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SYSTEMS AND STRATEGY: CAUSAL MAPS, COMPLEXITY, AND STRATEGIC COMPETITION
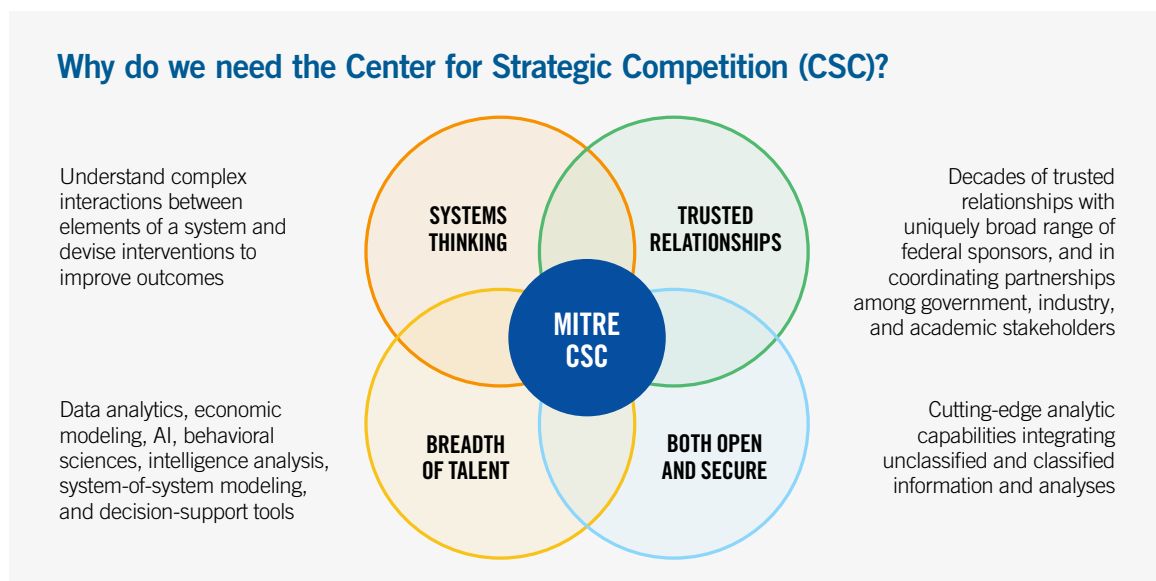
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Today's competitive strategy challenges are multi-faceted and complex. They exist in arenas of hard, "sharp," and soft power—from military capacity, technological innovation, economic development, espionage, trade, and finance to cyber conflict, law enforcement, politics and culture, and diplomacy. Well-crafted competitive strategy requires a true system mindset.

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Executive Summary

In developing and implementing an effective "whole of nation" (WON) response to the WON challenges we face in the modern world, such as those presented by China's full-spectrum competitive strategy, it is essential to provide U.S. and other Western leaders with the holistic situational awareness, "systems"-informed analysis, and cross-jurisdictional policy coordination that a genuinely "comprehensive" national strategy—and strategic "campaigning"—requires. China's effort to create what might be called a "leverage web" of mutually-reinforcing instruments of power and influence confronts U.S. leaders with a genuinely systemic problem of long-term competitive strategy. Yet the U.S. Government is presently not well organized to meet this challenge, and while our leaders struggle to draw meaning and divine useful guidance out of a bewildering cacophony of recommendations, prognostications, and would-be policy inputs, traditional means of aggregating policy advice in the U.S. system do not generally go much beyond the stereotype of "BOGSAT" methodologies: a "Bunch of Guys Sitting Around a Table." This paper aims to help suggest to such leaders—and those who do or would advise them—some ways to help meet this need.

We need much more sophisticated ways to assess and describe our strategic environment, to understand key patterns and dynamics therein that affect U.S. interests—including the *systemic* patterns that can be generated by and within complex systems—to evaluate possible courses of action (COAs) in response to developments, to identify ways to wield coordinated levers of national power in response to strategic challenges, to monitor the impact of policy interventions upon that environment, and to *repeat* such analysis and COA evaluation on a timely and iterated basis so as to ensure that U.S. responses fit the situation. Such understandings also need to be informed by what the bounded rationality of human beings and Complexity Science can teach us about behavior in such contexts, for complexity challenges the general assumption of linearity that so often underlies policy development (*i.e.,* that by devising the right policy input one can reliably drive the system to the desired outcome). National leaders thus cannot predictably "direct" outcomes in the complex adaptive social system of the global security environment. (The problem is compounded by the fact that one cannot "direct" what one cannot sense or is not aware of. Complexity also means that something happening in an area not seemingly relevant to what one is considering or is responsible for can perhaps have profound effects on one's equities nonetheless. Complexity dynamics and the data and analytical difficulties of holistic situational awareness thus exacerbate our challenges.) Having said that, policymakers can perhaps yet hope at least to influence events constructively—particularly if their decision-making is informed by "systems"-based analyses potentially pointing them to "leading indicators" of special significance among the broad universe of observable phenomena, but at the very least giving them an appreciation for the dynamics and patterns that manifest in that environment.

