

Data Visualization & Design

Week 1

Introduction to **this course**

Topic Progression

- **Weeks 1-3:** Principles of Visual Design and Human Perception; Visualization for Communication
- **Weeks 4-7:** Data Types and Visualization Methods
- **Weeks 8-12:** Visualization for Analysis: Creating Dashboards and Visualization Applications

Topic Progression + *Tools*

- **Weeks 1-3:** Principles of Visual Design and Human Perception; Visualization for Communication (**Powerpoint or Canva, Excel and Infogram, color tools**)
- **Weeks 4-7:** Data Types and Visualization Methods (**Tableau, R**)
- **Weeks 8-12:** Visualization for Analysis: Creating Dashboards and Visualization Applications (**D3.js, Carto**)

Topic Progression + *Assignments*

- **Weeks 1-3:** Principles of Visual Design and Human Perception;
Visualization for Communication (***Assignment #1***)
- **Weeks 4-7:** Data Types and Visualization Methods (***Assignment #2,***
Assignment #3)
- **Weeks 8-12:** Visualization for Analysis: Creating Dashboards and
Visualization Applications (***Assignment #4***)

Assignments

- *Weekly homework assignments & participation (25%)*
- **Assignment #1 (10%):** Visual Semantics
- **Assignment #2 (15%):** Truth and Lies in Visualization Graphic
- **Assignment #3 (20%):** Team Project
- **Assignment #4 (30%):** Visualization Application

Expectations

- Attend and participate in all classes
- Complete homework assignments thoroughly and thoughtfully
- Submit **only your own work**
- Communicate with professor/associate to address any questions

Introduction to **data** **visualization**

Data is a set of values of quantitative or qualitative variables.

Today:

- [] grocery shop
- [x] clean
- [x] walk dog

Tomorrow:

- [] pick up car
- [x] do laundry
- [] bake cake
- [] fix alarm

Next week:

- [] finish report
- [] book meeting
- [] mow lawn

Data visualization maps **values** to **visual forms**.

As a practice, visualization is the mapping of qualitative and quantitative data onto **shapes**, **patterns** and **colors**...

...in a way that **enables communication and insight** into the underlying patterns in the data.

Data Exploration and Analysis vs. Communication and Persuasion

Problems

- Communication implies **simplification**
- Data exploration implies **exhaustivity**

Visualization for **data exploration** supports a range of *unanticipated* questions...

...while visualization for **communication and presentation** answers specific, *anticipated* questions.

Where these distinctions come into play:

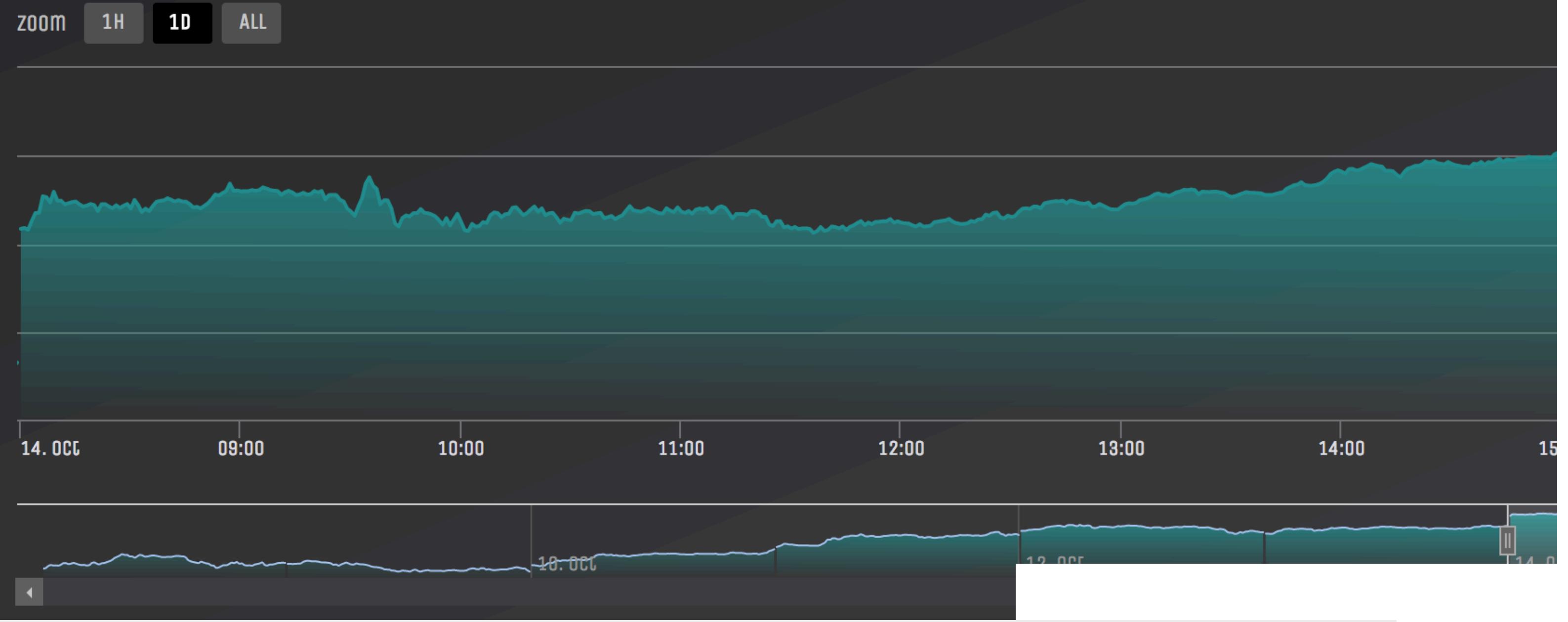
- **Format** Printed report? Dashboard? Poster?
- **Mode of interaction** Static? Interactive?
- **Intended audience** Analyst? Board member?

