The Fifth Debate and the Emergence of Complex International Relations Theory

Article *in* Cambridge Review of International Affairs · September 2007

DOI: 10.1080/09557570701574154

Cambridge Review of International Affairs,
Volume 20, Number 3, September 2007

Routledge
Taylor & Francis Group

The fifth debate and the emergence of complex international relations theory: notes on the application of complexity theory to the study of international life

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Abstract *The climate of post-Cold-War interactions remains uncertain. Rather than a transitory stage, the resilience of the pervasive randomness of international life has challenged the dominant frameworks for the study of world politics. Some commentators have therefore advocated the infusion of international relations theory with the conjectures of complexity theory. This article brings together the claims of the different proponents of such intersection and suggests the emergence of complex international relations theory. Although it requires further critical elaboration, the claim here is that this theory outlines the fifth debate in the study of international life and proffers intriguing heuristic devices that both challenge conventional wisdom and provoke analytical imaginations.*

> It is also possible that hard imaginative thinking has not increased so as to keep pace with the expansion and complication of human societies and organisations. That is the darkest shadow upon the hopes of mankind.
>
> HG Wells (1945, 34)

Introduction

This article pulls together the disjointed literature on complexity theory (CT) in the study of international relations (IR). One of the pervasive themes in the conceptualization of post-Cold-War international politics has been the prevalence of 'massive uncertainty' which has urged some to call for a 'massive transformation' of the conventional IR agenda (Steinbruner 2000, 11). At the same time, a number of commentators have insisted that 'surviving uncertainty is a normal part of being alive and being human' (Heinzen 2004, 4) and a 'substantive feature of [all] political life' (Cioffi-Revilla 1998, 22). So why then are policy-makers and IR scholars so surprised when the world turns out to be unpredictable?

The claim of this article is that part of the response to this query can be found in the patterns of linear causality that still seem to inform dominant IR approaches. In this respect, some commentators have noted the recent rise in cross-disciplinary

[1] The author wishes to thank James Rosenau for his infectious inspiration and encouragement. The five anonymous reviewers need also be credited for their discerning reading of earlier drafts. Financial assistance by the Izaak Walton Killam Memorial Fund is gratefully acknowledged. The usual caveat applies.

ISSN 0955-7571 print/ISSN 1474-449X online/07/030435–20 © 2007 Centre of International Studies
DOI: 10.1080/09557570701574154

pollination between the natural and social sciences. For instance, Duncan Bell (2006, 493–496) asserts that in the coming years mainstream IR theorists are increasingly likely to turn to biological sciences—'as the most ambitious of the sciences'—both for inspiration and intellectual legitimacy. Despite some caution about the 'crude scientism' of natural sciences (Bell 2006, 510; Manson 2001, 412), the interface between CT and the study of world politics has been hailed as 'the greatest opportunity for creative change' in the IR paradigm (Comfort 2000, 289). Thus, the proponents of a 'biological turn' in IR research insist that it provides perspectives centred on the pervasiveness of change, contradictions and non-linear dynamics which stress that 'diversity—not order—is normal' (Geyer 2003c, 572).

Before embarking on the exploration of these claims, two qualifications are required. First, this article reviews *primarily* the application of CT in IR theory, rather than its more popular use in the natural sciences. Such an approach is justified by the apparent lack of 'interaction' among the various proponents of the complexity paradigm to IR as well as their tendency to refer to CT exponents in the natural sciences rather than engage their fellow social science commentators.[2] Second, this is a *conceptual enterprise* motivated as an analytical overview of the implications of CT for IR—that is, investigating the conceptual ramifications of complexity research for the study of international life. In this way, the aim here is to suggest (programmatic) investigative pathways that will hopefully encourage further investigations.

This article proceeds by investigating the ways in which CT permeated the social sciences, and the meaning(s) that it has acquired in this process. It then zooms in on the notion of *complexity* and on its implications for the study and the patterns of international life. Such an assessment suggests the *emergence* of complex international relations (CIR) theory. Consequently, its main propositions are briefly summarized. The contention is that the epistemological and ontological innovations of CIR theory not only distinguish it from mainstream IR, but also initiate the *fifth debate* in the study of international life. This article then concludes with some inferences about the normative implications of CIR theory.

What is complexity theory?

'Complexity theory' has become an umbrella term for a number of approaches that emerged initially in the natural sciences (Lewin 1992; Weaver 1948). Some commentators have rejected this appellation altogether, insisting that there is no

[2] For instance, Rihani (2002) proposes the study of nations as *complex adaptive systems* without addressing the similar contention made by Cederman (1997). At the same time, the application of CT to IR overlooks the advances complexity research has made in the social sciences by authors such as Elise and Kenneth Boulding, John Lewis Gaddis, Frieddrich Hayek, Niklas Luhmann, Talcott Parsons and Herbert Simon (for a good overview of this literature see Adam 1998; Arshinov and Fuchs 2003; Beyerchen 1988/1989; Grosz 2004; Khalil and Boulding 2002; McCarthy 2006; Meinzer 2005; Protevi 2001; Rice 1997; Richardson and Cilliers 2007; Sawyer 2005; Taylor 2001). This article calls, therefore, for bridging the gap between both the social sciences and IR, as well as between different IR approaches in their engagement of CT (in this regard, see the outstanding compilation by Albert and Hilkermeier 2004).

one identifiable CT and have instead opted for the term 'complexity research' (Manson 2001, 405). Others, however, while acknowledging that CT is 'a simple title for a broad range of non-linear, complex and chaotic systems theories', still insist on its relevance (Geyer 2003a, 238). Femke Reitsma (2003, 13) notes that at the basic level of theoretical construction the glue that binds the somewhat fragmented complexity research is provided by the aphorism that 'the whole is greater than the sum of its parts'. Thus, as a result of systemic interactions, alterations occur whose outcomes are wholly unexpected and nearly impossible to predict. For instance, some have pointed out that the very forces of the current aid-and-trade regime which allegedly bring benefits to the developing world are at the same time feeding forms of violence that counter the positive aspects of this regime (Rihani 2002). Complexity theory asserts, therefore, the ubiquity of the dynamics of change, self-organization and emergence and contends that traditional reductionist methodologies are ill-suited to account for the panoply of diverse behaviours underwriting any phenomenon (Manson 2001, 411; Mathews et al 1999, 440).

Complexity theory found its way into the social sciences soon after its development in the natural sciences. As Robert Geyer (2003a) points out, between the 1930s and the 1950s scientists (especially physicists and mathematicians) built a significant case against the dominant Enlightenment paradigm. Premised on the belief in human rationality and fundamental physical order, this paradigm promulgated linear patterns for demonstrating high levels of order and predictability by using reductionist methods that postulated that all physical phenomena will change in a gradual manner and following foreseeable trajectories (Beaumont 1994, 169). The subsequent Industrial Revolution seemed to confirm the ability of human beings not only to comprehend but also to manipulate and control the natural world (LaPorte 1975, 121). In this respect, the framework of instrumental–rational action has become the standard against which alternative claims are judged. However, during the 20th century, the development of the theory of relativity and quantum mechanics initially probed and then pushed the limits of the linear Enlightenment paradigm (Rihani 2002, 67). These analytical innovations demonstrated that while some phenomena are orderly, others are disorderly and still others probabilistic (Geyer 2003a, 239).

