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Complexity and theories of change in international politics

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This article examines how the principles of complex systems can illuminate recurring mechanisms of change in theories of international relations. It applies the logic of complex systems to two specific puzzles in international politics – the problem of theorizing change in structural realism, and the dynamics of cross-border democratic diffusion. In the first case, by shifting the analysis of anarchy’s consequences from state behavior to state attributes, complex systems can illustrate the sources of domestic and international transformations embedded in structural theories. This approach offers a way to think about democratization as a global process of interstate competition and socialization driven by the pressures of anarchy. In the second case, the principles of co-adaptation in complex systems can help reframe diffusion not as the unilinear spread of democracy but as the interplay of self-reinforcing and self-dampening dynamics, whose interaction shapes both actor expectations and democratic outcomes. In both cases, complex systems serve a limited but useful role; although not conducive to theory creation, the approach provides a useful analytical prism for examining patterns of change and continuity in global processes, and highlights concrete ways of improving models of transformations in international politics.

Keywords: complex adaptive systems; structural realism; democratic diffusion

The study of complex adaptive systems (CAS) has recently yielded valuable insights into the dynamics of large-scale social interactions. Initially used to analyze physical phenomena like ecosystems and brain structures, complex systems have been applied to studies of electoral behavior, stock markets, and the evolution of warfare (Weisberg 1998; Ball 2004; Bousquet 2009). The emphasis on strategic interaction and unintended consequences seem to make complex systems particularly suitable for the study of global politics. Yet with a few exceptions, international relations theory has been hesitant to absorb its insights.¹ ‘Complexity appears at first glance to be precisely the paradigm

¹ Scholars have recently employed sophisticated tools of agent-based modeling to examine problems in international politics. This article, however, focuses on the theoretical implications

we need to understand global politics today’, write Earnest and Rosenau. ‘Yet, by and large, international relations scholars who use complex systems theories...are few and far between’ (Earnest and Rosenau 2006, 144).

The reluctance to employ CAS in international relations theory stems from two related obstacles often unaddressed by its proponents. The first is definitional. The lack of agreement over essential concepts relegates complex systems to the status of a superficially appealing but theoretically vacuous metaphor. To say that international politics are complex is trivially true, and does not offer any particular insight into international processes. Moreover, this vagueness can seem like an attempt to awkwardly graft concepts from the natural sciences onto the very different world of human interaction. Any effort to apply CAS to international politics must therefore deal with the serious charge of complexity as a forced and amorphous metaphor.²

Second, there is little agreement about the specific ways complex systems can help improve theories of international relations. Axelrod, for example, has called it a third, ‘generative’ methodology that overcomes the limits of both inductivism and deductivism, and can be used to predict a variety of social outcomes (Axelrod 1997, 4; see also Epstein and Axtell 1996, 20). To skeptics, however, it is nothing more than a ‘fact-free science’ and ‘a festival of bad metaphors’ (Smith 1995, 30; Green 2010, 292).

To be useful, the application of complex systems to international politics requires an understanding of its scope – that is, an analysis of both its uses and its limits. This article seeks to do so by applying the principles of CAS to two puzzles in international politics: the problem of theorizing change in structural realism, and the dynamics of democratization across state borders. These case studies suggest that the logic of complex systems can serve a real but limited role in understanding international politics. The approach is not conducive to theory creation because its assumptions are bounded by inherent uncertainty, and thus perform poorly at producing testable hypotheses that lend themselves to empirical verification. At the same time, CAS serves as a useful prism for critiquing existing approaches to international politics, primarily by offering insights into the dynamics of change in international politics. In short, it is more than a metaphor but less than a theory.

of complex systems rather than the quantitative application of these principles via simulation models. In this regard it follows the example of Jervis (1997), who examined international politics in the context of CAS without the use of agent-based models. See also Snyder and Jervis (1993). For recent uses of agent-based modeling in international politics, see Earnest (2008), Cioffi-Revilla and Rouleau (2010), and Cederman and Girardin (2010).

² This criticism extends even to the more specific applications of complexity to international politics. The fact that war magnitude follows a power-law distribution (reminiscent of ‘self-organized criticalities’ in complex systems) may be intellectually interesting but tells us little about the causes of wars.

Often criticized for its static approach to international politics, structural realism borrows essential elements from complex systems – namely, the rigid separation of systemic and unit-level effects, and the notion of emergent properties instantiated by anarchy. But in order to explain powerful continuities in international politics, structural realism focuses on analyzing state behavior while ignoring anarchy's effects on state attributes. The logic of complex systems, however, helps to draw out the effects of systemic constraints on the attributes of its constituent units, and outlines the mechanisms through which this influence takes place. Shifting the focus from domestic behavior to domestic institutions can therefore point toward systemic models of regime evolution within structural theories. The pressures of anarchy can illuminate both the sources of continuity in state behavior and the sources of change in state organization. This approach thus offers a way to think about democratization as a global process of interstate competition and socialization shaped by the imperatives of anarchy.

Moreover, despite its reliance on competition and socialization as drivers of global politics, the theory largely ignores the dynamics of unit-system interaction embedded in its own structural framework. By limiting this interaction to a one-way relationship, structural realism overlooks the sources of systemic transformations that logically emerge from its focus on relative power as the central element of international politics. Over the last few centuries, abrupt shifts in relative power have created windows of opportunity for rising hegemony to reshape the international system according to their own norms and preferences. Though systemic constraints on states are powerful and persistent, they are neither fixed nor eternal. Under some circumstances, anarchy truly does become what states make of it (Wendt 1992), and complex systems can help elucidate the conditions that make this outcome more likely. The neglect of change in structural realism thus stems not from the limits of the theory itself, but from a failure to fully develop the implications of system dynamics within its basic assumptions. The standard critiques of structural realism, which portray the theory as fundamentally opposed to thinking about change, make the same mistake as the object of their attack.

Turning to democratic diffusion, the logic of complex systems suggests that the widespread conception of diffusion as the self-reinforcing spread of a phenomenon (i.e. contagion or spillover) has been too narrowly defined. Democratic diffusion in international politics nearly always triggers *resistance* to diffusion, and the anticipation of this resistance fundamentally shapes both the incentives of the actors and the eventual outcome itself. The cross-border spread of democracy cannot be understood apart from the resistance provoked by this spread, in the same way that the advance of globalization cannot be understood apart from resistance to globalization.

