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welcome!

Mick Girdwood & Prasanna Sritharan

25 May 2022

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Research interests:
Musculoskeletal modelling, biomechanical simulation

I use R for:
Data analysis, wrangling, visualisation

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Mick Girdwood

PhD Student / Physiotherapist
La Trobe Sports & Exercise Medicine Research Centre

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Research interests:
Muscle strength and cortical processes in MSK injuries

I use R for:
Data management, wrangling, analysis and visualisation

OBJECTIVES

- Introduction
- Scenario
- Worked examples
- Over to you

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OBJECTIVES

Friendly and regular meet up to help share the joy of R and other coding methods, between researchers and students

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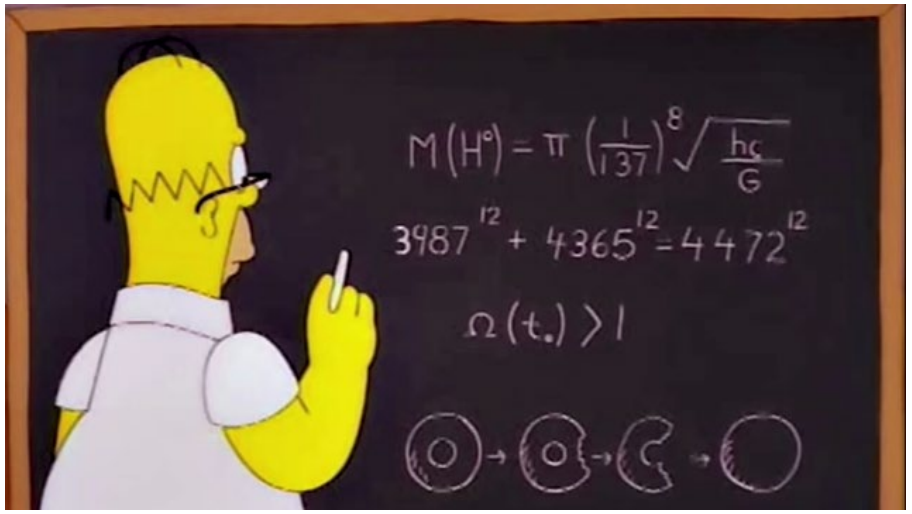
Share our experiences with new packages



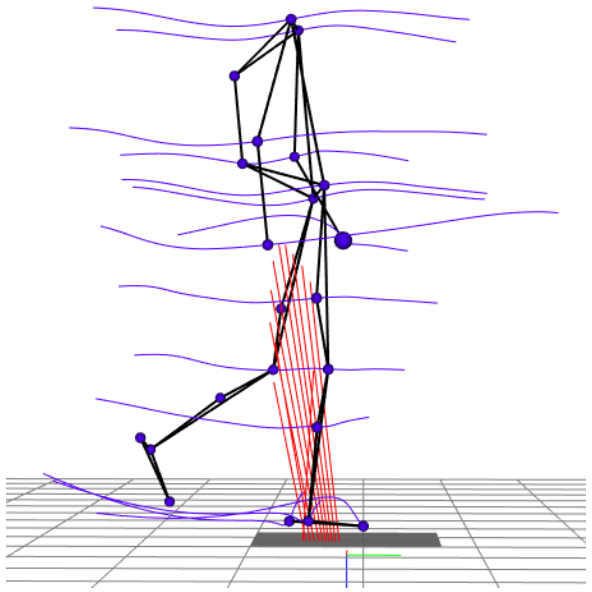
Workshops to help develop coding skills

Regular drop-in sessions for coding help

Initiate new collaborations
and explore new ideas and methods

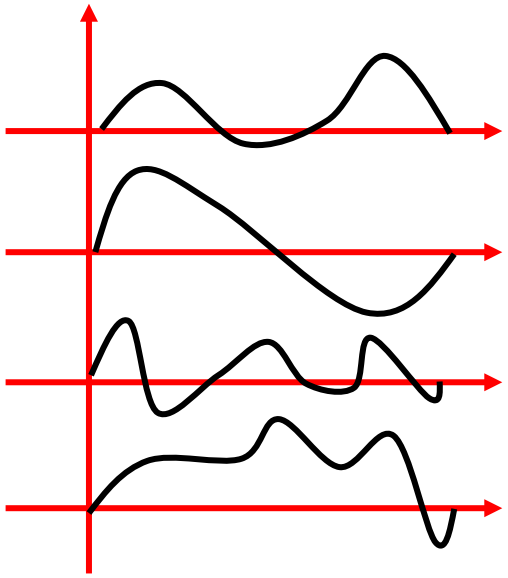
Scenario:
Gait Experiments

Experimental data



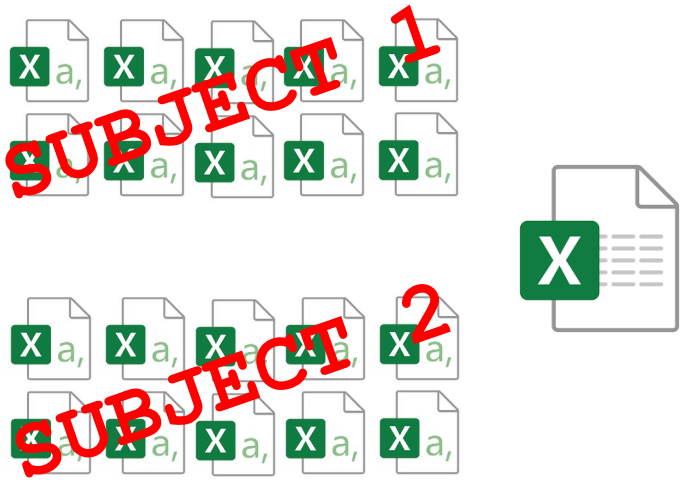
50 participants
25 symptomatic, 25 control
10 trials per participant

500 trials total
(250 trials per group)



20 measured temporal variables per trial + time

Each trial duration is different



10 CSV files per participant
21 data columns per file

+ 1 Excel spreadsheet
with participant info
(group, age, mass, sex, etc)

