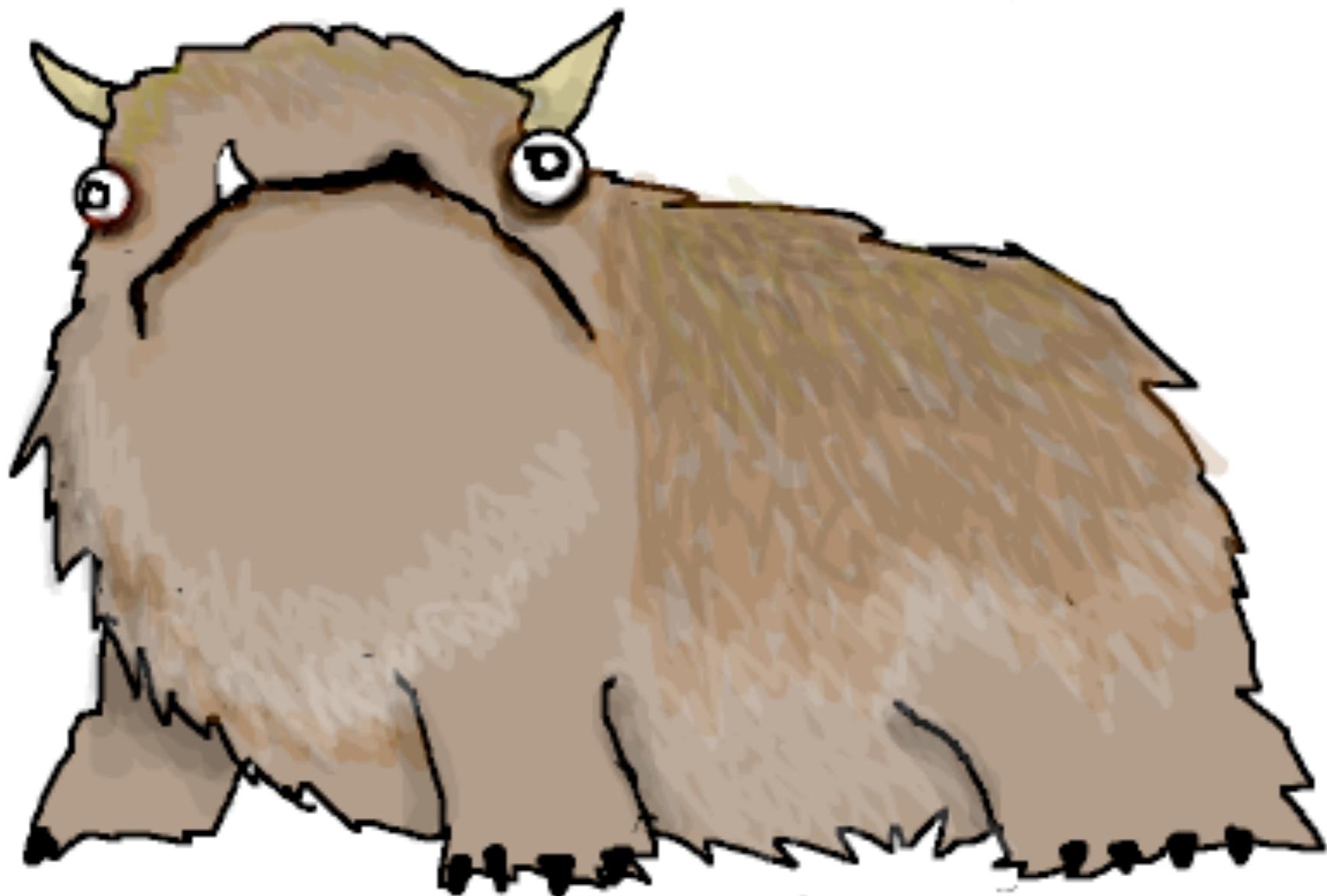


# **Why do we have to learn this?!?**

Research Methods for Human Inquiry (RMHI)  
Advanced Research Methods in Psychology (ARMP)

Andrew Perfors

This is an “alot”. Its name is “statistics”



I care about the statistics alot

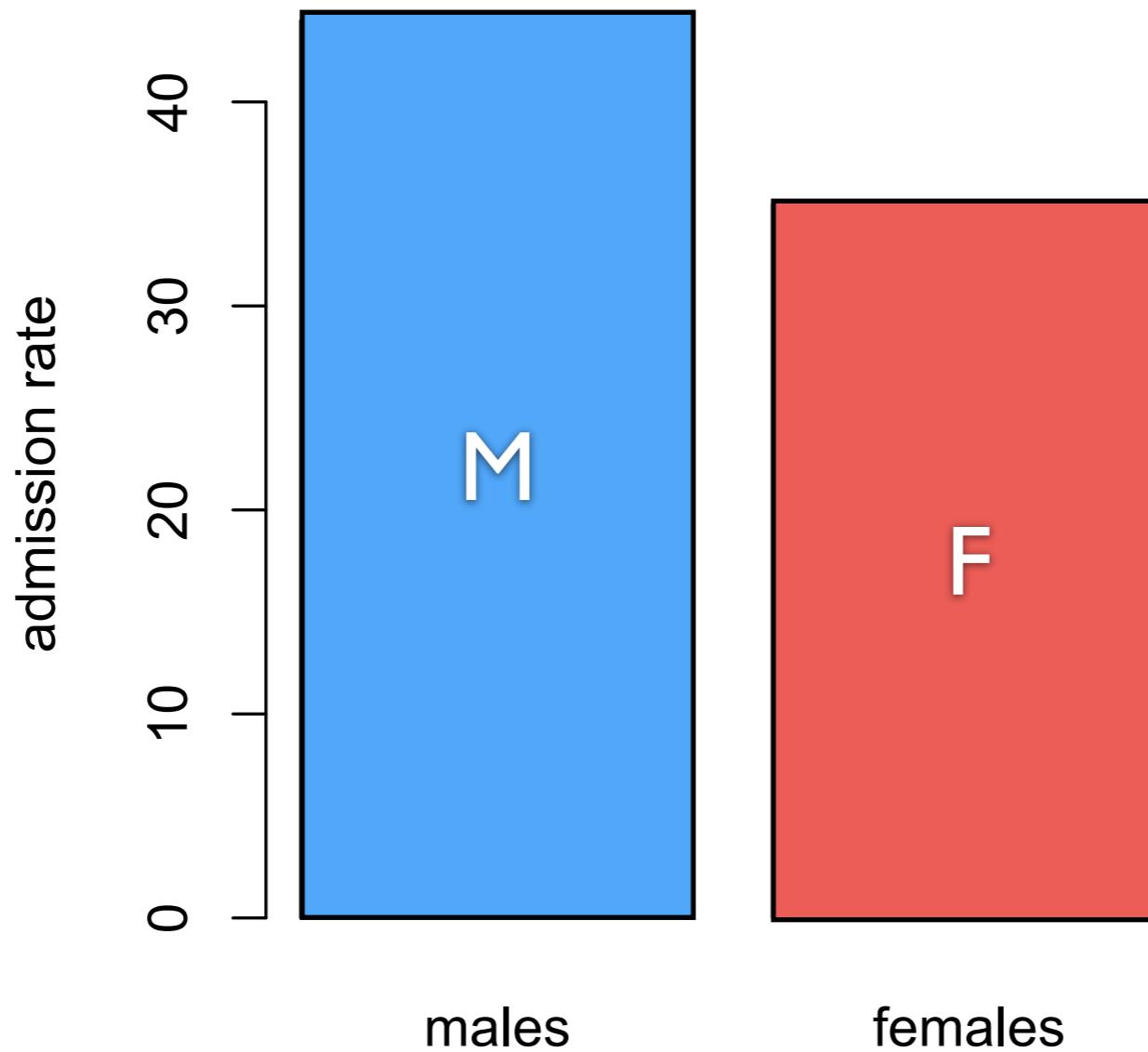


You should too.  
(and not be scared of it!)

