

## Chapter 3

# Research Strategies and Methods

The purpose of research is to create reliable and useful knowledge based on empirical evidence as well as on logical arguments. The evidence and the arguments need to be presented in a clear way to other researchers, so that they can review them and determine whether they hold up to the standards of academic research. In order to support researchers in creating, structuring, and presenting their results, many scientific communities have evolved and established a number of research strategies and methods. This chapter offers an overview of a number of well-established research strategies and methods for empirical research, particularly within the social sciences. These strategies and methods are also useful for design science research, in particular when investigating practical problems, defining requirements, and evaluating artefacts.

### 3.1 Research Strategies

A *research strategy* is an overall plan for conducting a research study. A research strategy guides a researcher in planning, executing, and monitoring the study. While the research strategy provides useful support on a high level, it needs to be complemented with research methods that can guide the research work on a more detailed level. Research methods tell the researcher how to collect and analyse data, e.g. through interviews, questionnaires, or statistical methods. Thus, a research strategy offers high-level guidance, while a research method can be seen as a technique or tool for performing a specific task.

As a number of different research strategies exist, a researcher to embark on a study needs to determine which one of these to choose. The choice depends on the goals and characteristics of the study being undertaken, and it is possible to identify three main questions for choosing an appropriate strategy:

- Is it suitable with respect to the research question?

- Is it feasible, taking into account the resources of the research project?
- Is it ethical, taking into account its possible effects on people, animals, and the environment?

A research strategy should be suitable for its purpose, i.e. it should be able to help the researcher to find an answer to the research question under consideration. For example, an experiment can be helpful for identifying the cause of some event, but is probably less suitable for exploring an unknown topic. It may be the other way around for grounded theory. Similarly, a case study can be the right choice for investigating complex social relationships in a specific setting, while it is probably inappropriate for measuring attitudes in a large population.

The research strategy should also be feasible from a practical standpoint. The researcher needs to have access to data sources, such as people and documents, which may be difficult to obtain when people are busy or documents are confidential. The researcher may also need special resources, such as laboratory equipment or computer software. The need for various resources is very much dependent upon the choice of research strategy, and therefore, some strategies may not be feasible in a certain situation. Furthermore, some research strategies, such as action research, are highly time-consuming, which can make them inappropriate for small-scale research projects.

It should be ensured that the research strategy chosen can be followed in an ethically responsible way. On a general level, this means that no one should suffer harm as a consequence of the research study, neither humans, nor animals, nor the environment. In social research, it is common to require that the participants of a study be allowed to remain anonymous, that they should have the possibility to withdraw from the study whenever they so desire, that they should be informed about their role and rights in the research study, and that data collected will be confidential and not used for purposes other than those of the study.

In the rest of this section, a number of empirical research strategies are discussed, followed by a brief summary of the role of simulation and mathematical proof in research.

### **3.1.1 Experiments**

An *experiment* is an empirical study that investigates cause and effect relationships. The purpose of an experiment is to prove or disprove a causal relationship between a factor and an observed outcome. Such a relationship can be formulated as a *hypothesis*, often in the form “Factor X causes outcome Y”. Some examples of hypotheses are:

- Sun radiation causes skin diseases.
- Introducing workflow systems causes an increase in productivity.
- High usability of an IT system has a positive effect on its actual use.

A hypothesis can be expressed more precisely by using the notions of *dependent variables* and *independent variables*. An independent variable corresponds to the cause in a hypothesis, while the dependent variable corresponds to the outcome. An independent variable affects one or more dependent variables, e.g. the amount of sun radiation positively affects the occurrence of skin diseases. In other words, the independent variable has a causal effect on the dependent variable, so the latter is dependent upon the former.

A researcher carrying out an experiment for testing a hypothesis will manipulate the values of the independent variable and then observe whether this has any effect on the dependent variables. This can be done by introducing, removing, or changing the value of an independent variable. For example, a researcher may distribute a new medication (the independent variable) to a group of people with diabetes and observe whether this reduces their symptoms (the dependent variables). If the people actually get better, this provides support for the hypothesis that the medication eases the symptoms of diabetes patients. However, the experiment cannot definitely prove that the medication has this effect, as other factors may have influenced the result, such as other diseases of the patients, their social situation, or their expectations. This observation holds true for all experiments. No experiment can definitely prove or disprove a hypothesis; an experiment can only increase or decrease the support for it.

The purpose of an experiment is to show that one single factor has a certain effect on another factor, but there is always a risk that other factors come into play and invalidate the results of the experiment. A researcher, therefore, needs to control these other factors, and several techniques have been designed for such control. One technique is to eliminate a factor from the experiment, e.g. people who have a cold would not be allowed to participate in the experiment described above. Another technique is to hold a factor constant, e.g. by only allowing people of the same age to participate in an experiment. A third technique is to randomly select the subjects in an experiment, as this would cancel out the effects of factors that could interfere with the results. Yet another technique is to use control groups, in which two groups with similar compositions are identified. One of the groups is the treatment group, while the other is the control group. The independent variable is manipulated for the treatment group, e.g. a medication is distributed, while the independent variable is not manipulated for the control group. The researcher then measures the values of the dependent variables of the two groups, and any differences between them can be attributed to the manipulation of the independent variable.

