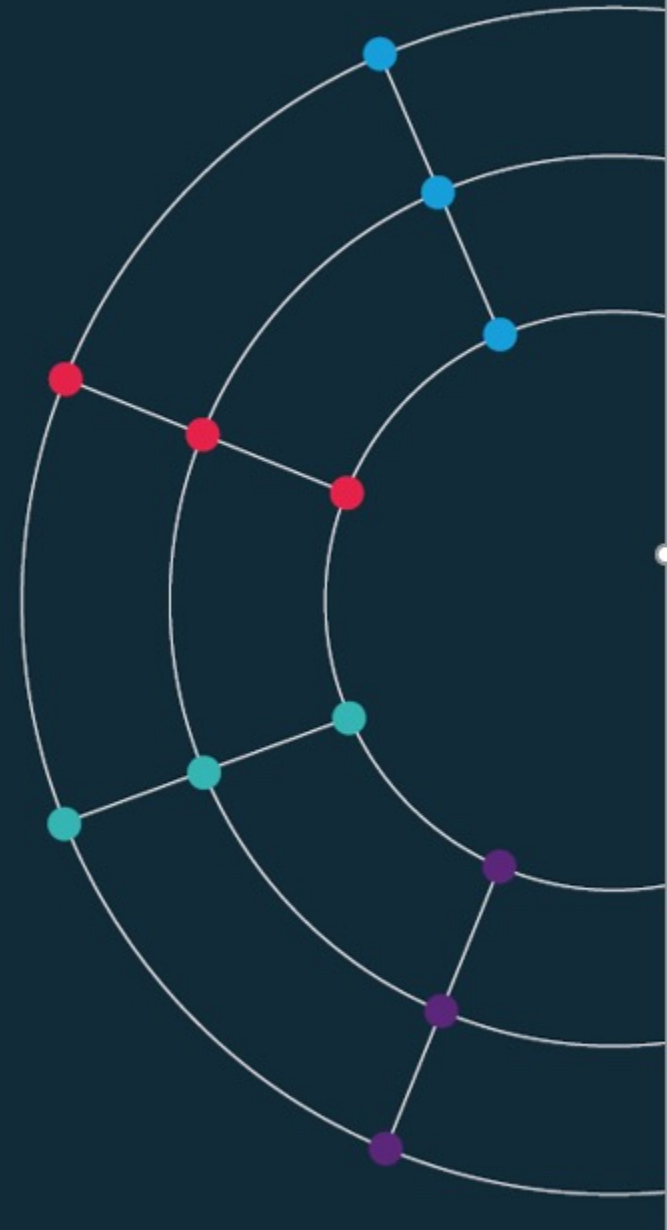




Session 4.

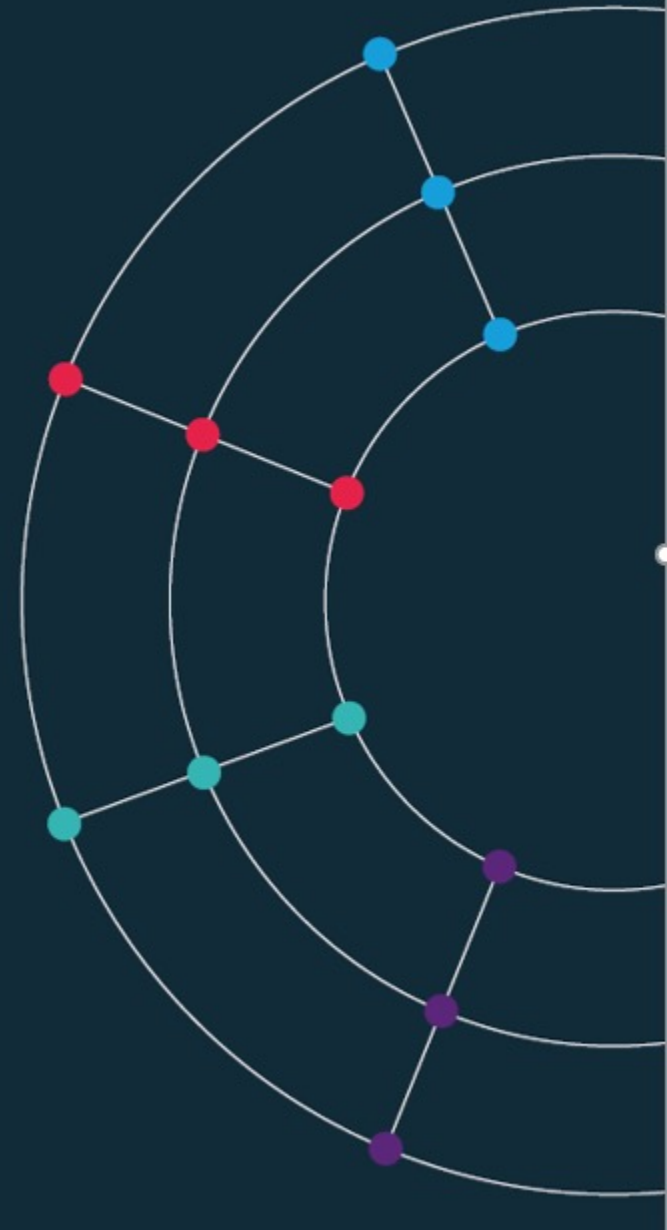
Advanced visualisations



Session 4.

