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Joseph C. Pitt

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## The Dilemma of Case Studies: Toward a Heraclitian Philosophy of Science

**Joseph C. Pitt**  
*Virginia Tech*

*What do appeals to case studies accomplish? Consider the dilemma: On the one hand, if the case is selected because it exemplifies the philosophical point, then it is not clear that the historical data hasn't been 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.*

After Kuhn cast doubt on the usefulness of abstract positivist models by appealing to the history of science, many philosophers have felt compelled to use historical case studies in their analyses. Kuhn, however, did not tell us how to do this. Further, it is not clear exactly what appeals to case studies accomplish. We can frame this issue as a dilemma. 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.

I will argue that 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, sort of the history and philosophy of science version of Manifest Destiny. If historical studies are to be useful for philosophical purposes, they must be extended historical studies that contend with the life span of a scientific problematic. It is not enough to isolate a single experiment or to look at the activity of a lab under one director. One needs to place the case in the context of a problematic and to explain a problematic in terms of its origins and its fate (Pitt 1992). But even if this were to be accomplished, it is not clear what philosophical work is being done.

This may be, at best, history of ideas. The point here is simple: just as philosophical problems are not problems about the single case, historical issues are particular and must be seen in context. But seeing an historical issue in context does not by itself suggest any particular philosophical point. It may be that the problem here lies in our understanding, or lack of it, of what constitutes a context. The importance of understanding the appeal to historical contexts is to show how doing history in context limits the possible range of philosophical ideas and explanations. By way of example, I will consider the philosophical question of what constitutes a scientific observation. I will argue that a serviceable universal account of scientific observation is not possible because the activity of making a scientific observation depends on, among other things, the sophistication of the technology available at the time, hence what we mean by a scientific observation changes. What is allowed as an observation varies in time, place and with respect to changing criteria influenced by technological innovation.

If I am right, this view provides a serious basis for rejecting Kuhnian paradigms. Problematics have histories, but that does not mean they are stable over time. Quite the contrary, the reason why it is important to appeal to problematics is that they change even as they serve to restrict research to certain topics. And it just may be this Heraclitian characteristic is a defining feature of science. As philosophers we seek universals, but the only universal regarding science is change. That seems to be a fact. But, it might be responded, as philosophers we are also interested in the normative—our job is to attempt to show what we ought to mean by *x* or *y*. While that is true, in our normative guise we also cannot ignore what in fact is the case. The hard job is to figure out how to do that. The lesson to be learned is that if philosophers wish to use historical cases to bolster their positions, then we will have to use very long studies and we will have to figure out how to relate the history to the philosophical point without begging the question.

The issue of not begging the question looms large. Let us start with a big question, which is continually begged: just *what* constitutes a case study? This goes to both horns of the dilemma, but particularly to the question of how to avoid appearing to manipulate historical data to fit philosophical theories. For without credible criteria for selecting or identifying a case as a case the charge can be legitimate.

Despite the currency of case studies, there are currently no criteria available to ascertain when we have one before us. We select the historical episodes we do for a variety of reasons with few, if any, operative guiding principles. I propose that we *can* develop a set of criteria for selecting a case study, but there are several costs. The problems involve the selection

criteria. For example, if we want to start with the science and see where that leads us, then, without begging the question, we have to find the science. Identifying the science in question in a non-whiggish fashion is a delicate matter. We simply cannot assume that what we call physics today, is what the scientists practicing physics in 1830 would call physics. We can't find the case study because we can't find the science in which it is a case. But there is a way out.

The way out is to proceed by identifying a problematic. A problematic consists of a set of intellectual concerns that motivate a scientist or a group of scientists to pursue the investigations they do. I suggest that this characterization skirts the demarcation question because where a group of investigators can be identified we have a social fact as a starting place. For an example of such a group, I suggest Copernicus, Tycho, Kepler, Galileo, Clavius and Scheiner. Their interests need not constitute a one-one correspondence, but each had to consider what the others had to say as relevant to their research interests, either singularly or in sets.

Now for the cost: problematics have their own history, they have starting points and end points, and in between they change, mutate, sometimes they evaporate, sometimes they metamorphise into something new. Further, in the course of working within the problematic, what emerges may not be what was expected. Finally, although this may seem obvious, to identify a problematic one must position it historically. This is to put the problematic in context, which is difficult, for in any historical setting there are many contexts, and we must avoid begging the question by selecting a context which conveniently supports our concerns. In short, if we start with case studies, we are assaulted on all sides by issues of question begging. Let us look more deeply at the notion of context.

