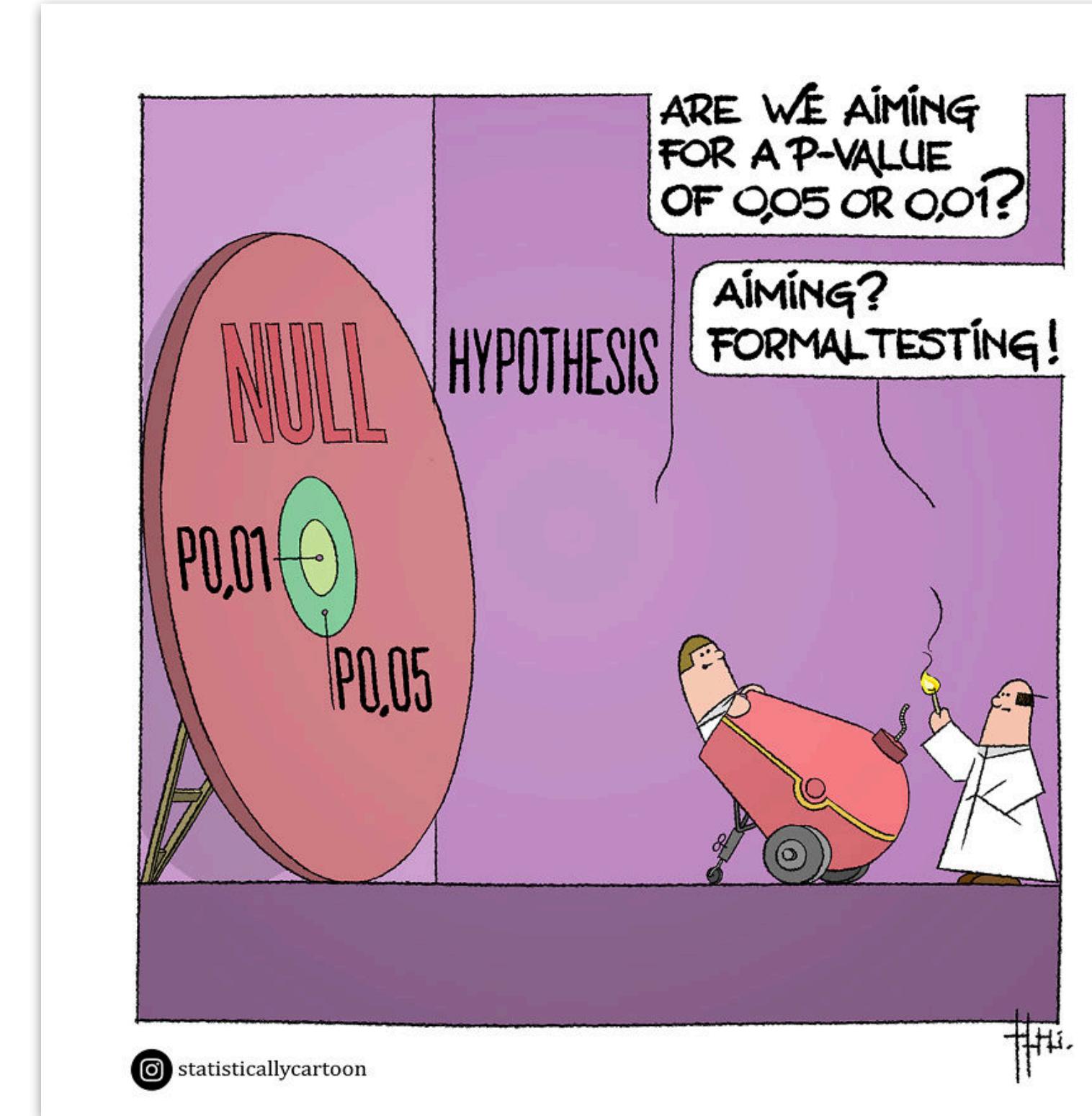


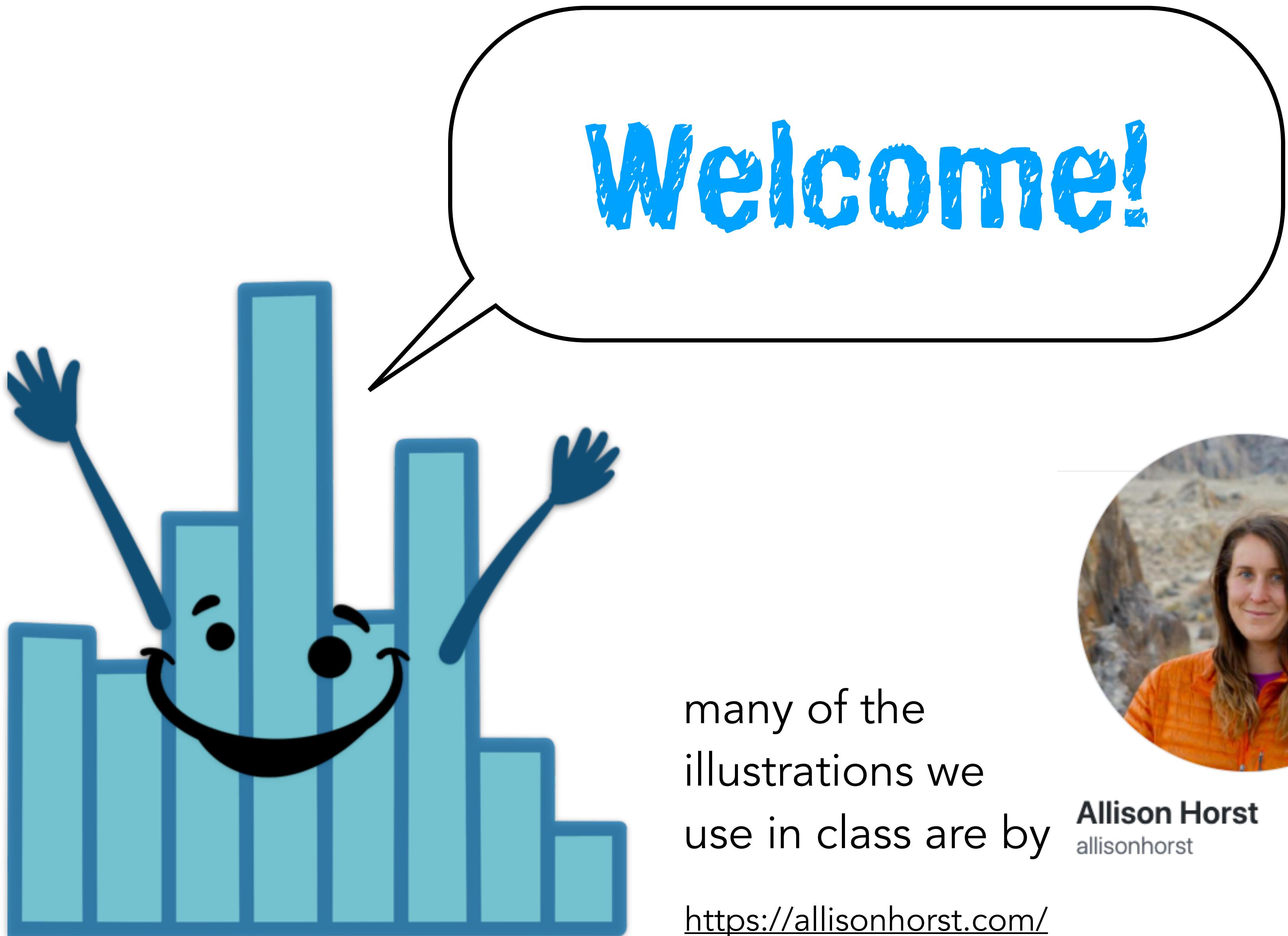
Introduction



COLLABORATIVE PLAYLIST
psych252
<https://tinyurl.com/psych252spotify25>

add songs that get you
into stats mood ↗

01/06/2025



many of the
illustrations we
use in class are by

<https://allisonhorst.com/>



Allison Horst
allisonhorst

Outline

- Introduction
- **What** will we learn?
- **How** will we learn?
- Tools we will use in class
- Some general thoughts
- Feedback

Introduction

Introduction to the class

master the tools that empower
you to do your research



develop statistical literacy

Introduction to the team

Tobi Gerstenberg

Pronouns: he/him

Department: Psychology

Interests:

- running the [Causality in Cognition Lab](#)
- computational modeling

Fun facts:

- I like surfing and R



Nilam Ram

Pronouns: he/him

Department: Psychology / Communication

Interests:

- running [The Change Lab @ Stanford](#)
- longitudinal design and data analysis

Fun facts:

- Trying out new ways to make data into music
(data sonification)



Alice Xue

Pronouns: she/her

Department: Psychology

Interests:

- Learning, memory, decision making

Fun facts:

- I like exploring California's beaches



Catherine Garton

Pronouns: she/her

Department: Psychology

Interests:

- political disagreement
- social influence

Fun facts:

- I climb (with my dad!)



Justin Yang

Pronouns: he/him

Department: Psychology

Interests:

- mental simulation
- learning

Fun facts:

- I like cooking



Verity Lua

Pronouns: she/her

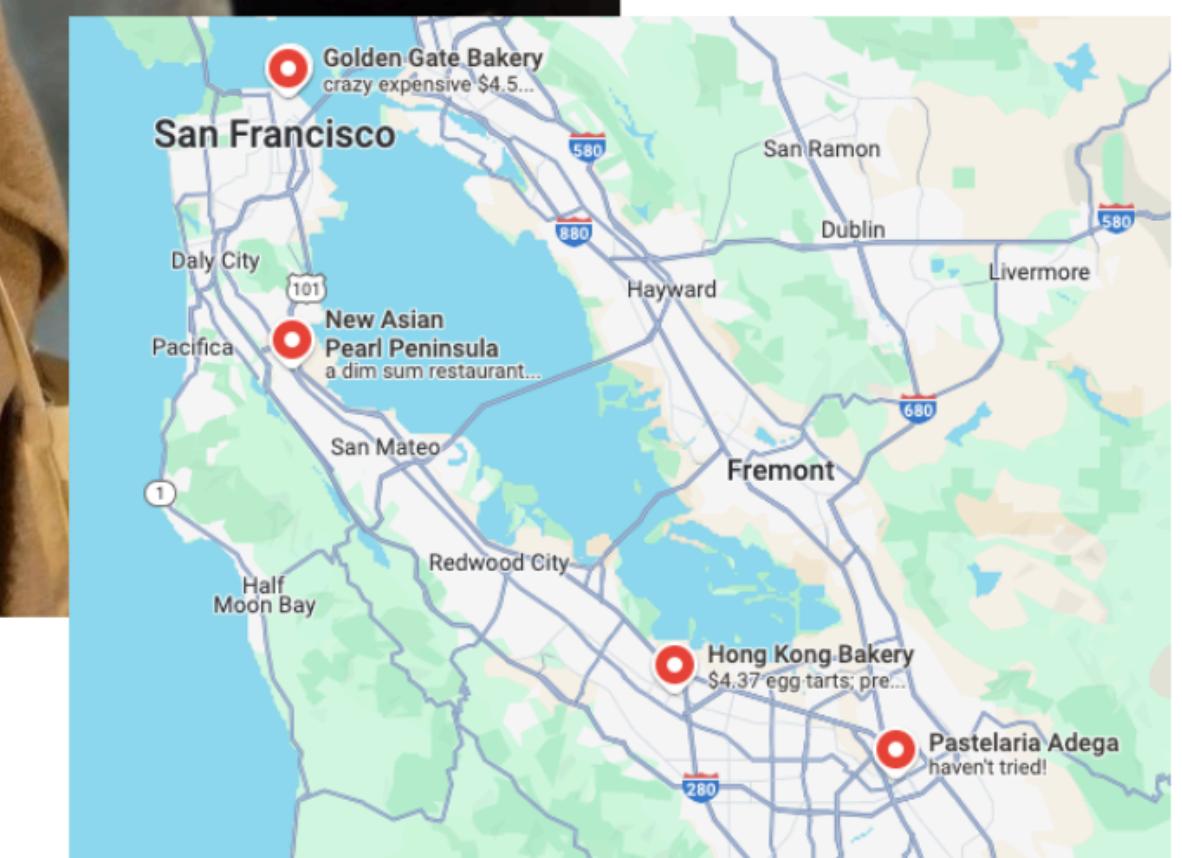
Department: Psychology

Interests:

- culture and emotions

Fun facts:

- I'm on a quest to find the best egg custard tarts around



Satchel Grant

Pronouns: he/him

Department: Psychology

Interests:

- number cognition
- neural representation transfer

Fun facts:

- I've won an award for my mechanical bull riding



What did you do during the winter break?

What are you hoping to get out of this class?

(5 minutes)

05:00

Introduction

The screenshot shows a Google Forms survey titled "Psych 252: Introductory survey". The interface includes a green header bar with the title, a "SEND" button, and a user icon. Below the header, there are tabs for "QUESTIONS" and "RESPONSES", with "QUESTIONS" being the active tab. The survey begins with an introduction: "This survey is meant to obtain some background information about the students in Psych 252, as well as to obtain some different types of data that we will use to analyze in the class. Please answer all questions as honestly as possible." It also states: "Some of the data collected in this survey may be made available to the class for use in analysis exercises. However, the data will be made anonymous before anything is released by removing any potentially identifying information, so that it will not be possible to determine which data came from which person in the group." A note at the bottom encourages users to use their Stanford email address for credit. The first question is "Email address *", with a placeholder "Valid email address" and a note that the form is collecting email addresses with a "Change settings" link. The second question is "What year of graduate school are you in? *", with options: 1. Undergraduate, 2. 1-2, 3. 3-4, and 4. 5+. The third question is "What department are you in? *", with options: Psychology (radio button) and Education (radio button). A question mark icon is located in the bottom right corner of the form area.

← Psych 252: Introductory : 📁 ★

SEND

QUESTIONS RESPONSES

Psych 252: Introductory survey

This survey is meant to obtain some background information about the students in Psych 252, as well as to obtain some different types of data that we will use to analyze in the class. Please answer all questions as honestly as possible.

Some of the data collected in this survey may be made available to the class for use in analysis exercises. However, the data will be made anonymous before anything is released by removing any potentially identifying information, so that it will not be possible to determine which data came from which person in the group.

Please use your Stanford email address in order to get credit for completing the survey.

Email address *

Valid email address

This form is collecting email addresses. [Change settings](#)

What year of graduate school are you in? *

1. Undergraduate
2. 1-2
3. 3-4
4. 5+

What department are you in? *

Psychology

Education

<https://tinyurl.com/psych252survey25>

What will we learn?

Learning goals

1. You will learn how to **use R** to ...
 - read, wrangle, simulate and analyze data
 - make publication-ready plots
2. Understand the philosophy behind null **hypothesis significance testing (NHST)** and **Bayesian statistics** through ...
 - running computer simulations and visualizing the results
3. Formulate **research questions as statistical models** and ...
 - determine which models work best for different situations
4. **Communicate** what you have learned about your data ...
 - in short presentations in class, showcasing your visualization and analysis
 - in written reports
5. Contribute to open and **reproducible science** through ...
 - adopting good coding practices
 - sharing your data and research reports online

What will we learn?

