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Published online: 26 Jul 2011.

To cite this article: Christine Brachthäuser (2011): Explaining global governance—a complexity perspective, Cambridge Review of International Affairs, 24:2, 221-244

To link to this article: http://dx.doi.org/10.1080/09557571.2011.558057

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Explaining global governance—a complexity perspective

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Abstract As patterns of global governance have undergone significant changes over time, there is a need for new theoretical concepts that are less oriented towards formal hierarchies and give more emphasis to social processes. A framework, however, that takes account of complex interactions and tangling relations bears the danger of losing analytical power. The article addresses the question of the extent to which complexity theory can overcome this problem by combining scientific rigour with contextual sensitivity. A dynamic mechanistic approach is explored that addresses the underlying processes that generate new collective patterns based on changed actor constellations and relational orders. An activator–inhibitor interaction model is introduced as a framework for analysing the multi-level processes that drive international change, using the example of climate protection. Global governance is theorized as it grows within the system fleshing out a new logic of collective action based on decentralization and clustering.

Introduction

‘Global governance’ has become a buzzword in international politics for a wide range of political phenomena and theoretical concepts. In a narrow sense, the term ‘global governance’ is applied to international regulations and formal agreements. From an analytical perspective this restricted focus has the advantage that global governance can be studied in the context of decision theory. Consequently, research has primarily been focused on international negotiations and institution-building at the intergovernmental level. Patterns of global governance, however, have undergone substantial changes over time, signified by a trend towards the proliferation of actors and the multiplication of spheres of authority (Dingwerth and Pattberg 2006; Rittberger and Nettesheim 2008). Global governance today operates at many levels from the local/subnational, national, regional, transnational and transregional to the global. In contrast to the restrictive definition, it in fact encompasses formal as well as informal processes and refers not only to political organization but also to social organization (Knight 2009; Grin 2006; Latham 1999).
Explaining global governance entails making sense of these complex relationships and multi-level interactions that create and inhabit the emergent collective pattern of ideas and behaviours that brings some ordered structure to the world. The evolving greater complexity of the international system poses new conceptual challenges. Rather than thinking in terms of formal hierarchies, this paper advocates a more fluid conception of mutual impact. Global governance emerges from complex processes of social pattern formation driven by rule-following, management and self-organization. As a consequence, governance becomes more ambiguous, as evidenced in tendencies towards convergence as well as divergence, owing to an environment of turbulence, flux, fragmentation, disequilibrium and uncertainty.  

This characterization of global governance as a complex phenomenon, however, raises serious doubts about the possibility of stringent analysis and explanation. Conventional rationalist approaches seem to be inappropriate for explaining collective outcomes in an increasingly interdependent and interconnected world. This paper explores to what extent complexity theory could serve as a framework for analysis. There are, of course, many different strands of complexity research one could consider, ranging from postmodern approaches (Cillier 1998) that come from an interpretivist perspective and advocate a metaphorical treatment of complexity, to positivist-oriented approaches that consider complexity science primarily as a computational tool to conduct hypothetic-deductive or variable based research. This article aims for a scientific approach without, however, following a conventional positivist research strategy. Rather, it seeks a model-theoretic mode of explanation based on causal processes that underlie and generate observed phenomena. The goal is to identify regularities in terms of process patterns rather than some universal scientific laws. Computational methods and tools are essential elements of such a research program, but they are toothless unless based on some meaningful theoretical ground.  

Agent-based modelling, social network analysis or equation-based simulation is by no means confined to complexity research. The challenge is to theorize complex social reality in a fashion amenable to quantitative and computational research (Sørensen 1998; Cederman 2005, Sawyer 2004b). Social theorists, however, have so far only rarely aimed at such a goal. In order to address the demand for new theoretical concepts, this paper explicitly turns to the question of how complexity can inform our conceptual thinking about international processes based on generative mechanisms. Complexity research in the social sciences seems particularly promising for the study of organizational phenomena where the creation of new order (processes, behaviour, structure) is more fundamental than an inevitable trend towards equilibrium (Lomi and Larsen 2001, Holland 1995, Epstein and Axtell 1996). It allows for conceptualizations of macro phenomena that emerge from the interactions of interdependent heterogeneous and ever-changing agents absent

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1 Rosenau was the first scholar in IR to apply complexity concepts to international affairs (Rosenau 1990), but he remained sceptical about a complexity-science-based analysis of global politics (Rosenau and Earnest 2006).

central control. The article suggests that relationalist\(^3\) and evolutionary theory\(^4\) may be the best-suited approaches to analysing the underlying dynamics of complex interaction. Neither is necessarily linked to complexity research, but certain strands of them are certainly compatible with it. Complex phenomena are theorized in the context of changing relational structures that bring about specific evolutionary dynamics. Relational aspects are emphasized over the command aspects of global governance.

The article is organized as follows. The first part argues in favour of a causal mechanistic model of global complexity based on the notion of the near decomposability of the international system. The next section discusses the explanatory importance of interaction and relational structure for collective outcomes and introduces the concept of a meso-level to address global governance in the context of multi-level interaction. In the last section an activator–inhibitor interaction model is introduced as a possible framework to study the complex modes of international organization, using the example of climate protection. Global governance is theorized as it grows within the system implying a new logic of collective action based on decentralization and clustering.

### Explaining complexity

‘Explaining complexity’ might initially sound like an oxymoron. Complex systems are characterized by a multitude of convoluted interactions that collectively determine the system’s dynamics (Bechtel and Richardson 1993; Strevens 2005). The possibility of multiple realizations, the context dependency of outcomes, and the non-linearity between causes and effects create major obstacles for scientific inquiry. It is thus a legitimate question whether causal inference is at all possible in complex systems. An analytical approach only makes sense if there are indeed some identifiable dynamic principles at the system’s core. Complexity does not exclude the possibility of observable regularities and patterns. Our ability to detect them, however, crucially depends on how we frame the problem of interest. Complexity is not entirely an intrinsic property of the system. How we describe a (complex) phenomenon shapes and frames the methods and modes of explanation that we apply in our investigation (McIntyre 1993; Agazzi 2002). Philosophy of science typically distinguishes between three types of explanation: covering law explanations, statistical explanations and causal mechanistic explanations.

