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"Exploratory experimentation" as a probe into the relation between historiography and philosophy of science

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ABSTRACT

This essay utilizes the concept "exploratory experimentation" as a probe into the relation between historiography and philosophy of science. The essay traces the emergence of the historiographical concept "exploratory experimentation" in the late 1990s. The reconstruction of the early discussions about exploratory experimentation shows that the introduction of the concept had unintended consequences: Initially designed to debunk philosophical ideas about theory testing, the concept "exploratory experimentation" quickly exposed the poverty of our conceptual tools for the analysis of experimental practice. Looking back at a number of detailed analyses of experimental research, we can now appreciate that the concept of exploratory experimentation is too vague and too elusive to fill the desideratum whose existence it revealed.

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1. Introduction

This collection deals with a meta-philosophical and meta-historiographical topic, namely the relation between and the possible convergence of historiography and philosophy of science. My plan is to use the concept "exploratory experimentation" as a probe into that relation. But before I begin, I need to clarify my own analytic perspective.

Prima facie, the more general topic of experimentation is ideally suited for the discussion of the convergence of history and philosophy of science because experiments have been a topic of discussion for both historians and philosophers of science at least since the 1980s. At that time, history and philosophy of science took a "turn to experimentation". But on closer look, matters are more complicated. There were several different developments leading to this turn, which means that several different aspects of experimentation have become topics of scholarly interest. Moreover, the turn to experimentation has provoked a lot of meta-philosophical debate about the scope of philosophical study.

One important driving force for the turn to experimentation was the impasse that had been reached in the debate about scientific realism. The sorry state of this debate around 1980 was one of the motivations for Ian Hacking to develop his "new experimentalism" in *Representing and Intervening* (Hacking, 1983). Hacking's work has stimulated novel epistemological and metaphysical analyses of scientific arguments, so we might say that *Representing and Intervening* is a philosophical book. However, this book also contains a wealth of comments on the nature of scientific practice that are not as obviously philosophical, such as Hacking's characterization of observation as a "skill"; his suggestion that scientific theories come in different forms, namely as speculation, calculation, models, and approximations; his comments on the professional status of "theoreticians" and "experimentalists" and so on.

Other scholars turned their attention to experimental practice because they wished to demonstrate that the study of published theories and arguments gives only an incomplete picture of investigative pathways, of the negotiations involved in producing inscriptions, and of the sites and tools of experimentation (e.g. Holmes, 1987; Latour & Woolgar, 1986; Shapin & Schaffer 1985). Moreover, the 1980s saw a revival of the debates about the logic of discovery, which also led to a new interest in the study of experimentation (Nersessian, 1992; Nickles, 1980). The turn to experimentation has inspired numerous studies from diverse perspectives, including, but not limited to, analyses of the ontological status of experimental effects; interpretations of laboratory

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notebooks; actual replications of past experiments; classifications of experimental strategies; analyses of interviews with scientists; and studies of scientific creativity. A number of these endeavors are hard to classify as "history" or "philosophy of science"; however, the language of convergence may not even be adequate because it implies that a distinction can in fact be drawn.

The more specific concern with exploratory experimentation too escapes easy classification. The term "exploratory experimentation" was proposed in the late 1990s, and since then, it has had a fairly successful career as a conceptual tool for the analysis of experimental practice.[1] Exploratory experimentation has been a topic of interest for philosophers and historians alike. But I am reluctant to take this fact as clear and straightforward proof that philosophy of science and history of science *converge* on exploratory experimentation. The problem is that in order to judge whether convergence is occurring, one would need to know the nature and scope of philosophical study. But where should this understanding come from, if not from a survey of current philosophical research? The problem is that in the last decades, philosophy of science has become so diverse that it is extremely hard to provide a meaningful characterization of philosophical study that will capture the majority of works in the field.[2]

I am putting the meta-philosophical conundrum aside for the moment. In the main part of this paper, my working distinction between philosophical and historiographical endeavors is sociological, based on the institutional affiliations and publication outlets of the scholars who scrutinize exploratory experimentation. I am going to use the labels "philosopher" and "historian", but only for convenience—if the authors of papers or books are members of philosophy departments and publish predominantly in philosophy journals, I call them "philosophers", if they publish mostly in history journals, present at history conferences, and work in history departments, I call them "historians". I discuss issues arising from the study of exploratory experimentation and characterize the tasks involved, but I hold off on the question of whether these issues are really "genuine philosophical" issues.

