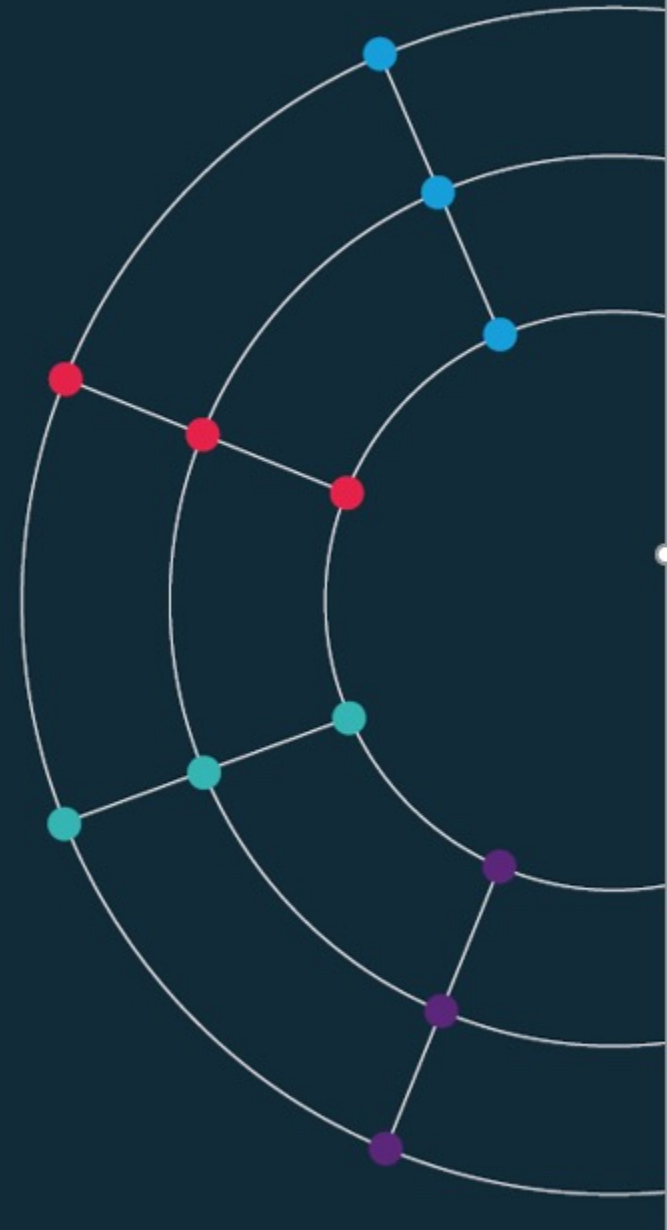




Session 4.

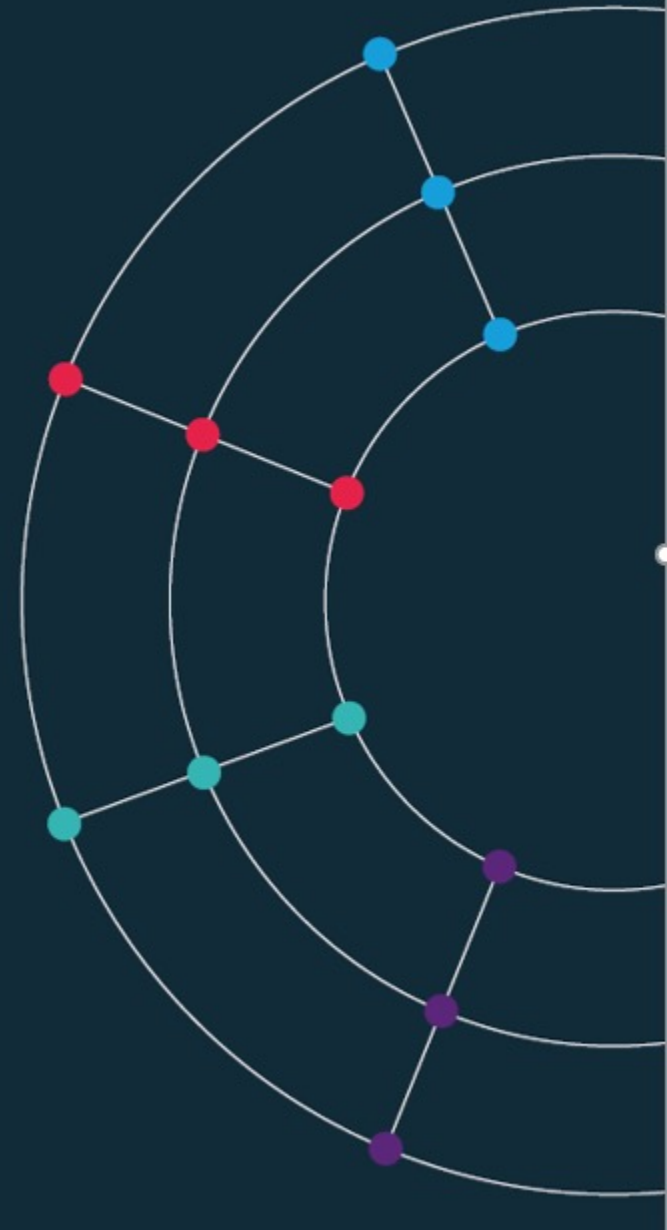
Advanced visualisations



Session 4.

