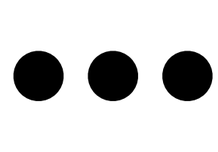
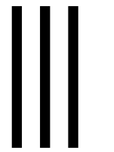
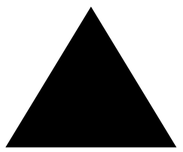
# Data Fundamentals

Data Visualization and Infographics with D3

Scott Murray
@alignedleft

# What is *information*?

Information is an abstract *concept* or *idea*

three 3   

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*The Treason of Images*
Rene Magritte, 1929

# *Modes of representation*

text

numbers

images

videos

sounds

smells

speech

motion

# What is *data*?

Data is a *structured* representation of information

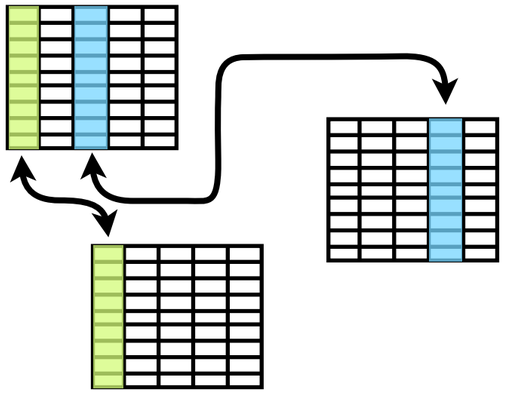
## *List*

3
6
12
25
32
78
124
5,932

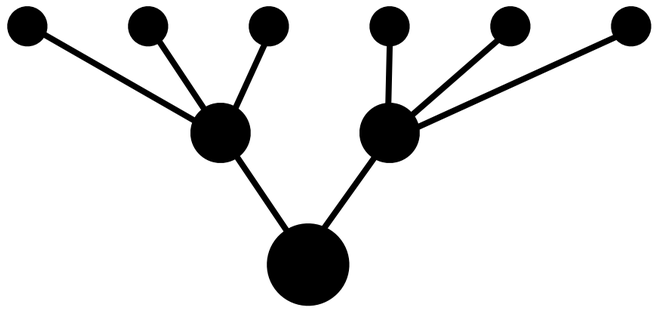
## *Table*

| | |
|---|---|
| Apples | 3 |
| Oranges | 6 |
| Bananas | 12 |
| Grapes | 25 |
| Kiwis | 32 |
| Strawberries | 78 |
| Raspberries | 124 |
| Pineapples | 5,932 |

## *Relational Tables*



## *Tree*



# Types of *data*

# *variable types in data graphics*

- qualitative
  - nominal
  - ordinal
- quantitative
  - interval
  - ratio

# nominal data

*unordered categories*

apples, oranges

trees, flowers, grasses, ferns

toucans, apartments, doctors

# ordinal data

*series of ordered categories*

grade AA, A, B

freshman, sophomore, junior, senior

puddle, pond, lake, ocean

# quantitative data

*numeric intervals*

*arbitrary zero point,*
*only relative values are significant*

1, 2, 3, 4, 5...

Sep 15, Sep 17, Sep 20, Sep 22...