Advanced visualisations

The grammar of graphics



What is Data Science?

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

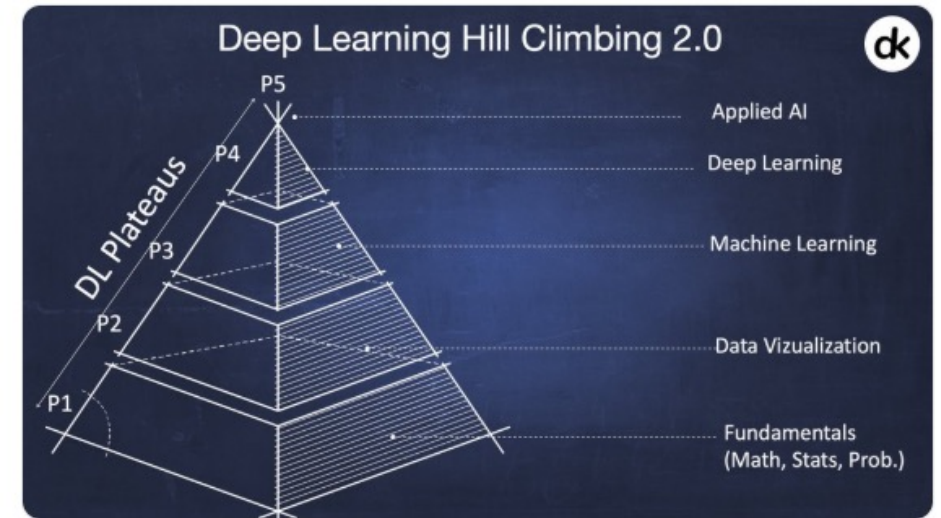


Tamara McCleary
@TamaraMcCleary



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



