Lecture 02: Asking good questions and gathering evidence

Being Scientific

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Attendance QR Code HERE

Key topics today

- The week ahead
- The research process you are beginning
- Effect sizes
- Lab preview - Literature, and making it your friend

The week ahead

This week (week 2) you have your Personality Essay Tutorial

“Insert info”

> title
>
> Deadline 10am Friday x
>
> Feedback on/by x

Perennial CHIP topics

I want to briefly draw your attention to the third (final) piece of coursework for this module, the so-called ‘CHIP Learning Log’

The earlier we flag topics and introduce little glimmers of content, the easier that will be.

1 - What is Science?

An amazing opportunity to consider this critical question while you do your Mini-Dissertation

Here is a thought-provoking initial overview - **Open Educational Resource**

Diener, E. (2022). Why science?. In R. Biswas-Diener & E. Diener (Eds), *Noba textbook series: Psychology.* Champaign, IL: DEF publishers. http://noba.to/qu4abpzy

2 - Artificial Intelligence - Promise or Peril?

Last year, this was a fairly philosophical question

This year, you are probably using AI on a daily or weekly basis. I don’t need to give you 1980’s movie references to show you how we thought computers were going to take over the world and enslave the human race, we can just look out the window!

CHIP topic approval process

Lectures identified with `CHIP` in the title e.g. weeks 16-20 [They change yearly!]

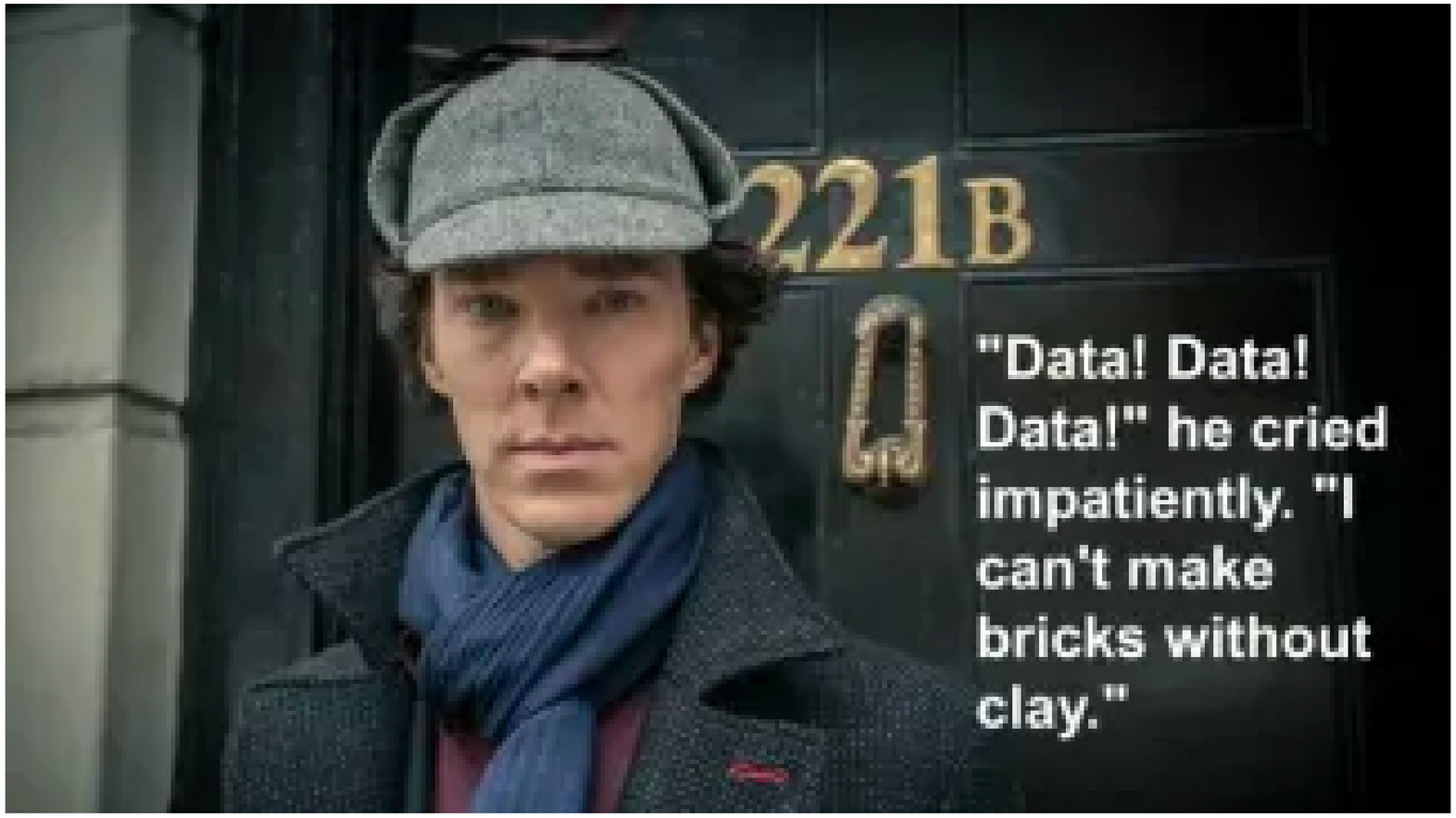
I am open to other topics, but they must fit the following brief, and be agreed in the Forum.

