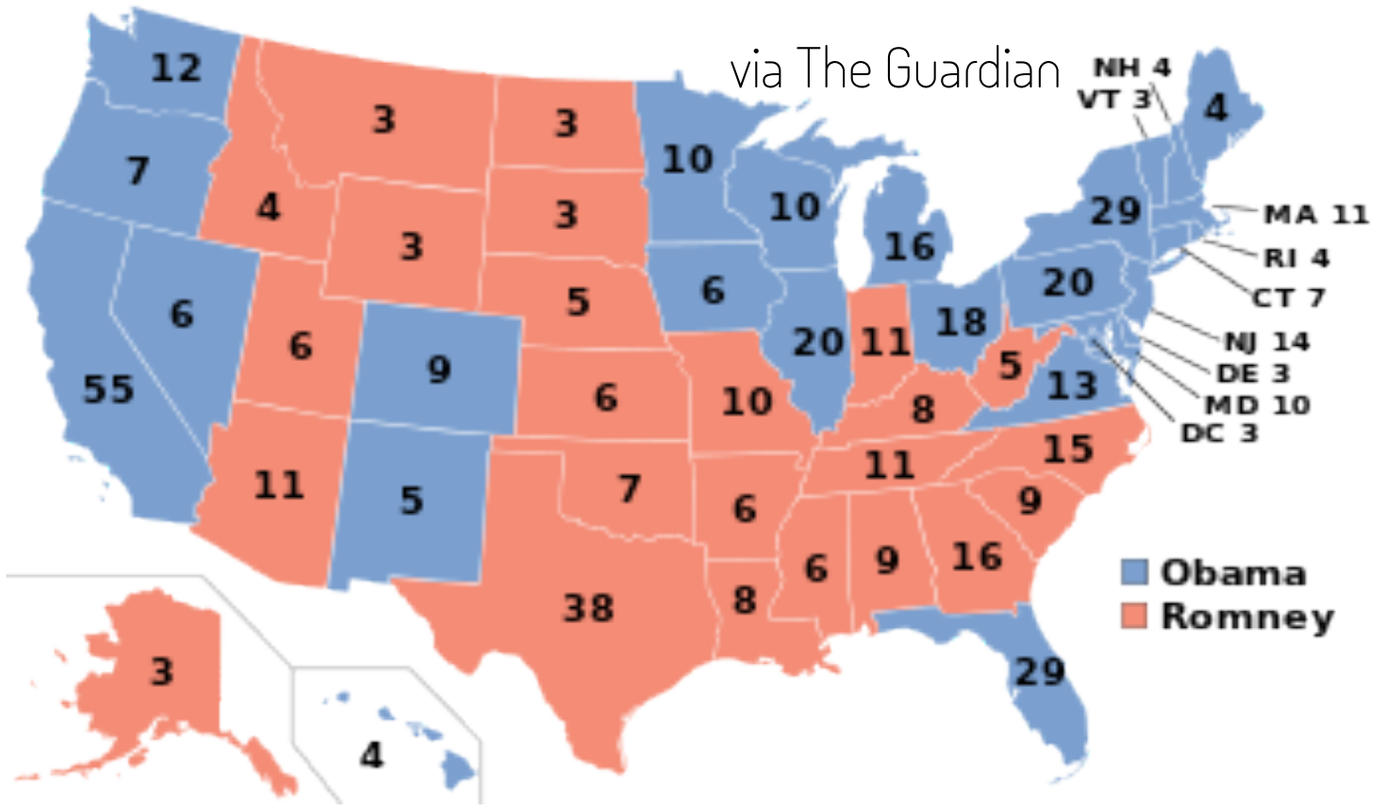
multidimensional data



Chernoff Faces

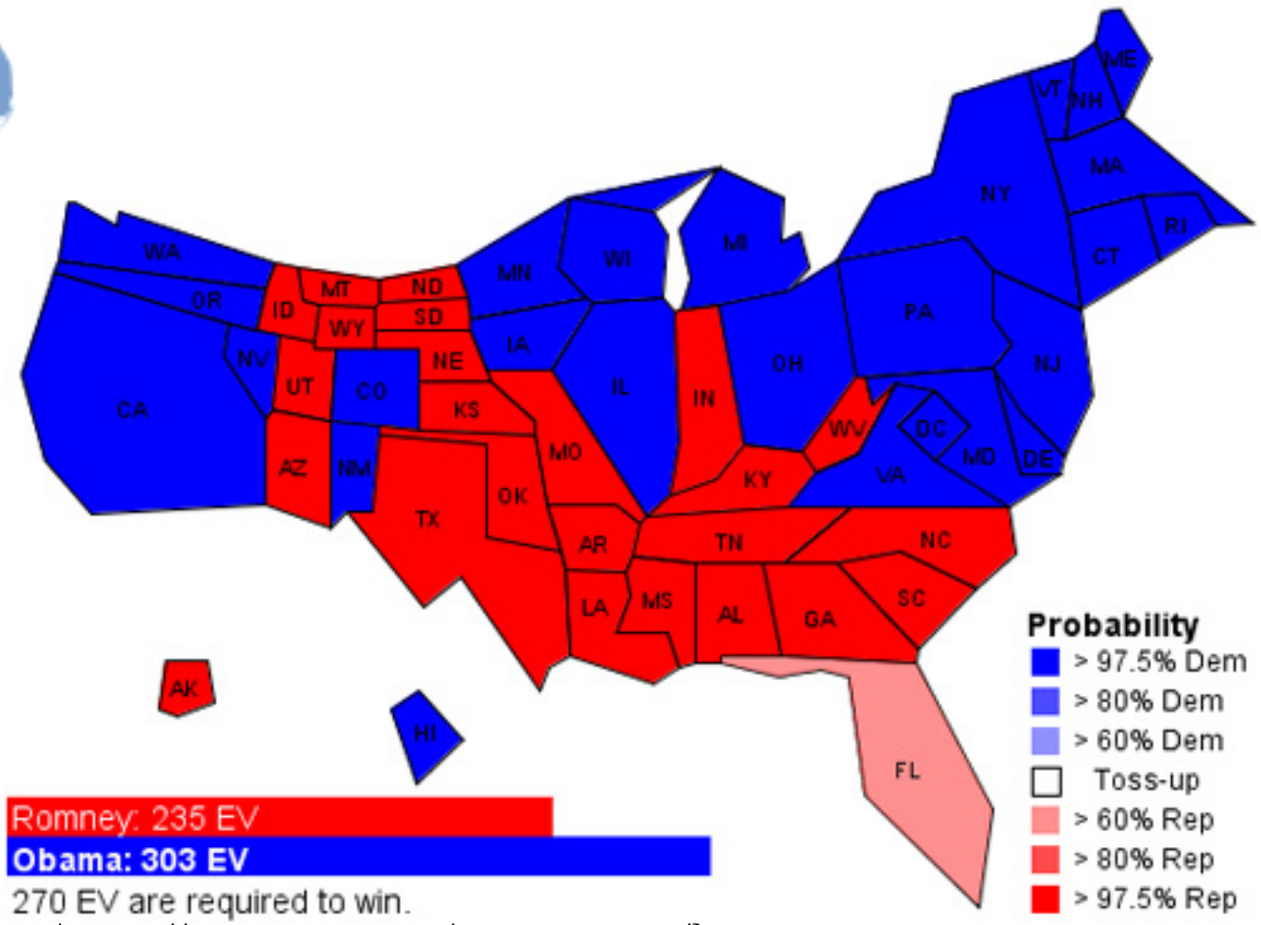


multidimensional data



via The Guardian

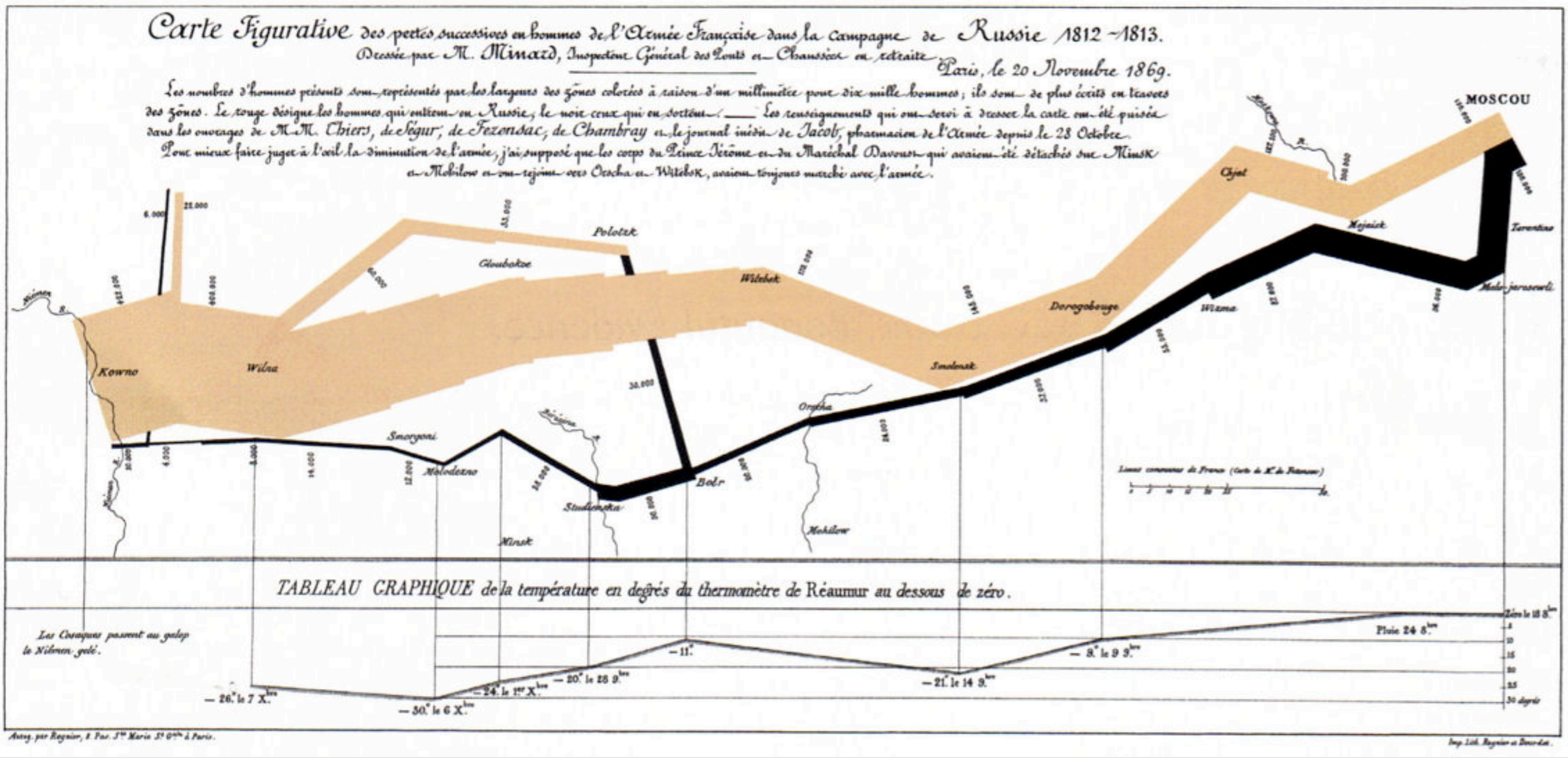
distorted to make area proportional to votes



(via http://zompist.wordpress.com/)

Obama–Romney 2012 victories by state

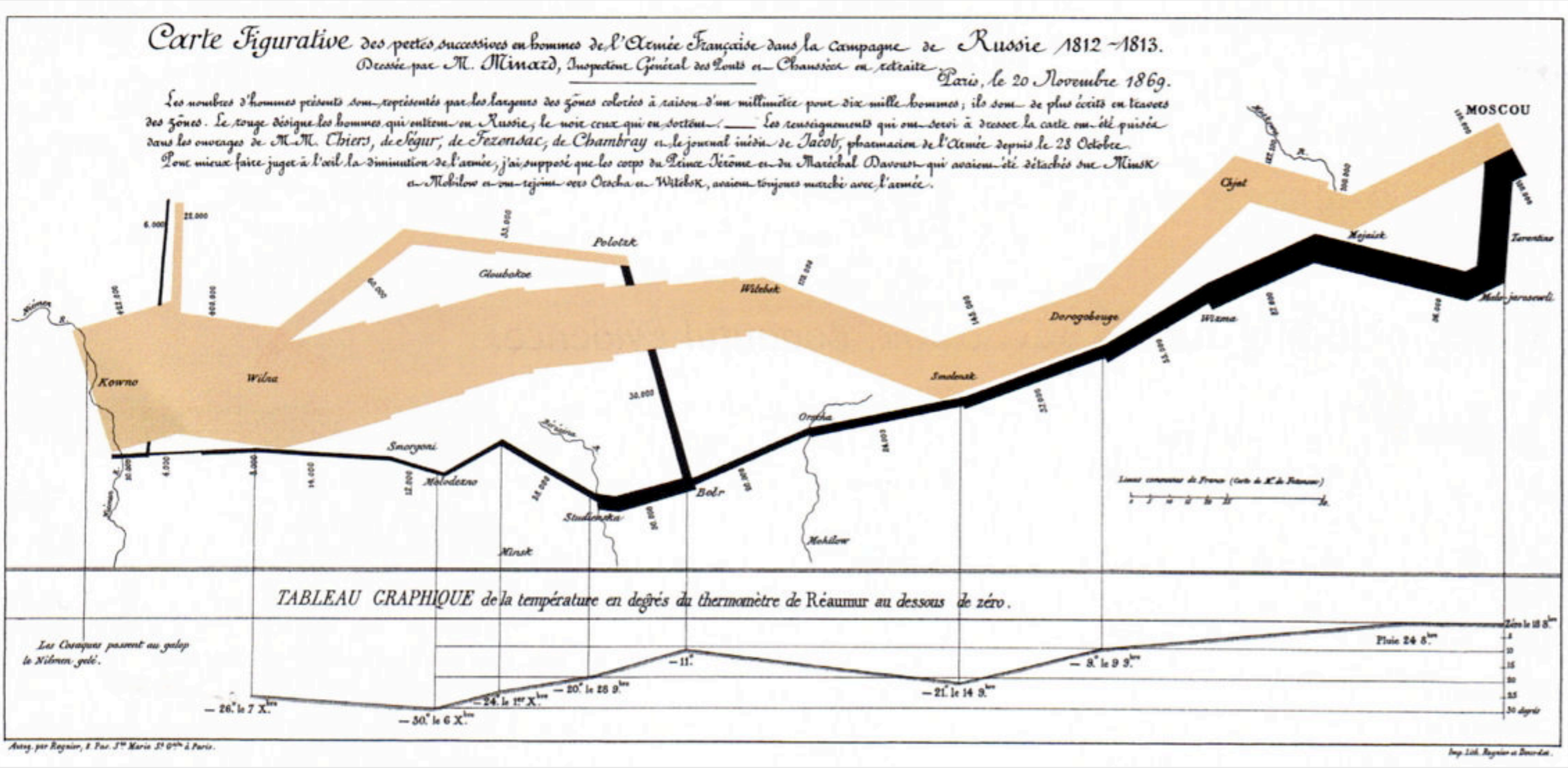
multidimensional data



napoleon's march to moscow

charles joseph minard

multidimensional data

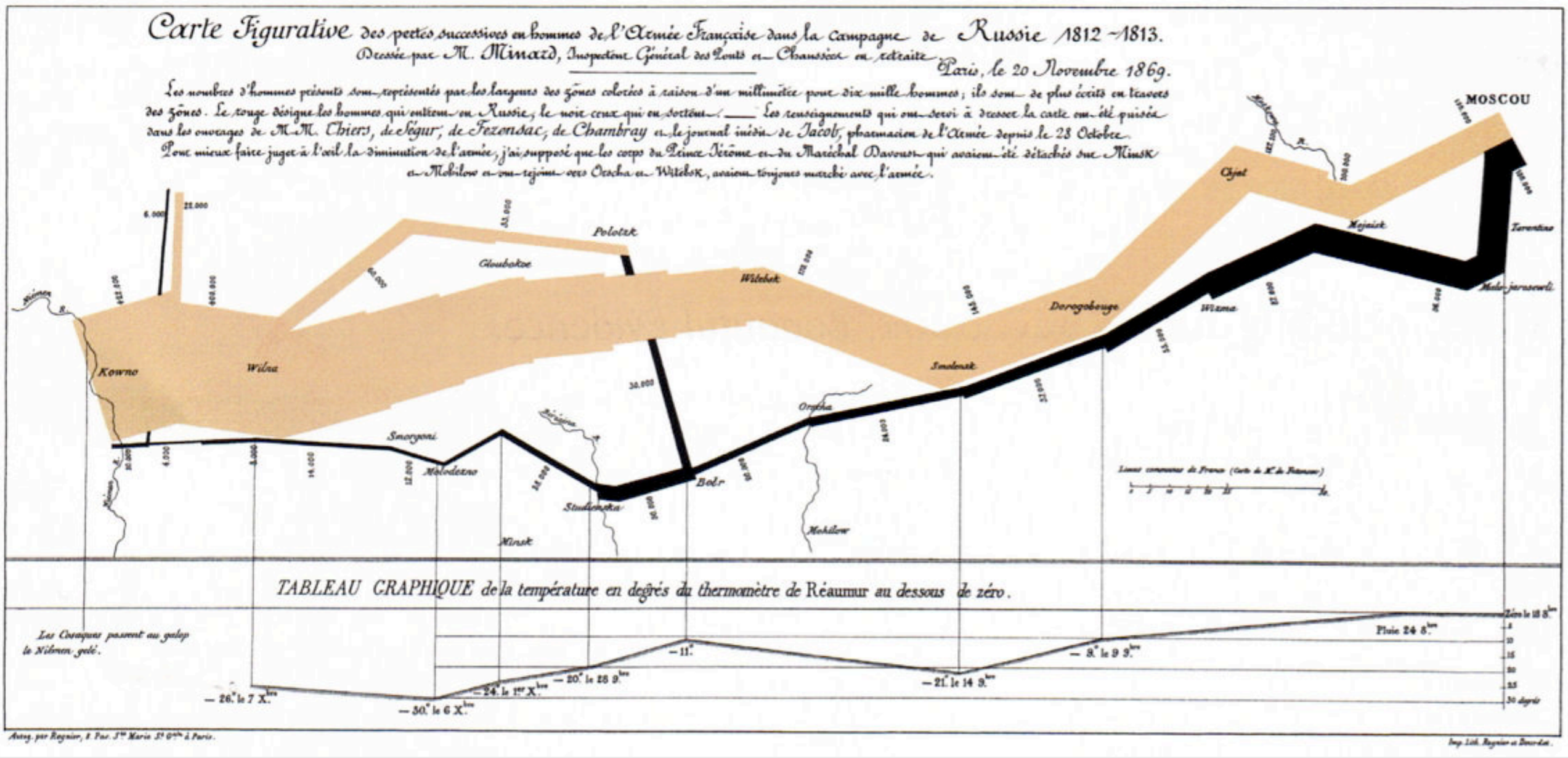


how many dimensions can you find?

napoleon's march to moscow

charles joseph minard

multidimensional data



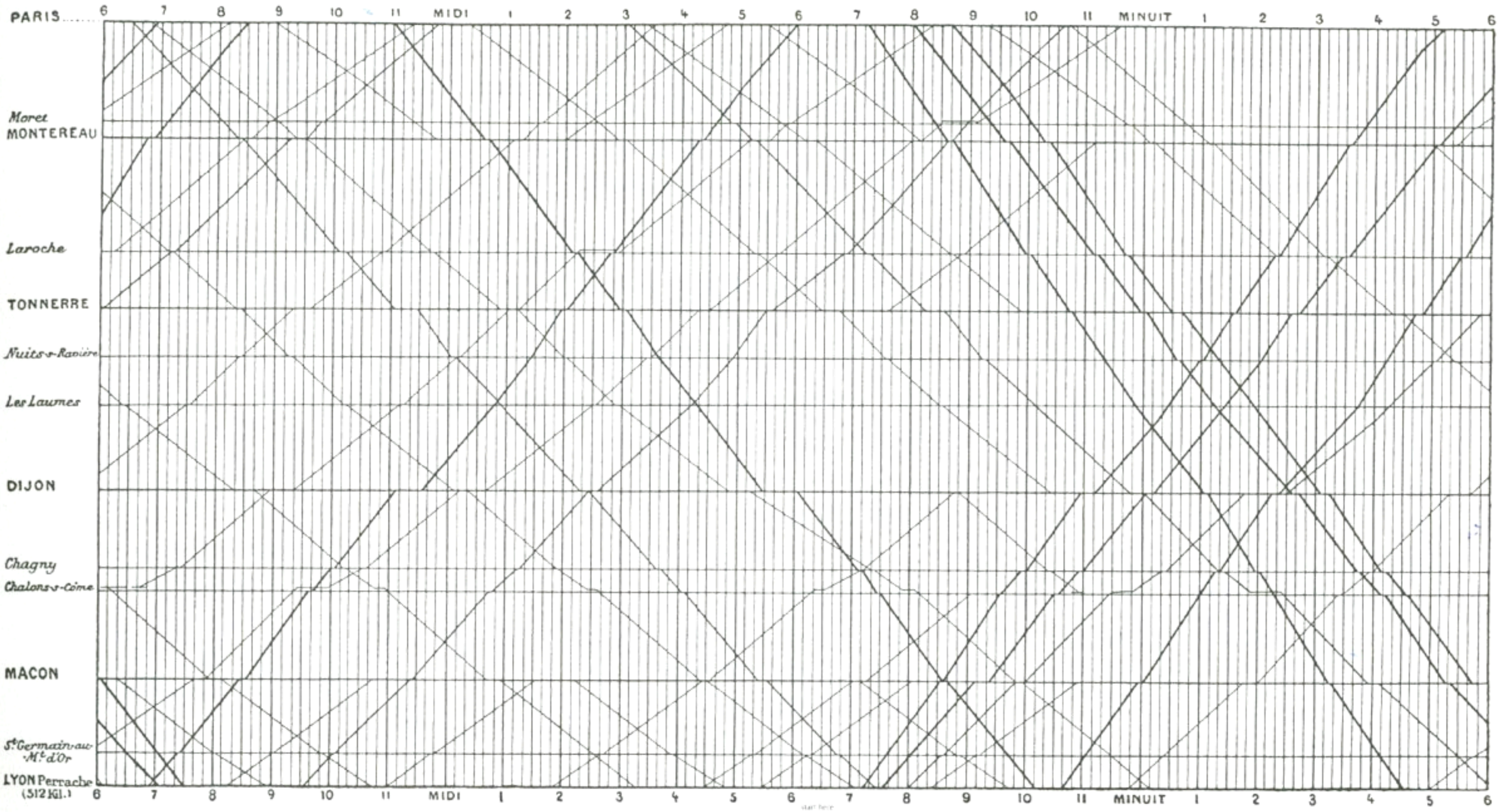
how many dimensions can you find?

ans: 1) size of the army 2-3) path (lat/lng) taken on a map
4) direction army was traveling 5) temperature 6) dates army reached particular locations

napoleon's march to moscow

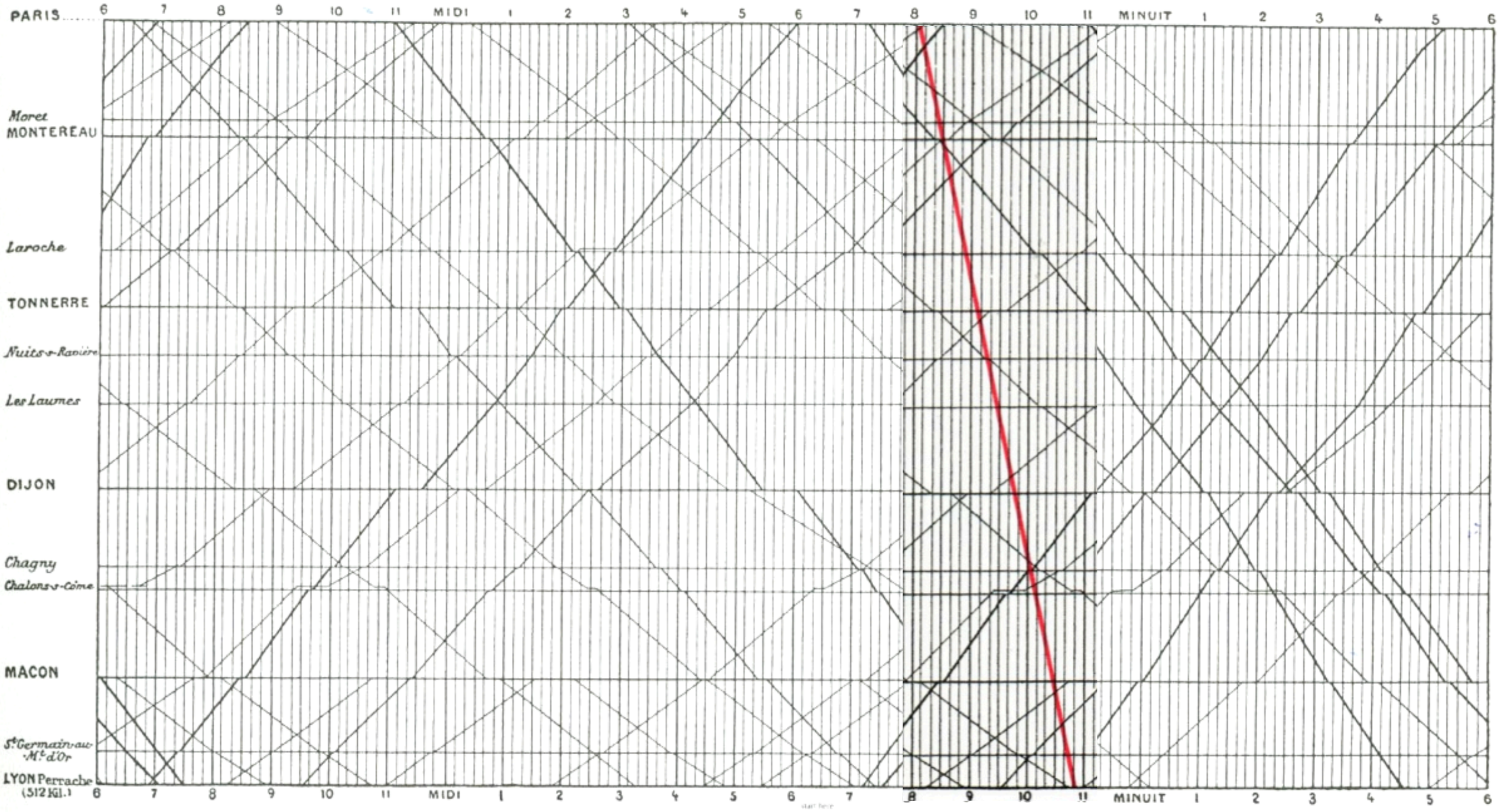
charles joseph minard

multidimensional data



E.J. Marey
La méthode graphique
(1885)