Advanced visualisations

The grammar of graphics



What is Data Science?

- Artificial Intelligence?
- Machine Learning?
- Deep Learning?
- Big Data?

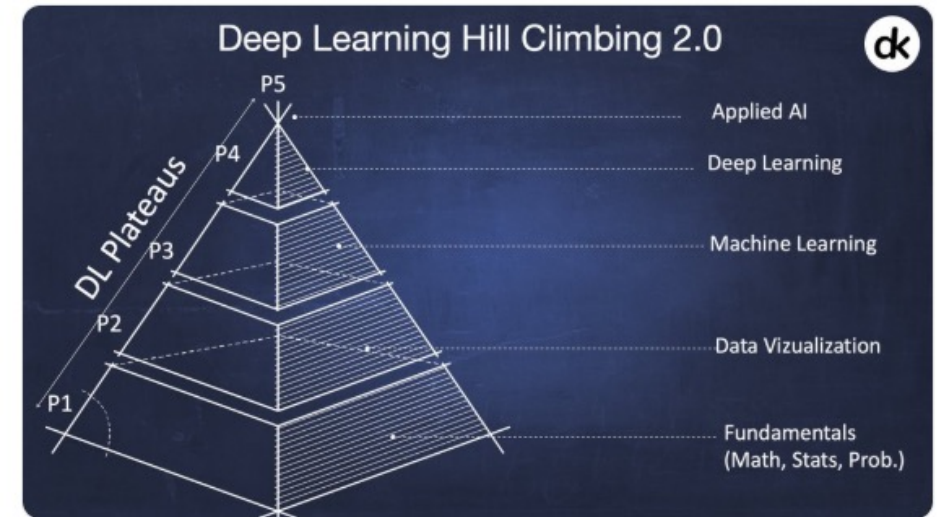


Tamara McCleary
@TamaraMcCleary



Artificial Intelligence In Enterprises -
Businesses Are Waking Up

forbes.com/sites/cognitiv ... #AI #BigData