- A concept or debate within Psychology
- A historical issue or controversy
- A methodology or approach and its promises or limitations
- A distinctive or divisive topic
- A modern innovation or applied challenge

https://www2.open.ac.uk/openlearn/CHIPs/

I can’t make bricks without clay!

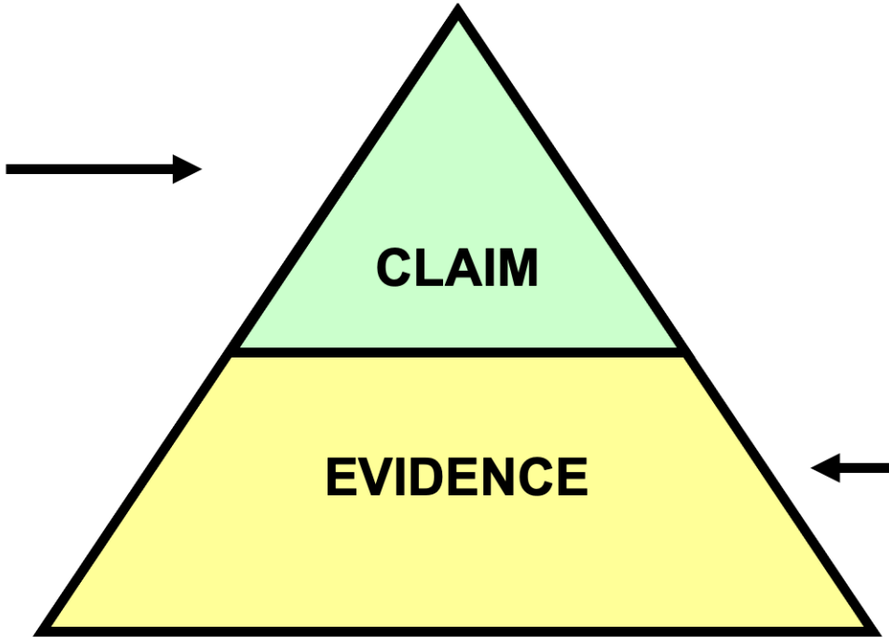
A psychologist? A scientist?

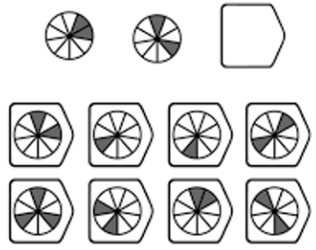


In this instance, Sherlock is talking about the need for data prior to solving a case. You can’t do science without data.

Scientists base their ‘claims’ on EVIDENCE

Theory
e.g., “There is only one general kind of intelligence”





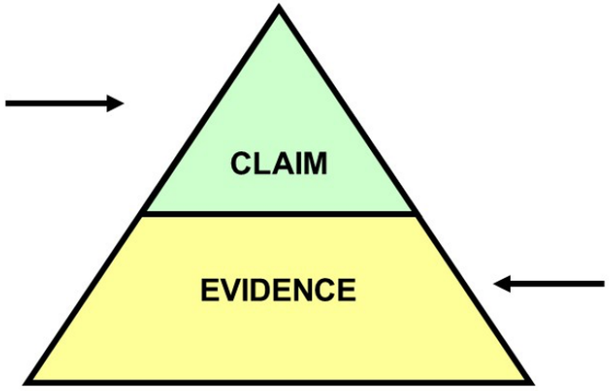
Personality and Individual Differences

Research
e.g., Do children with better spatial skills also have better reading skills?

Are people good at painting also good at maths?

Evidence quality = claim quality!

“We should spend more money on advertising!”



“How many people see these adverts?”

“Do people buy things they see online?”

“How does this compare to other kinds of advertising?”

It starts with a hypothesis

You've already been introduced to the idea of a hypothesis in stats last year.

