Week 1A: What is Science?

It is a standardised approach of collecting and gathering information and answering simple and complex questions in a manner such that errors and biases are minimised.

- It is a specific process
- It is a tool, a method to help us to understand the world and ourselves
- It minimises bias and error, but does not eradicate it (it is a cultural affair)

Myths about science

- Science provides absolute proof (i.e. facts) – support theory, never prove! – but, you can come close (the probability that the theory is correct becomes higher as the evidence supporting it increases over time)
- Science is not creative – yes it is!
- Science is about being mistrustful of other non- scientific ideas – science is sceptical, not cynical!
- Science claims to have all the answers, right now – think of it as an ongoing process!
- Science is difficult to learn – it requires patience, dedication, and interest
- Scientists are always making breakthroughs – scientific advance is slow

What is science?

- Science relies on observable data – to test out theories
- Hard sciences – natural sciences (more certain, less complex) eg. Biology, Physics, Mathematics, Neuroscience
- Soft sciences – social sciences (less certain, more complex) eg. Social psychology, Clinical psychology, Social science, Economics

What is the process of science? What is the scientific method?

1. Theory (research Q's)
2. Hypothesis/ collecting data (experiments)
3. Analysing the data (checking results)
4. Interpreting the results
5. Updating the theory
6. Testing new ideas

What is a theory?

- A **theory** is a set of principles that explains and predict certain phenomena
- It is constantly subject to testing, modification, and refutation as new evidence and ideas emerge
- To be 'accepted' a theory must be well-substantiated -> multiple experiments and observations supporting the theory

E.g., 'Theory of global warming' - Great Barrier Reef change, Measurement of sea temperature, Melting ice caps, Rising sea levels and Measuring carbon dioxide in the air

Attachment theory – Well substantiated and one of the most widely accepted theories. States that a strong emotional and physical attachment to at least one primary caregiver critical to personal development. Makes a specific set of predictions about how organisms will behave in a certain situation in the presence of their caregiver.

What is a hypothesis?

- A **hypothesis** is making a prediction that can be tested in the real world
- The behaviour or outcome the scientist is interested in must be measurable (i.e. observable)
- Based on the theory a scientist is testing – the theory leads them to predict something, given that the theory is correct

- It is not a question, it is a statement
- All hypotheses must **be *testable, replicable* and *falsifiable*** (able to be shown to be incorrect)
Falsifiability is the possibility that an assertion can be shown false by an observation or experiment.

Eg. Theory – Earth revolves around the sun in a particular direction
Hypothesis – The sun will rise in the East every morning
If a theory is correct, there are going to be a potentially infinite number of ways to demonstrate evidence for it.

What are the main types of experiments (procedures)?
1. True experiment
2. Correlational study
3. Quasi-experimental study
4. Case study

1. True Experiment
These are conducted to test the theory and more specifically the hypotheses, which are based on the theory and previous results.
- Experiments require variables:
    - **Independent variable –** a variable that the experimenter manipulates to examine its impact on the measured variable (dependent variable)
    Dependent variable – the measured outcome of a study, or the response of the subjects in the study.

Example:
Theory: Watching television causes you to become alcoholic
Hypothesis: Watching 4 hours of TV per day will make you drink more alcoholic drinks than if you watch no TV
This is a hypothesis because:
- It is a prediction in a specific direction (wrong = drinking alcohol is related to TV watching)
- It is measurable (we can measure the amount of television watched and the amount of alcohol drunk)
- It is replicable (another person can conduct the exact same experiment somewhere else)
- It is falsifiable (we can find evidence within the context of this experiment that contradicts our theory)

Independent Variable: Amount of TV watched
- Condition One: 4 hours TV per day in a week
- Condition Two: No TV in week - This is a **control variable**. A control variable allows us to infer causation to a greater extent. We can infer the impact of watching TV because, all things being equal, we know what the impact of not watching TV is (we can compare)

Dependent Variable: Amount of alcohol consumed before and after experiment manipulation
- Measured: Number of standard drinks per day

