

Science's moral economy of repair

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COMMENTARY



Science's moral economy of repair: Replication and the circulation of reference

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ABSTRACT

Responding to the so-called reproducibility crisis, various disciplines have proposed – and some have implemented – changes in research practices and policies. These changes have been aligned with a restricted and rather uniform conceptualization of what science is, and knowledge is made. However, knowledge-making is not a uniform affair. Here, we reflect on a salient fault line running through *Wissenschaft* (the whole of academic knowledge making, spanning the sciences and humanities), grounded in the relationship between the acts of research and writing, separating research as reporting from research as writing. We do so to demonstrate that replication and replicability cannot be treated as uniformly applicable and that assessment and improvement of research quality invites various tools and strategies. Among those, replication is important, but not omnipresent. Considering these other tools and strategies in context allows us to situate the value of replication for knowledge making as a whole.

KEYWORDS

Replication; replicability; epistemic pluralism; research; writing

Growing concerns about the reproducibility or replicability of well-known studies, as well as a number of high-profile cases of scientific misconduct, have produced narratives of crisis (e.g., Harris 2017; Randall and Welser 2018; Saltelli and Funtowicz 2017; Saltelli, Ravetz, and Funtowicz 2016). Though the label of crisis was also actively rejected by some (Fanelli 2018; Lash, Collin, and Van Dyke 2018; Redish et al. 2018), a series of changes to the process of knowledge making and reporting were proposed with explicit reference to the reproducibility and credibility crises in science. The dominant response has been to identify, expose and expunge as much bias as possible, and to continue to uphold objectivity as the hallmark for proper science (Ioannidis 2005, 2014). In support of this goal, at least three parallel trajectories have been initiated. First, through for instance meta-scientific studies (also sometimes referred to as meta-research or “research on research”), biases are actively sought, made visible and

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studied. Second, open science practices are meant to either expose bias or discourage biased work, and attempt to turn the ivory tower into a glass house. Similarly, norms, standards and expectations with respect to reporting conflicts of interest aim to make biases visible. Third, the ever-growing replication/reproduction movement actively seeks to promote objectivity from the scientific corpus by testing studies and evaluating them based on how well they hold up when repeated.

Combined, the three parallel, yet highly interconnected trajectories (metascience, open science and reproducibility movements) can be grouped into a *moral economy of repair* for science. Moral, since it is connected to specific normative expectations about how science should be. This moral economy of repair influences the social and epistemic foundations of science, reshaping the ways in which credibility is built within science and outside of it.¹

Regardless of whether there is agreement on the existence of actual crises of science, the attempts to repair science have very real effects. The problem we have with attempts to “repair” a “broken” system is not that we disagree on attempts at improving the conditions under which science and scholarship is undertaken, communicated and accounted for. Our key concern is whether the attempts to repair science take into account the plurality of its epistemic practices: the various ways in which knowledge is made. In this commentary, we focus on reproducibility and replication, but we suggest that the question applies to the other two aspects of the repair economy, as well.

Epistemic and evaluative plurality

Although we often speak collectively of academia or science, knowledge-making obviously is not a unitary activity. Observation, experimentation, modeling, theorizing, and simulation all present legitimate paths to knowledge. Additionally, objects of study and the tools required to access those objects of study differ remarkably. That these different approaches and objects combine into a mosaic of knowledge-making strategies has been the subject of multiple theories of plurality in science.² Aligning with plural knowledge-making practices are plural publication practices and, above all else, different conceptualizations of the relationship between research and writing.

In the sciences, writing predominantly takes the form of reporting. The scholarly text is a means of communicating the findings obtained in research elsewhere and before. This clearly detaches research from writing, although references between the two are cultivated and actively maintained. Paradoxically, at least *prima facie*, authors of papers need not have played a prominent role in writing them. Instead, authorship is conceived as intrinsically related to the performance of research labor (Kovacs 2017; Penders 2017). Sequencing a gene is an act separate from reporting it in writing –

physically and temporally. The analysis of that sequence data also exists separately, and again, the text reports on the task.

On the opposite end of the epistemic spectrum are the humanities and some interpretative social sciences. Rather than separating research and writing, these fields do not establish a clear boundary between the two, if they draw a boundary at all. The text can, but does not need to, report research that exists elsewhere, physically and temporally separated. In branches of, for instance, philosophy, the text *is* the research, and the act of writing the text is identical to the act of doing research. The argument and logic is developed in the production of a book, chapter or paper and even though some thoughts do not make it into the writing, the writing offers a bounded and coherent narrative in which *knowledge-making*, not just *knowledge made*, is visible. The epistemic spectrum is bounded by these positions but hosts many more intermediate positions. For instance, in anthropology, field notes and interview notes exist independent from the book or paper to which they contribute. The analysis of those notes, however, does not: it resides in the text. Similarly, a discussion of a work of art takes place in the text, even though the work of art itself cannot usually be contained in the text.