In the latter case, universalism provokes particularism; in the former, contestation provokes repression. Complex systems illustrate how positive feedback in the form of self-reinforcing mechanisms often produces negative feedback in the form of self-dampening mechanisms, and in doing so can help explain the Janus-faced nature of democratic diffusion.

Focusing on the effects of negative feedback can also help explain why waves of diffusion often fail to consolidate, leading to anti-democratic rollbacks. The initial period of diffusion produces strong self-reinforcing tendencies, leading to attempts at democratization in countries that cannot credibly sustain such reforms due to either elite opposition or the lack of structural pre-requisites needed for institutional consolidation. The immediate aftermath of diffusion creates a period of democratic over-stretch that produces an artificially high number of attempted transitions. The sources of failed democratization in processes of diffusion are thus linked to the causes that create the initial wave of transitions. In sum, diffusion is better understood as the complex interplay of positive and negative feedback rather than the unilinear process often portrayed by scholars of diffusion.

Examining the interaction of self-reinforcing and self-dampening tendencies is critical for understanding the advance and retreat of democracy across borders. This framework is applied to a brief analysis of the contrasts and parallels between the 1848 Spring of Nations, the 1989 Velvet Revolutions, and the Arab Spring of 2011. The mechanisms that produce both types of feedback appear to recur across a variety of cases, suggesting ways for future research to develop more theoretically integrated typologies of democratic diffusion.

The rest of the article proceeds as follows: the first section develops a definition of complex systems grounded in the context of international politics. While building on previous efforts, this definition contrasts co-evolution and co-adaptation, an important distinction often ignored or conflated in the current literature on complexity in the social sciences. Based on the definition, it then briefly outlines the uses and limitations of the approach for international relations theory. The second and third sections apply CAS principles to analyzing the logic of change in structural realism and the dynamics of democratic diffusion, respectively. The case studies demonstrate the concrete ways in which complex systems can help illuminate theoretically undeveloped elements in both structural realism and models of democratic diffusion. The last section concludes.

Defining CAS

As Eidelson (1997, 42) points out, complex systems analysis has been slow in gaining acceptance among social scientists in part because of confusion

over essential concepts. Moreover, its cross-disciplinary nature means that even careful definitions can vary widely across different fields, creating what Scott (1991, 3) calls ‘an interdisciplinary Tower of Babel’. With that in mind, what does it mean for a system to be complex and adaptive in the context of international relations? I define a complex adaptive system as a set of strategic actors whose repeated interaction produces (a) emergent properties, (b) non-linear dynamics, and (c) co-adaptation. Each of the three elements is briefly examined below.

Emergent properties

The first essential feature of a complex system is that its properties often cannot be inferred from the properties of its constituent units. This divergence can occur even if the actors are self-conscious, strategic, and perfectly aware of systemic constraints.³ In the context of global politics, emergent properties mean that attributes of the international system cannot be derived solely from the attributes of its constitutive units, a point forcefully emphasized by Waltz (1979). The repeated interaction of states, he argues, produces a system defined by anarchy, an emergent property that acts as a constraint on the actions of its members – and does so regardless of their intentions, behaviors, and characteristics. Cautious, security-seeking states may therefore create an unstable and conflict-prone world because they lack sufficient information about the motives of others and fear a pre-emptive attack. Thus, Reinken (1968, 469) is exactly wrong when he argues that ‘a system containing merely growth-seeking actors will obviously be unstable; there would be no provision for balancing or restraint’.⁴ Belligerent states may form a stable and peaceful system precisely because their mutual belligerence deters aggression and ensures that any gains from victory will be offset by the prospect of hard-fought battles.

Non-linear dynamics

The second element of a complex adaptive system is the presence of non-linear dynamics, where large inputs can lead to small outputs and vice versa. Seemingly major crises may fizzle out, while the assassination

³ In Adam Smith’s model of a free market, for example, profit-maximizing sellers interact to form a system of exchange that pushes profit to zero. As Axelrod and Cohen (2000, 29) note, Smith ‘introduced some of the key concepts of complex systems, including the notion of a hidden hand and market clearing, concepts that would now be called emergent properties of the system’.

⁴ As a corollary, he adds, ‘a system containing merely extreme balance-seekers should be, obviously, stable’.

of a Balkan archduke may blossom into a global conflagration. This means that the consequences of even seemingly insignificant actions are often very difficult to predict, and that a single event can have multiple unintended effects as it ripples throughout the system. In a complex system, notes Schweller (1998, 8), ‘relationships are non-additive and non-commutative’.

Thinking linearly about social processes is common, intuitive, and often false. If partial reforms bring some positive benefits, then extensive reforms will bring more. If moderate levels of foreign aid alleviate poverty, higher levels of aid can eliminate it. Causation in social systems rarely operates according to such principles. A common finding in the democratization literature, for example, is that mixed regimes are more prone to civil wars than either democracies or autocracies (Hegre *et al.* 2001; Fearon and Laitin 2003). Likewise, Mansfield (1994) finds that war is less likely to occur when global power is either highly concentrated or highly dispersed, and most likely when power concentration is somewhere in the middle. And Howard (2008) argues that too much or too little UN interest in a peacekeeping operation results in peacekeeping failures, while moderate interest is associated with success.

Two features of non-linear interactions are particularly important for theories of change in international relations. First, they can create loops of positive feedback, in which a cause and effect mutually reinforce each other. Common instances of positive feedback in international politics include arms races, the spread of financial crises, or the inertia of regional integration – what Haas (1958), discussing the development of the European Union, called ‘spillover effects’. Positive feedback is highly destabilizing and difficult to predict, which means change in international politics can sometimes take the form of a punctuated equilibrium, in which periods of relative stasis are interrupted by sudden and dramatic transformations.⁵

A second, more counter-intuitive feature of non-linear interactions is that the same cause can create both self-reinforcing and self-dampening dynamics. As a result, seemingly different or even opposite outcomes may share the same explanatory mechanisms. Both Gilpin (1981) and Kennedy (1987), for example, have argued that imperial expansion by great powers initially sets the conditions for more expansion by increasing the state’s material capabilities – a process of positive feedback. After a certain point, however, subsequent expansion leads to imperial overstretch, which

⁵ On punctuated equilibrium in international politics, see Krasner (1984), Katzenstein (1985), Krasner (1988), Goertz (2004), Baumgartner *et al.* (2009).

generates negative feedback through domestic stagnation and the rise of outside challengers.⁶ Although expansion and decline may appear like qualitatively different phenomena, they are in fact elements of the same process. The rise and fall of empires can thus be characterized as an endogenously driven cycle shaped by the interplay of positive and negative feedback. As I argue below, the diffusion of democratization reflects a similar dynamic: the initial spread of democracy creates opportunities for further spread via contagion and elite bargaining, which over time gives rise to negative feedback in the form of elite learning, counter-mobilization, and revolutionary overstretch.

