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Social sciences and planning

The view that social sciences are very different from other forms of science is common, hence the need to develop special methods. In section 1.1 it is argued that, although there are some important differences, modern developments both in social sciences and in what are called here *natural sciences* tend to reduce them, pointing towards a common methodological framework. This idea serves as an introduction to further sections where the scientific method for the social sciences is outlined, and then is shown the role that models play in it.

1.1 Natural and social sciences: the hypothesis of convergency

Traditionally, social sciences have been considered a very special form of science, different from biology, physics or natural sciences in general. Many arguments are put forward to support this distinction. Firstly, natural phenomena are said to be *permanent*, that is, they do not change through time. For instance, water boils at 100 °C at sea level and it will continue to do so in the foreseeable future. By contrast, social phenomena are considered to be ever-changing. As a result, theories that explain natural phenomena are permanent truths or *laws of nature*. It may well be that in natural sciences theories themselves change and old ones are replaced by new ones, but once adopted, they are considered as permanent. If social phenomena are ever-changing, social theories may be valid only for a short period of time; that is, they have a particular historical reference.

Because it is generally assumed that natural phenomena are permanent, theories that successfully explain their past behaviour have strong predictive power. In social sciences, even if a theory has been very successful in explaining a phenomenon that occurred in the past, it can only provide predictions as long as the historical conditions prevail.

Another difference that is commonly pointed out is that natural phenomena can be reproduced in the controlled conditions of a laboratory, which isolates them from unwanted externalities. The use of experiments has become a key element in the creation of knowledge in natural sciences. In social sciences it is impossible to experiment in this way, because it would be expensive, unfair to the people involved, and because the mere fact that an experiment is underway affects behaviour and hence distorts results. Social sciences are restricted because empirical evidence can only be inferred from data describing past events, and therefore a particular phenomenon can never be isolated from its complex surroundings.

Furthermore, a popular argument to explain the differences between natural and social sciences is that, since the social scientist is himself part of the social environment, his propositions are influenced by ideology and by his personal relationship with the phenomena being investigated. The natural scientist, on the contrary, is said to be neutral in that his political views bear no relationship with his research.

In spite of the strength of the arguments which attempt to make a distinction between natural and social sciences, scientists in both fields are beginning to recognise that such differences are fading, making it difficult to draw a clear line of demarcation. There are many factors that have helped to bring this about. In the last few decades, natural sciences have been shaken by the introduction of theories that have completely changed, if not contradicted, old theoretical bastions. The theory of relativity is often quoted as an example of a fundamental change in scientific thinking. Newton's law of gravity was thought to be a permanent truth, verified by innumerable experiments and able to produce successful and useful predictions. Yet relativity emerged as a new theory, and to make matters worse, it was based on little empirical evidence and difficult to prove through experiments. This was a direct challenge to *induction* as the method for creating knowledge. Induction states that scientific theories have to be inferred from direct observations of reality; for relativity this was clearly not the case. It became gradually evident that laws of nature should be understood as intellectual constructions rather than substantive real entities. Scientists became sceptical about permanent truths in general.

Nowadays, theories in natural science are simply considered as a set of propositions that attempt an explanation of real phenomena. There can be a large number of theories explaining particular phenomena, so that a scientist must choose from among competing theories the one he thinks gives a better explanation. Thus, theories are never absolute truths: they are preferred options to be replaced if no longer useful. Kuhn (1962) argues that scientists usually work with an accepted body of theories or *paradigms*. This is defined as *normal* science. However, they may come across a discovery which fundamentally contradicts or modifies an existing paradigm. A revolutionary period takes place, resulting in the replacement of the old paradigm. What has happened in this century is that the speed at which this process comes about is increasing steadily, making it difficult to distinguish between normality and revolution.

There has also been a change in the way scientists have been constructing theories about natural phenomena which brings them closer to the social sciences. The strictness between cause and effect used to be a basic principle respected by all. Between the cause 100 °C and the effect boiling water, there could be no leeway, and if the theory was to be accepted or even considered, it had to correspond exactly in all cases to the highest degree of accuracy. However, in the last few decades, this principle has been relaxed. Faced with the necessity of explaining a large number of simultaneous events, natural scientists have been creating theories in which a cause produces an effect with a certain degree of probability. Classic examples are thermodynamics and mechanical statistics. This is a relatively recent development, and it must be remembered that even Einstein abhorred the idea that in nature anything could happen by chance. Today, many natural systems in physics and biology are conceived as ever-changing entities, represented through concepts such as probabilities, likelihood, unexplained or random elements, error margins, and even catastrophes and surprises.

