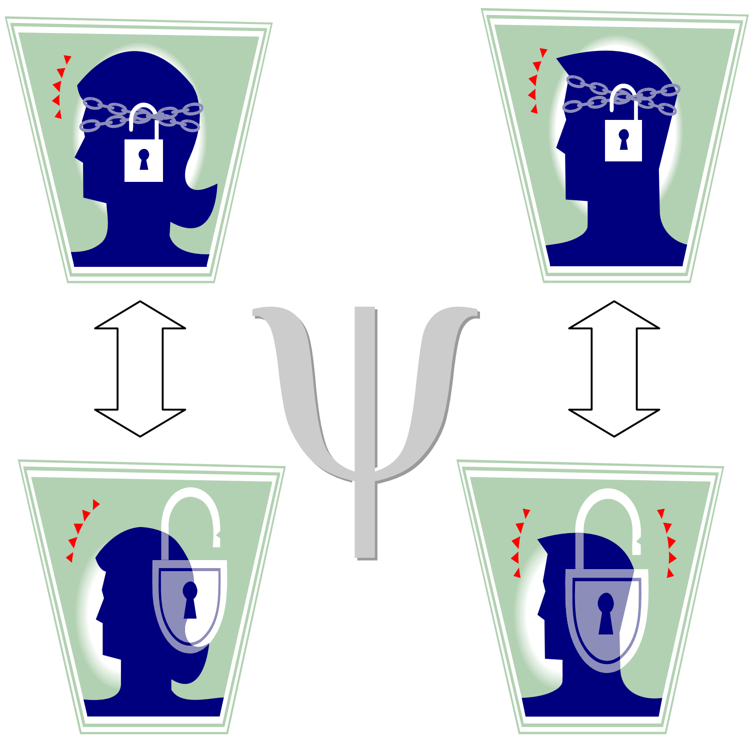
THE UNIVERSITY OF AUCKLAND
NEW ZEALAND

DEPARTMENT OF PSYCHOLOGY

MIND, BRAIN AND BEHAVIOUR: PSYCH 109



LABORATORY MANUAL 2008

THE UNIVERSITY OF AUCKLAND
NEW ZEALAND

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Ethical Requirements

All research or teaching using people at the University of Auckland requires approval of the University of Auckland Human Participants Ethics Committee.

We have chosen the exercises carefully in order to provide you with what we hope will be an informative learning experience. However, if you are uncomfortable with any exercises we strongly encourage you to contact your tutor and ask to be excused from participation. It is much better if you are able to do this before the lab is underway. It is therefore recommended you read the manual to find out what is coming up before each lab and decide if you think any of the exercises may be distressing to you. If an exercise becomes distressing or uncomfortable for you during the lab, you are still able to be excused. Please be aware that you will only be excused from the specific exercise of concern, not the entire lab. Please also be aware that you will not be able to be excused from parts of a lab AFTER it has taken place on these grounds; you must see your tutor before or during the lab.

For Ethical concerns contact: The Chair, The University of Auckland Human Participants Ethics Committee, The University of Auckland, Private bag 92019, Auckland. Tel: 373 7699 ext. 87830.

THE UNIVERSITY OF AUCKLAND
NEW ZEALAND

Student Declaration (Departmental Copy)

- I have received a copy of the course information handout for course PSYCH 109, *Mind, Brain and Behaviour*. I confirm that I have read and understood the assessment requirements, requirements for plussage, attendance requirements, and assignment requirements for this course.

- I understand that the four laboratory reports for PSYCH 109 are due to be handed in at my normal laboratory class in the weeks beginning 13th August, 20th August, 24th September and 8th October. I understand that these due dates are final deadlines.

- I understand that any late laboratory reports must be handed to the psychology departmental office and a receipt obtained and retained until the end of semester.

- I understand what plagiarism is, and realise that any plagiarism or other forms of cheating will be referred to the Discipline Committee of the University of Auckland. I agree that all of the coursework that I submit as a part of this course will be my own work in every respect.

- I understand the correct procedure to follow if I wish to raise individual concerns or course criticisms. I realise that I should first discuss the issue with the staff member most directly concerned. If I am not satisfied, then I should meet with the course co-ordinator. I may do this in person or request assistance from one of my class representatives. As a further course of action, my class representative may table the issue on the agenda of the Staff-Student Consultative Committee within the Department of Psychology.

- I understand that I must attend my correct lecture time and laboratory time each week. In addition, I understand that I must ensure that my tutor has correctly recorded my attendance at laboratories if I arrive late, or have been given permission to attend an alternative session.

ID Number:

Name: (last)

(first)

Signature: ______________________ Date: _________

THE UNIVERSITY OF AUCKLAND
NEW ZEALAND

Student Declaration (Student's Personal Copy)

- I have received a copy of the course information handout for course PSYCH 109, *Mind, Brain and Behaviour*. I confirm that I have read and understood the assessment requirements, requirements for plussage, attendance requirements, and assignment requirements for this course.

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ID Number: | | | | | | | |

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(first) | | | | | | | | | | | | | | | | | | | | |

Signature: ___________________________ Date: __________

Completing Laboratory Reports

Introduction

The laboratory reports for PSYCH 109 can count towards 40% of your final mark. Therefore, students are strongly advised to put significant effort into gaining good marks for their reports. When preparing reports, there are a number of things students should know. This section of the laboratory manual is written so that the appropriate information is available to all students.

The various areas of psychology taught in PSYCH 109 have a long history of research. An essential component of scientific communication is the requirement of conciseness and parsimony. This means that when communicating experimental outcomes and conclusions (such as from an international research project or an introductory level laboratory in psychology) it is very important to write in precise language. Furthermore, the simplest possible explanations, that in fact explain what was observed, should be given. However, oversimplification is not an acceptable course of action. Explanations need to account for what was observed: no more, no less.

General considerations for Laboratory Reports

- Never exceed the page limit that is prescribed for an assignment, You will be able to answer questions adequately within the space limit.
- Ensure that you use appropriate grammar correct and spelling.
- Try to write clearly. Never assume that the marker knows what you mean. Remember that a marker can only evaluate what you have *actually written* – not what you meant to say in your answer.
- Plan how you are going to write your answers. Do not simply write the first thing that comes into your head. Write a draft answer that you can edit and revise before writing your final answer.
- Try and use short sentences. Two short sentences are usually better than a long one. Ideas can be stated more concisely in shorter sentences. Often, long sentences end up being ambiguous.
- Remember to proof-read your work carefully before submitting your report. Sometimes it is a good idea to ask a friend who is not enrolled in 109 to proof-read your work and check for clarity. If this person does not understand your answer, it is likely that the marker will also struggle to follow it.
- If it is discovered that two or more Laboratory Reports are exactly the same, the concerned parties will be subject to disciplinary action. Plagiarism of any kind is not permitted.

General requirements

To help you write laboratory reports that will reward your effort with good marks, the following list of important points has been prepared. If you want to attain high marks you will need to incorporate the elements in this list into your written work for these papers.

Constructing graphs

Many of the laboratories require that you draw graphs of your results. Most of you will have had some experience of drawing graphs before and a few of you will have your own ideas of how a graph should be drawn. These ideas may come from what you were taught at school or from the way you were instructed to draw graphs in other departments.

Different scientific disciplines have their own codes of practice and communication. This is because the most concise mode of communication for one area of science may not (and usually is not) the most concise mode for another area. Psychology is a science that follows the codes of practice and communication set down by the American Psychological Association (APA), and the APA has produced a set of guidelines for the presentation of graphs from psychological research.

According to APA guidelines, there are strict rules for drawing graphs. In this Laboratory manual, however, when graphs are required, the emphasis will be more on how to interpret the graphs produced during the experiments. However, graphs must be legible and neat, and must follow the general guidelines below.

General considerations for graph drawing

- Graphs should always be drawn within the space provided in the manual. It is a good idea to draw a preparatory graph on separate paper (graph paper will help you here) so that you can make a neat, correct copy in the space provided.

- Graphs should be made as large as possible without causing cramping or squashing.

- All graphs should be drawn in pen (never pencil) and only one colour is permitted — preferably blue.

- All straight lines from which a graph is constructed must be drawn using a ruler.

- All errors need to be corrected either by redrawing the graph or, for a very small error, by neatly whiting out the error.

Statistical Analysis in the Social Sciences

Significant Differences

In psychology, we are often faced with the question of whether or not the difference we see in two groups of data is statistically significant. A *significant* difference observed in the data is one that is so large that it's unlikely to have occurred by chance alone. For example, we may be interested in knowing if students perform better in an examination under one condition than another – say, sitting an examination in a well-lit room as opposed to a dimly-lit room. We could randomly allocate half of a class of students to a well-lit room and the other half to a dimly-lit room, have them sit the examination in their allocated room, and then compare the two group's examination results. There will always be a difference between the groups' average results and there are two possible explanations for this difference:

1. **Non-significant Difference**

   The observed difference could solely be due to which students happened to be allocated to which room, i.e., could be just due to chance alone and nothing else.

OR

2. **Significant Difference**

   The observed difference is sufficiently large that we simply don't believe that it's likely to have occurred by chance alone but that the level of lighting in the room is also having an effect on each group's results, i.e., this difference is so large that it is unlikely to occur when nothing else (apart from the 'chance' effect) is 'going on'.

Significance Tests and the *p-value*

Sometimes the difference between two groups of data is really so large that, maybe with the aid of a plot, we can easily conclude that it is a significant difference. On most occasions though, it is not so clear cut and in order to objectively decide whether a difference is significant or non-significant we must perform **a significance test**.

When we conduct a significance test, the most important value produced in the output is the ***p-value***. The p-*value* is a probability, a value between 0 and 1, and it answers a question about the data: e.g., "How likely is it, i.e., what are the chances, i.e., what is the probability, that a difference this big, or bigger, would have been observed in the data if there really were nothing going on?"

Interpreting the *p-value*

Small *p-values* $\Rightarrow$ a **significant** test result
Large *p-values* $\Rightarrow$ a **non-significant** test result

If the *p-value* is small (less than 0.05) then it is saying that less than 5% (0.05) of the time (hardly ever) would we observe a difference(s) as big as this (or bigger) when nothing apart from chance is contributing to it – it would be highly unlikely to get a difference(s) this big by chance alone. We say 'the observed difference is significant at the 5% level'.

There are a large number of significance (hypothesis) tests available to use depending on the situation under study but in this course we will look at only two such tests:

1. Independent samples *t*-test
2. Paired samples *t*-test

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***Study Tip #1: What to Expect at University

Introduction

For those who are new to university or this university in particular, here are some pieces of advice to help you settle in to university life. It is hoped that this information will contribute to your study success. The Department of Psychology has great staff that can and will help you. In addition there are several other sources of support of which you may be unaware. These will be described in this section.

There are many emotions that you may experience when commencing university. For some students, university is a positive experience filled with many challenges; some may find the prospect of university daunting and terrifying, while others may be excited and terrified at the same time. One thing to remember is that *you are not alone*. This knowledge should encourage you; *many* students experience similar thoughts when beginning university study, but then go on to obtain good grades – and some even go on to become university teachers … but that is another story.

> Generally the first months at university have a considerable influence on the success of future studies. (Bryngfors & Barmen, 2000, pp.1-2).

Because these first months can make the difference between success and failure, it is vital that you learn the 'tricks' of university fairly quickly. By understanding the skills you require at university at this early stage, you will be prepared for almost anything that university throws at you. Remember, forewarned is forearmed.

Academic study & the skills required

Welcome to Auckland University; you are now one of our students. Before arriving at university, some of you may have spent a great deal of time contemplating what it means to be at university and what you were likely to face. Some of your preconceived ideas may be accurate and some less accurate. It is important to be aware of what university expects from you and what is in store for you. There should be *few* 'surprises.'

Student life *will* place certain demands on you. Lecturers *will* set exams and tests, give you essays and assignments, and expect you to participate in tutorials or labs. However, many skills you can acquire will make university less difficult. Once you learn these skills, study becomes far easier than you realise! The main thing is to be aware of *what is required*. The following lists on this page and the next detail some of the skills required for academic study and what you may experience at university.

Skills required *(by no means comprehensive!)*

- Orientation skills – how to use the library, finding the services on offer
- Understanding assignment/test/essay/exam questions
- Organisation & time management skills
- Memory & concentration skills
- Reading & note taking skills

- Critical thinking ability & research skills.

What to expect
- To change socially and personally
- Adjustment – you may find it more demanding (or easier) than school, work, or home life
- Lectures, labs, and tutorials
- Assignments, tests, essays, exams
- To meet new people.

University culture

You will be required to acquire certain skills and adopt certain behaviours at university just as you would in a work or social environment. For example, in a new job, you will need to know what the policies are, the location of particular items or facilities, and what behaviour is acceptable. In the same way, you need to learn about the particular culture of the university you are attending. Sometimes you can find out about the terminology, services, and facilities at your university in calendars, enrolment booklets, or on a web site. Other times there will be an unwritten code of conduct – an example of this is not to be disruptive in lectures.

Without a doubt, each university has its own distinct culture or way of doing things. Simply put, university culture refers to the language, beliefs, and rituals that it has (Ballard & Clanchy, 1988). Unfortunately, "a large body of students are proceeding to university without a clear understanding of tertiary culture" (Hamilton & Trewhella, 1993, cited in McInnes & James et al., 1995, p.29). This means that some students, because they are unaware of this 'culture', may not do as well as others who have learned early on what is required at university. Once you learn what is expected, you unlock the door to academic success. Some examples of university culture can be the distinction between certificate, diploma, degree, and postgraduate courses. It may include jargon such as "undergraduate", "postgraduate", "capping", "critical analysis", "literature review", "lectures", "labs", "prerequisite", and "co-requisites". It is like another language!

University sub-culture

Now that we understand a little about university culture and what it means, you also need to be aware that there are sub-cultures that also exist within the university. Similarly, as with the term culture, sub-culture refers to the language, beliefs, and rituals of *particular departments* within the university. An example of a university sub-culture can be seen in the psychology department, which has particular rules and conventions that they expect their students to follow when completing assignments, essays, or theses. A major influence on psychology assignments is APA format (American Psychological Association), which specifies the way in which students should set out their work. In contrast, the history department usually expects students to use a different format for their assignments.

<u>Survival tip: How culture will affect your studies</u>
So what, you might say? Who cares about this culture/sub-culture thing? Well, it may mean that your assignments will receive lower marks if you do not follow departmental guidelines. But how and where do I find out what is expected? The first is simply by reading course outlines, study guides, and writing guideline books. The second is by asking your tutor or lecturer what is required. Just follow the rules for each paper and do not assume that you will be using the same conventions for each paper you do; find out what is expected, and then obey those rules.

<u>Top ten ultimate tips</u>

1. **Timetable**
   You should know where you are supposed to be and when – check and double-check the times as well as any timetable changes. Buy a diary and <u>use</u> the diary! It is important to know which tutorials and labs are compulsory, when they start, and where they are being held. Usually, tutorials do not commence until the second or third week of lectures, but this varies. Also, write down your lecturer's or your tutor's office hours. Buy a year planner and write down all the dates that your assignments, tests, and exams fall. You do not want any surprises and, with good planning, there shouldn't be any. Do not forget to allow time for relaxation or breaks; they can be just as important as study itself.

2. **Keep up with your required readings**
   Each lecture has required material that needs to be read. It may comprise a chapter(s) from the textbook or readings from study guides. Follow the lecture outline so that you know what the required readings are and where to find them. Read the required material *before* the lecture, lab, or tutorial, to aid comprehension. Plan your timetable to include time for reading prior to and after the lecture, lab, or tutorial.

3. **Do not be afraid to ask**
   When you are sitting in a lecture or tutorial, do not be afraid to ask for clarification or to ask that 'dumb' question (most of the time, the question *isn't* dumb at all). Chances are there are many others who will be thinking the same thing! If you are shy, then approach the lecturer or tutor afterwards. University staff are here to help and this rule applies to wider questions regarding health, finance, or study, so please ask.

4. **Buy a dictionary and a thesaurus**
   The course you are studying will expose you to terms that you have not used for many years, if at all. A dictionary is invaluable. In addition, many academic texts have their own jargon and there are specialist dictionaries, such as medical, biology, and science dictionaries that can provide

definitions not found in general dictionaries. A thesaurus can be useful if you have ‘writer’s block’ and cannot find the correct expression or term; however, a thesaurus needs to be used with caution – you should only use words that you know the meaning of.

5. **Course changes**
   Be aware of the final dates to add and withdraw papers. If you want to make changes you will need to know if they will affect your degree, as you do not want to withdraw yourself from compulsory papers. If in doubt, ask your dean, or the appropriate course advisers. Again, check with an adviser if you think the degree you have started is not the one you want to do. You *ar*e allowed to make changes, but do so before the final dates.

6. **Amenities**
   Find out where facilities are such as toilets, study rooms, the library, lifts, computer labs, Health & Counselling, Students’ Association, and Student Learning Centre. Above all, find out where the best places for coffee, tea, or juices are. The many cafés around the university may provide a welcome break from study and can be a lively gathering place for class members.

7. **Introduce yourself**
   The first few weeks at university provide a great opportunity to meet new people. Students and staff members can provide vital information that you may miss out on. Get to know your class members – you can form study groups with them, go over readings together, or do exam preparation together.

8. **Transport**
   Plan your cycle, bus, walking, or car route, noting the times you need to leave from home or the hostels. Think about contingencies so that you are able to get to varsity if your normal mode of transport is out of service.

9. **Make appointments early**
   If you need to see your lecturer, tutor, or Student Learning staff member for help on an assignment or lab, do not leave it to the last minute! You may miss out on receiving help if you leave it to the last minute.

10. **Have fun**
    You *are* allowed to enjoy your studies and have fun, so please make sure you do. Remember, you only get out of it what you put into it – corny, but true!

Laboratory Class One: Research Methods Laboratory. Sex differences and thinking

(Assessed laboratory class)

Lecturers: Dr. Tony Lambert (author of lab class)
Dr. Doug Elliffe (author of Research Methods lectures)

Learning Objectives

After completing this laboratory students should

1. Understand the distinction between an independent-groups research design and a within-subjects or repeated-measures research design.
2. Be able to use a histogram in order to explore and evaluate the variability in set(s) of scores
3. Be able to calculate the standard deviation of a set of scores using SPSS
4. Be able to perform a *t* test in order to compare two experimental conditions
5. Understand the statistical nature of inferences based on the outcome of a *t* test
6. Gain an appreciation of the complex issues that may be encountered in considering possible relationships between experimental evidence and theoretical conclusions.
7. Be able to think critically about the relationship between experimental evidence, psychological theory and everyday behaviour.