Covering law explanations in the social sciences seek generalizations between independent and dependent variables in a nomological causal sense.\(^5\) The goal is to show that certain observed empirical regularities were to be expected based on the specific information about a particular situation and the general laws stated in the explanans (Hempel 1994, 350). Covering law explanations work best for

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\(^3\) In IR, Jackson and Nexon (1999) have advanced relationalism most prominently. For a general endorsement of a relationalist research programme in the social sciences, see Emirbayer (1997).

\(^4\) I draw particularly on concepts and ideas developed in evolutionary economics: for example, Anderson et al (1988) and Dopfer (2005).

\(^5\) For a discussion of the covering law model in the social sciences, see for example, Salmon (1989).
research designs based on linear regression models that require homogenous independent variables (Hoffmann and Riley 2002). From a complexity perspective, this procedure may lead to descriptions of a phenomenon that are so simple and detached from their spatiotemporal context (for example by applying the ceteris paribus clause) that the identified laws just state a truism and are not really explanatory (Scriven 1994). Feedback loops and other non-linear effects that are of central interest for complexity research are basically excluded from analysis. A more complex description of a social phenomenon that takes account of non-linear interactions, typically defies the identification of scientific laws. These difficulties are not just practical in nature, but rather point to some more fundamental problems. Most complexity researchers oppose the notion of a mind independent reality waiting to be discovered, that is underlying the covering law model (Jackson 2011, 42). Social construction and human reflexivity rather stand out against the existence of objective standards for assessing competing knowledge claims (Hoffmann and Riley 2002). Concretely, this means that simple observations of the surface are not sufficient to explain complex social reality. Rather there is a widely shared understanding in complexity science that the ‘why’ question needs to be addressed, for which the identification of causal mechanisms seems indispensable. Whether a mechanistic explanation, however, needs to be linked to some covering law, at least as convenient shorthand (Bunge 1997; 2004), remains disputed. Most complexity researchers favour a generative mechanistic approach without adhering to Hempel’s nomological ideal (Cederman 2005; 2010; Epstein 2006).

Statistical analysis as a mode of explanation for complex phenomena is also ambiguous. It is particularly important in detecting patterns that would otherwise go unnoticed. Missing the pattern would mean missing the explanation (Richardson 2006). Recognizing the pattern, however, does not automatically constitute an explanation. Statistics deals with the problem of large numbers essentially by eliminating complexity and deliberately treating the individual elements as if they were not systematically connected (Hedström 2005, 20–23). Analysis thus typically proceeds on the assumption that no information is required about how the elements are related and their relative position within the structure, ignoring any organizing principle (Hayek 1967, 29–31). That however, is exactly what social complexity is about and also needs to be considered by quantitative analysis. As Moss and Edmonds (2005) point out, particularly complex phenomena that show unpredictable episodes of clustered volatility in some data series cannot be explained without a model of the underlying social processes, that is, of how individual elements are structurally interrelated, which again underlines the need for a causal model.

Causal mechanistic explanations have a long history in the philosophy of science. Traditionally, mechanisms were exclusively associated with mechanical push–pull systems based on some linear cause–effect relationship in which one element after another is activated according to some conscious design. This is a concept congruous with a Newtonian worldview, according to which the physical universe operates like a giant clockwork mechanism, composed of identical particles, obeying deterministic laws of motion. For a review of mechanistic thinking in the philosophy of science see, for example, Bechtel (2006, 19–32).
which mechanistic explanations could also be applied to complex systems that developed through some sort of emergent, undirected process as in the life sciences (Bechtel and Richardson 1993; Machamer et al 2000) and the social sciences (Hedström and Swedberg 1998; Tilly 2001; Mayntz 2004) has received increasing attention. Social mechanisms are commonly understood in terms of the underlying processes that generate or produce social phenomena, based on interactions between individuals, or between individuals and some social aggregate (Elster 1998). This broader mechanistic view does not exclude non-linear phenomena. Non-linearity does not necessarily mean chaos. There still may be some recognizable regularities or patterns. Specific feedback effects or diffusion and escalation processes are ready examples. But as Campbell (2004, 62–89) notes, the specification of complex phenomena by dynamic mechanisms has remained vague so far and poses a major challenge for future research. A dynamic mechanistic explanation goes beyond giving causal meaning to the processes that lead from specified initial conditions to specified outcomes. Rather, dynamic mechanisms explicitly address open processes characterized by contingencies as well path dependence. As a consequence, dynamic mechanisms remain surrounded by strong indeterminacy, which, however, does not mean that generalizations were generally impossible. The goal rather becomes to identify regularities in terms of process patterns and to take them as a starting point for analysis focused primarily on the ‘how’ question and descriptive inference (Friedrichs 2011).

A complex mechanistic approach directs particular attention to the organizational structure in which action takes place. Due to considerable overlap and interdependencies as well as feedback, merely knowing the parts of the mechanism is insufficient to elucidate the outcome. Rather we need to understand how actions and interactions are specifically organized (Bechtel and Richardson 1993; Machamer et al 2000) as the emergent collective dynamics crucially depends on these organizing principles. The important role of interaction and interdependence also indicates the limitations of mechanistic explanations in complex systems. In order to decide whether and what kind of mechanistic approach is applicable, Simon (1969) suggested distinguishing between decomposable and non-decomposable systems. Decomposability and non-decomposability are used as heuristic principles. Their implications for the analysis of the international system will briefly be discussed in the following.

In non-decomposable systems, interdependence among components is so intense that the capacity for independent activity is significantly compromised. The connectivity or organization of the parts determines the operation of the mechanism, while the specific characteristics of the components are largely excluded from analysis (Bechtel and Richardson 1993; Simon 1969). Research on non-decomposable systems thus typically seeks to explain the phenomenon of interest with reference to the whole. Conventional (micro) mechanistic approaches that seek to explain a phenomenon in terms of component properties and relations thus do not apply. Nevertheless, the possibility of scientific explanation in terms of systems and mechanisms may still uphold (Sawyer 2004a, 2004b).

