

Experimental and quasi-experimental designs

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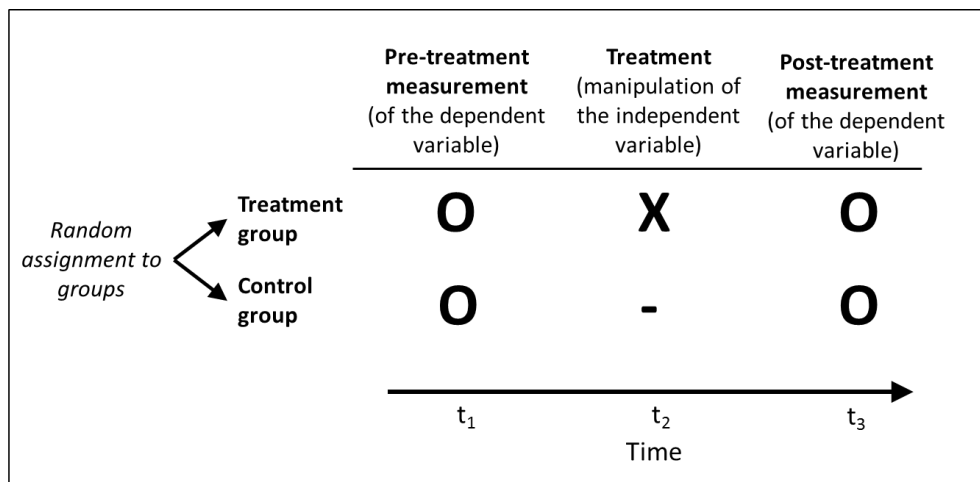
1 Introduction

This supplement expands the introduction to experimental and quasi-experimental research designs in Chapter 6. Along with additional details of how to carry out a grounded theory study it offers an overview of the design's strengths and weaknesses, along with additional references for further study.

The key feature of an experimental research design is that you deliberately vary something in order to find out what happens to something else – ‘to discover the effects of presumed causes’ (Shadish et al. 2002: 6). Using the terminology we introduced in Chapter 5, you manipulate one or more independent (i.e. treatment) variables to discover the effect on a dependent variable. Other characteristic features of experimental designs include the use of experimental controls to eliminate extraneous influences, measurement of the effects of the manipulation and the comparison of the resulting measures.

Figure 1 shows these features applied to a ‘classic’ experimental design that has a single treatment group, a control group and pre- and post-treatment measures. The levels of the dependent variable are measured for each group both pre- and post-treatment but only the treatment group receives the treatment. Analysis focuses on the difference in pre- and post-treatment scores for the treatment group compared to the difference in pre- and post-treatment scores for the control group. If the change is greater in the treatment group, you would infer that this was due to the treatment, i.e. the manipulation of the independent variable.

Figure 1 – Classic experimental design with treatment and control groups and pre- and post-test measurement



The extent to which you can be confident in making this causal claim is a function of the internal validity of the design. Even with the simple example in Figure 1, we can identify a number of potential threats to internal validity (Gomm 2008):

- Despite random sampling, there may still be differences between the treatment and the control group.
- There may be inaccuracies or inconsistencies in the measurement process or the measures used may not be reliable and valid.
- There may be unintended differences in the actual treatment administered or in the handling of the control group compared to the treatment group.
- If some participants leave during the course of the research or reject treatment, their dropping out may influence the results. Alternatively, particularly if the research is running over a long period, time alone may be introducing changes in participants giving rise to what are known as maturation effects.
- The researcher may deliberately or unwittingly bias the results through their actions by, for example, behaving differently towards the treatment group compared to the control group, thereby giving rise to what are known as experimenter-expectancy effects.
- Research participants may themselves react to the experience of being in an experiment. Some participants, for example, may be enthusiastic about taking part and this could influence the outcome, regardless of the actual treatment, demonstrating what are referred to as subject-expectancy effects.

Experienced experimenters are, of course, well aware of these (and other) issues and seek to address them. One important technique to address expectancy effects is known as blinding, whereby information that might affect how subjects and/or researchers behave or react is kept from them. The ultimate application of this technique is the double-blinded, randomised placebo-controlled trial from pharmaceutical testing where neither the subject nor the person administering the drug is aware of who is in which group and a placebo, for example a pill looking exactly like the real drug, is administered to the control group. Blinding is not, however, always possible or ethically appropriate.