# quantitative data

*numeric ratios*

*absolute/fixed zero point,*
*relative* and *absolute values are significant*

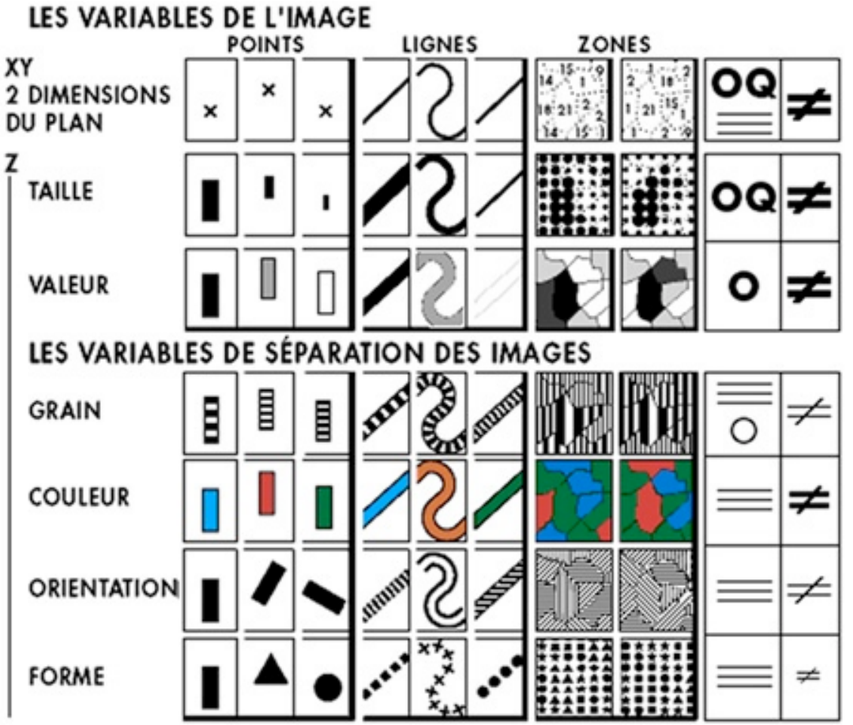
5 cm

16 GB

25 years

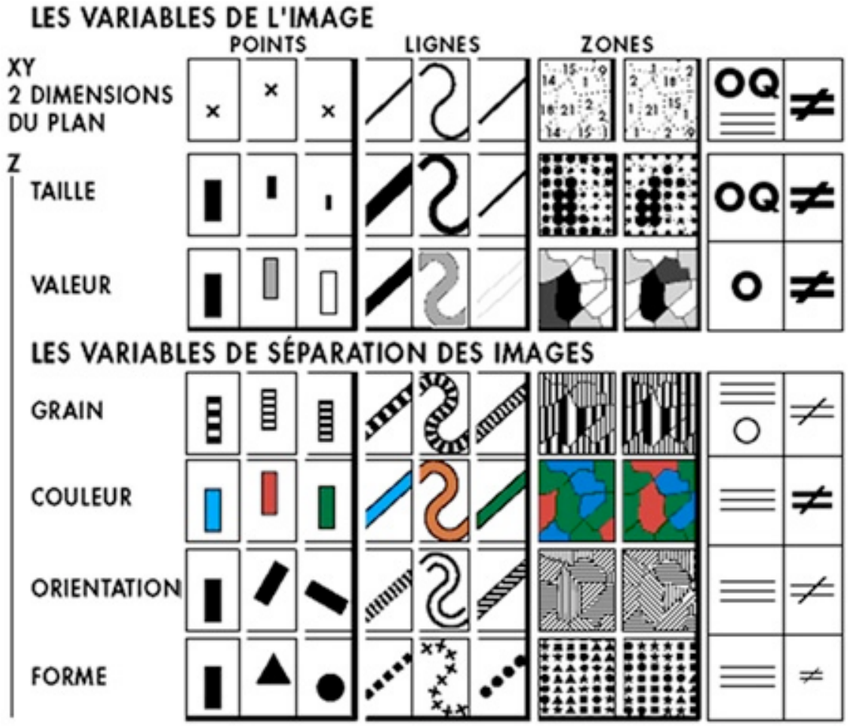
212°F

# Properties for visual *encoding*



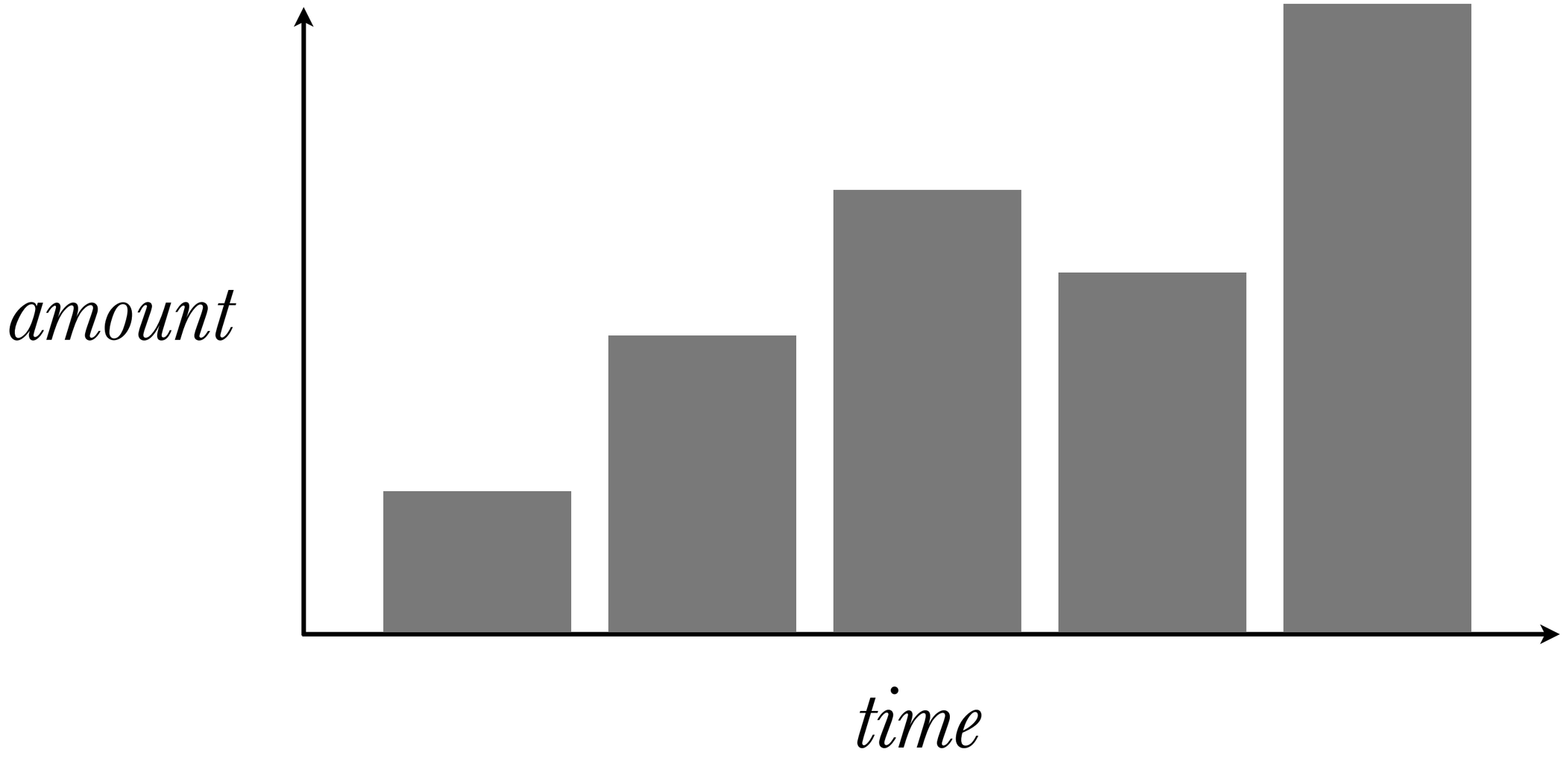

*Semiology of Graphics*
Jacques Bertin, 1983

| | | | |
|---|---|---|---|
| Position | N | O | Q |
| Size | N | O | Q |
| Value | N | O | |
| | | | |
| Texture | N | | |
| Color | N | | |
| Orientation | N | | |
| Shape | N | | |