#DeepLearning #MachineLearning



2:03 PM - 10 Nov 2018

59 Retweets 78 Likes



1 59 78

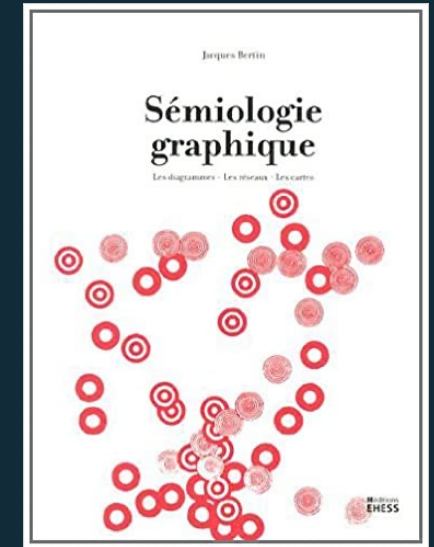


Tweet your reply

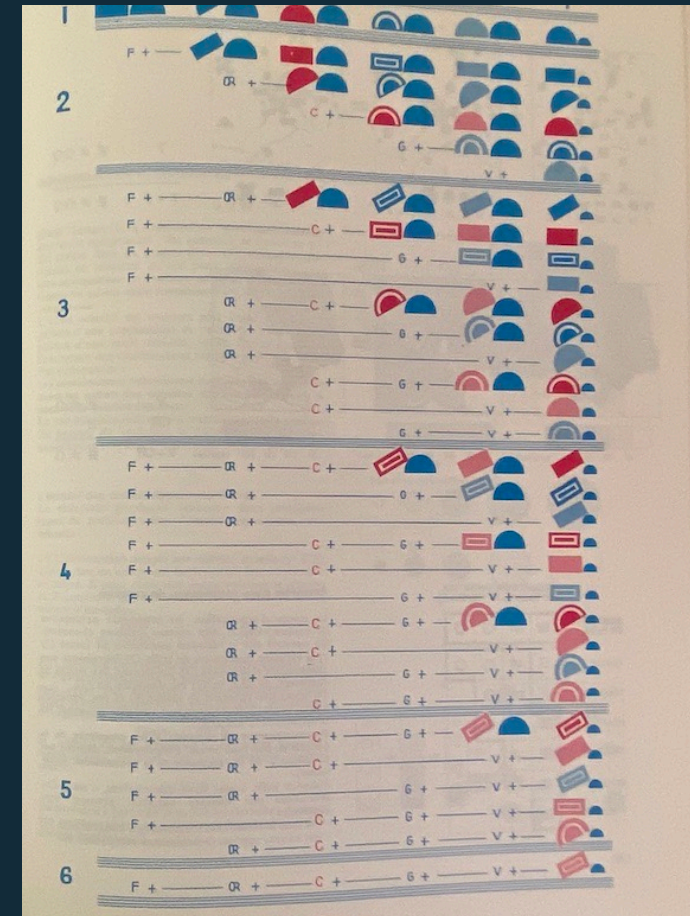
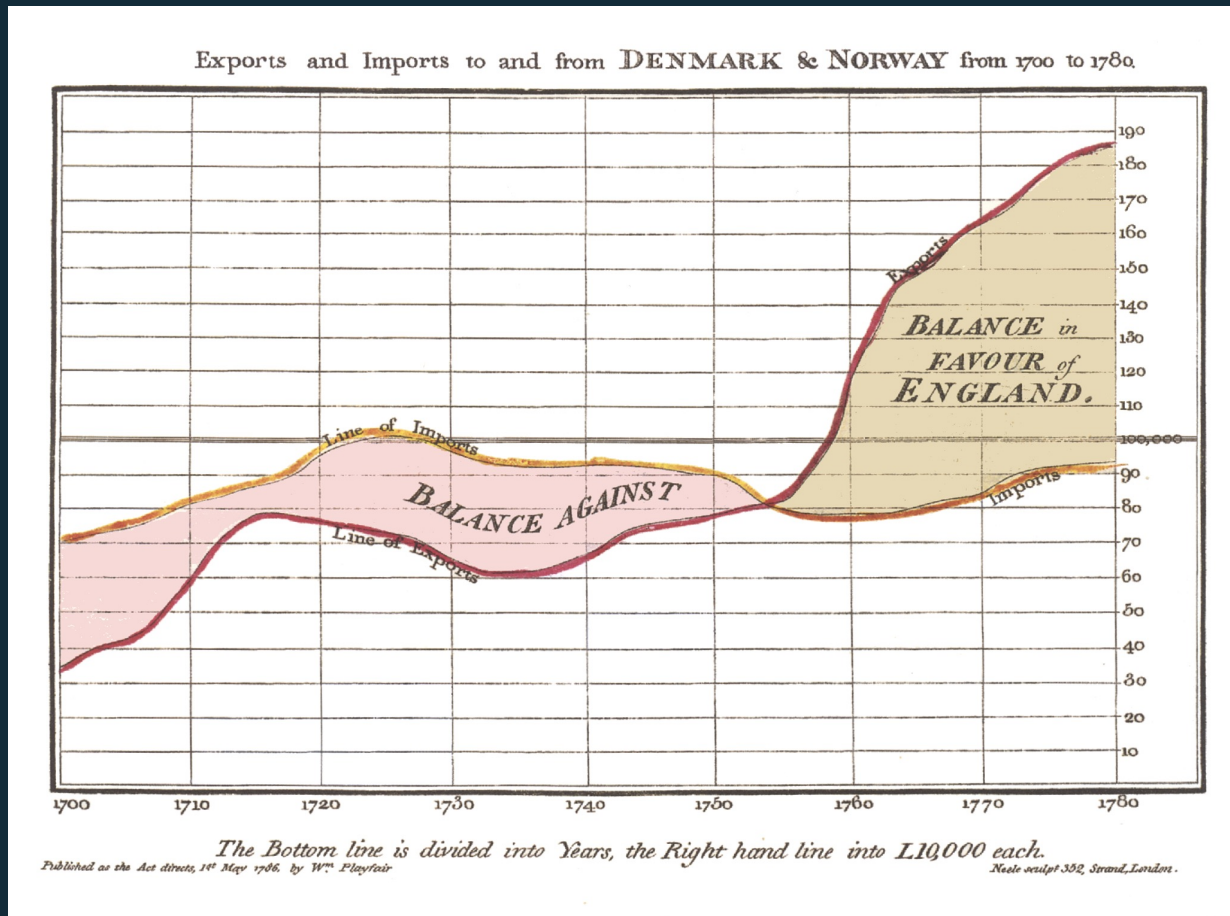
<https://twitter.com/TamaraMcCleary/status/1061197523610550272>

Visual language is a sign system.

