9 Carrying out the experiment and writing it up

Carrying out the experiment

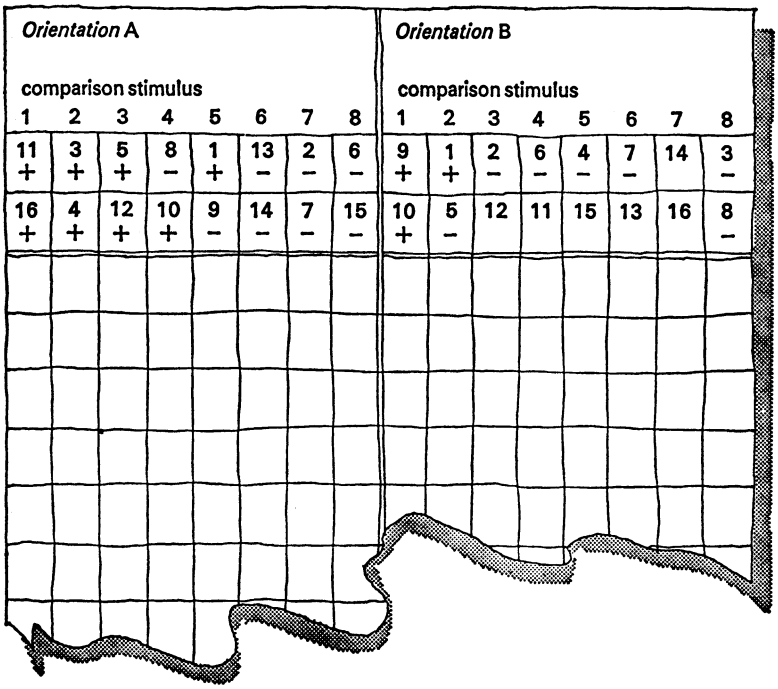
Once you have designed your experiment, the next stage involves actually getting to grips with your participants, as it were. The essential thing here is that you know exactly what you are going to do before you attempt to do it. There are a number of things that will help you to do this.

(1) Have verbatim (word-for-word) instructions for your participants.

(2) Have a prepared work sheet which shows you clearly what you have to do and the order in which you have to do it. It should also have spaces into which you can fit the results as you get them. Figure 26 shows an example of a work sheet.

(3) If you have apparatus, make sure it works and that you know what to do with it to perform appropriately.

(4) If this is a laboratory-type experiment, make sure that your participant is adequately screened from (a) your experimenter, together with your work sheet and any other information which should not be available to the participant, (b) other participants and experimenters and the world at large. Obviously, sound-proofed cubicles are a great help in many experimental situations, but common sense can remove a lot of the possible interference and distraction from your participants, e.g. using visual presentation of material and a visual metro-



Orientation A

comparison stimulus

1	2	3	4	5	6	7	8
11 +	3 +	5 +	8 −	1 +	13 −	2 −	6 −
16 +	4 +	12 +	10 +	9 −	14 −	7 −	15 −

Orientation B

comparison stimulus

1	2	3	4	5	6	7	8
9 +	1 +	2 −	6 −	4 −	7 −	14	3 −
10 +	5 −	12	11	15	13	16	8 −

Figure 26 An example of a worksheet.
Sixteen trials have been presented under orientation A, the randomized order of presentation being indicated by the numbers in the cell. These are followed by 16 trials under orientation B, 10 of which have been presented – comparison stimulus 4 would be presented next. There would be 64 trials under each condition, counterbalanced according to the sequence ABAB–BABA (in blocks of 16). The 'scores' are simply + or −, indicating a judgement of 'greater than' or 'less than'

nome (light flashing at intervals) for pacing of material or response, rather than using auditory presentation.

(5) **Most important of all, have adequate pilot trials before you start the experiment proper.** This ensures that the instructions are intelligible to the participants and that they can perform appropriately in the situation. It helps you avoid 'floor' or 'ceiling' effects (what are floor and ceiling effects? See p. 127) by

adjusting the difficulty of the material depending on how the pilot participants perform. You will find out as experimenter whether the task you have set yourself is feasible, e.g. whether you have enough time to make the appropriate manipulations and write down the results of one trial before the next is due, and so on. Quite often inexperienced experimenters will set themselves a task as experimenter which is way above the perceptual and/or cognitive capabilities of the human being. From the time taken by the pilot participants, you will be able to work out how long the experiment proper will take and to see whether you have seriously under-budgeted (likely) or over-budgeted (unlikely) on this.

After you have, if necessary, modified the procedures in the light of the pilot trials – and done further pilot work if the changes were extensive – then you are ready to go, and the best of luck!