"Coffee will improve memory scores"

(Experimental Hypothesis)

"Coffee will have no effect on memory scores"

(Null Hypothesis)

recap on hypotheses

However, two ways we can think about what a hypothesis is:

A hypothesis is a prediction about *what will happen in a study*

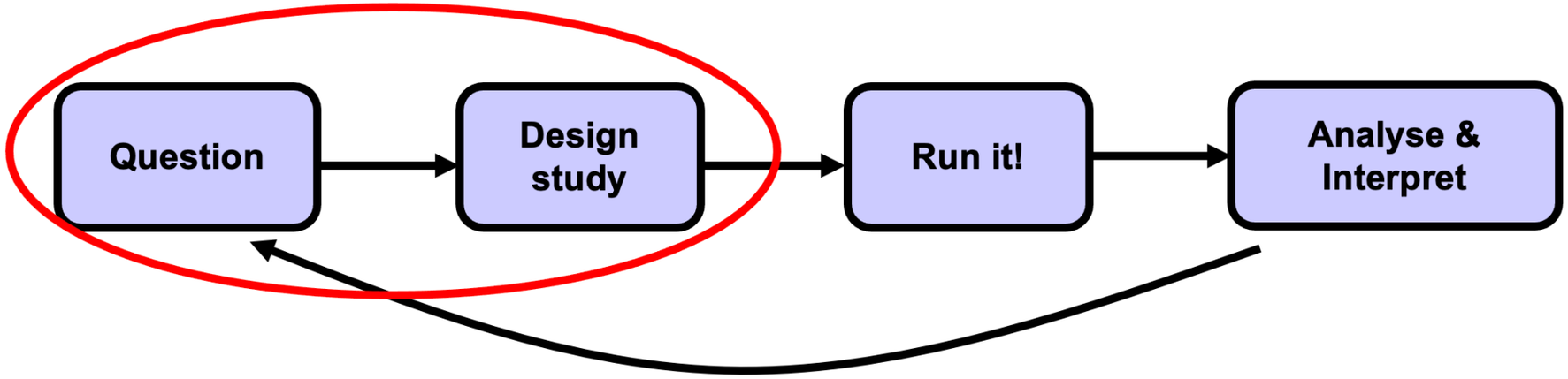
e.g., “Memory scores will be higher in the group that gets coffee”

Or a hypothesis is a claim about *how the world is*

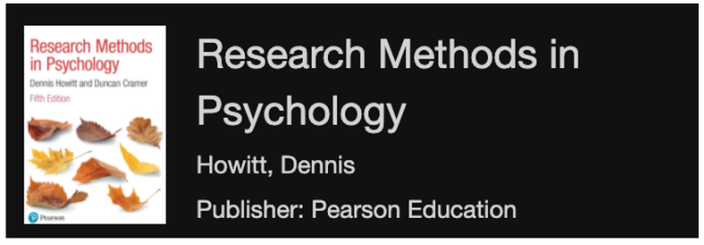
e.g., “Caffeine improves the strength of our memories”

The research process

The research process



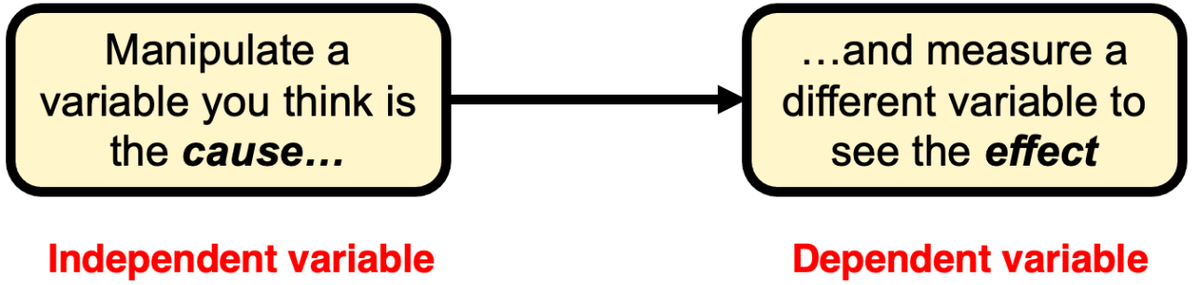
Chapter 1: Types of research and inferring causality
Chapter 2: Aims and hypotheses in research
ON THE READING LIST AND AVAILABLE ONLINE



The simplicity of an experiment

Experiments

- The word *experiment* has a very specific meaning in science
- Involves manipulating a variable to see the effect on another variable
- A way of testing claims about cause and effect



Operationalisation

Operationalisation is a key process in designing a research study. This involves translating general claims about cause and effect into specific variables to we can measure and manipulate.

"Caffeine improves the strength of our memories"

Cause: Caffeine

Effect: Memory strength

"Memory scores will be higher in the group that gets coffee"

