As module controller, Mike operates “Office Hours“, (11-1, Tuesdays) where he will be in his office for PS3021 issues. It would be helpful if you email beforehand to avoid clashes with other students.

Timetable

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Lecture, Monday 9-11 (Chemistry/Purdie B)</th>
<th>Practical, Monday 1-5 (Psych &amp; Neurosci Seminar Room)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>15th Sept</td>
<td>Introduction &amp; overview of course. Experimental design</td>
<td>Broad framework for experiments Philosophy of science &amp; testing hypotheses</td>
</tr>
<tr>
<td>2</td>
<td>22nd Sept</td>
<td>Ethical considerations in experimental design</td>
<td>Experimental details Tables of variables &amp; combination table</td>
</tr>
<tr>
<td>3</td>
<td>29th Sept</td>
<td>Describing and graphing data sets</td>
<td>Preparing your experiment</td>
</tr>
<tr>
<td>4</td>
<td>6th Oct</td>
<td>z-score, t-tests &amp; 1 way ANOVA</td>
<td>Preparing your experiment</td>
</tr>
<tr>
<td>5</td>
<td>13th Oct</td>
<td>2-way, within subjects, mixed design ANOVA</td>
<td>Preparing your experiment</td>
</tr>
<tr>
<td>6</td>
<td>20th Oct</td>
<td>Planned comparisons &amp; post-hoc tests</td>
<td>Changing ethics forms / collecting data</td>
</tr>
<tr>
<td>7</td>
<td>27th Oct</td>
<td>Non-parametric tests and when to use them</td>
<td>Collecting data</td>
</tr>
<tr>
<td>8</td>
<td>3rd Nov</td>
<td>Describing bivariate data sets: covariance, correlation and regression</td>
<td>Collecting / analysing data</td>
</tr>
<tr>
<td>9</td>
<td>10th Nov</td>
<td>Failures in the assumptions and what to do about them</td>
<td>Analysing data</td>
</tr>
<tr>
<td>10</td>
<td>17th Nov</td>
<td>Questionnaire design</td>
<td>Poster session of mini-projects</td>
</tr>
<tr>
<td>11</td>
<td>24th Nov</td>
<td>Qualitative data and its analysis</td>
<td>Revision lecture. Writing of final report</td>
</tr>
</tbody>
</table>

1. Optional group based design worksheet for feedback (deadline 5pm Friday 3rd October, upload to MMS)
2. Optional group based ethics forms for feedback (deadline 5pm Friday 10th October, upload to MMS)
3. Group ethics forms & design worksheets (deadline 5pm Friday 17th October, upload to MMS)
4. Assessed group posters to be submitted (deadline **2pm Thursday** 13th November, Upload to MMS)
5. Assessed individual write-up of the mini-project (deadline 5pm, Friday 28th November, upload to MMS)
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  Title ......................................................................................................................................16
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  Abstract (overview of ALL aspects of the study) .................................................................16
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  Methods (how you did the study) .........................................................................................17
  Results (what the study found) .............................................................................................21
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Disclaimer
Please note that any changes will be announced in lectures and distributed via email to those enrolled on the module. Any such up-dates take precedence over the information in this hand-out. Any changes in University or Faculty rules and regulations also take precedence over this hand-out.
PS3021: Aims and objectives

The module aims to foster your experimental skills. By completing a group based project (with individual write-up) you will have had direct experience in and feedback on:

- **Discipline specific abilities**
  - Numeracy
  - Use of appropriate resources (data collection & analysis programmes)
- **Planning and strategy**
  - Identification of goals
  - Ability to deliver outcomes on time
- **Team working**
  - Leadership, active engagement, taking initiative, collective responsibility
- **Presentation skills**
  - Summarising data, poster design, poster presentation, detailed reports
- **Ethical considerations (human & animal) of psychological study**
  - Ethical application procedures
- **Experimental design**
  - Ability to create a hypothesis and relate to broader theories
    - Identifying a good hypotheses
    - Inductive processes and its limitations
    - Deductive reasoning and its limitations
  - Appropriate identification of population & sampling method
  - Consideration of internal & external validity
  - Selection of suitable independent and control variables
    - How to determine the appropriate analysis method

The methodological techniques covered include aspects such as:

- **Univariate analysis methods**
  - z-score, t-tests, ANOVA (1-way, 2-way, random factor, within subject, hierarchical/nested, mixed design: planned comparisons & post-hoc tests)
- **Bivariate analysis methods**
  - Covariance, Pearson’s correlation & linear regression
  - Spearman’s correlation, Kendal’s Tau and Goodman-Kruskall gamma
- **Non-parametric analysis methods**
  - Sign test, Wilcoxon’s signed rank test, Mann-Whitney U, Kolmogorov-Smirnov, Friedman’s and Kruskall-Wallis tests as well as the bivariate methods above
- **How to detect failures in the assumptions and what to do about it**
  - Test for normality: Q-Q plots, residual plots, Kolmogorov-Smirnov, Shapiro-Wilk
  - Heteroskedasticity & sphericity: Devils triangle, Levene’s test, Mauchley’s test
    - Role of Satterthwaite’s, Greenhouse-Geisser corrections etc
  - Data transformations (arcsin, square-root, log, inverse, Fishers transformation) and when to use them
- **Questionnaire design**
  - Construct definition & operationalization
  - Scaling methods
    - Categorical, Visual analogue scale, Likert-like, Guttman, & Thurstone
  - Assessing reliability and content & construct validity
    - Test-retest reliability
    - Chronbach’s alpha, introduction to ideas behind item response theory
- **Qualitative methods**
  - Archival, case study, participant observation, in depth interviews, focus groups
  - Discovery and meaning focussed analysis
  - Methods of constant comparison & grounded theory
# PS3021 Lecture by lecture overview

The table below provides an overview of the core concepts covered in each lecture. The last three have been deliberately left incomplete: it should be easy for you to fill in the entries from the summaries and other handouts available on Moodle.

<table>
<thead>
<tr>
<th>Lecture</th>
<th>Main issues covered in PS3021</th>
</tr>
</thead>
</table>
| 1. Introduction & overview of course. Experimental design | Take time to think about the hypotheses  
Need to create meaningful null and alternate hypotheses  
The all-too-often null as $H_0$ is poor theorising  
Need to know why you are choosing the variables (theory driven design)  
Think about your sample  
What is your concrete population?  
How are you going to sample that concrete population:  
Why is a random sample the best way to go?  
Why is a random sample frequently not feasible?  
Consider the validity of the proposed study  
Internal & external validity are in opposition  
Internal validity = can the results be believed?  
External validity = can the results be generalised beyond your study?  
Create a table of variables and a table containing the combination of variables  
Make sure the design is balanced |
| 2. Ethical considerations in experimental design | The deontological stance ignores consequence, the teleological stance suffers from “the end justifies the means”.  
Bentham’s utilitarian approach argues that the cost-benefit should be used  
Universal declaration on bioethical & human rights forms the core of ethical considerations:  
Dignity & freedom  
Rights of the individual supersede all else. Must not stigmatise or discriminate...  
Maximise benefit, minimise harm  
Includes protecting the vulnerable, stopping if someone gets upset...  
Individual’s Autonomy  
Includes informed consent, right to withdraw... |
| 3. Describing and graphing data sets; using statistics to make inferences | You should always describe your data, not the analysis  
The way to describe data is to use measure of central tendency (where the data lies) and a measure of spread/uncertainty of the values (an indication of the distance between the data values)  
Mean, median and mode are measures of central tendency  
Variance, IQR and entropy are measures of uncertainty (how far apart data are from each other)  
Plot your data  
Use frequency plots to see ‘shape’ of the distribution  
Use line (continuous data), bar (discrete categories) and/or box plots to plot summaries of the data (central tendency and the measure of uncertainty)  
Making inferences from data  
Statistical methods allow us to make inferences when there is uncertainty (‘noise’) in the data  
Focus on objective probability & the frequentist approach  
Take the value of a statistic using our DV and ask how likely is it that we would observe that value or more extreme if our null hypothesis was true  
Neyman-Pearson found a way of determining what that statistic should be (how it should be calculated)  
Probabilistic hypotheses (on average $X>Y$, not always $X>Y$) present particular issues  
Set the critical value based on probability ($\alpha=0.05$)  
Use the model of the world (the null hypothesis) to calculate the likelihood of getting the observed statistic or higher |
### Main issues covered in PS3021