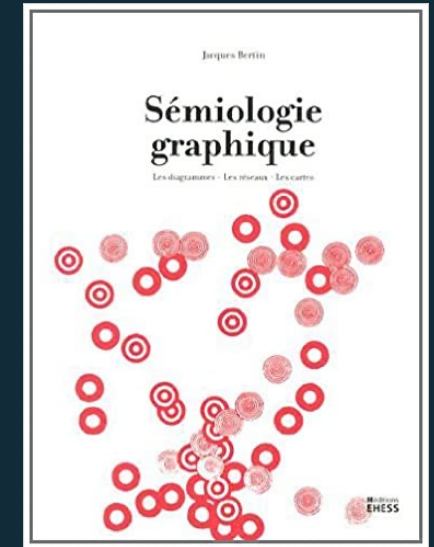
1 59 78



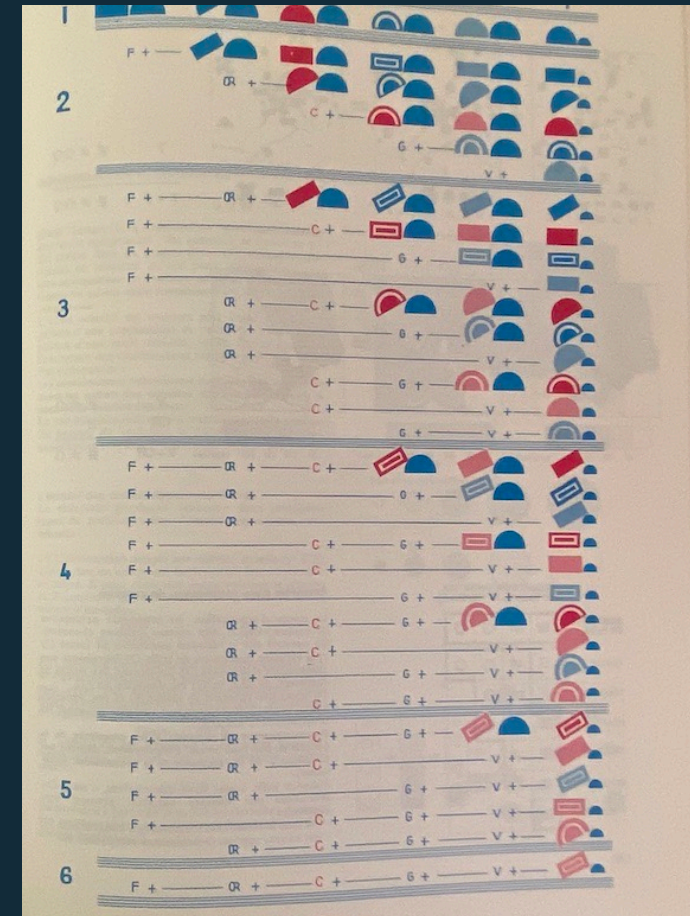
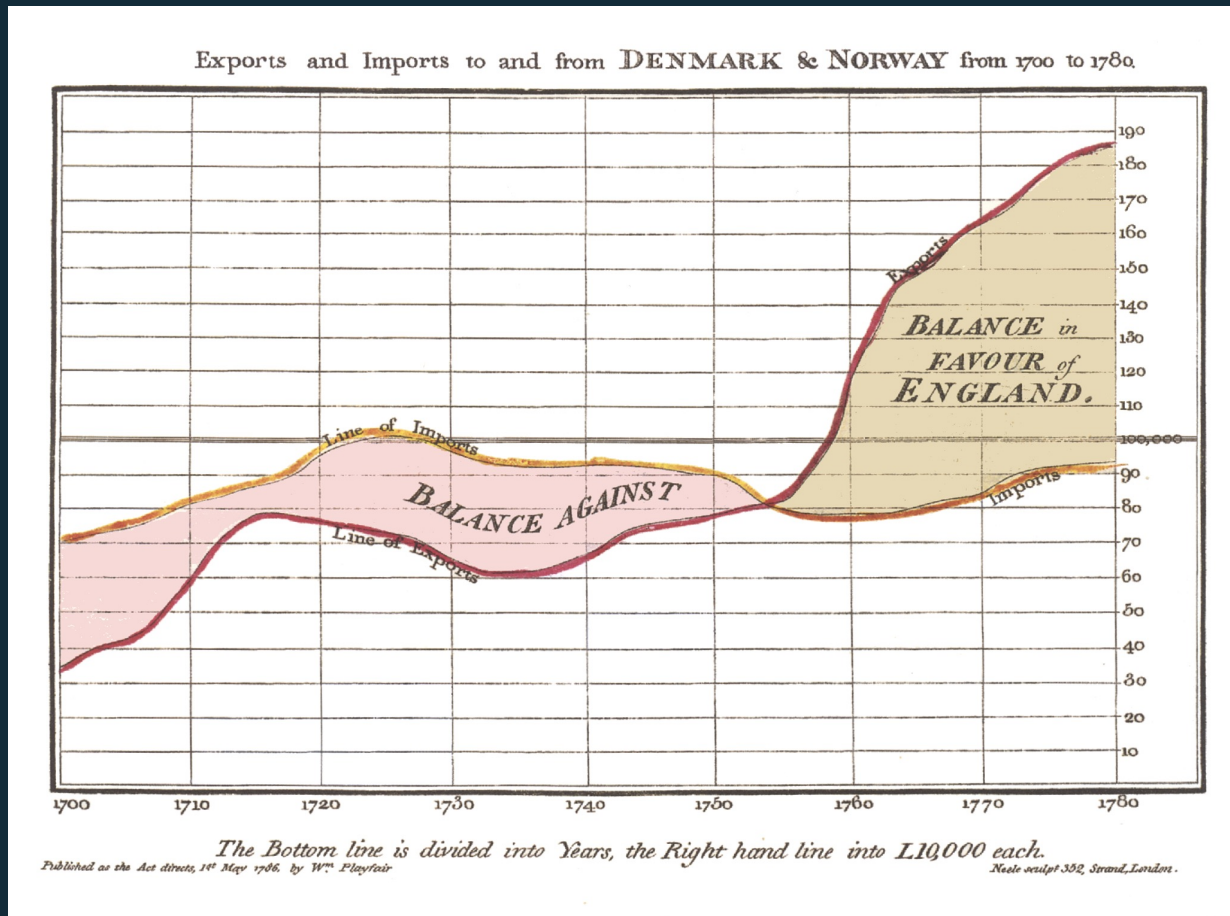
Tweet your reply

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**”

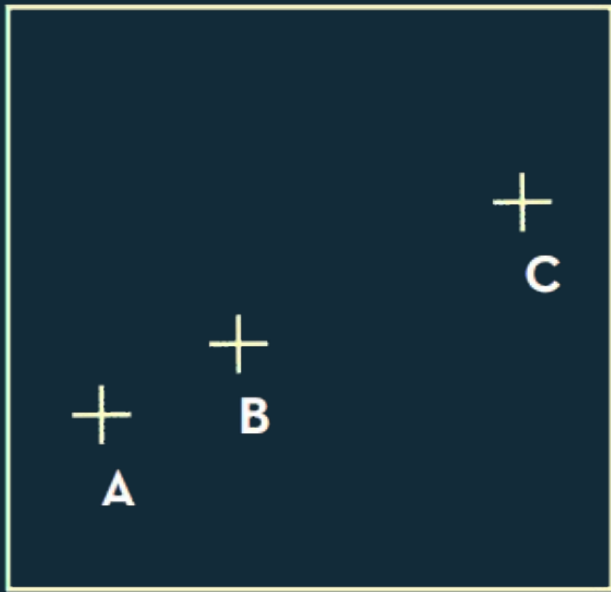


Visual language is a sign system.