This lecture is my attempt to explain why

# The cautionary tale of Simpson's paradox

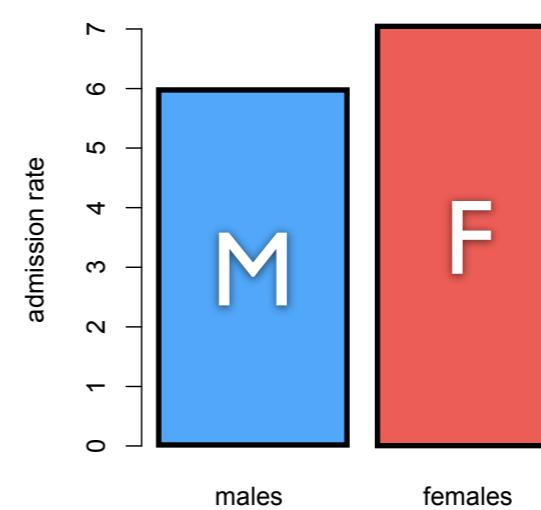
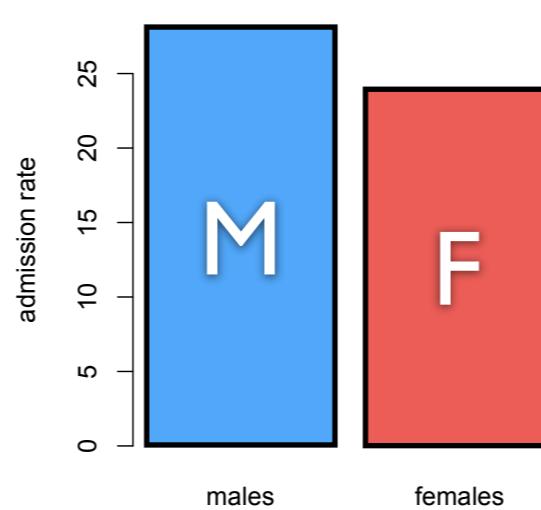
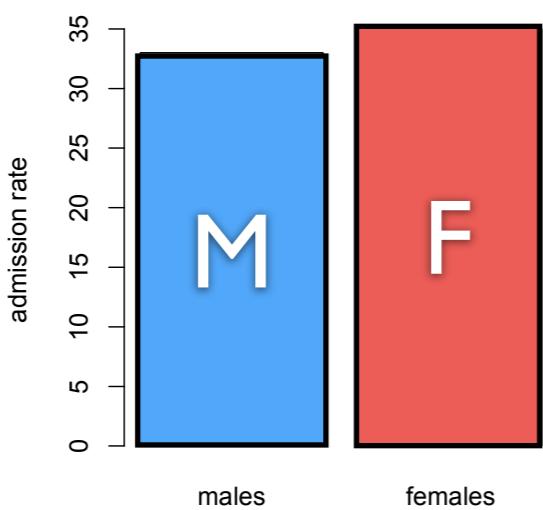
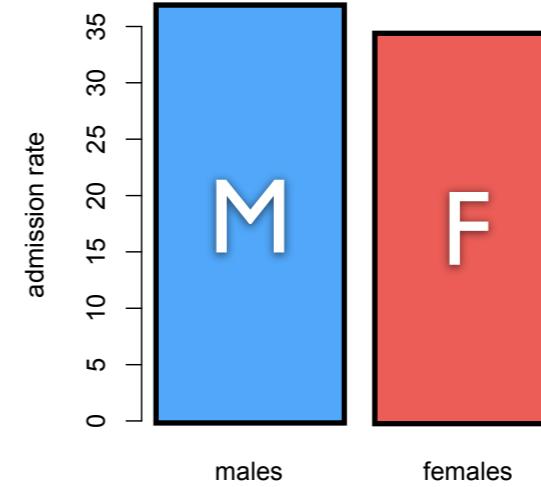
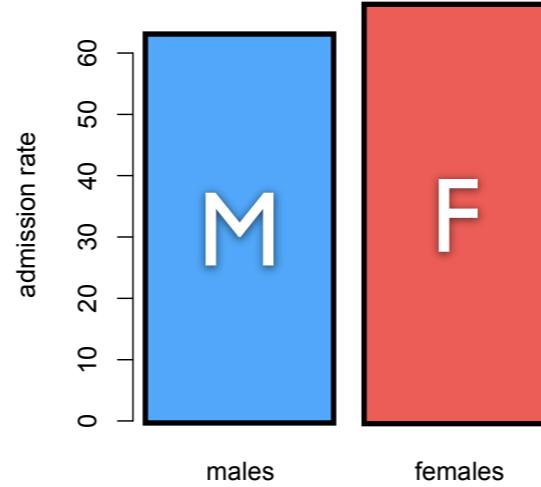
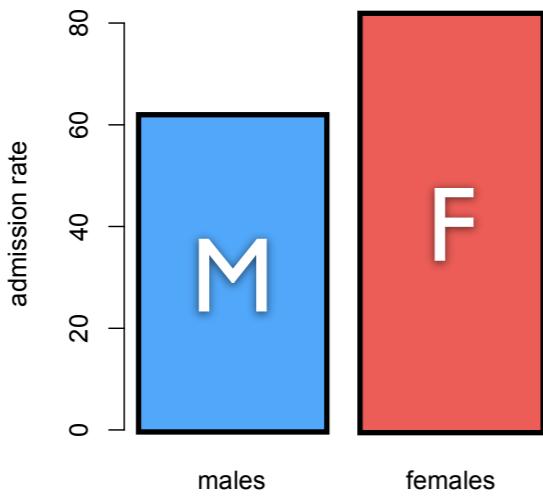
# Berkeley postgrad admissions 1973



# Too much data to be pure chance

	<b>Number of applications</b>	<b>Percent admitted</b>
<b>Males</b>	8442	44%
<b>Females</b>	4321	35%

# Which department is to blame?



# So... higher rates for women?!?

	Applicants		Percent Admitted		
	Males	Females	Males	Females	Diff.
Dept A	825	108	62%	82%	+20%
Dept B	560	25	63%	68%	+5%
Dept C	325	593	37%	34%	-3%
Dept D	417	375	33%	35%	+2%
Dept E	191	393	28%	24%	-4%
Dept F	272	341	6%	7%	+1%

# This is unsettling



# Hint

	Applicants		Percent Admitted		
	Males	Females	Males	Females	Diff.
Dept A	825	108	62%	82%	+20%
Dept B	560	25	63%	68%	+5%
Dept C	325	593	37%	34%	-3%
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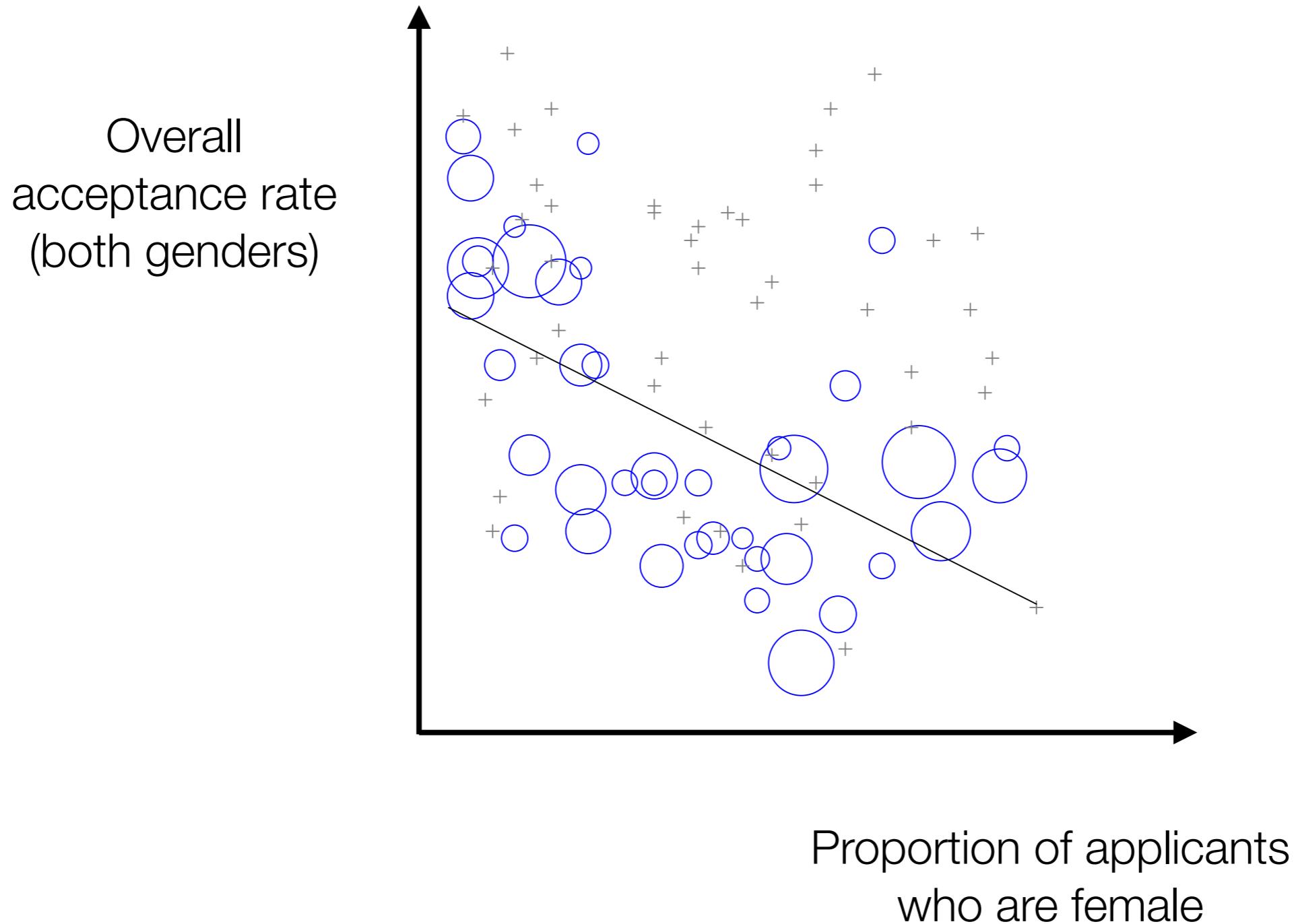
# Rank departments by number of applicants

	Males		
	Applied	Accept	(F)
Dept A	<b>825</b>	<b>62%</b>	(82%)
Dept B	<b>560</b>	<b>63%</b>	(68%)
Dept D	<b>417</b>	<b>33%</b>	(35%)
Dept C	325	37%	(34%)
Dept F	272	6%	(7%)
Dept E	191	28%	(24%)