<table>
<thead>
<tr>
<th>Lecture</th>
<th>4. The normal distribution, z-score, t-tests &amp; 1 way ANOVA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>The normal distribution can be thought of as an infinite number of processes, each influencing the outcome a little bit</td>
</tr>
<tr>
<td></td>
<td>When running experiments, we are targeting one (or a few) mini-processes and seeing if the targeted processes influence the DV (our chosen outcome)</td>
</tr>
<tr>
<td></td>
<td>z-scores standardise normal distributions so they are all the same: we need only think of one</td>
</tr>
<tr>
<td></td>
<td>But you have to know the population values for the mean and variance</td>
</tr>
<tr>
<td></td>
<td>t-tests express distance between two means as the number of ‘expected standard deviations’ they are apart</td>
</tr>
<tr>
<td></td>
<td>Use sample estimates of the mean and variance (unlike the z-score) to calculate the probability</td>
</tr>
<tr>
<td></td>
<td>1-way ANOVA expresses distances between 2+ mean in terms of their variance (remember that variance is a measure of spread or distance).</td>
</tr>
<tr>
<td></td>
<td>The F ratio calculates how many ‘expected variances’ apart the means lie</td>
</tr>
<tr>
<td></td>
<td>The expected variance of the spread of means comes from the expected variance of the means assuming all the means are equal: the pooled SEM pres, estimated using the variance of the iid error term</td>
</tr>
<tr>
<td></td>
<td>You predict F=1 if the population (true) means are all equivalent</td>
</tr>
<tr>
<td></td>
<td>The observed variance should be the same as the expected variance of the means</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lecture</th>
<th>5. 2-way, within subjects, mixed design ANOVA</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>You can add other factors to 1-way ANOVA giving both main effects and interactions.</td>
</tr>
<tr>
<td></td>
<td>Each main effect and interaction is assessed by their own F ratio</td>
</tr>
<tr>
<td></td>
<td>The calculation of each F ratio is conceptually the same as for the 1-way ANOVA</td>
</tr>
<tr>
<td></td>
<td>Within subjects ANOVA is a 2-way ANOVA with participant as a factor</td>
</tr>
<tr>
<td></td>
<td>Participants are a random sub-sample of possible people. This means the population means you are estimating for your IV will depend on the particular participants you have.</td>
</tr>
<tr>
<td></td>
<td>You have to take the ‘random’ bit of a random factor into account when analysing your data.</td>
</tr>
<tr>
<td></td>
<td>We tend to ignore the ‘participant factor’ and its interactions (i.e. we don’t care if they are significant or not), but the sums of squares etc are used to calculate the F ratios of the other factors (the ones we are interested in)</td>
</tr>
<tr>
<td></td>
<td>We are normally interested in what people do ‘on average’ rather than trial-by-trial</td>
</tr>
<tr>
<td></td>
<td>We therefore analyse data using participant means</td>
</tr>
<tr>
<td></td>
<td>Typical average measures include accuracy, mean RT, score across all items in a questionnaire...</td>
</tr>
<tr>
<td></td>
<td>This creates an ‘incomplete’ ANOVA</td>
</tr>
<tr>
<td></td>
<td>There is no estimate for the variance of the iid error term</td>
</tr>
<tr>
<td></td>
<td>This changes how we calculate the F ratios but otherwise leaves things conceptually the same</td>
</tr>
<tr>
<td></td>
<td>A “mixed design” ANOVA is when you nest one factor (typically a random factor such as participant) nested within a second factor.</td>
</tr>
<tr>
<td></td>
<td>Nesting means we cannot separate the interaction from the main effect of the nested factor (usually participant)</td>
</tr>
<tr>
<td></td>
<td>Again, we tend to ignore the nested factor, but the values need to be calculated to estimate the other F ratios</td>
</tr>
<tr>
<td>Lecture</td>
<td>Main issues covered in PS3021</td>
</tr>
<tr>
<td>---------</td>
<td>-------------------------------</td>
</tr>
</tbody>
</table>
| 6. Planned comparisons & post-hoc tests | Significant ANOVA tells us some aspect of the condition means differ  
   - There are lots of ways in which the means can vary, so need to control family wise errors  
   - For interaction terms, it is the difference of the differences that varies  
   Use post-hoc and, preferably, planned comparisons to look at the differences in detail  
   - Can use adjustments of the α level (PLSD, Bonferroni, Sidak’s)  
   - Can use studentized range distribution (Tukeys HSD, Neuman-Keuls)  
   Main effect analysis  
   - Use pooled estimates of iid for between subjects  
   - Can use pooled estimates for within. SPSS does not  
   Interactions  
   - First, simple effects analysis (“consistency of main effects”)  
   - Use SEM from the main effect to determine critical difference  
   - Second, look at the difference of the difference  
   - Use SEM from interaction to determine critical difference |
| 7. Non-parametric tests and when to use them | There are a limited number of non-parametric tests  
   - Non-parametric tests form an eclectic bunch of tests  
   The sign test is about the only distribution free non-parametric test  
   - Chi-squared is so long as counts are large enough (when the Poisson distribution of counts is close enough to being ‘normal’: the expected > 4).  
   For other non-parametric tests, the “distribution free” claims are overrated  
   - Indeed, the so called “distribution dependent” parametric tests are probably more robust against differences in spread and differences in the lack of normality of the distributions than the non-parametric tests  
   It is important to use the ‘exact significance’ test  
   - These are calculated by going through all possible outcomes for the data and converting the number of values which are the same or more extreme than the value seen with the data into a proportion (a probability)  
   The tests frequently (mostly) use ranked data  
   - Parametric tests using the ranked are then performed  
   More complex tests (i.e. beyond 1-way within and between subject ANOVA) are not readily available |
| 8. Describing bivariate data sets: covariance, correlation and regression | Covariance is core to thinking about bivariate data  
   - Always think of the 3rd variable before contemplating direct relationships  
   Correlation coefficient is the covariance of standardized (z-scored) variables  
   - Being standardised, it is used to determine the probability that the observed co-variance is due to chance or not  
   Regression give the quantitative description of covariance (correlation)  
   - If you replace the categories in ANOVA with the mean of the DV, ANOVA can be seen as a form of regression |
| 9. Failures in the assumptions and what to do about them | |
| 10. Questionnaire design | |
| 11. Qualitative data and its analysis | |
PS3021 Assessment
60% of the final module grade and is based on continuous assessment: the reports of data and experiments that you will design, implement, run and analyse. 40% is based on the examination. Failure to pass both the continuous assessment and the examination will result in a module grade no higher than 6.9.

Structure of the continuous assessment
Reporting of experiments is about giving the reader the main points of an experiment. With a bit of care and consideration, you should be able to give the information necessary for the reader to
1) Understand the context of the experimental question
2) Be able to replicate your experiment, including how to analyse the data
3) Know the key findings and their statistical evaluation
4) Know how your study relates to the bigger picture, including shortcomings and what to do next

These four “headings” are usually referred to as introduction, method, results and discussion. Regardless of space – be it a poster or a scientific paper – you should always cover these issues. The only thing that changes is the level of detail you give. The CA starts off with trying to get you to focus on the big experimental issues (design worksheet), then expand a little (the poster) before giving the full report.

Continuous assessment details
20% of CA grade: there will be a series of practical assessments in which you will download a data set, analyse and then answer a series of MCQ and numerical input questions based on that analysis. Example and practice tests (with different data sets each time) will be available which you can practice as many times as you want before taking the test itself.

Preparing your experiment (Ethics form & design worksheet, upload by end of week 5)
Design worksheet: The aim is for you to summarise what your experiment is about and how you intend to conduct it in as few words as possible. Do not give too much detail: stick to the key information. An example is available on Moodle and will give you a good idea of the brevity that is wanted.

The design sheet should take no more than 2 pages. If you go over 1.5 pages it is almost certainly too long and you are giving unnecessary detail.
Use either “Times new roman”, “Arial” or “Calibri” font.
Do not use variants of these fonts (e.g. “Arial narrow”)
Use at least 12 point font size for all text

Ethics application: Detailed instructions are available on the UTREC web site. An example of how to fill in the form is given in the associated lecture. You will not be able to collect data until you have ethical approval. Take care with it and follow the instructions given. Example information sheet, consent form and debriefing forms are available on Moodle.

One person in each group should upload the ethics application and design worksheet to MMS no later than the end of week 5. All the files, including any that have been zipped, should clearly indicate the matriculation numbers of all those in the group.

Remember to include the associated information sheet, the consent form and the debriefing sheet required for the ethics application form.

10% of CA grade: The Poster (by 2pm on the Thursday of week 9).
A poster should give the reader enough information to know what the experiment was about and the main finding and what those finding mean (recommend no more than 300 words).

Example posters are available on Moodle.

One person in each group should upload the poster to MMS by 2pm on the Thursday of week 9. The file should clearly indicate the matriculation numbers of all those in the group.

70% of the CA grade: The final report
Each student is to write their own, independent final report and upload it to MMS. It has limit of 2000 words. This includes the title, abstract, introduction, results and discussion but not the reference list, tables, figure legends nor any appendices. The in-text citations count. If you find you are using more than 1500 words, think carefully about the relevance of what you are saying.

The ethics forms, and associated information, should not be included (they have already been submitted) in the final report, but a statement that the study had ethical approval should.
Do not include the raw output from SPSS (or other programmes), nor any other experimental files.
Use either “Times new roman”, “Arial” or “Calibri” font.
Do not use variants of these fonts (e.g. “Arial narrow”)
All text must be at least 12 point
This includes headings, figure legends, references, the abstract, any appendices and any other text: “all text” has no exceptions.
All paragraphs must be at least 1.5 spaced
Titles, headings, figure legends, reference list, appendices, the main text and any other paragraphs you include: “all paragraphs” has no exceptions

The design worksheet
The design worksheet concentrates on the methods section, but should include the key/major points of the introduction and expected results. However, it is easier to see potential design shortcomings once they are made explicit (written down).

