THE DEPARTMENT OF PSYCHOLOGY GUIDE TO WRITING RESEARCH REPORTS

The following set of guidelines provides psychology students at Essex with the basic information for structuring and formatting reports of research in psychology. During your time here this will be an invaluable reference. You are encouraged to refer to this document each time you write a lab report.

The writing of laboratory reports is an essential part of any practical module in Psychology. This is because psychologists (and more generally most scientists) write accounts of their studies using a standard format, which makes explicit certain aspects of the study. There are two main reasons for doing this:

(1) Ease of communication: it is easier to find what you want from a study if it is written in the standard format.

(2) Provision of a precise and complete description: the format makes it clear what information is important for scientific communication. This information must be provided in detail. It should be added that many professions now include the skills of technical report writing, which requires clear, direct and concise expression, the ability to summarize and present data, and the ability to form hypotheses and draw valid inferences. Learning to write laboratory reports will provide you with a valuable and transferable skill.

This guide tells you about the structure and style that is required for a psychology laboratory report. Since most journal articles are written in similar formats, learning to write such reports will aid you in your reading of the literature. Whenever you read journal articles, think about the formats used and why they have been adopted. Not all articles are perfect, so whenever you come across a section that you do not understand, think about why it is unclear. The fault may lie with the authors who are not being as clear as they could be, if so, how could the section be improved? The books by Howitt and Cramer (2008), Sternberg (1993), Nunn (1998) provide additional help on writing reports and general writing style.

The purpose of a lab report is to communicate to others the important points of a piece of research: (i) why you did it, (ii) how you did it, (iii) what you found and (iv) what you think it means. Readers of reports will sometimes want the answer to very precise questions (e.g., Who were the participants? What exactly were the mean scores for the two groups?) and do not want to read the whole report in order to find this information. For this reason it is essential to follow a standard format (with correct headings) which allows the reader to locate the information that he/she requires immediately without having to work through the entire text.

The simple rule for report writing is *remember the reader.* In journals, papers are intended for an audience who know the general background for a topic but nothing about this particular study. People will usually see the title first, then perhaps read the abstract, and only then read the bulk of the report if their attention is caught. The format suggested below is the same as that used in most published papers. Therefore, any APA (American Psychological Association) journal such as *Psychological Review*, or British Psychological Society journal (e.g., *British Journal of Psychology),* is a good place to browse if you are unsure as to correct format or style. Fine details concerning exact format and required information will depend upon the nature of the study, but

most of the studies should follow this format fairly closely. Particularly important is the use of separately headed sections (and sub-sections in the method section). If you do not use these sections correctly you will incur severe marking penalties. The numbers next to each heading are included here to structure these notes; they should not appear in the report itself.

1. Title

The title should provide a single line description of the study. In many cases, the title will mention the independent and dependent variables. Thus, *The effect of sleep loss on the exploratory behaviour of gerbils* would be a suitable format for a title, as would *Exploratory behaviour in sleep-deprived gerbils*. *Keeping gerbils awake* would not be a good title. Try to avoid using catchy newspaper style headlines as titles (*Gerbil insomnia*); a formal report is not supposed to be an exercise in journalism. Remember that your reader will initially see the title and nothing else, but wishes to know whether or not the report is relevant to his/her research interests. Your title should be a brief, but accurate reflection of the content of the report.
Don't start a title with phrases like *An investigation into...* or *An experiment to determine...*

Such phrases are redundant and add nothing to the content, as well as being good indicators of sloppy thinking.

Do not start a title with *Title:* The reader will know that it is the title from its location.

2. Abstract

The abstract is a short summary of the report. It should contain a brief description of the rationale and of the method, results and discussion sections. Avoid fine details such as numbers and the names of statistical tests here. You should aim for an abstract which is about 100 to 120 words long. The abstract is the second thing any reader will see and it might be as much as they encounter (see the *Psychological Abstracts* in the library). It should, therefore, be a comprehensive but concise summary of the whole report which will enable readers to decide if they wish to read any further. A useful rule of thumb is to try to write four concise sentences describing: (1) Why you did it, (2) What you did, (3) What results you found and (4) What you concluded. Write the Abstract *after* you have written the rest of the report. You may find it difficult to write a short abstract in one go. It may be easier to write a long version first, then prune it.

3. Introduction

(Why you did it.)
The Introduction should present the reasoning behind the particular study which you are describing. This means that the reader, having read the introduction, should feel able to anticipate what your study will involve. At the same time your introduction should allow someone who is not an expert to understand why you did this study. For this reason the introduction will begin at a general background level and progress through to the specific reasons for and aims of the study. This will normally include a review of past work in the area and an explanation of the theoretical or practical reasons for doing the study. A logical progression of content for an introduction might go something like this:

Describe and define the area that you wish to study, perhaps explaining why it is interesting and/or important if this is not obvious.

