Philosophy of Science for the Replication Crisis

Replication crisis denotes the problem (crisis) faced by virtually all empirical disciplines. It is defined in terms of attempts at independent repeats of the original experiment that report results differing from the original. Replication attempts differ in the degree of similarity to the original study.

Failed replications have been suggested not to be a sign of the original result emerging from mistakes or errors. Such a view on the replication crisis focuses on a narrower issue but the one that received limited attention from philosophers of science, i.e., on the problem of conflicting results. 'Conflicting results' denotes a situation where one study delivers evidence for a positive relationship between two phenomena (variables) or a positive treatment effect and another study suggests the two phenomena to be unrelated or even a negative sign of that relationship.

This problem can be understood as a sub-problem of the replication crisis, where two methodologically sound studies report effect sizes differing in size or even sign. While the crisis of the replicability of results involves questionable research practices or honest errors, conflicting results emerge due to the malleability or fragility of statistical results, where minor changes in estimation techniques or decisions about concept operationalization and research design lead to obtaining different or even opposing effect sizes.

The project focuses on the problem of conflicting results understood as an aspect of the replication crisis, where outcomes reported by methodologically sound and error-free studies remain in disagreement. This research project involves using methods standard for philosophy (such as conceptual analysis and case study analysis), but also relies on a novel method of agent-based modeling, which has recently been successfully applied to address philosophy of science questions but has not been used to investigate the replication crisis so far.

The conceptual analysis will be used to address the questions of what are conflicting results and what is the sense in which data models represent phenomena. Conceptual analysis and conceptual engineering will also be used to deepen the understanding of the sense in which data models represent. The main part of the project will rely on agent-based modeling to address epistemic and non-epistemic factors that influence the prevalence of conflicting results. Such models describe the behavior of represented agents (e.g., research teams) with simple rules and then simulate the behavior of and interactions among agents. By comparing simulation results with different rules, the modeler learns which factors play a causally-relevant role in the simulated phenomenon.

The advantage of agent-based modeling is that some characteristics of the simulated process might emerge that, due to its complexity, could not be studied with formal methods. Such models have been argued to be a tool useful for integrated history and philosophy of science.