The first (optional) deadline is for you to hand in a table of variables and a combination table. This will make your design explicit and determine the analysis technique you will use. Use the feedback from this to help formulate your final, assessed, design worksheet

Remember that the design worksheet is not something that is fixed once it is written. It does, however, serve the purpose of getting you to think about the big issues without the clutter of smaller details or worrying about the results.

Example for filling in the design worksheet

| Overall design | Specific enough to remind you of why you are doing the experiment and the general idea behind the design. E.g. Previous literature suggests that people expressing an emotion are remembered better than those with neutral expression. This study will investigate the impact of different emotions (Happy, sad, surprised) or a neutral expression on memorability of the face. |
| Experimental hypothesis | Give the experimental hypothesis. *The effect of expression on memory performance is due to valence (happy, sad) rather than emotion per se (surprised)* |
| H₀ and H₁ | H₀: There will be no impact of facial expression on the ability to remember those faces
H₁: There will be an impact of valence expressions but not emotion per se |
<p>| Independent and control variables | List the IV and control variables. <em>Expression (neutral, happy, angry, sad, surprised). Participant will be noted</em> |
| Primary measure(s) | Give the dependent variable(s) and an indication of the number of trials. Often this is only a single variable (e.g. RT or accuracy). If you are doing a correlational study there will be more than one. In this example, <em>Recall accuracy (trials/10 correct)</em> |
| Secondary measures | Secondary measures are for things that you might look at but are not central to your experiment. RT will be taken in addition to accuracy to investigate any possible impact of a speed-accuracy trade off |
| Participants | Give the concrete population that you will be sampling from. <em>Participants aged 18-39, primarily students at St Andrews.[Almost certainly psychology students]</em> |
| Sampling method | Give the sampling method, including how participants will be recruited. <em>Self-selected sample from population accessing SONA and friends/associates of the researcher.</em> |
| Procedure | Give a brief outline of the core aspects of the procedure. <em>Two blocks. In each block, participants will try to remember a series of identities, 5 of each expression. This will be followed by a distracter task for ~5-10 minutes (2 min practice, 5 min experiment). Recall will be old/new tested using equal number of original and novel ID faces. All test faces to be neutral.</em> |
| Analysis method | Give the analysis method(s) and the basic details. <em>1-way repeated measures ANOVA, with 4 levels (happy, angry, neutral, surprised)</em> |</p>
<table>
<thead>
<tr>
<th>Analysis details</th>
<th>The details of each method given above and any more details. 4 levels of the “Expression”. Each participant’s accuracy (X/10) arcsin transformed. Planned contrast: (Happy+Angry)/2 – surprised = 0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subsidiary analyses</td>
<td>This is where you put any analyses that you are thinking about that do not related directly to the hypotheses. RT analysis also using 1-way repeated measures ANOVA. Data examined for mean~variance relationship. Sqrt or log transform expected. Use the mean of the transformed data for each expression. Correlation to investigate speed accuracy trade off</td>
</tr>
<tr>
<td>Predicted pattern</td>
<td>Describe the pattern of results for each hypothesis. H0: mean accuracies will be ~same (plot using bar graphs: SEM bars). H1: Happy to have highest accuracy, neutral &amp; surprised middle, sad lowest. [Stats might only pick up on happy v sad]</td>
</tr>
<tr>
<td>Ethical considerations</td>
<td>Give the main issues. To reduce any potential impact of viewing faces displaying emotions, the participants will be told to focus on identity for future testing. Use of emotive stimuli (particularly sad expressions), so will include “go to student support or medical professional if feel affected by the experiment” in de-briefing form.</td>
</tr>
<tr>
<td>Practical considerations</td>
<td>Try to think of things that might delay or otherwise derail your experiment. Possible problem generating enough distinct faces. Will use KDEF face data base and approach others if needed</td>
</tr>
</tbody>
</table>

NB experiment as described is poor and should be improved.

**Feedback for continuous assessment**

Each stage of the continuous assessment will receive feedback. This will take several forms

1) Generic feedback. This will be provided both in lectures and during the afternoon practical sessions. It will typically include comments such as “Several have asked about…”, or “Please, remember that you were told…”. This style of feedback is especially useful in teaching about common mistakes and misunderstandings.

2) Individual feedback. This is a specific aim of the afternoon sessions, providing verbal feedback on ideas and thoughts that you have about your experiments, planned analyses etc. We are always willing to arrange meetings with a student (or small group of students) to go over specific aspects of the work.

3) Written feedback. Comments written on submitted pieces of work and in accompanying emails will provide detailed feedback concerning specific aspects of the module. For assessed components, written feedback is trying to serve two purposes. One part is to help you identify the reasons behind the awarded grade and hence to help you to see the relationship between your work and the marking criteria. Other comments are to improve your writing and methodological skills. It is easy to focus on the specific comments and to brush over the more general comments. Do pay particular notice of any comments included at the start or end of your submitted work as these will give an overview and try to summarise the most important ways in which you can improve your skills.
**PS3021 Examination format**

40% of the module grade comes from the examination. You will have to answer 10 out of 15 short answer questions, designed to check your breadth of knowledge across the module. For example:

- What measures of dispersion are there and what scales are they associated with?
- What is the relationship between 1-way and 2-way ANOVA?
- What types of sampling method are there and which is regarded as the most statistically valid?

Short answer questions are meant to have short answers

Think about your answer before starting writing.

You should be able to write a thorough answer in no more than 5 minutes.
3-5 sentences will typically be enough. If you’re writing more it is probably too long

You can use bullet points rather than sentences.

While the examination is scheduled for 2 hours, it is possible to complete and get maximum marks (grade 20) within 1 hour. The exam is meant to assess what you know rather than what you can recall under time pressure. Do not feel that you must write for the 2 hours.
Appendix 1: Academic misconduct

“Academic integrity is fundamental to the values promoted by the University. It is important that all students are judged on their ability, and that no student is allowed unfairly to take an advantage over others, to affect the security and integrity of the assessment process, or to diminish the reliability and quality of a St Andrews degree.

Academic misconduct includes *inter alia* the presentation of material as one’s own when it is not one’s own; the presentation of material whose provenance is academically inappropriate; and academically inappropriate behaviour in an examination or class test. Any work that is submitted for feedback and evaluation (whether formative or summative, at any point in the programme of study) is liable to consideration under this Good academic practice policy. All work submitted by students is expected to represent good academic practice.” (Accessed 15/08/2014: see [here](#) for current policies).

How do I present referenced material in my assignment?
The following is clearly stated and hence copied directly from [Swansea University](#)

“There are two ways to refer to the works of other authors:
- **Paraphrasing** allows you to summarise another author’s ideas in your own words, whilst still acknowledging the original source. Quotation marks are not needed. A concise well-paraphrased account demonstrates your understanding of what you have read.
- When paraphrasing or referring to an idea contained in another work, you are encouraged to provide a page or paragraph number, especially when it would help an interested reader locate the relevant passage in a long or complex text. If you refer to a table or diagram, you must include a page number as the reader may wish to check it.
- **Direct quotes** can be used. However, an assignment cannot be a ‘cut and paste’ exercise.

Quotations should be used sparingly, as the person reading the assignment wants to see your views and analysis of what you have read. When you use a direct quote always give the page number(s) or paragraph number for non-paginated material and place double quotation marks around the quotation. ….

**Example of Paraphrasing**

**Text from the original article:** Little is known about whether and how early childhood living arrangements affect adult children's propensity to take aging parents into their homes. Past research on caregiving has focused on the characteristics of current family structure such as sibling composition, the marital status of parent or child, or competing roles. (Szinovacz, 1997)

**Bad paraphrasing:** Not much is known about how living arrangements in childhood affect adult children's willingness to take elderly parents into their homes. Past research on looking after elderly parents has focused on the characteristics of current family structure such as brothers and sisters, the marital status of parent or child, or competing roles. (Szinovacz, 1997) = only a few words have been changed, not reflecting any understanding or interpretation of the original.

**Good paraphrasing:** Research has tended to focus on the effect of current family structure on adult children's willingness to look after their elderly parents – in consequence, little is known about the effects of childhood living arrangements (Szinovacz, 1997). = the content has been rephrased” (from [Swansea University's guide](#)).

There is no such thing as accidental misconduct

When you read a web page, paper, text book or any other source MAKE SURE that you distinguish between any exact quotes, and notes written in your own words. It is ESSENTIAL that you avoid plagiarism when you write your reports (see above). One way that plagiarism might happen “by accident” is by forgetting which statements in your notebook are actually quotes, which are lazy (bad) paraphrasing and which are your own summaries of a research article. “I didn’t realize” or “but I didn’t mean to” is not an excuse
Appendix 2: Filling in ethics forms

All research has the potential to be exploitative and damaging, even when intended to benefit the greater public good. Even research that does not appear to have implications for human subjects may raise other ethical issues to do with intellectual property, sponsorship, roles in research, and so on. Every School has an Ethics Committee which oversees all ethical applications for that School and functions as a sub-committee to the University Teaching and Research Ethics Committee (UTREC). Generally ethical approval will be granted, on behalf of UTREC, by the School Ethics Committees (henceforth referred to as SECs); however, in some instances the School will pass applications to UTREC for approval.

You are taken through the ethical procedures in the lecture course, during which each question in the form is addressed. Approval is only given once all the questions are completed appropriately. To facilitate obtaining ethics approval for your study, you can opt to hand in a completed set of forms to obtain feedback. Use the feedback from this to help formulate your final, assessed ethics forms. There are three rules that will help you correctly fill out the forms:

1) Read the form.
2) Read the form!
3) Read the form!!!