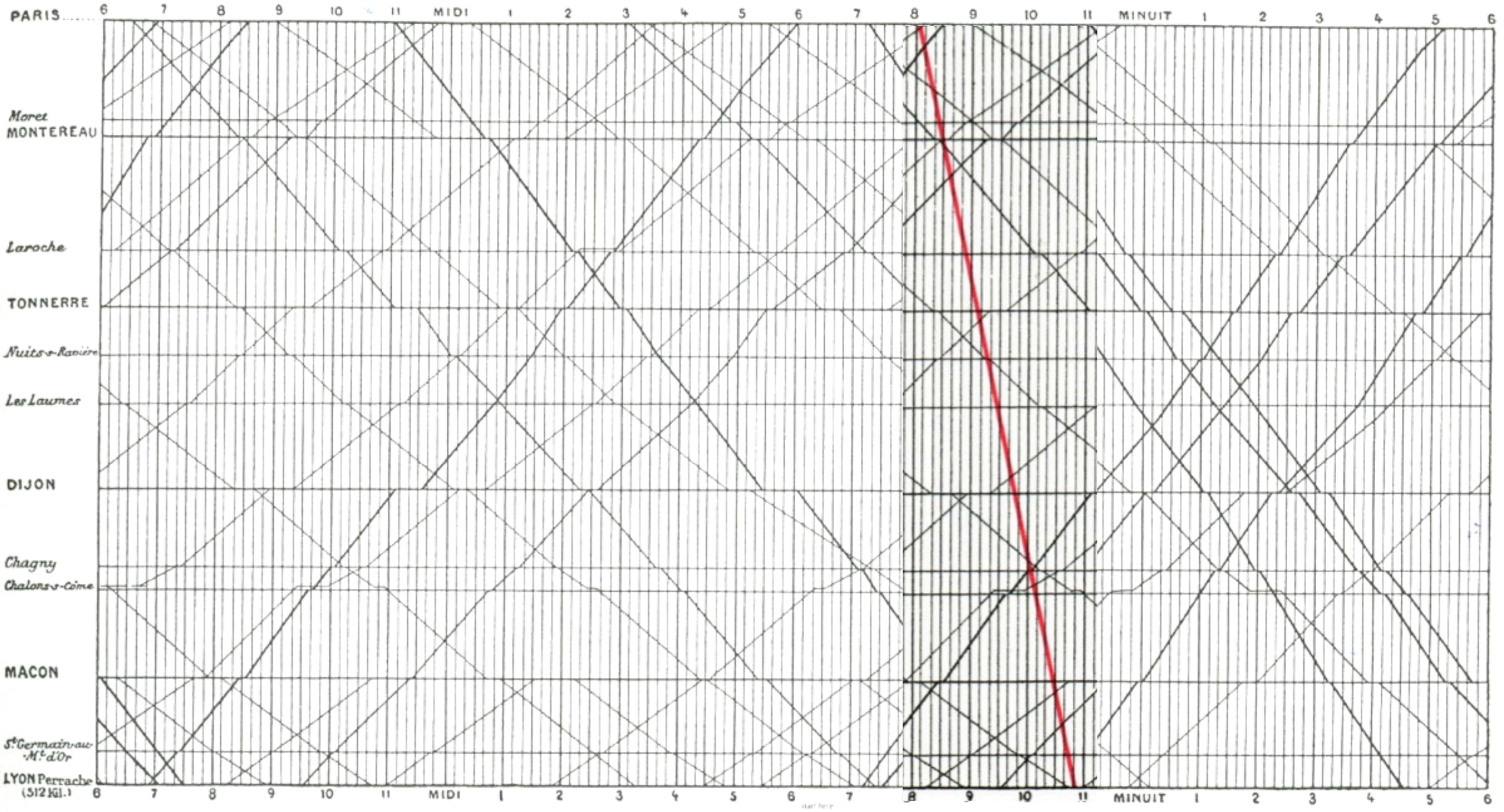
multidimensional data



E.J. Marey
La méthode graphique
(1885)

multidimensional data

TGV
Paris-Lyon



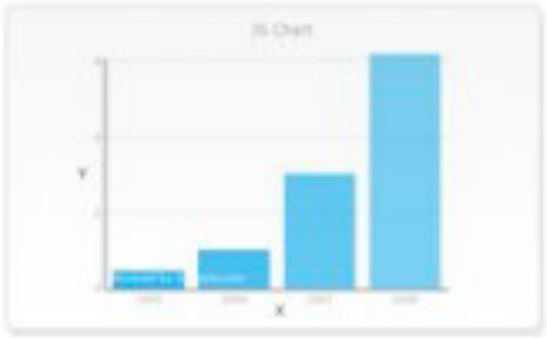
E.J. Marey
La méthode graphique
(1885)

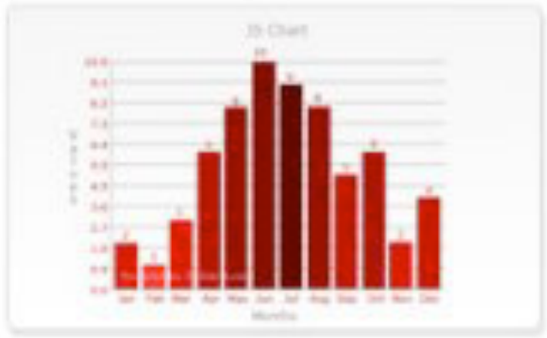
200 years that changed the world

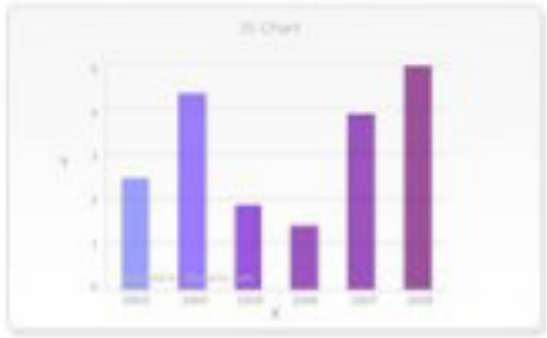
with Hans Rosling

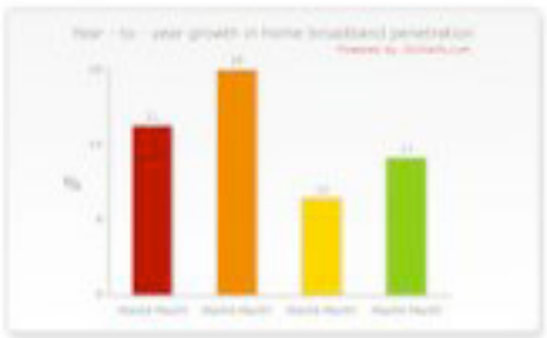
aaron koblin – flight patterns

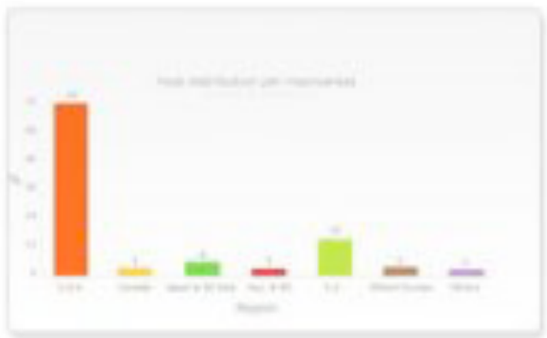
Android Global Activations Oct'08–Jan '11

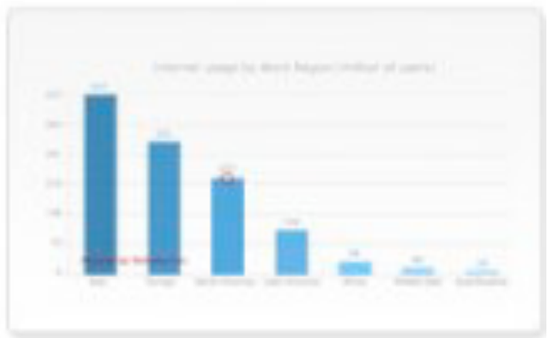


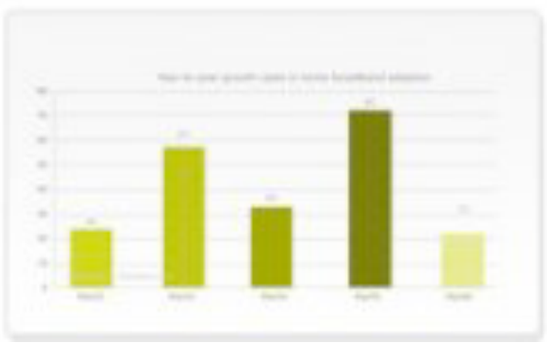


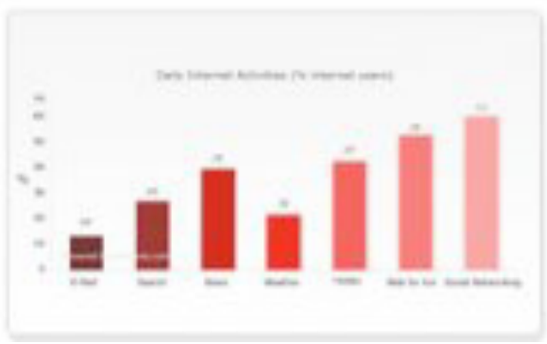












Standard Visualisation Techniques

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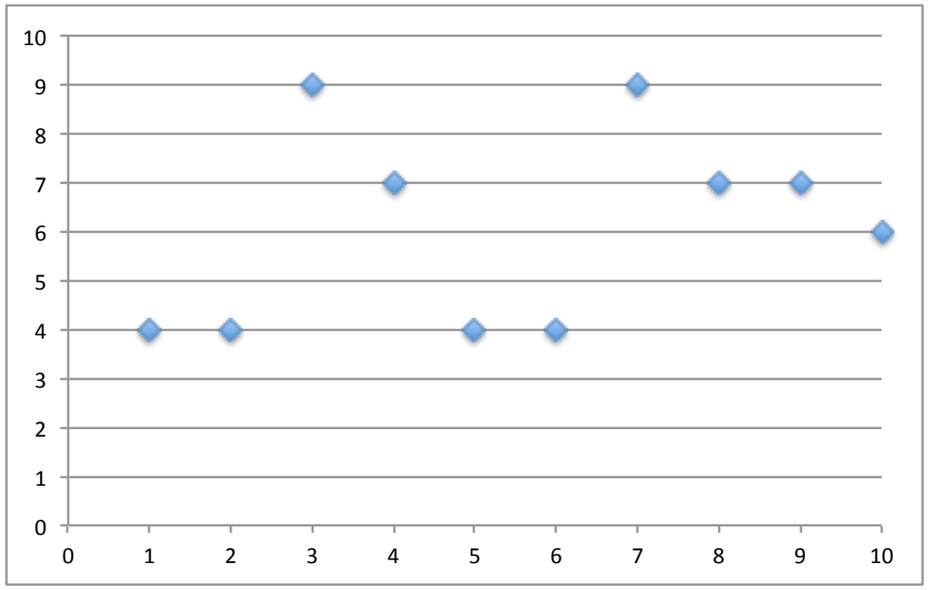

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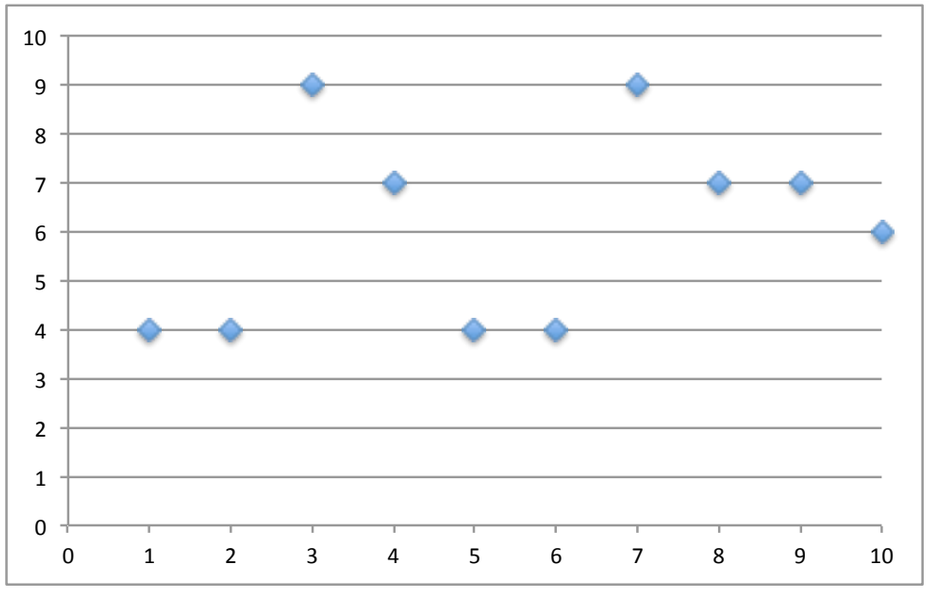

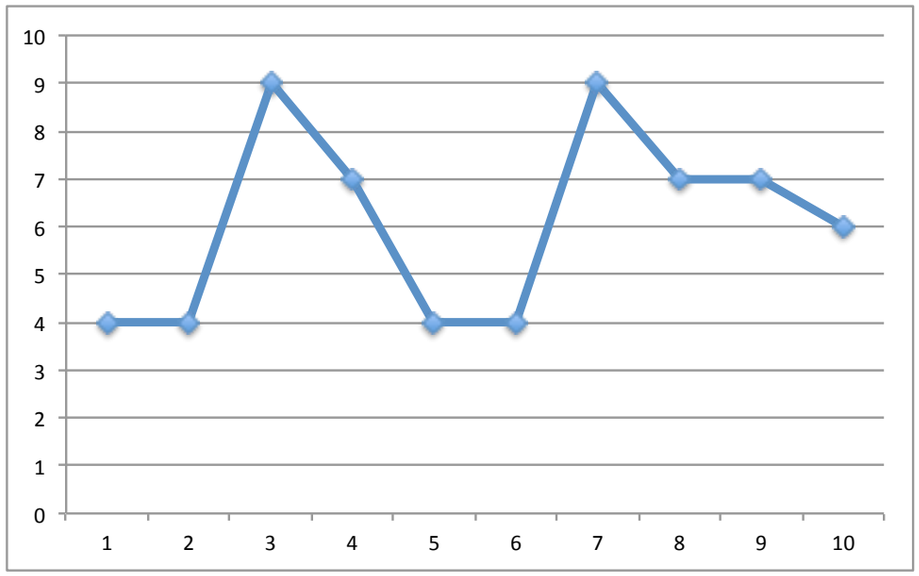

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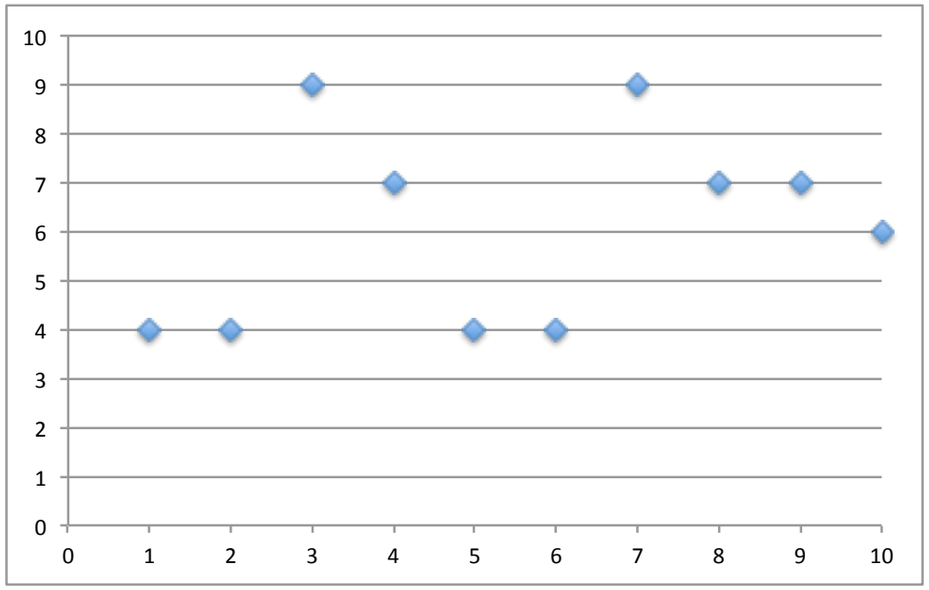
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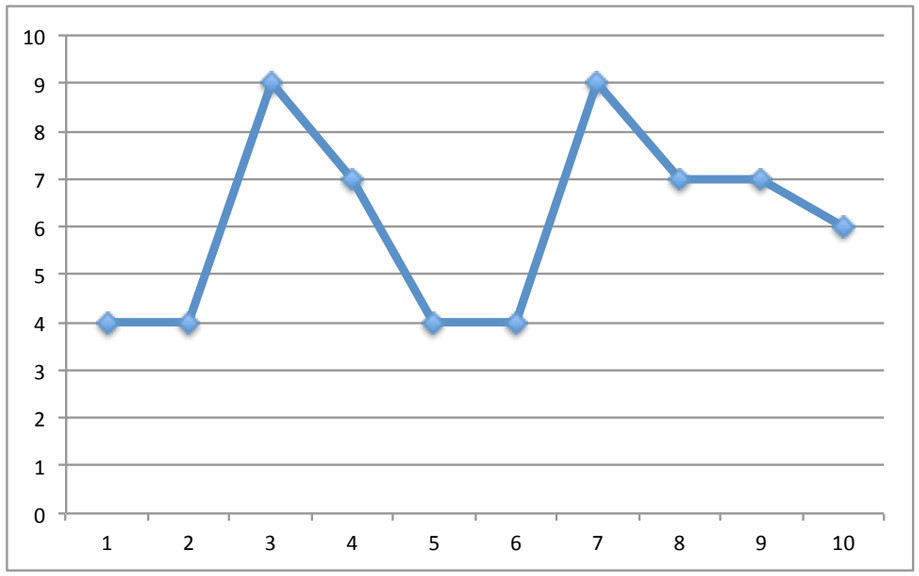
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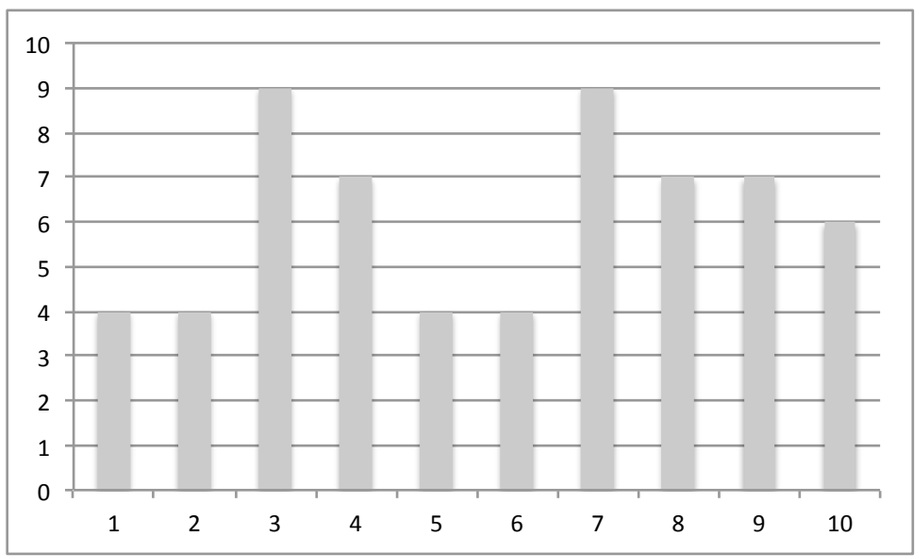
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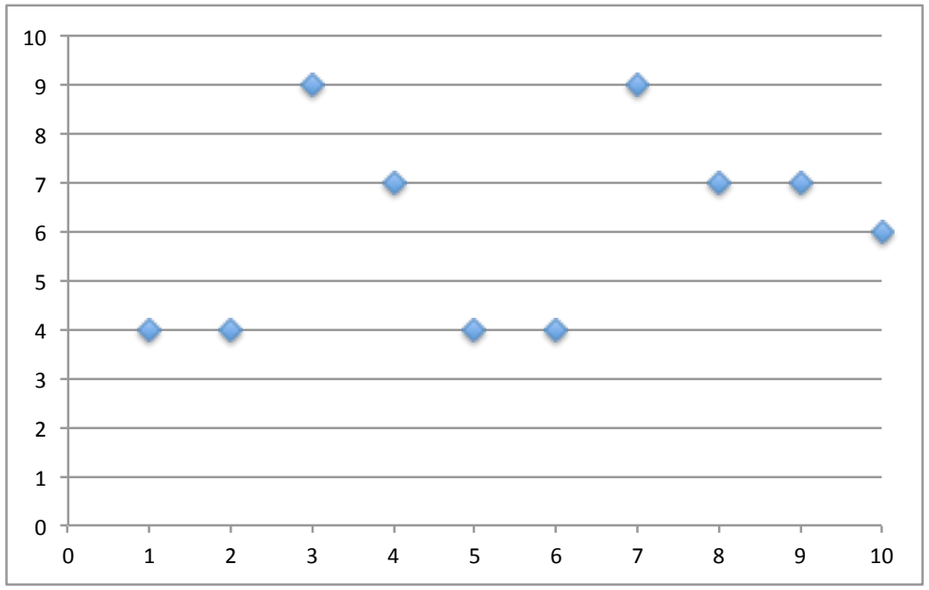

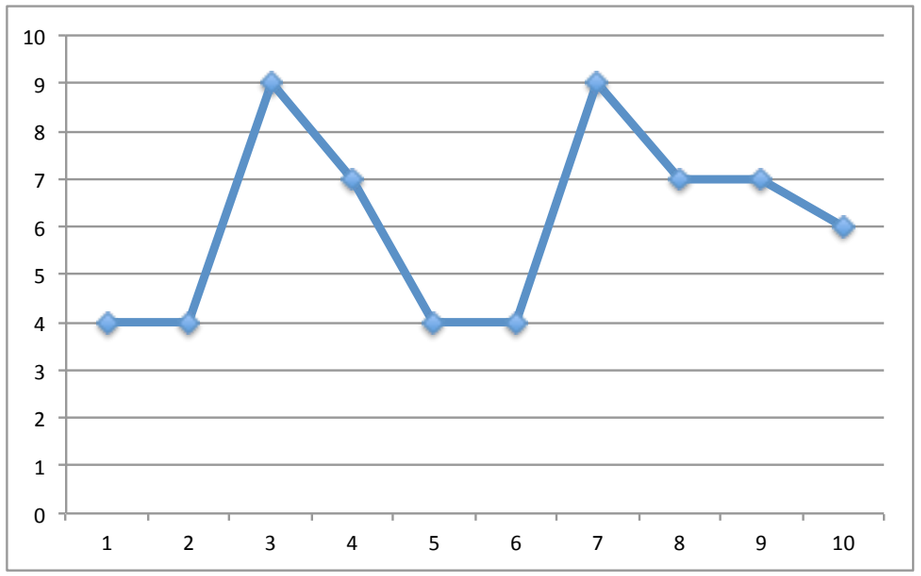

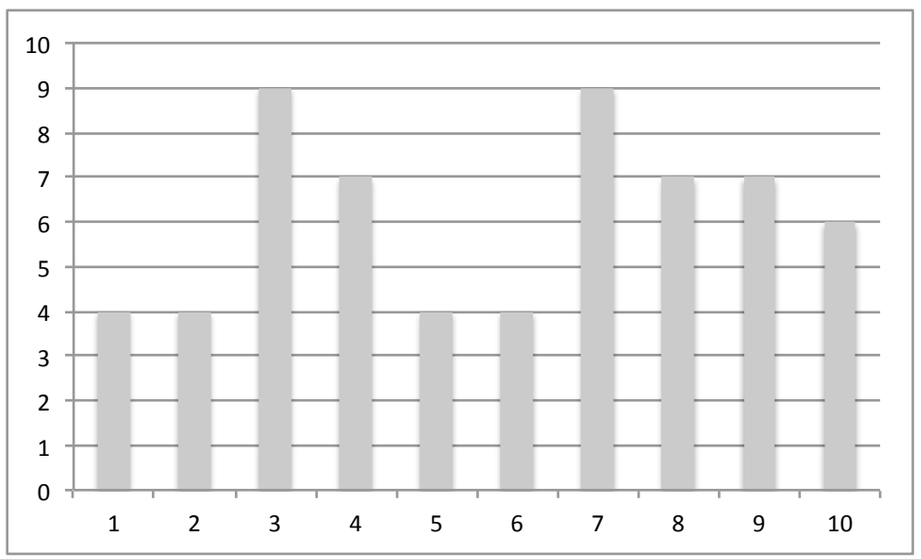

ordering significant

order insignificant

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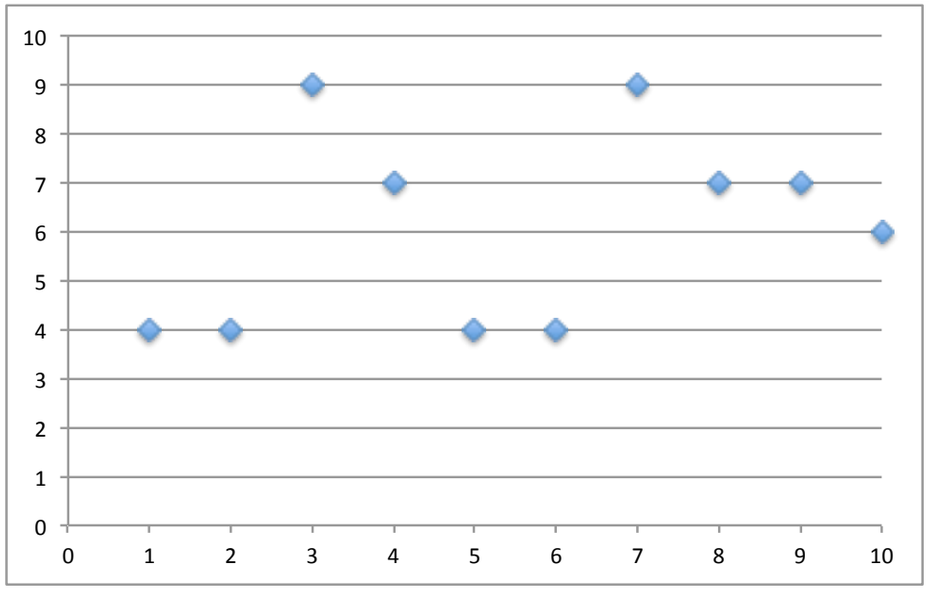

