THE UNIVERSITY OF MELBOURNE

Quantitative Methods: Introduction to Research Design and Descriptive Statistics

MBB1 2015 Tutorial Class 1

First Year QM Course

- MBB1 – Descriptive statistics
- MBB2 – Inferential statistics
- 4 MBB1 QM classes
  1. Introduction to psychological research I
  2. Measurement, variables, distributions of data
  3. Central tendency and variability
  4. Introduction to psychological research II

Helpful Reading

Two textbooks are helpful for this course.

- Gravetter & Forzano (2011) *Research methods for the behavioural sciences*
  - Custom publication of selected chapters for this semester only and useful for later years in psychology
- Gravetter & Wallnau (2011) *Statistics for the behavioral sciences*
  - 9th edition, but earlier editions also OK!
  - Also useful for later years in psychology

Aims for this session

- To emphasize the important of research in psychology as an evidence-based discipline
- To introduce fundamental issues and terms involved in designing and evaluating psychological research
- To introduce the role of quantitative methods in psychology

Recommended reading: Gravetter & Forzano, Chapters 1-6

Ponder this…

- Psychologists aim to help people.
  - But so do 'natural health' practitioners, like 'Spiritual Healers' (Spiritual Healing is also known as 'Vibrational' or 'Clairvoyant' Healing[1]).
- Psychologists commonly apply treatments that they believe to be effective, with the aim of reducing psychological distress.
  - But so do Reiki Masters (who believe that they transfer 'universal energy' through their hands to their clients in order to heal[2]).

1. http://www.naturaltherapypages.com.au/spiritual/Spiritual_Healing
2. http://en.wikipedia.org/wiki/Reiki

A question for you

- So, what then, distinguishes psychological practice from that of natural health such as spiritual healing?

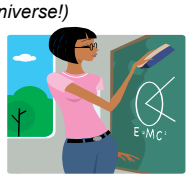
How is Psychology different?

- The discipline of psychology is *evidence-based!*
- So, psychologists only apply therapies that are supported by evidence!
- How do psychologists gather this evidence?
- By conducting rigorous research!

Psychological Research

Human beings are *complicated*

(Perhaps the most complicated phenomena in the known universe!)



So psychological research is not easy!

Why is Psychological research unique and challenging?

- Often, psychological research deals with the measurement of *abstract* or *nonmaterial* things called "constructs".
- For example, self-esteem, motivation and anxiety are all constructs.
- A construct is "A hypothetical attribute or mechanism that helps explain and predict behaviour in a theory" (Gravetter & Forzano, p. 67).
- Put differently, a construct can be thought of as an abstract concept that is thought to underlie observable behaviour.

Constructs continued

- Constructs cannot be measured directly…

BUT!

- Observable behaviours associated with constructs can be measured!
- Therefore, researchers can measure constructs *indirectly*.

Construct example

- Happiness
  - It's an abstract concept. Do you think we could measure it *directly*?

  - Unfortunately not.
    - But! We can measure happiness *indirectly*…
  - Remember, constructs, like happiness, are theorised to underlie *observable behaviour.*
  - So, what kind of behaviour could you observe that may allow you to measure happiness indirectly?
    - In other words, how could we *operationalise* happiness?

Constructs and the research process

- So, how do constructs fit into the psychological research process?
- The research process begins with a question. This question drives the whole research process:
  - Research design, data analysis, reporting, etc
- **Theory**: arguments about how the constructs can be related to one another to explain human behaviour
- (see Gravetter & Forzano, chapters 2 and 3)

Theories, constructs and hypotheses

- Theories are great. But! If we are to measure psychological phenomena accurately, we need to add some precision.
- Based on research questions and theories, researchers then form hypotheses about the constructs.
- Hypotheses should be:
  - specific and testable
  - should be falsifiable (refutable) G&F, section 1.4
    - What would the data be like if the hypothesis were **wrong**?

Theories, constructs and hypotheses

- For instance, a researcher might have a theory that:
  - Adult ADHD problems encourage alcohol abuse to alleviate stress
- The researcher predicts that adults with ADHD will have a higher prevalence of alcohol abuse than that observed in adults who do not have ADHD – the hypothesis.
  - This is quite specific and testable!
- To test this hypothesis, the researcher recruits a two groups of people (two "samples") to participate in the project: 1) Adults with ADHD; and 2) Adults who do not have ADHD.