Basic forms:

- **Charts and graphs** (statistical data representations)
- **Infographics** (data-driven storytelling)
- **Interactive dashboards** (e.g. Tableau)

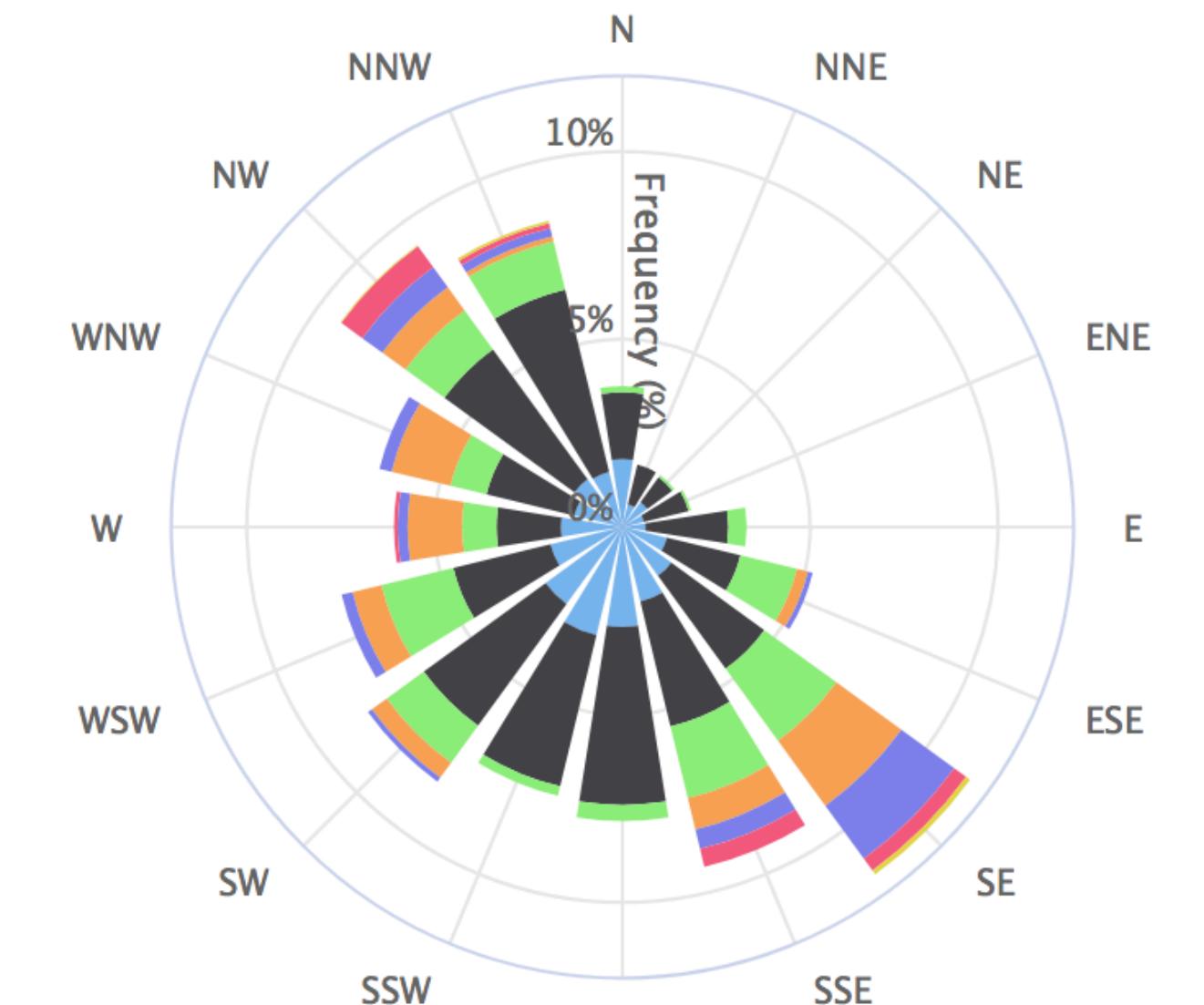
AAPL STOCK PRICE BY MINUTE

USING ORDINAL X AXIS



