Introduction

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‘Complexity’ is a useful term in many ways. It captures multiple dimensions of change in geographical space and time. It also frames a general sense of increased messiness, opacity and interlinked and unexpected cause and effect in a highly connected global system. It is therefore not surprising that there seems to be an increased interest in integrating insights from various branches of the complexity sciences with studies of governance and policy.

This ambition for integration is important for several reasons. Increased global trade, the rapid diffusion and penetration of information and communication technologies in all aspects of our daily lives, environmental changes from local to global scales, the expansion of global partnerships and networks and new patterns of cascading social–ecological changes are only a few examples of an increased connectivity between human, ecological and technological systems. Such connectedness doubtlessly leads not only to complex chains of causation, but also to complex adaptive systems behavior, including multilevel interactions, phases of stability followed by sudden unexpected change, path-dependence, cascades and ‘tipping points’.

Such a shift from simpler to more complex systems can be observed in governance as well. The well-analyzed shift in the political sciences from ‘government’ to ‘governance’ (Pierre, 2000) involves a profound move away from simplistic notions of steering, to analyses of more complicated settings of institutions, networks, policy actors and instruments in the public and private domain. Interactions between these unfold at multiple levels of social organization, resulting in both desired and (at least by some) undesired effects (Duit & Galaz, 2008). Policy and social learning, adaptability, co-production of knowledge, negotiations, innovation, norm-setting, policy diffusion, coordinated action, information-sharing, conflict, gridlock, free-riding and maladaptation are all possible outcomes of these interactions. A research agenda inspired by insights from the complexity sciences could, we believe, help research communities – ranging from legal studies to public administration – to discover new patterns, vulnerabilities and opportunities.

This volume builds on the common premise that theories about governance, in all its forms, need to acknowledge this changing reality if they are to offer useful insights beyond academia. This might sound like a bold statement, but is obvious to those working in research fields aiming to produce inter- and trans-disciplinary science of relevance to society. Complex connections between sectors and geographical scales emerge in all issue areas of importance for global challenges – including climate change, food security, forced environmental migration, marine stewardship, disaster resilience, green finance – to name but a few. Hence, exploring the role of governance *in* and *as* complex systems is not only a promising, but also an imperative goal. Needless to say, it is also a highly challenging one.

0.1 COMPLEXITY – FROM HYPE TO INSIGHT

While the term of ‘complexity’ has multiple and sometimes contested interpretations and applications in studies of governance (Duit & Galaz, 2008; Folke et al., 2005; Pierre & Peters, 2005), it is also clear that the observed behavior of complex systems has spurred a number of interesting theoretical and empirical efforts in both the social and more interdisciplinary sciences. These include a diverse range of disciplines, from economics, network theory, studies of socio-technological systems, to sustainability sciences.

A few intriguing examples of research that have emerged in these fields during the last few years include studies of the non-linear dynamics of social and technological innovation (Geels et al., 2017); polycentric governance as a means to address wicked global problems (see Chapter 7 in this volume); analyses of global action networks and their capacity to deal with surprise and ‘tipping points’ (Galaz et al., 2016); elaborations of legal dimensions of complex Earth system interactions (Kotzé & Kim, 2019); non-linear shifts in social norms (Nyborg et al., 2016); economic decision-making under the presence of thresholds (Crépin et al., 2012); and public policies for complexity (Colander & Kupers, 2014). These diverse efforts, I believe, illustrate that studies of ‘complexity’ over the last decade have proven wrong concerns about a complexity hype and ‘unease about the discipline’ (Hiatt, 2001, p. 109). As this volume intends to show, applications of complexity theory as a means to understand global challenges and their governance dimensions is very much a vibrant field of research inquiry. Not only does it have an unusual ability to bring together scholars from a wide set of academic disciplines – ranging from political science to economics and Earth system science – it is also able to attract scholars interested in producing science and actionable knowledge to help society tackle difficult and urgent global challenges.