Weeks 1-3

1. Use R!

- Data visualization
- Data manipulation/wrangling
- Understand key statistical concepts
 - Simulation, manipulation, visualization

2. Build models

Weeks 4-7

- Formulate hypotheses as statistical models

Weeks 8-9

- Bayesian statistics

**all the time
(& Week 10)**

3. Report results

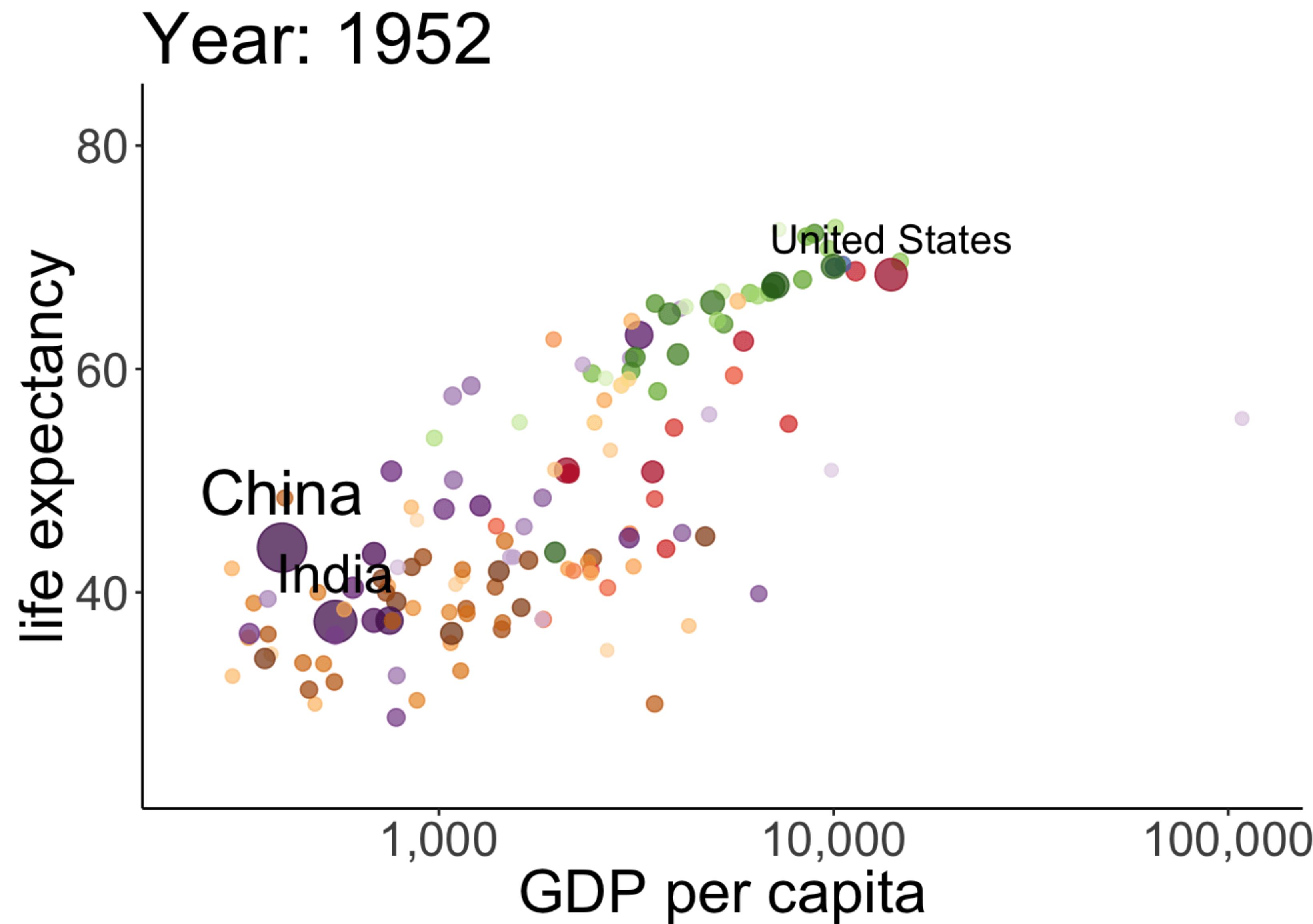
- Reproducible research

1. Use R!

4 Reasons for why ?

1. Visualization
2. Data manipulation
3. Statistical modeling
4. Communicating results

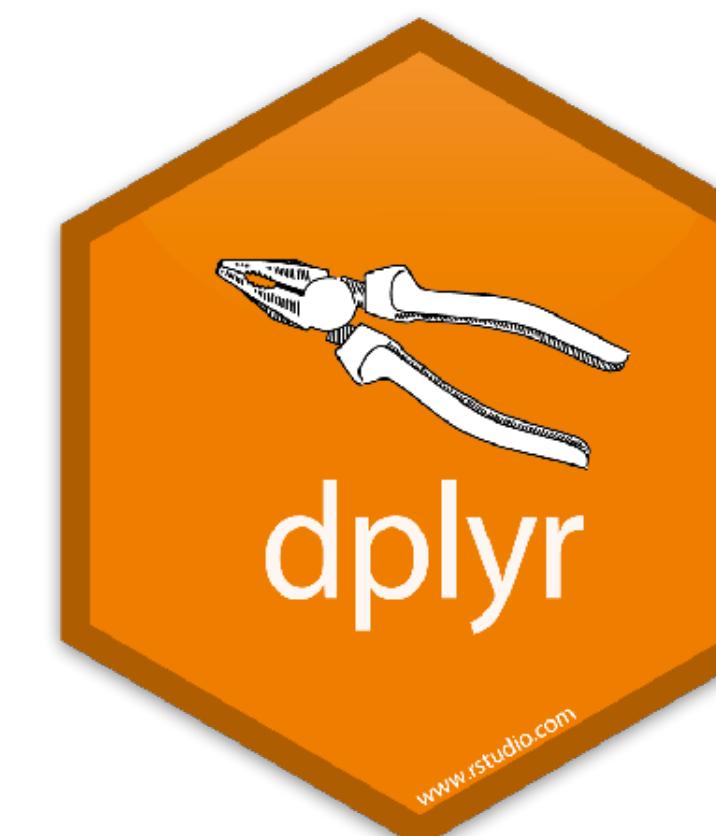
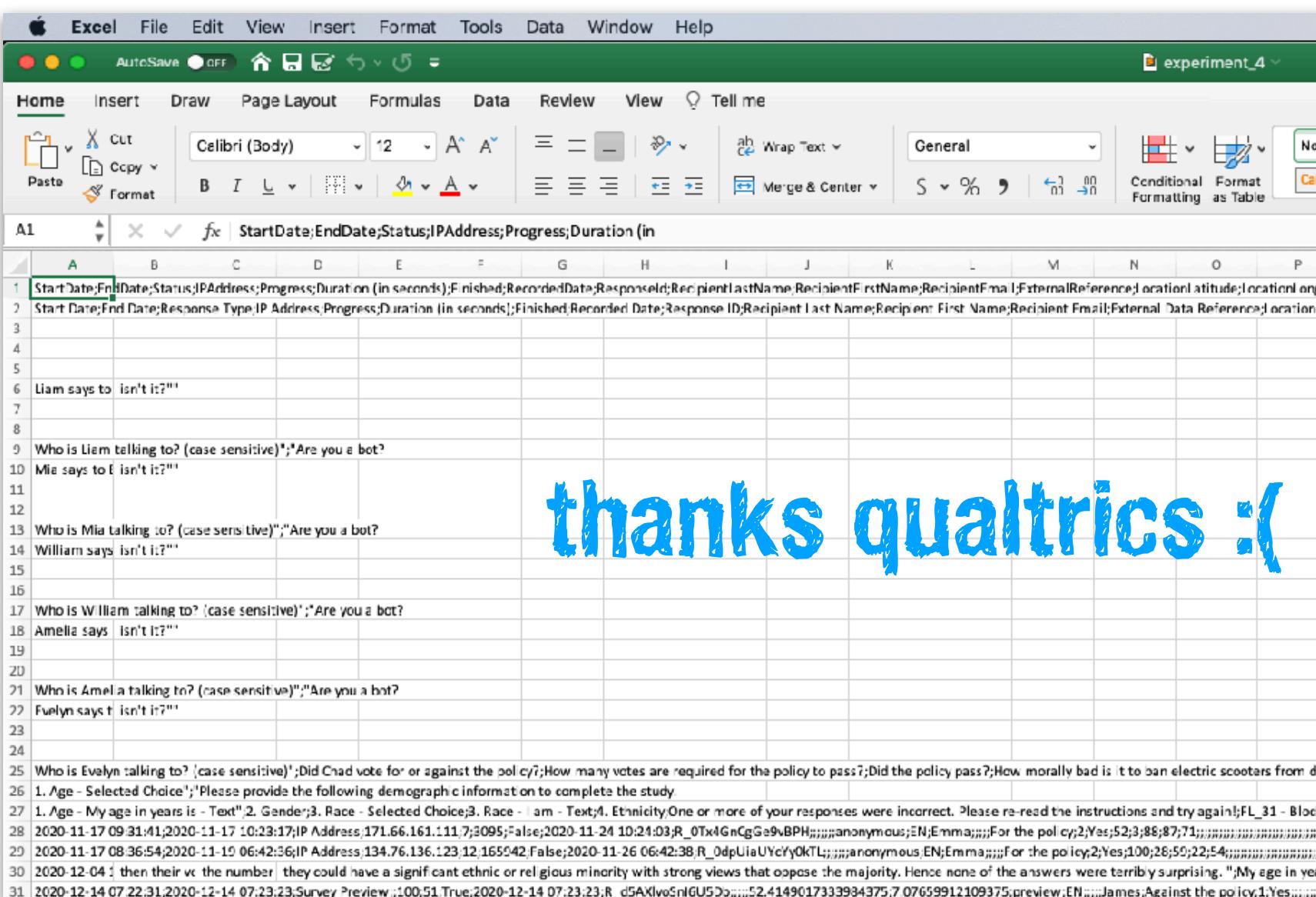
Why R? 1. Visualization



Why R? 1. Visualization

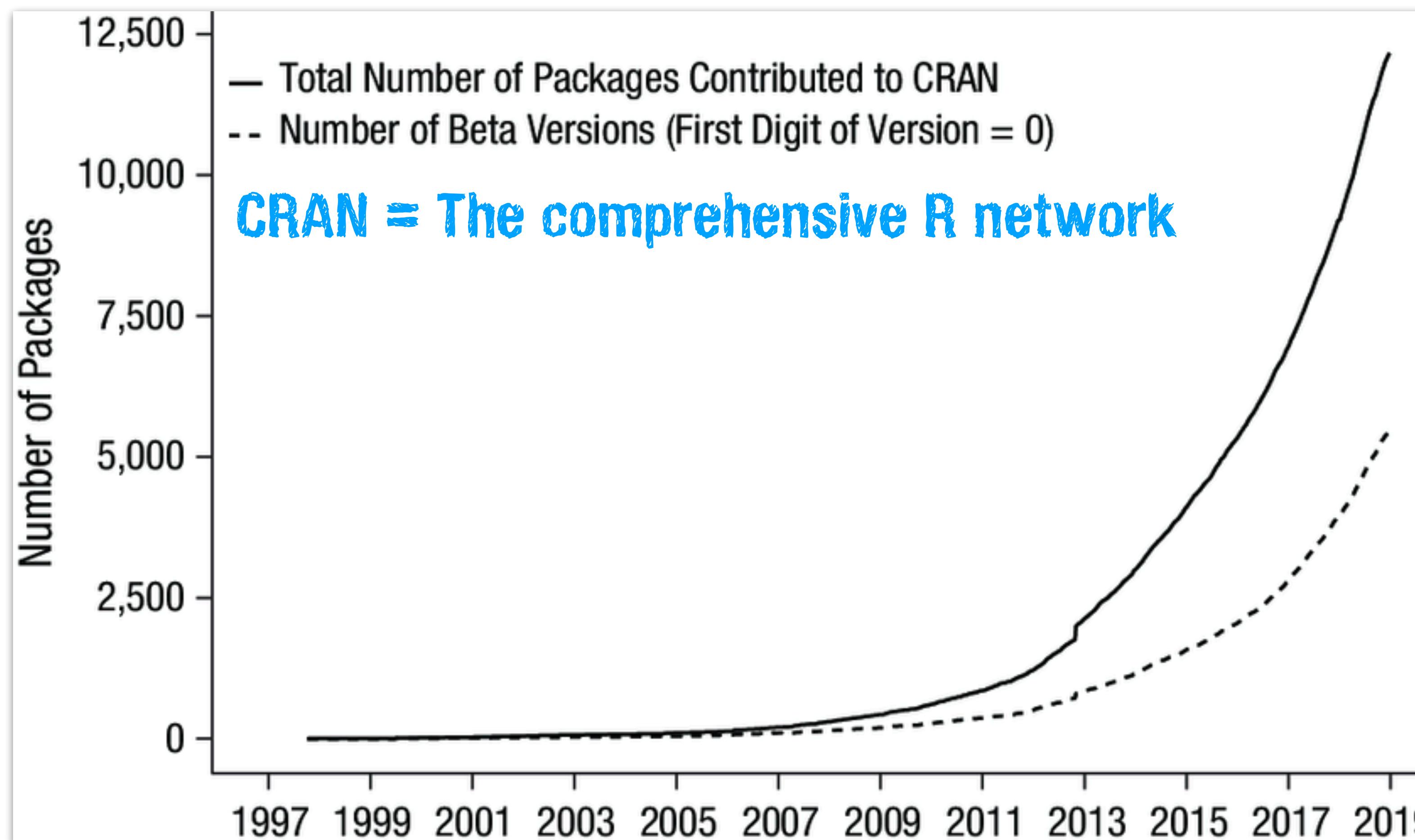
```
1 ggplot(gapminder, mapping = aes(x = gdpPercap, y = lifeExp, size = pop, color = country)) +
2   geom_point(alpha = 0.7, show.legend = FALSE) +
3   geom_text(data = gapminder %>% filter(country %in% c("United States", "China", "India")),
4             mapping = aes(label = country),
5             color = "black",
6             vjust = -0.75,
7             show.legend = FALSE) +
8   scale_colour_manual(values = country_colors) +
9   scale_size(range = c(2, 12)) +
10  scale_x_log10() +
11  labs(title = "Year: {frame_time}", x = "GDP per capita", y = "life expectancy") +
12  transition_time(year) +
13  ease_aes("linear")
```

Why R? 2. Data manipulation



Making Data Wrangling Suck Less

Why R? 3. Statistical modeling



This is what R was developed to do.
(and it continues to develop!!)

```
01-intro.Rmd x
ABC 🔎 Knit ⚙️
1 # Introduction {#intro}
2
3 You can label chapter and section titles using `#{label}` after them,
do not manually label them, there will be automatic labels anyway, e.
4
5 Figures and tables with captions will be placed in `figure` and `table`
6
7
8 ```{r nice-fig, fig.cap='Here is a nice figure!', out.width='80%', fi
9 par(mar = c(4, 4, .1, .1))
10 plot(pressure, type = 'b', pch = 19)
11 ```
12
13 Reference a figure by its code chunk label with the `fig:` prefix, e.
can reference tables generated from `knitr::kable()`, e.g., see Table
14
15 ```{r nice-tab, tidy=FALSE}
16 knitr::kable(
17   head(iris, 20), caption = 'Here is a nice table!',
18   booktabs = TRUE
19 )
20 ```
21
22 You can write citations, too. For example, we are using the **bookdown**
was built on top of R Markdown and **knitr** [@xie2015].
23
24 ```{r stats-help, fig.cap='Stats cheatsheet',fig.align='center',echo=
25 knitr::include_graphics('figures/cheatsheets/stats-help.jpg')
26 ```
27
28 See figure \@ref(fig:stats-help)
29
30
31 ```{r klippy, echo=FALSE, include=TRUE}
32 klippy::klippy()
33 ```


```

Chapter 1 Introduction

You can label chapter and section titles using `{#label}` after them, e.g., we can reference Chapter 1. If you do not manually label them, there will be automatic labels anyway, e.g., Chapter ??.

Figures and tables with captions will be placed in `figure` and `table` environments, respectively.

```
par(mar = c(4, 4, .1, .1))
plot(pressure, type = 'b', pch = 19)
```

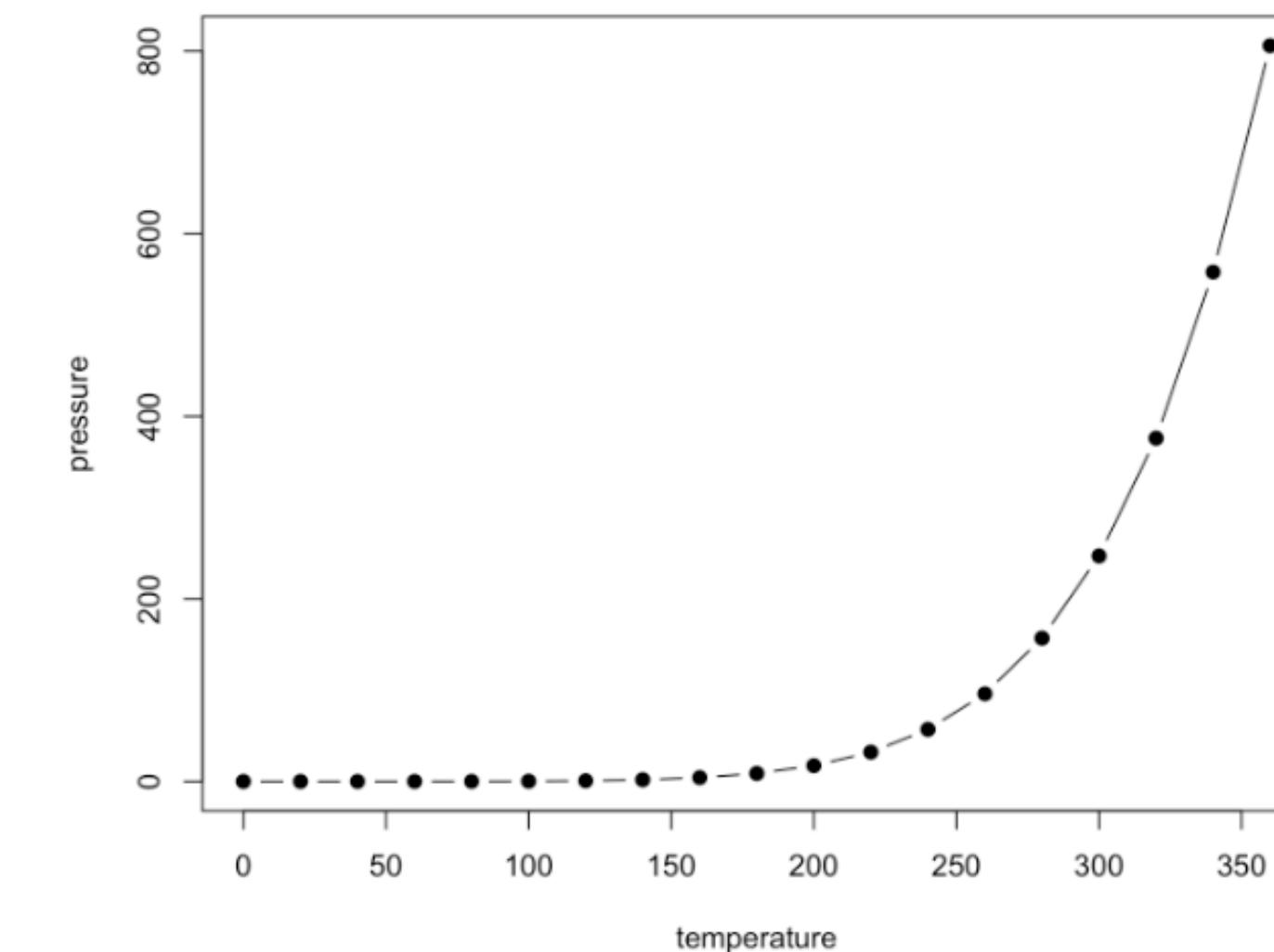


Figure 1.1: Here is a nice figure!