*Semiology of Graphics*
Jacques Bertin, 1983

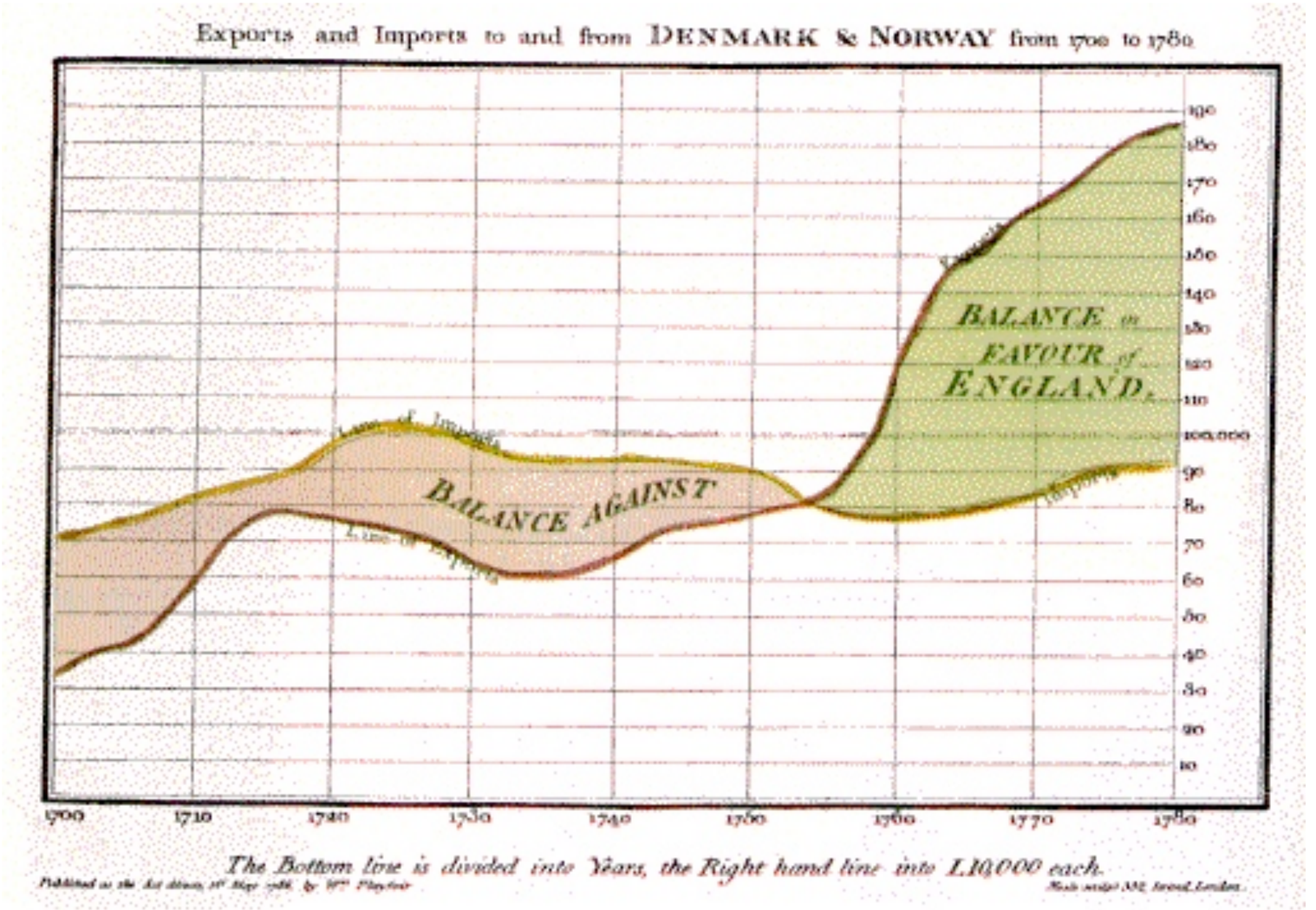
*quantitative values encoded with position*