For some reason, many groups find the process of obtaining ethical approval take several iterations. People consistently fail to answer basic questions correctly. Do not regard this process as mundane or trivial: data collection can only begin once approval has been obtained.

Dates
There are dates in several places: front page, page 2 (Research Information), page 7 (Declaration). For goodness sake, check ALL the dates EVERY TIME you submit the form. The number of times that a submission suggests the study is due to start (page 2) before the form has been submitted (front page) is staggering.

Rationale
This is a key piece of information, hence on the front page. The idea is to talk to a non-expert. So the rationale needs to be put in plain language. It is not “This study is being conducted to investigate which cue is dominant when interpreting a projectile’s vector”. Try “This study aims to determine how we catch a ball”. So keep technical jargon – pretty much any ‘theory’ or ‘process’ – to an absolute minimum. Imagine you have 4 sentences and no more to explain to a grandparent: the critical thing is that they won’t say “That’s nice dear”. You must also include who the participants are and where the experiment will take place.

Ethical considerations
For many experimental laboratory studies, these can seem rather minor (not having to answer all questions in case the participant finds them personal, making clear they can withdraw at any time in gets bored or tired, using minimum time to get sufficient data to minimise boredom & fatigue). When dealing with negative valence stimuli, be sure to say why you have to use negative rather than positive valence.

Some research may pose risks to participants in a way that is legitimate in the context of that research and its outcomes. Research involving the topics below are likely to have some significant ethical issues and will therefore extend the time to gain ethical approval beyond the expected 2 to 3 week approval time. Research involving the following is not permitted in PS3021 [it is not that it is necessarily unethical, its just that it involves significant ethical issues that can’t be dealt with within the constraints of PS3021].

- Research involving vulnerable groups (such as children aged 16 and under; those lacking capacity; or individuals in a dependent or unequal relationship)
- Research involving sensitive topics (such as sexual behaviour; their legal or political behaviour;
their experience of violence; their gender or ethnic status)
- Research involving a significant element of deception
- Research involving access to records of personal or confidential information (including genetic or other biological information);
- Research involving access to potentially sensitive data through third parties (such as employee data or information on relatives);
- Research that could induce psychological stress, anxiety or humiliation or cause more than minimal pain (e.g. repetitive or prolonged testing);
- Research involving invasive interventions that would not usually be encountered during everyday life (e.g. administration of drugs or other substances, vigorous physical exercise or techniques such as hypnotherapy);
- Research that may have an adverse impact on employment or social standing (e.g. discussion of an employer, discussion of commercially sensitive information);
- Research that may lead to ‘labelling’ either by the researcher (e.g. categorisation) or by the participant (e.g. ‘I am stupid’, ‘I am not normal’);
- Research that involves the collection of human tissue, blood or other biological samples.
- Research involving sensitive data (data, as defined by the data protection act, that are personal information about an identifiable individual. The presumption is that, because information about these matters could be used in a discriminatory way, and is likely to be of a private nature, it needs to be treated with greater care than other personal data. This includes asking information on political opinion, race or ethnic origin, religious beliefs, trade union membership, Physical or mental health status, sexual life, details of offending or court appearance.

**Participants**
For PS3021, participants are restricted to being ‘students enrolled in PS3021’. In general, give details of age range. Don’t forget to give the recruitment method (e.g. voluntary sample via word of mouth)

**Duration**
Give a sensible duration. Allow for 5 minutes to read the information sheet, consent form etc. Then give a realistic estimate, remembering that collecting sufficient data for the study to be viable – technically to have enough power – is an ethical requirement.
- For a 2X3 design when collecting RT, each trial would last ~5 seconds. So 30 seconds to get a single trial in each condition. A reliable estimate would require 20 trials per condition, so 10 minutes. A practice session would be another 5 minutes so giving a duration of 15-30 minutes should cover it.
- For a 3X3 memory task, you would want 10 trials per condition. Present each to-be-remembered stimulus for 2 seconds with a 1 second interval. If you run the study as blocks where you present 18 stimuli to remember (18*3 seconds ~ 1 minute). Then have a distracter task (2 minutes) followed by an old/new recall with 9 new (not seen before) 9 old (one of the to-be-remembered stimuli). Each trial would last 3 seconds. This is about another 1 minute. So every 4 minutes you get one trial in of each of the 9 conditions. 10 repeats (enough to get a good estimate of each participants’ recall accuracy) is ~40 minutes. So giving a duration of ~45 minutes should cover it.

**Ethical statement**
This statement should describe the proposed research in enough detail that the reader understands what you are going to do. If necessary, refer to appendices that contain further specific information about the experiment. This statement should demonstrate that you have an understanding of research ethics and that your study will be conducted ethically. The following is not sufficient for an ethical statement:

*There are no serious ethical concerns in this study.*
Your statement should demonstrate that you understand the ethical issues that arise in experimentation and that you have designed the study to respect these issues. If there are no serious concerns you should state why. At a minimum you should address the following broad categories of ethical issues:

1) Informed Consent
2) Assessment of Risks and Benefits
3) Selection of Participants

Example:
This study investigates how participants interpret motion information. During this experiment participants will view a computer monitor that displays dots moving either left or right and the participants will be asked to press a button indicating the direction of motion (for further specifics see Appendix A).

1) Informed Consent:
   a. Participants will be provided an information sheet detailing all relevant information (example attached). The researcher will give this form in person to the participants and will ensure that each participant fully understands what participation in the experiment entails.
   b. Participants will be given a consent form in which asks for the participants express permission for taking part in the study and utilizing their information and data.

2) Risks and Benefits
   a. This study will have participants interact with a computer in a manner that is consistent with how participants utilize computers in their day-to-day lives, as such it is not anticipated that there will be any increased risk of harm to the participants from the utilization of the experimental apparatus.
   b. Data collected from participants will be anonymous; it will not be possible to connect the identity of a participant to their data. Therefore there is no danger of inadvertent disclosure of potentially harmful information.

3) Selection of participants
   a. Participants will be aged 18 and up and recruited from the population around St Andrews.
   b. Participants will be recruited through a written ad posted at various places around the University of St Andrews (example advertisement is attached).

Document checklist
This is to help you remember everything that is needed for submission. This section is mostly self-explanatory.

Declaration
Don’t forget to list all your names and put the date. This date should be the same as the one on the front page.
Appendix 3: Advice for posters

Your (adapted) design worksheet should have the most important points already laid out, so a simple “cut & paste” followed by some editing should give you a good starting point for a summary of your experiment (recommend no more than 300 words, 500 words as a maximum). See Appendix 4 for detailed criteria.

First impressions:
Posters should be both eye catching and easy to read: first impressions really do count. The purpose of a poster is to get the study across to the reader quickly. The main focus is therefore to let the reader know the result quickly. How good does the poster look? Does the title say it all? Can you see who did the poster and their affiliation? Are the figures large & eye-catching? Is the poster too crowded? Does the amount of text look about right?

Introduction.
How clear is the introduction? Do you have to read the rest of the poster to get an idea what it is about? Are the hypotheses obvious and the only ones that make sense given the context?

Methods.
Do you know what was done? Could you do the same study if you wanted? Can you describe the conditions and stimuli? How clearly was the design laid out? Did you know how the data was to be analysed from reading the methods?

Results.
How clearly is the pattern of results presented? Is there clear interpretation of significant results? Are the appropriate statistics reported? Does the balance between describing the data and statistics favour the description? How clear and easy to read are the figures? Are any tables well laid out and self-explanatory?

Discussion.
Are the results placed in the context of the introduction? How considered are alternate explanations and other limitations of their results: have they applied the Duhem-Quine thesis appropriately? Are implications for the bigger issues missed out, mentioned or over played? Do any ideas for further studies focus on aspects that are relevant to the present study? How well does the discussion stay on topic and directly relate to the reported study?

