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Introduction to the Special Issue: Complexity and Time

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Time is a dimension that offers the modelling of complex social systems—or the analysis of these systems in general—a degree of predictability and stability. Time is irreversible and causality is emergent, in the sense of the "impossibility of undoing the past" (Byrne & Callaghan, 2014, p. 114). It structures and organizes the analysis of social systems and therefore our understanding of the social processes analyzed (Adam, 1990). In that capacity, time is "external to and abstracted from the processes it measures" (Adam et al., 2002, p. 12). Researchers conceptualize and measure it in different ways. One distinction is between duration, pace or tempo, trajectory or sequence, and cycles (Aminzade, 1992).

Duration concerns the amount of time that has elapsed for a certain event or sequence of events. This conceptualization of time requires the definition of a start and endpoint of the (sequence of) event(s), and it therefore assumes diachronic emergence (Teisman & Gerrits, 2014). Pace or tempo indicates the rate or speed of movement or progress, i.e., the density of events in a certain amount of time. It might also imply the repetition of events within a certain timespan (Aminzade, 1992). Trajectory or sequence is akin to Abbott's (1992) idea that processes are structured by events through time and it refers to "the sequential order of events" (Aminzade, 1992, p. 462). This is also the concept of time that, for example, Pierson (2004) focuses on when talking about path-dependent processes, and it is concerned more with patterns or directions of events. Trajectory refers to cumulative events, and researchers may be interested in analyzing the (types of) sequences leading to an outcome of interest (e.g., Spekkink, 2016). Cycles, finally, are concerned with the repetition of sequences of events (rather than with cumulative events), marked by regularly recurring ascending and descending phases (Aminzade, 1992). Trajectory and cycles allow for ambiguity about start and endpoints and can therefore be related to synchronic emergence (Teisman & Gerrits, 2014), i.e., identifiable patterns of emergence.

Time plays a crucial role in the study of complex social systems (Byrne & Callaghan, 2014), for instance through the analysis and application of notions such as emergence, self-organization, feedback, co-evolution, and non-linearity (e.g., Teisman et al., 2009; De Roo et al., 2020). As said, time often features as a structuring principle—e.g., as duration or pace in agent-based models or in the qualitative descriptions of cases over time, where cases are described by trajectories, phases, rounds, or cycles—but it does not take the center stage as a concept in itself. With this special issue, we want to draw attention to time in the analysis of complex social systems.

Before we provide a short overview of the articles in this special issue and highlight the contributions they make to time in the analysis of complex social systems, we wish to draw attention to some recent methodological advancements that seek to infuse the complexity sciences' toolkit with more time-sensitive methods. We do not focus here on agent-based modelling—which can be appropriately used to study the emergence (diachronic) of patterns and outcomes, exploring and developing a better understanding of how complex social processes develop and the policies that could influence them and how (e.g., Campbell et al., 2015)—but instead want to raise attention to two recent advancements that have received less attention. What unifies these two approaches is an interest with the complexity of cases, as a unit of analysis, rather than a structural method based on aggregate variable measurements. While the cases researched could be human participants, they are also often at the level of comparable policy organizations or even nation states. One aspect of the importance of case diversity in complex social systems, is understanding the trajectory of these cases and their differences and similarities over time.

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A first approach concerns Qualitative Comparative Analysis (QCA). This is a case-based, comparative, and configurational method, first introduced by Charles Ragin (1987). Since the beginning of the current century, it has been picked up by complexity scholars as a promising method to analyze complex social systems, in particular because of its premise of complex causality (Byrne, 2005, 2009; Byrne & Callaghan, 2014; Gerrits & Verweij, 2018). A critique on QCA has been that its cross-sectional nature diminishes the role of time; cases are frozen in time and then compared to identify complex configurations of conditions that may explain a certain outcome of interest at a certain time (De Meur et al., 2009). This critique has led scholars to explore ways to integrate time in QCA much more prominently (e.g., Caren & Panofsky, 2005; Hino, 2009; Pagliarin & Gerrits, 2020; Verweij & Vis, 2021). Although such more time-sensitive strategies have yet to prove their merits because their applications are few, they may prove valuable in making QCA not only appropriate for the study of static complexity but also of dynamic complexity (Verweij & Zuidema, 2020). In this special issue, Lasse Gerrits, Robin A. Chang, and Sofia Pagliarin take further the conceptualization of time in case-based methods.

A second advancement we wish to give attention to is Dynamic Pattern Synthesis (DPS) (Haynes, 2017). This is a recent development of the longstanding quantitative and case-based method of cluster analysis. In DPS, cluster analysis is adapted and expanded to consider configurational case patterns and trajectories over time. David Alemna uses a version of DPS in this special issue to compare policy responses in a group of West African states.

