2017

Research Methods 2

EXAM

Good luck

YOU CAN DO IT!

Basic Research Skills

The Scientific Method

Canons of Science

Assume them to be true & they form the foundation of how science works

- *Determinism*: we believe that phenomenon has a cause of some kind and can learn them, that they're not just random events (not interested in coincidences or accidents)

- *Empiricism*: try and understand phenomenon and their causes by observing behaviours and taking measurements (key)

- *Parsimony*: is good science. If we have lots of theories that could explain a particular behaviour, we go for the simplest explanations (that work)

- *Testability*: important. Ideas about how something works (theory) → can make predictions which must be testable. Can't study it if you cannot test it

Laws, Theories, and Hypotheses – Distinction Between

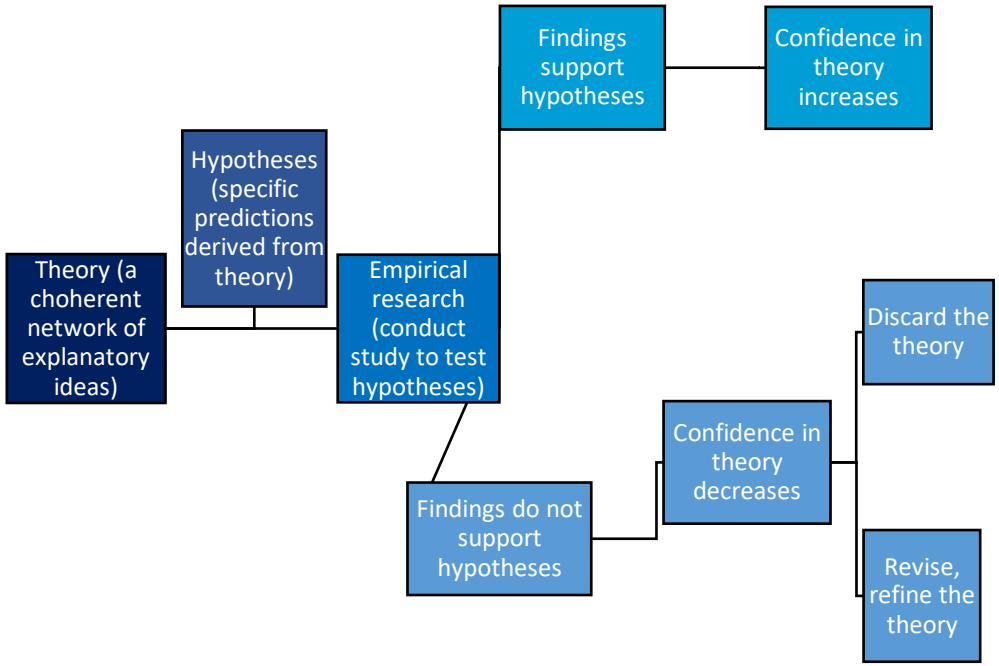
- *Laws*: Universal statements of the nature of things that allow reliable predictions of future events. High level theory essentially. (But don't worry about them because no psychology study has ever obtained law status – but we do have really good theories).

- *Theories*: constructs – general statements about the relationship between two or more constructs. Causal explanations of the world. Relate to all studies and are general. (Key terms: constructs & causes).

- *Hypotheses*: predictions about specific events that are derived from one or more theories. Not general, but specific and tied to the study you are doing. Comparing variables which relate & test the constructs of your theory.

Theory cycle

(Weiten 2004)



- Leads to confidence in theory or discarding the theory
- Just saying if we think one theory is better (never saying that it's 100% right)
- Any one individual study is never efficient (i.e., need many studies to determine if the results are reoccurring, then we might be able to make some more solid conclusions)

Key Concepts

Distinction between the following:

Constructs and variables

- *Constructs*: psychological phenomena (what we are interested in) – untestable
- *Variables*: what we actually measure to assess our constructs (how we decide to measure the construct) – testable

Theories and hypotheses

- *Theories*: constructs and causal links
- *Hypotheses*: relationships between variables (and NOT about causal links)

IV & DV

- *Independent variable*: presumed cause (predictor)
- *Dependent variable*: presumed outcome (outcome)