The good, the bad and the ugly.
It helps to think of a single sentence that highlights the best aspect of what you think of as the best part of the poster (the bit where someone in the group went “That’s a good idea. I’ll remember that”). Think of a second sentence on the aspect of the poster that needs improving: What change would make the poster better? The final sentence should be what the authors should avoid. What detracts from the poster being successful? Then act on your sentences.
Appendix 4: JH poster marking sheet

<table>
<thead>
<tr>
<th></th>
<th>3rd Level (minimum standard)</th>
<th>2.11 Level (will have most of these)</th>
<th>2.1 Level (should include several)</th>
<th>1st Class (only need a few if all others 2.1)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Title &amp; affiliation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Title</td>
<td>Given, and can work out IV/DV</td>
<td>Given with IV &amp; DV</td>
<td>Result given</td>
<td>Result and implication given</td>
</tr>
<tr>
<td>Affiliation</td>
<td>Partial</td>
<td>Complete</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Introduction</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Context</td>
<td>Placed in context</td>
<td>Contextual detail noted</td>
<td>Gap in knowledge noted</td>
<td>Relevance to gap in knowledge noted</td>
</tr>
<tr>
<td>Theory</td>
<td>No theoretical framework</td>
<td>Framework referred to</td>
<td>Framework outlined</td>
<td>Relevant details given</td>
</tr>
<tr>
<td>Hypotheses</td>
<td>Not given</td>
<td>Given</td>
<td>Clearly stated</td>
<td>Related to theoretical context</td>
</tr>
<tr>
<td><strong>Methods</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Design</td>
<td>Incomplete and without justification</td>
<td>Given, but not justified</td>
<td>IV’s given, but control variables missing</td>
<td>IV’s etc justified and complete</td>
</tr>
<tr>
<td>Participant information</td>
<td>Rudimentary</td>
<td>Sample method can be derived/inferred</td>
<td>Sample method given</td>
<td>Clear description</td>
</tr>
<tr>
<td>Procedure</td>
<td>Without detail</td>
<td>Not enough to really work out</td>
<td>Replicable</td>
<td>Easily replicable</td>
</tr>
<tr>
<td>Analysis</td>
<td>Not always the most appropriate</td>
<td>Appropriate analysis</td>
<td>Appropriate &amp; detailed</td>
<td>Appropriate, detailed &amp; justified</td>
</tr>
<tr>
<td><strong>Results</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Figures &amp; tables</td>
<td>Poor figures, lacking legends or poorly described</td>
<td>Good figure/legends, appropriately described</td>
<td>Careful selection of good figures/tables</td>
<td></td>
</tr>
<tr>
<td>Descriptive statistics</td>
<td>Minimal</td>
<td>Describing using “bigger than” etc</td>
<td>Describing with means, sems etc</td>
<td>Careful selection of which descriptive values given</td>
</tr>
<tr>
<td>Reporting of stats</td>
<td>Basics given in appropriate style</td>
<td>Consistent and complete</td>
<td>Appropriate use of “extras” such as post-hoc etc</td>
<td>Publication standard</td>
</tr>
<tr>
<td>Overall organisation</td>
<td>OK, but list like</td>
<td>Sensible flow</td>
<td>Logical with linking made clear</td>
<td>Leads reader along</td>
</tr>
<tr>
<td><strong>Discussion</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Summary of results</td>
<td>Given but list like</td>
<td>Given in context of study, not theory</td>
<td>Related to theoretical questions</td>
<td></td>
</tr>
<tr>
<td>Interpretation</td>
<td>Some, but disjoint of theory</td>
<td>Related to theoretical issues</td>
<td>Clear and detailed but not particularly insightful</td>
<td>Comprehensive and insightful</td>
</tr>
<tr>
<td>Comparison with literature</td>
<td>Little or listing</td>
<td>Placed in context</td>
<td>Comprehensive comparison</td>
<td>Careful selection of in depth comparison</td>
</tr>
<tr>
<td>Evaluation of limitations</td>
<td>Minimal, but at least something</td>
<td>OK, but restricted to obvious issues</td>
<td>Considered and useful points</td>
<td></td>
</tr>
<tr>
<td>Further work</td>
<td>Minimal or trivial</td>
<td>Good, but not insightful</td>
<td>Solid ideas that might be revealing</td>
<td>Insightful and novel with good chance of success</td>
</tr>
<tr>
<td>Overall organisation</td>
<td>OK, but list like</td>
<td>Sensible flow</td>
<td>Logical with linking made clear</td>
<td>Leads reader along</td>
</tr>
</tbody>
</table>
Appendix 5: Report writing

General advice for writing
Make sure that every sentence you write makes sense! This means that before you start to write the sentence, you have to be exactly clear in your own mind what it is that you are trying to say. This may sound obvious, but a vague and ill-defined thought, that ends up as a vague and nonsensical sentence.

Similarly, before you write the paragraph you have to be clear in your own mind what the paragraph is trying to say. If you have more than one message or idea in a paragraph, it will end up being confused and therefore you report will start to feel disjoint.

Plan the structure of your writing. What is each paragraph saying? What is the point of each sentence within that paragraph? In other words, organise your paragraphs and sentences by message, not by articles or references. This will help avoid creating list-like writing of previous literature (study a showed..., study b showed..., study c showed...).

The golden rule is ALWAYS to write concisely with clarity and precision. Proofread your work carefully before submitting it, to eliminate typographical errors. Use the spell checker in Word and check each word that has a wiggly red underline. Use the grammar-checker in word and check each sentence that has a green underline. While not perfect, the checkers in MS-Word are a great help for proof reading.

In summary

- Be as concise, precise and clear as possible.
- Write in a formal (but not pompous) style, and avoid colloquialisms.
- Write in the style of an essay, using proper sentences and paragraphs. Make the sense of the text flows, so that ideas rather than references follow each other in a logical sequence.
- All abbreviations should be defined in full when first used.
- Presentation matters. Your mark depends in part on the overall quality of the written presentation, including spelling, grammar, flow, and the quality of figures & tables.
- If in doubt about a style issue, study a suitable published paper to see how it has been tackled by a professional publisher. Check with your supervisor about which journals to use as models.

Use of figures & tables (and their legends)
Figures and tables provide the evidence that backs up statements made in the main text, but they do NOT substitute for the text itself. In other words, the main text should make logical sense to the reader without having to actually look at any of the figures or legends.

A core aspect of figures is that they display the intended results clearly and without clutter. That is, remove many of the default elements the software packages add. Make the font size as large as you dare. Always put the correct error bars on means (MS-Excel really has no idea whatsoever about error bars: always use hand-calculated values, never the in-built options). Axes should be visible but not overly crowded (may 5 or 6 markers on the y-axis, no more). Choose your scale carefully (should you include 0? If not, indicate this clearly in the legend).

All figures and tables must be numbered. Maintain separate lists for each (i.e. the first figure is Fig. 1, and the first table is Table 1). Maintain one number sequence throughout the piece: do not restart numbers in each chapter or section.

All figures and tables must be referred to by number in the text. You can use a text style that either refers to figures explicitly, such as “The experiments, illustrated in Figure 13, show that many birds like to eat pretzels.,” or implicitly, such as “Many birds like to eat pretzels (Fig. 13).” You should settle on one style and use it consistently, rather than swapping between styles (including
capitalising Figure, using Fig. or Figure...). Make sure that the numbering of figures and tables reflects their order of appearance in the text.

Where possible, figures and tables should be placed in-line in the text (rather than on a separate page) near to the place where they are first mentioned. This, however, is not as straightforward as you might think, hence the need for numbering figures and tables.

All figures and tables should have a legend associated with them. The legend is a short paragraph (maybe a single sentence) which allows the reader to understand what the figure/table shows without reference back to the main text. The legend should include the key to any symbols shown in the figure (unless they are defined as part of the figure itself). If you are not sure about what goes into a legend, look at range of textbooks or research papers for examples.

A set of figures which are closely related (e.g. a series of graphs showing the effects of different conditions) can be grouped into a single figure, with sub-section labels such as A, B, C etc. You can even have sub-sub-section labels (Ai, Aii, Bi etc) within the single figure.

Avoid repetition between graphs and tables. The reader needs each point to be made once. Repetition of information (e.g. a table and a figure) violates the golden rule: ALWAYS write concisely, precisely and clearly.

**What goes in which section in your research paper?**

This section aims to provide general advice and guidance on the organisation of the different components of a research paper or report. Ultimately the organisation and structure is always the responsibility of the author. While the advice outlined below is intended to aid the writing, you must bear in mind that there are many approaches and strategies that are valid. Given this proviso, the broad ideas expressed should facilitate you write a coherent and detailed report that readers (markers) would find acceptable. You should, however, discuss all details with your supervisor before writing your report.

**Title**

The title should provide a single line summary of what you actually did. Ideally, 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; “Keeping gerbils awake” would not. Try to avoid using catchy newspaper style headlines as titles; 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.

**Acknowledgements**

Please, inform in this section about who helped you with what. It is in principle the same as the declaration of authorship but without you signing it with your name to maintain anonymity. It will help the examiners in judging what you actually did by yourself. This includes a clear statement about whether you collected the data by yourself or whether they were given to you.

**Abstract (overview of ALL aspects of the study)**

Take particular care with your abstract; everyone will read it first, and first impressions matter! Keep it snappy and informative, giving a well-balanced and accurate summary of the main content of your thesis. It is important to give a clear description of the aims and the hypothesis. You should also include a brief statement of the methods, main results and conclusions.

**Introduction (why the aims of the study are interesting)**

The introduction should present the reasoning behind the particular experiment which you are describing. This means that the reader, once the entire introduction has been read, should feel able
to predict what your experiment will be. At the same time your introduction should allow someone who is not an expert to understand why you did this experiment. Normally, it is advisable to engage the reader’s attention as soon as possible by explaining the problem to be investigated and why it is of interest.