Experimenter effects

Many studies have shown that, if experimenters have an expectation that the results will turn out in a particular way, then they may influence the results by their expectations. The participant-experimenter situation is a social situation and it may well be that the participant attempts to please the experimenter by performing according to your expectations, wishes or hopes. Cues such as tone of voice, brusqueness or friendliness, sharpness of movement, involuntary noises of pleasure or despair can all influence the results in the desired direction. The answer to all this is to standardize the procedure as much as possible and, if a situation appears to be one where experimenter effects could be serious, to use blind techniques, e.g. with the experimenter handing over the running of the experiment to some other person who does not know the experimenter's expectations or hypothesis. There are many fascinating experiments one could carry out on the experimenter effect itself.

Care and treatment of participants

Participants are precious things, as you will find out if you want to run an experiment with a large number of participants from a particular population (e.g. male left-handers aged from twenty to thirty years). You must treat them properly. Psychologists are increasingly sensitive to the ethics of experimentation and the British Psychological Society has a 'Code of Conduct' covering this, and other areas of the work of psychologists (BPS, 1993) which you should refer to. Similar codes have been developed by the American Psychological Association and other national bodies.

The essential principle is that the experiment, or other investigation, should be considerd from the standpoint of all participants. Foreseeable threats to their psychological well-being, health, values or dignity should be eliminated. Important aspects of this are:

Consent

Participants should give their *informed consent.* The involves telling them in as much detail as possible what it is they will be asked to do and how long it will take. Remember also that many participants will be rather apprehensive and nervous in the experimental situation and that it is in your interest to get them calm and happy before you start.

Deception

Withholding information or misleading participants is unacceptable if they are likely to object or show unease when told about the real nature of the experiment. If it is essential for the purposes of the experiment that participants should be misled as to what it is all about, this should only be done under the supervision of an experienced experimental psychologist, and with the approval of an 'ethics committee' or other appropriate group.

Debriefing

Participants must be put fully in the picture as soon as possible after the experiment. Discussing with them their experience of the

experiment can not only help you monitor any unforeseen negative effects or misconceptions, but often provides interesting insights which help in its interpretation.

It is also courteous to let your participants know what your findings were, after you have analysed the results. People are often fascinated by the results of experiments in which they were involved and it is in your own interest, if you want to do further experiments, to keep their interest well-stoked.

Withdrawal from the experiment

Participants should know from the outset that they have the right to withdraw *at any time.* This can make things difficult for you as an experimenter, but it certainly encourages you to ensure that it will be an experience from which they won't want to withdraw.

Confidentiality

Participants have a right to expect that any information they provide about themselves in the experimental situation will be treated confidentially and if published in any way (including your experimental reports) it will not be identifiable as theirs. If, for any reason, this is not the case then they should know this before consenting to take part.

Writing up the experiment

Having carried out the experiment, you have next to analyse the results using those statistical techniques which you have previously decided would answer the questions that you are interested in, and which are appropriate to the experimental design and the kind of data collected.

It might appear that, having analysed and interpreted the results, that is the end of it. But, no – if you performed a worthwhile experiment then others ought to know about it. Which brings us to the experimental report. Whether one is dealing with the first faltering experimental effort of the student, or the thousandth

publication of the Nobel prizewinner, the objects of the exercise are the same: to inform the reader about the findings and how they were obtained, and to explain their relevance. In other words, how do the results fit in with previous data and/or theories, or with the theory presented in the report?

Suggested sub-headings for an experimental report

There is no one correct way of presenting an experimental report. However, the use of standardized sub-headings does help to provide a check-list to ensure that nothing important has been omitted. The following set of sub-headings is put forward in that spirit.

1 Title

This can often be given simply in terms of the independent variable and dependent variable, e.g. 'To investigate the effect of word frequency on recognition' or 'The effect of overtraining on discrimination reversal'.

2 Introduction

This begins with a general statement of the problem. It continues with a review of previous experimental work in the area (with references) and the explanations or theories which have been associated with the previous work. It then leads on to a statement of the hypothesis or hypotheses to be investigated. Some prefer to have the hypothesis as a separate section, others have it as a subsection of the introduction.

3 Method

In this section the reader is told exactly what was done in the experiment. The best way of deciding what should fit in this section is by asking the question – could the reader repeat the experiment exactly using the information given? It is useful to subdivide this section as follows:

a Design

A succinct statement of the variables in the experiment, together with their operational definition. The type of design (independent samples, matched samples or repeated measures) should be given together with an indication of how participants are assigned to conditions and how other variables are controlled.

b Participants

State the type and number of participants and give a brief description of the population from which they are drawn, together with the procedures used for obtaining the experimental sample. (In some cases you may be unable to sample, e.g. when the participants are drawn from your own class or group – if this is the case, say so.)

c Apparatus and materials

Any apparatus used should be described in sufficient detail for a reader to obtain the same. If the apparatus is available commercially, the manufacturer's name and the type or model number should be given. If it is not commercially available then details of construction and dimensions should be given. A fully labelled diagram is often very helpful.