In order to be able to fully control the various factors influencing experiments, researchers typically prefer to carry them out in an artificial environment, such as in a laboratory. Such *laboratory experiments* not only allow for close control of factors but also for precise measurements. However, laboratory experiments have the drawback that the settings where they are carried out can be so artificial that the conclusions drawn from them are not valid outside the laboratory. In order to overcome this challenge, field experiments can be made. A *field experiment* starts from a naturally occurring situation and tries to study it in the form of an

experiment. For example, in order to determine whether there is a cause and effect relationship between sun radiation and skin diseases, a researcher could identify all people in a country who suffer from skin diseases and compare the sun exposure of this group to that of the general population. However, in this situation there are many factors that the researcher cannot control, so the results of the study can be highly uncertain.

The advantages and disadvantages of laboratory and field experiments can be explained in terms of internal and external validity. *Internal validity* depends upon whether the observed change in a dependent variable is, indeed, caused by a corresponding change in an independent variable, and not by other factors. *External validity* depends upon the generalisability of the results of an experiment, i.e. whether the same results can be expected for other occasions and situations. Laboratory experiments are typically strong on internal validity, as potentially interfering factors can be well controlled, but they can be weak on external validity, as their artificial characteristics may not apply to real-world situations. For example, even if a medical treatment has beneficial effects when given in a controlled hospital environment, the same effects may not be observed when patients receive the treatment in their ordinary, day-to-day, life environment. The situation is reversed for field experiments, in which internal validity is low, because many factors cannot be controlled, while external validity can be high.

### 3.1.2 Surveys

The word “survey” means to look upon or oversee something. This is also the purpose of a *survey* as a research strategy, which aims to map out some world, be it physical or social. A survey usually has a broad coverage and provides a helicopter view of some area of interest. In the social sciences, surveys are frequently used for gathering basic data about large groups of people, including their activities, beliefs, and attitudes. This is also done in nonacademic surveys, such as opinion polls and market surveys. The breadth of surveys means that they work best for collecting data on narrow and well-defined topics, while they are less suitable for studying complex phenomena in greater depth. For example, a survey is a good strategy for finding out the attitudes people in different income groups say they have about the value of various diets, while a survey is less appropriate for investigating the feelings that people experience when they fail in the use of a new diet.

Surveys can take many different forms. A traditional form of a survey is the *postal survey*, where a questionnaire is mailed to a number of people. *Telephone surveys* have also been used in the social sciences for a long time, and they enable a researcher to interact with a respondent during the telephone call. Another survey form that is becoming more popular is the *Internet survey*, for which the Internet is used as a medium for delivering the survey. This can be done via email and a website or through social media, such as Facebook or Google+. A common disadvantage of postal as well as telephone and Internet surveys is that they tend

to get low response rates, because people are often too busy to participate in them. A form of survey that is able to, at least partially, overcome this problem is the *face-to-face survey*, in which the researcher directly interacts with the respondents. An example of a face-to-face survey is one in which a researcher interviews people who are waiting at a bus stop. While all of the above forms of surveys aim to obtain responses from people through interviews or questionnaires, there are also surveys that build on observations or documents.

An *observational survey* does not view people as respondents but as actors whose behaviour can be studied. An example of an observational survey is a study that measures how much people actually consume of various food categories, i.e. the real intake is recorded, and not what people state that they eat. A *document survey* uses documents for gathering data. Such documents include newspaper articles, legal documents, annual reports, medical records, computer logs, web pages, or photographs. The wealth of data continuously produced by social media nowadays provides a rich source for document surveys, e.g. a survey based on retweets of Twitter posts by European politicians.

A main concern of any survey study is that of sampling. *Sampling* is about the selection of individuals within a population, e.g. selecting 500 people to interview from a city population of 1,000,000. Sampling is almost always required for surveys, as studying an entire population is usually prohibitively expensive. However, a major challenge in sampling is to determine whether results that hold for a selected sample can be generalised to the population from which it has been drawn. A useful distinction here is between representative samples and exploratory samples. A *representative sample* is intended to offer a true mirror image of the entire population in the sense that it has the same distribution of relevant characteristics. For example, a representative sample of a national population should include roughly as many men as women and have an age distribution similar to that of the population. An *exploratory sample*, on the other hand, is not required to be representative of its population but instead is used as a means for gathering information in order to explore a new area. For example, an exploratory sample of people for suggesting requirements on a new tech gadget would include people with a special interest in that type of gadget, as these people probably would provide the best ideas; it is not important that they faithfully mirror the population from which they come.

In order to generate a representative sample, various sampling techniques can be used. Common to all of them is that they ensure that the researcher cannot influence the inclusion of particular individuals in the sample. *Random sampling* means that each individual has an equal chance of being selected and is seen as the gold standard for creating representative samples. However, in some cases, random sampling can become expensive, and other techniques have been designed that offer a balance between cost-effectiveness and random selection, e.g. cluster sampling and stratified sampling.

*Purposive sampling* is a useful technique for generating an exploratory sample. The goal is here to identify a small number of individuals that can provide especially valuable information to the researcher. The individuals may have some

privileged knowledge or experiences about the topic being explored, e.g. through their professional roles. Therefore, the researcher may personally invite them to be part of the sample. An example could be a study of electronic health records, where experienced physicians and nurses could be handpicked to form an exploratory sample. Purposive sampling is sometimes combined with *snowball sampling*, in which the first participants are selected and they, themselves, suggest additional individuals to add to the sample.

A strength of surveys as research strategy is that it allows for collecting large amounts of data inexpensively and over a short time span. They also enable the collection of quantitative as well as qualitative data. A disadvantage is that the collected data can be superficial when individuals do not have the time or inclination to provide detailed answers to the questions posed by the researcher. For the same reason, some individuals may choose not to participate at all, resulting in a low response rate.