Reference a figure by its code chunk label with the `fig:` prefix, e.g., see Figure 1.1. Similarly, you can reference tables generated from `knitr::kable()`, e.g., see Table 1.1.

The screenshot shows the homepage of the R for Data Science website. The header includes the title "R for Data Science" and authors "Garrett Grolemund" and "Hadley Wickham". The main content area features a "Welcome" section with a detailed description of the book's purpose and contents. To the right is a sidebar with a navigation menu containing chapters from 1 to 21, grouped by section (I, II, III, IV). Below the menu is a box for "IV Model". On the far right, there is a sidebar with a red "O'REILLY" logo and a green parrot illustration, followed by the book cover image and author names.

R for Data Science

Garrett Grolemund
Hadley Wickham

Welcome

This is the website for “R for Data Science”. This book will teach you how to do data science with R: You’ll learn how to get your data into R, get it into the most useful structure, transform it, visualise it and model it. In this book, you will find a practicum of skills for data science. Just as a chemist learns how to clean test tubes and stock a lab, you’ll learn how to clean data and draw plots—and many other things besides. These are the skills that allow data science to happen, and here you will find the best practices for doing each of these things with R. You’ll learn how to use the grammar of graphics, literate programming, and reproducible research to save time. You’ll also learn how to manage cognitive resources to facilitate discoveries when wrangling, visualising, and exploring data.

This website is (and will always be) **free to use**, and is licensed under the [Creative Commons Attribution-NonCommercial-NoDerivs 3.0 License](#). If you’d like a **physical copy** of the book, you can order it from [amazon](#); it was published by O’Reilly in January 2017. If you’d like to **give back** please make a donation to [Kākāpō Recovery](#): the **kākāpō** (which appears on the cover of R4DS) is a critically endangered native NZ parrot; there are only 148 left.

The book is written in [RMarkdown](#) with [bookdown](#). It is automatically rebuilt from [source](#) by [travis](#). R4DS is a collaborative effort and many people have contributed fixes and improvements via pull request.

Welcome

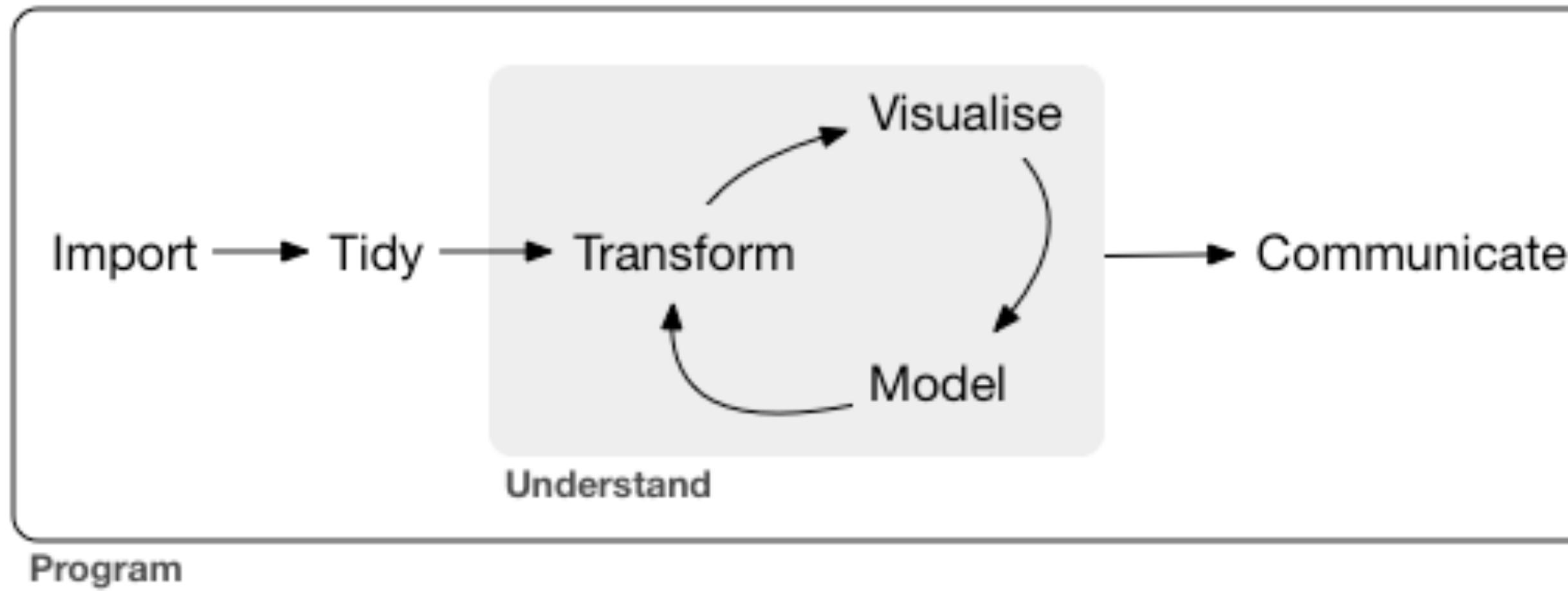
This is the website for “R for Data Science”. This book will teach you how to do data science with R: You’ll learn how to get your data into R, get it into the most useful structure, transform it, visualise it and model it. In this book, you will find a practicum of skills for data science. Just as a chemist learns how to clean test tubes and stock a lab, you’ll learn how to clean data and draw plots—and many other things besides. These are the skills that allow data science to happen, and here you will find the best practices for doing each of these things with R. You’ll learn how to use the grammar of graphics, literate programming, and reproducible research to save time. You’ll also learn how to manage cognitive resources to facilitate discoveries when wrangling, visualising, and exploring data.

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The book is written in [RMarkdown](#) with [bookdown](#). It is automatically rebuilt from [source](#) by [travis](#). R4DS is a collaborative effort and many people have contributed fixes and improvements via pull request.

<https://r4ds.had.co.nz/>

Why ? Tidyverse

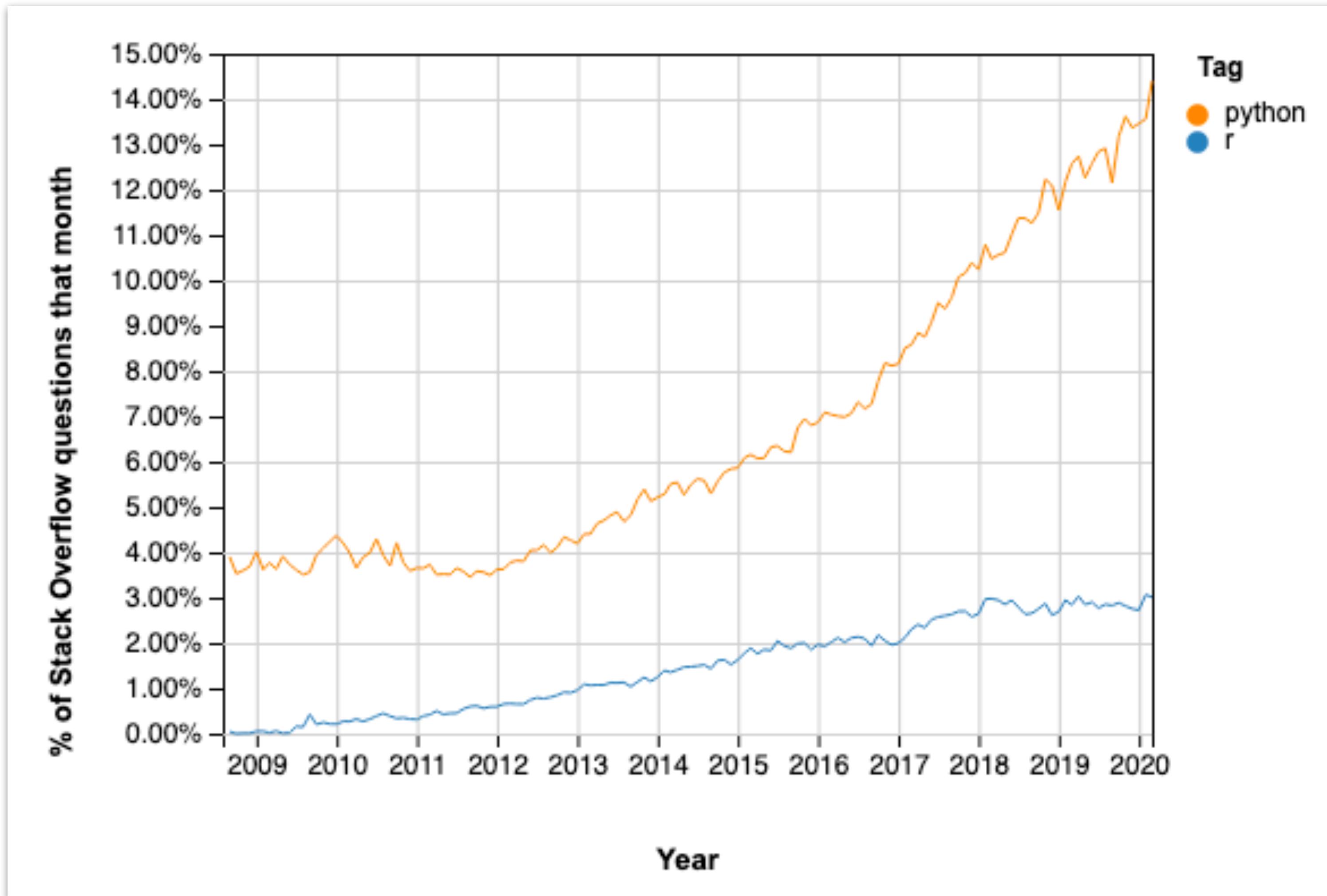


- *Import*: get data into R
- *Tidy*: clean and format the data
- *Transform*: select variables, create new ones, group and summarize
- *Visualize*: "look" at the data in different ways
- *Model*: answer questions about the data
- *Communicate*: write reproducible research reports

Why ? Also ...

- many of us here at Stanford use it
- R has a nice online community. **#rstats**
- RStudio is a great IDE (Integrated Development Environment)!

But what about python™ ?



But what about python™ ?

- You should learn python, too! :)
- Python is great for machine learning (e.g. deep learning, LLMs, ...).



 python™

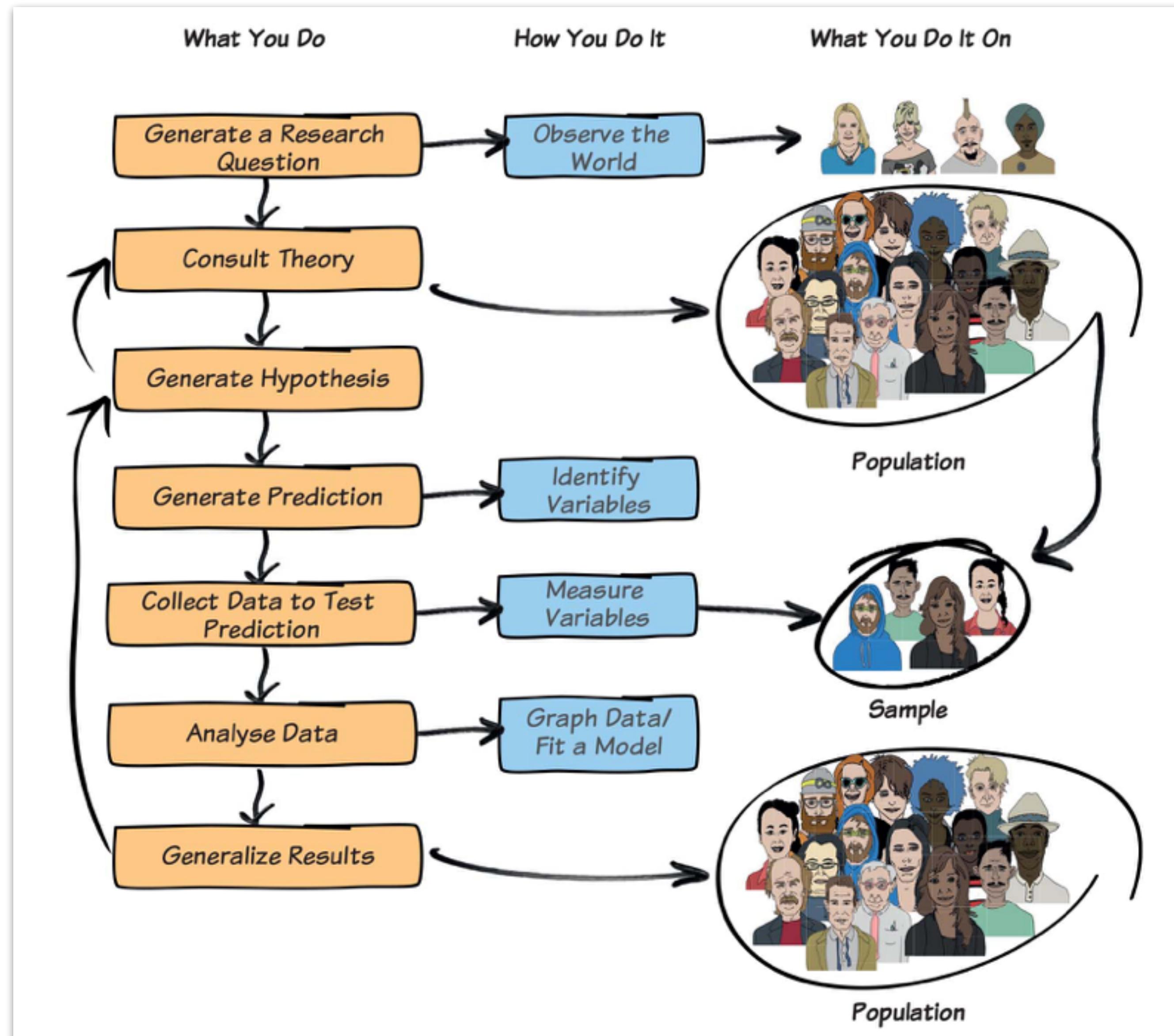
-  visualization
-  data manipulation
-  statistical modeling
-  reporting





2. Build models

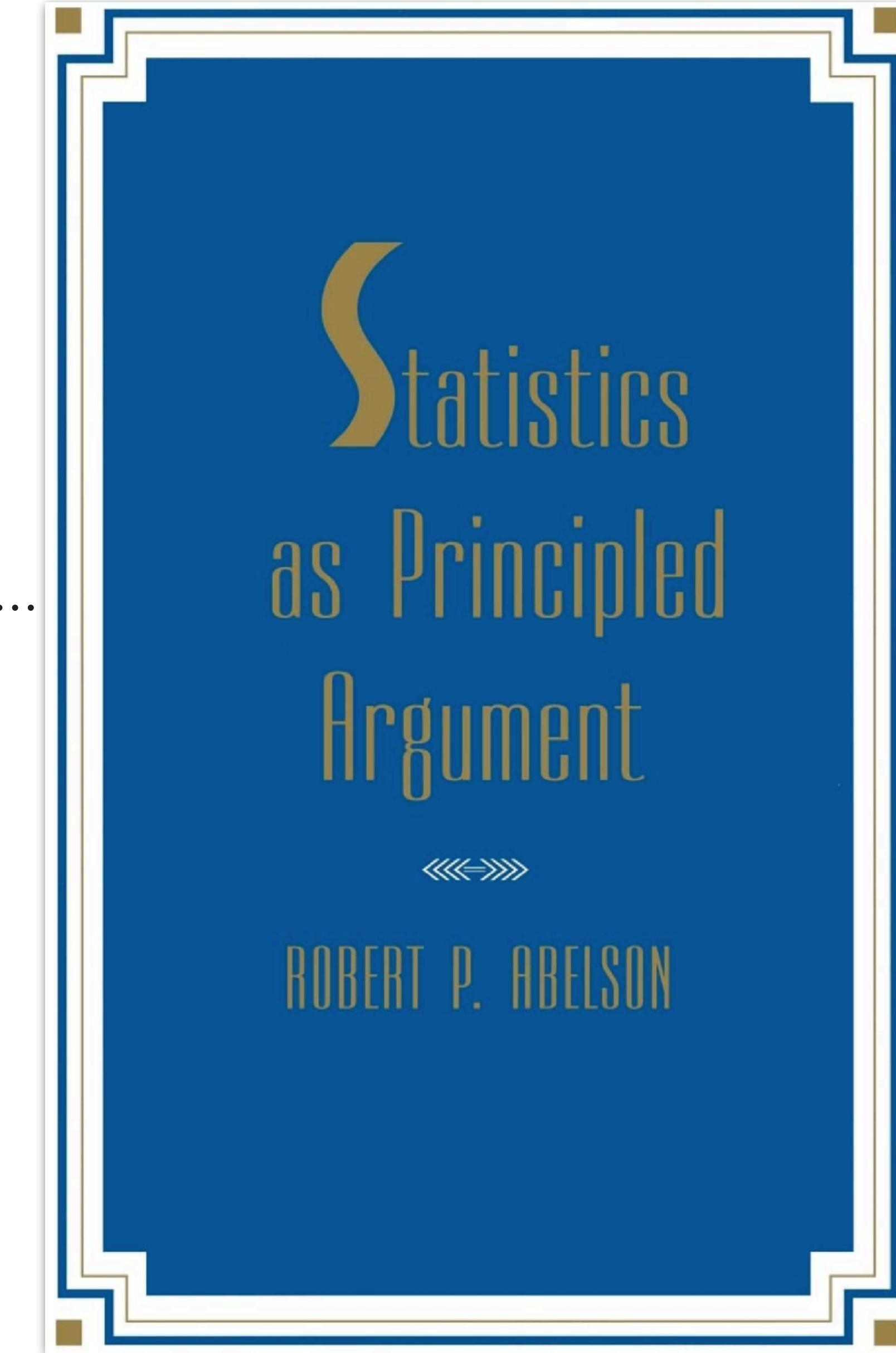
The research process



Statistics as argument

Researchers use empirical observations (data) for **making arguments about research questions**.