Wind rose for South Shore Met Station, Oregon

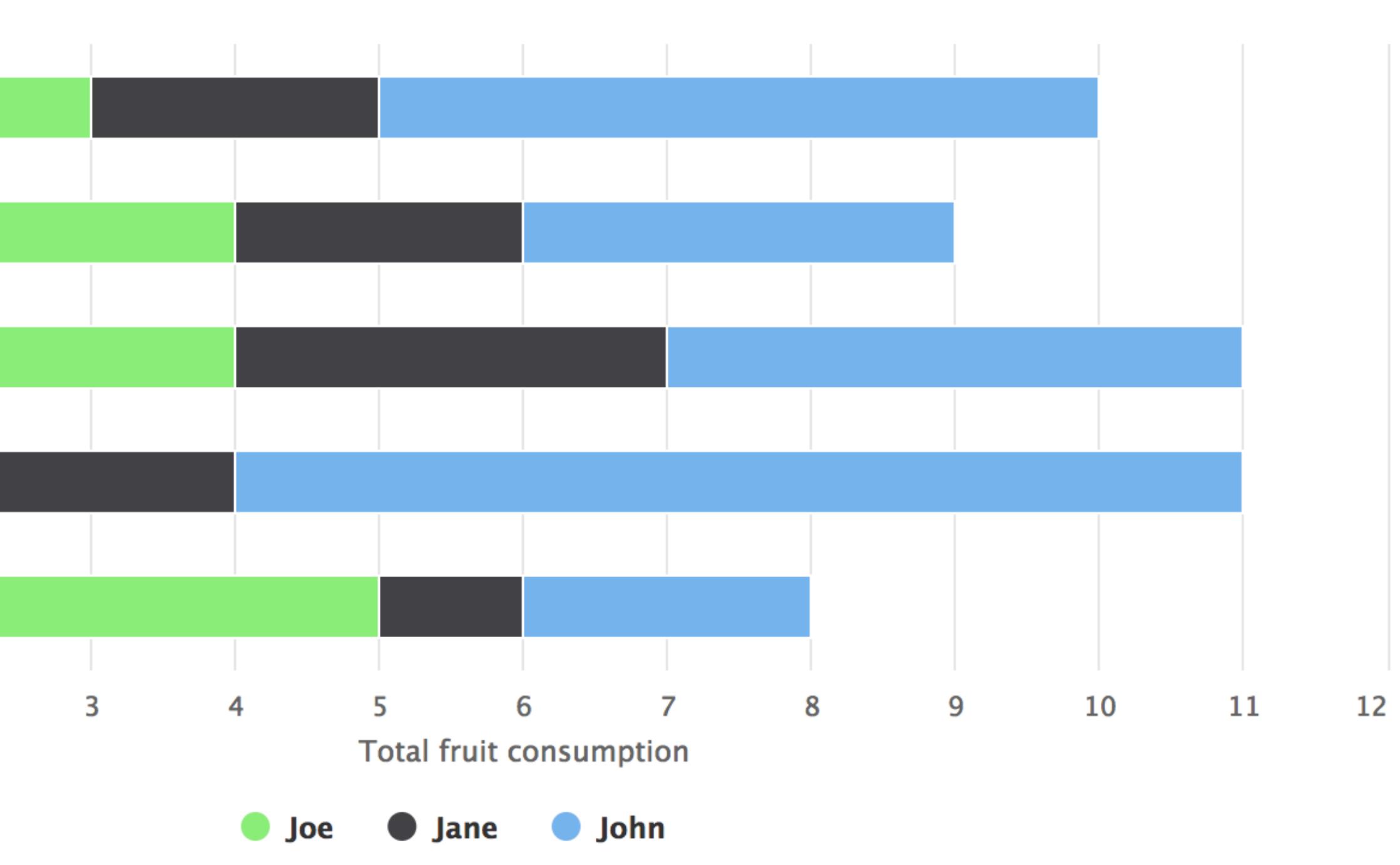
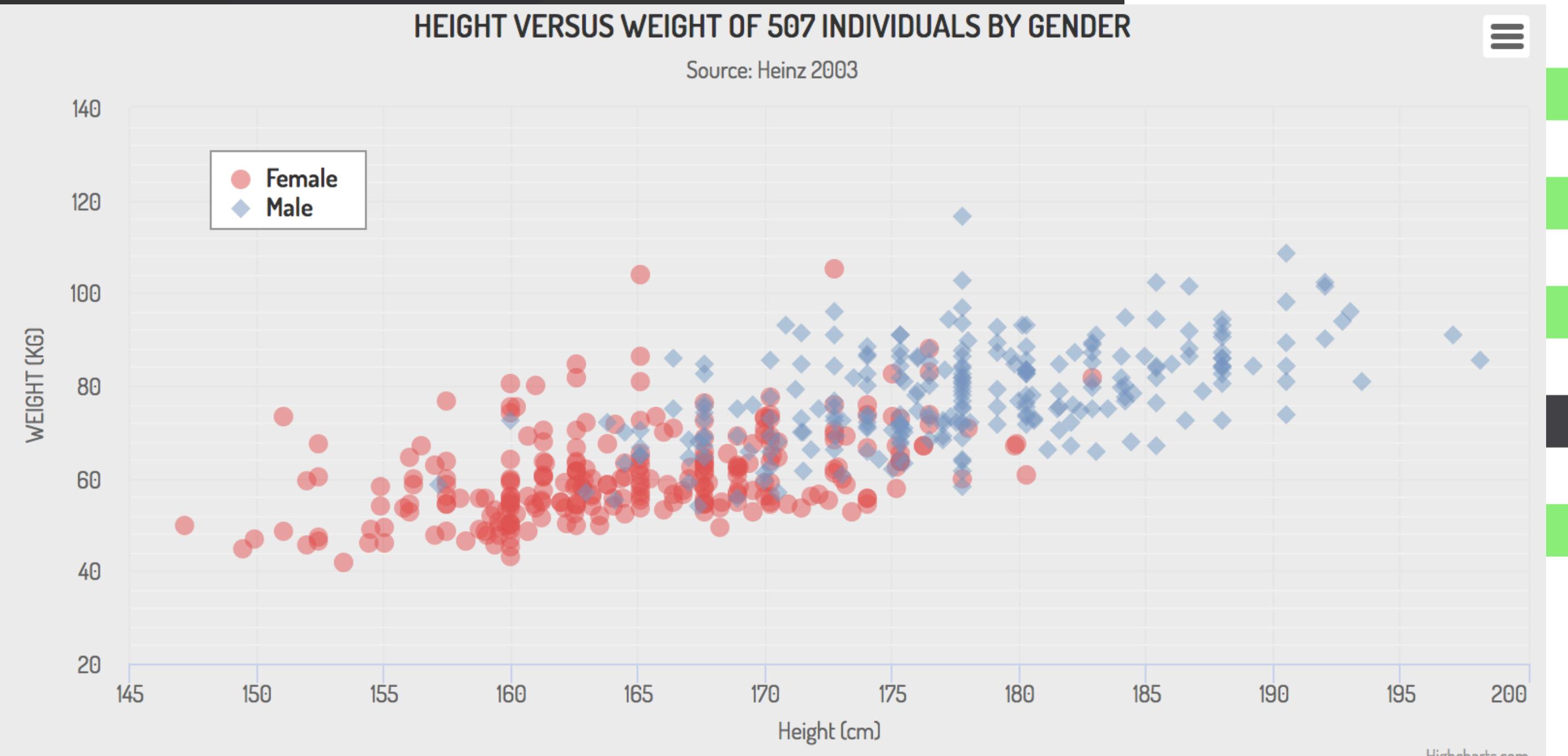
Source: or.water.usgs.gov