Trickling into the social sciences, the ideas of CT eroded 'the faith in a "makeable world"' (Heinzen 2004, 4) and advanced the notion of a world that enacts itself to produce 'non-linear flows' and recognizes 'more mobile subjectivities' (Law and Urry 2004, 199). Yet, it was only the end of the Cold War that encouraged mainstream IR to take CT seriously and acknowledge the inherent complexity of global affairs (Brown 1995, 137; Gaddis 1992/1993; Cioffi-Revilla 1998, 3). Thus, it is argued that the nascent patterns of world politics beckon more fine-grained hypotheses that would present the character of international life as 'open, complex, partially organized and coupled in complex, conditional ways' (Snyder and Jervis 1993, 13). Acknowledging the pervasive complexity of the international system, Lars-Erik Cederman (1997) claims that mainstream IR theory has little to say about the alterations and dynamics that underline global politics. In a similar vein, James Rosenau (2003, 207) insists that the recognition of the widespread normative and empirical uncertainties that mark world affairs made it impossible for social scientists to persist in relying on previous parsimonious models while ignoring the premises of CT. Instead,

the pace and multidirectional transformations in international life have necessitated looking beyond linearity.

Complexity research, therefore, does not 'yield answers, at least not in the sense of those we have typically sought to describe our world and predict its events since the beginning of the Scientific Revolution. What it does yield is a new way of thinking about the world' (Gingrich 1998, 1). Before I address the emergent study of complexity in IR, the following section discusses the concept at the heart of CT—complexity.

What is complexity?

Although the notion of complexity is central to complexity research, it is 'rarely attended by any but the most general of accounts of the attributes of this phenomenon' (LaPorte 1975, 128). Many commentators have noted the intellectual opacity accompanying the definition of complexity (Cederman 1997, 50). Despite these difficulties, in both the natural and social sciences, the meaning of complexity usually suggests the properties of a system (see Table 1).

Complex systems can be defined in objective and subjective terms (Snyder and Jervis 1993, 9). Objectively, complex systems are identified by the multitude of their components, the many feedback loops between those components, and the numerous interconnections among the subsystems of a complex system. Subjectively, complex systems involve 'unfamiliar … or unplanned and unexpected sequences, either not visible or not immediately comprehensible'. In this respect, complexity tends to be identified by its *relationships* rather than by its constituent parts. Such distinction between objective and subjective definitions implies that: (i) complex systems are not uniform—there are relationships of differing strengths between their components (and those with especially tight connections form sub-systems); and (ii) any components in the system can participate in multiple sub-systems—so even 'homogeneous components can support internal diversity through re-alignments of relationships to create non-identical sub-subsystems' (Manson 2001, 409; Elhefnawy 2004, 153). The usage of complexity, therefore, indicates that seemingly chaotic relations are patterned in nonlinear ways (Pil-Rhee 1999). Such ignorance of the different causes involved

Table 1. Comparing the paradigms of order, complexity and disorder (Geyer 2003a, 244; Geyer 2003b, 569)

Order	Complexity	Disorder/chaos
Linear paradigm Premised on: • rationality • predictability • determinism • no inherent limits to human knowledge and progress	*Nonlinear/systemic paradigm* Premised on: • bounded rationality • limited (un)predictability • evolutionary change • significant limits to knowledge and progress due to uncertainty	*Alinear paradigm* Premised on: • irrationality • total unpredictability • causality is meaningless • knowledge creation and progress are impossible to know

in the production of events intimates that interactions cannot be understood solely in terms of the behaviour of participating actors; instead it is the very interaction that produces complex behaviour.[3]

In this context, most commentators distinguish between different 'types', 'levels' or 'measures' of complexity (Geyer 2003b, 21; Manson 2001, 405; Reitsma 2003, 13). However, such attempts at classification often mislead (and fail to render) the multiple and indirect effects that will become increasingly important as the system responds to diverse stimuli (Jervis 1997, 89). Therefore, the focus here is on complexity's contextualization of change. Broadly speaking, CT postulates that complex systems self-organize into emergent forms that cannot be predicted on an understanding of their parts (Reitsma 2003, 14). In this respect, CT advances two main explanations for complexity: (i) 'diversity begets diversity'—the interaction among entities creates niches that new entities can fill, allowing for a greater variety of possible connections; and (ii) 'structural deepening'—a system becomes more complex so that it can operate in a wider range of environments and enhance its resilience by improving its performance and ability to adjust to exceptional circumstances (Elhefnawy 2004, 154). This calls attention to the notions of emergence and self-organization.

Emergence is a key attribute of complexity which underwrites the uncertainty of its properties, which toggle between the old propensities and the sprouting dynamics. It suggests a focus on process rather than on structure (Cederman 1997, 214). Yet, the emergent properties of complex systems are often surprising, because it is difficult to anticipate the full consequences of even simple forms of interaction (Axelrod 1997, 4). Emergence, therefore, is a function of conjunction, whereby system-wide characteristics do not result from superposition (additive effects of system components), but instead from interactions among components (Manson 2001, 410). In objective terms, emergence can be defined as historical novelty; the subjective definition entails unpredictability of results compared with the observer's knowledge (Cederman 1997, 51). For instance, in 1991 it seemed highly unlikely that the United States would opt for the fairly ambiguous 'threat of terrorism' to supplant the 'threat of communism' as the dominant rationale of its foreign policy.

Self-organization defines the response of complex systems to the unpredictability of emergence—that is, it reflects the search for stability in the instability that characterizes periods of emergence.[4] Self-organization indicates the capacity of complex systems to generate 'their own new forms from inner guidelines rather than the imposition of form from the outside' (Mathews at al 1999, 447). According to Emanuel Adler (2005, 32), it marks a shift from 'being' to 'becoming' a new pattern of international affairs in response to the pervasive simultaneity of instabilities and fluctuations. In this respect, behaviour as well as physical and ideational structures self-organize in a manner that resembles a phase transition—a dramatic transformation in the state of a system such as a 'shape-shifting' passage from order to disorder—thereby 'tracing a temporary path referred

[3] Smith and Jenks (2006, 251–253) insist that the nonlinearity of interactions confirms that the pattern of complexity does not constitute 'disorder' but a 'counter-order' (or 'spontaneous order') of 'emergent complex orders'.

