Critical thinking
Research Methods 1

Lecture 3

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- The scientific method
- Research designs

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Thinking critically

- Psychology is a science
- Science revolves around questions
  - Systematic asking and answering of questions
- Goal of psychological science: to gain new insights in our understanding of human behaviour/mind/thoughts

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Methods of knowledge acquisition

- Tenacity: "it's always been that way"
- Intuition: "it feels true"
- Authority: "the boss says it's true"
- Rationalism: "it makes sense logically"
- Empiricism: "I observed it to be true"
- Science: a combination of rationalism & empiricism

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The scientific method

- A system that guides how scientists should collect and analyze the data that they obtain

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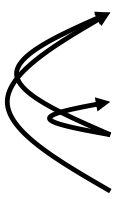
7 Steps of the Scientific Method



1. Formulate a testable theory
2. Formulate a testable hypothesis
    1. Operationally define variables
3. Select a research method
4. Data collection
5. Data analysis
6. Report findings
7. Revise theory (to account for findings)

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Step 1: Formulate a Theory

Theory: A testable set of ideas that can explain the phenomenon of interest.

Example

You've noticed that a few of your friends who are good at math played music as kids.

Theory: training in music facilitates the acquisition of mathematical skills

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Step 2: Formulate a Hypothesis

Hypothesis: A specific *prediction* about how (and often why) the variables in question are associated with one another.

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We have our hypothesis

Kids who do well through extensive musical training will be more likely to show good math skills.

But how do we determine:

- The quality of musical performance?
- The amount of musical training?
- The quality of math skills?

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We need an operational definition

An explanation of how we're defining our variables for our study.

- Speed and accuracy of playing.
- Time taken to identify musical components.
- Number of years of musical training.

- Speed and accuracy of completing math problems.
- Time taken to count backwards from 100 by fours.
- Grades in math class at specific level.

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Use the operational definition in the hypothesis

Three years of musical training on a violin between age 5 and 8 will result in higher math grades in 3rd grade.

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Step 3: Select a Research Method

Let's try to do an experiment

- Suzuki violin training from 5-8 years old (10-20 hrs/wk).
- Math grades in Grade 3.

- No music training.
- Math grades in Grade 3.

Try to control everything else so that the groups are identical except for musical training

What are some relevant variables to control?

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Step 4: Data Collection

Collect your data in the most controlled way possible

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Step 5: Data Analysis

Remember, this may lead back to more data collection or a revision of your hypothesis.

1. Formulate a theory.
2. Formulate a hypothesis.
3. Select a research method.
4. Data collection.
5. Data analysis.

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Step 6: Report Findings

In your department, at a conference, in a journal.

Why is this so important?
- Peer evaluation process
- Replication

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Step 7: Revise Theory

A back and forth process

1. Formulate a theory.
2. Formulate a hypothesis.
3. Select a research method.
4. Data collection.
5. Data analysis.
6. Report findings.
7. Revise theory.

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Science vs. pseudoscience

- To be scientific, work must be able to withstand the rigorous tests of science
  - Pseudoscientific claims are often in the form of:
    - Case studies
    - Personal reports
    - 'Scientists'
  - These are not necessarily 'bad' forms of information, but to be trusted as science, they must be able to be demonstrated and replicated

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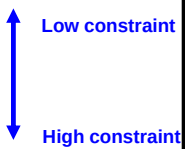
Designs in psychological research

- Different designs have different uses and different levels of constraint (limits and controls)
  - Case study (description)
  - Naturalistic observation (description)
  - Correlational research (relationship)
  - Experimental research (causal explanation)



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Case study

- Case studies examine one individual in great detail
- Savant: Leslie Lempke
- Severe MR, blind, limited speech
- No musical training BUT able to reproduce an entire concerto after a single hearing!
- And can sing in several languages!

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Case study: Memory and the brain

- H.M.
- (Henry Molaison)
- Brain surgery in 1950's to counteract epilepsy
- Could form no new long-term memories
- Studied throughout his life – now his brain is being studied

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Hippocampus is crucial for memories.

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Case studies

Pros

- Good for giving ideas for future research
- Extreme cases that would be unethical to create
- Often studied in natural conditions

Cons

- Usually only descriptive, not explanatory
- Only studying one person – may not be representative of the population
  - Anecdotal evidence
- Hard to avoid influencing behaviour of participants
- Can be time consuming

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Using a sample

- We want to draw conclusions about how a whole population (everyone we're interested in) would behave, but it's impractical to test everyone
- Instead we draw a representative sample of people, test them, and generalize to the population
- How do we know it's representative?

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Naturalistic observation

- Classroom observation
- Roger Hanlon: octopus camouflage

- flexible, open questions since the work was ground-breaking
- but observation is systematic: carefully recorded and organized

- can be observation from afar or can involve participation of observer

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Naturalistic observation

Pros

- Good for giving ideas for future research, investigating new areas
- See people behave as they typically would
- Can be useful to verify (possibly artificial) lab results.

Cons

- Usually only descriptive, not explanatory
  - e.g. People who live in cold climates are more likely to die of heart disease. Why???
- Sample not randomly selected - may not be representative of the population
- Hard to avoid influencing participants
- Time consuming
- Little control

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