The MITRE Corporation's Center for Strategic Competition has been working to develop and refine methodologies to help: (1) find ways to aggregate the input of multiple Subject Matter Experts (SMEs) in a scalable way through the construction and aggregation of causal maps; and (2) understand such causal maps in ways that identify characteristic patterns therein in order to focus policy deliberations upon the development of effective interventions designed to break, impede, or nudge such systemic dynamics in more salutary directions. This approach allows a considerable degree of complexity to be intelligibly captured, while yet permitting one to "unpack" advice given on the basis of such maps in detail, allowing leaders to assess its plausibility, identify its underlying assumptions, spot the areas of relative consensus or contestation encoded therein, test counterfactuals against received wisdoms, and explore the merits and demerits of alternative policy interventions in a rigorous and systematic way. Using such tools, it is also possible to discern and visualize the most significant sub-system interrelationships in a complex system such as that of People's Republic of China (PRC) global strategy. Identifying characteristic configurations and the dynamics that may lie behind systemic behavior can help open up important new insights into strategy and possibilities for policy interventions.

Today, it is increasingly appreciated that the structure, dynamics, and attributes of systems are important factors in international behavior, and that they can have a significant impact upon the threats facing and opportunities available to states in a competitive security environment—particularly in areas of economic statecraft. Complex systems can have many attributes, and various different (but generally complementary) models can be used to help understand them. What seems inescapable, however, is that we do need to understand systems as such. As Western leaders struggle with competitive strategy challenges vis-à-vis the PRC in the years ahead, for instance, it will be necessary to be much better at evaluating the policy implications of system structure and behavior. Since it is possible for essentially any form of asymmetric dependence to be exploited, we must understand how potential adversaries may be seeking to construct and manipulate such dependencies.

Causally mapping an adversary's strategy and analyzing it from a complex systems perspective—thus approaching it *as a policy system*, as it were—can allow one to understand its dynamics in order to help identify: (a) where the adversary's activities present the greatest threat; (b) where one's own policy interventions may have the greatest chance of impeding, delaying, or reversing that adversary's successes by affecting the behavior of that system as a whole; (c) how to make oneself more resilient in the face of the adversary's efforts to use its own policy instruments for competitive advantage; and (d) what the consequences of particular COAs and the adversary's likely responses would be, whether intended or unintended. Systems-focused analysis, for instance, can help identify possibilities for changing the structure of the adversary's policy system via policy interventions that could add new causal connections among key actors, or that impede, delay, or alter positive feedback dynamics, and introduce negative feedbacks that could dampen "runaway system" dynamics.

Such an "effects-based and systems informed" approach to framing the questions one asks oneself in the course of developing and implementing policy can add valuable new perspectives, and may indeed point to important new possibilities for effective intervention. The use of such maps and associated systemic models with methodologically sound and repeatable COA development and evaluation processes can help facilitate the sort of economic statecraft *campaigning* that is likely to be crucial in strategic competition.

Houston, We Have a Problem

The "WON" Aspiration

As the author noted in an earlier paper in this series,[1] it is now commonplace to hear talk of the need for a "whole of nation" (WON) response as modern American policy elites consider what the United States should do in response to its contemporary "China challenge" of competitive strategy. However, *developing* and *implementing* such a WON response is very difficult—and just what a full suite of "best practices" would look like, in the development and implementation of WON strategies in a modern democracy, has not yet been fleshed out.

Indeed, in some regards, as will be discussed further below, the U.S. system could be said to be poorly organized for such efforts. Thus, it is essential for us to devise effective ways to achieve the kind of holistic situational awareness, "systems"-informed analysis, and cross-jurisdictional policy coordination that genuinely "comprehensive" national strategy requires.

A "Leverage Web" of PRC Strategy

American leaders certainly have a strategic situational awareness and analysis problem. We face a strategic competition challenge that manifests worldwide, and across a breadth of issue areas and in interrelated ways, in a fashion that our institutions of governance are not organized (or at the very least unaccustomed) even to perceiving. Indeed, the United States faces a holistic, systemic challenge that we are in many ways ill prepared even to *understand* in the kind of rigorous, systematic, scalable, and repeatable ways that are needed to support coordinated national policymaking and effective long-term strategy in response.

At this point in our history and the development of the international system, the People's Republic of China (PRC) stands clearly as our "pacing challenge"—a term

popularized in Department of Defense (DoD) circles with regard to military capabilities,[2] but which is equally true in other aspects of global power and influence, from diplomatic and political affairs to economic and technological challenges. Approaching strategic competition on the basis of a holistic conception of national influence that Chinese scholars and Chinese Communist Party (CCP) officials have termed "comprehensive national power"[3] and that involves efforts simultaneously to progress along multiple axes of advance,[4] the PRC seeks nothing less than an architectural revision of the international order into a Sinocentric form centered around Beijing.[5]

Making matters more complicated still, the aspects of Chinese strategy are not intended to be, nor are they in fact, effective merely linearly—that is, through the summation of or direct extrapolation from their various economic, technological, political, informational, diplomatic, military, and socio-cultural effects. Rather, they aspire, at least, to a sort of "systemic" coherence and extra impact through the relationships between them. (Such synergies, for instance, can be seen in efforts by the CCP to advance its efforts at global "discourse control"[6] by leveraging China's growing economic weight to condition individuals, corporations, and governments in the rest of the world into habitual patterns of speech and expressive behavior congenial to Chinese officials and deferential to CCP interests.[7]) China's effort to create what might be called a "leverage web" of mutually-reinforcing instruments of power and influence confronts U.S. leaders with a systemic problem of competitive strategy.