Any materials specially prepared should be described here (e.g. sheets on which responses are to be made; jumbled words or anagrams). It may help to include an example in an appendix.

d Procedure

This consists of a detailed step-by-step description of exactly what happened when the experiment was taking place. It should include all the things that happened to participants between their coming into the room and leaving it. Verbatim (word for word) instructions should be given whenever possible. The way in which stimuli are presented to the participant should be detailed, together with the way in which the response is made (verbal, written, etc.). Any time intervals or limits imposed by the experimenter should be given

(e.g. participant given a maximum of two minutes to recall the items; rate of presentation of slides was one per five seconds).

4 Results

The results should be presented as simply and clearly as possible. Make use of tables and of graphs, histograms or scattergrams. If, as is often the case, the analysis is concerned with the mean scores under two conditions, display these means very clearly. All too often such scores are tucked away almost out of sight. Any graphs should be understandable in their own right without reference back to the text, so they should be fully labelled on both axes, showing the units of measurement where appropriate. Remember that the convention is that the independent variable appears on the horizontal axis, the dependent variable on the vertical axis.

As well as the display and description of your results, this section should include the results of the statistical tests performed. An essential part of this is the statistical significance level associated with the results of the analysis. A common fault of new experimenters is to quote the significance of the result and stop short at that – 'this result is significant at the 5 per cent level'. Remember that you are not doing the statistical analysis just for its own sake. You are doing it for the light it throws on your experiment. So you must go on from this statement of significance to explain what this means in terms of the experiment – 'this result is statistically significant at the 5 per cent level, i.e. the mean time to react in the "alcohol" condition exceeded that in the control condition at the 5 per cent level of significance'.

It is not usually necessary to include all the experimental observations nor the details of the statistical computations in the body of the report. They can, however, be included as a appendix to the experimental report, which has the advantage that anyone going over the report can check details of computation and give help if you are making any mistakes.

5 Discussion

The discussion starts with the results of the statistical analysis and their bearing on the hypothesis or hypotheses that were put forward

in the introduction. It then goes on to consider their relevance both in theoretical and practical terms. The way in which these results tie in with previous results is considered, together with suggestions for research leading out of the present work.

Limitations of the usefulness of the results should be considered here. It may be, for instance, that certain variables were, avoidably or unavoidably, left uncontrolled. The effect of this lack of control should be considered carefully. Be realistic about this. You cannot expect to control everything and just because, say, the wind changed direction in the middle of the experiment it doesn't necessarily mean that you throw up your hands in despair and the whole experiment is worthless. There may, of course, be occasions when the lack of control of one or more variables does mean that the experiment is inconclusive. All that one can do here is to recommend that the experiment be re-run with appropriate changes. Even an experiment of this type is not a complete waste of time; it has at least made a contribution towards your education as an experimenter.

References

A common convention is to indicate all references in the body of the write-up by a name and date, e.g. 'As Clark and Stephenson (1989) and Ellis et al. (1993) have pointed out . . .'

The reference section of the experimental write-up puts all the references together in alphabetical order of the authors' names. Thus your reference section might read (in part):

Clark, N. K. and Stephenson, G. M. (1989) 'Group remembering', in P. B. Paulus (ed.) *Psychology of Group Influence*, Erlbaum.

Ellis, H. D., Ellis, D. M. and Hosie, J. A. (1993) 'Priming effects in children's face recognition', *British Journal of Psychology*, 84, 101–110.

Webley, P., Robben, H., Elffers, H. and Hessing, D. (1991) *Tax Evasion: an experimental approach*, Cambridge University Press.

For journal articles, as with the Ellis et al. article referred to above, the sequence is author's name, year of publication, title of article,

title of journal, volume number, and first and last pages of the article. Note, by the way, that a convention is to use 'et al.' (i.e. 'and others') in the text of your report when three or more authors are involved.

Some general points about writing up experiments

An experiment should be written up as soon as possible after the experiment itself is completed. This is important both in motivational and informational terms. If you are still 'involved' with the experiment, then the report will not be a chore, but will appear as a necessary completion of the whole process. It is a bad habit to write up experiments in batches. A great deal of information loss and of interference between experiments is possible with this approach. I have seen some fascinating examples of transposition of procedure between the accounts of one experiment and another. However full and clear your notes appear at the time of the experiment, leaving the write-up for a few weeks will often transform them into confusing hieroglyphics.

As far as presentation of reports is concerned, there is a lot in favour of a ring binder, particularly if you are carrying out a set of experiments. In this way material can be readily added or removed, the order of presentation of different reports changed, and so on.

It is also sensible to have a look at some good examples of experimental reports produced by people in similar situations to yourself. Published articles are worth looking at, providing that you are not put off by complex statistics and other features beyond your present capabilities. Have a look through books of readings containing journal articles. Or, if you have access to libraries possessing journals of experimental psychology you could look through some recent copies.