What do philosophers expect to accomplish by appealing to history and historical contexts? We all know that, contrary to popular belief, Kuhn was not the first to wag an historical finger at us; Norwood Russell Hanson was doing history and philosophy of science in the fifties and his work was well received within the inner circle. Lakatos, borrowing freely from Kant, asserted that philosophy of science without history was empty and history of science without philosophy was blind. In what sense is philosophy of science without history blind? Have we not been able to see clearly through the lens of logic to important structural characteristics of, for example, explanation and confirmation? If the claim is that what we have come up with doesn't match what scientists actually do, then it is not clear that that is a valid criticism since we have a normative, not merely a descriptive role to play. Determining the logic of key concepts and working that out is a perfectly legitimate activity. What is it that history is supposed to supply?

In part, this is a question concerning what it is we think we are doing. Or to be brutally frank, what are the goals of philosophers of science who use history in *some way or other*, or more specifically, who see the appeal to historical context as important?

Let us begin by reviewing the evils contextualization is supposed to avoid:

1. Whig History; a term coined by Herbert Butterfield (1931), it refers to the attempt to impose current categories of analysis on historical events.
2. Universalism—a corollary to (1); the idea that certain features of science are constant over time.
3. Modernism; the insistence that the most important developments of any epoch are science (conceived in contemporary terms) related.
4. Abstraction; the reification of key features of a period.
5. Internalism; the process of examining the work of a person by appeal only to his or her notes and texts without consideration of any social or external factors—falls prey to (3) or to (1), since to really know is already to understand the context in which an author writes.

Assuming it is possible to avoid the above, there remain serious dangers facing the contextualist. For what the historian concentrating on context does, having avoided these five cardinal sins, is to concentrate on individuals and to consider the influences on and the consequences of these influences for their work. What this means is the following. First, given (5), all that the historian can do is to reveal the social and intellectual factors that might be said to motivate the views expressed by the particular historical figure under consideration. For to provide a close analysis of the work of the person in question (it must be a person to avoid (3) or (1)), exposing its logic or even its content amounts to (5). To the extent that the views of some person or other are to be considered, it is only by virtue of his perceived audience or influences. But determining who are the audiences and influences falls to the historian to identify since, we are told, historical figures cannot be trusted to know whom they really are influenced by or to whom they are really responding. How the historian avoids (1), (3) or (5)—or how he or she knows whom to identify as the relevant audiences or influences—remains something of a mystery. The problem here is fundamental: (a) it is not enough to say '*x* read *y*'—since that alone does not establish influence except in a trivial manner; (b) nor is it enough that *x* quoted *y* or that *x* admitted to either reacting to *y* or even attempting to extend *y*'s position—since *x* may not know what really motivated him or her. (The contextualist has opened the door to this objection

by using it to reject Internalism, i.e., *tu quoque*); (c) it is equally inadequate to cite who read  $x$ , for it can be the case that  $x$  was read for all the wrong reasons—(c.f., the misuse of Nietzsche by the 3<sup>rd</sup> Reich).

The contextualist historian is now left in the position of arbitrarily identifying people in places and can only hope that the preponderance of the evidence and correlations account for what  $x$  said about  $y$ . The laudable intent of the contextualist is to show that great figures do not emerge from a vacuum. The problem, however, is that there is no obvious principle of selection that guides the identification of people who or events that allegedly transform the vacuum into a social context. The result can be that the figures highlighted can be minor or obscure; likewise for social factors. Without a well-articulated and defensible principle of selection, the attempt to construct a context is at best arbitrary; at worst it is self-serving. Why certain figures are identified is also not clear, since all the objections used above with respect to  $x$  apply equally well to these problems. The contextualist project, seen in this light, is hopelessly flawed.

As we have seen, if we pay too close attention to the standard justification for contextualization, the program collapses. And yet there is something positive to be said in favor of each of (1)–(5), i.e., the rejection of Whig History, Universalism, Modernism, Abstraction, and Internalism. It is just that taken together nothing much is left. Have we taken a wrong turn somewhere?

It might appear that we have been led to our unhappy conclusion by concentrating on only one aspect of the contextualization of history, i.e., individuals. But the collapse of contextualism does not occur only when individuals are the subjects of discussion. For example, an anti-Whig historian will also justifiably reject talk of “science” in the 16<sup>th</sup> century, there being natural philosophy for the study of the natural world. Thus, the reification of concepts also seems to be a problem.