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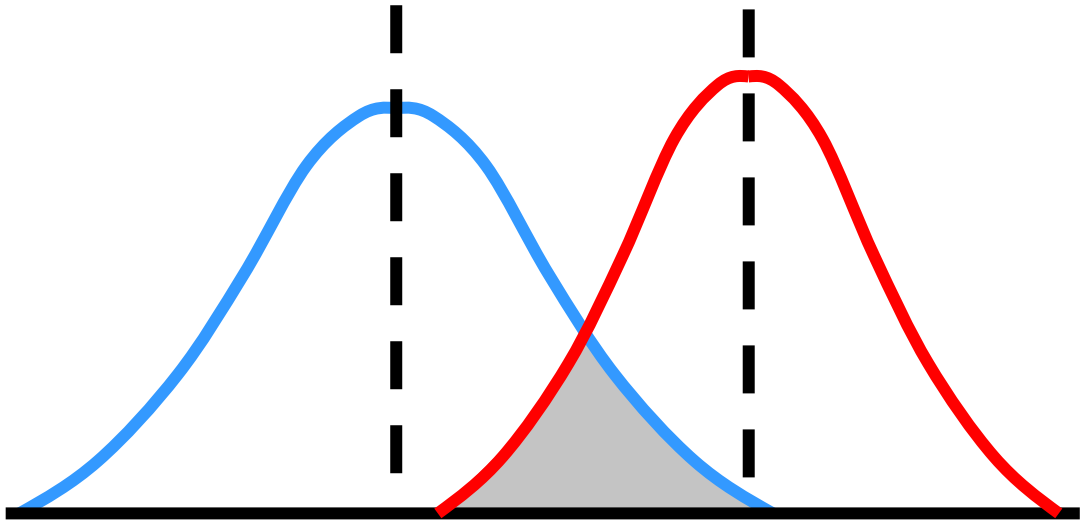
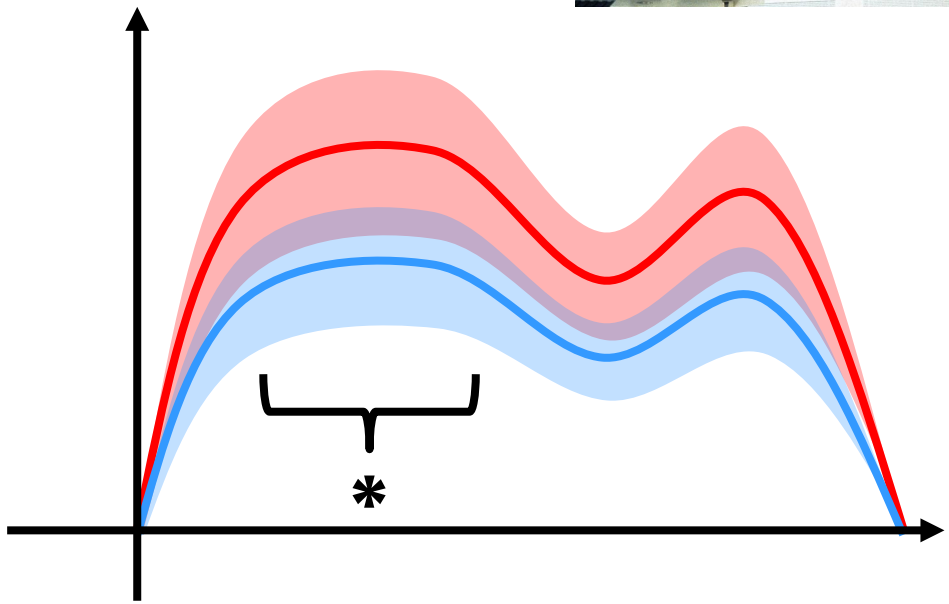
Your mission



Calculate descriptives for each variable
(mean, variance, etc)

Perform inferential testing on each variable
(t-tests, F-test, ANOVA, SPM{?}, etc)



Generate plots of the mean of
each temporal variable with
±1 std dev shaded

Indicate regions of significance

HOW CAN SCRIPTING HELP?

A scripting language is a programming language that automates the execution of tasks that would otherwise be performed individually by a human operator.

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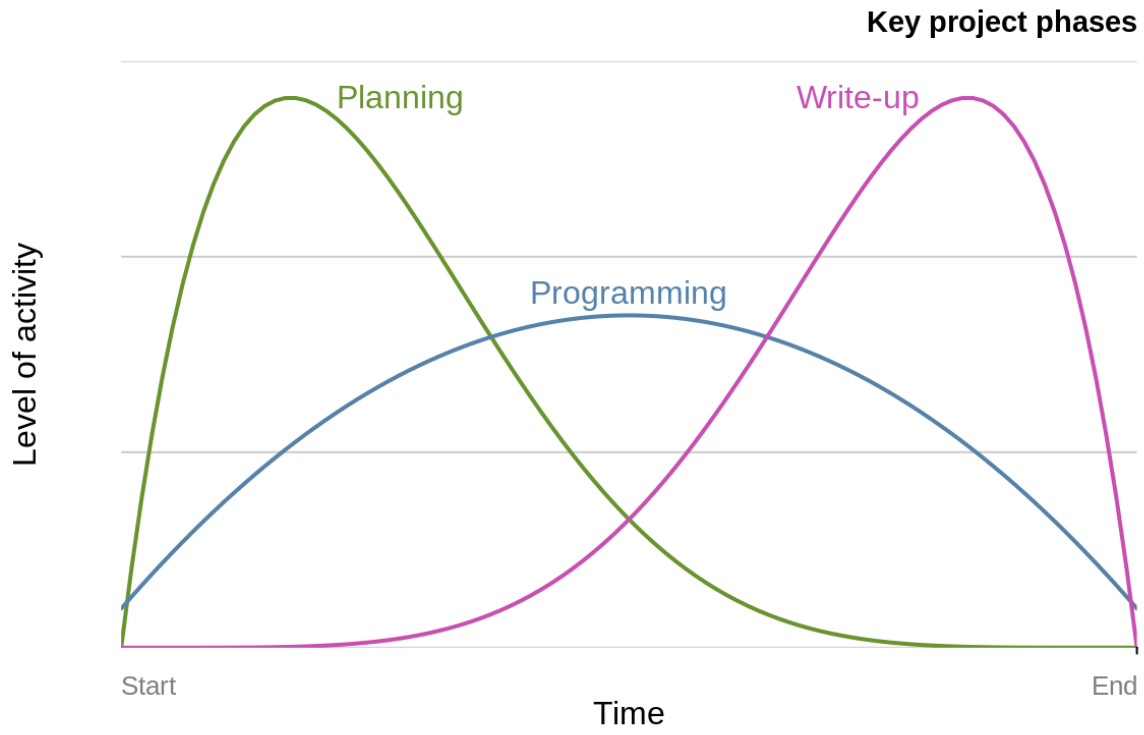
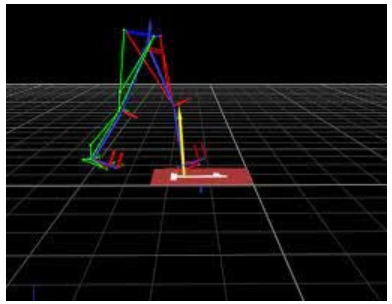
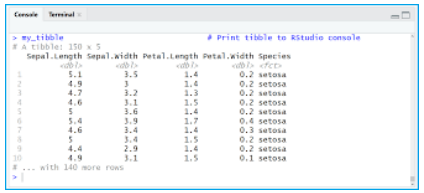
SCRIPTING ≠ STATISTICS

