

# Complexity theory and public management: a 'becoming' field

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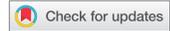
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## Complexity theory and public management: a ‘becoming’ field

Since the special edition of *Public Management Review* on ‘Complexity Theory and Public Management’ in 2008 (Volume 10 (3)), co-edited by Geert Teisman and Erik-Hans Klijn, academic interest in complexity theory, and how it might be used to understand the world and inform design and intervention in the public policy/public management field, has grown and matured. The inspiration for this special issue arose out of intensive interactions among interested scholars in conference panels (at American Society for Public Administration, International Research Society for Public Management, and the Challenges of Making Public Administration and Complexity Theory group) over the past few years and the realization that a ‘stock-taking’ was required. While many public management scholars knew a little bit about complexity – and some knew a lot – there was still no consensus about the contribution complexity theory could or could not make to theory and practice. While we did not achieve consensus this time around, the papers selected for this edition provide a picture of where we are and where scholars in this field think we should go, and some examples of the most promising routes to get there. Before summarizing these findings, we provide a brief overview of where we have come from and why we are still a ‘becoming’ field.

### Challenging fundamental assumptions

Nineteenth- and twentieth-century sciences which developed beneath the umbra of Newtonian theories, embedded some pervasive assumptions which might be crudely summarized as (1) relationships between individual components of any system can be understood by isolating the interacting parts, (2) there is a predictability to the relationship among the parts, and (3) the result of interactions and the working whole might eventually be understood by simply summing the parts. So in much the same way as the expert clockmaker might be able to design, build, disassemble, and modify a clock, understanding the individual parts and how they fit together leads to understanding the functioning whole and the capability to replicate it precisely as required. This paradigm is dominated by mechanical metaphors and leads to an assumption that the sum of the parts equals the whole.

Dissatisfaction with the limitations of mechanical explanations led to more sophisticated models which were better at explaining the observed behaviour, initially of the physical world, and then increasingly the biological, ecological, and social worlds (e.g. Byrne 1998; Cilliers 1998; Holland 1995; Kauffman 1993; Prigogine 1978; Prigogine and Stengers 1984; Stacey 1993; Waldrop 1992). Such modelling offered new ontological insights about the nature of our world and the way it behaves. This is summed up briefly by saying that there are recursive, ongoing non-linear interactions between the elements that make up the whole and these elements adapt to each other in

non-linear ways. Their interactions create contingency and uncertainty about what the future will become. As a result, the whole lacks the predictability of the machine model. Boulton (2010) refers to a complex world view as 'becoming' because individual components in these worlds are interdependent and in processes of ongoing interaction with each other with the result that the world is not static and fixed, but dynamic, ever-changing, and becoming something different from what it was in the past. Recognition of such inherent uncertainty leads to a conclusion that Newtonian-like mechanical models are inadequate for these types of systems because the sum of the parts *does not* equal the whole. Understanding of the whole cannot be based only on an understanding of the disaggregated parts because of the ongoing non-linear change caused by the interactions between the parts. This shift in understanding brings us to a complexity world view: 'sandwiched between a view that the world works like a machine and a view that the world is chaotic, unpredictable and without structure' (Boulton, Allen, and Bowman 2015, 29).

In this complexity-informed world view, ongoing non-linear interactions result in macro patterns becoming established. Complexity theory explains the way many, repeated non-linear interactions among elements within a whole result in macro forms and patterns which emerge without design or direction. Further, an initial pattern might be disrupted by external events or internal processes and reform into some new pattern. Boulton and colleagues sum up what they call the 'central tenet of complexity theory' and its contribution to understanding change as 'the detail and the variation' of each action – the effect of a regulation on various actors for example – 'coupled with the interconnection' of action and environment that 'provide the fuel for innovation, evolution and learning' (Boulton, Allen, and Bowman 2015, 29). That is, the future is a contingent, emergent, systemic, and potentially path-dependent product of reflexive non-linear interactions between existing patterns and events. Its variety, diversity, variation, and fluctuations can give rise to resilience and adaptability; is path dependent, contingent on local context and on the sequence of what happens; subject to episodic changes that can tip into new regimes; has more than one future; can self-organize, self-regulate; and have new features emerge.