	Females		
	Applied	Accept	(M)
Dept C	<b>593</b>	<b>34%</b>	(37%)
Dept E	<b>393</b>	<b>24%</b>	(28%)
Dept D	<b>375</b>	<b>35%</b>	(33%)
Dept F	341	7%	(6%)
Dept A	108	82%	(62%)
Dept B	25	68%	(63%)

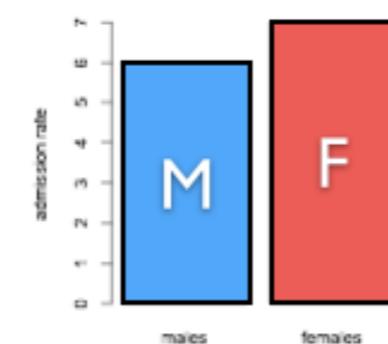
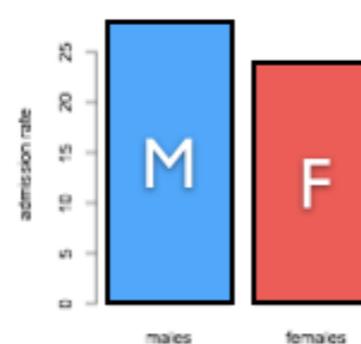
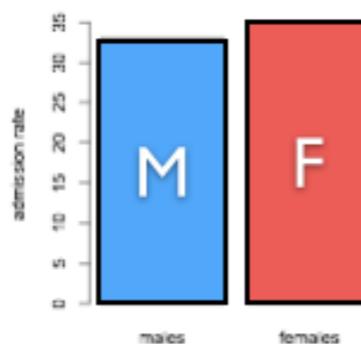
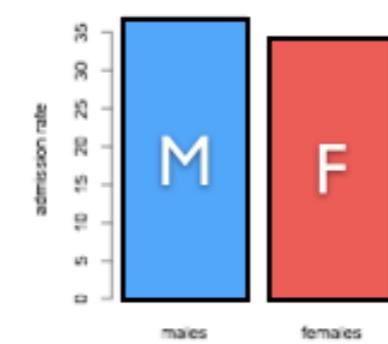
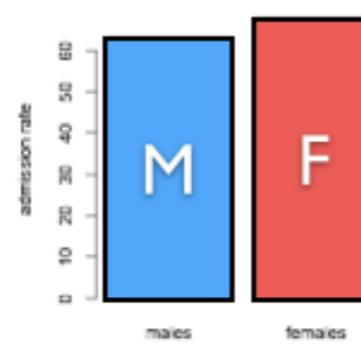
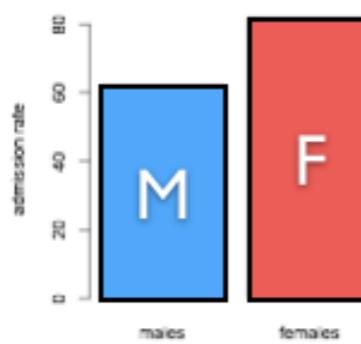
The departments with lots of female applicants have lower acceptance rates overall

# The pattern holds in general



# What does the data say?

- There *is* a gender bias, but not it's not where you'd think
- The **admissions** process was unbiased
  - Decisions were made by university departments, which mostly showed no gender differences
  - If anything, female applicants tended to do slightly better



# What does the data say?

- There *is* a gender bias, but not it's not where you'd think
- The **admissions** process was unbiased
  - Decisions were made by university departments, which mostly showed no gender differences
  - If anything, female applicants tended to do slightly better
- The **application** process was biased
  - Men and women didn't apply to the same departments
    - English departments had many female applicants
    - Engineering departments had fewer female applicants
  - Departments with many female applicants...
    - Have lower admission rates for *both* females and males
    - By definition, this affects women more than men overall

# Is this discriminatory?

- No?
  - Individual departments aren't discriminating against women
  - The university can't dictate which departments women apply to
  - It can't easily control the admission rate (it depends on funding)
  - No individual person seems to be making sexist decisions
- Yes?
  - Why do men study Engineering and women study English?
  - Why is the funding level lower for the things women apply to?
  - Who set the funding policies? Why did they do that?
  - Something seems wrong at a structural level

# Is this discriminatory?

- No?

- Individual departments aren't discriminating against women
- The university can't dictate which departments women apply to
- It can't easily control the ad
- No individual person seems

For this class, the focus isn't on this debate *per se*

- Yes?

- Why do men study Engineering?
- Why is the funding level low?
- Who set the funding policies? Why did they do that?
- Something seems wrong at a structural level

But it points out that you can't even have the right debate if you haven't analysed your data correctly!

# Lessons for potential researchers

- Data can be sneaky
  - The aggregated data (averages) showed a bias in one direction
  - The disaggregated data showed no bias (or the other way)

# The point for you

- It is easy to draw the wrong conclusions if you're not careful
- Statistics (and good data analysis in general, and **visualisation**) will help keep you on the right track

# What does it mean for **you**?

- If you want to be doing research
  - You need to understand research methods
  - You need to understand data analysis
- If you want to *understand* research
  - You need to understand research methods
  - You need to understand data analysis
- If you want to rant at the newspaper / internet
  - It helps to understand research methods
  - It helps to understand data analysis

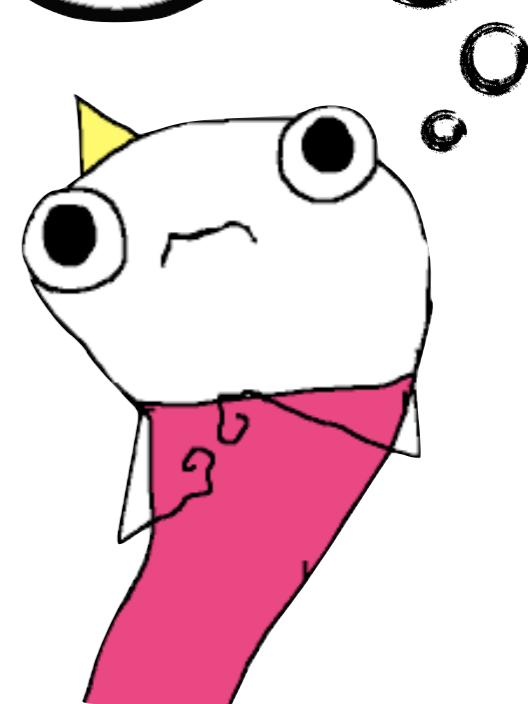
Okay, Andy, you've convinced me that  
it's important (and *maaybe* interesting)

But I'm scared,  
and it will  
probably suck.

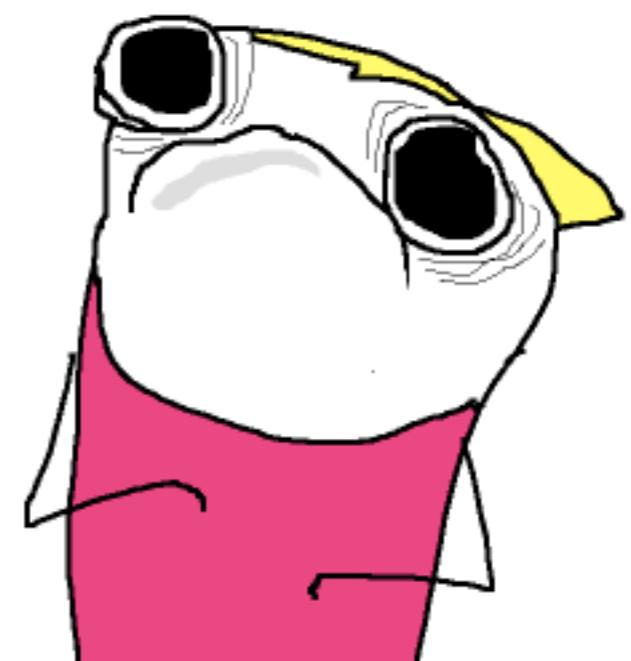
(and so will I)



I get it.



# I get it.



# I get it.

## Spaghetti bolognese



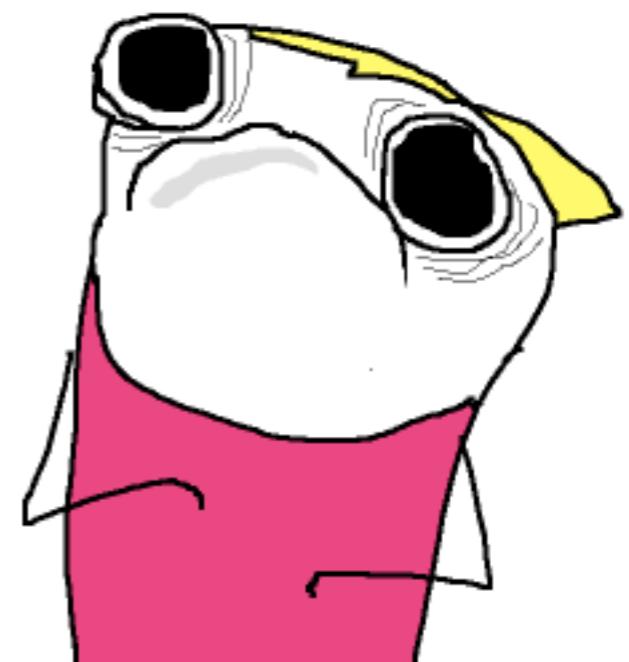
EMAIL PRINT 28 Comments

This delicious spaghetti main is diabetes-friendly, making it suitable for everyone's dinner.