For a discussion of the applicability of a causal mechanistic approach in complex systems see, for example, Sawyer (2004a).
278). In such a case, however, the description of the mechanism also has to include macro properties based on the assumption that there exist autonomous social properties exerting independent causal powers.  

Analysts and commentators of the first wave in globalization theory (Martell 2007, 173–174) have likened the international system to a non-decomposable system. According to this ‘hyper’ globalist account, the web of international relations generates global processes that subsume their components so that they are no longer clearly separable as components. Local, national, regional and global political processes are inseparably linked by some internal dynamic of the system without any observable processing hierarchy. Such a characterization may hold particularly for times of crises (for example, panics), which unfold according to some inherent dynamic and decisively limit individual political leeway. The current financial and economic crises may serve as an example. Systemic risk to global financial stability and the world economy due to processes of escalation and contagion triggered the largest liquidity injection into the credit market, and the largest monetary policy action, in world history (Fender and Gyntelberg 2008), supposedly leaving central banks and governments without further options.

As a general characterization of the international system, the concept of non-decomposability, however, seems misleading. Even in the face of globalization individual agency persists. International actors are still clearly identifiable as individual actors—be they states, non-governmental organizations (NGOs), International Organizations (IOs) or alliances—and, in virtue of their actorhood, they fulfil specific roles and functions. They follow their own rules, regulations and decision-making procedures, and their behaviour can hardly be reduced to international pressures alone. The international system carries at least some features of a decomposable system, which facilitates a mechanistic explanation that works from the bottom up. But rather than assuming actors to be atomistic, complexity models typically allow actors to be socially embedded.  

Embeddedness does not deny general autonomy to political actors, but acknowledges that they act in specific social contexts that affect their behavioural choices (Granovetter 1985). Lower-level phenomena are aligned with contextual factors and processes that originate at higher levels in the organizational system. Thus, we have to look at a system of interaction between individuals and their environment, that is, between individuals and other individuals and between individuals and the collectivity. International embeddedness of actors fits the notion of near decomposability. Near decomposability acknowledges that each component operates primarily according to its own intrinsic principles and rules (Simon 1969; Bechtel and Richardson 1993). These behaviours, however, do not independently replicate those of the system as a whole, owing to the international system’s own dynamics.

The organization of the system, which is based on interactions and interdependencies among and between components and subsystems is critical for the collective outcome, as it transforms individual actions into a new collective pattern.

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8 This is a basic claim by critical realists. See for example Archer (1995).
9 In IR the concept of embeddedness was introduced in the 1980s by John Ruggie (1982) and has since become widely adopted.
This conceptualization of the international system adopts a configurational approach to social causation. The underlying presumption is that causal mechanisms inhere in the patterns of interaction or in interactions themselves (Nexen 2010).

Typically, social and political processes are too complex to be captured by a single mechanism. Rather we find a nested hierarchy of mechanisms that operate in complex concatenated patterns (Gambetta 1998). Often a mechanism is a component of a yet higher-level mechanism that imposes constraints on the behaviour of the lower-level mechanism. A mechanistic account may thus give rise to a cascade of levels. The occurrence of an international financial crisis may serve as an example. Each crisis takes place in a specific historical context and is thus unique. Nevertheless, certain features and processes are involved, like (over-) leveraging, herding and contagion, that in one way or another are common to most crises and allow some generalizations in terms of mechanisms. These mechanisms, however, do not operate independently from each other, but rather are linked up. How and why they act together is specific to each unique crisis.

In most cases, a mechanistic explanation of a complex phenomenon thus cannot be based on universally operating processes. Generalizations may only be possible in regard to specific regularities in terms of repetitive patterns or repeating relationships in specific contexts. This limited objective for explanation, however, does not undermine dynamic mechanisms as an analytical tool. The identification of process patterns is indeed a valuable goal in its own right, for example as a guide for action (Hayek 1967). When faced with conditions of deep uncertainty that impede reliable predictions, process patterns can produce candidate explanations that limit the number and range of possible pathways based on plausible scenarios for specific cases derived from process tracing and/or computational modeling.

Global governance as multi-level process

In the following I will elaborate on the new perspective a research program that explicitly addresses global governance as a complex phenomenon may provide based on a dynamic mechanistic account. The underlying contention is that the complexity of global governance is expressed particularly in increasing multi-level interactions. Universal, continental, trans-regional, regional, trans-national, national and sub-national centres of authority provide overlapping and interconnected spheres of influence. The entanglements become particularly manifest in the changing relationship between the public and private spheres and the fading dividing line between domestic and international politics. Some authors suggested the term ‘heterarchical order’ for the emerging system of

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10 Note that this distinction of levels is purely methodological in the sense of different mechanism levels. It is not an ontological statement about different levels of social reality.
11 On the anatomy of financial crises, see for example Kindleberger (1989)
12 Complex interdependence and the importance of trans-national relations are longstanding issues in IR; see for example, Keohane and Nye (1977) and Risse-Kappen (1995). Global governance research has renewed this interest in recent years (Whitman 2009).
13 See, for example, Rittberger and Kruck (2010).
global governance which includes rule-following, management and self-organization.

Global problems that may be addressed range from climate change to financial stability and from international terrorism to global health. That they all are simultaneously local and global problems unites them. They require active participation and support by the local population, since corresponding policies have to be implemented domestically, while the problems themselves are truly trans-national and global, in that power is widely distributed and not under hegemonic control. Diverse types of actors are constantly inventing new ways of configuring their actions and relations, which produces an internal dynamic within the international system which serves as a complex organizing device. Horizontal (country to country, or sector to sector), top-down (global to local) and bottom-up (local to global) processes operate simultaneously. As an example, one could consider financial regulation, or better deregulation, which is typically decided domestically, though decisions are embedded in a larger international context. Simmons and Elkins (2005) also speak of uncoordinated interdependence in this regard. Countries adopt neoliberal policies to liberalize their capital markets based on mechanisms like competition, learning, emulation or coercion. The more countries liberalize their capital markets the freer that capital can move around the world. This unfolds some inherent dynamics, which leads to specific patterns of capital allocation which further enhance competitive pressures.