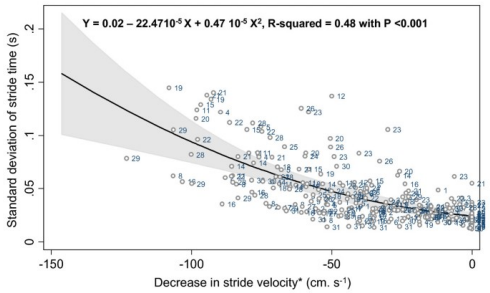


HOW CAN SCRIPTING HELP?



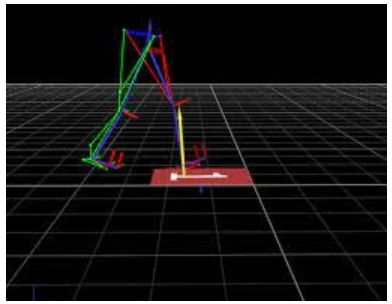


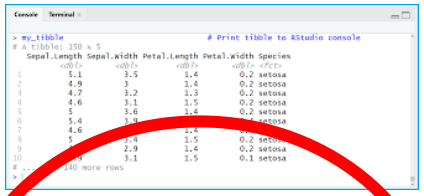
$$t = \frac{\overline{X}_1 - \overline{X}_2}{\sqrt{\frac{s_1^2}{N_1} + \frac{s_2^2}{N_2}}}$$



Acquire data → Prepare data → Modelling & Analysis → Report/ Visualise

HOW CAN SCRIPTING HELP?





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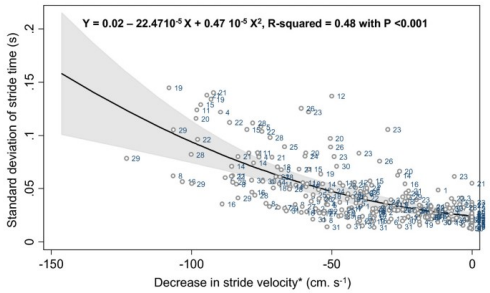

Acquire data → Prepare data → Modelling & Analysis → Report/ Visualise

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Workflow

Raw data

Collate & merge data

Clean

Reshape

Resample

Mutate

Recode

Prepped data

(not necessarily in this order)

Preparing for analysis ("Data wrangling")

Gather all the raw data into one place

Raw data

Collate & merge data

Clean

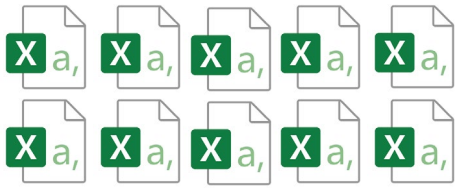
Reshape

Resample

Mutate

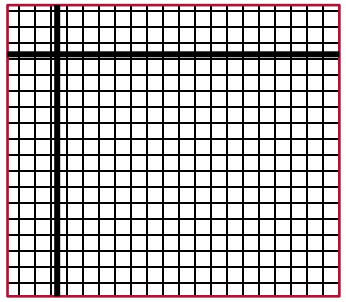
Recode

Prepped data



500 CSV files & 1 spreadsheet

1 table



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Raw data

Collate & merge data

Clean

Reshape

Resample

Mutate

Recode

Prepped data

Throw out or rectify bad data

Deal with missing data

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Raw data

Collate & merge data

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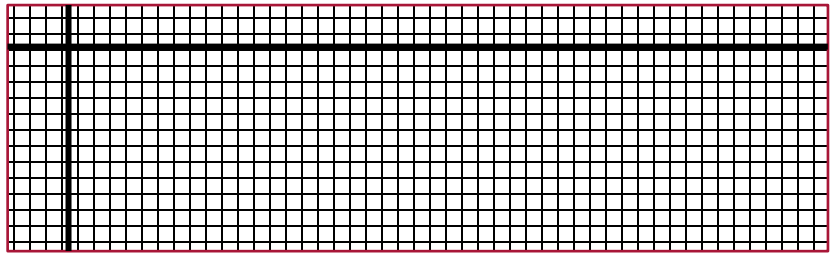
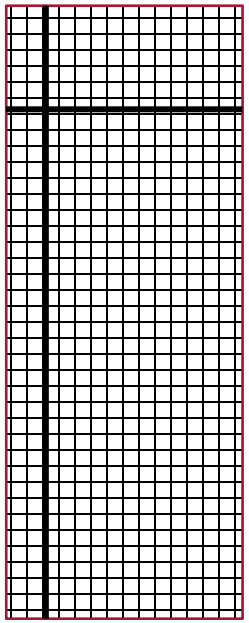
Prepped data



