The Science in Computer Science. In Search of New Frameworks

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The debate on the disciplinary nature of computing has been going on for years: it is reflected in the name of the discipline [2], [4], [11]; it deals with the role of computing with respect to other disciplines [3], [12]; it is also about what kind of conceptual instruments philosophers and theoreticians are supposed to use to reason about the discipline's foundations. Computing has often been placed somewhere between science (due to its rigorous foundations) and engineering (for its focus on the production of technology, i.e. the construction of artefacts such as computers and robots).

In this debate, the traditional tools of the philosophy of science were used in most cases. For instance, in the discussion on the methodological nature of computing some researchers still grant the traditional experimental method a primary role in the study of its disciplinary nature, and focus on trying to adapt long established concepts to accommodate computing into existing frameworks [7].

However, there seems to be enough evidence showing that, although there is an undeniable and essential continuity, the engineering and technological aspects of computing set the discipline apart from traditional science, from the perspective of both objectives and methodologies [8]. Although this issue has already been acknowledged by the ACM in the Denning Report [5], we believe that it still needs to be considered further from a conceptual point of view. In this paper we propose to widen the traditional conceptual framework by going beyond the boundaries of the philosophy of science and including discussions that take place in other (both already existing and novel) disciplines, such as the philosophy of technology, the philosophy of computing/computer science, and the area of analysis labelled as "philosophy and engineering".

The distinction of computing from traditional scientific disciplines naturally calls for the search of a proper conceptual framework with which one can reason about it. Adopting what exists and extending it for a better fit to computing is indeed a good starting point, but such effort must be integrated with the introduction of new concepts that reflect its peculiar status. In our endeavor, we plan to move along three different but interconnected directions. The first one deals with the notion of *directly action-guiding experiment* [6], as characterizing a significant part of the experimental practice in computing, in opposition to the one of epistemic experiment. Whereas an experiment is epistemic when it aims at providing us with information about the workings of the natural world, an experiment is directly action-guiding if and only if it satisfies two criteria: a) the outcome looked for should consist in the attainment of some desired goal of human action, and b) the interventions stu-

died should be potential candidates for being performed in a non–experimental setting in order to achieve that goal. The second direction concerns the debate around *engineering ontology* and *engineering epistemology* [9], [10], and whether adapting frameworks from the traditional philosophical debate can suffice to take into account the peculiarity of the discipline. Finally, the third direction acknowledges the empirical turn in the recent philosophy of technology [13], introduces the framework of *technoscience* as an engineering way of being in science, and invites philosophers of science to take this notion seriously in order to shed light on a range of questions that have been neglected so far [1].

In this endeavor we focus, in particular, on experimental computer science as a paradigmatic case, in which the call for experiments is a way to assess the scientific status of the discipline, and a full adequacy to the standards of the traditional experimental sciences is advocated. As a result of extending the framework of discussion, we propose to stretch the traditional notion of experiment along the directions listed above.

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