

Narrative and Evidence.

How Can Case Studies from the History of Science Support Claims in the Philosophy of Science?

Katherina Kinzel

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Abstract

A common method for warranting the historical adequacy of philosophical claims is that of relying on historical case studies. This paper addresses the question as to what evidential support historical case studies can provide to philosophical claims and doctrines. It argues that in order to assess the evidential functions of historical case studies, we first need to understand the methodology involved in producing them. To this end, an account of historical reconstruction that emphasizes the narrative character of historical accounts and the theory-laden character of historical facts is introduced. The main conclusion of this paper is that historical case studies are able to provide philosophical claims with some evidential support, but that, due to theory-ladenness, their evidential import is restricted.

Keywords

HPS, confrontation model, historical case studies, historical evidence, narrative, theory-ladenness

1. Introduction

It is widely accepted that philosophical conceptions of scientific knowledge and practice need to be adequate to the historical record of science. A common method for warranting the historical adequacy of philosophical claims and doctrines is that of relying on historical case studies. Often, and in a wide variety of philosophical areas, reconstructions of selected episodes from the history of the sciences are supposed to exemplify conceptual points or provide philosophical doctrines with evidential support.

For example, defenders of various types of scientific realism have claimed the historical record to agree with their philosophical agendas. The historical fates of the

luminiferous ether (Hardin and Rosenberg, 1982; Kitcher, 1993; Worrall, 1994; Psillos, 1999), the caloric theory of heat (Psillos, 1999) and phlogiston theory (Ladyman, 2011) were taken to support realists' claims about the continuity of reference or about the preservation of approximately true theoretical constituents across theoretical ruptures. Yet anti-realism too has claimed to be supported by the historical evidence. Case studies of historical developments in fields such as quantum mechanics (Cushing, 1994) and hereditary theory (Stanford, 2006) exemplify the (transient) underdetermination of scientific theories. Social constructivists have heavily relied on case studies as well. Attempting to demonstrate to skeptics that even the so-called hard sciences are amenable to sociological analysis, they have presented social explanations of the emergence of the standard model of particle physics (Pickering, 1984), of the early searches for high fluxes of gravitational radiation (Collins, 1985), of the detection of solar neutrinos (Pinch, 1986), and of Millikan's oil drop experiments (Barnes, Bloor, and Henry, 1996). At present, case studies continue to play a role in the philosophical exploration of more restricted issues, such as the workings of scientific modeling practices, the robustness of scientific results, scientific concept formation, visualization in science, and so on.

In most of these areas, historical case studies have been taken to provide philosophical claims with independent evidence. They are sometimes even thought to settle philosophical conflicts, since they seem to allow for an assessment of which philosophical doctrine agrees most with the historical facts. And yet, the idea that history provides the philosophy of science with unproblematic evidence in the form of case studies has an air of naïveté. Problems arise with regard to how episodes are chosen for analysis, how we can infer from a limited number of historical cases to a general philosophical claim, what constitutes a historical fact, whether and how historical reconstructions are informed by philosophical commitments, what type of evidence they offer exactly if so informed, and how to deal with the existence of plural, conflicting case studies.

This paper addresses some of these questions. It seeks to clarify what evidential functions historical case studies can play in the context of philosophical debates. It argues that in order to assess case study evidence, we first need to understand the methodology involved in producing historical case studies. It therefore presents an account of the historiography of science that emphasizes the narrative character of historical accounts and the theory-laden character of historical facts. The main conclusion of this paper is that

historical case studies are able to provide philosophical claims with some evidential support, but that, due to theory-ladenness, their evidential import is restricted.

The paper has five parts. In the first part I discuss some recent contributions to HPS methodology, most importantly Jutta Schickore's criticism of the so-called "confrontation model". I argue that while the confrontation model is indeed as problematic as Schickore suggests, the intuition that historical case studies provide evidence to philosophical claims need not be equally misguided. The second part presents a narratological account of historical case studies and explores the ways in which historiography is a constructive endeavor. The third part explains in which sense historical facts are theory-laden. The fourth part distinguishes between different evidential functions that historical case studies may be said to fulfill: providing novel information, forcing belief revision, confirming philosophical claims, and adjudicating between conflicting philosophical views. Having distinguished between these four evidential functions, in the fifth part I offer an analysis of how case studies can support philosophical claims despite being theory-laden. I argue that case studies do provide some degree of empirical confirmation despite being laden with theoretical assumptions, but that their evidential import is limited. They can fulfil some, but not all of the evidential functions distinguished. In particular, they fall short of adjudicating between conflicting philosophical doctrines.

Before I begin my discussion, I need to add a word on the focus of this paper. First, this paper is not about the relations between the history and the philosophy of science in general, nor about the many different roles that historical arguments may possibly play in the philosophy of science. There exist various forms in which historical research and material may inform and become relevant to the philosophy of science. Yet in this paper, I restrict my discussion to a specific "genre" of historical writing, namely case studies. Second, my arguments concern the use of case studies for the empirical justification of philosophical claims. There exist other uses of case studies worthy of discussion, heuristic, hermeneutic and illustrative uses for example. In this paper, I do not put a strong focus on such non-evidential uses. I am primarily concerned with empirical justification, and with whether historical case studies can provide it.

2. Historical evidence and the confrontation model

The intuition behind philosophical use of case studies is often inductivist. More than merely exemplifying philosophical theses, the use of case studies conveys the expectation that there will be more cases similar to the one described, and that therefore the actual episode under study reveals some general or at least typical features of the scientific endeavor.