Statistics is part of a narrative and requires **figures**, context, rhetoric, prose, ...



Abelson, R. P. (1995). *Statistics as principled argument*. New York: Psychology Press.



R helps us with building models

instead of

$$\begin{aligned}
 \sum_{\mu,\nu,\lambda} \hat{M}_{\mu\nu\lambda}^{(3)} F_{\mu\nu\lambda} &= \hat{M}_{000}^{(3)} F_{000} + 3 \sum_i \hat{M}_{00(i)}^{(3)} F_{00(i)} + 3 \sum_i \hat{M}_{0ii}^{(3)} F_{0ii} + 3 \sum_i \hat{M}_{0(i)i}^{(3)} F_{0(i)i} \\
 &\quad + 6 \sum_{i < j} \hat{M}_{0(ii)(jj)}^{(3)} F_{0(ii)(jj)} + 3 \sum_{i < j} \hat{M}_{0(ii)(ij)}^{(3)} F_{0(ii)(ij)} + 3 \sum_{i \neq j} \hat{M}_{ii(jj)}^{(3)} F_{ii(jj)} + 6 \sum_{i < j} \hat{M}_{ij(ii)}^{(3)} F_{ij(ii)} + \dots \\
 &= S^{(0)} F_{000} - \frac{2S^{(1)}}{d} \frac{\sigma_1^2}{\sigma_0^2} \left(2 \sum_i F_{00(ii)} - \sum_i F_{0ii} \right) - \frac{2S^{(2)}}{d^2(d+2)} \frac{\sigma_1^4}{\sigma_0^4} \\
 &\quad \times \left[3(d-1) \sum_i F_{0(ii)(ii)} - 6 \sum_{i < j} F_{0(ii)(jj)} + \frac{3d}{2} \sum_{i < j} F_{0(jj)(jj)} + (d+2) \sum_{i \neq j} F_{ii(jj)} - (d+2) \sum_{i < j} F_{ij(jj)} \right] \\
 &\quad + \frac{3S_2^{(2)}}{d(d+2)} \frac{\sigma_1^4}{\sigma_0^4} \left(3 \sum_i F_{0(ii)(ii)} + 2 \sum_{i < j} F_{0(ii)(jj)} + \sum_{i < j} F_{0(jj)(ii)} \right) + \dots. \tag{85}
 \end{aligned}$$

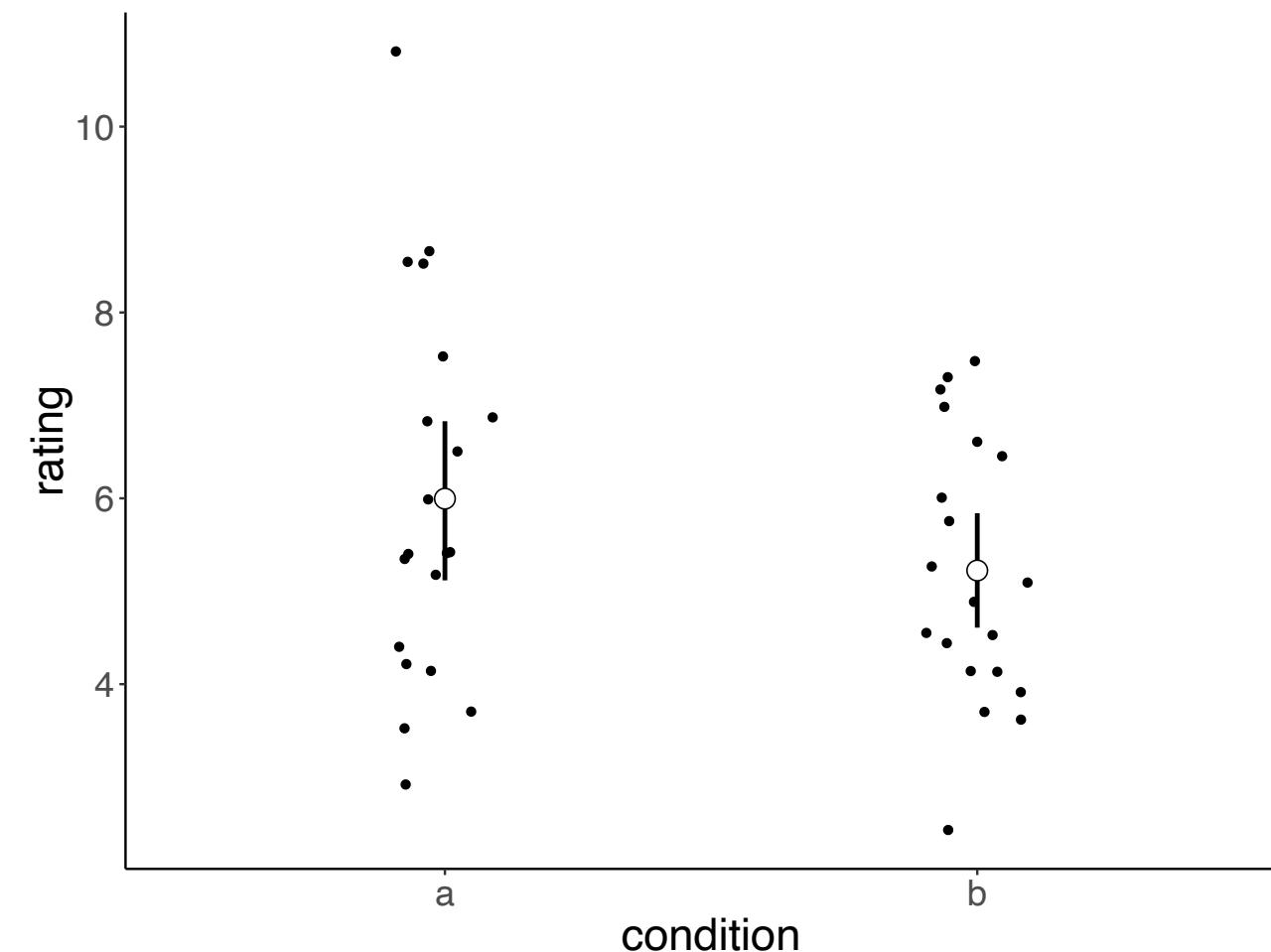
(google search "complicated statistical equation")

we'll do

```

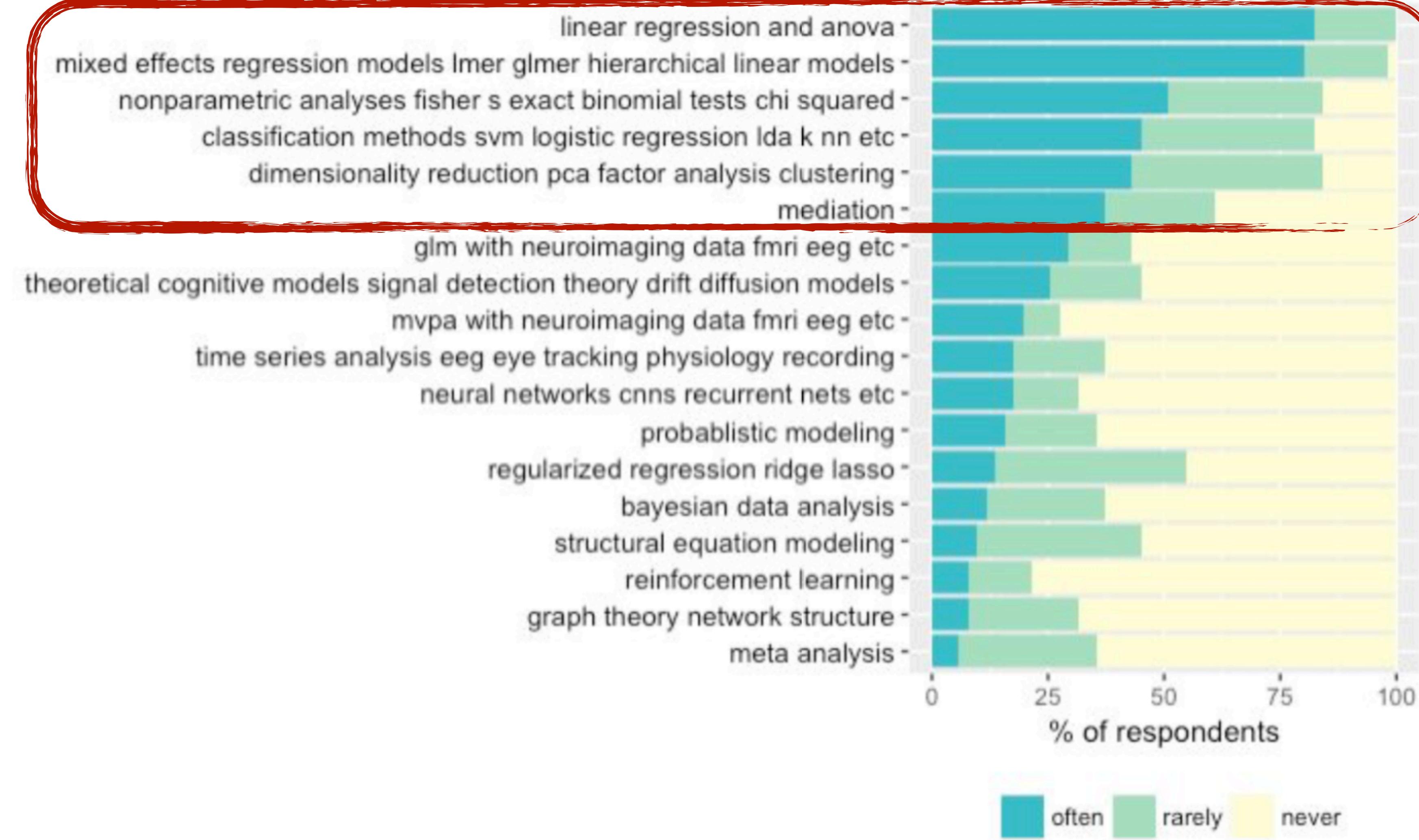
1 set.seed(0)
2 df.data = tibble(
3   a = rnorm(20, mean = 6, sd = 2),
4   b = rnorm(20, mean = 5, sd = 2)
5 ) %>%
6   gather("condition", "rating")
7
8 df.data %>%
9   group_by(condition) %>%
10  summarize(rating.mean = mean(rating),
11            rating.sd = sd(rating)) %>%
12  kable()
13
14 # calculate the difference between conditions
15 difference.actual = df.data %>%
16   group_by(condition) %>%
17   summarize(rating.mean = mean(rating)) %>%
18   pull(rating.mean) %>%
19   diff() %>%
20   -

```

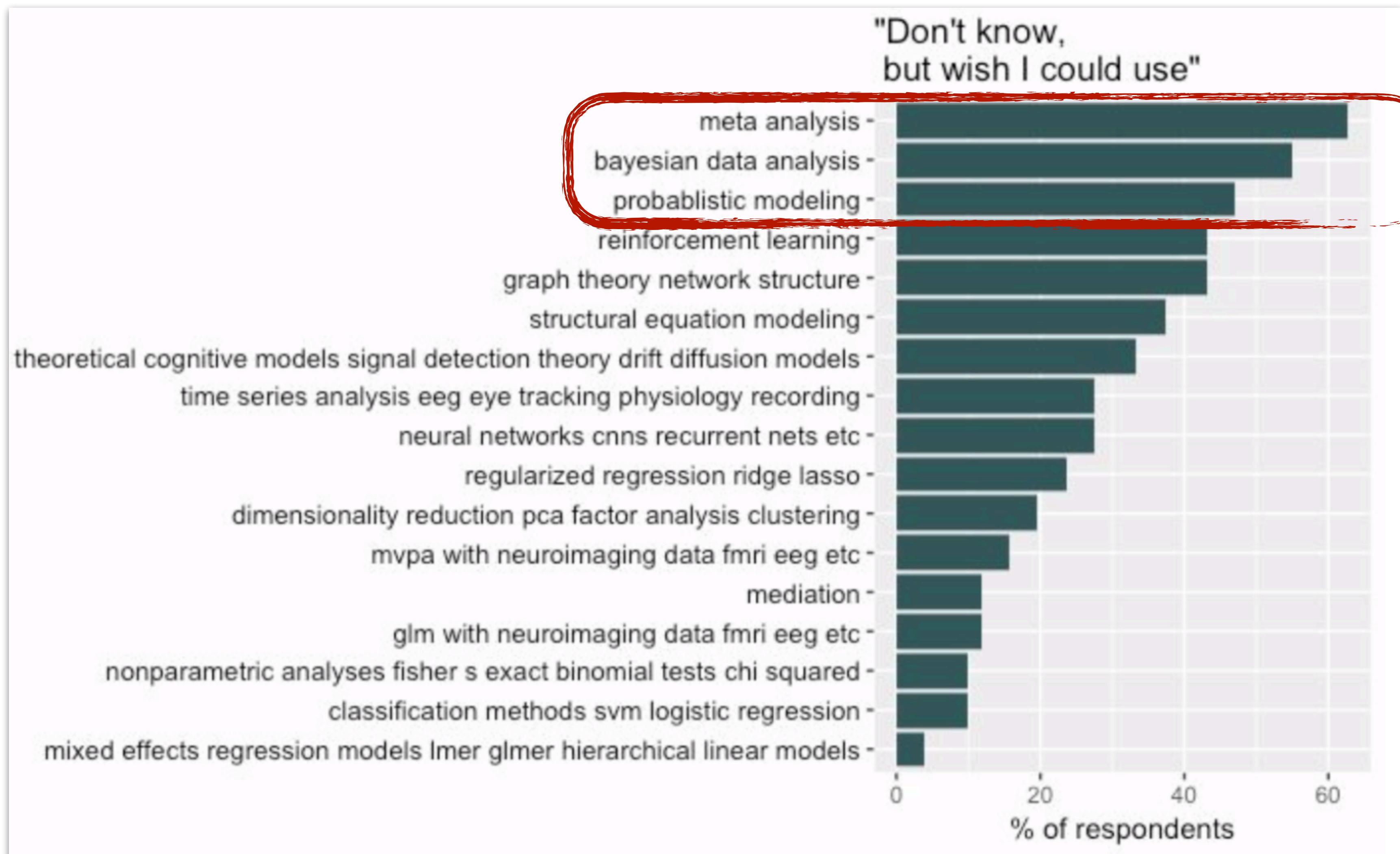


Psychology grad student survey

“How often do you **use** the following skills?”



Psychology grad student survey



3. Report results

Replication crisis

Google search results for "replication crisis in psychology" showing various articles, charts, and infographics.