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.

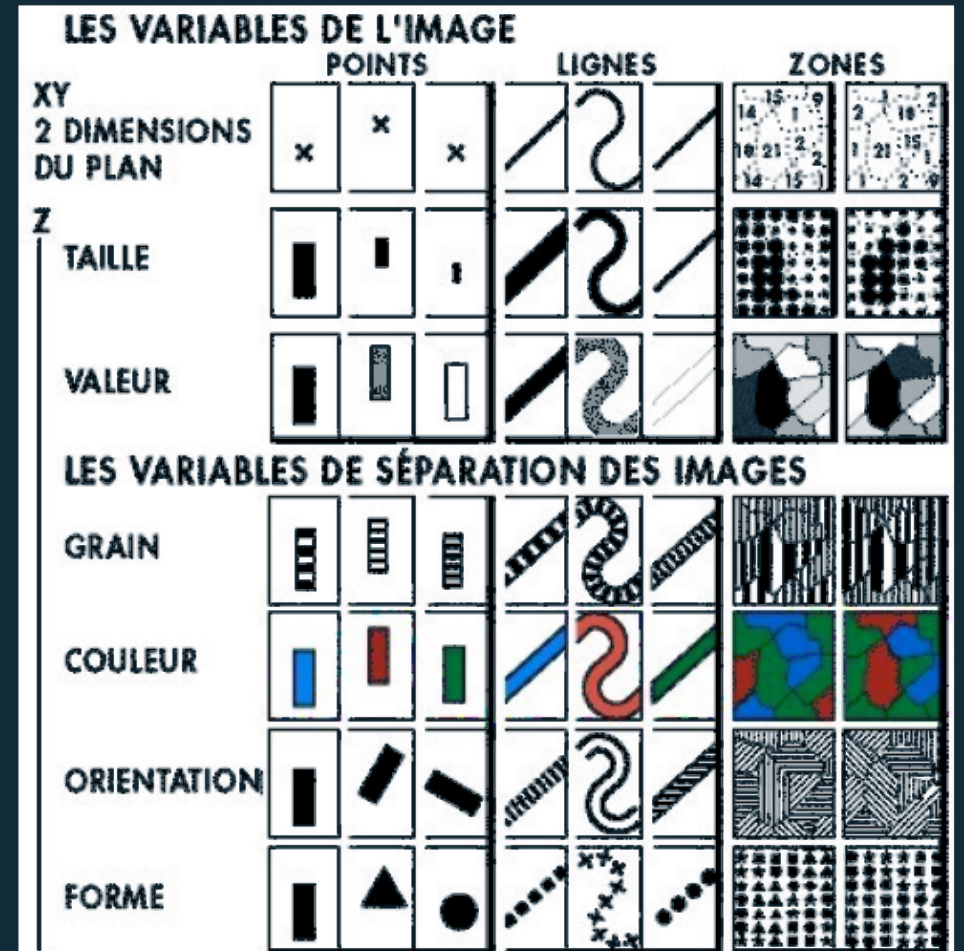
\therefore Encode quantitative variables

"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:

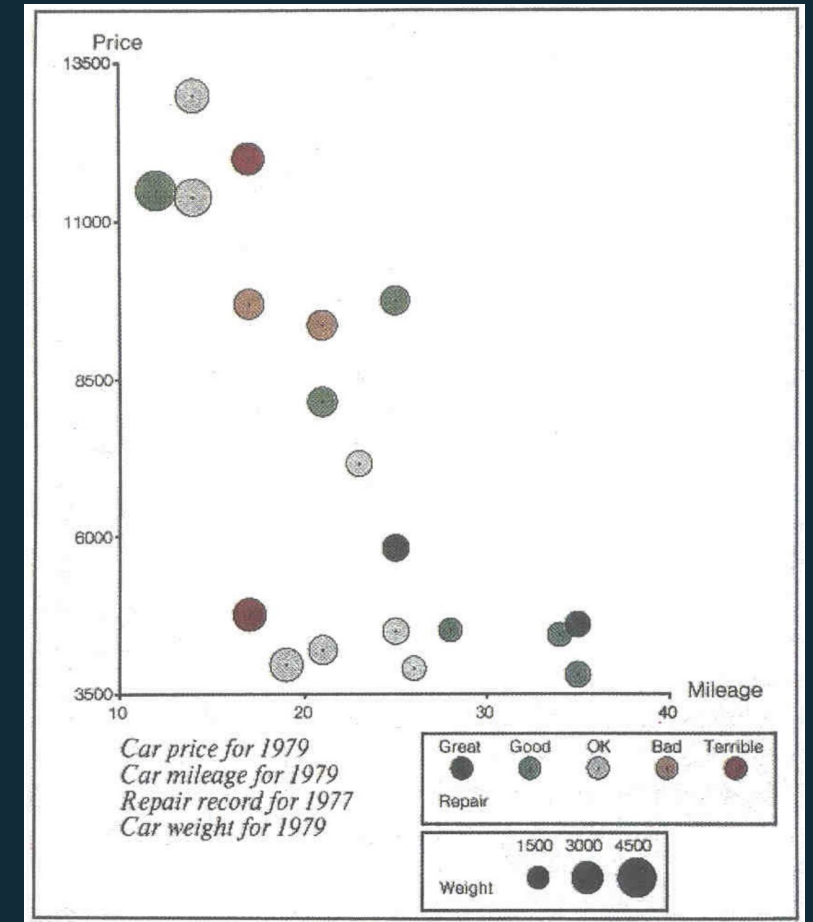
based on theoretical
considerations of
semiology