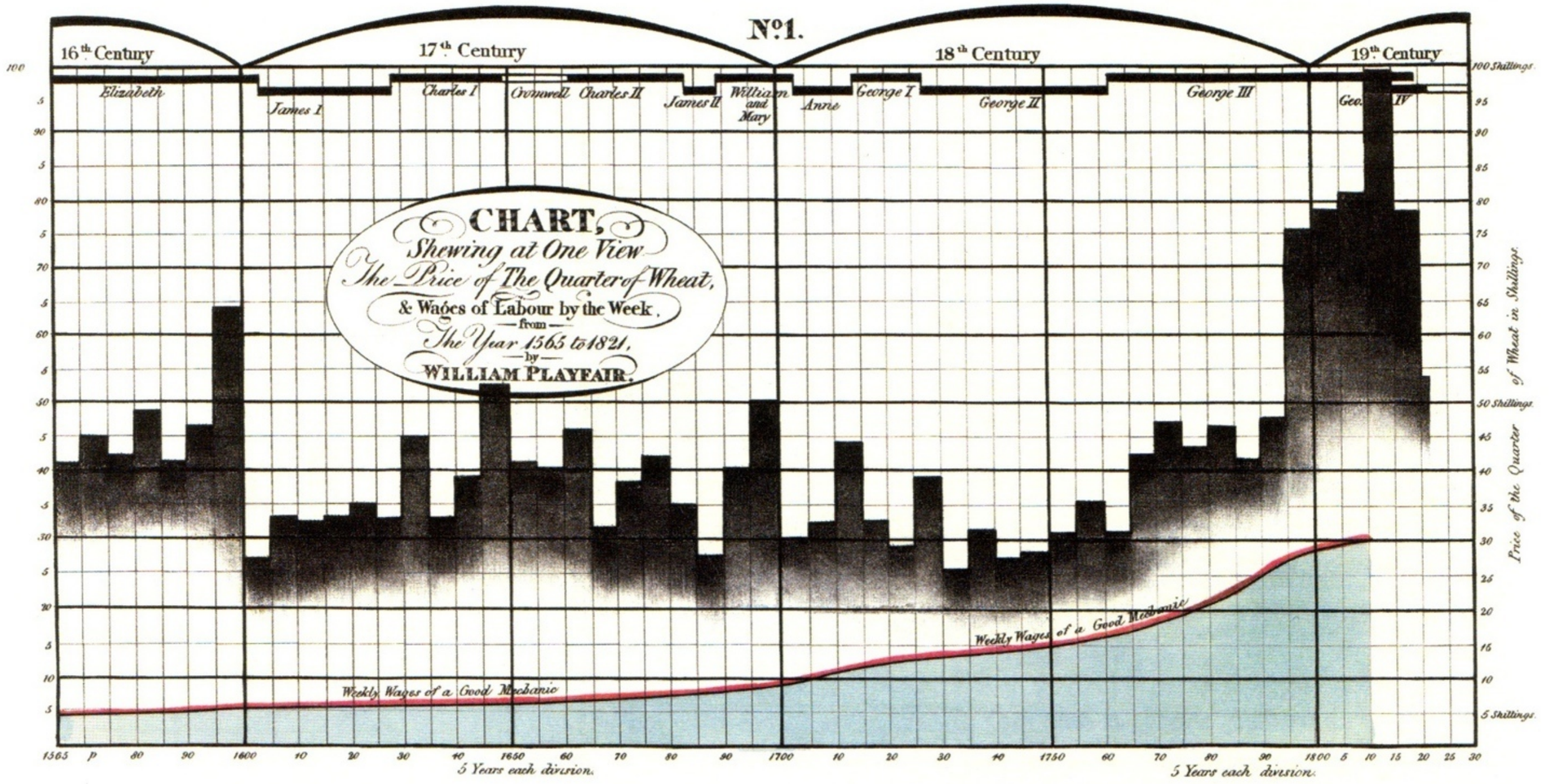
*quantitative values encoded with value and color*