- Images perceived as a **set of signs**.
- **Sender** encodes information in signs.
- **Receiver** decodes information from signs.
- In his foreword to the 1983 English translation, Howard Wainer called Bertin's work “**the most important work on graphics since the publication of Playfair's Atlas**”

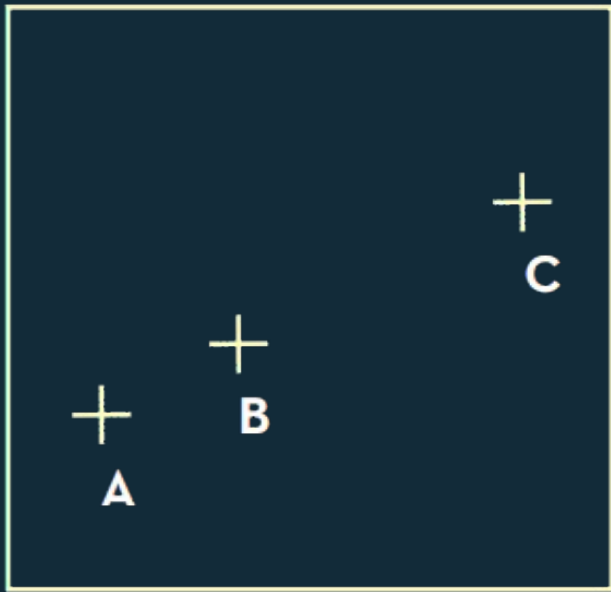


Visual language is a sign system.



William Playfair, The Commerical and Political Atlas, 1785 and Jacques Bertin, Semiologie Graphique, 1967
both collected from Jemery Norman's HistoryOfIformation.com, 2021

Bertin's semiology of graphics.



1. A, B, C are distinguishable
2. B is between A and C.
3. BC is twice as long as AB.

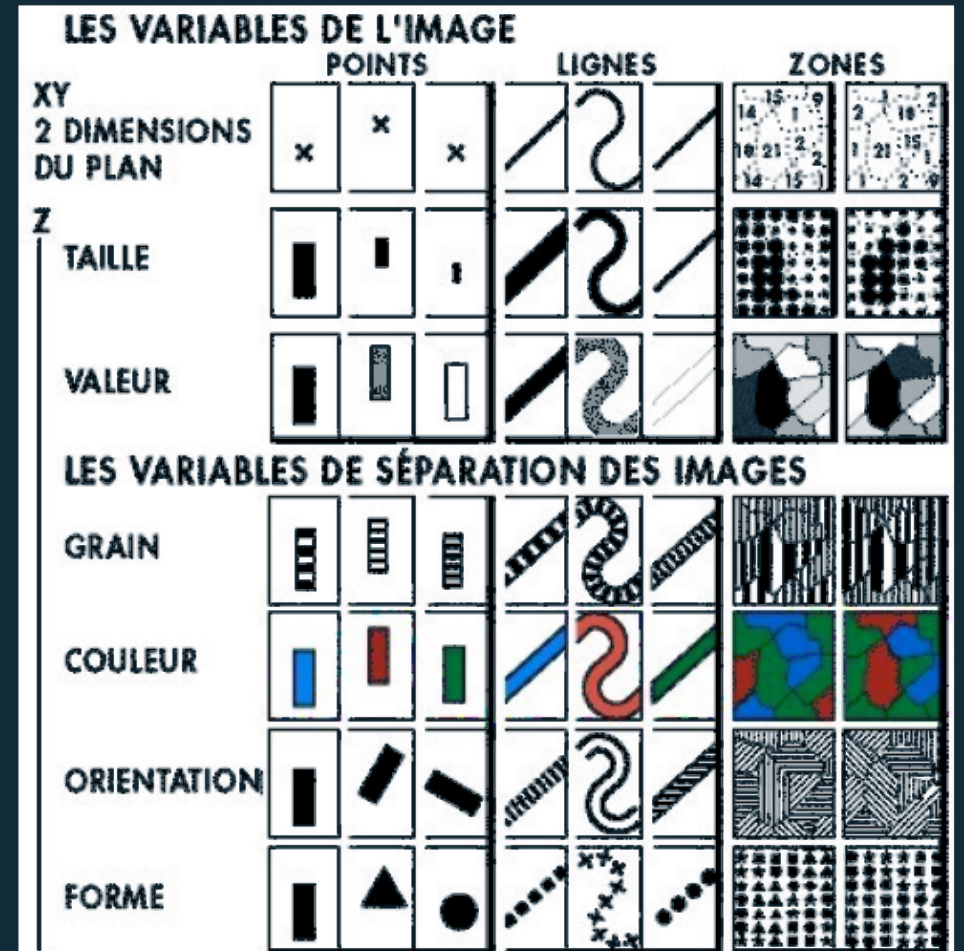
\therefore Encode quantitative variables

"Resemblance, order and proportion are the three signifieds in graphics." - Bertin

Visual encoding variables.

Visual Grammar.