Unfortunately, this makes philosophical uses of historical case studies vulnerable to a version of the problem of induction. Given that the field of history is vast and complex, defending a general philosophical interpretation of scientific knowledge on the basis of a small set of historical cases is objectionable. The cases may have been selected simply because they accord with the philosophical picture defended, while other historical episodes that would be harder to reconcile it with have been ignored. Thomas Nickles warns that history is similar to Bible exegesis: “if one looks long and hard enough, one can find an isolated instance that confirms or disconfirms almost any claim” (Nickles, 1995, p. 141). On the basis of similar considerations, Joseph Pitt detects a dilemma in the philosophical use of historical case studies:

On the one hand, if the case is selected because it exemplifies the philosophical point being articulated, then it is not clear that the philosophical claims have been supported, because it could be argued that the historical data was manipulated to fit the point. On the other hand, if one starts with a case study, it is not clear where to go from there – for it is unreasonable to generalize from one case or even two or three. (Pitt, 2001, p. 373)

The dilemma between top-down manipulation and bottom-up insignificance leads Pitt to claim that even the best historical case studies cannot do any philosophical work. At worst, case studies may lure us into agreement by giving “the false impression that history is on our side” (ibid.). Case study evidence, according to Pitt, is not evidence at all. If we seek to retain the common practice of supporting philosophical views with historical case studies, it seems we ought to find a way to avoid this harsh judgment. We ought to show that Pitt is wrong.

Jutta Schickore develops a criticism of Pitt’s dilemma in the context of her discussion of the “confrontation model of HPS” (Schickore, 2011, p. 468). The

confrontation model consists of a set of assumptions about the relations between historical research and philosophical analysis that became dominant when the project of naturalizing philosophy of science began to flourish. In the model

accounts of past scientific episodes function like empirical data for the construction of scientific theories. They are the starting point for generalizations about science or the basis for tests of general theories of science.(Schickore, 2011, p. 468)

The model is thus structured by the opposition between general and particular –the philosophy of science formulating general claims on the one hand, the history of science providing evidence about particular cases on the other. Moreover, it assumes that philosophical hypotheses and historical evidence are produced independently of each other, and envisions their relation as a post hoc confrontation.

Although the model usually remains implicit, structuring the rhetoric that surrounds the evidential uses of case studies, there exist some examples that illustrate the model in a particularly clear manner. One such example is Arthur Donovan's, Rachel and Larry Laudan's *Scrutinizing Science* project (R. Laudan, L. Laudan, and Donovan, 1988; L. Laudan, 1989; for critical discussion see Nickles, 1986; Radder, 1997). The project seeks to test existing theories of science against the historical record. Each contribution to the volume confronts the empirical claims that are entailed in a specific philosophical account of scientific change with a historical case study. The methodology is hypothetico-deductivist, with philosophy presenting the hypotheses and history the tests.

Another variant of the confrontation model can be found in debates on scientific realism. Putting forward his famous attack on the no-miracles argument, Laudan presents a list of past scientific theories that were empirically successful at the time but turned out to be either non-referring or false. He makes this list into the basis of a pessimistic projection about the epistemic status of current and future scientific theories. But while he claims that the list "could be extended *ad nauseam*" (L. Laudan, 1981, p. 33), realists typically deny that successful but false theories are very common in the history of science. They attempt to reduce the inductive base of Laudan's challenge by arguing that only predictively successful theories of mature sciences are at issue(Boyd, 1984; Worall, 1994, p. 335) and they seek to reconcile the remaining mature and successful theories on the

list with the realist picture of truth preservation (Psillos,1999, pp. 115-145). The underlying assumption is that philosophical positions stand or fall by whether they provide valid generalizations of the historical record of science.

It is fairly obvious that Pitt's dilemma too is based on the assumptions of the confrontation model. Because philosophical claims and historical reconstructions are supposed to be independent, any philosophical guidance in the selection and interpretation of the historical material is suspect of illegitimate manipulation. Because philosophical claims are assumed to be general while historical cases are particular, a single case study is philosophically insignificant.

One way to avoid this dilemma is to abandon the model it is based on. But where exactly does the confrontation model go wrong? For Schickore, the problem lies with the analogy with science. "[T]he confrontation model (...) portrays philosophical analysis as akin to the practice of natural science, as a practice of constructing a general theory, producing data, and confronting the theory with the data"(Schickore, 2011, p. 471). In this way, it neglects that philosophical analyses of science are dependent on hermeneutic acts of interpreting, clarifying and explicating scientific concepts and arguments (ibid.).¹

Consequently, Schickore's alternative proposal for HPS is hermeneutical. Schickore presents her approach as a continuation of earlier contributions to the debates on the "marriage" between the history and the philosophy of science. According to her, in reflections by Peter Achinstein (1974), Ernan McMullin(1974), and Richard Burian (1977) looms a hermeneutic alternative to the confrontation model. This alternative conceives of the analysis of science as a project in which historical and philosophical research are not clearly distinct: the historical case is approached on the basis of initial interpretative concepts, but these concepts, in turn, are modified in response to the findings that they enable(Schickore, 2011, pp. 471-473).Schickore's proposal is also historicist, in that it is based on the maxim that understanding something depends on understanding how it came about. The philosophical value of historical case studies thus lies in their contributing to a hermeneutic "history of the present". By providing an understanding of how present scientific concepts, norms and practices emerged

¹ One may add that the confrontation model is oversimplified for natural science too. It neglects the role of lower level theorizing and model building in science and therefore misses that not all scientific theory is general in the way the model assumes. It also downplays the complexities of theory-evidence relations in the sciences that have been explored in debates on underdetermination, theory-ladenness, and the experimentalcreation of phenomena. I will come back to this point in my own assessment of the weaknesses of the confrontation model.

historically, case studies retain philosophy's contact to actual science (Schickore, 2011, pp. 461–462, p. 474).²

But what should we say about the evidential functions of case studies? While Schickore gives us an account of what makes case studies philosophically significant, her proposal shifts the focus away from the problem of historical evidence. In her hermeneutic-historicist proposal, historical inquiry does not even serve to provide philosophical views with evidential support. Rather, history serves to further our understanding of present scientific concepts.