Introduction

Do men and women think differently? If so, to what extent and in what ways does the thinking of women differ from that of men? Judging from the enormous popularity of publications such as *Men are from Mars, Women are from Venus;* it seems that almost everyone has at least some interest in this question. In addition to popular publications of the Venus and Mars ilk, a substantial amount of serious science has been directed at answering this question. It will come as no surprise to discover that this work is controversial. Controversy over research into sex differences in thinking is apparent at several levels.

There has been disagreement concerning the reliability of the findings: Sex differences have been reported in a number of published studies, but not all these findings been replicated successfully by other researchers. Therefore, questions remain concerning the reliability of results in this area. In addition to the question of empirical reliability, there is the rather thornier question of what the experimental findings may signify in terms of psychological theory. There are many strands to this question. For example there is of course the perennial nature-nurture issue. So if we find, for example, that men and women differ in their verbal and spatial skills, is this due to environmental factors arising from different childhood experiences and child-rearing practices for boys and girls; or is it due to innate factors, related to biological and relatively immutable differences in brain structure and function for men and women? In addition to this rather baldly stated dichotomy between nature and nurture, a third state of affairs is possible – that both nature and nurture contribute, and that biological factors interact with learning and experience in complex ways during childhood. One might also wish to consider the size of any effect – although men and women may differ as a group on a particular cognitive task, there will also be considerable overlap in the scores. Clearly, the degree of overlap between the cognitive performance of men and women will have a bearing on the conclusions that can be drawn.

These are just some of the issues that have confronted researchers interested in the question of whether men and women think differently. The laboratory activity for this week involves carrying out a study on sex differences in verbal and spatial thinking. The aim of the exercise is to enable students to learn about, and gain some first hand experience of the research process - from research design to data collection, to data analysis and interpretation (see *Learning Objectives* listed above). This is a tall order for a two-hour lab session! Therefore, our main focus will be on illustrating and consolidating ideas that were discussed in the Research Methods lectures delivered recently.

The research findings of Halari *et al.* (2005)

In a study published very recently, Halari *et al.* (2005; *Behavioural Neuroscience, 119,* 104-117)[1] asked 42 men and 42 women to perform a variety of verbal and spatial tasks. Blood samples were also taken, so that measures of circulating hormones, especially oestrogen and testosterone, could be measured. This was done because one aim of their study was to discover whether there is any relation between hormone levels and performance on cognitive tasks. There were three main findings:
(1) Females performed better than males on a verbal fluency task; (2) Males performed better than females on a spatial task involving mental rotation;
(3) There were no clear relationships between hormone levels and performance on any of the cognitive tasks. In the laboratory exercise for this week we will attempt to replicate the first two findings of Halari *et al.* (2005). (Obviously, it is impractical to look at their hormonal findings in PSYCH 109 – and even if we could, attempting to replicate their 'null result' may not tell us very much.)

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[1] A copy of this paper is available via CECIL as a pdf file. However, please note that it is not necessary for students to read this paper as part of the assignment. It is entirely possible to complete the assignment and obtain high marks without reading the Halari paper, which contains a great deal of technical detail which is well beyond the scope of this Stage One course. Nevertheless, I have placed a copy on CECIL so that students who wish to, can satisfy their curiosity about the original work which provided the inspiration for this class. In addition, I have placed a commentary paper by Doreen Kimura on CECIL. Again, this is not required reading, but interested students might like to take a look, since this commentary piece provides a snap-shot (albeit a rather one-sided one!) of the lively debates that surround the question of sex differences and thinking.

Our study, and that of Halari *et al.* (2005) make use of an ***independent-groups*** research design (also known as a ***between-subjects*** research design). As you will remember from the recent Research Methods lectures, an independent groups (between subjects) design involves comparing different groups of individuals. In this case, our ***independent variable (IV)*** is sex (see footnote [2]), because the experiment involves comparing men and women with respect to scores on verbal and spatial tasks. Other examples of independent - groups designs might involve comparing extraverts with introverts (independent variable is personality), or five year olds with seven year olds (IV) is age), or left handers with right handers (IV is handedness), or anxious with non-anxious individuals (IV is anxiety), and so on. An alternative, and equally popular approach is to use a ***within-subjects*** research design (also known as a ***repeated-measures*** research design). In a within-subjects (repeated-measures) experiment the same individuals are tested repeatedly in two or more experimental conditions. An example of this kind of design could involve comparing the driving behaviour (using a simulator!) of individuals before and after consuming varying amounts of alcohol (IV is alcohol dosage). Another example could involve asking individuals to employ different strategies (e.g. mnemonics vs. rote learning) for memorising information, and then comparing their performance under these different instructional conditions (IV is memory strategy). Each kind of design (i.e. repeated measures and independent groups) has advantages and disadvantages which render them useful for research in different kinds of situation. One advantage of the repeated-measures design is that it is often

[2] You should notice that we're using the term 'independent variable' a little loosely here. In terms of the strict definition, an independent variable is something manipulated by the experimenter. That is, if the research design isn't an experiment, then there isn't an IV. However, many sources use 'independent variable' to mean the variable that is presumed to cause changes in the dependent variable (the measure of behaviour). You'll be aware that the lecturer for this part of the course (DE) thinks something is lost by not keeping to the strict definition. This is because inferring causation is more difficult with the looser definition. In the case of this experiment, we're interested in knowing whether being male or female causes differences in performance on the tasks (A causes B). We know that performance on the task doesn't cause people to be male or female (B definitely doesn't cause A). But we don't know whether there might be some other variable which is correlated with sex that actually causes any difference in performance (like socialisation, as discussed elsewhere in this lab description). Remember, we can be much more confident about inferring causation if we've done an experiment, where WE control the independent variable. This study is not an experiment, and DE would argue that it doesn't have a true independent variable. In several areas of psychology it is either impossible or unethical to manipulate variables that are of interest to the researcher (e.g. comparing men with women, comparing anxious with non-anxious individuals, comparing older adults with young adults). In the present example we have no experimental control over the sex of our participants - we cannot randomly assign participants into male and female groups!
Studies in which participants are compared with respect to variables that cannot be controlled by the researcher are really looking for a correlation between dependent variables, and don't have a true independent variable. They are therefore observational or correlational designs, and confer less ability to infer causation.
But, you should be aware of both the strict and looser uses of the term 'independent variable', because you'll come across both as you continue in your study of Psychology, and because there's dispute between different psychologists about this issue. It's not too soon to learn that nothing is really clear-cut, even apparently simple definitions …

more sensitive than an independent-groups design. This is because each person is being compared with themselves under different experimental conditions. A disadvantage of repeated-measures designs is that the results can be contaminated by practice and/or fatigue effects. A common strategy for eliminating or minimising this problem is to *counterbalance* the order of performing in the different experimental conditions. For example, in the driving and alcohol example just mentioned, half the participants might perform the driving task in the alcohol condition first followed (several days later!) by the no alcohol condition; the other half would participate in the two experimental conditions in the reverse order. Independent-groups is of course the appropriate design in any situation where the research question is related to individual differences, such as personality or handedness. Independent-groups designs are also often used in the clinical trials of medical researchers, where the effectiveness of one treatment is compared with that of another.

Hence, our study will employ an ***independent-groups*** research design with sex (female vs. male) as the "***independent variable"*** (see footnote [2]). The study will have two ***dependent variables:*** scores on a verbal fluency task and scores on a mental rotation task. As you will remember from *Research Methods* lectures dependent variable(s) are the quantities or factors that are being assessed to see whether they might be related to (i.e. dependent upon) changes in the independent variable

How to carry out the study

As mentioned earlier, our aim is to try and replicate the findings of Rozmin Halari and her colleagues published two years ago in the journal *Behavioral Neuroscience* (Halari *et al.,* 2005). To do this, each student participant will need to carry out a mental rotation task and a verbal fluency task. All participants will perform the mental rotation task first followed by the verbal fluency task.

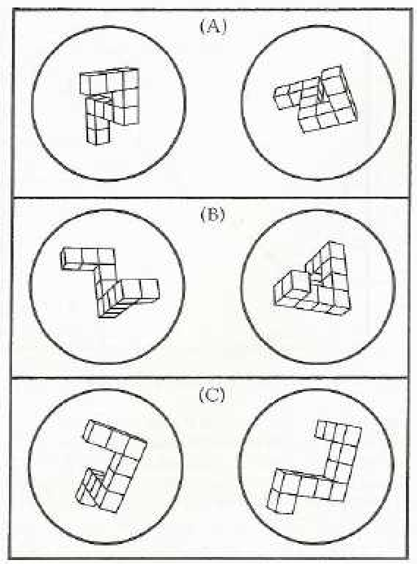

Figure 1. In the mental rotation task (see text) participants must decide whether pairs of shapes, such as those shown in A, B and C are identical or different.

Mental rotation task Look at the top pair of pictures (A) shown in Figure 1. Are the shapes shown in the pictures exactly the same, or are they different? How did you arrive at your answer? Most people report that they solve this problem by imagining what would happen if one of shapes were rotated. In this case, if you imagine rotating the left hand shape clock-wise (or the right hand shape anti-clockwise), you may be able to 'see' in your mind's eye, that the two shapes are exactly the same. Now, decide whether the pairs shown in (B) and (C) are also the same. By using the same strategy, you might be able to 'see' that the shapes in B are also identical, but the shapes in C are different – and remain different, whichever way you rotate them in your imagination.

The drawings shown in Figure 1 are similar to those used by Roger Shepard and Jacqueline Metzler in a classic study published in the journal *Science* in 1971. Shepard and Metzler found that the time taken to make a decision in this mental rotation task increases systematically as the angular disparity between the two drawn objects increases. These findings attracted great interest at the time, and continue to attract interest nearly four decades later. One reason for this enduring fascination is that Shepard and Metzler's findings showed that a mental phenomenon such imagination, which appears at first glance to be irredeemably private, subjective, and unobservable (by anyone else, aside from the person doing the imagining) can nevertheless be studied scientifically. Furthermore, their findings showed that one aspect of imagination, the mental rotation process, appears to operate in a highly systematic and lawful way.

In the version of the mental rotation task to be used for this laboratory exercise, you will be presented with pairs of line drawings representing 3D shapes, and will be asked to decide whether the two shapes are the same or not. As in the examples shown in Figure 1, the shapes will be presented at varying orientations. On trials where the correct response is 'different' the two shapes are usually mirror images of each other. These features of the task make it relatively difficult! Do not be concerned if you make errors when you carry out this task. The ***dependent variable*** for this part of our experiment is *percent correct*; clearly the experiment would fail if everyone was able to perform the task with 100% accuracy!

After you have completed the 3D Mental Rotation task, use the scoring sheet provided by your tutor to calculate how many of your answers were correct. There were 48 trials in this experiment, and it is a straightforward matter to calculate the percentage of correct answers from this:

Mental rotation (MR) percent correct = 100 * (Number of correct trials / 48)

First dependent variable (DV):

Percent correct = _____%

Verbal fluency task: This task involves writing down as many words as you can think of from a particular category in the space of one minute. This procedure will be repeated three times, producing an overall *verbal fluency score,* which is the total number of category examples produced. This verbal fluency score is our second ***dependent variable***. Your demonstrator will provide some further instructions explaining how to carry out this part of the experiment.

Verbal fluency score = total number of category exemplars produced

Second dependent variable (DV):

Verbal fluency score = _____

Thinking about data analysis

Our experimental hypotheses, based on the work of Halari *et al.* (2005) are:

1. That women will, on average, have a higher verbal fluency score than men.
2. That men will, on average, be more obtain a higher accuracy score (percent correct) than women on the 3D mental rotation task.

The **null hypothesis** in this situation is that men and women will not differ, with respect to verbal fluency or performance on the mental rotation task.

Our two experimental hypotheses will be tested by carrying out ***t* tests for independent groups**. More on this shortly. However, in my own experience as a researcher I have found that an important stage in analysing the results from an experiment is to explore and get to know the data. After all, one has usually spent a LOT of time preparing a new piece of research. This will often include: considering different hypotheses and ways of testing them, choosing and designing experimental tasks, thinking about experimental procedures, thinking about possible confounds (see Research Methods lecture notes and Psychology Text) and ways to avoid them. Having spent so much time thinking about a piece of research, most investigators agree that it is a good idea to take a good hard look at the data resulting from it. In an experiment such as this one, the data comprise, essentially, two sets of figures – one representing the performance of men the other the performance of women. Before carrying out the *t* test it is a good idea to take a look at our two sets of scores in order to gain some idea of the main features of the data set. In this case we are probably interested in features such as the following. What is the range of scores (i.e. what are the highest and lowest scores?); were these obtained by men or women? How much overlap is there in the scores of men and women? How much variability is there in the scores of men and women? What was the average score for men and women? This stage of ***exploring*** the data is usually carried out first, and is followed by a more formal analysis, such as a *t* test, which will usually involve a test of statistical significance. In this case we want to know if the performance of men is significantly different from that of women, on mental rotation and verbal fluency tasks. However, before carrying out either stage of analysis it is necessary to enter the data into SPSS.

Using 'Variable View' to set up your data table

When you open up SPSS for the first time you will see a table of cells. At this stage they are empty, waiting for data to be entered. Now look at the bottom left of the screen; you will see two tabs, labelled '**data view'** and '**variable view'**. As its name implies, the 'data view' contains a table of the data that one wishes to analyse. However, the variable view is equally important, since this page tells SPSS what the values contained in the data view actually represent.

In SPSS each row of figures in the data view represents the scores of a different individual. Each column represents an attribute or score relating to that individual. Therefore, if thirty one people participated in our study (17 women and 14 men) we will need to enter thirty one rows of data. For this experiment we will also need to set up three columns. The first column will represent participants' sex; the second will represent rotation accuracy (percent correct); the third will represent verbal fluency (number of category examples).

A feature of SPSS that you might find slightly confusing at first is that each **row** in 'variable view' represents a different **column** in the data view. We will use the first 'data view' column to tell SPSS whether an individual is male or female. Here is the sequence of actions you need to carry out in order to set up the 'Sex' column:

1. Click on 'variable view' and enter 'Sex' into the first cell of the first row. This is now the name of your first variable.
2. Click on the cell in the first row that is located under 'Decimals'. Reduce the number of decimals to zero.
3. Click under 'Label' and enter 'Sex'
4. Click under Values, and then click again on the small grey square on the right hand side of this cell.
5. A small pop-up box will appear. Enter '1' in the Value cell and 'Male' in the Label cell, then click Add. Now enter '2' in the value cell and 'Female' in the label cell, then click Add, again. This tells SPSS that the variable called sex can take two values, and that 1 represents a male and 2 represents a female. Now click 'OK' to return to 'variable view'
6. If you switch back to 'data' view' you will see that the first column now has an informative heading ('Sex').

The next step is to set up a column for the mental rotation scores. This is what you need to do:

1. In 'variable view' click on the first cell in the second row (under 'name') and enter 'Rotation'.
2. Reduce the number of decimals to 1.
3. Click under label and enter 'Percent correct''

Setting up a column for the verbal fluency scores follows the same procedure:

1. In 'variable view' click on the first cell in the third row (under 'name') and enter 'Fluency'.
2. Reduce the number of decimals to zero.
3. Click under 'Label' and enter 'Number of category examples'.

Entering the data

This is the boring part! Go back into 'data view' and notice that the first three columns are now labelled 'Sex', 'Rotation' and 'Fluency'. For each participant, enter their sex (1 for a male or 2 for a female), rotation accuracy (percent correct) and verbal fluency (number of category examples).

Exploring the data

A handy first step in getting to know your data-set is to draw a histogram or dot-plot of the data. If you run the Viewlet program for carrying out an independent samples *t* test you will find that this also shows you how to draw a dot-plot. However, a histogram will show you the same information in what I find to be a slightly clearer format. To display a histogram of our data you will need to perform these actions:

1. Choose Graphs from the menu at the top of the screen, then choose Histogram.
2. A pop-up box will appear. Click on Percent correct [Rotation], then click on the uppermost of the rightward facing arrow-heads. This will move 'Percent correct' into the box labelled Variable:
3. Click on Sex, then click on the middle arrowhead. This will move sex into the box labelled Panel by/ Rows:
4. Click 'OK'.

When you click 'OK' SPSS will automatically generate a window containing the SPSS output file. Now repeat steps 1-4, replacing 'Percent Correct' with 'Number of category examples' in the 'Variables:' box. At this stage your output file will contain two pairs of histograms showing mental rotation (percent correct) and verbal fluency (number of category examples) data, for men and women, respectively. Additional information will be added to the output file as we perform further analyses of the data. Notice that the arrangement of each pair of histograms enables you to see several important features of the data-set in a single glance. It is easy to see where the highest and lowest scores lie, and it is easy to see the degree of overlap between the scores of men and women. It is also worth remembering that you can switch back and forth at any time between the 'Data Editor' window and the 'SPSS Output' window by clicking on 'Window' from the menu at the top of the screen.

Calculating descriptive statistics (Mean and Standard Deviation)

Having explored the data by translating them into visual form as histograms, the next step is carry out some more formal comparisons of scores for men and women. To begin with we need to calculate means and standard deviations for men and women. This can be done by:

1. Click on 'Analyze' from the main menu, then choose 'Descriptive Statistics', then choose 'Explore.'
2. A pop-up box will appear. Click on Percent correct [Rotation] and move it into the upper box labelled 'Dependent list:'
3. Now click on 'Number of category examples [Fluency], and add it to the 'Dependent list' box.
4. Click on 'Sex' and move it into the 'Factor list:' box.

These actions instruct SPSS to calculate descriptive statistics separately for male and female individuals. Once again, the Output file will appear. You will notice that a wealth of information has been produced by the last command.

However, in this context we are really only interested in two out of the many statistics shown: these are the **mean** and **standard deviation**.

The mean: a measure of central tendency

As you will remember from elementary school mathematics, the mean is the average score; it is calculated by adding all the scores together and dividing by the number of cases (N). The symbol $\overline{X}$ (X-bar) is often used to represent the mean. The mean (i.e. average) fluency score for men is of course calculated by adding together all the fluency scores for men, then dividing by the number of men in our sample. This can be written as:

$$\overline{X}_{men} = \frac{\sum X_{men}}{N_{men}}$$

Where: $\overline{X}_{men}$ is then mean score for men
(not to be confused with the (arguably) more exciting X-Men)
$\sum X_{men}$ is sum of scores obtained by men, and
N_{men} is the number of men in our sample

Obviously, mean scores for women ($\overline{X}_{women}$) are calculated in the same way.

Variance and Standard deviation: measures of variability

Although most students will be familiar with the mean, many of you may be less familiar with the ***standard deviation*** of a set of scores. This is a measure of the variability in a set of scores. Are the scores clustered tightly around the mean, or is there a wide spread of scores? The standard deviation assesses the degree of variability or dispersion in a set of scores.