- Position (x2)
- Size
- Value (Saturation)
- Texture
- Colour
- Orientation
- Shape
- (Time/Animation, Focus, Opacity)



Adapted from Jeffrey Heer, 2018, UW CSE442, after Jacques Bertin, *Semiologie Graphique*, 1967

Position	N	O	Q
Size	N	O	Q
Value	N	O	Q
Texture	N	o	
Color	N		
Orientation	N		
Shape	N		

Nominal

Ordered

Quantitative

Note: Q < O < N

- Bertin's list:

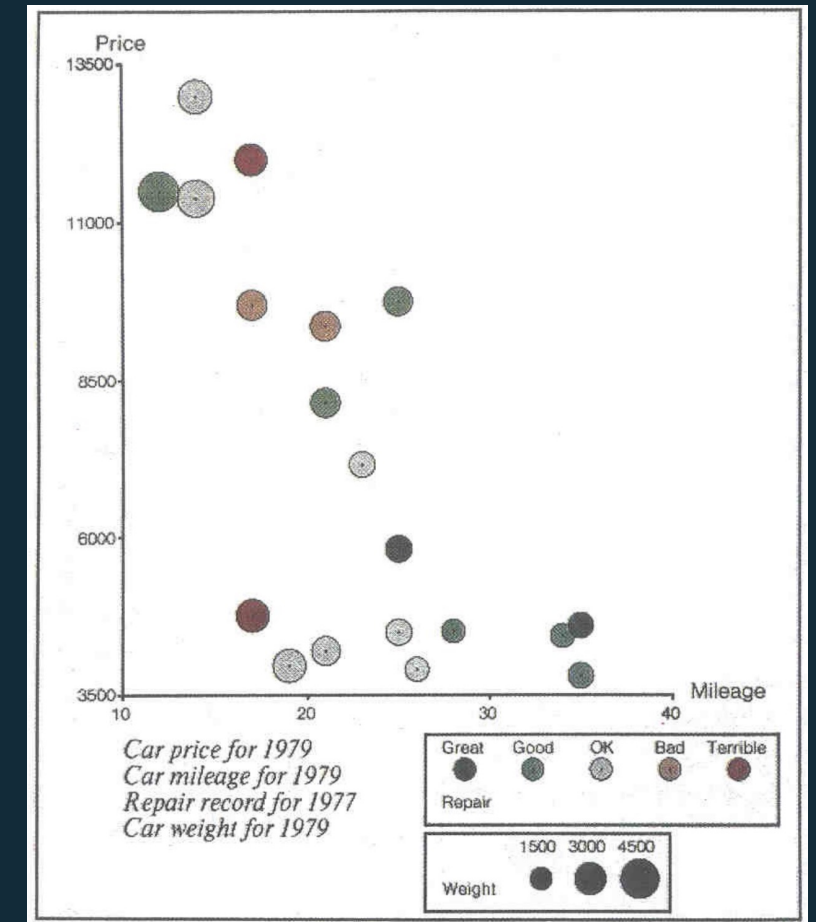
based on theoretical
considerations of
semiology

Bertin's

“Levels of Organisation”

Mackinlay design criteria.

- Formalizes Bertin **for machines**.
- **Expressiveness** A set of facts is expressible in a visual language if the sentences (i.e. the visualisations) express **all the facts in** the set of data, **and only** the facts.
- **Effectiveness** A visualisation is more effective than another if the information conveyed by one visualisation is more **readily perceived** than the information in the other visualization.

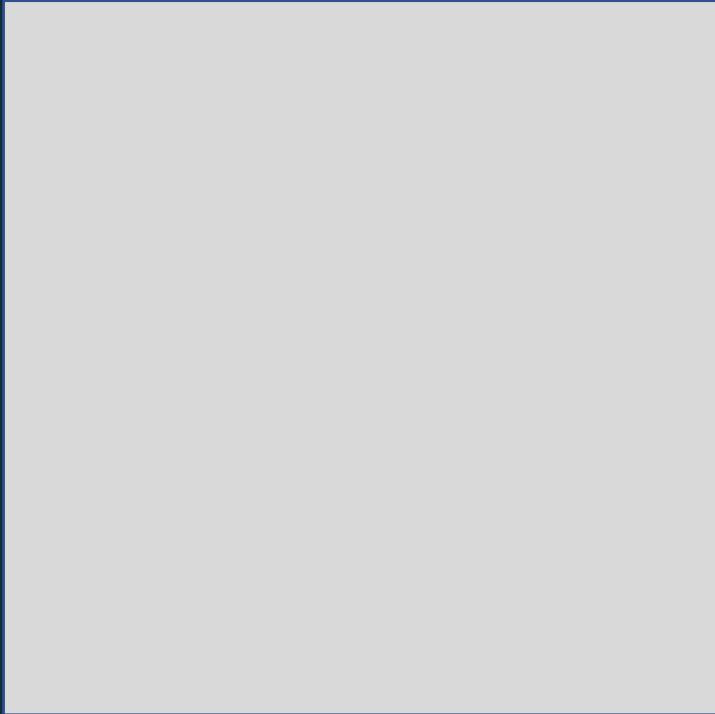


Mackinlay design criteria.