A similar turn away from the problem of historical confirmation can be observed in Hasok Chang's proposal for integrating history and philosophy of science. Chang suggests to think of the history-philosophy relation not as a relation between the particular and the general, but rather as a relation between the concrete and the abstract. He notes that any analysis of concrete historical episodes depends on abstract ideas and concepts. When extracting abstract insights from a historical case, we are therefore not inductively generalizing from the case. Rather we articulate our concepts and ideas. According to Chang, historical research can turn into a productive resource for philosophical thinking. "[H]istorians can actively engage in the creation of new philosophical ideas through their concrete investigations (...) History writing can be a very effective method of philosophical discovery." (Chang, 2012, p. 111) Chang puts a strong emphasis on the productive heuristic role of the historiography of science. The question as to whether and how historical research can provide empirical confirmation to philosophical claims is pushed into the background.

Pace Schickore and Chang, we may not wish to give up the idea that history serves evidential functions. In the past, evidential uses of case studies played an important role in correcting for the idealized images of science that have been conjured up by armchair philosophers. Philosophy's contact with actual scientific practices was not only retained because case studies offer hermeneutical understanding or heuristic guidance in the

²Another alternative to the confrontation model has been outlined by Hans Radder (1997). Radder discusses Ian Hacking's conception of styles of reasoning and Nickles' reconstructionist interpretation of the development of science as promising strategies for combining historical and philosophical perspectives. Unlike Schickore, he stresses the relative autonomy of philosophy from history and the generalist character of philosophical theorizing. On his view, theoretical philosophy aims to make sense of non-local patterns in the historical development of science, i.e. "patterns that are not (or not necessarily) universal but still possess a broader historical significance" (Radder, 1997, p. 649). In this paper I cannot go into the question as to how "general" and "autonomous" philosophical theorizing ought to be. But let me note that, like Radder, I believe that philosophical analysis and historical research are both strongly interdependent and partly autonomous.

articulation of concepts. It was also retained because the production and use of case studies was motivated by a norm of historical adequacy: *a philosophical claim that is historically plausible is better warranted than a philosophical claim that is not. And in order to be historically plausible, philosophical concepts need to do justice to the complex and changing realities of science that are revealed by historical case studies.* Trying to make sense of this norm, the confrontation model ended up with an oversimplified and misleading account of the relations between the history and the philosophy of science. But let us not throw the baby out with the bath water. Historical case studies might provide some kind of evidence for philosophical claims even if the confrontation model is misguided.

Before I proceed to developing my own account of the evidential functions of historical case studies, I want to return to the question as to what exactly is problematic about the confrontation model. My diagnosis of the main problems of the model leads in a natural way to two desiderata for a better account of the role of historical evidence.

As explained above, Schickore suspects the analogy with scientific theory production and evidence gathering to be the source of the problem. I do not fully agree with this assessment. I believe the blame is to be put not on the analogy with science, but rather on an oversimplified idea of historical evidence on the one hand, and an outdated concept of theory confirmation on the other. In both respects, the failures of the confrontation model reveal a deep irony in philosophers' dealings with historical research.

First, the confrontation model reduces the historiography of science to an empirical record of facts about past science. Historical evidence is treated as if it were unproblematically available. In this way, the confrontation model drastically underestimates the methodological and theoretical investments historians and philosophers of science need to make when writing case studies. It renders invisible the interpretative efforts involved in retracing the reasoning processes and knowledge practices that past scientists engaged in, and the constructive efforts required when trying to render intelligible the dynamics of scientific change. In short, it neglects that engaging in historical research raises specific methodological demands. It is ironic, if not outright absurd, that people whose profession it is to reflect on the complex methodologies of the natural sciences – philosophers of science – should be blind to methodological questions arising in the discipline of history.

Second, the confrontation model depends on outdated conception of theory confirmation. While philosophical debates on the Duhem-Quine thesis, the theory-ladenness of observation, underdetermination, tacit knowledge, the experimental creation of phenomena, and so on, reveal theory confirmation in science to be a highly intricate issue, philosophers of science tend to fall back on naïve inductivist and naïve falsificationist intuitions when it comes to their own use of historical case studies. Again it seems deeply ironic that philosophers have failed to apply the lessons about the confirmation of knowledge claims that they themselves generated to their own practices of empirical justification.

To conclude, the problem with the confrontation model is not so much that those who implicitly or explicitly adhere to it treat the relations between history and philosophy of science too much like theory-evidence relations in the natural sciences. The problem is that they fail to appreciate that the history of science, and its role in philosophical contexts, is just as complex and philosophically demanding as are theory-evidence relations in the sciences.

This diagnosis provides us with two general desiderata for thinking about the evidential relations between historical case studies and the philosophy of science. First, we need a more refined concept of historical evidence that acknowledges the methodological efforts involved in historical reconstruction. And second, we need a more refined account of theory confirmation. To pave the way to such an account, in the following I present a view of the historiography of science that emphasizes the constructive efforts involved in devising plausible narratives about historical episodes and that highlights the theory-laden character of historical facts.

3. A narratological account of historical case studies

If historical case studies provide evidence in the context of the philosophy of science, they do so because they offer factual knowledge about the past. But the historical fact is not simply found. Historical events and processes have to be reconstructed from available sources, meaningful connections between historical events have to be identified, an episode or case needs to be isolated, the appropriate context for that episode must be identified, and so on. The historical fact is not a simple given, but rather the outcome of a complex and partly constructive methodological process.