How can this be done? The first step is to calculate the mean and then compare each individual score in turn with the average score. That is we calculate the difference between each score and the average score:

$$\mathbf{X} - \overline{\mathbf{X}}$$

If the scores are tightly clustered around the mean, most of these deviation scores ($\mathbf{X} - \overline{\mathbf{X}}$) will be quite small; conversely if the scores are widely dispersed many of our $\mathbf{X} - \overline{\mathbf{X}}$ scores will be large. Perhaps we could gain a measure of variability by just working out the average of all the deviation scores? Unfortunately this will not work. Some of the deviation scores will be positive (higher than average scores) and some will be negative (lower than average scores). These will balance each other out, so that the average deviation score will always be zero. This problem can be avoided by taking the square of each deviation score. Since the square of a negative number is always a positive number, the problem of deviations in one direction balancing out deviations in the other is eliminated. The average of the squared deviation scores is known as the **variance**. The symbol s^2 is usually used when referring to variance. It is calculated using this formula:

$$s^2{}_x = \frac{\sum (X - \overline{X})^2}{N - 1}$$

Standard deviation and variance are very closely related. Standard deviation is simply the square root of the variance. The symbol ***s*** (or SD) is usually used when referring to standard deviation. The formula for calculating **s** is the square root of the formula for variance, shown above. That is:

$$s_x = \sqrt{\frac{\sum (X - \overline{X})^2}{N - 1}}$$

Although this might look like rather a brainful, especially if maths is not your strong point, it is not too difficult to understand. The standard deviation basically measures the average deviation between individual scores and the average score. We have worked out the difference between each score and the average score, then squared those differences and divided by N-1 to work out the **variance**. The **standard deviation** is the square root of the variance. Unlike the variance, the standard deviation is expressed in the same units as the original scores in our data-set. However, you might still be wondering about one aspect of these equations. Why are the squared differences divided by N-1 instead of N? The reason is slightly complex. We have calculated the standard deviation and variance using scores drawn from a ***sample*** of participants. In this case our sample comprises women (and men) enrolled in PSYCH 109. However, we hope that our results will generalise to the whole ***population*** – of men and women respectively. It turns out that using N-1 in the equation for standard deviation (and variance) provides a more accurate estimate of standard deviation (and variance) in the ***population***, from which our ***sample*** of scores has been drawn.

As a further aid to understanding how a standard deviation is calculated the table shown below contains a worked example.

Standard deviation example

Verbal fluency scores (X)

N (number of scores) = 10

Participant	***X***	$\boxed{X - \overline{X}}$	$\boxed{(X - \overline{X})^2}$
1	5	1	1
2	3	-1	1
3	1	-3	9
4	6	2	4
5	3	-1	1
6	4	0	0
7	5	1	1
8	6	2	4
9	3	-1	1
10	4	0	0
$\sum$	40	0	22

$$\text{Mean} = \overline{X} = \frac{\sum X}{N} = \frac{40}{10} = 4.0$$

$$\text{Standard Deviation} = s_x = \sqrt{\frac{\sum (X - \overline{X})^2}{N - 1}} = \sqrt{\frac{22}{9}} = 1.56$$

It is important for students to understand what a standard deviation measures and how it is calculated, as explained above. However, as you can see, the calculations are potentially rather cumbersome, especially if N is large. Luckily, it is not usually necessary for you to plod laboriously through all the steps shown above. SPSS can calculate means and standard deviations for large data-sets instantaneously (In addition, most scientific calculators include functions for calculating means and standard deviations.)

Nevertheless, it is important to understand what is happening when SPSS outputs means, standard deviations, or indeed any other statistic.

The *t* test for independent groups
Having entered the data, explored the data and calculated descriptive statistics, the final and crucial stage of our data analysis is to use *t* tests to evaluate whether the performance of men differs from that of women, with respect to verbal fluency and mental rotation scores. However, once again, before diving into SPSS and clicking on the *t* test functions, it will be useful to pause briefly, in order to examine the nature of the *t* statistic and what it can tell us.

As you will remember from the recent Research methods lectures, the *t* statistic is essentially a ratio, where

$$\mathrm{t} = \frac{\text{difference between two means}}{\text{standard error of the difference between means}} = \frac{\overline{X}_{women} - \overline{X}_{men}}{\text{standard error of difference between means}}$$

As was mentioned in *Research Methods* lectures, we can reject the null hypothesis and conclude that two experimental groups differ from each other when the value of *t* is greater than a critical value. You may also remember that the magnitude of this critical value varies with sample size. As you can see from the equation just given, the value of *t* will increase as the size of the difference between the means increases. However, notice that the value of *t* is also determined by the denominator – the **standard error of the difference between means**. As you can see, a large value of *t* will only be obtained if the experimental effect is large ***in relation to*** the standard error. What is a standard error? The standard error represents an estimate of how much a statistic would vary, if one were to repeat a set of observations several times, using different samples drawn from the same population. In this case we are interested in the standard error of the quantity which forms the numerator of our *t* ratio – the difference between mean scores for men and women. The computational formula and rationale for calculating this standard error are somewhat complex, and will not be presented here. Nevertheless, it is worth noting that the standard error in the denominator of a *t* ratio is calculated from the **variance** (s^2) of scores in the two samples, together with the size (N) of each sample.

Performing *t* tests on the data
t tests can be performed on the data we have collected by following these steps:

1. Click on ‘Analyze’ then select ‘Compare means / Independent-Samples *t* test.
2. Click on ‘Sex’ and move it into the box labelled ‘Grouping Variable’
3. Click on ‘Define Groups’, check ‘Use specified values’, then enter 1 in the box for Group 1 and 2 in the box for Group 2. Click continue. This

tells SPSS to compare males with females, as we defined them when setting up the data editor in ‘Variable View’.
4. Click ‘Number of category examples’ and move it into the box labelled ‘Test Variable(s). Click on Percent correct (Rotation) and move it into the Test Variables box.
5. Click ‘OK”

After clicking ‘OK’ the output window of SPSS should appear, displaying the outcome of two *t* tests. These *t* tests compare men and women with respect to their performance on the verbal fluency and mental rotation tasks respectively. As usual, the output window contains a wealth of information; for our purposes, the crucial pieces of information in the output are the *t* value, the degrees of freedom (df), and the significance level (sig two tailed).

Like many other statistics, the value of *t* obtained from our *t* test is associated a quantity known as **degrees of freedom**. In this case, the degrees of freedom associated with our *t* test is equal to the number women in our sample minus one, plus the number of men minus one:

$$df = (N_{women} - 1) + (N_{men} - 1)$$

Degrees of freedom are important because the critical values of t, which are used for deciding whether or not to reject the null hypothesis vary with df. For the curious, a fuller definition is that the degrees of freedom associated with a statistic is the number of number of independent pieces of information remaining after one or more parameters have been estimated.

The most important piece of information in the SPSS *t* test output is the upper value shown in the box labelled ‘Sig (two-tailed). This value is the probability that the difference between the mean scores for men and women would have occurred by chance, given the degree of variability in our samples of scores. As you will remember from Research Methods lectures, a probability criterion is used for deciding whether to reject the null hypothesis. In Psychology and several other disciplines this criterion is often set at $p<.05$. That is, the null hypothesis is rejected and we conclude that the performance of men differs from that of women if the probability associated with our *t* test comparison is less than .05. Conversely, if this value is greater than .05 then the null hypothesis should be accepted. That is, we conclude that any difference observed in the average performance of men and women can be attributed to chance variation, and that that men and women do not differ in their performance of this task.

Laboratory write-up

The write-up for this week’s laboratory class involves preparing: (1) A concise *Results* section which describes the main findings of our experiment, and (2) a brief discussion section, which considers what the results might be telling us about sex differences in thinking.

The **Results** section of a laboratory report should normally includes:

- Tables and/or figures which display statistics (such as means and standard deviations) and graphs that summarise the data
- A brief prose description of the main features of the results. This description will normally refer the reader to tables and figures summarising the main findings. When reporting the outcome of statistical tests, the degrees of freedom and *p* value associated with that statistic should be quoted. Here is an example: "The experiment showed that left handed participants obtained significantly higher creativity scores (Mean creativity score = 59.2, SD = 8.4) than right handers (Mean creativity score = 45.3, SD = 7.9), $t = 4.83$, df=53, $p<.05$." As far as I know, left handers are no more creative than right handers – the example is fictitious, but I hope it gives you an idea of the correct convention for reporting the outcome of a *t* test in your Results section.
- Remember that a *Results* section is primarily *descriptive,* and should be as concise as possible. Extended discussion and interpretation of the results in terms of theoretical ideas is reserved for the *Discussion* section – though sometimes it can be appropriate to combine these into a single *Results and Discussion* section.

In addition you should write a brief Discussion section. **Important:** your discussion section should be about **one** page long and must not exceed the space provided. In writing your discussion, you might like to consider points such as the following.

- Were sex differences apparent in the verbal fluency task, the mental rotation task, or both?
- If the *t* test(s) that were performed did reveal statistically significant differences between men and women, what can we conclude? In considering your answer to this question you might want to think about several further issues, such as:
- How much overlap is present in the scores?
- Our experiment made use of laboratory tasks, measuring verbal fluency and mental rotation. What relationship(s) might exist between the performance of these laboratory tasks and the performance of verbal and spatial tasks in everyday settings? For example, do you think that the ability to write a clear and fluent essay, or deliver a well crafted speech, would be strongly related to scores on our verbal fluency task. Do you think that the ability to park a car, or design an apartment block might be strongly related to performance on the mental rotation task?

The list provided above should be regarded as suggestions for discussion, rather than an exhaustive list to be worked through. Feel free to consider other points, but remember that your discussion must be focused clearly on the results of ***this*** experiment, and should not digress into a more general essay about sex differences – however interesting that may be!

THE UNIVERSITY OF AUCKLAND
NEW ZEALAND

PSYCH 109: Laboratory Report One

(Write neatly within the boxes provided)

Please provide all information requested in this box on every laboratory assignment that is submitted for marking.

Name:____

Laboratory Session: ____________________

Full Name of Instructor: ____

Laboratory Room: ____________________

RESULTS

*Write a brief description of the main findings of the experiment in the space below (**2 MARKS**). You should also construct a table that summarises the results (**1 MARK**)*

RESULTS (continued)

DISCUSSION

Write a brief discussion of results from the experiment in the space below. Your discussion should about one page long. It must ***NOT EXCEED THE SPACE PROVIDED.*** **(7 marks)**

***Study Tip #2: Lectures, Labs, & Tutorials

Lectures

Lectures are part of the university tradition. They are presentations by the lecturer to large numbers of students. Lecturers may use overhead transparencies (OHTs), handouts, PowerPoint presentations, or video clips to present their material. The audience is expected to be attentive and there is usually some opportunity to ask questions. For some students, one of the most difficult aspects of lectures is staying awake. Some find the challenge of attending the right lecture demanding enough, whilst a few may find keeping up with the torrent of information that seems to be rushing toward them the major concern. Nevertheless, lectures are not just exercises in learning to sleep with your eyes open; they can be valuable sources of information if you know what to do *before*, *during* and *after* lectures.

Why take notes?

Given that you may be provided with handouts and such, you may wonder why you should bother taking notes during lectures. Here are some reasons:

1. Note taking helps you *concentrate during the lecture* – it gives you something to do and focus on.
2. Taking notes reinforces the material you have been studying and aids retention.
3. Notes will provide you with a useful revision source at exam or test time.

Active listening

Active listening involves analysing the information you are receiving by looking for deeper meanings and considering the relationships between concepts. To learn lecture material effectively, you need to process it beyond a surface level, and to think about the significance of this new information in relation to your current knowledge. Active listening will help you to do this.

When listening to lectures, think about:

- How does this information fit into what I have read or experienced?
- Is the lecturer stating *fact* or *opinion*?
- What *examples* are used to illustrate points – are they useful?
- What are the *main arguments*? Are they *valid*?
- Does the lecturer *give evidence* to support arguments?
- Is there evidence of *contrary views*?
- What are the lecturer's *sources* and *references* – are they *reliable*?
- What do *I* think about what has been presented? Do I *agree* or *disagree*?
- What questions remain unanswered?

What to do Before, During, and After Lectures

Before the lecture

- Read the relevant text(s) *before* the lecture! Pre-reading helps you incorporate new knowledge into your existing knowledge framework more easily - even if you have only read the summaries or the glossary of terms, it will still be useful going into the lecture. Course outlines tell you what to read and when.
- Scan your notes from the previous lecture
- Arrive early to collect handouts and read through the lecture outline to find structure – this helps you when taking notes from the lecture
- Sit where you can see clearly, feel involved in the lecture, and avoid distractions.

During the lecture (finding structure)

- Work out the *structure* of the lecture:
  - Some lectures are *very* structured and easy to follow whilst other lectures may appear to be less-structured, but it will be organised in some way – so look for structure.
  - Pre-reading the topic will help you find structure where there appears to be little because the textbooks or readings will be structured themselves
  - The lecturer may outline the format of the lecture by *writing it on the whiteboard*, on a *handout,* on *Cecil* or an *OHT*
  - Most lecturers will *introduce* the topic, *develop* it, and finish with *conclusions*
  - Pay attention to language such as:
    - "To begin…my first point is…in conclusion…to sum up…"
  - Listen to *verbal cues* that the lecturer uses to indicate how the main points are organised, for example: "There are *four categories* of interventions that aim to delay the onset and severity of neurological disease. *Firstly* …"
  - Overt cues: "This will be in the test…this would make a great exam question…"

After the Lecture

- Revise your notes *as soon as possible* after the lecture – add your own comments or questions. You may want to expand on areas you need to recall later. You may even *rewrite notes* for use in essays and exam revision.
- Fill in any gaps and complete diagrams, using the textbook if appropriate
- Note down points of poor understanding and ask lecturer or tutor for clarification after the lecture or during labs or tutorials.
- Try to create a visual summary, this will allow you to link ideas together.
- Check reference details and note points that link to your own research and assignments.
- Put your finished notes in a folder or other filing system.

Tutors:

Tutors are exceptionally useful people to know. Tutors are often postgraduate students. However, they can be quite busy and there is a protocol that you should observe to make your life, and theirs, easier.

1. The first thing you must do is take note of their *office hours and where* to find them. This is important, especially around essay/assignment/exam time – please give them advanced warning for appointments rather than seeing them the day before an assignment is due or if you require an extension.

2. Sometimes, you can check with your tutor if you have interpreted the assignment question correctly and show them your assignment plan (but, read point 3).

3. Try to work out the problem yourself *before* you see the tutor, *don't go to them with nothing*; try and work out a plan or answer yourself, *and then* see the tutor.

4. Talk over any concerns with the tutor; they will give you good advice.

5. Get feedback from your tutors when you receive your assignments back. Find out what worked *as well as what went wrong* – it can save you repeating your mistakes.

What to do Before, During, and After Labs and Tutorials

Before (Prepare)

- Pre-read – what question or activity have you been set?
- Work through questions or problems set for the lab or tutorial
- Note areas that you need clarified, or any difficulties you have with the text
- Anticipate questions that might be asked.

During (Participate)

- Work through exercises that have been set, ask questions, and discuss with other students possible solutions or ideas
- Ask questions you have brought with you. **Make sure you get the answers before you leave** – usually, many others have the same question – so don't be afraid to ask
- Get to know students so you can organise support groups – get phone numbers!
- Make an oral presentation to the group and invite feedback on your ideas
- Rephrase what someone has said as a way of clarifying ideas.

After (Post-mortem)

- Go over your notes in the same way you do after lectures
- Make links between your tutorial notes and your lectures as well as essay topics, etc.
- Check your understanding of concepts and problems
- Write up your lab results as soon as possible
- Convert tutorial notes into one-page summary, diagram, or mind-map – this can help when it is time to revise for exams.

Laboratory Class Two: Basic Neuroanatomy and Function

Lecturer: Ms. Michelle Burstall

Learning objective:

- The aim of this laboratory is to enable students to gain a basic knowledge of the locations and functions of basic structures and divisions of the human brain.

Lobes of the Cerebral Hemispheres

The cerebral hemispheres are divided into four major lobes named after the skull bones which overlie each. They are the frontal, temporal, parietal and occipital lobes.

Frontal lobes
The frontal cortex covers about one third of the cerebral hemispheres. This makes the frontal lobe the largest. The frontal lobe is separated from the parietal lobe by the central sulcus (also known as the central fissure), and the lateral fissure separates the frontal and temporal lobes.

A major region in the frontal lobe is the primary motor area which lies in the precentral gyrus. Lesions to the motor cortex may cause deficits in the organisation and initiation of movement. Speech disorders are associated with lesions of the posterior inferior area (Broca's area). These are termed expressive aphasias.

Temporal lobes

The organisation of the temporal lobe is very complex. It is related to the senses of olfaction and audition whose primary projection areas lie within its boundaries. It is also related to the visual system and serves to integrate visual perception with information from the other sensory systems. The temporal lobes play an important part in memory in both its general and specific aspects and have important connections with the limbic system, which partly enables the integration of the emotional and motivational aspects of the organism.

Lesions in the temporal lobes may have many complex results due to the complexity of the lobe's functions but unilateral temporal lobe lesions usually result in some auditory, visual, or intellectual changes. Lesions to auditory association areas produce sensory or receptive aphasia (Wernicke's aphasia) which results in the person having difficulty distinguishing and comprehending speech sounds.

Parietal lobes

The parietal lobe has two main surfaces, one lateral and one medial. The primary somatosensory cortex is located in the post central gyrus. This is the main area for reception of numerous forms of somatic sensation. As the parietal lobes are situated between the frontal, occipital, and temporal lobes, it is closely related in function to each of these other regions and a greater variety of clinical manifestations may result from damage to the parietal lobe than any other area. Deficits in association areas tend to be perceptual or cognitive in nature rather than simple disturbances of sensation. Disorders of spatial orientation may be the result of parietal lobe damage. These may include difficulties with the spatial location of objects, disorders of personal space, and impairment of memory for location. A well known disorder called unilateral spatial neglect may result from right parietal lobe damage; the sufferer of this disorder would neglect stimuli to their left side. This means that only the right page of a book would be read, food on the left side of the plate would remain uneaten; the left side of the body would not be dressed, and so on.

Occipital lobes

The occipital lobe forms the posterior part of the cerebral hemispheres and does not have a dividing line on the surface, but a natural demarcation on the medial aspect called the parieto-occipital fissure seems to separate the occipital lobe from the others. Due to the fact that external landmarks are rare, the occipital lobe appears to merge into the parietal lobe above, and the temporal lobe below. The most posterior section contains the primary visual cortex and it is here that nerve fibres relay visual information from the eyes. Lesions in the visual pathway from the retina to the primary area may produce a variety of visual defects.

