



Scientists' attitudes on science and values: Case studies and survey methods in philosophy of science



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ABSTRACT

This article examines the relevance of survey data of scientists' attitudes about science and values to case studies in philosophy of science. We describe two methodological challenges confronting such case studies: 1) small samples, and 2) potential for bias in selection, emphasis, and interpretation. Examples are given to illustrate that these challenges can arise for case studies in the science and values literature. We propose that these challenges can be mitigated through an approach in which case studies and survey methods are viewed as complementary, and use data from the Toolbox Dialogue Initiative to illustrate this claim.

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1. Introduction

Philosophers of science have widely debated the topic of values in science, articulating a variety of contrasting positions on the proper role of non-cognitive or non-epistemic values¹ (Douglas, 2000, 2009; Elliott, 2011; Harding, 1986, 2015; Jeffrey, 1956; Kourany, 2010; Lacey, 1999; Longino, 1990, 2002; Rudner, 1953; Shrader-Frechette, 1991; Steel, 2010). Much of this work is naturalist in orientation, and typically that involves close attention to and respect for how scientists think and operate. However, despite previous quantitative survey work in philosophy of science (see Griffiths & Stotz, 2008; Stotz, Griffiths, and Knight 2004), little in the way of survey research exists about the attitudes of scientists on philosophical questions about values in science.² In this article, we consider implications that such data might have for philosophers working on science and values, and we present some preliminary empirical data to illustrate our claims.

We approach this topic by way of literature that raises critical methodological questions about the use of case studies in the philosophy of science (Faust & Meehl, 2002; Kinzel, 2015; Machery & Cohen, 2012; Pitt, 2001). Two methodological concerns can be helpfully extracted from this literature:

1. Small Samples: A small number of cases are not a sufficient basis for generalization about science.
2. Potential for Bias: Cases are often generated in a manner that does not adequately guard against biases in selection, emphasis, and interpretation.

We give several examples to illustrate that these concerns are also relevant to case studies in the philosophical literature on science and values. Our positive proposal is to suggest that the concerns highlighted in 1 and 2 can be mitigated by an approach that treats cases studies and surveys as complementary.

Combining survey and qualitative methods in case studies is a longstanding methodological approach in social science (Gable, 1994; Larsson, 1993; Morgan, 2012; Yin, 1981). In this article, we suggest that such an approach can be useful for philosophical discussions of values in science. It can combine, for example, the potential of survey research to discover systematic variation in practices or attitudes of scientists according to discipline, gender, or other factors with the ability of case studies to provide nuanced, in-depth analyses of local details. Indeed, we suggest that this complementary relationship is well illustrated by the process of survey validation, wherein a combination of qualitative, context specific

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¹ Throughout we use 'values' to refer specifically to non-epistemic values unless otherwise noted.

² Several studies do exist that survey scientists' views on values issues in specific fields, such as ecology (Nelson & Vucetich, 2009; Reiners et al., 2013; Steel, List, Lach, & Shindler, 2004), or topics, such as toxic chemicals (Kraus, Malmfors, & Slovic, 1992; Slovic et al., 1995), genetically modified foods (Gaskell, Allum, Wagner, & Kronberger, 2004), or airborne particulate matter (Spruijt, Knol, Petersen, & Lebre, 2016).

approaches are often used in tandem with quantitative methods to assess how well a survey succeeds at measuring what it is intended to measure.

We illustrate our argument with data drawn from the Toolbox Dialogue Initiative, an NSF-funded initiative that uses a workshop-based dialogue method to understand and facilitate collaborative, interdisciplinary science (O'Rourke & Crowley, 2013). The central insight of the Toolbox Dialogue Initiative is that interdisciplinary scientific collaborations are often hindered by implicit philosophical presuppositions about the nature of science that vary according to discipline (or at least often across collaborators). The Toolbox Dialogue Initiative produces both survey data in the form of responses to questionnaires and qualitative data in the form of transcripts of participant discussions. Moreover, Toolbox workshops can be viewed as cases in their own right insofar as they involve a context that is relevant to understanding the practice of scientific collaborations. Thus, data from the Toolbox Dialogue Initiative illustrate our central proposal concerning the combined use of case study and survey approaches in the study of philosophical issues related to science and values.

2. The methodology of case studies in philosophy of science

For the purposes of this article, we understand a philosophy of science case study to be a description of an episode of actual scientific research or practice used to support a philosophical claim. Philosophy of science case studies—henceforth, just ‘case studies’—often involve an in-depth analysis of distinct sources of information about a topic, such as publications, laboratory notes, correspondence, or interviews, and result in a narrative linked to a philosophical idea or proposal (cf. Burian, 2001, pp. 384–385; Morgan, 2012, p. 688). However, given our understanding, case studies can vary in their level of detail, scope, and multiplicity of source materials. Some case studies may be based upon only a few publications, while others reference archive materials and biographies of leading actors. And while quantitative data and methods of analysis can be used in conjunction with case studies (Morgan, 2012, p. 688), such an approach is rare in philosophy of science (Machery, 2016).