The purpose is to make clear the issues, the aims and hypothesis of the 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 experiment. This will entail a brief review of past work in the area and an explanation of the theoretical or practical reasons for doing the study. You could consider using the following general plan (but remember that being general, it will almost certainly need adaptation to suit your needs):

- Describe and define the area that you wish to study
  - Explain why it is interesting and/or important if this is not obvious
- Describe previous work by others that is relevant to the area.
  - This is likely to be the bulk of your introduction
- Explain why the previous work is not sufficient. In many instances, studies are carried out to address the Duhem-Quine problem/thesis (trying to eliminate alternative explanations). You position should be backed up by the literature. For example,
  - Previous studies used abstract stimuli: What about common/familiar stimuli?
    - Find references that processing varies for abstract vs common stimuli
  - Conditions where no effect was found in previous studies involved trivial differences
    - Find references that big differences have an effect
  - Previous studies where an effect was reported used unrealistically large differences between conditions
    - Find references that big but not unrealistic differences have no effect
  - Previous studies only done in children
    - Find references that adults behave differently in related processes
- Given the results in the literature and current theoretical models, what would you predict the outcome of your study to be and why? You should end this section with your experimental hypotheses. The hypotheses can either
  - Be explicitly expressed (e.g. The null hypothesis is that there will be no difference between conditions A and B while the alternative hypothesis is that there will be a difference between conditions A and B) OR
  - Be expressed as predictions (e.g. based on the outcomes of previous research we expect the mean of condition A to be greater than the mean of condition B).

**Methods (how you did the study)**
The concept of repeatability is at the very heart of the scientific method, and the purpose of the methods section is to give enough information about the technical aspects of what you did and how you did it to enable another scientist to repeat your experiment as precisely as possible. Remember, you are telling the reader about the methodology you used in your study, not about ongoing work (let alone a study you are planning for the future) so use the past tense. And stick to the golden rule: ALWAYS to write concisely with clarity and precision.

**Clear methods sections and sub-headings**
The APA format for the methods section is in reality very loosely defined: the variation in methods used within psychology makes a formulaic or constrained section unfeasible. The only real constraint is the (lack of) sub-headings. You do not need to have sub-headings, but if you choose to do so, select from the following:

Participants, Apparatus, Materials (or Apparatus & Materials), Design, Data analysis (or Design & Analysis), Procedure
The use and selection of sub-headings in the methods section is probably the most difficult part of writing reports to master. While you should conceptually include the above sub-headings, it does not always make sense to separate them out. For example, the describing the procedure, which includes the allocation of participants to the different conditions might require describing (the between subjects) part of the design in the procedure. As a guide, you would normally expect to see the sub-headings of participants, materials, procedure and data analysis (or design & analysis). Remember, this is not definitive let alone compulsory: write the methods as concisely and precisely as you can, then look to add sub-headings to help the reader.

Having argued that you don’t need sub-headings, the following is organised by the sub-headings. To reiterate, you do not have to include the sub-headings, but you should include the relevant material somewhere in your methods section.

**Participants**
As a minimum you should detail the number of participants, the concrete population and the sampling method (e.g. ‘28 self-selected undergraduate students at the University of St. Andrews completed the online questionnaire’ or ‘20 opportunity sampled undergraduate psychology students taking PS3021 completed the study’).

The extent to which you can generalise from your study will depend on many other characteristics. For example, the two examples above used undergraduate participants: this means that generalising to the elderly or less educated may be problematic. You should treat this as a potential advantage: if there is evidence that, for example, the elderly may behave differently in similar tasks, you already have a valid discussion point.

To help readers know how far they can generalise from your study, it is not uncommon to give other important characteristics (demographics) of the participants. However, this information should only be gathered if there is a valid scientific reason related to your study. For example, if your hypothesis concerns decision making processes (how do we combine cues to reach a perceptual decision), then there is no reason to gather demographic information beyond that implicit in “undergraduate students reading psychology” (age ~18-24; well educated; mostly women).

**Apparatus**
Use the apparatus section to indicate precisely what equipment central to the study was used (make and model). This will often include a data collection programme (e.g. Cog Demos, v0.34, in house software; e-Prime v2.0, Psychology Software Tools Inc., USA; www.qualtrics.com, Qualtrics, Utah, USA).

Most difficulties arise when deciding what apparatus requires details and what does not. For example, when running a psychophysical study the make and model of the display unit is required. This is because the precise control over the appearance of the stimuli is central to the study. For many studies, for example when words to be remembered are being displayed, this simply does not matter (‘displayed on a windows PC with a 24” LCD screen’ is sufficient). However, in both cases details of the stimuli themselves are needed (‘Gabor patches subtending 0.5 degrees with a frequency of 10 cycles per degree and of 78% Michelson contrast’; ‘presented in black Arial 24 point font’: see Materials section for more information).

**Materials**
Stimuli, words, puzzles, questionnaires etc., are materials, and this section should describe what these are and how you devised them. Unlike most other sub-headings, the Materials heading can be replaced with Stimuli or Questionnaires if the entire section is about the generation / source of your stimuli/questionnaires. If there are more materials than just stimuli/questionnaires, describe the “other bits” first under Materials, then use the sub-sub headings Stimuli and/or Questionnaires.

If you didn’t devise your materials, you need to give credit to the person who did and refer to a source that the reader can turn to if they want to know more about how they were developed.
Stimuli
If you are using an already published stimulus set, reference the relevant paper and give the key information (‘The concrete and abstract word lists, matched for frequency, were those used by Smith and Jones (1986)’). It is often a good idea to use an existent stimulus set as you can compare your results (more) directly with the previous literature.

If you need to make your own stimuli, give details of the criteria you used to select the particular items for the study. For example, if using words as your to-be-remembered stimuli in a memory experiment you should tell the reader about features of their selection (it is always a good idea to control word length, word frequency\(^1\) and meaning (noun, verb, concrete, abstract etc.)). If you are creating your own visual stimuli, give the details (e.g. ‘Gabor patches subtending 0.5 degrees with a frequency of 10 cycles per degree and of 78% Michelson contrast’; ‘presented in black Arial 24 point font’; ‘neutral expression faces taken from the Karolinska Directed Emotional Faces (KDEF) database\(^2\)’).

Questionnaires
It is (nearly) always better to use an established questionnaire than to try and make your own. How well a questionnaire performs and how well it measure what you want (the psychometric properties) depend critically on the wording of each item (question), the order of items, the response format to name but a few issues. Established questionnaires (should) have been through extensive testing and evaluation to determine how well each of these psychometric properties is met. This is a long process involving many large scale studies (100’s of respondents) which are used to whittle down the number of items and fine tune the wording etc.

If you have to devise your own questionnaire include a brief argument about why possibly related but established questionnaires are not suitable in this section (talk with your supervisor about it). Remember that using an isolated ‘part’ of an existent questionnaire (e.g. taking those items that measure a particular facet of personality) is not the same as using an established questionnaire. You will also need to acknowledge that the properties of the new or adapted questionnaire are unknown in your discussion, emphasising that your conclusions are tentative. Finally, you will need to include, as an appendix, all the items of your new questionnaire, including clear indication of the response format etc. (do NOT include it in the methods section).

Remember that many questionnaires require payment to use (e.g. Beck’s Depression Inventory), at least require permission from the authors to use (e.g. Cognitive Emotion Regulation Questionnaire). You must ensure that you meet any restrictions before planning to use such a questionnaire.

Other materials
The materials paragraph(s) should also detail any specific chemicals or compounds if applicable. Describe & name them accurately, and, where appropriate, identify the source/supplier. Any non-human organisms that you used will be named in full in the materials section. Use the proper scientific terminology, source and authority.

Details of Schools, hospitals etc. should also be given (assuming it is appropriate and permission has been given). If you are doing fieldwork, give the specific sites etc., stating map references wherever possible.

In the case of a secondary data analysis project or computational study, the materials section contains full information about the source of the data used.

\(^1\) Blair & Urland (Behavior Research Methods, Instruments and Computer 34(2): 286–290) show that using an internet search engine and noting the number of exact hits for each word is as good as any and allows the frequencies of any word (e.g. place names) to be found.

\(^2\) Remember to include the relevant reference for any database: for the KDEF faces it is Lundqvist, D., Flykt, A., & Öhman, A. (1998). The Karolinska Directed Emotional Faces - KDEF, CD ROM from Department of Clinical Neuroscience, Psychology section, Karolinska Institutet.
Design
You should make clear the type of study you are reporting. While this does not have to be in its own sentence, it is important that the reader understands the basic type of study (i.e. experimental, correlational or observational). This sentence is useful for inclusion in the abstract as it gives the overview of your study (but remember to take out abbreviations etc.). [In the examples, it is assumed that the scales have been described in the materials section]

For experimental studies, state what were the independent variable(s) (i.e. the variable which you manipulated) and the dependent variable(s) (i.e. what was measured). Other variables that you may need to mention (if used) are classification or control variables (which are like independent variables, except that you cannot manipulate them, such as the sex or age of your participants). For example, ‘The impact of manipulating the number of time management sessions students received on academic burnout (MBI-SS) was investigated while controlling for individual differences in the five factors of personality (OCEAN), depression and anxiety (DASS).’

For correlational or regression based studies, state the variables that you measured. If you plan to build a model, make clear which are predictor variables and which are the dependent, to-be-predicted variables. For example, ‘Anxiety & depression (DASS) and the five factors of personality (OCEAN) were used as predictors of academic burnout (MBI-SS).’

For observational studies, state what it is that you are observing and how they are going to be related.

The design paragraphs should make clear any within- and between-subject factors. For example, ‘The study used a mixed 4X3X2 design. The within-subjects factor was set size which had 4 levels (1,2,5 and 9). There were two between-subjects factors, number of practice sessions and level of neuroticism. Subjects received either no, 1 or 3 practice sessions. Participants were categorised as showing either high or low levels of neuroticism.’ As always, you can condense things down (e.g. ‘The mixed 4X3X2 design consisted of one within-subjects factor (set size: 1,2,5 and 9) and two between-subjects factors (number of practice sessions: 0,1 or 3; neuroticism: high or low’). You should probably aim for a compromise between these extremes.