### **Introducing a complexity frame to public management**

As an alternative to Newtonian mechanics, this last observation about the contribution of complexity theory for understanding unpredictability and change in human systems leads us to its relevance for the study of public policy and public management. Scholars and practitioners of public policy and public management are concerned with how to create or change particular patterns of interaction between actors to get a particular result: for example, how might governments design a set of institutions to bring about certain behaviours; or given a set of institutions, how might the interactions between actors and the institutions be governed to achieve a particular outcome; and how might unintended negative effects be avoided or positive ones enhanced? Furthermore, complexity theory facilitates a focus on multiple levels of scale simultaneously. Thus the individual actors, and multiple layers of institutions of varying complexity which interact, can all be brought into view through the multi-scalar complexity lens.

We note, within the diverse scientific traditions of public policy and public management theories, attempts to explain dynamism and non-linear contingency in how

change takes place have become an increasingly pertinent concern (Eppel 2017). In the last 20 years – and rising sharply from around 2008 (Gerrits and Marks 2015) – we see increasingly explicit use of complexity theory concepts for explaining the way the public policy/management worlds behave and how we might better design and manage change in these worlds. David Byrne has also deepened our understanding of the methodological implications of complexity for the social sciences generally (Byrne, 1011, Byrne and Callaghan 2014).

Scholars such as Sanderson (2009), Room (2011), and Morcol (2012) have all argued for complexity theory for understanding of how the social world of policy processes work. Cairney (2012, 2013; Cairney and Geyer, 2017) caution us that the looseness with which complexity concepts are sometimes applied could be an impediment but they also see a place for complexity theory as a bridge between academic and policymaker perspectives in support of pragmatism and insights about how to influence emergent behaviour. Sanderson (2009) advocates that the ambiguity and uncertainty arising from a complex adaptive world can be mitigated through the use of an epistemology based on pragmatism and complexity theory. Room (2011) suggests a blending of extant theories such as institutionalism with complexity theory for better understanding the micro/macro dynamics of public policy. He suggests that there is a complementarity in which complexity theory supplies the micro mechanisms lacking in institutional theory and institutional theory supplies a macro framing specific to public policy which complexity theory lacks. Morcol (2012) argues further that complexity theory provides mechanisms and concepts for understanding the macro/micro problems at the heart of public policy process. That is, complexity theory provides a micro mechanism for explaining the macro patterns of interest to public policy scholars. Growing interest in complexity and policy is evidenced in the establishment of a new *Journal on Policy and Complex Systems* in 2014.

In a parallel and consistent vein, Teisman and colleagues in the Netherlands (Teisman, van Buuren, and Gerrits 2009), Rhodes and colleagues in Ireland (Rhodes et al. 2011), Koliba and colleagues in the United States (Koliba, Meek, and Zia 2011), and Eppel and colleagues in New Zealand (Eppel, Turner, and Wolf 2011) have each employed complexity theory concepts to better understand the core processes of public management such as agenda setting, policy formation, decision-making, and implementation. These authors have more or less independently come to the conclusion that complexity theory and network theory are required and should be linked together to provide an adequate basis on which to develop governance theory and practice guidelines in modern public management contexts. The extent of complementarity between complexity theory and network governance (Klijn and Koppenjan 2014; Koppenjan and Klijn 2014) and new public management theories is reflected in the establishment of the journal *Complexity, Governance and Networks* in 2014.

Others have taken aim at how public sector change might be better managed generally by enlisting complexity thinking and concepts to inform processes of designing and generating change (Boulton, Allen, and Bowman 2015; Geyer and Rihani 2010; Innes and Booher 2010). These authors identify common themes such as the impossibility of prediction and therefore the need to adopt more experimental approaches to intervention based on the assumption that there will be new phenomena (unknown unknowns) likely to emerge endogenously. What has occurred previously will continue to affect the present (and the future). As a result, any externally

applied change will have uncertain effects, some of which will lead to a helpful change and some not so. Doing public policy and public management in such a world requires cognisance of the above characteristics – and particularly the dynamics of self-organization, path-dependency, adaptation, and emergence – in how we approach policy and change (Rhodes et al. 2011). We also need complexity's lens to see the whole while taking into account the relationships between the elements at different levels of scale. Koliba and Zia (2012) talk about the need for complexity friendly methods for modelling the complex governance system. Innes and Booher (2010) built their theory of collaborative rationality for public policy on analysis of the ongoing dialectic interaction between collaboration and praxis as a means for understanding complex change. Cairney and Geyer (2015) have made a substantial contribution to thinking about the contribution of complexity theory to policy studies and how it might add to understanding of particular policy fields, such as health (Tenbenschel 2013) or concepts such as power (Room, 2015) as well as complexity friendly methods for research and practice.