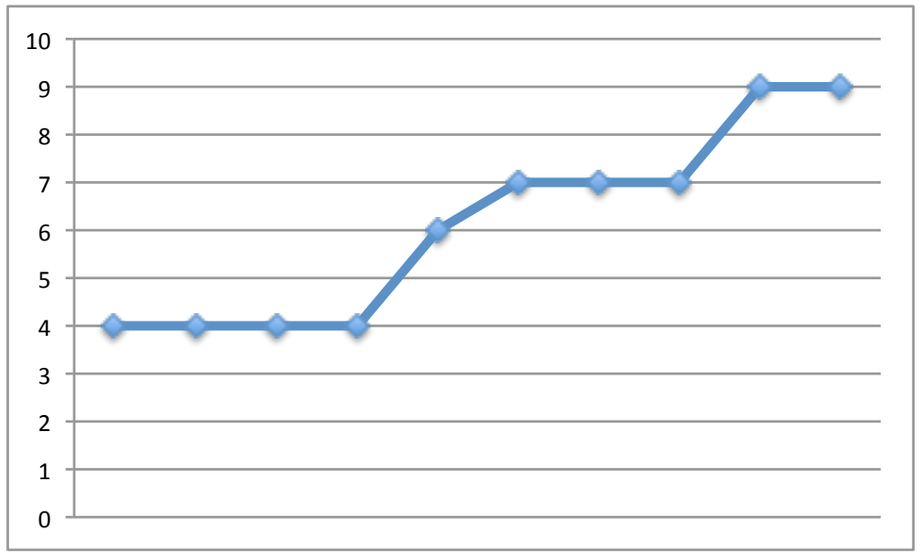

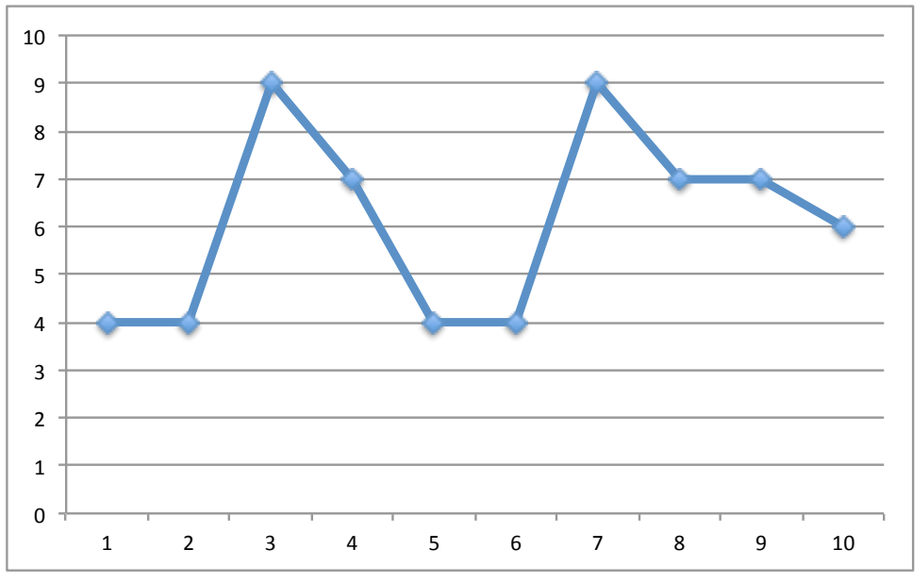

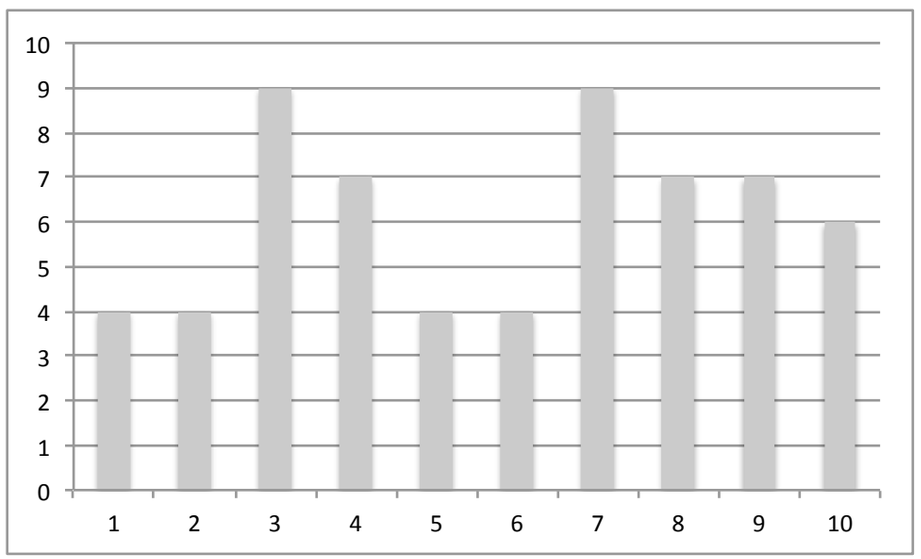

ordering significant

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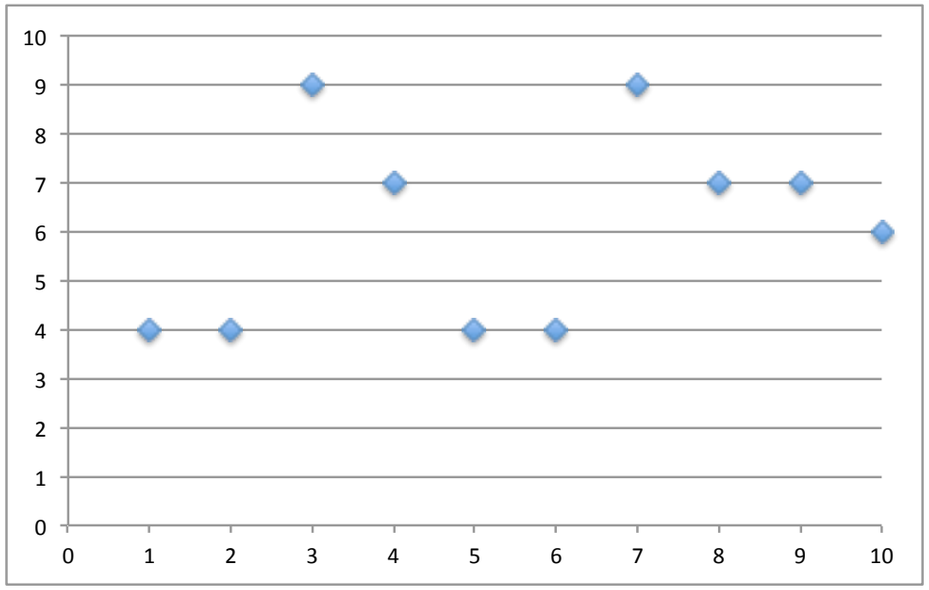
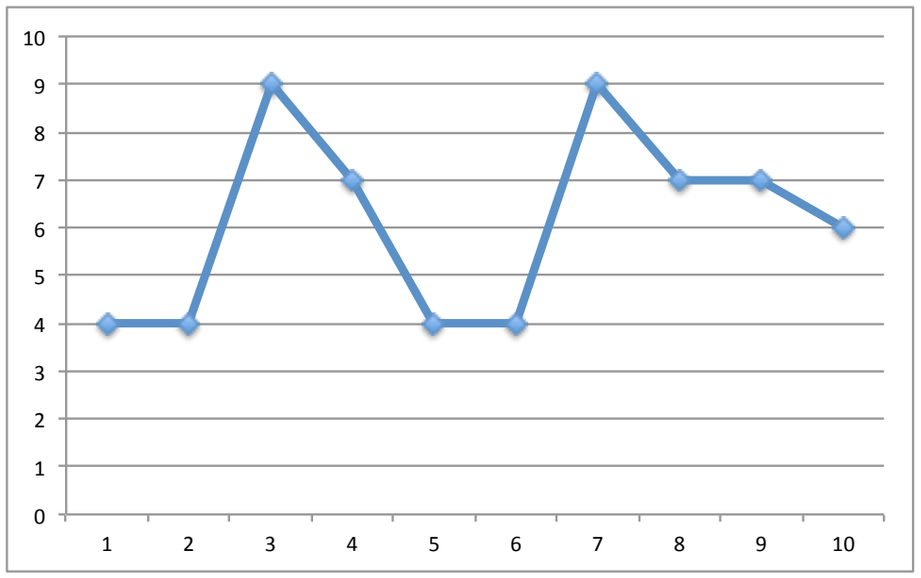
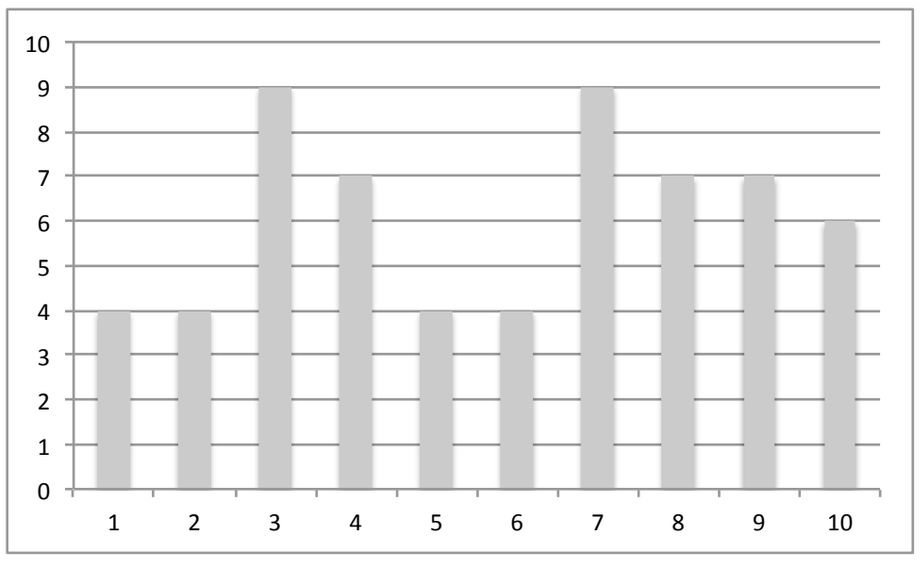
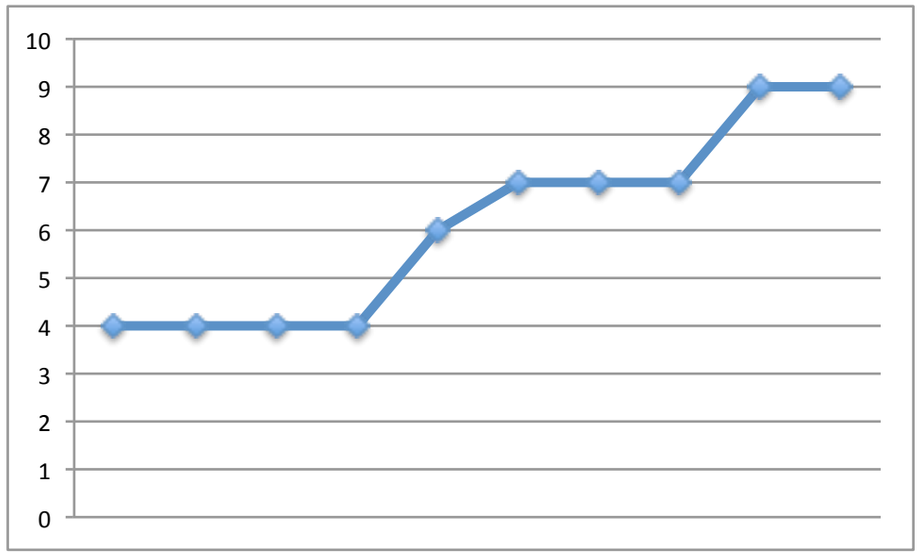
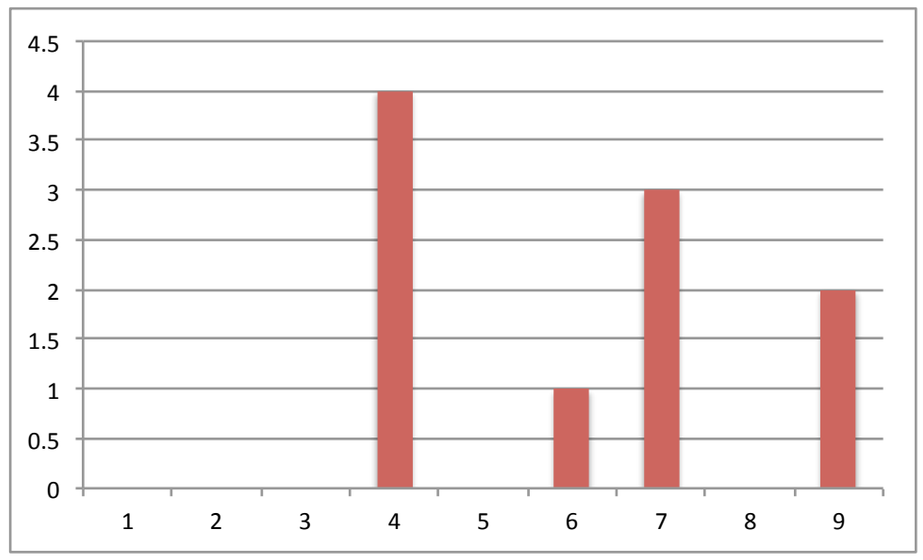






ordering significant





histogram

order insignificant

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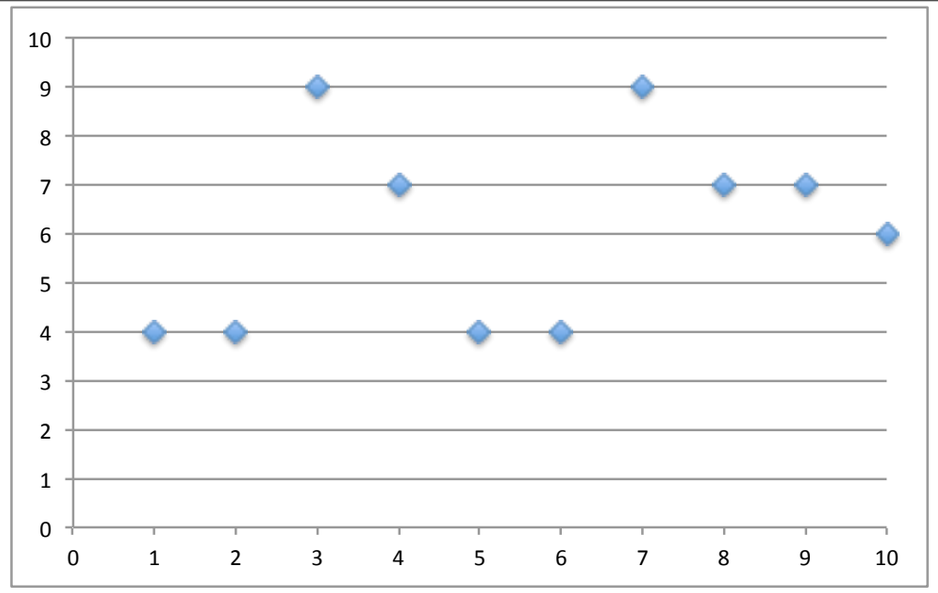

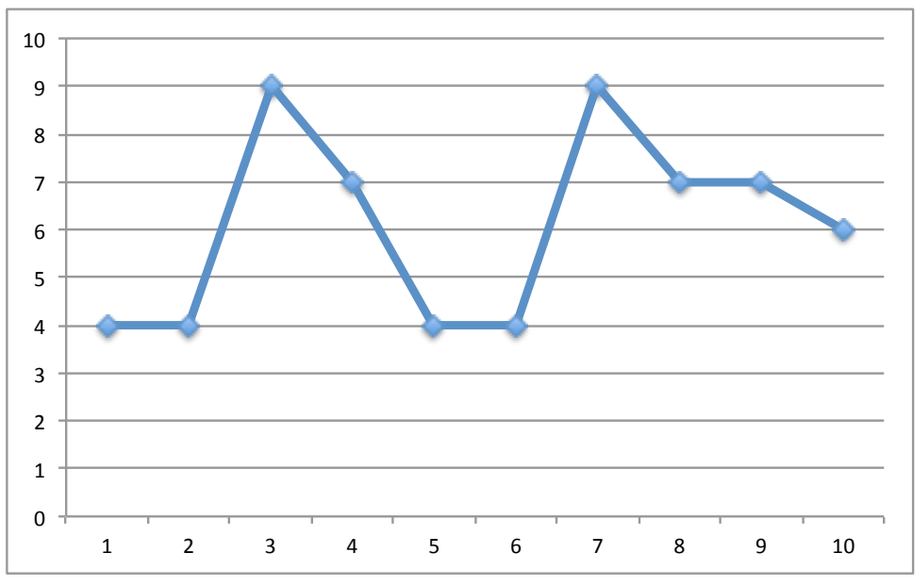

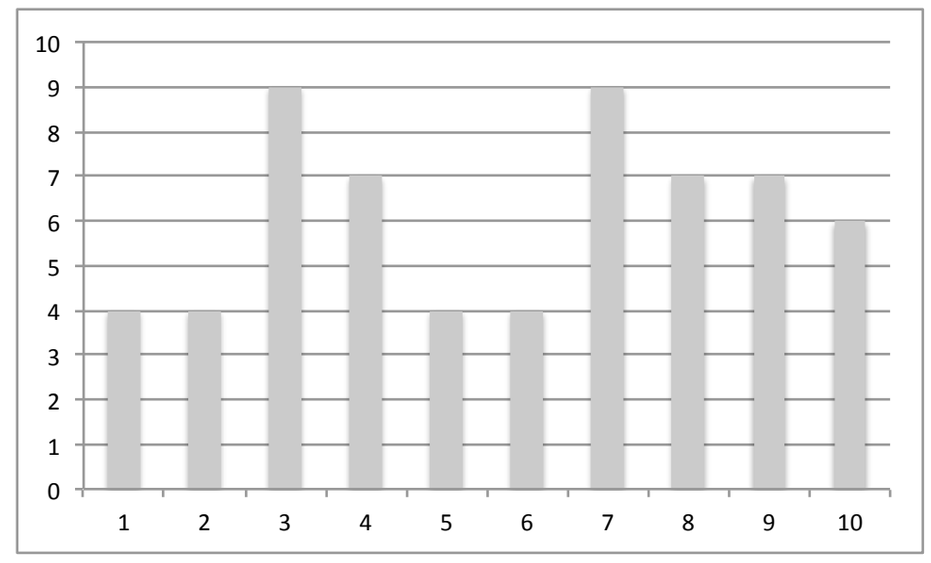

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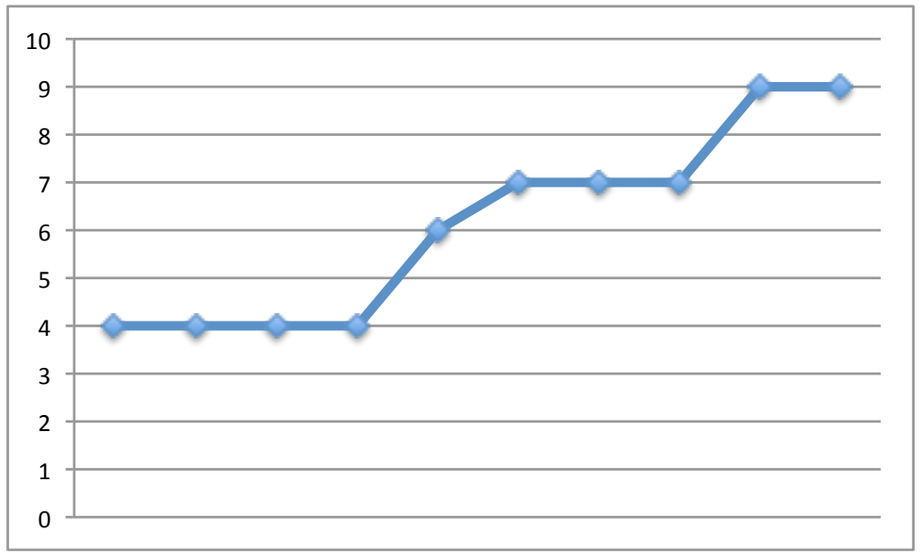
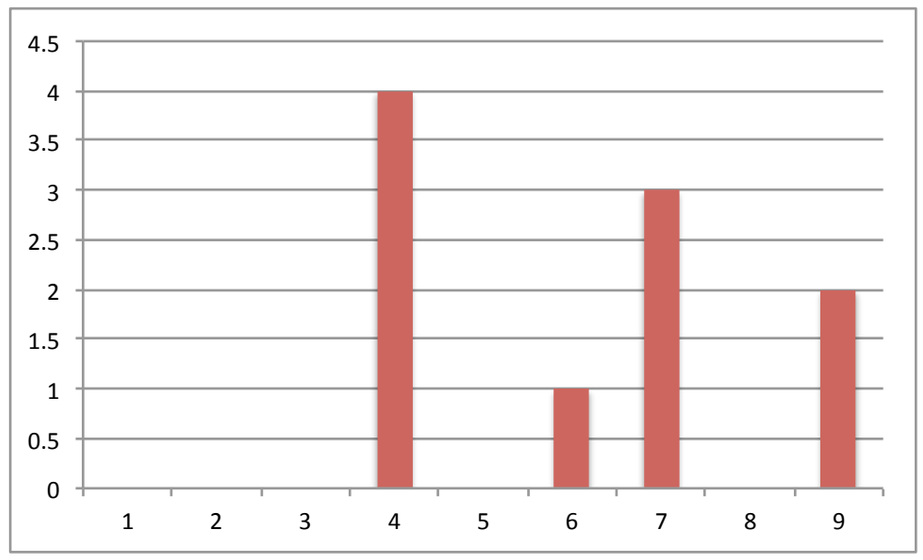
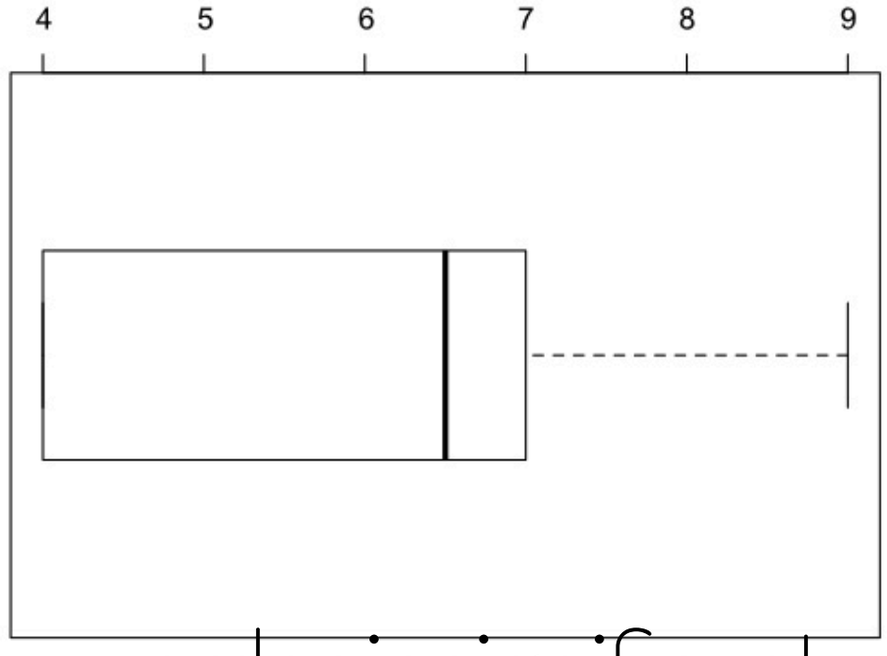


