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Section 74. Philosophy of Science

Philosophical Boundaries Between Scientific Disciplines

Abstract: This paper explores the often assumed but understudied disciplinary assumption in the philosophy of science: that philosophical commitments are uniform within disciplines and vary substantially across them. Preliminary findings from interviews with scientists across diverse disciplines suggest partial endorsement of this assumption. While some philosophical commonalities exist between disciplines, distinctions also prevail. The study highlights the need for further research, including a large-scale survey, to comprehensively examine and understand the philosophical landscape within and between scientific disciplines.

Keywords: philosophical commitments, scientists, interviews, scientific disciplines, cross-disciplinary

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In philosophy of science, one significant boundary is that of scientific disciplines. Work is commonly divided into specializations by disciplines (e.g., philosophy of physics) or disciplinary branches (e.g., philosophy of social science). Yet, a common form of scientific practice is cross-

disciplinary research (Hackett et al., 2017). Some philosophy of science has acknowledged this shift, exploring, for example, how disciplines can be integrated (Bechtel, 1993). So far, insufficient attention has been paid to the boundaries between scientific disciplines themselves, and specifically to whether they can be drawn as cleanly as commonly supposed. Here, we report preliminary data from a large-scale project aiming to map these boundaries.

For years, scholars have highlighted challenges associated with cross-disciplinary research (CDR). An important class of challenges relates to how different scientists conceptualize the world and its scientific study (Palghat et al., 2017). These conceptualizations frame how scientists understand and pursue their research practice. We refer to these conceptualizations as *philosophical commitments*. The prevailing assumption—**the disciplinary assumption**—is that philosophical commitments are relatively uniform within disciplines but differ substantially across them (Eigenbrode et al., 2007; Osbeck & Nersessian, 2017).

These philosophical commitments reflect the epistemological, ontological, and axiological dimensions widely employed in philosophy of science (e.g., Hitchcock, 2004) and social science (e.g., Moon & Blackman, 2014). Science involves positions on what we can know about the world and how we can come to this knowledge (epistemology), fundamental beliefs about the things that exist in the world and their nature (ontology), and views about how science ought to proceed and the social values it should promote (axiology). Choosing, for example, a classification system for predicting the impacts of damage and restoration efforts on a waterway embodies epistemological commitments about what we can come to know (Lave, 2009). Settling on a method for substantiating a causal relationship between a medical condition and a potential agent presupposes ontological commitments about the nature of causation (Andersen et al., 2019). Determining how to communicate uncertain results to the public about climate change and environmental pollutants turns on axiological commitments about the importance of social values such as protecting public welfare and maintaining public trust in science (Elliott, 2011).

These commitments influence decisions throughout the research process, from choosing what to study to determining how and to whom to communicate results. Consequently, scientists' philosophical commitments may facilitate or inhibit CDR. For example, the nature of the evidence required for scientific knowledge is an epistemic issue about which a scientist of any discipline can have a philosophical commitment. If scientists collaborating on a CDR project have different epistemic commitments, addressing such differences may be necessary to collaborate effectively (Lélé & Norgaard, 2005; O'Rourke & Crowley, 2013).

The disciplinary assumption is prevalent and taken as given within multiple literatures, including science and technology studies (e.g., Jacobs & Frickel, 2009; Leahey, 2016),

interdisciplinarity (Pooley et al., 2013), and philosophy (O'Rourke & Crowley, 2013). Indeed, in a recent review, Sandoval et al. (2016, p. 469) refer to "obviously different epistemological perspectives among the disciplines." Prior case studies and qualitative investigations indeed establish contours of a few philosophical differences among a few disciplines (e.g., Rotter et al., 2021). Yet, only a handful of quantitative studies measure philosophical commitments across multiple disciplines (e.g., Beebe & Dellsén, 2020; Mizrahi, 2020; Robinson et al., 2019; Robinson et al., 2016; Starmans & Friedman, 2020), and these are limited in the breadth of disciplines surveyed or the depth of philosophical commitments examined.

Qualitative case studies provide much of our limited understanding of philosophical differences between disciplines (e.g., Brown et al., 2015; Klein, 2012; McLeod et al., 2018), mostly focusing on the divide between social sciences and the physical or biological sciences (Charnley et al. 2017; Olsson & Jerneck, 2018). For example, Rotter et al. (2021) describe how anthropologists tend to treat knowledge construction as situated and iterative, while marine ecologists and geologists approach data collection as utilizing predetermined methods to generate objective truths.

Our team is in the process of interviewing ~50 scientists across the sciences and then and then conducting a survey of ~3,500 scientists across the disciplinary spectrum. Here we report preliminary findings from the semi-structured interviews on the question of whether scientists themselves believe these philosophical commitments are consistent within their discipline and distinct from other scientific disciplines. To determine our interviewees, we first identified the main US-based professional society for each scientific discipline and its flagship journal. We then randomly selected 8 journals per scientific family (life sciences, physical sciences, and social/behavioral sciences). For each journal, we randomly selected an associate/assistant editor to invite for an interview. As of October 2023, 12 interviews have been conducted, of which 5 were randomly selected to report here from the following disciplines: biology, geology, meteorology, anthropology, and atmospheric sciences.

Regarding philosophical consensus within disciplines, one meteorologist stated that within meteorology they expect some "to have different opinions, maybe about like the policy advocacy stuff…. But there's certainly strong consensus on things like some of the fundamentals of the scientific process." A biologist said they "think there's pretty decent consensus" at least when it comes to "major topics." An atmospheric scientist is more uncertain, stating, "As a as a community, we don't talk about these things very much, which is interesting…. When you go to grad school, no one sits down and tells you this is how you're a scientist. I honestly don't know the extent to which people would agree." An anthropologist, however, is certain there is "not a lot" of consensus in their discipline. "Most anthropologists are over in their corners."

A geologist we interviewed addressed both internal unity and external distinctiveness at the same time, saying, “I think that if I sat down with other geologists… there would be some things we'd agree upon, and some things we wouldn't. But I think geologists agree more than if we had a mixed table of geologists and microbiologists and astronomers, it might be a lot bigger of a range.” Everyone else in our sample expressed a similar view of their discipline being philosophically distinct from at least one other discipline. For example, the biologist stated, “I'm thinking about contrasting like biology with like physics or chemistry… they tend to be a lot more concrete. They tend to actually embrace some laws about the world around them. I think biologists tend to be a lot more, a lot less sure that what we've discovered is generalizable.” The meteorologist stated, “I think, the nature of atmospheric science is it's rooted in a desire to predict the atmosphere, right? There's a lot of other sciences that aren't necessarily strongly rooted on that timescale.” Finally, the anthropologist stated, “So I think, and the ethics of anthropology are different…. And I think we look at a lot of other fields, and we feel that they're not adhering to the same set of ethics.”

These preliminary findings suggest that scientists appear to partially endorse the disciplinary assumption. They see some philosophical similarity with other disciplines, but some distinctions too. There is less certainty in our sample regarding philosophical consensus within their own disciplines. Future research, including a large-scale quantitative survey, is currently underway to investigate these findings further.

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