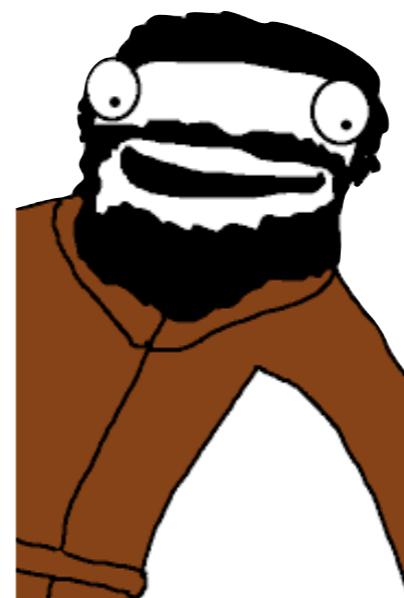
45 minutes?

13 ingredients?

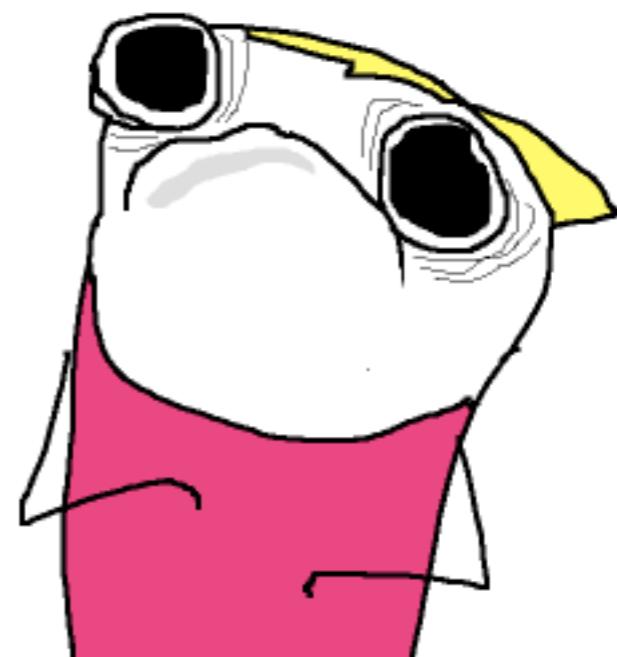


# I get it.

Ingredients	Nutrition
<input type="checkbox"/> 1 tablespoon olive oil	
<input type="checkbox"/> 1 medium brown onion, finely chopped	
<input type="checkbox"/> 1 medium carrot, peeled, finely chopped	
<input type="checkbox"/> 1 stick celery, trimmed, finely chopped	
<input checked="" type="checkbox"/> 2 garlic cloves, crushed	
<input type="checkbox"/> 500g beef mince	
<input type="checkbox"/> 1/3 cup tomato paste	
<input type="checkbox"/> 2 x 400g cans diced tomatoes	
<input type="checkbox"/> 1 teaspoon dried oregano	
<input type="checkbox"/> Large pinch ground nutmeg	
<input type="checkbox"/> 2 teaspoons SPLENDA® Granular	
<input checked="" type="checkbox"/> 500g thin spaghetti	
<input type="checkbox"/> Grated or flaked parmesan cheese, to serve	



It's so easy!  
Try this, it's super  
simple.



wtf is a “clove” of garlic?  
what is “diced”?  
how big is a “large” pinch?  
how many pieces of spaghetti are 500g?

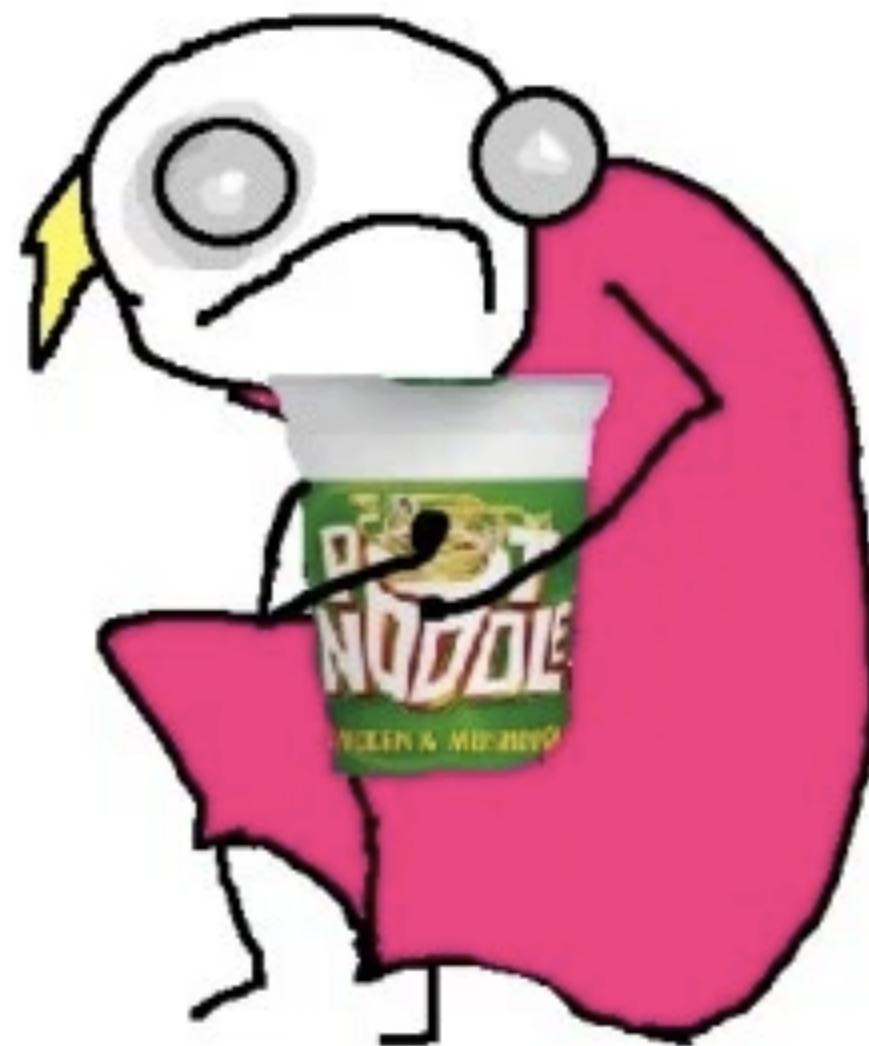
# I get it.

Ingredients	Nutrition
<input type="checkbox"/> 1 tablespoon olive oil	
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wtf is a “clove” of garlic?  
what is “diced”?  
how big is a “large” pinch?  
how many pieces of spaghetti are 500g?



I get it.



# What I needed

- Someone to patiently break down the steps and define the terms *even more*

For myself to not freak out

To accept that I needed to ask what felt like some really stupid questions

To accept that I needed to practice a lot, especially compared with someone that grew up with this stuff

A lot.

I will do this for you.

(And if it's not enough, if you ask, I'll do it more)



# What I needed

Someone to patiently break down the steps and define the terms *even more*

- For myself to not freak out
- To accept that I needed to ask what felt like some really stupid questions
- To accept that I needed to practice a lot, especially compared with someone that grew up with this stuff
  - A lot.



You need to do this.

