

The University of Edinburgh

SCHOOL OF PHILOSOPHY, PSYCHOLOGY AND LANGUAGE SCIENCES

Psychology 2
PRACTICAL COURSE HANDBOOK
2013/2014

Psychology 2 Course Organiser

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Your Practical Session, Day & Time:

Your Tutor Name:

Tutor contact:

Psychology 2 Practical Course Timetable

Semester 1

Week	Beginning	Lecture Topics	Tutorial Topic	Textbook	Coursework	Deadline
1	16/9/13	Research design and ethics	No Tutorial			
2	23/9/13	Basic Statistical Concepts (1)	Basic statistical concepts - Manipulating Data	CH 3 & 4		
3	30/9/13	Basic Statistical Concepts (2)	Graphs & Charts and report writing	CH 6		
4	7/10/13	Correlation	No Tutorial		Draft Introduction & Methods Submission	Practical Time Mon. 2pm, Tues. 2pm, Wed. 10am or Wed. 2pm
5	14/10/13	Parametric 2-group comparisons	Correlation	CH 9		
6	21/10/13	Non-parametric 2-group comparisons	Parametric 2-group Comparisons	CH 10		<i>Work returned (in tutorials)</i>
7	28/10/13		No Tutorial		Draft Results & Discussion Submission	Practical Time Mon. 2pm, Tues. 2pm, Wed. 10am or Wed. 2pm
8	4/11/13		No Tutorial			
9	12/11/13		Non-parametric 2-group comparisons	Ch 23		<i>Work returned (in tutorials)</i>
10	18/11/13		No Tutorial			
11	25/11/13		No Tutorial		Final Report Submission	Mon. 25/11/2013 at 2pm
12	2/12/13		No Tutorial			

Semester 2

Week	Beginning	Lecture Topics	Tutorial Topic	Textbook	Coursework	Deadline
1	13/1/14	Frequency data	No Tutorial			<i>Work returned (from teaching office) by 17/1/2014*</i>
2	20/1/14	One way ANOVA	Frequency data	CH 15		
3	27/1/14	Post ANOVA comparisons	One way ANOVA	CH 12		<i>Provisional exam results posted on notice board by 30/1/2014</i>
4	3/2/14	Two way ANOVA (1)	No Tutorial			Practical Time Mon. 2pm, Tues. 2pm, Wed. 10am or Wed. 2pm
5	10/2/14	Two way ANOVA (2)	Post ANOVA comparisons/ Report writing	CH 13	Draft Introduction & Methods Submission	
6	17/2/14	Innovative Learning Week				

7	24/2/14	Qualitative data	Two way ANOVA (1)	CH 14		<i>Work returned (in tutorials)</i>
8	3/3/14		No Tutorial		Draft Results & Discussion Submission	Practical Time Mon. 2pm, Tues. 2pm, Wed. 10am or Wed. 2pm
9	10/3/14		No Tutorial			
10	17/3/14		Two way ANOVA (2)	CH 14		<i>Work returned (in tutorials)</i>
11	24/3/14		No Tutorial			
12	31/3/14		No Tutorial		Final Report Submission	Mon. 31/3/2014 at 2pm
						<i>Work returned (from teaching office) 28/4/14</i>
<p><i>* Timing may be later for individual students who submit coursework late. Otherwise, work will be returned on or before the date shown; if this date changes the class will be notified. All marks are provisional until confirmed by the pre-honours exam board in early June. These marks, together with Semester 2 exam marks, are returned to Registry after the board meeting; final marks become available on the student database shortly afterwards.</i></p>						

Introduction to the Course

1. Course Objectives

The Psychology 2 Practical Course is an independent component from the Psychology 2 Lecture Course. The Practical Course is designed to train you in the practical skills of doing Psychology. Its objectives are to help you:

- Understand how psychological theories are developed from experimental research
- Understand how psychologists design experimental studies and collect quantitative data
- Understand how statistical models and techniques help psychologists summarise data and evaluate results from experimental studies
- Develop your ability to critically assess psychological journal articles
- Develop your ability to interpret statistical information in general, and specifically to evaluate inferences and conclusions present in psychological literature

- Develop your ability to write about psychological topics and to report an experimental study accurately.

2. Course Outline

The Psychology 2 Practical Course is developed across both semesters. Practical sessions will be divided into a one hour large-group session (*tutorial*) followed by two hours in which you will carry out experiments and/or analyse data on the computers in the practical cubicles. The course follows an incremental structure: each tutorial and practical class builds on the previous one. Therefore, **it is very important that you do not miss tutorials or practical sessions during the course of the year.**

3. This handbook and further reading material

This handbook **is only intended as a guide** and is only the starting point of your learning process. In order for you to be able to reach any of the course objectives set out above, you will need to read further appropriate material for the practical course in the same way that you need to do appropriate reading beyond lecture notes.

Reading the recommended book chapters or journal papers will provide you with the minimal information that you will need for each of the research tasks that comprise the course. **However, you are expected to go beyond these initial recommended readings and independently select adequate literature as the course develops.**

4. Practical Course Requirements

4.1 Practical Course Attendance

These are the Psychology 2 Practical Course Attendance Guidelines:

- Attendance at *all* Practical Sessions is *compulsory* – i.e. it is a *course requirement*.
- If you miss a practical session for medical or serious personal reasons *or* if you expect to be absent from a future session because of medical or serious personal reasons please contact the Teaching Fellow and your Tutor by e-mail as soon as possible (stating your name and matriculation number).

- **If you fail to contact the Teaching Fellow about your absence, your Personal Tutor will be informed.**
- You should also obtain either a medical note or a letter from your Personal Tutor (in the case of serious personal reasons) and hand it to the Psychology 2 Course Secretary.

If you miss a session you are expected to complete the relevant practical tasks before the next practical session.

4.2 Practical Course Assessment

During the year you will be required to produce and hand in work to be assessed and to take an active part in the research experiment associated with the practical course. **It is a course requirement that you should submit all draft write-ups and final reports.** Even if they do not contribute to your final mark, the draft write-ups are extremely important to gain feedback from your Tutor. The draft write-ups are intended to highlight the areas you have to work on to achieve a good mark in the final report.

To make the course more interesting, we produce the dataset from your participation/collaboration. However there is a tight schedule and it is in your interest that you collect data or take part in the studies in a timely fashion, especially when the data collection exercises are not slotted within the practical sessions; non-compliance will affect the quality of the data and therefore affect the results for your reports! **All collected data must be kept and returned to your tutor when you submit your report.**

4.2.1 Assessed work deadlines and submission methods

Final reports should be handed in via the dedicated box situated in the entrance foyer in the Dugald Stewart Building AND ALSO submitted electronically through Turnitin. You must fill in and attach a Report Cover Sheet (these are available next to the box).

4.2.3 Report writing – structure and style

You will find the Guidelines for Report Writing in Appendix 2 of this Practical Handbook. In addition, it is strongly recommended that you consult the following for advice on writing reports and empirical papers:

- Sternberg, R.J. (1988). *The psychologist's companion: A guide to scientific writing for students and researchers* (2nd Ed). Cambridge: Cambridge University Press/British Psychological Society).
- Bem, D. J. (2003). Writing the empirical journal article. In J.M. Darley, M. P. Zanna, & H. L. Roediger III (Eds), *The Complete Academic*. Washington, DC: American Psychological Association. Retrieved on July 2006 from <http://dbem.ws/WritingArticle.2.pdf>

4.2.4 Report formatting requirements

- All reports must be word-processed;
- Reports should be a maximum of 3000 words (including abstract, title, references and excluding appendices)
- Reports should be printed using black ink on A4 paper
- Pages should be stapled together and clearly numbered
- Reports should be *double spaced* with *3 cm margins*, to enable markers to add comments
- Do not cut and paste basic default tables and graphs directly from SPSS – graphs can be edited in SPSS then pasted into Word
- It is acceptable for you to include *neat* hand-drawn graphics although it is preferable that you learn how to include tables and graphs directly into your document
- Each report must be accompanied by a completed cover sheet (available in the basement concourse, close to the report submission box)

4.3 Practical Session Conduct Guidelines

Punctuality

- When you arrive for your 3 hour practical session, you should go directly to your tutorial room for the first hour and sign the attendance sheet.
- It is essential that you are punctual, otherwise you will have great difficulty in understanding and carrying out the tasks in the practical session.
- At the end of your tutorial, you will go to the computer labs for the remainder of your practical session.

- You should go to the labs promptly, with the rest of your group, so that the group do not have to wait for you to start their work.

Participation and involvement

- You are expected to contribute and participate in all tasks during all practical sessions.
- In any team work, it is imperative that all members of the team contribute to each task to the same extent.
- It is not acceptable to deflect this responsibility and force others to do the work for you.

Use of mobile phones during the practical sessions

- Please ensure that your mobile is switched off throughout your practical session.

Ending and leaving your practical session

- When you have completed the session's tasks and objectives, **you must call on your Tutor** to assess whether your work has been completed successfully. Only then may you leave.

4.4 Practical Course Material

You are required to bring the following material to every practical session:

- This Practical Course Handbook
- The Practical Course textbook: Field, A. (2013). *Discovering Statistics Using SPSS*. London: Sage Publications Ltd.

We also strongly recommend that you consult in the library (or purchase) the following textbook:

- Howitt, D. & Cramer, D. (2008). *Introduction to Statistics in Psychology (4th Edition)*. Essex: Pearson Education Limited.

Please note that we have specified the 4th Edition of this book and not the most recent 5th Edition because the 5th Edition contains a number of errors in the mathematical formulas.

Statistics Software

SPSS (Statistic Package for the Social Sciences) is the software used to perform statistical analysis in this practical course. The most recent version of SPSS is available in every University

public lab. You can buy SPSS for your own laptop or computer from the Main Library helpdesk at around £35.

An important tip when you access data from multiple systems/locations: you should FIRST start SPSS, and then open your file through the Open command in the File drop-down menu. Do NOT try to open your file by clicking twice on it when in your data folder.

Saving and Backing up your data

It is important that you maintain multiple copies of your files and back up your documents and data.

Semester 1 – Tutorial 1 Week 2 (16/09/13 – 20/09/13)

TITLE:

Manipulating and Editing Data

TOPICS:

Review of basic statistical concepts
Introduction to SPSS environment

OBJECTIVES:

- Understand the relationship between a sample and population in statistical terms
- Define the different levels of measurement (nominal, ordinal, interval, ratio) and understand how they can be identified
- Review independent variables, dependent variables, and list the different designs for psychological studies
- Understand what hypotheses are – null hypothesis and alternative hypothesis
- Understand the format of an SPSS data file
- Manipulate the basic SPSS environment
- Enter some data into SPSS

Work BEFORE the session:

- Read Howitt & Cramer (2008), Chapters 1 and 9
- Revise your lectures notes on research and methodology from Y1

PRACTICAL SESSION:

- Field (2013), Chapters 3: Work through all of Chapter 3 up to the end of 3.7, except for the following:
Omit everything from p93 to the end of the yellow box on p97.
Omit '3.5.2.2 Creating a date variable' on p103.
Omit '3.5.3 Missing values' on p107.
- Smart Alex's tasks 2 and 6

COMPLETE BEFORE THE PRACTICAL SESSION:

What is a *variable* in statistical and research terms? Give 3 examples of *variables*.

Sampling

(Howitt & Cramer, 2008, Chapter 9)

How are *sample* and *population* of scores defined in statistics?

Sample:

Population:

Why does the size of a sample matter in statistical inference?

Imagine you were studying reaction time in a driving simulator. Would the following samples be good (or bad) representations of 'people as a whole'? Explain your reasons.

- a) Edinburgh Psychology undergraduates, randomly sampled
- b) Acquaintances of members of the Psychology undergraduate class, randomly sampled
- c) Cambridge housewives, randomly sampled
- d) People who agree to come to the lab to be tested when cold-called (phoned) at home
- e) Adults recruited in Princes Street gardens

Does the word 'random' have a specific meaning in statistics? Define what statisticians mean by a *random sample*.

Imagine you are trying to study the role of vision in ball-catching behaviour by briefly illuminating tennis balls at the start or towards the end of their flight path. You have recruited friends, 12 of whom are fielders from a local amateur cricket team, and 18 of whom have not had substantial practice in catching balls. You want to create two participant- groups of 15 each. Should you:

- a) Allocate all 12 cricketers, with 3 non-cricketers, to form one of the groups

b) Allocate half of the cricketers and half the non-cricketers to each group

c) Allocate participants to the two groups using a random number table, and disregarding their experience of catching

Explain your reasons for this choice of strategy for allocating participants to groups.