Bertin's

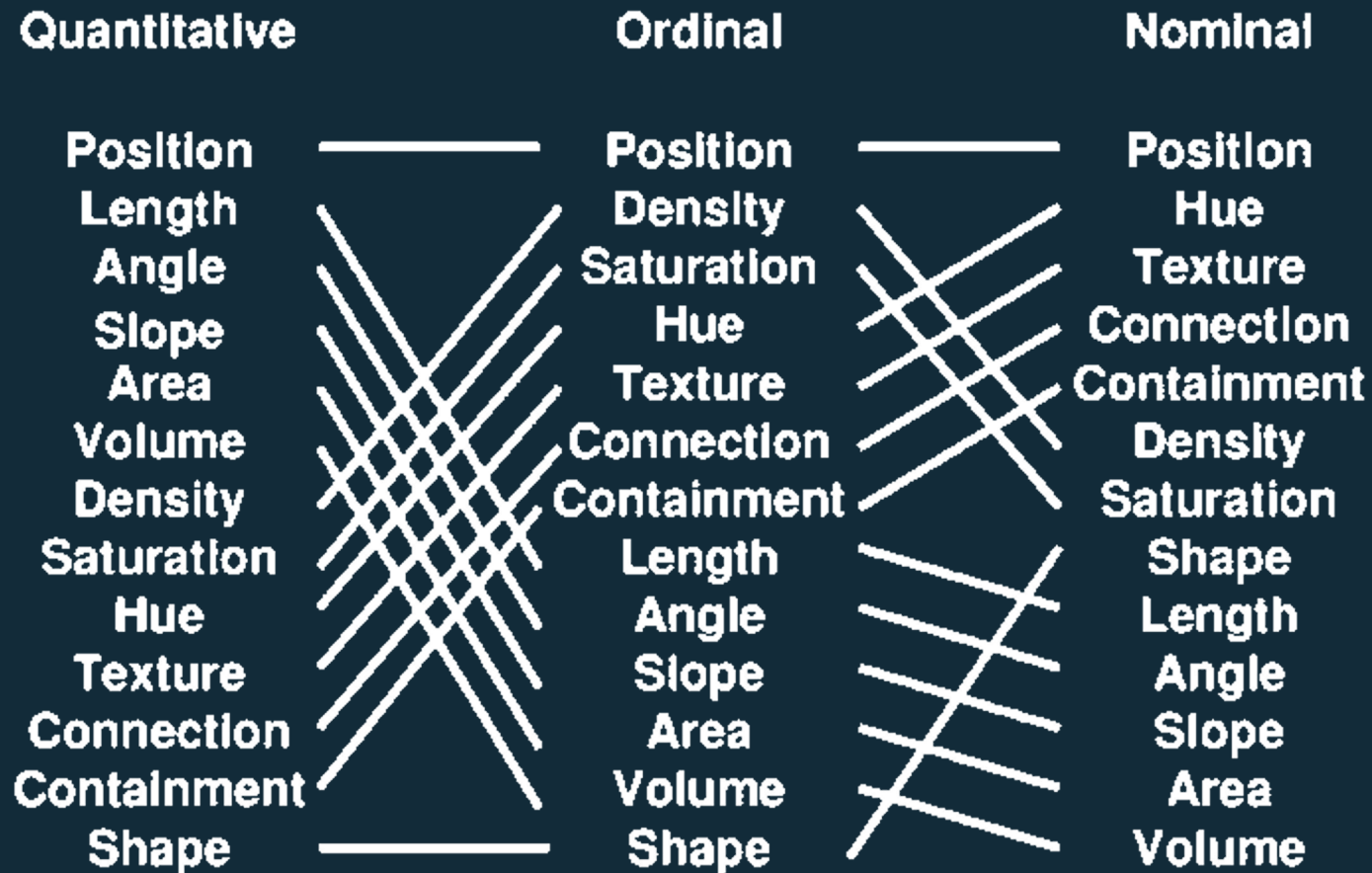
“Levels of Organisation”

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.

