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## Special issue on computational and mathematical approaches to societal transitions

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The event which eventually was to culminate in this special issue was the February 2007 Leiden University's Lorentz Center workshop "Computational and Mathematical Approaches to Societal Transitions". This workshop was intended to boost the exact-oriented research on societal transitions by bringing together researchers from diverse fields. During the course of that week a couple of dozens of physicists, sociologists, economists, ecologists and social simulation researchers worked together producing ideas and prototypes for modeling approaches for transitions. Those ideas and prototypes further evolved into the articles in this special issue.<sup>1</sup>

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<sup>1</sup>The February 2007 Leiden University's Lorentz Center workshop "Computational and Mathematical Approaches to Societal Transitions" has been a first event where scholars from very different fields have spent time, energy and passion by collaborating in transition studies. This occasion paved the way for this special issue and future events under the moniker of *ExTraScience*, which is short for Exact Transition Science. We thank all participants in this workshop: Floortje Alkemade, Tanya Araujo, Riccardo Boero, Vincent Buskens, Emile Chappin, Catherine Chiong Meza, Peter Davis, Jessica de Boer, Hans de Haan, Mark De Kok, Virginia Dignum, Marc Dijk, Albert Faber, Niki Frantzeskaki, Paulo Freire da Silva, Koen Frenken, Julian Garcia, Frans Hermans, Georg Holtz, Louis Hutten Mansfeld, Sharad Karmacharya, Rene Kemp, Juergen Kluever, Jonathan Köhler, Marius-Ionut Ochea, Christina Stoica, Michela Pelusio, Karolina Safarzynska, Michel Schilperoord, Koen Schoots, Flaminio Squazzoni, Jeroen Struben, Harry Te Riele, Jos Timmermans, Jeroen van den Bergh, Joost Vervoort, Luat Vuong, Gerard Weisbuch, Yangang Xing, Gonenc Yucel.

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Both the Leiden workshop and this special issue are signs that a research field is beginning to take shape. It is a research field where the researchers have open minds about methods and a common interest in large-scale and long term processes of societal change. Necessarily and intrinsically interdisciplinary and where bottom-up knowledge production is the standard. This is especially apparent in this special issue because it shows that the research subject of societal transitions poses interesting new questions for existing methods and fields while simultaneously the young field gains understanding from these approaches.

What is hard to tell is if there is such a thing as a preferred or best approach for transition modeling since all articles showed a contribution to the research on transitions by virtue of their specific method. Conversely one could observe that each article pushed the boundaries of their approaches a bit in applying them to transitions.

The introductory article by Squazzoni positioned the field of societal transitions in traditional and contemporary sociological thinking and provided theoretical constructs to put the modeling approaches into perspective. This leads him to identify problems and challenges in building theory for transitions and the role an analytical approach combined with computational methods should play in the emerging field of transition studies. This article is very much an embedding for the rest of the special issue and also in many aspects a critical introspective of the field and therefore important.

Agent-based modeling was innovated with agent transformations and landscape signals by Schilperoord et al. System dynamics was given agency by Chiong Meza and Yücel. Timmermans complexified Coleman's linear system of action into a nonlinear one. Even the articles that stayed relatively close to their methodological roots did this by freely cross-fertilizing their methods with others, de Haan treated transitions as a nonlinear dynamics and pattern formation problem and Weisbuch et al. explored the paths of a technological transition combining methods from physics and economics. The concluding article by Timmermans, De Haan and Squazzoni provides an overview of social science theorizing about transitional change and use the concepts encountered to answer the main question posed in this special issue; what exactly entails a transition model?

The matter remains of the emerging research field and the role of this special issue in it. In any case the very existence of this special issue proves that the topic of societal transition invites researchers from various disciplines and trained in various methods to put their creative curiosity to work. Apparently something is happening. Something that made it possible that the Leiden workshop was more than just scientists meeting and discussing some common topic. Something that sparked new ideas and collaborations that demanded to be elaborated in this special issue and future events under the moniker of ExTraScience, which is short for Exact Transition Science.

For a new research field to take shape however, it is necessary that at a certain point the research converges to more than just various methods applied to a common phenomenon under study. That is not to exclude beforehand the value of any approach, but similar to how a common conceptual language is arising slowly. In other words there has to emerge a more refined idea of what is transition modeling and what are computational and mathematical approaches to societal transitions. It is to this that this special issue not only hopes to have contributed, but also has provided a basis.

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