PSYC1111 (Measuring Mind and Behaviour)

Research Methods

The Basics of Science

What is science?

- Science is a process of obtaining knowledge, by testing ideas through systematic observation and experiments
    - We ask questions about:
        - *Existence:* does X exist, does Y exist? (description)
        - *Relationships:* does X co-vary with Y? (prediction)
        - *Causation:* does X cause Y? (explanation)
- To answer scientific questions, we need evidence – and we need to *evaluate* the evidence
    - We evaluate evidence by looking at methodology and statistics
    - Statistics alone are not enough; the same statistics can be used in different ways to support different arguments
- Why is the scientific method important in psychology?
    - Folk wisdom and "common sense" are flawed e.g. contradictory idioms
    - The problem of *argument from authority* (expertise heuristic): information that comes from an "expert" seems more credible, but it isn't necessarily true
    - We are prone to believing "urban myths" e.g. "we only use 10% of our brains"
    - We are vulnerable to many *biases* – there is thus the need for *systematic observation*

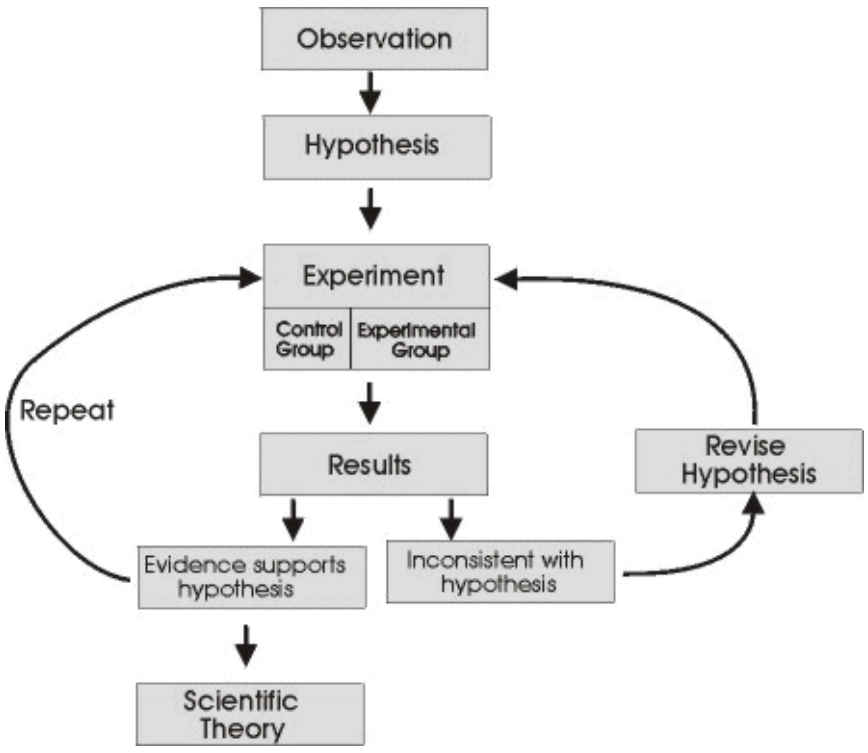
Knowing

- The earliest explanations for human behaviour were *metaphysical* (supernatural) explanations, which attributed behaviour to nonphysical forces
    - *Animism:* belief that natural phenomena (e.g. wind, rain) are alive and influence behaviour (e.g. people who have the traits of particular animals are similar to those animals)
    - *Mythology and religion:* religious systems are based on different assumptions and evidence than scientific systems
    - *Astrology:* belief that the movement of celestial bodies influences behaviour
- *Philosophy* is the study of knowledge, behaviour and the nature of reality through the use of logic, intuition and empirical observations (it became increasingly rooted in empiricism, particularly by the mid-19th century)

- Idea of *positivism*: that theories/knowledge should only be based on observations that can be made with complete certainty

- *Physical sciences including physiology:* physiology is the study of the functions and interactions between the different parts of the brain and body, through experimentation
- *Psychology* was influenced by both philosophy and the physical sciences
  - Experimental psychology arose in Germany, around the mid-late 19th century
- There are various ways for people to have knowledge about something:
  - *Intuition* (subjective belief that something is so), *logic* (reasoning), *authority* (accepting what an authority figure says), and *observation* (empiricism)
    - Also, knowing by tenacity (believing in tradition e.g. superstitions and myths)
  - In science: observation > logic > intuition > authority
- How to obtain knowledge from observations…
  - *Induction:* reasoning from the specific to the general (developing general principles by reasoning from observation of many specific instances)
    - David Hume's "problem of induction": we can never make enough observations – the very next observation may violate the general principle
  - *Deduction* (Karl Popper)*:* reasoning from the general to the specific (using a general statement to develop predictions that are then tested by observation)

The scientific process/method



- Key terms…
    - *Hypothesis:* specific testable statement about the relationship between variables
    - *Theory:* more general than a hypothesis – refers to a relationship between variables that should hold across many instances
    - *Law:* general, universally true relationship between variables (very rare in science)
- The scientific process never really results in a particular theory being deemed "true" or "proven" as it can always be changed in light of new evidence
- *Interactive process:* scientists collaborate and communicate their ideas, and publish their work in peer-reviewed journals
- There are various approaches to *developing hypotheses*:
    - Inductive approaches: using case studies, using paradoxical incidents (very strange observations), and "analysing the practitioner's rule of thumb" (analysing what experts in a certain area do to achieve certain outcomes), serendipity
    - Deductive approaches: reasoning by analogy, functional/adaptive analysis (asking questions about what organisms must do to thrive in their environments), hypothetico-deductive method (starting with some basic assumptions), accounting for conflicting results and exceptions
- There are 3 basic approaches to *hypothesis testing*: *validation* (attempting to find evidence to support a theory/hypothesis), *falsification* (attempting to find evidence that invalidates a theory/hypothesis), and *qualification* (attempting to identify the boundaries of a theory/hypothesis i.e. the conditions under which it is and isn't true)

Assumptions of science

- There are at least 4 fundamental principles that are accepted by scientists; they are known as the *canons* of science

1. *Determinism:* there is some underlying systematic order to many (but not all) phenomena in the universe
    - This is significant because without this assumption, we would never be able to develop a consistent set of rules/causes for anything
2. *Empiricism:* need for systematic observations and evidence to support claims
    - Anecdotal evidence and expert opinion are inadequate
3. *Parsimony* a.k.a. *Occam's razor:* the simplest hypothesis (the one with the fewest assumptions) is preferred when there are competing hypotheses that are equally good at predicting results
    - "Occam's razor" named after William of Occam, a medieval English philosopher who advocated for parsimony