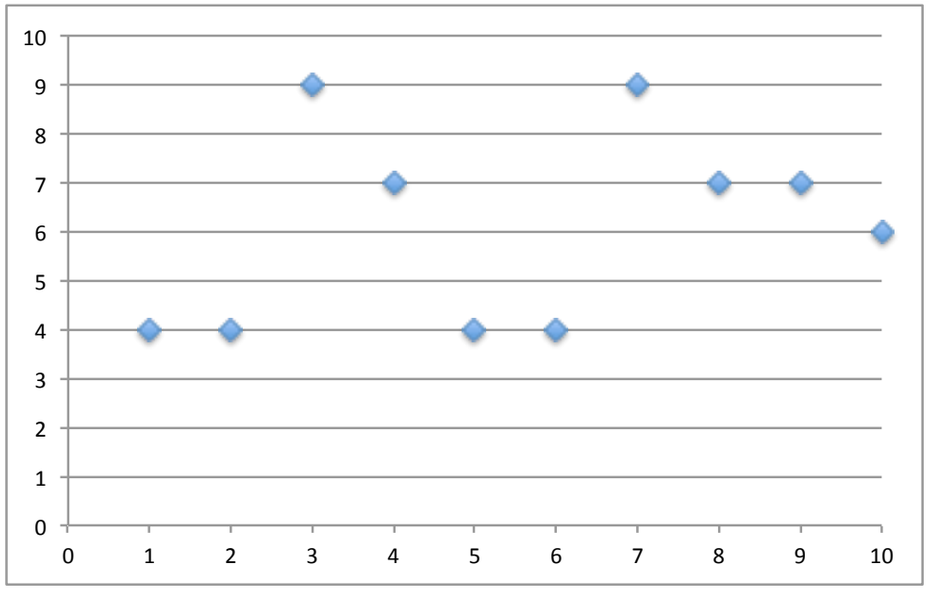


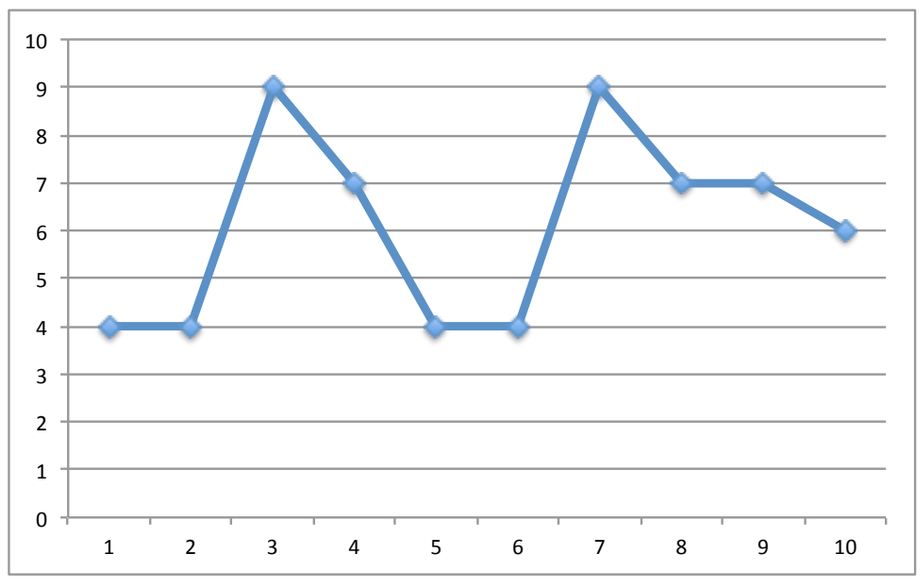
histogram

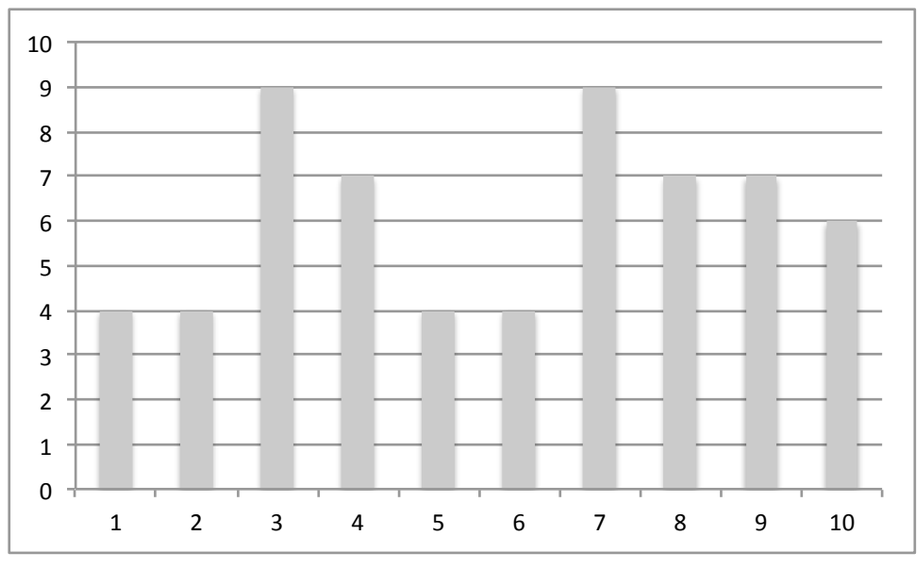


order insignificant

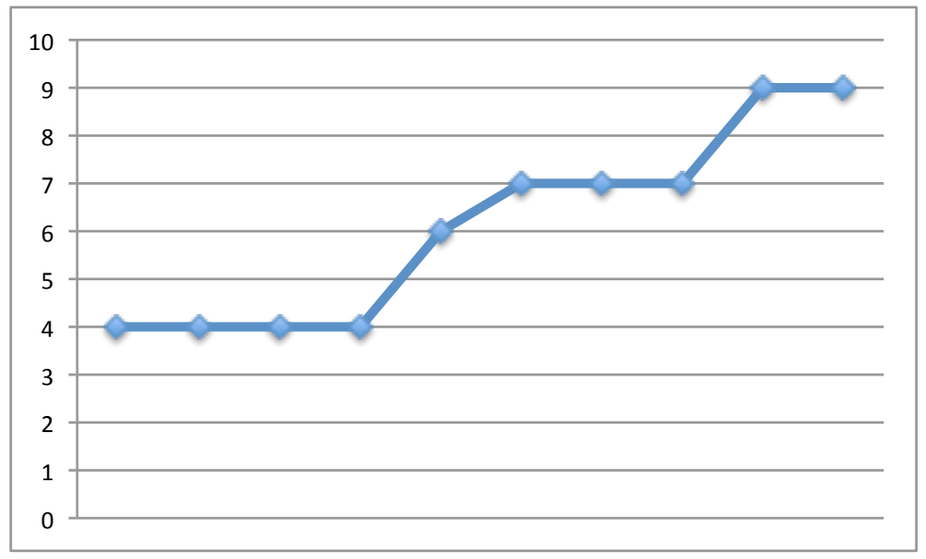
4 4 9 7 4 4 9 7 7 6



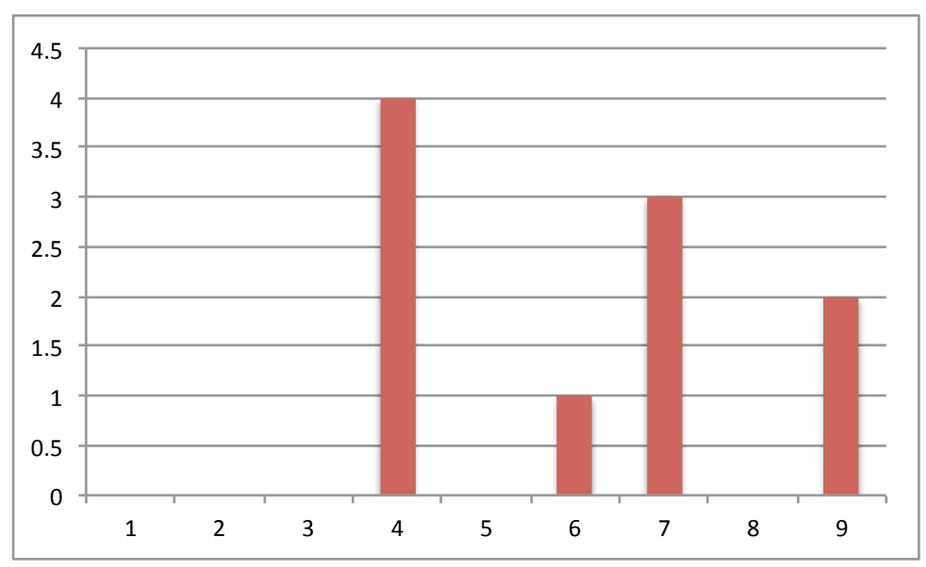




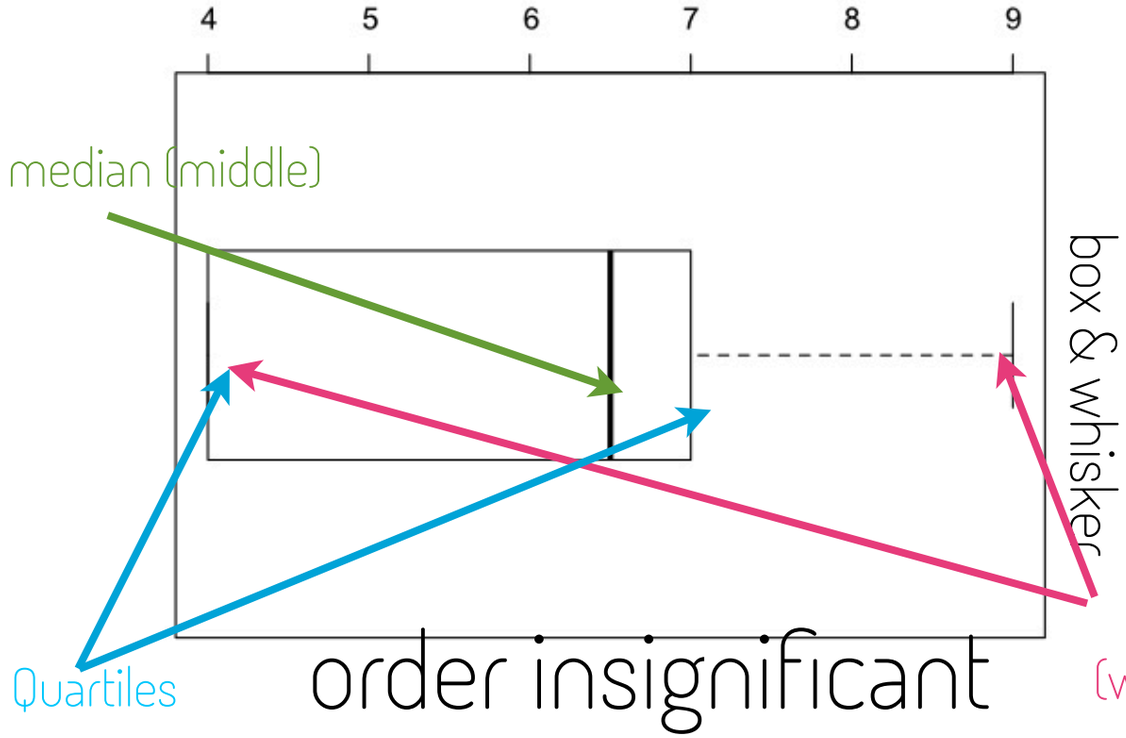
ordering significant



sorted

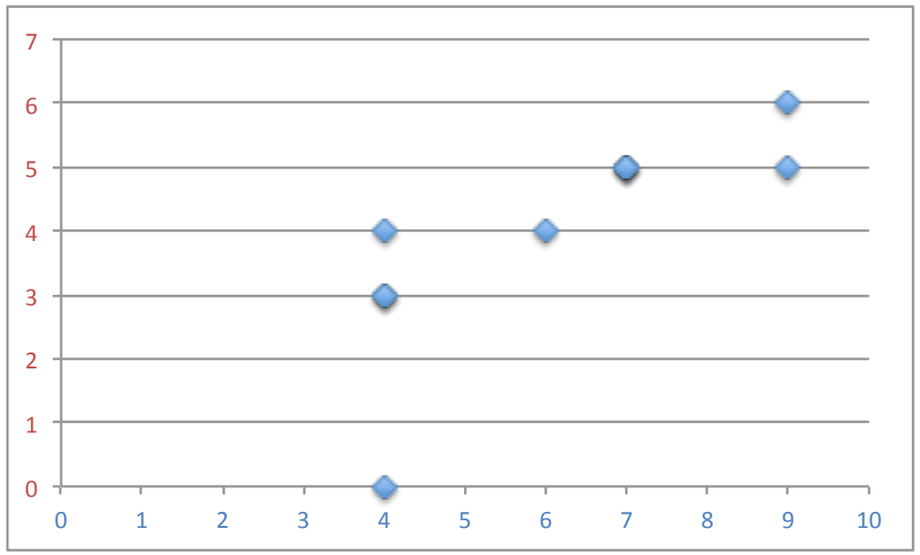


histogram

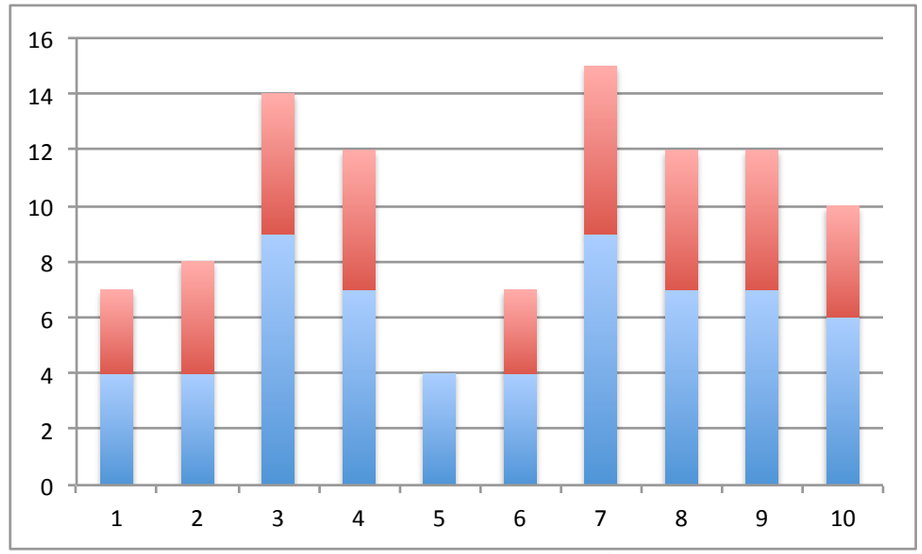


order insignificant

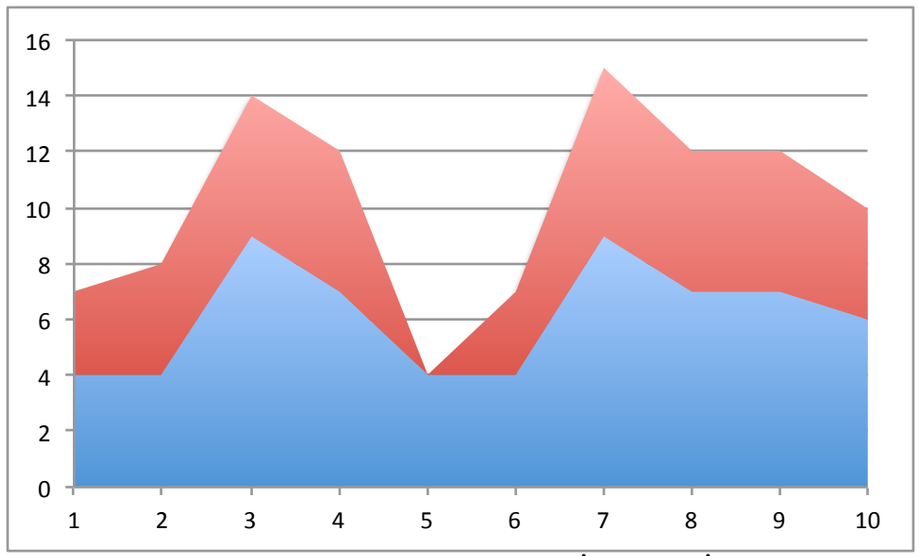
4	3
4	4
9	5
7	5
4	0
4	3
9	6
7	5
7	5
6	4



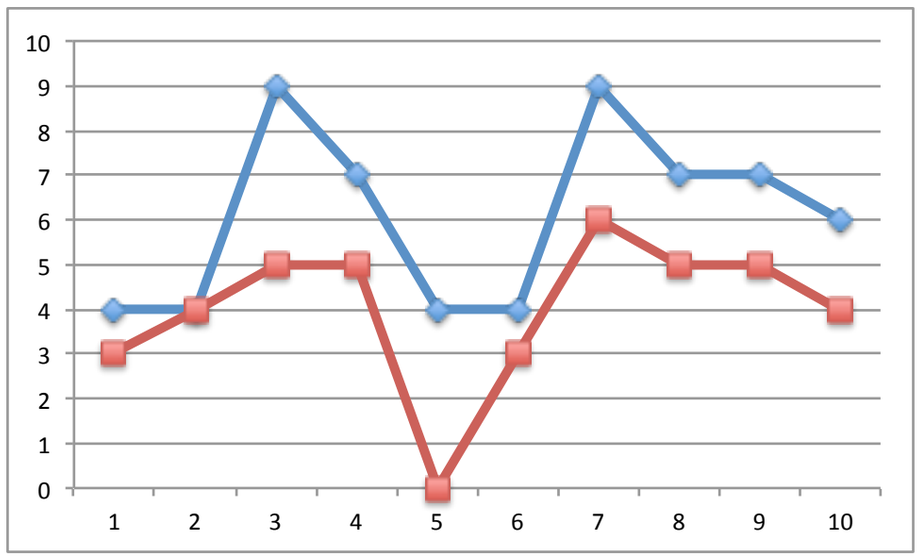
scatter



stacked bar



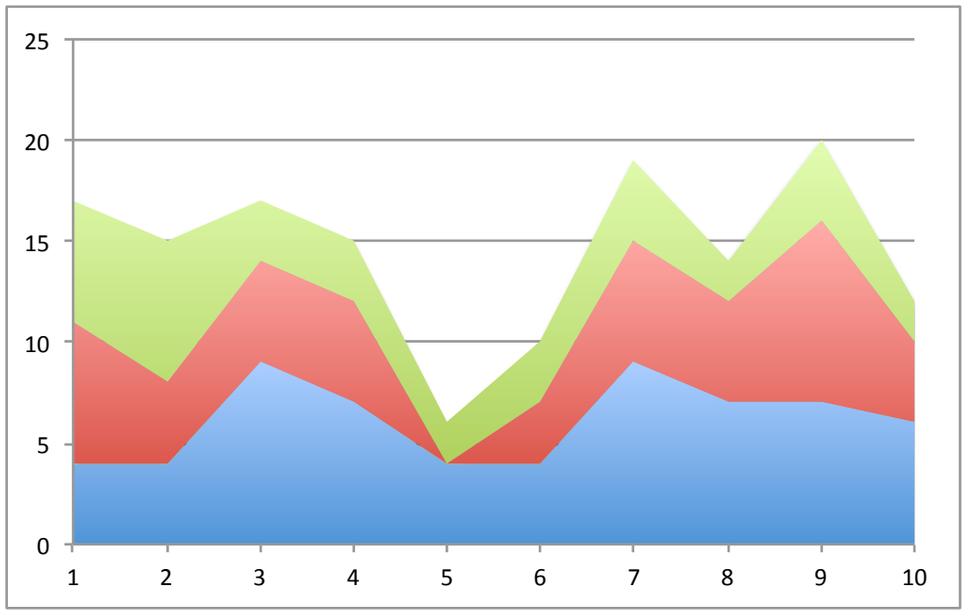
stacked area



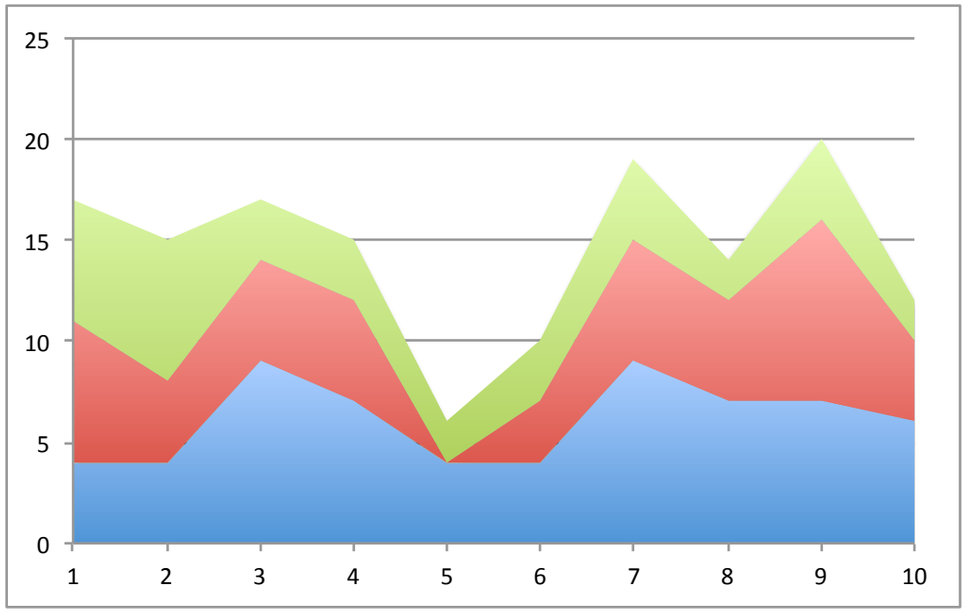
(independent)
line chart

(an aside: bad stacked areas and “streamgraphs”)

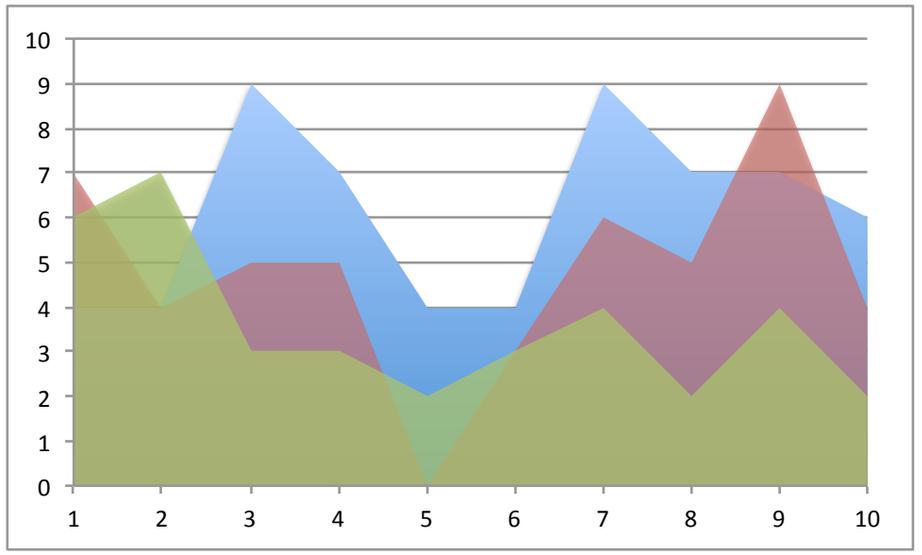
(an aside: bad stacked areas and "streamgraphs")



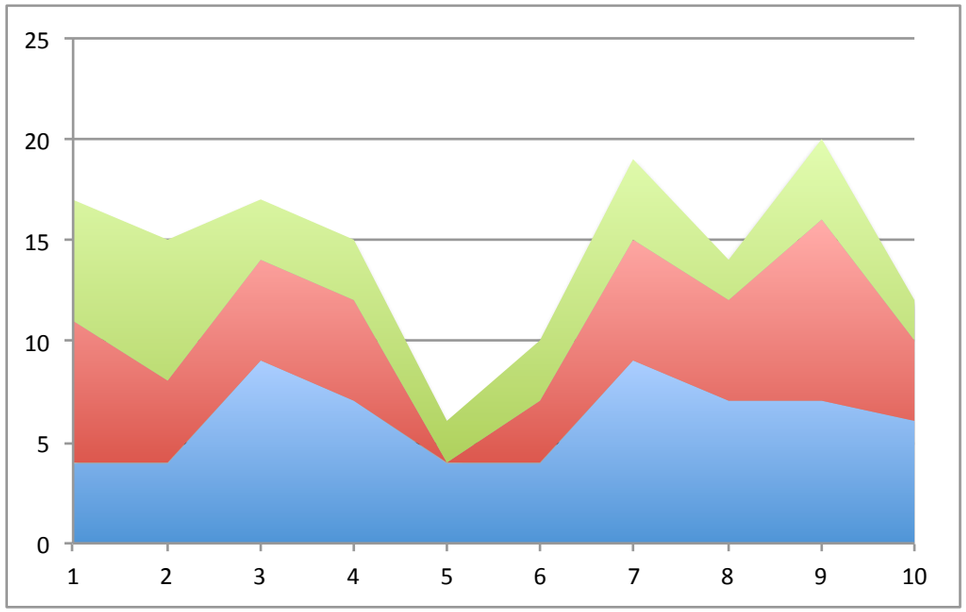
(an aside: bad stacked areas and "streamgraphs")



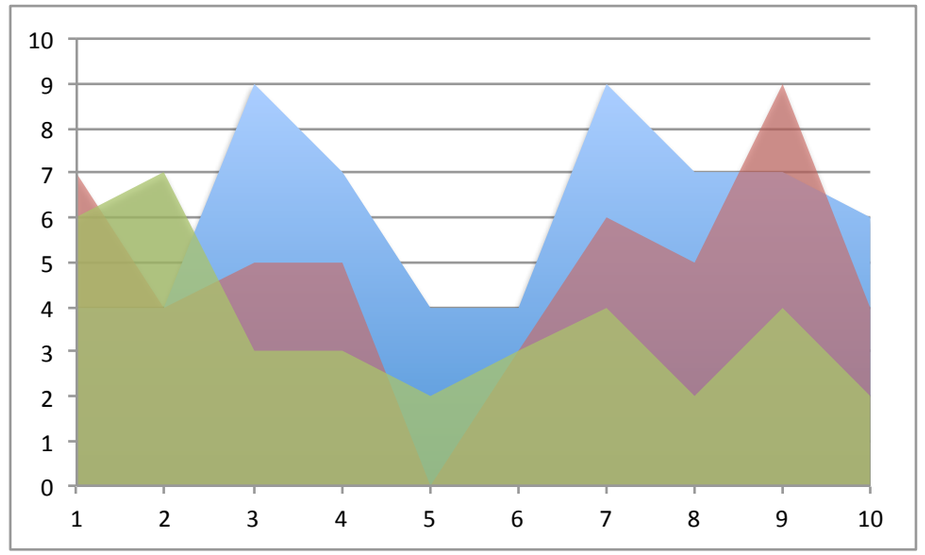
?