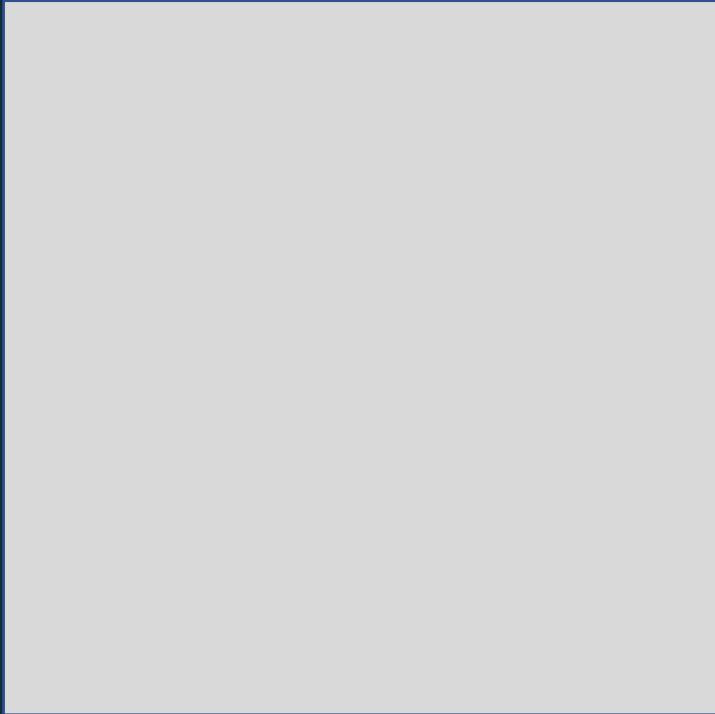


Mackinlay design criteria.



- **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?



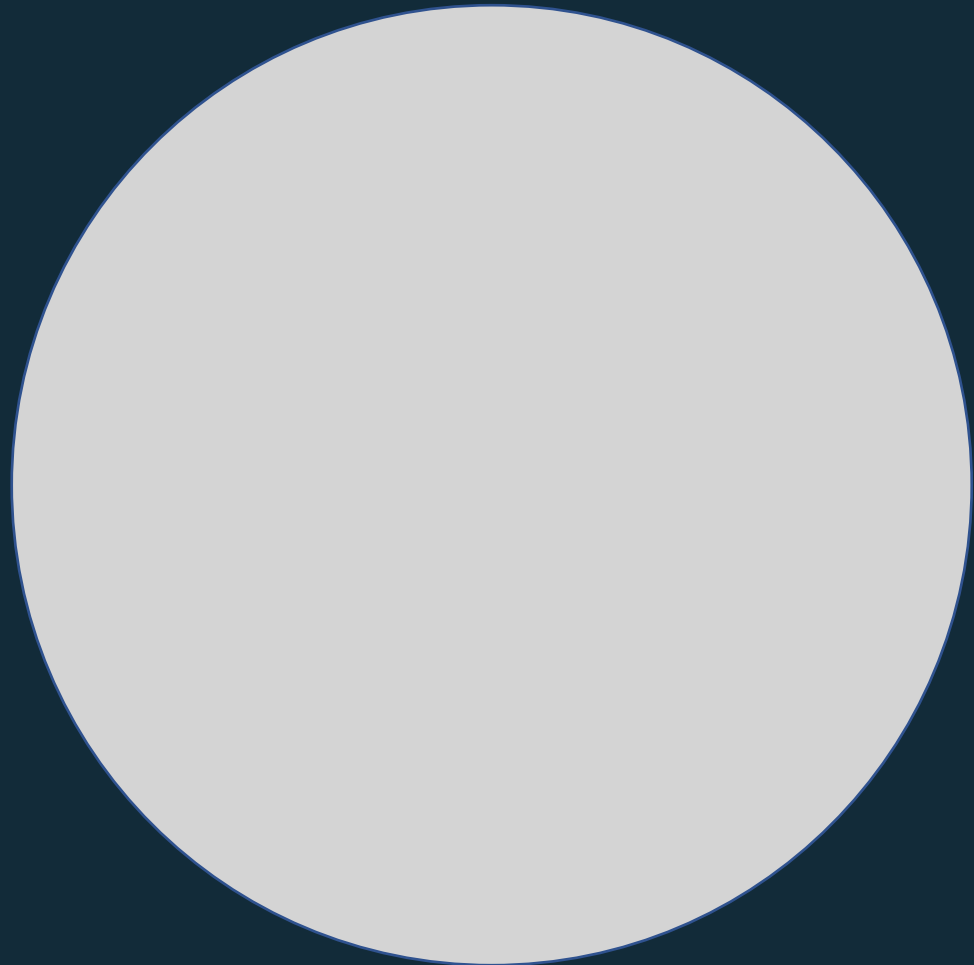
Which square is lighter?