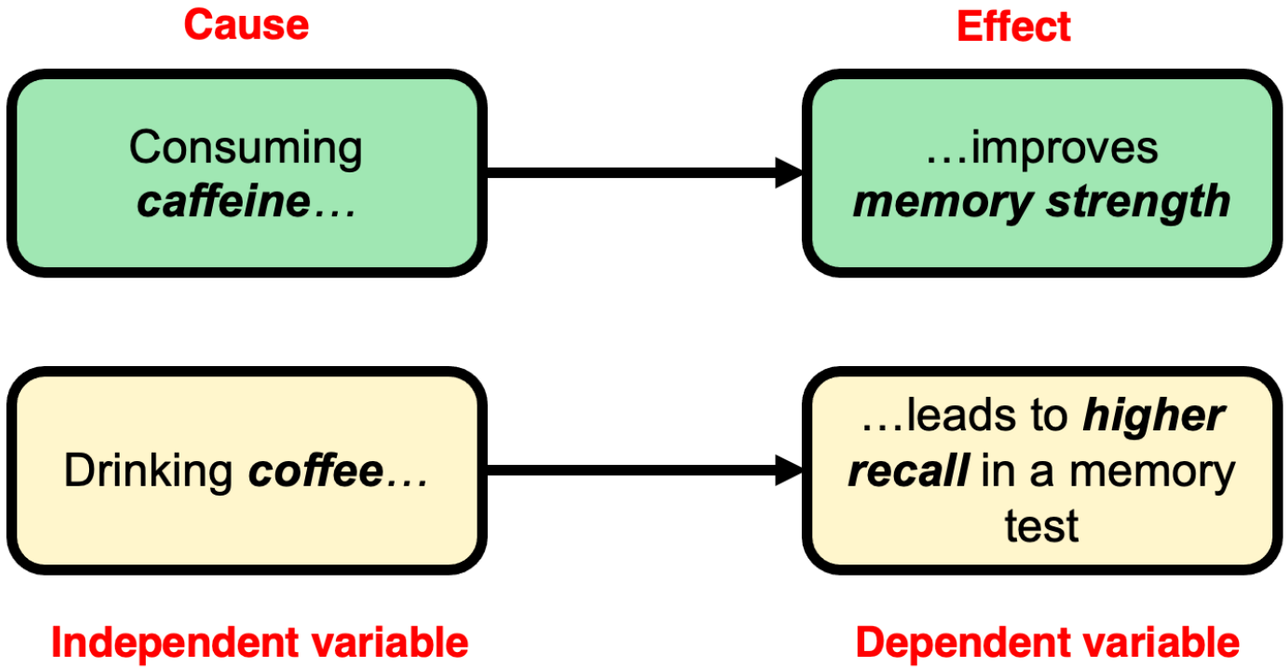
Independent variable: Coffee

Dependent variable: Memory scores

The challenge of operationalisation

Operationalisation = Translating general claims into specific IVs and DVS

e.g.,



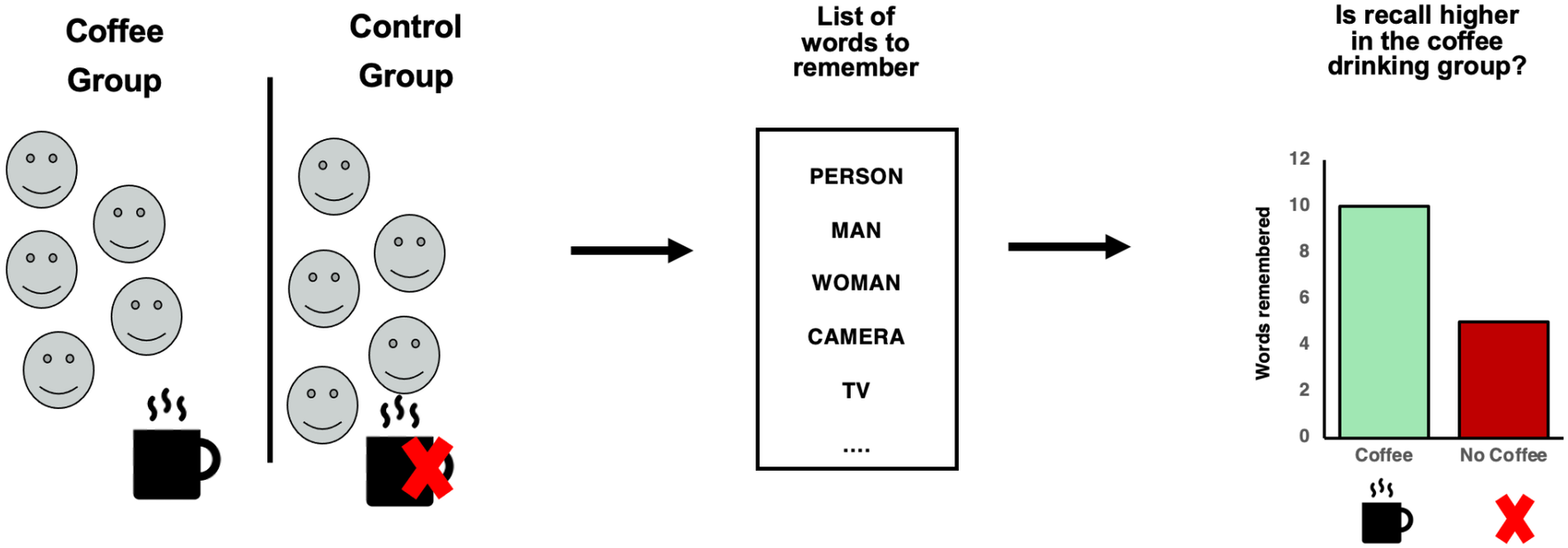
A toy example