0.2 ‘COMPLEXITY’ AS COMPLEX ADAPTIVE SYSTEMS

Complex systems are not just ‘messy’, yet their unpredictable nature does not defy conceptualization. In this volume, we use the term *complex adaptive systems* (CAS) to shed light on what complexity is, and how one could make sense of it. CAS are characterized by the four following traits (from Duit & Galaz, 2008, pp. 312–313): *agents* (such as social actors, firms, species) with the ability to *self-organize* as they respond to changing circumstances, and to information about other agents’ behavior. Over time, these responses lead to *co-evolutionary processes* and systems behavior with limited predictability (so-called *emergence*). The suite of system behaviors that emerge from these interactions are well-studied, and include, amongst others: multiple basins of attraction and strange attractors, critical thresholds, bifurcation points, hysteresis, feedback loops, and surprise (Duit & Galaz, 2008; see also Chapter 1, Chapter 2, and Chapter 3 in this volume). This means that those involved in governing can no longer count on a relatively stable and predictable context. Harnessing complexity requires a much more ambitious focus on the features of institutions, legal frameworks, policies, social networks and leadership that underpin capacities to deal successfully with change, surprise and rapid shifts (see especially Chapter 1 and Chapter 2 in this volume).

While the terms that the perspective of complex adaptive systems introduces might sound theoretical and vague, their implications for governance are far from that. As the chapters in this volume will show in detail, the fact that systems entail properties of CAS result in tangible, and difficult challenges for those involved in governance at the local, national and international level. This can be briefly illustrated with a few recent contributions from colleagues showing the type of intriguing global challenges we need to engage with as a governance community.

0.3 THE REALITIES OF COMPLEX ADAPTIVE SYSTEMS

In 2017, Steve Lade and Jamila Haider and colleagues published a paper in *Science Advances* exploring the multiple ways that humans and ecosystems interact, especially in relation to ‘poverty traps’ – self-reinforcing mechanisms that maintain poverty (Lade et al., 2017). Using a CAS approach to understand poverty traps, Lade, Haider and colleagues challenged conventional one-dimensional poverty-trap models, and highlighted other normally ignored factors that influence poverty traps such as agricultural production, environmental

degradation and cultural aspects. By combining modeling, case analyses and theory they were able to compare different ‘poverty alleviation pathways’, illuminating the way in which different contexts influence, in a very tangible way, what constitutes effective management and governance responses for rural development challenges. For example, while development agency strategies – e.g. to focus on asset inputs such as cash, technology, artificial fertilizer, or pesticides – make sense in a one-dimensional poverty-trap model, these may under certain circumstances actually reinforce poverty.

Another example stems from the Earth system sciences. The Earth system sciences have made impressive advances over the last few decades, especially concerning applications of complexity theory to identify emergent patterns and ‘tipping points’ in the climate system (Lenton & Williams, 2013). As Steffen et al. (2018) suggest, the Earth system seems to have a limited number of stable pathways defined by self-reinforcing feedbacks. These feedbacks are determined, for example, by slow changes in the Earth’s orbit and inclination. These have, over very long time-periods in the history of the planet, led to shifts between ice ages and warmer periods at the planetary level, with the last 11,000 years showing an unusual stability in the climate system. However, climate change and the degradation of the biosphere (such as tropical and boreal forests) could trigger ‘self-reinforcing feedbacks [which] could push the Earth System toward [...] a “Hothouse Earth” pathway even as human emissions are reduced’ (Steffen et al., 2018, p. 8252). This is not a trivial observation as – in the most dangerous scenario – it could mean that current international and national attempts to address climate change (such as climate negotiations) are at risk of losing their influence once these self-reinforcing feedbacks unfold into ‘tipping cascades’ that drive the Earth system towards extreme high-end climate scenarios.

A last highly intriguing example worth mentioning is the work of Marten Scheffer and colleagues on the dynamics of inequality (Scheffer et al., 2017). Exploring the mechanisms by which inequality amplifies environmental degradation has been an important issue in the sustainability sciences (see Hamann et al., 2018). However, Scheffer et al. (Scheffer et al., 2017) not only show that patterns of distribution and dominance that evolve over time in natural communities (ranging from mushrooms, trees, bacteria and algae, to rodents and fish), and in societal data (in this case wealth distribution) are surprisingly similar; they also share similar underlying mechanisms, and may emerge over time from chance alone. That is, even ‘if no actor is inherently superior to others, inequality can emerge naturally if wealth (or abundance) is subject to random losses or gains’ (Scheffer et al., 2017, p. 13155). Creating effective wealth-equalizing institutions therefore becomes vital as a means to avoid the most detrimental effects of inequality.

Specifying underlying principles such as these is challenging of course, and efforts to do so will meet with certain unavoidable obstacles. But, whilst the three articles summarized here might seem very disparate, they contain common features with implications for policy-makers, non-state actors including business and civil society, and others involved in attempts to govern.

For example, while the issue areas are very different, they all highlight the need for decision makers to understand how interacting factors (sometimes denoted as feedbacks in CAS terminology) create undesirable system outcomes: i.e. poverty traps, irreversible changes in the climate system, and inequality. Addressing these outcomes requires institutional and policy interventions that target these underlying dynamics in one form or the other. In the case of poverty traps, this requires policies that shift towards interventions that focus less on asset investments and more on transformations. Avoiding a 'Hothouse Earth' scenario requires international institutions strong enough to stabilize the resilience of 'tipping elements' in the Earth system (say, the Amazon rainforest) in parallel to conventional mitigation efforts. And in the case of inequality, it shows that *laissez faire* economic policies in a globalized economy are likely to result in increased and extreme inequality due to the intrinsic dynamics of distribution in connected systems.

Another common feature is that change unfolds at several spatial and temporal scales. As an example, a possible 'Hothouse Earth' future is determined not only by global climate dynamics, but also by regional changes that trigger feedbacks in Earth's climate system. Changes in the cryosphere (simply put, melting frozen water surfaces on Earth) are not unidirectional where global changes trigger regional ones. The latter also feed back – as darker unfrozen areas on water and land contribute to increased warming due to an increased absorption of heat.

In addition, changes in CAS can build up under considerable time, suddenly become visible, and then accelerate. The Earth system clearly displays these properties (see especially Clark et al., 2016). Poverty traps may very well embed similar spatial and temporal dynamics, where global and national drivers of change (say, economic, social and trade policies) over time push local communities or groups towards practically irreversible, precarious conditions.

Hence, studying and trying to govern global challenges requires a different way of thinking about change. Change is not steadily incremental but can slow down, build up, accelerate, and even lock into specific trajectories that defy governance interventions; or all of these at the same time. Real-world complex adaptive systems will, of course, always be fundamentally uncertain, and we should remain humbly aware of this fact. The observation that human activities are modifying the Earth system in all its components, does not make these real-world systems more predictable. As has been shown repeatedly, successful

attempts to make complex systems more predictable in the short term (such as economic systems, forest ecosystems and fish stocks), have a tendency to make them more unstable and may even trigger unwanted irreversible shifts in the long term (Carpenter et al., 2015; Holling & Meffe, 1996).

Trying to tackle global challenges clearly often entails numerous difficult political, institutional and, sometimes, ethical dilemmas. This is not a trivial observation. There is a tendency, at least in some parts of the research community, to assume that governance, institutions and collaborative governance networks can be redesigned somehow to ‘optimize’ steering and control of complex systems with incomplete or incorrect information (see Galaz et al., 2017 for a summary), thereby ignoring underlying value trade-offs, path-dependent political dynamics, possible skewed distributional impacts, and all the messiness that comes with politics – who gets what, when and how (in the famous words of renowned political scientist Harold Laswell). The social sciences hence have a fundamental role to play in our ambitions to understand, adapt to, and govern the broad implications of a changing planet.

0.4 AMBITION AND THEORETICAL APPROACHES

What can be said about the various governance dimensions of intricate global challenges, recognizing that these often display properties associated with complex systems? The ambition of this edited volume is to provide state-of-the-art overviews in this emerging field, explore key theoretical and empirical insights, and showcase promising methodological approaches. This volume includes key thinkers from multiple streams of research, each with different empirical, methodological and theoretical foci as a means to showcase the richness of this emerging field. From this diversity emerges not only complementarity, but hopefully – as in many complex systems – novelty.

One important step in this process is of course to specify the properties of complex adaptive systems – why they matter – and to identify emerging research frontiers. Chapter 1 by Simon Levin provides an introduction to the topic by connecting insights from ecology, studies of financial collapses and network theory, to the issue of robustness. As Levin elaborates, dealing with the augmented fragility and loss of resilience created by increased connectedness requires us to understand how the social, economic and ecological are ‘interlinked ineluctably’, and to find new ways to deal with dynamics on multiple scales and of organizational complexity.

Carl Folke explores this issue further in Chapter 2. As one of the founders of this research field, Folke unpacks the role of ‘resilience thinking’ as a means to understand and govern change in complex adaptive systems. Resilience thinking and theory has made several important advances in the last 10 years (Biggs

et al., 2012; Folke, 2016). One important aspect emerging from this body of work is the notion of ‘adaptive governance’ – models of governance including institutions, social networks and adaptive patterns of information sharing and collective action, with the capacity to deal with various forms of surprise and change. As Folke notes, one of the most important yet least understood challenges for governance stems from *emergence* – the continuous interplay between micro–meso. Emergence leads to macro-level changes with limited predictability, but has important effects on any system of interest. He explores some recent insights with regard to understanding the role of multilevel governance for emergence, and the role of learning, adaptation and transformation.

Rika Preiser and Minka Woermann (Chapter 3) elaborate on the features of CAS in more detail in their contribution by specifying key concepts, methods and their wider governance implications. The latter includes how the behavior of CAS relates to central properties of governance such as framings, network building, social capital, leadership, power and normativity. Their contribution highlights the unavoidable normative dimensions of CAS and their governance. An important point is that complex systems cannot be optimized or redesigned in a simple way since their technical dimensions are inseparable from their normative aspects.

These normative aspects become very clear as political actors try to define and talk about complex problems and solutions. Hubert Schmitz and Ian Scoones’ contribution (Chapter 4) is an excellent illustration and analysis of the power of (and in) narratives. Drawing on earlier traditions in political sociology and political economy, they focus on what we can learn from rapid transformations in the past. As Folke also notes in his contribution, transformations play a key role in studies of CAS and global challenges. Schmitz and Scoones explore insights from historical transformations that were ‘deep, rapid and purposeful’ in China and Vietnam. They observe a number of commonalities of interest to the growing literature about transformations. These relate to the importance of transitional institutional arrangements; the explicit role of step-by-step experimentation; and the need for continuous adaptive responses. Successful deep transformations however, need to be advanced by strong transformational coalitions and alliances with the capacity to deal with both agents of change, and agents of resistance.

Chapter 5 by Michael Cox and Michael Schoon takes a different theoretical approach to adaptive governance and CAS by unpacking its evolutionary dimensions. Cox and Schoon elaborate on the intellectual roots of the notion of ‘adaptive governance’, and argue that an evolutionary perspective can provide much needed conceptual clarity to this idea, and help specify the mechanisms that link the features of adaptive modes of governance to positive outcomes. While the theoretical starting point is very different from other contributions in this volume, Schoon and Cox also bring to light the importance of diversity,

experimentation, selection, and a balance between cooperation and conflict in governance systems able to deal with change.

0.5 APPLICATIONS

These theoretical reflections and contributions are followed by a number of chapters with a more applied focus. These chapters clearly also include theoretical dimensions of CAS and governance, yet investigate the issue in more specific research fields than the opening chapters. As these contributions clearly illustrate, CAS approaches to governance create a broad intellectual space to explore from multiple disciplinary perspectives.

Rakhyun Kim's contribution (Chapter 6) about the role of network analysis and complexity thinking for the study of institutional complexity is an excellent example of this. Network analysis has been part of the methodological toolkit of complexity sciences for a considerable time. While it certainly is possible to study networks without analyzing their complex systems properties (and the other way around), it is becoming increasingly clear how these two fields of inquiry not only complement each other, but can also function synergistically. As an example of this, Kim's chapter shows the way that international institutional complexity can be analyzed through network approaches. To be more precise, he shows emerging typologies of international institutional architectures, network position effects, and possible ways to intervene in these to direct change.

The need to understand and intervene in institutionally nested systems as those described by Kim, has also been a very prominent issue in studies about polycentric governance. As Cox and Schoon noted, a number of key concepts in this research field remain somewhat vague and overlap considerably. In their contribution, Dave Huitema, Andrew Jordan, Harro van Asselt and James Patterson (Chapter 7) note the key challenge is not only conceptual clarity, but also how to assess the performance of polycentricity. By combining criteria developed in John Dryzek's work about 'ecologically rational decisions', and empirical evidence about polycentric climate governance, Huitema and colleagues show both the strengths and weaknesses of such governance models. As they clearly illustrate, a serious elaboration of modes of governance able to address complexity related to global challenges, requires both theoretical refinement and solid empirical evidence.

The features and effects of complexity in governance has also spurred important discussions amongst legal scholars. In Chapter 8, J.B. Ruhl and Daniel Katz elaborate on the ways in which legal systems can – and should – be analyzed as complex adaptive systems. Ruhl and Katz make an important observation in this chapter: complexity in legal systems is not about 'complicatedness'

but rather about system structure and behavior (as discussed in Chapters 1–3). As Ruhl and Katz highlight, CAS perspectives on law have multiple dimensions, including descriptive, prescriptive and ethical. These are all fundamental to understanding how adaptive law supports adaptive governance.

Complexity sciences and CAS also plays a role in our understanding of the economy, and its wider interactions with society and nature. Anne-Sophie Crépin's contribution (Chapter 9) explores this issue with a focus on resilience theory and its implications for economics. As discussed in several of the earlier chapters, principles related to (for example) diversity, learning and polycentricity are key to our understanding of how resilience is maintained in CAS (e.g. Biggs et al., 2012). Crépin elaborates on the way in which these principles relate to economy theory – including insights from portfolio theory, the concept of externality, principal-agent problems, institutional economics, to name but a few. It is interesting to note that not only does economic theory have much to contribute to our understanding of governance and CAS. A complex systems approach also challenges conventional approaches and methods in economic theory itself. The possibilities for fruitful methodological and theoretical cross-fertilization between these two research traditions are clear.

A contribution from the political sciences can be found in Chapter 10 by B. Guy Peters, Jon Pierre and myself. In this chapter, we note that current insights from the complexity sciences stand in striking contrast to recent emphasis in the policy sciences on efficiency. While there is a widespread understanding in the literature that we might need to 'fight complexity, with complexity' (Duit et al., 2010; see also Chapter 3 in this volume), Chapter 10 explores 'simple' policy strategies at the national level that are flexible enough to allow for adaptation to changing circumstances in complex systems. These strategies can be summarized broadly as policies to force self-organization, design information management processes, network steering, creating a proper environment for action, and applications of fuzzy logic and gambling.

One of the most challenging aspects of governance and complexity, however, is related to what the literature denotes as 'systemic risks' – emergent vulnerabilities that evolve as the result of increasing connectivity within and between systems. As Caitlin Chambers and colleagues elaborate in Chapter 11, such risks seem to evolve in parallel to globalization, increased speed and efficiency, and subsequent growing complexity. The focus of this chapter is global capital markets and the governance challenges that emerge as these markets behave as complex adaptive systems. Connections, thresholds, feedback loops and contagion play a key role here as in all CAS, with repercussions that impact on the global financial system as experienced during the last financial crisis in 2007–2009. As Chambers and her co-authors note, governing complex systems behavior in financial systems requires a focus not only on macro-structures and individual behavior, but also on relationships between actors

inside and outside of the financial sector. If poorly understood connections and emerging secondary, and sometimes even tertiary, effects are those that lead to volatile eruptions of systemic risks, then that's also where stringent policy interventions need to be considered (see also Leduc & Thurner, 2017).

Policies, institutions, networks and emergent phenomena aside, complex adaptive systems do not operate without individuals. As many of the chapters highlight, small disturbances under certain circumstances have the ability to trigger disproportionately large system changes. In such contexts, the role of centrally placed key actors can prove to be immensely important. Sibout Nootboom and Geert Teisman (Chapter 12) elaborate on the features of complexity leadership, especially as it unfolds through trust-based informal adaptive networks with the ability to balance power and knowledge, and create narratives for change. Nootboom and Teisman not only summarize insights from this evolving field inquiry, but also explore some difficult methodological challenges for those interested in studying complexity leadership empirically. How can scholars grapple with leadership in continuously changing contexts, build trust with those individuals central for a study, at the same time as the analysts' integrity and intersubjectivity is maintained? Considering the growing need in society for complexity leaders, such issues are worthy of serious attention by the research community.

Understanding governance in and of complex adaptive systems is, as many of the contributions have discussed, related to narratives and mental models. It seems unavoidable that any attempt to design policies (Chapter 10 in this volume), reform legal frameworks and institutions (Chapter 8 in this volume), identify benevolent institutional interactions in institutional networks (Chapter 6 in this volume), or mobilize alliances for change (Chapter 4 in this volume), is dependent on the ability of social and political actors to understand, learn, and think about CAS and their likely future trajectories. These cognitive dimensions are the focus of Manjana Milkoreit's highly intriguing chapter (Chapter 13) about climate 'tipping points'. The science of 'tipping elements' has advanced considerably over the last decade (as I discussed earlier). Milkoreit explores how these dynamics emerging from the Earth system's behavior present novel challenges for international climate change governance, first and foremost for the existing mental models of key policy makers, in this case international climate negotiators. As Milkoreit's chapter shows, even very knowledgeable political actors in international climate change negotiations are often unable to fully grasp the future risks inherent in the non-linear dynamics of climate change. This is worrisome, and again highlights the need for scholars to clarify and communicate the profound practical implications of a world shaped by evolving complex adaptive systems ranging from the climate system, to technology, finance and the biosphere.

0.6 CONCLUDING THOUGHTS

In 2010, my colleagues Andreas Duit, Jonas Ebbesson, Katarina Eckerberg and myself edited a special issue in the journal *Global Environmental Change* about complexity, resilience and governance (Duit et al., 2010). It might be worth reflecting on the advances made in this field of inquiry almost 10 years after. My summary is as follows.

First of all, there is a larger body of evidence today that shows that important features of global challenges of profound importance for societies all over the world, can fruitfully be understood as complex adaptive systems. Systemic risks in financial systems, poverty traps, global inequality, non-linear and cascading changes in important natural resources, future climate change risks, and many other issues can (and I would argue even *should*) be understood as dynamic, networked, multiscale and complex systems. This fact should spur scholars interested in governance, institutions, decision-making and politics to think through implicit assumptions about the ‘system-to-be-governed’. As many have discussed before (e.g. Duit & Galaz, 2008; Folke et al., 2005; Young, 2017), changing these assumptions has important repercussions for what is to be viewed as effective problem-solving in governance.

Second, studies and theory development at the interface between CAS research and governance (broadly defined) continues to evolve as an intriguing multidisciplinary field. It inspires new thinking in economics (Chapter 9 in this volume), network sciences (Chapter 6 in this volume), political sciences (Chapter 10 and Chapter 7 in this volume), political economy (Chapter 4 in this volume), the cognitive sciences (Chapter 13 in this volume), law (Chapter 8 in this volume), and leadership studies (Chapter 12 in this volume), just to mention a few. While the technical jargon might seem overwhelming, and the rich terminology can be confusing and even seem to be contradictory at times, it also provides an intriguing space for methodological and theoretical innovation (cf. Blackwell et al., 2009).

Third, it is clear that there are no easy shortcuts as decision makers both inside and outside of government struggle to navigate complexity. Interventions in complex systems require a deep understanding of the behavior of the problem at hand and it’s social, economic, technological and ecological context. I’ve summarized some of the key issues we have explored in this volume to bring to light insights of relevance when discussing the role of complexity in, and for, governance (Table 0.1). Needless to say, the categories and chapters are not mutually excluding, but are intended as a way to structure key issues in this volume in a simple way.

In sum, governing complexity requires a deep understanding of how complex adaptive systems behave and how they differ from simpler linear systems

Table 0.1 Governance and complexity: Key challenges and attributes

Key challenges to governance	Attributes of complexity	Contribution/s in this volume
<i>Understanding complex systems behavior</i>	Continuous change, multilevel change	Levin
	Evolutionary dynamics	Folke
	Complex causality	Preiser and Woermann
	Adaptive behavior, self-organization	Cox and Schoon
	Non-linear change, thresholds, catastrophic shifts, bifurcation points, irreversible shifts	
	Surprise, shocks, cascades	
<i>Understanding system vulnerabilities</i>	Rapid change, transformations	
	Robustness, resilience	Levin
	Systemic risks	Ruhl and Katz
	Networked failures	Kim
	Institutional, legal complexity	Chambers <i>et al.</i>
<i>Understanding ethical and political dimensions of complexity</i>	Limitations in cognitive capacities	Milkoreit
	Defining system boundaries and its social implications	Preiser and Woermann
	<i>How, why and to what end</i> to intervene	Schmitz and Scoones
	Partial knowledge, normative assumptions	Peters <i>et al.</i>
	Trade-offs, winners and losers	Nooteboom and Teisman
	Alliances and counter-movements for change	
	Forcing adaptation and innovation	
<i>Governing uncertainty and change</i>	Polycentric governance	Folke
	Network governance	Schmitz and Scoones
	Adaptive governance	Cox and Schoon
	'Simple' adaptive policies	Huitema <i>et al.</i>
	Complexity leadership	Crépin
	Economics for resilience and complexity	Kim
<i>Governing rapid change</i>		Peters <i>et al.</i>
		Nooteboom and Teisman
	Governing for 'emergence'	Folke
	Governance strategies supporting rapid transformations	Schmitz and Scoones
	Complexity leadership	Nooteboom and Teisman

(Chapters 1–3 in this volume); of the key properties of adaptive modes of governance including policy, economics, law, networks and institutions (Chapters 5–10 in this volume). And lastly, of how mental models, leadership and alliances provide both obstacles and opportunities for directed transformative change (Chapters 4 and 12).

Hence, together, these contributions not only show the implications of complexity sciences for individual disciplines, but also display emerging multi-disciplinary approaches, methods and frameworks that can be used to analyze important global challenges through a complexity lens. This is an exciting and, not least, increasingly important endeavor. Let us continue to explore this vital path together.

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