Types of measurement

(Howitt & Cramer, 2008, pp. 4-7)

Data generally fall into two broad categories and four sub-categories. Explain how you define each kind of data, and give an example:

1. Non-parametric data

a) Nominal

b) Ordinal

2. Parametric data

a) Interval

b) Ratio

Research design

Imagine a study aimed at understanding how high altitude slowed decision making. 12 mountaineers tackle a test involving a series of logical problems at 2,000 feet in the Scottish Highlands, and 12 more tackle the same test above 27,000 feet in the Himalayas. Time to complete the test was compared between the two groups.

- The *independent variable* is the variable that is being manipulated. In this example the independent variable is altitude;
- The *dependent variable* is the variable that is being measured. In this example the dependent variable is time to complete the test.

What other dependent variable could have been measured in this study?

Hypotheses

(Howitt & Cramer, 2008, pp. 96-98)

What do statisticians mean by:
The *null hypothesis*

The *alternative hypothesis*

Why is the concept of *null-hypothesis* so fundamental to inferential statistics?

Taking the example above, set out what would be possible experimental hypotheses in this study.

Again, what would be the related possible null hypotheses?

Hypothesising the direction of influence of one variable over the other – one-tailed and two-tailed studies.

- In a *one-tailed design*, we predict that one variable will change another in a particular direction. For instance, in a study to measure the effect of psychotherapy for anxious students, the prediction was that compared with the control group who had no therapy, the treated group would show a greater improvement (become less anxious).
- A *two-tailed design* implies no prediction of how one variable will influence another. It does state that there will be an effect. For instance, in a study to compare counselling and cognitive behavioural therapy as a treatment for anxiety, we might have no preconception about which treatment group would show greater improvement.

Give another example of each kind of design.

Practical Session

Field (2013), Chapters 3: Work through all of Chapter 3 up to the end of 3.7, except for the following:

Omit everything from p93 to the end of the yellow box on p97.

Omit '3.5.2.2 Creating a date variable' on p103.

Omit '3.5.3 Missing values' on p107.

Smart Alex's tasks

Task 2 – enter the data, creating a new file then:

1) In your own words, describe how to enter the gender variable

2) Draw a sample of what your data editor looks like

Task 6 – enter the data, creating a new file.

Write down anything you found difficult in this class and how you addressed it.

Semester 1 – Tutorial 2 Week 3 (23/09/13 – 27/09/13)

TITLE:

Exploring Data and Graphs & Charts

TOPICS:

Review of the components of a psychology journal article

Descriptive Statistics

Graphic Representation of Data

OBJECTIVES:

- Review the components of a psychology article (introduction, methods, results, discussion, references, and appendix) and understand what each part is for
- Define the mean, median, variance, and standard deviation of a set of data, and find the standard error of the mean
- Define quartiles, interquartile range, fences, outliers
- Understand and use a basic histogram, bar chart, box-plot
- Understand how simple transforms are used to improve normality (in the distribution of data)
- Understand the concepts of 'outliers' and 'extreme cases'
- Understand what demands your data needs to meet so that it is suitable for parametric statistical tests – i.e. parametric assumptions
- Explore data and create graphs and charts using SPSS

Work BEFORE the session:

- Read Howitt & Cramer (2008), Chapters 2-5 and 11

PRACTICAL SESSION:

- Field (2013), Chapter 4: Work through from the beginning of the chapter up to and including section 4.8.2 (you can omit 'Jane Superbrain 4.1', and section 4.7 Line charts). Stop at the end of section 4.8.2, on p153.
- Smart Alex's tasks 1,2,5,8 and 12

Understanding the components of a Psychology journal article

Journal articles in Psychology have a standard format which simplifies the task of readers, editors, and referees in picking out the essential information quickly. Understanding this standard format is important because it will allow you to:

- read original research articles efficiently,
- write structured and clear research reports for this course and beyond

Some journals depart from this format, for instance placing the Methods section at the very end of the article, or advising that the article is written as a whole, connected text as you would find in a newspaper. The standard format, however, is very widely used, and it is important that you master it in writing up your practical work.

The standard article / report format has the following components, in this order:

- Title
- Abstract
- Introduction
- Methods
- Results
- Discussion
- References
- (Appendix)

For more detailed information on these components consult:

- Appendix 2 of this handbook;
- Bem, D. J. (2003). Writing the empirical journal article. In J.M. Darley, M. P. Zanna, & H. L. Roediger III (Eds), *The Compleat Academic*. Washington, DC: American Psychological Association. Retrieved on July 2006 from <http://dbem.ws/WritingArticle.2.pdf>
- Sternberg, R. J. (1988). *The psychologist's companion: A guide to scientific writing for students and researchers*. Chapter X. Cambridge University Press. (Multiple copies, Edinburgh University Main Library)

You can find an example of this structure in:

- Skegg, K., Nada-Raja, S., Paul, C. & Skegg, D. C. G. (2007). Body piercing, personality, and sexual behavior. *Archives of Sexual Behavior*, 36, 47-54

TO BE COMPLETE BEFORE THE PRACTICAL SESSION:

Measures of central tendency

(Howitt & Cramer, 2008, Chapter 3)

Define the following concepts:

- Mode

- Median

- Mean

In choosing the appropriate measure of central tendency for your data set, what characteristics of your data set must you take into account?

What is the median of the following set of values?

a) 1 3 4 5 8 9 11 15 15

What is the median of the following set of values?

b) 1 3 6 11 15 19 24 24 29 33

What are the means of datasets a) and b) above?

Measures of Spread or Variability of scores

(Howitt & Cramer, 2008, Chapters 3 and 11)

Variance

Calculate the mean and variance of the following sample of data

c) 1 2 2 4 5 5 6 8 8 9

Mean:

Variance:

Standard error of the mean

Define (and understand the difference between) *standard deviation of scores* and *standard error of the sample mean*

Calculate the standard deviation of dataset c).

What is the standard error of the mean for dataset c)?

Upper (UQ) and lower quartiles (LQ) of a data set

Quartiles and the median divide the dataset into quarters, as follows:

1 3 4 LQ 6 8 11 MED 12 15 16 UQ 18 19 21

For this dataset

LQ = 5

MED = 11.5

UQ = 17

The shape of the distribution

(Howitt & Cramer, 2008, Chapter 4)

Using a simple line graph:

- a) represent graphically; and
 - b) describe what information is provided by the following curves, which represent the distribution of scores of an imagined data set
- A 'normal' curve
 - A positively skewed distribution
 - A steep distribution curve (leptokurtic curve)
 - A flat distribution curve (platycurtic)
 - A multimodal curve

Graphical Representation and exploration of the data

(Howitt & Cramer, 2008, Chapters 2 and 4)

Identify the characteristics and use of the following ways of graphically representing your data.

- Frequency tables
 - Bar Charts
 - Stem-and-leaf displays
 - Box-plots
 - Histograms
 - Error bars
-

Practical Session

- Field (2013), Chapter 4: Work through from the beginning of the chapter up to and including section 4.8.2 (you can omit 'Jane Superbrain 4.1', and section 4.7 Line charts). Stop at the end of section 4.8.2, on p153.
- Smart Alex's Tasks 1,2,3,5,8 and 12

Write a summary of what each graph shows

Task 1:

Task 2:

Task 3:

Task 5:

Task 8:

Task 12:

Semester 1 – Tutorial 3 Week 5 (14/10/13- 18/10/13)

TITLE:

Correlations

TOPICS:

Tests of association or correlation

OBJECTIVES:

- Correlation – definition and pitfalls in its interpretation
- The graphical representation of association – scatter plots
- Calculate by hand a Pearson or Spearman correlation on a small dataset
- Introduction to the idea of significance testing – how the Pearson correlation is tested for significance
- Explain how correlations are reported in the literature
- Run correlational analysis using SPSS

Work BEFORE the session:

- Background reading from Howitt & Cramer (2008), Chapters 6, 7, and 10

PRACTICAL SESSION:

- Field (2013) Chapter 7: Read and carry out tasks in sections 7.1, 7.2, 7.2.5, 7.3, 7.4.1, 7.4.2.1, 7.4.2.2 and 7.4.3. Finally, read 7.8 on how to report correlations.
- Smart Alex's Tasks 1, 2 and 3

TO BE COMPLETED BEFORE THE PRACTICAL SESSION:

Correlation

Consider the following:

“As ice cream sales increase, the number of shark attacks also increase. In other words, there is a strong positive correlation between ice cream sales and shark attacks.”

What does this tell us about the relationship between ice cream sales and shark attacks?

Is there a third variable which may be influencing both ice cream sales and shark attacks?

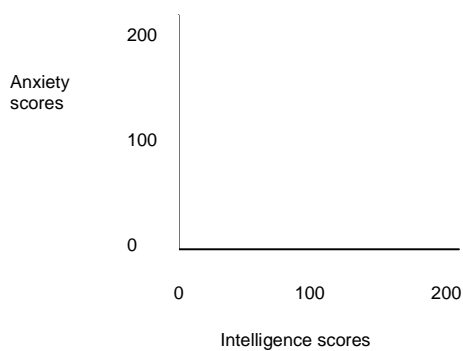
What types of research designs would allow you to establish a causal relationship between variables?

The graphical representation of association – scatter plots

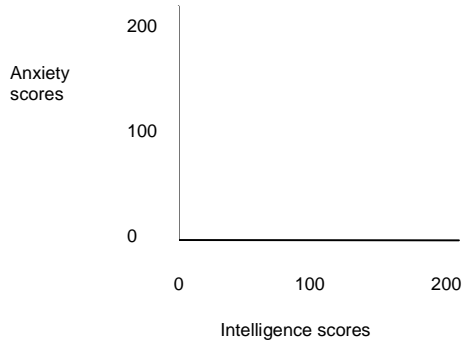
(Howitt & Cramer, 2008, Chapter 7)

From an imagined correlational study, take the x axis to represent scores on an intelligence measure, and the y axis to represent scores on a measure of trait anxiety. Use scatter plots (with a possible best fitting straight line) to represent the following relationships and describe what possible conclusions you may draw from them:

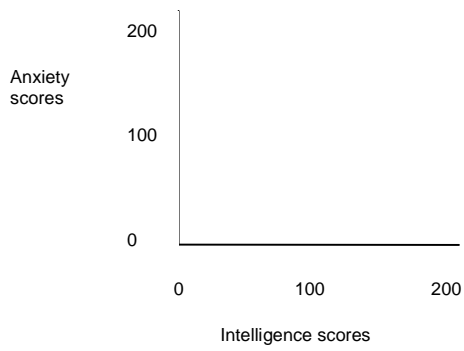
A positive correlation between intelligence test performance and anxiety



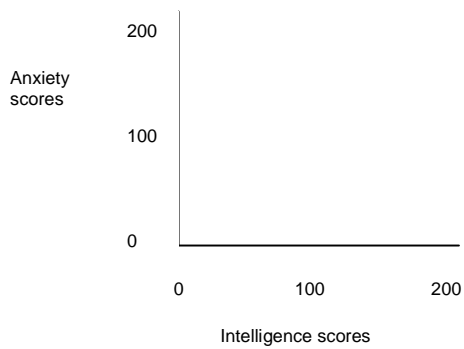
A negative correlation between intelligence and anxiety



A perfect negative correlation between intelligence and anxiety



No correlation between intelligence and anxiety



Correlation Coefficients – definitions

(Howitt & Cramer, 2008, Chapter 7)

What information does a *correlation coefficient* provide us with?

What types of correlation coefficients do you know and what types of data do they best fit?

Describe what the following features of an imagined Pearson Correlation Coefficient allow you to learn about the association between intelligence and trait anxiety with a correlation coefficient, $r = -0.42$.

The sign:

The value:

What conclusions can you draw from this value?

COMPLETE IN CLASS:

Calculate by hand the Pearson correlation coefficient for the data set handed out in the tutorial

$$Pearson\ r = \frac{\Sigma XY - \frac{\Sigma X \Sigma Y}{N}}{\sqrt{\left(\Sigma X^2 - \frac{(\Sigma X)^2}{N}\right) \left(\Sigma Y^2 - \frac{(\Sigma Y)^2}{N}\right)}}$$

What do statisticians mean by *probability testing* or *significance testing*?

Reminding yourselves that in statistics inferences are based on the characteristics of the population as defined by the null hypothesis, consider the following statements about probability or significance level p (also known as the α level).

p expresses...

- The likelihood (probability) of obtaining the scores in the sample by pure accident.
- The likelihood of the null hypothesis (H_0) being true.
- The likelihood of the experimental hypothesis (H_1) happening in the sample of scores if this sample comes from a population in which the null hypothesis (H_0) is assumed to be true.

Discuss how adequate each statement is.

What are the most commonly used (probability) *critical values*?

Going back to the value that you found for the correlation coefficient (r) above, determine if it is statistically significant at the 5% critical value (consult table in Howitt & Cramer, 2008, Appendix C).

Bringing it all together – how are correlations reported in the literature?