Drinking ***coffee***…

…leads to ***higher recall*** in a memory test

Independent variable

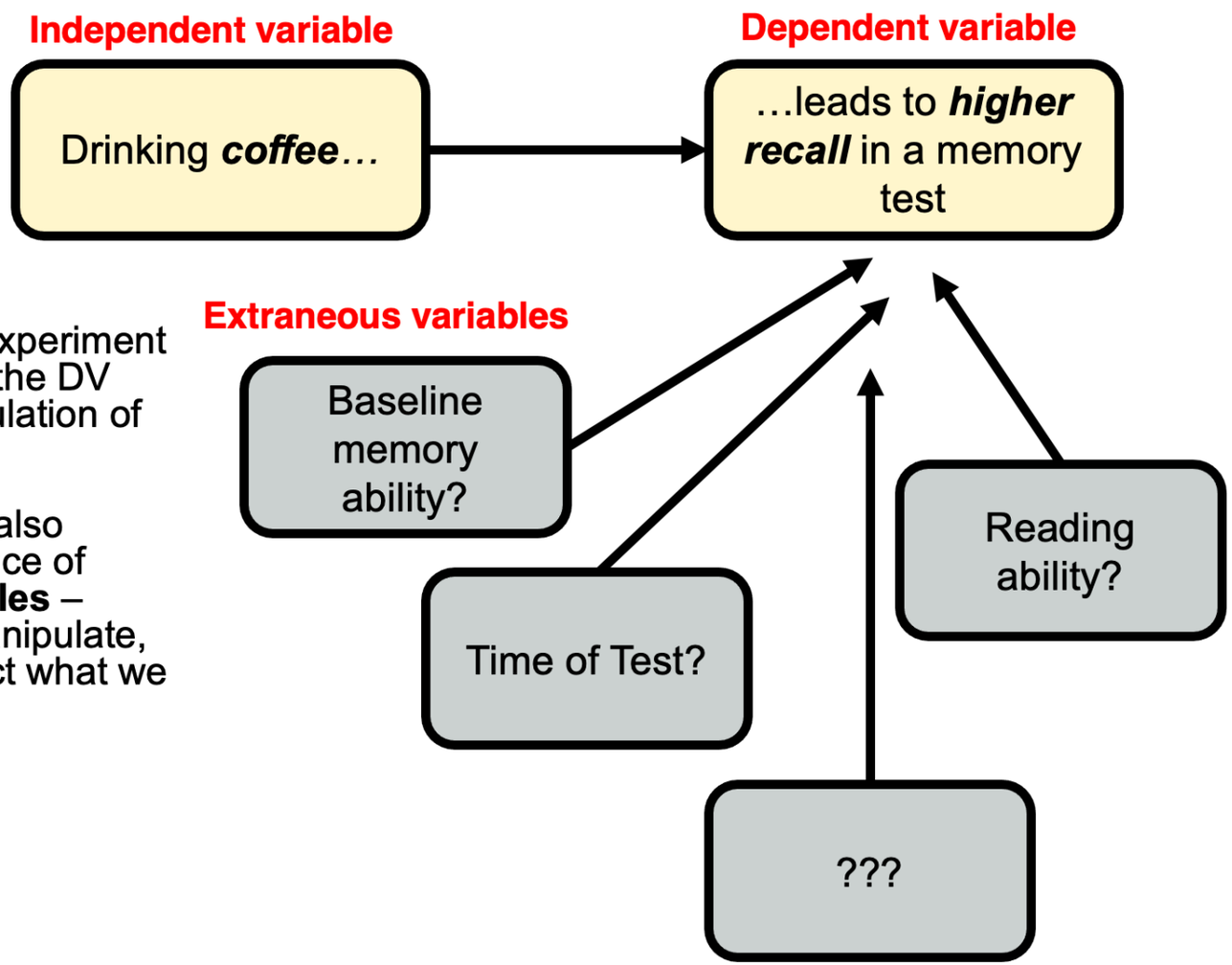
Dependent variable



Extraneous variables

Assumption of an experiment is that variability in the DV depends on manipulation of the IV.

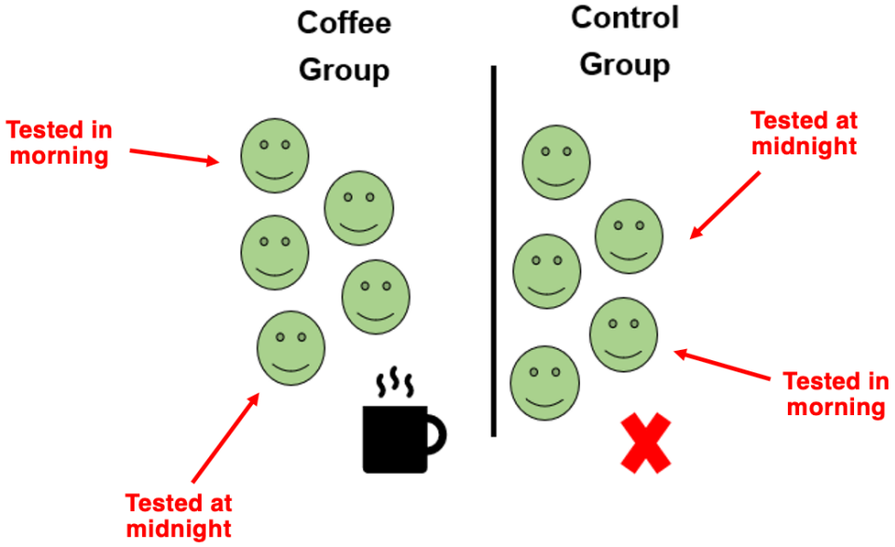
However, we must also consider the influence of **extraneous variables** – factors we don't manipulate, but which also affect what we measure

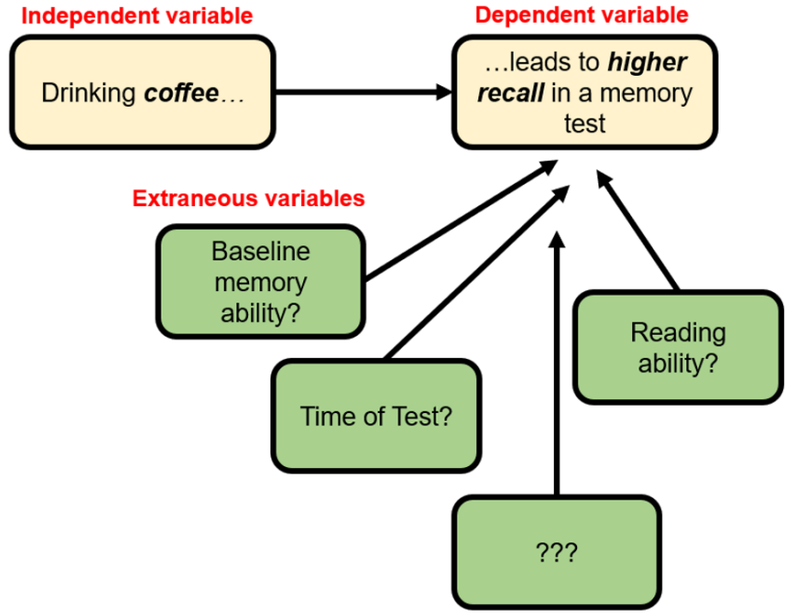


Usually…

Most **extraneous variables** just add noise to your measurements i.e. they add variability to your dependent variables that is separate from your manipulation

e.g., if time of test affects memory, and this randomly varies between groups, will make it harder to detect effect of manipulation