### Overview of papers in this edition

This plethora of contributions and theoretical explorations cries out for framing and assessment to help guide scholars engaging with complexity in the public management/policy domains. To that end, our call for contributions asked authors to consider how complexity contributes to public management theory and practice using one (or more) of three lenses: (1) complexity theory-informed *alternative perspectives* on the framing of problems and design of processes of public administration to be considered, (2) insights into *alternative institutions* that are shaping public administration and management processes, and (3) *alternative practices* to match the complexity of the environment and the challenges faced by public management scholars administrators.

Furthermore, we note the need for a distinction to be made between the use of complexity theory to create and test concepts and theories to *describe* the world as it is (which is often the domain of the natural sciences), and the use of these concepts and theories to *design* and bring about change (this latter often the domain of social sciences). While these perspectives inform each other, they often rely on different ontological and epistemological foundations, and this is apparent in the papers in this special edition where we see both describe and design features in the way authors have used complexity theory.

### Alternative perspectives

Alternative perspectives provided by complexity theory have evolved markedly in the intervening years between this issue and the last special issue of PMR addressing complexity. We have already mentioned the application of complexity concepts to understanding multi-actor decision-making and institutional change for instance. The authors in this issue further explore models which attempt to incorporate the specific use of complexity concepts such as feedback loops, adaptation, attractors, and emergence to reframe understanding of common phenomena experienced in public administration such as policy processes, implementation, natural resources management, and public-sector reform.

In all of the papers in this issue, there is the explicit recognition that a complexity perspective entails the rejection of assumptions of predictability and control in public management, and the adoption of assumptions of multiple, interacting self-organizing entities that learn and change over time. While there are periods of stable behaviour and features of the system that function as constraints on elements of the system, the diversity and adaptation of entities creates the possibility for both evolutionary and unpredictable, sudden change.

An example of two inter-country independent decision-making processes that became coupled over time is used by Marks and Gerrits to illustrate the contribution of *game theoretic* models to understanding complex public administration processes. Their game theory model is tested through an experiment aimed at explaining how representatives of the two governments involved who met each other in two presumed independent decision-making arenas took the history of their interactions from one to the other, thereby influencing the overall outcome. Thus they demonstrate the interdependency and connectedness between systems that otherwise might be assumed independent. Further, the authors provide a testable formalized model that describes the interaction and co-evolution of independent agents over time for future scholars to build upon.

Haynes makes use of complexity theory to focus on multiple levels of public administration systems. He extends the conceptualization of the public administration complex system to include the behaviour disposition of the individual in relation to their public and personal values, to conclude that the multi-level capacity in complexity theory is, in part, bounded by public service values. Further, he uses the complexity concept of *attractors* to explain how public service values at different levels (individual, family/community, professional, and political) can play a role in constraining (or indeed enabling) system change over time. Both Haynes and Marks & Gerrits extend the understanding of complex adaptive systems (CAS) theory and public management by taking their analysis of participating actors below the level of description of the organization and the institutions. They consider the largely unconscious psychological dispositions of individual actors and their history with other actors and its influence on patterns of institutional and organizational decision-making which are relevant to the design.

Rather than develop new models, Rhodes and Dowling assess to what extent *fitness landscape* models (Wright 1932; Kaufmann and Levin 1987) have been used effectively by public management scholars to date through a systematic review. Fitness landscapes are evolutionary models that capture how the behaviour and characteristics of independent agents operating in a shared context result in individual and system-wide outcomes. The authors remark on their frequent use at the level of metaphor and the limited attention paid to mapping the concepts of the model to the features of the empirical phenomenon being described. This conclusion might easily be applied to a number of other complexity concepts (Cairney and Geyer 2017), which, after several decades of scholarly effort, raises concerns about the translation of these concepts into the public management domain. Nevertheless, Rhodes and Dowling conclude that in combination with network theory, fitness landscape models are 'more aligned with the actual features of complex governance systems than game theory models which rely on highly stylized assumptions about how agents behave and equally fuzzy definitions of performance' (Rhodes and Dowling, this issue). We return to these 'fuzzy definitions of performance' in our conclusion.

