Introduction to R

SpelkeLab R workshop

Irene Canudas Grabolosa, 07/18/24

Agenda for today

1. Getting ready (15 mins)
2. Basic notions about data analysis (30 mins)
    1. Types of data & why do we care
    2. What type of data are you collecting this summer?
    3. Statistical analysis in R
    4. Presentation of our dataset
3. Hands-on! (45 mins)
    1. Importing data
    2. Tiding data
    3. Transforming data
    4. Visualizing data
    5. Modeling data

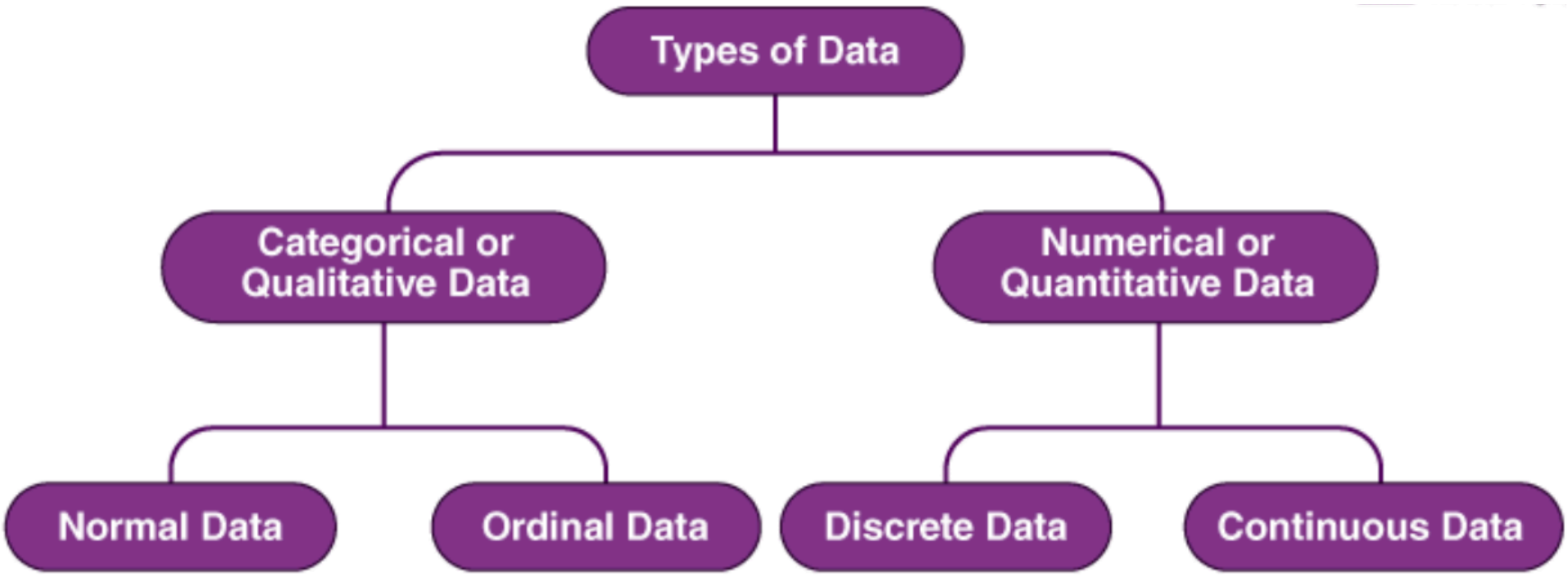
Getting ready

- Create an account at Posit Cloud (if you haven't done it)
- Download the data and the script from: https://github.com/irenecanudas/RWorkshop

Recapping: Types of data

Fast reminder

- **DV (dependent variable):** the response/outcome we're measuring
- **IV (independent variable):** Variables not affected by any other variables measured by the study



Recapping: Types of data

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- **DV (dependent variable):** the response/outcome we're measuring
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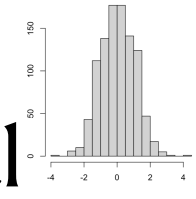
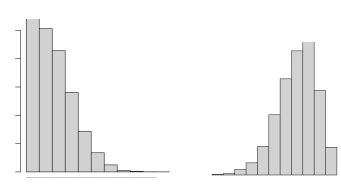
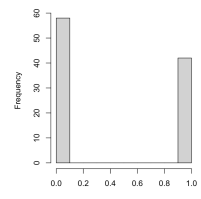
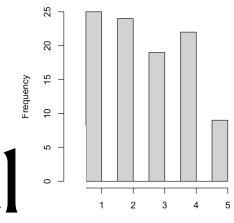
- How should the distribution of your DV look like?
  - **Numeric data:** normal 
  - Skewed = NOT normal 
  - **yes-no responses:** binomial 
  - **Likert scales:** ordinal 