The constructive dimension of historiography has long been emphasized in the narratological tradition within the philosophy of history (White, 1973; Ricoeur, 1980; Barthes, 1981; Ankersmit, 1983; Carr, 1991). Yet, narratological debates did not make a huge impact on the historiography of science, let alone HPS (notable exceptions are Christie, 1993; Feldhay, 1994; Clark, 1995). Recently, Jouni-Matti Kuukkanen (2012) called for a narrativist turn in the historiography of science. According to Kuukkanen, historians of science, partly due to the influence of sociological and anthropological empiricism in science studies, have neglected their own role as active “constructors” of historical narratives about past science. Instead, they have espoused an uncritical “Rankean realism” towards their own representational activity (Kuukkanen, 2012, p. 342). According to Kuukkanen, narratology could fulfill a self-critical role for the historiography of science and encourage debate about the epistemic standing of historiographical writing outside the realist mold (Kuukkanen, 2012, pp. 358–363). I will draw on the narratological tradition for similar purposes, using its insights to complicate the notion of historical evidence.

The main premise of narratology is the idea that historical representation takes a narrative form. The constructive act of historiography is seen to consist of endowing past events with a narrative structure. Historical events are rendered intelligible by being embedded in meaningful stories. Moreover, what type of story is being told determines what information the historical account can convey. Put in a nutshell, history is storytelling, and stories convey knowledge.

In his reflections on the narrative principles that underwrite historical discourse, Hayden White (1973) develops some of the tools that allow us to account for the “narrativization” of historical events and processes in case studies in the history of science. In particular, three features of narrativization identified by White can serve to understand how case studies actively (re)construct the historical facts that they talk about – selection, emphasis, and emplotment.³

Selection. White observes that unlike past reality, a narrative has a beginning, a middle and an end. In order to build a historical account, the infinite series of historical events (the chronicle) has to be molded into a story that characterizes these events in

³ I will not reproduce White’s conception of narrative in detail. White’s account has some deeply problematic features, among them the rigid and ahistorical character of his structuralist taxonomy of styles of historical writing, and his anything-goes relativism. My use of White’s concepts in this paper is pragmatic and unsystematic. It is based on the idea that we can utilize some of the central insights of the narratological tradition for our purposes without thereby buying into the more dubious features of White’s account.

terms of inaugural motifs, transitional phases and endpoints (White, 1973, p. 5). This is particularly salient in case study history which is usually concerned with local, temporally restricted episodes. The identification of a case or episode depends on selecting from the infinite web of historical processes a definite set of events that occur within a finite time-span.

Emphasis. However, a historical narrative does not only select some historical events while excluding others. To some events it attaches a central significance for the progress and resolution of the story, while other events receive only a subordinate status. Events are thus arranged into a “hierarchy of significance” (White, 1973, p. 7), as they are assigned different functions in the story (see also White, 1978, pp. 54–55).

Emplotment. White emphasizes that the way in which events are emplotted – what precise story is being told – has consequences for the information and meaning that a historical narrative brings across. The same historical episode can be reconstructed as a tragedy, a romance, a comedy or a satire (or, if we leave the strict parameters of White’s genre taxonomy behind, as any other story type), and depending on the mode of emplotment, different aspects of the episode under study will be brought to light, and different philosophical and moral conclusions will attach themselves to the historical events (White, 1978, pp. 46–48; White, 1984, pp. 42–45). The closure of the narrative is particularly important for conveying philosophical significance. When the story reaches its resolution, the questions that were raised at the beginning are answered, and the expectations built up throughout the narrative are either satisfied or disappointed. In this way, an episode of the past is experienced as a more or less coherent, self-contained and meaningful whole that carries a moral or ideological significance (White, 1980, pp. 23–25). This aspect is also particularly important for case study history, since narrative closure endows case studies with unity.⁴

The concepts of selection, emphasis and emplotment help to explicate what the constructive dimension of historiography consists in. They are also useful for identifying the ways in which historical accounts in general, and case studies in particular, are theory-laden.

4. Theory-ladenness in historiography

⁴ For detailed analyses of how the narrative structures of particular works in the historiography of science endow historical events with meaning and thus convey specific philosophical conclusions, see Feldhay (1994), Clark (1995) and Kinzel (forthcoming).

Introducing the concept of theory-ladenness allows one to conceptualize the historical confirmation of philosophical claims in analogy to the theory-laden confirmation of theoretical claims in science. Exploring this analogy, David Hull observes that “[h]istory of science cannot be written from no perspective whatsoever.” (Hull, 1992, p.472) He argues that the beliefs and assumptions that influence historiography are usually implicit and do not take the form of systematic theories of history. And because of their implicit and half-formulated character, “their influence on the ‘data’ that are gathered are likely to be even more pervasive and elusive than the parallel situation in science.” (Hull, 1992, p. 471) Nevertheless, Hull believes that even theory-laden historical facts can challenge philosophical theories and in this sense can provide a limited degree of evidential support.

I fully agree with this general conclusion. However, Hull does not explicate his views on theory-ladenness in great detail. I go beyond his analysis in two respects. First, in this section I offer a more detailed account of the nature of theory-ladenness in historiography. I discuss the different ways in which theoretical assumptions can structure historical reconstructions. My discussion is informed by the narratological insights into the constructive dimension of historiography discussed above. Second, in the sections to follow I distinguish between four different evidential functions that historical case studies may be said to fulfill. On this basis I identify the challenges that arise for evidential uses of historical case studies, arguing that theory-ladenness impedes some but not all of their evidential functions.

What is the nature of theory-ladenness in historiography? In the philosophy of science, the theme of theory-ladenness has originally been introduced with respect to observation or perception (Hanson, 1958; Kuhn, 1962; Feyerabend, 1975). However, it has since been stressed that various aspects of the scientific process may be affected by distinct forms of theory-ladenness. The production of data, the evaluation and interpretation of the evidence, scientists’ attention and memory, and the processes of scientific communication may all be subject to different forms of theory-ladenness (Brewer and Lambert, 2001). Discussing the role of theoretical assumptions in scientific experimentation, Michael Heidelberger introduces a useful distinction between theory-ladenness and theory-guidance. While theory-ladenness proper occurs when experimental observation is interpreted in the light of a theory, such that the meaning of an observational term is determined by theory (Heidelberger 2003, pp. 140–141, p. 145), the concept of theory-guidance refers to “how the disposition to make a particular

observation depends on the theoretical background of the observer” (Heidenger, 2003, p. 144). The distinction is between which observations are being made (theory-guidance) and what the observations made mean (theory-ladenness). Equivalents to theory-guidance and theory-ladenness can be found also in historiography.