This has meant that both natural and social sciences are increasingly adopting similar methods. Statistics has become, perhaps, the major common ground, and an exception in the sense that it is one of the few branches of mathematics specifically developed for the social sciences and later adopted by physics and biology.

Social sciences recognised very early on the changing character of real phenomena. Marx (1847) criticised the formulation of permanent social laws which classical economists had adopted so enthusiastically. Such laws, Marx claimed, must be understood as mere human constructions, therefore, they can be adopted as long as they are useful. 'The same men who establish social relations . . . also produce principles, laws and categories, in conformity with their social relations. Thus, these categories are no more eternal than the relations which they express. They are historical and transient products.'

In the case of planning, the main subject of this book, the process of convergency has been accelerated by the fact that many disciplines that originated in the tradition of natural sciences have moved into areas like economics, town planning and architecture. Transportation engineers have expanded their area of interest from traffic to the causes that generate traffic, such as the location and socio-economic characteristics of drivers. Industrial engineers have moved from the technical aspects of productive processes, to a much broader view of the social and economic environment of production. Their contribution to social sciences is significant, the best-known being linear programming, systems analysis and cybernetics. Geography has also helped in the process of convergency, firmly incorporating urban and regional analysis into its field, and introducing many methods and theories formerly applied in physical geography.

Many authors describe this process as a *quantitative revolution* (Batty, 1976), because it represents an important change in the way of thinking. Just over a century ago, the social sciences were considered by the scientific establishment as a soft area of research, interested in subjects that nobody could seriously describe as scientific problems. In the battle for recognition, social scientists reacted by building a defensive wall, insisting that exclusive methods and a jargon of its own were required. Those initiated were expected to adopt these peculiarities wholeheartedly, and any attempts to use methods from, or analogies to, natural sciences were denounced as anathema. Nowadays, as social sciences have acquired a solid reputation, this tendency to break away has lost strength, and cross-fertilisation with other disciplines is no longer considered negatively.

In this process of convergency, the invention and increasing availability of computers has become another important common element. Social events are best described as large sets of data that are easily manipulated by computers. Once data have been stored conveniently, many different types of analysis become possible, from simple statistics to complex numerical analysis and econometrics. In the case of urban and regional studies, the possibility of building large data-banks with spatial referencing enables a kind of analysis that would be impossible without a computer.

The main contribution of digital computing is, however, the possibility of *simulation*, enabling the social scientist to perform experiments. This, it was mentioned, was something that social scientists could not do in the past. Since ideal laboratory conditions cannot be created, simulation becomes a viable substitution: instead of making experiments in real environments, the analyst recreates a simplified version of reality in a computer model. Once satisfied that the model reproduces reality to an accepted degree of accuracy, the analyst can perform experiments on the artificial environment. The importance of these experiments contributes not only to decision making in planning, but to theory building in scientific research as well.

1.2 The scientific method

Here, the process of constructing scientific knowledge is presented, based primarily on Popper's (1963, 1972) explanation. These ideas are then adapted, in a later section, to the way in which people build social knowledge, to the planning process, and to the creation of knowledge in social sciences. This leads to the discussion of two particular cases: the social scientist and the planner.

For a long time it was thought that a scientist distinguished himself from other intellectuals because he used facts to support his statements about the real world. This process of building hypotheses on accumulated observations of specific instances is known as *induction*, and was originally described by Bacon. According to this method, the scientist identifies a phenomenon located at some point on the fringe between what is known and what is ignored. Scientists collect information about the phenomenon until several hypotheses can be formulated in order to explain it. Discussion then takes place and the hypothesis that manages to collect the largest number of corroborating facts becomes the accepted truth. The frontier between knowledge and ignorance is then pushed one step further, and a completely new area of research becomes available.

Induction is based on the principle that confirming evidence is the proof a particular hypothesis requires in order to be accepted, and therefore is the basis for the creation of scientific knowledge. However, it is clear that even if overwhelming confirming evidence leads us to believe that a certain hypothesis is correct, it does not necessarily demonstrate it. Popper (1963) uses the statement 'all swans are white' as a classical example to explain this; based on this hypothesis, a scientist can devote a considerable amount of energy looking for white swans, obtaining thousands of confirming events to show that the hypothesis is true. The magnitude of the confirming evidence may be such that we may be induced psychologically to believe that we have arrived at an absolute and permanent truth, and zoologists can work happily and creatively on this basis for years – until someone discovers a single black swan. The conclusion is, then, that confirming evidence does not necessarily prove anything, yet this was thought to be the basis of all scientific knowledge. This disturbing argument was first put forward by Hume, and is known as *Hume's problem*.

To solve it, Popper proposed the concept of *logical asymmetry* between verification and falsification, which simply states that even if no amount of confirming evidence can demonstrate the truth of a statement, a single piece of refuting evidence falsifies it. This, however, must not be regarded as unfortunate, because it is precisely the refuting evidence that allows the scientist to improve upon his previous statement. In the above example, the original statement can now become 'not all swans are white', or better still, the scientist can look for an improved statement that describes swans in terms other than colour, such as the genetical structure and other elements, resulting in a more general statement which at the same time contains more information. Therefore, to create knowledge, scientists should always look for refuting rather than confirming evidence.

According to Popper, the fact that a particular statement is potentially subject to refutation, establishes the *criteria of demarcation* between science and non-science. For example, the statement 'the sun will rise tomorrow between 6 and 9 a.m.' is a scientific statement, because even if it might have a high degree of probability in particular latitudes, there is always a chance that it might fail to be true. The statement will run a greater risk if it is modified to 'between 7:30 and 7:32 a.m.', but it will be more useful. For this kind of statement it is always possible to devise an experiment that can potentially put the statement at risk. By contrast, a statement like 'Buddha is eternal' might be considered by millions as an inspiring and useful idea, but since it is impossible to refute, it cannot be considered as a scientific statement.

Popper also explains the construction of knowledge as a social process, in which three *worlds* can be distinguished: world one, the world of existing material things; world two, the world of individual minds where the process of building knowledge takes place; and world three, the world of culture, books, works of art, schools, institutions, traditions, and so on, where knowledge is accumulated. World three, then, exists independently of individuals, and for this reason is called *objective knowledge*.

The scientific process is as follows: the phenomenon being investigated exists in world one; theories are devised in world two in the form of potentially refutable propositions, which are then tested against world one events; preferred theories are added to previous knowledge, becoming objective knowledge in world three. Previously accumulated objective knowledge affects the way in which individuals perceive the real world, and provides the cultural background in the process of testing and selecting a preferred theory.

Whether or not individual solutions are accepted, they become part of objective knowledge. This is where intellectual products are stored, so that others can use them in the next cycles of scientific research. A rejected theory can be as valuable as accepted ones, because eventually it may become accepted, or because parts of it can be used to assemble an improved theory, or simply because if it failed the tests, the question as to why it failed gives rise to problems that would otherwise have remained unnoticed.

The way in which the scientific method is structured is also important. The traditional inductive method is a linear process, where the starting element is observation. The next stage in the process is generalisation, from which a hypothesis is *induced* and then tested through experimentation. If the tests provide sufficient confirming evidence, the successful statement becomes knowledge.

Popper argues that simple observation of reality cannot be the starting point in the process of research. What is chosen as a subject for observation is determined by the need to solve problems. Problem identification replaces observation as the driving element in the scientific method, after which a proposed solution (new theory) leads to the deduction of testable propositions. After tests (attempted refutations), a preference must be established between competing theories. Once a preferred solution has been decided, new problems arise, beginning the process all over again. The scientific method becomes cyclic or iterative, rather than linear. The inductive method and Popper's proposition are compared in figure 1.1.

1.3 Social phenomena and social objective knowledge

The approach presented above is particularly relevant to social phenomena, and in this section a particular adaptation of Popper's scientific method is proposed. The idea of the three worlds, to start with, can be usefully applied to social events in general. All individuals, human organisations and their relationship with the environment constitute world one. At the same time, each individual member of society constitutes world two and, as such, identifies a set of problems, conditioned by his cultural, ideological and political background. This background, the storehouse of accumulated experiences of society,

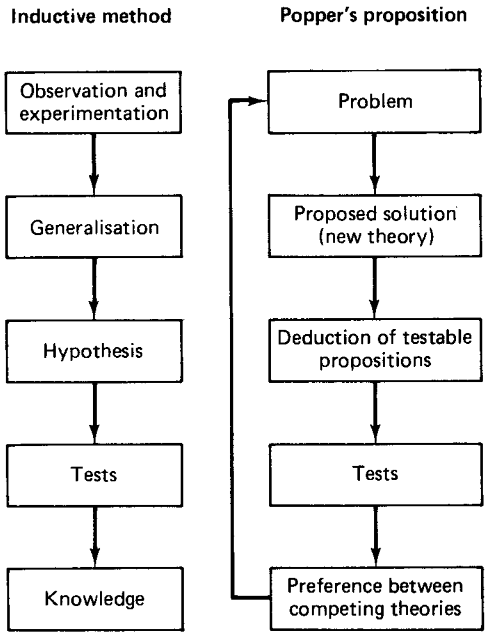

Figure 1.1. The scientific method – induction and Popper's proposition

constitutes world three, social objective knowledge. Within world two, individuals devise alternative solutions to the problems they have identified, in the form of proposed courses of action, rather than scientific theories.

If Popper's description of the scientific process is followed strictly, the next stage should be the deduction of testable propositions, that is, experiments or attempts to refute the alternative solutions. In the case of social events, however, individuals cannot perform experiments. They can, instead, resort to historical evidence by assuming that if a certain course of action did or did not work in the past, it similarly might or might not work in the foreseen future.

Each individual will decide among alternative courses of action open to him according to the level of benefit he expects from each one. In other words, individuals will estimate the benefits that each alternative course will produce, should they carry it out, and then opt for the one they think will reward them with the highest benefits. This is roughly what is called utility maximisation in economics. But how are individuals able to estimate the expected benefits? For this, they must have some idea of how society is structured, of the way in which they relate individually to the rest of society, and of how other individuals or groups will react to their own actions. Each individual will understand his social environment in a particular way, and will conceive of society as a set of elements (the state, institutions, social groups, etc.) and a set of relationships among them. In other words, each individual will have, consciously or unconsciously, a *model* of his own social environment.

Individuals will use their models of society to test the proposed courses of action in an imaginary and anticipated way. From these simulated tests, a preferred solution will emerge and action will follow, modifying world one. Action, however, may or may not produce the anticipated effects. The similitude between the anticipated effects and the outcome of the actions in real terms will depend on the accuracy of the model, on the action taken by others, and on other unpredicted events.

All courses of action will become part of world three, the objective knowledge of society. New problems will emerge, because the social environment changes, because corrections to previous actions are necessary, or as a direct consequence of the actions taken. The main feature of this process, in which a large number of individuals are simultaneously defining problems, testing alternative courses of action with numerous models, and finally acting simultaneously upon a common social environment, can be defined as the *multiplicity of social objective knowledge*.

Failure to recognise this multiplicity can lead to misconceptions. Popper (1966) himself assumes that there is a certain oneness in the creation of social knowledge, which is true, but only to a certain extent. In a way Popper makes a straightforward translation from his own description of the way in which scientists create knowledge to the way in which society builds social knowledge. In order to encourage this process, Popper (1966) proposes an *open society*, in which criticism, discussion and the principle of refutation are the means of developing social knowledge. Campbell (1969) uses a similar idea to define an *experimental society*, where real-life tests are regularly carried out to increase social knowledge. Batty (1975) describes this as a *social learning* process, but recognises the existence of conflicts. Social groups can have different, conflicting goals and thus might consider a proposed solution to a common problem as against their own interests. The role of the planner, according to this view, consists of identifying these conflicts and providing channels of communication in order to arrive at compromise solutions, halfway between two conflicting interests.

From a Marxist point of view, the possibility of achieving consensus or even compromise is limited in a class-structured society, because basic conflicts like the exploitation of labour by the owners of the means of production are unsolvable. The only possible solution is to achieve a classless society, i.e. to abolish private ownership of the means of production: only then can conflicts (these would still exist) be solved.

It can be concluded, then, that social processes are much more complicated than scientific ones because of the two factors described above: multiplicity and conflict. All members of society are actively working in numerous worlds two, so that the preferred solution in the scientific process becomes a large number of courses of action, often contradicting each other. A new social situation emerges as a result of these numerous actions, forcing their way through a network of social relationships. The degree of success of each individual will depend on his share of power within the social structure, as much as of the rightness of their actions. In order to increase their influence, individuals will tend to group with others whose model of society is similar, and with whom compromise lies within an acceptable range. This leads to political parties, trade unions, action groups, and so on. Each group will create its own objective knowledge.

1.4 Social scientists and planners

The process described above applies to all members of a particular society, but there are two special cases that deserve further discussion: the social scientist and the planner.

1.4.1 The social scientist

The aim of the social scientist is to improve knowledge about social phenomena. In order to achieve this, he will follow roughly the same process described above for all scientists.

The first question that can be raised is: to what extent is the social scientist biased in his research because of the fact that he is an active member of the society which constitutes his subject matter? The answer must be that, from the stage of problem identification to the final creation of knowledge, the social scientist is conditioned by his position in society, his cultural background and his political views. But the same can be said of any scientist. When a physicist or a biologist chooses his subject of interest, he is also conditioned by his social environment. What is certain is that the subjectivity of science in general cannot be considered as a deficiency. The fact that a scientist belongs to society does not blind him; it merely provides him with a necessary perspective, and vision and perspective go together. On the other hand, problems, whether natural or social, are problems because they affect people; if they did not, they would not be worth investigating. The only source of information available to a scientist to help him decide which are the most relevant problems and to motivate him to solve them, stems from his particular position in society.

The social scientist, then, can be seen as an active member of society investigating his own environment, in the same way as any other scientist would proceed with respect to any other subject. The fact that he belongs to society is precisely what enables him to identify problems, in this case, a particular social phenomenon of relevance. He will formulate one or more theories to explain the problem at hand, and from these he will derive testable propositions. It was said that in the case of social sciences, laboratory-type experiments cannot be performed, so that the scientist must resort to models. Models are, then, testable propositions derived from theories.

A simple example may be useful at this point. A scientist identifies education as a problem in a particular city, because he realises that students with similar IQs perform differently. He elaborates a theory that explains this as due to two factors: crowded classrooms and the educational level of parents. This theory as such cannot be tested in the traditional way, because the scientist cannot change the teacher/student ratio or the educational level of parents for the sake of the experiment. But he can build a model which states that the level of performance measured, say, in terms of success rates in examinations, is a linear function of the teacher/student ratio, and of an index of parental education. He can then collect the relevant data and test the model.

From this example, several conclusions can be drawn. Firstly, a model is a reinterpretation of a theory in a testable form. Next, it must be noted that from a single theory several models can be built. For example, it could have been an exponential function instead of a linear one, or the variables could have been measured in different terms. It is also possible that the same model can be used to test different theories, for instance, that the educational level of parents plays only a minor role. The results of the tests will help the scientist to establish a preference among the competing theories. It can also be concluded that if the tests are carried out with reference to a particular case, say the secondary schools in Bombay, the theory can be established at that level, but if a more general statement is sought, tests should be carried out with a much broader data set. Therefore, certain theories can be considered valid only for certain realities. Equally, and because of the changing character of society, theories may be valid for particular historical instances, but not for others, so that theories should be updated periodically.

1.4.2 *The planner*

The planner has a more direct involvement because he participates actively in the decision-making process of society. The problems he identifies might be the same as those identified by the social scientist, but the solutions he considers are courses of action rather than explanations or improved theories.

The planning process can also be viewed in a cyclical way, as shown in figure 1.2. The first step in the planning process is the identification of a problem. The planner then formulates a set of alternative courses of action in order to solve the problem. The planner will also have a theory about the way in which reality is structured, and about how it will react to the changes being considered. Planners will then test their proposed solutions, and in order to do so, they will simulate them with a model derived from the theory. The model can be expressed in a variety of forms, such as verbal, physical or mathematical. Simulation will produce as a result the probable effects of each alternative course of action.

The results of the simulations are then pre-evaluated in order to assess the positive or negative effects that each alternative course might produce on the various social groups and on the physical environment. This is called *pre*-evaluation because it takes place before action is carried out. Once alternatives have been compared, a preference must be established.