### 3.1.3 Case Studies

A *case study* focuses on one instance of a phenomenon to be investigated, and it offers a rich, in-depth description and insight of that instance. With its focus on depth and context, a case study differs from a survey or a laboratory experiment. While a survey can provide a broad but shallow view of an area, a case study can paint a pregnant and detailed picture of its subject. A laboratory experiment reduces complexity by controlling, even eliminating, factors that can interfere with the experimental results. In contrast, complexity is essential to a successful case study, as it investigates multiple factors, events, and relationships that occur in a real-world case.

The case study research strategy can be characterised by the following:

- *Focus on One Instance.* The idea is “To see a World in a Grain of Sand, And a Heaven in a Wild Flower, Hold Infinity in the palm of your hand, And Eternity in an hour” as expressed by William Blake (2012).
- *Focus on Depth.* As much information as possible about the instance studied should be obtained, without shying away from any details.
- *Natural Setting.* The instance exists before and independently of the research project, and it should be studied in its ordinary context; it should not be moved to, or created in, a laboratory.
- *Relationships and Processes.* The instance should be studied in a holistic way, taking into account all the relationships and processes within the instance as well as in its environment.
- *Multiple Sources and Methods.* Multiple information sources should be consulted in order to obtain rich, many-faceted knowledge about the instance; when doing this, different data collection methods could be used, such as interviews and observation.

A case study often addresses only a single instance, but it can also address a small number of instances. Each instance should be self-contained and have a clear boundary so that it can be distinguished from its environment. In social sciences, a typical instance can be a person, a company, a department in an organisation, a project, an IT system, or a regulation. An instance can be studied at a single point in time by investigating the present situation, but it can also be studied over time in a *longitudinal study*.

Case studies can be used for different purposes, including exploratory, descriptive, and explanatory ones. An *exploratory case study* is used for generating research questions or hypotheses that can be used in other studies. It is particularly valuable when a researcher enters a new area where little is known, and the literature is scarce. A *descriptive case study* aims to produce a rich and detailed description of an instance and its environment. An *explanatory case study* does not only offer a description but also tries to identify cause and effect relationships that can explain why certain events occurred.

A key decision in any case study is the choice of the instance to be studied. The first step here is to determine the kind of phenomenon to investigate, which depends on the research question to be answered. For example, in the context of workflow systems for companies, there are at least three kinds of phenomena that can be investigated: people, companies, and workflow systems. If the research question is about the effect of workflow systems on profitability, the instance could be a company. On the other hand, it could be a person, if the research question is about the psychological effects of workflow technology. When the kind of phenomenon has been determined, the next step is to choose the actual instance. This choice can be based on several different considerations. One option is to choose a typical, representative instance so that findings from it can be generalised to an entire class. Another option is to choose an extreme instance in order to investigate special and unusual features of a phenomenon. Yet another reason for choosing an instance is that it can work as a test bed for a theory, i.e. it can be used for investigating whether predictions and explanations offered by a theory actually conform to the instance. A complementary reason for choosing a certain instance is convenience, i.e. that it is easily accessible.

A common criticism of case studies is that their results only apply to the instance being studied, i.e. that the results cannot be generalised. To address such criticism, a case study researcher needs to clarify the extent to which an instance is representative of a class of similar instances. For example, if the use of workflow systems has been studied in a small company in the retail sector, it would be reasonable to claim that the results from the study can be generalised to other small companies in that sector. However, the results may neither generalise to large companies in the retail sector nor to companies in other industry sectors.



### 3.1.4 *Ethnography*

*Ethnography* is about describing people or cultures. Ethnography has its roots in anthropology, in which researchers visited far-off exotic places and studied the people living there. The researchers did so by staying at one place for a long time and trying to live as its inhabitants, thereby learning how the people perceived their world, interacted with each other, and formed beliefs about themselves and their environment. While anthropology has focused on people in foreign lands, ethnography has turned to study groups and subcultures in modern society. Some work in ethnography has targeted people that can be seen as living outside mainstream society, such as drug users, religious sects, criminal gangs, and homeless people. Other ethnographic work has investigated more mundane settings, such as schoolyards and workplaces. Within the IT area, ethnographers have studied topics, such as the work practices of programmers and the development of information systems. Regardless of the area studied, ethnographic works have a number of common characteristics:

- Ethnographers spend a large amount of time in the field, living together with the people they are studying; they are active participants rather than passive observers.
- Ethnographers do not set up any laboratory experiments but take part in the existing practices of the people they are studying.
- Ethnographers try to understand the culture they are studying from the perspective of its members, i.e. how they perceive and understand their world and how they attach meaning to it.
- Ethnographers do not only study special events and ceremonies in a culture but also the activities and thoughts of ordinary people in their everyday lives.
- Ethnographers take a holistic stance incorporating a multitude of perspectives in their work, including social, cultural, religious, political, and economic ones.
- Ethnographers use multiple data collection methods including interviews, observations, and documents and record their experiences and interpretations in extensive field notes.

There are different approaches, or schools, of how ethnographic work is to be carried out. The *holistic school* emphasises empathy and argues that the ethnographer needs to live among the people being studied. Only then can they fully understand and absorb the culture of those people. Critics argue that this is an unrealistic goal and that the preconceptions and previous experiences of the ethnographers will limit their empathetic capabilities so much that a deep understanding of unknown cultures is out of reach. The *semiotic school* does not focus on identification and empathy but instead argues that the ethnographer should primarily investigate signs, symbols, and signification. Key research objects are then words, expressions, sayings, rules, institutions, and rituals. The ethnographer studies the relationships between these symbolic forms and how they relate to each other and to the culture at large. The *critical school*, in contrast, suggests that the



ethnographer needs to go beyond the symbolic forms and investigate the power relationships and structures of subordination that lie beneath them. The researcher should take a critical attitude and reveal unstated assumptions that are taken for granted in a culture, e.g. about the role of women or the authority of political leaders.