Describe previous work by others (and perhaps yourself) that informs the issue that is the topic of your investigation.

Explain why the previous work is not sufficient. It may have methodological problems, or perhaps there is plenty of scope for extending previous work, perhaps it has not been replicated before, or you may be comparing the adequacy of different theories. (If the previous work is complete and has no problems and has been replicated many times, or it is known which is the best theory, then there would be no point to any further study.) Explaining why previous work was inadequate should lead naturally on to the study that you have run. You do not need to give specific details here, but it should be clear how the present study addresses unresolved theoretical issues, and/or overcomes the shortcomings of previous studies, and/or how it extends our current knowledge.

Given the results previously found, and your proposals, what would you predict the outcome of your study to be, and why? End this section with your research hypothesis (what you expect to happen given your theoretical stance and/or the limitations of previous studies). If you are doing a more exploratory research in which you are genuinely unsure as to the outcome, describe the aims of your study and what you hope to achieve. This final part of the introduction is the real key to understanding the study itself, and the report. If this part is clear then describing and interpreting the results becomes much easier. Make sure that you integrate your hypotheses with the main body of the text. Avoid listing and/or bullet-pointing your hypotheses.

4. Method

(How you did it.)

The method section is not a single section by itself, instead it consists entirely of the five or so sub-sections described below. In the method section, you describe the essentials of how you gathered your data. This section must contain enough information for the reader to be able to repeat the study, but should exclude any irrelevant details. For example, if you are studying the effect of word types on the ability to remember lists of such words, then the characteristics of the words that make up the lists are extremely important. You would not be expected to explain in detail how participants were seated at a desk, say, unless you were specifically studying the effects of seating arrangements on memory. Unfortunately, the details which are relevant and which are irrelevant vary from study to study. When in doubt, consult a journal article that is related to your work and see which details have been included there. *All text in the method section should only be given under one of the sub-headings below. The apparatus section or the materials section may not be necessary if the contents are trivial, other sub-sections will always be needed.*

A final, general point: your memory for the methods should be clear when you write the method section. Therefore it is a good idea to write (or at least draft) this section as soon as you can after completing the study.

4a. Participants

This should state how many participants were tested, who they were (i.e., from what population they were drawn), how they were selected and/or recruited (e.g., randomly selected sample, volunteers, module requirement etc.) and any other important characteristics (e.g., mean or median age, the age range or SD, composition in terms of males/females, educational level). Which characteristics are important will depend upon the task you are asking people to perform and the kinds of conclusions you wish to draw. If you study only undergraduate students, you may not be able to generalize to the elderly. If most of your participants are female (a common imbalance in

psychology student populations) then you may not be able to generalize to male populations. Depending on the research, these details may be trivial or extremely important.

4b. Apparatus

Apparatus consists of the equipment used to present stimuli and to record dependent variables. Some studies just involve trivial items (e.g., pencil, paper, stop-watch etc.), and so an apparatus section is often not needed. This section is only required when more complex equipment is used (e.g., a computer running special software). If purpose-built equipment is used, you should describe it in sufficient detail, using a diagram if necessary, to allow equivalent apparatus to be constructed.

4c. Materials

Words, problems, questionnaires, pictures of faces to remember etc. are *materials*, and this section should describe what these are and how you devised them (or who did devise them if you did not). The criteria used to select the particular items that you used should be described. For example, if using words as your stimuli for a memory test you should tell the reader about any features of their selection, such as word length, word frequency (in the English Language), or their grammatical role (noun, verb, concrete, abstract, etc). For some materials it may also be useful to enumerate or provide a list of the items (e.g., the numbers from 1 to 7 inclusive). Please note that listing the materials is no substitute for explaining how you selected them. For extensive materials, listing the items is an inappropriate way of describing the materials. If there is an extensive list, it should be provided in an appendix.

4d. Design

Here various aspects of the design should be described. These will vary according to the analysis that you use.

For simple studies in which you are comparing a pair of means and are not using more complicated statistics than a *t*-test, state the design (within- or between-subjects) and state what your independent variable(s) (or classification variable) and dependent variable are. In research where there are two or more conditions in the study, you should use clear and informative names for the conditions (not numbers or letters as labels for these). This is the section where you would first define these condition names, which should then be used throughout the remainder of the report.

For example: This experiment used a between-subjects design. The independent variable was drug dosage (high or low dosage). The dependent variable was the number of problems successfully completed.