Measurement scales

- Classical distinction: nominal, ordinal, interval, ratio
    - *Nominal* = categories e.g., gender/religion (numbering the categories would mean that a different number represents a different group and has no value, e.g., ones not higher than the other, they're just different groups)
    - *Ordinal* = bit of order to it but differences between levels are unknown but can be anything (one is higher than the other – use numbers to indicate a group that is higher on the construct that you are trying to measure)
    - *Interval* = are similar to ordinal but has one extra feature; the difference between two levels is the same no matter what way we look at it
    - *Ratio* = score of 0 represents none of that particular characteristic (e.g., 0 actually means something)
- Categorical & continuous (quantitative vs. qualitative)
    - Ordinal = varies
    - Nominal = categorical
    - Interval & ratio = continuous

An Introduction to Experimental and Non-Experimental Designs

Conditions of a True Experiment

Random allocation: the group/condition that a participant gets allocated to is random

- This is important to minimise the differences between the groups/conditions (other alternative explanations are more likely is you do not randomly allocate)

Manipulation of the IV: the experimenter decides what the levels of the IV are and who gets them

Experiments allow us to:

- Rule out almost all alternative explanations; and
- Be confident that our manipulation caused changes in the DV

Check for:

- Confounds
    - The way you manipulate the variable
    - Did you unintentionally manipulate something other than the variable?
- Did the manipulation work? How can we tell?
    - Ask the participants with a questionnaire (manipulation check)
    - Pilot testing (do this before you begin the study)

Some Measurement Issues

(A greater focus will be given in later topics, however the role of measurement in the research process with be discussed at various times during the topic)

- Alternative explanations for our results

Basic Quantitative Data Analysis with One or Two Variables

A descriptive statistic is a (single) number that describes data (essentially summaries the data)

What is the best descriptive statistic to use?

- Depends on
    - Whether we are making a claim about a single phenomenon (construct); *or*
    - We want to describe relationships between two (or more) variables
    - How we measured our variable(s)
        - Categorical or continuous? Variable distinction

Univariate Descriptive Statistics

Describes one variable (simple questions) e.g., what is the rate of autism in the population? (variable = autism diagnosis)

A univariate descriptive statistic is a (single) number that summaries the data by:

- Describing features of how the scores are distributed in the data
- The features of the distribution of scores depends on how we measure our variable (categorical vs. continuous)

Questions to ask:

1. What is the variable?
2. How is it measured?
3. What descriptive statistic should we then use?

Categorical Variables

For each category/group:

- Frequencies; or
- **Percentages (proportions)** *better

These frequencies (or percentages/proportions) represent the distribution of scores

- How many participants scored that number/result

(Comparing group percentages/proportions)

Continuous Variables

Can get much more information and more features of the distribution

Key features:

- Central tendency – **mean**
- Variability (dispersion) – **standard deviation (SD)**

(Comparing group means)

Central Tendency

"The most likely value", "The most typical person", "the average person"

Statistics to measure central tendency

- Mean *most used
    - Average score of all the scores
- Median
    - Score of the person who is in the middle of the sample/distribution
- Mode
    - Score that occurs most frequently (highest point in the histogram on a graph)

Variability (Dispersion)

A measure of the extent to which the scores (people) in the sample vary

How we express that people are different

- No variability = everyone got the same score
- Large variability = means that scores that are quite discrepant from our scores of central tendencies

Statistics to measure variability (dispersion)

- Standard Deviation (SD) *most used
    - Average deviation from the mean

    - How each person is different from the mean and then the average of all those scores
    - Reflection, on average, how much people are different from the mean
    - Large: lot of people who are different from the mean
    - Small: people are clustered around the mean
- Range
    - Difference between the smallest score to the largest score (difference)
    - E.g., scores range from 15 – 109
- Interquartile Range
    - Represents the middle 50% of scores (ignores people in the bottom & top corners of the distribution)

Bivariate Descriptive Statistics

Two variables (more complex questions) e.g., are males at greater risk of being diagnosed with autism? (Gender = variable 1, Autism diagnosis = variable 2)

Used for describing the relationship between <u>two</u> variables

Questions to ask:

1. What are the variables?
2. Which one is the IV (presumed cause) and which one is the DV (presumed outcome)?
3. How are they measured (categorically or continually)?
    - We use different statistics depending on the scale of measurement for each variable
    - Possibilities:
        - Both categorical
        - Both continuous
        - One of each

When you use each and under what circumstances?

Statistical Decisions for Bivariate Descriptive Statistics

Table 5 (conceptually)

		DV (outcome)	
		Categorical	Continuous
IV (predictor)	Categorical		
	Continuous		

Correlations

A measure of a linear relationship

Point-Biserial Correlation Coefficient

For a categorical DV

Complex Questions

….

