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# Situating technological and societal futures. Pragmatist engagements with computer simulations and social dynamics

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ABSTRACT

This article employs pragmatist ideas to conceptualise the interdependencies of epistemic instruments and societal futures. Drawing on recent discussions in science and technology studies, it argues that the numerical predictions of computer simulations do not only create novel kinds of future knowledge (epistemic performativity), but also new practices and arrangements of prediction (social performativity). The conceptual framework centres on Dewey's logic of inquiry as the transformation of indeterminate into determinate situations and the role which epistemic instruments such as computer simulations play in this transformation. In order to trace the social performativity of numerical predictions, the paper will provide answers to three questions from a pragmatist perspective. The first question concerns the agency of computer simulations as transformative means in social relations. The second revolves around the impact of these simulations on specific ways of thinking about the future. And, third, the observation and analysis of these changes through empirical research will be addressed.



## 1. Introduction

The deep interrelation of novel technologies and social change continues to drive societal dynamics and spur social research. Of the manifold technological innovations that occasion social transformations, this paper specifically addresses computer technologies, namely computer simulations. Since the field of computer simulations itself presents a diverse mix of approaches, methods and technologies, the following arguments will be set in a more limited scope. The main focus will be on numerical predictions of social dynamics, i.e. using numerical computer simulations to predict social dynamics such as market or political processes. Since computational power has become more widely accessible within the past 25 years, computer simulations increasingly transgress the boundaries of science. These instruments are now broadly employed in other societal fields, such as the economy or politics.

In the context of this special issue, the migration of epistemic technologies from the scientific laboratory to societal applications is taken as a case in point for studying the dynamics and transformations of technical and social change. In contrast to the nimbus of exact calculability which surrounds most of modern science, technology, and society, computer simulations are approximations with heuristic value. They are neither true nor false in the classic sense, but instead they are more or less useful for guiding further action or understanding [48]. In this way, computer simulations may serve as corrective epistemic agents or heuristic devices to inform decisions or theories. But numerical predictions are not self-evident and have to compete with other forms of future-knowledge or normative objectives. Therefore, they require specific epistemic strategies in which they are embedded in order to be 'made true'. These new epistemic strategies are inherently bound up with the concrete socio-technical arrangements in which computer simulations are calculated and the societal fields in which they circulate – for instance from science to politics.

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The paper will sketch out a framework for conceptualising such transformations based on a pragmatist understanding of 'tools-in-use' and a focus on situations as basic units of analysis. The situational focus acknowledges social praxis as fundamentally contingent and continuously produced by the actors and artefacts involved. It is a non-reductive perspective that precludes any reduction of the social to the technical or vice versa. At the same time, it enables the researcher to trace the reciprocal stabilisation of technical and social dynamics into increasingly durable heterogeneous arrangements. With regard to numerical predictions, both the contingency and stability of social praxis will be conceptualised as products of the interdependency between epistemic instruments and social coordination.

Following the discussion on performativity in science and technology studies (STS [5,33]), the argument emphasises the role of computer simulations as epistemic devices which co-produce the futures they predict. In addition to such an epistemic performativity, which is inherent to all predictions of social dynamics in the sense of the Thomas Theorem [52, p. 572], the paper especially seeks to elaborate how computer simulations may be seen as generators [46] of new social practices and arrangements of prediction in the present. My main thesis is that social performativity might actually have a larger impact on the creation of societal futures than epistemic performativity itself, because it is the social processes of legitimation and justification in which – in a pragmatist sense – the predictions are '*made* true' [24, p. 142]. From a pragmatist perspective, the logic of inquiry therefore cannot be separated from the logics of justification. The interrelations of epistemic and sociological questions become even more prominent, since numerical predictions are mostly produced in teams and used in organisational contexts. Therefore, we must ask ourselves how novel epistemic instruments impact on forms of social coordination and vice versa.

The conceptual discussion will be linked to three more general questions which make up the general outline of the paper. The section that follows (2) will be concerned with the transformative agency of computer simulations. This section elaborates an understanding of computer-based numerical predictions based on Dewey's notion of 'inquiry' [8] as an ongoing transformation of indeterminate into determinate situations. Dewey's ideas on the mediation of instruments and knowledge will extend this basic understanding [7,11]. In this perspective, instruments are neither autonomous nor neutral, but transformational in the context of social relations. Moreover, and in line with my main argument, instruments not only create new knowledge, but also novel forms of social organisation. The next section (3) will consider the question of how numerical predictions may impact on specific conceptions of the future. Based on a pragmatic understanding of truth [25], the self-fulfilling potential of predictions will be discussed, along with its relevance for numerical predictions. Truth is therefore not a prerequisite for predictions themselves, but rather their outcome. The idea that societal futures are situated in a social present will be elaborated in section (4) by discussing Mead's [35] ideas on the relations of past, present and future. Last but not least, a brief conclusion will revisit the previous arguments in order to sketch out a comparative epistemic strategy that links empirical and conceptual issues.

## 2. Numerical predictions and the logic of inquiry

Since the early days of computer simulations in the 1950s, they have been used to model, analyse and predict social dynamics. And since the beginning, a diversity of the uses and understandings of the term simulation can be observed in the then nascent scientific field. Simulations were broadly conceived as 'the act of representing some aspects of the real world by numbers or symbols which may be easily manipulated to facilitate their study' (McCoy cited in Refs. [34, p. 6]). Within a few years, computer simulations became broadly employed in a variety of academic fields and pertaining to diverse research questions, e.g. in political and management science or sociology [49]. Predicting social dynamics using computer simulations was one of the main interests, even though it was already at that time heavily contested in methodological terms [32] and in terms of its political application [20]. Until today, numerical predictions of social dynamics have retained a somewhat precarious existence in the social sciences.

The field of futures research, which is predominantly concerned with the forecast of social dynamics, employs computer simulations only sparsely and if so, only in addition to qualitative methods such as literature reviews, delphi methods or scenario techniques [45]. And prominent numerical predictions in the field, such as the Club of Rome's study 'Limits to Growth' [38] are not valued for their epistemic accuracy, but rather for their social impact [3]. The emerging field of computational social sciences [17], on the other hand, draws exclusively on computer simulations, but refrains from making predictions in the traditional sense, since simulations in the social sciences aim at 'the development of explanations, rather than the prediction of specific outcomes' [18, p. x]. Last not least, the field of science and technology studies has been concerned with computer simulations in the natural and engineering sciences from general epistemic questions [22,54] to concrete socio-political issues, e.g. in case of climate simulations [14,47]. However, STS has not focussed on simulations of social dynamics, especially those used outside of science in fields such as politics or the economy.

Thus, there is a twofold abstinence from numerical predictions of social dynamics in the fields mentioned above. Future studies and computational social science refrain from *using* computer simulations as a means of predicting social dynamics whereas science and technology studies refrain from *studying* computer simulations of social dynamics in their fields of application. But as numerical predictions of social dynamics increasingly proliferate in diverse societal fields, e.g. in risk management departments of banks and insurance companies or in political think tanks that calculate the impact of novel regulations, their impact on society needs to be addressed in more detail. I will do so by following arguments from STS concerning the performativity of epistemic devices as generators of social order [46] and the questions of