For all experiments, you should also explain how you decided which experimental condition was performed by which participant (between-subjects designs/factors) – usually by random allocation. Also, you need to say in what order the conditions were presented (for example in repeated-measures designs where a set of tasks are being given) again this can be done by *randomising* the order of trials or by *counterbalancing* blocks of trials.

For correlational studies there is no experimental design and no independent variable(s). The aim is to measure the relationship between a number of different dependent measures that you are studying. Say what the dependent measures are and why they are included, and in what order the tests were given. *For example: This was a correlational study in which AH4 test score was a*

measure of intelligence and VA7 test score was a measure of verbal ability. Half the participants were given the AH4 test first while the other half were given the VA7 test first.

4e. Procedure

This section describes how the design was actually implemented and should describe exactly what took place during the testing session. You should write impersonally, slanting the description towards the events that happened to the participant during the study. Be very careful to decide which details are necessary for replication and which are not.

You do not begin description of the study from the beginning of the afternoon when the lecturer started describing the lab class for the day, only from when you started testing participants. Similarly, if the class data has been written on the blackboard, you do not need to describe this at all (you have already collected your data, and writing it on the blackboard should not have any effect on it!).

This section should include a description of the instructions given to participants. You do not need to quote the entire instructions in the main text unless the exact wording was important for your results. Any particular emphasis (e.g., instructing participants to be as fast and as accurate as possible, or to look closely at each item and try to remember it) should also be mentioned.

You must specify in precise detail the events that occur on each trial, such as any warning signal, how long the stimuli are presented for, how the participant responds, etc. Other details could include the rate of presentation of trials (e.g., one every five seconds), maximum times allowed to come up with an answer and other times, such as lengths of rest periods.

You also need to specify how much practice participants had before the main task (e.g., the number of practice trials) and how many measurements were taken (e.g., the number of experimental trials in each condition).

In this section you should particularly remember the needs of the readers. There should be enough information for them to repeat your study in every important respect. The only details which can be left out are those that do not matter (e.g., *how* you actually randomized the order of the experimental conditions; you can assume that your reader knows how to perform randomisations).

How you treated your data after you collected it has nothing to do with the procedure. Likewise, the statistical tests that you use should not be described or included in the method section, as they are tools for analysing data, not gathering data.

As a final consideration, if you have written your method well, you should be able to determine, from reading the description, what it was like to be a participant in your research. (For example: What did you see on each trial? What decision did you make? Did you make the same kind of decision on each trial? Did you do the whole procedure several times with different stimuli or instructions?) All such details are important if the study is to be replicated successfully. If YOU cannot work out from your description what happened to the participant, an independent reader has NO chance of understanding your research.

5. Results

(What you found.)

Begin this section with a description of how you treated your data. This means that you should describe how you got from all of the responses that were made by each participant to the scores that were analysed. For instance, if each participant has answered 40 questions, and you are analysing the overall percentage of correct responses rather than (or in addition to) the performance on each individual question, you should say so. In the event that you discarded some data, you should say what data were discarded and why (i.e., give the "exclusion criterion").

Follow the description of the treatment of the data with a clear, concise summary of the data using descriptive statistics. In a simple experiment, this will often take the form of putting means and standard deviations for each condition in the sentences that follow the treatment of the data. In a more complex study (with several dependent measures, or three or more conditions), the descriptive statistics are often put in a table. Sometimes it will be better to use a graph instead of putting the descriptives in a table or in the text. For instance, this is common when you want to illustrate that there is a trend across conditions, or when there is a complex pattern of results (e.g., an interaction between two variables).

All tables and figures should be clearly numbered, and should include a title that identifies the relevant variables, conditions, and units of measurement. Also, make sure that the axes are correctly labelled. Moreover, any time that you include a graph or table, you should refer to it from the text of the report. In other words, your reader should know when they should refer to the figure or table.

Reporting means and standard deviations may not be best for all kinds of study – other descriptive statistics may be appropriate. When analysing count data or frequency data, percentages are helpful. When analysing relationships, correlation coefficients are usually the best descriptive statistics. It is common to include measures of effect size: this can be done either alongside the other descriptive statistics or can be presented when the statistical tests are reported.

Never put tables of raw (i.e., unsummarized) data in the results section, give summarized data (means/medians and standard deviations) instead. Raw data for first and second-year laboratory reports should be kept but not handed in. For PS300 Final-year Research Projects the raw data are also not included in the report, but they ***must*** *be handed in separately.*

Never cut and paste output from a statistical package into your report. You should always think carefully about which information is relevant and useful, and present it in the best way without repetition.

In your results section, use the same informative names for the conditions that you set out in your method section. This will help your reader.