An interesting condition known as prosopagnosia is described in most introductory texts and is usually a result of bilateral lesions in the occipital lobe. It has proved difficult to isolate the regions of damage in this condition. The result of this deficit is the inability to recognise faces, even one's own!

Primary cortex

Primary cortex is devoted to the reception and initial processing of information. These areas project to secondary regions which then connect to association areas whose function is to integrate diverse information for purposeful action. Association areas make up the largest proportion of the cerebral cortex.

As previously mentioned, the frontal lobe contains the primary motor cortex, the parietal lobe contains primary somatosensory cortex, the temporal lobe contains primary auditory cortex and the occipital lobe contains primary visual cortex.

Localisation of function

Knowledge about localisation of function (which region of the brain is responsible for which particular neurological function) has mostly come from lesion studies (the study of behaviours resulting from damage to specific brain areas). Cerebral trauma may result from physical injury; with some of the most influential research findings have come from military injuries where projectiles such as bullets and shrapnel have penetrated brain tissues. Also, motor vehicle crashes, haemorrhage, and contusions can result in brain lesions which then cause a wide variety of behavioural deficits. Nowadays investigations of these traumas are carried out by a variety of means including Computerised Tomography (CT scan), Positron Emission Tomography (PET scan) and more recently, Magnetic Resonance Imaging (MRI).

The material covered in this laboratory is designed to give a basic understanding of the anatomy and function of the Human Nervous System. The focus will be on structures in the brain and the understanding of brain-behaviour relationships.

Method

Apparatus

A computerised interactive neuroanatomy atlas called “Brainiac”

Procedure

Begin the “Brainiac” computerised neuroanatomy atlas program and click on the gyri and sulci module. Locate the structures and areas in the following table, checking off each when you understand their location and function. Please do not divert from the instructed program as this may mean that you do not cover the required material.

Review the structures shown then test yourself by clicking on the test function and using “show structure or show name of structure”

Note: In order to complete your laboratory assignment you will need to read the relevant material in Chapter 2 of your textbook.

	Structure/Area	Function
	Brain Stem	connects brain to spinal cord
	Cerebellum	co-ordination, balance and muscle tone
	Corpus Callosum	transmits information between hemispheres
	Lateral sulcus	separates the temporal lobe from the frontal and parietal lobes
	Longitudinal cerebral fissure	separates the left and right hemisphere
	Occipital gyri	visual processing
	Precentral gyrus (Primary motor cortex)	planning, controlling and executing movement
	Postcentral gyrus (Primary somatosensory cortex)	processes incoming sensory information from the body, such as pain, pressure, and temperature.
	Temporal lobe	auditory processing
	Thalamus	relays incoming sensory information (except olfaction)

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Laboratory Report Two:
BASIC NEUROANATOMY AND FUNCTION
(Assessed laboratory class)

(Please write neatly within the boxes provided)

Please provide all information requested in this box on every laboratory assignment that is submitted for marking.

Name:__________________________ Laboratory Session: ___________

Full Name of Instructor:_________________________________

1 Read the following case report.

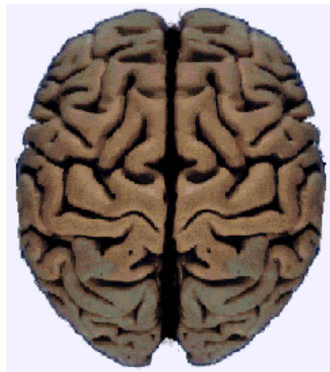
Rob was hit in the head by a ball while playing cricket. Later, after regaining consciousness in hospital, it was noted that he could not move the fingers on his right hand easily, and also that he had poor balance and co-ordination.

Briefly outline the areas of Rob's brain that were most likely damaged by his accident. How did you come to your decision?

Answer (3 marks)

2 Indicate on the picture below the area(s) that would most likely be damaged if a person was to experience weakness in their left hand and visual problems following a head accident. Label the area(s) and provide a title for the illustration.

Answer (2 marks)



3 Read the following case study

After drinking with his friends one night, John decided to climb a lamppost. Falling from half way up the post, John landed face down on the sidewalk, striking his forehead on the concrete.

What symptoms or impairments *might* he suffer as a result of such a blow to the front of his head. Explain why?

Answer (2 marks)

4 Read the following case study

Following a car accident Sue was unable to comprehend or generate speech.

What disorder(s) is Sue likely suffering?

Draw a diagram of Sue's brain, clearly labelling the area(s) most likely damaged in the car accident. Remember to include a title.

Answer (3 marks)

Laboratory Class Three: Brain and Mind

(*Non-assessed laboratory class)*

Lecturer: Ms. Michelle Burstall

Learning Objectives

After completing this laboratory students should

1. Understand the arguments for the proposal that what we think of as mind is entirely generated by activity in the brain.
2. Be familiar with the experimental and observational tools that can be used to study the brain and mind.

Introduction

The consideration of the relationship between Brain and Mind is known as the Mind-Body problem. Neuroscientists operate on the assumption that all that we think, feel, and remember - the very experience of ourselves as conscious individuals - that which we refer to as our mind, is generated in it's entirety by the activity of our brain.

All in the Mind –

In this laboratory, you will be shown the video "All in the Mind" – an episode in the "Brain Story" series from the BBC, presented by Professor Susan Greenfield.

In this episode, several lines of evidence are presented that support the contention that mind is generated by the activity of our brains. After the video, you will be separated into groups to discuss how the different lines of evidence support this view and how well they do so.

Pay particular attention to

1. **Electrical Brain Stimulation**
2. **Phantom Limb**
3. **Brain lesions – the effects on specific high-level cognitive processes (e.g. amusia).**
4. **Parkinson's, dopamine and movement (changes in brain chemistry change behaviour).**
5. **Effects of brain lesions on emotional behaviour/personality**
6. **Epilepsy – effects on sensory perception**
7. **Brain Imaging (e.g. MEG) during cognitive tasks**
8. **Other evidence not covered – e.g. effects of alcohol and recreational drugs on brain and mind.**

No written report is required for this laboratory, but you should use it to consolidate your knowledge. Make sure you understand the terms shown in the above section in **bold***.*

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Laboratory Class Four: Visual Illusions

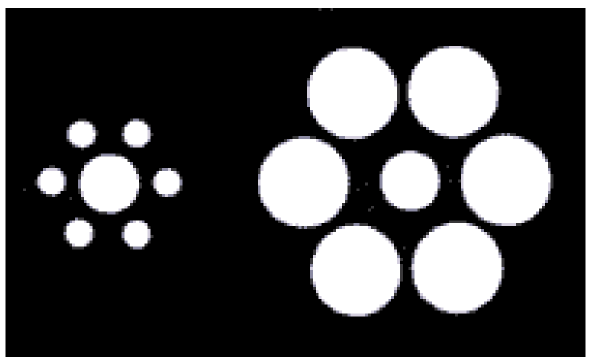
(Non-assessed laboratory class)

Lecturer: Dr. Tony Lambert

Learning Objectives

After completing this laboratory exercise students should be able to:

1. Describe the Muller-Lyer illusion of line length.
2. Describe the phenomenon of constancy scaling.
3. Describe at least two alternative theories of the Muller-Lyer illusion.
4. Be able to adopt a critical stance when considering alternative interpretations of psychological phenomena.



Introduction: Seeing is believing?
Look at the two central circles in the above diagram. Which circle is bigger? When shown this figure for the first time, most people are pretty confident in judging that the left hand circle is bigger. However, if you measure the circles with a ruler you will readily discover that the circles are equal in size. Now that you *know* they are of equal size, look at the circles again. Do they seem equal now, or does the left hand circle still look larger? I have seen this illusion, and shown it to students many, many times – but the left hand circle still looks larger to me! Psychologists and philosophers have long been fascinated by situations like these, in which our perception of the world (the circle on the left looks larger) and our knowledge of 'reality' (the circles are the same size) do not correspond.

One of the earliest known illusions was described by the ancient Greek philosopher Aristotle. Cross your index and middle finger. Now close your eyes and either rub the tip of your nose between your crossed fingers, or touch the tip of your nose in rapid alternation with your fingers, while keeping them crossed. What do you feel? Again, many people experience an odd mismatch between perception (*'I can feel two noses'*) and knowledge *('My face has **a** nose, singular, and unaccompanied'*).

There are two main reasons why psychologists interested in perception often study illusions. Firstly, exploring and experiencing illusions can be fun. (After you complete this lab class, you might like to take a look at www.eyetricks.com and www.illusionworks.com.) Secondly, it is believed that insight into psychological processes can often be gained by examining what happens when the functioning of that process goes awry. So, in the case of perception it is hoped that studying unusual distortions and misperceptions may provide important clues concerning 'normal' perception. The processes responsible for normal perception are undoubtedly very complex and in a sense this complexity is masked by the effortlessness and immediacy of everyday perception - we just open our eyes and we see the world. What could be simpler? However, it has become clear from research that 'seeing' involves not only our eyes, but also intricate neural activity across a whole network of areas, spanning a surprisingly large amount of the brain. As you will learn from lectures and from Chapters 5 and 6 of the course text, the study of illusions is one of several tools used by psychologists and neuroscientists in their attempts to unravel and explain the mystery of human perception.

In this class you will examine one very well known illusion: the Muller-Lyer illusion of line length.

The Muller-Lyer Illusion

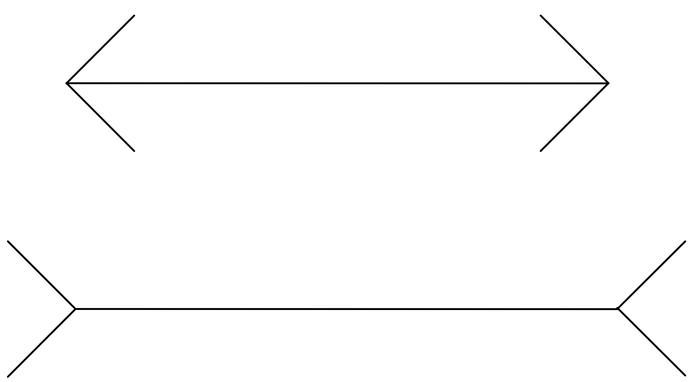


Figure 1. The Muller-Lyer illusion. For most people, the bottom line appears to be longer even though the two lines are of equal length.

The Muller-Lyer line length illusion is illustrated in Figure 1. Most people agree that the lower line, with the outgoing fins looks longer. The aim of this lab class is to shed some light on the question of *why* the lower line looks longer. While several theories of the Muller-Lyer illusion have been proposed, this class will focus on the two most popular and, in my view, most plausible explanations.

The Constancy Scaling Theory

The clearest version of this theory was proposed by Richard Gregory, a well known British psychologist. This theory takes as its starting point, our automatic tendency to see two dimensional shapes and patterns drawn on a piece of paper as a representing three dimensional objects and scenes. Our tendency to do this is illustrated most vividly in the power of cartoons to evoke a vivid experience of a person or scene, on the basis of a highly simplified line drawing. An example of this is shown in Figure 2. According to Gregory's theory, the visual system also tends to interpret the Muller-Lyer figures as representing a three dimensional scene. As shown in Figure 3, the figure with the ingoing fins could be interpreted as representing the edge of a box, or a rectangular building, viewed from the outside. The figure with the outgoing fins could be interpreted as representing the edge of a box or room, as viewed from the inside. Why then, should an interpretation of the Muller-Lyer figure in terms of perspective lead to misperception of line length? The answer lies in the notion of *size constancy*. Size constancy refers to the tendency of the visual system to compensate for changes in size as objects become increasingly distant (see Psychology Text, pp.141). If two objects of similar size are placed one metre and four metres away from the eyes, they look fairly similar in size, even though the retinal image of the nearer object is four times larger than that of the more distant object. Your tutor will provide several concrete examples of size constancy at work. One way of describing size constancy is to say that the visual system compensates for distance by 'scaling up' the perceived size of objects that appear to be more distant.

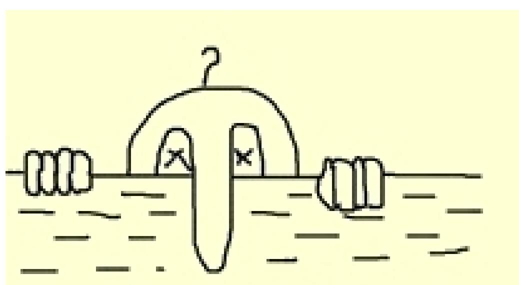


Figure 2: The 'Chad' cartoon which was popular in graffiti of the 1940s and 1950s. Cartoons illustrate the ability of the visual system to generate a vivid mental representation of a 3D scene on the basis of a highly simplified line drawing.

Gregory's theory of the Muller-Lyer illusion proposes that this size scaling process is responsible for the distorted perception of line length that occurs in the Muller-Lyer illusion. To see how this works, look again at the illustration in Figure 3. The fins in the figure shown on the left suggest a receding perspective, in which the edge suggested vertical line is relatively distant from

Figure 3. The fins of the Muller-Lyer illusion can be interpreted as suggesting depth.

the observer; the fins in the figure on the right suggest a different perspective, in which the edge suggested by the vertical line is nearer to the observer. The effect of constancy scaling in this situation would be to make the more distant edge appear larger. It is worth remembering if a distant object produces a retinal image of the same size as a nearer object; the distant object really would be larger. The same kind of mechanism can explain another well known illusion of line length, the Ponzo illusion, which is illustrated in Figure 4. Therefore, Gregory's constancy scaling theory of the Muller-Lyer asserts that the line in between the outgoing fins looks larger because this line *is larger,* if the visual system is using the depth perspective suggested by the fins to infer that the line is relatively distant from the observer.

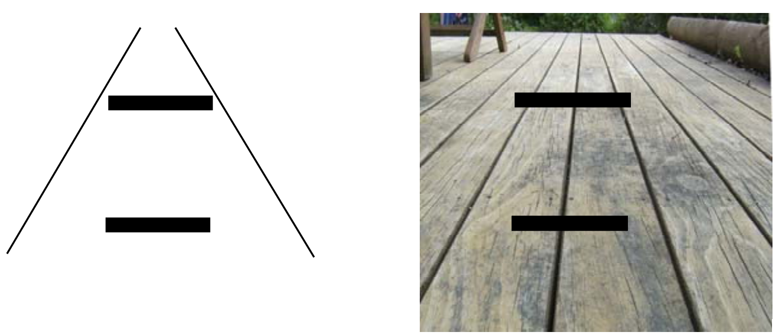


Figure 4. The Ponzo illusion. The two bars are the same size, although the upper bar appears to be larger

Gregory's theory is perhaps the most popular explanation for the Muller-Lyer, and as we have seen it has the advantage that it can also explain other illusions such as the Ponzo. On the other hand, one obvious problem is that the depth perspective, which Gregory argues is suggested by the fins, is not immediately apparent to most observers. To most people, the Muller-Lyer figures look flat and two dimensional. This is an awkward problem for the theory. To overcome this difficulty Gregory argues that constancy scaling can operate in an automatic and non-conscious, way in response to very sparse and simplified depth cues, such as the Muller-Lyer fins. According to Gregory, these depth cues are not strong enough to trigger a full blown perception of the lines as part of a three dimensional object (as in Figure 3), but they are sufficient to trigger a process that he calls *primary constancy scaling,* which can operate independently of conscious depth perception. One of your tasks when you divide into small groups for this class will be to decide whether you think the idea of primary constancy scaling, and indeed Gregory's theory as a whole is at all plausible.

<u>The Context theory</u>

An alternative theory of the Muller-Lyer has been proposed by another British psychologist, Michael Morgan. According to this theory the misperception occurs because participants' judgements of line length are unavoidably biased by the overall size of the two versions of the Muller-Lyer figure. Morgan points out that the visual system is notoriously poor at abstracting elements and making perceptual judgements that are independent from the surrounding context. The field of perception research contains many, many examples of contextual effects in perception, as recent lectures have shown. Our perception of the colour and lightness of an object is strongly influenced by the colours and lightnesses of objects in the surrounding context. The moon illusion provides anther striking example. The full moon when seen near the horizon looks strikingly different in size to a full moon seen in a different context – when it is high in the sky – even though the size of the moon's image in our eyes is identical in both cases. Morgan asserts that the misperception of line length in the Muller-Lyer can be seen as a further example of a context effect on size perception. He points out that the outgoing fins version of the figure *really is longer* than the ingoing fins version, and suggests that our perception of central line is unavoidably biased by the presence of the outgoing fins, which increase the overall size of the object. That is, he argues that the larger overall size of the outgoing fins version of the illusion leads to a bias in which the central line is also perceived as larger. Our perception of the central line is unavoidably biased by the surrounding fins, just as our perception of the lightness of an object is unavoidably biased by the lightness of the surroundings.

<u>Which theory is correct?</u>

The two theories do have some elements in common. In a sense, they both propose that we see some elements of the figure as larger because they *really are larger*. In the case of Gregory's theory this proposal is tied to the presence of perspective and the idea that a distant object really would be larger than a near object that produces an image of the same size. Morgan's theory, in contrast, makes no appeal to the idea of depth cues, and proposes that our length judgement for the central line is biased by the overall size of the object, which is larger when the outgoing fins are added.

The elements which distinguish between the two theories enable one to think about what each theory would predict if one were to start fooling around with the illusion to alter it in various ways. What would happen if instead of using impoverished depth cues such as fins, one used realistic depth cues and presented the lines in the context of a realistic scene? Do the two theories make different predictions about what should happen here? What would happen if instead of fins, one used other shapes which influenced the overall size of the object without suggesting depth? What would each theory predict in this case? Over the years visual psychologists have dreamed up many different variations on the Muller-Lyer theme, and assessed their perceptual consequences. What would happen if one varied the size and angle of the fins? What would happen if the fins and the central lines were presented in different colours? What would happen if the fins were made less salient, by presenting them as very faint lines, or perhaps as single dots that merely suggest a line?

This is perhaps a good place to make a general point about the nature of scientific work. One popular misconception about the distinction between the work of artists and scientists is the view that imagination and creativity are an important of the former, but not the latter, which relies on logical analysis. Nothing could be further from the truth. This popular caricature of the divide between science and the arts relies on an inappropriate and mistaken dichotomy between creative and analytic thinking. Imagination and creativity are crucial to both scientific and artistic work. As we have just seen, an important part of scientific work is the ability to imagine 'what if?' scenarios. Indeed, if one is a physicist this can extend to imagining entire Universes! In this specific case, we are trying to make progress concerning the best explanation for the Muller-Lyer by imagining what might happen if we played around with different features and aspects of the distorting figures. However, in scientific work the creative play of imagination must be allied with a clear analysis in which elements of the proposed experiment are linked tightly with elements of the theory (ies) which are being tested. That is, before performing an experiment on the Muller-Lyer, we need to have a clear idea of the predictions made by each of our two competing theories concerning the outcome.