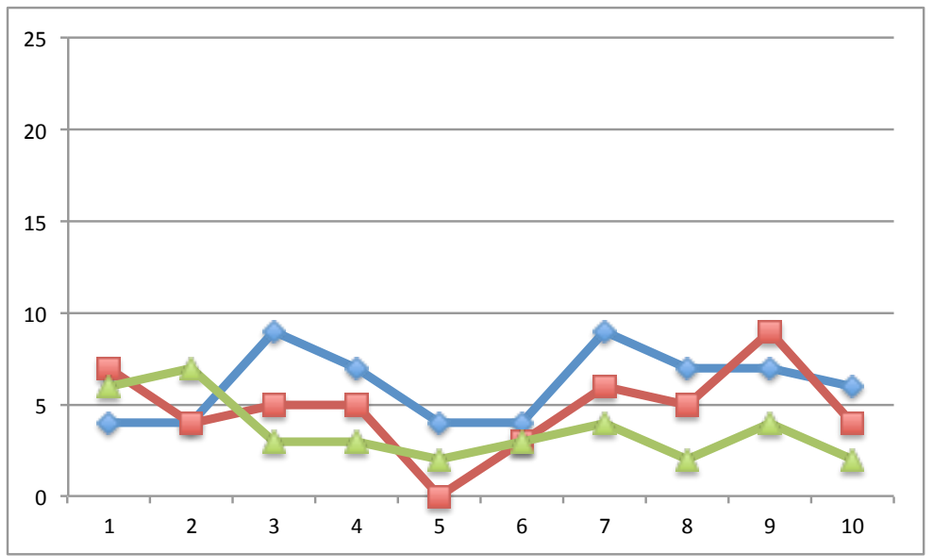


(an aside: bad stacked areas and "streamgraphs")

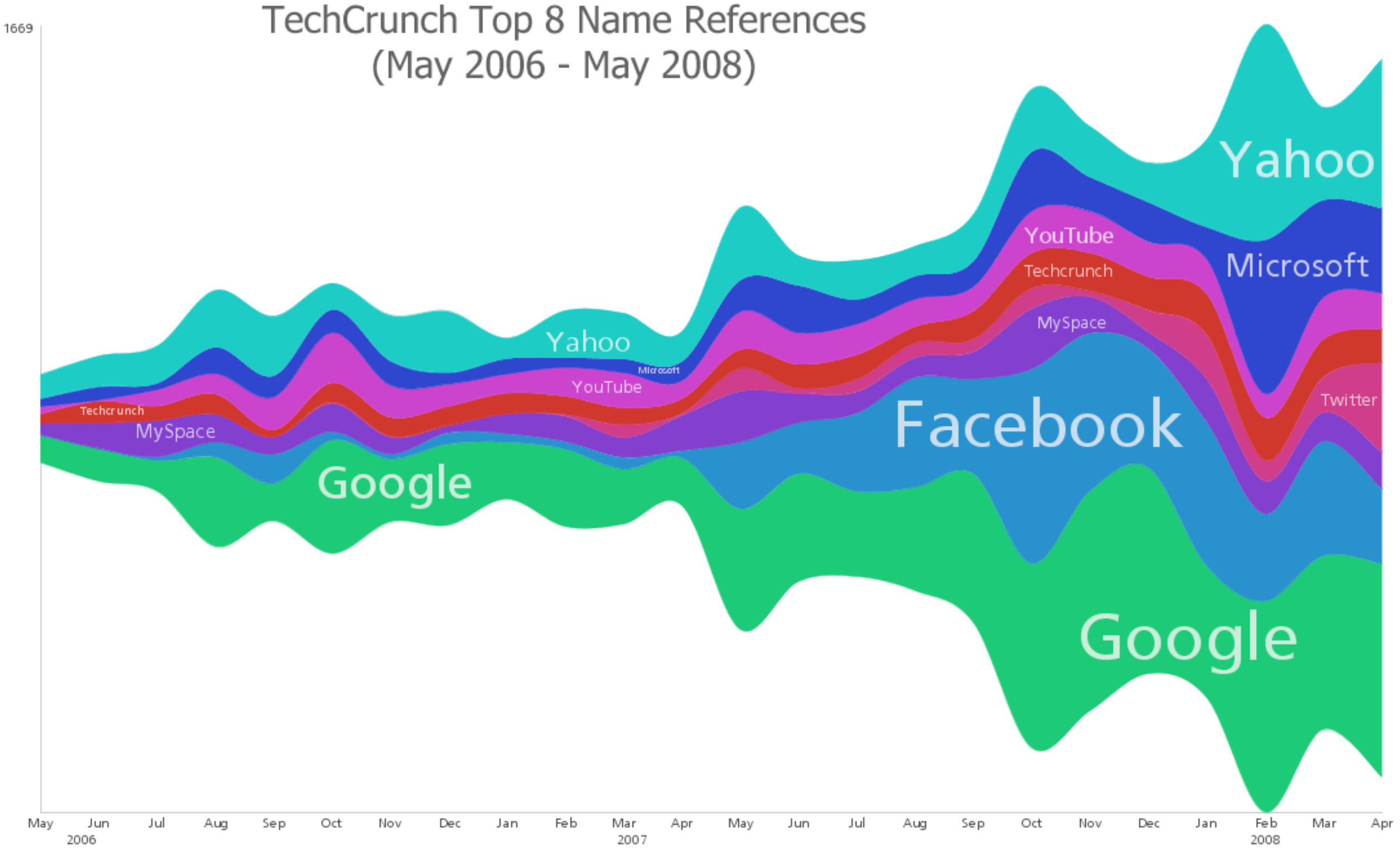


?



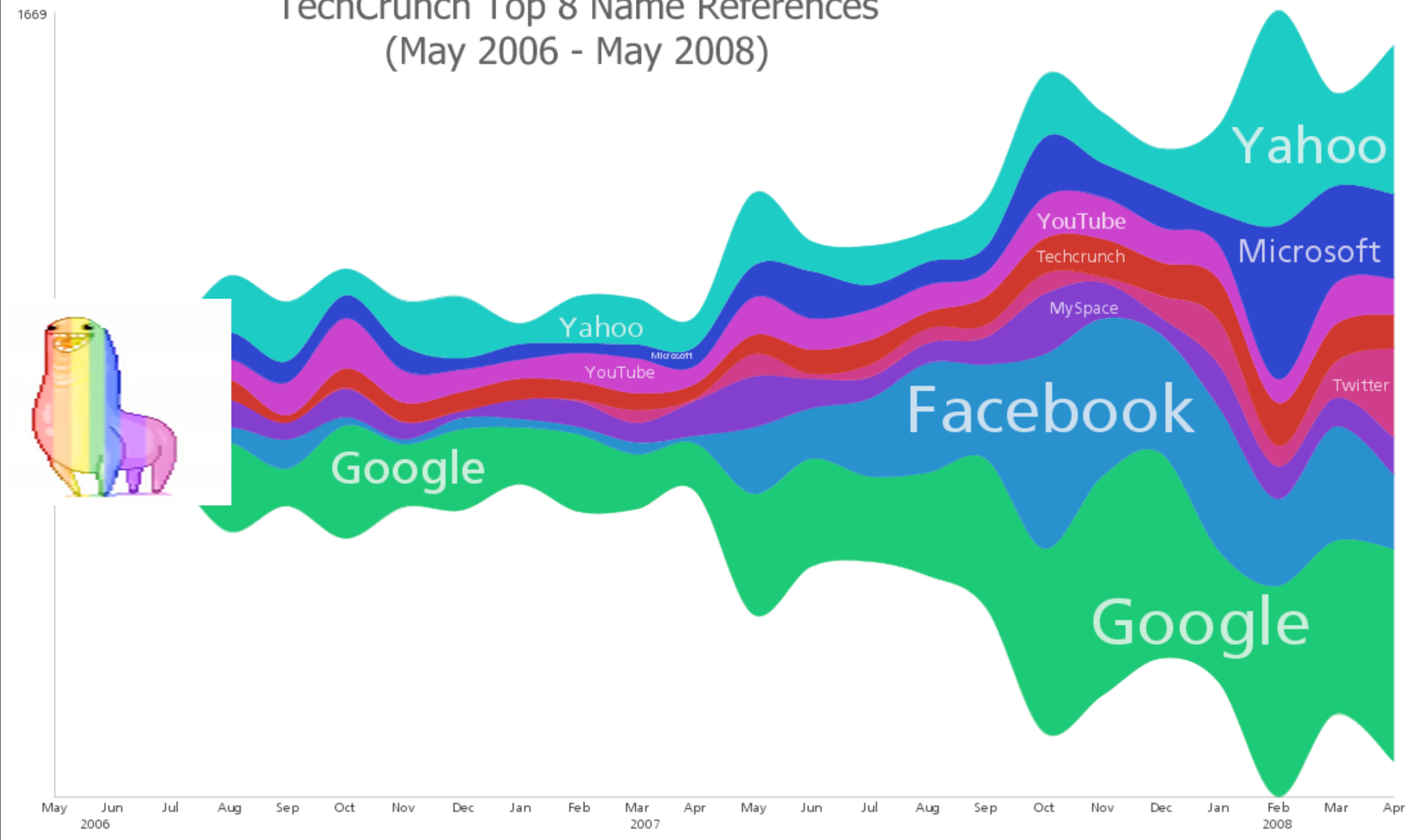


(an aside: bad stacked areas and "streamgraphs")



"abandon all hope ye who vieweth"

(an aside: bad stacked areas and "streamgraphs")

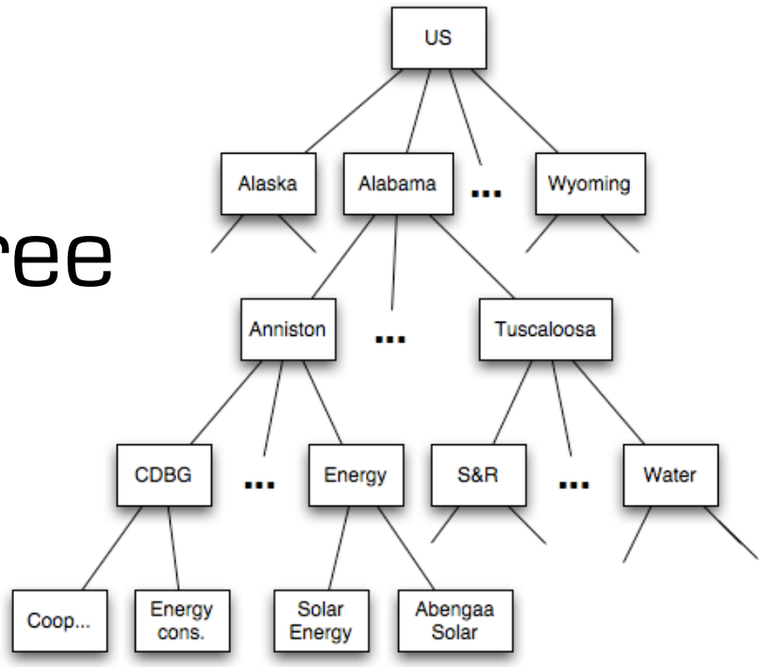


"abandon all hope ye who vieweth"

multivariate relational data: hierarchical

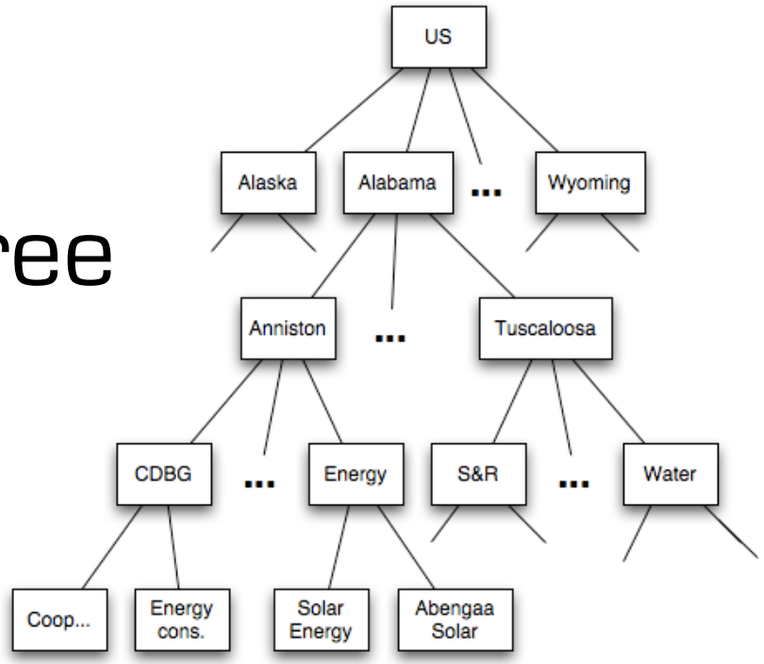
multivariate relational data: hierarchical