Wide form
Categorical data is grouped
Easy to read and interpret



Long form
One observation per row
Easy to store, select and manipulate

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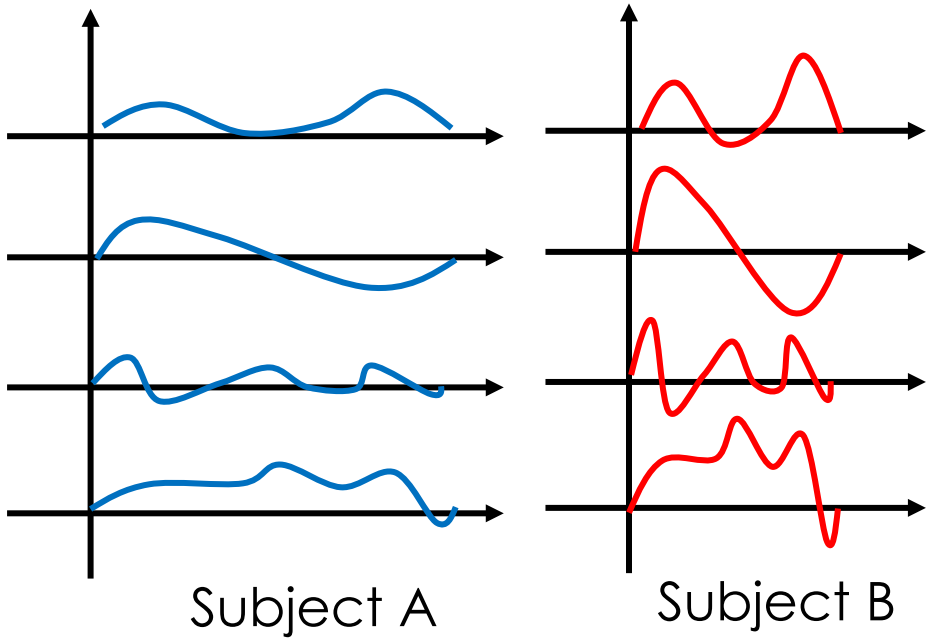
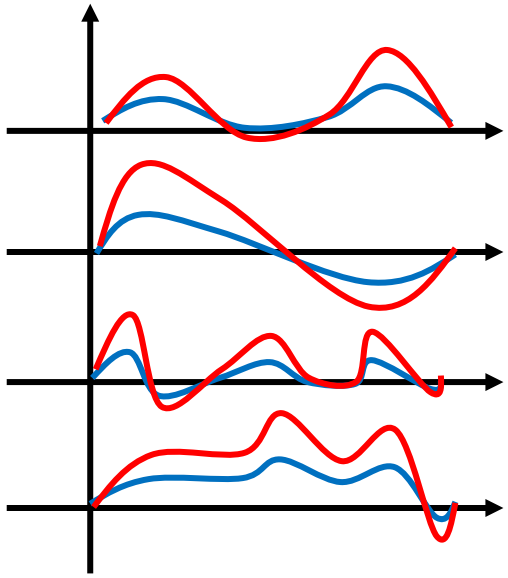


Collate & merge data

Raw data

Clean

Reshape



Resample

Mutate

Recode

Prepped data

Create new variables from existing ones

Raw data

Collate & merge data

Clean

Reshape

Resample

Mutate

Recode

Prepped data

Newtons → Body weights

Normalisation

$$P = T\omega$$

Joint angular power from joint moments and joint velocities

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Raw data

Collate & merge data

Clean

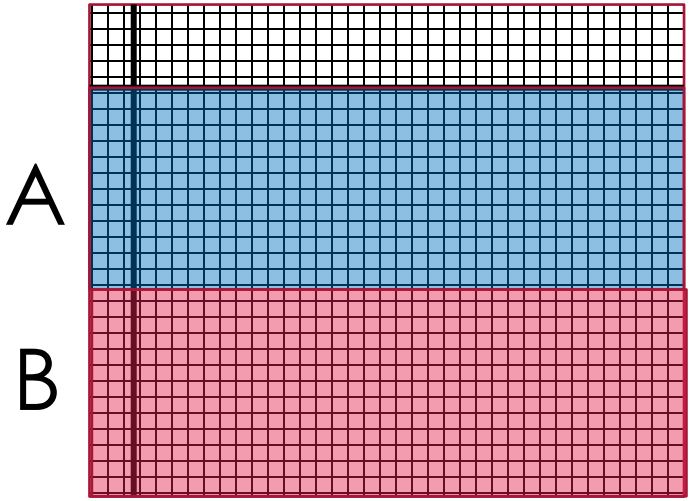
Reshape

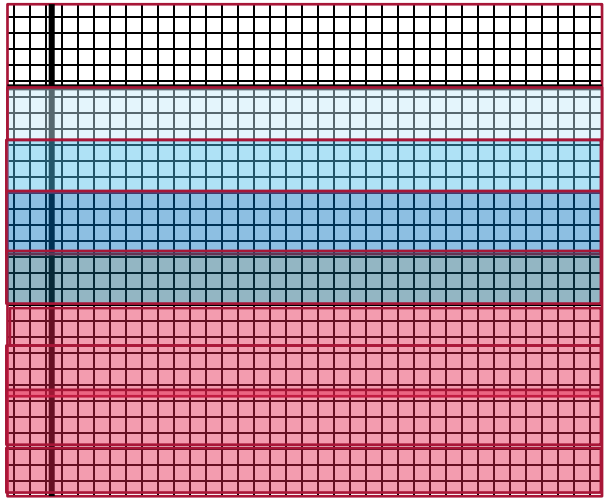
Resample

Mutate

Recode

Prepped data

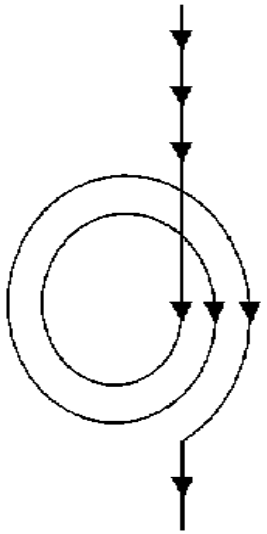




HOW CAN SCRIPTING HELP?

- Lifelong skill, improves problem solving through structural thinking
- Flexibility, the language isn't important, it's the thinking – languages are the easy part
- Enables abstraction, reusability, efficiency, and minimises errors
- Competitive advantage, scripting is not domain-specific, take it with you to your next job
- Develop an in-depth understanding of what your are doing and why

HOW CAN SCRIPTING HELP?



Algorithms, data structures, control flow, functions

e.g. Loops:
Repeat actions until job done
e.g. load each CSV and append data to a table.

