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Introduction – ‘Design’ as Distinct from Methods



ONE

What is research design?

SUMMARY

- Attention to research design at an early stage is necessary for rigorous social research.
- Many areas of social science do not pay enough attention to design.
- Many existing resources for new researchers over-emphasise research methods at the expense of design.
- The elements of a research design include the cases studied, their allocation to sub-groups, the timing and sequence of data collection, and any interventions.
- These elements can be portrayed in a simple design notation to represent new or existing designs.
- An important part of research design involves thinking beforehand about the kinds of conclusions that you might want to draw.

1.1 Introduction to design

This is a book about research design for social scientists. It argues that research design has been largely ignored in the development of new researchers, at the expense of a focus on methods of data collection and analysis. Perhaps this is because so many people generally care so little about their social science. To understand what I mean by this, consider areas of innovation where research design is strong. These might include the development of transport such as cars or elevators, of consumables such as medicines or packaged foods, and of gadgets from toasters to internet-capable televisions. In all of these areas, and many more, all of the products are tested before use. In many countries it is illegal to market such a product without rigorous testing. Even if it were not illegal, a strong pressure to test all products would come from the consumer. People want their aircraft to

fly rather than crash, and their medicines to work rather than to poison them inadvertently. So, the research to test these things must be designed with a robust approach. Of course medicines and aircraft still fail, despite testing. This regrettable fact is not an argument against testing; it is an argument for more and better designed testing.

People should also care about the quality of studies in economics – witness the worldwide economic downturn in 2007/08 that was almost entirely un-predicted by the thousands of professional economic researchers in each country. The public should care about the billions of public money spent on school ‘improvement’ schemes that have no discernible impacts on the desired outcomes. Similar concerns should arise in research relevant to housing, crime, social services, business leadership, politics, international development, well-being, social inequalities, marketing, and a host of other fields. Perhaps people do not care as much as they might because, even where research in social science has serious public implications, the ‘result’ could be a long way off in the future, or hard to discern in the present. People rarely fall ill or die as a direct result of poor social science research. Now, this should not mean that they do not want improvements in public services like housing, education, or criminal justice. But perhaps their concern is less immediate than the fear that a badly designed plane might crash, because the consequences of poor design in social science could be less visually dramatic.

Two other reasons may be that social science research is often ignored by its potential users such as politicians, and practitioners in the public services, and that its research findings are often of very poor quality anyway. None of these reasons is an excuse, but in combination they might form an explanation for how and why social science research gets away with ignoring research design. What this book does is to imagine that more people genuinely care about the quality of social science research, in the way that they care about the effectiveness and safety of aircraft and medicines. The book imagines that when a child is taken into care, or a government changes the sentencing guidelines for criminal courts, then the public would demand that these decisions are made using the best possible evidence.

Design is not chiefly about techniques or procedures. It is more about care and attention to detail, motivated by a passion for the safety of our research-based conclusions. At its simplest, research design is about convincing a wider audience of sceptical people that the conclusions of the research underlying important decisions are as safe as possible. This is perhaps the major difference between the objects of design in medicine and engineering, where things can be seen to work or fail quickly, and in most social sciences, where we can only seek to be convincing. If something works, that is convincing in itself, but where we do not know whether something works, we can at least demand to be convinced that it *ought* to work. We should want to be convinced that it is worth risking the happiness of a family by removing a child from its parents, risking public safety by releasing prisoners early, or spending public money on almost any intervention. Such decisions might be correct, or they might be a wasted opportunity or worse. It is

the task of social scientists to help make such decisions as foolproof as possible. At present, despite a small amount of excellent work in every field, this is just not happening sufficiently.

New researchers largely complete their development lacking any understanding of research designs, and this is reflected in the inadequate work of many areas of public policy research. There are many examples of public policy interventions, some covered in this book, that have been well-intended and rolled out into practice on the basis that they seem plausible and unlikely to do any harm. Yet when they have been rigorously evaluated, they have been found to be ineffective or even harmful. This means that ineffective and even harmful initiatives can divert scarce resources away from effective ones – a particular problem in the current economic downturn, when decisions are being made to abandon programmes on a whim rather than in terms of genuine cost-effectiveness. So, policy-makers and public auditors are increasingly calling for good research evidence on the development of cost-effective and efficient policy and practice solutions, establishing causal-type relationships between innovative changes and their desired effects. This is a key ethical issue for publicly-funded research.