Theory-guidance. We can speak of theory-guidance in historiography when the *selection* of a historical episode and of the relevant historical events is informed by theoretical concepts, or when prior theoretical and methodological assumptions structure the *emphasizing* of historical events, and the resulting “hierarchy of significance”. As Hull has pointed out, the relevant assumptions do not have to take the form of explicit theoretical commitments, but may remain implicit. Moreover, they do not have to build a systematic or even consistent theoretical framework. Quite often, a historical account is guided by a set of incoherent, rough and ready assumptions about past events and their significance.

An example for theory-guidance in the history of science can be found in Geoffrey Cantor’s and Steven Shapin’s competing reconstructions of 19th-century Edinburgh phrenology (Cantor, 1975a; Shapin, 1975). Taking phrenologist and anti-phrenologist worldviews to be incommensurable, Cantor puts a strong emphasis on the theological, philosophical and methodological issues that were at stake in the debate. Shapin selects and emphasizes rather different features of the episode. Defending a sociological perspective, he situates the phrenological debates in the context of the social transformations of 19th-century Edinburgh society, includes information about the class affiliation of phrenologists and anti-phrenologists, and stresses the connections between political and scientific ideas. In their respective historical narratives, the two authors make different theory-guided selections of historical events, they include different types of information, and emphasize different aspects of the scientific controversy they study (Further examples for the theory-laden selection of historical events are discussed in Kinzel, forthcoming).

Theory-ladenness. However, the constructive dimension of historiography is not restricted to selection and emphasizing. The historical fact is an outcome of a constructive process on a more fundamental level. Historical events are not simply found, but have to be inferred from the available sources. And the inferential and interpretative processes that enable historians to identify facts, events and their interrelations are informed by

theoretical assumptions. Hence, historiography is not only theory-guided, but theory-laden in the sense that historical events are partly constituted by theory.

The theory-laden construction of historical events proceeds in two directions: bottom-up, from the sources to the events; and top-down, from the narratives to the events. In the bottom-up inferential processes that lead from the sources to the events, theoretical assumptions enter already when it comes to determining which sources are considered relevant and reliable. But perhaps more importantly, once this is determined, the sources are then related to each other, compared and interpreted, such that past events, actions and meanings can be inferred from them. And these inferential processes are structured by prior theoretical assumptions. Deriving historical events, actions, arguments, historical actor's beliefs and value judgments from the available sources is a theory-laden process.

The top-down identification of historical events is also laden with theoretical assumptions. As Paul Roth observes, "events may be sliced thick or thin, a glance may be identified as an isolated event or as an instance in an event. What the unit-event is depends on the telling of it" (Roth, 1988, p. 9). Since some theoretical assumptions are built into the narrative structure of a historical account, the fact that the precise story that is being told is constitutive for what historical facts and events are identified is a phenomenon of theory-ladenness. The processes of *emplotment* that I have described above are processes of the theory-laden identification of historical facts and events.

As an example, consider controversies over the Scientific Revolution. Whether one can identify a massive rupture in 17th- and 18th-century knowledge practices that deserves to be called a "revolution" depends on our concept of revolutionary processes in science (a useful discussion is given by Porter, 1986): what types of discontinuity mark a revolutionary change, how rapid and profound do the transformations have to be, how much debate and resistance is required, and so forth? Theoretical presuppositions regarding these and related questions, in turn, structure and constrain the narratives that historians tell about 17th- and 18th-century science. Rivka Feldhay gives a detailed analysis of how the theoretical and ideological presuppositions that are embodied in the historical narratives told by Eduard Jan Dijksterhuis, Alexandre Koyré, and Frances Yates determine which patterns and driving forces they are able to identify in the Scientific Revolution (Feldhay, 1994). What type of event the Scientific Revolution is depends on the theory-laden telling of it.

We are now better equipped to reconsider the question as to how historical case studies can provide evidence in the philosophy of science. To summarize my main claims, case studies support philosophical doctrines on the basis that they provide factual knowledge. However, the historical fact is not a simple given. It is the result of complex constructive processes. These processes involve *theory-guidance*, because the *selection* and *emphasizing* of historical events in a narrative is shaped by (explicit or implicit) theoretical and methodological commitments. They also involve *theory-ladenness*. First, because historical events are reconstructed from the sources in inferential maneuvers that rely on prior theoretical assumptions. And second, because the identification of historical events depends on how they are *emplotted*, that is on which precise story is told about them.

That historical events are constructed in the manner described does neither automatically imply that they are no real facts of history, nor that case studies cannot provide the philosophy of science with evidential support. It means, however, that phenomena of theory-ladenness complicate the empirical confirmation of philosophical claims and doctrines. In the next two sections of my paper, I address this problem.

5. The Evidential Functions of Historical Case Studies

When philosophers claim that case studies provide their views and doctrines with empirical evidence, it is not always clear what is at stake. Sometimes, the claim is that we can learn something specific from the episode in question that we would not have known otherwise. Sometimes, the suggestion is that the case makes the philosophical view in question more plausible than it would be without the historical evidence. And sometimes it is claimed that the historical evidence adjudicates between conflicting philosophical views. In order to arrive at a more nuanced account of empirical confirmation by case studies, we first need to distinguish more clearly between these various evidential roles that case studies can play. I believe we can discern at least four different evidential functions that we may wish historical case studies to fulfill in the context of the philosophy of science – novelty, recalcitrance, confirmation and adjudicating.