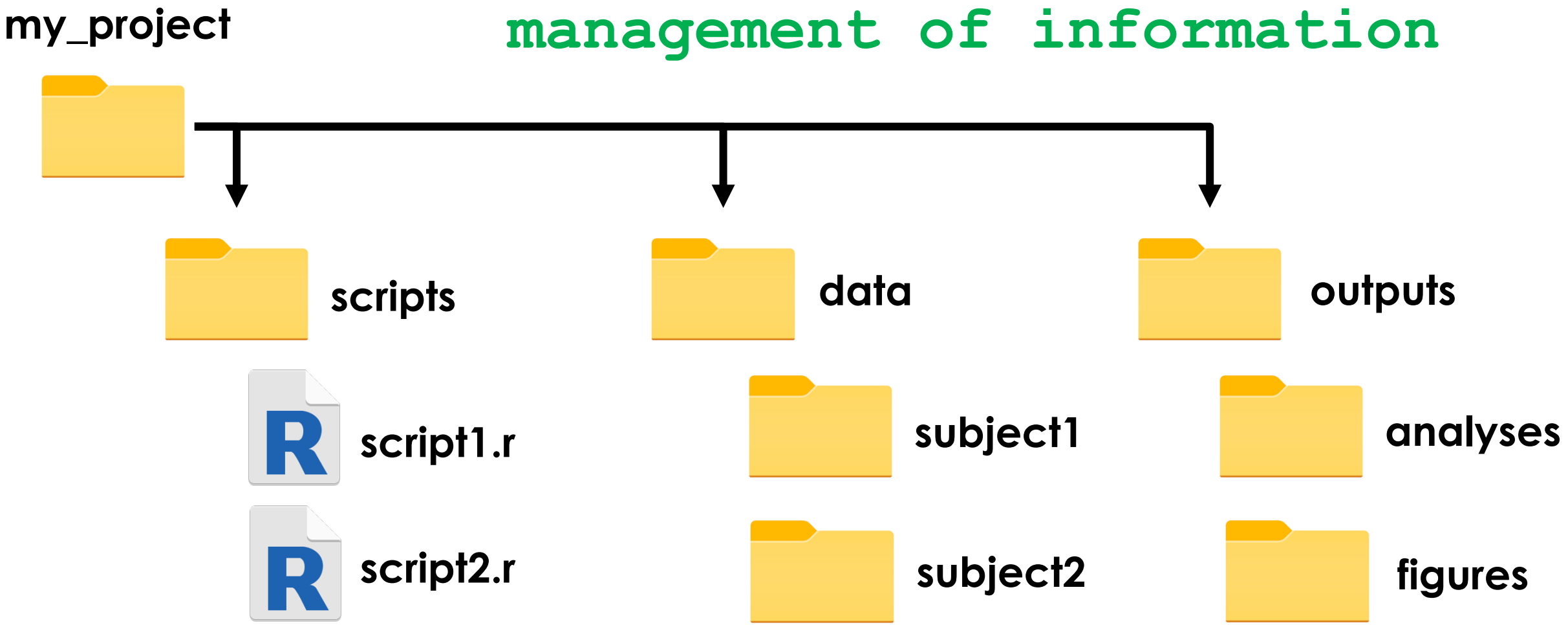
Tools and functionality

Useful tools to help you do what you need to do, e.g. tidyverse for data wrangling and visualisation.

Reusability & flexibility

Scripts and functions you develop can be modified and reused for other projects, saving time and effort.

Promotes more systematic management of information



WHY USE R?

- R is a programming language
- Rich, flexible and powerful
- Specifically developed for statistical programming and data analysis
- Comes pre-built with many useful tools for statistics and analysis, data wrangling and visualisation
- Easy to set up, easy to learn

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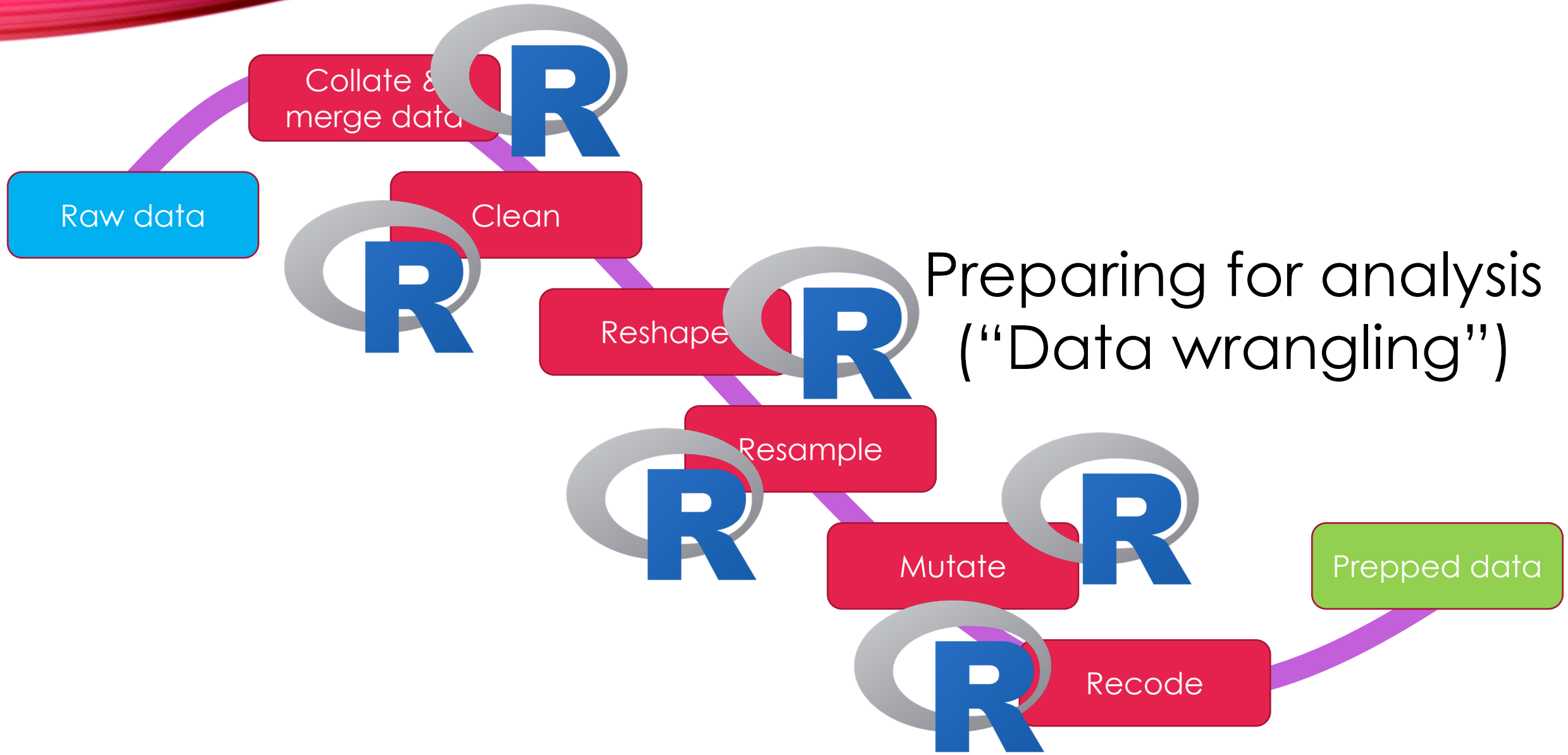
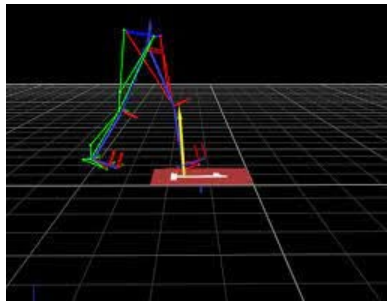
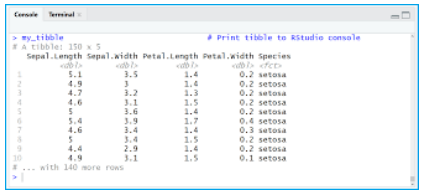


Preparing for analysis ("Data wrangling")

Implement your whole workflow with R scripts!