In an attempt to improve the situation, this book is for a range of audiences. These suggested readers include newer researchers in those areas of social science where design is already important – including health promotion studies, for example. For them, the purpose of the book is to provide a relatively gentle introduction that can lead to more advanced templates for rigorous research design. The book is also for newer researchers in areas where research design is present only in a limited fashion. It should encourage them to go beyond focusing almost exclusively on longitudinal designs in sociology, or merely laboratory experiments in psychology. For them, the purpose of the book is to set the common design(s) within their disciplines into a wider context, and to suggest that a mature social science requires a greater variety of designs. Perhaps, most urgently, this book is for newer researchers in those many areas of social science where design is almost completely absent, where methods resources do not even address design, or it is confused with instrument design, *post hoc* statistical procedures, or bizarre issues like ‘paradigm wars’ (Gorard 2004a). This is probably the situation in most fields, including economics – the supposed ‘queen’ of the social sciences.

This is most definitely a book for readers who do not know what research design is, did not take a course on it as a doctoral researcher, who would otherwise feel content to continue with their existing approach to generating evidence for public consumption, and whose mentors, supervisors and colleagues feel the same. As this book argues, such complacency is unethical and unwarranted. In the example areas listed so far there are key issues of safety, efficiency and equality. People have lost their jobs as a result of an economic downturn caused partly by untested financial products, for example. The public should care about such things, but the researchers who work in such areas often claim to care about them even more. If

they do care, they will want to ensure that they design their research to be as rigorous as possible. Ignoring design is one way of saying openly to the world – ‘I don’t care about the quality of my research, the wasted opportunities it represents, the waste of peoples’ time participating in or reading it, or the dangers to the very people that the research is meant to help’.

1.2 Design and methods

An important point for readers to understand is that research design is not about methods of data collection and analysis. What all rigorous research designs, and variants of them, have in common is that they do not specify the kind of data to be used or collected. No kinds of data, and no particular philosophical predicates, are entailed by common existing design structures such as longitudinal, case study, randomised controlled trial or action research. A good intervention study, for example, could and should use a variety of data collection techniques to understand whether something works, how to improve it, or why it does not work. Case studies involve immersion in one real-life scenario, collecting data of any kind ranging from existing records to *ad hoc* observations. The infamous ‘Q’-words of qualitative and quantitative, and mixed methods approaches are therefore not kinds of research design; nor do they entail or privilege a particular design. Of course, all stages in research can be said to involve elements of ‘design’. The design of instruments for data collection is one example. But research design, as usually defined in social science research, and as discussed throughout this book, is a prior stage to each of these. Thinking about methods before design is similar to an architect ordering building materials or setting deadlines for construction before settling on what the building will be (de Vaus 2001).

This point is quite commonly confused in the literature, where randomised controlled trial designs are seen as tied to ‘quantitative’ methods of data collection and analysis (Ceglowski et al. 2011), or it is assumed that a life-course research design must be ‘qualitative’ (Fehring and Bessant 2009). This point is also confused in some research methods resources, even those purportedly about design, including Creswell and Plano Clark (2007) who are really writing about methods issues not about research design. These writers and many like them contribute to the widespread misunderstanding of design issues. Do not be misled. Otherwise, judgement about what should be a design issue, such as how well the research will cater for rival explanations of the evidence, will be confused with judgement about the perceived merits of a method, such as whether to use a survey or interviews.

A study that followed infants from birth to adolescence, weighing them on 1 January every year, would be longitudinal in design. A study that followed infants from birth to adolescence, interviewing their parents about their happiness every year, would also be longitudinal. A study that did both of these would

still be longitudinal, even though some commentators would distractingly and pointlessly categorise the first study as ‘quantitative’, the second as ‘qualitative’, and the third as ‘mixed methods’. In each example, the design – ‘longitudinal’, or collecting data from the same cases repeatedly over a period of time – is the same. This illustrates that the design of a study does not entail a specific form of data to be collected, nor does it entail any specific method of analysis; nor does any method require a specific research design.

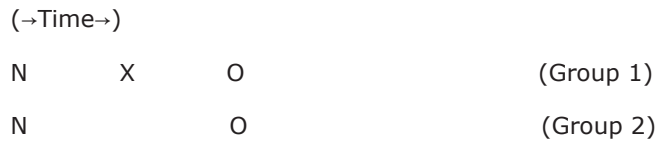
Almost all existing research resources for newer researchers concern methods of data collection and analysis, and almost all of the rest concern red herrings about paradigms, or treating serious subjects like epistemology as though they were fashion items to be tried on and rejected on a whim. This is true even of many texts that claim to be about research design. This book is very different. Methods of investigation and the philosophy of social science are important, and aspects of both appear throughout the book. But they are not its starting point or its focus.