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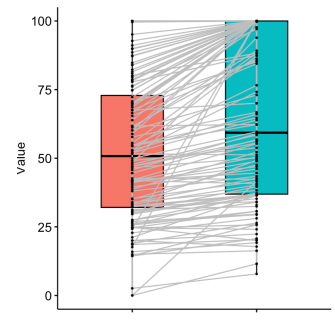
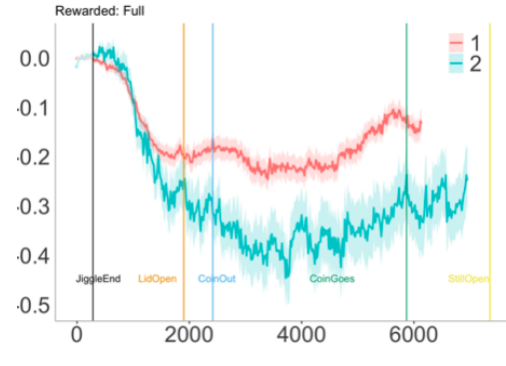
- How should the distribution of your DV look like?
- How many observations of your DV are you taking?

- **One observation per participant:** Each participant is assigned to a different condition

- **Few observations per participant**: Pre and post test/ multiple conditions per participant



- **Multiple observations per participant** (e.g. time analysis: looking time, eeg…)



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- **DV (dependent variable):** the response/outcome we're measuring
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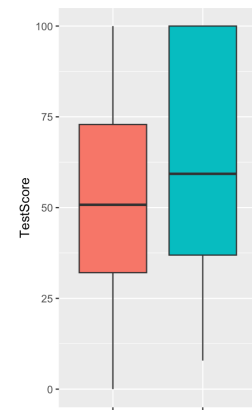
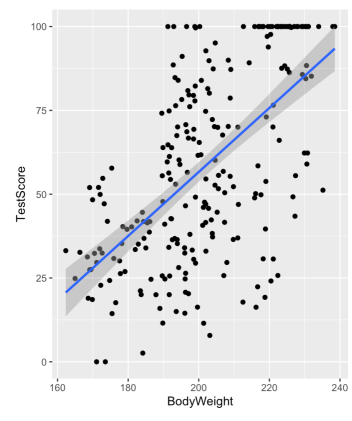
- How should the distribution of your DV look like?
- How many observations of your DV are you taking?
- Which kind(s) of IV do you have?

[assuming a continuous DV]

- **Categorical IV:** e.g. pre & post tests



- **Continuous IV:** e.g. how tall you are based on how much you weight



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- How many observations of your DV are you taking?
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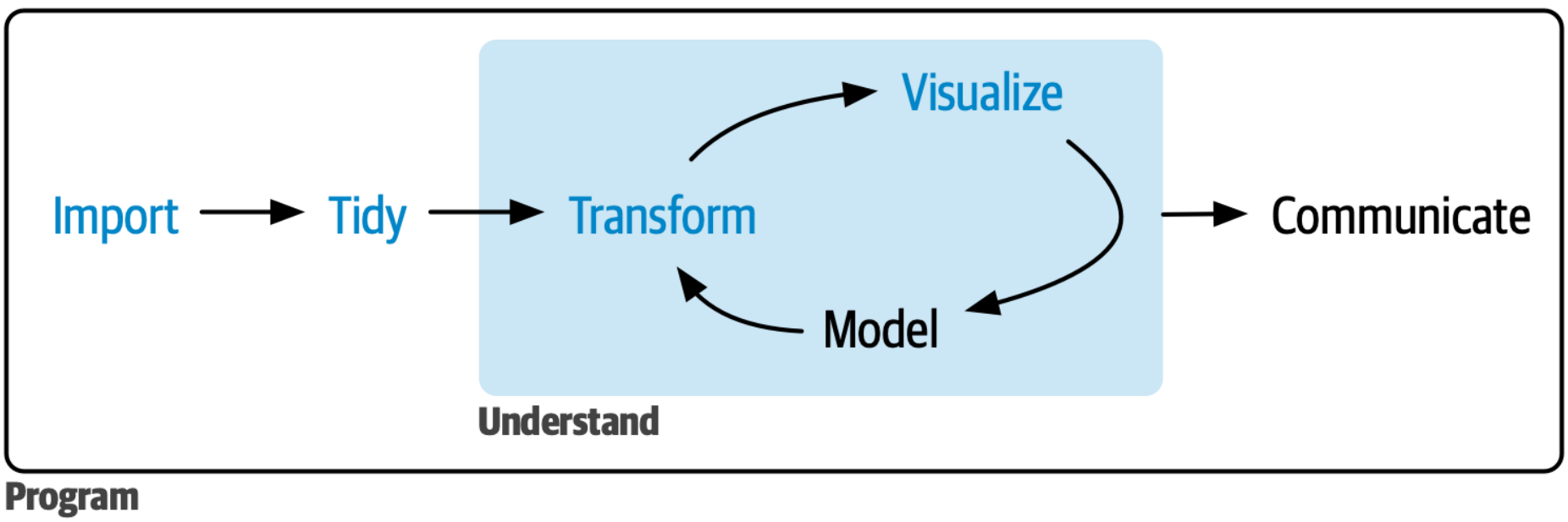
- The type of DV and IV will influence the statistical test we use
- **Which kind of data are you collecting?**

Statistical analysis with R



- R has:
  - Variables: *placeholders for information*
    - Different types:
      - characters [~text]
      - integers & numbers
      - factors [labels]
      - ...
  - Functions: *commands to transform the data*

One important thing to keep in mind!