Take the following extract from a journal article as an example:

[The full reference for this article: Deady, D.K., Law Smith, M.J. (2006). Height in women predicts maternal tendencies and career orientation. *Personality and Individual Differences*, 40, 1, p. 17–25]

Abstract

Previous research has shown that variation in sex-specific personality traits in women can be predicted by measures of physical masculinisation (second to fourth digit ratio and circulating testosterone). This study aimed to test the hypothesis that certain sex-specific traits in women (maternal tendencies and career orientation) could be predicted by one index of masculinisation, height. Data was collected via online questionnaires. (...)

Results

Pre-reproductive women (age 20–29)

Normality of distribution of all the variables was tested for using Kolmogorov–Smirnov test. None of the variables were normally distributed (all z s > 2.7, all p s < .001). Therefore, the non-parametric statistic, Spearman’s rank correlation was used to analyse the height and personality relationships. **As age was not correlated with height ($r = -.002$, $p = .96$, $n = 678$), it did not need to be controlled for in the following analyses. As parental income whilst growing up was not correlated with height ($r = .04$, $p = .26$, $n = 671$) it also did not need to be controlled for in the following analyses.** Height was significantly negatively correlated with importance of having children ($r = -.24$, $p < .001$, $n = 678$) and self-rated broodiness ($r = -.22$, $p < .001$, $n = 678$). Height was significantly positively correlated with importance of having a career ($r = .11$, $p = .005$, $n = 678$) and career competitiveness ($r = .12$, $p = .003$, $n = 668$). Height was significantly negatively correlated with ideal number of children ($r = -.14$, $p < .001$, $n = 672$) and positively correlated with ideal own age at time of having first child ($r = .11$, $p = .004$, $n = 636$).

Examine how the correlation results are reported:

a) How do you evaluate the values of these correlation coefficients?

b) What do the authors mean by a “significant correlation”?

c) What conclusions might the authors have drawn from these results and how might they have *correctly* expressed them?

Have a closer look at the section in bold, why do you think the authors included this information in their reporting of results?

Practical Session

- Field (2013) Chapter 7: Read and carry out tasks in sections 7.1, 7.2, 7.2.5, 7.3, 7.4.1, 7.4.2.1, 7.4.2.2 and 7.4.3. Finally, read 7.8 on how to report correlations.
- Smart Alex's Tasks 1, 2 and 3

For each task, in your own words write a hypothesis for the study and summarise the results. Do your results support the hypothesis?

Task 1:

Task 2:

Task 3:

Semester 1 – Tutorial 4 Week 6 (21/10/13- 25/10/13)

TITLE:

Parametric 2-group Comparisons

TOPICS:

Inferential Statistics: Tests for comparisons between 2 groups (parametric tests)

OBJECTIVES:

- Understand the differences between 1-tailed and 2-tailed statistical tests
- Explain the differences between designs using related vs. unrelated groups
- Explain the use of Student's t-tests to
 - compare the mean of a single group with a theoretical value (e.g. zero)
 - compare the means of related and independent groups
- Explain how t-tests can be adapted where variance in the two groups is unequal
- Calculate by hand a related or independent t-test on a small dataset
- Explain how the results of t-tests are reported in the literature
- Conduct t-tests using SPSS

Work BEFORE the session:

- Read Howitt & Cramer (2008), Chapter 12, 13, 15, 16 and 17

PRACTICAL SESSION:

- Field (2013) Chapter 9: Work through section 9.1, the introductory paragraph of 9.2 and 9.3, 9.5.1, 9.5.3, 9.5.4, 9.5.6, 9.6.1, 9.6.3, 9.6.3.1, 9.6.5.
- Smart Alex's tasks 3 and 7.

TO BE COMPLETED BEFORE THE PRACTICAL SESSION:

1-tailed and 2-tailed statistical tests

(Howitt & Cramer, 2008, Chapter 17)

Provide an example of:

a) A one-tailed hypothesis:

b) A two-tailed hypothesis:

Thinking now in terms of probability, sketch (with a line graph) and explain in words the way in which the critical value of 5% probability is built up in each type of hypothesis testing:

Related vs. unrelated groups

This tutorial is concerned with statistically comparing one group of scores (one sample) with a second group of scores (another sample) which are defined by the 2 possible levels of one single independent variable (e.g. males vs. females, experimental vs. control subject)

What types of research questions would this design fit?

What sampling issues arise with each of these research questions?

In the following examples identify the dependent variable, independent variable, the levels of the independent variable, and if the design is unrelated (independent groups) or related (within-subjects and matched-pairs designs):

- “Time taken to correctly identify an embedded geometrical figure presented to the participants in their left visual field and in their right visual field”
 - DV?
 - IV?
 - Levels of IV?
 - Related or Unrelated?

- “Depression scores in healthy older adults, and those diagnosed with dementia”

- DV?
 - IV?
 - Levels of IV?
 - Related or Unrelated?
- “Observed collaborative behaviour score in construction task at 3 years old and 5 years old”
 - DV?
 - IV?
 - Levels of IV?
 - Related or Unrelated?

TO BE COMPLETED IN THE PRACTICAL SESSION:

Student’s t-test

(Howitt & Cramer, 2008, Chapters 12 and 13)

One-sample t-test

Compares the mean of a single group to a theoretical value (e.g. zero). Briefly describe a study for which this would be the appropriate test statistic.

t- test for related samples:

Compares the means of two related samples scores to see whether the means differ significantly. Describe a study for which this would be the appropriate test statistic.

t- test for unrelated samples:

Compares the means of two unrelated samples of scores (ex. two separate groups) to see whether the means of the two groups differ significantly. Describe a study for which this would be the appropriate test statistic.

What does Levene’s test check for?

Calculate by hand a related/unrelated t-test using the dataset handed out in the tutorial

(Howitt & Cramer, 2008, Chapters 12 and 13)

Unrelated:

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\left(\frac{(\sum X_1^2 - \frac{(\sum X_1)^2}{N_1}) + (\sum X_2^2 - \frac{(\sum X_2)^2}{N_2})}{N_1 + N_2 - 2} \right) \left(\frac{1}{N_1} + \frac{1}{N_2} \right)}}$$

Related:

$$t = \frac{\bar{D}}{SE \text{ of difference scores}}$$

Bringing it together – how are results of t-tests reported in the literature

(Howitt & Cramer, 2008, Chapter 16)

t-test results are reported in a specific manner. Notice the elements that are reported and the order in which they appear:

- The statistical distribution used (in this case *t*)
- The degrees of freedom
- The result of your calculation
- The probability (or significance level)
- The type of hypothesis, one or two tailed

Take the following elements: $p < .001$; $df=85$; two tailed, $t = 11.69$. Put them in the correct order for expressing a result of a group comparison using a *t*-test

Read the following extract from a journal article, focusing on the way the authors report the results

[McLean, D. K., et al. (2000). Ascription of resemblance of newborns by parents and nonrelatives. *Evolution and Human Behavior*, 21, 11-23, from pp. 15-16]

In experiment 1, where photographs of adult males and females were simultaneously presented, judges correctly matched newborns to parents at a significantly higher mean rate than the 3.33 expected by chance (mothers: $t = 6.14$, $df = 159$, $p < .001$; fathers: $t = 2.51$, $df = 159$, $p < .025$). Mothers were matched to their newborns at a significantly higher rate than were fathers (mean match-difference = 0.44, $SE = 0.19$, $t = 2.31$, $p < .05$, $df = 159$, paired-difference *t*-test).

a) What do the authors mean by “significantly higher”?

b) What conclusions can the authors draw from these results and how would you *correctly* express them?

Practical Session

- Field (2013) Chapter 9: Work through section 9.1, the introductory paragraph of 9.2 and 9.3, 9.5.1, 9.5.3, 9.5.4, 9.5.6, 9.6.1, 9.6.3, 9.6.3.1, 9.6.5.
- Smart Alex’s tasks 3 and 7.

For each task, in your own words write a hypothesis for the study and summarise the results. Do your results support the hypothesis?

TASK 3:

TASK 7:

Semester 1 – Tutorial 5 Week 9 (11/11/13- 15/11/13)

TITLE:

Non-parametric 2-group comparisons

TOPICS:

Non-parametric tests

OBJECTIVES:

- Understand the context in which non-parametric tests are used in place of parametric alternatives
- Know about the following generally-useful non-parametric tests
- Carry out by hand a simple non-parametric test on a small dataset
- Carry out non-parametric tests using SPSS

Work BEFORE the session:

- Read Howitt & Cramer (2008), Chapter 18

PRACTICAL SESSION:

- Field (2013), Chapter 6: Work from the beginning, but leave out section 6.4.1 and section 6.4.2. You'll need to enter the data from Table 6.1 into SPSS. Now do section 6.4.3, 6.4.4, and 6.4.6. (You can leave out the box at the top of p223). Now turn to section 6.5 on p228. Read the introductory paragraph, then leave out section 6.5.1, and do sections 6.5.2, 6.5.3, 6.5.4 and 6.5.6. You don't need to do any of the rest of the chapter.
- Smart Alex's tasks 1 and 2

TO BE COMPLETED BEFORE THE PRACTICAL SESSION:

The importance of non-parametric statistics

Howitt & Cramer, (Chapter 18, and Appendix B1 and B2)

What type of data is analysed using non-parametric statistics?

The null hypothesis suggests:

The alternative hypothesis suggests:

What are the disadvantages of using non-parametric analyses?

What are the similarities between parametric and non-parametric tests?

- If for parametric data you would use an independent-groups **t-test**, then if you have non-parametric data you would use:
- If you would use a **related t-test**, then with non-parametric data:
- If you would use an **independent groups one-way ANOVA**, then with non-parametric data you would use:
- If you would use a **related one-way ANOVA**, then with non-parametric data you would use:
- If you would use a **Pearson Correlation**, then with non-parametric data you would normally use:

TO BE COMPLETED IN CLASS:

Calculate by hand a Mann-Whitney U test on the dataset handed out in the tutorial:

(Howitt & Cramer, 2008, pp. 174-176)

$$\text{Mann-Whitney } U = (N_1 * N_2) + \frac{N_1 * (N_1 + 1)}{2} - R_1$$

(R_1 = sum of ranks for the larger group)

Calculate by hand a Wilcoxon Matched Pairs test using the dataset handed out in class:
(Howitt & Cramer, 2008, pp. 172-174)

Wilcoxon

1. Rank the Ds, ignoring their sign
2. Separately, sum the ranks for the positively and negatively-signed Ds
3. T = smaller of the two sums of ranks

Practical Session

- Field (2013), Chapter 6: Work from the beginning, but leave out section 6.4.1 and section 6.4.2. You'll need to enter the data from Table 6.1 into SPSS. Now do section 6.4.3, 6.4.4, and 6.4.6. (You can leave out the box at the top of p223). Now turn to section 6.5 on p228. Read the introductory paragraph, then leave out section 6.5.1, and do sections 6.5.2, 6.5.3, 6.5.4 and 6.5.6. You don't need to do any of the rest of the chapter.
- Smart Alex's tasks 1 and 2

For each task, in your own words write a hypothesis for the study and summarise the results. Do your results support the hypothesis?

Task 1:

Task 2:

Semester 2 – Tutorial 1 Week 2 (20/1/14 – 24/1/14)

TITLE:

Frequency Data

TOPICS:

Nominal data

OBJECTIVES:

- Understand measures of association to analyse nominal data
- Carry out by hand a Chi-square analysis
- Analyse frequency data using SPSS

Work BEFORE the session:

- Read Howitt & Cramer (2008), Chapter 14

PRACTICAL SESSION:

- Field (2013), Chapter 18: Read sections 18.1, 18.2, 18.3 (first paragraph then go to section 18.4) and complete until end of section 18.5.4. Finally, read section 18.5.7.
- Smart Alex's tasks 1,2,3,4 and 5.

Chi-square analysis

The formula for Chi-square (χ^2) is as follows:

$$\text{Chi-square} = X^2 = \sum \frac{(O - E)^2}{E}$$

where O = observed frequency in a particular cell

E = expected frequency in the same cell, calculated from marginal totals

Sum = the sum is over all the cells of the contingency table

What is the observed frequency?

The expected frequency can be calculated as follows:

$$\text{Expected frequency} = \text{frequency for that type of respondent} \times \frac{(\text{frequency for the group})}{(\text{total number of responses})}$$

Observed Frequencies of Boys and Girls TV preferences

Preference	Boys	Girls	Row frequencies
Violent TV preferred	40	15	55
Non-violent TV preferred	30	70	100
Column frequencies	70	85	Overall frequency = 155

Inserting the expected frequencies:

Preference	Boys	Girls	Row frequencies
Violent TV preferred	observed = 40	observed = 15	55
	expected =	expected =	
Non-violent TV preferred	observed = 30	observed = 70	100
	expected =	expected =	
Column frequencies	70	85	Overall frequency = 155

You can now calculate the Chi-square for the data set.