[4] Smith and Jenks (2006) distinguish between 'auto-eco-organization', 'autopoiesis' and 'self-organization'. For reasons of brevity this distinction is not addressed here.

to as a *punctuated equilibrium*' (Rosenau 2003, 216).[5] In other words, each component of a system participates in the production or transformation of other components, while the system itself is produced by its constituent parts and, in turn, produces those parts (Walby 2007). Likewise, Paul Cilliers insists that the dynamic nature of self-organization, where

> the structure of the system is continuously transformed through the interaction of contingent, external factors and historical, internal factors, cannot be explained by resorting to a single origin or to an immutable principle … self-organisation provides the mechanism whereby complex structure can evolve without having to postulate first beginnings. (Cilliers 1998, 106)

Complexity theory proffers two dominant types of self-organization: adaptation and co-evolution (Guastello 2002). Adaptation reflects complexity's ability to learn to adapt to transformations in its internal and external environments (Axelrod 1997, 153). Such adjustment concerns either the system as a whole, or its parts, or both (Cederman 1997, 50), and reflects the ability of complex systems to keep their essential structures within acceptable limits (Rosenau 2003, 214). The notion of co-evolution refers to the capacity of a system to change with the environment. Since the environment is composed of other systems, those other systems also change and impact on each other as a result of this interaction (Walby 2007). It should be emphasized that adaptation and co-evolution are complementary (and often simultaneous) processes of self-organization (Rihani 2002, 236; Rosenau 1990, 174) which indicate the *resilience* of complex systems—that is, their ability to adjust to change.[6]

The notion of resilience calls attention to the significance of feedback for the ways complex systems behave (Jervis 1997). Such focus on feedback emphasizes the centrality of complex interactions—that is, the multidirectional feedback dynamics—to the process of self-organization. Most authors distinguish between positive and negative feedback (Jervis 1997, 125–130; Manson 2001, 407). Positive feedback is self-reinforcing—that is, a change in one direction sets in motion pressures that produce further change in the same direction. For instance, trivial events could be magnified, through positive feedback, into major upheavals—as indicated by the 'Romanian Revolution' of 1989 that started as an isolated incident involving primarily the Hungarian minority in the town of Timişoara (that is, the eviction of the local priest László Tőkés), but which grew into demands for

[5] The notion of 'punctuated equilibrium' entered the discourse of international relations as a result of Stephen Krasner's (1984, 240–243) borrowing from the natural science of Stephen Jay Gould. Krasner read Gould's conjecture that change is not a gradual (evolutionary) process but a geographically instantaneous (and discontinuous) event (resulting from the breakdown of the reinforcing mechanisms of 'static' equilibrium—that is, stressing a stable structure beyond its capacities to resist and absorb) as 'an apt description of an analytical stance [which confirms that] in a world characterised by punctuated equilibrium there is more uncertainty and chance'.

[6] Although parallel dynamics, 'adaptation' and 'co-evolution' produce different results. Also, it should be noted that adjustment alone does not always translate into a resilient system—that is, a system 'does not always adapt appropriately, and even adaptations adequate to a particular challenge have effects that are maladaptive' (Elhefnawy 2004, 154). A sophisticated treatment of 'resilience' (from a CT point of view) has been developed in the literature on 'ecological security' (Barnett 2005, 111; Hoffman 2005; Homer-Dixon 2006; Hornborg 2007).

broader political reform and led to the removal and eventual execution of Nicolae and Elena Ceauşescu.[7] Negative feedback is stabilizing—that is, the change triggers forces that counteract the initial alteration and return the system to *something like* its original position. Thus, regardless of the upheaval caused by the 1989 student protests on Beijing's Tiananmen Square and the subsequent crackdown, the Chinese Communist Party has remained (arguably) unperturbed in its control of the country (Rosenau 1990).

These instances draw attention to the issue of causality in complex systems. Owing to the unpredictability of interactions, it is impossible to discern 'the causal arrows, precisely because in feedback loops causal arrows are directionless or circular' (Hoffman and Riley 2002, 311). In this respect, complex systems indicate sensitivity to alterations in initial conditions and random events. Thus, actions have indirect and complicated effects and outcomes may not correspond with the intentions of any of the actors. Interactions are more likely than not to call up unintended consequences that can defeat purposive behaviour, because,

> in a system, the fates of the units and their relations with others are strongly influenced by interactions at other places and at earlier periods of time ... [and] it is hard to treat issues separately: disputes that would be small if they could be isolated are highly consequential because the world is tightly interconnected. (Jervis 1997, 17–24)

It is this density of self-organization that makes complex systems—like the pattern of international politics—hard to understand (Snyder and Jervis 1993, 5). The following sections address the frameworks for understanding and explanation implied in the use of CT to the study of international life and the ways in which it constitutes a complex system.

What is CIR theory?

The applications of CT to the study of world politics offers perhaps the best confirmation of the insistence that 'the value of complexity exists in the eye of its beholder' (Manson 2001, 412). As a referent for the intricacy of international processes, 'complexity' has become an integral part of IR discourses as is instanced by the notions of 'complex interdependence' (Nye 1993, 169), 'complex learning' (Wendt 1999, 170), 'complex political emergencies' (Goodhand and Hulme 1999), 'complex security' (Booth 2005, 275), 'complex socialization' (Flockhart 2006) and 'complex political victims' (Bouris 2007)—to name only a few. Yet, despite their sophistication, such indications fall short of suggesting the analytical paradox of the complexity of international life—'the less foreseeable the future, the more is foresight required; the less we understand, the more is insight needed; the fewer the conditions which permit planning, the greater is the necessity to plan' (Ruggie 1975, 136). The proponents of a CT approach to world politics insist that mainstream IR scholars are unaware of the built-in limitations of the conventional IR agenda (Cederman 1997, 20).

[7] Unwittingly revealing the patterns of complexity, Siani-Davies (2005, 53) notes that it was the unusually warm weather of December 1989 that assisted the 'revolution', as it 'encouraged the crowds to stay on the streets'.

In order to address these shortcomings, the application of complexity research to IR has cut across the intellectual purview of the discipline: (i) *revision of IR paradigms—rationalism/realism* (Axelrod 1997; Brown 1995; Byrne 1998; Jervis 1997), *constructivism* (Adler 2005; Cederman 1997; Hoffman 2005), *postmodernism* (Cilliers 1998; Dillon 2005), *eclecticism*—synthesizing rationalist and reflectivist approaches (Geyer 2003b); (ii) *international history* (Beaumont 1994; DeLanda 1997; Hoffman and Riley 2002; Jervis 1997; Richards 2000; Rosenau 1990); (iii) *globalization* (Chesters 2004; Geyer 2003c; Grande and Pauly 2005; Rosenau 2003; Urry 2003; Walby 2007; Whitman 2005); (iv) *European integration* (Barry and Walters 2003; Clemens 2001; Geyer 2003b); (v) *conflict resolution* (Bueno de Mesquita 1998; Davis 2004; Pil-Rhee 1996; Raphael 1982; Sandole 1999; Suedfeld and Tetlock 1977); (vi) *development* (Farrell 2004; Parfitt 2006; Rihani 2002) (vii) *state-building* (Cederman 1997; Coghill 2004); (viii) *policy-making* (Comfort 2000; Feder 2002; Kiel 1992; Wallace and Suedfeld 1988); (ix) *security studies* (Alberts and Czerwinski 1997; Dillon and Wright 2006; Dunn 2007; Elhefnawy 2004); et cetera.