- **R is stupid**
  - If you don't close a parenthesis/quotation marks/brackets... error
  - Pay attention to the variables' type! A variable containing a 2 BUT labeled as a "character" cannot be summed.
  - name ≠
    - Name
    - NAME
    - nme
  - "name" = string of letters "n" "a" "m" "e"
    Vs
    name = a variable you want to access its content
  - name-of
    - That means, take the value of the variable "name" and subtract the value of the variable "of" from it
  - If you ask R to open a file that is not directly in the folder (even if it's in the immediate subfolder) it will give you an error.
- **R is powerful**
  - If you ask it to perform an inadequate statistical test for your data, it will do it. It won't warn you that that's the wrong thing to do!

Our dataset: dragons

- We're dragon trainers
- **Aim:** We want to understand the effect of training in dragons.
- **The dataset:**
  - Two dragon populations: Southern & Maritime dragons
  - Both male and female dragons
  - Also collecting their age
  - 2 data points: pre & post training
    - IQ score (TestScore)
    - Body Weight

} Independent variables

} Dependent variables

- **Hypotheses:**
  - *H1:* The training should work equally across populations:
    - *H1.1.* Dragons will have higher Test scores after training than before
    - *H1.2.* Where a dragon is from should have no effect on their improvement.
  - *H2:* Being smarter will impact on their ability to hunt: smarter dragons will hunt more, eat more, and therefore will weight more:
    - *H2.1:* Dragons will weight more after training than before
    - *H2.2:* The smarter a dragon is, the heavier it will be

1. Importing the data

- Importing the data into R
- Visually inspect the dataset to make sure it was correctly imported.

2. Tidy the data

- Format and tidy the data so R can understand it
  - All variables are assigned to the correct type
  - Columns contain information about ONE variable

ID	Words produced
865934	3,car, bus and dog
583945	0
328492	4, chair, table, piano, palnt
58374	2, computer, glasses
201834	5; basketball, football, phone, party, bus
838739	6; car, dog, cat, jellyfish, key, clock

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3. Transform the data

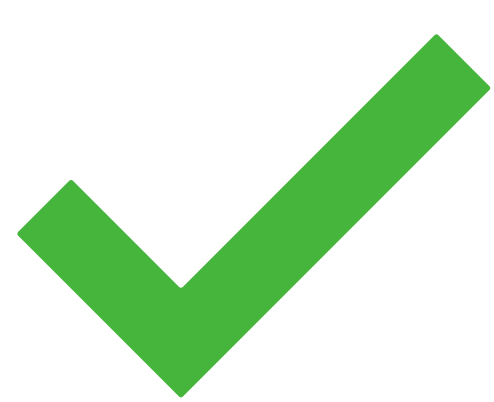
- Format and the data so R can use it for the analysis you want
- General rule of thumb: one row per observation

ID	Trial 1	Trial 2	Trial 3	Trial 4
865934	1	3	8	3
583945	5	4	6	5
328492	7	2	4	3
58374	3	5	7	6
201834	6	6	2	7
838739	3	7	1	4

3. Transform the data

- Format and the data so R can use it for the analysis you want
- General rule of thumb: one row per observation

ID	Trial	Value
58374	1	3
58374	2	5
58374	3	7
58374	4	6
201834	1	6
201834	2	6
201834	3	2
201834	4	7
328492	1	7
328492	2	2
328492	3	4
328492	4	3
583945	1	5
583945	2	4
583945	3	6
583945	4	5
838739	1	3
838739	2	7
838739	3	1
838739	4	4
865934	1	1
865934	2	3
865934	3	8
865934	4	3



4. Visualize the data

- Think about what you want to see from the data
- Usually the best way to intuitively understand whether you had the effect you were looking for

5. Model the data

- Stick to the hypotheses: it's very easy to get lost.
  - *H1:* The training should work equally across populations:
    - *H1.1.* Dragons will have higher Test scores after training than before
    - *H1.2.* Where a dragon is from should have no effect on their improvement.
  - *H2:* Being smarter will impact on their ability to hunt: smarter dragons will hunt more, eat more, and therefore will weight more:
    - *H2.1:* Dragons will weight more after training than before
    - *H2.2:* The smarter a dragon is, the heavier it will be
- What variables do we need to consider to analyze the hypotheses?
- Exploratory analyses will come later

Useful links

- R for data science: https://r4ds.hadley.nz/
- Introduction to linear models: https://gkhajduk.github.io/2017-03-09-mixed-models/
- Another nice intro to linear models: https://pagepiccinini.com/2016/01/08/introduction-and-linear-models-part-1/