Concern with temporality is thus a key component of non-linear interactions: elite learning, after all, is a temporal dimension of democratic diffusion, and early democratic adopters will therefore experience a different form of negative feedback than later adopters. While many theories of international politics focus on equilibrium outcomes, the timing and sequencing of events profoundly shape political development.⁷ To take one example, Ertman (1996) argues that the timing of interstate military competition had far-reaching effects on the institutional development of European states, because early outcomes became self-reinforcing and path-dependent over centuries. At the same time, the focus on path dependence in historical institutionalism over-emphasizes processes of positive feedback; taken to the extreme, path dependence veers close to teleology, since every process at time $t-1$ shapes the outcome at time t . By underscoring the importance of both positive and negative feedback, complex systems allow for a more nuanced sense of temporality in the dynamics of social processes.

Co-adaptation

Co-adaptation is perhaps the most misunderstood element of complex systems. In international relations theory, evolution and adaptation are often used synonymously.⁸ Evolution, however, implies local maximization while adaptation implies strategic actors. In an adaptive process, actors learn from experience, anticipate moves by others, and plan ahead. Evolution, by contrast, is never strategic; it can never take a 'one step backwards, two steps forward' approach; it has no memory of the past

⁶ Similar dynamics are present in a number of theories of general wars and long-term cycles of hegemonic rise and decline, such as Wallerstein (1974), Modelski (1978), Doran (1983), and Väyrynen (1983), though most do not explicitly employ the language of positive and negative feedback.

⁷ For an overview, see Pierson (2004).

⁸ For some examples of this conflation, see Modelski (1990), Modelski and Thompson (1999), or Clemens (2006).

nor any insight into the future (Elster 1983, 50–51; Dawkins 1986). Because evolution is bound by local maximization, it is subject to low-level equilibrium traps. At the same time, ‘strategic’ does not imply that actors are rational, omniscient, or even efficient. They may act foolishly, panic in herds, slavishly follow others, and daringly pursue high-payoff/low-probability outcomes – but do so with the knowledge of past attempts, and the anticipation of how their actions will be perceived by other actors in the system. Unlike their biological counterparts, social processes are rarely evolutionary and often adaptive.

Moreover, in evolutionary processes the mechanisms of biological reproduction and inheritance are discrete – that is, proceeding from generation to generation. In adaptation, however, the mechanisms of social reproduction and inheritance are continuous. As a result, selection pressures in social systems need not involve the death or reproduction of an agent to manifest themselves. This seemingly trivial distinction becomes enormously important when evolutionary analogies or critiques are misapplied to adaptive processes.⁹ Critics of structural realism, for instance, have argued that state death is too rare to be a plausible outcome of anarchy, and thus no process of selection can be observed in the international system. The ‘evolutionary principle’, argues Keohane (1986, 73), ‘can hold only for systems with many actors, experiencing such severe pressures on resources that many will disappear over time’. Jervis (1997, 105), otherwise sympathetic to structural realism, likewise argues that except for a few cases like the Soviet collapse, ‘it is hard to see much natural selection working in this way’.

In both cases, the conflation of evolution with adaptation leads Keohane and Jervis to treat state death as the selection mechanism. But in adaptive processes, where selection operates through continuous rather than discrete mechanisms, it is not death itself but the ever-present *threat* of death that acts as the feedback mechanism and spurs policy-makers into action. The argument that state death rates must be high for systemic forces to be powerful falsely assumes that feedback loops operate through the mechanisms of evolution rather than adaptation. A state in decline feels the pressure of the selection mechanism just as acutely, since the anarchy of politics guarantees, in Stalin’s words, that ‘those who lag behind are beaten’. In effect, the daily execution of government policy provides a continuous feedback mechanism to that state. In democracies, elections and referenda provide another periodic feedback mechanism, which may suggest a heretofore under-theorized benefit of democratic

⁹ See, for example Elster’s (1983) critique of evolutionary applications in the social sciences.

institutions – they are more sensitive to feedback and therefore more adaptive than their non-democratic counterparts.

Moreover, complex systems are not merely adaptive but co-adaptive. This means that actors are not only shaped by the system but can also shape the system itself. In the biological world, the environment affects the evolution of animals within it, but animals themselves can also shape their environment (Thompson 1982; Jervis 1997, 48–49). In the social sciences, the influence of powerful actors upon systems often serves as a source of systemic transformations. For instance, states exist in a world of international norms, and in some cases these norms constrain the scope of legitimate behavior. But actors can also take steps to reshape these constraints or forge new ones: for example, in Finnemore and Sikkink's (1998) model of norm development, norm entrepreneurs can alter the existing normative landscape through persuasion and socialization. This process is facilitated when early norm promoters possess a high level of relative power, whether material or ideological. Similarly, studies of firm organization note that while market forces regularly constrain firm behavior, powerful or innovative firms can take steps to radically alter their business environment (Volberda and Lewin 2003). In both cases, the unit's ability to defy or transcend systemic constraints depends on the amount of relative power possessed by that unit. This focus on relative power is a central concern for structural realism, pointing toward theories of systemic transformation consistent with its fundamental assumptions about anarchy. But for structural realism system-unit interaction is relegated to a one-way street: the system shapes state behavior but not vice versa. Despite emphasizing the importance of relative power, the theory thus ignores the co-adaptive nature of the very framework it seeks to inhabit. In that sense, the logic of complex systems offers a useful critique of structural realism, as examined below.

The uses and limits of complex systems

Before turning to the application of CAS to specific puzzles, and bearing the above definition in mind, it is important to briefly outline what complex systems can and cannot accomplish. Most applications of complex systems in international politics rely on agent-based simulations. Cederman and Girardin (2010), for example, model the emergence of territorial states in early modern Europe, while Cioffi-Revilla and Rouleau (2010) examine the effects of insurgency in a complex polity. In both cases, agent-based simulations are used to form hypotheses and make testable predictions about outcomes. But despite their advantages, agent-based models have a tenuous and rarely examined relationship with mainstream approaches to

social science. As Axelrod (1997, 3–4) and others have noted, agent-based modeling is neither inductive nor deductive: like deduction, it starts with explicit assumptions, but does not prove theorems. Like induction, it uses data to predict outcomes, but produces this data from a set of rules rather than real-world observations.