So, what is the point of contextualization? What is the appeal to context supposed to accomplish? Minimally a context is supposed to provide an *explanatory framework* for specific historical developments, i.e., it sets the stage on which the historian’s explanations will be seen to make sense when offered. The crucial mistake made by advocates of historical contextualization is to give the impression that there is only one appropriate context that satisfies the explanatory-allowing role. The writing of history is necessarily selective. However, the shift from individuals or activities such as history or art to context is no less selective or arbitrary, for (with apologies to Nelson Goodman) contexts are where you find them. For example, consider the contexts in which Galileo could be said to have operated. (1) The Renaissance, (2) The Scientific Revolution, (3) The

Medicean Court (*pace* Biagioli), (4) The Archimedean tradition, (5) The Euclidean tradition, (6) The Aristotelian tradition, (7) The Platonic Tradition, (8) The Medieval tradition, (9) the battle between the Vatican and the Italian secular states for political control of the Italian peninsula, (10) the Age of Exploration, (11) The Age of Elizabeth, (12) the Sixteenth Century, (13) the Seventeenth Century, (14) a personal struggle to financially support his family, (15) the personal politics of the struggle between theologians and natural philosophers (*pace* Redondi), (16) The Counter Reformation (*pace* Shea). And so far we haven't even begun to explore whether we should approach Galileo as an engineer, a physicist, an astronomer, an instrument maker, an amateur musician, a father, a philosopher, a theologian, a good catholic or an irritation of the Pope's.

However, picking the relevant explanatory framework may not be as difficult as I appear to be suggesting. The trick lies in figuring out what it is about the person or the event you want to explain. The mistake to be avoided is assuming there is necessarily only one explanatory framework. Even so, there is something more problematic than determining which framework to pick, that is the problem of determining what constitutes an appropriate explanatory framework or frameworks for a topic, i.e., what constitutes an explanation in these contexts, or what constitutes an historical explanation *simpliciter*.

To ask this question assumes that there is one kind of historical explanation that fits all sizes. Clearly, this is not the case. We actually have two questions here—first, there is the problem of selecting an appropriate framework. Second, once a framework has been selected, we still need to be able to sort out what kinds of explanations are appropriate and satisfactory and which ones are not. Answering these two questions is clearly beyond the scope of this paper. I will concentrate here only on one part of the second question and I will do so by trying to answer a slightly different question, namely, “What do we want from an historical explanation?”—i.e., what is the point?

Rephrasing it, the question reads, “Why do we seek historical explanations,” which sounds a lot like, “Why do philosophers of science turn to history?” One tried and true answer is, “To learn from the past.” It is unlikely, however, that we seek historical explanation only to understand how we got to where we are now. We seek more from history—not merely an answer to the question, “How did we get here?” but also, “How can we avoid ending up in this situation in the future?” There is little doubt that that question cannot be answered for several reasons. First, the analogies between the past and the present are just those, analogies. Learning from the past is only as successful as the strength of the analogy between past and present, and in drawing the analogy we need to be careful not to fall

into the trap of doing Whig history. Second, there is no single fact of the matter of the past—more information is constantly surfacing, depending on what we think we need to know. Ideologies, cultural fads, etc., also influence the plasticity of our histories.

And yet the situation is not hopeless. The search for criteria by which to select frameworks to use in obtaining answers from the past depends as much on the perceived state of the present as on our perception of the options for the future. And it is in the latter that we will find out clues to the adequacy of historical explanation. The central idea is the notion of a *coherent story*. What makes for an adequate explanation is the sense that our account of why things happened in the past hangs together with what we know proceeded and followed the event in question.

Appearances to the contrary notwithstanding, I want to argue that this is not Whiggish. Nothing in this suggestion of a coherent story suggests that we necessarily must see what happened in the past in a direct, causal line with the future, which is our present. It therefore makes no sense to talk about the global importance of current events, theories, etc., since that verdict awaits the future. A relevant set of contexts can be identified in terms of their explanatory value, i.e., the coherence they contribute to the story accounting for why what happened happened. One is justified in expanding the set of contexts to the extent that the failure to include certain factors can be shown to be relevant to understanding what happened after the events in question. So, an historical context is a set of factors that provide an explanatory framework for an event, a person's actions or work, or a social trend, etc. The adequacy of the context is a function of its ability not only to account for the event in question, but also for its prior and subsequent history.