Key search terms visible in the interface:

- All
- News
- Images
- Videos
- Shopping
- More
- Settings
- Tools
- SafeSearch

Image filters visible in the interface:

- precis
- reproducibility crisis
- scientific
- estimating
- science
- social science
- psych
- nature
- studies
- recommendations
- social psychology
- psychological science
- research
- randall
- monroe
- stapel

Sample search results:

- No Evidence for a Replicability Crisis ... projects.iq.harvard.edu
- Economics (n=18) Camerer et al., 2016
- Psychology (n=100) Open Science Collaboration, 2015
- The Replication Crisis in Psychology | Noba nobaproject.com
- Are internal replications the solution ... brainsidea.wordpress.com
- What is Replication Crisis? | Popular ... popsci.com
- Teaching High School Psychology ... teachinghighschoolpsychology.blogspot.com
- The CHRONICLE OF HIGHER EDUCATION
- How to Fix Psychology's Replication Crisis researchgate.net
- Tradition of controlled experiments
- Strong basic theory
- Replication Crisis in Science ... simplystatistics.org
- The Reproducibility Crisis in ... slideshare.net
- Science Only 36% of studies replicated!!
- The Reproducibility Crisis in ... slideshare.net
- psychological science ... science.sciencemag.org
- Replication Crisis Overblown ... thecut.com
- Health News Digest ... bfm.my
- Are conceptual replications part of the ... pigee.wordpress.com
- 6 Principles of Open Science
 - Open Data
 - Open Source
 - Open Access
 - Open Methodology
 - Open Peer Review
 - Open Educational Resources
- The Replication Crisis in Psychology | Noba nobaproject.com
- How will stereotype threat get ... progressfocused.com
- PSYCHOLOGY'S REPRODUCIBILITY PROBLEM
- psychological science ... science.sciencemag.org
- Replication Crisis ... cambridge.org

R Markdown

R Markdown :: CHEAT SHEET

What is R Markdown?

.Rmd files - An R Markdown (.Rmd) file is a record of your research. It contains the code that a scientist needs to reproduce your work along with the narration that a reader needs to understand your work.

Reproducible Research - At the click of a button, or the type of a command, you can rerun the code in an R Markdown file to reproduce your work and export the results as a finished report.

Dynamic Documents - You can choose to export the finished report in a variety of formats, including html, pdf, MS Word, or RTF documents; html or pdf based slides, Notebooks, and more.

Workflow

① Open a new .Rmd file at File ▶ New File ▶ R Markdown. Use the wizard that opens to pre-populate the file with a template

② Write document by editing template

③ Knit document to create report; use knit button or render() to knit

④ Preview Output in IDE window

⑤ Publish (optional) to web server

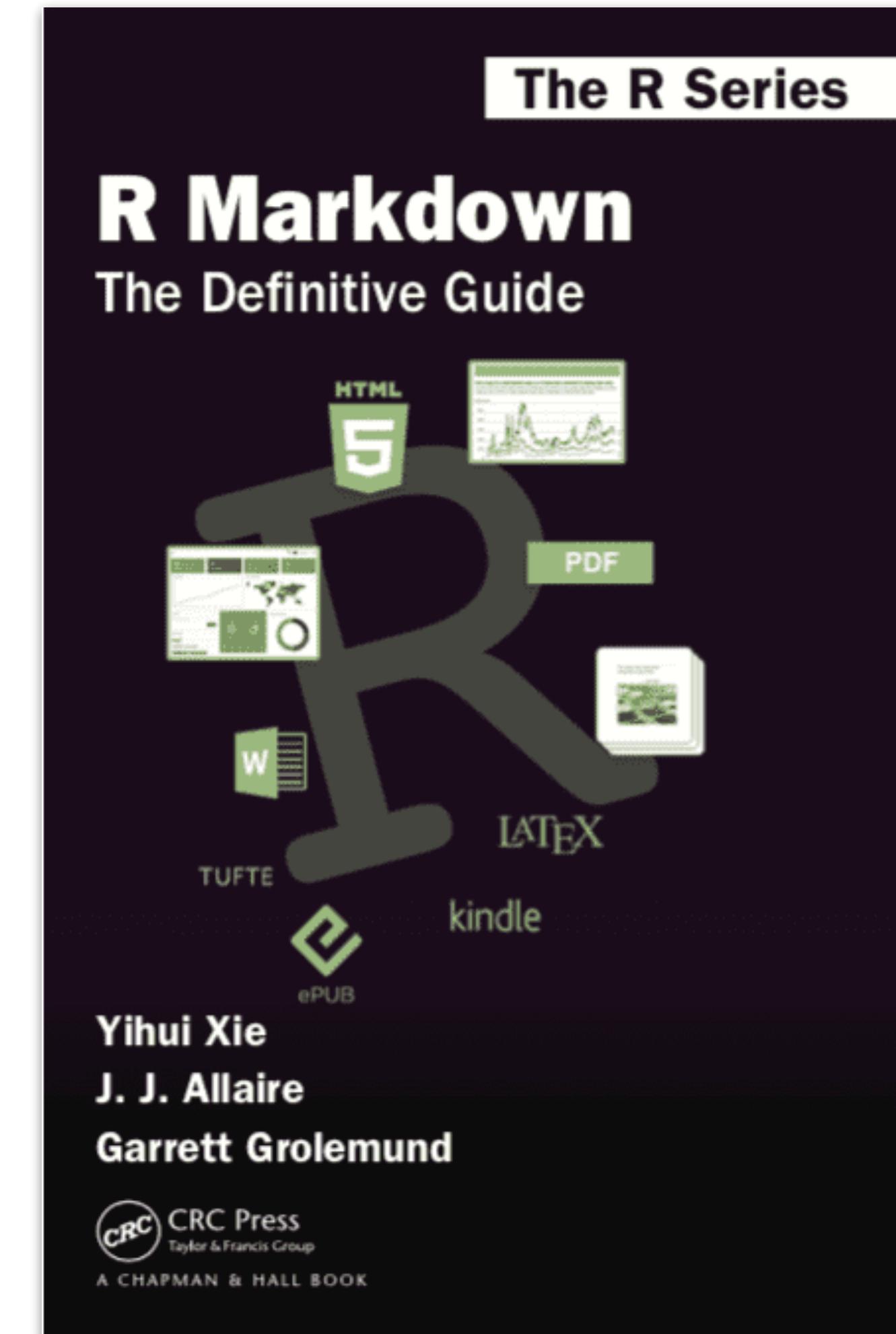
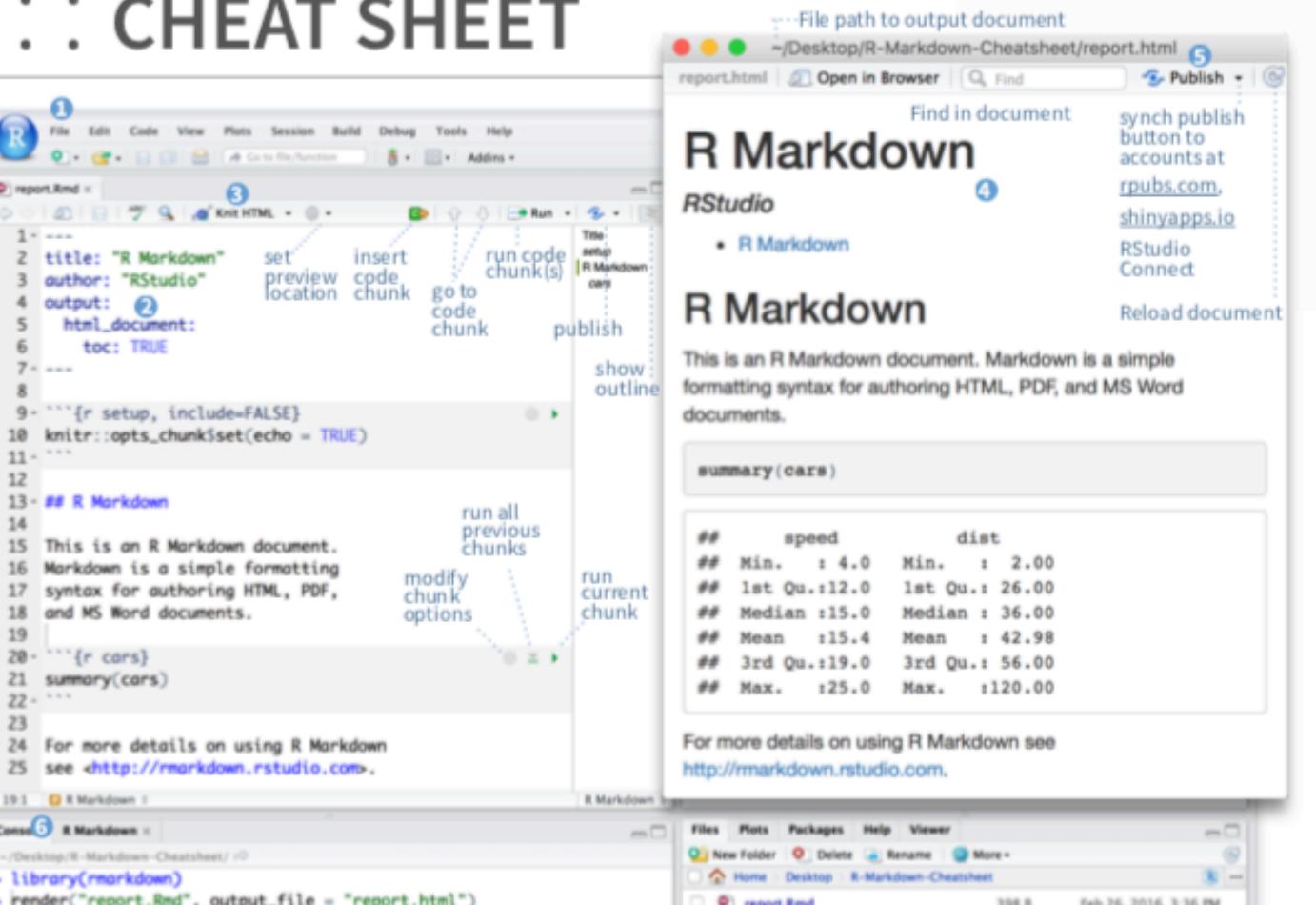
⑥ Examine build log in R Markdown console

⑦ Use output file that is saved along side .Rmd

render

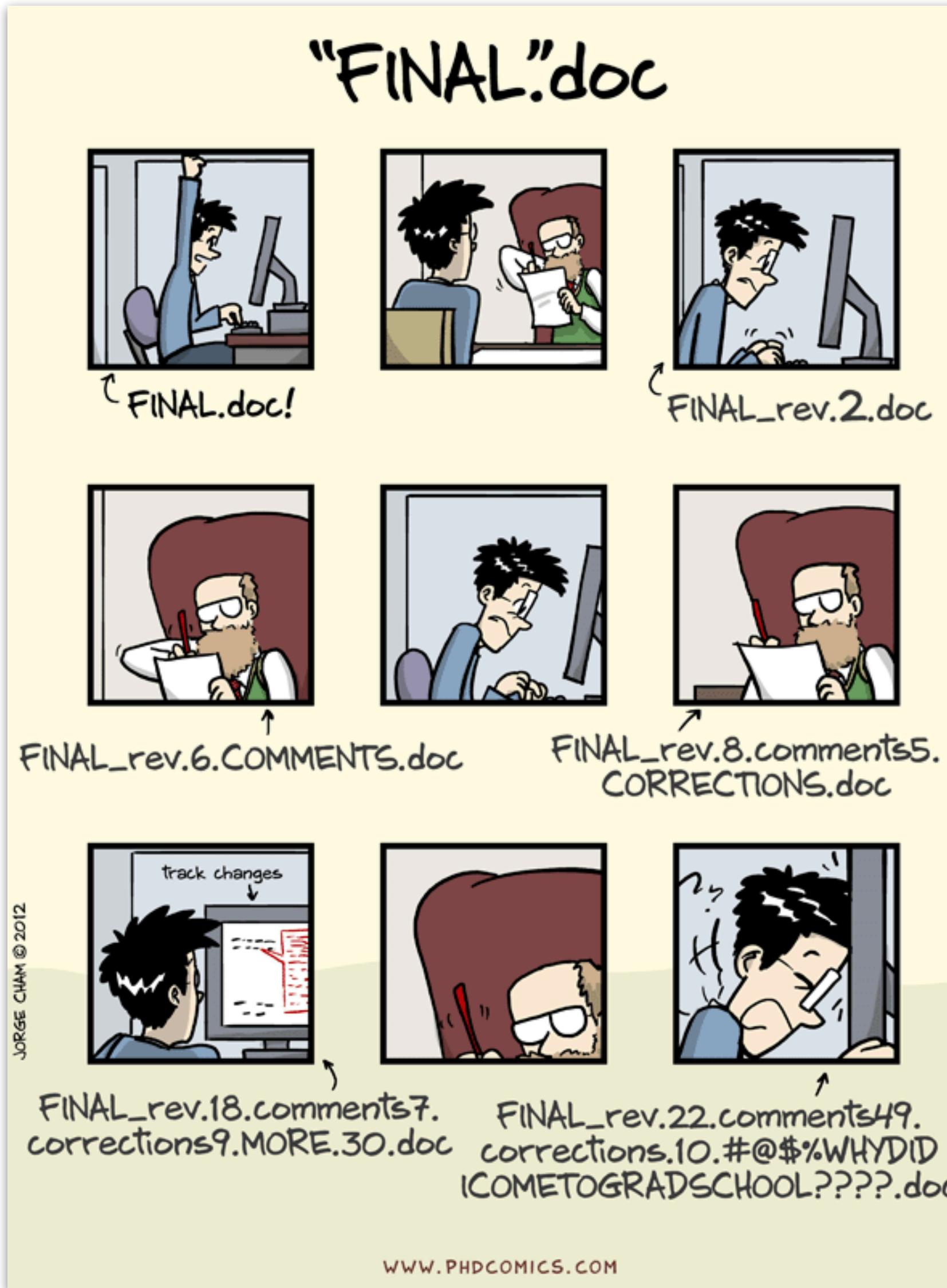
Use `rmarkdown::render()` to render/knit at cmd line. Important args:

<code>input</code> - file to render	<code>output_options</code> - List of render options (as in YAML)	<code>output_file</code>	<code>params</code> - list of params to use	<code>envir</code> - environment to evaluate code chunks in	<code>encoding</code> - of input file
-------------------------------------	---	--------------------------	---	---	---------------------------------------



<https://bookdown.org/yihui/rmarkdown/>

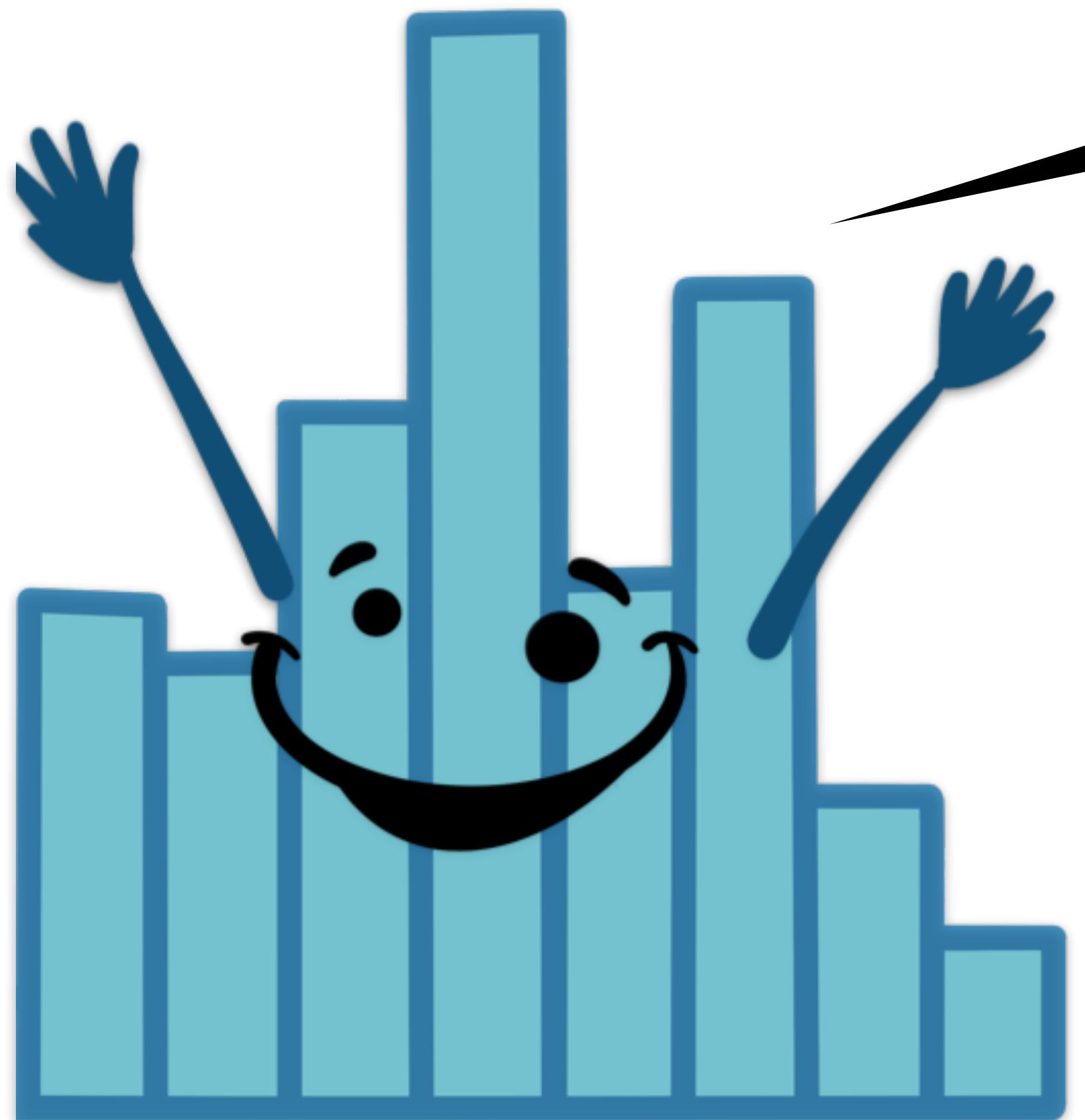
R Markdown



- if we use a word document ... :
 - figures change
 - results change
 - copy and paste is error prone
- in R Markdown ... :
 - figures and statistics are updated
 - no need for copy and paste
 - everything in one place
 - even better with version control (e.g. via github)

01:00

stretch break!