Several philosophers of science have raised methodological concerns relating to case studies. For example, Pitt (2001, 373) argues that case studies face a dilemma of being chosen to fit a predetermined philosophical position or being standalone curiosities from which no philosophical generalizations about science can be made. From this dilemma, Pitt concludes, “even very good case studies do no philosophical work. They are at best heuristics. At worst, they give the false impression that history is on our side” (373). Faust and Meehl (2002) raise two similar concerns about case studies in philosophy of science: “First, the data base of scientific episodes or occurrences is massive and growing rapidly. ... Second, relations between the methods that scientists employ and the outcome of their efforts are largely probabilistic, not deterministic” (2002, S186). The first of these points cautions against generalizing from a small number of cases, while the second is a concern about bias in case selection. That is, given the probabilistic relationship between methods and outcomes, a philosopher who advocates method A and opposes B can always find cases in which A succeeds and B fails.

Kinzel (2015) develops these ideas in further detail with “a narratological account of historical case studies,” according to which a case study is a type of historical narrative that involves *selection*, *emphasis*, and *emplotment* (Kinzel, 2015, p. 51). Selection consists of choosing a case out of the many possible and carving out its boundaries. Emphasis concerns which aspects of the case are treated as salient and important and which are consigned to the

background. Finally, emplotment has to do with how the events are pieced together to construct a story that conveys a coherent message. Kinzel suggests that selection and emphasis are likely to be theory-guided, insofar as they are influenced by each philosopher's theoretical commitments. Furthermore, emplotment is likely to be theory-laden, insofar as the meaning ascribed to the case is likely to be heavily shaped by one's philosophical perspective (Kinzel, 2015, p. 52).

The above discussion highlights four methodological concerns related to case studies in philosophy of science that can be labeled as follows: small samples, and biases related to selection, emphasis, and interpretation. We use the terms ‘selection’ and ‘emphasis’ in a similar manner as Kinzel, but note that emphasis bias is selection bias within a case. That is, selection bias occurs when unrepresentative cases are used to support philosophical generalizations about some aspect of science. This could happen for a number of reasons, for instance, because the choice of cases is driven by an author's theoretical views or because the cases the author happens to be familiar with are atypical in some relevant respect. Once a case has been chosen and its borders set, decisions about which aspects of the case to emphasize can be similarly biased. A case often consists of a large number of elements (events, scientists, documents, etc.) and which are emphasized can be significant for which philosophical morals it suggests. As illustrated below, authors do not always precisely define the boundaries of their case studies, and as a result the distinction between selection and emphasis bias is not always clear. Our use of ‘interpretation’ is somewhat similar to Kinzel's ‘emplotment.’ An interpretation is an inference from a case study to a philosophical claim about science, often of a normative nature. For example, a case might be interpreted as supporting the claim that the ideal of value-free science is feasible and desirable, and that criticisms of it are mistaken.

All four concerns discussed in the previous paragraph (small samples, selection bias, emphasis bias, and interpretation bias) create challenges for generalization from case studies. We take this point to be obvious for small samples and selection bias, but it also goes for emphasis and interpretation bias: misplaced emphasis within cases or mistaken interpretation of cases, even when the sample is large and representative, may result in generalizations that go significantly awry.³ In addition, emphasis and interpretation bias can raise concerns about inferences within cases. Even if no attempt is made to generalize beyond the case at hand, biases in emphasis and interpretation may result in problematic conclusions. This latter point is important. While case studies are sometimes used to support philosophical generalizations, they can also be used in other ways, for instance, to show that something is possible or to refute a general claim.

To illustrate the above issues, consider two examples from influential philosophical work on science and values.⁴ In her (2009) book, *Science, Policy, and the Value-Free Ideal*, Douglas criticizes the ideal of value-free science and defends an alternative proposal that relies on a distinction between direct and indirect roles of values. In a direct role, values “act as reasons in themselves to accept a claim,” while values occupy an indirect role when they “help to decide what should count as sufficient evidence for a claim” (2009, 96). According to Douglas, values in an indirect role “can completely saturate science, without threat to the integrity of science” (2009,

³As Kinzel (2015, pp. 50–51) points out, this explains why merely examining a larger, more representative sample of cases would not adequately address methodological challenges confronting the use of case studies in philosophy of science.

⁴For further examples, see Douglas's (2000) examination of dioxin research, Kourany's (2010, 69–75) discussion of Carolyn West's research on domestic violence, Longino's (2013) analysis of behavioral research on aggression and sexuality, and Winsberg's (2012) study of climate change modeling.

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