The desire to use strong experimental controls to achieve high levels of internal validity might encourage you to conduct your experiment in a laboratory or other highly-controlled environment. The experimental conditions may well be very different to the normal lives of participants and the actual conditions in which the phenomenon of interest naturally occurs, giving rise to doubts about whether the findings from the experiment will hold in the real world. The term ecological validity is used to describe this aspect of research design. One solution is to conduct your experiment in a natural setting. Such field experiments can have higher ecological validity than equivalent laboratory experiments but it may be harder to achieve equally high levels of internal validity because of reduced control over the sort of threats discussed above.

There are many variations in experimental research designs but we can usefully distinguish between true experiments which feature random assignment of participants to groups and so-called quasi-experiments which do not. The logic behind random assignment is that, with a sufficiently large sample size, random selection will ensure that the groups are comparable before treatments are applied thereby reducing a potential threat to internal validity (Cook and Campbell 1979). A quasi-experimental design may be the only option if random assignment is not possible, in which case careful attention has to be given to sampling procedures.

2 Applications of experimental designs

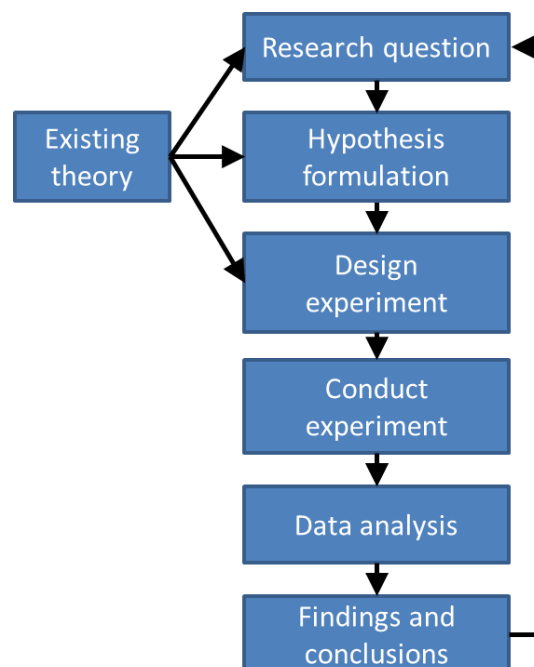
Experimental designs are primarily used for answering questions about cause-and-effect. Whilst some organisations, such as pharmaceutical or research and development companies, use experiments as part of their normal business activity, experimental research designs are relatively rare in general organisation and management research (Gill and Johnson 2010: 75),

outside of specific disciplines such as marketing, psychology and information systems. Despite this, an understanding of the logic of experimental designs is essential to a critical understanding of other ways of doing causal research.

3 Outline of the design

In Figure 2 we show the key steps to be followed when undertaking an experimental study. The variety and complexity of experimental designs precludes an exhaustive discussion but the basic steps discussed here provide a starting point for approaching more complex experimental designs.

Figure 2 – Steps in an experimental study



In keeping with the deductive approach, the early stages of an experimental study usually involve the formulation of appropriate hypotheses, based on your research questions and informed by existing theory. Important at this stage is the clear identification of the dependent and independent variables, their expected relationships as well as potential extraneous variables that need to be controlled during the experiment.

Design of the experiment covers a range of activities. You should specify the overall design taking into account factors such as the nature of the treatment, how many treatment groups will be required, the measurement strategy to be used and the duration of the experiment. You will need to decide on the experimental setting (i.e. laboratory or field) and develop an

appropriate sampling plan. This should include how you will allocate subjects to groups, particularly if random assignment is not possible. You will need to work out how you will vary the independent variable during the experiment. Your data collection plan must be specified including reliable and valid measurement procedures. Data collection methods can include questionnaires, structured observation of behaviour and the use of appropriate administrative data (for example, sales data). Quantitative data may be supplemented by qualitative data, for example from in-depth interviews with participants, if appropriate.