Ray ✅
@ray4tesla

Subscribe

...

80% of Covid patients put on ventilators died. This is probably most shocking revelation unknown to the public.



2:38 PM · Oct 31, 2023 · 10.1M Views

2.2K

2.5K

4.5K

565





Post



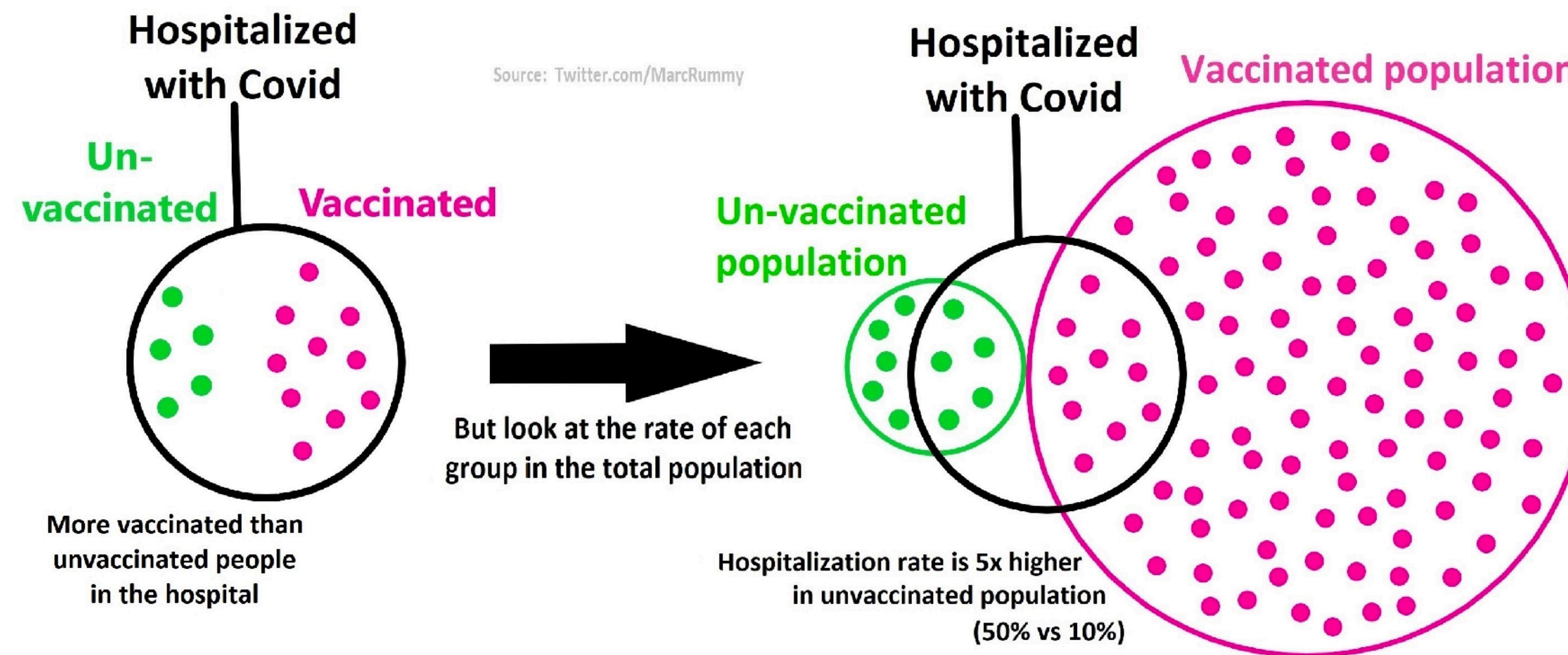
Daniël Lakens

@lakens

...

This is why people need basic training in logic (in this case about the positive predictive value). After selecting patients on 'needing to go on a ventilator' many will die, whatever you do.

More vaccinated people are
hospitalized with COVID than
unvaccinated people!

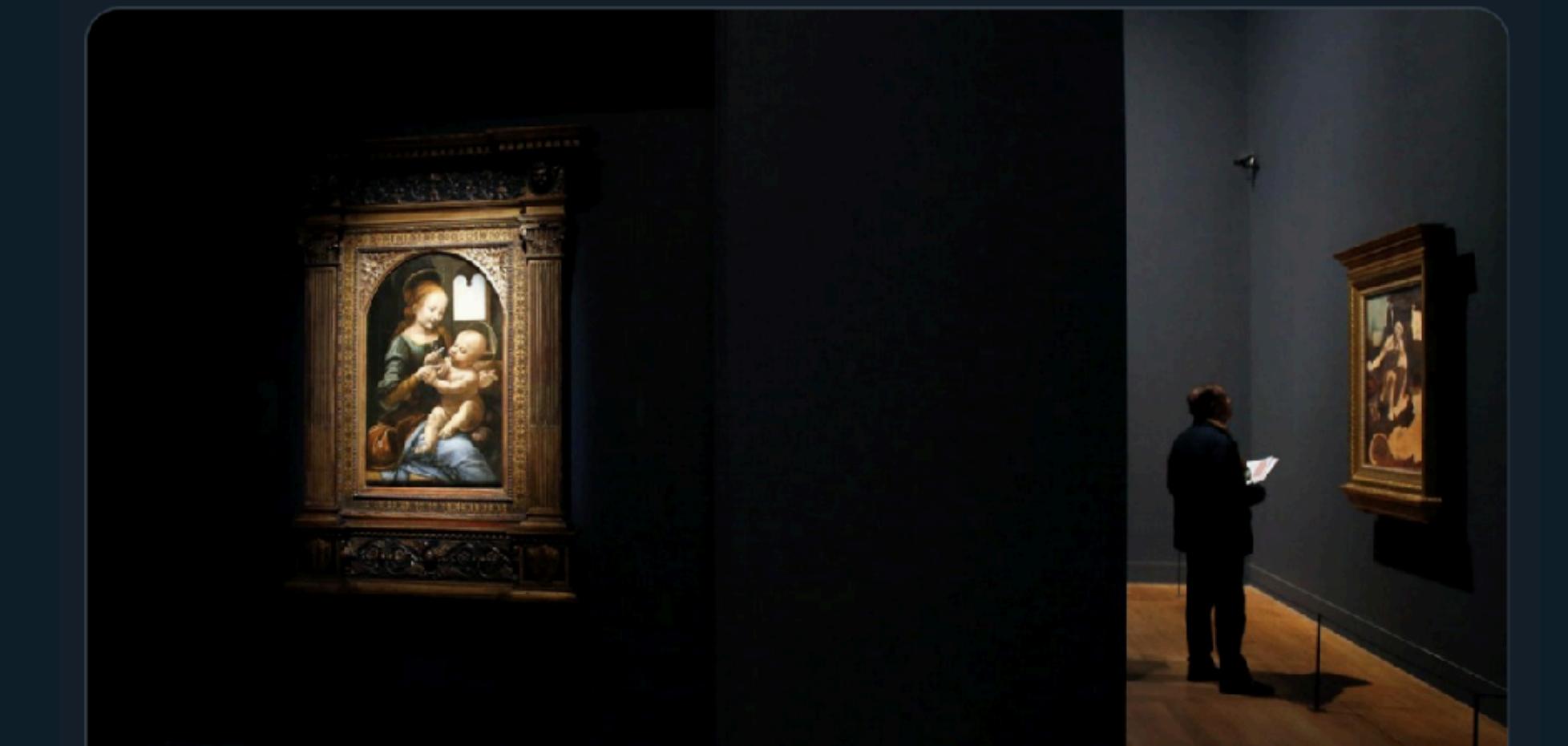


Note: The ratios presented are made to illustrate the concept of the base rate fallacy when the vaccination rate is high



NYT Health
@NYTHealth

Want to live longer? Try going to the opera. Researchers in Britain have found that people who reported going to a museum or concert even once a year lived longer than those who didn't.



Another Benefit to Going to Museums? You May Live Longer

Researchers in Britain found that people who go to museums, the theater and the opera were less likely to die in the study period than those who didn't.

nytimes.com

9:19 AM · Dec 22, 2019 · SocialFlow

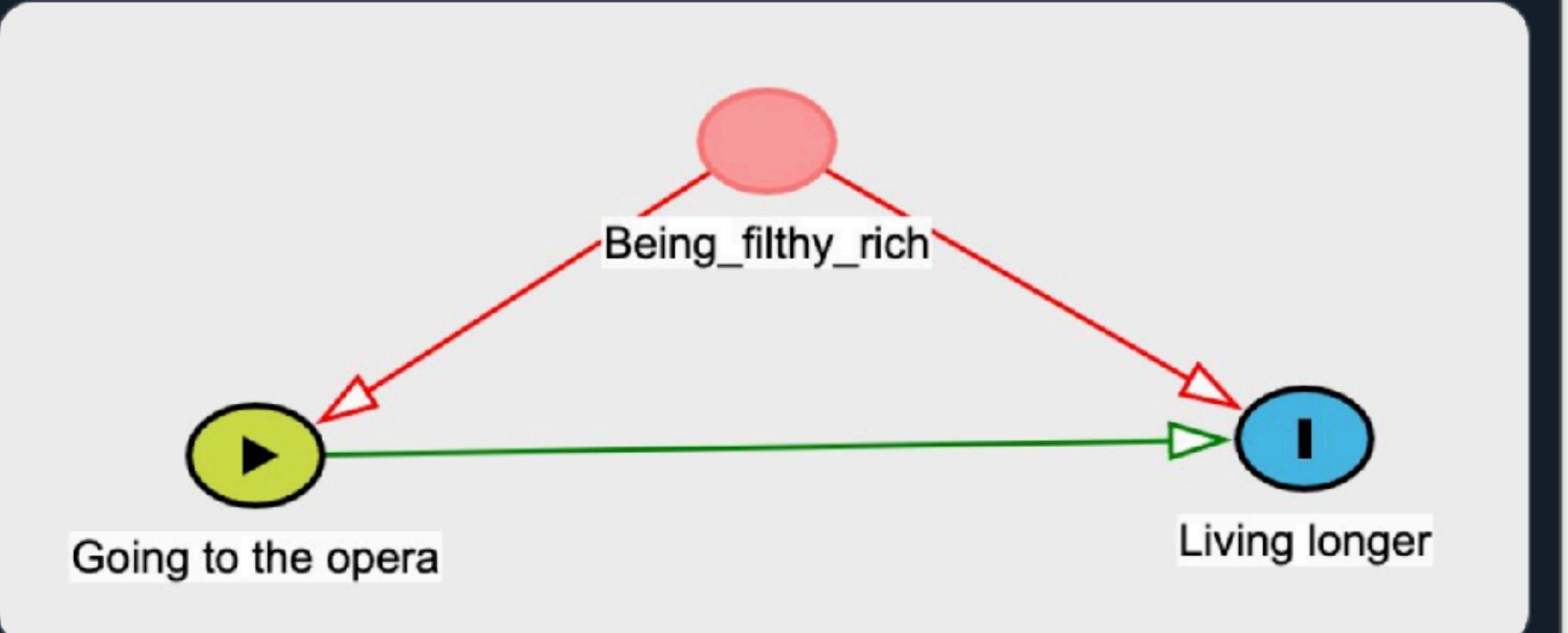
336 Retweets 1.3K Likes



 **Andrew Heiss**
@andrewheiss

ooh ooh i can draw the dag for this one!

```
graph TD; A((Being_fi)) --> B((I)); C((GotoOpera)) --> B
```



 **NYT Health** @NYTHealth · Dec 22, 2019
Want to live longer? Try going to the opera. Researchers in Britain have found that people who reported going to a museum or concert even once a year lived longer than those who didn't. nyti.ms/2Q9AmZV

2:47 PM · Dec 22, 2019 · [Twitter Web App](#)

 View Tweet activity

837 Retweets 3.9K Likes

How will we learn?

How will we learn?

- Lectures
- Sections
- Office hours
- Homework
- Midterm exam
- Final project
- Grading

How will we learn?

- **Lectures**

- Monday, Wednesday, Friday **10:30-11:50am**

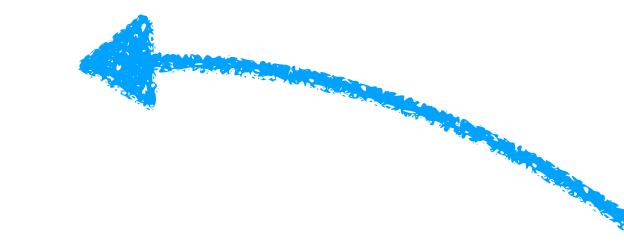
- get familiar with R and RStudio

- visualization

- data manipulation

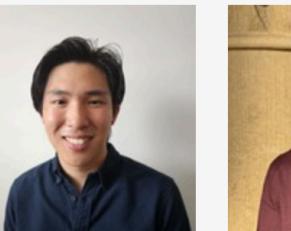
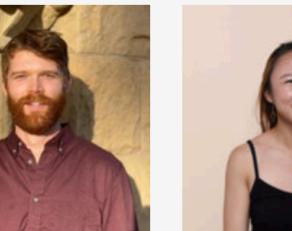
- simulation

- learn statistical methods



**if you know R very well
already, you could skip the
visualization and data
wrangling classes (but you
might still learn some new
tricks)**

How will we learn?

Alice Xue	Catherine Garton	Justin Yang	Satchel Grant	Verity Lua
				
Teaching assistant				
she/her	she/her	he/him	he/him	she/her

- **Sections**

- section times are **Tuesday and Thursday 3:30-4:20pm**
- **R tutorial** in week 1 ← **recommended if you have little R experience**
- work on the homework assignments together
- ask the TAs questions
- attending sections is **optional** (but **recommended**)

How will we learn?

- Office hours

	Tobi Gerstenberg	Nilam Ram
		
Role	Instructor	Instructor
Pronouns	he/him	he/him
Email (@stanford.edu)	gerstenberg	nilamram
Office hours	Wednesday 1:30- 2:30pm	Monday 1:30- 2:30pm

How will we learn?

encouraged!

- Homework

- one assignment per week (7 in total)
- the last one is optional and the best 6 count toward your grade
- you can work in groups
 - clearly indicate who you worked with on your submission
 - each group member should write their own code and written responses
- download and submit via Canvas
- you'll submit **two** files:
 - raw .Rmd file
 - rendered .pdf file
- homework will be available **after class on Fridays**, and is due **Thursday 8pm** the week after

How will we learn?

- **Homework**

- late submission policy:
 - you have 5 slip days in total
 - if you submit a homework within 24h of the deadline, this costs 1 slip day (or 2 slip days if it's submitted within 48h, ...)
 - once you have used up all your slip days, a late homework will receive a 0 score

How will we learn?

- **Midterm exam**
 - like a homework assignment, but:
 - you have to work on it **on your own**
 - will be made available on Friday (2/7) and is due on **Friday (2/14) at 8pm**
 - no class on Wednesday that week so you have more time

How will we learn?

- **Final project**

- you can work in groups of up to 3 members
- everyone in the group will receive the same grade
- the expectations for the project scale with the size of the group
- you can find examples on canvas under Files > final_project

How will we learn?

- Final project
 - structure:
 1. short written project proposal
 2. oral presentation
 3. written report

How will we learn?

- **Final project**

1. short written project proposal

- due Thursday 2/20
- we'll provide an RMarkdown template
- examples from prior years are on Canvas

How will we learn?

- **Final project**

- 2. oral presentation

- during exam week
 - short slideshow of the project
 - groups present together

How will we learn?

- **Final project**

- 3. written report

- due **Friday 3/21**
 - ~ 2000 words per group member
 - answer an interesting research question
 - demonstrate what you've learned in class:
 - data wrangling
 - visualization
 - statistical modeling
 - reporting
 - you'll be using github to publish your final project online
 - examples are on Canvas

How will we learn?