The degrees of freedom are:

Using the Chi-Square value you obtained and the degrees of freedom, consult a table (H&C, Appendix F) of minimum acceptable values needed for significance for the Chi-Square test at a given level.

The results are reported in a similar way to other test you have seen, e.g.

There was a significant gender difference in favourite type of TV programme ($\chi^2=13.56$, $df = 1$, $p < 0.05$).

Practical Session

- Field (2013), Chapter 18: Read sections 18.1, 18.2, 18.3 (first paragraph then go to section 18.4) and complete until end of section 18.5.4. Finally, read section 18.5.7.
- Smart Alex's tasks 1,2,3,4 and 5.

For each task, in your own words write a hypothesis for the study and summarise the results. Do your results support the hypothesis?

Task 1:

Task 2:

Task 3:

Task 4:

Task 5:

Semester 2 – Tutorial 2 Week 3 (27/1/14- 31/1/14)

TITLE:

One-way ANOVA

TOPICS:

One-way ANOVA

OBJECTIVES:

- Explain why, to compare 3 or more groups, a single one-way ANOVA is preferred to t-tests
- Understand and explain the different elements of an ANOVA table
- Calculate by hand a one-way ANOVA on a small dataset
- Explain how the results of ANOVA are reported in the literature
- Run a one-way ANOVA in SPSS

Work BEFORE the session:

- Background reading from Howitt & Cramer (2008), Chapters 19-21

PRACTICAL SESSION:

- Field (2013), Chapter 11: start at section 11.6 (p460) leaving out 11.6.2 and 11.6.5. Carry on with 11.7 leaving out 11.7.2. Finally, read section 11.9 on p474.
- Smart Alex's task 1

TO BE COMPLETED BEFORE PRACTICAL SESSION:

Looking for differences.

If Anne's school primary had 6 teachers at the same level, how many 2-group comparisons would be necessary to check for differences between the arithmetic marks of their classes?

What is meant by Type I and Type II errors? (Howitt & Cramer, 2008, p. 100)

One-way ANOVA

Describe the two types of one-way ANOVA:

- An **uncorrelated** or **unrelated** 1-way ANOVA:
- A **correlated** or **repeated measures** 1-way ANOVA:

Some technical terms relating to ANOVA designs

(Howitt & Cramer, 2008, Chapter 20)

On the basis of your background reading, explain the following technical terms:

- Factor
- Level
- Degrees of freedom
- Sum of Squares (SOS)
- Mean Square (MS)

What properties of the data should be checked before a parametric ANOVA is employed?

TO BE COMPLETED IN CLASS:

ANOVA: Basic steps

<p><u>One-way ANOVA</u></p> $\text{Correction Factor} = \frac{G^2}{N}$ $SS_{[total]} = \sum X^2 - \frac{G^2}{N}$ $SS_{[between]} = \sum \left(\frac{T_i^2}{N_i} \right) - \frac{G^2}{N}$ $SS_{[error]} = SS_{[total]} - SS_{[between]}$ <p>(where T_i is the individual column totals)</p>	<p><u>One-way ANOVA (related)</u></p> $\text{Correction Factor} = \frac{G^2}{N}$ $SS_{[between\ people]} = \frac{\sum P_i^2}{\text{Number of columns}} - \frac{G^2}{N}$ $SS_{[between\ conditions]} = \frac{\sum C_i^2}{\text{Number of rows}} - \frac{G^2}{N}$ $SS_{[residual\ error]} = \sum X^2 - \frac{\sum C_i^2}{\text{Number of rows}} - \frac{\sum P_i^2}{\text{Number of columns}} + \frac{G^2}{N}$ <p>(where P_i is the individual participant totals and C_i is the individual column totals)</p>
--	--

Where: $\sum X^2$ = the sum of the squares of each score
 $(\sum X)^2$ = the square of the sum of all scores
 N = the number of scores
 N-1 = the degrees of freedom

Therefore, you can calculate the variance of all scores across all groups using this formula, and tabulate the following overall values:

- Total Sum of Squares (SOS), corrected to reflect deviations around the grand mean
- the corresponding degrees of freedom (df)
- and Mean Square (MS = SOS/df), the variance estimated mentioned above

In the example below, calculate the degrees of freedom for the group factor (with 3 levels):

Also, calculate the degrees of freedom for the error component:

Simon's class	Helen's class	Anne's class
10	15	24
11	12	20
15	16	19
8	10	16
16	18	28
12	17	23
10	15	22

- The null hypothesis suggests that differences between the groups are due to sampling error, rather than real differences related to the influence of the independent variable.
- If the null hypothesis is correct, the variance estimate derived from the true score should be no different from the variance estimate derived from the error scores. After all, under the null hypothesis the variation in the true scores is due to sampling error, anyway.
- If the alternative hypothesis is correct, then there should be rather more variation in the true scores than is typical in the error scores.

Therefore, the greater the difference between these two variances, the more likely that the hypothesis is correct.

Equality between these two components of variance is tested by calculating the ratio of **between-groups variance** to **error variance** (termed **F**). The greater the ratio, the lower the chance that differences among groups can be explained purely in terms of sampling error.

The **F-ratio test** (variance ratio test) involves the following calculation:

$$F = (\text{Variance estimate}_{\text{true scores}}) / (\text{Variance estimate}_{\text{error scores}})$$

The value obtained for the F-ratio determines if there is a significant difference between the component due to between-group differences and the component arising from error.

Compare the calculated F-value to a table of critical F-values for the appropriate number of degrees of freedom (between-groups df vary across the top of these tables, error df vary down the side of the table) and significance level ($p=0.05$, 0.01 , etc.).

A value of F higher than the tabulated critical value indicates that the observed between-groups difference is unlikely to have occurred by chance. The choice of significance level, as you have already learned, lets you choose how strictly you want to ensure that you do not reject the null hypothesis when the observed result is due to chance; with the 1%

significance level, the tabulated value of F will only be exceeded by chance in 1 % of cases when there is no real difference among groups. If the value of F is lower than the appropriate tabulated value, there is no statistically significant difference among the groups.

Displaying your ANOVA results correctly

Source of Variation	Sum of Squares	Df	Mean Square	F-ratio	P
Between Groups	368.667	2	184.333	$(184.333)/(10.349) = 17.811$	0.000
Error (within Groups)	186.286	18	10.349		
Total	554.952	20			

Notice that...

- The upper two Sums of Squares add up to the total Sum of Squares, and that the upper two df values add up to the total df in the bottom row;
- Each Mean Square is calculated as SOS/DF, e.g. $184.333 = 368.667/2$.
- We never use the Total SOS to calculate the Mean Square in the bottom row of the table.

Using information extracted from the table (notice that you need both the between-groups and the error or within-groups df), you might write:

There was a significant effect of the teacher on children's scores in the reading test ($F(2,18) = 17.811, p < 0.001$).

It is crucial to understand where the values from the table are used in the text and what the values in the table tell you.

Fill in the missing values in the table below [look up the p value in Howitt & Cramer (2008)], and answering the following questions:

- How many participants were involved in this study, overall?
- How many groups were employed?
- How many participants were there in each group?

Source of Variation	Sum of Squares	Df	Mean Square	F-ratio	P
Between Groups	68.222	3			
Error (within Groups)		16			
Total	87.556				

Perform a one-way ANOVA by hand on a dataset handed out in the tutorial using the 'quick method' (Howitt & Cramer, 2008, pp. 199-202 and p. 215-216).

Follow the various steps listed in Howitt & Cramer (2008) to work out the SOS values that you will need. Then:

- Draw up an ANOVA table and fill in all of the cells
- Use the information in this table to find an F value
- Look up this F value in H&C and see if, given the df, if this value is significant

Is the F value significant? Report the F value in APA format here:

Practical Session

- Field (2013), Chapter 11: start at section 11.6 (p460) leaving out 11.6.2 and 11.6.5. Carry on with 11.7 leaving out 11.7.2. Finally, read section 11.9 on p474.
- Smart Alex's task 1

In your own words write a hypothesis for the study and summarise the results. Do your results support the hypothesis?



Semester 2 – Tutorial 3 Week 5 (10/2/14- 14/2/14)

TITLE:

Multiple Comparisons in ANOVA and Report Q & A

TOPICS:

Multiple Comparisons in ANOVA
Report Q&A

OBJECTIVES:

- Understand when and why post ANOVA comparisons are used
- Understand the difference between planned and post-hoc comparisons
- How to choose appropriate contrasts
- Explain how post ANOVA comparisons are reported in the text
- Carry out and interpret post ANOVA comparisons using SPSS

Work BEFORE the session:

- Read Howitt & Cramer (2008), Chapter 23

PRACTICAL SESSION:

- Field (2013) read section 11.4
- Complete Questions 1-4 of the Research Design Exercise (See Appendix 1).
- Smart Alex's tasks 3 and 6.

When the F-ratio is statistically significant for a one-way ANOVA with 2 groups (levels) then we know that the means of the two groups are different as there are no other groups to compare with.

When the F-ratio is statistically significant for a one-way ANOVA with more than 2 groups (levels) then we need to determine which groups differ significantly from each other. This is because a statistically significant F-ratio indicates that there is a difference between the means of at least 2 of the groups however it does not indicate exactly where these differences lie.

Following a significant result in an ANOVA where there are more than two groups, it is common to carry out multiple comparisons to determine where the differences in the means of each of the groups lie.

Review

Explain what is meant by the following:

Type I error:

Type II error:

It is important to bear these in mind when carrying out any multiple comparisons in ANOVA as The more comparison you make between pairs of means the more likely is a significant difference merely due to chance.

Multiple comparison procedures are established to control the type I error rate in some way

There are two main types of comparisons that can be carried out. **Describe the two types below.**

Planned Comparisons:

Post hoc Comparisons:

Now explain when you would use each type of comparison:

Planned Comparisons:

Post hoc Comparisons:

Example:

It is predicted that students will learn most effectively with a constant background sound, as opposed to an unpredictable sound or no sound at all. She randomly divides twenty-four students into three groups of eight. All students study a passage of text for

30 minutes. Those in group 1 study with background sound at a constant volume in the background. Those in group 2 study with noise that changes volume periodically. Those in group 3 study with no sound at all. After studying, all students take a 10 point multiple choice test over the material. Their scores follow:

Group	Test scores	Mean
Constant sound	7 4 6 8 6 6 2 9	
Random sound	5 5 3 4 4 7 2 2 3	
No Sound	2 4 7 1 2 1 5 5	

Given that $F(2,21) = 3.59, p < 0.05$;

Which (if any) planned comparisons would you make on this data? (i.e. based on the hypothesis)

Which post-hoc comparisons would you carry out?

Assuming that the tests you wish to carry out are significant, report the results of this one-way ANOVA and multiple comparisons as you would in a results section of a psychology report.

Describe the differences between the following types of post hoc tests (your lecture notes should help you with this):

Least Significant Difference (LSD)

Tukey honest significant difference (HSD)

Newman-Keuls

Bonferroni (Dunn)

Scheffé

Dunnet Method

PRACTICAL SESSION:

- Field (2013) read section 11.4
- Complete Questions 1-4 of the Research Design Exercise (See Appendix 1).
- Smart Alex's tasks 3 and 6.

In your own words write a hypothesis for the study and summarise the results. Do your results support the hypothesis?

Semester 2 – Tutorial 4 Week 7 (24/2/14 – 28/2/14)

TITLE:

Two-way ANOVA

TOPICS:

Two-way ANOVA - Independent groups

OBJECTIVES:

- Explain how a two-way ANOVA differs from a one-way ANOVA
- Understand what is meant by main effects and interactions
- Understand how to determine what kind of 'design' an experiment has
- What are the IVs and how many levels does each have
- What is the DV (or the DVs)
- Design differences (Between subjects, Mixed, Within subjects)
- Perform a 2-way independent ANOVA on a suitable dataset with SPSS

Work BEFORE the session:

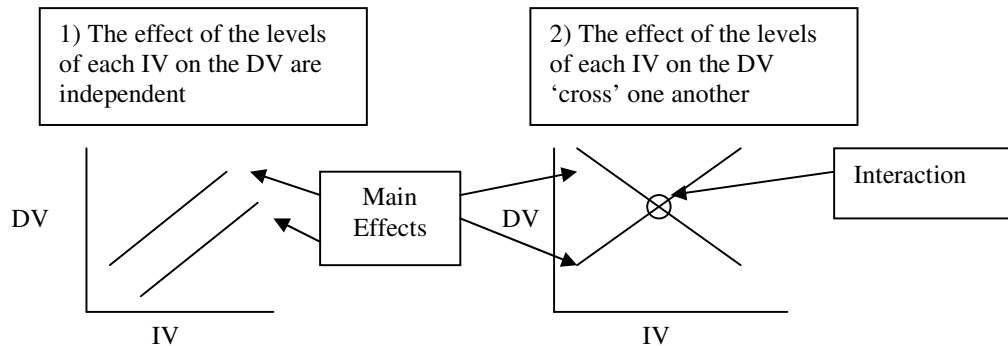
- Read Howitt & Cramer (2011), Chapter 22

PRACTICAL SESSION:

- Field (2013), Chapter 13: Read from the beginning of the chapter up to the end of first paragraph on p510. Now work through from section 13.4 leaving out 13.4.4, 13.4.5, 13.4.6. Work through all of section 13.5 leaving out 13.5.4. Then do 13.6 and 13.8.
- Smart Alex's task 1

TO BE COMPLETE BEFORE TUTORIAL:

How does a 2-way ANOVA differ from 1-way ANOVA?