If we contrast the two writing cultures on the opposite ends of the spectrum, we can summarize them as *writing as reporting* versus *writing as research*. When it comes to putting the world into words, both maintain different strategies. The first maintains networks of circulating references – connections between all the ingredients of a body of research both material and textual – that extend far beyond the text: into materials, tools, equipment, other texts and people, and more. The latter also maintains networks of circulating references, yet these exist in the text (and in other texts) (Latour 1999). The tools we have to assess the value and quality of both types of networks are different. On the extreme end of the second writing culture, assessing the text equals assessing the quality of the research and the integrity of the network of circulating references. In the first writing culture, however, assessing the text does not suffice to assess the quality of the research, since it offers only partial and potentially skewed access to the network of circulating references that ties it to samples, materials and the objects data points refer to. Reproduction or replication are ways to assess the research underlying the text and test the integrity of the network of circulating references. If another team repeats the research, by asking the same question, producing their own data (replication), or using existing data (reproduction), analyzing it and reporting results and analysis in writing and reported findings overlap sufficiently (ideally: fully), this counts toward quality assessment greatly.

Evaluating products that emerge from both writing cultures invites questions about their relationship to the knowledge they represent, the purposes and goals of the research agendas underlying them and the ways in which

they aim to reach them. Writing as reporting, especially when supplemented with well-organized replication efforts, aims to end debate and assemble consensus. It aims to establish *matters of fact*. Writing as research, in contrast, often aims to establish *matters of concern* (Latour 2004). It may offer competing interpretations of a thinker (philosophy), parallel descriptions of cultures (anthropology and cultural studies), conflicting interpretations of social structures and movements (interpretative sociology), or contrasting readings of Shakespeare, Leonard Cohen, or Damian Hirst (arts). In short, it aims to create, maintain or expand debate and question consensus. It is worth noting that, within the humanities matters of fact are sometimes pursued as well. The provenance of a work of art, or its age, the distribution of linguistic patterns, these are issues for which consensus would be desirable and attainable. Consequently, confined to these issues, replication does enhance credibility (for examples, see Peels and Bouter 2018). However, in its exact mirror image, many problems in the physical and life sciences are unique to such extents that replication cannot take place or enhance credibility (for examples, see Leonelli 2018).

Reward or risk?

Replication, as an instrument of accountability and as a facilitator of knowledge making, offers great rewards when mobilized in the appropriate epistemic context. It allows displaying and assessing the quality of research and the matter(s) of fact underlying the text, tracing circulating references tying together world and word, to some extent regardless of the textual quality of the presentation of the research in the text. Many proposals to incentivize researchers differently only makes sense in “writing as reporting” research cultures, for instance through publishing datasets, databases, curated collections or code. An interesting example is the proposition of “nano-publications” – smallest units of publication that enable dissemination of data as independent outputs with or without an accompanying article.³

However, when extended beyond the appropriate epistemic context, those incentives and rewards turn into risks. In an epistemic culture in which writing equals research (in full, or in part), a nano-publication is nonsensical, and successful replication would require the subsequent repetition of analysis the original study laid out. If those research practices are textual practices, it would mean that successful replication equals, or at least approaches duplicate publication⁴ of the same or an insufficiently different paper. The duplicate paper would add nothing to our evaluation of the matter of concern. It would not represent original thought or add credibility to a consensus, since that is not its aim. It could harm, or at best be irrelevant to, research geared toward maintaining debate and facilitating social learning through the production of variability (Van Gunsteren 1994).

Replication, we argue, is indispensable to assess large bodies of research in pursuit of matters of fact: to validate, value and assess it, helping to build its peer and public credibility. Replication can, however, also harm research credibility. This is the case when it is required of knowledge-making practices that pursue matters of concern. In these practices, being asked to engage in replication may even be seen as research waste, since duplication does not – as replication can – add credibility to a claim. Current replication drives, debates and movements are well aware of various practical limitations on replication, including but not limited to sparse research materials, temporally isolated events or changing positions, opinions, perspectives in populations. The epistemic diversity of science, however, is underrepresented or ignored in most replication accounts, allowing replication expectations and perhaps even requirements to misalign with many articulations of relevance, impact, value or quality of research (Peels 2019; Penders, Holbrook, and de Rijcke 2019). There is no one size fits all in science and neither is there when it comes to replication and accountability.

Notes

1. Research on research is hardly new and finds its roots in the philosophy, sociology, history, and anthropology of science (De Solla Price 1965). Similarly, the pursuit of openness in scientific conduct and reporting can be traced back to, for instance, public witnessing of experiments (Shapin and Schaffer 1985). Finally, discussions on how to assess whether a research finding holds up are as old as research itself. Repetition, in its many forms, has always been an important part of that discussion.
2. Many frameworks for plurality in science have been proposed, ranging from paradigms and thought styles (Fleck [1935] 1980; Kuhn [1962] 1970) to epistemic cultures (Knorr-Cetina 1999, 1991). For an overview of (the history of) plurality in science, see Chang (2012).
3. See e.g., http://nanopub.org/wordpress/?page_id=65 (accessed 25 November 2019).
4. Some would argue plagiarism (we thank Matthias von Herrath, who reviewed this paper, for this point).

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