- **Grading**
 - Homework: 40%
 - Midterm: 20%
 - Final project: 40%
 - Proposal: 5%
 - Presentation: 10%
 - Report: 25%
 - Bonus:
 - Ed discussion: 2%

Tools we will use in class

- Canvas
- Course website
- PollEverywhere
- Datacamp
- Ed Discussion
- Slack
- Github
- Free online books
- chatGPT

Tools we will use in class

- **Canvas**

- **We** will:
 - send announcements
 - upload:
 - slides
 - class notes / code files
 - homework assignments
- **You** will:
 - read announcements :)
 - upload homework

Tools we will use in class

- **Course website**

- general information
- schedule with links to materials
- links to relevant datacamp classes

PSYCH 252: STATISTICAL METHODS

[Home](#) [Schedule](#) [Information](#) [Book](#)

This course offers an introduction to advanced topics in statistics with the focus of understanding data in the behavioral and social sciences. It is a practical course in which learning statistical concepts and building models in R go hand in hand. The course is organized into three parts: In the first part, we will learn how to visualize, wrangle, and simulate data in R. In the second part, we will cover topics in frequentist statistics (such as multiple regression, logistic regression, and mixed effects models) using the general linear model as an organizing framework. We will learn how to compare models using simulation methods such as bootstrapping and cross-validation. In the third part, we will focus on Bayesian data analysis as an alternative framework for answering statistical questions.

Requirement: [Psych 10](#), [Stats 60](#), or equivalent.

Team

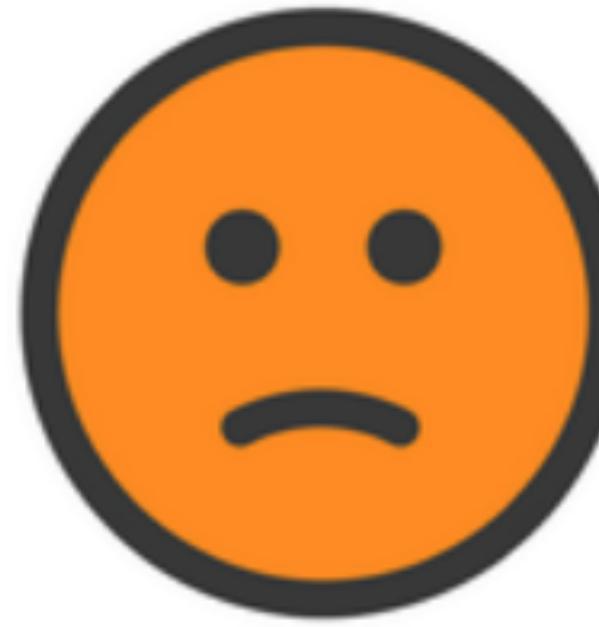
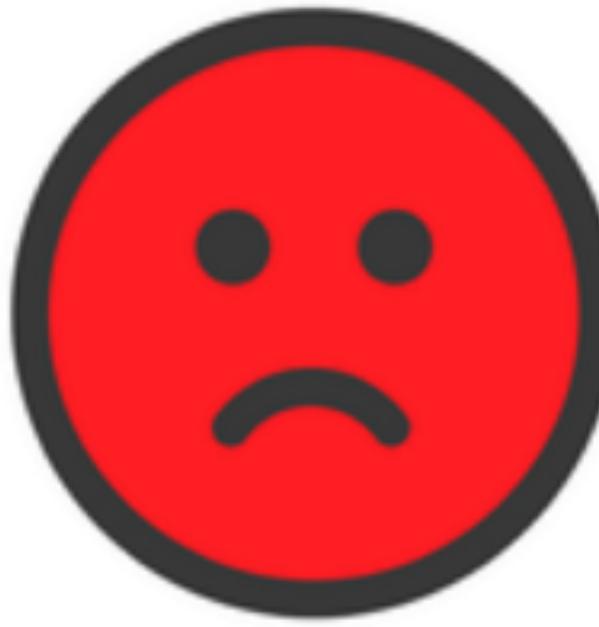
	Tobi Gerstenberg	Nilam Ram	Alice Xue	Catherine Garton	Justin Yang	Satchel Grant
Role	Instructor	Instructor	Teaching assistant	Teaching assistant	Teaching assistant	Teaching assistant
						

<https://psych252.github.io/>

Tools we will use in class

- **PollEverywhere**
 - quick polls in class
 - feedback at the end of class
 - address: pollev.com/psych252

How are you feeling today?



Demonstrate that data are in fact anonymous

Tools we will use in class

- **DataCamp**

- use your **stanford.edu** address to sign up!
- if you haven't already, sign up here: <https://tinyurl.com/psych252datacamp25>

Visualization 1

Content:

- Get familiar with the RStudio interface.
- Take a look at some suboptimal plots, and think about how to make them better.
- Understand the general philosophy behind ggplot2 – a grammar of graphics.
- Understand the mapping from data to geoms in ggplot2.
- Create informative figures using grouping and facets.

Resources:

- [Cheatsheet ggplot2](#)

Datacamp:

- [ggplot \(intro\)](#)
- [Reporting](#)
- [visualization best practices](#)

Reading:

- [Course notes: Visualization 1](#)
- [Data visualization \(#1\)](#)
- [Data visualization \(#3\)](#)



The DataCamp website homepage features a dark blue header with the DataCamp logo and a search bar asking "What would you like to learn today?". Below the header, a large yellow button says "Start Learning For Free". The main title "Learn Data Science Online" is prominently displayed in white. A subtext explains that the skills needed for success are changing and that DataCamp helps learners understand data science today and apply it tomorrow. At the bottom, there are icons for Python, R, SQL, Spark, Git, Shell, and Spreadsheets.

Tools we will use in class

- Ed Discussion

- post your own questions and answer those of your colleagues

if you only want to ask the teaching team

if you want to be anonymous

New Post

Question Post Announcement

Title:

Category: General, Lectures, Homework, Midterm, Final Project, Social, Random

Subcategory: HW1, HW2, HW3, HW4, HW5, HW6, HW7

I have a question!

Pinned
Keep at top of thread list

Private
Visible to you and staff only

Anonymous
Hide your name from students

Anonymous Comments
Allow anonymous comments

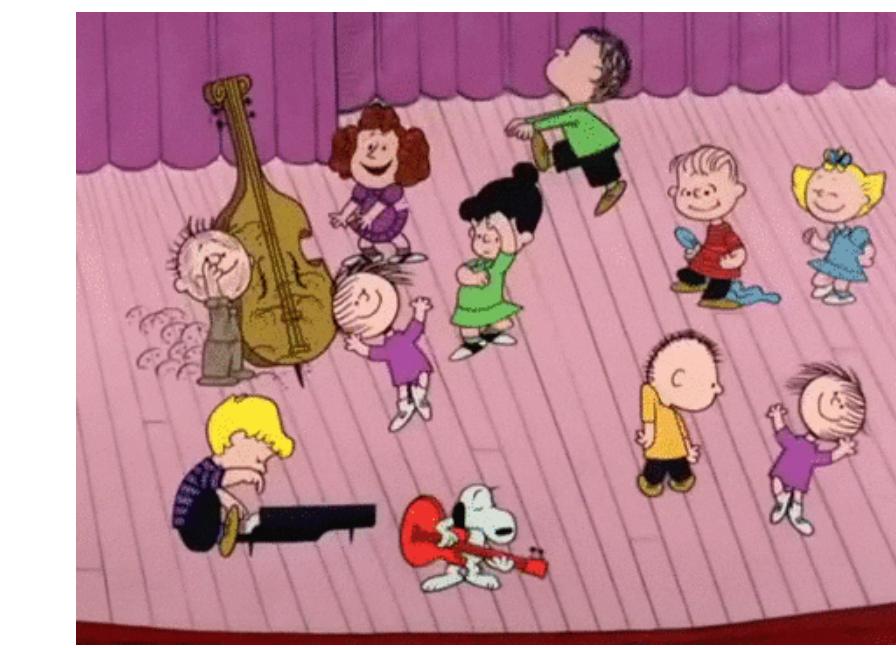
Megathread
Resolvable comments

Post

Tools we will use in class

- **Slack**

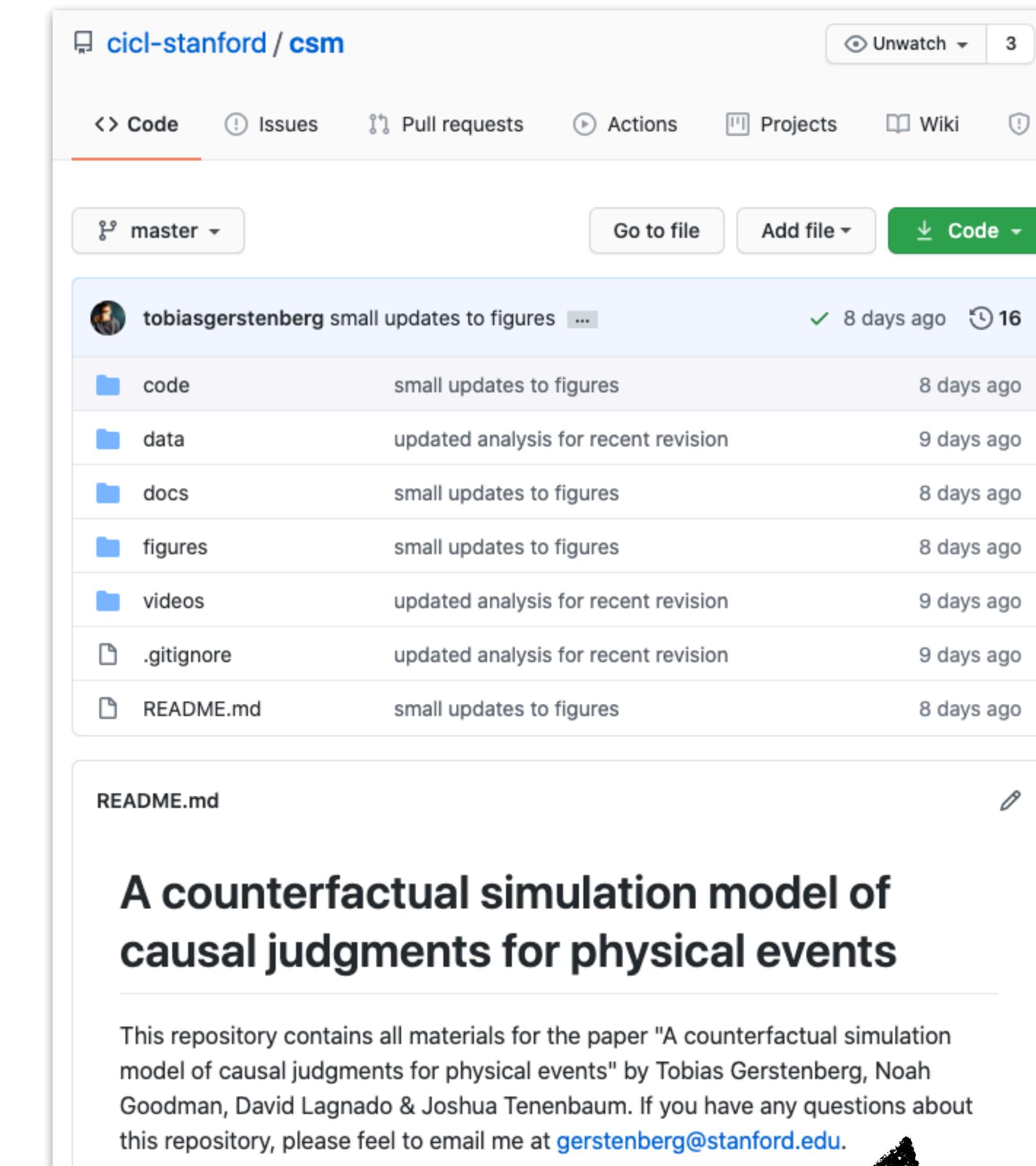
- just a space for you to build community
- the teaching team won't monitor what's happening on slack
- you can join via the Slack tab on Canvas



Tools we will use in class

- **Github**

- we will use github for the final project
- it's an essential collaboration tool and critical for contributing to open science

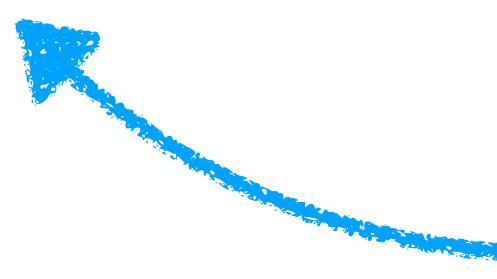


you want one of these for each paper you publish!

Tools we will use in class

- **Free online books**

- we won't use a text book in class
- statistics and data science are developing fast and I didn't find a single book that fits the bill
- **but:** many great, free books online
- **and:** I will point out suggested readings as we go along
- **also:** I'll update our course notes as we go along



feedback always welcome!

Tools we will use in class

- Free online books

The screenshot shows a website for "PSYCH 252: STATISTICAL METHODS". At the top, there is a navigation bar with links: Home, Schedule, Getting ready, Information, Book, and a social media section with Twitter, Facebook, and LinkedIn icons. A red arrow points from the "Book" link to the main content area. The main content area features a large title: "Psych 252: Statistical Methods for Behavioral and Social Sciences" by Tobias Gerstenberg, published on 2021-01-08. Below the title is a section titled "Preface" which contains text about the book's purpose and how it should be used in combination with course lectures. There is also contact information provided.

PSYCH 252: STATISTICAL METHODS

Home Schedule Getting ready Information **Book**

Psych 252

Preface

Course description

Course homepage

1 Introduction

2 Visualization 1

3 Visualization 2

4 Data wrangling 1

5 Data wrangling 2

6 Probability and causality

7 Simulation 1

8 Simulation 2

9 Modeling data

10 Linear model 1

11 Linear model 2

12 Linear model 3

Psych 252: Statistical Methods for Behavioral and Social Sciences

Tobias Gerstenberg

2021-01-08

Preface

This book contains the course notes for [Psych 252](#). The book is not intended to be self-explanatory and instead should be used in combination with the course lectures posted [here](#).

If you have any questions about the notes, please feel free to contact me at: gerstenberg@stanford.edu or post an issue on the book's [github repository](#).

<https://github.com/psych252/psych252book>

Tools we will use in class

- **GPT, Gemini, Claude, etc.**
 - coding is thinking
 - there is a lot of value in coding yourself (particularly when you're just learning a new language)
 - if you don't know how to code, it will be difficult for you to check generated code
 - helpful tool once you've mastered the language (just like autocomplete on your phone ...)

Ed discussion

I have a question about the homework.

Datacamp

I would like to learn more about a topic.

PollEverywhere

I have an idea how to make this better!

Canvas

I would like to submit my homework on time.



Slack

I want to connect with others in my class.

Course website

I don't remember the schedule.

Section & Office hours

I'd like to discuss something in person.

Anonymous feedback form

Something bothers me ...

with help from

Some general thoughts

Stats has a very troubled past

JOURNAL OF STATISTICS AND DATA SCIENCE EDUCATION
2024, VOL. 32, NO. 1, 108–119
<https://doi.org/10.1080/26939169.2023.2224407>



OPEN ACCESS



Teaching the Difficult Past of Statistics to Improve the Future

Lee Kennedy-Shaffer

Department of Mathematics and Statistics, Vassar College, Poughkeepsie, NY

ABSTRACT

In recent years, the discipline of statistics has begun reckoning with its difficult history. Institutions are reconsidering names that have honored key historical figures in statistics who have deep ties to eugenics movements and racial and class prejudice. These names, however, continue to appear in our classrooms, where we teach the methods created by these individuals, raising the question of how instructors should address their legacies. Three examples of famous statisticians and their work—Francis Galton’s use of conditional probabilities to demonstrate “hereditary talent,” Karl Pearson’s attempt to quantify the intelligence of Jewish immigrant students, and Ronald A. Fisher’s creation of the analysis of variance to de-emphasize environment in human development—highlight the intimate ties between statistics and eugenics. These examples, along with a discussion of the context of these men, eugenics movements, and the statisticians and scientists who opposed their eugenic programs, can humanize the field for students, teach them about the challenges in accurate and unbiased data collection and analysis, and connect historical mistakes to contemporary ethical issues. Confronting this history in the classroom can both improve the teaching of the statistical methodologies themselves and begin a broader conversation about the role of statistics in the world. Supplementary materials for this article are available online.