What is a main effect?

What is an interaction?

What is a 'between subjects' IV?

What is a 'within subjects' IV?

Consider the effects of years of playing pool and anxiety on performance. Our IV 'years of playing' splits competitors into: professionals and amateurs. Our IV 'anxiety' also has two levels: some players are comfortable before the match, others feel the pressure. This would make the study a 2 x 2 design.

Is the years of playing variable a between or within subjects IV?

Is the anxiety variable a between or within subjects IV?

In the blank space provided, draw a line graph of the scores of each group (where the x-axis represents levels of the anxiety IV, and the y-axis represents performance) when:

1) **No** interaction is occurring. What does this mean?

2) The amount of anxiety **interacts** with level of experience. What does this mean?

Why not just run two separate ANOVAs?'

Going back to the playing pool example:

1) How many IV's there are?

2) How many levels are in each IV?

Give examples of a 2 x 3 between subjects design.

Give examples of a 2 x 2 within subjects design.

Give examples of a 2 x 3 mixed design.

COMPLETE IN CLASS:

Carry out a two way independent ANOVA on the dataset handed out in class:

Two-Way ANOVA (independent groups)

Correction Factor = G^2/N

$$SS_{\text{tot}} = \sum X^2 - \frac{G^2}{N}$$

$C = \Sigma$ (squares of column totals)/(N of scores per column)

$R = \Sigma$ (squares of row totals)/(N of scores per row)

$T = \Sigma$ (squares of cell totals)/(N of scores per cell)

$$SS_{\text{IV(rows)}} = R - G^2/N$$

$$SS_{\text{IV(cols)}} = C - G^2/N$$

$$SS_{\text{interaction}} = T - R - C + G^2/N$$

$$SS_{\text{error}} = \sum X^2 - T$$

Practical Session

- Field (2013), Chapter 13: Read from the beginning of the chapter up to the end of first paragraph on p510. Now work through from section 13.4 leaving out 13.4.4, 13.4.5, 13.4.6. Work through all of section 13.5 leaving out 13.5.4. Then do 13.6 and 13.8.
- Smart Alex's task 1

In your own words write a hypothesis for the study and summarise the results. Do your results support the hypothesis?

Semester 2 – Tutorial 5 Week 9 (17/3/14 – 21/3/14)

TITLE:

Two-way ANOVA continued

TOPICS:

Two-way ANOVA – Within Subjects

OBJECTIVES:

- Explain how a two-way ANOVA differs from a one-way ANOVA
- Understand what is meant by main effects and interactions
- Understand how to determine what kind of ‘design’ an experiment has
- What are the IVs and how many levels does each have
- What is the DV (or the DVs)
- Design differences (Between subjects, Mixed, Within subjects)
- Perform a 2-way within subjects ANOVA on a suitable dataset with SPSS

Work BEFORE the session:

- Read Howitt & Cramer (2008), Chapter 22

PRACTICAL SESSION:

- Field (2013), Chapter 14: Read through from the beginning to the end of section 14.2.1, and then read section 14.2.3. Work through sections 14.5.1, 14.5.4, 14.6.1, 14.6.2, 14.6.3, 14.6.5, and 14.8.
- Complete questions 5 and 6 of Research Design Exercise (Appendix 1).
- Smart Alex’s task 5.

PRACTICAL SESSION:

- Field (2013), Chapter 14: Read through from the beginning to the end of section 14.2.1, and then read section 14.2.3. Work through sections 14.5.1, 14.5.4, 14.6.1, 14.6.2, 14.6.3, 14.6.5, and 14.8.
- Complete questions 5 and 6 of Research Design Exercise (Appendix 1).
- Smart Alex's task 5.

In your own words write a hypothesis for the study and summarise the results. Do your results support the hypothesis?

Appendix 1

Research Design Exercise

You are interested in examining the effect eating breakfast has on learning and concentration throughout the day. Consider the following research questions on how to address this and answer the questions below.

- 1) Do those who eat breakfast perform better on a maths equation learning task than those who don't eat breakfast?

Please state:	
Null hypothesis	
Alternate hypothesis	
Research design (as you would write in a methodology)	
Type of data	
Statistical test you would use	

- 2) You found that the people who ate breakfast perform significantly better on the task than those who didn't. You now want to consider if the improved performance in those who ate breakfast is maintained throughout the day by testing them first thing in the morning and then again after lunchtime.

Please state:	
Null hypothesis	
Alternate hypothesis	
Research design (as you would write in a methodology)	
Type of data	
Statistical test you would use	

3) Are males or females more likely to eat breakfast in the morning?

Please state:	
Null hypothesis	
Alternate hypothesis	
Research design (as you would write in a methodology)	
Type of data	
Statistical test you would use	

4) Does the type of breakfast people have impact on their performance on a learning task? You will test 3 groups, no breakfast, cereal with banana and juice and fried breakfast on their performance on the equation learning task.

Please state:	
Null hypothesis	
Alternate hypothesis	
Research design (as you would write in a methodology)	
Type of data	
Statistical test you would use	

5) You find that the participants in the cereal condition performed best on the learning task, followed by the no breakfast then the fried breakfast condition. You now want to investigate whether the time that participants have their breakfast interacts with the type of breakfast they have. As well as the types of breakfast above you also measure whether they have their breakfast as soon as they get up, or if they wait until they get to university.

Please state:	
Null hypothesis	
Alternate hypothesis	
Research design (as you would write in a	

methodology)	
Type of data	
Statistical test you would use	

- 6) Finally, you want to investigate the impact of type of breakfast and time of breakfast on learning throughout the day. You use the same groups as in question 5 and test them on the equation learning task first thing in the morning and again in the afternoon.

Please state:	
Null hypothesis	
Alternate hypothesis	
Research design (as you would write in a methodology)	
Type of data	
Statistical test you would use	

Appendix 2

Guidelines for Report Writing

An experimental report should convey its message *briefly* and *clearly*. Ideally, it should be directed at a *non-specialist reader*, e.g. a reader who might have a general level of understanding of the topic of cognitive Psychology, but does not specialise in hemispheric differences in information processing.

These are just very brief guidelines of what is expected of you when writing a practical report for this course's assessment. Ideally, you will master this skill and finish the year writing in a way that is close to a publishable article.

However, do remember *that the more experimental articles you read yourself, the better you will get at writing experimental reports.*

1. Writing Style

Sternberg (1988) in Chapters 3 and 4 provides a useful set of rules that you should consider in writing a Psychology paper. Please refer to these Chapters for guidance.

The aim of the experimental report is to convey findings to the world in a clear way. Good writing is precise, unambiguous and economical. However, it should also be readable: a) not telegraphic; b) motivating, (i.e. it should invite and interest the reader enough for him/her to proceed); c) easy to follow and understand (i.e. it is your task as a writer to make yourself understood, and not rely on the reader to make an enormous effort in understanding what you mean).

The use of the first person as an author used to be discouraged (e.g. 'I' and 'we'), as it was argued that this tends to draw attention to the author(s), rather than to what he/she has to say.

However, there are occasions when it is far easier to say 'We did...' or 'I tested' than to employ baroque forms of expression. You should take example from the literature, for instance, pay attention to turns of phrase that you like and feel you can adapt to your own style.

Brevity should also be worked on. Although achieving a brief exposition of a complex concept is difficult and may involve many re-writings of the same passage, do remember that lengthy expositions containing repetitions and irrelevant information are unlikely to be read and assessed positively.

Finally, take special care with spelling and grammar. Persistent bad spelling and grammar are *not admissible* at this stage of your academic career. Also, the presence of spell checkers in any word processing software and the availability in the Main Library (at least) of reference books (dictionaries, thesaurus, and grammar) removes any excuse.

2. Report format and length

Your report should follow APA format guidelines

- <http://www.apastyle.org/electref.html>
- <http://www.lib.usm.edu/legacy/tutorials/apatutorial/tutorialindex.html>

Below is a description of how your report should be laid out. This is logical and clear method of exposition which has gained widespread acceptance. However, some publications (e.g. *Nature*) do not necessarily use this format. In any case, most Psychology journals that you will consult during your degree do use the following sequence, with one or two differences. These notes below are provided for quick reference. More details are provided in the APA format guidelines above, and also in Sternberg (1988; Chapters 3 & 4) which gives a useful set of rules that you should consider in writing a Psychology paper.

The word length is 3000 words, and your submission must be point 12, double-spaced, in a Times font, with the word count written on the front. Word-counts include everything (title, tables, figures, abstract, references, etc) EXCEPT for any Appendices. The following is the departmental policy on word-limits:

“Adhering to the word limit is one factor among a number of factors that will be taken into account by the examiner in deciding on the overall mark. While we do not have an explicit algorithm regarding the number of marks that will be deducted for exceeding the word limit by X amount, you should assume that there will be a consequence for excessive length. Markers use their academic judgement in deciding on the overall mark.”

As a guideline, you should normally work within the following roughly-specified limits:

- Title: 15-20 words
- Abstract: 200-300 words approx. (0.5 sides)
- Introduction: 3-4 sides of A4
- Method: 1.5-2 sides of A4
- Results: text, 1-2 sides of A4 (i.e. excluding tables & figures)
- Discussion: 2-4 sides of A4

These are rough guidelines for length. As you know, this will also depend on the content of your report and writing style. However, do remember that length by itself without purpose, relevant content or meaning is pointless and will detract from your grade.

3. Report Sections

Your report should be divided into a series of *clearly labelled sections*, each one reflecting various stages of the experimental study. Use numbers, bold type or a different font to clearly label each section. You are also advised to use sub-labels within each section to signpost:

- a sequence of arguments/ideas in your Introduction or Discussion;
- a sequence of categories in the description of the study’s method;
- a sequence of steps of statistical analysis.

These will increase the readability of your report and also help you structure and restructure your report.

3.1 Title

The title should be short and descriptive (try to keep it to a maximum of 15 words). Here are some guidelines:

- It should include a title and sub-title;
- The title should convey the overall content of the report: this should include keywords that are immediately recognisable and or that identify an area of research (e.g. 'Priming effect of...', 'Change blindness...');
- The sub title should describe the independent and the dependent variable, and do so implicitly (e.g. not 'The independent variable was overtraining...', but, 'The effect of overtraining on discrimination recall');
- Ask yourself: 'under what topic would I naturally look in a subject index of a journal if I were searching the literature on the subjects addressed in my report?' Your answer will give you some idea of what keywords should go into your title.
- Look at published titles for guiding ideas (however, do not simply copy other author's titles).

3.2 Abstract

The Abstract is presented at the beginning of the report and should contain clear statements on:

- The overall research area;
- The research question, including an articulate summary of the experimental hypothesis;
- The study's method, including *specifically* the study's variables and experimental design;
- The results, including the statistical model used and a synopsis of main findings results and significance levels;
- The discussion, including the conclusions you drew from the results, specifically if the hypothesi(e)s was supported or not.

The abstract should be concise, providing a general summary of the entire report in a maximum of 200-300 words. It represents a sort of halfway house between the title and the report as a whole. Its function is to provide enough information to help the reader decide whether or not the article/report it is worth reading the whole article/report in detail. Its use in databases is

invaluable and a well written abstract also fulfils the function of attracting and motivating the reader

A good abstract will elaborate on the title, and condense the full contents of the report, and it should appear on the same page as the title. However, writing an abstract is difficult and it is again a skill that you will master with practice, trial and error and time. It is often the last part of a report/article that one writes and it is almost without exception the result of much re-writing.

3.3 Introduction

Overview of Introduction Contents:

- What is the general area of research
- What is the research question?
- What is the theoretical justification?
- What is the evidence from previous research?
- How does the experiment test it?
- Translate the research question into experimental hypothesis(es), stating explicitly what it is and how it was derived.

The function of the introduction is to clearly describe and contextualise the specific topic of your study. It should state the problem addressed by the research, incorporate it into its theoretical context (by briefly appraising relevant literature), and present the reasons for investigating it. It should end with a clear statement of the experimental hypotheses. As it was stated above, the use of sub-labels (such as the ones used in this text) are very useful for signposting the progression to contents in the Introduction. Some advice follows.