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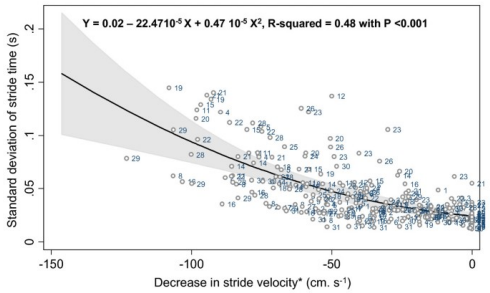

Acquire data → Prepare data → Modelling & Analysis → Report/ Visualise

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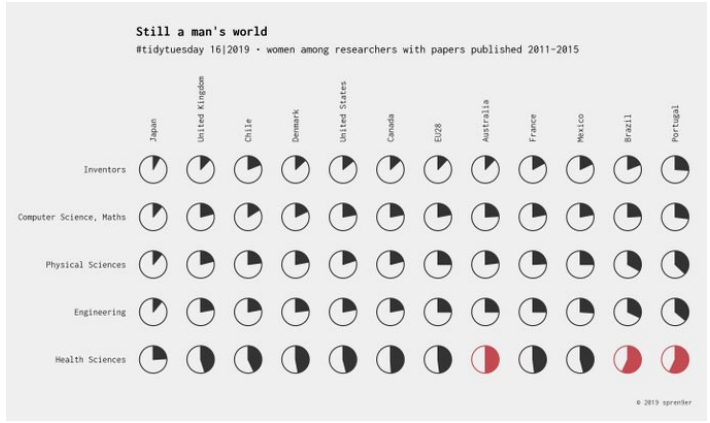
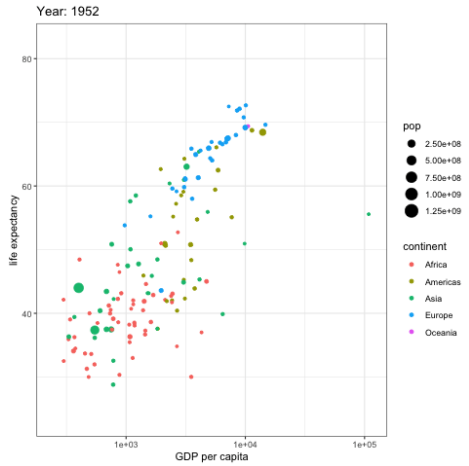
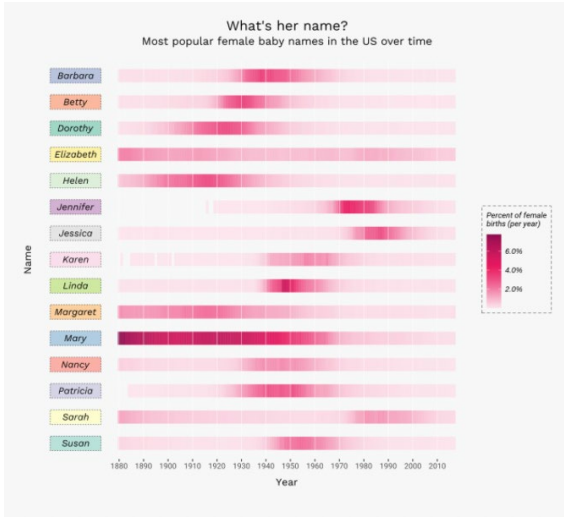
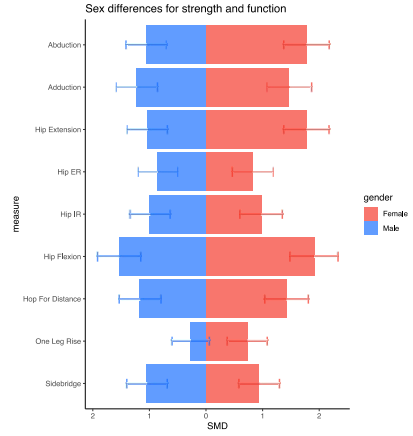
LESS OBVIOUS APPLICATIONS