This week's lab class will be carried out in two stages. In the first stage, each student will experience the Muller-Lyer illusion by viewing program which presents a standard version of the task, and measures the extent of the illusion. Having experienced the illusion in its most familiar form, students will divide into small groups in order to consider what will happen if we were to alter the Muller-Lyer figures in various ways, which are explained below. Will the illusion be enhanced or reduced? Will the illusion disappear or remain the same? A crucial feature of your discussion task is to think about whether the constancy scaling theory and the context theory make ***different*** predictions about each situation. Three different versions of the Muller-Lyer illusion have been prepared for you to try out. However, your small group discussion need not be limited to these pre-programmed versions of the task. It will also be interesting and worthwhile to dream up new versions of the Muller-Lyer figures, and to consider whether these novel figures will help decide between the constancy scaling theory and the context theory.

Variations on the Muller-Lyer theme

Three different versions of the Muller-Lyer task have been programmed for you. Your demonstrator will provide instructions on how to run these programs.

1. ***Standard Version*** This version simply presents the familiar version of the task. Participants are presented with the two Muller-Lyer figures, and are asked to adjust the length of one of them until the two central lines appear to be the same length. The expected result is that participants will adjust the figure with the outgoing fins to be somewhat shorter than the figure with the ingoing fins.
2. ***Enhanced perspective version:*** In this version of the task, the Muller-Lyer figures are presented against photographs depicting realistic three-dimensional scenes. In this case, the judgement of line length is carried out, not in the context of highly simplified depth cues (the fins), but in the context of a realistic scene containing a rich set of cues, producing a clear perception of depth.
3. ***Non-perspective version:*** In this version, the fins at either end of the lines are replaced with circles, producing a shape resembling a weightlifter's barbell. In this version the perspective suggested by the outgoing and ingoing fins has been removed, but as in the original, the two figures differ in overall size.
4. ***Minimalist version:*** Here, the fins have been replaced by single dots. What do you think will happen to the extent of the illusion in this situation? Will the effect disappear entirely? Do the constancy scaling theory and the context theory make different predictions about consequences of this manipulation?

The lab exercise

This week's lab exercise can be carried out in several stages, as suggested below:

- Carry out the standard version of the task, and measure the extent of the illusion.
- Divide into small groups of about 6-8 students
- Consider and review the constancy scaling theory and context theory of this illusion. What do you think are the strong points and the weak points of each theory?
- Consider the three different variants of the Muller-Lyer task, and think about the predictions that each theory makes about the extent of the illusion in each case.
- Consider and decide which of the three variants of the illusion will provide the most valuable information for deciding between the two

theories. Measure the extent of the illusion for the variant(s) you have chosen to explore.

- Use SPSS to draw two histograms which summarise the results for your group. One of these histograms should summarise results for the standard version of the illusion. The other histogram should summarise results for the variant you have chosen to explore. If time permits, feel free to explore other variant(s) of the task as well.
- After collecting your data, each group should reform in order to decide whether findings from the experiment you have performed tend to support the constancy scaling theory, the context theory, or are inconclusive on this question
- Before concluding the discussion, you might like to consider how you would design further experiments which could shed light on the question of which theory provides the best explanation for the Muller-Lyer illusion.

**Study Tip # 3: Memory Skills

1. Repetition

If you are trying to memorise something, repeat it to yourself a number of times. The more you do this, the easier it is to remember. Even so, please note that "although repetition is *necessary* for learning it is not *sufficient* for most learning" (Higbee, 1988, p.62). Basically, repetition, by itself, is not enough.

That being acknowledged, repetition really makes huge improvements to memory and recall through the '*over learning*' of material. In other words, keep learning the material over and over again, even if you feel that you have just mastered the concept. This over learning will improve your ability to remember and recall information (Higbee, 1988).

2. Recall, Recall, Recall, Revise, Revise, Revise

When learning material it is important to recall and revise it. You will need to, when studying, regularly close the textbook and recall what you have just read. There is a tendency to forget a great deal of what you have read within the first 24 hours, so revision within this 24-hour period is vital to memory. But, do not just stop there; revise 48 hours later, and so on. Eventually what will happen is that you will end up learning, remembering and recalling the information with little effort!

3. Look for structure and the main ideas

When studying a chapter in a book, or a particular theory, try to look at the overall structure or the main ideas. If you get a feel for the overall organisation of a theory, you can then begin to learn the specific details of the theory later.

Another reason why you should look for structure is because it helps set up 'memory files'. Your memory can be organised similar to a filing cabinet. Within each drawer are files that need to be 'labeled' so that you can find the material on a certain topic. Looking for structure can be used when drawing mind or concept maps, planning essay outlines, and in studying for exams and it is a useful method that affects many other areas of your university course work.

4. Look for meaning

An active learner who engages in deep processing of the material by looking for meaning will be able to recall information better. If something doesn't make sense to you then it will be more difficult to learn and hence remember and recall (Higbee, 1988). Active learners ask questions and try to make the material meaningful. Sometimes you can connect a theory with your personal experience or ask questions to gain an understanding of a topic. Don't ignore dictionaries and encyclopaedias, they may allow you to 'get your head around' a topic; it is vital that you *understand* what you're supposed to be learning. If you do not understand something, you will find it difficult to remember it.

5. Rhymes

"I" before "e", except after "c" or when sounded like "a", as in "neighbour" and "weigh…"

A rhyme like this is an effective way to learn and recall material because it is more than just words on a page; it has a song-like quality to it that involves more than just visual processing but auditory processes also. This is one reason why a rhyme is memorable.

6. Chunking

"0800 83 83 83"

This (in)famous (?) set of numbers illustrates the rhyme and chunking principle. Chunking involves grouping material together rather than learning each item separately. Our short-term memory can only deal with a limited amount of information (around seven items) before we 'bump out' old information to make room for new information. When we chunk things together, we are able to remember *more than just 7 separate items*. For example, the above number comprises *10* digits: 0 8 0 0 8 3 8 3 8 3. But, when grouped into four chunks, "0800"; "83"; "83"; "83"; it is far easier to remember.

7. Association

When you try to memorise information, make links between the information you have to remember with other things. To illustrate, when trying to remember whether you should use the word "principle" or "principal", you can remember that a princip**<u>le</u>** is a ru**<u>le</u>** and a princi**<u>pal</u>** is your **<u>pal</u>** (*sometimes*) and use the appropriate word accordingly.

Another example of association involves the way to remember an area of the brain called "Broca's area" and how it relates to speech (it *produces* speech). Memorise **"BP"**: **B**roca's **P**roduces speech. "BP" is easy to recall. When you want to remember that Wernicke's area is responsible for speech *comprehension*, memorise **"WC"**: **W**ernicke's **C**omprehends speech. Now, "BP" is a petrol station and "WC" stands for water closet or toilet. When you want to remember the location of these two areas on the left hemisphere, memorise "*at the **BP** station, the toilets (**WC**) are at the back*" – this allowed you to remember that Broca's area is toward the front of the left hemisphere while Wernicke's area is toward the back of the left hemisphere. In addition, and probably MUCH easier to remember, B comes before W in the alphabet and Broca's area is anterior to (or further to the front of) Wernicke's area.

Though these are actually gross generalisations of what these areas actually do, the memory methods outlined allow you to easily remember the major differences between these areas.

8. "***<u>See</u>*** me, ***<u>hear</u>*** me, ***<u>touch</u>*** me, ***<u>taste</u>*** me, & ***<u>smell</u>*** me"*

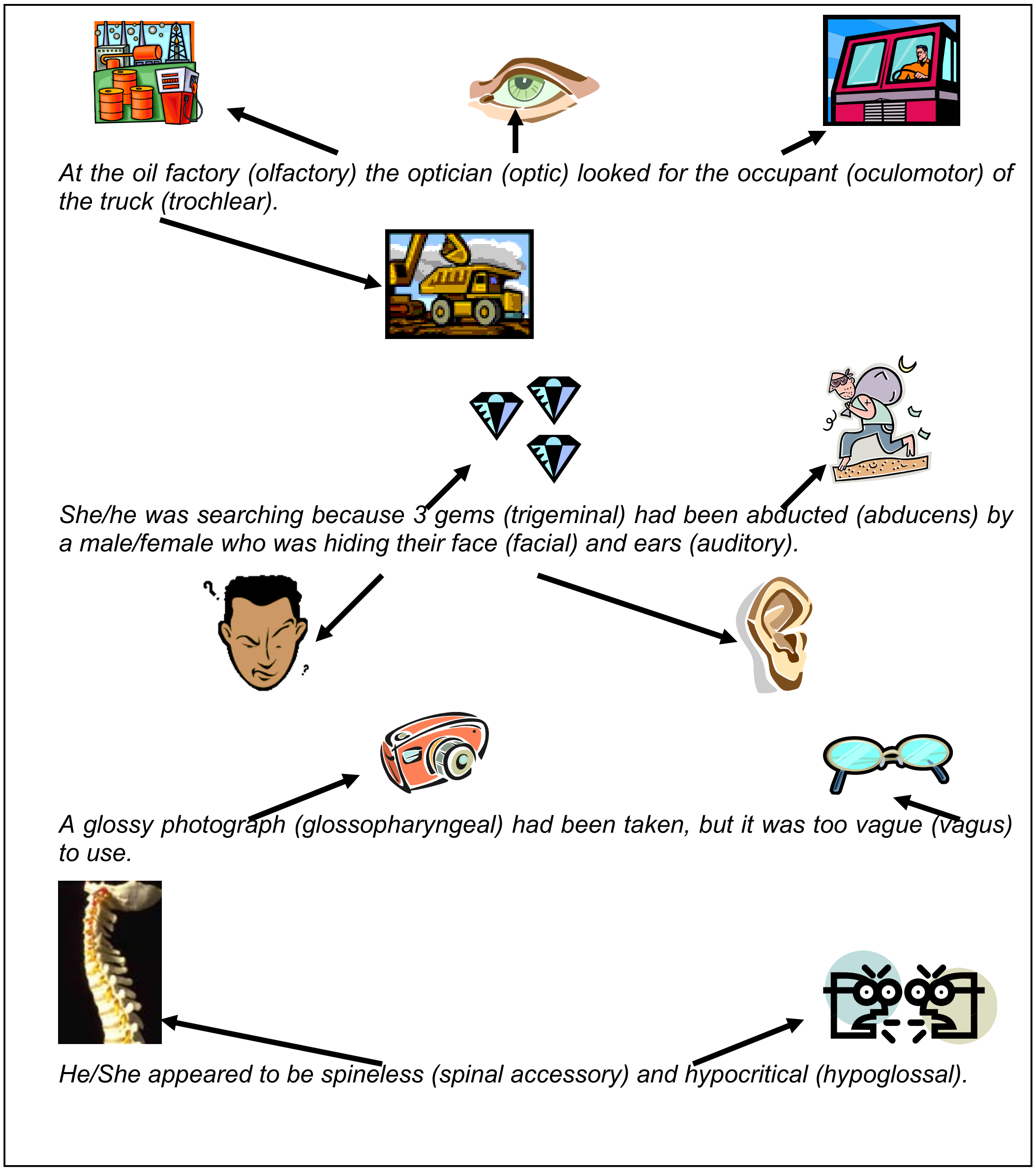
Trying to remember something by using visual images is an extremely powerful memory technique. However, combined with smells, sounds, and touch, we evoke strong emotions and make more links to the material to be remembered, thereby increasing our ability to retain and recall that information.

*No, we're not trying to be gross, just *memorable*.

9. Other mnemonic strategies

Mnemonics refer to methods that aid memory (Buzan, 1974; Higbee, 1988; McPherson, 1999). Technically, that could cover all of the methods above, but they usually refer to particular strategies that strengthen the memorisation and recall of material (Higbee, 1988).

How about learning the 12 cranial nerves? (Higbee, 1988, p.140):



Acrostics

Acrostics are phrases or poems in which the first letter of each word or line functions as a cue to help you recall the words that you are trying to remember. One popular example is the phrase: "Every Good Boy Deserves Fruit". This acrostic is used to remember the order of notes on a musical scale – E G B D F. Another example is the acrostic used to remember resistor colour codes and their values (useful in Engineering & Technology): "Betty Brown Runs Over Your Garden But Violet Grey Walks" – Black, Brown, Red, Orange, Yellow, Green, Blue, Violet, Grey, and White.

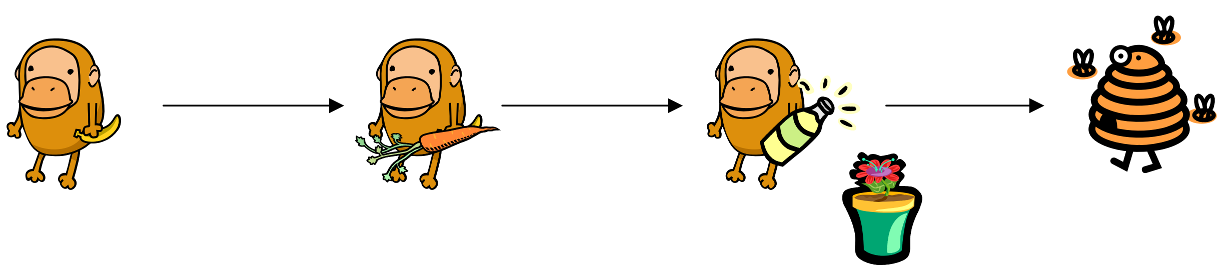
Acronyms

Acronyms make up pronounceable words (unlike acrostics) that are formed out of the first letters of a series of words you are trying to remember. A popular acronym is "FACE", again another musical application.

Imagery

Pictures can be recalled more easily than verbal descriptions (Higbee, 1988). Also, *concrete images* such as car or boat, will be better remembered than *abstract concepts* such as intelligence or love (Higbee, 1988; McPherson, 1999).

One imagery method you can use to enhance retention and recall is the *link method* (Buzan, 1974; Higbee, 1988). For example, if you need to remember bananas, carrots, lemonade, and honey, you could imagine a monkey eating *bananas*, while planting *carrots*, and watering them with *lemonade*. The sweet syrup in the lemonade attracts bees who use the syrup to make *honey*.



Stories

Another imagery method, **narrative** (stories)**,** can also be used to aid recall. Stories can even be used to memorise formulas such as the conversion from Fahrenheit to Centigrade (Higbee, 1988, p.141):

($F = 9/5C + 32$): Friday (**F**) is the same as (**=**) 9 to 5 (**9/5**) drag in college (**C**); and (**+**) I've only got 32 minutes to go!

Stories are easy to remember and, combined with the other methods outlined in this section; provide a powerful memory strategy that will enhance your learning, memory, and recall.

Method of loci

Linked to imagery, the *method of loci* involves taking an imaginary walk in your mind through a *familiar* path along which you associate items that you are trying to remember. For example, take the grocery list above (see

“Imagery”) and place the items (visually in your imagination) throughout your room, house, street, or wherever! From the earlier grocery list, you could imagine a giant *banana* on your doorstep that you have to step over so that you can get in the house. Then you find that *carrots* have been planted in the hallway. Moreover, you step into the bathroom to find the bath filled with *lemonade*! You storm into the lounge to find that bees have decided to make a hive on your TV and that honey is dripping down the television screen. Now, try and recall the list, it should be easy.

Laboratory Class Five. Memory Recall and the False Memory Task

(Assessed laboratory class)

Lecturer: Dr. Tony Lambert

Learning objectives

After completing this exercise students should be able to:

1. Describe the effect of memory cues on recall performance.
2. Consider practical situations in which memory cues might used in order to improve recall.
3. Describe a procedure used to induce ‘false memories’.
4. Consider possible practical implications of findings obtained from the false memory task.

Introduction

The laboratory exercise for this week involves carrying out two memory demonstrations. Both demonstrations are concerned with the accuracy of human memory, but they provide very contrasting perspectives. It is hoped that the juxtaposition of these exercises will prove thought provoking, and stimulate discussion concerning the design features of *human* memory – which as we shall see differs radically from the type of memory storage found on computer disks or DVDs.

Does the brain store everything?

A popular myth about human memory is that ‘the brain stores everything’. According to this myth, all of our experiences are stored in memory. The problem we experience in remembering the past occurs not because the information has been lost, but because it has become difficult to retrieve from the labyrinths and deep recesses of our memory. This myth is sometimes associated with the claim that hypnotic regression can be used to recall and re-experience any previous event, such as your fifth birthday, or even the experience of being born. Sadly, careful investigation has shown that hypnosis does *not* bring about a seemingly magical improvement in our ability to recall events from the past (see Psychology Text pp. 257).

However, although there is no real evidence that *everything* is stored in memory, there is plenty of evidence for the idea that memory contains a lot more information than can be recalled on any particular occasion. Have you ever sat in an examination room feeling sure that you ‘know’ some material related to a question, but can’t quite retrieve it – only to find that the information comes back to you later on, after the exam is over when you are reviewing the experience? You can probably think of many other examples where information that eludes your memory on one occasion, comes back to you at a later time.

Memory Recall
The first part of this week's memory exercise involves reproducing a classic experiment carried out back in 1966 by Endel Tulving and Zena Pearlstone. Your demonstrator will provide instructions on how to run the program that presents the memory experiment. The experiment does not take long to perform, and provides a nice illustration of how memory 'cues' can enable us to retrieve information that has apparently been forgotten

The fallibility of memory
As mentioned earlier, the second part of this week's class, the *False Memory Task,* provides a very different perspective. This task illustrates the fallibility, rather than the capacity and accuracy of memory. In a way it might 'give the game away' to describe the nature of this task in too much detail before you perform it. It is probably best to simply follow the instructions of your demonstrator and see what happens when you perform the task.

Discussion task
After completing both memory demonstrations, students should divide into groups of about five people. Your task in these groups is to consider possible implications of the two demonstrations for views of human memory. As an aid to focusing your discussion, you might like to consider questions such as the following:

- Do you think that results from the *Memory Recall* task might have any practical implications? Results from this procedure show that providing 'cues' to prompt memory can produce a striking improvement in recall. Can you think of practical situations where a cueing procedure might be employed to improve memory? If so, might this kind of procedure have disadvantages as well as advantages?
- Do you think that results from the false memory task might have any practical implications? For example, might the process whereby our memory 'fills in' certain details, on the basis of context and expectations have implications for eyewitness testimony in the judicial system? Do you think that there will be some circumstances where false memory will be a problem and other circumstances where false memories will not be an issue? If so, can you describe these circumstances?
- The false memory demonstration shows that a memory system, such as ours, which 'fills in' missing information on the basis of previous knowledge and expectations, has some disadvantages. Can you think of any advantages that this feature might confer on a memory system?
- Can you think of ways to improve the experimental procedure of the *Memory Recall* and or the *False Memory* demonstrations?