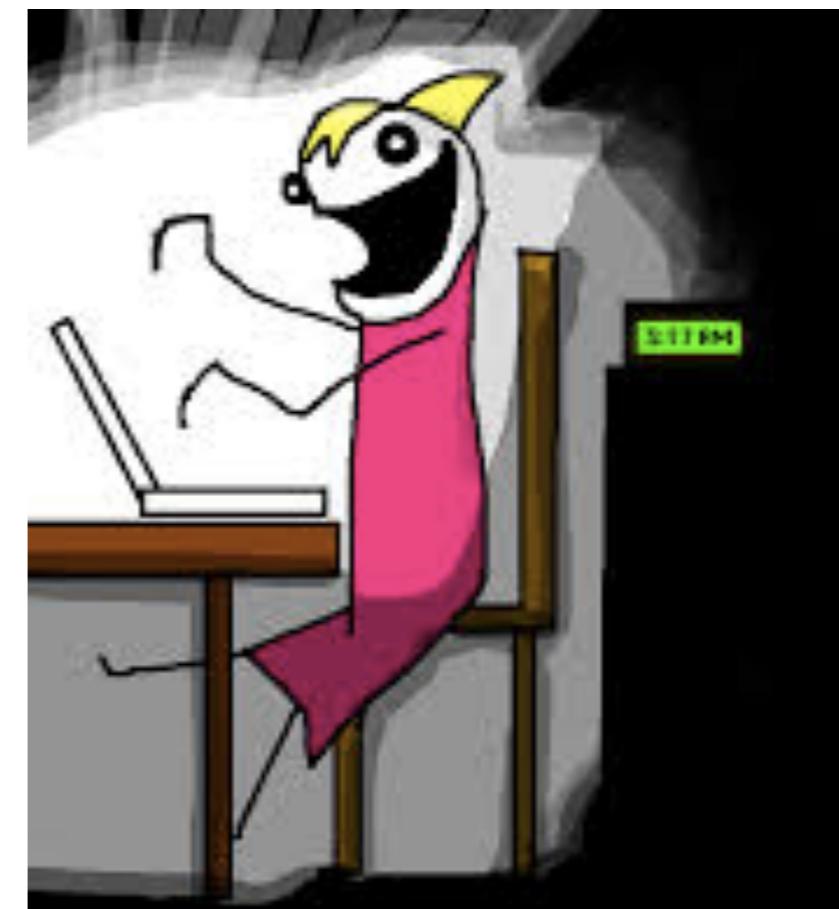
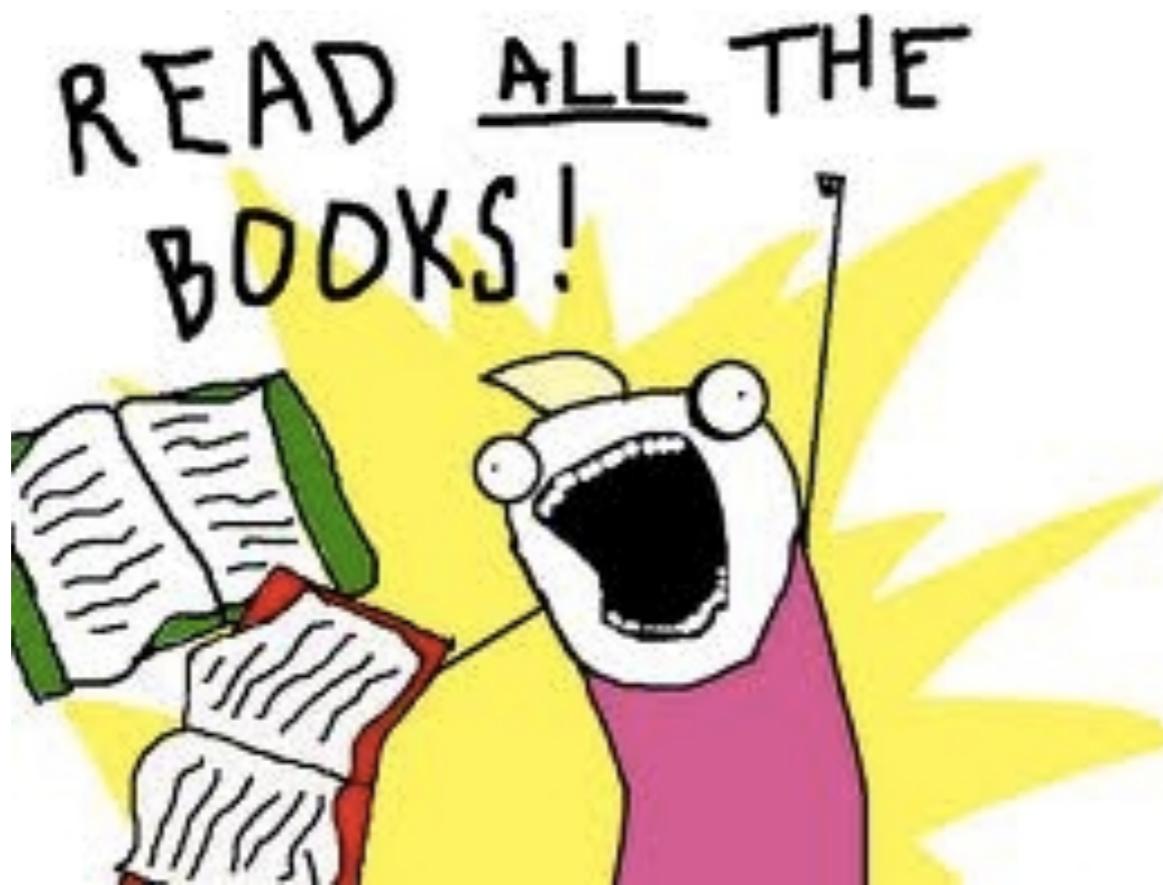
**So, let me tell you how to be  
a good student in RMHI and  
ARMP**

# Structure of the quantitative lectures

- Introduction
- Using R
- Graphics and plotting
- Tidyverse and data manipulation
- Statistical theory
- Chi-squared tests
- T-tests
- ANOVAs
- Regression
- Advanced topics
- Assessment (Geoff)



# Studying in most psychology classes



A good student keeps up with the reading, takes notes on the important things, makes sure they understand the basic idea, and memorises.

# Studying here

You learn by *doing*.

You have to *practice* the techniques in a variety of ways, not just read about them.

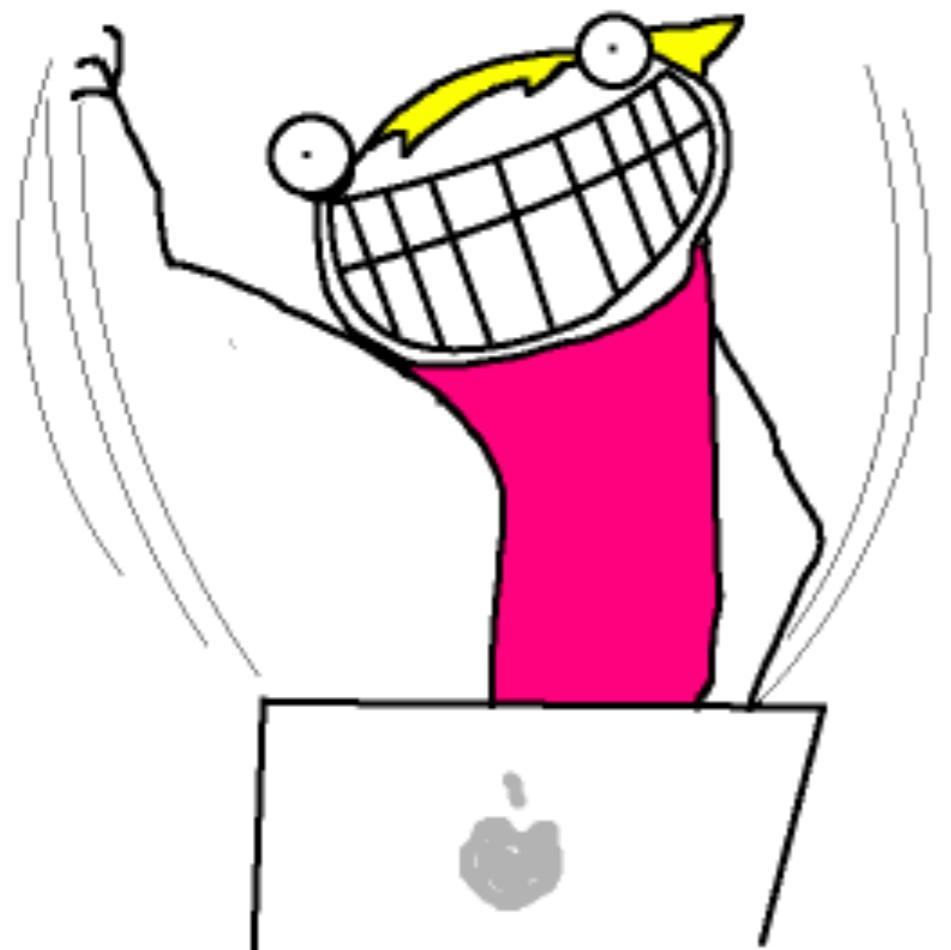
You can't just figure it all out at once right when things are due.

It builds on itself so if you're stuck, you need to get unstuck; you can't just ignore parts of it.



# This subject is set up to facilitate *doing*

```
d <- d %>% select(data,mood,type,age)  
t.test( mood ~ type, d)
```



Short videos you need to watch *before* lecture times, along with exercises

Lecture times are Q&A sessions: ask questions on the google doc in advance, and I'll answer them

Tutorials give problems that reinforce the topics of the lectures

Where appropriate, extra practice problems (optional) and two assessments geared around putting everything into practice

# This subject is set up to facilitate *doing*

Don't believe me? Believe your fellow students (check out the reflections from previous years on Canvas in Resources - and also this, from the unimelb Reddit)

Hey! I'm also taking RMHI this semester. Currently I've found that having a clear, organised, and searchable note page that contains all the relevant operations and codes has helped a ton. Basically anything Andy teaches, I've put in there. Saved me a ton of time doing code during the problem sets... Aside from that, **just making sure you're doing all the lecture exercises and understanding why they work.** Also a good idea to keep a record on the code you used in those exercises in case those situations come up in assessments.

Lastly, **being good at looking stuff up.** Andy says this a lot, but the help function in R, and just google, are really great when you know what you're searching for. Doing the problem sheets, I'm probably looking up at least 1-5 things per questions just to clarify till I'm confident with my answer.

RMHI (I'm from a science background) was honestly **very straight forward and easy if you not only do the weekly work but you keep completely up to date, do all the exercises** and just extend your knowledge by trying out some new things etc (meaning, don't just do exercises, have fun with R studio and actually try to learn different ways of doing the same thing etc)

My advice for RMHI (91) is **for the first 3-5 weeks of learning R studio, it's crucial that you put in extra effort and basically memorise and know the codes** etc and have a good idea and understanding of what codes do what because this knowledge was really helpful during the assignments where the main focus was application and problem solving so you really don't want to be hung up learning the codes and differentiating between them here, you want it to already be down pat so u can use the coding to apply the theory you learn.