A main concern in ethnography is that of *reflexivity*, i.e. the relationship between the ethnographer, the people being studied, and the research process. It is purported that the researchers can never be objective and disinterested observers of a culture but will always perceive and interpret, based on their own culture and background. Thus, an ethnographic work may not reflect the lives and beliefs of the people being studied but rather the preconceptions and prejudices of its author. In other words, the researchers themselves can obstruct the study of the people and culture. In order to meet this challenge, researchers need to reflect on, and in their writings report upon, their own background, including age, gender, education, personal beliefs, and interests. Other related issues are how the researchers may influence the people they study and how they may be perceived by them.

One of the main difficulties in ethnographic work is the tension between the desire to provide a descriptive account of a culture and the insight that any such description is inevitably coloured by the background of the researcher. Another difficulty is that ethnographic studies easily become stories, which may be vivid and interesting reads in themselves, but do not contribute to analytical insights or theory development. Ethnographical work also often gives rise to ethical challenges, in particular concerning privacy and consent.

### 3.1.5 *Grounded Theory*

*Grounded theory* is a research strategy that strives to develop theories through the analysis of empirical data. In contrast to experiments, grounded theory does not start with a hypothesis to be tested but instead with data from which a theory can be generated. Grounded theory also differs from research strategies, such as ethnography, which are content to provide rich descriptions of particular situations, but no theories. Grounded theory challenges a top-down theorising approach, in which the researcher first develops a theory and then checks whether it conforms to empirical data. Instead, grounded theory insists that empirical data is the starting point, upon which theories are to be built. Theory emerges through analysis and is grounded in the data.

Grounded theory is particularly useful for exploratory research studies. When a researcher addresses an area for which established theories do not exist, grounded theory offers an approach for developing a new theory. Grounded theory is also well suited for small-scale projects, as it does not require the collection of huge amounts of quantitative data.

Open-mindedness is essential to the research process of grounded theory. Researchers should not start with a theory or preconceptions through which they

view the field and the empirical data. No theory should determine what the researchers focus upon. Instead, the analysis of empirical data should guide the researchers in their investigation. In other words, researchers should come with an open mind to the field and be prepared to discover new data, concepts, and insights as they go along. This does not mean that they must be ignorant about existing theories that might be relevant, but that they should not allow themselves to be limited by these.

In most research strategies, the sample to be used in a study should be determined at the beginning of the research process. However, in grounded theory, the sample emerges gradually during the entire process. The researchers start by collecting and analysing data on one or a few objects (a person, site, event, document, etc.), and based on the outcome of the analysis, they select additional objects to investigate. When selecting these objects, the researchers do not try to identify typical or representative objects but instead look for objects that can help to illuminate or extend concepts and categories that have been built in the previous analysis. The researchers select objects that they can compare and contrast to other objects already analysed, thereby helping them to further develop the partial theory that they have built so far. Thus, the sampling is informed by the analysis of the empirical data, and sampling, data collection, and data analysis proceed in an iterative manner. This form of sampling is called *theoretical sampling*.

The researchers collect data continuously, i.e. they add objects to their sample as long as these provide new insights. In grounded theory, this idea is expressed by saying that the researchers continue sampling until they reach the point of *theoretical saturation*. At this point, new empirical data does not help the researchers to further develop the theory, i.e. no new concepts, categories, or relationships between these are discovered. When theoretical saturation has been reached, additional data do not extend or refine the theory but only confirm it. Reaching theoretical saturation can be seen as a “stop condition” for data collection.

In grounded theory, the researchers typically collect qualitative data, e.g. from interviews. The data are analysed through coding and categorisation. This means that the researchers identify small pieces of the raw data and label them by assigning codes to them. For example, if researchers have interviewed people about their experiences of a new IT system that has been introduced in their organisation, they will first transcribe the interviews and then start coding. They will identify perceptions, attitudes, emotions, and other factors expressed in the material. For example, they may identify that the respondents have talked about things like *increased control*, *short response times*, and *training needs*. They will make these into codes and highlight portions in the transcription, thereby producing so-called excerpts. They will then assign one or more codes to each excerpt. In this way, the researchers label pieces of data, based on their content. This activity is often called *open coding*.

Open coding describes empirical data by chopping it up and labelling the resulting pieces, but this is not sufficient for arriving at a deep understanding of the data. There is also a need to categorise the codes and relate them to each other. In *axial coding*, the researchers identify the most important codes and suggest

categories under which the codes can be grouped. For example, they may introduce categories, such as *success factor* (and make it to include the codes: *short response time*, *barrier*, and *positive attitude*). Finally, the researchers move on to *selective coding*, where they focus on the main codes and categories and identify relationships between these. Based on the results from the open, axial, and selective coding, the researchers can suggest and identify core concepts and their interrelationships in the domain under investigation. From these, they can then build a theory for explaining events and other phenomena in the domain.

A major challenge for any study using grounded theory is to maintain the ideal of an open mind. Every researcher will have a background of previous experiences and knowledge, and the extent to which these really can be set aside when collecting and analysing data in the field is an open question. Another question is whether researchers should refrain from acquiring knowledge on a domain before embarking on a grounded theory-based study. The advantage of doing so would be that they can avoid preconceptions that could bias their work, but at the same time, they might forgo valuable knowledge that could help to build a relevant theory.