In order to study these processes, however, we need to go beyond structural analysis that takes international influences just as exogenous factors, a procedure that typically suggests higher degrees of convergence and homogenization than can be supported by empirical evidence. Policy adoption is typically rather highly clustered. Simmons and Elkins (2004) conclude that policy transmissions are influenced by international economic competition as well as the policies of a country’s socio-cultural peers. In combination these diverse forces structure the overall development and bring about specific group dynamics. But even though the importance of multi-level processes based on complex interdependence has long been recognized, the topic has remained under-researched, which may primarily owe to a lack of theoretical concepts.

Conceptual progress is particularly needed to incorporate individual and international organizational influences simultaneously in order to understand how organization and interaction patterns influence the collective outcome that emerges from the activities of the individual parts (Lomi and Larsen 2001; Smith et al 2006). Problems of multi-level interactions are typically theorized in the context of the micro–macro link. Micro- and macro-levels in the social sciences are often simply understood as levels of aggregation. In most complex systems, however, a clear distinction of levels becomes increasingly opaque given overlapping spheres of influence and cascades of interacting levels (Harrison and Singer 2006). Against this background there have arisen serious doubts as to whether such a nested hierarchy of levels and the underlying interactive processes

\[14\] For the relationship of governance and complexity see also Jessop (2007)

\[15\] An overview of conceptualizations of the micro–macro link is provided by Alexander et al (1987).
that bind them together can be captured by conventional analyses of the micro–macro link. A meso-level approach that moves real world clusters, networks and all kinds of group culture to the centre of analysis seems to be more promising (Smith et al 2006; Dopfer 2005, 40–55; Elsner 2007). The ‘meso’ is here understood as the location of heterarchical governance and refers to embedded relational contexts (Nexon 2009). International actors, be they nation states, IOs, NGOs or international firms, are embedded in a nested hierarchy of relations. The specific characteristics of these relational orders and the dynamic interactions they entail bestow on them a common identity that typically becomes manifest in their own political agendas, strategies, interests and goals. On this basis they are able to act, although at the same time they are also acted upon. Individual agency remains very much the product of the ongoing relations in which they are embedded. Boundaries are reconfigured as all actors constantly revise their relations, forming new coalitions, alliances and networks, and create new public–private spaces, providing for new modes of governance in the larger meso-group. The interactions between meso-groups due to their network character typically show some specific characteristics that distinguish them from traditional hierarchical action as well as from coordination through anonymous systemic forces (market or anarchy).

The integration of various centres of authority at multiple levels brings about specific patterns of interaction that leave potentially more room for norms and new ideas to influence collective behaviour and to channel self-organizing forces in a certain direction. The contention is that meso-groups display a variety of specific behavioural patterns based on institutional learning and inter-organizational communication which are typically not found in other settings and potentially also affect global processes. Innovative collective action like systems of innovation and social niche construction which are based on specific forms of institutionalized cooperation and reciprocity may serve as an example. Generally, the impact of meso-group interaction on global governance may thus be threefold. First, they trigger meso-level co-evolutionary dynamics, since changes in relations between meso-groups typically involve reciprocal interaction with organizational changes. If a group of countries, for example, agrees to establish a common market for emission rights, this entails organizational and institutional changes at various administrative levels (public and private). Second, meso-group alliances give rise to lower-level dynamics within the alliance itself. This is the case, for example, when the establishment of a common market for emission rights triggers diverse socio-economic and technological adjustment processes at the domestic level. Third, an alliance event potentially also induces higher-level dynamics pertaining to the interactions between an alliance and its broader environment. The introduction of an emission-trading system, for example, also affects trade relations with countries outside the alliance. Such reciprocal interactions could have a substantial impact on the speed of diffusion processes and need to be considered.

The central argument that follows from this for global governance is that the structure of social interaction is of considerable explanatory importance in its own

16 The concept of systems of innovation is discussed, for example, by Lundvall (1988) and Edquist (1997).
right. Emergent patterns of social ties and organization give rise to changing relational contexts that potentially shift the underlying logic for collective action at the global level. The complexity of global governance results exactly from the multi-level dynamic provided by specific corporate actor constellations and relational structures (Mayntz 2004). Different relational contexts also produce different collective action dynamics (Nexon 2009, 48–60). Since Mancur Olson’s seminal study, it has become common to analyse collective action problems in the context of group size. As is well known, he comes to the conclusion that in large groups, even with a common interest, cooperation among rationalists is rather unlikely without some form of compulsion (Olson 1965). This theory considers group size the main explanatory factor for collective action independent of the internal stratification of these groups. Under the condition of socially embedded actors in a structured environment, the situation may well thus be different (Hedström 2005, 87–100). This means that in large heterogeneous groups all encompassing collective action may be more likely to emerge than in socially undifferentiated settings, owing to alliances and other forms of social clustering that make use of different strengths of ties. In regard to global governance these findings suggest that the fragmentation of the world and the high heterogeneity among countries may not be such a large impediment to global collective action as is often assumed. Quite the contrary, this very fragmentation provides greater incentives for individual action and coalition-building than a more unified world could, allowing a global governance structure potentially to emerge based on decentralized arrangements rather than centralized global action. Particularism could breed globalism.