Quantitative		Ordinal		Nominal
Position	—————	Position	—————	Position
Length		Density		Hue
Angle		Saturation		Texture
Slope		Hue		Connection
Area		Texture		Containment
Volume		Connection		Density
Density		Containment		Saturation
Saturation		Length		Shape
Hue		Angle		Length
Texture		Slope		Angle
Connection		Area		Slope
Containment		Volume		Area
Shape	—————	Shape		Volume

- **Mackinlay's list:**
based on his experiments with computer graphics, trying to automate and formalize the creation of charts
- The **Vega** visual language/grammar is built on Mackinlay's work

Which square is lighter?



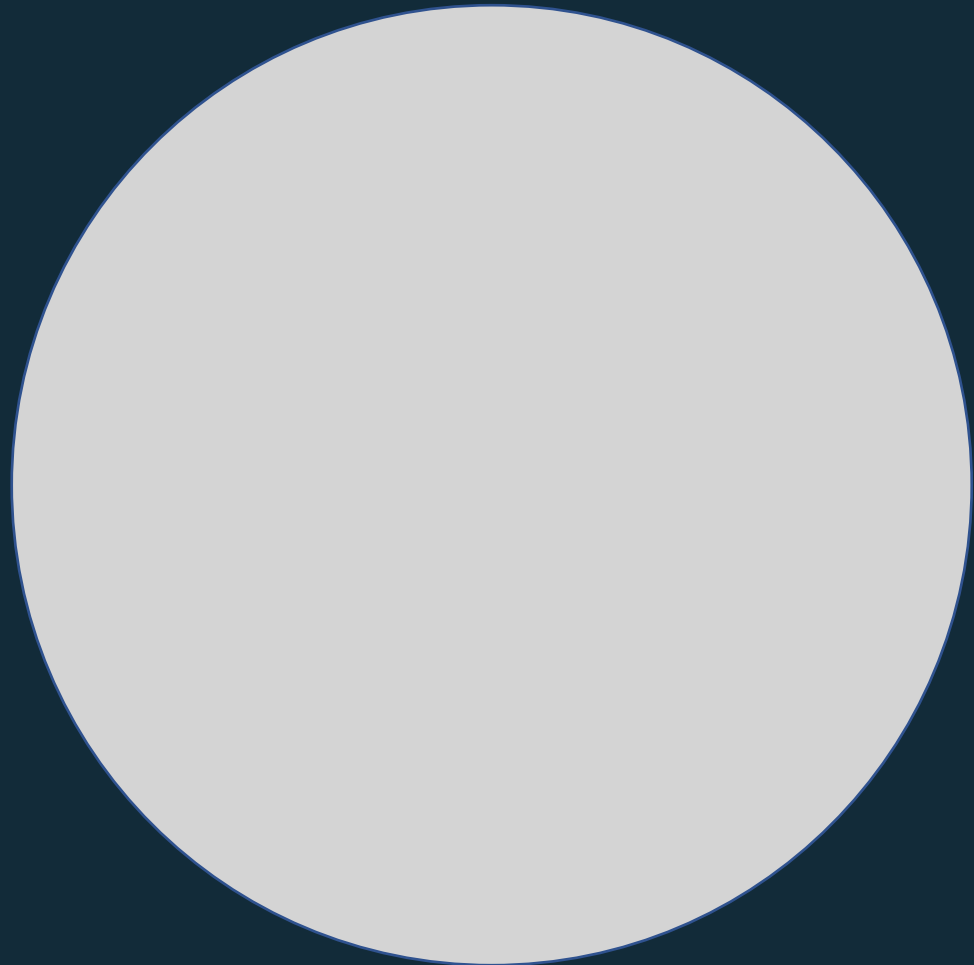
Which square is lighter?

217, 217, 217

> 2 %

212, 212, 212

How many times is the right circle larger?



How many times is the top bar longer?