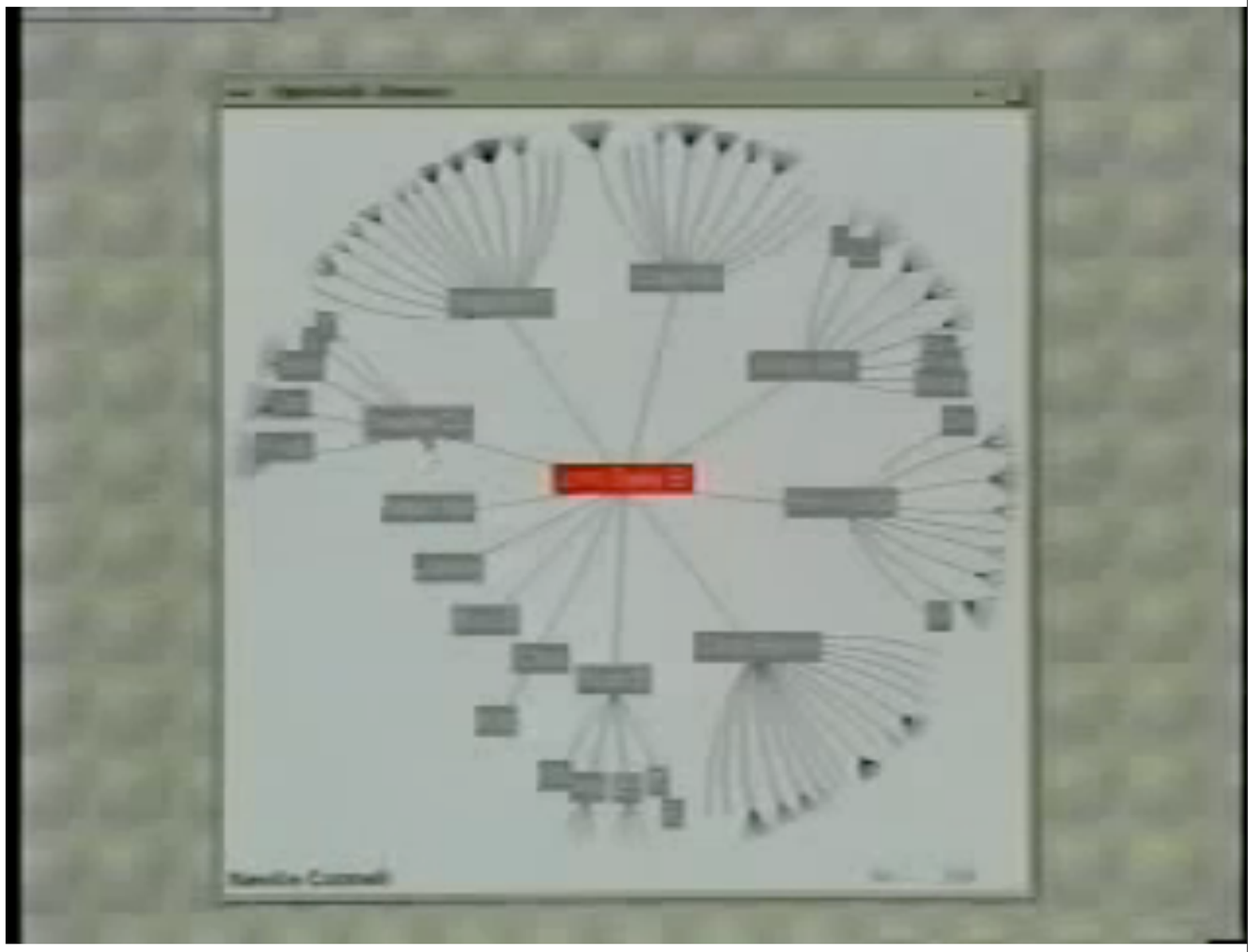
tree

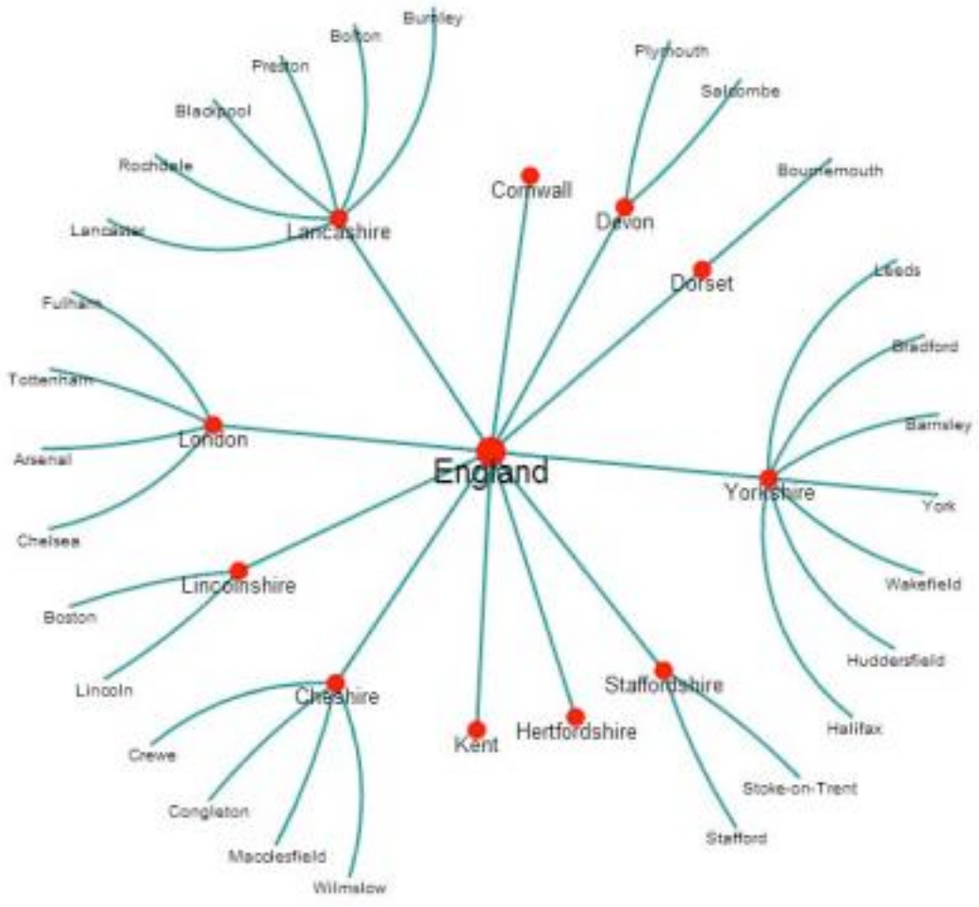


multivariate relational data: hierarchical

tree



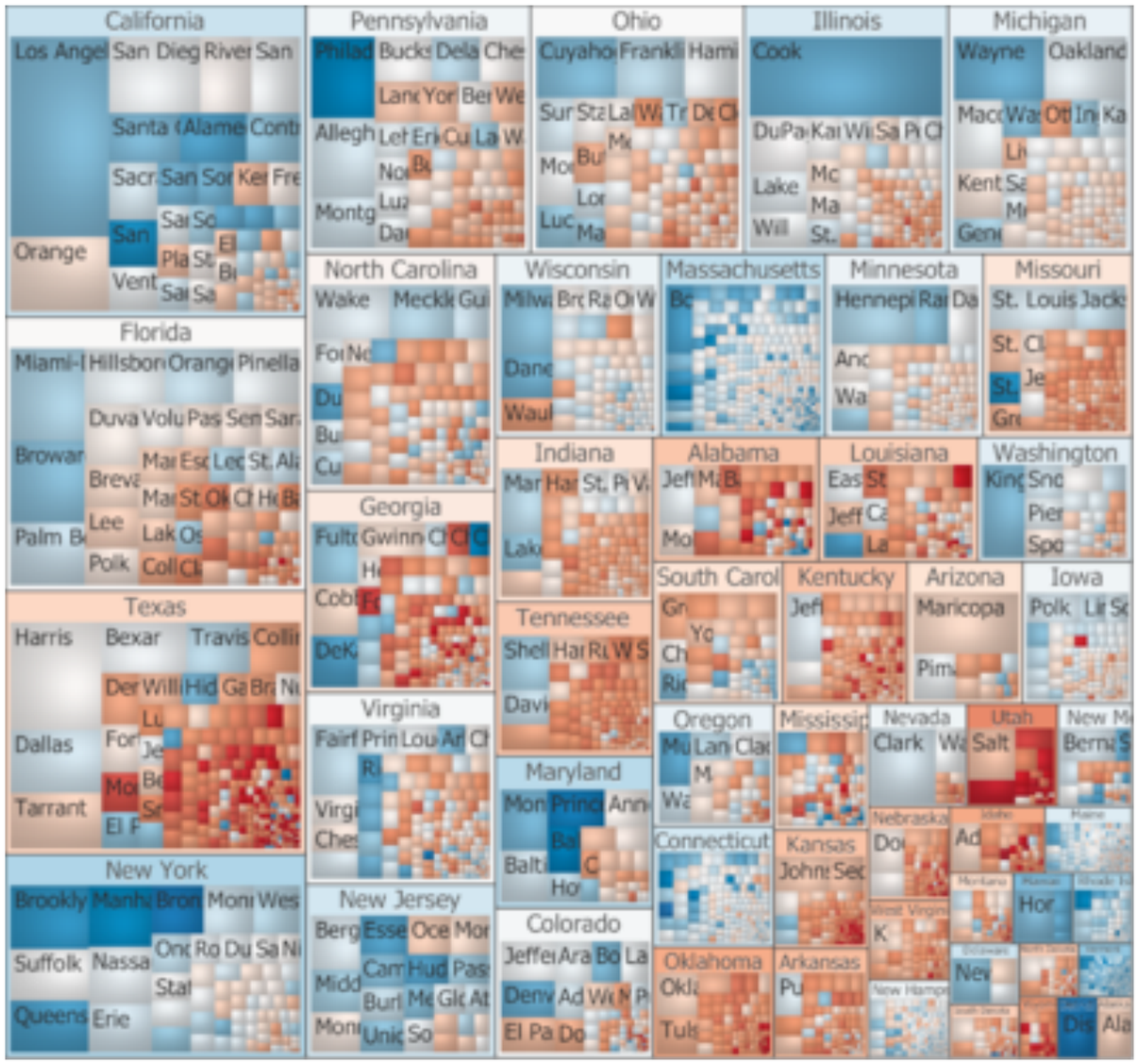


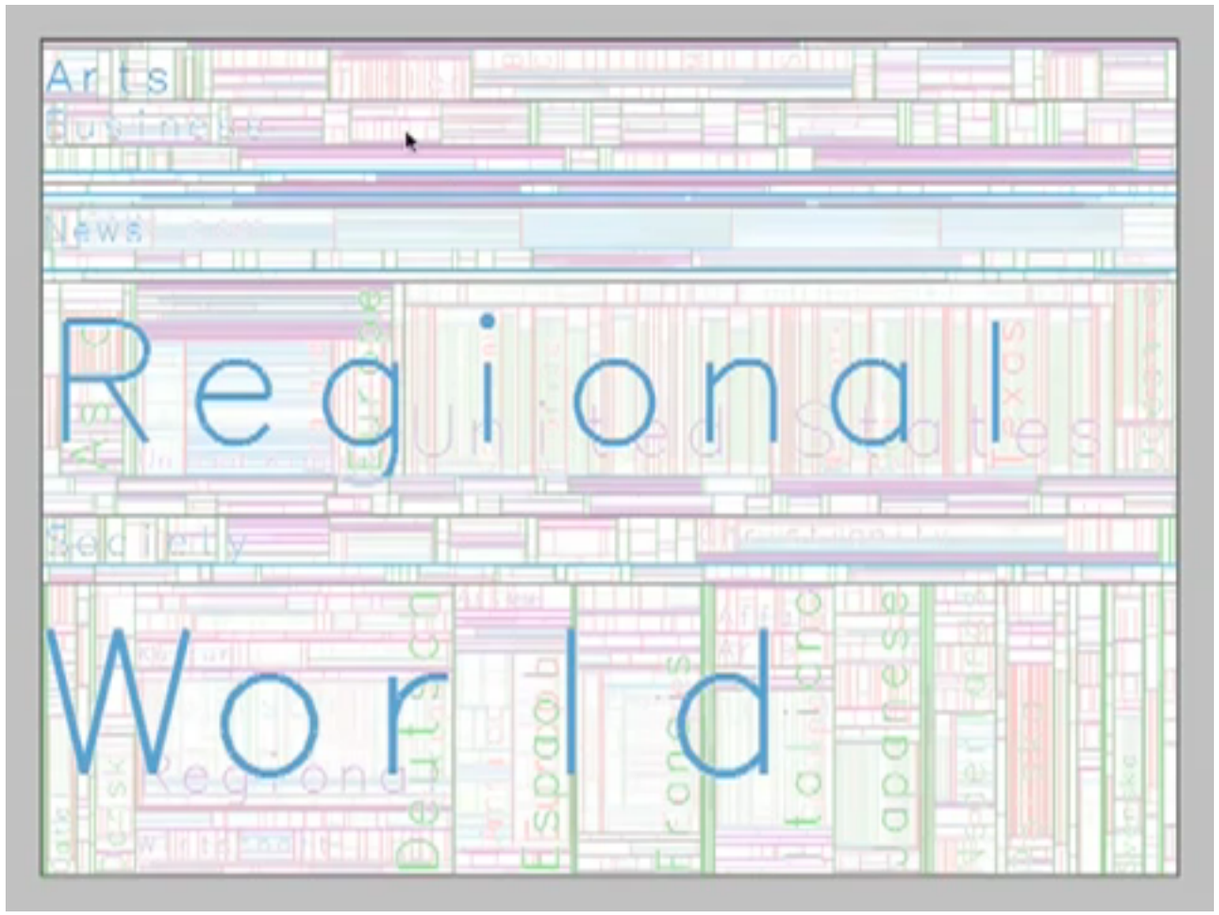


hyperbolic tree

multivariate relational data: hierarchical

treemap

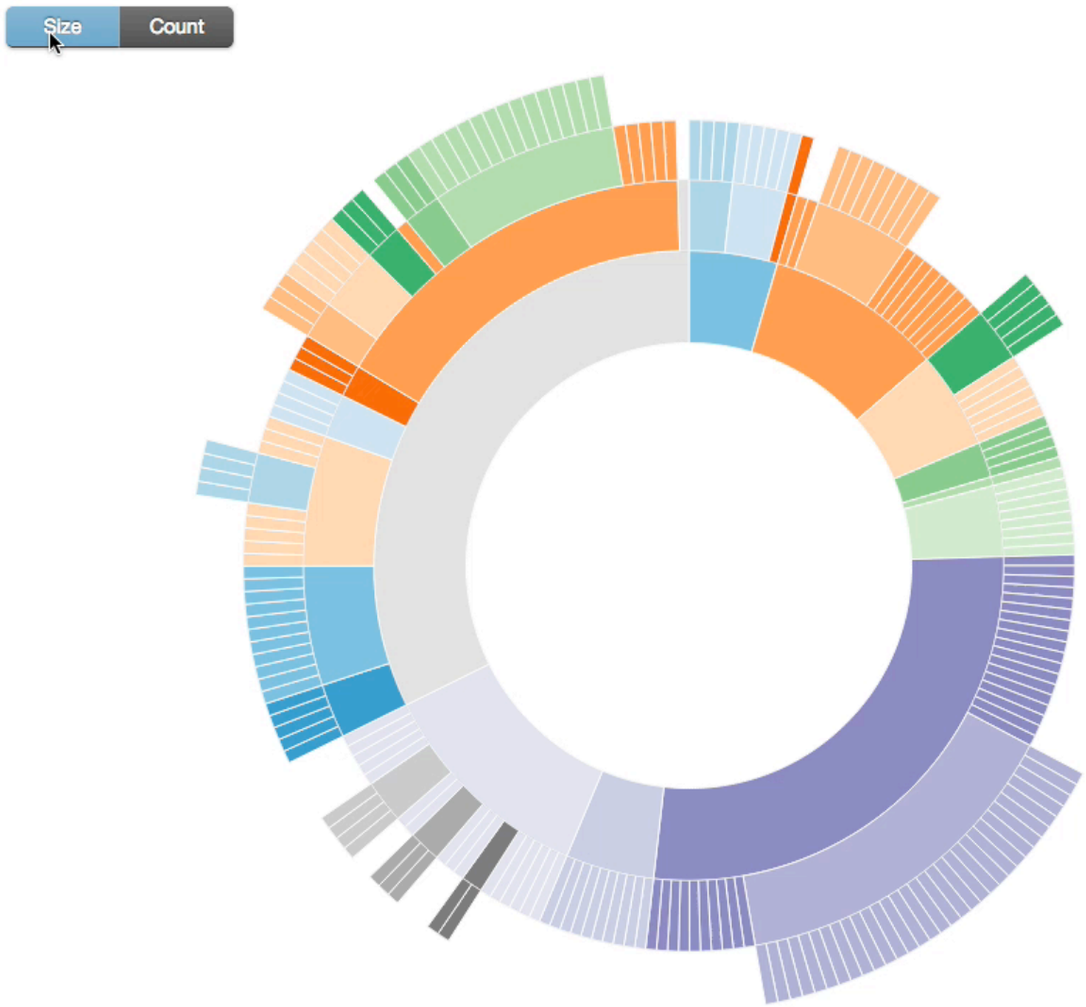




multivariate relational data: hierarchical

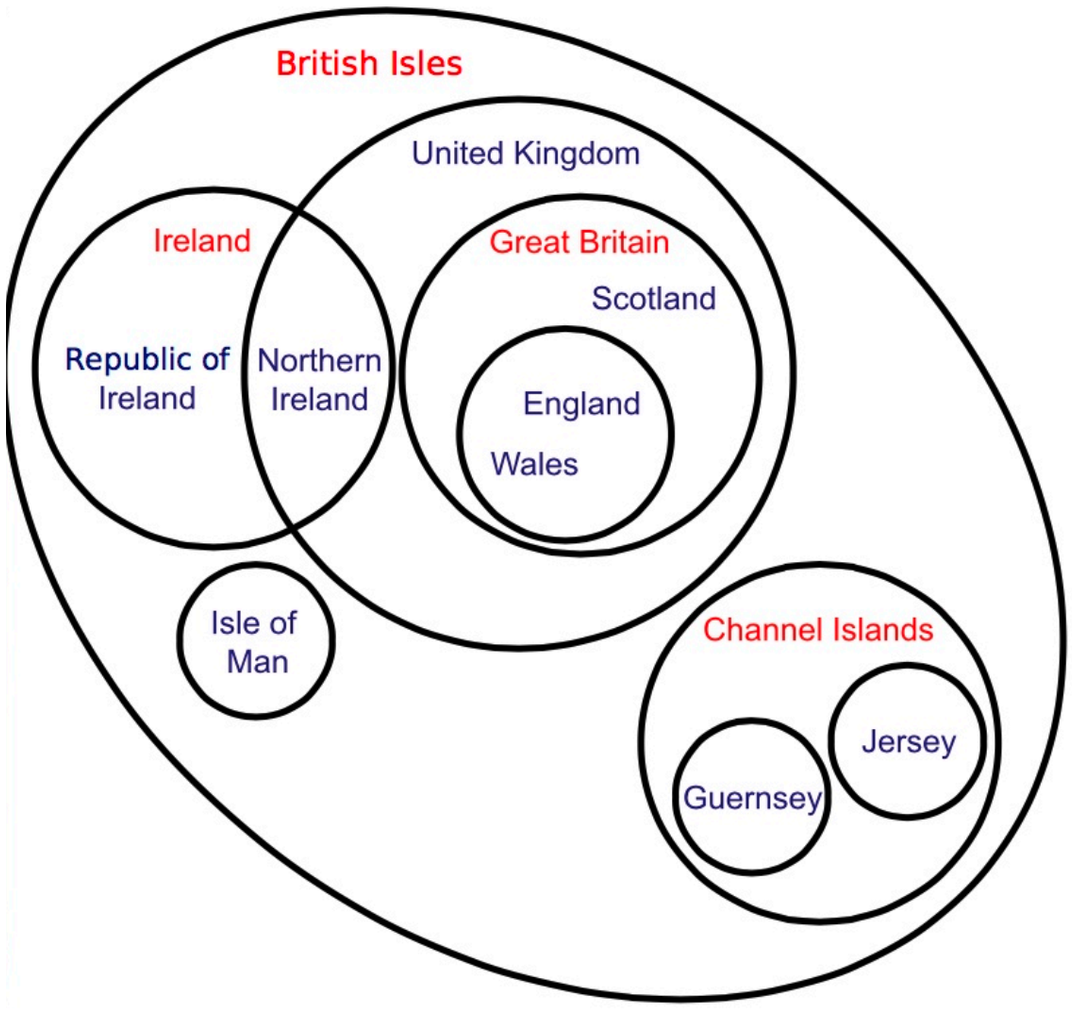
sunburst

multivariate relational data: hierarchical



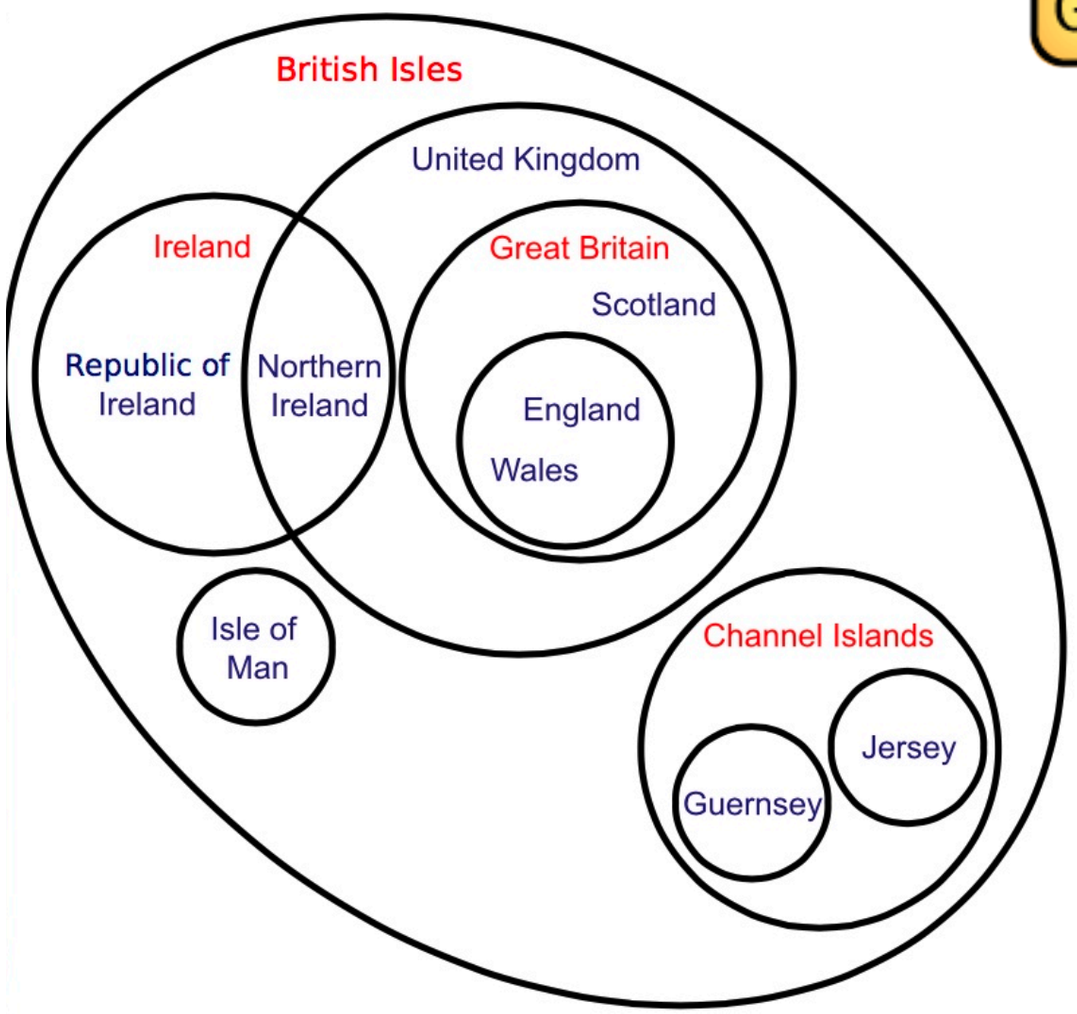
sunburst

multivariate relational data: non-hierarchical

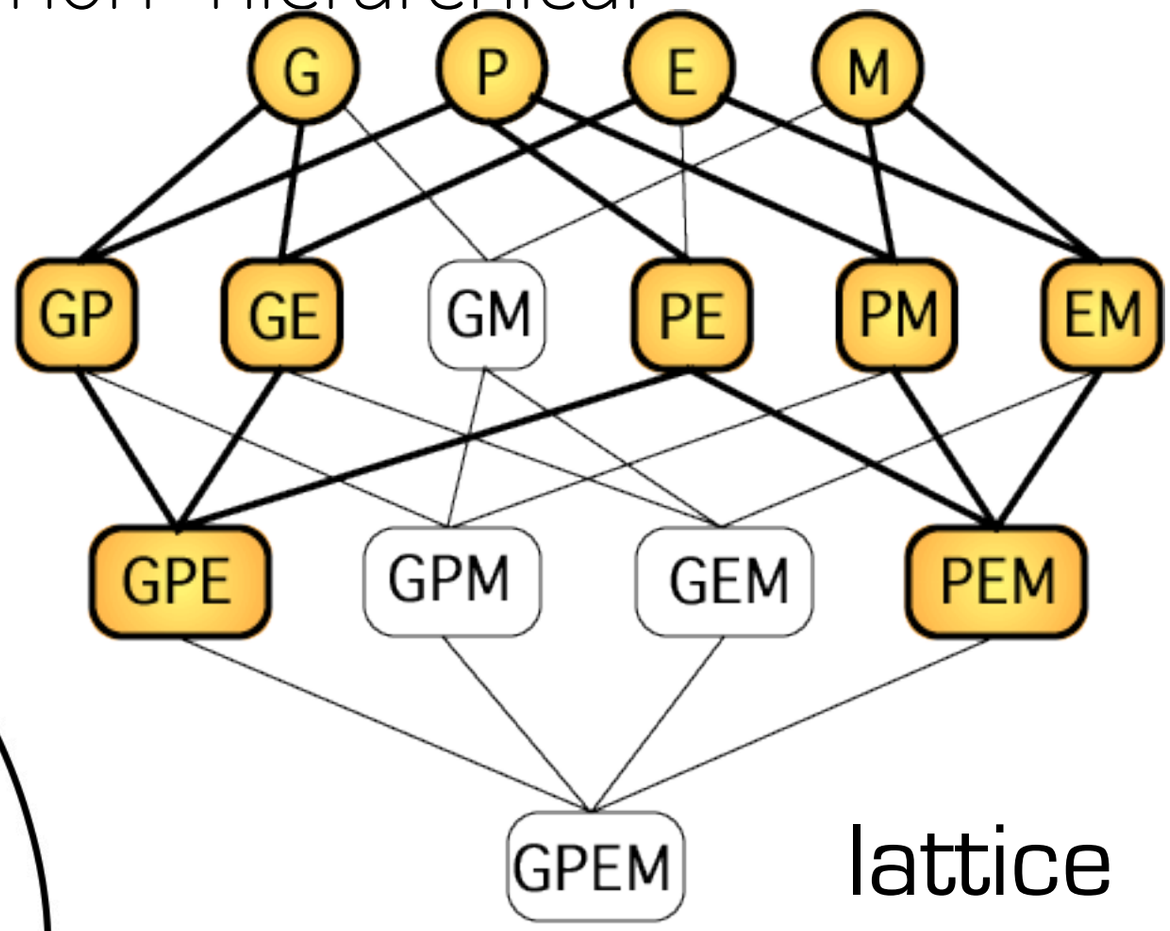


venn diagram

multivariate relational data: non-hierarchical

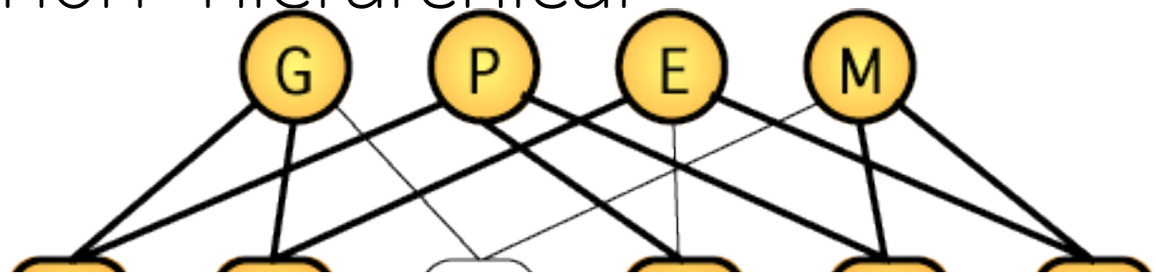


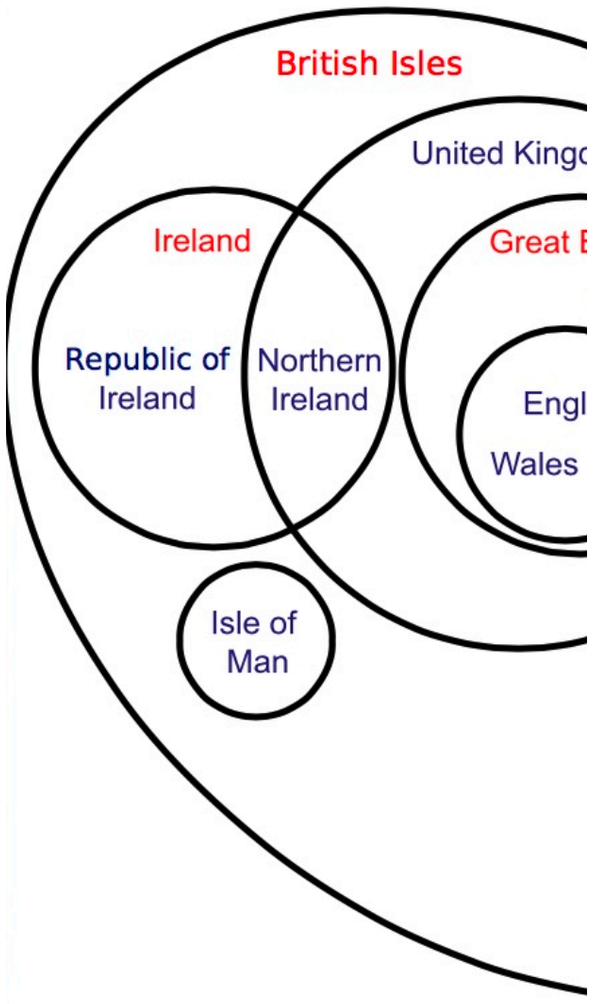
venn diagram



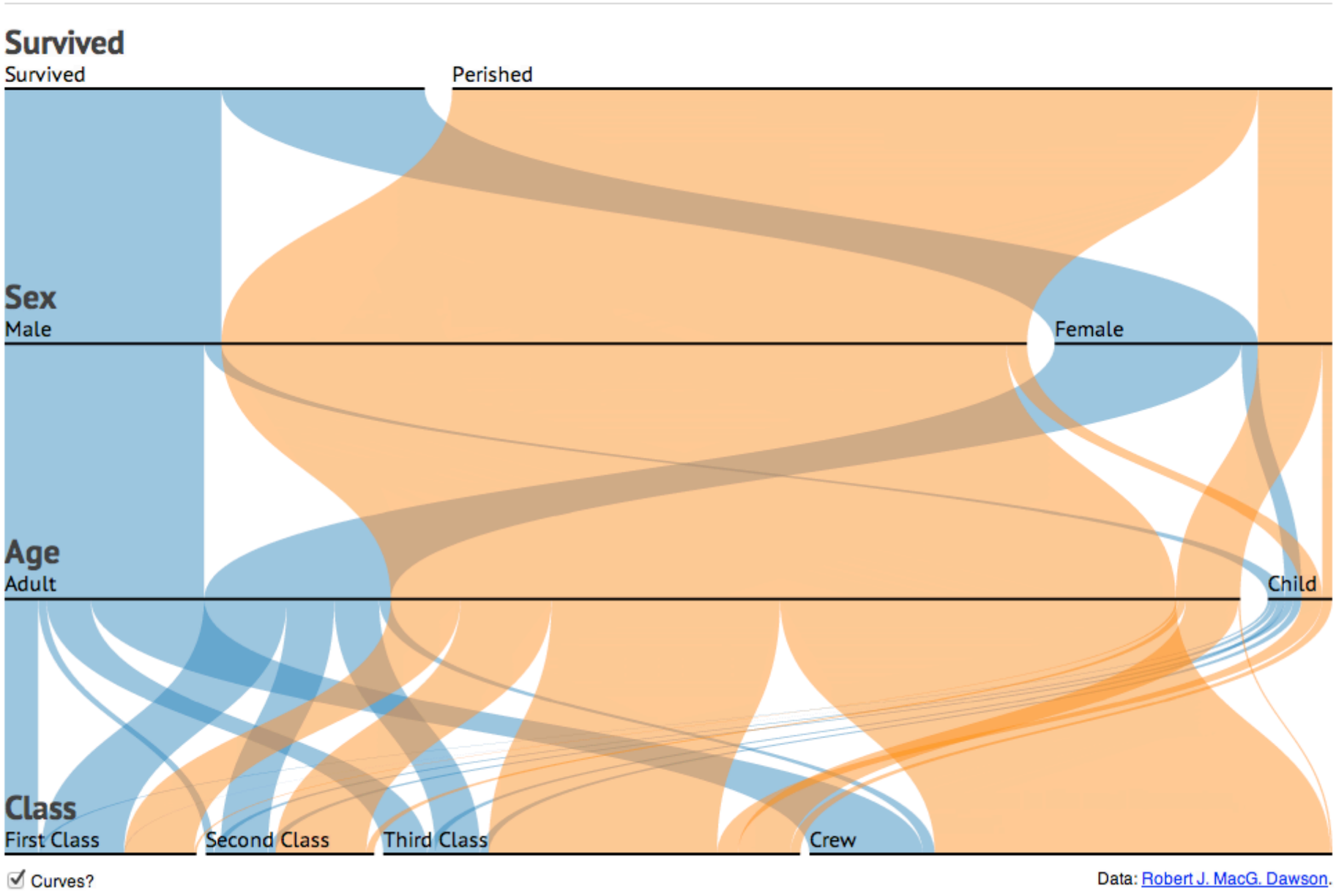
lattice

multivariate relational data: non-hierarchical



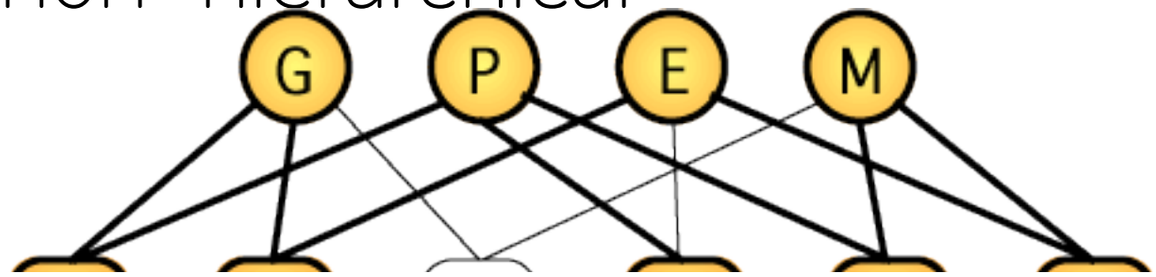


venn diagram



parallel sets

multivariate relational data: non-hierarchical



Titanic Survivors

Plenty of other interesting visualisations....

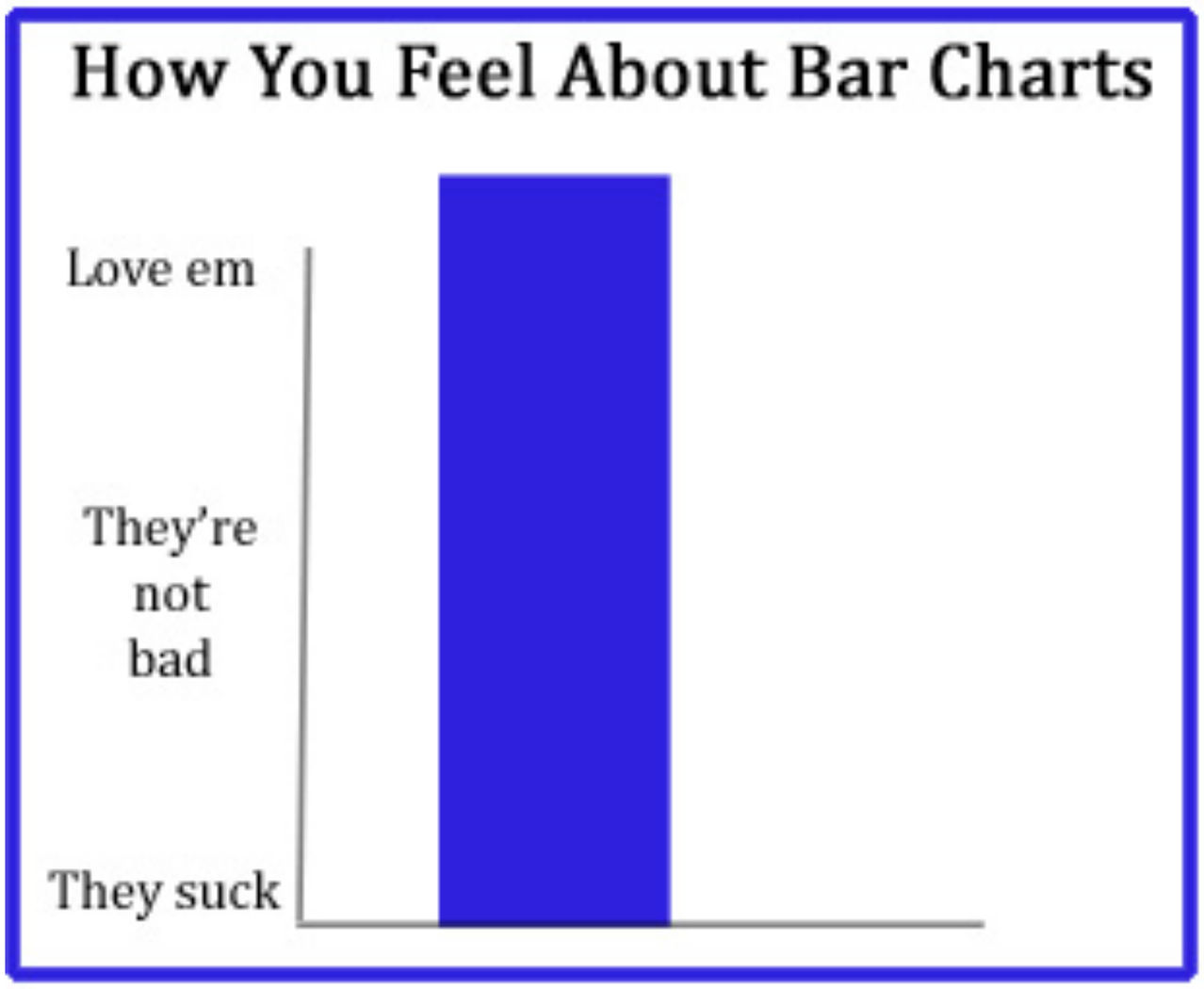
Some favourites I didn't mention?