All that having been said, we still cannot account for the philosopher of science's appeal to history. The job of explaining why the past was the past is the historian's job. The philosopher who looks to the past as revelatory of the present is doing bad history, so that can't be the justification. Nevertheless, there *is* a philosophical job to be done with respect to the past. One of the features that need uncovering when we try to understand an individual's actions is the set of assumptions with which he or she is working. In particular, we need to know what were the expectations at play at the time in order to assess the quality of the work being done. Uncovering assumptions and exploring texts for hints to expectations are jobs philosophers are good at. But in so doing, we learn little about what is relevant for today. So, at the moment, it is not at all clear what the cash value of case studies is for the philosopher of science who starts with history.

Let us now turn to the other horn of the dilemma. Instead of starting with historical cases selected for the way they are assumed to illuminate



contemporary philosophical issues, or for providing the data for building a philosophical theory, let us start from the side of theoretical questions. Unfortunately, things don't get any better. The kind of question I have in mind is, "What is a scientific explanation" or, "What is a scientific observation"—when we look to history to answer such questions, we stumble in many ways over assumptions that at first seem innocent and yet eventually prove fatal. For example, when one asks what is a scientific observation, it seems that we are asking about the "observation" part, assuming that we know what "scientific" means. But even if we have a good solid understanding of what "scientific" means (which we don't), we can't simply assume that we can apply that understanding backwards in time—to do so is to engage in Whig historiography, which we all now know is inappropriate.

Now, let's assume that we not only know what "scientific" means, but also what "observation" means and what "scientific observation" means (which we don't)—now each of these expressions has a history and their meanings have changed over time. To look to Galileo's telescopic observations to enlighten us as to the meaning of "scientific observation" today is to run rough shod over good historiography and to assume that philosophical analysis has some sort of a temporal *a priori* intellectual legitimacy and that as philosophers we can appropriate history to our own ends, confirming our assumptions. What would it mean for Galileo to make a scientific observation of the moons of Jupiter? "Scientific" is not a term in play at the time. To claim that his observations were scientific is to read backwards from the present into history, which is unjustified. Second, it is not clear that at the beginning of the seventeenth century there was a formal understanding of what was meant by an observation as opposed to any number of other similar activities such as seeing, perceiving, sighting, etc.

Finally, with the advent of new instruments we can trace the transformation of the concept of an observation. We can agree on why certain highly constrained settings in a lab can yield observations. But what about the pictures of the surface of Io being sent back from the Galileo probe? There are a number of different kinds of steps in between the taking of a measurement of Io and our seeing the result here on earth. Transmitting devices need to be aligned, involving computers and computer programs. There is the encoding of the measurement and then the sending and the assumption that nothing happens to it while it makes its way from the orbit of Jupiter to Earth. Then there is the reception of the data, more computers and programs to transform the encoded data into a picture and Lo! An observation! To accept those pictures as observations requires an expanded understanding of what constitutes an observation from the simple

naked eye seeing of nature and our report of that seeing to something considerably more complicated and sophisticated. The extent to which we have accepted the fact that we can use remote instruments to make observations is a far cry from simple seeing.

I propose that not just observation, but all of the concepts we use to discuss science are in constant flux. Peter Galison makes that case with respect to the meaning of “experiment” in the 20<sup>th</sup> century. What constitutes an explanation, evidence, data, observation, etc., all change over time and usually in response to some technological innovation.<sup>1</sup> That being the case—i.e., that the meanings of these concepts are in constant flux—it would seem impossible that we could learn anything about our present concerns from the past. And so once again, the question remains as to what we can gather from case studies.

So where does this leave us? We don’t know what a case study is—if we shift to a problematic we open up a can of worms—problems are embedded in historical contexts, but selecting the right context without begging the question isn’t obvious. On the other hand, if we assume that concepts associated with philosophical analyses of science have some sort of atemporality, we violate legitimate historiographical concerns.

Does this mean that Kuhn’s wake-up call to philosophers to pay attention to history was misguided? I think not. However, as philosophers we need to lower our sights, or perhaps we need to raise them and consider more than only abstract philosophical criteria. Further, we need to develop a more robust sense of the sloppiness of our conceptual history. We seek precision, definitional clarity, analytic sophistication. These are good—but there is more to understanding: depth, flexibility, and a sense of the give and take and contingency found in history.<sup>2</sup>

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1. Documenting this claim is the object of a project currently in progress, *Seeing Near and Far, a Hericlitian Philosophy of Science*.

2. This leads me to believe that my colleague Richard Hirsh may be correct when he suggests that if you can’t call the guy up and interview him it isn’t history.

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