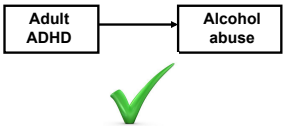
Samples and Populations

- A *population* is every possible individual who of relevance to the research question.
- A *sample* is a group of individuals selected (by some means) from the population to participate in research.

Random Sampling

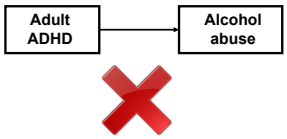
- You want a *sample* that is representative of the *population*.
  - Best chance to do this is with a random sample.
  - all individuals or groups in the population have the same chance of being selected in a sample
  - See Gravetter and Forzano Chapter 5 for more types of sampling.

ADHD example continued



If there are relatively more adults with ADHD who abuse alcohol, then the hypothesis is supported!

ADHD example continued



If:

- There are relatively fewer adults with ADHD who abuse alcohol, then the hypothesis is not supported.
- There is no difference between the groups in terms of alcohol abuse, then the hypothesis is not supported.

Hypothesis recap

- Specific
- Testable
- Can either receive support or not; there is no grey area, no partial credit etc.
- Now that we know a little about the research process, let's do Activity Sheet 1, Part A.

Your ideas

- Enter a sample of student hypotheses here.

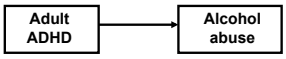
Measurement

Psychological Research: Measurement

Measurement: Variables

- Variable — a measurable characteristic or condition of people that can change or take on different values for different individuals
  - *Independent Variable (IV)*
    - a variable that is thought to influence another variable
    - the *explanatory* variable
  - *Dependent variable (DV)*
    - the variable influenced by the IV
    - the *response* variable

Variables example



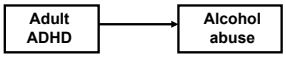
In this theory:
Adult ADHD is an explanatory variable (IV).
Alcohol abuse is a response variable (DV).

Research Design

- Psychology is a very broad discipline with a seemingly endless number of research questions!
- As such, psychological research projects are designed in many different ways.
  - Different research designs permit us to investigate research questions in different ways
- Let's take a look at some research designs…

THE UNIVERSITY OF MELBOURNE | Research Design

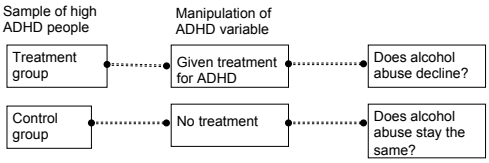
- Descriptive designs:
  - the researcher merely observes the occurrence of particular behaviours (no manipulation of variables)
  - eg. Proportion of alcohol abusers with ADHD



Question the researcher might ask: What is the proportion of people with ADHD who abuse alcohol?

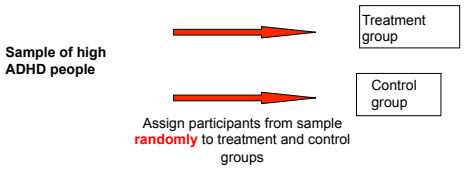
THE UNIVERSITY OF MELBOURNE | Research Design

- Experimental designs:
  - the researcher *manipulates* a variable in order to investigate its influence on some kind of behaviour (i.e., the DV);
    - experimental group (treatment group); control group



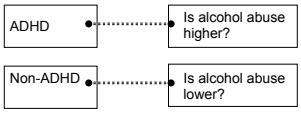
THE UNIVERSITY OF MELBOURNE | Research design

- **In experimental** designs:
  - participants randomly assigned to conditions of an experiment: **Random assignment design**
  - *Random* means each person has an equal probability of being in each condition



THE UNIVERSITY OF MELBOURNE | Research Design

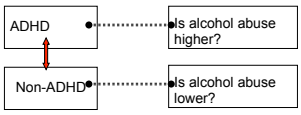
- Quasi-experimental designs:
  - the researcher does not manipulate variables, but assigns subjects to different groups based on their inherent differences; e.g.,
    - males & females
    - child, adolescent, & adult
    - **ADHD and non-ADHD**