NOTE – THESE VARIABLES MUST BE OPERATIONALISED.
The purpose of these definitions is to allow us to *measure* a certain concept. That is what it means to operationalise something – to derive a system whereby **objective tangible measurement is possible.**

Eg. The variable love can be measured:
    - Number of hugs between two people over a period of 1 year
    - Increase in blood levels of oxytocin over a period of 1 year
    - Amount of love a person reports feeling for another on a scale from 1-5
Hence, the no. and variety of ways to operationalise (measure) love is infinite. This is because the concept is abstract. It only exists in so much as we have labeled it. This does not mean we should not try to define it,

measure it, study it – but it does mean there will be disagreement over what we accept as a good operationalization of it – and the definition may change over time.

The Sternberger Triangular Love Scale (1997) operationalizes love as comprising 3 separate abstract concepts (intimacy, passion and commitment). Each of these is measured by a score on a questionnaire. The higher the score the more love an individual is theorized to possess. Hence, operationalization can be driven largely by theory – this theory suggests that love is multifaceted.

2. Correlational study
A correlational study is one here researchers try to show the **relationship** (or correlation) between 2 variables.
  – Only have dependent variables.
  – Only observing (not manipulating anything)

Positive correlation
  – As one event tends to increase, the second event tends to increase
  – Positive associations may be stronger or weaker

Negative correlation
  – As one event tends to increase, the second event tends to decrease
  – Negative associations may be stronger or weaker

Perfect positive correlation - Means that an increase in one event is always matched by an equal increase in a second event. Almost never observed in research settings. Eg. 1 Revolution of the earth around the sun (365 days) is correlated to you turning one year older

Zero correlation - There is no relationship between the occurrence of one event and the occurrence of a second event. Often observed in research – e.g., hypotheses not supported.
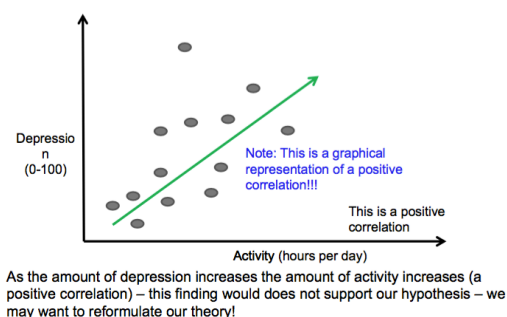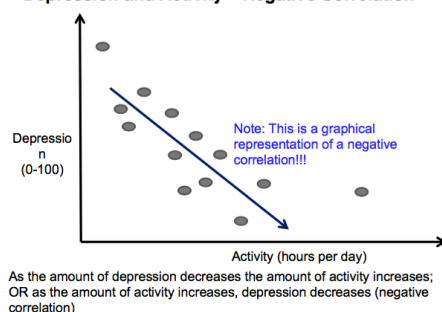
Example
Theory: Being inactive causes depression
Hypothesis: The fewer hours your spend per week being active the greater your depression will be

Dependent variable: We only measure variables and see if they are correlated
  – We will measure how many hours per day people are not active (behaviour)
  – Operationalise = Number of hours spent active
  – We will measure how depressed people are (self-report questionnaire)
  – Operationalise = Score (0-100) on self-report questionnaire

Depression and Activity – Negative Correlation

Depression (0-100)

Note: This is a graphical representation of a negative correlation!!!

Activity (hours per day)

As the amount of depression decreases the amount of activity increases; OR as the amount of activity increases, depression decreases (negative correlation)

Depression (0-100)

Note: This is a graphical representation of a positive correlation!!!

This is a positive correlation

Activity (hours per day)

As the amount of depression increases the amount of activity increases (a positive correlation) – this finding would does not support our hypothesis – we may want to reformulate our theory!

Note: The fewer participants we have (in any type of study) the less valid our study findings become. The less likely it is we will observe an effect, the less likely it is our findings are representative of what might be observed in the 'real world.'