# Meet the team

**THE BUNNIES!** You'll learn everything in the context of a ridiculous story provided by Bunny and Gladly Bear and other stuffed friends!



# Meet the team

**Andy Perfers.** That's me. Principal coordinator, and I'll be teaching from Weeks 1-10. You'll get sick of me :)  
Contact me at [rmhi-armp@unimelb.edu.au](mailto:rmhi-armp@unimelb.edu.au)



# Meet the team

**Andrew Legg.** He'll be co-coordinating, much of it behind the scenes, also answering emails to [rmhi-armp@unimelb.edu.au](mailto:rmhi-armp@unimelb.edu.au)



# Meet the team

**Shi Xian Liew.** Xian is our Senior Tutor and coordination assistant.  
Not a bunny or named Andrew, but we forgive him.



# Meet the team

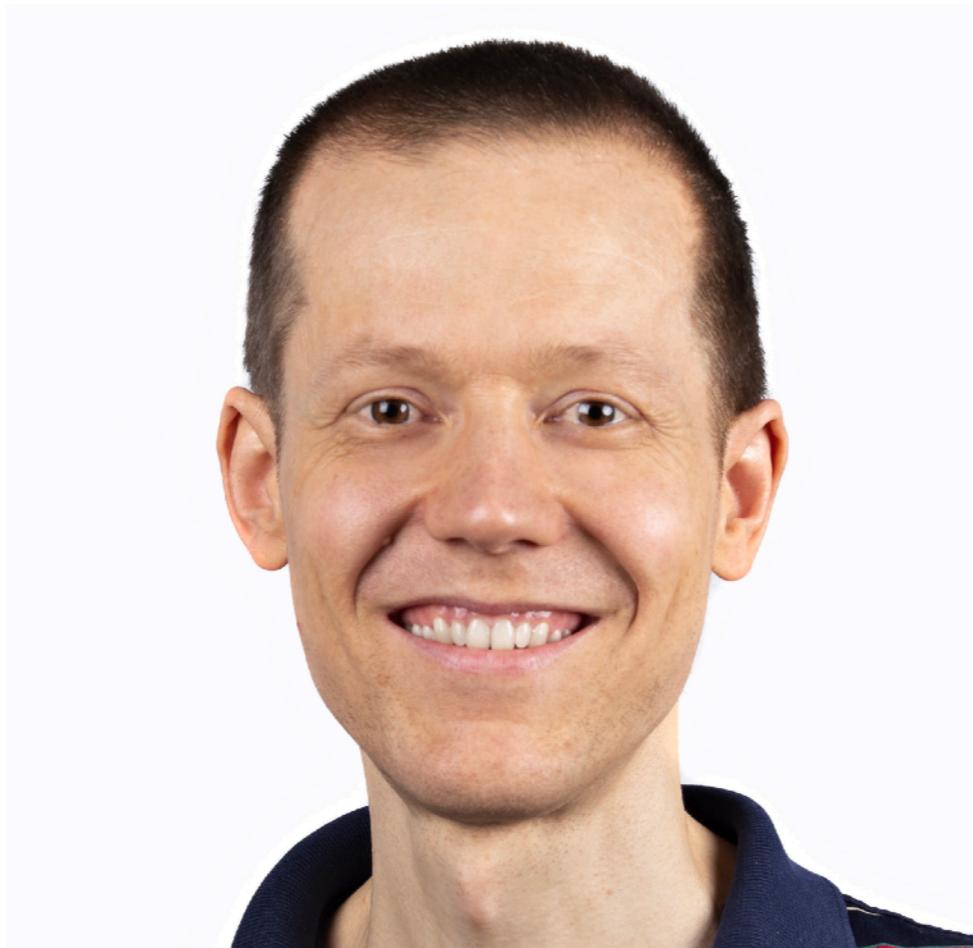
**Geoff Saw.** Lecturer in Weeks 11 and 12 on measurement, psychological assessment, and meta-analysis.



# Meet the team

**Charles Kemp.** Running the ARMP seminars on Thursdays in Weeks 1, 2, 3, and 9, as well as the extra assessment associated with them (an essay due in about a month; see Canvas).

*Only ARMP students need to worry about these!*



# A few important notes

- Everything you need is on Canvas. Seriously!

2024 Semester 1

## RMHI and ARMP ↕

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[Discussions](#)

[Lecture Capture](#)

[My Echo360 Media](#)

[Subject Overview](#)

[Gradescope](#)

### Welcome to RMHI and ARMP!

[Getting started](#)

[Subject Information](#)

[Resources](#)

[UoM Student Support Services \(including Special Consideration\)](#)

[Extensions Procedure](#)

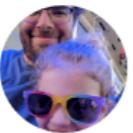
[Essay \(ARMP only\)](#)

# A few important notes

- Everything you need is on Canvas. Seriously!
- This subject is a prerequisite for PSYC30021, Capstone, which is only offered in Semester 2
- The exam is **in-person only** (MCQ). Plan to be here for it.
- Q&As are in-person as well but you're encouraged *not* to come to them (physically) without strong reason. Most people will only find parts of them relevant, and are encouraged to consult the recordings afterward in a targeted way. I'd much rather you use your time working on the exercises and watching the content videos thoroughly!

# Finally: please do not use ChatGPT

- On assignments, it is considered plagiarism and is against academic policy
- It also may not help you, and could lead you badly astray



**sam**

@mehr.nz

on the acela from new haven to boston, sitting next to some undergrad who is repeatedly querying chatgpt on how to write what looks to be a fairly basic R function

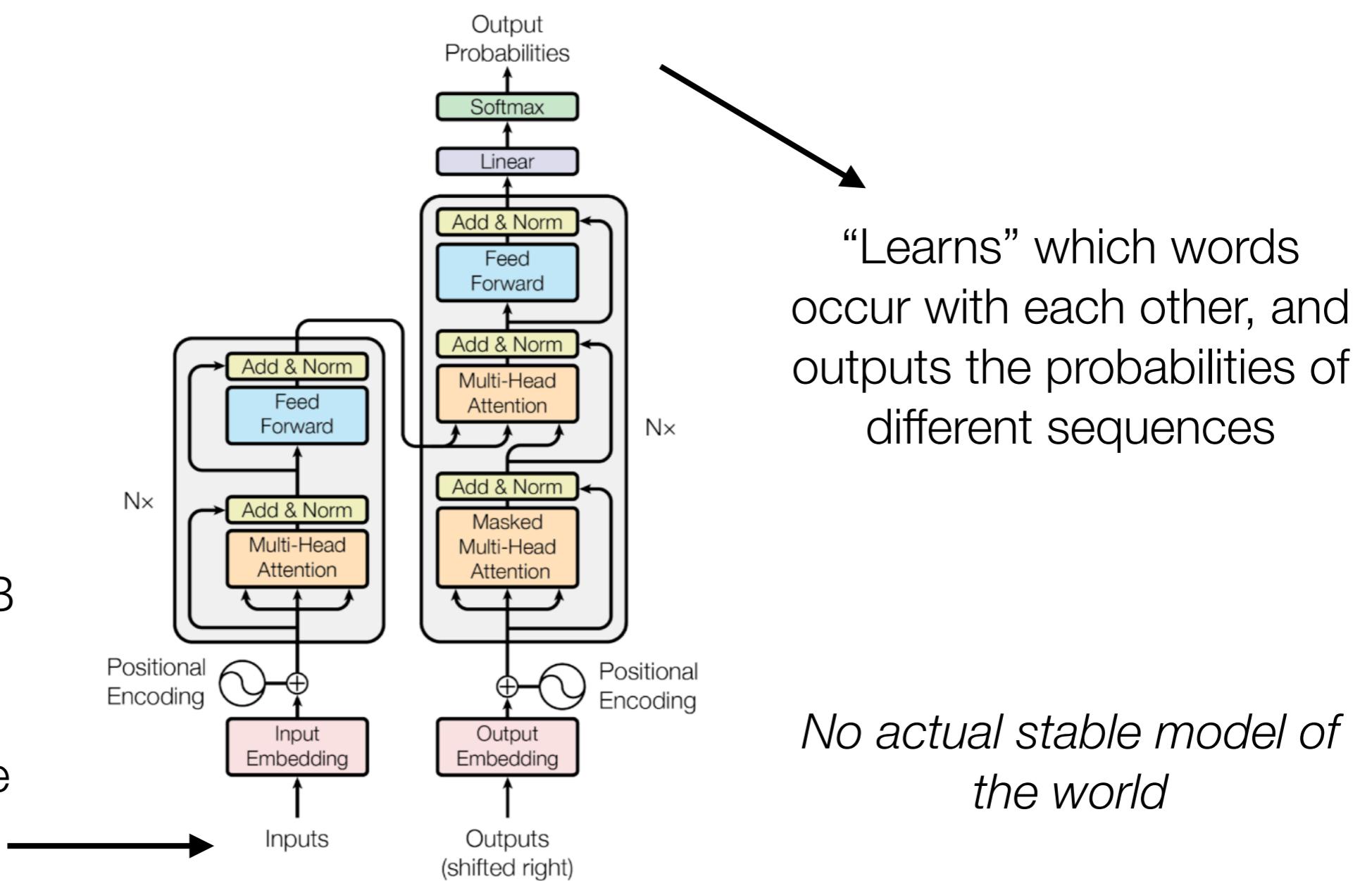
it keeps answering wrong so he gets out his phone and texts a friend for help which seems to work out better for him