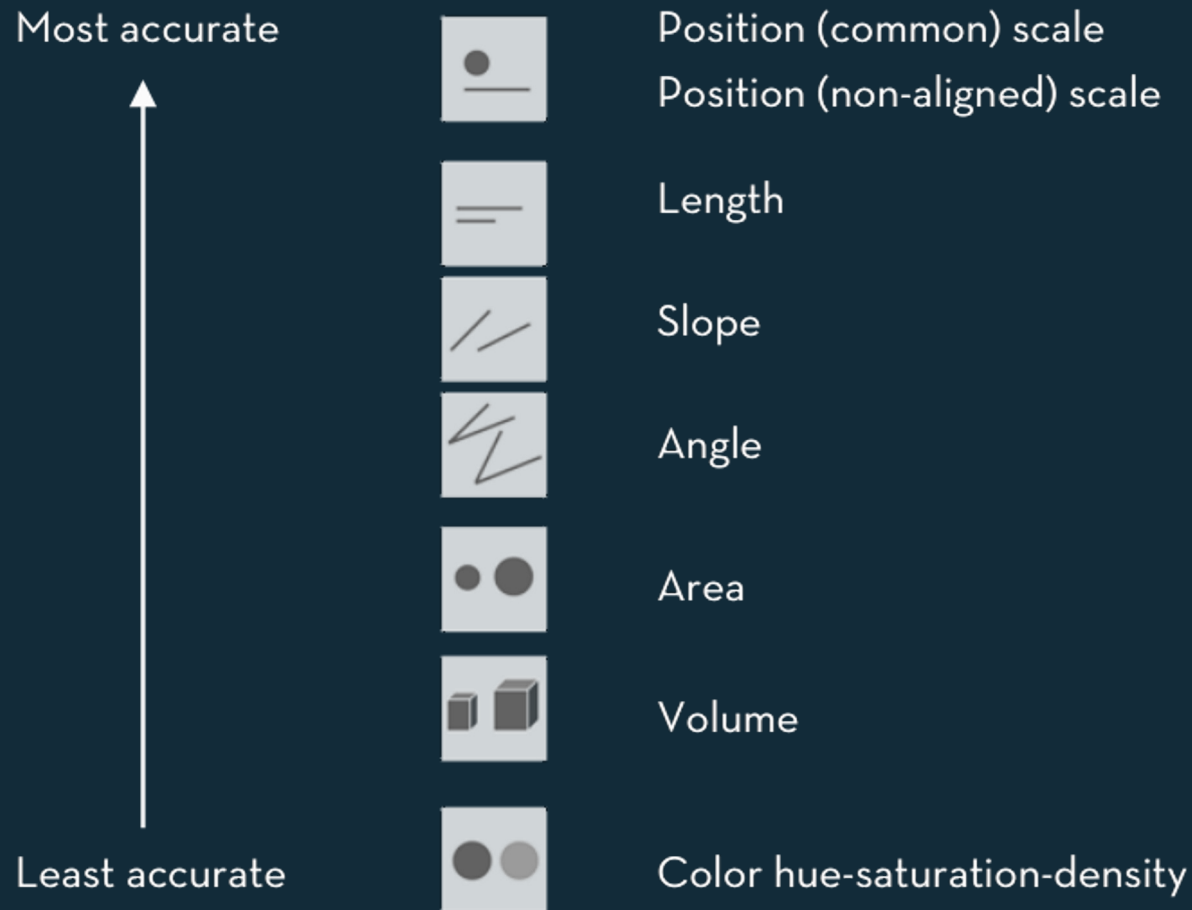
Stevens' power law.

$$\text{sensation} = \text{intensity}^{\text{exponent}}$$

Our senses are not linear!



Stevens' power law.



Stanley Smith Stevens, Harvard, 1957


Stevens' list:

based on psychological
experiments with
human senses

Visual language is a sign system.

- When designing visual information use correct encodings
- data → information correct data model
- information → knowledge correct visual representation
 - Bertin's semiology of graphics
 - Mackinlay design criteria
 - Stevens' power law

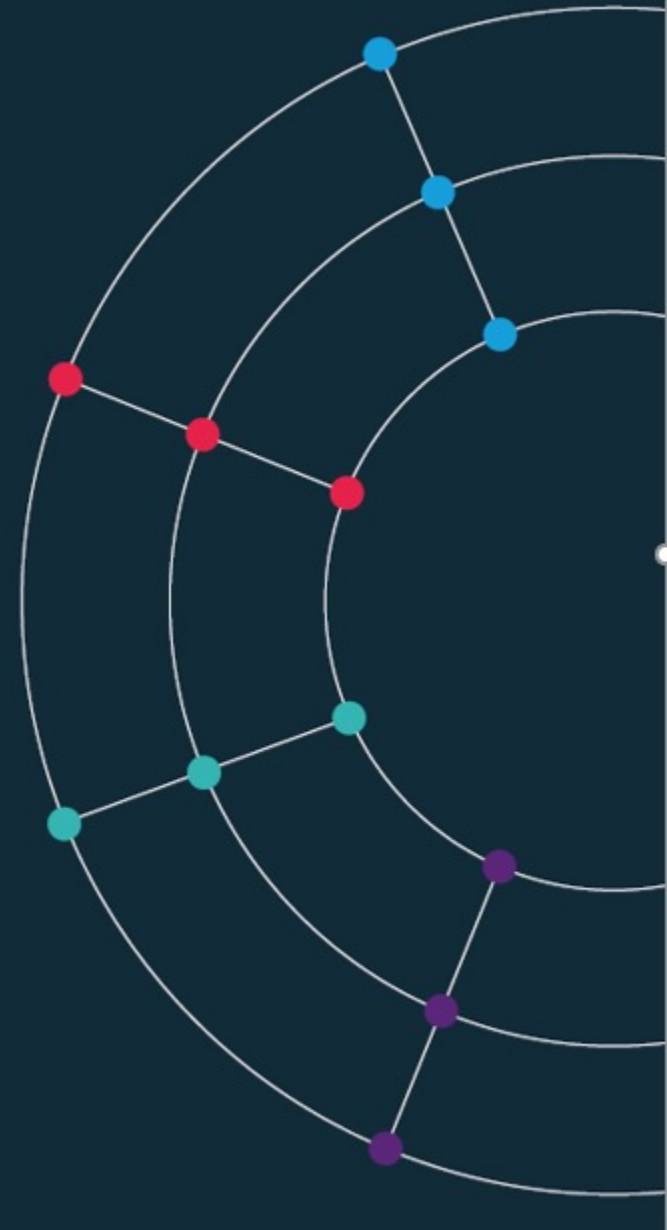
Data visualization zoo.