send them to: max@hip.cat

and I'll compile a list for the class

venn diagram

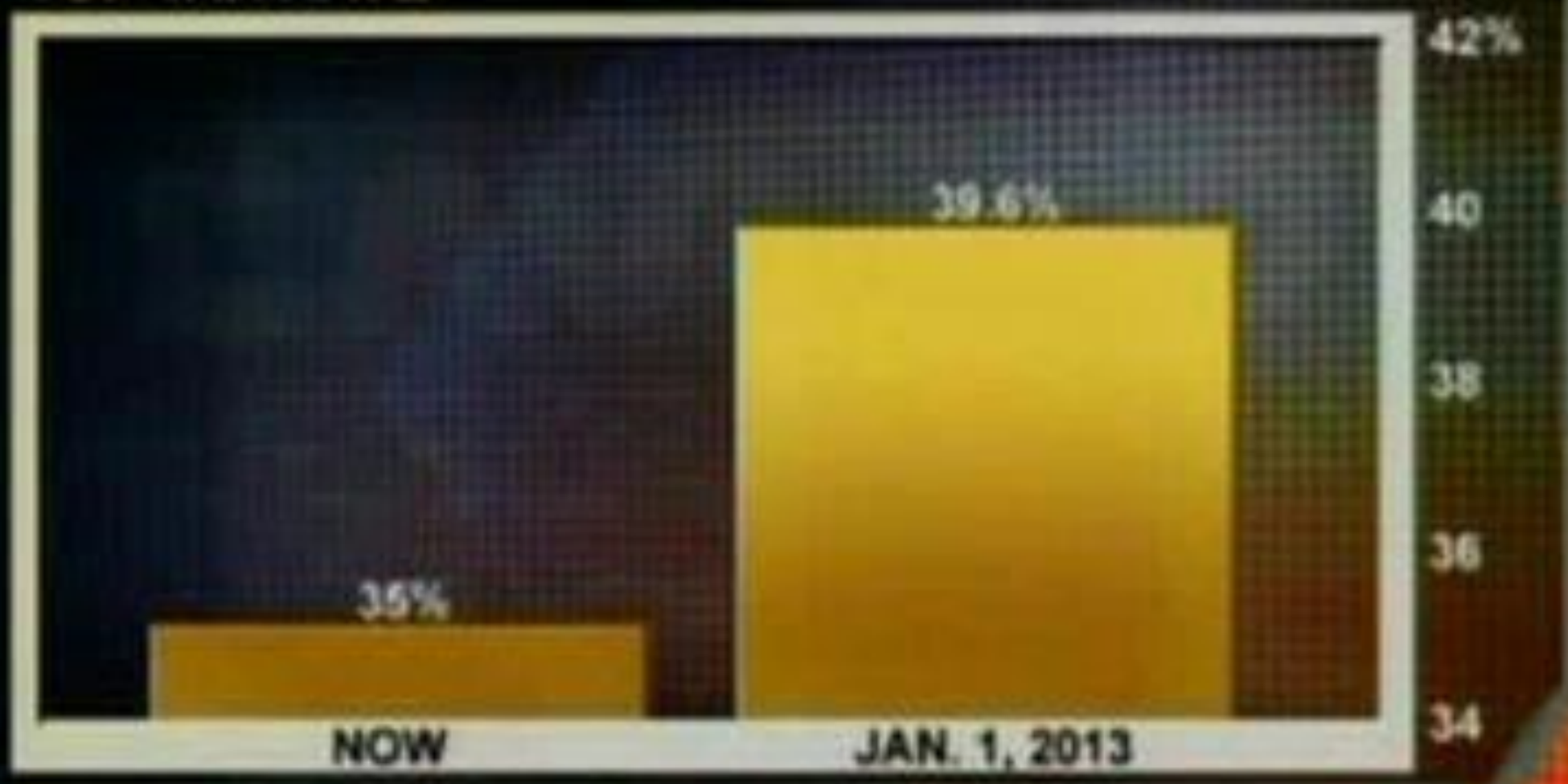
parallel sets



infographic fails:

visual + statistical sleight of hand to mislead the audience

IF BUSH TAX CUTS EXPIRE



8:01p ET

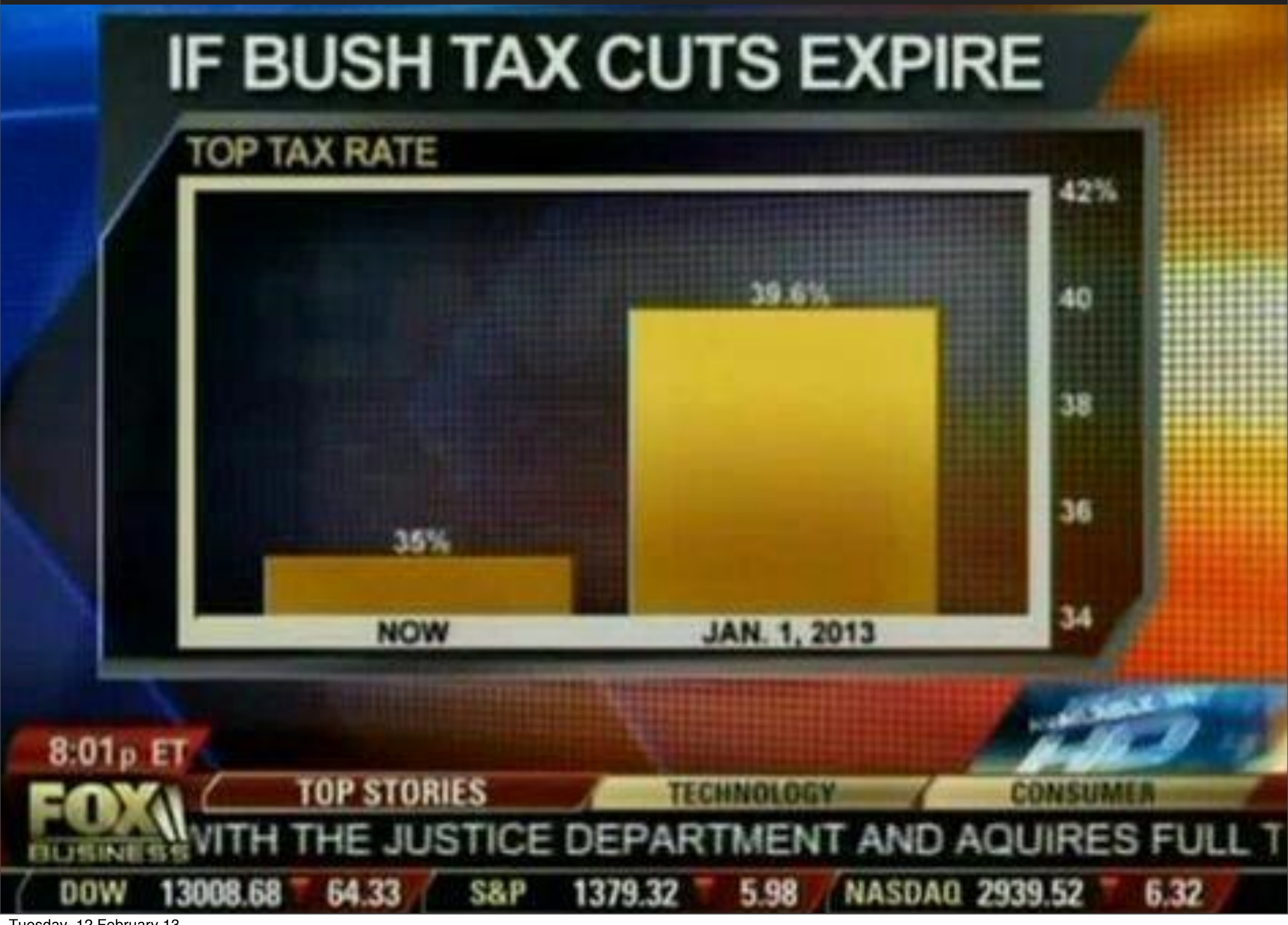
FOX BUSINESS

TOP STORIES | TECHNOLOGY | CONSUMER

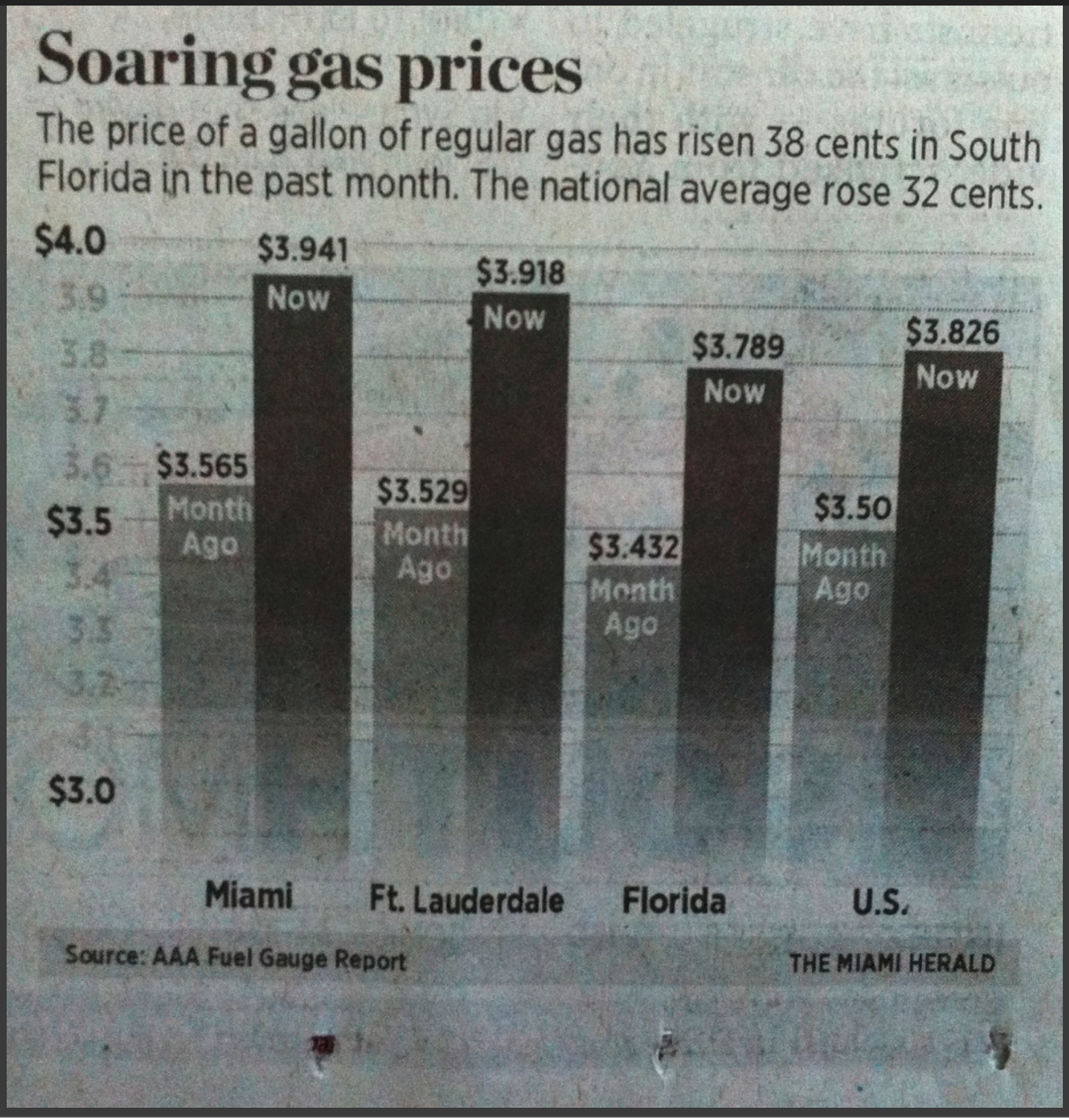
...VITH THE JUSTICE DEPARTMENT AND AQUIRES FULL T

DOW 13008.68 ▼ 64.33 | S&P 1379.32 ▼ 5.98 | NASDAQ 2939.52 ▼ 6.32

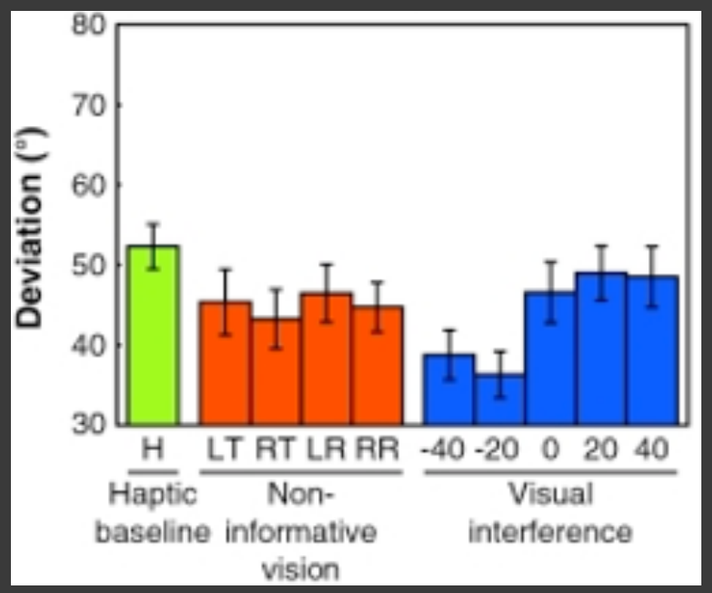
1. Barchart baseline fail



1. Barchart baseline fail

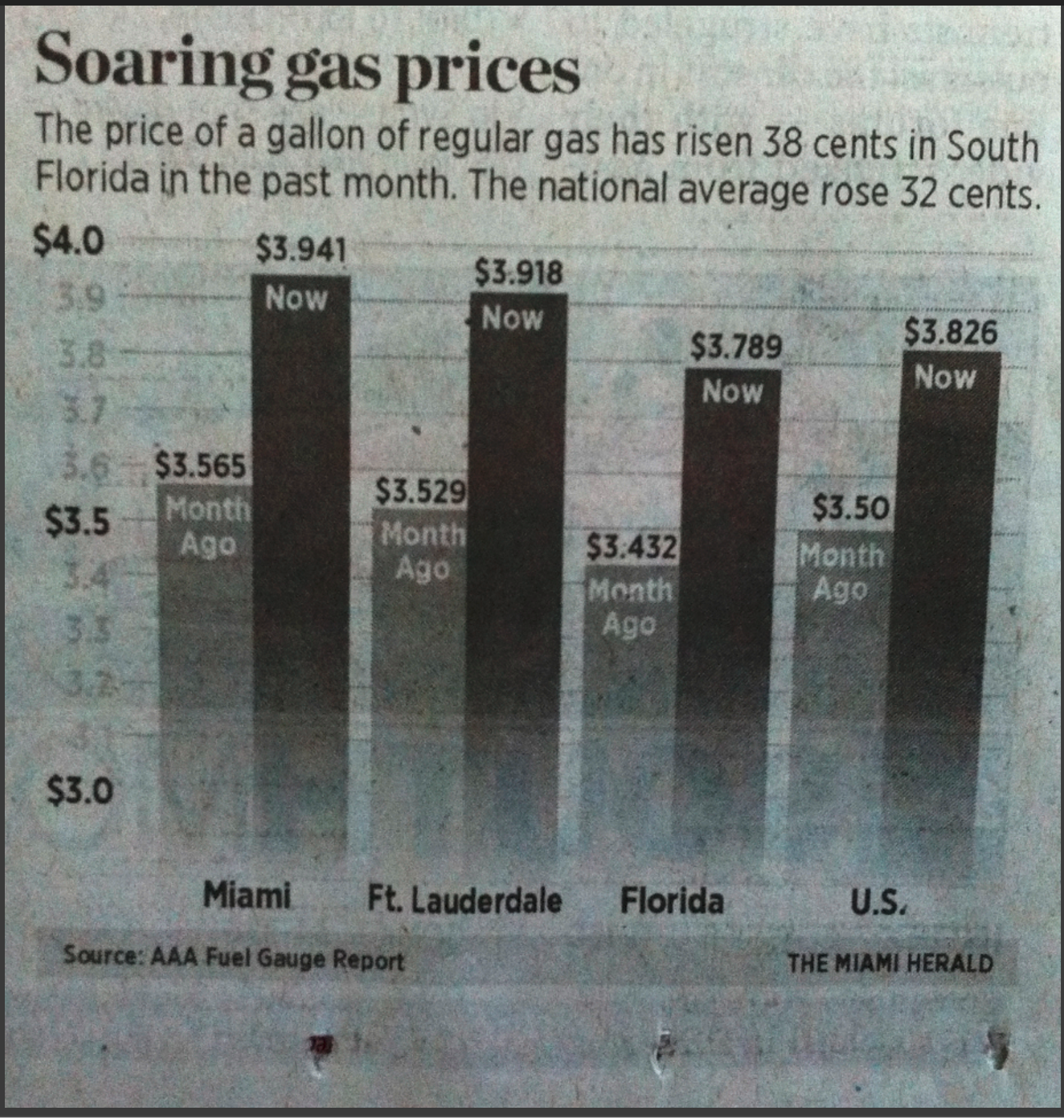


1. Barchart baseline fail



Soaring gas prices

The price of a gallon of regular gas has risen 38 cents in South Florida in the past month. The national average rose 32 cents.

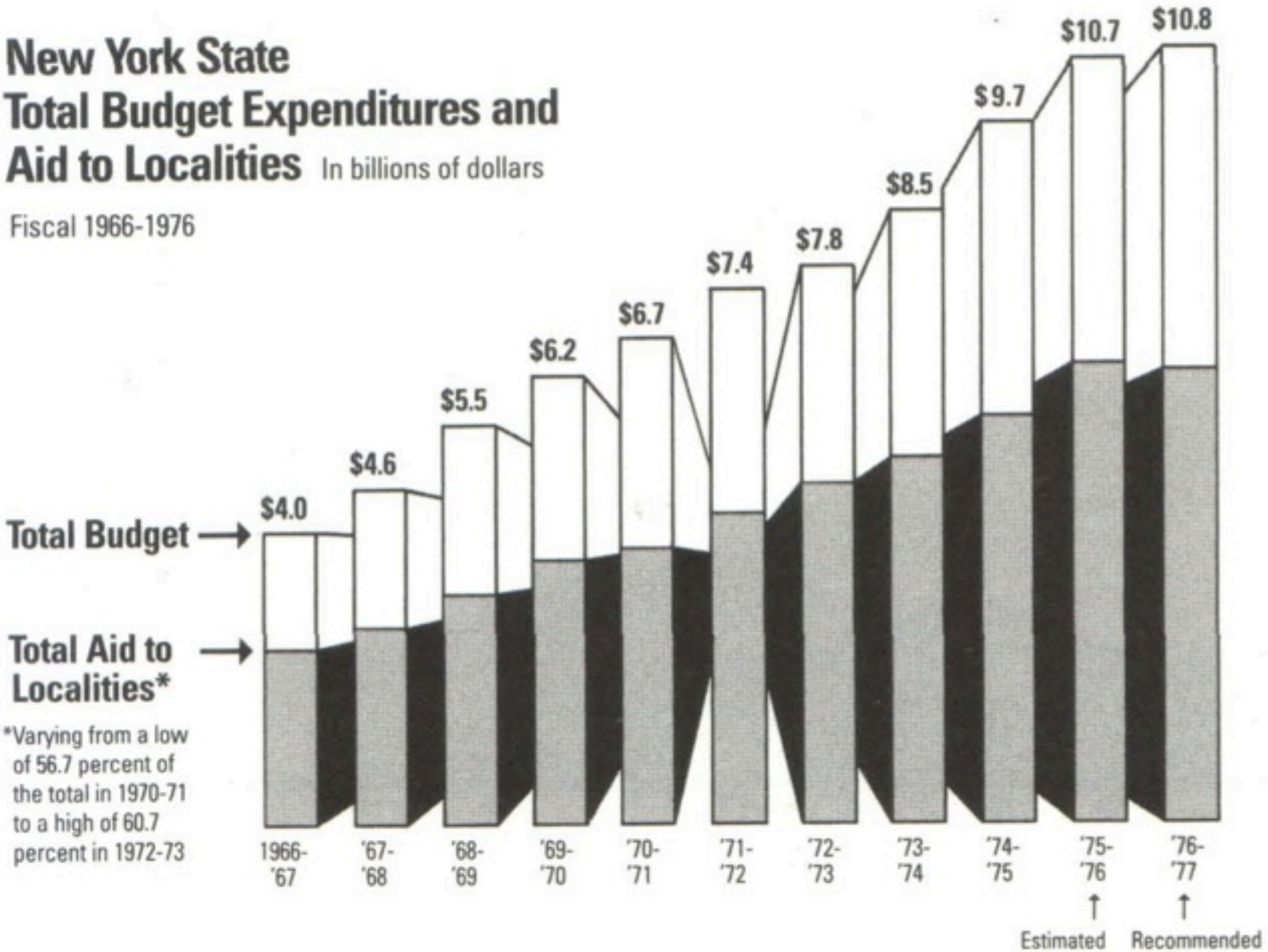


Source: AAA Fuel Gauge Report

THE MIAMI HERALD

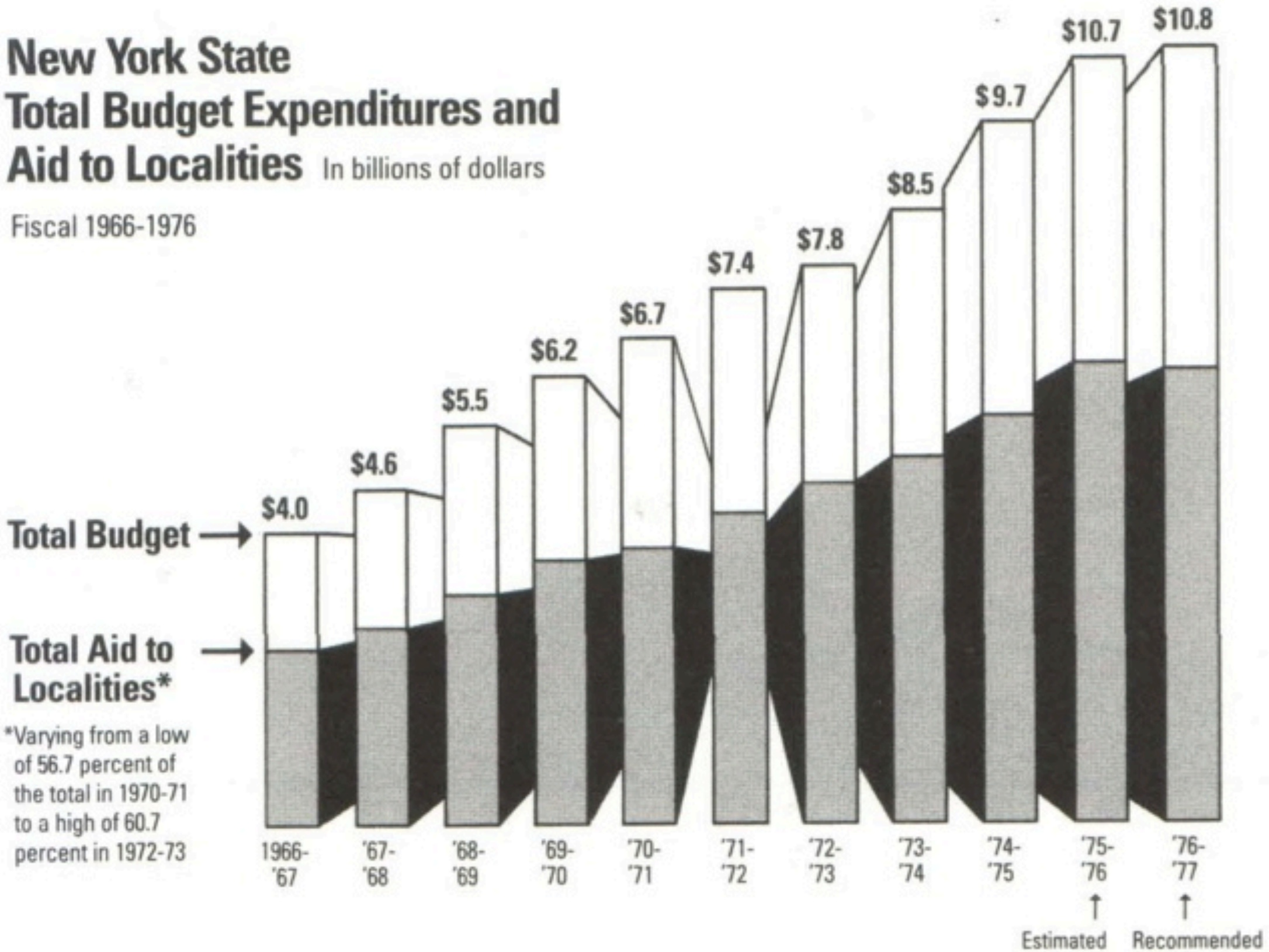
New York State
Total Budget Expenditures and Aid to Localities In billions of dollars

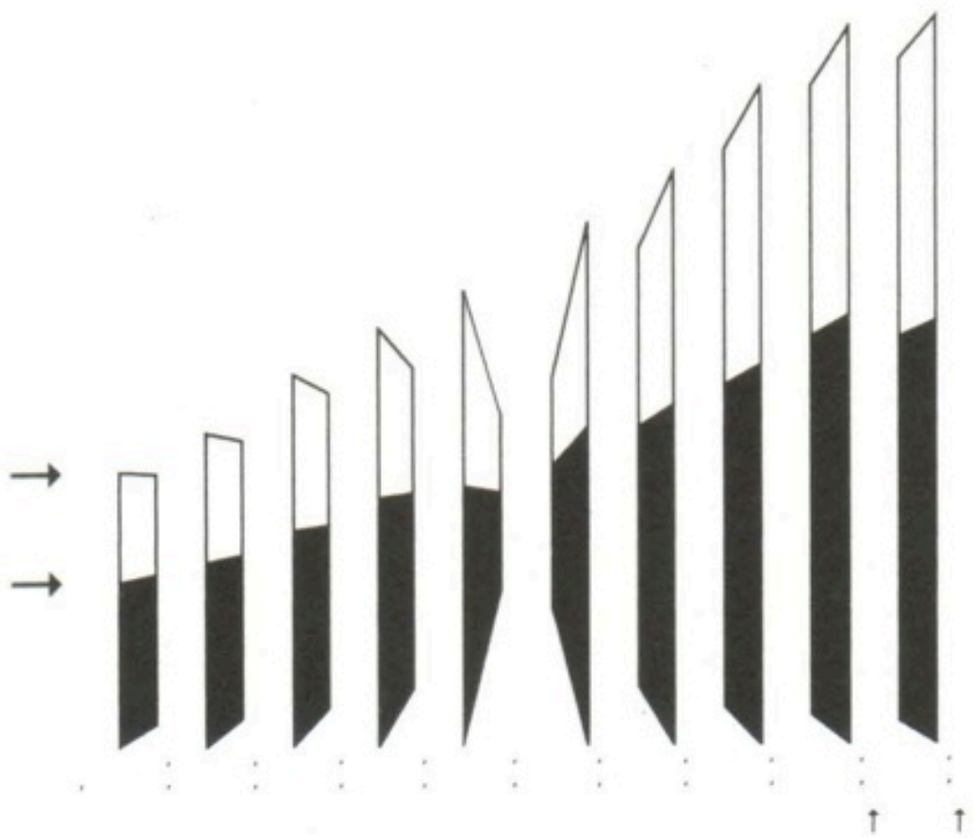
Fiscal 1966-1976

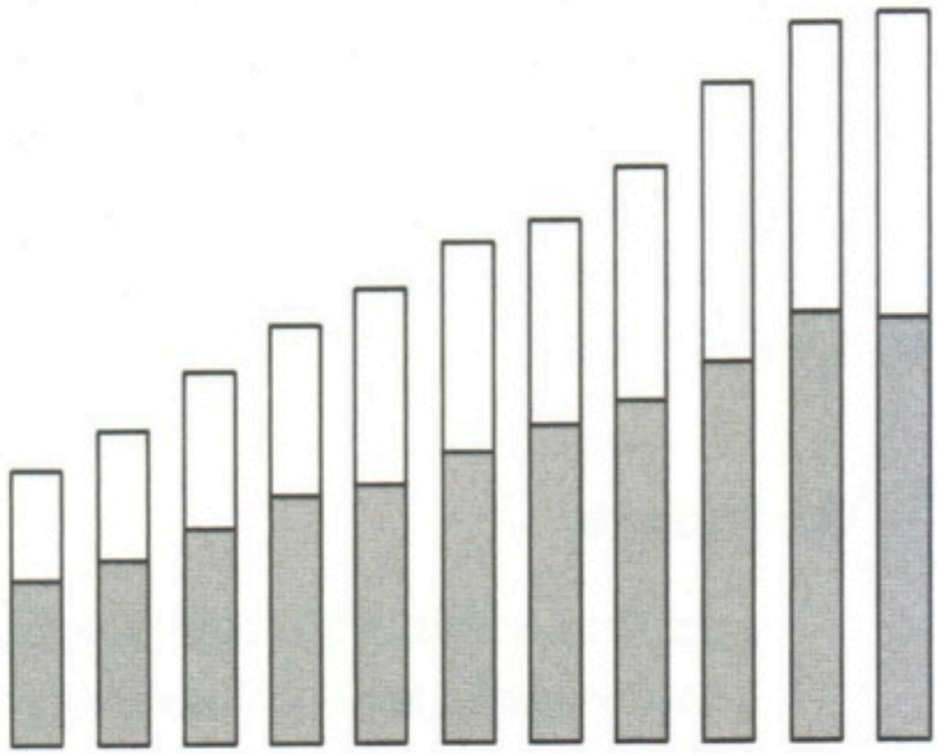


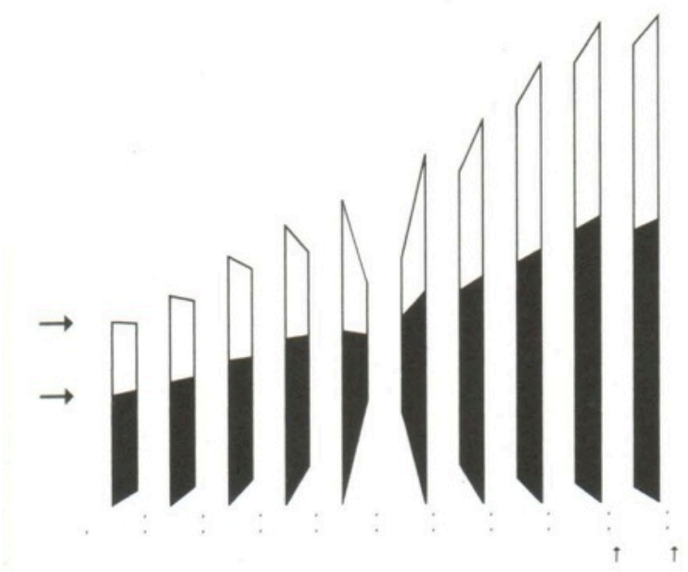
*Varying from a low of 56.7 percent of the total in 1970-71 to a high of 60.7 percent in 1972-73

