Much of recent philosophical literature on computer simulations has mainly focused on their epistemological and methodological side. As currently framed, studies on the epistemology of simulations can be found in the form of comparing simulations with experimentation, fathoming their features as measurement devices, and sizing up similarities and differences with thought experiments. As for the methodological side, we can mention the works of Paul Humphreys and Eric Winsberg as the most prominent on the current literature. Naturally, there are more topics relevant for the philosophy of computer simulations, as well as a large amount of literature. Much more can be brought into the picture by addressing questions about the nature of an algorithm, and about the epistemic and practical dimensions of visualization, just to mention two examples.

The purpose of my work is to deepen into the epistemology of computer simulations by showing their explanatory virtues. More specifically, I analyse under what conditions results of computer simulations are explained, and what sort of understanding is obtained. For this, I proceed in a two-fold fashion. Firstly, I address methodological issues of simulations, such as the design, inclusion of strategies, and implementation of a simulation model; questions about the techniques that make simulations similar – and different – from laboratory experimentation and mathematical modeling are also discussed; as well as the structures involved in a representation of a target system. The purpose of this analysis is to conceptualize in a systematic way the notion of computer simulations and of their results.

EXPLAINING SIMULATED PHENOMENA. A DEFENSE OF THE EPISTEMIC POWER OF COMPUTER SIMULATION

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As expected, these methodological issues convey epistemological questions that seek for an answer.

Secondly, and based on the previous analysis, I discuss the explanatory virtues of computer simulations. For this, I must find a suitable theoretical framework where I can accommodate computer simulations. Since the purpose is to understand the logic of explanation for computer simulations, as opposed to any pragmatic or agent-based account, I address different theoretical frameworks. In this respect, I begin by discussing – and later disregarding – the deductive-nomological account, Salmon's causal-mechanical model, and pragmatic accounts as unsuitable for computer simulations. Next, and due to the abstract/mathematical nature of simulations, mathematical explanation of physical phenomena is discussed. Ontic accounts, such as mechanistic models, and model explanation are also discussed and disregarded on different grounds. I finally arrive at the unificationist account, as elaborated by Philip Kitcher. Within the unificationist framework, I display not only its suitability for accommodating simulations, but also show what is the explanatory relation between the results of a simulation (i.e., explanandum) and the simulation model (i.e., explanans). In addition, I argue that explanation in computer simulations provides understanding of the given results as well as of an empirical phenomenon represented by such results.

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