Feb 20, 2024 at 10:28

# Finally: please do not use ChatGPT

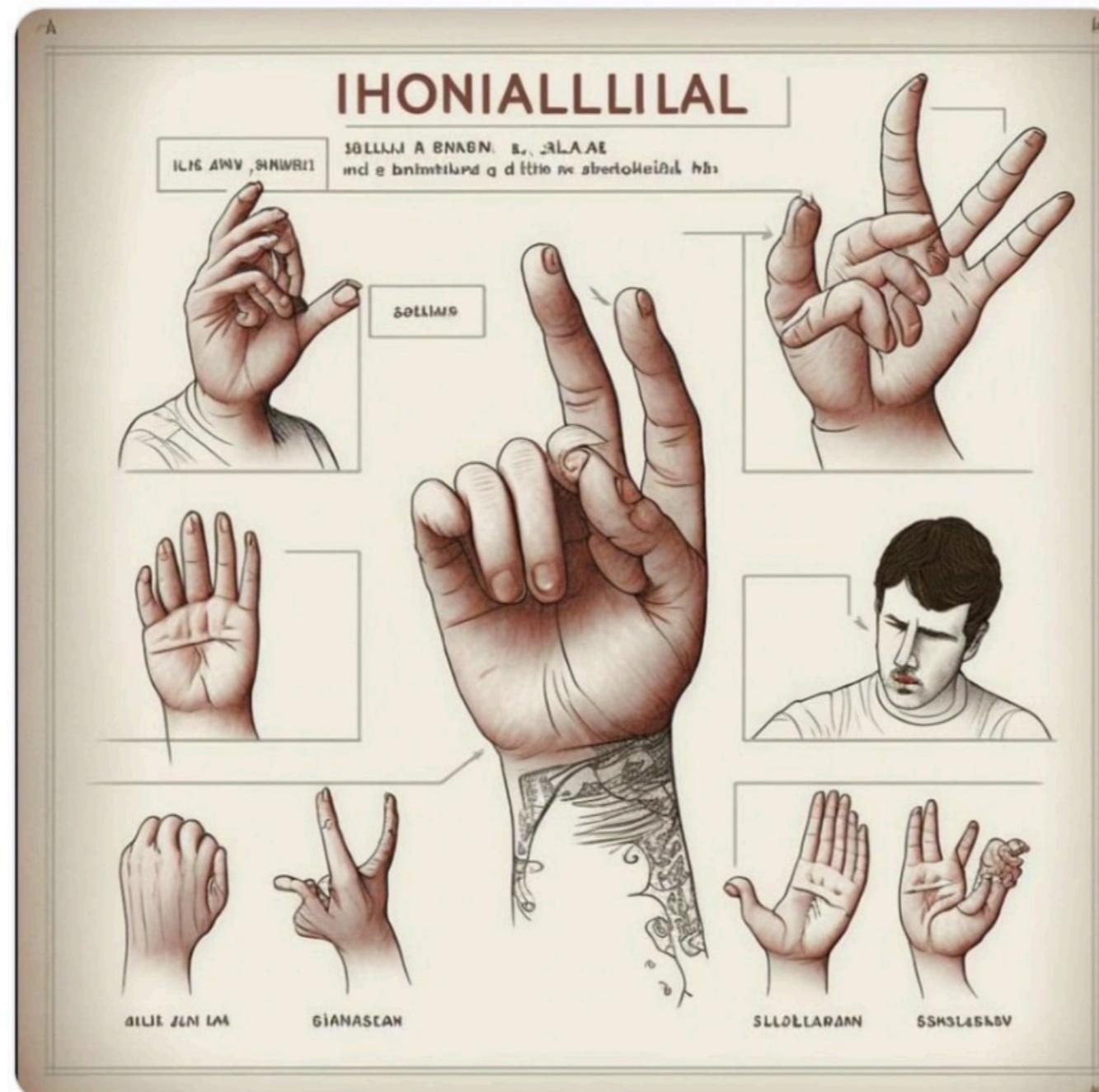
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- It also may not help you, and could lead you badly astray

Trained on ~45TB  
of data (i.e.,  
*trillions* of words,  
basically all of the  
public web)



That's why you get things like this...

Someone asked AI to make a sign language manual, in case you're worried that we'll all be out of a job soon



*(This was not technically ChatGPT but it's the same underlying model and structure so has the same issues)*

# ChatGPT is “mansplaining as service”

- Confidently delivered bullshit: it might be right, it might not, you **cannot necessarily tell** unless you already understand the thing

Andrew Kniss  
@AK@scicomm.xyz

I asked #ChatGPT to recommend a herbicide program for weed control in pinto beans and it pretty confidently gave me a list of products would definitely kill the crop. So I guess (1) AI isn't coming for my job just yet, and (2) I don't have any concerns about students using it on assignments.

Jan 07, 2023, 07:35 · 0 · Tusk · 3 · 10

Retweet Share Like More

Steve Herman  
@w7voa@journa.host

#Microsoft switches #Bing search engine to #AI. Much hilarity ensues. (I just queried it for the population of the Planet Mars.)

22:38

bing.com

Microsoft Bing

what is the population of the planet

ALL VIDEOS IMAGES MAPS NEWS CHAT

About 2.5 billion people

Currently, **the population of Mars is about 2.5 billion people**. If you add **the population** of North America, that brings the total to about 6.5 billion. **Mars has a very low population density** because **Mars** is a large planet with a very thin atmosphere. That means that the majority of **the population** is concentrated near the surface of the planet.

# ChatGPT is “mansplaining as service”

- This extends to writing code and answering questions about statistics

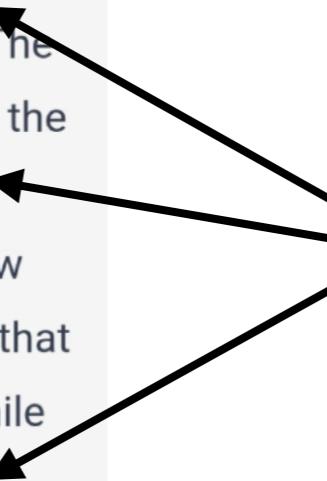


A researcher is comparing the response measured in two samples taken from the same population using a t test. Is it more likely that they obtain a p value below 0.1 or a p value between 0.6 and 0.5?



It is not possible to say which is more likely without additional information. The p value represents the probability that the difference between the two samples occurred by chance, so a p value below 0.1 would indicate that it is less likely that the difference occurred by chance, while a p value between 0.6 and 0.5 would indicate that it is more likely that the difference occurred by chance. The exact p value will depend on the specific data and the parameters of the t test.

Completely incorrect



# ChatGPT is “mansplaining as service”

- This extends to writing code and answering questions about statistics

 **W. Kyle Hamilton**  
@kylehamilton@social.esmarconf.org

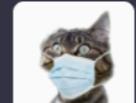
Dec 15, 2022

@wviechtb o no, ChatGPT can already make code for metafor.

```
data <- read.csv("data.csv")  
  
# Create the meta-analysis model  
model <- rma(yi, vi, data = data)  
  
# Summarize the model  
summary(model)  
  
# Visualize the model  
forest(model)
```

In this example, we first load the `'metafor'` library, which provides the functions for performing a meta-analysis.

Next, we load the data from a CSV file and create the meta-analysis function. We specify the effect size (`'yi'`) and the corresponding variance (`'vi'`) arguments provided to the `'rma'` function.

 **Wolfgang Viechtbauer**  
@wviechtb@scholar.social

@kylehamilton While this is neat on the one hand, it also imitates the common mistake of not adding random effects at both levels 😞 [metafor-project.org/doku.php/a...](http://metafor-project.org/doku.php/a...) This is a nice demonstration of how this kind of tech can lead to outsourcing of understanding to something that doesn't understand (at least not atm). But the moment it can rewrite `rma.mv()` in code that isn't such a mess, I will be there first to kneel before it.

# ChatGPT is “mansplaining as service”

- Finally, even if its code is correct, you still have the hard part of adapting whatever it wrote to your problem. I provide lots of code templates to you in this subject! Figuring out how to adapt them to different problems is the key part, and if you use the templates I provide at least you’ll know that you’re starting from the right thing.

To create the figure you described, we can use the `ggplot2` package in R. Here is the code  

```
r
library(ggplot2)

# Define the fill colors for each measure
diff_color <- "#80b1d3"
lfb_color <- "#fb8072"
rainbow_color <- "#8dd3c7"

# Create the plot
ggplot(dh_new, aes(x = score, fill = what)) +
  # Set the scale of the x axis for each panel based on the range of scores
  facet_wrap(~ what, scales = "free_x") +
  # Define the histogram with a density curve for each panel
  geom_histogram(aes(y = ..density..), color = "black", alpha = 0.7, position =
  geom_density(color = "black", size = 1.2) +
  # Set the fill colors for each measure
  scale_fill_manual(values = c(diff_color, lfb_color, rainbow_color)) +
  # Add titles and labels for the axes and panels
  labs(title = "Distribution of Responses", x = "Score", y = "Density", fill =
  theme_classic()
```

Ok but weird and not what I taught, likely to confuse you

WTF is this. Even if it works (I don't think it will?) it's way more complicated than what is being asked for and references a variable that I don't think exists

# You're robbing Future You if you do this

- You're paying a lot of money to get a very good education and develop skills that you will tell future employers that you have. Why put Future You in a situation where you don't actually have those skills and didn't develop them when you could?