Evaluating Bivariate Descriptive Statistics – Effect Size

How we judge the strength of our bivariate descriptive statistics (measure of the strength of a relationship)

…..

For Correlation Coefficient & Point-Biserial Correlation:

…..

For Comparing Group Means

…..

For Comparing Percentages/Proportions

……

Inferential Statistical Analyses of Bivariate Relationships

…

- ….

Important to understand difference between *sample* and *population*

- ….

Problem of sampling error

- ….

Simulation on Sampling and the Sampling Distribution

….

Two main inferential statistics:

Confidence Intervals

- ….

Significance Tests

Two types:

- …

p values

- …

Interpreting a *p* value

- …

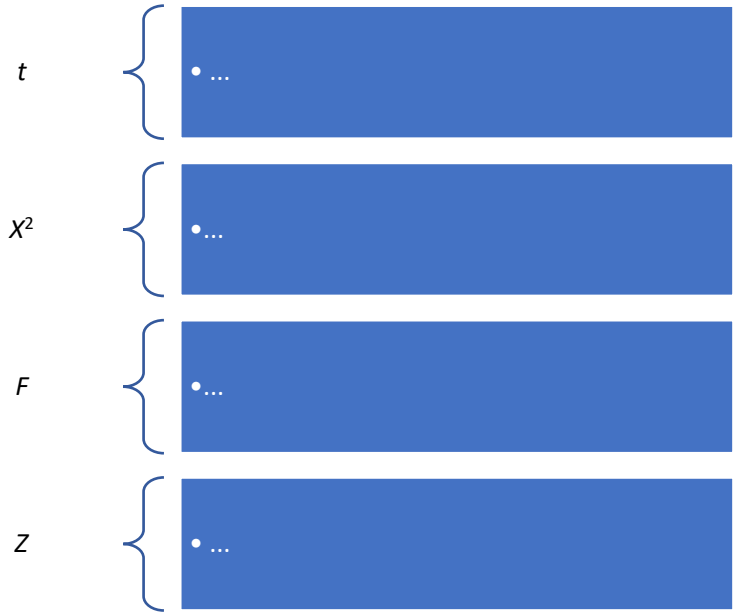
Reporting Significance Test Statistics

- ….

Distributional Statistics

….

Common ones are:



- …

Degrees of Freedom

…

p value

- …

Types of Designs for Comparing Groups

For continuous IVs:

- …

For categorical IVs:

…

Between-Subjects Design

- …

Within-Subjects Design

- …

We use different types of statistical tests depending on the type of design

- Categorical DV
  - …
- Continuous DV
  - …

Table 11

		Number of levels on the IV	
		Two-level (dichotomous)	Multiple-level
Design	Between-subjects		
	Within-subjects		

Experimental Design

Basics

Remember that it's not always an experiment!

Conditions of a true experiment:

- …

Experimental Realism

- …

Factorial Design

Applies to (many) designs involving <u>more than one</u> IV where they are categorical…

Statistical Analysis Decision Process

What you need to do when you have to make any statistical decisions

5 steps

1. …
   - Look at table 5!
2. …
3. …
   a. …
   b. …
   c. …
4. …
5. …

Statistical Analysis with SPSS and its Interpretation

Complete analyses including significance tests

Correlation

…

Assumptions for a Correlation

- …

Statistical Inference

- …

Effect size

- …

Chi-Squared Test of Independence

…

Need Contingency Table Analysis (Chi-Square Test)

- …

Assumptions for a Contingency Table Analysis

- …

Statistical Inference

- …

Effect Size

- …

Independent Samples *t*-test

Run our analysis then go through the steps:

3a. …

3b. …

3c. …

4. …

5. Write up your results

- …

Paired Samples *t*-test

Comparing two conditions from the same people

- …

Complex Quantitative Data Analyses Common in Psychological Research

Assumptions for ANOVA Models

- …

One-Way ANOVA

…

We have three groups – must take this into account for hypothesis

- …

Run the analysis and go through the steps!