The activator—inhibitor—interaction approach

So far, it has been argued that, even though the complexity of the international system generally provides for unpredictable dynamics, it may still show some regularity in terms of process patterns that could serve as the basis for explanation. Detecting those patterns, however, requires new concepts that take account of the fluid nature of global governance. In the following section, an activator–inhibitor interaction approach is introduced as a new framework for studying global governance as it grows within the international system. In order to develop my argument, I take conventional rationalist theory that still dominates our analytical thinking in IR as a point of departure. Using the example of climate protection, I shall illustrate how the activator–inhibitor interaction approach brings in a new analytical perspective on global governance. The focus of this section lies on conceptualization and theory development rather than empirical analysis.

Analytically oriented approaches to global governance are confronted with the fundamental problem of explaining the interplay between individual action and social structure as discussed previously. Methodological individualism is unsatisfactory, since collective behaviour typically cannot simply be reduced to

17 The approach is here specifically developed for the analysis of socio-political transformation processes. The terms ‘activator’ and ‘inhibitor’ are occasionally used in social science literature, but to my knowledge there does not yet exist a theoretical concept of activator–inhibitor interaction.
the intentions and properties of individual actors; something that impedes the explanatory power of conventional rational choice models significantly (Green and Shapiro 1994). In order to give the multi-level aspect of global governance some firmer conceptual ground, rational choice modellers have increasingly turned to institutionalism for inspiration.18 Rational choice institutionalists seek to integrate a rationalist-actor-centric approach with context dependency by employing game theory. The basic idea is that international problems can be identified with a typified matrix game based on the revealed preferences of relevant players. The game formalizes the constraints for individual action imposed by the interdependent choices of others. The structural setting of a particular situation then allows predictions of which collective outcomes are likely to result from individual choices. This kind of research marks an important advance for studying international cooperation in several respects. It recognizes that individual choice needs to be embedded in a broader social and institutional context and it makes important steps towards integrating economic and sociological modelling, which are often treated in strict separation from each other.

From a complexity perspective, however, there are also major shortcomings, due to highly simplifying assumptions.19 Structural properties (preference and payoff structure) are fixed, for example in terms of a Rambo game or the prisoner’s dilemma. A dynamic perspective is only reflected in terms of repeated games, where players adapt their behaviour according to the previous actions of their counterparts, while the game structure and preferences remain the same.20 This procedure has clear analytical payoffs from the point of view of homogenizing and predicting international (social) phenomena based on equilibrium analysis, but it is unable to account adequately for change, which would require greater attention to endogenous processes. In the following, some consequences for explaining global governance will be discussed through the example of climate protection.

It has become common practice among scholars and policy-makers alike to identify the problem of climate protection with the prisoner’s dilemma.21 The underlying presumption is that the free-rider incentive holds individual actors off contributing to the public good so that a non-cooperative outcome results leaving everyone worse off. Given that individual efforts to curb greenhouse gas (GHG) emissions indeed fall far short of what is commonly considered necessary to keep climate change under control, at least at first sight the prisoner’s dilemma explanation seems cogent. But what exactly does it say about global governance?

The prisoner’s dilemma approach is based on the assumption that it is possible to draw a clear distinction between cooperation and non-cooperation, whereby non-cooperation is defined in reference to a hypothetical collective optimum. Non-cooperative behaviour does thus not imply that no climate protection policies will be carried through. It is only assumed that no extra measures will be taken that go

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18 I refer primarily to the approaches that have been developed in sociology (Scharpf 1997), in economics (Ostrom 1990) and in IR (Zürn 1992).

19 I refer only to these simple matrix games based on rational choice. This is not to deny that game-theoretic modelling has become more sophisticated over time, including advances in regard to learning and evolution in games. See, for example, Durlauf (2010).

20 Confer, for example, Axelrod (1984).

21 For applications of the prisoner’s dilemma to analyse climate protection, see for example Barrett (2003).
beyond the abatement and mitigation levels that actors consider beneficial for themselves irrespective of what others are doing (Swanson and Johnston 1999; Barrett 2003). These ‘no-regret’ measures are assumed to fall far short of the collective optimum that would provide for a sustainable development path.

In practice, however, we observe a number of first-mover initiatives at various levels of political and social organization, where individual actors commit themselves to substantial reduction targets. Even a state like China that strongly refuses to subject itself to an international binding agreement and corresponding international control mechanisms takes its own national emission reduction targets quite seriously. From a prisoner’s dilemma perspective, these policies still qualify as non-cooperative behaviour that solely follow an individual utility-maximizing strategy. If, however, we realistically assume that state actors are socially (internationally) embedded rather than atomistic, then the distinction between independent and coordinated action becomes increasingly vague. In a highly interconnected and interdependent world, any domestic climate policy decisions are simultaneously also influenced by international factors and broader social processes. This raises substantial doubts about the validity of the prisoner’s dilemma as an adequate description of the problem structure given the implied fixed preference order and linear cause and effect relations based on the assumption of individual utility maximization.

The prisoner’s dilemma approach suggests that not much has changed over the last twenty years of climate debate (Helm 2009). A closer look, however, reveals that in regard to problem definition as well as implementation and strategy development there have occurred some substantial changes. Most obvious is a tendency to reframe the problem in terms of seizing opportunity rather than assuming that climate protection policies are per se disadvantageous from an individual perspective. Political actors throughout the world have come to stress the importance of climate protection in order to secure long-term competitiveness and to avoid falling behind major technological and social developments. These changes, even though they have not yet led to substantial global emission reductions, may potentially exert a decisive influence on the underlying dynamic that drives global governance formation. The question is thus of where the focus of explanation of global governance should be.

The activator–inhibitor interaction approach allows studying global governance as a process of social self-transformation. Adaptation and imitation are stressed over individual optimization. Adaptive behaviour potentially provides for highly complicated dynamics at the aggregate level and is a major source for endogenous structural change. Drawing on relationalist and evolutionary theory the approach is distinct from rational choice on two major accounts. First, it avoids methodological individualism and the reification of agency. Rather, the approach seeks a dynamic and context-dependent conceptualization of agency which is compatible with processes that involve both deliberate strategic intervention and

22 For information on international climate policy and national commitments, see for example the Natural Resource and Defense Council (<www.nrdc.org>).
23 For an analysis of China’s climate policy, see for example the World Resources Institute (<www.wri.org>).
24 Only recently have social theorists begun to turn their attention to the socio-political dimension of climate change; see for example Giddens (2009), Shove (2010) and Beck (2010).
self-organizing dynamics. For this, the concept of assemblage is introduced. Second, it directs attention explicitly to the underlying processes of global governance rather than a hypothetical equilibrium. Equilibrium analysis fails to follow what may happen along the way, such as feedback processes and other non-linear dynamics that may very well not converge to any standard equilibrium. Complexity research explicitly focuses on these underlying processes that are most likely to decide the outcome and hence need to be studied in their own right. Explaining global governance then boils down to making sense of the relational structures that emerge from all the political, social, and economic interactions relevant for a particular policy issue across administrative and territorial borders.

Activator and inhibitor as assemblage

A basic feature of the activator–inhibitor approach is that it allows global governance to be studied in the context of diffusion rather than decision-making. Agency is understood in terms of the channelling or shaping of relations and practices across a plurality of spaces. In order to conceptualize the entities and forces that are the relevant agents of global governance, the activator–inhibitor approach draws on the notion of assemblage. The concept of assemblage refers to the meso-level and connotes a structure-like surrogate that takes account of ‘emergence’, heterogeneity, the centred and the ephemeral in nonetheless ordered social life (Marcus and Saka 2006, 101). It emphasizes the permeability and movement of agents that are linked to and act within a common field of relations, meanings and cooperation (DeLanda 2006; Venn 2006). The implication is that actors and institutions are less unified and bounded than assumed by conventional analysis. Defining activator and inhibitor as assemblage allows the possibility of revealing complex relationships that transcend the traditional strict separation between the public and the private, the political and the social, and the local and the global and might otherwise be obscured (Porter 2009, 90).

The activator represents all the forces (public and private) that push for certain policy innovations in the form of new ideas and practices. Analogously, the inhibitor encompasses all the forces against these new policy initiatives which function as a barrier to change. As a whole, activator and inhibitor are not formally organized but rather represent a loose network structure of political entities that are not territorially bounded. What unites them is some common distinctive purpose or meaning (for example climate protection). The concept of activator and inhibitor thus combines formal relational features with cognitive elements and social dynamics. A set of entities, oriented towards a common governance object, is brought into new relationships with one another across administrative and organizational levels. These new arrangements and the relational and compositional order they entail determine how new initiatives come to life, are communicated and diffuse within the system.

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25 DeLanda (2006) has studied the concept from a philosophical perspective. In social research, Sassen (2006) has applied it most prominently.

26 Emergence is here understood in terms of relational emergence that becomes manifest as topological or configurational order that arises from the local interaction of agents.
In principle, all types of international, national and trans-national actors relevant to a particular policy issue, be they state actors, business actors, NGOs, civil society networks or social movements, can be part of an activator or inhibitor assemblage. Together activator and inhibitor reflect all the structural, institutional, economic and other powerful constraints and opportunities relevant for a particular policy issue. This broad conceptualization does not generally undermine the role of the state as a major player in global governance, but acknowledges that the political process has become more participatory and multi-layered as non-state actors are actively involved in shaping global processes directly and indirectly at the national, regional and international levels. The increasing state-society nexus (Latham 1999) creates a web of interacting and overlapping competencies and processes across the political, economic, and social spheres. The concept thus recognizes not only the heterogeneity of actors but also their internal stratification. This is important, since international actors typically are not monolithic blocs. Their (internal) entanglement across levels potentially has a decisive impact on the aggregate dynamics that emerge from interaction. The reduction of state actors to the national level alone, for example, would overlook that local actors, while still embedded in the larger state structure, pursue at least to some extent their own political agenda within their own networks that may well spread across national borders and be instrumental for more widely integrated policy measures.

In the case of climate protection, we find that, even though the United States (US) government under the Bush administration acted largely as an inhibiting force, several American states under the leadership of California became actively involved in climate protection. They took legislative steps towards reducing climate change by incentives and plans for clean cars, renewable energy, and stringent caps on heavily polluting industries and sought some regional agreements. At the local level, more than 1000 cities representing more than 87 million Americans from all 50 states have joined the US Mayors Climate Protection Agreement. Some of them also take part in the Cities for Climate Protection Campaign (CCP), a global network. The collective dynamic that emerges from these initiatives may be driven by policy diffusion as well as by social and market forces. If, for example, a sufficient number of states adopt certain higher environmental standards (for example, product standards), then industries affected by these regulations may voluntarily extend the higher standards to the whole country independent of whether single states require them or not, in order to avoid the costs of complying with different regulatory frameworks. Closing down business operations or moving them to other locations

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27 Latham (1999) has already advanced the idea of a state–society nexus in global governance.
28 Indicative are the withdrawal from the Kyoto Process, the paucity of ambitious national greenhouse gas emission reduction targets, and accusations of a deliberate disinformation campaign on climate change on the part of the White House (Eilperin 2006).
29 Confer, for example, the regional Greenhouse Gas Initiative (RGGI) by ten northeastern states and the Western Climate Initiative (WCI), which also includes some Canadian provinces.
30 See <www.usmayors.org>.
certainly remains a threat, whose credibility, however, highly depends on individual circumstances and only intensifies the political pressure to seek the harmonization of regulatory standards.

The interaction process

In order to study the collective implications of new policy initiatives, it is not sufficient to examine activator dynamics alone. Global governance formation does not occur without conflict; the inhibitor is an inherent part of the governance grid. It is the central claim of the approach that activator and inhibitor need to be conceptualized together. Their interactions and mutual adaptations provide for wider societal feedback loops. Global governance becomes the causally productive result of the interaction process without being foreseeable in light of activator or inhibitor activity in isolation. Problem analysis, goal formulation and strategy development and implementation typically evolve over time as activator and inhibitor mutually adapt. Preference and payoff structures are largely endogenous to interaction. Mutual adaptation, however, does not necessarily imply the convergence of interests. Rather, conflicts are endogenous to the overall changing context, too. As actors cannot afford to ignore relevant arguments and general political and socio-economic trends, however, a common understanding of a problem may emerge even in the presence of persisting conflicts of interests. California’s initiative to introduce strict emission standards for cars,31 for example, was met by fierce opposition and legal challenges from the US car industry,32 which feared high implementation costs and competitive disadvantages with respect to foreign auto-makers. However, in the course of a price hike in the oil market in 2007, the US car industry suffered severe losses in market share anyway and in the wake of the financial market meltdown in 2008 Chrysler LLC and General Motors had to file for bankruptcy. They both sought the reorganization of their companies under chapter 11 of the US bankruptcy code. The successful restructuring, however, was only possible thanks to a rescue plan from the federal government. President Obama made clear that he expected the restructured companies to be more environmentally sensitive. In May 2009, the administration reached a deal with the car industry on new national fuel efficiency standards that followed California’s lead and that eventually were enacted in April 2010. Canada adopted similar standards shortly afterwards.

These developments, however, do not mean that inhibiting forces in general have been severely weakened. A comprehensive climate and energy bill is still missing and the Senate seems unlikely to pass the necessary legislation in the near future; a situation that continues to weaken the US position in international climate negotiations. California’s Global Warming Solutions Act33

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31 Confer California Vehicle Global Warming Law (2002), which requires automakers to reduce emissions by 30 per cent by 2016.
32 The lawsuit was rejected in 2007 in court (Broder and Barringer 2007), but the Bush administration refused to grant California a waiver from the Clean Air Act in March 2008, effectively blocking the standards from taking effect.
33 AB32 is the first enforceable state-wide programme in the US to cap all GHG emissions from major industries. For information see, for example, <www.pewclimate.org>. 
of 2006, known as ‘AB32’, also had to withstand massive resistance. In the wake of the financial and economic crisis of 2008/2009 the so called California job initiative (Prop23\textsuperscript{34}) came into being that effectively sought to stop the implementation of AB32. The election in November 2010, however, brought a stunning defeat of Prop 23 by more than 60 per cent of the votes. Crucially, the dispute over Prop 23 in California revealed some important relational and compositional changes within and among activator and inhibitor assemblages. The Prop23 movement was initiated and largely financed by some oil companies from out of state who seemingly fear the possible trigger effect of California’s example going national or even international.\textsuperscript{35} Local support for Prop 23 came primarily from the Tea Party and small businesses. In contrast, the opposition against Prop 23 was supported by a broad coalition of political leaders from both parties, environmental groups, as well as CEOs of major californian companies, which reflects the structural changes that have already taken place in recent years as investors have poured billions of dollars into making new technologies to meet the standards set by AB32. California is the state with the most advanced and fastest-growing green technology industry in the US. Many studies thus dispute the claim that AB32 is bad for the economy and rather point to the potential for economic growth and job creation.\textsuperscript{36} There seems to have emerged a system of innovation in California in which the broader social context and specific institutional arrangements have led to some self-reinforcing development. A high-tech industry structure, first-class research institutions, comparatively advanced environmental standards and high environment awareness among the population at large provide an innovation environment in which environmental innovations can develop and mature based on mutually reinforcing processes. Nevertheless, California’s green development is still only a niche, and widespread diffusion anything but certain.

The political battle in California and the relational changes it entailed are symptomatic of a wider trend in climate policy. As new actors rise to power (in politics as well as business) and new alliances are formed, the basis for the activator cause is widening well beyond traditional green constituencies. There seems to be a tendency for activating forces to move from the grassroots to the political and socio-economic mainstream, while inhibiting forces increasingly reflect outright deniers and special interests. These changes may give important insights about potential development paths long before the political effects materialize. The underlying collective dynamic of activator–inhibitor interaction obeys the logic of emergent group size. Conventional collective action models take group size to be an independent variable. The size of a group decides the likelihood of cooperation occurring (Olson 1965; Sandler 2004).

\textsuperscript{34} Prop 23 is called the California job initiative and demands that the implementation of AB32 be postponed until the state unemployment rate has fallen below 5.5 per cent for four consecutive quarters, which is extremely unlikely to happen in the foreseeable future.

\textsuperscript{35} More than 90 per cent of contributions to the Yes campaign come from petrochemical interests, 74 per cent alone from Texas oil companies Tesoro and Valero. The No campaign is able to raise significantly more money thanks to broad support from Silicon Valley technology companies, investors and environmental groups (Woody 2010).

\textsuperscript{36} In July 2010, for example, more than 100 Californian economists signed an open letter on clean energy and global warming in support of the No Prop 23 campaign.
The activator–inhibitor model, by contrast, endogenizes group size as a dependent variable. The way activator and inhibitor are internally organized affects their ability to attract new members. New members, in turn, impact on their internal organization and political agenda-setting. The interplay of internal and external relations among and between activators and inhibitors potentially transgresses former borders and boundaries as different expectations and agendas are confronted, discussed and aligned. These underlying dynamics of global governance, though non-linear, do show some observable pattern.

Activator growth typically also triggers inhibitor growth, which simply signifies that increasing pressure for action (change) also motivates opposition so that conflicts of interests tend to intensify, which in turn constrains further activator growth. Inhibiting forces thus clearly tend to dominate the interaction process, which underlines the high degree of path dependence in socio-economic life. Nevertheless, activator initiatives are not necessarily doomed to fail. The non-linear nature of interaction and positive feedbacks provide the possibility that initially minor changes and marginal developments may evolve into major structural changes that eventually turn the whole system dynamic around. For this to happen, there must be a point where activator and inhibitor growth become decoupled. In other words, structural changes impact on the overall selection environment so that inhibitor growth takes the shape of an inverted U. The fragmentation of the business sector and the emergence of green technology companies serve as a vivid example. Traditionally, business has been associated with a major inhibiting force. A closer look, however, reveals a more differentiated picture.

The insurance sector, some financial institutions and particularly the green technology sector are staunch supporters of the activator cause. The emergence of green industry is the result and medium of activator pressure, while at the same time it is weakening the inhibitor position. In general terms, the underlying organizing principle can be described as interplay of interaction and replication, which is responsible for differential population growth. Replication manifests itself in the way activator and inhibitor are able to maintain or even increase their membership and to strengthen their ties. Replication does not imply the exact reproduction of the same; replication is also the source for renewal. It is the result of direct and indirect interaction at various levels. Global governance understood in these terms becomes a function of how interaction changes replication, and how new replication patterns feed back to the interaction process. The emerging aggregate dynamic is based on new configurational and relational orders among activator and inhibitor components that structure the context and background of further interaction and cause replication to be differential. Replicators provide the crucial link between levels in this multi-level process of endogenous change. They are a source of path dependence and stability as well as the medium for change. Candidates for replicators are habits, practices, ideas and goals. They guide individual behaviour and are constantly reinforced through interaction and institutionalization. If interaction patterns change, driven by some inherent

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37 On path dependence and economic development, see for example North (1990) and Arthur (1994).

38 For the role of business in global environmental governance, see Levy and Newell (2005).
aggregate dynamic, this potentially also leads replicators to change as actors become situated in new relational orders. As an example, one may think about relational changes in terms of international competitiveness, which triggers imitation and adaptation processes and potentially exerts a strong influence on new business practices and goals. Figure 1 summarizes the basic principle of activator–inhibitor interaction.

In sum, the activator–inhibitor approach provides a framework for studying global governance formation in the context of deep-rooted socio-economic changes that cannot be attributed to particular policies or single interventions. Rather, it seeks to explain how such changes result from daily interactions in business and social life based on the notion of differential replication. It directs special attention to the role of the inhibitor, which is an inherent part of the governance grid, but often underestimated by conventional institutional analysis. The activator–inhibitor approach examines how the interaction process can influence the forces of path dependence to change course endogenously. It is established wisdom that the innovations that have the best chance to diffuse are those which resonate well with established norms and practices (for example, Campbell 2004).

The activator–inhibitor interaction model adds a dynamic, adaptive component by drawing attention to co-evolutionary dynamics that lead to

![Figure 1. Global governance formation as activator–inhibitor interaction process.](image-url)
changes in the selection environment itself. New governance structures emerge from differential population growth, which in turn is influenced by changing institutional settings and interaction patterns. This dynamic framework could shed some new light on two central questions of global governance formation: the prospects of a first-mover strategy and the impact of single defectors. Compared with conventional rationalist analysis, which is rather sceptical about the possibility that first-moving will trigger collective action and predicts that even single defectors are able to undermine large-scale cooperation, a complexity approach that turns the analytical focus to the socio-economic and cultural organizational characteristics as determinants for collective action provides a more differentiated picture.

Conclusion

Attempts to explain complex systems are fraught with difficulties. The main danger is simplifying too much or too little. In both cases, we would miss the big picture. This paper has explored the possibility of a dynamic mechanistic approach that seeks to identify the set of mechanisms that sufficiently describes the complex, non-linear organization of its components and the temporal orchestration of their actions which are responsible for collective pattern formation. The approach takes account of contextual sensibilities as well as path dependence. Activator–inhibitor interaction describes a social pathway that binds the global and the local together in a web of tangling relations and competencies. The terms ‘activator’ and ‘inhibitor’ are used to stress impact and process over decision-making and determination. The conceptualization of activator and inhibitor as assemblages allows the analysis of relational and compositional changes between various types of actors across levels of organization as they channel and shape global governance. Positive feedbacks and non-linear interactions are theorized as inherent parts of global governance. They cause activator and inhibitor populations to grow differentially and in doing so drive endogenous structural change. The promise of complexity research is exactly a better analytical handling of the problem of endogeneity that poses such serious difficulties for traditional methods.

The need for new theoretical concepts arises out of the tendency in international politics towards regionalization and decentralization. A research programme, however, that is able to address the question of global action based on decentralized power with a well-founded methodology is still missing. Complexity research offers the possibility to fill this void and to place the debate on a firmer scientific footing. Given the limited space available, this article has only laid out in very basic terms the concept of activator–inhibitor interaction. So far, the approach remains essentially abstract and serves primarily heuristic purposes. Its abstractness, however, may also be its strength. Activator-inhibitor interaction as a process pattern of social change may be observed across a wide variety of cases and disciplines potentially providing for a transdisciplinary research program based on comparative case studies that may be able to detect regularities of wider generality within the social world (Friedrichs 2011).

39 Hoel (1991) provided the theoretical groundwork for this debate.
In particular, it may be possible to identify some change indicators with regard to problem definition, actor constellations and interaction practices. These could provide important insights about the conditions for a decoupling of activator and inhibitor growth and may guide research from descriptive to causal inference.

In order to explain global governance, however, we do not only need to analyze the multitude of interactions within and among activator and inhibitor assemblages and the relational changes they entail, we also need to study how all these interactions generate new collective patterns at the global level. These processes, however, are usually too complex to be handled without the use of formal analytical tools and computational models. Simulations based on agent-based modelling in combination with dynamic system models can help us explore the transformative power of decentralized action for collective action based on clustering and adaptation processes. Even though reliable predictions will hardly be obtainable, the simulations can still show likely scenarios of how the system may evolve under various circumstances. They may reveal possible chains of reactions that could provide cognitive assistance to reconstructing the problem of interest and thus influence the way ongoing governing activities are shaped. The activator–inhibitor concept thus not only serves analytical purposes. Reflexive governance rather implies that the distinction between explaining and making increasingly vanishes. Our models exert a strong influence on how we perceive the world and what problem-solving strategies we develop. In this regard, it makes a huge difference whether we start from the premise that we are caught in a social dilemma or whether we assume that we are rather taking part in an activator–inhibitor interaction process.

**Notes on contributor**

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40 On the potential benefit of such a hybrid approach, see Geller and Alam (2010).


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