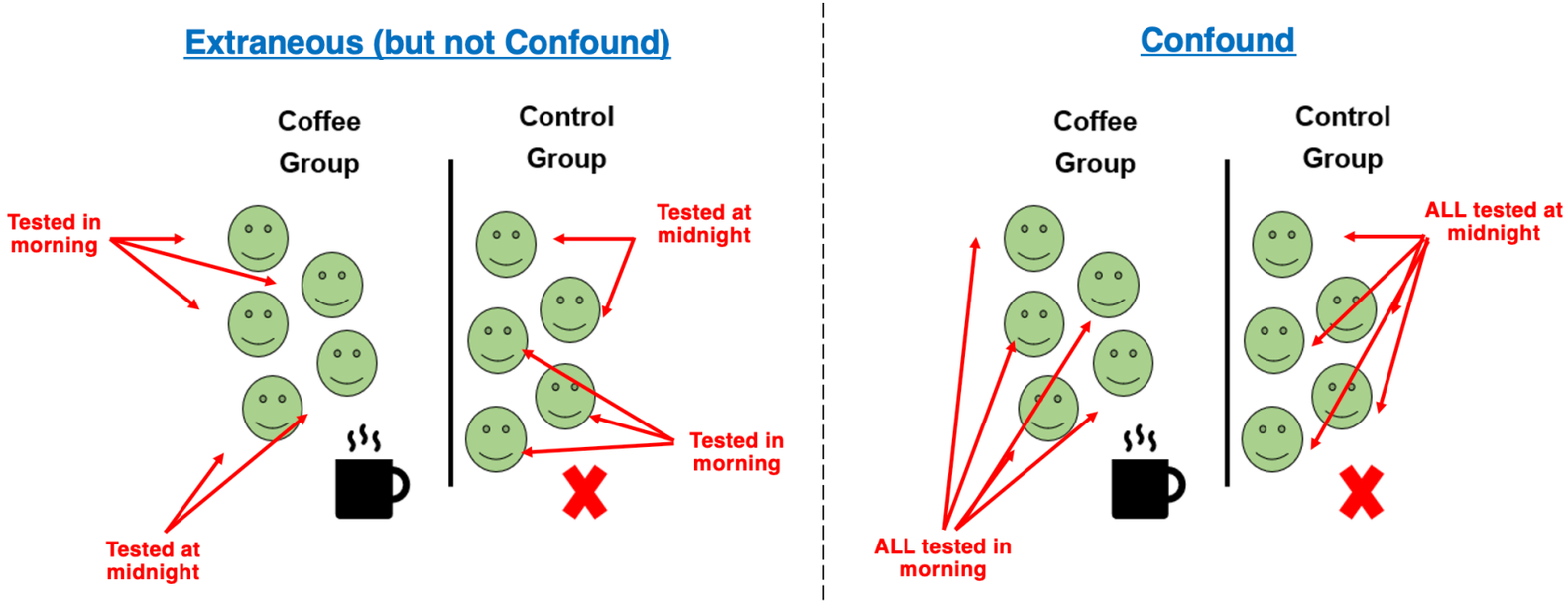




but occasionally…

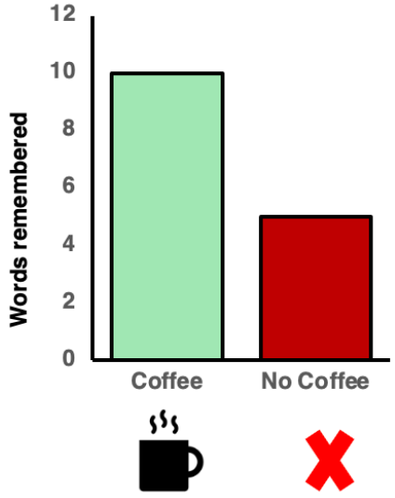
you hear of ‘confounds’ or **‘confounding variables’**

A confounding variable is an extraneous variable that systematically varies with one of your independent variables. These are rare, but nothing can save the experiment.



An impossible interpretation

If things are **confounded,** and we see this pattern of results….



It could be….

Drinking ***coffee***… → …leads to ***higher recall*** in a memory test

Independent variable — **Dependent variable**

Or it could be….

Being ***tested in the morning***… → …leads to ***higher recall*** in a memory test

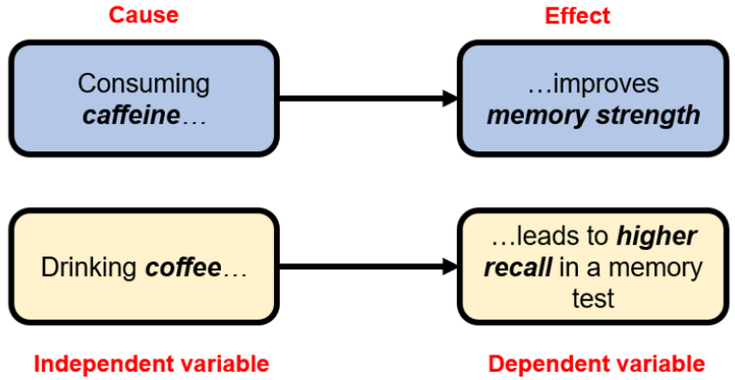
Confounding variable — **Dependent variable**

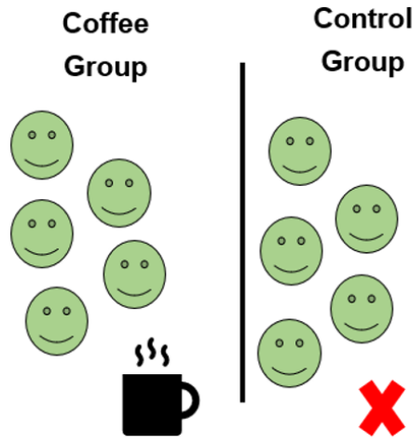
<u>Confounds make results impossible to interpret!</u>

Manipulations almost always introduce potential confounds

Could be:

- ***Caffeine?***
- Drinking something warm?
- Drinking anything?
- Holding a mug?
- Brief social interaction with the experimenter?
- ???





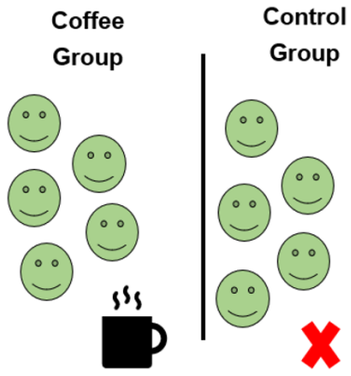
Experimental skill + careful thought + piloting + randomness!