In the next section, I trace the emergence of the conceptual tool "exploratory experimentation" in the late 1990s (1). I then turn to the suggestion that exploratory experimentation produces a new kind of knowledge and discuss a weak and a strong version of this suggestion. I show that only the weak version is plausible (2). The concept "exploratory experiment" was initially devised to problematize philosophical thought about theory testing, but this project quickly turned out to be ill conceived. Still, the discussions about exploratory experimentation have been productive because they have helped elucidate two key conceptual tools for the analysis of scientific practice: the concepts "theory" and "instrument". I show how the study of episodes of "exploratory experimentation" has produced a more nuanced conceptual framework for the analysis of experimental practice (3). One of the early approaches to the study of exploratory experimentation leads into discussions about methodological strategies for experimenters. Even though it takes me away from the topic of exploratory experimentation I follow this lead because I can draw out additional aspects of the relation between historiography and philosophy of science (4). In conclusion, I come back to the question of the possible "convergence" between historiography and philosophy of science.

2. Simultaneous introduction?

Many, if not most contributors to the discussion about exploratory experiments maintain that the term was coined simultaneously, if independently, by Richard Burian (Burian, 1997) and Friedrich Steinle (Steinle, 1997).[3] Reading the two sources, however, one quickly finds that the two notions of exploratory experimentation they present are really quite different. Both authors introduce the term to characterize a specific mode of research, but they do so for different purposes, and each author highlights a different aspect of experimental practice.

Steinle pitches his concept against what he calls the "standard view" in philosophy of science, namely the position that it is the role of experiments to test scientific hypotheses. This view is usually associated with Popper, who stated in his book *The Logic of Scientific Discovery* that the "the theoretician puts certain definite questions to the experimenter, and the latter, by his experiments, tries to elicit a decisive answer to these questions, and to no others. All other questions he tries hard to exclude" (Popper, 2002, 89). Popper's pronouncement has become the foil against which the concept of exploratory experimentation is set. In his 1997 paper, Steinle claims that experiments are not always performed to test theories. Drawing on examples from the history of electricity, especially the work of Faraday, Steinle characterizes a kind of experimentation that is performed to obtain empirical regularities in situations where no well-developed theories are available.

Steinle's initial presentation of the topic as a critique of traditional, specifically Popperian philosophy of science leads straight into the meta-philosophical conundrum that I brought up in the introduction. Insofar as this critique takes Popper's statement as an empirical statement about actual scientific practice, the critique strikes me as misguided. To be sure, Popper's statement *sounds like* an empirical description of scientific practice, but it should not be taken out of its context. Most 20th-century philosophers of science, Popper included, would happily agree that exploratory experimentation can be epistemically significant in the weak sense that it may play a part in the generation of new knowledge. The point Popper (and others) wished to make was that while experimentation can have many functions in actual scientific practice, the function of experiments as tests of theories is the only function that is relevant for the justification of these theories and hence the only function that philosophers should care about.

If this is a correct reading of Popper, then making the case that exploratory experimentation is a theme for *philosophy of science* requires more than showing that some new theories were in fact generated through exploratory research. It requires showing either that exploratory experimentation has a *justificatory* function or that the scope of Popperian philosophy of science is too narrow and that philosophy of science has to include descriptions of actual practices of knowledge generation. To show that exploratory experimentation has a justificatory function, one would need to demonstrate

[1] Scientists themselves, by the way, also use the term "exploratory experimentation". In science journals, the term "exploratory experimentation" appears prior to the 1990s; but as far as I can see, it was then not very common. Nowadays, both the NSF and the NIH are funding "exploratory" work. It would be very interesting to examine the NSF's understanding of "exploratory" research and compare it with the understanding of the term in history and philosophy of science. But this topic goes beyond the scope of the present paper.

[2] It seems to me that the nature of history of science is much less problematic in the sense that much less boundary work is done in history of science than in philosophy of science. Meta-historiographical disputes are either concerned with assessing and comparing different approaches *within* history of science or with the question of what might be called *science*. One may doubt that, say, the study of "science in the (Victorian) pub" is indeed history *of science*, but there will be little doubt that it is *history*.

[3] Incidentally, both scholars come from an interdisciplinary background: In 1997, Burian was Professor of Philosophy at Virginia Tech and at the same time affiliated to the STS Program. Steinle had completed a dissertation in history of science and was working as a researcher at the Department of Philosophy at the University of Göttingen, Germany.

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