The descriptive statistics would usually be followed by inferential statistics (statistical tests that will help you to decide what you should conclude about the data). It should be clear what test(s) you have used, and on what data the tests were performed. For most statistical tests (e.g., a *t*-test) there is a test statistic that should be reported (e.g., the *t*-value) along with the *p*-value. Often, there is other information to be included (e.g., the degrees of freedom). For each different test, you will need to learn what information to report.

When reporting p-values, the preferred method is to report the exact *p*-value (e.g., $p = .045$ or $p = .678$). If a computer package shows a p-value of 0.000, this means that the *p*-value is too small to be shown exactly with three decimal places, and this is generally reported as $p < .001$.

Here are three separate examples to show you how an investigation of mean differences can be reported in a results section. Each example includes: a statement of how the data were treated, the relevant descriptive statistics, the report of the appropriate *t*-test, and a clear statement of what is concluded from the *t*-test.

(1) Solution times (in seconds) were calculated separately for each participant by obtaining the mean completion time for each of the six problem solving tasks. The mean (standard deviation) solution times for the primed and unprimed conditions were 45.0 (12.3) and 56.3 (14.2) seconds, respectively. The effect size for this difference is large ($d = 0.85$). An independent-samples *t*-test established that the solution times in the primed condition were quicker than the solution times in the unprimed condition, $t(32) = 2.48$, $p = .019$.

(2) The mean number of seconds taken to complete the six problems was calculated in order to produce a solution time for each participant. The mean (standard deviation) solution times for the primed and unprimed conditions were 49.0 (12.3) and 56.3 (14.2) seconds, respectively. An independent samples *t*-test showed that there was no significant difference between the mean solution times of the primed and unprimed conditions, $t(32) = 1.60$, $p = .119$, $d = 0.55$ (medium effect size).

(3) Solution times (in seconds) were calculated separately for each participant by obtaining the mean completion time for each of the six problem solving tasks. The mean (standard deviation) solution times were 38.5 (12.3) seconds for the primed condition and 56.3 (14.2) seconds for the unprimed condition. An independent samples *t*-test showed that there was a significant difference between the mean solution times of the primed and unprimed conditions, $t(32) = 3.91$, $p < .001$. Solution times were quicker when participants were primed rather than unprimed.

Note that these examples include a clear statement of the direction of any significant effect. In other words, we know that solution times are quicker in the primed condition – not just that there is a difference between the conditions (without being told which one gives the faster times).

Different research fields sometimes have conventions for reporting results that differ slightly from those outlined above. Where this is the case, guidance will be given on how to present your results (e.g., by project supervisors or lecturers for a Year 2 laboratory class).

6. Discussion

(What you think it means.)

This is the section in which you interpret the results of the study and discuss their meaning. It is important that your discussion relates to the issues raised in the introduction, since this presented the reasons for conducting the study and the results should provide more details about these issues. You should link the arguments made in this section with the issues and research hypotheses raised in your introduction section.

In particular:

(1) How do your results compare with your research questions and/or predictions?

(2) How do your results compare with relevant published results?

(3) What are the implications for future research?

It is a good idea to start with a clear statement of what your study found. When you do this, you will often need to remind the reader of the main goals of the study, so that the results make sense in this context. Then comment on your results in relation to the predictions or research questions that your study addresses. Say which predictions are supported by your findings, and identify any unexpected results. In the next two parts of the discussion, consider the possible explanations for these findings.

Now, discuss your findings in relation to previous research on the same or related research questions. The most important thing is to say how your results shed light on the theory or theories that you outlined in your introduction. If relevant, this can begin with a comparison between your findings and those of other studies. For instance, is the general level of performance similar to previous studies, or is the distribution of individual scores comparable to previous research? Is the size of mean difference or the strength of relationships similar to that found in other research on this topic? It is in this part of the discussion where you should discuss some of the studies mentioned in your introduction. One suggestion is to look at the methods of other studies as a possible source of any discrepancies between your results and theirs. These comparisons with previous research may provide insight into your results, or may suggest alternative explanations for your findings. Remember, everything that you discuss should be relevant to the theoretical questions that your study set out to address. Make sure that you state which theories are supported by your results, and say how theories may have to be modified in order to account for your findings.

Now that you have stated and discussed your findings, you ought to identify what unanswered questions remain and what new questions have arisen. This leads into what future research it is important to carry out. If there are alternative explanations for your findings, this will provide a good reason for suggesting new studies that could be conducted. You should try to be as specific as you can: say what kind of study should be done, and why it will help to determine which explanation is better. If there are ways that your study could be extended to address new related questions – for instance, by adapting one of the conditions, or modifying the dependent variable(s) – you can discuss these here. Be wary of being too speculative: always make clear the possible consequences and benefits of any changes you propose, backed up with suitable sources.