Novelty. One function of historical case studies is that they provide us with new, previously unknown and perhaps surprising information. New information about the precise historical dynamics of an episode of scientific change, new insights into the structure of a scientific debate, new knowledge about the reasons and causes that

motivated a certain scientific decision, and so on. Providing us with new knowledge is perhaps the weakest sense in which case studies can be evidential.

Recalcitrance. A somewhat stronger claim is that engaging in case study research can force us to revise our beliefs. The hermeneutical process of historical reconstruction described by Schickore is such that initial assumptions are revised and modified in the process of historical reconstruction (Schickore, 2011, 472). But belief revision only becomes necessary when the historical material resists being interpreted in terms of the initial judgments and preconceptions. It is the recalcitrant character of the historical material that enables us to learn from history in the sense of having to revise our beliefs. The concepts of recalcitrance and belief revision are, of course, Duhemian surrogates for the notion of falsification. The reference to Duhem reminds us that findings that clash with theoretical expectations do not disconfirm any isolated theoretical hypothesis, and hence that there is some flexibility regarding which assumptions we end up modifying and how we do so (Duhem 1954, p. 185, pp. 216–217). But modify them we must. Forcing us to revise our beliefs is another evidential function that case study research may play.

Confirmation. The most common expectation regarding case study evidence, however, is that it in some sense confirms a philosophical view. While there are many different accounts of theory confirmation on the market (Hypothetico-deductivism, Corroborationism, Bayesianism, and others), the common intuition is that the available evidence makes the belief in question more justified, better warranted, more plausible, more acceptable, or more likely to be true, than it would be if the corresponding evidence were not available. Confirming a philosophical claim in the sense of raising its credibility and probability is usually considered the central evidential function of case studies in the philosophy of science.

Adjudicating. Finally, the strongest sense in which a case study may provide evidence is as an arbiter in a philosophical controversy. The idea is that history is an independent and neutral ground for assessing competing philosophical views and that historical case studies can therefore be used for settling philosophical conflicts. Much like a crucial experiment in science, a case study may be taken to confirm one philosophical doctrine while falsifying a rival position. In this way, a case study may provide the philosophy of science with evidence that adjudicates between conflicting philosophical views.

Having distinguished between these four different evidential functions of historical case studies, we can now turn to the question whether some of these functions are impeded by the theory-guided and theory-laden character of historical facts.

6. Limited Evidential Support

In this section, I explore the nature of the challenges that arise from the theory-laden character of historical evidence. I argue that historical case studies are able to provide philosophical claims with some types of evidential support, but that, due to theory-ladenness, their evidential import is limited. Case studies can fulfill some but not all of the four evidential functions described above.

First, theory-ladenness does not seem to undercut the possibility of gaining new knowledge from a case study. In the narratological account of historiography, the picture of what historical facts and historical knowledge consist of has become somewhat more complicated. But even if historical accounts are not just records of given facts, but theory-laden narrative constructions, they can tell us something about the historical world that we did not know before. In his response to Pitt, Richard Burian emphasizes the capability of case studies to “produce findings that cannot be gotten from more abstract ‘armchair’ philosophical work” (Burian, 2001, p. 388). And he stresses that in order to be epistemically useful, case studies do not have to be “philosophically innocent” (ibid.). Put differently, the evidential function of providing novel knowledge is not necessarily curtailed by theory-ladenness.

The second function that I identified above – recalcitrance – is more controversial. The problem is familiar from debates on theory-ladenness in science. Theory-ladenness is often thought to bias the empirical evidence that is used to test a theory towards that same theory. It thus immunizes the tested theory against disconfirming evidence, such that a circular structure of self-confirmation results: “If a theory determines its own empirical basis it is hard to see how, if ever, there could arise any conflict between theory and evidence” (Carrier, 1989, p. 406).

One answer to this difficulty is the “independence argument”, that is, the claim that theory-ladenness is not problematic as long as the lading theory and the tested theory are independent of each other (Kosso, 1989; 1992, pp. 159-176). Alison Wylie argues the case for archeology. She shows that the security and independence of the middle-range theories involved in the construction of archeological evidence allows this same evidence

to act as a constraint on interpretation (Wylie, 2000). Given that independence arguments are fruitful in the case of archeology, they may be relevant for the historiography of science as well. However, there are difficulties when it comes to carving out the notion of independence – especially in the context of HPS, where the question is not under which conditions different scientific theories can be said to be truly independent of each other, but under which conditions different philosophical assumptions are independent. While I do not deny that some version of the independence argument may be relevant for thinking about the ways in which historical narratives can provide evidence despite being philosophically informed, I find it hard to come up with a general account of what makes various philosophical claims truly independent of each other.

A more straightforward strategy for dealing with problems of theory-ladenness is to question whether theory-ladenness necessarily implies a circular structure of justification (Franklin et al., 1989; Hudson, 1994). After all, it is not clear why theory-laden evidence cannot prove recalcitrant. Even on the assumption that a theory helps to produce, select, structure and interpret evidence, this does not necessarily imply that the result of this process will always confirm the theory. Theory-ladenness may be a pertinent feature of scientific practice, but it does not seem to preclude the emergence of recalcitrant evidence. Hence, it does not preclude the possibility of one having to modify theoretical assumptions by recourse to the evidence.⁵

I think the situation is similar when it comes to the historiography of science (see also Hull, 1992, p. 471-472). Even if historical reconstructions are dependent on theoretical assumptions, this does not guarantee that the result of the constructive process will necessarily agree with the initial assumptions. Sometimes, we will have to revise some of our initial judgments and conceptions in the process of historical reconstruction, just as Schickore describes. There may be plural ways in which we might successfully modify historical narratives in order to account for recalcitrant evidence, but

⁵ Robert Hudson argues that difficulties for theory testing arise not from theory-ladenness, but from the Duhem-Quine problem. According to him, what corrupts the constraining power of the evidence is not the presence of background theories, but rather the fact that experimenters „always have an option to question an auxiliary, background hypothesis when confronted with a disquieting empirical result“ (Hudson, 1994, 606). I am not entirely convinced that theory-ladenness is never to blame. Even if theory-ladenness is harmless most of the time, there may remain some genuinely troublesome cases in which it does lead to a circular structure of self-confirmation. Like Harold Brown (1993) I believe that the precise relations between theory and evidence and the possible difficulties for theory testing must be determined on a case-by-case basis.

this does not mean that our initial theoretical commitments are immune to revision. Despite theory-ladenness, case studies can force us to revise our beliefs.