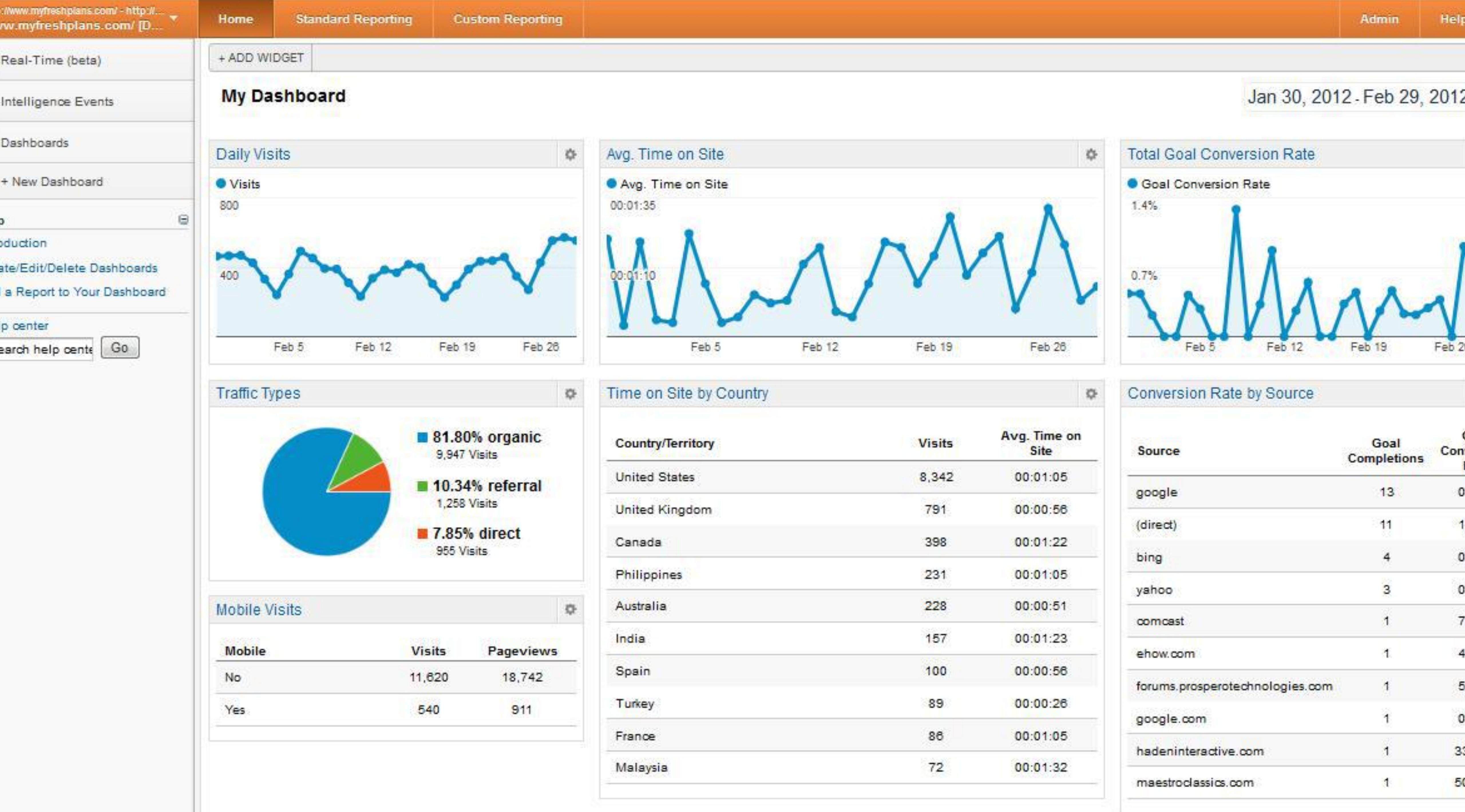


Stacked bar chart

HEIGHT VERSUS WEIGHT OF 507 INDIVIDUALS BY GENDER

Source: Heinz 2003





The same visualization methods may appear
across **any of these forms**...

...implying that ***data informs method***, while
purpose informs form.

Data visualization is **not new**.