As Harrison (2006, 186) notes, positivism relies on two sources of knowledge, deductive logic and empirical evidence, wherein ‘the former is *a priori* true; the latter must be verifiable by experience’. By rejecting both approaches, agent-based modeling distances itself from the positivist emphasis on testable propositions. Thus Cederman (1997, 220) explicitly rejects positivism in his models of state formation and collapse, in which simulations become ‘a source of theoretical inspiration rather than a positivist, prediction-generating crystal ball’.¹⁰

Yet if agent-based simulations are perceived as a throat-clearing complement to positivist methods, they will possess limited appeal for most scholars of international relations. Because of the limits of simulation models, argue Earnest and Rosenau (2006, 149), the entire body of complex systems theory amounts to ‘little more than thought experiments on a computer – much ado about nothing’. Here, however, they make the mistake of conflating complex systems with agent-based modeling. While often connected, the two concepts are not synonymous. Agent-based models are not a part of the ‘hard core’ of the CAS research program (Lakatos 1980). Instead, they are a tool for testing hypotheses drawn from the principles of CAS.

Without agent-based simulations, CAS lacks the ability to create hypotheses that can be verified, replicated, and employed to test theories. The inherently contingent nature of international politics, as well as actors’ ability to detect patterns (and in doing so disrupt them) greatly limits the ability to make determinant predictions. This built-in uncertainty means that ‘the same axioms are likely to produce different, even divergent, outcomes’ (Earnest and Rosenau 2006, 148). Yet complexity does not imply chaos, since systemic effects produce regularities. The system imposes itself upon the choices and preferences of the actors through recurring, identifiable, and non-obvious mechanisms.¹¹ While the principles of CAS are too broad to produce a testable theory of international politics, they can point to hidden deficiencies and omissions in existing theories.

¹⁰ Likewise, for Axelrod (1997, 4) agent-based modeling is a ‘way of doing thought experiments’ designed to ‘aid intuition’. And Kreutzer (1986, 7) argues that ‘simulation is used at a prototheoretical stage, as a vehicle for thought experiments’.

¹¹ I use the term in Elster’s (1998) sense of mechanisms as ‘frequently occurring and easily recognizable causal patterns’ that reside at the middle level of explanation between universal laws and descriptive case studies.

As the above definition and Jervis (1997) illustrate, the basic insights of complex systems – contingency, non-linearity, strategic interaction, and emergent properties – do not depend on the methodology of agent-based modeling. Instead, these elements can serve as useful tools for critiquing approaches to international relations. Complex systems are thus best conceptualized as an analytical framework, or a set of epistemological principles that highlight mechanisms which can be used for examining the underlying assumptions of commonly used theories.¹² To echo Snyder's goal in a volume on complexity in global politics, this article does not seek 'a new theory of the international system' but offers 'suggestions and illustrations for thinking in new ways about international systems effects' (Snyder 1993, 2, 20).

CAS and change in structural realism

The logic of complex systems, and particularly the notion of emergent properties, is a central if often implicit element of structural realism. Waltz (1979) goes to some lengths to differentiate between systemic and reductionist approaches. The latter, which seeks to explain phenomena by breaking them down into smaller components, is not suitable when dealing with an environment in which the whole cannot be known through the study of its parts (Waltz 1979, 18–19). When properties of a system cannot be deduced from its components, and when intentions differ from outcomes due to systemic pressures, the object to be studied becomes inherently irreducible (Waltz 1986, 342; see also Nexon and Goddard 2005, 10). This emphasis on unit-system separation is also a crucial element of complex systems (e.g. Miller and Page 2007, 27).

In structural realism the repeated interaction of states gives rise to anarchy as the central emergent property of the international system. And because the international system is competitive and anarchically structured, it will select for states that are able to successfully ensure their own security. Those who do not will fall by the wayside (Waltz 1979, 71, 91, 118–19). This selection is manifested through competition and socialization – the twin engines through which the system exerts pressure upon states. States competing in anarchy will be eliminated on the basis of their relative fitness, and socialization produces norms that encourage the survivors to adopt the qualities of their successful peers.¹³

¹² Gilpin (1981, 2) defines a 'framework' as 'an analytical device that will help to order and explain human experience', as contrasted with a theory, which serves as 'an overarching explanatory statement'.

¹³ For the often-overlooked emphasis on the importance of socialization and emulation in structural realism, see Waltz (1979, 74–77, 92, 118–19, 127–28).

The international system thus acts as catalyst for a perpetual and intense process of turmoil – change both within surviving states, and in the combination of states that comprise the international system. The structure of anarchy acts as a sieve through which unfit institutional arrangements pass into the dustbin of history. It is surprising that such an implicitly dynamic theory should be criticized for being so ahistorical, so disinterested in process, transformation, and adaptation (see, e.g. Ruggie 1983; Ashley 1986; Kratochwil 1993; Schweller 1996; Spruyt 1996). The criticism holds, however, because structural realism abandons the logic of complex systems in favor of a continuity-oriented framework. It does so by focusing exclusively on explaining state behavior while dispensing with the concomitant explanations of state attributes. Because anarchy is the fundamental condition of political life, state behavior in one period will resemble state behavior in another. The theory thus powerfully explains surprising historical ‘rhymes’, as Mark Twain called them, of states breaking treaties, entering seemingly irrational arms races, balancing against aggressors, and acting in proportion to restraint defined by relative power. But as the emphasis on competition and socialization suggests, the structure of anarchy shapes not only unit behavior but also unit properties, and this aspect of change is a sorely neglected dimension of structural realism. Focusing on the primacy of international structure allows the theory to ignore the intentions of states, but not their domestic characteristics. To employ Waltz’s own oligopoly metaphors: saying that the insides of states do not matter because structure dominates decisions is akin to saying that a firm’s internal organization does not matter because the market dominates firm behavior. Both are patently untrue. The international system selects for certain institutional features over others, although the criteria for selection may change over time. The unit’s success, in other words, depends on both the choices it makes and how it organizes itself. The pressures of anarchy can thus explain both continuity in domestic behavior and dis-continuity in domestic institutions.