The breadth and scope of this literature corroborate the suggestion of a 'paradigm shift' in the study of world politics (Albert and Hilkermeier 2004; Brown 1995; Geyer 2003b; Harrison 2006; Mathews et al 1999; Rihani 2002). At the same time, Adler (2005, 32) insists that the application of the framework of complexity to IR proffers images and sets of perceptions about causality which are broader and more profound than the concept of 'paradigm' would suggest. The claim here is that such disciplinary cross-over between complexity research and the study of international affairs also reflects the *emergence* of a CIR theory.[8]

The fall of the Berlin Wall changed not only the dynamics of international life, but also the ways in which such changes in the patterns of world politics are conceptualized. In this respect, the creative engagement of CIR theory with the world we live in responds to the suggestion of the Gulbenkian Commission on the Restructuring of the Social Sciences that social inquiry should be 'based on the dynamics of non-equilibria, with its emphasis on multiple futures, bifurcation and choice, historical dependence and … intrinsic and inherent uncertainty' (Wallerstein 1996, 61–63). The contention is not that complexity was not a feature of Cold War international affairs, but that its pattern was rendered redundant due to the inability to conceive its dynamics. Therefore, as John Ruggie anticipated, it is the intensification of global interdependence that would lead to an increase in the awareness of the patterns of complexity that characterize international life (in LaPorte 1975, 129).[9] The interconnection between an ever larger number of components makes it impossible to overlook the effects of randomness (Elhefnawy 2004, 153). Thus, for instance, while the density of global interactions allows relief organizations and other agencies to raise and deliver funds-in-aid promptly, the very same dynamics permit the flourishing of illicit trafficking. The recognition of interdependence (in particular the occurrence of unplanned interaction) removes the constraints on analytical imagination, which allows

[8] Its distinction from dominant IR approaches is addressed in the following section.

[9] Thus, Booth (1979, 145) has presciently criticized the alleged stability of Cold War deterrence for its underestimation of 'the extent of social conflict throughout the world [which] tends to exaggerate the degree of order which exists'.

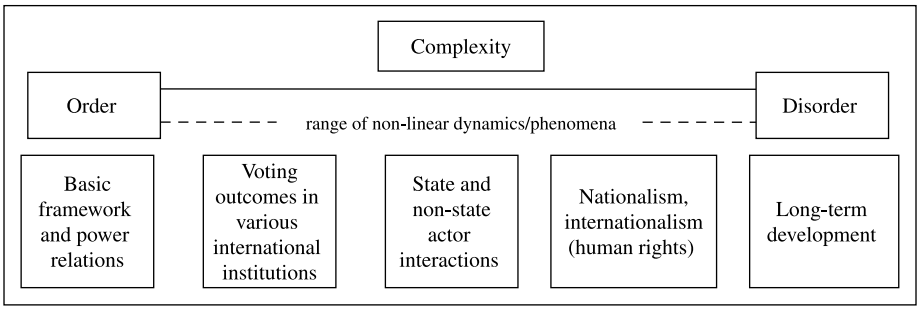

Figure 1. A sample of CIR phenomena (Geyer 2003b, 29)

the discipline of IR to rethink what it is that it wants to study. Such fundamental overhaul of how research is conceptualized and conducted in IR reflects the necessity to 'resocialize' (Johnston 2005, 104) the field.

Thus, on a theoretical level, the application of CT to the study of world affairs proffers a 'new way of thinking about how global politics unfold' in an environment where 'uncertainty is the norm and apprehension the mood' (Rosenau 2003, 208). Exponents of CIR theory, therefore, have termed the perceived stability of post-1945 international relations—both in terms of the (near) universal acquiescence to a bipolar order as well as the disciplinary paradigms from which it was justified—as an aberration in the 'normal' patterns of complexity (Cederman 1997; Geyer 2003b).

The value of CIR is to *start thinking* about the interconnections of international life in terms of complex systems. Complex international relations theory should not be understood, however, as a 'systems theory of politics' (Jervis 1997, 3–11); instead it points out that world politics are complex and contingent. At the same time (as Figure 1 indicates), CIR does not argue that international life is marked by the absence of regularities; rather that order (*linear* patterns), complexity (*nonlinear* patterns) and disorder (*alinear* patterns) coexist—that is, there is not just one type of 'order', but a whole range of types (Geyer 2003b, 21).

Such application of CT to IR asserts that uncertainty and unanticipated consequences should not be surprising, but should be expected (Beaumont 1994, 155; Cioffi-Revilla 1998, 25). Although this might seem like a truism, it is surprising how little attention mainstream IR theory spares for the study of contingency and contradictions. Ruggie's assertion that the leitmotif of international politics is 'better orderly error than complex truth' is still valid (in LaPorte 1975, 145). In translating the jargon of complexity to the vocabulary of IR, Rosenau (2003, 11) has substituted it with the term 'fragmegration'. His intention is to suggest 'the pervasive interaction between fragmenting and integrating dynamics'. As such, fragmegration

> serves as a constant reminder that the world has moved beyond the condition of being 'post' its predecessor to an era in which the foundations of daily life have settled into new and unique rhythms of their own. Equally important, the fragmegration label captures in a single word the large degree to which these rhythms consist of localising, decentralising, or fragmenting dynamics that are interactively and causally linked to globalising, centralising, and integrating dynamics. (Rosenau 2003, 11)

Exponents of CIR theory define the pattern of international life as a *complex adaptive system* (CAS).[10] This suggests that: (i) it is not a cluster of unrelated activities but an interconnected system; (ii) that this is not a simple system, but a complex one; (iii) the interconnectedness between the parts of the system is not unchanging, but constantly self-organizing—that is, it is their capacity to cope with new challenges that makes the system adaptive (Cederman 1997, 50; Comfort 2000, 281; Rosenau 2003, 212). Such conceptualization has important implications for the understanding of agency and structure. Actors in international life are themselves perceived in terms of CAS, which calls for their problematization in systemic ways. Structure, on the other hand, is not determinative—that is, the impact of the external environment is not so compelling as to negate the effect of interactions and to obviate the role of idiosyncratic events and subjective perceptions and choices (Cederman 1997, 20; Jervis 1997, 204; Rosenau 2003, 235).

The CAS perspective, therefore, helps explain why the results of actions are often unintended and why attempts at regulation often misfire—because the participants in world politics can rarely be fully constrained and will react in ways that those who seek to influence them are unlikely to foresee or desire (Jervis 1997, 91). Yet, the point of CIR theory is not to suggest *the one way* for studying international life, but (by acknowledging that there are many ways) to provide a conceptual framework within which IR theory can learn, adapt and interact 'to maximise its own local interactions and complexity to find its own way' (Geyer 2003a, 254). Such contextualization calls attention to the ontological and epistemological purview of CIR theory and its distinction from conventional IR, which is addressed in the following section.

How CIR differs from dominant IR theories? The outlines of the fifth debate

The above discussion intimates the guiding principles of CIR's paradigm: (i) the *dialogic principle*, that allows for the maintenance of aporetic duality (between agency and structure, for example) while at the same time transcending that duality and creating a unity of the whole; (ii) the *principle of recursivity*, in which causes simultaneously are effects; (iii) the *holongrammic principle*, based on the notion of 'holons'—whole/parts—entities that are both wholes and parts of ever greater wholes, simultaneously and at all times (Browaeys and Baets 2003, 336). These principles belie the distinction between CIR and traditional IR. The claim here is that these differences articulate the outlines of the *fifth debate* in the study of international life (see Table 2).[11]

[10] Dillon (2005, 2) seems to detract from this perspective by discussing the pattern of world politics as a *complex system of circulation*: 'complex systems are not only adaptive entities … they are also socio-technical systems, [which are underwritten by the circulation of contingency]—massive and dynamic sets of spatio-temporal conjunctions and correlations'. For the purposes of this article, Dillon's suggestion is treated as a qualification of CAS.

[11] The caveat is that the representation of the conventional/traditional/dominant approaches of IR is consciously exaggerated in order to emphasize not that they are *blind* to the complex relationality of international life, but that they choose to ignore it. At the same time, it is suggested that more sophisticated reflectivist/critical/feminist IR approaches attempt to incorporate this complexity into their analyses, but they are often hindered by their focus on *willed* human/political phenomena.

Table II. The five debates in the study of international life (modification of Wiener 2006, 2)

Frame	First debate	Second debate	Third debate	Fourth debate	Fifth debate
Time	1920s–1930s	1950s–1960s	1980s	1990s	2001 + *
Paradigm	Idealism vs. realism	Scientific behaviourism vs. traditionalism	Post-positivism vs. positivism	Constructivism vs. rationalism vs. reflexivist approaches	Linearity vs. nonlinearity
Focus	Institutions vs. interests	Science vs. history	Epistemology: positivism vs. post-positivism/ critical theory	Ontology: social vs. material capabilities	Epistemology and ontology: acceptance vs. rejection of a reflexive 'biological turn' to explanation and/or understanding
Innovation	State system vs. society of states	Behavioural explanation	Explanation vs. understanding	Causal vs. constitutive explanation and/or understanding	Interrelatedness vs. separation of human and nonhuman systems

* 2001 is taken as a start date mainly due to the symbolism of 9/11 as an event, an idiom and a moment that *confronted* scholars, policy-makers and publics with the reality of complexity.

This proposition is underwritten by the *complex adaptive thinking* of CIR theory—the suggestion that by making reality claims in social science we are also helping to make some social reality more or less real. As John Law and John Urry (2004, 397) insist, CIR's 'ontological politics' debunks the hidden assumption of traditional IR that 'in any particular context, at any particular time, there is a single reality out there waiting to be discovered'. Thus, in contradiction to the 'different *perspectives*' of conventional approaches, CIR theory enacts 'different *realities*' and asserts that there is 'no single "world"'. In effect, the framework of international life suggested by CIR is not a framework at all (in the conventional IR sense) but a 'nexus of relevant events' that are simultaneously partly impression, partly construction and partly experienced (Smith and Jenks 2006, 52). Hence, in contrast to the *hierarchical* analytical perspectives of traditional IR, CIR theory proffers the concept of *panarchy*—a framework for the integration of ecological, economic and institutional processes as a result of the expanding influence of human activity that begs the analytical coupling of 'people and systems of nature' (Gunderson and Holling 2002, 21). Such a shift from epistemology (where what is known depends on perspectives) to ontology (where what is known is also being *made* differently) is central to the discourses of CIR (Law and Urry 2004, 397).

In this respect, although most IR scholars would agree that the world of their investigations is complex, they would still insist that the proper way for acquiring knowledge about it is through the modelling of linear relationships with homogeneous independent variables that distinguish between discrete stochastic and systemic effects (Hoffmann and Riley 2002, 308; Johnston 2005). Such ontological commitment bears the stamp of Hans Morgenthau's insistence on 'the science of international politics' (Gaddis 1992/1993, 7), which has led conventional IR into a 'misleading' measuring of the effects an 'independent variable' has on the 'dependent variable' (Hoffman and Riley 2002, 311). The shadow of such intellectual reductionism in the tradition of IR has driven it into the rut of hylomorphism—'the doctrine that production is the imposition of formal order on chaotic or passive matter' (Parfitt 2006, 421). This attitude of traditional IR has led it to adopt a mindset of continuities that makes it difficult to address randomness and has convinced a number of its representatives of the utility of ignoring the complexity of interactions (Richards 2000, 3).

The ambition of traditional IR to control reality epitomizes its 'closure of political thought, by reliance upon a technologized instrumentalization of it as representative-calculative thought'; whereas the endeavour of complexity research to account for articulations between the disciplinary fields concerns itself with the 'philosophy of the limit', which concerns itself with the operation of boundary—that is, the making of the human thought through the advent of boundary by thinking 'the very "inter" of the interval of being and not-being' (Dillon 1996, 4). In this respect, the insistence of CIR theory that complex systems such as international politics are self-organizing allows it to account for endogeneity (whose random feedback loops pose a serious challenge to traditional IR approaches) and treat it as a normal ingredient of international life (Hoffmann and Riley 2002, 311). This inclusive ontological purview presents a number of analytical challenges, which have led CIR proponents to adopt distinct methodological responses. Epistemologically, all of them seem united in their rejection of conventional IR methodology. For instance, Jack Snyder insists that the worldviews promoted by IR orthodoxies obfuscate the understanding

of complexity (Snyder and Jervis 1993, 18). Thus, what are assumed to be 'commonsense methods' are deemed fallacious (Jervis 1997, 79). At the same time, many proponents of CIR theory acknowledge that studying the complexity of international life rests on 'intuitive judgment or "gut feel"' (Bradfield 2004, 35; Cederman 1997, 10). Thus, Harlan Wilson asserts that the 'analytical complexity' of studying the complexity of international life should reflect the interdependence of conceptual factors, variables and components, that relate in systemic ways (in LaPorte 1975, 282).[12]

The bulk of CIR research promotes agent-based modelling and computer simulations—which rest on mathematical algorithms and data sets—as tools for grasping the complexity of international life (Axelrod 1997; Cederman 1997; Pil-Rhee 1999; Rosenau 2003). At the same time, these investigations take issue with the rational-choice paradigm (and game theory) and its failure to account for the pervasiveness of adaptive behaviours (Axelrod 1997, 4). For some, 'the linear hegemony' of rationalist causal thinking represents an 'intellectual attempt to control' the study of politics by imposing a conceptual framework that is 'blatantly untrue' about the patterns of international interaction (Brown 1995, 4, 144). For others, it 'restricts' interpretation by 'structuring perceptions of reality' and inhibiting 'creative thinking' (Bradfield 2004, 37). In a less radical mood (but equally forcefully), Robert Jervis (1997, 91) demonstrates that the acknowledgement of the complexity of international life renders the methodological apparatus of rationalism useless by 'confounding standard tests of many propositions, and undermining the yardsticks or indicators for the success of policies'.

In what was intended as a qualification of agent-based modelling,[13] Cederman (1997, 10) has advanced a counterfactual mode of macro-historical process-tracing, premised on the production of 'imaginary constructs' that allow for the examination of 'judgments of possibility'. His claims are based on the acknowledgement that it is impossible to encompass all the uncontrolled factors and endless details that are required for making an empirically valid model of complexity. Therefore, he insists that understanding the dynamics of change in world politics requires a historically contextualized perspective, whose attention to the discontinuities of the past would facilitate the anticipation of future structural transformations in the international system (Cederman 1997, 22).

In a further examination of the cognitive perspective, some proponents of CIR theory have suggested 'scenarios' as tools for the modelling of complexity (Feder 2002; Harcourt and Muliro 2004). Scenarios are defined as 'imaginative stories of the future that describe alternative ways the present might evolve over a given period of time' (Heinzen 2004, 4). They focus on subjective interpretations and perceptions. Understanding complexity, therefore, would depend on the relationship between the 'cognitive schema' (that is, available knowledge) and the 'associative network' (that is, the activation of the links between different concepts) of the observer (Bradfield 2004, 40). The suggestion is that in some sense

[12] The following is only a brief representative sample rather than an exhaustive list of methodologies for the study of complexity in international life.

[13] It could be argued that the qualifications of agent-based modelling during the 1990s mark the *second* stage in the application of CT to IR (the *first* one being the development of agent-based modelling during the 1970s and 1980s).

'we create our own consciousness of complexity by seeking it out' (LaPorte 1975, 329). In this respect, some proponents of CIR theory have asserted the analysis of discourses as an important distinction between human and nonhuman complex systems (Geyer 2003b, 26).[14]

The intellectual considerations of these epistemological frameworks suggest the challenging conceptual and methodological problems facing CIR theory. On a metatheoretical level, the problem stems from the realization that students of the complexity of international life can never be fully cognizant of the underlying truths, principles and processes that 'govern reality' because this would (i) involve (a degree of) simplification of complex phenomena (LaPorte 1975, 50), as well as (ii) imply 'knowing the not knowable' (Cioffi-Revilla 1998, 11). As suggested, analytically, the conscious consideration of complexity is hindered by the inherent difficulty of formalizing uncertainty and contingency (Whitman 2005, 105). Some commentators, therefore, have rejected the possibility of constructing comprehensive models for the study of complexity altogether in an attempt to overcome the trap of having to justify their methodologies in ways that are understandable to conventional IR. Therefore, a number of CIR proponents rely on 'sensemaking' (Browaeys and Baets 2003, 337; Coghill 2004, 53), 'what-iffing' (Beaumont 1994, 171) and other forms of 'speculative thinking' (Feder 2002, 114) for their interpretations of the complexity of international life. The claim is that the acceptance of endogeneity as a 'fact' of international life provides more insightful modes of analysis than the linear-regression-type approach of traditional IR (Johnston 2005 1040). Without ignoring some controversial aspects of incorporating ontological and epistemological reflection into methodological choices, the claim here is that CIR theory suggests intriguing heuristic devices that both challenge conventional wisdom and provoke analytical imaginations.

Complex international relations theory, therefore, proffers analytical tools both for explaining and understanding discontinuities. It is claimed that its approaches offer 'antidotes' to the anxiety that randomness engenders in traditional IR as well as provide a paradigm that accepts uncertainty as inevitable (Feder 2002, 117). Thus, in contrast to the typically linear perceptions of change in mainstream IR—that is, changes in variables occur, but the effect is constant—CIR suggests that 'things *suffer* change'. The contention is that the unpredictability of the emergent patterns of international life needs to be conceptualized within the framework of *self-organizing criticality*—that is, their dynamics 'adapt to, or are themselves on, the edge of chaos, and most of the changes take place through catastrophic events rather than by following a smooth gradual path' (Dunn 2007, 99). Complex international relations, in other words, suggests that change entails the possibility of a 'radical qualitative effect' (Richards 2000, 1). Therefore, the alleged arbitrariness of occurrences that conventional IR might describe as the effects of randomness (or exogenous/surprising shocks) could (and, in fact, more often than not does) reflect ignorance of their interactions. In fact, the reference

[14] The discursive study of complexity takes as its point of departure Heidegger's assertion that 'the word becomes a name for something indeterminate'. Thus, the fickleness of the narratives of international realities evidences that 'the word, any word, is a fragment. Any fragment deprives the present of peace (and piece) of mind. It breaks the assumed chain of natural continuity' (Dillon 1996, 113).

to 'chance' is merely a metaphor for our lack of knowledge of the dynamics of complexity (Smith and Jenks 2006, 273).

In this respect, CIR theory sketches the *fifth debate* in the study of international life (see Table 2). Its outlines follow the proposition of the Gulbenkian Commission to break down the division between 'natural' and 'social' sciences, since both are pervaded by 'complexity'. Therefore, scholars should not be 'conceiving of humanity as mechanical, but rather instead conceiving nature as active and creative [to make] the laws of nature compatible with the idea of novelty and of creativity' (Wallerstein 1996, 61–63). Complex international relations (unlike other IR approaches) acknowledges that patterns of international life are *panarchic* 'hybrids' of physical and social relations (Urry 2003, 18) and advocates such fusion (through the dissolution of the outdated distinction) of scientific realities (Whitman 2005, 45–64). Its complex adaptive thinking in effect challenges the very existence of 'objective standards' for the assessment of competing knowledge claims, because these are 'not nature's, but rather always *human* standards, standards which are not given but made … adopted by convention by the members of a specific community' (Hoffmann and Riley 2002, 304). The complex adaptive thinking of CIR theory, therefore, is an instance of 'true thinking'—'thinking that looks disorder and uncertainty straight in the face' (Smith and Jenks 2006, 4).

Although such reflexivity animated the discussions of the *fourth debate* in IR, it nevertheless failed to challenge the *hierarchical one-world* view of the discipline. Such ontological commitment still allows for the perpetuation of linear thinking and the division between natural and social sciences. The main contribution of constructivism—the driving force behind the *fourth debate*—is its ability to bring scholars from diverse perspectives 'to sit at one table' (Wiener 2006, 4). It is these conversations around the IR table that made possible the permeation of their discourses by CT. In this respect, CIR theory reflects the 'mosaic' of constructivist theory-building (Wiener 2006, 16), but it takes it outside the immediate ontological realm of 'political science' and positions it within the broader context of living systems.[15] Within the *fourth debate*, the study of international life is mainly about the examination of interdependent and overlapping sets of *social* arrangements.

Constructivism, therefore, perpetuates the false dichotomy between 'human' and 'non-human' systems which prevents it from augmenting the study of international life with 'naturalistic scientific updatings' (Alker 2000, 143). Thus, despite constructivism's emphasis that theorizing does not develop outside of context, it still remains preoccupied mainly with the respective *political* cultures, practices and behaviours without acknowledging the very ('natural') environment within, through and with which interactions occur. In other words, 'environment' connotes not an abstract linguistic construction, but a concept that is 'localised, heterogeneous, radically temporal and is itself a collection of systems' (Smith and Jenks 2006, 53). Thus, constructivism's delineation of the *fourth debate* in the study of international life overlooks the foundational *panarchic* ontology

[15] It has to be noted that the approaches of feminist IR—especially the 'methodology of mess'—touch upon many of the analytical suggestions of CIR theory; yet, they remain consciously self-limiting in their study of the complexity of international life, owing to their focus on uncovering women's daily (bodily) experiences (Ackerly et al 2006, 45).

of complexity—that is, human/social systems are also networked with nonhuman/natural ones. In this respect, CIR theory aims to rectify such shortcoming of traditional IR approaches and, thereby, outlines the *fifth debate* in IR—the cross-pollination between natural and social sciences.

(In) conclusion: what next?

As Beaumont (1994, 145) has quipped, there is something paradoxical about concluding an article on complexity, since the sequential unfolding of uncertainties, dilemmas and paradoxes works against focusing analysis and drawing neat conclusions. Yet, the perception of complexity does not automatically imply a '"defeatist" attitude' (LaPorte 1975, 328). Therefore, this overview of the application of CT to world politics calls us to start thinking about the study of international life from a complex systems perspective.

The proponents of CIR theory maintain that complexity cannot be regulated (and, thereby, structured through methodological tools), but that it is experienced. Such an assertion confronts the conventional wisdom of IR with the patterns of complexity: the former is premised on the separation of the 'objects of knowledge from their contexts' and the latter, while distinguishing between the objects, 'interconnects' them (Browaeys and Baets 2003, 335). The emergent attempts at comprehending the complexity of international life, therefore, have initiated the *fifth debate* in IR. The claim here is that this development has important emancipatory (and, thereby, policy) implications. Such a prospect has been made possible through the ontological innovation of CIR theory—the envisioning of social science imagination as a 'system of interference' that makes particular forms of the social real while foreclosing others (Law and Urry 2004, 397).