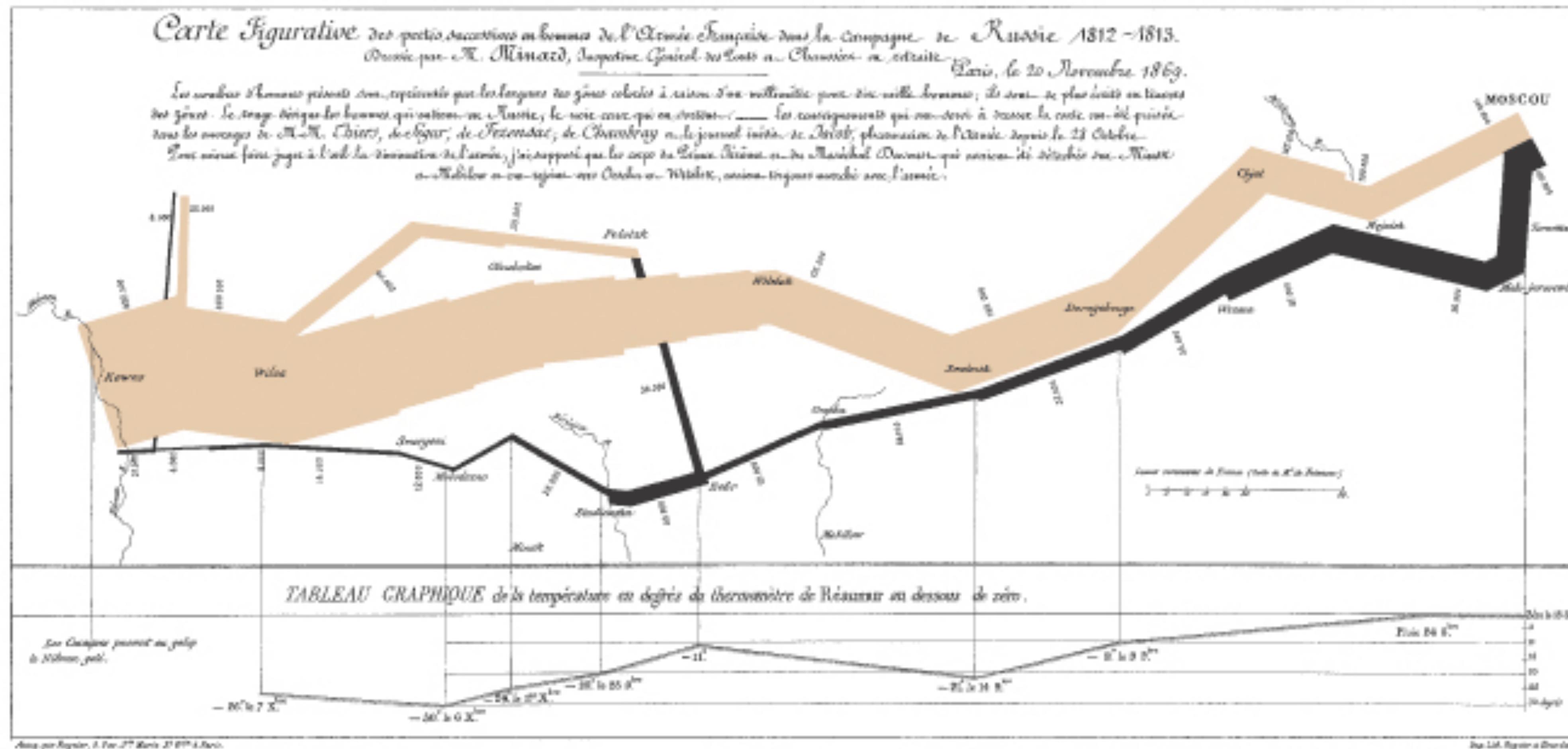
Map of Catal Huyuk (6200 BC) (The first map ever?)