217, 217, 217

> 2 %

212, 212, 212

How many times is the right circle larger?



How many times is the top bar longer?



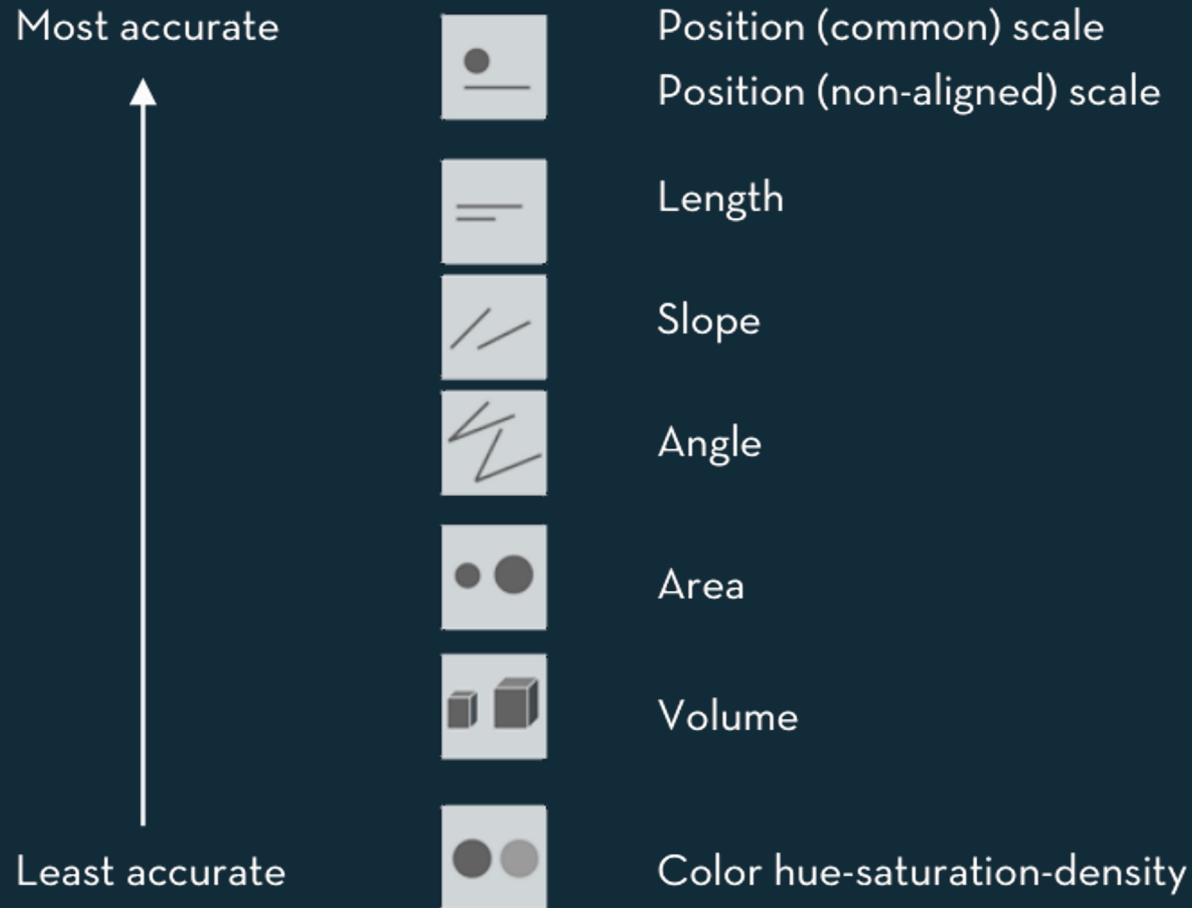
Stevens' power law.