3.3.1 Start in a direct and clear manner

The first sentence, or at least the first paragraph, of the introduction is very important. It should focus the reader's attention on the precise subject being treated, and give some idea of how it will be studied. For example, take the following first paragraph of an article on a memory experiment:

'The study of recall for unconnected lists of words has been used to motivate theories about the organisation of human memory. However, some researchers question the validity of such studies and suggest that a more naturalistic approach, using the idea of meaning schema, might provide more useful insights (e.g. Kelly, 2000).'

These two sentences immediately focus the reader's attention on the relevant subject area (i.e. human memory), and suggest how the forthcoming experiment will examine this topic (using connected text). Having introduced the reader to the relevant subject matter, the next requirement is to provide a general statement of the question being addressed. Returning to the example, the next sentence might be:

'The present study was carried out to investigate how participants' understanding of text, and the perspective they adopt whilst reading it, affects what they recall.'

3.3.2 Review relevant background literature:

The next task of an Introduction is show why this question is of interest by familiarising the reader with the *relevant* background literature. This will represent the main body of the introduction. It is therefore important to confine yourself to those studies which directly bear on the experiment you are reporting. Avoid digressions, even if you think that these are interesting additions.

Follow a *logical* progression (as an inverted pyramid). Start out with a brief introduction to research in the general subject area (e.g. memory/memory research), and then focus more and more specifically on the particular aspect of that general area that the present study is concerned with (e.g. the importance of a perspective on recall, the use of recall schema). Avoid providing excessive detail on the procedural aspects of the reviewed experiments (unless this is directly relevant to your research), however, provide enough information for the reader to appreciate this contextual literature.

Your summary of the pertinent literature should lead seamlessly and naturally to the reason for the present experiment, i.e. the research question. The research question may arise for a number of different reasons – there may be a gap in the literature, the existing results may be

contradictory, or the literature review may reveal the existence of evidence which is not adequately explained by any existing theory. The research question, or problem, must be solvable, and its hypothesised solution must be testable if it is to form the basis of an experiment.

3.3.3 Formally state the experimental hypothesis:

The next stage of the introduction is to state the proposed solution to the problem in a manner which suggests how it might be tested – this is done by stating the experimental hypothesis (or hypotheses, if there is more than one).

For our purposes, a hypothesis may be defined as a testable statement of a potential relationship between two or more variables. The variables referred to are the independent and the dependent variables. The hypothesis should mention those three all important experimental elements:

- the independent variable (IV),
- the dependent variable (DV),
- suggest how they might be related.

The hypothesis should be clearly stated, i.e. expressed in the simplest language possible and containing only essential information. It is best, but not crucial, that you present the hypothesis in the form of the predicted relationship between these variables. Depending on the precision of the predictions they make, hypotheses may be *one-tailed and two-tailed*, that is, *directional or not directional*. Howitt & Cramer (2008) provide examples of hypothesis along the book.

3.3.4 General Points:

The scope and precision of your Introduction will be intrinsically related to the breadth and depth of your own reading. The advice here is clear, read relevant literature. This includes reading journal articles in full, as abstracts only will not suffice. Therefore, you must do the suggested background reading and go beyond it, as evidence of still broader reading will be rewarded.

When using references, take great care so that you *do not plagiarise* another author's work. Plagiarism is claiming the words, ideas, and efforts, of others as your own. So do not copy

sections of the sources word for word, and do not present the ideas of others without fully citing them. Instead, draw out the most important points and summarise them in your own words, making clear where ideas were drawn from other sources. This will help to convince your marker that you actually understand the area. If you must quote from a paper, ensure that you attribute the quotation to its author (giving name, date, and page number), and present it within quotation marks.

In a similar way, when referring to results of previous research always indicate the source of those findings – do not say, 'it has been shown that x is the case', without indicating where this has been shown, as it stands, this is a meaningless statement. There are two acceptable ways to refer to the source of such statements:

'Previous research has shown that recall for a passage is enhanced if... (Holloway and Kelly, 1998).

'Holloway and Kelly (1998) have shown that recall for a passage is enhanced if...'

In the same way that sloppy spelling and grammar is not admissible, *sloppy referencing will not be tolerated and will be penalised.*

Student Publications: The results from student coursework (projects, literature reviews, dissertations) can sometimes be of high enough quality to be submitted for publication in a peer-reviewed journal and/or presentation at a conference. This is particularly true for 4th year dissertations, but can apply to any work of sufficient quality, especially where novel data or ideas are generated. Your year 2 projects have been conceived of (and had their principal methodology designed) by the faculty staff-member supervisor. Given this, students should not expect to play an authorship role in any articles arising. (For projects in later years, where research is conceived by, and/or primarily designed, by the student(s), any possibility of publication should begin with a discussion between the supervisor and student(s) to clarify each person's level of contribution, and, if a paper is to be written, the order of authorship.) Students should note that the output of a supervised project must NOT be submitted to a journal or conference without the supervisor being consulted. A staff member's supervision of projects represents intellectual property in its own right, and so must be recognised. For similar reasons,

where two or more students collaborate on a project, all potential student authors must also be consulted, if a publication is to arise.

3.4 Method

This section is usually subdivided (Sternberg, 1988, p.50-51) in the following way:

- Design;
- Participants;
- Apparatus/Materials;
- Procedure

3.4.1 Design:

Here you should state the type of research and statistical design used (i.e. independent groups, repeated measures, etc.), and indicate the dependent and independent variables. Details of how participants were assigned to treatments, and any randomisation techniques should also be given here. All of the information should normally fit into one concise sentence. Again, this is mastering this skill will take time and multiple attempts, but, this is something that is very useful.

- Good example: *"Choice reaction times were measured for randomly presented pairs of shapes in each of four orientations, using a within subjects design."*
- Bad example: *"The dependent variable was choice reaction-time and the independent variable was the orientation of the shape. A repeated-measures design was used, with the same participant in each condition. The order in which the treatments were given was randomised."*

3.4.2 Participants:

Type of participant (students, neonates, etc.), the number of participants tested, and their age range and sex. Other characteristics which may affect the results of your study should also be mentioned (e.g. handedness, socio-economic status, etc), but only if they are relevant to the study.

3.4.3 Apparatus:

Specialised apparatus and materials used should be included here (with sufficient detail to allow the reader to make or purchase the equivalent items), e.g. Tachistoscope, particular word lists or rating scales, commercial ability and personality tests. However, this should be done with restraint and with logic and reason – e.g. the type of computer or monitor that you used would not usually (unless particularly relevant to an experimental manipulation) be included here.

3.4.4 Procedure:

Here you should give a detailed, step-by-step account of what happened to the participants from start to end of the experiment. You must include sufficient detail to allow the exact procedure to be repeated, including details of how stimuli were presented, numbers of trials given in each experimental condition, how performance was measured, etc. Instructions to participants should be reported verbatim, although these should be placed in an appendix if they are excessively long. Also include what participants were told after the experiment ended in relation to the study, their participation or results – i.e. to what extent and in relation to what were your participants *debriefed*.

3.5 Results

The Results section is the place where you present what you have found in such a way that readers are able to see the whole picture of your experimental findings (Sternberg, 1988, p. 51-52). Again, it takes much practice, guidance from your textbook, course handbook and, most importantly, from your Demonstrator, for you to attain this skill. Once you have done so, and are able to write up your experimental findings *correctly, completely and clearly*, you should find this section easy to write.

This part of the report must be purely descriptive; it should not include any discussion or speculation. In this section you have two tasks:

- First, you must present and summarise your data in a way that a) prepares the readers for the subsequent analysis, and b) points at preliminary implications of these results for the experimental hypothesis – this should be achieved in the *Descriptive Statistics* sub-section;
- Second, you must report on a) the statistical analysis of your data (what statistic or model did you use?), b) the results that were produced, and c) crucially, on the

meaning of these results, i.e. what inferences do they allow you to make about the validity of the experimental hypothesis – this should be achieved in the *Inferential Statistics* sub-section.

3.5.1 Descriptive Statistics:

Always begin the results section with a description of your results, using descriptive statistics for your sample(s) (mean, standard deviations, etc.). Normally, a summary of results should be presented as *labelled* tables and graphs (see below, and read Chapter 7 in Sternberg, 1988), and you should refer to these in the text. These are *not alternative ways* of presenting your results, you *must* present them verbally *and* graphically.

In the verbal description make references to the graphical representations of the data and statistics to a) point out the most important features of your data set, b) to describe patterns in the data, and c) to make preliminary observations in relation to the hypothesis that you are testing. This should be done seamlessly and descriptively (as a possible example: "*A preliminary assessment of the data (in Table 1) reveals that extroversion scores measured before social exposure were consistently higher than...*") and not as an isolated statement ("*The results are given in Table 1*").

Relating these descriptive results to your hypotheses presented in the Introduction is *essential*, as the purpose of any experiment is to gather evidence to evaluate the proposed experimental hypothesis(es). It is therefore very important to keep in mind the hypothesis(es) when deciding on the manner in which to present your results. Presenting results well is again a complex skill, but a very useful one to acquire, as the clear presentation of results is central to understanding them.

A summary of descriptive results will also be done graphically. Whether or not tables and graphs are both used to illustrate data will depend on the type of data, and the ingenuity and motivation of the writer. Tables and graphs are used for summarising the data, rather than presenting raw data (a term which implies that the data have not been statistically treated). Raw data belong, if at all, in an Appendix, but this is rarely necessary. Also, do not paste in un-edited output or graphs from a computer statistical package (e.g. SPSS) – this typically includes

a great deal of unnecessary and inappropriate information which the reader should not be expected to wade through. As a summary:

- *Tables*: should present the numbers which illustrate the main findings of the study systematically, precisely, and economically. When reporting means, always include the corresponding SD's in the same table (as SD gives a measure of the variation among the scores within each group). You should also include the row and column means (i.e. marginal means).
- *Graphs*: Often graphs clarify patterns of results and relationships between variables in a more immediate and accessible way than is possible in a table. When deciding on how to illustrate your data graphically, think very carefully about what sort of relationship you are trying to clarify. Different types of results call for different types of graphs (Sternberg 1988, Chapter 7). Refer to your statistics texts for guidance on which types of graphs are appropriate for which types of data. Good use of graphs will greatly enhance your results section.

Take the time and effort to create your own tables with the relevant information and to edit labels and titles on graphs appropriately, so that they can be understood easily and without reference to the text. This means that

- Tables and graphs will have: a clear title and a sequence number, using the prefixes 'Table' and 'Figure' (e.g. 'Table 1'; 'Table 2'; etc., 'Figure 1'; 'Figure 2'; etc.).
- Table sections (columns and rows) and graph axes will have:
 - Clear labels.
 - Fully labelled conditions – make sure that the condition labels (IV levels) are intelligible (e.g. 'condition 1' means nothing) and used consistently throughout the report. In importing graphs from SPSS or any other statistical package into your report, make sure you have edited these first – *unedited SPSS graphs are not acceptable*.

3.5.2 Inferential Statistics:

In this section you will report on the process of and on the results and conclusions afforded by your inferential statistical analysis in relation to your hypothesi(e)s, and, as you will know by

now, your statistical analysis will be guided by the predictions made in your experimental hypothesi(e)s.

The presentation of inferential statistics needs to follow a logical sequence (if various test statistics are used these follow a logical order), and needs to obey the reporting *rules* that each test statistic requires (e.g. a *t*-test has a different presentation layout to an F-ratio calculation for an ANOVA model). In this sense, there is no room for innovation here, as all the elements that are crucial to the understanding of the test statistic result (e.g. degrees of freedom, probability or significance level, etc) *have to be present and in their correct order*. Your textbook and handbook include specific guidelines for each test statistic, and you should follow them *precisely*.

It is fundamental that in your verbal report you always relate the statistical result to your hypothesi(e)s, therefore, providing it with meaning. For example, it is not sufficient to say "*the result was significant at the $P=0.05$ level*" – this is meaningless. You need to provide the reader with the meaning of the result – "*Left-handed participants were significantly faster at this task ($t(12) = 2.24, p < 0.05$), this lends support to the experimental prediction that was made*". The report of the statistic result (above, the *t*-test result) is there to lend support to the finding (that left handed participants were faster at...), which in turn lends support to the experimental hypothesis. The statistical result is not sufficient by itself.

Any further calculations which you wish to include in the report should be placed in an Appendix. Equally, do not paste in un-edited output from statistical packages, as this will almost certainly contain inappropriate material. If you wish to present a summary table of statistics results (for example, of an ANOVA model), follow the same guidelines that were provided above for the graphical representation of descriptive statistics regarding labels, sequence numbers, etc. However, make sure that the table fulfils the function of providing information that is above and beyond that which is included in the verbal account of the results – use them, if at all, with restraint.