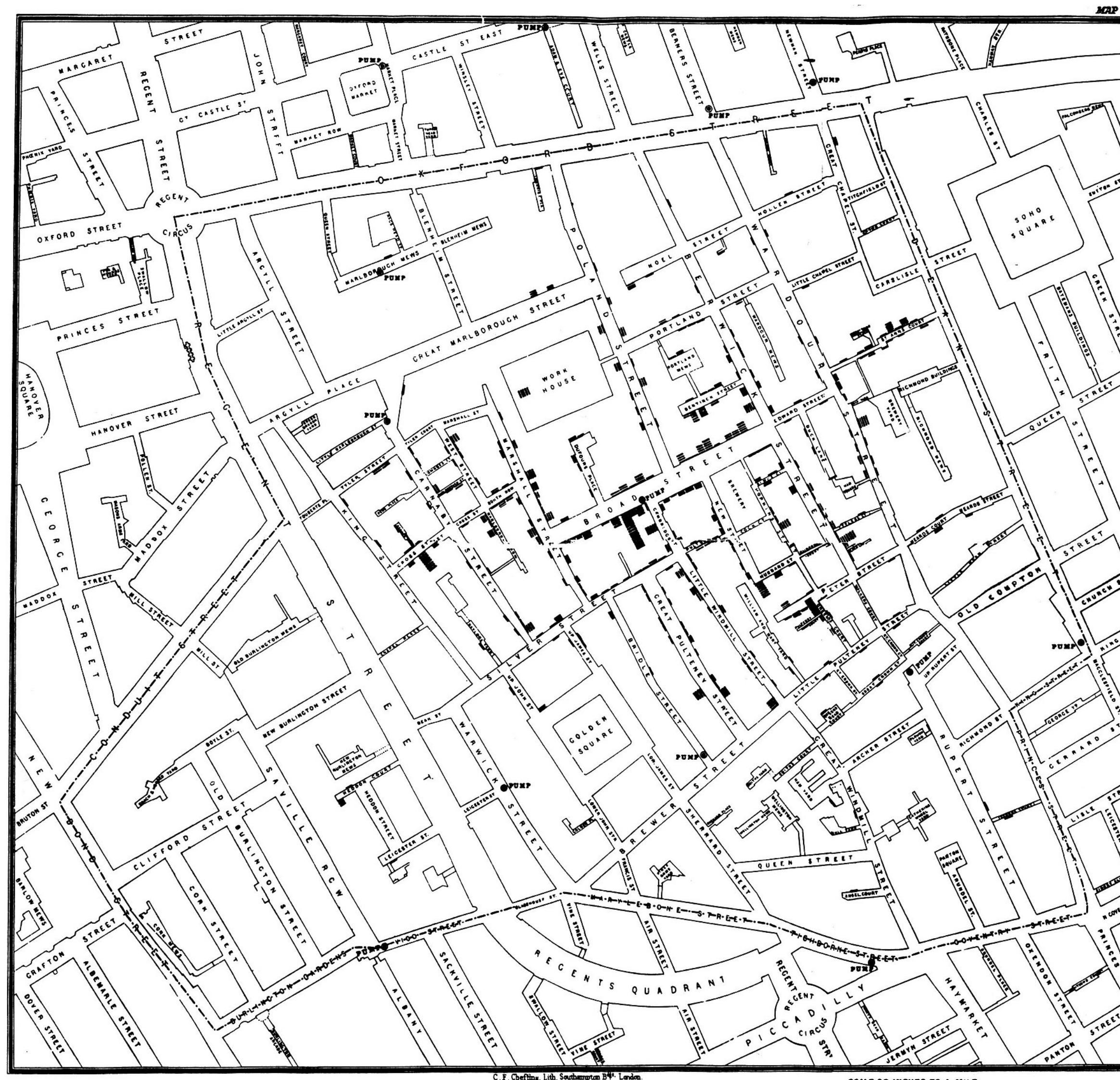
Thematic map — Star map and European observatories (early 18th cen.)