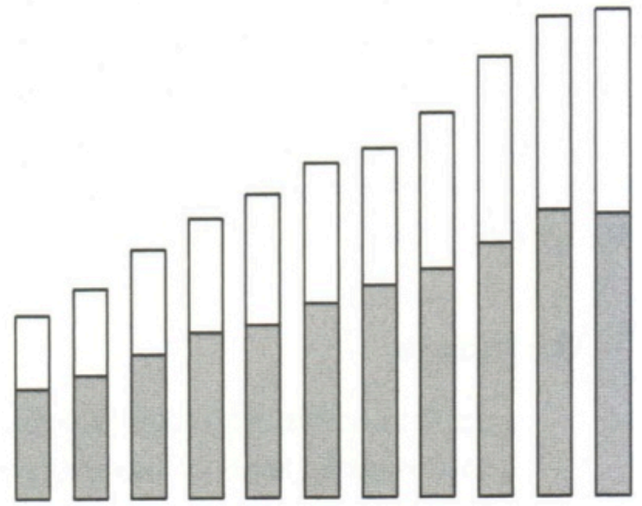
2. Perspective and measurement fail





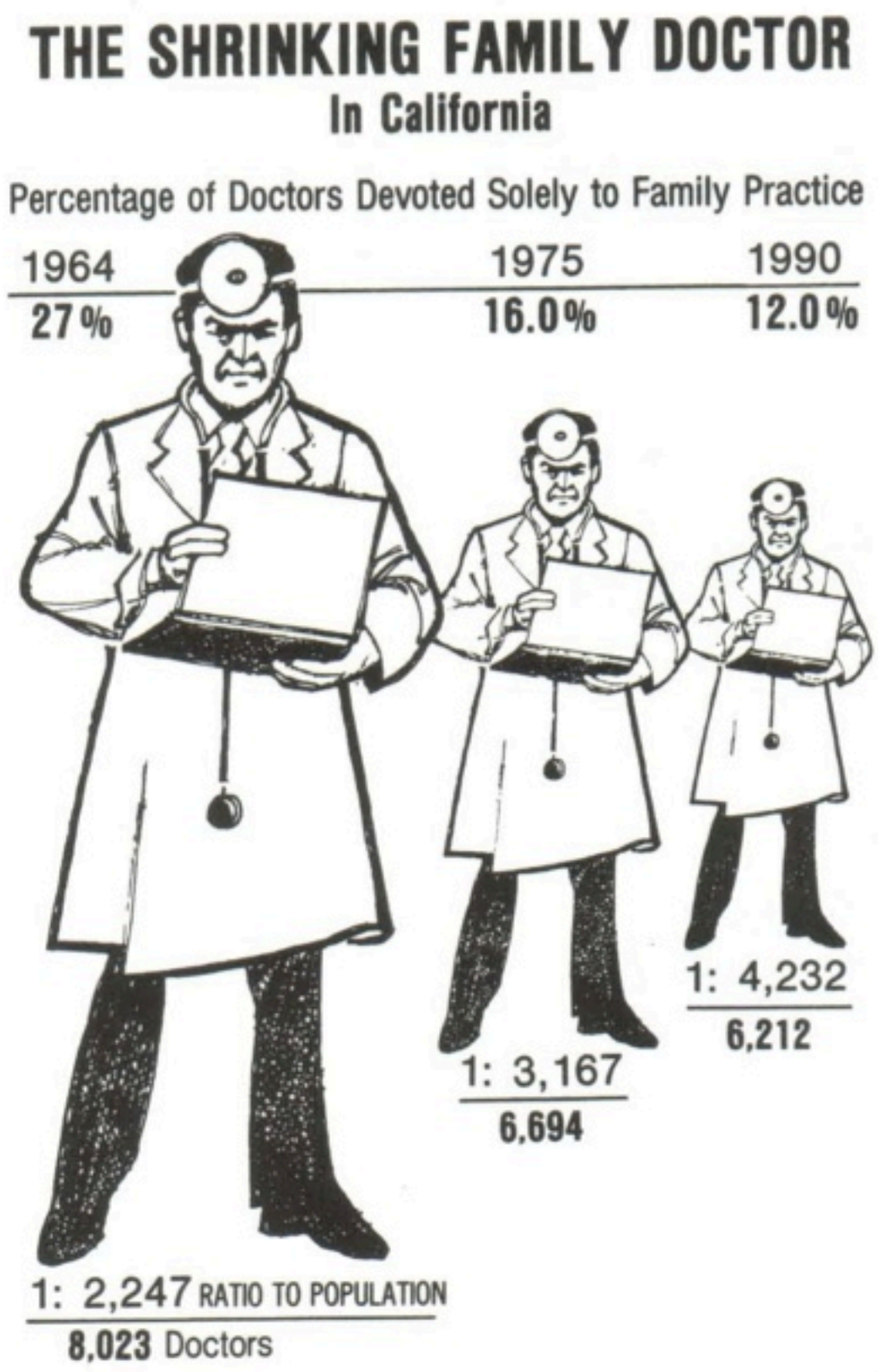


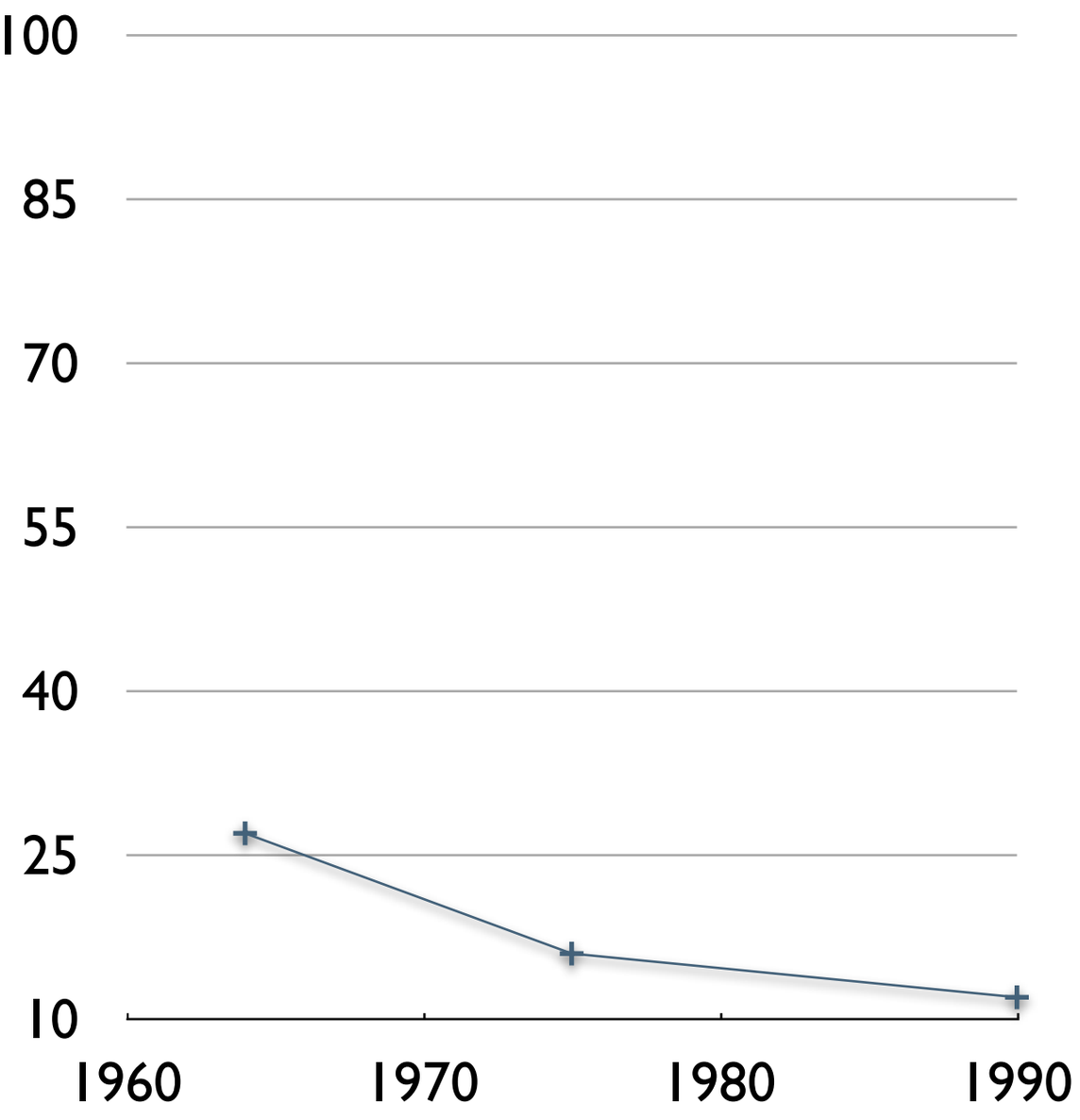




Per capita
budget expenditures,
in constant dollars

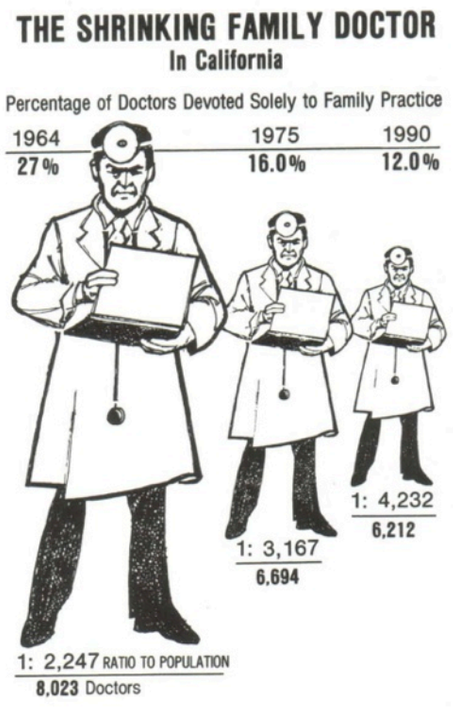
2. “Huge differences” fail





using area (2 dimensions) to represent one dimension

2. “Huge differences” fail



using area to represent one dimension

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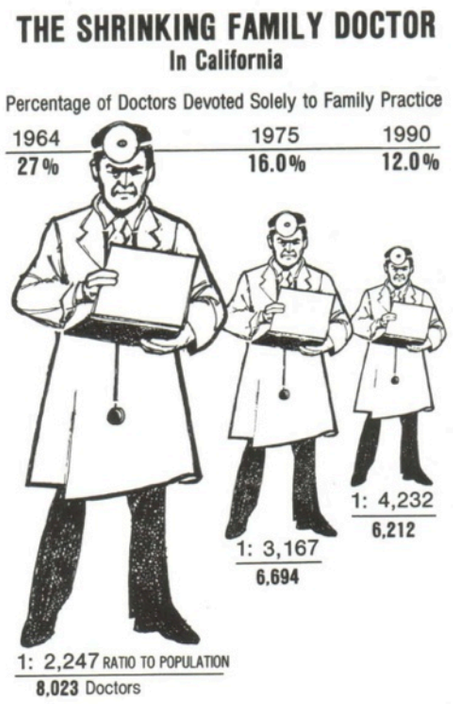

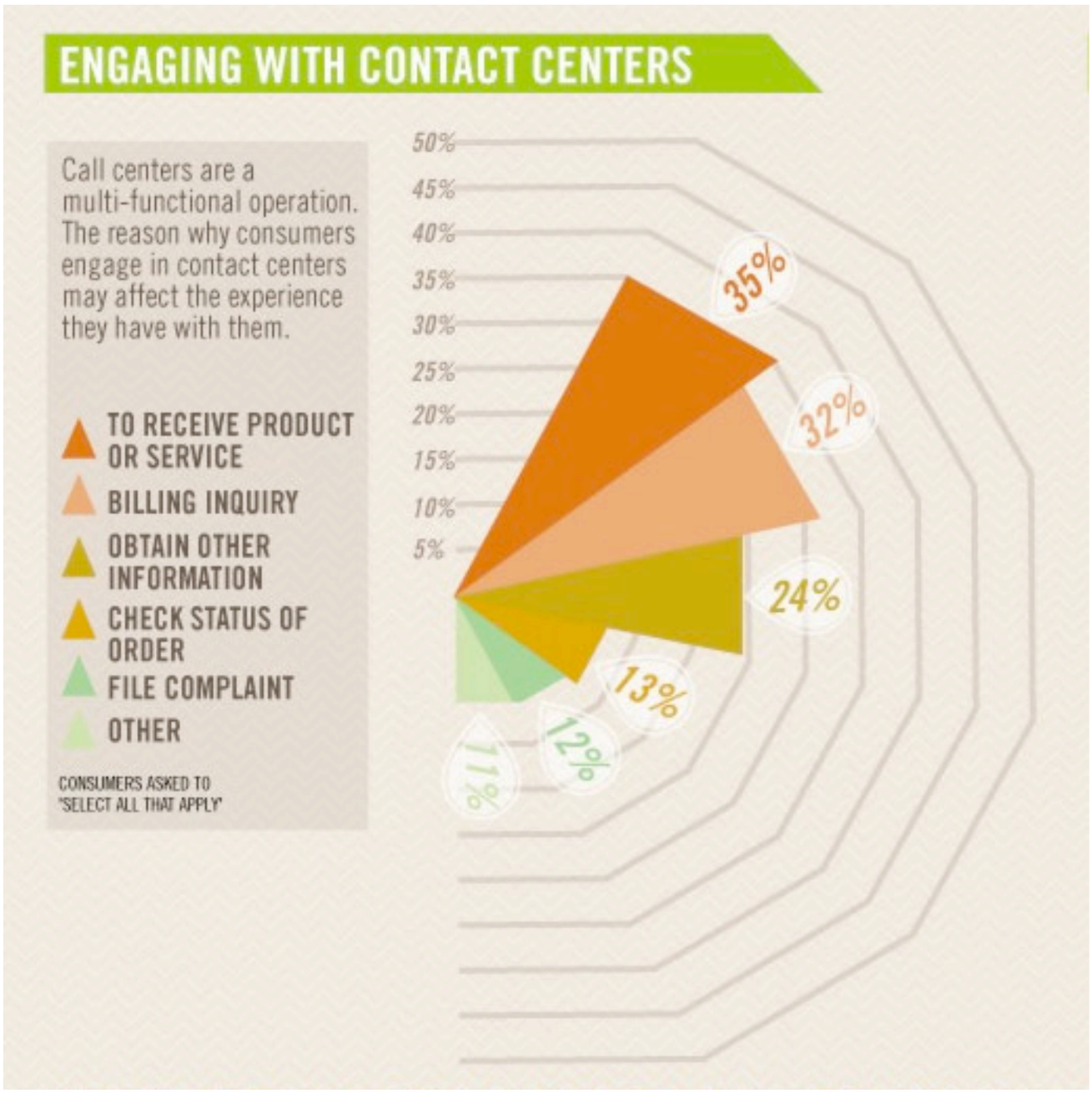

using area to represent one dimension

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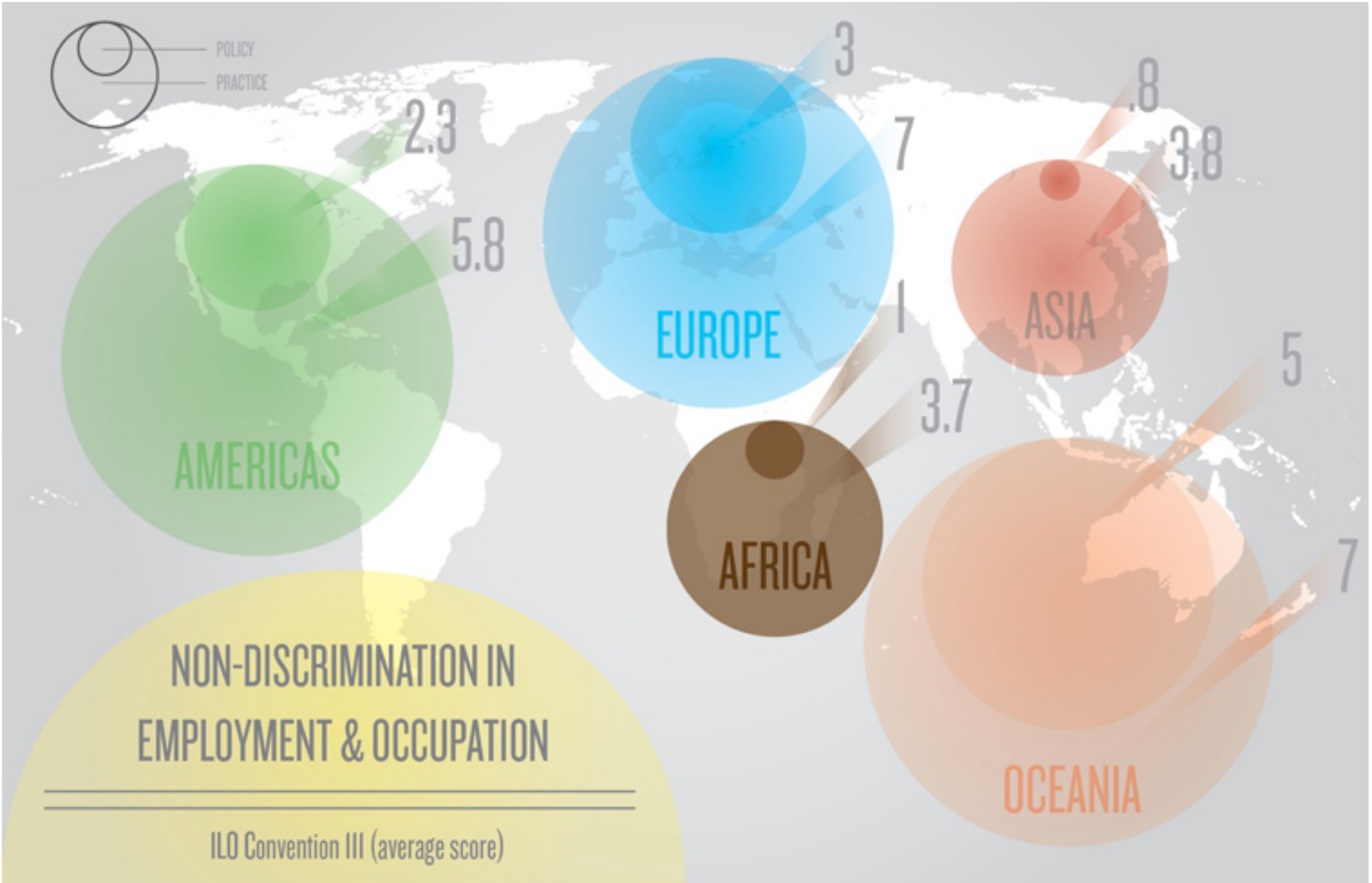


using area to represent one dimension

Quiz: How does this fail?

THE ISSUE OF TRUST

ACCENTS AND DISTRUST

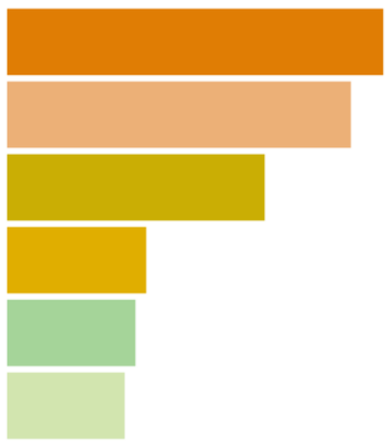
Another reason why accents affects customer service is the question of credibility. If I can not understand you, then I can not trust you.

An experiment conducted by the University of Chicago demonstrated this aspect. The question posed, do trivia statements sound less true when spoken by a non-native speaker? Furthermore, listeners were told in advance that all of the trivia questions were provided by the experimenter. This way, even listeners who were knowingly prejudice against non-native accents should not have been affected.

The results showed that the heavier the accent the less trust worthy the person became.

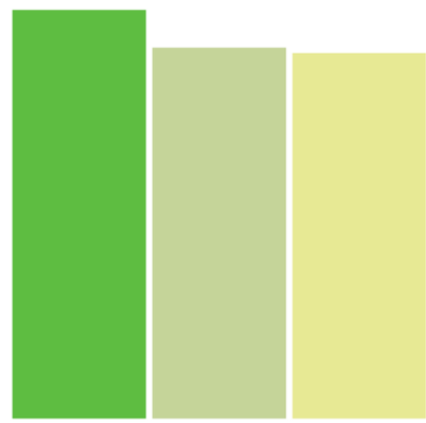
- NATIVE ACCENT
- MILD ACCENT
- HEAVY ACCENT

Distortion factor: 2.5



True data

Distortion factor: 5.0



True data

SUBSIDIZE THIS

THE PRICE THAT YOU PAY FOR ENERGY—WHETHER ELECTRICITY AT YOUR HOUSE OR GAS AT THE PUMP—ISN'T ACTUALLY THE PRICE THAT THE MARKET WOULD SET FOR THAT ENERGY.

The government spends billions of dollars to support the energy industry, which allows it to make energy cheaper than it should cost on the open market. These subsidies—either in the form of tax breaks or direct funding—favor some types of energy over others, giving our country a skewed sense of what each gallon of gas or wind-powered electron costs. This is a look at where the government directed its subsidy dollars from 2002 to 2008.

SOURCE "Estimating U.S. Government Subsidies to Energy Sources" by the Environmental Law Institute

CARBON CAPTURE AND STORAGE

$2.3 BILLION

TAX BREAKS $.3 BILLION

DIRECT SPENDING $2 BILLION

RENEWABLE ENERGY

$12.2 BILLION

TAX BREAKS $6.2 BILLION

DIRECT SPENDING $6 BILLION

CORN ETHANOL

$16.8 BILLION

TAX BREAKS $11 BILLION

DIRECT SPENDING $5 BILLION

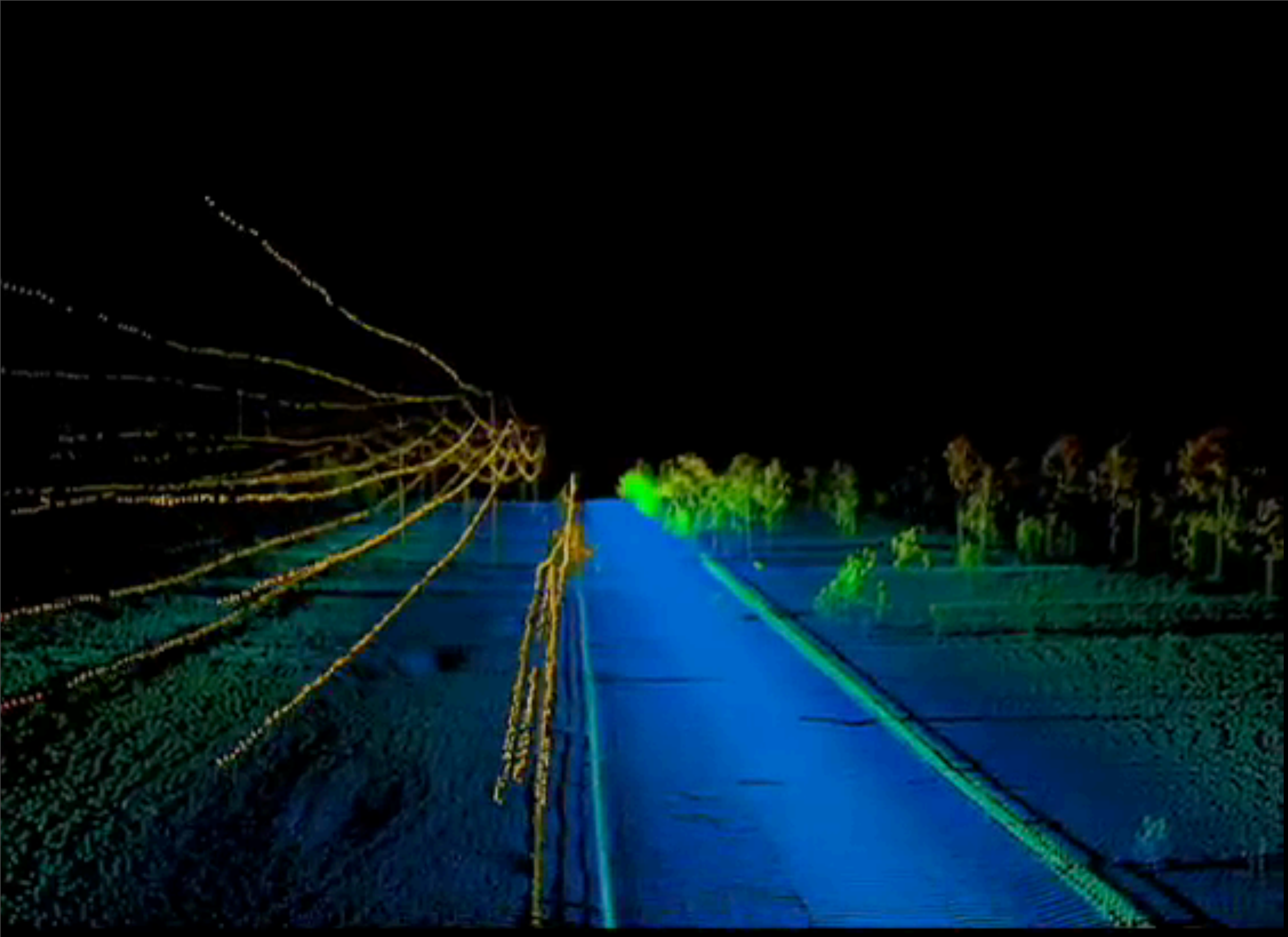
FOSSIL FUELS

$70.2 BILLION

TAX BREAKS $53.9 BILLION

DIRECT SPENDING $16.3 BILLION

A collaboration between **GOOD** and **Deeplocal**



In conclusion

Designing effective infographics

is about effectively conveying or facilitating an understanding of relationships in data

offloading “heavy lifting” to our trained neural circuitry.

While still an art, many design principles grounded in usability can provide guidance: natural mappings, simplicity, & avoiding distortion