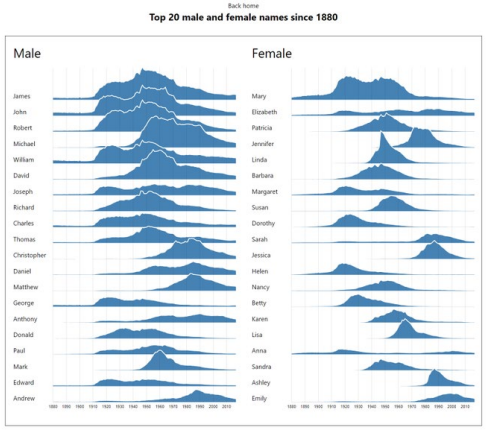
- Rich, sophisticated visualisations

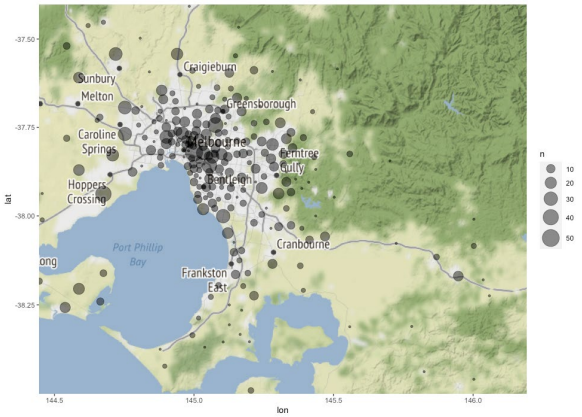


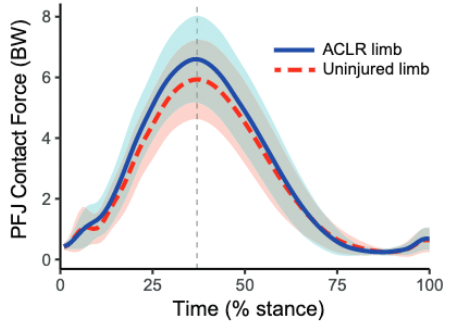


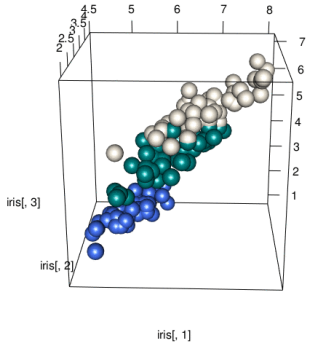












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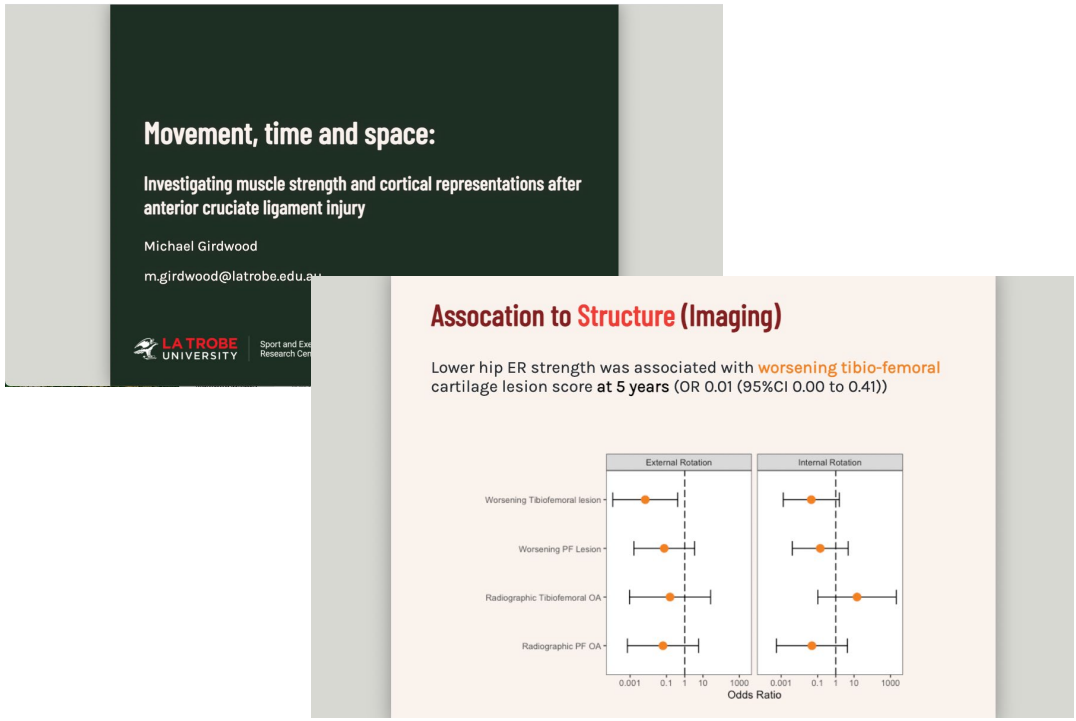
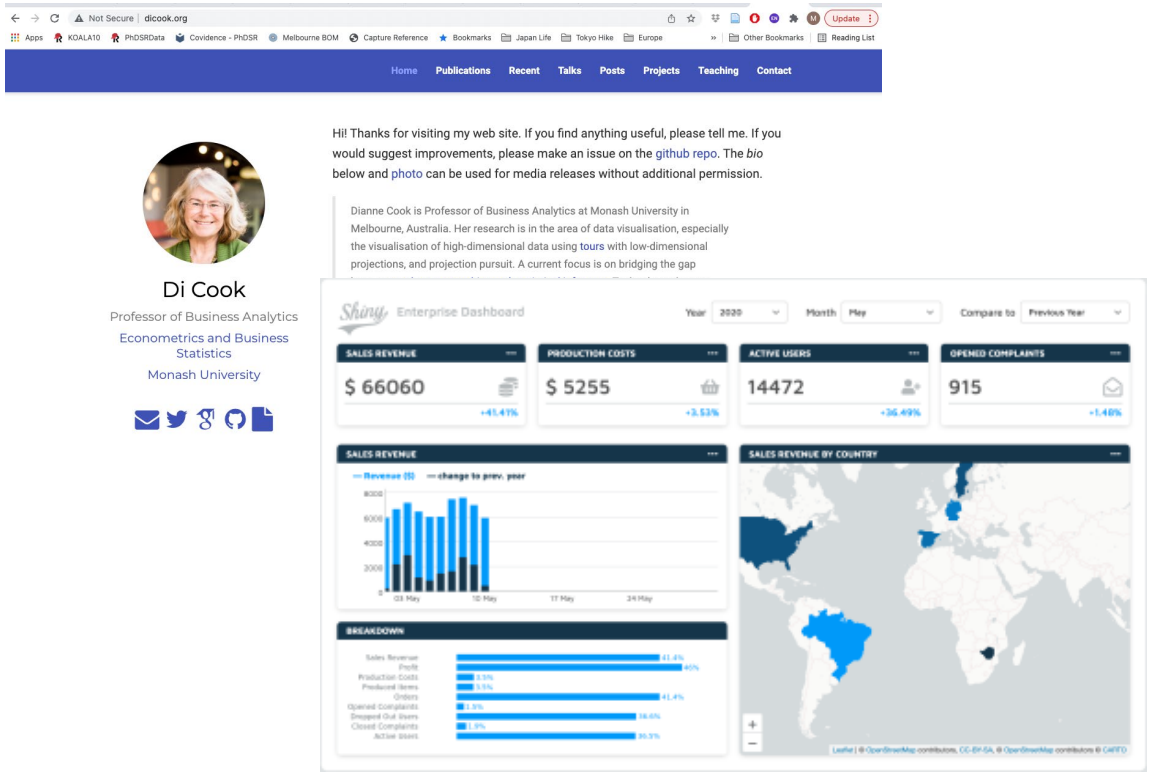
LESS OBVIOUS APPLICATIONS