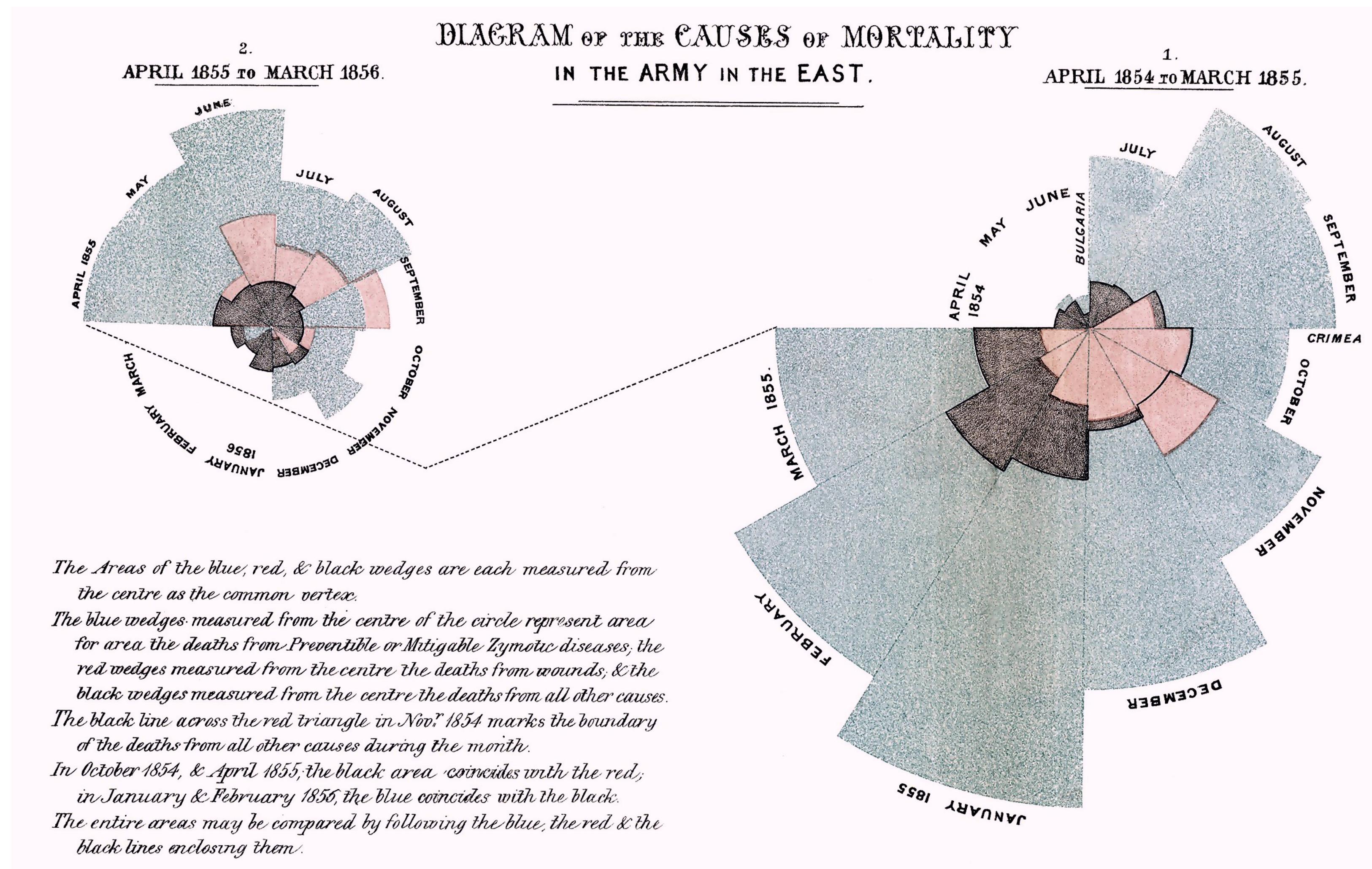
Statistical graphic – *Napoleon's March, Charles Joseph Minard (1869)*



Statistical graphic – Broad Street cholera outbreak, John Snow (1854)



Statistical graphic — Mortality in the British Army, Florence Nightingale (1858)



Introduction to **data types**

Data types — Qualitative

1. Nominal —

Nominal scales are used to ***name***, or label, variables without any quantitative value.

What is your gender?

- M – Male
- F – Female

What is your hair color?

- 1 – Brown
- 2 – Black
- 3 – Blonde
- 4 – Gray
- 5 – Other

Where do you live?

- A – North of the equator
- B – South of the equator
- C – Neither: In the international space station

Data types — Qualitative

2. Ordinal —

For ordinal scales, **order** is significant, even though the differences between values may not really be known.

How do you feel today?

- 1 – Very Unhappy
- 2 – Unhappy
- 3 – OK
- 4 – Happy
- 5 – Very Happy

How satisfied are you with our service?

- 1 – Very Unsatisfied
- 2 – Somewhat Unsatisfied
- 3 – Neutral
- 4 – Somewhat Satisfied
- 5 – Very Satisfied

Data types — **Quantitative**

1. **Interval** —

Interval scales give us the **order** as well as the **exact differences** between values. However, there is **no “true zero.”** This means that we can add and subtract, but not multiply or divide.

Examples: temperature, dates

Data types — **Quantitative**

2. **Ratio** —

Ratio scales tell us about the ***order***, the ***exact value between units***, and ***do have a “true zero,”*** allowing us to apply descriptive and inferential statistics to the data.

Examples: height, weight

Interval vs. Ratio

10 degrees + 10 degrees = 20 degrees

20 degrees is not “twice as hot” as 10 degrees; the value of the attribute is just twice as large. Here, meaningful fractions cannot be computed.

10 pounds + 10 pounds = 20 pounds

20 pounds is “twice as heavy” as 10 pounds. Here, meaningful fractions can be computed.

Qualitative

- Nominal
- Ordinal

Quantitative

- Interval
- Ratio