1.3 || The elements of design

The elements of design covered in this book include the cases (participants) involved, the ways in which cases can be allocated to sub-groups, the time sequence of data collection episodes, and any manipulated interventions. These elements are the same, except perhaps for some terminology, as those presented by de Vaus (2001) and Shadish et al. (2002). The book presents these elements of design using a shorthand notation, as a convenient way of expressing more complex designs, and the differences between them. The notation is very simple, and all designs will also always be fully described and illustrated with examples where they first appear in a chapter. Do not be alarmed. What follows here is a brief introduction to the notation.

In a design, the cases are the participants in a study or the objects of a study. The letters R, C, M and N are used to denote groups of cases, allocated to their groups randomly (R), by using a cut-off point (C), through matching (M) or none of these (N). The letter O is used to represent an episode of data collection, which could be observation, measurements, conversations, text or indeed any form of data. If it is necessary to distinguish two or more different types of data collection, a sub-script will be added to the standard notation O. Thus, O_1 and O_2 might represent two different kinds of data taken from the same cases (such as a standard test and an interview). This vagueness about what the methods of data collection are is deliberate (see above). The letter X is used to represent an intervention or change of some sort that might influence the cases to which it is applied. Again, if it is necessary to distinguish two or more different types of intervention, a sub-script will be added to the standard notation X. Thus, X_1 and X_2 might represent two different kinds of treatments given to the same cases. I also use a square bracket, as in [X], to

denote an intervention that occurs naturally rather than created by the research. Time is represented by a flow of events from left to right, and different groups of cases are denoted by different lines on the page. A simple example could be:



This shows a study of an unknown number of cases, sub-divided into two groups (two lines on the page), and divided naturally or non-randomly (N for each). The first group of cases is given a treatment or intervention (X) and the second group is not (blank). Both groups then have the same unspecified data collected from them (each have an O without any sub-scripts). The diagram shows that the data collection (O) occurs after the intervention (X), and the intervention occurs after the allocation to groups (N) because of their order in the line representing time from left to right. There are varieties of design notations, and more complex issues involved, but this shorthand will do for the present. It will enable me to present the designs in this book as an easy picture, once you get the hang of the notation, and should allow you to make notes on any research you are reading and to communicate designs to colleagues.

1.4 || The structure of this book

Research design in the social sciences is a way of organising a research project or programme from its inception in order to maximise the likelihood of generating evidence that provides a convincing answer to the research questions for a given level of resource. Chapter Two presents a simplified cycle for a field or programme of research and how this relates to the elements of design. The next section of the book looks at the rationale for research designs. It provides grounds for deciding on which design is most appropriate for a given study. Chapter Three looks at research questions, how we might generate them, and best express them in order to achieve useful and meaningful answers. Chapter Four introduces the idea of a warrant for research claims, as the part of an argument that could convince a sceptical person to believe the answers to the research questions. Chapter Five is all about the nature of causal claims, which have a special place in explanatory social science research.

The third section of the book concerns the various elements of a design. There are many elements to consider in a research design, but they commonly include the selection of cases of interest to be used in the research (Chapter Six), the appropriate allocation of cases to sub-groups and their subsequent comparison (Chapter Seven), what happens over time (Chapter Eight), and any intervention to be evaluated (Chapter Nine). A specific design or project may have only some

of these elements, but some well-known designs involve all of them. These elements of a research design can be combined and varied in many ways, so that each new project might devise a completely new kind of design. On the other hand, there is a variety of standard designs that it is worth being familiar with, both to assist when reading the research of others, and to give some idea of the range available for your own research.

The next section moves to slightly more advanced issues relating to design. A range of further and currently less common research designs is presented in Chapter Ten. Chapter Eleven discusses traditional and generic threats to the validity of research conclusions, and introduces some important new ones. The key issue of how to differentiate between patterns or simply 'noise' in the data is addressed in Chapter Twelve. Chapter Thirteen looks at the ethics of research design, and conflicts of interest in the conduct of research.

Finally, Chapter Fourteen sums up the argument that a robust approach to social science research design is necessary, and offers a few guidelines for choosing a design and developing a grant application, using the principles and ideas in this book.

Each chapter also ends with three 'exercises' that readers might like to consider while reading. These exercises will tend to get more complex and involve greater judgement as the book progresses. They are followed by my notes and suggestions for discussion, which are an important part of the argument and narrative of the book. They often introduce material in a different way, or even suggest ideas not covered elsewhere, and so should be treated as an integral part of the text. Each chapter ends with a suggestion for further reading on the same topic.