The evidential functions of novelty and recalcitrance prove particularly powerful in combination. This can be illustrated by reference to Chang's approach to integrating historical and philosophical analysis. As noted above, Chang believes that historical research can become a resource for philosophical thinking:

We start with an existing philosophical framework, and find historiographical puzzles, namely episodes that are difficult to describe and understand. In attempts to find an apposite description of these episodes, historians can *generate* new concepts and ways of thinking that philosophers may not come up with from their entirely abstract work. (Chang, 2012, pp. 121-122)

Chang's reflections show that a historical episode cannot only prove recalcitrant with respect to previously held philosophical assumptions. Because case studies provide novel knowledge they can also serve as a guide to how the initial assumptions should be modified and revised. Beyond being heuristically useful, case studies fulfill important evidential functions by constraining the processes of belief revision.

How about confirmation? In order to answer the question whether case study evidence can confirm philosophical views, it makes sense to briefly return to Pitt's dilemma. The two horns of the dilemma were, on the one hand, top-down manipulation, the charge that the historical evidence may have been manipulated to fit the philosophical point, and on the other hand, bottom-up insignificance, the problem that one cannot generalize from an isolated case.

I hope my discussion of narrativity and theory-ladenness shows that the first horn of Pitt's dilemma is not as problematic as it appears at first sight. The selection and reconstruction of a historical episode on the basis of philosophical assumptions does not constitute a case of illegitimate manipulation, but rather a case of theory-guidance and theory-ladenness. As I have just argued, it also does not prevent a case study from providing new knowledge or from forcing us to revise our beliefs. To the degree that we can learn from a case study, both in the sense of gaining new information and in the sense of modifying our previously held assumptions, case studies can be philosophically

significant. I believe that for these reasons, they also provide some degree of confirmation to philosophical views. A philosophical doctrine that has sought out contact with history and has produced historical case studies that correspond to its preferred picture of science has, at least ideally, incorporated new knowledge and gone through a process of revision. It is thus richer and more refined than a philosophical doctrine that has not produced any historical case studies, and should therefore be considered more justified, better warranted, more plausible. Because case studies fulfill the evidential functions of novelty and recalcitrance, they can also fulfill a function of confirmation.

However, the confirmation that case studies provide is usually limited. The reason for this is expressed in the second horn of Pitt's dilemma. As long as philosophical views are conceived of as general characterizations of the nature of science, there will always be room for skepticism about whether sufficient historical support for such views can be assembled. But not all philosophical claims take the form of general theories of science. As Burian notes, case studies cannot support universal methodologies of science or general theories of what the essence of science consists in. However, they allow for limited generalizations about the local or regional standards of scientific enquiry (Burian, 2001, pp. 399-400). The degree to which a case study confirms a philosophical claim thus depends on the precise formulation of that claim – on how generalist the philosophical aspirations are, on how well the philosophical doctrine in question can deal with local historical variations, and so forth. This means that case studies do offer empirical support and confirmation to philosophical views, but the exact degree of confirmation depends on the philosophical view in question.

Finally, let us turn to the adjudicating role of historical case studies. In order to settle philosophical disputes, historical case studies would have to provide a type of evidence that can serve as a neutral arbiter in a philosophical conflict. However, theory-ladenness is usually thought to curtail the possibility of deciding between different theories on the basis of neutral, theory-independent evidence. Kuhn and Feyerabend formulated their views of theory-ladenness largely by reference to scenarios in which theory choice is difficult (Kuhn, 1962; Feyerabend, 1975). The idea is that two rival theories may each produce a corresponding body of theory-laden evidence. Even when each theory is forced to incorporate recalcitrant evidence and, as a result, introduces serious modifications to its claims, the evidence does not constitute a neutral ground on which to adjudicate between the rivals. While evidence may turn out to be recalcitrant

despite being theory-laden, this does not imply that it can neutrally decide between conflicting theories.

The corresponding situation in historiography is that of alternative theory-laden “narrativizations” of the same historical episodes that encapsulate rival philosophical conclusions. In situations in which one and the same case is reconstructed from competing philosophical viewpoints, the historical evidence cannot settle the philosophical conflict in question. In these situations, historical case studies cannot adjudicate between conflicting philosophical views.

We could perhaps avoid this conclusion if there were to exist a generally agreed upon and neutral procedure for deciding between conflicting narratives of the same events. If there were criteria for the evaluation of historical case studies that were neutral with regards to the philosophical issues at stake and that could therefore be accepted by anyone participating in the debate, historical evidence could perhaps still be used to settle philosophical conflicts.

Alas, such neutral criteria are hard to find. The problem takes the form of a dilemma. On the one hand, there do indeed exist neutral criteria for the evaluation of historical case studies. But these criteria are too weak to settle all historiographical conflicts. On the other hand, there exist stronger methodological criteria that can settle most conflicts. But these criteria are usually not neutral. I have given a more detailed account of this dilemma elsewhere (Kinzel, forthcoming). In the following, I will briefly recapitulate my findings.