You should include the method by which participants were assigned to different experimental conditions in the design section. Continuing the above example, it might be something like ‘The number of practice sessions each participant was determined randomly by asking each participant to roll a dice [a roll of a 1 or 2 = no practice sessions, 3 or 4 = 1 practice session, 5 or 6 = 3 practice sessions]. A median split on the score from the neuroticism scale of the personality questionnaire was used to determine whether a participant was allocated to the high or low neuroticism condition.’ Note that the mechanism for the assignment is given, not simply ‘randomly assigned’.

If you design includes covariates (e.g. age), remember to spell these out. In general, it is better to keep covariates as continuous variables wherever possible. The example above should really use the neuroticism score as a covariate rather than dichotomising the variable into high/low scores.

Data analysis
Your methods section should also include details of any statistical analysis method that you apply. This is particularly important for theses based on data analysis, in which the analysis methodology is likely to comprise an important component of the overall project design.

Remember to consider the scale type that you are using and how this influences the type of analysis that you perform. You should justify your choice of analysis method, particularly if you are using parametric analyses on ordinal data types or data that is clearly non-normal. Some useful things to note in this regard are that a score derived by combining several ordinal items (i.e. using the arithmetic average of several items in a questionnaire answered on a Likert-like response scale) produces a scale that can be considered interval providing there are not too many individual scores
at the boundaries (the ends of the scale)\(^3\). The F ratio (ANOVA – and by extension t-tests – and MLR) is robust against non-normality (it assumes all error term distributions are the same, not that they are normally distributed). For data which is highly non-normally distributed, applying parametric analyses to the ranked data is often legitimate\(^4\) (for example, it’s what the non-parametric equivalent of 1-way ANOVA – the Krukskal-Wallis test – does). Talk with your supervisor about the most appropriate test and how to justify the choice if it is not obvious.

It is often a good idea to put the tests of the assumptions underlying your analyses in this section. For example, the assumption of homoscedasticity in between-subject factors in ANOVA can be assessed using Levene’s test. Stating ‘Levene’s test indicated homoscedasticity in the data for the between subject factors (all p>0.05)’. Similarly, data transformations to reduce heteroskedasticity (e.g. square-root or log transformation of reaction time data) can be reported in the analysis section. While these are technically a result, repeated tests of the assumptions in the results section will often get in the way of presenting the main results in a clear and concise manner. Talk to your supervisor about which tests of the assumptions to use and if it is appropriate to have them in the analysis section.

NOTE: if you design your own analytical methodology and verify it with tests on known data, then you should describe these tests in the opening part of your results section.

**Procedure**

The procedure covers the techniques and protocols that you adopted. In many cases you will be using a standard (variant of a) paradigm. Where the experimental procedure was standard but an essential part of the work you may describe it in brief (do not give a numbered list of steps like a cookery book) as well as giving the reference.

If you are using a variant of a standard paradigm of your own devising, alert the reader to “A novel variant of XXX was used.” Then give the standard variant, highlighting your modifications. Where the procedure was of your own devising, describe the method in detail including all measures and how they were administered.

You may find that describing your procedure seems to replicate other aspects of your methods section. For example, in one of the fictitious studies above, participants had to roll a die to determine which condition they would be assigned to. You should either back-reference the reader to the purpose ‘Each participant first rolled a 6 sided die, the result used to randomly assign the participant to a particular experimental condition (see above)’, or move the reason to the procedure. Do not repeat the information: it leads to confusion and checking (“I’m sure I read something like this earlier but was it exactly this?”).

**Indicate ethical approval**

It is vital that you provide information that the study has received the relevant ethical approval. For human based studies, this will be the ethical approval code (e.g. PS14063). For animal studies, this will be – if appropriate – the home office project licence code (your supervisor will be able to provide this). The statement normally comes at the end of the methods section (‘This study received ethical approval from the School of Psychology and Neuroscience Ethics Committee (SEC), approval code PS14063’).

**Results (what the study found)**

The results section consists of a body of text, with figures and tables embedded in it. The text should be a cohesive piece of writing that describes the major features of your results, and which can be read on its own without the figures and tables.


The general format for presenting a result is (1) description, (2) [inferential] analysis, (3) the inference expressed in English.

If the description of a result includes a measure of central tendency (e.g., mean, median or mode), give the measure of variability (i.e., an indicator of the uncertainty of that value). Most parametric tests will allow inferences about the means: therefore the appropriate measure of variability is the standard error or the mean (sem).

Perhaps the most important (and most commonly missed) aspect of an inferential test is the associated effect size. This allows the reader to form a clear impression of how much impact the result might have independent of the number of participants and the statistical significance (p value). The metric will depend on the statistic (for t values, use Cohen’s d; for F ratio’s use partial eta squared (ηp²); for correlations and regressions, use the coefficient of determination (aka R²)).

You can state key numerical findings within the flow of the text, but do not include full numerical details of all findings; these should be placed in figures or tables. The figures and tables thus serve as evidence for, and illustrations of, the results described in the text. They enable the reader to verify that the statements of findings within the text are actually substantiated by the data. It is advisable to make figures or tables to illustrate and support your key comparisons. This is probably even more important if your hypothesised effect is non-significant (i.e. the group means were not statistically different from each other). [Remember that statistical significance is only one, often over-emphasised, way of evaluating results]

Avoid ‘floating’ figures or tables (a figure that is not mentioned in the main text). To this end, all figures and tables should be clearly numbered and have a legend with a title: e.g.

Figure 1. Mean reaction time in [condition A] and [condition B]. The mean reaction time of the 20 participants is plotted for each condition. Error bars = SEM.

You them must make sure that each is mentioned in text (the examples of reporting a t-test below refer the reader to Figure 1).

Do not be afraid to have short results sections. For a simple experiment the results describing the central hypothesis could be as simple as

The reaction time in [condition A] and [condition B] were (mean±sem) 748±25ms and 704±31ms (see Figure 1). This difference was statistically significant (t=4.6, df=18, p<0.01, Cohen’s d = 1.5). We therefore conclude that [condition A] slows processing compared to [condition B].

To help the reader understand the results, use suitable short-hand names for your conditions to replace [condition A] and [condition B]. If you have a number of points to make in your results (which will normally be the case), you can condense the above to:

Processing in [condition A] took longer on average than in [condition B] (RT mean±sem: 748±25ms vs 704±31ms respectively, see Figure 1; t_{18}=4.6, p<0.01, Cohen’s d = 1.5).

In general, aim for somewhere in between the long and short versions above. Whichever approach you take, remember to give the inference in English: this is the key part and must not be missed out.

You should not attempt detailed explanation or interpretation of the meaning of your findings with the results section; leave that for the discussion. However, it can sometimes be difficult to banish all explanations of data from the results section. The results may describe a series of analyses, and the purpose of a later analysis can often only be understood in the context of the explanation of the findings of previous analyses. So one has to use common sense in deciding what level of explanation needs to go into the results section, and what should be postponed until the discussion section.
Discussion (what the study tells you)
The discussion section is where you round off your paper, explain what your findings mean, and place them in the overall context of the field. You will usually include a summary of your main findings near the start of your discussion, but you should go well beyond this.

When writing your discussion you should think back to the aims that you stated in your introduction, and possibly explicitly (but briefly) re-state them, and then show to what extent your experiments have actually accomplished those aims.

You must consider any shortcomings in your data or methodology, and, if possible, argue that these do not detract from your main conclusions. If your data are open to several different interpretations, you should consider these in turn, and then suggest which you think is the most plausible (Occam’s razor can be a useful instrument, here).

You can discuss what further work could be performed to take the project to a more advanced stage or to decide between possible alternative interpretations of your data. If you take this route, make sure that the suggested projects are clearly justified, not simply a “you could do this” (a theoretical studies are always possible, but no one would bother doing them).

You can speculate on interpretations of your data that go beyond what you have actually demonstrated, so long as you make it clear that this is indeed speculation. However, be careful as each element of the speculation needs to be backed up with plausible argument based on the literature, not simply because you think “it could be like this”.

You may want to end of your discussion with a succinct and pithy statement of how, hopefully, your findings have advanced knowledge in the field of your research. Be careful as these statements can come back and haunt you (at the very least, be sure that the ‘advance’ is not already known or does not contradict other research).

N.B. In some subject areas it is permissible to combine the Results and Discussion sections, especially where the results of one experiment are used to plan the next. Consult your supervisor.

References, referencing and reference lists
When you give a piece of information, or describe an idea in your thesis, it will either be a result of your own work, or of someone else’s. In the latter case, you need to decide whether you should give a reference for it. Some ideas or information come into the category of “general knowledge”, and these do not need to be referenced. However, others are more specific, novel or detailed, and these should be referenced. If in doubt, reference! The point of referencing is to give credit where it is due (and thus avoid any accusation of plagiarism), and to allow the reader to follow up or verify the information that you give.