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

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

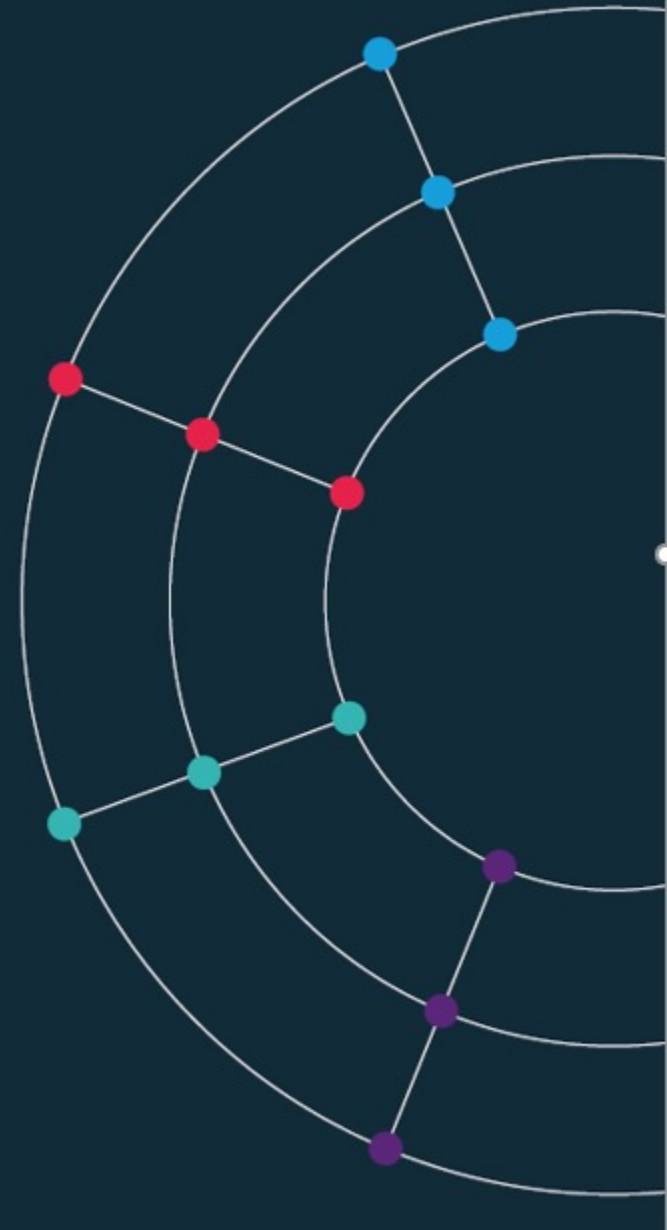
Data visualization zoo.

- 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

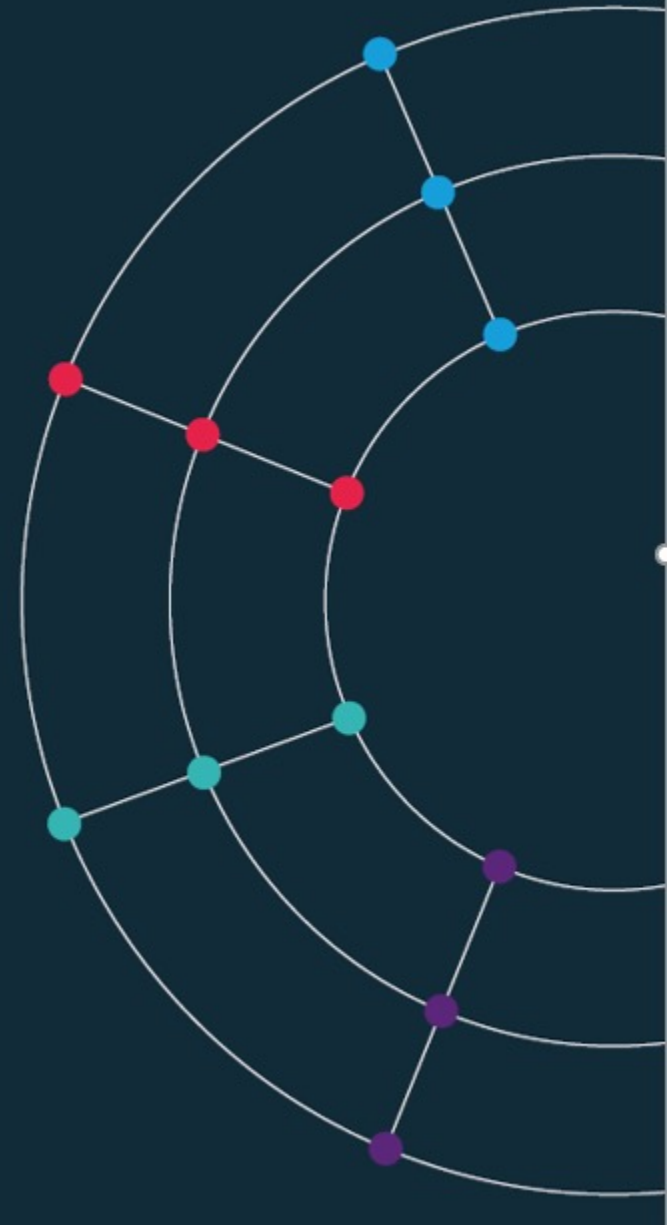
Adding multi-dimensional charts



Session 4.

Advanced visualisations

*[https://github.com/EconomicsObservatory/
courses/blob/main/README.md](https://github.com/EconomicsObservatory/courses/blob/main/README.md)*



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: “[more_example_charts](#)”