Constitutional limits on state power, for example, increase individual liberty – but more importantly, in doing so they enhance state stability. Weingast (2002, 680) echoes a common refrain of institutionalist theory when he argues that ‘when constitutions limit the stakes of politics in ways valued by most citizens, the citizens are less likely to resort to extraconstitutional means to defend themselves’. The question of stable succession is of crucial importance in autocracies, which often lack institutionalized mechanisms for the transfer of power. Institutional arrangements that credibly commit everyone to the rules of the game help states overcome such uncertainties. In stable democracies, the losing party gives up power because its leaders know they will have a chance to regain

it in the future (Przeworski 1991). Weingast concludes: 'This argument implies a selection effect: democracies that limit the stakes of politics are more likely to survive'. Here, by using the term 'democracies' instead of 'states', Weingast makes the common error of confounding the selection process with the outcome to be explained: states that limit the stakes of politics are more likely to survive, and those states look like democracies.¹⁴

Moreover, institutions that promote credible commitments not only create political stability but may also foster economic prosperity, allowing countries to endure crises and triumph in wars – in short, to assure their own survival in an anarchic and competitive international system.¹⁵ Dictatorial regimes, by contrast, face institutional dilemmas that democratic regimes can overcome. The possibility of treason forces dictators to hire on the basis of loyalty rather than merit, leading to fewer talented people within the state and especially the military. Fear of coups can lead autocratic elites to play factions against each other, hampering overall government effectiveness. More generally, any use of incentive schemes by a dictator is limited by the fact that rewards are conditional on his willingness to keep promises, while punishments are conditional on his survival (Egorov and Sonin 2011). Such regimes cannot credibly limit the scope of politics.

Within the framework of structural realism, democratization can thus be conceived as a dynamic process of selection and socialization guided by systemic pressures. From this perspective, democracies survive and multiply because they are better able to face the pressures of anarchy than other regime types, and inspire others to emulate their success. This need not imply that the process is teleological or that democracy is the logical end state of regime evolution (e.g. Fukuyama 1992). The process of selection is shaped by the kind of pressure exerted by the system, and the nature of this pressure is subject to change due to exogenous shocks or transformations in the nature of the actors. The relative fitness of a regime type, in other words, shifts due to changes in its environment. A future international system may select for state attributes that are unrelated to democracy, or indeed are biased against it. The onset of economic crises in

¹⁴ Huntington (1968), for example, argues that democracies possess more labile and 'adaptive' institutions, which allow them to better manage the tumult associated with social and economic modernization. Similarly, Mannheim (1940, 112) notes that 'authoritarian dictatorships certainly have far less elasticity than democratic forms of government'.

¹⁵ Lake (1992), Reiter and Stam (2002), Acemoglu and Robinson (2012). One of the most established findings in political science is that stable democracies are associated with higher levels of economic development, although debates continue about the exact nature of this relationship. See, for example, Geddes (2007).

Europe and the United States since 2008 has already led a number of observers to argue that democratic capitalism is in the process of being replaced by state capitalism – an institutional bundle embodied by China and characterized by a capitalist system of production undergirded by state ownership and guidance. This regime type, it is argued, is better able to withstand the vicissitudes and complexities of the modern global economy (Gat 2007; Bremmer 2009; Halper 2010). While this outcome remains uncertain, the systemic pressures driving the evolution of domestic institutions are unlikely to possess a logical end-point. When measured against the timespan of civilization, large-scale democracy is a relatively new institutional development.

Beyond explaining domestic change, a related problem for structural realism is its apparent inability to account for systemic transformations. This deficiency also stems from an emphasis on continuity – in this case, assuming the persistence of systemic constraints upon unit actions. For structural realism, the international system is taken to be the unmoved mover: it arises out of the interactions among states and thereafter shapes their behavior. But the logic of co-adaptation in complex systems means that the relationship between units and systems is a mutual one, and that while the international system shapes the countries within it, countries can also take steps to shape the system itself.¹⁶ The system does not exist as an external and unchanged construct, and its emergent properties, arising from the continued interaction of its constituent units, are neither static nor isolated from those units. Anarchy, in other words, is not the only possible emergent property of the international system, although it has arguably been the most persistent. Because anarchy stems from the lack of an external enforcer, shaping the system in the absence of a world government is an extremely difficult task, and one that can be pursued only by the most powerful states.

This does not mean the task is in impossible one. Settlements after major wars are a clear example of this dynamic at work. The treaties of Westphalia (1648), Utrecht (1713), Vienna (1815), Versailles (1919), and especially the set of agreements after 1945 all attempted to shape the nature of the international system via the collective action of the most powerful actors within it. These agreements ‘attempted to fashion a stable

¹⁶ There is in fact some ambiguity about whether anarchy is an input or an emergent property of the system, as demonstrated by the schematic in Waltz (1979, 100). In the figure, states both create the system and are shaped by it. This duality serves to emphasize the feedback-loop nature of the argument: the system and the states exist in a state of constant co-adaptation. For a discussion on the relationship between the system and its units in structural realism, see Wendt (1987, 341–43).

status quo and establish a mutually recognized set of rules and rights', Gilpin (1981, 36) writes, creating rules 'for the resolution of disputes, the imposition of penalties on the losers, the mutual recognition of security guarantees, etc.' In the language of complex systems, these were attempts to institutionalize mechanisms of negative feedback in order to enhance the system's stability. The frequent failures of these attempts act as a vivid reminder of the power of systemic constraints, but also illustrates that in some cases, powerful actors can take steps to alter their environment in significant ways.

The Concert of Europe, for instance, was an attempt by powerful states to shape the nature of the European system. The Concert exercised negative feedback by coordinating the repression of revolutionary uprisings throughout central Europe (Elrod 1976; Kupchan 2010). This arrangement successfully promoted stability on the continent for over three decades before being irreparably damaged by the Spring of Nations. And US behavior in the years after World War II is perhaps the most prominent example of a very powerful actor bending the system to fit its own needs and desires. After its triumph over Germany and Japan, the United States pursued a systemic transformation of the international system via the creation of a global architecture whose institutions and values reflected the material and normative preferences of the United States. These institutions coordinated the nature of interactions among states via the Bretton Woods system, the creation of NATO in Europe, the OAS in Latin America, and a number of bilateral treaties in Asia. The United States also used its military might to impose regimes through coercion, and employed its economic influence (via the Marshall Plan in Europe and the Dodge Line in Japan) to embed other states in a web of trade and cooperation (Hogan 1989; Ikenberry 2000; Judt 2005).