THE UNIVERSITY OF MELBOURNE | Research Design

- **Matched groups** design:
  - each participant in one condition "matches" a participant in other condition on extraneous variables.
  - Rules out the extraneous variable as an explanation
  - *Extraneous* variables might be age, sex, pre-test score, etc

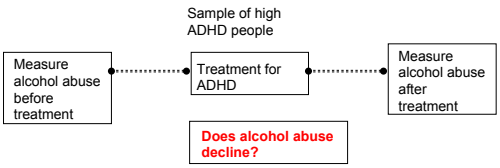
Each ADHD participant is *matched* with a non-ADHD participant with the same education



Because the two groups are matched on education, education cannot explain any differences in alcohol abuse

THE UNIVERSITY OF MELBOURNE | Research Design

- **Repeated measures** design:
  - each participant is measured several times
  - Is there a difference before or after some form of treatment or change?



THE UNIVERSITY OF MELBOURNE | **Activity Sheet Part B**

- **Now that you know more about the research process, let's do Activity Sheet 1, Part B.**

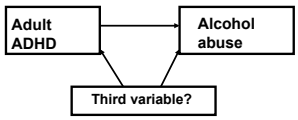
THE UNIVERSITY OF MELBOURNE | **What can go wrong with research? Study validity.**

Internal validity

– the degree of confidence we have in inferring a causal relationship between the IV and DV

– A "confounding variable" might be the real cause

Gravetter & Forzano (sections 6.2–6.4)



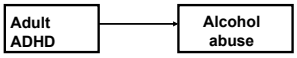
Maybe there is a third variable that explains both ADHD and alcohol use??

THE UNIVERSITY OF MELBOURNE | **What can go wrong with research? Study validity.**

External validity

– the degree to which the results generalise to other individuals and situations

Gravetter & Forzano (sections 6.2–6.4)



If the sample involves people from only low socio-economic groups, maybe the relationship does not hold for high socio-economic groups?

What can go wrong with research? Study validity.

Construct validity

– The extent to which an instrument actually measures the construct

Gravetter & Forzano (sections 3.3)

If there is poor measurement of alcohol abuse, then obviously a researcher cannot infer any association between the two variables.

Ethical considerations

Ethics

- As researchers we are bound by strict ethical guidelines. We must:
  - minimize harm;
  - respect privacy and confidentiality;
  - be competent in our research;
  - manage records appropriately;
  - obtain informed consent from participants
- See Gravetter and Forzano, Chapter 4

Summary

- Psychology deals with theories about people's behaviour conceived in terms of constructs
- Theories rely on research to guide, develop & test them
- Research questions are the engines driving such inquiry
- Answers to a research question require some kind of research design
- Samples and variables are components of research designs

THE UNIVERSITY OF MELBOURNE

Summary

- Variables relate to constructs
- Samples relate to populations
- Data are the "stuff" from which answers are obtained ~ evidence about theories
- Statistics are used to understand what is in the data, and to make inferences about the population

THE UNIVERSITY OF MELBOURNE

Feedback: Do I understand?

- Four sets of feedback multiple choice questions for practice via the web
  - *assessed as you go*

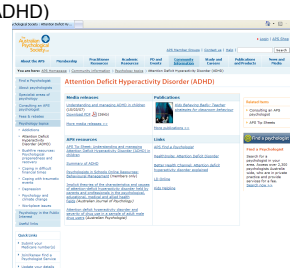
THE UNIVERSITY OF MELBOURNE

Australian Psychological Society

http://www.psychology.org.au

For your interest at home

In today's session, examples centered on the psychological construct of Attention deficit hyperactivity disorder (ADHD)



ADHD: for your interest at home

There are several interesting documents on ADHD in the Australian Psychological Society website: http://www.psychology.org.au/

- Look at the APS website
- Obtain electronic version of following article mentioned on the website:

  Yewers et al (2005). Attention deficit hyperactivity disorder and severity of drug use in a sample of adult male drug users. *Australian Psychologist, 40*, 109-117.

  Click Library on Melbourne Uni website

  Type the title of the article into "Discovery Search".

To aid your understanding of this article, download "QM Tute 1 Research Article Guide" from the LMS.

That's all, folks!

Next time we'll begin to talk about measuring psychological phenomena with numbers!

Rick Astley would never: