

Abstract

Increasing attention is being paid to the application of complex systems theories in the social sciences. Although this trend is less prominent in the field of public administration, some examples of the use of complexity theory in research in this domain can be found. This article discusses three central ideas in complex systems theory that are relevant for public administration research: dynamics, self-organization and co-evolution. After briefly introducing each idea, the article traces similar concepts in public administration research. It then contrasts them with each other, and discusses how they can improve our understanding of phenomena in public administration. Finally, the article explores how the manager's role is perceived in public administration and what insights complexity theory can add to that view.

Key words

Complexity theory, public administration, overview, dynamics, co-evolution, self organization

COMPLEXITY THEORY AND PUBLIC ADMINISTRATION: WHAT'S NEW?

**Key concepts in complexity
theory compared to their
counterparts in public
administration research**

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Vol. 10 Issue 3 2008 299–317

Public Management Review ISSN 1471-9037 print/ISSN 1471-9045 online

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<http://www.tandf.co.uk/journals>

DOI: 10.1080/14719030802002675

INTRODUCTION: COMPLEXITY AS KEY WORD

Over the decades, public administration researchers have enriched their understanding of government and governance processes by incorporating ideas and concepts from other disciplines. Some recent examples of the latter include the concepts of discourse, frames and sense making from organizational theory, and the concept of principal–agent relations (which is very popular in the new public management literature) from economics.

Complexity: A key term in modern public administration?

At the same time, there has been a clear shift in the theory and practice of public administration. In the beginning, public administration as an academic discipline focused strongly on the stable elements and appearances of government, and especially on formal organizational structures, such as bureaucracy (see Pierre and Peters 2000; Frederickson 2005). In most public administration theories, the dominant assumption was that organizations were unified, rational actors (Braybrooke and Lindblom 1963). But gradually, researchers began paying attention to the fact that both rational behaviour and the assumption that the Government was a unified actor were more exceptions than the rule in the practice of public administration. Public policy implementation turned out to be a complex endeavour (Pressman and Wildavsky 1973/1983) and multi-actor approaches were introduced. These stressed the interaction and dynamic character of policy processes and used concepts such as games (Allison 1971) garbage cans (Cohen *et al.* 1972; for public administration, see Kingdon 1984) or mutual partisan adjustment (Lindblom 1965) to analyse the complexity of forming and implementing policies. Later, this attention to complexity in public administration phenomena was enhanced by the well-known conceptual move from government to governance, where much attention was paid to the networks in which public policy is formed and realized (Rhodes 1988; Pierre and Peters 1990; Marin and Mayntz 1991).

Thus, complexity seems to be an important concept for understanding modern government and governance processes. Nevertheless, the field of public administration has not made extensive use of the concepts and ideas of complexity theorists, so that the latter has had little influence on theories of public administration.¹ The concepts of complexity, originally developed in the natural sciences and biology, have, however, influenced other social sciences, such as organization theory and management (Stacey 1995; Maguire and McKelvey 1999). Although there are many different strands of complexity theory, they each attempt to understand change and the dynamics of systems as result of the complex interaction of the parts of those systems (see MacIntosh *et al.* 2006).

This article: Exploring the relationship between complexity theory and public administration

Since understanding and explaining change and complex dynamics is one of the central research themes in much of the governance literature, it is worth investigating if public administration can learn from or even use some complexity theories. It is also interesting to look at the history of public administration and see how some of the main ideas of complexity theory match existing concepts and theories in public administration. In that way, we can obtain an impression of complexity theory's current contribution to existing theories, and its potential to do so in the future.

It is not possible to explain complexity theory in its entirety in this article. Thus, after a short description of the main concepts of complexity (section two), we focus on three prominent ideas that are relevant for public administration: non-linear dynamics, self-organization and co-evolution. Next (sections three, four and five), we explore these three concepts, and specifically analyse their relationship with and contribution to certain well-established ideas in public administration. In section six, we detail the dominant perspectives on management in public administration and suggest how ideas from complexity theory can affect these viewpoints.

COMPLEXITY THEORY AND PUBLIC ADMINISTRATION

Before summarizing the main features of complexity theory, it is important to acknowledge that what has become known as complexity theory is actually a collection of a number of different theories. Mitleton-Kelly (2003) distinguishes five distinct areas of research: complex adaptive systems (such as Kaufmann), dissipative structures (Prigogine), autopoiesis theory (Maturana and Varela, and in social science, Luhmann) chaos theory and increasing returns and path dependency in economics (Arthur 1994). Each strand of work has its own character and differs, sometimes significantly, from the other. Their differences will not be discussed here, as that has been done elsewhere (Mitleton-Kelly 2003; MacIntosh *et al.* 2006). Although they share some common features, they also have different views on certain common topics (such as the characteristics of equilibria – see later).

What all these theories do share is the idea that the whole (the system) is more than the sum of the parts (the individual agents), while, at the same time, developments of the whole stem from the (interaction of the) parts. Complexity theories stress that systems tend to develop non-linearly and are subject to various feedback mechanisms. They are also dominated by self-organization and usually co-evolve with other systems.

Complexity theories: Systems, feedback and emergent properties

Complex systems are thus systems 'comprised of numerous interacting identities (parts), each of which is behaving in its local context according to some rule(s), law(s) or force(s)' (Maguire and McKelvey 1999: 26). When the individual parts of complex systems (the agents) respond to their own local conditions, they cause the system as a whole to display emergent patterns, even if there is no deliberate co-ordination or communication between the parts (Maguire and McKelvey 1999). In other words, and as many theories of complexity stress, systems are self-organizing and display emergent properties which cannot be traced to the behaviour of the individual agents alone.

These emergent properties and the relatively autonomous character of the agents cause systems to have unpredictable and complex dynamics. Seemingly stable equilibriums can be suddenly disrupted by unexpected events. One of the reasons for this is that these equilibriums are often sustained by complex feedback mechanisms. Positive feedback (reinforcing) drives change while negative feedback (balancing and moderating) maintains the stability of the system (Stacey 1995). The classic example of negative feedback in complexity literature is the central heating system, where the thermostat registers a drop of temperature and activates an adjustment mechanism, which restores the temperature. In social systems, one has to envisage these processes less mechanically and more in terms of social processes comprised of sets of actor interactions and reactions. These feedback mechanisms can be very complex in themselves and can result in a system stagnating (a locked-in situation), even though a diverse set of interactions are taking place within it. Translated to the public administration context, one can imagine decision making being completely blocked (the system finding itself in an equilibrium that has the character of a locked-in situation), because several (groups of) actors employ different but conflicting strategies that act against each other and sustain the deadlock.

Which complexity theory ideas are interesting for public administration?

Given the growing attention in public administration on governance networks and complex service delivery, some of the ideas from complexity theories seem to be very pertinent. For example, the concept of dynamics offers a different perspective on the decision and interaction patterns in governance networks, and also generates insights on how complex integrated service delivery can be governed. In particular, the concept of unstable equilibrium may enhance the notion of incremental change, which is well known in public administration. Finally, the concepts of negative and positive feedback can also shed light on some of the unexpected changes in decision making in public administration.

Besides the above concepts, self-organization and co-evolution are also very relevant for public administration. Across any trend in public administration that one sees as the most important, both in the NPM literature and in the governance literature, there is a

strong hint that organizations or even networks are self-organizing. From an NPM point of view, this issue should be handled by directing organizations from a distance with performance indicators, while, from a governance point of view, the focus is on bringing these self-organizing units together and enhancing their co-operation. The question then arises as to how these agents will react to these governance incentives.

Complexity theory can enhance our understanding of phenomena and challenge our basic assumptions about governance (Buuren and Teisman 2007). However, the literature on complexity and governance networks in public administration also draws our attention to the ways in which different decision-making processes influence each other. An example of a context where this applies would be the problematic connections between locally bounded initiatives and projects and national governmental policy initiatives (see Agranoff and McGuire 2003). Thus, the concept of co-evolution, as developed in complexity theory, may help enrich public administration theories. In the next three sections, we will explore more closely each of the above-mentioned concepts: *dynamics*, *self-organization* and *co-evolution*.