On the one hand, CIR theory insists that complex systems thinking 'should compel the strongest states to act in ways that reduce the vulnerability of the weakest' (Snyder and Jervis 1993, 20). Rosenau (2003, 330), for instance, argues that the complexity (or what he calls 'fragmegration') of international life has made it possible for a wide range of individual and collective actors to put pressure on 'rights-insensitive states' across all the dimensions of state capabilities that have previously been impervious to demands on behalf of human rights. This acknowledges that activism generates its own countervailing forces that assume a continuing expansion of the analytical skills that enable people to alter their priorities across whole systems and subsystems (that is, alter habit-driven behaviour) as they discover that 'the former cannot provide satisfying solutions to major problems and that the latter cannot contain low-intensity conflicts and maintain a satisfying degree of public order' (Rosenau 1990, 457). Thus, in contrast to the reactionary stance of mainstream IR, CIR theory advocates an emancipatory agenda for a 'new vision of politics that emphasises responsibility' (Barnett 2005, 115) made possible by the promise of 'immanent self-ordering' (Parfitt 2006, 424).

On the other hand, several CIR theoreticians have pointed out that the recognition of the complexity of international life diminishes the likelihood of recourse to force in world affairs—the suggestion is that the acknowledgement of the unpredictability and contradictions of international interactions as well as policies informed by CT should make foreign-policy-making more peaceful (Puente 2006; Suedfeld and Tetlock 1977). For instance, some have argued that

policy-makers who recognize the unintended consequences of complexity indicate preferences for diplomacy over military confrontation (Raphael 1982; Wallace and Suedfeld 1988). For instance, the case of the 2003 invasion of Iraq points to the problem of reductionist decision-making—that is, even if the 'rules of the game' are completely known and understood at the local level, it might be impossible to predict regional/global outcomes; furthermore, the quandary of policy formulation based on parsimonious (simplifying) analysis is inherent rather than situational, because 'planning based on predictions is not merely impractical; it is [also] logically impossible' (Mathews et al 1999, 450).

Such discussion of the emancipatory aspects of CIR theory is not intended as a distraction from some of its shortcomings. Instead, the suggestion is that these flaws necessitate further exploration of the CIR framework as it is alone in taking the discontinuities of international life seriously. This article contends that the application of the complexity paradigm to the study of international life would refocus the study of global affairs. Returning to the words of Herbert Wells in the epigraph of this article, the promise of CIR theory is that it can help lift 'the darkest shadow' from the totalizing discourses of terrorism and fear that seem to pervade current world politics by volunteering 'imaginative thinking' on the complexity of human societies and their interactions.

References

Ackerly, Brooke, Maria Stern and Jacqui True (2006) *Feminist methodologies for international relations* (Cambridge, United Kingdom: Cambridge University Press)

Adam, Barbara (1998) *Timescapes of modernity: the environment and invisible hazards* (London: Routledge)

Adler, Emanuel (2005) *Communitarian international relations* (Cambridge, United Kingdom: Cambridge University Press)

Albert, Mathias and Lena Hilkermeier (eds) (2004) *Observing international relations: Niklas Luhmann and world politics* (London: Routledge)

Alberts, David and Thomas Czerwinski (eds) (1997) *Complexity, global politics and national security* (Washington: National Defence University)

Alker, Hayward (2000) 'On learning from Wendt', *Review of International Studies*, 26:1, 141–150

Arshinov, Vladimir and Christian Fuchs (eds) (2003) *Causality, emergence, self-organisation* (Moscow: NIA-Priroda)

Axelrod, Robert (1997) *The complexity of cooperation* (Princeton, New Jersey: Princeton University Press)

Barnett, Jon (2005) *The meaning of environmental security* (London: Zed Books)

Barry, Andrew and William Walters (2003) 'From EURATOM to "complex systems', *Alternatives*, 28:2, 305–329

Beaumont, Roger (1994) *War, chaos and history* (Westport, Connecticut: Praeger)

Bell, Duncan (2006) 'Beware of false prophets', *International Affairs*, 82:3, 493–510

Beyerchen, Alan (1988/89) 'Nonlinear science and the unfolding of a new intellectual vision', *Papers in Comparative Studies*, 6, 369–392

Booth, Ken (1979) *Strategy and ethnocentrism* (New York: Holmes & Meier)

Booth, Ken (ed) (2005) *Critical security studies and world politics* (Boulder, Colorado: Lynne Rienner)

Bouris, Erica (2007) *Complex political victims* (Bloomfield, Connecticut: Kumarian Press)

Bradfield, Ron (2004) 'What we know and what we believe', *Development*, 47:4, 35–42

Browaeys, Marie-Joëlle and Walter Baets (2003) 'Cultural complexity', *Learning Organization*, 10:6, 332–339

Brown, Courtney (1995) *Serpents in the sand* (Ann Arbor: University of Michigan Press)

Bueno de Mesquita, Bruce (1998) 'The end of the cold war', *Journal of Conflict Resolution*, 42:2, 131–155
Byrne, David (1998) *Complexity theory and the social sciences* (London: Routledge)
Cederman, Lars-Erik (1997) *Emergent actors in world politics* (Princeton, New Jersey: Princeton University Press)
Chesters, Graeme (2004) 'Global complexity and global civil society', *Voluntas*, 15:4, 323–342
Cilliers, Paul (1998) *Complexity and postmodernism* (London: Routledge)
Cioffi-Revilla, Claudio (1998) *Politics and uncertainty* (Cambridge, United Kingdom: Cambridge University Press)
Clemens, Walter (2001) *Complexity theory and European security* (Lanham, Maryland: Rowman & Littlefield)
Coghill, Ken (2004) 'Federalism: fuzzy global trends', *Australian Journal of Politics and History*, 50:4, 41–56
Comfort, Louise (2000) 'Disaster', *Cambridge Review of International Affairs*, 14:1, 277–294
Davis, Lynn (2004) *Education and conflict: complexity and chaos* (London: Routledge)
DeLanda, Manuel (1997) *A thousand years of nonlinear history* (New York: Swerve)
Dillon, Michael (1996) *The politics of security* (London: Routledge)
Dillon, Michael (2005) 'Global security in the 21st century: circulation, complexity, and contingency', ISP/NSC Briefing Paper, 05:02, 2–3
Dillon, Michael and Chris Wright (eds) (2006) *Complexity, networks and resilience* (London: Chatham House)
Dunn, Myriam A (2007) 'Securing the digital age: the challenges of complexity for critical infrastructure protection and international relations theory' in Johan Eriksson and Giampiero Giacomello (eds) *International relations and security in the digital age* (London: Routledge), 85–105
Elhefnawy, Nader (2004) 'Societal complexity and diminishing returns in security', *International Security*, 29:1, 152–174
Farrell, Katharine (2004) 'Epistemology, complexity and democracy', *Local Environment*, 9:5, 469–479
Feder, Stanley (2002) 'Forecasting for policy-making', *Annual Review of Political Science*, 5, 111–125
Flockhart, Trine (2006) 'Complex socialisation', *European Journal of International Relations*, 12:1, 89–118
Gaddis, John Lewis (1992/93) 'International relations theory and the end of the Cold War', *International Security*, 17:3, 5–58
Geyer, Robert (2003a) 'Beyond the third way', *British Journal of Politics and International Relations*, 5:2, 237–257
Geyer, Robert (2003b) 'European integration, the problem of complexity and the revision of theory', *Journal of Common Market Studies*, 41:1, 15–35
Geyer, Robert (2003c) 'Globalisation, Europeanisation, complexity', *Governance*, 16:4, 559–576
Gingrich, Gerry (1998) 'Simplified complexity', *Strategic Forum*, 139, 1–3
Goodhand, Jonathan and David Hulme (1999) 'From wars to complex political emergencies', *Third World Quarterly*, 20:1, 13–26
Grande, Edgar and Louis W. Pauly (eds) (2005) *Complex sovereignty: reconstituting political authority in the twenty-first century* (Toronto: University of Toronto Press)
Grosz, Elizabeth A (2004) *The nick of time: politics, evolution, and the untimely* (Durham, North Carolina: Duke University Press)
Guastello, Stephen (2002) *Managing emergent phenomena* (Mahwah, New Jersey: Erlbaum)
Gunderson, Lance and CS Holling (ed) (2002) *Panarchy* (London: Island Press)
Harcourt, Wendy and Arthur Muliro (2004) 'What next?', *Development*, 47:4, 1–3
Harrison, Neil (ed) (2006) *Complexity in world politics* (New York: SUNY Press)
Heinzen, Barbara (2004) 'Surviving uncertainty', *Development*, 47:4, 4–8
Hoffman, Matthew (2005) *Ozone depletion and climate change* (New York: SUNY Press)
Hoffman, Matthew and John Riley (2002) 'The science of political science', *New Political Science*, 24:4, 303–320
Homer-Dixon, Thomas (2006) *The upside of down* (London: Island Press)

Hornborg, Alf (ed) (2007) *World-system history* (Lanham, Maryland: AltaMira Press)
Jervis, Robert (1997) *System effects* (Princeton, New Jersey: Princeton University Press)
Johnston, Alastair (2005) 'Towards mid-range theorizing', *International Organization*, 59:4, 1013–1044
Khalil, Elias and Kenneth Boulding (eds) (2002) *Evolution, order and complexity* (London: Routledge)
Kiel, L Douglas (1992) 'The nonlinear paradigm', *Systems Research*, 9:2, 27–42
Krasner, Stephen (1984) 'Approaches to the state', *Comparative Politics*, 16:2, 223–246
LaPorte, Todd (ed) (1975) *Organised social complexity: challenge to politics and policy* (Princeton, New Jersey: Princeton University Press)
Law, John and John Urry (2004) 'Enacting the social', *Economy and Society*, 33:3, 390–410
Lewin, Roger (1992) *Complexity* (New York: Macmillan)
Manson, Steven (2001) 'Simplifying complexity', *Geoforum*, 32:3, 405–414
Mathews, K Michael, Michael White and Rebecca Long (1999) 'Why study the complexity sciences in the social sciences', *Human Relations*, 52:4, 439–462
McCarthy, John (2006) *Remapping reality* (Amsterdam: Rodopi)
Meinzer, Klaus (2005) *Symmetry and complexity: the spirit and beauty of nonlinear science* (London: World Scientific)
Nye, Joseph (1993) *Understanding international conflict* (New York: HarperCollins)
Parfitt, Trevor (2006) 'Hylomorphism, complexity and development', *Third World Quarterly*, 27:3, 421–441
Pil-Rhee, Yong (ed) (1996) *Complex systems model of South–North Korean integration* (Seoul: National University Press)
Pil-Rhee, Yong (1999) *The dynamics and complexity of political systems* (Seoul: Ingansarang Press)
Protevi, John (2001) *Political physics* (London: Athlone Press)
Puente, Carlos (2006) 'More lessons from complexity', *Emergence*, 8:3, 115–122
Raphael, Theodore (1982) 'Integrative complexity theory', *Journal of Conflict Resolution*, 26:3, 423–450
Reitsma, Femke (2003) 'A response to simplifying complexity', *Geoforum*, 34:1, 13–16
Rice, Thomas (1997) *Joyce, chaos and complexity* (Champaign: University of Illinois Press)
Richards, Diana (ed) (2000) *Political complexity* (Ann Arbor: University of Michigan Press)
Richardson, Kurt and Paul Cilliers (eds) (2007) *Explorations in complexity thinking* (Mahwah, New Jersey: ISCE)
Rihani, Samir (2002) *Complex systems theory and development practice* (London: Zed Books)
Rosenau, James (1990) *Turbulence in world politics* (Princeton, New Jersey: Princeton University Press)
Rosenau, James (2003) *Distant proximities* (Princeton, New Jersey: Princeton University Press)
Ruggie, John (1975) 'Complexity, planning, and public order' in Todd LaPorte (ed) *Organised social complexity: challenge to politics and policy* (Princeton, New Jersey: Princeton University Press), 119–150
Sandole, Dennis JD (1999) *Capturing the complexity of conflict: dealing with violent ethnic conflicts of the post-Cold War era* (London: Cassell)
Sawyer, R Keith (2005) *Social emergence* (Cambridge, United Kingdom: Cambridge University Press)
Siani-Davies, Peter (2005) *The Romanian Revolution of December 1989* (Ithaca, New York: Cornell University Press)
Smith, John and Chris Jenks (2006) *Qualitative complexity: ecology, cognitive processes and the re-emergence of structures in post-humanist social theory* (London: Routledge)
Snyder, Jack and Robert Jervis (eds) (1993) *Coping with complexity in the international system* (Boulder, Colorado: Westview Press)
Steinbruner, John (2000) *Principles of global security* (Washington: Brookings: Institution Press)
Suedfeld, Peter and Philip Tetlock (1977) 'Integrative complexity', *Journal of Conflict Resolution*, 21:1, 169–184
Taylor, Mark (2001) *The moment of complexity* (Chicago: University of Chicago Press)
Urry, John (2003) *Global complexity* (Cambridge, United Kingdom: Polity Press)

Walby, Sylvia (2007) *Globalization and complex inequalities* (London: Sage)
Wallace, Michael and Peter Suedfeld (1988) 'Leadership performance in crisis: the longevity–complexity link', *International Studies Quarterly*, 32:4, 439–451
Wallerstein, Immanuel (1996) *Open the social sciences* (Stanford, California: Stanford University Press)
Weaver, Warren (1948) 'Science and complexity', *American Scientist*, 36:4, 536–544
Wells, HG (1945) *The mind at the end of its tether* (London: Heinemann)
Wendt, Alexander (1999) *Social theory of international politics* (Cambridge, United Kingdom: Cambridge University Press)
Whitman, Jim (2005) *The limits of global governance* (London: Routledge)
Wiener, Antje (2006) 'Constructivist approaches in international relations theory: puzzles and promises', Constitutionalism Webpaper 5, Queen's University, Belfast, <http://www.qub.ac.uk/schools/SchoolofPoliticsInternationalStudiesandPhilosophy/FileStore/ConWEBFiles/Filetoupload,52215,en.pdf > , accessed 24 February 2006