*amount*

*time*

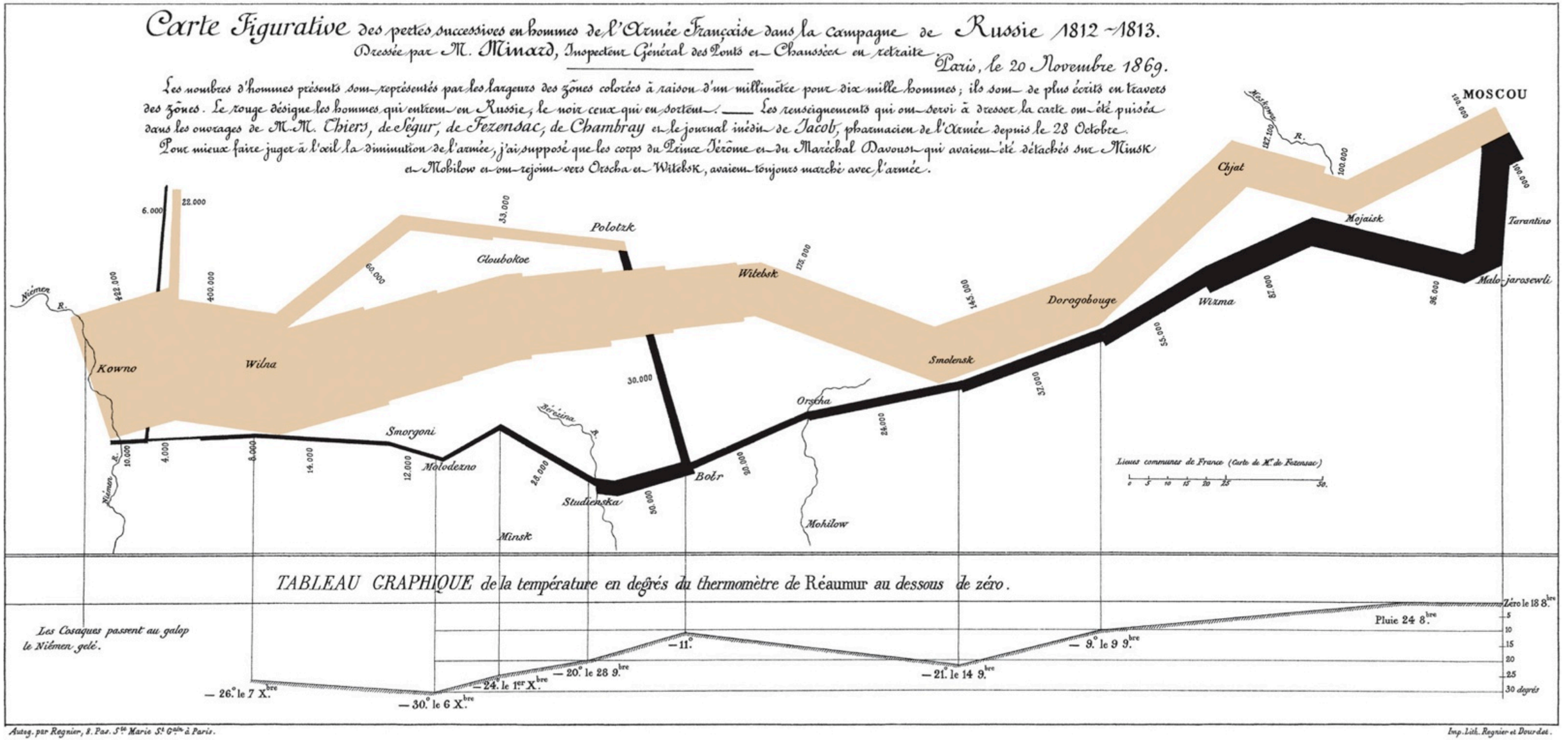



William Playfair, 1786



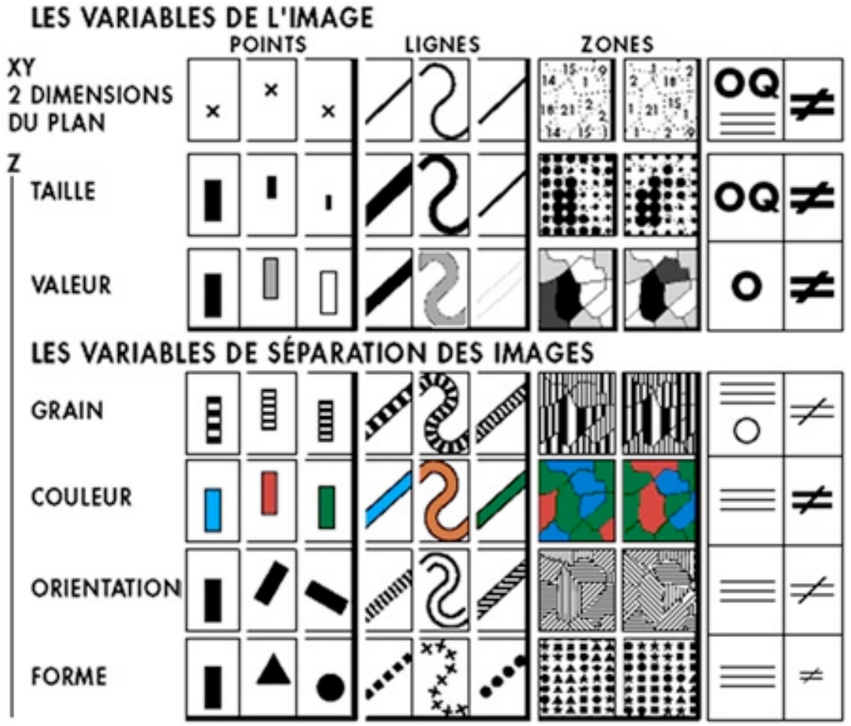

William Playfair, 1822

John Snow, 1854



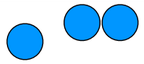
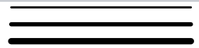
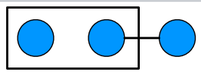
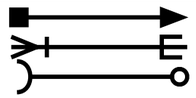
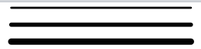

Charles Joseph Minard, 1869

| | | | |
|---|---|---|---|
| Position | N | O | Q |
| Size | N | O | Q |
| Value | N | O | |
| | | | |
| Texture | N | | |
| Color | N | | |
| Orientation | N | | |
| Shape | N | | |




*Semiology of Graphics*
Jacques Bertin, 1983

# Properties and Best Uses of Visual Encodings

| Example | Encoding | Ordered | Useful values | Quantitative | Ordinal | Categorical | Relational |
|---|---|---|---|---|---|---|---|
|  | position, placement | **yes** | **infinite** | Good | Good | Good | Good |
| 1, 2, 3; A, B, C | text labels | **optional** (alphabetical or numbered) | **infinite** | Good | Good | Good | Good |
| | length | **yes** | **many** | Good | Good | | |
| | size, area | **yes** | **many** | Good | Good | | |
| | angle | **yes** | medium/few | Good | Good | | |
| | pattern density | **yes** | few | Good | Good | | |
|  | weight, boldness | **yes** | few | | Good | | |
| | saturation, brightness | **yes** | few | | Good | | |
| | color | no | few (< 20) | | | Good | |
| | shape, icon | no | medium | | | Good | |
| | pattern texture | no | medium | | | Good | |
|  | enclosure, connection | no | **infinite** | | | Good | Good |
| | line pattern | no | few | | | | Good |
|  | line endings | no | few | | | | Good |
|  | line weight | **yes** | few | | Good | | |

Noah Iliinsky • ComplexDiagrams.com/properties • 2012-06