There do exist some basic evaluation criteria that are neutral with regards to philosophical conflicts. Whether one is a scientific realist, anti-realist, social constructivist, pluralist, or what have you, usually does not matter for whether one believes a historical account to be internally consistent and based on a sufficiently broad range of reliable sources. Criteria such as internal consistency, source-reliability, range and variance of the sources can be used to adjudicate between conflicting historical reconstructions in a neutral manner. However, these neutral criteria are weak in that they are easy to meet. It is often possible for two (or more) conflicting accounts of the same events to be both (or all) internally consistent and based on a sufficiently broad range of source material. The basic and neutral evaluation criteria cannot adjudicate between such rival reconstructions.

As an example, take Cantor's and Shapin's rival reconstructions of the Edinburgh phrenology debates. Both historians cover a broad range of sources –publications, lectures, private correspondence– which they examine with great care and rigor. Both present internally consistent narratives that are firmly rooted in the empirical material. As far as criteria concerning internal consistency and the use of empirical sources are concerned, both reconstructions are acceptable. The basic and neutral evaluation criteria are too weak to settle the conflict.

Now, there do exist evaluation criteria that are stronger than the basic ones. They are usually of a methodological character: has the historical episode been adequately contextualized, has the true meaning of a historical text been restored, have anachronisms and present-centered backwards projections been avoided, have the right causal factors been identified, and so forth? Considerations such as these can usually decide between conflicting reconstructions of the same episode. Yet, contextualization, interpretation, present-centeredness, and explanatory power are highly contested issues. And they are seldom neutral with regards to the questions at stake in conflicts between different historical reconstructions.

For example, Cantor criticizes Shapin's historical reconstruction on the basis of reflections about the methodology of historical explanation. He chides Shapin for failing to provide an "adequate translational theory linking the social and the cognitive realms" (Cantor,1975b, 247). According to Cantor, it remains unclear how Shapin can explain belief systems in terms of social structure and social conflict, given that the cognitive and social realm are of a different nature. Moreover, social influences on science, although being relevant, can only give a partial, not a complete account of the content and development of scientific belief systems (Cantor,1975b, pp. 155-156). Cantor is using the methodological criteria of explanatory power and explanatory completeness to settle the conflict between the two rival historical reconstructions. It seems the issue can be decided with the help of these criteria.

And yet, the situation is a great deal more complex. In particular, the concepts of explanatory power and explanatory completeness as understood by Cantor are not neutral between the rival conceptions of science that inform the conflicting case studies. First, a sociologist like Shapin may not accept the assumption that the cognitive and social realm are of a truly different nature and that a good explanation would therefore have to provide a mediating link between the two. Indeed, much of Shapin's paper is devoted to

illuminating the social and political meanings of phrenological and anti-phrenological beliefs. For Shapin, the concepts and arguments of the phrenologists and their critics have an inherent social significance. They are not separated from social issues in the first place (Shapin, 1975, pp. 221-222; Shapin's general stance on the internalism-externalism problem is detailed in Shapin, 1992). In pressing Shapin to offer a "translational theory" that mediates between the social and the cognitive, Cantor is assuming one of the points at issue – namely that the social and the scientific are of a fundamentally different nature. Second, the criterion of explanatory completeness that Cantor applies when arguing that Shapin's sociological reconstruction does not offer the full story of the historical happenings is not neutral either. This becomes particularly obvious when considering that Shapin too mobilizes this criterion when criticizing Cantor. According to him, Cantor's reconstruction is incomplete, because it avoids the social dimension of the phrenology debates (Shapin, 1975, pp. 219-220). What is a complete explanation and what is not depends a lot on one's theoretical preferences.

The example illustrates that the methodological criteria for what constitutes a good and complete explanation are not always neutral with regards to the issues at stake in a historiographical conflict. Put differently, these criteria themselves are theory-laden. This is, I believe, a general point about the methodological criteria of historical evaluation. The resulting dilemma is that neutral criteria are weak, while strong criteria are often theory-laden and therefore not neutral. Because of this dilemma, history does not provide the neutral ground for adjudicating between different philosophical positions. Historical case studies typically cannot settle philosophical conflicts.

The upshot of my argument is as follows. Historical reconstructions do provide some types of evidence in the context of the philosophy of science – in particular, they produce novel knowledge, force belief revision and to some degree confirm philosophical claims, making each claim individually stronger than it would have been without the related historical support. However, because historical accounts are theory-laden constructions, they fall short of constituting neutral arbiters in philosophical conflicts. We may learn from historical case studies and they can be put to a variety of legitimate evidential uses. However, settling philosophical conflicts is not one of them.

7. Conclusion

My goal in this paper was to clarify what types of evidence historical case studies can provide in the context of the philosophy of science. Attempting to answer this question, I pushed for a more complex notion of historical evidence, as well as for a more nuanced understanding of the practices of historical reconstruction.

In the course of my discussion, I combined arguments from the history of science, the philosophy of science and the philosophy of general history. But my strategy for integrating these perspectives is notably different from other approaches to HPS. While the history of science is very often used to enrich the philosophy of science, in this paper I proceed the other way around: I use themes from the philosophy of science, in particular the theme of theory-ladenness (alongside insights from the narratological tradition in the philosophy of history) in order to enrich our understanding of the constructive dimension of the history of science, and of the bearing that historical case studies have on philosophical arguments.

I am convinced that in order to secure the historical adequacy of philosophical conceptions of science, we do not only need to engage in case study research. We also need a better understanding of the historiography of science, and of the case studies it produces – an understanding that appreciates the methodological complexities involved in the practices of historical reconstruction, and the philosophical questions that arise with regard to the epistemic status of historical writing. My account of the evidential functions that narrativized and theory-laden reconstructions of past episodes of science can fulfil in the context of the philosophy of science is meant as a step in this direction.

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