3.5.3 Common stumbling blocks in results sections:

- Incorrect grammatical forms and expressions

Singular	Plural
Datum	data
Hypothesis	hypotheses
Phenomenon	phenomena
Appendix	appendices

Correct	Incorrect
The <i>effect of</i> the experimental manipulation on reaction time was...	The <i>affect of</i> the experimental manipulation on reaction times was...
Reaction time was <i>affected by</i> the experimental manipulation...	Reaction time was <i>effected by</i> the experimental manipulation...
"the <u>result x</u> is statistically significant"	"The <u>data</u> are significant"
"the results were <u>non-significant</u> "... "the results were <u>not significant</u> "	"the results were <u>insignificant</u> "
"The <u>results provide support</u> for the experimental hypothesis, that is..."	"The <u>data prove</u> that the experimental hypothesis..."

this	is different from	this
<i>No results</i> (lack of results, i.e. not physically present)		<i>Negative results</i> (results that do not support your experimental hypothesis)

- Lack of clear description of results;
- Inadequate labelling of Tables/Graphs.
- Unnecessary/poorly-presented statistical information.
- Failure to cross-refer to Tables/Graphs in text.

3.6 Discussion

Overview of Discussion Contents:

- Was(were) the experimental hypothesis(es) supported?
- What are the similarities and differences between your findings and those of previous research and widely accepted points of view?

- Are there limitations in the ability of the experiment to answer research question?
- What further research could be done to follow up this study?
- What are the implications for theory or practice?

This is the last major section of your report, and here you have your chance to a) provide your interpretation of your results in relation to relevant psychological theories, b) compare your results with those in previous experiments, c) discuss any shortcomings of the experiment, and d) suggest possible important developments for future work.

It may be useful to look upon this section as the inverse of the introduction. There you started with a fairly general review of the relevant literature, and focused progressively on the present experiment, ending with a statement of the experimental hypotheses. In the discussion, you should take the opposite course: you will start by discussing the experimental hypothesis, stating how it fared in relation to the results of your experiment; then widen the area of discussion to include earlier research (e.g. does it add anything to the previous literature; does it agree with/contradict the earlier work, etc.); and state its significance implications for the area's theoretical models or research practices.

The Discussion and Introduction should be consistent with and complement each other. However, these should not repeat each other – remember, these two sections have different aims and functions in the report. In the same way, the discussion should not *just* be a continuation of the Introduction. A lot has happened in the meantime (remember, you have carried out an experiment, you have learnt from your results, etc.). The Discussion has to *add to* Introduction, not just continue it as though nothing has been learnt.

As mentioned above, you should start the discussion by re-stating the main results of the experiment in an articulate manner and always in relation to the hypothesi(e)s that you have been working on – are your hypotheses supported? If so, how? If not, how?

After this, contextualise your results in relation to the previous literature (how does it compare or add). Simultaneously provide an explanatory frame for you results, using the same theoretical models you cited in your introduction. If the experiment has resulted in negative or unexpected

findings, do the same as above, and try to suggest alternative theoretical models that may frame or account for the result. Negative and unexpected results are not problematic or second rate results. They are experimental results just like those that support the hypothesis that you tested – remember that the operative word here is ‘*tested*’ not ‘*sought to confirm*’. Also, such results may actually be interesting. It is your function as a researcher and as an author to find how they may be interesting (this may take some further reading, beyond that which you had done so far).

Also, if you can see any methodological shortcomings in the study, describe these and (if you can) suggest ways in which they can be overcome. However, these should be relevant – ask yourself, could such shortcomings realistically have had any influence in the results? The obvious fact that (usually) your participants are all Psychology undergraduates, may well affect certain cognitive and personality related studies, but not performance related ones. Try to balance imaginative suggestions with realism. However, please do not *always* mention ...

the sample size,
use of undergraduate participants,
or ambient noise

... as the default culprits of, for instance, negative results – these need to make sense.

Next, try to think of implications of your results for future research, and how you might extend the present experimental model to consider additional hypotheses. Similarly, you should also consider the extent to which the results may be generalised: to what populations may you safely generalise? To what extent are the generalisations limited by uncontrolled variables?

Finally, restate your main findings and conclusions in a fluent and clear final paragraph, so that the reader has some sort of ‘take home’ message from the study.

There is no easy guide to the length of a discussion: an experiment which has clear cut results, and little previous work, may warrant a short discussion; one with less clear results and an extensive literature may require a longer one. In all cases, remember that the key word is relevance and not length.

3.7 References

The content of this section should not be new to you in any way. The use, purpose and format of referencing has been covered extensively in Psychology 1. Therefore, you *are expected* by now to be able to construct a correct reference list.

Consult the APA format guidelines

- <http://www.apastyle.org/electref.html>
- <http://www.lib.usm.edu/legacy/tutorials/apatutorial/tutorialindex.html>

Look at examples of reference lists in the Psychological literature (i.e. learn by example). As it was mentioned above, *bad referencing will not be tolerated*.

As a very quick overview, here are some rules:

- *Order:*

The list's order is alphabetical, using the first author's last name – e.g. Kelly, P. *comes before* Kendall, L, *and after* Johnson, R.P.

- *Format:*

- The first author's last name should be easily spotted. Therefore, as demonstrated in the examples below, if the complete reference of a book, chapter or journal article takes up more than 1 line, *slightly indent* all lines after the first line (this is easily done in *Word*, for instance, with the help of the top ruler).
- Notice that *italics* are used in the examples below to note the first step in a series of steps that would take you to find the exact reference (think about the path that you would take if you were going to the Main Library to find this reference):
 - For a journal article, what would be the first step in finding it? Finding the "journal", therefore this is noted in italics;
 - For a book chapter, what would be the first step in finding it? Finding the "book", therefore this is noted in italics;
 - For a book, what would be the first step in finding it? Finding the "book", therefore this is noted in italics.

Here are some examples:

1. Journal Article:

Sigurdsson, J.F., Gudjonsson, G.H., Bragason, A.V., Kristjansdottir, E., Sigfusdottir, I.D. (2006). The role of violent cognition in the relationship between personality and the involvement in violent films and computer games. *Personality and Individual Differences*, 41 (2), p. 381-392.

NOTE: JOURNAL ARTICLES SHOULD BE IN THIS FORMAT IRRESPECTIVE OF WHETHER YOU OBTAIN THEM FROM A PAPER COPY OF THE JOURNAL OR ONLINE. YOU SHOULD **NOT** INCLUDE THE WEB ADDRESS OR ANY ADDITIONAL INFORMATION FOR JOURNAL ARTICLES THAT YOU FIND ONLINE.

2. Chapter in a Book:

Edwards, D. (1998). The relevant thing about her: social identity categories in use. In Charles Antaki and Sue Widdicombe (Eds.), *Identities in talk*, p. 15-33. London: Sage.

3. Book:

Bentall, R. (2003). *Madness Explained*. London: Penguin Books.

4. Webpage:

Koestler Parapsychology Unit Glossary of Parapsychological Terms. Retrieved 15th July 2003 from http://moebius.psy.ed.ac.uk/Glossary_H.html

A note about referencing webpages: there is a growing trend of students referring to webpages which have not been peer reviewed or screened for the validity of their content, and may largely consist of personal opinion. Be aware that referencing such sites is not encouraged. If in any doubt about any source, consult your demonstrator before using it.

5. Reference work:

American Psychiatric Association (2000). *Diagnostic and Statistical Manual of the American Psychiatric Association, 4th edition – text revision (DSM-IV-TR)*. Washington DC: American Psychiatric Association

3.8 Appendices

The final section of your report is the Appendices section, containing all material which adds or complements the information in the report, but which would otherwise damage the flow of the main report. However, these should be used *with restraint* and clearly referred to in the main text – e.g. “*Individuals were asked to, first, carefully read and sign a consent form for their participation in this study (in Appendix 2). They were then requested to read the trial’s*

instructions (in Appendix 2), before initiating the task". Appendices should follow a logical order. Therefore, in the example above, Appendix 1 would include the study's consent form, which was mentioned before the trials instructions, which is then included in Appendix 2. For practical reasons, we do not expect you to reproduce materials that we give to you (e.g. experimental materials) in the Appendix.

4. Some final words and thoughts

Please make sure that your report is *your own independent work*, even when you have collaborated on data collection, data analysis or other tasks with other students. This is a fundamental requirement – see section on plagiarism in the Psychology 2 course handout. As you will be aware, Edinburgh University as a whole does not tolerate plagiarism of any sort. Regrettably, there have been several cases of plagiarism/cheating in recent years, which have been very unpleasant for all concerned, and have resulted in significant penalties being imposed on the students involved. If you develop Tables or graphs in conjunction with your peers, you must include an Acknowledgements section at the end of the report, where you list the Tables and graphs and provide the names of those you worked with. IMPORTANT: any text in the Report must be your OWN. You must NOT include sentences that are identical to those of your peers.

Finally, remember that your Demonstrator can help you develop a good report writing style. Pay close attention to their comments, both written and verbal, and you should soon acquire the necessary skills for good report writing. This is something that you are expected to develop during this year, not come into this year knowing beforehand – it is, and should be, a *learning process*. What has been presented here is a well-defined format, so that you can learn how to write reports using a firm set of guidelines. As you become more experienced in report writing, you will develop a more flexible approach, tailored to the needs of the specific experiment you are reporting, and to your own style.

It is also absolutely essential that you look at published papers to get a full idea of what is involved in a complete published journal article. The course will make use of journal articles throughout, use these not only as references for content, but also for format and style – *the more you read, the better you get at writing*.

Take the following as further suggestions, just to get you started:

- Take the *British Journal of Psychology*, *Journal of Experimental Psychology: General*, or *Perception, Personality and Individual Differences* (these journals are available in the Main Library catalogue, including electronic access);
- Look through the last two years of the journal series for examples of recent practice;
- Note how many published papers contain all of the details specified above;
- Take examples in style and some generic turns of phrase (e.g. “*recent research suggests...*”, or “*the consensus so far is that...*”, or “*insofar as these result suggest that there is an effect of social pressure on task precision, these seem to be in accordance with Potter’s (2004) model of ...*”).

Appendix 3

Searching and locating journal articles

Using a literature database

Most of your literature searches will be conducted using a literature database such as PsycInfo. A journal database consists of a huge collection of records with the essential data of many thousand academic articles, e.g. author, publication year, title, journal name, and abstract. Usually, the database does not include the text of the article itself. Searching a literature database involves narrowing down the list of articles to the ones that are relevant to you, whilst at the same time not accidentally sifting out those that you want.

Accessing Databases

Different Institutions buy access to different journals, therefore when you find a reference in a database, this does not necessarily mean that the University has subscribed to that resource.

Log into MyEd and you will be recognised as a University of Edinburgh Student. Click on the **Library tab**, and then click on the **Library Resources** button. You can then select a database from the **Databases A-Z** list.

Useful Databases

PsycInfo (www.bids.ac.uk): Large database with Psychology articles. Together with the *Web of Knowledge* your main source for literature searches. Requires a MyEd authentication.

Web of Knowledge & Web of Science (at wok.mimas.ac.uk): WOS is a large scientific database (WOK includes WOS), not specialised in Psychology. Requires an ATHENS password if accessed off-campus. Links directly from the lists of articles produced by searches to findit@edinburgh (see below)

The Library Catalogue (www.lib.ed.ac.uk). You can use it to search for books directly and use the *journal search* function to check whether a journal that you found in an online database is available at the university. Also contains links to electronic journals if available.

ScienceDirect (<http://www.sciencedirect.com/>): Database of journals published by Elsevier. As a nice extra, many of the journals are directly available in an electronic format, which can save a lot of time. Requires a MyEd authentication.

findit@edinburgh A very recent update, which is in testing mode at the time of writing, but should be made the standard search tool soon, is a unique catalogue offered to Edinburgh University users, which allows to run a multiple search into selected database this is accessible via this link: www.searcher.lib.ed.ac.uk

Google Scholar (<http://scholar.google.com>) Google Scholar provides a simple way to broadly search for scholarly literature. From one place, you can search across many disciplines and sources: peer-reviewed papers, theses, books, abstracts and articles, from academic publishers, professional societies, preprint repositories, universities and other scholarly organizations. Google Scholar helps you identify the most relevant research across the world of scholarly research.

Google, Altavista, MSN, Lycos and many more are search engines. Some authors publish their articles online, either directly on their own websites or as downloadable pdfs. If you know that a certain author is relevant for your work, it often pays to see if you can find her personal university website and check the publication list and downloadable materials. This is also useful to try when the University does not hold a subscription for a specific paper you sourced from a database.

