

LETTER TO THE EDITOR

In response to: “Never the strongest: reconciling the four schools of thought in system dynamics in the debate on quality” — beyond pragmatismMohammad S. Jalali*  and Hesam Mahmoudi *Syst. Dyn. Rev.* (2023)

System dynamics (SD) is fundamentally committed to rigorous scientific standards, a principle that should remain uncompromised in any debate on quality. The discussion around schools of thought in SD by Clancy *et al.* (2023) aims to provide a broad view of the current state of the field. Two critical responses to Clancy *et al.* discussed the mischaracterization of the SD community as fragmented and, instead, argued for the community’s inclusive, cooperative evolution (Eberlein, 2023; Schoenberg, 2023). Our threefold focus is on how Clancy *et al.*’s piece might inadvertently de-emphasize evidence and method quality in SD. We delve into dilemmas in their paper, discuss the nuances of research segmentation, and critique the implications of their “pragmatic” school of thought.

First, there are different, yet seemingly related, dilemmas in their paper:

- Should the reliance be heavier on quantitative evidence for its objectivity or on qualitative insights for capturing rich, context-specific information? The rise in quantitative data availability and computational capabilities has resulted in its growing applications. While quantitative data form part of the scientific approach, it is essential to build confidence in models by cross-examining the model with both qualitative and quantitative evidence, a balance that mitigates biases and leverages the strengths of each evidence type.
- Should exploratory models be pursued for their potential to uncover new insights, even if they present challenges in rigorous testing and confidence-building? The structural school of thought in Clancy *et al.*’s paper can potentially be misunderstood as a modeling approach that does not require vigorous confidence building. Without anchoring exploratory models to the real world using qualitative or quantitative evidence, we may be developing models as flawed as our mental models.
- Should the SD conference expand the pool of presenters or try to enforce the highest standard of quality? While this dialog is essential to keep the conference successful, the necessity of expanding the pool of SD practitioners and researchers should not compromise the overarching standards of quality in SD research.

Overall, we firmly believe that any compromise in SD’s adherence to high standards must not be justified because of a need to address challenges such as these dilemmas.

Harvard Medical School, Harvard University, Boston, Massachusetts, USA

* Correspondence to: Mohammad S. Jalali, 101 Merrimac St, Boston, MA 02114, USA. E-mail: msjalali@mgh.harvard.edu

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Second, the authors' effort to define the different schools of thought creates a risk of setting up stiff and restrictive boundaries, narrowing the analysis scope by placing diverse works into fixed categories. Applying SD in the real world is a nuanced process where the lines between different approaches are blurred. Although the article notes ongoing interaction and evolution, dividing the schools into static categories encourages a segmented approach to modeling.

The diverse nature of problems that SD deals with demands a diversity of approaches, methods, and tools. Thus, it is imperative to refrain from building rigid boundaries between these approaches and attributing pieces of SD literature to single categories, as Clancy *et al.*'s exercised in their supplementary table 1. Such a classification runs the risk of promoting research with insufficient diversity of confidence-building approaches and ultimately damaging the quality of research.

Third, among their four schools of thought, the pragmatic school prefers a flexible approach that focuses on delivering impact to sponsors to the extent that the confidence-building tools and even the definition of quality for the pragmatic approach are left to be "defined by stakeholder or client needs." This approach may risk sidelining scientific rigor, potentially leading to models more influenced by sponsors' biases than by rigorous, data-driven analysis. This can lead to a cycle of creating models that merely support the sponsors' biases and generate skewed insights. The danger lies in the ripple effect of these decisions, which can have negative implications on communities and sectors and diminish public trust in science, compromising efforts to address complex problems.

To clarify, this is not a call to discount the inputs or preferences of the client. Engaging the client is not merely a collaborative necessity but a rich resource, leveraging the profound capabilities of SD to elucidate and expand upon the client's existing mental models concerning the problem at hand. Moreover, concurrently maintaining adherence to scientific standards ensures the integrity and effectiveness of the engagement; it safeguards the process from deviating into a path of potentially misleading or incorrect conclusions. This practice not only helps in carving out solutions that are reliable but also fosters a culture of intellectual trust between the modeler and the client.

Looking ahead, we encourage research that is not only practical and beneficial to society but also grounded in rigorous scientific methodologies and evidence-based analysis, rather than an ad hoc pragmatic approach. In essence, every model must meet high standards of science, be evidence-driven, and be stakeholder-conscious. Additionally, the increased emphasis on transparency in both qualitative (Jalali and Beaulieu, 2023; Turner and Goodman, 2023) and quantitative (Jalali *et al.*, 2021; Rahmandad and Sterman, 2012) modeling is crucial for advancing scientific integrity. Strict adherence to this approach ensures that insights can be tested, refuted, and replicated. This commitment is key to advancing SD, enhancing the field's credibility for both academic and practical applications.

Biographies

Mohammad Jalali ("MJ") is an Assistant Professor at Harvard Medical School and leads MJ Lab, which develops simulation models to address complex health

problems. He works closely with decision and policy makers, with research support from FDA, CDC, NIH, NSF, and the European Commission, among others.

Hesam Mahmoudi is a postdoctoral research fellow at MJ Lab at Harvard. During his PhD, he focused on the dynamics of learning from experience in biomedical clinical research, specifically as part of the moonshot to cure cancer. Currently, his research centers around developing simulation models to investigate the behavioral dynamics of opioid crises and cancer screening.

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