In a world with a few powerful actors, altering the international system requires the difficult task of continued coordination of national interests. The Concert's failure after 1848 showcases the difficulty of such cooperation under anarchy. Likewise, the global institutional infrastructure created by the United States after World War II required the presence of an actor with massive capacity to bend and transcend systemic constraints. To the extent that this global infrastructure has been underpinned by US power, American decline and the accompanying unease about the future of the post-war system illustrates that systemic imperatives are indeed powerful – though, once again, neither constant nor eternal.

A unipolar world is one in which the hegemon can exercise considerable latitude. It is a tenet of structural realism that systemic pressures are able to constrain state behavior only in proportion to that state's material capacity. Thus the more powerful the hegemon, the more latitude it has in

shaping the international system. In the postwar era, writes Arrighi (1994, 67), US hegemony has ‘considerably restricted the rights and powers of sovereign states to organize relations with other states and with their own subjects as they see fit’. In those rare moments when an especially powerful state (or a concert of states) achieve a high level of relative power, systemic constraints are at least temporarily subject to revision by these great powers, and the emergent properties of anarchy are ameliorated or transformed. Just as escaping anarchy at the domestic level requires the rejection of individual sovereignty, transcending anarchy at the international level demands the suppression of national sovereignty, which can occur through overwhelming force (i.e. hegemony) or voluntarily through the coordination of national interests among powerful states. Because both hegemony and great power cooperation are immensely difficult to sustain, the emergent properties of the international system are usually defined by anarchy. Nevertheless, over the past few centuries, abrupt hegemonic transitions – that is, periods of sudden rise and decline of great powers – have created short-lived but immense opportunities for systemic transformations. Namely, they opened up a possibility for rising hegemonic powers to shape the regimes of others through coercion and imposition, to create international institutions that govern interstate relations, and to set the norms that bind countries in a society of states. Consistent with the principles of structural realism, systemic transformations are directly tied to the geopolitical cataclysms produced by abrupt shifts in relative power.

In sum, by focusing on state behavior at the expense of state attributes, structural realism ignores the dynamics of domestic transformation embedded in its core principles. Likewise, by limiting unit-structure interaction to a one-way relationship, it ignores the sources of systemic transformations that logically flow from its focus on relative power as the central element of international relations. Here, complex systems can help shed light on both elements of change. With regard to domestic transformations, the principles of complex systems delineate how the interaction of systems and units can be expanded to include the analysis of unit properties as well as unit behavior. Turning to systemic transformations, the logic of co-adaptation illustrates how powerful actors can take steps to alter and transcend the nature of the international system.

Waltz has consistently argued that structural analysis is better suited for explaining continuities, and that explanations of change are thus located at the unit level (Waltz 1986, 327–29, 1996, 56–57).¹⁷ But examining structural

¹⁷ See Nexon and Goddard (2005, 30–34) for an insightful elaboration. They likewise note that structural realism offers an implicit theory of international change, but locate this theory at the level of units or unit-level interactions.

realism through the prism of CAS suggests that change is far from an alien element in its theoretical framework. More generally, structural-functional theories need not be associated with static or ahistorical approaches to international politics.¹⁸ Mechanisms of both unit-level and systemic change are perfectly compatible – are indeed an essential element – of any structural theory of international politics.

CAS and democratic diffusion

Turning to diffusion of democracy, complex systems offer a useful reframing of this still-developing concept. Over the past few years, studies of democratic diffusion have begun to move beyond aggregative empirics and toward the analysis of specific causal mechanisms that produce these cross-border effects. However, the vast majority of these approaches still emphasize positive feedback as the central element of diffusion. That is, they seek to explain how an event in one country increases the likelihood of the same event in another country – self-reinforcing tendencies that lead to institutional contagion across borders through mechanisms like coercion, competition, learning, or emulation (Simmons *et al.* 2006). Simmons and Elkins (2004, 171), for example, characterize the diffusion of liberalization as ‘the spread of liberal economic ideas and policies throughout the world’. And discussing the diffusion of democracy, Brinks and Coppedge (2006, 464) focus on neighbor emulation, defined as the process by which ‘countries tend to become more like their immediate geographic neighbors over time’.

The logic of complex systems, however, strongly suggests that positive feedback is analytically inseparable from negative feedback. As the above discussion of non-linear interactions illustrates, in complex systems qualitatively different behaviors can share the same explanatory mechanisms. In such instances the same initial cause leads to both self-reinforcing and self-dampening dynamics, and the interaction of these two sets of factors shapes both actor strategies and final outcomes. The standard view of diffusion as a unilinear and self-reinforcing process therefore describes only part of the story.

Some of the diffusion literature has very recently and tentatively begun to examine the negative forces that impact the spread of democratization.

¹⁸ Not all variants of realism are characterized by emphasis on continuity. Gilpin (1981), for example, explicitly focuses on explaining change in the international system, as do a number of other neoclassical realists. It is beyond the scope of this article to examine the vast realist literature through the prism of complex systems; instead, my goal here is to explicate the generally under-theorized mechanisms of change within structural realism and to examine the consequences of structural anarchy on domestic transformations.

In a study of the Color Revolutions, for example, Beissinger (2007) argued that the initial successes of the protests could be attributed to elite defection. That is, successful cases of democratization demoralized incumbent elites by lowering expectations about their survival in office, facilitating their exit and encouraging pro-democracy bandwagoning. But as the revolutions continued to spread, a dampening dynamic took hold, which Beissinger dubbed the ‘elite learning’ model. Over time, incumbent elites learned critical lessons from the failures and successes of their peers, and imposed additional constraints to prevent democratization from succeeding. Fear of contagion led to greater restrictions on civil society by leaders in Russia, Belarus, Uzbekistan, Azerbaijan, and Kazakhstan. As adaptive actors, these leaders soon saw the benefits of taking aggressive steps to stem the tide. They began to proactively suppress opponents, shut down democracy-promoting NGOs, establish closer relations with Russia, and bolster their own pro-regime youth groups to offset the impact of transnational youth movements (Beissinger 2007, 270; see also Torbakov 2005; Way and Levitsky 2006; Tolstrup 2009). In this wave of diffusion, elite defection served as the mechanism of positive feedback while elite learning served as negative feedback, and it was the mutual interaction of these effects that shaped revolutionary outcomes in the post-Soviet space.