Initial exercises on research design

- Using the simple design notation described in this chapter, a piece of research might be presented as:

N	O	X	O	(Group 1)
N			O	(Group 2)

Assume that this design represents an evaluation of a new training course for social workers. The intervention (X) is the training course. In one region, a group of volunteers (Group 1) take the training course, and their remaining colleagues (Group 2) do not. The volunteer group are initially given a test of the skills that the training is intended to improve. After training, the volunteers and their colleagues (Group 2) are given the same test.

- How many groups of cases are there in this research design?
- How have the cases been allocated to groups – and have they been allocated by chance or not?

- c How can we tell from the design notation that Group 1 was given a test before the training?
 - d If the volunteers score better on the test after the training than they did before, suggest a few reasons why this is not necessarily evidence that the training is the cause of the improvement.
 - e If the volunteers also score better on the final test than their colleagues, suggest a few further reasons why this is not necessarily evidence that the training is the cause of the difference between Groups 1 and 2.
 - f Finally, if the colleagues do as well as the volunteers in the skills test, suggest at least one reason why this is not necessarily evidence that the training is ineffective.
- 2 Imagine designing a new piece of research that tries to follow a group of all men leaving a specific prison after their custodial sentence, in a specific month. The researcher will interview each person once as soon as possible after they leave prison, and then monitor them a year later to see if they have a job, have re-offended, and so on. What would the simplest version of this research look like in design notation?
- 3 Select a journal article reporting new research in your own area of interest. Try to present the design of this research using the simple notation introduced in this chapter.

≡ Notes on initial exercises

- 1 a There are two groups in this design because there are two lines of notation, with each line representing the research process as experienced by one group.
- b The cases have not been allocated to groups by chance. We know this because each line begins with N, denoting a non-random division between them. In the example, the first group consists of volunteers, and the second of everyone else in the study.
- c We know from this design that Group 1 is given the skills test before the training, because the first episode of data collection (O) appears to the left of the treatment (X). Time is assumed to flow from left to right.
- d The volunteers might score better on the test after the training than they did before simply by chance, especially if the difference is small. They might also do better through practice, because they have already taken the same test before the training. Or something else might have happened between the two tests, such as formative experiences at work. Any of these explanations and a host of others could show that the difference between the before-and-after tests is not related to the training. This is why it is important to have a comparable group that are also tested but do not receive the training.
- e The volunteers might score better on the test than their colleagues, by chance or as a result of practice, or due to some other experience that is unique to the volunteers. But the simplest explanation could be that the two groups are clearly not comparable. By volunteering, the group that receives the training has perhaps shown itself to be more enthusiastic, better motivated and keener to improve their skills than the other group. They might therefore have performed better in the test than their colleagues even without the training. We do not know from this design.
- f It is possible that the training is effective, even if the colleagues do as well as the volunteers in the skills test. Again, there are many possible reasons for this, including chance, or that the effect of the training is too small to be detected, or even that the volunteers were those who felt most in need of training, having a lower level of skill

initially. Another quite common problem is termed 'contamination'. Where volunteers who receive the training and other colleagues work together in the same offices or departments, the colleagues may learn about the training second-hand via inadvertent cascading in conversation. The volunteers might show their friends materials from the training course to help them as well. So, the training could be effective but the results not show up as a difference in the scores because, in reality, the training has affected both groups. These ideas begin to give some idea of the complexities of design and the difficulties of designing a study whose results will convince a sceptical audience.

- 2 The simplest notation that matches the design for the prison leaver study could be:

N O₁ O₂

There is only one group (one line). The group is a natural cluster in one prison (not random), and there are two different episodes of data collection (not a repetition of the same data collection, as in question 1). There is no intervention – the prisoners have already left prison at the outset.

- 3 A surprising number of articles report research without specifying a design. In many cases this is because so few of the elements of a design are included in the study that it is not worth discussing. For example, a simple survey of business leaders might have this design:

N O

It does not matter how complex the subsequent analysis is, nor how sophisticated the questionnaire is. There is only one designed group. This is so even if the analysis later divides the cases temporarily into sub-groups like male/female or by the size of their businesses. As there is only one group, there is no pre-specified method of allocating cases to groups. There is no intervention and no time sequence. It is a snapshot study. The same design notation would be used if individual interviews replaced the survey, because the design is independent of the precise methods of data collection. And the same notation would be used if a series of focus groups replaced individual interviews. The 'groups' in a research design, represented by different lines in the notation, are those for whom the research process is different. If research involves six focus groups all doing the same thing, there is only one 'group' for design purposes. The same applies to 100 interviewees, or 1,000 survey respondents.

≡ Suggested reading

Chapters One and Two in de Vaus (2001) *Research Design in Social Research*. London: SAGE.