- Presentations/Slides

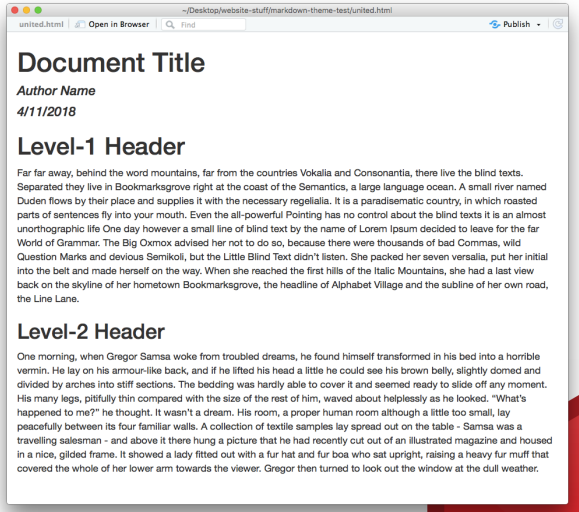


- Websites / Dashboards / Apps

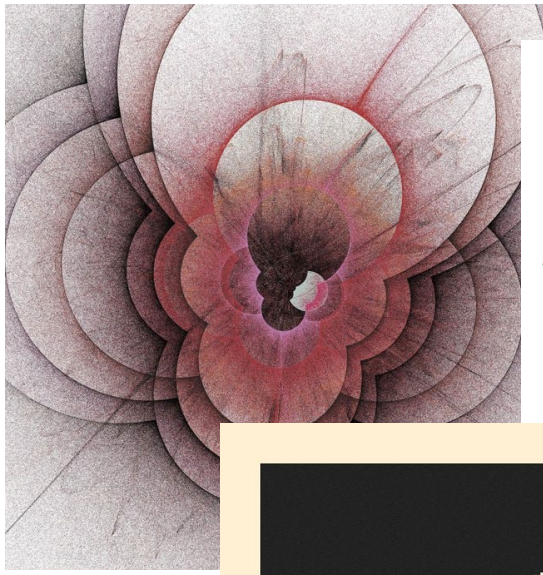


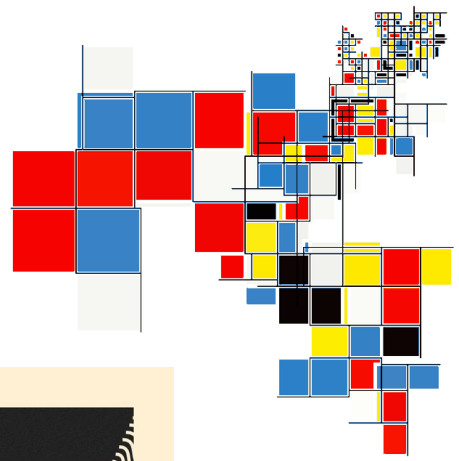
LESS OBVIOUS APPLICATIONS

- Documents / Reports



- Art!





WORKED EXAMPLE

OVER TO YOU!

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RESOURCES

https://swirlstats.com/

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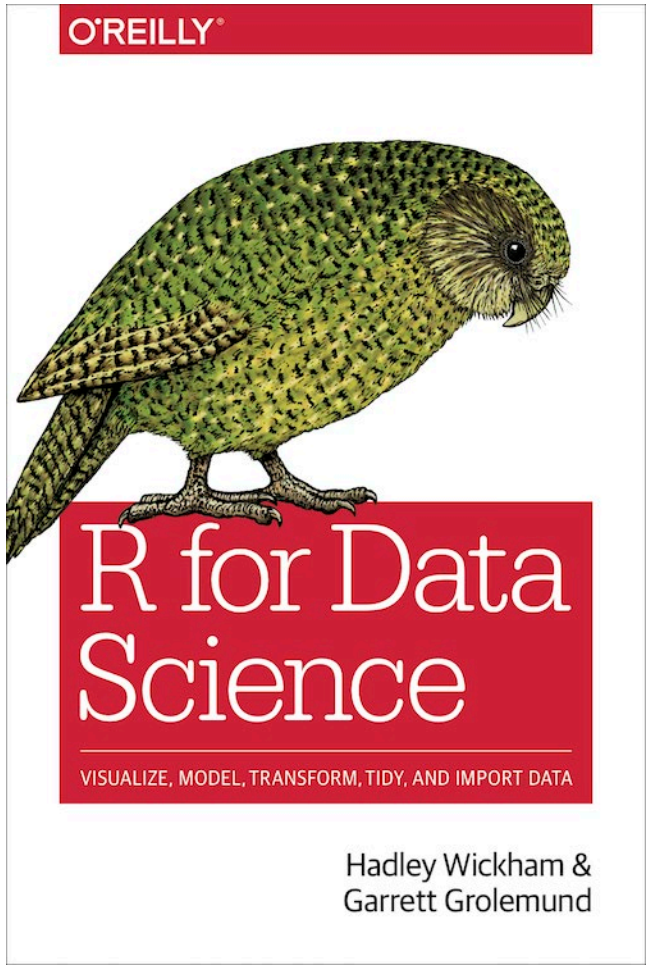
RESOURCES



https://r4ds.had.co.nz/index.html

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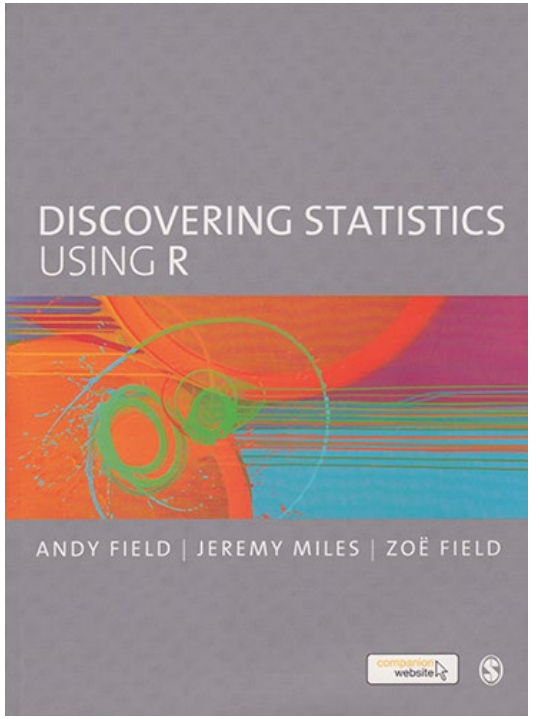
RESOURCES

https://bookdown.org/ndphillips/YaRrr/



https://www.discoveringstatistics.com/books/discovering-stat

RESOURCES

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BRING A PROBLEM TO SOLVE!

THANK YOU!

Presentations, code and other stuff available here
(for the moment, until we can find a nice place for them):

https://github.com/latr-meetups/latr