The bullet points above should be viewed as a set of suggestions, rather than a list to be worked through. Feel free to ignore some or all of them if you can think of other issues concerning human memory that are prompted by this exercise.

THE UNIVERSITY OF AUCKLAND
NEW ZEALAND

PSYCH 109: Laboratory Report Three: Memory

(Write neatly within the boxes provided)

Please provide all information requested in this box on every laboratory assignment that is submitted for marking.

Name:____

Laboratory Session: ____________________

Full Name of Instructor: ____

Laboratory Room: ____________________

1. *How does human memory differ from the kind of memory used in artificial devices, such as computers and DVDs?* **(2 marks)**.

2. *Either* *(a) Briefly discuss the possible relationship between findings from the Memory Recall task and memory failures and successes in everyday situations,*
or *(b) Briefly discuss the possible relationship between findings from the False Memory task and memory for real events outside the laboratory.*
(6 marks)

3. *Briefly describe and discuss the one advantage and one disadvantage of the tendency of the human memory system to 'fill in' missing information on the basis of previous knowledge and expectations* **(2 marks)**

Laboratory Class Six: Memory – The Past Imperfect

(Non-assessed laboratory class)

The laboratory class for this week will involve viewing and discussing video material on memory.

***Study Tip #4: Movies for Psychology Students

Seeking inspiration during your psychology degree is important for many reasons. Firstly, you can be motivated to continue your studies, even if you find the course difficult (remember, this course *does* require you to put in a moderate amount of effort to do well). Secondly, you may be inspired to study a certain area of psychology, such as cognitive, clinical, developmental, neuropsychology, and so on. Finally, inspiration may raise issues or ideas, which can influence your future research or career plans. Many good ideas have come from simple sources.

There are many sources of inspiration. Speak with lecturers, tutors, and other students about issues and ideas that you have. Engaging with people helps you understand ideas and may even help with future research opportunities. Other sources of inspiration include books and journals (see the Reference section of this guide), which will really get you interested in certain topics (or put you off completely!). Finally, movies can be a great source of inspiration, as well as being entertaining (sometimes).

In that regard, here are some movies that might inspire as well as entertain. They may not all accurately portray particular disorders and may have other concerns. However, these should serve to challenge and engage your critical thinking abilities (yes, you do have them).

You could try forming a psychology movie group made up of friends and fellow classmates (not that your classmates are not your friends…) and have regular movie-viewings followed by discussion afterwards. A good idea is to have people from various disciplines or backgrounds to see how their views differ. It is a great way to make movies more interesting! These movies have been taken from: http://home.epix.net/~tcannon1/psychopathmovies/all.html. The full list of movies is available from this address.

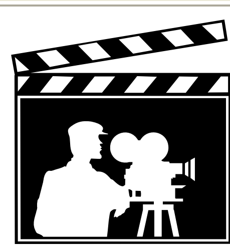
Codes:
A=Action M=Mystery C=Comedy R=Romance Do=Documentary
D=Drama T=Thriller H=Horror SF=Science Fiction

After Darkness (1985, D)	A man's elder brother removes him from a mental institution, motivated by guilt, to care for him, but the psychosis may be too much to handle.
American History X (1998, D)	A neo-Nazi (Ed Norton) in prison for murder begins to question his prejudiced belief system. When he is released, his goal is to "deprogram" his brother.
An Angel at my Table (1990, D)	Autobiography of a New Zealand poet who was misdiagnosed as schizophrenic and spent 8 years in a mental hospital.
As Good As It Gets (1997, C/D/R)	Jack Nicholson with Obsessive-Compulsive Disorder, as well as plenty of Axis II. Really great movie.
At First Sight (1999, D)	If you were blind and had the chance to have sight, would you choose to see? Seems like a simple question, but the psychological impact of such a situation is effectively portrayed in this film, based on an Oliver Sacks' case. Nathan Lane as the psychologist who specializes in work with the visually impaired.
Awakenings (1990, D)	Wonderful movie. Another based on Oliver Sacks' clinical cases. L-dopa's effects on encephalitis lethargica. Interesting glimpse inside a mental hospital in the 1960s. Why do you think paranoia/psychosis developed after prolonged L-dopa treatment? Neuronal supersensitivity?

A Beautiful Mind (2001, D)	A must see for any psychology major. Russell Crowe portrays Nash, a brilliant mathematician. There is a major plot twist - stop reading here if you don't want it spoiled...We learn that we are misled - situations and characters turn out to be portrayals of Nash's delusional thinking and hallucinations. We see him spiral downward in the throes of his psychotic thinking or the side effects of his medications. What do you think about the suggestion that he was able to self-challenge the reality of the hallucinations, as at the end of the movie? What do you think this movie did for public perception of schizophrenia? If you really want to know his story, read the book - not an easy read, mind you, but with plenty more information missing from the Hollywood version...
Bedlam (1946, H)	A glimpse at the history of psychiatric hospitals, set in 18th century London. Think chains and rats are therapeutic?
Benny and Joon (1993, C)	Mary Stuart Masterson portraying schizophrenia and issues regarding interpersonal relationships.
Bird (1988, D)	Story of jazz great Charlie Parker, with drug use and compulsive eating.
Boys Don't Cry (1999, D)	One of the few movies portraying a woman who cross-dresses as a man. This story is based on true events and earned an Oscar for Hillary Swank. [Submitted by Sheila Fling, Southwest Texas State University]
Citizen Kane (1941, D)	A classic. The story of a newspaper publisher's climb to success. Also, the power of early childhood memories?
Clean and Sober (1988, D)	Michael Keaton struggles with alcoholism.
Conspiracy Theory (1997, A/M/T)	Mel Gibson and Julia Roberts - good combo, but realistic movie? Mel is paranoid, conspiracies everywhere; once in awhile, "just like a stopped clock" (wonderful analogy from Roger Ebert), he's right. There also is a government psychiatrist (are his treatments therapeutic?!). Diagnosis for Mel? [Submitted by Victoria Mellody, University of Arizona-Tucson]
Crazy People (1990, C)	The title alone should put this one on the list. According to the Maltin summary: "A stressed-out ad exec (Dudley Moore) devises a series of brutally honest (and very funny) advertisements, which prompt his partner to place him in a mental institution..." [Submitted by Celeste Wallin, NY]
The Crying Game (1992, A/D/R)	This film has one of the biggest plot twists at the end, stop reading now if you don't want it spoiled! It involves a British soldier, Jody, a member of the IRA, Fergus, and Jody's girlfriend, Dil, with whom Fergus develops a relationship, only to ultimately find out that Dil is a cross-dressing man. The movie also has a haunting theme song.
The Deer Hunter (1978, D)	Robert DeNiro, Christopher Walken, Meryl Streep - a top notch cast portraying the impact of serving in the Vietnam War, showing their lives before, during, and after the conflict. Another look at PTSD. [Submitted anonymously]
Ed Wood (1994, C/D)	Johnny Depp as the quirky movie maker - and transvestite. Cute film.
Fatal Attraction (1987, T)	A film which demonstrates why flings can be dangerous. So, what diagnosis would you give Glenn Close's character in this one?
Fearless (1993, D)	Very powerful, have plenty of tissues handy (particularly if you are a parent). The film effectively illustrates how people can have very different reactions to the same traumatic experience, in this case a plane crash. Jeff Bridges and Rosie Perez are great. [Submitted by Laura McGee]
Fight Club (1999, D/T/A)	I thought this was on the list, but Chad Loewen (Trinity Western University) pointed out that it was missing! The film can be considered to be the personification of Edward Norton's psyche. After you've seen it once, watch it again once you know what to look for.
Firefox (1982, A)	Clint Eastwood with "Post-Combat Stress Syndrome." Accuracy of depiction?
Fisher King (1991, C/D/R)	A suicidal radio DJ (Jeff Bridges) meets up with a deranged street person (Robin Williams) who catches him up in his psychosis - folie a deux? Also their relationship seems to bring salvation for both. Interesting film. [Submitted anonymously]
Frances (1982, D)	Jessica Lange portrays the 1930s actress, Frances Farmer, who is placed in a mental institution by her overbearing mother.
Frenzy (1972, T)	Hitchcock has a man dealing with his impotence by strangling women. Interesting therapeutic intervention...
Girl Interrupted (1999, D)	I really enjoyed this movie! I suspect that the "Borderline" diagnosis given to Susanna more appropriately refers to her psychotic depression, with the former use of the term referring to the zone between neurosis and psychosis, i.e., on the "borderline" of psychosis. "Lisa" demonstrates a good manic, and seems more of today's "borderline personality disorder" than the movie's antisocial diagnosis. What do you think? [Submitted by Desiree Jasso, California State San Marcos University, San Diego, CA]

Good Will Hunting (1997, D)	Robin Williams provides psychological treatment for the main character. Some ethical violations, and at first seems like too much self-disclosure, but it served a therapeutic purpose. I'm not quite sure that the catharsis depicted truly would have cured both the Axis I and II disorders depicted in the untreated - "bad (?)" Will Hunting. Academy award winner. [Submitted by Allen Stigers, Pacific Lutheran University, WA]
The Hours (2003, D)	Oscar winner Nicole Kidman portrays Virginia Wolfe, who is writing the novel Mrs. Dalloway, another woman reading the book in the 1950s, and a third present day woman living it. Three of the women make suicide attempts; two are successful.
I Am Sam (2001, D)	Sean Penn portrays a mentally retarded man fighting for custody of his 7-year-old child. [Submitted by Kathleen Krach]
I Don't Buy Kisses Anymore (1992, C/R)	Male shoe store owner with a compulsive eating disorder befriended by a psychology student.
Instinct (1999, D/T)	Cuba Gooding, Jr. as a young psychiatrist tasked to perform an evaluation on Anthony Hopkins, an anthropologist who had been living as a primitive man among the gorillas he had been studying. Hopkins is indicted for murder, after he killed the men who were trying to "save" him from the gorillas.
King of Hearts (1966, D/C)	This sounds like a great film. Set in France during World War I. According to the submitter, "The Germans have set a bomb to go off at 12 midnight and the only people left in the village are the "crazy" people in the asylum" and a Canadian soldier checking out the village after the Germans had retreated. Once again, we see the "who are the crazy ones" theme. [Submitted by Nancy Porter, Chestnut Hill College, PA]
Lady Sings the Blues (1972, D)	Story of jazz singer Billie Holiday (Diana Ross) and her troubled life, with alcohol and drug addiction; includes withdrawal scenes.
Leaving Las Vegas (1995, D)	Depressing, but realistic film with Nicholas Cage as the suicidal alcoholic. [Submitted by David Biek, Monroe Community College, NY]
Less Than Zero (1987, D)	Dangerous combination of youth, money, lost girlfriend, and cocaine.
Life As A House (2001, D/C)	Kevin Klein portrays a man diagnosed with terminal cancer and given 4 months to live. He attempts to rebuild his relationship with his drug-using, life-hating teenage son, while they rebuild a ramshackle house that was his lifelong goal. [Submitted by Carey Corbett, University of South Florida]
The Madness of King George (1994, C/D)	A great movie. Psychosis caused by a metabolic disorder (porphyria).
Memento (2000, D/M/T)	This definitely is a film for those interested in neuropsychology. Leonard has anterograde amnesia (he can't form new memories). To compensate, he tattoos notes to himself all over his body. He is on a quest to find the person who raped and murdered his wife. You'll have to watch this one closely to follow the plot - it is told in reverse. The attempt to accurately portray anterograde amnesia should be commended, but there are several points where Leonard acts as if he has "held" a memory longer than in working memory. What else can you find that is inaccurate?
Mercury Rising (1998, A/D/T)	Accuracy of portrayal of autism? [Submitted by Kim Mecca, Marywood University, PA]
Million Dollar Hotel (2000, D)	Unusual movie about an LA hotel home to several people with mental illness. A drug abusing artist falls (was pushed, jumped?) off the roof and public attention is now drawn to the hotel residents
My Left Foot (1989, D)	Great film about childhood misdiagnosis of cerebral palsy as mental retardation and the difficulties adjusting to an adult life with disabilities.
Nell (1994, D)	According to the submitter: "Jodie Foster plays a rustic hermit, believed to be crazy. She isn't." [Submitted by Ron Yamauchi]
Of Mice and Men (1992, D)	This classic Steinbeck story has been remade with John Malkovitch and Gary Sinise. How about a diagnosis for Lenny and for Curly's wife (never named in the movie or the book)? This story's ending never fails to get me teary..."tell me about the rabbits..." [Submitted anonymously]
One Flew Over the Cuckoo's Nest (1975, D)	A classic, must see. Why faking insanity to avoid jail may not be a good idea (at least not during this era).
One Hour Photo (2002, D/T)	This was a very interesting movie. Pay attention to the sets and use of colour. Robin Williams portrays the one hour photo worker who becomes very attached to a particular family. Although some viewed Williams's character as menacing, my take was quite different. What do you think? Diagnosis? How about that ending - what was your interpretation?

Patch Adams (1998, C/D)	The power of humour for medical patients. Robin Williams portrays the main character, who suffers from mental illness early on, makes it through med school, and "illegally" treats patients with humour. Based on a true story. [Submitted by Stacy Landry, Marywood University, PA]
Permanent Midnight (1998)	(Drama) True story of TV writer with major cocaine habit, starring Ben Stiller.
Pink Floyd the Wall (1982, D/Mu)	This film was not particularly well-reviewed by critics, but does portray a rock star's descent into madness, fuelled by his social isolation. Good soundtrack - sort of a long music video. [Submitted anonymously]
Rain Man (1988, D)	Dustin Hoffman's excellent portrayal of an adult with autism. Highly recommended Academy Award winner.
Regarding Henry (1991, D)	Harrison Ford portrays a survivor of a brain injury. Accurate? I wonder how real survivors feel about this portrayal... [Submitted anonymously]
Rush (1991, D)	Undercover cops who are sucked into drug use. Illustrates the danger of believing that one can simply and easily "quit" using addictive drugs.
Shine (1996, D/R)	Academy award winner. A disturbed man finds solace in music, after being driven over the edge by his father, when he was a young piano prodigy. Diagnosis?
Silence of the Lambs (1991, T)	This film leads many students to the field of forensic psychology. Jody Foster as a junior FBI agent, off to find a psychopathic killer.
Silent Fall (1994, D/T)	Richard Dreyfuss as a burned-out child psychologist manipulated into helping a 9-year-old autistic murder suspect and his sister (her diagnosis?). Some interesting ethical conflicts here. [Submitted by Lynne Flannigan, Marywood University, PA]
The Sixth Sense (1999, T/D/H)	Bruce Willis as a child psychologist whose 6-year-old patient claims to see the spirits of dead people around him. Good film; nice plot twist. [Submitted by Christina Martini, NY]
Solaris (1972; 2002, D/SF)	Sci-Fi flick about a psychologist sent to a space station to investigate mysterious deaths. Typical job for psychologists in the future?!
Sophie's Choice (1982, D)	This one led to an Oscar for Meryl Streep, as she portrayed a World War II victim dealing with traumatic memories and guilt. Kevin Klein as her schizophrenic (?) boyfriend. I would never want to be faced with the "choice" she had to make... [Submitted by Danielle Langlois, SC]
Sybil (1976, D)	A classic. This movie about multiple personalities fuelled the dissociative field - later, her diagnosis was questioned by one of the examining psychiatrists.
Taxi Driver (1976, D)	Classic film with Robert DeNiro as the Vietnam vet cab driver who is obsessed with pornography and violence. Source of the much-since-used line, "Are you talking to me?!" Diagnosis, please?
The Tic Code (1998, D)	Story of a boy with Tourette's Syndrome who becomes an underage jazz pianist. He pairs up with an accomplished sax player who, ironically, also has Tourette's and has developed strategies for covering up the symptoms. Interesting contradictions in how each of them views the disorder and the associated stigma. Think about parallels between Tourette's and obsessive-compulsive disorder. [Submitted by Rebecca Vauter Stredny, Virginia Consortium Program in Clinical Psychology]
Three Faces of Eve (1957, D)	Early story of psychiatric treatment to fuse multiple personalities. One of the "training films" used by the Hillside Strangler in his attempt to fake multiple personality disorder.
Tin Men (1987, C/D)	A comical look at two battling aluminium siding salesman who demonstrate that antisocial personalities can be quite profitable. [Submitted anonymously from Binghamton University, NY]
Titicut Follies (1967, Do)	This is a highly controversial documentary, with graphic images of abuse of patients in a Massachusetts psychiatric hospital. The filmmaker was unable to find a distributor for 25 years.
Twelve Monkeys (1995, D/SF)	A convict (Bruce Willis), sent back in time to stop a devastating plague, is sent too far back and is hospitalized as insane. Brad Pitt plays the off-the-wall fellow asylum patient. Do the followers of Brad Pitt's character have Shared Delusional Disorder? [Submitted by Ruth Morales, San Diego State University]
Vertigo (1058, M/T)	Classic Hitchcock with an acrophobic Jimmy Stewart.
What About Bob (1991, C)	Cute movie with Richard Dreyfuss as the competent (or burned out?) psychotherapist and Bill Murray as the patient (who seems to have more insight...).
What's Eating Gilbert Grape (1993, C/D)	Johnny Depp dealing with pre-Titanic DiCaprio portraying his brother with autism and with a very obese mother who has some psychological issues, as well. [Submitted by Christie Santore, NY]
When a Man Loves a Woman (1994, D)	The effects of a woman's alcoholism on her family, and life after going through detox.



Laboratory Class Seven: Exploring the Stroop effect

(Assessed laboratory class)

Lecturer: Dr. Tony Lambert

<u>Learning objectives</u>

After completing this exercise students should be able to:

1. Describe the three main features of automatic processing, together with everyday examples.
2. Be able to describe the Stroop effect, and explain the relationship between this effect and the distinction between automatic and controlled processes.

In 1935 John Ridley Stroop carried out a very simple but powerful experiment which has been repeated many times since (see Psychology Text., p.54). In a standard 'Stroop experiment' subjects are asked to name the colour of the ink in which a string of letters is written. In the Control condition, the letter strings are meaningless (e.g. XXX in red ink, XXX in blue ink, etc.). Performance in this condition is compared with performance in the ***Interference*** condition, in which the letter string is a colour word that is *different* from the ink colour (e.g. RED printed in green ink, GREEN printed in blue ink). Typically, naming the ink colour is substantially slower in the Interference condition compared to control. This effect is highly robust, producing clear effects on naming time for most people.