### 3.1.6 Action Research

*Action research* is a research strategy that is used to address practical problems that appear in real-world settings. An action researcher does not only strive to generate new scientific knowledge but also to solve important problems that people experience in their practices. Action research has become particularly popular in areas where the practitioners themselves can contribute to the improvement of their own practices, such as in education, healthcare, and organisational change. The main characteristics of action research are as follows:

- *Focus on Practice.* While a laboratory experiment takes place in an artificial environment, an action research study is carried out in a local practice, in the real world where people live, breathe, and act.
- *Change in Practice.* The local practice should be changed, and the change should be evaluated; researchers need to move beyond observing, describing, and theorising and become change agents.
- *Active Practitioner Participation.* The practitioners are not passive subjects to be studied by the researcher; they are active participants who contribute with their own knowledge to help solve practical problems, and they may even initiate and govern an action research study.
- *Cyclical Process.* Research is carried out within a feedback loop in which the researcher plans changes to be introduced in a practice, carries out these changes, and then evaluates and reflects on them; this cycle can then be repeated several times.
- *Action Outcomes and Research Outcomes.* An action research project should ideally produce results that are valuable for the local practice in which the

project was carried out as well as results that contribute to the academic knowledge base.

The cyclical action research process consists of five phases:

- *Diagnosis.* Investigate and analyse the problem situation in order to understand how it can be changed.
- *Planning.* Plan actions that can change and improve the current situation.
- *Intervention.* Carry out actions in order to change the current situation in accordance with the plan.
- *Evaluation.* Evaluate the effects of the intervention, in particular whether the situation has improved.
- *Reflection.* Reflect on the research carried out, in particular the results for the local practice and the new knowledge generated; decide whether to carry out a new action research cycle.

Action research differs significantly from other research strategies with respect to active practitioner participation. The typical situation for most research work within other strategies is that a researcher asks a research question and designs a study to answer it. Without active participation of practitioners, the researcher then carries out the study and arrives at results that answer the research question. The results may be shared with the practitioners involved in the study, and they may decide to use the results later on to improve their practice if they so desire. Thus, carrying out research is separate from making changes in a practice. In contrast, doing research and introducing changes is intertwined in action research studies, and practitioners take a leading role in both these activities. Practitioners may even initiate and sponsor an action research study, and their knowledge and actions are essential resources for the research process.

Action research studies can have different purposes, and a distinction can be made between technical, practical, and emancipatory studies. *Technical action research* aims at functional improvements, i.e. improving effectiveness and efficiency in a practice, often from a managerial perspective. *Practical action research* also aims to improve the practitioners' understanding of themselves and their work. The purpose is not only practice improvement but also self-education, including self-reflection, which can help people to change themselves. *Emancipatory action research* includes the purposes of technical and practical action research, but it also aims to help people to critically evaluate and reflect upon their practice as well as its organisational and social context. Practitioners are equipped with the means to question the goals of their practice and organisation. Instead of accepting the goals uncritically as they have been handed down through tradition or have been defined by management, practitioners are empowered to reject or revise the goals on rational grounds.

One challenge for action research studies is to generalise their results, as they are often closely tied to just one local practice. Another challenge is that the participants in an action research study, both practitioners and researchers, may not be able to remain impartial, as they are deeply involved in the study personally. From a

project management point of view, another challenge is that practitioners may be so busy with their ordinary work that they cannot contribute as much as desired to the action research study.

### 3.1.7 Phenomenology

*Phenomenology* is a research strategy that focuses on the perceptions and experiences of people as well as their feelings and emotions. The goal of a phenomenological study is not to establish cause and effect relationships or to describe a population through statistical means. Instead, it aims to describe and understand the lived experiences of people and thereby provide insight about the topic being studied. For example, a phenomenological study of drug addicts does not seek to identify the causes of drug abuse or to survey the frequency of drug addiction in a certain population. Instead, the goal is to gain understanding about what it means to be a drug addict, what it feels like, and what kinds of experiences the drug addicts have in their daily lives.

A key notion in phenomenology is that of *lived experiences*, i.e. how people experience the world in an immediate sense, pre-reflectively, without objectifying, classifying, or abstracting it. Based on these lived experiences, phenomenology investigates how social life is constructed by the people who participate in it. This means that social structures are not given from above and neither are people just automatons that follow some basic script. Instead, they create the social world together by giving meaning to their lived experiences. The goal of the phenomenological researcher is to understand this meaning.

In order to understand the lived experiences and sense-making of other people, phenomenological researchers need to step back from their own preconceptions and common sense. They need to suspend, as far as possible, their everyday beliefs as well as theoretical assumptions, so they become able to approach other people with an open mind. Only then can they get a clear understanding of the perceptions and experiences of other people.

The primary form of data collection in a phenomenological study is the long, unstructured interview. In such an interview, the respondents are able to really tell their own story without being unduly influenced by the researchers. They can also choose to bring up now topics that are important to them, but which were not foreseen by the researchers. The researchers can also use the interview for checking that they have understood the respondent correctly.

Phenomenological work often generates results that are highly readable and interesting for a broad audience, as they concern ordinary people in their everyday lives. Phenomenology can also enable novel insights into complex social phenomena, as it frees the researcher from specific theories. However, phenomenology has been criticised for lacking scientific rigour and for being too focused on description, rather than on analysis and explanation. Thus, phenomenology has many

similarities with ethnography, but it is more focused on the creation of individual meaning and identity.