- The actual “[A Tour through the Visualisation Zoo](#)”
- Economics Observatory  [Visualisation Guidelines](#)
- [Financial Times Visual Vocabulary](#)
- [Vega Edition](#) of the Visual Vocabulary
- The [D3 Graph Gallery](#)
- [Andy Kirks's](#) [The Chartmaker Directory](#)

Session 4.

Advanced visualisations

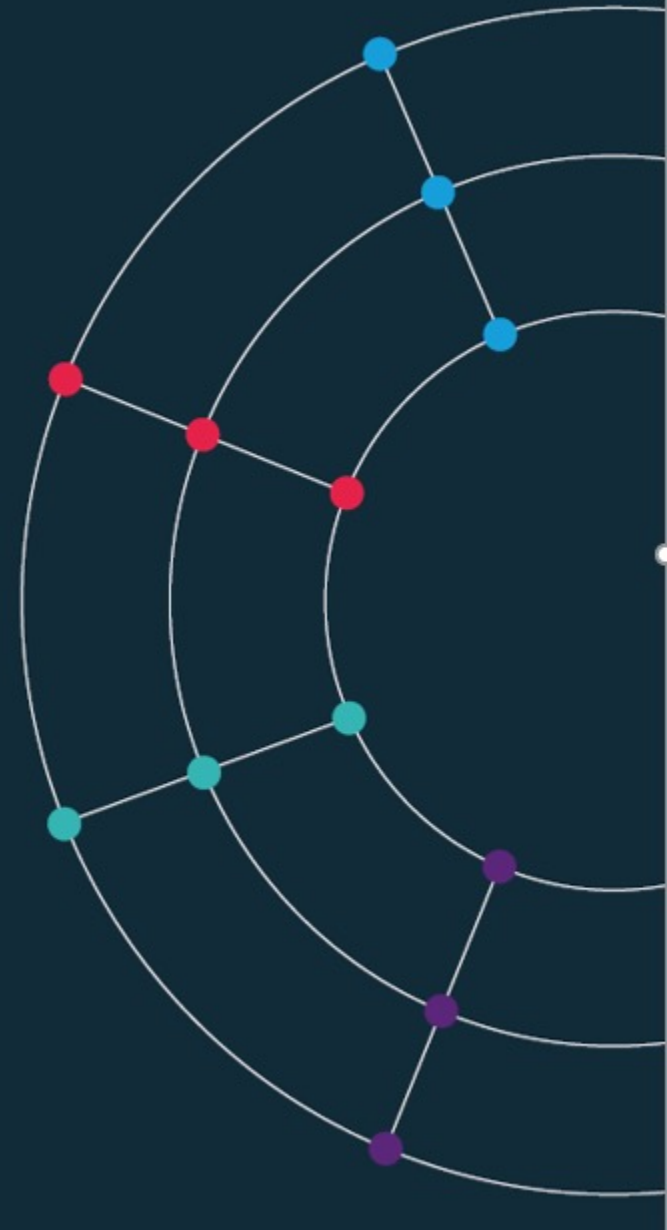
Adding multi-dimensional charts



Session 4.

Advanced visualisations

<https://economicsobservatory.com/modern-data-visualisation>



Code-along.

In this fourth practical session, we will use [Vega-Lite](#), [VS Code](#) and [GitHub](#) to explore and embed a multi-dimensional chart into your website using one (or more) of the following:

- Beginner: “[s4_chart1.json](#)”
- Intermediate:
 - “[s4_chart2.json](#)”
 - “[s4_chart3.json](#)” (map)
- Advanced: “[s4_chart4.json](#)”
- More examples: “[s4_more_example_charts](#)”