- **WARNING:** There is a lot of incorrect information on the Internet. **Do not cite websites unless they belong to a reputable organisation**, such as a governmental website when quoting a statistic. Internet resources are generally considered unreliable.

Searching a database

- Enter a single word or a string of words that will be treated as a single whole phrase and click Search.
- The result will be shown as a list of titles ordered by date. Have a quick look at the number of hits. If there are more than 100 you probably need to refine your search further. If there are less than 10 check the spelling of search terms and try to find other keywords. In this case, 2134 hits for “fMRI” means that we have to further refine the search.

- You can shortcut this process by using “*and*” or “*or*” in your search expression (“fMRI and autism”). The “*or*” option is very useful if you have two different names for similar concepts that you would like to cover with a single search, e.g. “affect or emotion”.

Open the “Complete Record” for an article that seems relevant. Check the abstract to see whether it really is relevant. If it is, skim title and abstract for useful keywords that you had not thought of and, most importantly, check the field labelled “Major Descriptors” as these are the subject keywords used by the database. Take a note of the potential keywords and use them for further searches.

Author’s names can be very useful keywords, as many researchers specialise in a certain area. When you know some of the “big names” in an area (e.g. from lecture notes), searching for a name plus a broad keyword can give very good results.

Semester 2 (Dr J Simner)

Experiment Brief: Individual Differences in Synaesthesia

Background: Synaesthesia is an inherited condition in which stimuli are experienced with unusual secondary associations. For example, synaesthetes listening to music might see colours in addition to hearing sound (Ward et al., 2006); other synaesthetes might experience tastes in the mouth when reading words (Ward & Simner, 2003). One common variant is grapheme-colour synaesthesia, in which graphemes (letters or digits) are associated with colours (e.g., A might be red; B might be blue etc.). Synaesthetic colours can be either seen in the mind's eye, or projected into space, or they can sometimes simply be 'known' as a strong and automatic association. Empirical estimates place the prevalence of grapheme-colour synaesthesia at between 1-2% of the population (Simner et al., 2006). One unanswered question is whether the condition is stronger or weaker in certain types of people, and we explore this issue in 2 ways:

Question 1: Is synaesthesia stronger in younger versus older people? We might expect synaesthesia to diminish with age since perceptual experiences are subject to age-related declines (e.g., olfactory ability declines with age; Doty et al., 1984).

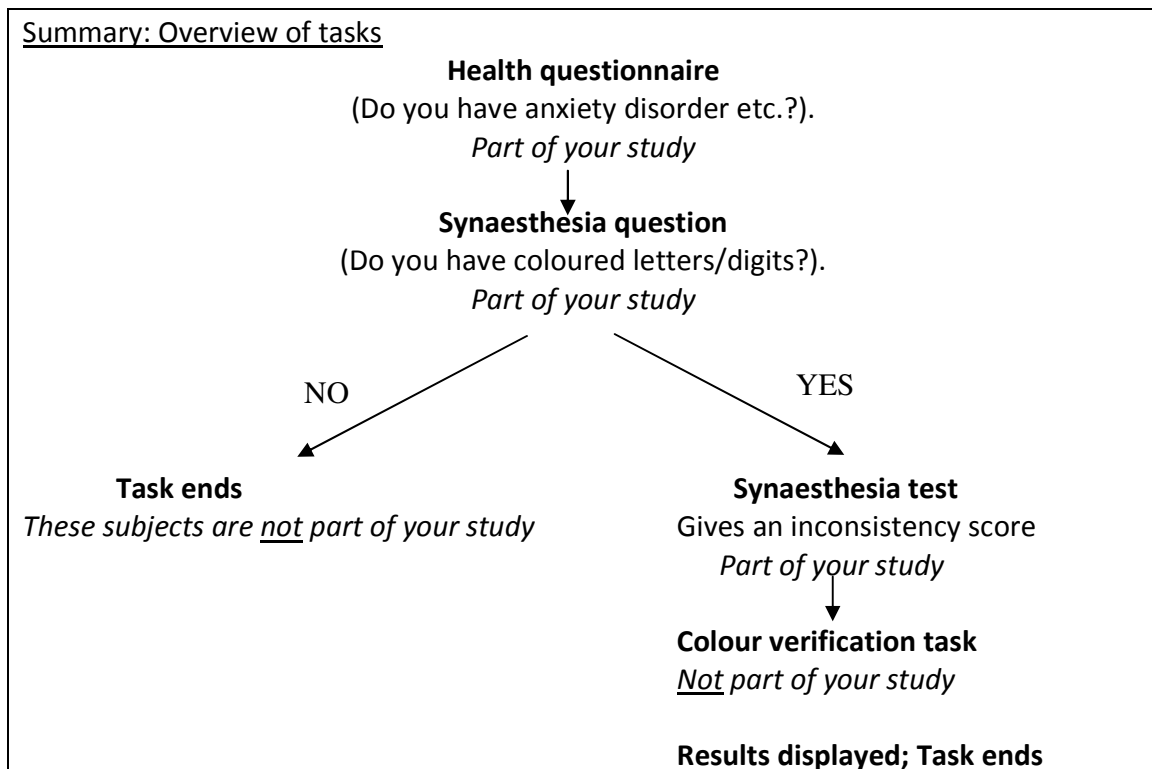
Question 2: Is synaesthesia stronger for people who suffer from anxiety? Synaesthesia has been associated with increased schizotypy (Banissy et al., 2012) and one symptom of schizotypy is anxiety (Lewandowski et al., 2006). You will therefore directly test whether synaesthetic tendencies are higher in people with anxiety disorders, compared to people without anxiety disorders. *In summary, the aim of this study is to establish whether a tendency towards grapheme-colour synaesthesia declines with age, and, separately, whether the tendency is found more strongly in people with anxiety disorders than in people without anxiety disorders. Finally, you will also be asked to provide a descriptive statistic (see further below).*

Methods overview: You must send your participants to a website where they will take part in an online test which first registers their age, then asks them about their health (e.g., do you suffer from anxiety disorder?), and then determines whether they have synaesthetic tendencies. The test for synaesthetic tendencies works by first asking participants if they experience colour associations for letters or digits. Participants who respond *no* end the test and should be classified as firmly non-synaesthetes. Participants who respond *yes* continue to a further test that assesses how synaesthetic they really are. This test for synaesthetic tendencies is described below (see also Eagleman et al., 2007 for a published description of a similar website).

The *Test for Synaesthetic Tendencies* works by repeatedly asking participants to pair colours with graphemes. For example, it repeatedly asks them choose a colour to pair

with the letter A (and B and C and so on). Synaesthetes tend to be very consistent in their grapheme-colour pairings (e.g., Simner et al. 2006) while non-synaesthetes are **inconsistent**. For example, a synaesthete might consistently pair A with red when asked repeatedly, but someone less synaesthetic might pair A first with red, then with yellow, then with blue, and so on. The test therefore provides an ‘inconsistency score’: a high score mean the person was very inconsistent and therefore not very synaesthetic. A low score means the person was consistent – so more like a synaesthete. This inconsistency score is a continuous scale and can be considered a metric of how synaesthetic somebody is (lower score = more synaesthetic). **THIS IS THE DEPENDENT MEASURE IN YOUR STUDY. In your project you will analyse (a) whether younger people have lower scores (i.e., are more synaesthetic) than older people, and (b) whether people with anxiety disorders have lower scores (i.e., are more synaesthetic) than people without anxiety disorders. You will also provide (c) a descriptive statistic, which is described in more detail below.**

(Please note that this website also has one other task that your participants *must complete*, but which you are not required to analyse. Participants claiming to be synaesthetes (who therefore do our *Test of Synaesthetic Tendencies*) will also complete an extra 5 minute *colour verification task* at the very end, in which they are again asked further questions about their colours. This *colour verification task* produces 2 scores: a % correct and a RT. It is a second verification of synaesthesia (synaesthetes tend to score higher in accuracy with a shorter RT; see Eagleman et al. 2007). You will not be required to analyse the *colour verification task*. **However, your participants must work through to the end of the web test in order for you to satisfy your requirements for this assessment. This will be checked by the teaching co-ordinator.**)



These are the instructions you must give to your participants:

*Instructions for participants: Many thanks for taking part in my study. This study is being led by my supervisor Dr. Julia Simner (Edinburgh University: jsimner@ed.ac.uk). Below you will see a web-link. When you are told to do so, please click on the link to begin the test. Please do not pass this web-link onto anybody else -- only people invited directly by me can take part in this test. When the test starts, you will fill in a questionnaire about yourself and your experiences. Thank you for answering honestly throughout. ***Responses will be sent back to me entirely anonymously so I will not be able to tell what answers you gave (this information is stored in confidence, accessible only by my project supervisor, and will not be passed onto any third party)*.** You will also be asked who sent you to the website and you must specify my full name [student inserts his/her full name here]. Depending on your answers, some people will be told to stop at the end of the questionnaire and the test will be over; other people will be asked to carry on and will be given two short tasks. The website will make it very clear what you need to do. The questionnaire takes about 5 minutes, and the tasks take an additional 20 minutes. Please make sure you do not start the test unless you have enough time to complete it. ***It is very important you DO NOT complete this study more than once – if you have already been sent to this website by somebody else, please stop the test and let me know*.** Thank you again for taking part. Please now click on the link to start the test -- it may take a few moments (if this does not take you to the website, please copy-and-paste the link into your web-browser; e.g. Explorer. If you still have trouble seeing the test, please let me know).*

<http://homepages.inf.ed.ac.uk/s1063900/index.html>

End of instructions

Recruitment information for students

Because your task is simply to send participants to a website, rather than to conduct testing yourself, you must recruit 8 participants -- all participants must be 18 years or over. Please aim to recruit an equal number of men as women (i.e., 4 men, 4 women) if possible, but you will not be marked down so long as you have 8 overall. Ideally you will try to recruit both younger and older participants but we understand this may be difficult so please just try your best. You **MAY NOT** include yourself as a participant, but you may run through the test with the name "JUNK DATA" (as first and surname respectively) to familiarise yourself with the site. This will allow us to identify your data and remove it. The data will be collected online and returned to you in a spread-sheet by the teaching co-ordinator.

Your most important consideration in the entire study involves an issue of recruitment. It is very important not to unintentionally skew the data, so (a) **DO NOT** deliberately seek out those people you already know are synaesthetes (b) **DO NOT** deliberately avoid those people you already know are synaesthetes (c) **DO NOT** inform your participants in

advance of testing that this is about synaesthesia (participants must only learn this once the test has begun). Instead, simply ask yourself who you would usually ask to take part in a study (e.g., brothers, sisters, parents, friends, aunts/uncles, grandparents) and then ask them to take part, without revealing the topic. **YOU DO NOT SCORE EXTRA POINTS FOR RECRUITING PEOPLE WHO TURN OUT TO BE SYNAESTHETES.** One of your goals is to also find out the prevalence of synaesthesia when sampling randomly from the general population (see below) so you must not skew the sample. So the best way to recruit for this study is simply to imagine it is about something else entirely (d) **DO NOT** post the testing website link on Facebook or any other internet site. You may use Facebook to ask friends to get in touch with you if they're willing to be a participant (for an unspecified experiment – do not mention synaesthesia) and once they agree, you must email each participant the URL separately (e) **DO NOT** send more than 8 people through the test or allow your participants to send the URL on to anybody else. You must recruit in a controlled manner.

Faking data: You have been asked to recruit 8 participants to take part in this study. Be aware that **faking data is a very serious offence and equivalent to cheating in an exam.** **Faking data means running the same person more than once or running yourself as if you were someone else. Faking data will be dealt with severely.** We have put measures in place to ensure that we detect and/or deter anybody from completing the test more than once, either in their own name or in somebody else's name; any such occurrence will have very serious consequences. If a participant informs you he/she has been through the test twice (e.g., if already recruited by another student) you must inform your tutor so their data can be removed. There is no penalty if this has happened accidentally **so long as you inform your tutor.**

Analysis: Please carry out at least the following three statistics, all of which are based on the same dependent measure: the 'inconsistency score' from the *Test for Synaesthetic Tendencies*. Remember that a lower 'inconsistency score' = more synaesthetic.

- 1) A statistical test of whether people show less of a tendency towards having synaesthesia as they get older.
- 2) A statistical test of whether people who report anxiety disorders tend to be more synaesthetic than people who do not report anxiety disorders. In other words, you will perform a comparison of the mean inconsistency score across two groups: people who said they had anxiety disorder vs. people who said they did not have anxiety disorder.
- 3) Finally, a descriptive statistic in which you first split the inconsistency score into two groups: people scoring <1 vs. the rest. Assuming (following Eagleman, 2007) that people scoring <1 can be called "genuine synaesthetes", please evaluate what percentage of our total sample size (i.e., everybody who was recruited) were genuine synaesthetes.

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Semester 2 (to be announced)

You will receive information on Project 2 later in the year