### 3.1.8 Simulation

While the above empirical research strategies investigate a naturally occurring or contrived reality, a simulation studies an imitation of reality. More precisely, a *simulation* is an imitation of the behaviour of a real-world process or system over time. Simulations are useful for training people, when the real-world process can be hazardous or expensive, e.g. flight simulations. Simulations can also be used for analysing and making predictions about complex systems, e.g. weather simulations. Today, simulations are used in a wide variety of contexts, including safety engineering, education, finance, production, and games.

A *computer simulation* is a simulation that runs on computers and reproduces or predicts the behaviour of a system. Underlying the computer simulation, there is an abstract model of the system being simulated. As the power and sophistication of computers increase, ever more complex computer simulations can be carried out, in areas such as traffic engineering, weather forecasting, climate change, and strategic management.

Simulations can also be carried out by humans, e.g. in role-playing. A *role-play simulation* is a simulation, in which human participants take on different roles or profiles in the enactment of a process in a contrived setting. An example is a war game in which no actual military engagement occurs. Instead, the participants use maps, computers, and other devices to simulate combat. Role-play simulation has also become popular in learning, as it allows for more creative and engaging learning experiences than language-based learning.

### 3.1.9 Mathematical and Logical Proof

A *mathematical proof* is a rigorous deductive argument that demonstrates the truth of a certain proposition. In a proof, other previously proven propositions can be used as parts of the argument. In the end, a proof should rest on self-evident or assumed propositions, often called *axioms*. A proven proposition is called a *theorem*, while a still unproven proposition that is believed to be true is called a *conjecture*. Mathematical proofs typically employ logical reasoning but also make use of more informal reasoning through natural language. A proof that is written in a symbolic language instead of a natural language is called a *logical proof* or *formal proof*.

Mathematical proofs differ from the empirical research strategies discussed above in terms of certainty. A proof demonstrates unequivocally that a proposition is always true, while an empirical study only can provide additional support for a

**Table 3.1** Overview of research strategies

Strategy	Purposes	Key concepts	Key activities	Forms	Major concerns
Experiment	Investigate cause and effect relationships	Hypothesis Dependent variable Independent variable	Control factors that may influence the dependent variable	Laboratory experiments Field experiments	Weak external validity for laboratory experiments Weak internal validity for field experiments
Survey	Investigate some aspects of a phenomenon to get an overview	Sample Representative sample Exploratory sample	Sampling (random, purposive, and convenience)	Interview survey Observational survey Document survey	Lack of depth Limitation to measurable aspects Lack of theoretical grounding
Case study	Investigate in depth a phenomenon with a well-defined boundary	Case/instance Natural setting Holistic view	Multisource data collection Triangulation	Exploratory case study Descriptive case study Explanatory case study	Weak generalisability
Ethnography	Investigate cultural practices and social interaction	Culture Empathy Researcher as active participant	Field work Capture social meanings	Holistic study Semiotic study Critical study	Reflexivity A-theoretical storytelling Ethical dilemmas
Grounded theory	Develop concepts and theories through analysing empirical data	Categories and codes Open-mindedness Theory and concept generation Theoretical saturation	Theoretical sampling Coding (open, axial, and selective)	Positivist Interpretivist Constructivist	Reflexivity Lack of context

(continued)



**Table 3.1** (continued)

Strategy	Purposes	Key concepts	Key activities	Forms	Major concerns
Action research	Produce useful knowledge by addressing practical problems in real-world settings	Active practitioner participation Change in practice Action and research outcomes	Cyclical process Diagnosis Planning Intervention Evaluation Reflection	Technical action research Practical action research Emancipatory action research	Weak generalisability Lack of impartiality
Phenomenology	Describe and understand the lived experience of people	Lived experience Reflectivity	Unstructured interviews		Lack of rigour

proposition. Even if a large number of empirical studies support a certain proposition, future studies can always invalidate it.

The empirical research strategies discussed above are summarised in Table 3.1.

## 3.2 Data Collection Methods

A key activity in any empirical research study is to collect data about the phenomenon under investigation. For this purpose, *data collection methods* are used. The data collected may be numeric (often called *quantitative data*), e.g. number of lines of code or number of search results. Other kinds of data include text, sound, images, and video (often called *qualitative data*). Regardless of the kind of data, five of the most widely used data collection methods are: questionnaires, interviews, focus groups, observation studies, and document studies. Some of these data collection methods have become closely associated with certain research strategies, e.g. surveys typically use questionnaires, and ethnographic studies almost always involve observation. However, in principle, any data collection method can be useful for a given research strategy, and the traditional associations should not restrain a researcher in choosing an appropriate data collection method.

Within a research project, it is common to use only a single data collection method. However, it can be helpful to employ several methods in order to improve accuracy and to broaden the picture. For example, researchers can be more confident in the results of a questionnaire if they carry out a number of interviews and these produce confirming results. Likewise, a questionnaire can be used to collect a large amount of basic, quantitative information, which can be complemented with more qualitative information from interviews, thereby providing a more complete picture. A researcher can also carry out a number of interviews to better understand what questions to ask in a questionnaire. The approach of combining research strategies and methods (not only data collection methods) is called the *mixed methods* approach.

The mixed methods approach is related to the principle of *triangulation*, which is about viewing the same phenomenon from different perspectives. One way of doing this is to use different research strategies and methods but also different sources of data or even different researchers.