## For a Student Who Used AI to Write a Paper

Now I let it fall back  
in the grasses.  
I hear you. I know  
this life is hard now.  
I know your days are precious  
on this earth.  
But what are you trying  
to be free of?  
The living? The miraculous  
task of it?  
Love is for the ones who love the work.

# You're robbing Future You if you do this

Obviously, no one can speak for all writers, but let me make the argument that starting with a blurry copy of unoriginal work isn't a good way to create original work. If you're a writer, you will write a lot of unoriginal work before you write something original. [And the time and effort expended on that unoriginal work isn't wasted](#); on the contrary, I would suggest that it is precisely what enables you to eventually create something original. The hours spent choosing the right word and rearranging sentences to better follow one another are [what teach you how meaning is conveyed by prose](#). Having students write essays isn't merely a way to test their grasp of the material; it gives them experience in articulating their thoughts. If students never have to write essays that we have all read before, they will never gain the skills needed to write something that we have never read.

# You're robbing Future You if you do this

The same thing goes with other things I teach. When I teach coding and statistics, the skills I aim to impart are the habits of thought and the ease with concepts and ideas that come from *actually* doing the coding and *actually* figuring out how to apply and interpret the statistics on *actual real data*. These skills do not come by asking an AI for the code and copying that code into the console without understanding. Just as real facility with advanced math requires a facility with numbers (not using a calculator every time you need to add something), so too facility with statistics and coding and analyses comes from internalising the base skills; and you only really internalise those by doing and creating things yourself.

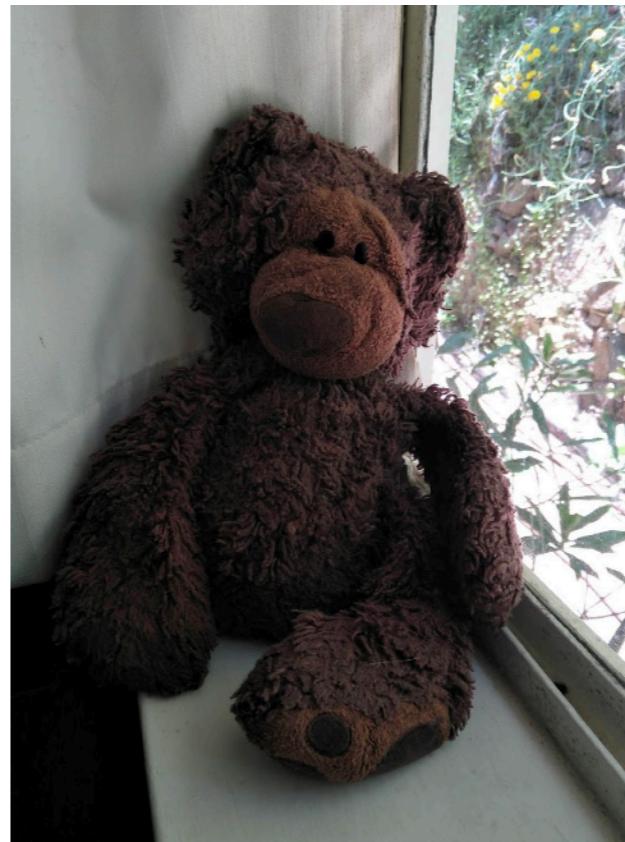
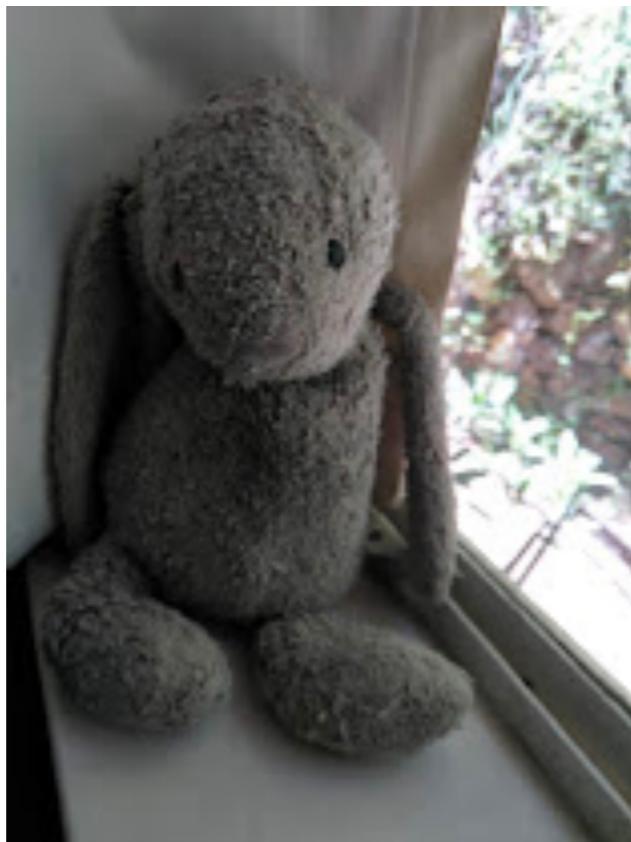
**We lose so much of what learning should be if the goal of education becomes to pass it to an AI and then fiddle with the content it outputs.**

# If you want help

- Ask (anonymously) in the Q&A! (no question is stupid, although it helps if you tried to think it through yourself first)
- Rely on each other: you are *strongly encouraged* to work closely with a friend on **everything except the assessments** — this is the kind of thing you learn best along with other people
- In fact, WATCH THE VIDEOS AND DO THE EXERCISES TOGETHER. Some groups have twice-weekly watch parties and they enjoy things a lot more *and* learn more too!
- The google is your friend (seriously - googling is one of the key skills that I aim to help you build)
- Your tutor, in tutorials
- Discussion board!!!!!!!!!!!!!!
- Two free textbooks linked from the LMS (Resources) are both really good (and kind of funny too). Lots of other free resources too.

# Before Wednesday...

- If you haven't already, install R and RStudio on your laptop according to the instructions on Canvas
- Watch the Week 1 Day 2 videos and try the exercises at the end of them (with a friend if you can)
- Ask any questions you have on the discussion board or the google doc linked to from Canvas. I'll answer them in the Q&A on Wednesday.

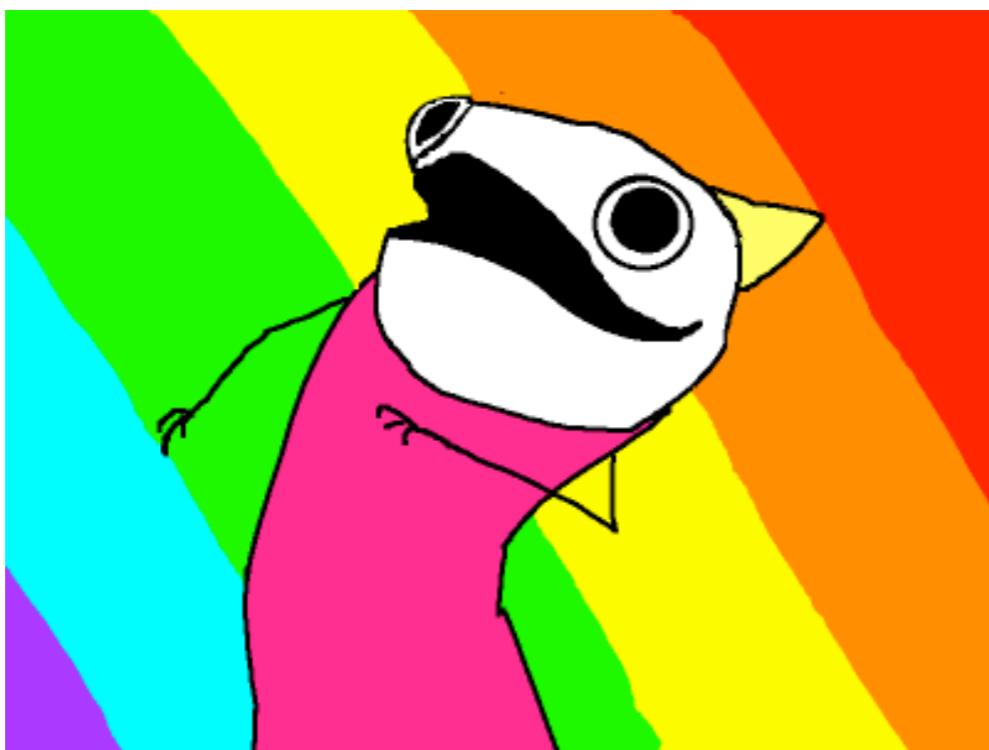


# Take home messages

1



2



**DON'T PANIC!!!!**

Statistics and R are both kind of like stage magic. They look impossible until you know the secret...

**YOU'VE GOT THIS.**

... but once someone shows you how the trick works, it's not so difficult after all