To take another example, della Porta and Tarrow (2012) have recently argued that street protests and police responses to these protests mutually shape each other, a process they call ‘interactive diffusion’. ‘Just as police forces responded to protester behavior with both repression and reform’, they write, ‘demonstrators adopted their performances in response to them’.¹⁹ A similar learning dynamic occurred in Iran during the 2009 protests, in the course of which the country’s authorities ‘had familiarized themselves with the tactics that would be used’ and as a result could ‘counterbalance’ them (Beacháin and Polese 2010, 237). Likewise, Bunce (2001, 5) argues that diffusion is always ‘double’ – that is, that while successful examples ‘invite emulation by those who seek similar changes in their own country, they provide at the same time an instructive warning’ to incumbent elites.

The most explicit effort to include counter-diffusion as part of theories of diffusion has been made by Weyland (2009 and 2010). Examining the historical waves of mass contention of 1830, 1848, and 1917, he argues that many of their failures can be attributed to a type of elite adaptation: a

¹⁹ della Porta and Tarrow (2012, 143). Both protestors and the police, they conclude, should be viewed ‘as part of an interactive process of social learning between protesters and their antagonists’ (p. 144).

democratic overthrow in one country ‘can induce established rulers elsewhere to prepare against challenges and thus stifle replications’. As a result, ‘many emulation efforts end up failing, and the reaction they provoke can exacerbate repression and set back the cause of democracy’ (Weyland 2009, 1155). In 1848, Weyland (2010) argues, revolutionary leaders pursued democratic reforms in part because of cognitive heuristics that caused them to misinterpret other examples and over-estimate their own chances of success. As a result, many of these movements lacked the pre-requisites to achieve their goals and were suppressed by the continent’s conservative rulers.

In these analyses of diffusion, negative feedback enters in an implicit way. The logic of complex systems places these insights onto firmer theoretical ground. From this perspective, the likelihood of revolutions spreading across borders depends on which form of feedback is more likely to prevail. Factors that produce dissatisfaction – high food prices, unemployment, and perception of corruption, among other things – make revolts more likely. The diffusion of revolts is shaped by the prevalence of communication and information channels across borders, which in turn depends on observable factors like education levels, television ownership, and shared languages. The suppression of these revolts, on the other hand, depends on factors such as the resolve and reputation of the dictators, their organizational capacity, their relationship with the military, and their ability to play off rival factions against each other. A useful path for future research on diffusion is to consider more deeply the specific factors that make either type of feedback more powerful and thus more likely to prevail.

Moreover, analyzing diffusion as the interplay of positive and negative feedback helps highlight the important causal linkages between the two sets of mechanisms. Factors that arrest and reverse diffusion are intimately linked to the factors that produce diffusion in the first place. Waves of democratic diffusion have nearly always been followed by partial or total collapse of the waves, a question that has not been seriously examined in the comparative democratization literature. In the 20th century, the three major cases of democratic diffusion experienced reversals shortly after their peak – a catastrophic reversal after 1919, a severe one after 1945, and a partial but persistent one after 1989. Here the interaction of positive and negative feedback appears to play an important role. The initial diffusion of democracy creates extremely strong but temporary incentives for domestic reforms, including within states that would not have undertaken these reforms otherwise. The result is a period of democratic overstretch that stems from a combination of both cognitive and structural factors. First, cognitive biases that encourage optimistic opposition leaders to emulate

foreign protests also ensure that this emulation takes place under unfavorable domestic conditions, which then limits the spread of protest (Weyland 2009). These biases facilitate the initial diffusion of democracy, but also lead to the failed consolidations that follow. Second, at least some of the diffusion occurs in countries that lack the domestic pre-requisites for successful democratic consolidation, such as economic stability, an independent bourgeoisie, or past experience with democratic governance. As diffusion continues to unfold, negative factors such as elite resistance and structural obstacles begin to re-assert themselves. After World War I, for instance, the defeat of absolutist monarchies, coupled with Woodrow Wilson's calls for popular self-determination, created intense incentives for democratization and forged a wave of liberal reforms across the European continent. However, these new regimes had immense difficulties consolidating democracy in countries plagued by economic uncertainty and ethnic unrest, leading to a number of democratic reversals (Polanyi [1944] 2001; Huntington 1991). In processes of diffusion, therefore, the catalysts behind the initial spread of democracy can plant the seeds for the negative feedback that hastens its demise. The proliferation of hybrid regimes over the past two decades followed a similar dynamic: the collapse of the Soviet Union initially created powerful and self-reinforcing pressures for global democratization. But as these immense external incentives dissipated, a number of regimes became unable to sustain these reforms due to unfavorable domestic circumstances, leading to a democratic rollback (Lawson 1999; Levitsky and Way 2010).

In general, each instance of successful democratization accomplishes two opposing tasks – it informs other pro-democracy movements about effective tactics and organizational strategies, and reveals to elites which strategies of suppression will or will not succeed. Learning the fates of their peers causes autocratic elites to update their beliefs about the necessity of suppressing the protests. This dynamic manifested itself in the Arab revolutions, where initial successes were followed by increasingly forceful efforts by autocrats to repress the uprisings. 'As the Arab awakening has spread', noted *The Economist* in the early stages of the Arab Spring, 'each leader has sought to save his skin by being crueller than the last'. Learning from recent outcomes, dictators changed their strategies in line with their updated beliefs:

In Tunisia Zine el-Abidine Ben Ali met peaceful crowds with concessions. In Egypt Hosni Mubarak tried to ride out the protests by mixing concessions with force. In Bahrain King Hamad bin Isa al-Khalifa resorted to violence, but did not have the stomach for the fight. In Libya Mr Qaddafi seems to crave blood (*Economist* 2011, 11).

Though Qaddafi's attempt to push back against the uprising ultimately failed, it required extensive outside intervention, and his behavior demonstrated the importance of negative feedback in processes of diffusion. More recently, the case of Egypt illustrates how elites can learn to manage rebellion more effectively even within the same country. In November 2011, the country experienced another major wave of unrest. Thousands of Egyptians gathered in Tahrir Square to demand that the Supreme Council of the Armed Forces (SCAF) cede power to a civilian-led government. Yet unlike the initial wave of protests in January 2011, these demonstrations failed to achieve their goals because the army had learned to contain the demonstrations without physically suppressing its participants. '[T]his second revolution has one major problem', writes Trager:

so long as Egyptians avoid Tahrir Square, it is somewhat easy to ignore... [T]he generals have taken at least one lesson from the former dictator's downfall: the first step to ending a revolt is preventing it from disrupting the lives of ordinary people. In this vein, they have made Tahrir's perimeter a firm border between the revolutionary action and regular life (Trager 2011).

Because mechanisms of positive and negative feedback appear across a wide variety of cases, analyzing their interaction can help clarify the parallels and contrasts among different waves of democratic diffusion. While the Arab Spring has drawn superficial comparisons to the 1989 revolutions in Eastern Europe, the mechanisms of negative feedback have played a vastly different role in the two waves. In particular, resistance to diffusion – both within states and in the international system – was a much more prominent element in 2011 than in 1989, while positive feedback in the form of outside assistance has been a much weaker element. During the Cold War, Soviet military presence was the major instrument of negative feedback in eastern Europe, employed whenever democratization threatened to spiral out of control, as it did in East Germany in 1953, Hungary in 1956, or Czechoslovakia in 1968. In 1989, however, the collapse of the Brezhnev doctrine removed the major obstacle to democratic diffusion, which then encountered few obstacles on the way to democracy's spread in the region. (There were, to be sure, feeble attempts at negative feedback such as Ceaușescu's resistance in 1989 and Soviet military actions in Lithuania in 1991.) Moreover, the international environment, in the form of democracy promotion by Europe and the United States, as well as the prospects of EC membership, greatly bolstered both the legitimacy and the appeal of democratic diffusion.

In the case of the Arab Spring, however, the presence of negative feedback has been far more pronounced, portending a much more difficult

and uncertain outcome for the countries in the region. The Arab world has not witnessed the equivalent of a Soviet collapse; on the contrary, regional great powers like Saudi Arabia have aided their autocratic peers in clamping down on protests (Bradley 2011). Unlike Communist puppet states, rulers in the Arab world command both a degree of loyalty and access to resources. In addition, the role of the international system has been much more ambivalent. The West has at times reinforced the process of diffusion by aiding popular uprisings, most notably in the case of Libya. In other cases, however, such as Yemen and Syria, they have declined to promote democratization or counter the suppression of protests by the sitting elites. Moreover, there is no regional equivalent of the European Union to provide additional incentives for the successful consolidation of democracy (Way 2011).

In sum, the diffusion of democracy in the Middle East has proceeded in a setting where mechanisms of negative feedback are much stronger – and the mechanisms of positive feedback much weaker – than was the case in 1989. Both episodes were instances of diffusion; but reframing diffusion as the interplay of opposing forces clarifies the important differences between them. Comparative analysis of waves of diffusion thus needs to take into account both the factors that lead to the spread of revolution and factors that seek to control and reverse this spread. From this perspective, the most comparable candidate for the Arab Spring is the 1848 Spring of Nations. This wave of contention reflected the intensification of regional dynamics that bolstered popular sentiment against unrepresentative elites. Like the Arab Spring (but unlike 1919, 1945, or 1989), diffusion stemmed from horizontal contagion rather than vertical shocks stemming from sudden shifts in the global distribution of power. Unlike the Color Revolutions, whose timing was driven by internal dynamics centered on flawed elections – and which therefore stretched out over a number of years – the timing of the 1848 revolts was exogenous to domestic processes, leading them to spread throughout Europe in a matter of months (Robertson 1968; Rapport 2008). The Spring of Nations was intense, rapid, far-reaching, and ultimately unsuccessful, defeated by the concerted efforts of the region's autocratic rulers. At the same time, it left a deep footprint on the subsequent evolution of European states. Given the similarities in the content and pace of interaction between positive and negative forces, the Arab Spring is likely to meet the same fate.

Conclusion

CAS are not an epistemological panacea or a foundation for a self-contained theory of international politics. But highlighting the limitations of the

approach can also highlight its strengths. As I have aimed to demonstrate, it is especially useful as a framework for thinking about change in global politics. Examining structural realism through the prism of CAS clarifies its apparent inability to explain domestic or systemic transformations. The theory's emphasis on continuity stems from viewing structural approaches as explanations for recurring patterns of unit behavior, while ignoring the dynamic effects of anarchy on state attributes. The neglect of political change in structural realism therefore stems not from its ontology but from the failure to fully develop the implications of complex system dynamics within its own underlying assumptions. Structural-functional theories of international politics need not be associated with static approaches to political transformation.

Unlike realism, the study of democratic diffusion is a relatively new area of research in international politics. Since the collapse of the Soviet Union, it has become increasingly obvious that international factors can play a crucial role in domestic transformations – that how democracy spreads, in other words, can provide important insights into the nature of democracy itself. The recent shift from aggregative empirics toward theory-building is a healthy development for the diffusion research program. Most approaches, however, continue to suffer from an overemphasis on diffusion as the 'spread' of democratization. Moving the focus away from unilinearity and toward the interplay of positive and negative feedback can help sharpen the focus on specific factors that propel and inhibit this process. While the predictive capacity of diffusion theories is limited by chance and contingency inherent in complex systems, focusing on mechanisms that reinforce and weaken diffusion can highlight regularities that make particular outcomes more or less likely. Future theories of democratic diffusion should explicitly specify mechanisms of both positive and negative feedback – catalyzing forces in the form of mass protests, emulation, external democracy promotion, and elite defection, as well as dampening forces such as authoritarian repression, the regional environment, cognitive biases by opposition leaders, and lack of structural pre-requisites for the successful consolidation of pro-democracy movements. The mechanisms that produce both types of feedback persist across a number of different cases, revealing common patterns and paving the way toward integrated theories and typologies of democratic diffusion.

In occupying the middle ground between metaphor and theory, the principles of complex systems help highlight these recurring mechanisms. By providing new ways to think about change in anarchic systems or the causes of failed democratic diffusion, the principles of CAS offer not only a critical research program but a generative one as well. To be sure, the contingency of systemic effects prevents the application of strong *a priori*

assumptions toward the creation of novel social science theories. But insofar as complex systems highlight mechanisms that probe the implications of existing theories, they offer pathways toward better explanations of political outcomes, even if they do so in non-systematic or non-nomological ways. And while this article has focused on two specific issues in international politics, the framework of complex systems is amenable to analyzing other issues involving change and continuity in global politics. At the general level of theory, this requires a careful definition grounded in the context of international relations, and the disaggregation of evolutionary processes from adaptive ones. Applying the framework to concrete puzzles, moreover, requires an awareness of its weaknesses and a focus on system-unit interaction as a prism for examining processes of change. Future applications of CAS to specific questions in international politics can further the complexity research agenda beyond both metaphors and agent-based models (Hoffman and Riley 2002; Bousquet and Curtis 2011). More importantly, this approach can shed light on the dynamics of stability and transformation in international politics, and in doing so advance the scholarly understanding of global and domestic transformations.

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