What then do the articles in this special issue further contribute to the discussion and advancement of time in the analysis of complex social systems? The articles share the discussion and/or application of methodological developments in policy research and their attachment to the meta-theoretical framework of complex systems. Several articles included here in the special issue—the article by Jean Boulton and the article by Graham Room—look at the intersection of such "grand theory" with interdisciplinary policy analysis and consider the importance of identifying patterns across time in an applied and interdisciplinary sense, along with what such patterns might mean for governance leadership and decision-making.

Jean Boulton develops the ontology of "process complexity" to raise attention to the world as complexity-in-process (ever-emerging, becoming). Building on the work of Prigogine on irreversibility and the thermodynamics of open systems, and by showing the ontological resonances with quantum gravity, Daoism, and thinkers such as Bergson, Whitehead, and James, she argues the case for processes taking center stage in the study of complexity. Boulton asserts the need to acknowledge "ontological uncertainty." Policy makers have numerous potential policy futures in front of them. Events become more important than things. Discerning "patterns of relationships" is argued to be of seminal importance. Policies need to be agile and aware of the systemic influences. In a world of "ontological uncertainty," action is as much informed by ethical choices as it is by "evidence."

Graham Room has a more policy-conceptual aim and endeavors to marry the policy science literature with the complexity science literature by focusing on "complex timescapes." Timescapes stress the intricate connection between time and complex landscapes. His work is influenced substantially by Kauffman's (1995) scientific concept of "fitness landscapes." Room argues there are "critical junctures" where shifts in the landscape encourage decisive policy action. At some points in time, there is a greater chance of making an influence. He illustrates from political and policy analysis literature how previous seminal thinkers have come close to such a complex policy "metatheory" before, each with their own original concepts and narrative. He is particularly influenced by Hirschman's ideas of "interlocking vicious circles" that prevent development, and "upward spirals" that can bring together opportunities in time when the necessary resources for change are aligned. His analysis is ironically "timely" given the formidable challenges of the COVID-19 pandemic and climate change that are knocking at the door of politicians and policy makers the world over. Graham Room, like Jean Boulton, also notes the ethical requirement to attempt subjective action, given the never-ending quest for a complexity science of explanation in a world where much will remain unknowable.

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The article by Lasse Gerrits, Robin A. Chang, and Sofia Pagliarin and the article by David Alemna are more concerned with the methodological development and empirical application of time within the meta-theoretical framework of complex systems.

Lasse Gerrits and colleagues emphasize the different pacing of events and time pressures within diverse policy circumstances. They stress the importance of "following the dynamics of how time passes" in cases. This leads to the development of the approach of "temporal casing." This takes further the importance of case-based methods for applied social scientists motivated by complexity theory. "Within case variation" becomes central to this new conceptualization and an extension of the case-based method. Instead of adopting a priori a certain convention of time in terms of duration, pace, sequence, or cycle (Aminzade, 1992; see above)—and some length, speed, or order of events or period—a core point is to take the "developmental stages" of cases as the dictating logic for the reconstruction of cases. Their article makes the argument for how a temporal dimension can be an essential and integrated addition to case-based policy research. The authors set out the different steps involved in temporal casing, with applied examples given from previous policy megaprojects research.

David Alemna's quantitative study develops case-based research that can capture the political and economic complexity of continental governance and its high dynamics. He adopts the 'year' as a conventional measurement of time as duration, and then endeavors to identify stages or phases in countries' developments characterized by specific configurations. Using the method of DPS, he illustrates the formidable challenges for the policy aim of achieving economic stability through currency convergence in West Africa. Because of instabilities, both within the member countries and in the global market external to them, he demonstrates how a wide range of adaptations and interventions are needed if any small policy progress is to be made. The data analysis illustrates the relational complexity in pan-West African governance. There is much diversity in the experience of each country, with only small subgroups of countries forming similar patterns over time. Different subgroups and countries have contrasting experiences of convergence.

This special issue makes an important contribution to the further integration of complexity science into policy and governance studies. Three words stand out more than others across these four articles: cases, dynamics, and patterns. Several of the articles take forward the use of case-based methods as a central part of a research strategy to better understand complexity. As a result, the diversity of cases and their experience are amplified, rather than the aggregation of simplified variable relationships. Similarly, the application of policy analysis using the complexity framework is increasingly leading to an emphasis on the unstable dynamics of the policy world with its often unpredictable and unknowable futures. Nevertheless, the contributing scholars and policy analysts in this special issue illustrate a continuing determination to find appropriate concepts and models, that while respecting the humility required by a complex world, can still uncover the occasional temporal patterns of stability and meaning that will aid policy makers to have the best chance to make favorable decisions going forward.

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