DYNAMICS IN COMPLEXITY THEORY AND PUBLIC ADMINISTRATION

Although plans for a road to connect two important highways from Amsterdam to The Hague and through the territory of the municipality of Voorburg had been around since before World War II (in 1938), they had never seen fruition. In the early 1980s, the Ministry of Transport attempted to re-launch this idea. However, the municipality of Voorburg strongly opposed the plan because of various negative effects. Even when the ministry unilaterally attempted in November 1994 to force the municipality to cooperate with the decision to implement the road, it took the initiative of a private actor, who came up with an integrated project comprising a tunnel, to reduce the noise and other negative effects of the road, and new dwellings and offices, something Voorburg wanted, to end the deadlock (see Edelenbos and Klijn 2007). What is interesting here is that, at first glance, one would assume that, for instance, the period between the early 1980s and 1994 would be a simple deadlock, that is, a stable equilibrium with a negative outcome. But, a closer look would reveal that much was actually happening in this deadlock situation. Both actors (and other actors) were actively using various strategies to achieve their goals. However these different strategies actually dampened each other. Thus, we observe a dynamic equilibrium with both positive and negative feedback taking place, which maintain the equilibrium as it is.

Non-linear dynamics in complexity theories: Systems at the edge of chaos

Complexity theories tend to emphasize that systems are best characterized neither by linear dynamics, where an increase in one incentive leads to an increase in another, nor

by stability or stable equilibriums. Dynamics in systems often show signs of unstable or at least temporarily stable situations that are held in that position by negative and positive feedback mechanisms; however, these can be suddenly disrupted (see MacIntosh and MacLean 1999). They also reveal signs of non-linear dynamics, where increases in a certain incentive or factor can lead to varying effects, due to contextual changes, with new effects occurring when certain time thresholds are crossed (Mitleton-Kelly 2003; Teisman 2005).

There temporarily stable equilibriums and connected non-linear dynamics are conceptualized in various ways. For example, dissipative structures (Prigogine and Stengers 1984) refer to new structures formed when systems move from stability to chaos. This relates non-linear dynamics, equilibrium and emergent patterns to each other. The concepts of the edge of chaos or bounded instability, more frequently used in the complex adaptive systems literature, emphasize that systems seem to be constantly adapting and self-organizing in a zone between order and chaos. One often finds in organizational studies that use complexity theory the argument that organizations are the most innovative in that situation, while a stable equilibrium implies 'death', to use the metaphor of biology where the idea comes from (Stacey 1995; Pascale 1999). Systems remain in a state of bounded instability because of the balance in the levels of positive and negative feedback. This holds the system at a particular state, whereas if either were dominant, stability (negative feedback) or instability (positive feedback) (Stacey 1995; Mitleton-Kelly 2003) would result. Although one will find different conceptualizations of system dynamics, equilibriums and feedback in the various branches of complexity theory, they all stress the relatively dynamic character of equilibriums that can change as the result of feedback mechanisms.

Dynamics in public administration: From incremental steps to complex processes

The idea of dynamics in post-war public administration theory is dominated either by the fairly straightforward feedback of Easton's (1953) system theory, where inputs (supports and demands) are converted by the system to outputs (authorized decisions), or the small steps of Lindblom's incrementalism. Easton's model was based on system theory but has little relation to the complexity theory. Lindblom's incrementalism, where he proposed a movement away in small steps from an undesirable state in a situation of limited knowledge, was a criticism against rational decision making, where the policy maker was asked to look at all options, weigh them against as much as information possible and then choose the best one (Lindblom 1959; Braybrooke and Lindblom 1963). One of the criticisms he received was that policy makers could never realize significant changes. Lindblom's answer, paraphrased in a slightly stronger way than he did, was that small incremental changes would, in the end, result in significant changes, and that it was better to be modest and pragmatic than perish in unrealizable

ambitions (Lindblom and Cohen 1979). However, the complexity theories described above would offer Lindblom a different answer, which was that the cumulative effects of various small steps could, at some point, reach the moment where the system would just about lose its stability (or its seemingly stable position).

In the 1970s, an entire generation of theories emerged that focused on the interconnectedness of a variety of actors and the notion that their strategies influence each other. The ideas of complexity, dependency, unpredictability and connectivity are manifest in these theories of complex decision making, although they are not related to balanced equilibriums like in complexity theory. Some of the well-known ones are: the garbage can approach (Cohen *et al.* 1972), mutual partisan adjustment (Lindblom 1965; Lindblom and Cohen 1979) and model II (a partisan model) in the multiple perspective approach of Allison (1971).

In organization theory, strategy and strategy formation can be explained as the consequences of the deployment of different actors' strategic actions. Mintzberg emphasized the complex character of strategic processes: while some strategic patterns might be intended, many are emergent and arise out of reactions to unexpected external events or are reactions to other actors' strategies (Mintzberg 1996). Emerging strategies are no longer seen as anomalies of effective policy making and management, but as outcomes of learning processes. The game theory literature often presents decisions as the outcomes of interactions. Thus, the strategies of actors are based on their own considerations, but can still influence other actors' outcomes in a series of games (inter-connectiveness, see for a modern use of game theory: Scharpf 1997).

Many elements of these theories, which stress the complexity caused as a result of actors (agents) and their choices, can be observed in recent governance theories. The governance literature focuses on the dependence between governmental organizations and a wide variety of societal organizations. Interconnections form a central element in theories of governance, something that is even truer for network theories (Rhodes 1997a; Kickert *et al.* 1997). Resource dependencies between actors are a basic characteristic, and cause actors to develop and sustain networks (Hanf/Scharpf, Rhodes 1997b; Kickert *et al.* 1997; Koppenjan and Klijn 2004; Sorenson and Torfing 2007). Most network theories focus on the complex interactions that arise out of these dependencies, the resulting policy outcomes, and the limitations and possibilities for guiding and governing these interaction processes.

Dynamics: Revolutionizing existing theories in public administration

Hence, the concept of dynamics is not new to public administration research, although interest in it is a fairly recent occurrence. One could argue that the ideas of dependencies and connectivity are better developed in public administration than in the field of complexity theory. In addition, more advanced empirical analyses have been

carried out here too. Empirical analysis with complexity theory concepts in public administration (as well as in other social science fields) is relatively scarce. However, public administration researchers have not done much with the concept of non-linear dynamics and dynamic equilibrium. The idea of badly predictable systems and non-linear dynamics are additional steps on the path already trodden by public administration research (see also the article of van Buuren and Gerrits in this issue). Good empirical analysis of these feedback mechanisms, however, needs detailed empirical research of the system under study, which could be a decision-making process, an organization or a network.

SELF-ORGANIZATION AS GUIDANCE FOR PROCESSES

Since the mid-1970s, urban renewal in the city of Rotterdam has been planned and implemented by a rigid coalition of civil servants, politicians and tenants. However, the position of the housing associations, the bodies that actually implemented the policies, was weak. Given that the actors in this situation followed the informal rule that 'he who pays decides', it was unsurprising that the housing associations were hardly consulted. This was because the considerable subsidies provided by the central government were distributed by the city administration's housing department, thus placing the latter in a stronger position. The situation shifted when central subsidies, especially for post-war housing, were stopped at the end of the 1980s. Housing associations took a stand against their lowly role and conflict arose when they refused to implement plans that they had to pay for even though they could not influence them much. This refusal shook up the existing decision-making network and resulted in a number of deadlocks. Gradually, however, the actors involved succeeded in constructing new rules, which offered a more prominent role to housing associations and specified new modes of interaction (Klijn 2001). In terms of complexity theory, this case exemplified how new properties, in this case position rules and interaction rules, could emerge out of the interactions of distinct agents.

Self-organization and emergent properties: Creating spontaneous new order?

Many theories on complex systems stress that systems are governed by spontaneous order that is self-organizing. Systems show emergent properties because of the interaction of their individual elements (Mitleton-Kelly 2003). In this way, the macro-structure of the system is related to its micro-structure (the interaction between its agents) without the need for active steering (Checkland 1981). There are different views on how spontaneous this self-organization is in the various branches of complexity theory. While the literature on bounded instability stresses the spontaneity (Kaufman 1993; Stacey 1995; Pascale 1999), the literature on dissipative structure lays more

emphasis on the deep structures of systems that are not apparent when observable structures break down but which are important in constituting the new order; in a way, this becomes a self-referencing process (MacIntosh and MacLean 1999; Mitleton-Kelly 2003). One could thus interpret the empirical example provided at the beginning of this section as a self-referential process in which the existing rules pre-structure the new, emerging properties. There is some evidence to support this interpretation (see Klijn 2001).

This idea of self-referencing is highlighted even more in autopoiesis theory, which states that systems can regenerate and continuously recreate themselves (In 't Veld *et al.* 1991; Twist and Schaap 1991; Styhre 2002). Systems are thus self-generating enclosed structures whose mechanisms are inter-connected and mutually dependent. Autopoiesis envisages a system not as an open system, as is often done in organizational theory (see Silverman 1970; Burrell and Morgan 1979; Morgan 1986), but as a system continually interacting with the environment. However, this 'interaction is always determined by an organizationally closed system of production relationships' (Twist and Schaap 1991: 32). Most examples of these systems come from biology (Maturana and Varela 1980). This also means that systems have a certain self-containment and closure to their environment. They adapt to their environment but do so with properties and characteristics that are created and sustained in the system itself. In that sense and from a public administration perspective, closure implies a situation that is 'less governable and less susceptible to incentives'.

Self-organization and emergent properties in public administration

The concepts of emergent properties and self-referentiality can be found in theories of public administration, although they are not phrased in the same way as in complexity theory. Theories that combine these concepts with the concept of self-organizing are scarce, although the idea that systems or organizations can be self-organizing is mentioned in several governance theories (Kooiman 1993; Sorenson and Torfing 2007).

Public administration has imported and used insights from the literature on games, especially rational game theory, which is associated with economics. For example, Scharpf (1997) uses this literature to characterize strategy patterns in decision making, by combining actor and structure variables. One could consider certain games, such as prisoners' dilemma, chicken or assurance games, as emergent strategy patterns that arise out of the strategic behaviour of individual agents. These emergent patterns can be analysed, as Axelrod (1984) has done, using computer simulation. He showed that, in a prisoners' dilemma ecology of games, co-operation can emerge between actors without any external co-ordination.

The concept of emergent properties is also present in institutional theory and in institutional perspectives on public policy. Institutionalism has received much attention in public administration the last twenty years, with various theories, such as contractual

theories, implementation theories (Hanf and Toonen 1985) and other management theories in general (Peters 1999; Pollitt 2003), being based on it. Although there are different versions of institutional theory, many of them, especially those based on sociology (see Scott 1995), stress that institutional structures arise out of the interaction between individual agents. Agents shape or reshape institutional structures with their actions, because they use as well as interpret existing institutional rules (Giddens 1984). Thus, in the language of complexity theory, the combined actions of individual agents in the system lead to the emergence of new features that solidify and form the structures of the social system.

Although references to the concept of self-organization can also be located in public administration research, they are closer to the related notions of self-referentiality and closure. If systems are seen as self-organizing as well as self-regenerating, they will have their own distinctive dynamics and react to the environment in their own, specific ways. This means that they are, to a certain extent, closed to outsiders or external pressure, or, at the very least, have unique responses to such pressure. This idea can be found both in the growing literature on frames and perceptions, as well as in the literature on the accessibility or closure of networks. The former domain stresses that actors have frames of references by which they interpret and evaluate information, actions and developments (see Rein and Schön 1992). This means that actors can share certain frames; however, frames can also be very different and thus inhibit interaction, collaboration and goal achievement. This idea can be expanded by proposing that certain groups of actors share frames that distinguish them from other actors. This can be seen in theories such as Sabatier's advocacy coalitions (Sabatier and Jenkins 1993), which emphasize coalitions of actors that share basic policy beliefs (for similar thoughts see Benson 1982). These ideas can also be located in organizational theory research on learning and organizing (a famous example is Weick's (1979) 'organizing' theory). Closure is also emphasized in certain sections of the network literature that focus on policy communities, which are characterized by strong interaction ties, dependencies and common views (especially in sector policy communities) (see the early work of Rhodes (1988, 1997b) and others on networks (Laumann and Knoke 1987).

The value of self-organization

It is clear that complexity theory's concepts of self-organization and emergent properties resemble the notions of frames, closure and the development of institutional characteristics in public administration research. At first glance, the ideas in complexity theory seem to be more radical than those in public administration, as they focus our attention on the spontaneous character of systems, as well as the closed nature of regeneration and their self-organization. From a complexity theory perspective, it can be argued that self-organizing systems are hard to govern and/or influence. In addition,

the notion of closure challenges the idea that systems or agents can be governed by clear signals or incentives, something that is usually taken for granted in public administration.

CO-EVOLUTION AS EXPLANATION FOR THE COURSE OF PUBLIC SECTOR PROCESSES

In much decision making about infrastructure, a tension exists between: (a) the needs and urgencies of the (local) projects and the ambitions of the actors connected to these local projects; and (b) more general policy streams where (political) ideas and policy initiatives ‘flow’ and disappear. Successfully completing such projects involves two tasks: (1) activating local actors, by creating content which interests them and which they will either invest their resources in or not veto, and (2) connecting the general policy streams to the particular project. Thus, managers have to link their projects and ideas to existing policy initiatives to create support and acquire funding from the national policy level (see Klijn 2007). These two different networks are two different systems, which have to co-evolve to be fruitful. In other words, the projects need support and resources, while the policy stream and its component programmes need concrete results and feedback to evaluate the relevance of political ideas. This idea of co-evolution is prominent in complexity theories, and is discussed in more detail below.

Co-evolution: Connectivity and the mutual influence of systems

The concept of connectivity does not apply only to elements within a single system, but also to the relations between systems. Systems development also stems from co-evolution with other systems. In biology, co-evolution essentially means that organisms are related to each other and that the adaptation of one particular organism to its environment influences the entire environment in which other organisms function. In that sense, all organisms co-evolve with each other and with the environment simultaneously and in a complex manner. Thus, the ‘landscape’ in which the organisms function and their position and fit to that landscape also change. The classical image in biology is a ‘fitness landscape’, where peaks illustrate the higher fit of an organism (Kaufman 1993).

Thus, specific trajectories develop as a result, not only of adaptation to a changing environment, which has been elaborated on by a variety of managerial and governance theories, but also because of co-evolution with changing environments. Co-evolution can be described as ‘the evolution of one domain or entity (that) is partially dependent on the evolution of other related domains or entities or that one domain or entity changes in the context of the other(s)’ (Mitleton-Kelly 2003: 7). ‘Entities’ is a general

term and can refer to individuals, teams or organizations. Co-evolution in empirical analysis is thus strongly related to the definition of the level in which that system operates.

In social systems, co-evolution results from a combination of the strategic actions of agents and collectives of agents. In complexity theory, strategies are seen not as one-sided responses to a changing environment or another agent, but as adaptive moves, affecting both the initiator of the action and all others influenced by it (Mitleton-Kelly 2003). Co-evolution does not have to manifest itself as a relationship that occurs at the same time. In most cases, it can be observed in short or longer time adaptations. It is also something that takes place at all levels and scales. Thus, from the lens of co-evolution, complex systems can be seen as multiple, inter-related interactions and relationships that influence each other in direct and indirect ways.

Co-evolution in complex decision-making processes

The idea that different levels of decision making influence each other can be found in several public administration theories. One example is the public choice theory of decision making, where separate levels of interactions can be distinguished (see, for instance, Kiser and Ostrom 1982). Another example is the application of network theory to decision making, which stresses that, while decision making occurs within networks of actors (Hanf and Scharpf 1978), it is often tied to decision making in other networks. Thus, decision making in one system co-evolves with decision making in other systems. This co-evolution operates in two ways. In network theory, decisions that take place in different arenas can be situated in the same or different networks (Koppenjan and Klijn 2004). Within the arena concept, various subsystems in a system (network) co-evolve with each other or with other networks, if certain decision-making arenas influence decisions being studied in other networks.

However, the notion of co-evolution is also present in earlier theories of organization and decision making. Cohen *et al.* (1972) challenged the conventional view of organizations as well-organized rational systems, and described organizations as anarchies where separate streams of solutions, problems and events flow which have to be connected. This garbage can image of organizations inspired Kingdon (1984) to conceptualize a model of decision making and agenda formation in which several separate streams can be traced: a stream where problems are constructed and refined, one where solutions are developed and a stream of political events. Decisions are made when couplings are achieved, that is, where an experienced problem is connected to a known solution and is backed by political events that support action. Moments such as these, which are favourable for making decisions and enabling policies to be achieved, are termed 'policy windows' by Kingdon. Policy entrepreneurs work to promote such moments or to seize the opportunity when they occur.

Co-evolution as a conceptual possibility in research

Kingdon's ideas indicate how co-evolution can be conceptualized in terms common to public administration and how it can thus contribute to understand complex decision making. It is also interesting that Kingdon highlights the complexity and unpredictability of processes, since policy windows can occur because of specific moments (like crises), which are difficult to predict in advance.

The notion of co-evolution challenges researchers to search for more complex relations in decision making. More specifically, researchers should expand the existing notions of public administration, such as connected arenas or separate streams, even further and look for other patterns of relations between decisions and developments. In that sense, the notion of co-evolution may be the most promising concept in complexity theory from the perspective of public administration.

On the other hand, does the focus on co-evolution make it harder for the researcher to carry out his or her work? This may be because she or he has to cover a larger area of research and pay attention to developments in other systems that are connected to the system she or he is researching. A closer comparison of the way the concept of co-evolution is used in complexity theory and public administration, along with some attempts at its empirical application, will help provide insight into the possibilities and limitations of research in this domain.

PUBLIC MANAGERS COPING WITH COMPLEXITY

What do the insights from complexity theory mean for our notions of management or public management? To answer that question, we first look at the dominant view on public management in public administration. We next suggest some conceptualizations for management following the reasoning of complexity theory. Finally, we contrast the two with each other.

Two dominant views on management: New public management and governance

In the last two decades, two dominant perspectives on public management have evolved: new public management and governance. New public management emphasizes the separation of responsibilities and authority with regard to policy making and policy implementation, and with regard to political decisions and their ultimate realization. The governance perspective focuses on improving inter-organizational co-ordination to improve policy proposals and their implementation, and to tie important actors to the policy process.

In general, one can say that NPM is characterized by five connected features that do not necessarily have to be present at the same time (Pollitt 1990; Hood 1991; Kickert 1997; Ketll 2000; Lane 2000). These are:

- (1) Improving the effectiveness and efficiency of government performance.
- (2) Using ideas and techniques that have proven their value in the private sector.
- (3) Privatizing and contracting out governmental services, or (parts of) governmental bodies to improve their effectiveness and efficiency.
- (4) Creating markets or semi-market mechanisms, or at least increasing competition in service provision and in realizing public policy.
- (5) Using performance indicators to specify the desired outputs of privatized or separated parts of government.

The governance perspective focuses on horizontal co-ordination and tries to cope with complex interdependencies by improving inter-organizational co-ordination and management. Important elements of its response to uncertainty are:

- (1) Horizontal types of steering that are supposed to be better able to acquire the co-operation of societal actors. These mechanisms supposedly ensure that actors will use their veto power less frequently (*enhance support*).
- (2) Use the knowledge of societal actors to improve policy and public services and create better and more innovative service provision and policy outcomes (*quality improvement*). While private actors often possess knowledge of markets, societal organizations have access to the preferences of service users and citizens, and an understanding of societal trends or sector knowledge.
- (3) Early involvement of societal actors, so that the legitimacy of decisions is enhanced (*enhancing legitimacy*). Frequently, governance reform proposals are linked to improve or introduce innovation to the democratic process, or at least to the ambition to re-establish the link between politics and citizenry.

The two views treat complexity differently. NPM tries to get a grip on or reduce complexity by creating clear responsibilities and dividing policy making from policy implementation. NPM achieves this by abstaining from detailed governance. Instead, it focuses on governing based on output criteria and by organizing the playing field (market mechanism, privatization, etc). Complex government systems, such as agencies, or entire industries, like the rail industry in the UK after privatization in the 1980s and 1990s, are treated again as black boxes. In the new public management framework, the manager tries to keep as far as possible from the complex interaction of the system itself.

The governance perspective addresses complexity by stepping into the complex system and designing governing mechanisms and strategies that are specifically targeted

at the situation and the characteristics of the process. From this perspective, the manager attempts to move with the system and take advantages of opportunities to connect actors and ideas in the system, so that temporarily stable situations for achieving policy outcomes can be arrived at.

Management ideas from a complexity theory point of view

Various authors have written about management from a complexity point of view. There are also different assumptions about how complex adaptive systems can be managed. The idea of the edge of chaos, as discussed earlier in this article, has evoked debate as to whether a manager can hold the system at that point (or direct it to that point), given that the edge of chaos is seen as the moment where the system is at its most adaptive and creative (Stacey 1995; Pascale 1999). However, this argument is probably pushing complexity theory too far, while also making heroic assumptions about the way in which systems can be controlled, which seems to be at odds with the basic ideas that come from these theories. Even though a well-developed conceptual model on management based on complexity theory is absent, three important management concepts can be found in complexity theory (see Flood 1999; Maguire and McKelvey 1999; Teisman 2005).

The first is that the complexity and the multiple, emergent properties of complex systems will make these systems *unmanageable*. Flood (1999) calls this 'managing in the unmanageable'. The argument is that since dynamics, self-organization and emergence are the norm, adjusting to these changes is often a wiser strategy than trying to get a grip on them. In this situation, a manager adjusts and adapts to developments rather than directing them. For public administration, this would be a radical idea indeed, since the assumption of governance is pervasive in public administration theories.

The second contribution for management from complexity theory points to something akin to 'smart interventions'. If complex systems are unpredictable and display emergent properties, then particular knowledge about each specific situation is necessary. Interventions should be aimed very specifically at a system's characteristics and try to establish specific interactions between agents that realize interaction patterns and/or outcomes that are in the desired direction. Here, just as in the governance perspective, a manager is not only part of the complex system she or he is managing, but also interacts with the separate agents to influence interaction patterns and outcomes. This view resonates with the literature on network and process management (Kickert *et al.* 1997), where a manager has a facilitating role, in the sense that she or he connects actors with the elaborate content of proposals, and explores whether this content matches the preferences of the involved stakeholders and the organizational arrangements for interactions (Koppenjan and Klijn 2004).

The third inspiration from complexity theory is the view of management as ‘riding the fitness landscape’ (see also Pascale 1999 for this image). If the events in a social system are seen as a range of mutual influencing interactions, where choices and events shape new situations and the positions of actors (the fitness landscape), then the task of the manager is to be aware of the opportunities in that landscape, as well as the positions of the actors, and use them to realize interesting policy proposals or to adapt proposals and actor coalitions, in such a way that they fit the landscape. This image of the manager and his/her tasks and strategies resembles the notion of a policy entrepreneur in Kingdon’s stream model. A policy entrepreneur is someone who attempts to connect the different streams (problems, solutions and choice opportunities) or use them to promote policy proposals. This perspective is similar to the previous one in that the manager needs a very good understanding of the system she or he is in to take advantage of it. However, it also stresses the positions and the state of the system the manager is in.

CONCLUSION: THE ADDED VALUE OF COMPLEXITY THEORY

We have seen that the ideas and concepts from complexity theory are closer to the development of public administration than the scarce use of such theories in this domain would have led us to believe. Many of the ideas and concepts of complexity theory are a good fit with modern ideas of complex decision making, complex strategies and processes, and the emergent characteristics of processes and institutions in public administration theory. However, some ideas are relatively newer to public administration, such as co-evolution, non-linearity and the fitness landscape, or are more radical in their conception than comparable concepts in public administration. Finally, some other concepts are fairly similar to existing notions in public administration, such as dynamics and feedback. In that sense, ideas from complexity theory can be regarded as the next generation of ideas that have come forth as a result of the use of earlier theories and because of the problems recently experienced in public administration.

That does not mean, however, that the concepts arriving from complexity theories are useful for all public administration phenomena, or that they are unproblematic. The conceptual framework of complexity theory is suitable for so-called wicked problems. Thus, it is a conceptual approach, which resembles governance theories, network theories and other theories that focus on the analysis of complex processes and problems. Much work still remains to be done in the empirical operationalization of these concepts and their application to empirical phenomena.

NOTE

- 1 Apart from some rare examples like the use of evolutionary dynamics in agenda literature (see van Buuren and Gerrits in this issue).

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