ARTICLE HISTORY

Received January 2023
Accepted May 2023

KEYWORDS

Correlation; Ethics; Eugenics;
Genetics; History of statistics;
Interaction

you can find the article under Files > papers

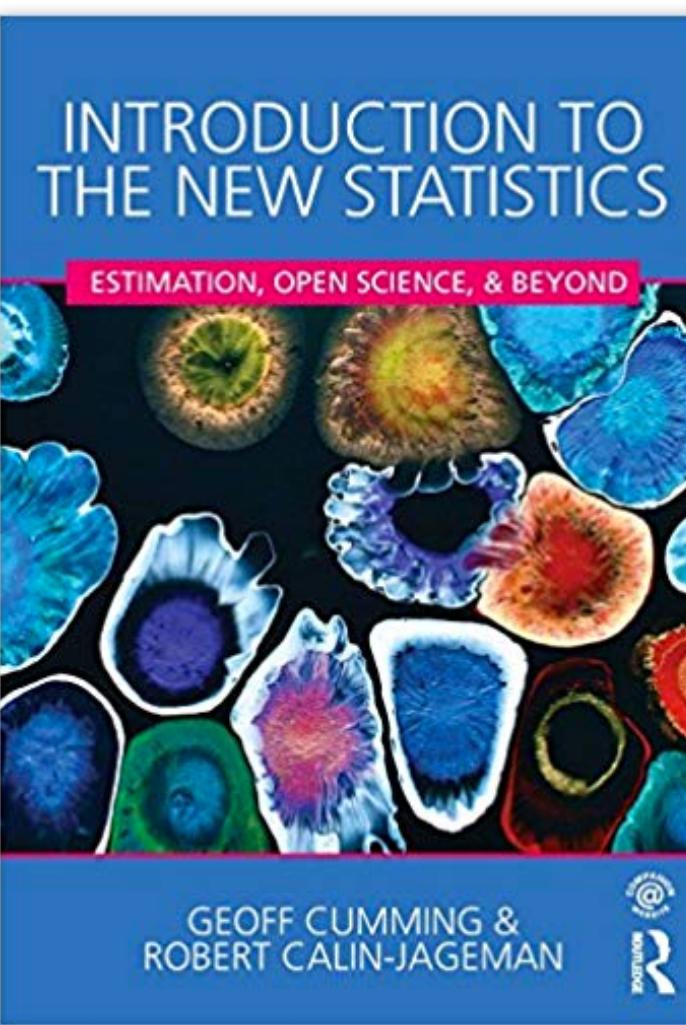
Vision for this class

In “[A Vision for Stanford](#)”, it says that Stanford wants to be

“an inspired, inclusive and collaborative community of diverse scholars, students and staff, where all are supported and empowered to thrive.”

Let's try our best together in this class to make this happen!

Fear of statistics



Change a Fixed Mindset to a Growth Mindset

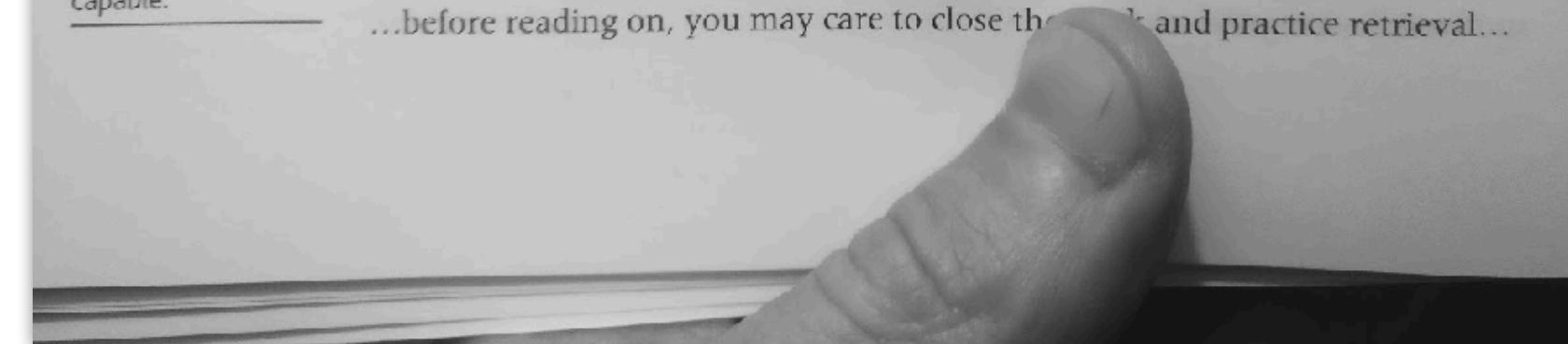
A further key idea is the distinction between a *fixed mindset* and a *growth mindset*. Carol Dweck and colleagues have demonstrated that helping students adopt a growth mindset can be a highly effective way to help them learn better and achieve more. Here's how Dweck describes the two mindsets:

Fixed mindset:
The belief that my capabilities are more or less fixed, whatever I do.

Growth mindset:
The belief that effort, persistence, and using good techniques can help me learn more successfully and become more capable.

In a fixed mindset students believe their basic abilities, their intelligence, their talents, are just fixed traits. They have a certain amount and that's that.... In a growth mindset students understand that their talents and abilities can be developed through effort, good teaching and persistence. They don't necessarily think everyone's the same or anyone can be Einstein, but they believe everyone can get smarter if they work at it. (Carol Dweck, tiny.cc/dwecktalk)

I've mentioned three important ideas about learning.
...before reading on, you may care to close the book and practice retrieval...

A grayscale photograph of a person's hand pointing towards the text on the right side of the slide.

my thumb



Carol Dweck

Try to adopt a growth mindset!

fixed mindset:

students believe their basic abilities, their intelligence, their talents, are just fixed traits.

growth mindset:

students *understand* that their talents and abilities can be developed through effort, good teaching and persistence

Stats is important but ...

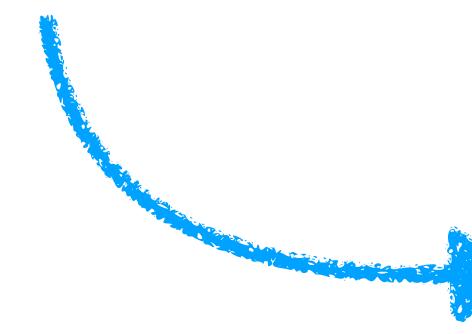
- it's not the only thing that matters for being a good scientist
- generating research ideas matters
- writing matters
- presenting matters
- ...
- (nobody is very good at all of these things)

Feedback

Teaching philosophy

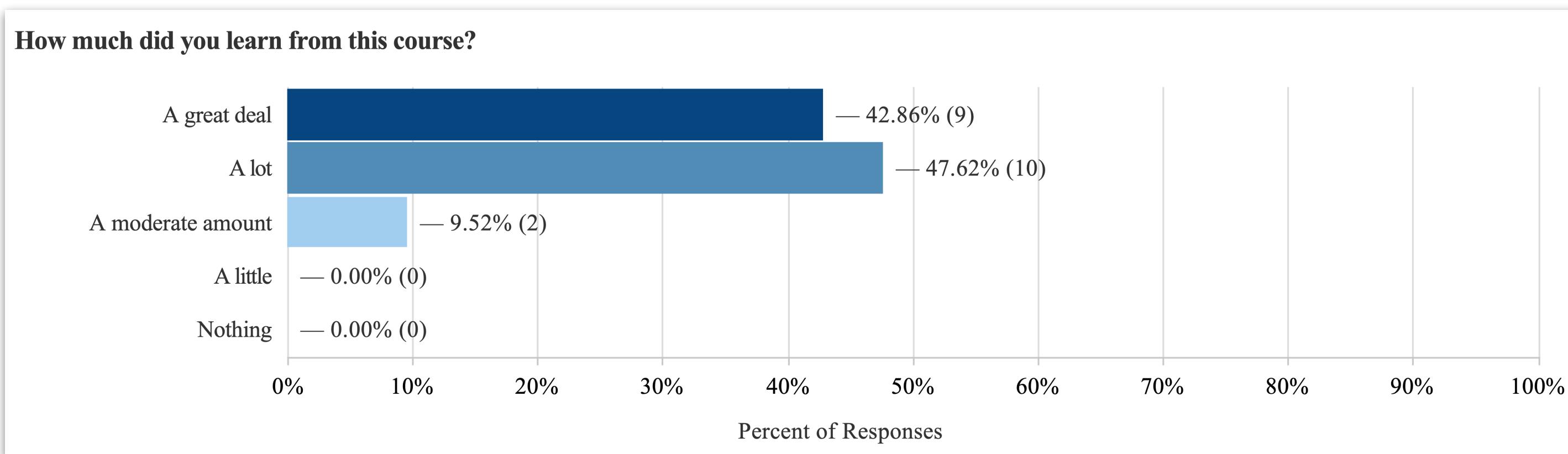
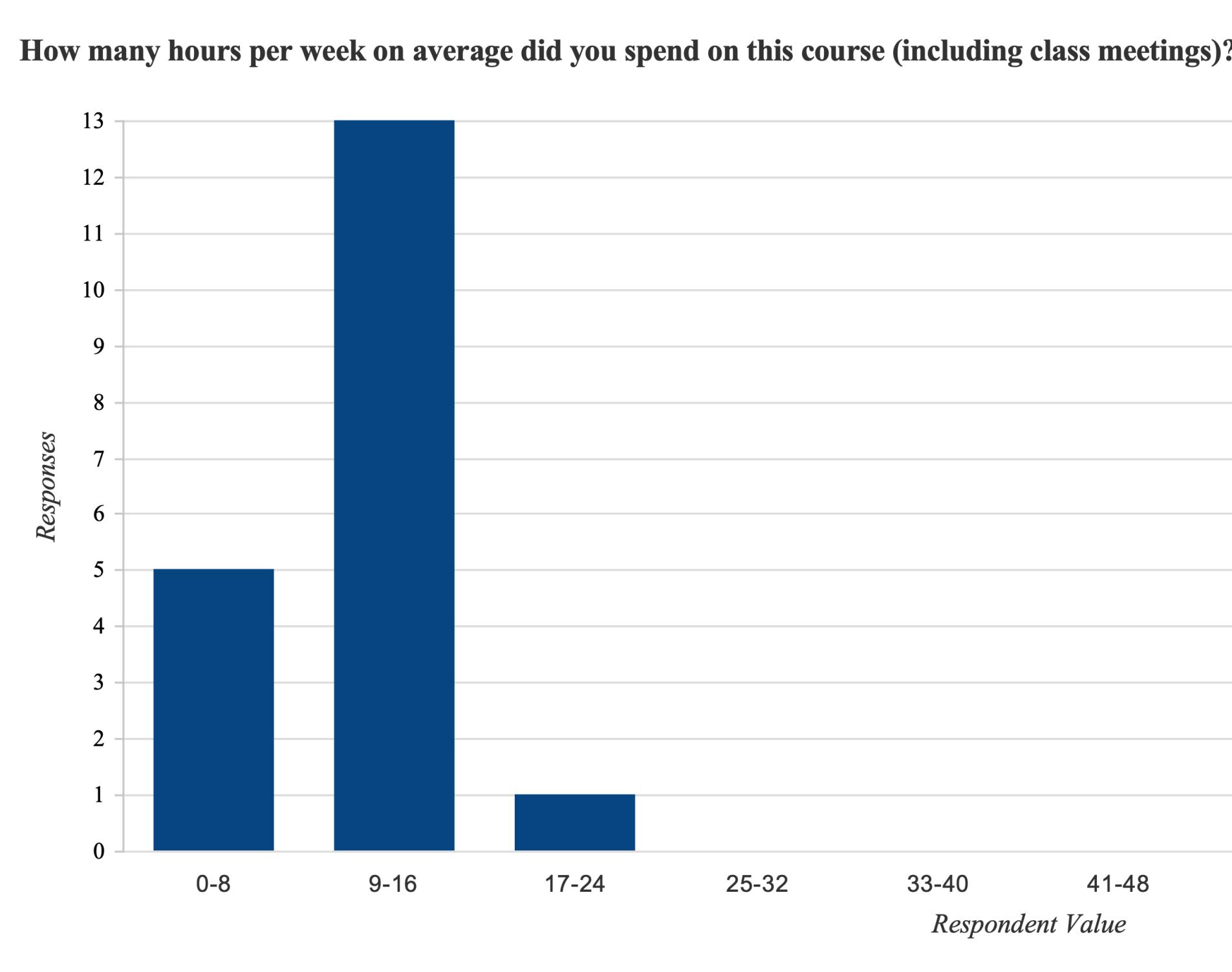


"The one who does the work does the learning." (Doyle, 2008)

 **we will try our best to make you do the work!**

Doyle, T. (2008). *Helping students learn in a learner-centered environment: A guide to facilitating learning in higher education.* Stylus Publishing, LLC.

Doing the work takes time ...



... but it's worth it

What would you like to say about this course to a student who is considering taking it in the future?

- "It will be a lot of work, but it will teach you a lot!"
- "I would absolutely recommend taking this class. I came into this class with random/haphazard stats knowledge (ex. STATS60) and no coding experience, and I left as pretty much a convert to R and model comparison approaches."
- "It can sometimes feel like a ton of work but I advise that **you use office hours at least once**. Even if you think you don't need it. It will help you during the midterm (I struggled a bit with this) and the problem sets."
- "This is a great course to get more comfortable running your own stats and to secure proficiency in R. There is a ton of course material, though, and sometimes that felt really overwhelming. It was **hard to balance actually understanding the stats with bringing my coding skills up** to where they need to be to do this course."
- "Don't take it unless you are an R wizard before the start of the class. It is impossible to get the R skills in 2 weeks. And the class gets REALLY high level just before the midterm (and it just gets worse...)."

Feedback

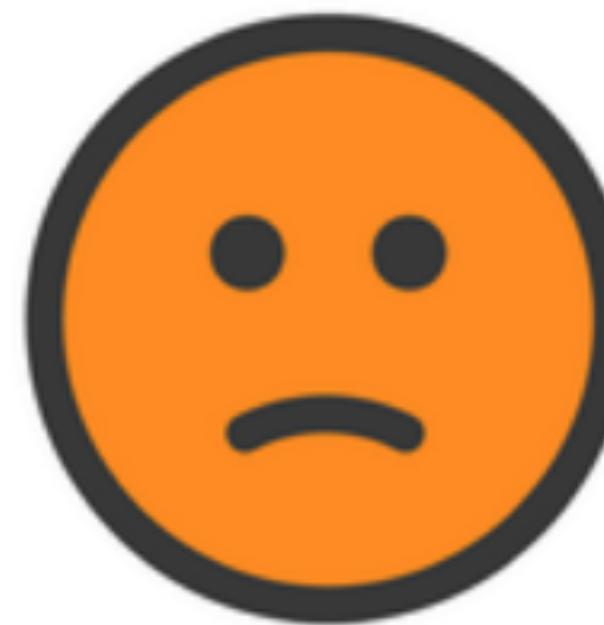
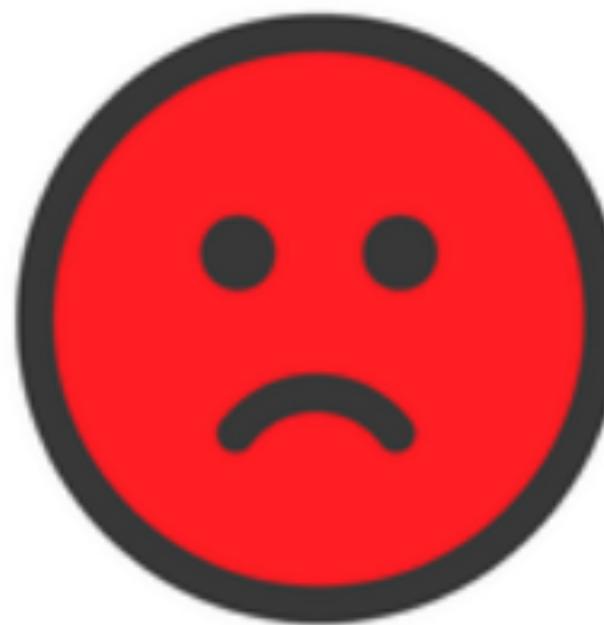
Help us help you!

- ask questions in class and stick around after class
- come to sections
- post questions on Ed discussion (you can post anonymously)
- send us an email (but use Ed discussion for questions about homework or class!)
- use anonymous feedback form (link at the bottom of the course website)
<https://tinyurl.com/psych252feedback25>

How was the pace of today's class?

much a little just a little much
too too right too too
slow slow fast fast

How happy were you with today's class overall?



What did you like about today's class? What could be improved next time?

Thank you to ...

Alexandra Chouldechova
Allison Horst
Andrew Heiss
Ben Baumer
Benoit Monin
Bodo Winter
David Lagnado
Ewart Thomas
Henrik Singmann
Julian Jara-Ettinger
Justin Gardner
Kevin Smith
Lisa DeBruine
Maarten Speekenbrink
Matthew Kay
Matthew Salganik
Mika Braginsky

Mike Frank
Mine Çetinkaya-Rundel
Nick C. Huntington-Klein
Nilam Ram
Patrick Mair
Paul-Christian Bürkner
Peter Cushner Mohanty
Richard McElreath
Russ Poldrack
Stephen Dewitt
Solomon Kurz
Tom Hardwicke
Tristan Mahr

Thanks!

see you on **Wednesday**

make sure to have
R and **RStudio** up to date



post on Ed discussion if
you experience any
problems