The Stroop effect can be interpreted in terms of the <u>automaticity</u> of reading. Reading is so well practised and automatic that it seems impossible <u>not</u> to read the colour word. This automatic response to the printed word interferes with the desired response - naming the ink colour.

Automatic processes can be distinguished from *controlled* processes (see Psychology Text. p.244). Automatic processes are thought to have three important characteristics:

- *Conscious control:* *O*nce initiated, it is difficult to exert conscious control over an automatic process. This feature of automaticity will be explored in today's lab exercise.
- *Mental resources:* Automatic processes require few mental resources. That is, they are relatively effortless.
- *Speed:* Many automatic processes can be performed very rapidly.

Many everyday skills, such as reading or typing are carried out initially as a controlled process, and then become more automatic as the skill is practised. For a very young child reading is likely to be a slow process, requiring conscious effort and control. With increasing practice, performing this skill becomes rapid and quite effortless. However, as we shall see, it can be difficult to exert conscious control over an automatic process.

This week's exercise involves measuring Stroop performance, firstly in a standard version of the task, and then in an experimental (i.e. novel) version of the task.

Performing the Standard version of the Stroop task

We can use *PowerPoint* to display the colour words. You will need to record the time taken to name the ink colours. This can be done using a watch with a second hand, or better still one with a stop-watch function.

Work in pairs, with one person (the experimental participant) reading the colour words, while the other person (the experimenter) records how long it takes. Alternate these roles, making sure that one of you performs the control condition first followed by the interference condition. The other person should do the interference condition first, followed by the control.

1. Locate the files called Practice Stroop Int.ppt, Stroop Int.ppt, Practice Stroop Con.ppt and Stroop Con.ppt. These are located in a folder called Stroop Task, within the shared teaching drive for PSYCH 109.
2. Each participant should begin by performing some practice trials. If you are performing the Interference condition, double click on the file called Practice Stroop Int.ppt. If you are performing the Control condition, double click on the file called Practice Stroop Con.ppt.
3. Press 'F5'.
4. The screen will now show the message 'Stroop Experiment. Press the 'right arrow' key to begin. However – do not begin until you understand the task!
5. Each time you press the right arrow key, a new slide will be displayed. Your task is to say the INK COLOUR of each letter string. So the correct response to the word GREEN, printed in red is "Red". Similarly, the correct response to XXXX in red ink is "Red". Since the lab is being shared by many pairs of students, it might be advisable to whisper the response, rather than saying it out loud.
6. Slides alternate between coloured letter strings and a black + in the middle of the screen, which is there merely to provide separation between the coloured strings.
7. Advance through the slides as quickly as you can, whispering the colour words as you go.
8. When you reach the final slide, which bears the word 'Done' in black letters, say "Done!" The experimenter should record the number of seconds from beginning the sequence until the participant says "Done!"
9. Close the 'Practice' file by choosing Close from the File menu.

10. Choose 'Open' from the File menu. Double click on either 'Stroop Int' (Interference condition) or Stroop Con (control condition).
11. Repeat Steps 6-9 to perform the experiment proper.

When you have completed the colour naming trials, copy down your naming time results onto a sheet of paper.

Designing your own Stroop Experiment

The second part of this week's laboratory exercise class involves designing your own Stroop experiment. By using the editing functions available in PowerPoint, we can manipulate the nature of the coloured letter strings in the Interference condition. This enables us to ask a variety of psychologically interesting questions.

To help you get started, here are some ideas.

> What would happen if you replaced the three colour words with words that are semantically related (i.e. related in meaning) to RED, GREEN & BLUE (e.g. BLOOD, SKY, GRASS)? Would naming time in this condition be slower than the Control, or no different?
>
> What would happen if you used letter strings that are unrelated in meaning to the colour words, but which sound like the words RED, GREEN, BLUE? (e.g. BED, PREEN, GLUE.)
>
> What would happen if you used letter strings that are have some visual similarity with the colour words, but are dissimilar in meaning and sound (e.g. RXD, GXXXN, BXXE)?
>
> What would happen if you just repeated the standard version, making a particularly strong effort to resist the interference on response incompatible trials?

You should get together in groups of 8-12 students to discuss which design to adopt. Having done this, all the students in each group should perform the *same* Stroop version. Half the participants in each group should perform the novel version of the Stroop Interference condition first, followed by the Stroop Control condition. The other participants should perform in the reverse order. The results will then be analysed using SPSS.

To create your novel version of the Stroop task, you should load in the file called Stroop Novel. From the Edit menu choose Replace. Enter the word RED in the upper box. In the lower box, type in the letter string that you want to use instead of RED (e.g. BLOOD). Click on 'Replace all'. Now enter the word GREEN in the upper box; in the lower box enter the letter string word you want to use instead of GREEN (e.g. PREEN). Click Replace All. Finally, enter the word BLUE in the upper box, and in the lower box enter the word you want to use instead of BLUE (e.g. BXXE). Click 'Replace All.

When you have finished editing, press F5 once again. Record naming time as before. Remember that participants will need to repeat the control condition. As before, half the participants should perform the control condition before the novel version –half should perform in the reverse manner.

When all the students in your group have completed both the novel version and the control condition, you should appoint a results monitor to collate the naming time results. These data can then be displayed on the white-board and/or data show projector.

Analysing the novel version of the Stroop task using SPSS

For the sake of simplicity, our analysis of Stroop performance will focus on the speed of naming, rather than number of errors made. Most previous investigations of the Stroop effect have also concentrated on response speed rather than accuracy.

The aim of our study is to discover whether there is a general difference in performance speed between the Interference and Control conditions of the Stroop task. Hence, our *dependent variable* is naming speed (in seconds); our *independent variable* is Stroop Condition (Interference vs. Control). Notice that in contrast to our exercise on sex differences, which used an *independent groups* research design, this experiment has employed a *repeated measures* design. As you will remember, in a repeated measures design each participant takes part in all experimental conditions. In this case, each person has performed in both the interference and control conditions of the Stroop task. An appropriate test for comparing two experimental conditions in a repeated measures design is the ***t* test for paired samples**.

How to perform a t test for paired samples using SPSS

The procedure used for performing a *t* test for paired samples is closely to similar to the procedure employed earlier in the semester, when you performed a *t* test for independent groups when analysing data for the sex differences assignment.

In order to save time, I have already prepared an SPSS data file, containing four columns labeled *'Standard Interference', 'Standard Control', 'Novel Interference'* and *'Novel Control'*. The file is located inside the Stroop task folder, and is called Stroop Data.sav. You can open this file by double clicking on it. This will cause SPSS to launch and display the *data view* window containing the four labeled columns. Each row in this file represents data from a single individual. Therefore, data can be entered by asking each member of the group to write down or call out their naming times for each of the four experimental conditions, in the order corresponding to the four column headings.

The next step is to perform two *t* tests for paired samples. The first of these will compare performance in the Standard Interference with performance in the Standard Control condition. The second will compare performance in the novel interference condition with performance in the novel control condition. To perform your first *t* test, carry out the following actions.

6. Click on ‘Analyze’ then select ‘Compare means / Paired Samples *t* test.
7. Click on ‘Standard Interference’; click on ‘Standard Control’. Now move both items into the right hand box, which is labeled ‘Paired variables’.
8. Click ‘OK’.

Now repeat these actions, selecting ‘Novel Interference’ and ‘Novel Control’ as your paired variables. Before doing this, it is a good idea to remove ‘Standard Interference’ and ‘Standard Control’ from the Paired Variables box on the right of the pop-up window.

SPSS will now display the outcome of your two *t* tests in the output window. If you like you can delete the Paired Samples Correlations table (by selecting it and pressing the delete key), since this information is not needed.

From the upper table, you need to copy down two important pieces of information for each condition: the mean response time and standard deviation. These should be entered into the Stroop Results sheet.

From the lower table you need to copy down the t value, the degrees of freedom for the t test, and whether the t value is significant or not. (**Note:** to see the degrees of freedom, and level of significance you may need to scroll across to the right hand side of the table). If the value shown in the Sig. column on the far right of the table is ***less than*** .05, then the difference between the two conditions is significant.

As mentioned earlier in the semester, fairly strict conventions are followed when reporting the outcome of statistical tests in scientific reports. As in many other domains, communication is much easier and faster if a standard convention is adopted. The convention for reporting t tests in your Results section is as follows. If the value of t is significant, then you would report it like this:

$t = 2.89$, d.f.=14, $p<.05$

or, if the test is non-significant,

$t=0.56$, d.f.=14, n.s.

<u>Laboratory Write-up</u>

The write-up for this week’s laboratory class involves preparing: (1) A brief description of the experimental manipulation that you chose to explore, together with a brief statement of your predictions concerning the effect of this manipulation. (2) A concise *Results* section which describes the main findings of our experiment, and (3) a brief discussion section, which considers what the results might be telling us about the automatic process of reading in our two versions of the Stroop task.

The **Results** section of your report should include:

- A table which displays the mean naming time and standard deviation for each of the four experimental conditions. Remember to indicate the units used (seconds).
- A brief prose description of the main features of the results. This description will refer the reader to your table of descriptive statistics. When reporting the outcome of your *t* tests, the degrees of freedom and *p* value need to be quoted. Remember that the *p* value is the item labeled (somewhat perversely) as ‘Sig. (two tailed) in the SPSS output table. Here is an example of how to report the outcome of a *t* test: “The experiment showed that participants recalled significantly more items in the Imagery Mnemonic condition (mean recall score = 23.2, SD = 8.4) compared to the Control condition (mean recall Score = 11.1, SD = 7.9), t = 4.83, df=53, $p<.05$.” This is a fictitious example, but I hope it reminds you of the correct convention for reporting the outcome of a *t* tests in your Results section.
- Remember that a *Results* section is primarily *descriptive,* and should be as concise as possible. Extended discussion and interpretation of the results in terms of theoretical ideas is reserved for the *Discussion* section.

In addition you should write a brief Discussion section. **Important:** your discussion section should be about **one** page long and must not exceed the space provided.

A Discussion section often begins with a brief paragraph that recapitulates the main features of the Results, together with a statement indicating whether any experimental predictions have been confirmed or disconfirmed.

The next step is to offer an interpretation of your findings. In this case we are interested in finding out more concerning the processes responsible for the Stroop effect. What you write in this section will of course depend on what manipulation you chose to explore, and on the consequence of this manipulation. Nevertheless, you might appreciate some suggestions concerning possible avenues of discussion. The first issue is of course what happened in your novel condition? Was naming time still slower on *Interference* trials compared to *Control* trials? If so, what can be concluded? If the words you chose for your *Interference* condition were similar in meaning (grass, blood) to the colour response words (red, green), but dissimilar in sound, and the Stroop effect was still observed, then you might like to argue that the Stroop effect does not depend on sound similarity, but can be driven by semantic (i.e. meaning) similarity between the interference words and the colour naming response. The same form of reasoning can be followed if you chose *Interference* words that were similar in sound (bed, glue), but dissimilar in meaning to the colour response words (red, blue). If the Stroop effect disappears then you might argue that the effect is depends upon similarity of the meaning between the Interference words and the colour response words. An alternative outcome is that the Stroop effect continues to be observed in both of these novel conditions. This might be taken as indicating that the Stroop effect may be driven partly by the similarity of meaning between the interference word and the response word and partly by the similarity of sound between the interference item and the response word.

After offering an interpretation of findings from the experiment, and perhaps considering alternative interpretations, your Discussion section may progress to evaluating possible problems with the design and/or procedure of the experiment. Were appropriate steps taken to control for possible confounding effects such as practice, fatigue or boredom?

This section also often includes a paragraph in which the author suggests further experiments which could shed light on the issue at hand. These further experiments could offer improvements to the Method employed. Alternatively, further experiments could help one to decide between alternative theoretical interpretations of the results that have been found.

These suggestions concerning the structure of your Discussion section can be summarised in bullet form:

- What was found? Were the experimental predictions confirmed or disconfirmed?
- What are the Results saying to us about the psychological processes responsible for the Stroop effect?
- Is the experimental design flawed, and if so, what improvements could be made to the design?
- What questions remain unanswered by this experiment? How could these unanswered question(s) be answered by future research?

THE UNIVERSITY OF AUCKLAND
NEW ZEALAND

PSYCH 109: Laboratory Report Four

(Write neatly within the boxes provided)

Please provide all information requested in this box on every laboratory assignment that is submitted for marking.

Name:____

Laboratory Session: ____________________

Full Name of Instructor: ____

Laboratory Room: ____________________

INTRODUCTION

(a) ***Experimental Manipulation*** **(One mark)**

Provide a brief description of the experimental manipulation used in your novel version of the Stroop task

(b) Experimental Prediction **(One mark)**
What did you predict?

RESULTS

*Write a brief description of the main findings of the experiment in the space below (**2 MARKS).** You should also construct a table summarising the results. This should include means, standard deviations and N (number of participants (**1 MARK)***

DISCUSSION

*Write a brief discussion of results from the experiment in the space below. Your discussion should about one page long. It must **NOT EXCEED THE SPACE PROVIDED.*** **(5 marks)**

***Study Tip #5: Restoring Equilibrium

(To be read between semester one and semester two)

by Paul Fenton.

homeostasis *n.* the physiological process by which the internal systems of the body are maintained at equilibrium, despite variations in the external conditions.

With exams a distant memory or current nightmare, it is useful at this juncture to discuss something that has nothing to do with university life whatsoever, or so it would appear. Although many people use the 'break' to earn money to pay their fees for next semester, it is important to use this time to reassess, recharge, and more importantly, restore homeostasis i.e. bring balance to a life that may have been preoccupied with university. So here are some ideas that may contribute to the achievement of balance in your hectic life. University is only a small part of what your life is comprised of so it is important to work on other areas of your life that appear to have nothing to do with marks or grades and may have been neglected of late. I say "***appear*** to have nothing to do with marks or grades" because maintaining or attaining homeostasis will have a positive impact on your studies as well as your ability to cope with them.

Tip one: Seek inspiration

inspire *v.tr.* **1.** ...stimulate or arouse...**2.a**...animate a person with feeling.

Inspiration can be found in the most amazing and unexpected places. A movie, theatre performance, music, art, or nature can be sources of inspiration that allow you to revive your passion for life. Inspiration acts as an energising experience that is the starting point in the equilibrium process. It allows you to add new elements to your life as well as supplying the energy to manage all the tasks you need, or want, to attend to.

Tip two: Take up a hobby

hobby[1] *n.* (*pl.* **ies**) **1.** a favourite leisure-time activity or occupation.

Why? Well, the semester break is the ***perfect*** time to take up something you have always wanted to. More importantly, it can be therapeutic, depending on the hobby, to maintain your hobby during the semester. Take up oil painting, it is great fun and really messy, and is something you can use during the semester to de-stress during times of peak demand. I hear that the bagpipes are popular in certain quarters; you could start a trend (or perhaps a wave of emigration) by forming a bagpipe group. A hobby allows you to focus on something other than university with balance being restored by attending to areas of your life other than study.

Tip three: Take some time to prepare for next semester

prepare *v.* **1.** make or get ready for use, consideration, etc…

Think about your degree, the major you are doing, and whether you want to be doing it at all. Now is the time to think about change. That being said, talk to someone first. Ask for advice, talk to the relevant people, and seek wise counsel. This is a great opportunity to examine how things went and what alterations you need/want to make to your schedule. It is where study takes a back seat and homeostasis is achieved. Prepare yourself by becoming more organised so that you can cope with study as well as the other facets of your life in the coming semester.

Well, coming to the end of the article, I apologise to those who were expecting something academic. Academic work *is* important, but so is social and personal development. We are not only interested in what you are studying but also the person behind the assignment, essay, or exam. Don't be imbalanced, one day university will end and then where will you be? A person with a piece of paper wishing they'd made the most of the other opportunities inside or outside the university environment? There ***is*** more to life. Think about it.

think v*. & n.* **2**…judge or consider…consider; be or become mentally aware of.

Laboratory Class Eight: Shaping the behaviour of 'Sniffy' the virtual rat

(Non-assessed laboratory class)

Lecturer: Dr. Doug Elliffe

Learning objectives

After completing this exercise, you should:

1. Have gained some experience of shaping a new behaviour
2. Understand the difficulties and pitfalls of shaping, and know what features of the shaper's behaviour lead to most effective shaping
3. Consider how you might use the method of successive approximations in applied or everyday situations.

Introduction

Aim

The aim of this laboratory is to demonstrate how an animal can be trained to perform a novel behaviour; that is, a behaviour that is not already in its repertoire. A technique known as the method of successive approximations, or shaping, will be demonstrated with a computer simulation. The simulation displays a rat inside an operant-conditioning chamber, or Skinner box. The rat displays a variety of behaviours (e.g., sniffing, rearing, preening) likely to be in its natural repertoire. However, it is naive to the chamber and is very unlikely to press, simply by chance, the lever mounted on the back wall. The student's task is to train this behaviour using the method of successive approximations.

The Law of Effect

The Law of Effect is perhaps the single most important principle in psychology. It states that a piece of behaviour that is followed by a favourable consequence is more likely to be repeated in the future. The piece of behaviour is called a response, and the favourable consequence is called a reinforcer. More formally, the Law of Effect states that the probability of a response will increase if the response is followed by a reinforcer.

It is easy to see that reinforcing a response that is already emitted by an animal will increase the future likelihood of that response, but how can the Law of Effect be used to train a new response; that is, a response that is not already in the behavioural repertoire of the animal? It is not practical to simply reinforce occurrences of the response because it may never occur by chance. A new technique called shaping, or the method of successive approximations, is required.

The Method of Successive Approximations (or Shaping)

Shaping involves reinforcing progressively closer approximations to the response being trained. This is accomplished by defining an operant class; that is, a group of responses that we will reinforce. At first, this operant class will include a wide range of different responses. As training progresses, the operant class will be progressively narrowed (that is, the number of different responses that will be accepted and reinforced will be reduced) until the animal is emitting only the response that is desired.

The following example shows the steps that might be followed to train a pigeon to turn circles:

1. Establish a suitable reinforcer. [*e.g., food for a hungry pigeon*]

2. Repeatedly present the reinforcer [*food*] at irregular intervals, and without regard to the animal's behaviour, until the subject approaches the delivery site as soon as stimuli [*e.g. magazine light and sound*] signal reinforcer availability. (This is often called magazine training and is critical for establishing conditioned reinforcers that ensure the immediacy of reinforcer delivery).

3. Begin by defining a wide operant class [*e.g., any movement in the experimental chamber*].

4. Reinforce all occurrences of the operant class every time they appear [*e.g., give the pigeon food every time it moves*].

5. When the operant class is occurring reliably, narrow the class and reinforce all occurrences of only that new class [*e.g., when the pigeon is reliably moving around, only give food when the pigeon turns to the right*].