Good manipulation = fewest possible confounds

A **poor experiment** manipulates the variable of interest (caffeine) but also introduces other confounds

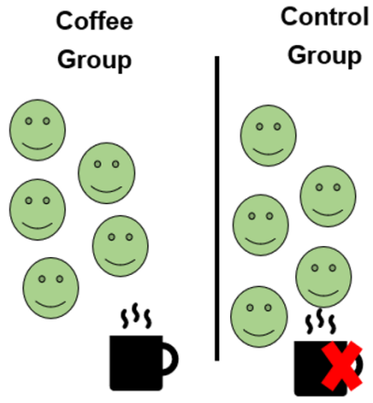
Poor manipulation

(Coffee vs Nothing)



Good manipulation

(Caffeinated vs Decaffeinated)

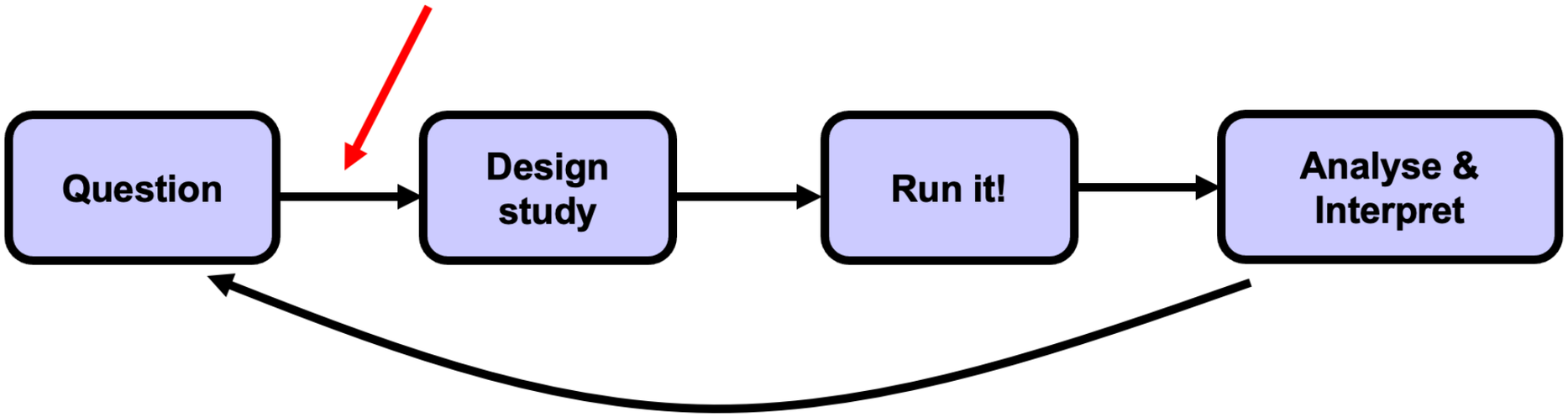


A **good experiment** manipulates the variable of interest (caffeine) but minimises other differences between conditions

Remember this when designing your projects!

The importance of operationalising your variables well

Good operationalisation is key to good study design.



If operationalisation from broad question to specific details is bad, the study can't answer the question we are interested in

Reading along

I highly recommend reading along with the general topics we cover in the first few weeks.

Research Methods in Psychology by Dennis Howitt and Duncan Cramer is excellent. Chapter 2 in that book (right at the top of the module reading list and here) deals with Hypotheses and aims of research, essentially what we cover this week, and Chapter 1 deals with the basics and golden rules of research design and designing good experiments.

Another interpretation of “I can’t make bricks without clay!”

Garbage in, Garbage out

Last year someone selected a ‘target paper’ for their Critical Proposal [next week’s lecture topic] from a Sociology Journal - it presented a ‘thought experiment’.

No data, no methodology, no participants, no actual experiment.

How do you think they did?

The literature you read will drive the quality of your output

- This applies to the study you design for your Mini-Dissertation
- This applies to your Module Essays
- This applies to your Critical Proposal
- It is NOT a question of QUANTITY
- It is very much a question of QUALITY
- It is a function of QUALITY and QUANTITY

Lab 2 is about Literature Search and Management

Effect Sizes

A measure of the Effect (MOTE)

Effect sizes represent the magnitude of a relationship between variables, for example between a Manipulation and the Dependent Variable.

It’s like the ‘strength’ of your pill, or intervention, or manipulation.

Do not run an experiment that is designed to fail - you must believe a manipulation will have an ‘Effect’

If the manipulation works, then there will be an Effect

The Effect Size is just how big that visible effect was.

Let’s imagine the simplest example possible

An independent t-test. Working Memory Capacity.

I have a magic pill to increase working memory capacity.

7 ± 2 is the Miller Law. Let’s read this as normal mean working memory capacity for a group of humans is mean 7 units with a standard deviation of 2 units.

Let’s say my pill was tried on a group of humans, and when we measured their mean working memory capacity it was 11 units with a standard deviation of 2 units. Wowsers!

That’s an effect size of d=2. Simply put, Cohen’s d is always presented in units equivalent to 1 standard deviation. So 11 is 2 SDs higher than 7.

Calculating Effect Sizes (shinyapps.io)