## Alternative institutions

Alternative institutions are those that can influence the actions of interdependent, autonomous agents as they iteratively explore alternative solutions to wicked problems, such as distributed authority arrangements, multi-sector for a for decision-making and multi-channel feedback arising from new communication technologies. For example, in Haynes' contribution, the notions of public service values and public value are explored through the lens of CAS theory. The paper offers a concrete and practical example for understanding the dynamic influence of values on complex policy systems. Haynes argues for recognition of 'soft' patterns of values such as belief systems and their dynamic influence on organizational behaviours as well as 'hard' patterns such as rules and structures and shows how the CAS lens enables this.

Castlenovo and colleagues attend to the issues raised by the federal–state–local governance structures and how these might be re-imagined/understood using complexity theory. For them, their complexity-based lens acts as a heuristic device to understand the misalignment of locally implemented outcomes with the centrally defined objectives of a nationwide public programme in Italy where the 'Napoleonic' administrative traditions dominate – arguing for a rethinking of these traditions.

Tenbense, rather than arguing for a particular type of institutional change, builds on the approach taken by Room (2011) and advocated by Cairney and Geyer (2017) in bringing institutional theory together with complexity theory using Crouch's concept of recombinant governance. Through an examination of the fitness of various governance hybrids in the health sector in New Zealand he demonstrates the usefulness of being able to distinguish among various versions of hybridity and to argue for a more evolutionary perspective on institutional design and change.

## Alternative practices

Complexity offers alternative ways of framing intervention and bringing about successful change that navigates the traps of unexpected changes and opens up different ways of achieving innovation. Gear and colleagues take us into the conceptual framing and research methodology needed to examine the complex problem of intimate partner violence (IPV). They identify the limitations faced in developing healthcare interventions in the absence of a complex adaptive systems view. Existing efforts to understand sustainable approaches in primary healthcare settings have been dominated by the direct cause–effect thinking reflected in randomized control trials and like methodologies that have been so prevalent in health research. Reframing the person entrapped by IPV and their world, and the world of a primary healthcare setting as two interacting complex adaptive systems, shifts the research focus to the reflexive interactions that occur between the person experiencing IPV and the primary healthcare setting. According to CAS theory, we would expect these interactions to lead to mutual adaptations within each of these complex systems, and therefore intervention sustainability will occur when the interaction and mutual adaptation generate outcomes that stimulate ongoing engagement by both systems. Without the CAS perspective, the self-organization, coevolution, and emergence that leads to sustainability cannot be studied. The conceptualization and research design developed to study healthcare responses to IPV might also be more widely applicable to other complex social interventions.

Sustainability of the collaborative governance network is also the focus of Scott and colleagues. Complexity theory concepts are used to both describe how sustainability is linked to the adaptability and flexibility of the collaborative project but also to offer insights into how the collaborative process might be designed to encourage the development of sustainability. Like many other papers in this edition, their use of complexity theory is combined with other theories – collaborative governance, in this instance.

Meek and Marshall use a CAS lens to understand how the multi-actor institutional governance of a complex Southern Californian metropolitan water system contributes to an adaptive resilience able to respond effectively to the external stressors of severe and sustained drought. Ongoing self-organization and adaptation within and among the governance actors and other stakeholders are characteristics of the governance system which lead to emergent features which help maintain resilience.

In the Castelnovo paper referred to already, we encounter the empirical descriptions needed to interpret the complexity factors that shaped an implementation trajectory. They offer self-organization, co-evolution, and emergence as mechanisms for understanding the peculiar implementation path which might otherwise be assumed to be the cumulative effect of a series of legislative interventions not always coherent in and among themselves. In so doing they pave the way for the design of alternative implementation practices.

Finally, scholar-teachers have also begun to incorporate complexity theory into teaching practice. It has proved useful for both integrating theories and for helping students and practitioners to better frame and understand the challenges of public management. In schools of government, planning, and business we are starting to see individual modules, components of programmes, and indeed entire master's degrees being developed to introduce students to a complexity 'perspective' and to be exposed to the tools and techniques to understand and intervene in complex systems. Due to constraints of space, this issue does not include any articles on this topic, but instead the editors are working on a separate special issue in 'Complexity, Governance & Networks' dedicated to the ways complexity is being taught to public management/policy students around the world.

### **Whither complexity in public management?**

The relevance of complexity theory for circumventing the weaknesses of a mechanistic approach to understanding public policy and management has been well-trodden ground for decades. That this continues to be pursued as complexity theory spreads across policy domains suggests that it is this fundamental capacity that is at the core of the attraction for many scholars and practitioners. As highlighted above, the use of complexity theory in public management has developed both in relation to the description of phenomena and design of institutions and interventions to effect change.

From a theoretical perspective, the scholarship of the last decade and the papers in this volume demonstrate that complexity theory sits alongside, and in many cases augments existing theories of public policy and public management. Public policy and public management draw on a variety of parent disciplines such as politics, organization science, economics, management, sociology, and psychology (Raadschelders 2011) and bridging or integrating this plurality continues to be an

implicit – and in some cases explicit – objective of scholars applying complexity theory to this domain. A complexity perspective can describe how interdependent agents interact over time – within the constraints of history, institutional forms, and/or values – to increase or decrease overall (or individual) fitness, sustainability, or resilience. It does this without the need to fall back on predictable cause and effect relationships among agents or contexts while still leaving room for the identification of patterns and likely pathways.

Furthermore, the ‘positive role for complexity theory as a way to bridge academic and policy maker discussions’ (Cairney and Geyer 2017, 1) – and we would add ‘practitioners’ – is evident in many of the papers. Complexity acts as a challenge to the quest for certainty in policymaking and also prompts discussion about the role of pragmatism in policymaking. In this issue, authors have argued for linking complexity frameworks with institutional theory, network theory, public value theory, and game theory to better understand the dynamics of processes, outcomes, and change in public policy/management systems over time. Its strengths lie in its facilitation of a focus on multiple levels of scale and its provision of micro-level mechanisms for macro-level theories such as institutional theory and punctuated equilibrium theory (Eppel 2017). The key mechanisms explored in this issue are based on game theoretic interactions, search processes on fitness landscapes, evolution arising from recombinant novelty, and information exchange in networks – building on the core complexity dynamics of self-organization, adaptability, and emergence. In respect of institutions, the conclusion one may draw from these papers is that it is unlikely that current institutional forms – whether they be hierarchical, market, network, or values based – exhaust the range of potential institutional forms that could be designed or evolve in the public policy and administration space. Experimenting with new forms would appear to be an important complexity-friendly policymaking practice that would lead to more sustainable public systems.

The concepts of ‘sustainability’ and ‘resilience’ make an appearance in several of the articles in this issue as objectives of research and practice that are facilitated by a complexity approach. However, there is little agreement or indeed clear definition about what either of these outcomes represent in the context of public administration. Survival – or the ongoing existence of agents, institutions, or systems if not of the individual humans that make these up – is, of course, one option, but this is not clarified or challenged either in the papers in this issue or in the wider academic community. It is incumbent upon those scholars working in this area and using these concepts to clearly define and debate what they mean if the policy or practice recommendations arising from their research are to be seriously considered.

In addition to this definitional lacuna around sustainability and resilience, the incorporation of performance management research, theory and practice, has been largely absent in the public administration complexity literature. The fitness landscape literature would appear to provide an obvious link to performance, as evidenced by the use of the phrase ‘performance landscapes’ to describe this approach in organizational theory (Siggelkow and Levinthal 2003; Rhodes and Donnelly-Cox 2008). This leads us to speculate about the compatibility of complexity theory with our basic understanding of the nature of performance management. The issue may partially be due to the multidimensionality of performance management (Bouckaert and Halligan 2008) and the limitations of how performance management has been conceived and practised in the new public management environment (Moynihan et al. 2011). Moynihan and colleagues (2011) point to the limitations of current research on performance

management to take adequate cognisance of governance complexity. So there appears to be some room for each scholarly trajectory to learn from the other.

But perhaps more important is that fact that we are still quite far from developing complexity-based models of agent interactions, behaviour, and change over time that demonstrably produce/predict real-world outcomes of any kind, not just performance. However, the kind of direct cause and effect theories we have come to believe represent the pinnacle of scholarly achievement and the reliance on experiments or random control trials to prove same are unlikely to address the sorts of ‘wicked’ problems (Rittel and Webber 1973) that lie at the heart of public policy and management. The need to continue to adopt and refine complexity-informed theory, institutions, and practice in a domain of human endeavour as rich and varied as public administration is as vital now as it was a decade ago.

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