6. Each time an operant class is mastered, narrow it a bit more [*e.g., once the pigeon is reliably turning to the right, only give a reinforcer when it makes a quarter turn, then a half turn, and so on*].

7. Eventually the desired response will occur reliably [*e.g., eventually the pigeon will be turning in circles consistently*].

Keys to successful shaping

1. It is often useful to begin by making reinforcers contingent on a wide range of behaviours that occur in rapid succession; that is, define the first operant class as general activity occurring at high rates.

2. If the rate at which reinforcers are delivered is too low, the level of activity of the animal will decrease, thereby making it difficult to identify reinforceable behaviours.

3 Ensure that each successive approximation differs only slightly from the previous one so that the rate of reinforcement does not drop suddenly and sharply, and that transitions between operant classes are "fluid".

4 Reinforce all occurrences of a given operant class so that the extinction of this class is rapid when the operant class is later narrowed. Remember the partial-reinforcement effect (see Lecture Notes).

5 A reinforcer is most effective when it follows the response very closely in time.

6 The art of shaping is knowing when to move from one approximation to a stricter one. If one operant class has been reinforced often enough, changing the contingencies for reinforcement should result in the animal engaging in behaviours which are variants of the previously reinforced class.

7 It is important to reinforce the movements of the animal rather than its static postures. This helps to maintain high levels of activity.

Method

Subject

The subject for this experiment is a virtual rat that has been mildly deprived of food. The rat is simulated by software that gives it a small repertoire of behaviours. The simulation has been programmed to model (or closely follow) the behavioural and learning characteristics of a living rat.

Apparatus

The virtual rat is simulated on a computer system. It will be trained in a virtual operant chamber that is equipped with a lever connected to a switch, a food dispenser (or food magazine), and a water spout. Activation of the food dispenser can be controlled by the experimenter via the keyboard and/or mouse.

Procedure

Your task as the experimenter is to use the method of successive approximations to train the subject (Sniffy the rat) to reliably press the lever mounted on the back wall of the operant chamber. This will require an initial period of magazine training. When successfully trained, Sniffy will press the lever frequently. Stop delivering reinforcers as soon as five responses have been made. Over the next several minutes, reinforcers will be delivered automatically and the response rate will climb; the cumulative record at the bottom of the screen will grow steeper and steeper. When the rat has made approximately 80 lever presses and the line reaches the top of the record, the line will reset down to the bottom and continue climbing back up. Consider shaping complete when the pen resets. Try to use the least number of reinforcer presentations possible to achieve this criterion. Be sure to keep your own record of the number of reinforcers delivered throughout the training session, as the cumulative record notes only those reinforcers that were delivered automatically.

Your laboratory instructor will give you information on how to operate the software. Three subjects should be trained to press the lever. Do not begin shaping another subject until the training of the current subject is complete. Your instructor will assess the shaping of your subject, and will give you permission to begin training another.

Results

Watch the cumulative record at the bottom of the screen and note how many reinforcers were required before each of the subjects made the 80 or so responses that caused the pen on the cumulative recorder to reset. (Note that the 'paper' on the cumulative recorder can be scrolled back to let you examine the entire training session). Did the number of reinforcers needed to shape Sniffy successfully decrease across successive Sniffys?

If there is sufficient time, feel free to train more rats and consider shaping something other than lever pressing such as sitting still in a crouched position for at least five seconds. Or you could try implementing one of the schedules of reinforcement you've learned about in the lectures.

Discussion points

- Did your skill in shaping improve over time?
- What mistake in shaping did you make most often, and how did that affect Sniffy's behaviour?
- Why is it important to reinforce as immediately after the target behaviour as you can?
- As a psychologist, you are presented with a client who cannot speak but occasionally grunts. Briefly describe how you could apply the principles outlined in this laboratory to train the client to utter a few words.
- While you were shaping Sniffy's behaviour, was Sniffy shaping yours? Explain.

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Appendix 1: Statistical Tests

Independent samples t-test

The independent samples *t*-test is used to determine whether the difference between the means of two sets of data is (statistically) significant. The two sets of data must be independent from each other – this usually means the two sets of data are obtained from two different groups of individuals.

Example: Interviewing Techniques I

Fisher and Geiselman (1992) developed a method for interviewing eyewitnesses called the cognitive interview method. Suppose 20 people in a hypothetical study were shown a video of a bank robbery. The participants were randomly allocated to one of two groups. Each person was then interviewed by the same interviewer in an attempt to elicit accurate information about details of the robbery. One group was interviewed using the cognitive interview technique whereas the other group was interviewed using the standard police interview technique.

Is there evidence of a difference between these two interview techniques?

Data collection and recording

The variable measured is **number of details recalled.**

Group 1 **Cognitive Method**	**20, 22, 17, 29, 15, 12, 18, 19, 23, 24**
Group 2 **Standard Method**	**17, 11, 21, 9, 14, 23, 11, 14, 20, 11**

To graph the data in SPSS follow these steps

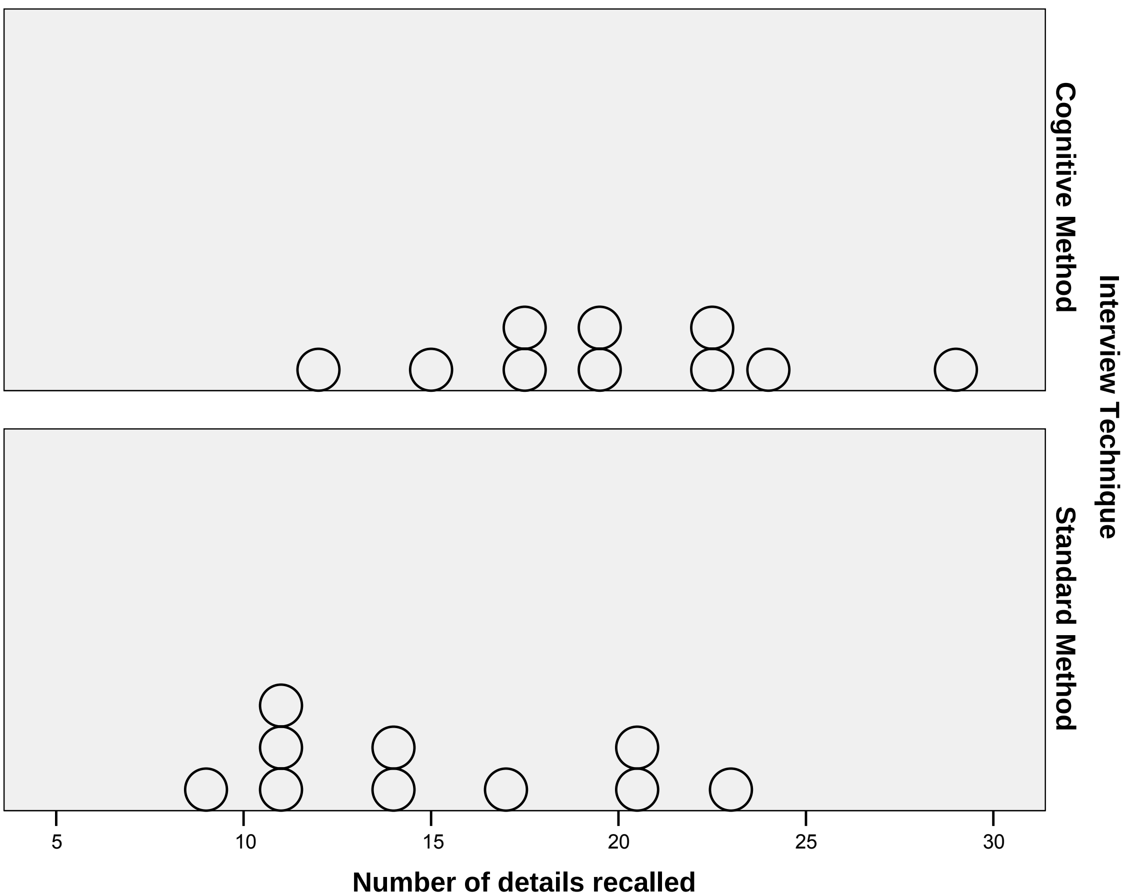
SPSS: *Graph → Scatter/Dot → Simple Dot →Define*
Enter the data for the scores into the X axis variable and the data for the groups into panel by rows →OK

This will produce two graphs in the output file.

You will need to amend the scale of the graphs, so double click inside the graphs and a chart editor window will appear.

Go to *edit →select x axis* and a properties window will appear.

De-select minimum, maximum and major increment and apply the scale that you require in these boxes. Click on apply. Close the properties window and the chart editor window and the scale on your graphs will be the same.



What do you see in the graph?

There is some overlap between the groups but the number of details recalled for the cognitive method tends to be higher than that for the standard method. The spread of the results are roughly similar for both groups.

To obtain the summary statistics and t-test results

SPSS: *Analyze → Compare means → Independent T-Test*

Place the 'score' variable into the test variable and the 'group' variable into the grouping variable and click on define groups. Enter one for group one and two for group two → *continue* → *OK* and the statistics will appear.

Group Statistics

	Interview technique	N	Mean	Std. Deviation	Std. Error Mean
Number of details recalled	cognitive method	**10**	**19.90**	**4.864**	1.538
	standard method	**10**	**15.10**	**4.886**	1.545

From the output obtained by SPSS we can determine that;

	Sample Size	Sample mean	Sample standard deviation
Group 1 (Cognitive method)	10	19.90	4.86
Group 2 (Standard method)	10	15.10	4.89

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Number of details recalled	Equal variances assumed	.131	.722	2.202	18	**.041**	4.800	2.180	.220	9.380
	Equal variances not assumed			2.202	18.000	.041	4.800	2.180	.220	9.380

The *p-value* = **0.041**

Interpreting the *p-value*

If the *p-value* is smaller than some predetermined value, say, a value that corresponds to a probability of 0.05 that the observed difference between the means is due to chance, then the observed difference between the means is said to be significant at the 0.05 level of significance. The level of significance is denoted by the Greek letter α (alpha), and the level of significance most often used in psychology is α = 0.05. The word "significant" has, therefore, a very special meaning in statistics and should be used with great care. It is important to keep in mind that even when you do obtain a significant result, that just means that the probability of getting a *p-value* (or equivalently, a difference between the means of the two groups) as large as you obtained by chance is less than 0.05. This means that one time in twenty a significant result is really an error.

To interpret the results in the example given above we would use the following format;

The difference between the means of the two groups (19.90 – 15.10 = 4.8) is statistically significant at the 0.05 level. (P-value < 0.05).

Therefore, on average, participants were able to recall accurately almost 5 more details by the cognitive interview method (mean =19.9, sd = 4.86) than by the standard interview method (mean = 15.10, sd = 4.89). The difference is significant. (P-value = 0.042 < 0.05)

How do you interpret non-significant results?

If you do obtain a *p-value* greater that 0.05 then the results are non-significant at the 0.05 level of significance. This means that the difference between the means of the two groups is so small that it may be due to chance i.e., sampling variability.

Paired-samples *t*-test

The paired-samples (dependent-samples or matched-samples) *t*-test is used when data have been observed in naturally occurring pairs. Paired-data can arise in a number of ways:

- Each person is measured twice under two different conditions (e.g. the weight of a person is measured before a diet and then again after a diet, the experimental unit measured is a 'person').
- Each person has two similar measurements made on them (e.g., a person's actual weight and self perceived 'ideal' weight is measured, the experimental unit measured is a 'person').
- Two individuals who are related or matched-up in some way are each measured (e.g., twins are each measured for their IQ, the experimental unit measured is a 'set of twins'; or a married couple are each measured for their age, the experimental unit is a 'married couple').

For computer analysis we present our data in a table-format where each row represents the experimental unit measured (e.g., a person, a married couple, a set of twins) and contains the pair of observations for the unit in adjacent columns (see the table below).

In this situation, even although we have what looks like 2 sets of data, the focus is on the set of differences between each member of the related pairs of data.

We use the paired-samples *t*-test to determine whether the average of the set of differences between related pairs of data (the mean difference) is significantly different from zero.

Example: Actual and Ideal Weights

Each of ten female students gave their *actual* weight and their self-perceived *ideal* weight. The students were randomly selected from a group of first year statistics female students whose actual weights were less than 75kg and who had participated in an online course survey.

Is there evidence of a systematic difference between the actual and ideal weight?

Experimental Unit Person (female)	Variable 1 Actual weight (kg)	Variable 2 Ideal weight (kg)	Difference Actual – Ideal
1	43	43	0
2	46	48	-2
3	52	50	2
4	65	62	3
5	59	57	2
6	63	60	3
7	73	68	5
8	57	53	4
9	58	58	0
10	51	50	1

To compute the difference column in SPSS

This will compute a differences column on your dataset for you automatically.

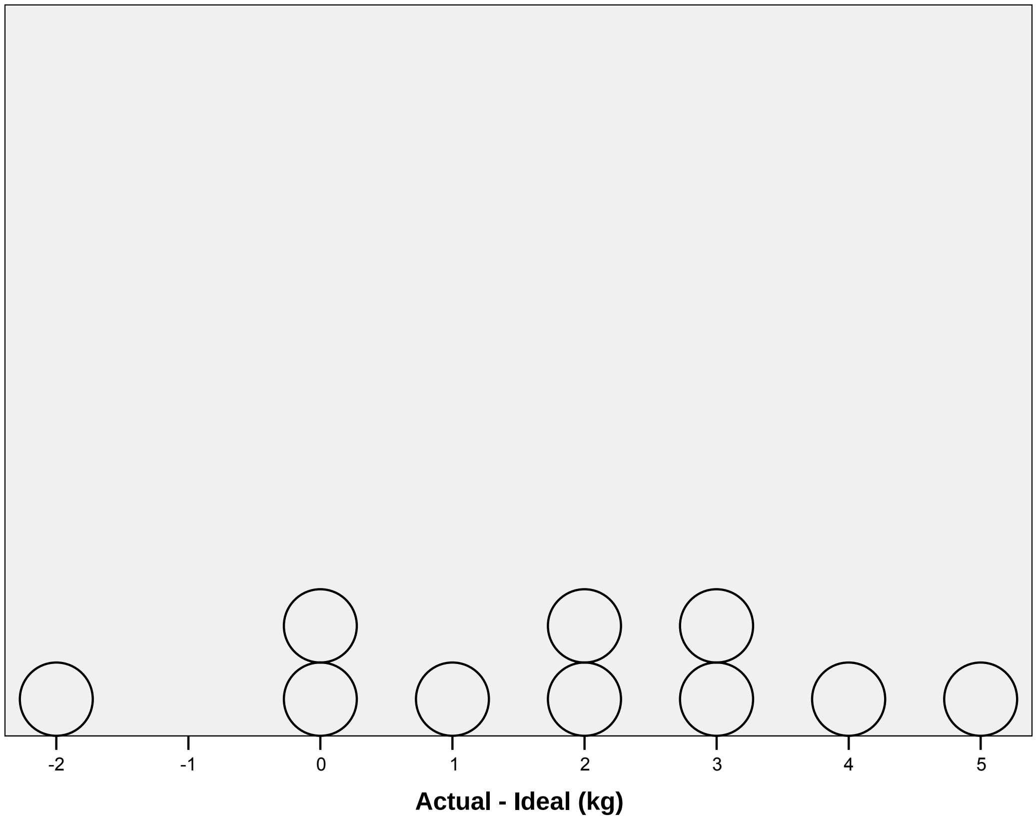
SPSS: *Transform → compute → in target variable box type 'differences' in the numeric expression box enter actual weight – ideal weight → OK.*

To graph the data in SPSS follow these steps

SPSS: *Graph → Scatter/Dot → Simple Dot →Define*
Enter the data for differences (actual – ideal) on the X axis →OK

To change the scale on the graph

Double click inside the graphs and a chart editor window will appear. *Go to edit →select x axis* and a properties window will appear. De-select minimum, maximum and major increment and apply the scale that you require in these boxes (use the data to guide you in this). Click on apply. Close the properties window and the chart editor window and the scale on your graphs will be amended.



What do you see in the graph?

7 of the 10 differences are greater than zero, with only 1 difference being less than zero. This means that 7 of the 10 females are heavier than their ideal weight and only 1 female is lighter than her ideal weight.

To obtain the summary statistics and t-test results

SPSS: *Analyze → Compare means → Paired samples T-Test*

Place the 'actual weight' and 'ideal weight' variables into the paired variable box → *OK* and the statistics will appear.

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Actual weight	56.70	**10**	9.056	2.864
	Ideal weight	54.90	**10**	7.475	2.364

	Sample Size	**Sample mean**	**Sample standard deviation**
Differences	**10**	**1.80**	**2.10**

Paired Samples Test

	Paired Differences					t	Df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pair 1 Actual weight - Ideal weight	**1.800**	**2.098**	.663	.299	3.301	2.714	9	.024

The *p-value* = **0.024**

Interpretation of the p-value is exactly the same as that used in the independent samples t-test.

To interpret the results in the example given above we would use the following format;

The mean of the differences is (statistically) significantly different from zero at the 0.05 level, (P-value < 0.05).

This means that the mean of the differences (i.e., the mean difference) is so much greater than zero it is hard to believe that it is just a chance result, i.e., simply due to sampling variability.

Therefore, On average, the 10 females' actual weights are about 2kg more than their self-perceived ideal weights (differences: mean = 1.80 kg, sd = 2.10 kg). The mean difference is significant. (P-value = 0.024 < 0.05).

THE UNIVERSITY OF AUCKLAND
NEW ZEALAND

PSYCH 109 Lab Survey

Dear PSYCH 109 student, we hope that this semester has been challenging, stimulating, and rewarding. This manual has been designed jointly by staff and students in the Psychology Department together with staff from the Department of Statistics. We have attempted to design stimulating laboratories and have included extra study tips that we hope have been useful for PSYCH 109, and perhaps other courses as well. In light of this, we would appreciate your feedback on our latest edition of the PSYCH 109 Laboratory Manual.

If you would like to let us know your views on the new set of laboratory exercises by completing this survey, be aware that:

- Filling this survey in is ***voluntary***
- This survey is ***anonymous***, ***do not write your name on the form***
- Filling in this survey ***will not affect your grade***
- The results of this survey ***will be used to <u>improve</u> future lab manuals***.

Questions:

1. What was/were your favourite laboratory exercise(s)?

2. What was/were your least favourite exercise(s)?

3. What exercise(s) were the most relevant to the course?

4. What exercise(s) were the least relevant to the course?

5. What study tips were the most useful?

6. What study tips were the least useful?

7. What did you enjoy most about the laboratories?

8. What did you like least about the laboratories?

9. What other laboratory exercises might be useful?

Additional comments: