Induction

Chapter · August 2008

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To cite: Fox, N.J. (2008) Induction. In: Given, L.M. (ed.) *The SAGE Encyclopaedia of Qualitative Research Methods.* London: Sage.

In scientific research, induction is a form of reasoning used in pursuit of understanding and knowledge, establishing a relationship between observations and theory. Science applies inductive reasoning to establish theories, the purpose of which is to remove the need for continual observation in order to make statements about reality, using past experience to generalise with reasonable levels of certainty about the future. Research approaches that generalise from a particularity (typically a set of observations of some sort) to a broad statement such as a theory or general proposition concerning a topic apply inductive reasoning. Inductive reasoning in science is sometimes contrasted with deduction (q.v.), or more properly, the hypothetico-deductive method, in which sense is made of data by locating it within a general or theoretical context. However induction and deduction may better be considered as complementary components of scientific reasoning.

It has been suggested that induction is of particular importance in qualitative research approaches. Induction lies behind any effort to generate general statements based upon observations, or efforts to develop theory from empirical data. For example, interview or ethnographic data (particularities) may be used to propose broad understanding or theories (generalities) that are intended to apply beyond the sample of subjects interviewed or observed. Whenever such general statements are made, inductive reasoning is required. The validity of reasoning may be supported by probabilistic or statistical assessments, by recourse to claims concerning representativeness, triangulation with other data sources, previous research, knowledge or experience, or by analogy with similar generalisations. In qualitative research, inductive reasoning is used whenever it is argued that an explanation or theoretical framing of data from a small sample should be applied more generally. Such generalisations face the 'problem of induction', however.

The Problem of Induction

Because induction involves inference, the outcome of inductive reasoning is never binding, as a contradictory case may always overturn the generalisation. For instance, if it is argued inductively that (based on a series of observations), all birds fly, this reasoning can be overturned when a single flightless bird is observed. Philosophers have identified this as the 'problem of induction', arguing that all theory must be regarded as tentative and prone to being overturned if a contradictory observation is made. This 'problem' faces all using

research (whether as practitioners and users or as researchers), especially if theory is contested, as it may often be within the social sciences. Inductively-derived theory may provide reasonably dependable propositions that allow people to trust in certain regularities in everyday life, be it in the home or the laboratory. Within the natural sciences, induction has led to many theories that appear to operate in many settings (for example, the 'laws' of physics or of chemical reaction). However, in the social sciences, the numerous factors that may affect phenomena, the role of reflexive subjectivity in determining many processes, and the dependency upon context, all mean that theories may not survive translation into settings other than those where they were initially developed. When appraising research based on inductive reasoning, users (be they practitioners or social scientists) must always exercise caution, particularly if they seek to generalise the findings beyond the case or setting described. They may also choose to postulate alternative explanations of data, using rival inductive reasoning. This has also been described as the 'under-determination of theory by data'.

Philosophers of science have argued that the problem of induction can be overcome partly by incorporating inductive and deductive reasoning within the practice of science. Deductive reasoning contributes to scientific knowledge whenever a general theory, proposition or axiom is used to explain observational data, and much scientific activity involves 'puzzle-solving' using an established theoretical framework rather than development of new theory. The philosopher of science Karl Popper suggested further that scientists should intentionally seek out data that can falsify current theory. Growth in knowledge occurs as falsified theories are replaced by rival theories that explain a wider range of data. However, this does not replace induction within the research process, as inductive reasoning is still required to develop new theory on the basis of cumulative observations.

Induction in Qualitative Research

Inductive reasoning is used to develop generalised propositions, hypotheses and theory from empirical observations in all natural and social scientific disciplines. In social science research, inductive reasoning is of particular relevance in qualitative approaches that are used to extend existing theory into a new setting, or to develop understanding and theory where none currently exists. Methodologies such as 'grounded theory' (q.v.) use induction to

systematically develop higher-level propositions that explain the structure of data. Theory here is grounded within the data that has been gathered, the intention being to make claims about the factors that determine not only the activities of the sample but of the category of actors from which the sample has been drawn. Thus for example, a study of old people living in residential homes may reason inductively from interview data with a sample of 20 that dependency, infirmity and fears for the future are factors that more generally impact on the population from which this sample has been drawn.

Such inductive inferences are highly contestable, because the under-determination of theory by data permits rival theoretical elaborations from the same data set, as well as the relatively small sample size in most qualitative research designs. For this reason, qualitative researchers are generally cautious about generalisation beyond the setting in which data has been collected. However, theory generated by this kind of research is rarely submitted to falsification using the kinds of hypothetico-deductive approaches outlined above. Analytic induction (q.v.), developed originally by Florian Znaniecki, is one attempt to improve the generalisability of qualitative research by incorporating induction and deductive reasoning. In this approach, hypotheses developed by inductive reasoning from data are systematically tested against fresh data to progressively develop more universal rules or theory. Cases studies are used to stimulate theory-building, and to probe the plausibility of these theoretical formulations. Crucial case studies are used to attempt to falsify theory, and must be selected based on a full understanding of the field of study. When no cases can be found that falsify the theory developed during the research programme, this assures higher generalisability.

Induction is a key element of scientific reasoning in qualitative research studies that seek to develop theory or models, but as an approach to knowledge growth is limited by the problems of generalisation beyond the specific research setting.

See also **analytic induction**; **deduction; grounded theory**

Further readings

Alvesson, M. and Skoldberg, K. (2000) *Reflexive Methodology. New Vistas for Qualitative Research.* London: Sage.

Martin, R.M. (1997) *Scientific Thinking*. Peterborough, ONT: Broadview Press.