Measurement options include:

- Post-test measurement only. The control and treatment groups are measured only after the experiment and the differences compared. This strategy assumes that the groups are equivalent before the experiment. If this cannot be assumed, pre-test measurement should also be included.
- Pre- and post-test measures. This option allows you to check whether groups are similar prior to the experiment. A potential disadvantage is that pre-test measurement may have some influence on the subjects' performance in the experiment.
- Solomon four-group design. This approach has two pairs of groups, one control and treatment group in each pair. One pair of groups receives pre- and post-test measurement the other pair of groups only receives post-test measurement. This approach allows assessment of any effect of pre-testing. It requires more participants and more time and resources so its application in practice is limited.
- Repeated measures designs. In the classic experiment in Figure 1, each subject is put in a separate group and each group receives a different treatment (either treatment or control). This type of design, where each subject is put in a different group and each group gets a different treatment is known as a between-subjects design. An alternative is the repeated measures or within-subjects design in which an individual subject will experience all, or at least more than one, of the treatments, including the control. Repeated measures designs can allow you to achieve a bigger sample size and can also help eliminate effects due to differences between group members (since everybody potentially experiences the same treatments). The primary difficulty arises from 'carry-over' effects from one treatment to another. If the sequence in which treatments are administered makes a difference to the result you need to take this into account.

You will also need to plan all the practical aspects of your experiment, including administrative support such as transport and refreshments for participants, along with any health and safety arrangements that may be required. Ethical aspects of the research need careful attention and you may need to seek additional guidance and support in some situations as we discuss in Chapter 8. Once all of these arrangements are in place, you should conduct a pilot study where feasible. The aim of such a study is not to produce valid data but to test the logistical and procedural arrangements prior to the main study. Careful design and piloting will help to reduce risks of problems during the conduct of the experiment, which should conform to the procedures specified by the design process.

Analysis of experimental data will usually require formal testing of the research hypotheses, the results of which form the basis for your conclusions. When presenting your results, you should pay particular attention to potential threats to the internal validity of the study.

Research in practice 1 gives an example of a simple experimental study.

Research in practice 1 – Experiment

The effects of shelf placement on consumer purchases of potato chips

Sigurdsson et al. (2009) use a field experiment to evaluate the effects of shelf placement on consumer purchases of potato chips. The experiment involved an alternating treatment design in which the target brand of potato chip was placed on the high, middle or low shelf in two budget stores. The dependent variable was the proportion of all unit sales of potato chips accounted for by the target brand. The treatment variable was therefore the shelf placement; this was randomised over the course of the experiment to reduce threats to internal validity. Prices of the target brand were kept constant, as were other factors in the marketing mix. Researchers visited each store at least once a day to check on product placement and to note possible extraneous variables. In addition, the researchers also collected data on sales prior to the experiment to act as a baseline. The research found that the highest percentage of purchases recorded when the potato chips were placed on the middle shelf compared to the high or low shelf. In their conclusions, the authors suggest that this may be due to lower response effort required by consumers. This research supports the findings from proprietary commercial research into the effects of shelf placement.

4 Strengths and weaknesses of experimental designs

The key strength of the experimental design is usually seen as its ability to address the causal criteria we identified in Chapter 5. According to Shadish et al. (2002: 6) ‘no other scientific

method regularly matches the characteristics of causal relationships so well'. Perhaps not surprisingly, the randomised controlled trial is often referred to as the 'gold standard' in evidence-based policymaking by both its critics and its advocates. Even when an experiment cannot be used, however, the logic of experimental design can be seen operating in other deductive, quantitative approaches to studying causality as we will see in the next section.

Against these strengths we have to set some significant limitations that restrict the potential application of experiments within organisation and management research. Experimental research faces several practical and ethical challenges:

- In many situations it is simply not feasible to carry out an experiment. This arises, for example, when the independent variable cannot be changed by the researcher for practical reasons.
- Experiment involves manipulation which introduces particular ethical concerns if the subjects are human or animal. Alternatively it may be deemed unethical to deny treatment to a control group or to use random allocation to different groups. Ethical considerations may therefore be particularly important in experiments and in some cases will mean tight restrictions on what is possible or even rule out an experimental approach altogether.
- Experiments require access to subjects willing to take part. Finding and gaining access to such subjects can be difficult, especially if the experiment is demanding in terms of their time and effort.
- The time, facilities and other resources needed may make it impractical to conduct a particular experiment.

Experimental research has also been the subject of more fundamental critiques. These range from questions about the extent to which experimenters in the past have adequately respected the rights of their research subjects to reactions against the perceived privileging of experimental method over other research designs. Experiments, as the archetypal quantitative deductive research design, are closely linked to positivism so are subject to similar critiques. Oakley (2000) provides interesting insights into aspects of this broader debate if you are interested in exploring it further.

5 References

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