Assumptions for all ANOVA models

- …

Inferential Statistics

This is a two-step process for this analysis:

- …

Two-Way Factorial ANOVA

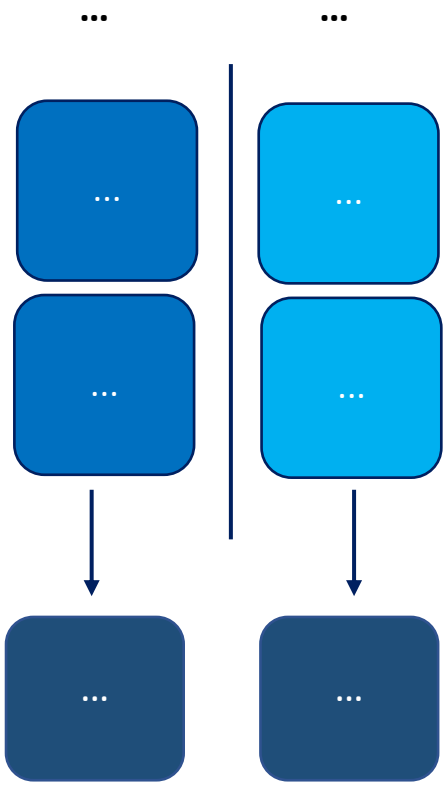
- …

Multiple Effects

…

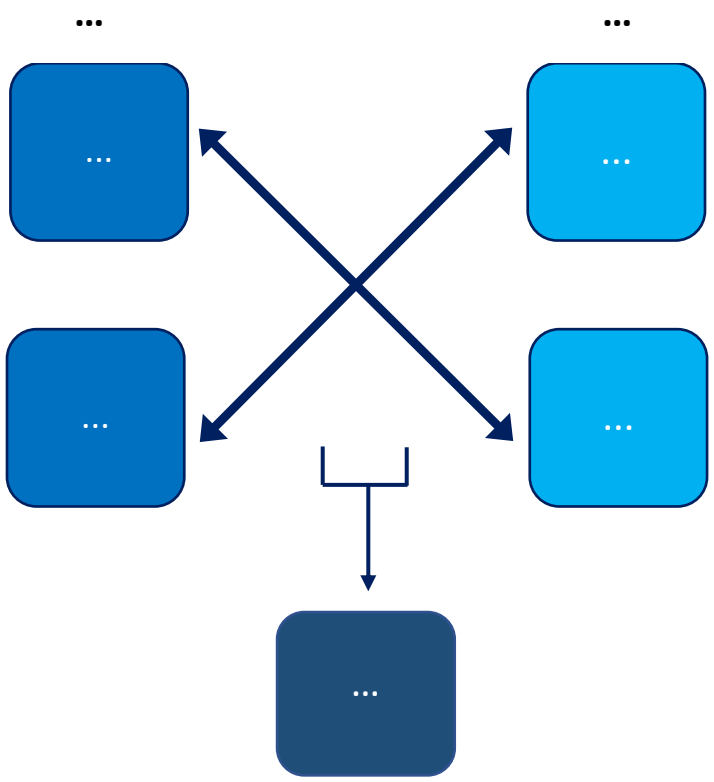
Main Effects

- …



Interaction

- …



Descriptive Statistics

Set up a table that includes both effects (main and interaction) for the descriptive statistics:

IV_2	IV_1	
	…	…
…		
…		
…		

Inferential Statistics

…

Multiple Regression Analysis – Interpreting a Significant Interaction

- …

Need to analyse the data in a way that matches ?? & ??!

- …

Hypotheses for an Interaction

- …

Regression and Non-Parametric Statistics

- …

Non-Parametric Statistics

- …

Non-Parametric Statistics

- …

Categorical variable	Parametric test	Non-parametric test
Dichotomous, between-subjects		
Dichotomous, within-subjects		
Multiple level, between-subjects		
Multiple level, within-subjects		

One-Tailed vs Two-Tailed Tests

Operational Definitions

- …

Power Analysis

- …

Effective Communication of Research Findings

Misinterpreting – Threats to Internal Validity

- …

Threats due to Changes Over Time

…

Threats due to Individual Differences

- …

Threats and Experimentation

  - …

Why Alternative Explanations Matter

- …

Correlational Research – How do we Misinterpret?

- …

Bi-directionality Problem

- …

Third Variable Problem

- …

How to deal with the bi-directionality and third variable problems

  - …

Writing Research Reports

Abstract

- …

Introduction

- …

Hypotheses

…

Two types:

Theoretical hypotheses

…

Research hypotheses

  - …

Method

  - …

Design Statements

- …

Results

…

Graphs

- …

Discussion

  - …

Appendices

…