### 3.2.1 Questionnaires

A *questionnaire* is a written document including a list of questions to be distributed to a number of respondents. When the respondents answer the questions, they provide the researcher with data that can be interpreted and analysed. Questionnaires are typically used to gather straightforward information that is brief and unambiguous. The information collected may be about simple facts, such as the

age, gender, or income of the respondent. The information may also pertain to opinions, e.g. consumer preferences or political views. As questionnaires are inexpensive to distribute, they are particularly appropriate for gathering information from a large number of people. A questionnaire often consists of three parts:

- *Background.* Information about the researchers and their sponsors including contact information, the purpose of the questionnaire, ethical concerns including confidentiality and voluntary participation, and a thank you statement.
- *Instructions.* Detailed instructions on how to answer the questions, preferably with an example.
- *Questions.* A list of numbered questions.

The questions in a questionnaire may be open or closed. A *closed question* is a question for which the researcher has determined a set of permissible answers in advance. For example, “What is your marital status?” is a closed question with “single” and “married” as permissible answers. An *open question* is a question that has no predefined answers, and the respondents answer in their own words. An example is “What is your opinion on EU’s response to the climate question?” The respondents answer this question using their own formulations. Closed questions have the advantage of being easy and quick to answer for the respondent, and they are also easy to analyse with statistical methods. On the other hand, closed questions do not allow for nuances in the answers, as the respondent only can answer by choosing from a set of predefined alternatives. Open questions have the opposite characteristics. They are more difficult and time-consuming to answer and require more effort to analyse, but they allow for more elaborated and creative answers. Many questionnaires include both closed questions for collecting basic information and open questions for gathering more subtle and complex information.

The questions of a questionnaire need to be carefully chosen and formulated; in particular, as suggested by Peterson (2000, pp. 50–59), they should be:

- *Brief.* The question should preferably not be more than 20 words.
- *Relevant.* The question should be relevant to the questionnaire and its purpose.
- *Unambiguous.* The question should have only one possible interpretation; ambiguous and unfamiliar words should be avoided.
- *Specific.* The question should not be vague, e.g. “Do you often read email on your tablet?”
- *Objective.* The formulation of the question should not suggest an answer, e.g. “Do you agree that our country needs a new government?”

The questions should be ordered in such a way that earlier questions do not affect answers given later in the questionnaire. The number of questions should also be limited so that respondents do not feel overwhelmed and refrain from completing the questionnaire.

As questionnaires can be difficult to design, it is often useful to carry out a pilot study before distributing the real questionnaire. In such a pilot, a small number of test subjects answer the questionnaire as if they were actual respondents. The pilot will help to determine whether the instructions given are sufficient, whether there

are unclear or ambiguous questions, whether the predefined answers are exhaustive, and whether the questionnaire can be completed in a reasonable amount of time.

Questionnaires can be distributed in different ways. Traditionally, postal questionnaires have been the most popular ones. The questionnaires were sent by post to the respondents, who then had to send them back. Today, however, the Internet has become the most common medium for administering questionnaires, and there are many web-based tools that support the design, as well as the distribution and analysis of questionnaires.

A main advantage of questionnaires, compared to other data collection methods, is that they are inexpensive, as many respondents can be reached at a low cost. Another advantage is that questionnaires offer standardised data when closed questions are used, which eliminates the need for interpretation of answers and thereby simplifies data analysis. However, closed questions carry the risk that the respondents' answers will be biased to the views of the researchers, as they are the ones who decide which answer-options are available. Another disadvantage of questionnaires is that it can be difficult to achieve a high response rate, as respondents easily can ignore a request to answer a questionnaire.

### 3.2.2 Interviews

An *interview* is a communication session between a researcher and a respondent, in which the researcher controls the agenda by asking questions of the respondent. While questionnaires are appropriate for collecting simple and straightforward information, interviews are more effective for gathering complex and sensitive information. Thus, interviews are often used for eliciting emotions, attitudes, opinions, and experiences from the respondents. Interviews are also suitable for getting into contact with people who have access to privileged information, i.e. people possessing deep and unique information and knowledge about some domain.

Interviews allow for a more or less structured interaction between the researcher and the respondent. A *structured interview* follows a predefined protocol and is similar to a questionnaire, as it builds on a fixed list of questions that can be answered by choosing from a predetermined set of allowed responses. A *semi-structured interview* is also based on a set of questions, but these can be discussed in a flexible order and they are open, i.e. the respondents are allowed to formulate the answers in their own words. In an *unstructured interview*, the researcher is as unobtrusive as possible and lets the respondent talk freely about a topic without being restricted to specific questions. Structured interviews have the advantage that they can be carried out relatively fast, and that the researcher does not need to interpret the answers. However, semi-structured and unstructured interviews are better when it comes to investigating complex issues, as the respondents can express their ideas and feelings in a more unrestricted way.

When conducting an interview, researchers need to be aware of the possible effects of their personal attributes as well as the venue for the interview. Respondents may be less willing to fully disclose information to someone who is very different to them, for example, in terms of age, gender, and occupational status, especially when sensitive issues are discussed. Furthermore, the venue for an interview may affect what a respondent is prepared to disclose, for example, if the interview is carried out in an office or in the respondent's home.

A researcher should seize the opportunities for interaction in an interview. The researcher can do so by mixing closed and open questions and by prompting, probing, or checking. Prompting is about nudging the respondent to start speaking. Probing means asking for more details. Checking is to make sure that the researcher has correctly understood what the respondent stated. Through these techniques, the researcher can guide the interview so that the respondent provides answers that are as informative as possible.