Direct quotations should always be referenced AND included in quotation marks or, for longer sections, indented, to give a clear indication of what text is included in the quote. It is NOT sufficient just to give a reference at the end of a section of text which is even close to direct word-for-word copy from that reference. Also note that simply changing a few words within the text of a quote does NOT remove the need for quotation marks around the rest. If you want to insert some words of your own within a quotation, the standard way is to put them in square brackets; if you want to remove a few words from a quotation, replace them with an ellipsis. Thus “If want to insert some words within a quotation [to clarify its meaning], the standard way is to put them in square brackets” (ref). For a direct quote, the page number of the publication it is taken from should also be given (eg, Smith (2014, p. 32)

References come in two parts; a citation in the text placed at the point where the information or idea is first presented and a citation in the Reference List at the end of the text where full bibliographic information is delivered.
Make sure there are no “orphans”: all citations in the text should also occur in the reference list, and vice versa.

You should use the APA referencing system. A brief description follows.

**Use APA format for citations within the text**

Use the American Psychological Association (APA) format. Within the text you only give the surname(s), date, and, if necessary, a letter qualifier for the date for each reference.

There are two styles; explicit and implicit - e.g. “As Smith (1999) proved, blue is better than red” (explicit), or “Blue is better than red (Smith, 1999)” (implicit). Either style is acceptable, but it is best to choose one and stick with it throughout your thesis.

If you quote two or more references for the same topic, put them in alphabetical order: e.g. “Blue is better than red (Bloggs, 1999; Smith, 1993)”, or “As shown by Bloggs (1999) and Smith (1993), blue is better than red”.

If an author published two separate articles in the same year and you need to reference them both, use a letter qualifier with the date- e.g. “Blue is better than red (Smith, 1993a) but yellow is better than green (Smith, 1993b)”. This letter qualifier is also used in the reference list at the end of the thesis. However, make sure that you don’t blindly copy the letter qualifier from a reference list given in a paper that you read, if you yourself only refer to one of the articles.

For a multi-author article, if there are two authors, give both names, e.g. “Smith and Jones (1999) showed...” or “Blue is better than red (Smith & Jones, 1999)”. If there are more than two but less than 6 authors, give all authors the first time (e.g. “Kentucky, MacDonald and Dominos (1999) found chicken is better than beef or pepperoni.” or “Chicken is better than beef or pepperoni (Kentucky, MacDonald & Dominos, 1999)”). After the first time, use et al., e.g. “Kentucky et al. (1999) showed...”. If there are more six or more authors, use “et al.” from the onset. Regardless of the number of authors always give the full list of all the names in the reference list.

If you are referencing work that you have not read personally, but have found referred to in a paper that you have read, use the format “(Smith 1988, cited in Jones 1990)”. Put both references in the reference list. Don’t do this more than you can help - it looks amateurish or lazy. What is more, the author of the paper that you have read may be misquoting the paper that you have not read - this is one way errors and misconceptions spread through the scientific literature. If the paper is a key paper, than you should definitely read it yourself, if necessary getting it translated from a foreign language (you should approach your supervisor if you think this is required).

**The reference list and APA format**

The reference list should also be in APA format. It occurs at the end of the thesis but before appendices. It should contain the full bibliographic information about the references. It must contain enough information for the readers to be able find and read the references for themselves. Regardless of the number of authors always give the full list of all the names in the reference list.

There are standard formats that are used in the reference list by the American Psychological Association. The precise format depends on whether you are citing a journal article, book, book chapter etc. The most common of these are shown below.

**Reference to a journal article:**

Last name, initial(s)., & Last name, initial(s). (Year). Article title. Journal title, Volume Number (issue or part number if needed), page numbers.

Note: journal names have standard abbreviations: e.g. the Journal of Experimental Psychology: Human Perception and Performance is *J. Exp. Psychol.-Hum. Percept. Perform.* Always use the full form of journal titles in the reference list.

**Reference to a book:**
Last name, initial(s)., & Last name, initial(s). (Year). *Title*. Place: Publisher.


**Reference to an article in a book:**
Last name, initial(s). (Year). Chapter title. In Initial. Last name (Eds.), *Book title* (pages of chapter). Place: Publisher.


**Reference to a website:**
Author. (Year). *Title*. Retrieved month day, year, from URL


There are a large number of more obscure reference formats, and many of these are shown on the [APA Style webpage](http://www.apastyle.org), but those above are the most common. If in doubt, look at the website, or ask your supervisor.
## Appendix 6: JH report marking sheet

<table>
<thead>
<tr>
<th>Mark in margin:</th>
<th>Tick/Fine 3rd Level (min standard)</th>
<th>Good 2.II Level (will have most of these)</th>
<th>V. Good 2.1 Level (should include several)</th>
<th>Excellent 1st Class (need a few if all others 2.1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title</td>
<td>Can work out IV/DV</td>
<td>IV and DV clear</td>
<td>Result included</td>
<td>Result and implication given</td>
</tr>
<tr>
<td>Abstract: Intro</td>
<td>Partial/unclear</td>
<td>Context identified</td>
<td>Main issue identified</td>
<td></td>
</tr>
<tr>
<td>Abstract: Expt Q</td>
<td>Missing/unclear</td>
<td>Design can be inferred</td>
<td>Design clear</td>
<td>Design clear &amp; placed in context</td>
</tr>
<tr>
<td>Abstract: Design</td>
<td>Mish-mash/unclear</td>
<td>Main result given</td>
<td>Design clear</td>
<td></td>
</tr>
<tr>
<td>Abstract: Discuss</td>
<td>A theoretical/beyond the data</td>
<td>Trivial but clear</td>
<td>Main point given</td>
<td>Stated along with implications</td>
</tr>
<tr>
<td>Intro: Context</td>
<td>Placed in context</td>
<td>Contextual detail noted</td>
<td>Gap in knowledge noted</td>
<td>Relevance to gap in knowledge given</td>
</tr>
<tr>
<td>Intro: Theory</td>
<td>No theoretical framework</td>
<td>Framework referred to</td>
<td>Framework outlined</td>
<td>Relevant details given</td>
</tr>
<tr>
<td>Intro: Hypotheses</td>
<td>Not given</td>
<td>Given</td>
<td>Clearly stated</td>
<td>Related to theoretical context</td>
</tr>
<tr>
<td>Methods: Design</td>
<td>Incomplete and without justification</td>
<td>Given, but not justified</td>
<td>IV’s given, but control variables missing</td>
<td>IV’s etc justified and complete</td>
</tr>
<tr>
<td>Methods: Participant info</td>
<td>Rudimentary</td>
<td>Sample method can be derived/inferred</td>
<td>Sample method given</td>
<td>Clear description</td>
</tr>
<tr>
<td>Methods: Procedure</td>
<td>Without detail</td>
<td>Not enough to really work out</td>
<td>Replicable</td>
<td>Easily replicable</td>
</tr>
<tr>
<td>Methods: Analysis</td>
<td>Not always the most appropriate</td>
<td>Appropriate analysis</td>
<td>Appropriate &amp; detailed</td>
<td>Appropriate, detailed &amp; justified</td>
</tr>
<tr>
<td>Results: Figures &amp; tables</td>
<td>Poor figures, lacking legends or poorly described</td>
<td>Good figure/legends, appropriately described</td>
<td>Careful selection of good figures/tables</td>
<td></td>
</tr>
<tr>
<td>Results: Descriptive stats</td>
<td>Minimal</td>
<td>Describing using “bigger than” etc</td>
<td>Describing with means, sems etc</td>
<td>Careful selection of which descriptive values given</td>
</tr>
<tr>
<td>Results: Reporting of stats</td>
<td>Basics given in appropriate style</td>
<td>Consistent and complete</td>
<td>Appropriate use of “extras” such as post-hoc etc</td>
<td>Publication standard</td>
</tr>
<tr>
<td>Results: Overall organisation</td>
<td>OK, but list like</td>
<td>Sensible flow</td>
<td>Logical with linking made clear</td>
<td>Leads reader along</td>
</tr>
<tr>
<td>Discussion: Summary of results</td>
<td>Given but list like</td>
<td>Given in context of study, not theory</td>
<td>Related to theoretical questions</td>
<td>Put in terms of the theoretical questions</td>
</tr>
<tr>
<td>Discussion: Interpretation</td>
<td>Some, but disjoint of theory</td>
<td>Related to theoretical issues</td>
<td>Clear and detailed but not particularly insightful</td>
<td>Comprehensive and insightful</td>
</tr>
<tr>
<td>Discussion: Comparison with previous work</td>
<td>Little or listing</td>
<td>Placed in context</td>
<td>Good comprehensive comparison</td>
<td>Careful selection of in depth comparison</td>
</tr>
<tr>
<td>Discussion: Evaluation of limitations</td>
<td>Minimal, but at least something</td>
<td>OK, but restricted to obvious issues</td>
<td>Considered and useful points</td>
<td>Comprehensive and insightful</td>
</tr>
<tr>
<td>Discussion: Further work</td>
<td>Minimal or trivial</td>
<td>Good, but not insightful</td>
<td>Solid ideas that might be revealing</td>
<td>Insightful and novel with good chance of success</td>
</tr>
<tr>
<td>Discussion: Overall organisation</td>
<td>OK, but list like</td>
<td>Sensible flow</td>
<td>Logical with linking made clear</td>
<td>Leads reader along</td>
</tr>
</tbody>
</table>