Never (lamely) conclude that further research is required, leaving your reader to guess what the further research possibly could be. Never simply list a series of possible shortcomings, and say that these could have affected your results in some (unspecified) way. Always make sure that, whatever you say, it is highly specific to the study that you have done and not simply a discussion of general factors that apply to all or most psychological research.

7. References

The Department has a guide to referencing that must be used when reporting psychology research. It can be found in the Psychology on-line resources, and it is reproduced in the Undergraduate Handbook.

8. Appendices

The final, optional, section of the report is the Appendix section (or Appendices). You should include here all material that would have been obtrusive or damaging to the 'flow' of the report itself, and not just use it as a bin to contain things you wished to say but could not fit into the main report. Therefore, the contents of the Appendices usually consist of raw data, statistical formulae

and computations, lengthy protocols, examples of stimuli and details of stimulus preparation, etc. Have a separate appendix for each type of material, instead of just 'lumping' everything together in one appendix. For first-year and second-year reports, an appendix is rarely necessary.

GENERAL NOTES ON STYLE FOR RESEARCH REPORTS

Using an appropriate style can be very difficult, even if you have written formal reports before. In time, the conventions described below should become fairly automatic. Again, by reading journal papers you should learn and remind yourself of what the usual practices are.

1. Use of personal pronouns

Be sparing with the use of personal pronouns (we, I, our, me, etc.). Frequent use of personal pronouns can make your writing sound anecdotal (i.e., based on limited evidence), or appear dependent upon your subjective interpretation (e.g., as if others would not draw the same conclusion from the evidence that you have presented). When writing a method or results section, it is rarely essential to use "I" or "we". For instance, you would NOT need to write: "I conducted a *t*-test", as it is obvious that you as the author of the report conducted the test. Similarly, you should NOT write: "I conclude that the result is significant", as other people would draw the same conclusion given the same data and the same test result.

Any time that you use a personal pronoun you should check that it is clear whom "I" or "we" refers to, and that this provides the best way to express what you want to communicate. Conventions concerning the use of personal pronouns do vary from one area of research to another. You can expect to receive guidance where conventions differ from those described above (e.g., from your project supervisor).

2. Use of tenses

Tenses can be very difficult to use correctly. These guidelines can only be very general rules of thumb. Basically, anything that is history should be written in the past tense. When you write up your work, even your method and results will be history, and should be described in the past tense. The conclusions of previous workers are history, however yours are still current and should be described in the present tense. The theories and models that were derived from the results and conclusions still make predictions today (even if they are the wrong ones) and their predictions thus should be described using the present tense. Thus, for a previous piece of work that you are describing:
"Smith et al. (1970) found that… they concluded that…and developed the XYZ model. This predicts that…"
If you were discussing the results of *your* experiment:
"It was found that… and thus we conclude that…. the ABC model predicts that…"

3. Other Points to Note

Avoid contracting words (don't, can't, couldn't, etc.).
Always proof read your work for typos. For example, the spell checker will not alert you to 'trials' being incorrectly spelled as 'trails'.

The word "data" is plural. For example, write: *"the data were collected"*, not *"the data was collected"*.

Affect (verb) to have an influence on something: *"something has affected my experiment";* something has changed my experiment.
Effect (verb) to cause something to happen: *"something has effected my experiment";* something has done my experiment for me.
Effect (noun) a consequence or an outcome: *"this is a negative effect";* this is a bad outcome.
Affect (noun) an emotional state: *"this is a negative affect";* this is a bad mood.
Most common usages are affect (verb) and effect (noun): e.g., "The problems described above affected the results by diminishing the size of the experimental effect."

4. Some general advice

On the whole, pieces of information should occur only once in the report, and therefore, if you find yourself repeating large chunks of material in different sections you have gone astray and either one of the occurrences is wrong or perhaps you have not planned the content of your sections properly. The exception to this rule is the abstract, which should contain *only* information reported elsewhere, but of course reported much more concisely.

Write the title and abstract last (once you know what is in the rest of the report), then add this to the front of your report. Keep the raw data and intermediate calculations but do not include them in the report (other than in an appendix).
For more comprehensive guides to the reporting of research read:

Howitt, D., & Cramer, D. (2008). *Introduction to research methods in psychology* (2nd ed.). Harlow, Essex: Pearson. (Chs 5 and 6).
Sternberg, R. J. (1993). *The psychologist's companion* (3rd ed.). Cambridge: Cambridge University Press.