The answers provided by a respondent need to be recorded and transcribed so that the researcher can further interpret and analyse them. An interview is often documented through both an audio (or video) recording and field notes, i.e. written notes taken by the researcher. While the audio recording captures all of the speech, the field notes complement with non-verbal communication. Sometimes, a respondent can refuse to record the interview, and the researcher will then have to rely only on the field notes.

A main advantage of interviews is that they allow a researcher to go into depth in order to gather detailed and complex information. Another advantage is that interviews typically have a high response rate. A disadvantage is that interviews are time-consuming, in particular the transcription and analysis processes after an interview. Another disadvantage is that the researcher's personal attributes can affect the outcome of an interview.

### **3.2.3 Focus Groups**

A *focus group* can be seen as an interview in which a group of respondents participate and discuss a specific topic. The aim of a focus group is to understand and interpret the topic from the perspective of the participants. Focus groups allow for interaction between the participants, which can enable them to be more creative and pursue the topic addressed in greater depth than in one-to-one interviews. The participants can surprise, inspire, and encourage each other to come up with novel ideas.

Focus groups need to be designed and executed so that they support free and fruitful discussions. For this purpose, researchers have two roles to play, as moderator and as note-taker. The main task of the moderator is to encourage the participants to contribute actively to the discussion. The moderator also guides the focus group, ensures that the discussion stays focused, and handles any conflicts that may arise. While the moderator is highly active in running a focus group, the

note-taker has more of a back office role, taking field notes of the discussion, including activities or movements that cannot be captured by an audio recording.

Focus groups have become popular in the social and health sciences, as they allow researchers to study the conversation and thought patterns of people in a more natural way than in one-to-one interviews. Focus groups are also cost-effective, as many respondents can participate in the same session. However, a drawback of focus groups is observer dependency, i.e. the results obtained are often highly dependent on the interpretation and analysis of the researcher, which can make them quite subjective. Strong participants in the group can also influence the rest of the participants during the focus group sessions, and, thereby, drive the discussion in a certain direction. A focus group might, therefore, not be useful for understanding the views of every participant.

### 3.2.4 Observations

*Observation* is a data collection method, where a researcher directly observes phenomena. Observation is often an alternative to questionnaires or interviews and offers the advantage that the researcher can observe what people actually do, not what they say they do or think. The researcher is in immediate contact with the observed phenomenon, as she watches or listens to people as they act in a situation where the phenomenon appears. Observation can be used within any research strategy, both in the field and in the laboratory as part of an experiment.

There are different kinds of observation, and two of the main ones are systematic observation and participant observation. *Systematic observation* addresses the *reliability* issue, which is one of the most challenging problems for observation. When two researchers observe the same situation, their accounts of it may differ widely due to differences in competence, experiences, interests, perception, etc. People do not passively record information from the environment like a camera, but they inevitably interpret it, which can result in large discrepancies in their accounts of it. In order to overcome these difficulties, systematic observation suggests a number of techniques that can help make observation more objective. The main technique is the *observation schedule*, which consists of a predefined system for classifying and recording events and interactions as they occur. It tells the researchers explicitly what they should look out for and how they are to record their observations, often by means of a checklist. An observation schedule also includes rules for the timing of observation, e.g. a schedule could state that it is to take place during 1 hour, three times a day for 1 week. By following an observation schedule, data collection becomes structured and systematic, thereby improving its reliability.

The main advantage of systematic observation is that it is structured and rigorous, which helps to produce reliable and objective results. It can also be efficient, as it allows researchers to collect large amounts of data in a short period of time. A disadvantage of systematic observation is that the data collected may be

superficial, as observation schedules can bias researchers to focus on easily observable events in isolation, meaning that they miss the context around the events.

*Participant observation* is a data collection method, in which a researcher builds a deep and close familiarity with a group of people by observing them in their daily life, often for an extended period of time. Participant observation is a key method within ethnography, since it enables the researcher to gain an understanding of a culture from the perspective of its members. In participant observation, researchers often remain covert, i.e. they do not disclose their identity and purpose to those being studied. In this way, they are able to preserve the naturalness of the setting, as people will continue to behave naturally if they do not know that they are observed by an outsider. Furthermore, participant observation allows researchers to arrive at a holistic understanding, as they are able to study the context in which people act and interact.

Participant observation can produce valid and context-sensitive results, as it enables researchers to study a phenomenon in depth and without the restrictions of observation schedules or other protocols that can limit the scope of the observations. However, the method is highly dependent on the individual researcher's competence and experiences, which may jeopardise reliability and objectivity. Another issue is that there are ethical problems when researchers act undercover, as they cannot obtain informed consent from the research subjects.

### 3.2.5 Documents

*Documents* constitute an alternative source of data, in addition to those of questionnaires, interviews, and observations. Documents often contain textual data, but they can also consist of photographs, images, audio or video files, etc. Some common types of documents are the following:

- *Government Publications*. These include official statistics, laws and regulations, political documents, official reports, and public records, such as electoral registers.
- *Organisational Records*. These include annual reports, personnel records, sales figures, company memos, and minutes of meetings.
- *Academic Publications*. These include publications in journals, conferences and workshops as well as monographs and doctoral dissertations.
- *Newspapers and Magazines*. These include daily newspapers, trade press, and illustrated magazines.
- *Personal Communications*. These include diaries, letters, emails, SMS messages, movie tickets, and to do lists.
- *Social Media Streams*. These consist of posts on social networks including blog posts and tweets.

A main issue when using documents for data collection is to assess their credibility, i.e. to determine if they are authentic, correct, and free from bias and