Yet the U.S. Government is at present not well organized for the development and implementation of counter-strategy that approaches things in an analogously holistic, "comprehensive," and "systems"-informed way. We suffer, in fact—in multiple broad and lamentably self-reinforcing ways—from what Lewis Irwin once described (in the context of the failure of U.S. nation-building in Afghanistan) as "disunified interagency structures, processes, and effort."[8]

American leaders have gamely tried to build effective coordination mechanisms into the U.S. foreign policy and national security process for many years, most obviously in the creation of the National Security Council process, beginning with the National Security Act of 1947.[9] Despite all the progress that has been made,[10] however, it remains the case that in essentially *every* U.S. department and agency, cross-institutional perspectives, authorities, and approaches first come together to be balanced and assessed holistically only at the level of the Deputy Secretary—an exalted position that, because of inescapable factors of personal and organizational finitude, cannot reasonably be expected always to analyze and balance all the competing equities effectively within a single human cranium.

An analogous problem exists within the U.S. interagency, where there is no genuinely cross-cutting consideration of U.S. Government-wide equities below the level of the Deputies Committee (DC). According to the Biden Administration's National Security Memorandum-2 of February 2021, for instance, Interagency Policy Committees are expected to be "the main day-to-day *fora* for interagency coordination of national security policy,"[11] but even they, in practice, are organized only on a specifically regional or functional basis. There exists no truly cross-cutting perspective below the level of the DC, and no part of the U.S. system is really designed, resourced, or equipped to provide one. U.S. leaders lack the ability to approach the development and implementation of competitive strategy vis-à-vis the PRC in a holistic way, informed by a cross-cutting understanding of the strategic environment and its myriad, inter-related components, and supported by data analytics and decision-support tools that allow one to grasp—and to orchestrate effective counter-strategy for—the complex system dynamics of global strategy.

Strategy may indeed be conceived of as something as simple, in Lawrence Freedman's words, as "a story about power told in the future tense from the perspective of a leading character."[12] The devising

and implementation of strategy, however, can be a complicated challenge that demands much in terms of situational awareness, sophisticated understandings of systemic causalities and non-obvious inter-relationships, and coordinated orchestration of strategic counter-moves—demanding more, indeed, than the U.S. system has hitherto been prepared to provide.

An Informational Cacaphony

But that is not all. It is *also* the case that as U.S. leaders struggle with these strategic competition challenges, they must try to draw meaning and divine useful guidance out of a bewildering cacophony of recommendations, prognostications, and would-be policy inputs. It is not merely that U.S. Government departments and agencies all have their own staffs devoted to providing senior leaders with policy recommendations and guidance. It is also that the broader U.S. policy community is one characterized by a breadth and depth of almost metastatic proportions.

TRADITIONAL MEANS OF AGGREGATING POLICY ADVICE IN THE U.S. SYSTEM DO NOT GENERALLY GO MUCH BEYOND THE STEREOTYPE OF "BOGSAT" METHODOLOGIES—THAT IS, A CONVOCATION OF A "BUNCH OF GUYS SITTING AROUND A TABLE."

In their attempts to develop effective U.S. counter-strategy, our leaders are somehow expected to draw useful advice out of the ever-expanding collective work product of an effervescent ecosystem of government staffs, think tanks, media pundits, academic institutions, and other professional opinion-havers.

The views of this sprawling group of would-be policy advisors include not merely what is conveyed to policy elites through prestigious and often peer-reviewed journals and traditionally-curated newspapers and broadcasts, but also an exploding array of modern websites, talk shows, social media feeds, talk radio programs, and so forth. In modern America, policy advice comes in more forms and variations than one could possibly personally digest, even as all these variegated sources feed—separately, alas—into socio-political information ecosystems that appear both to be increasingly sealed off from each other[13] and to be subject to powerful dynamics of "groupthink,"[14] anchoring bias,[15] and confirmation bias.[16] Even leaving aside the proliferating *ersatz* opinion-providers of the broader information space, the class of ostensibly expert policy professionals in Washington, D.C., is an enormous one. As one scholar has recounted,

> "Washington's 'ideas' economy, based in its think tanks and universities, has made the city an intellectual leader. In 2009, the University of Pennsylvania conducted a survey of the world's think tanks. It identified 6,305 in 169 countries. At the center of this universe was Washington. Some 393 think tanks were located in the District, more than in any other city in the world; DC is home to about one-fifth of all the think tanks in the United States. Another 149 are in Virginia and Maryland."[17]

Traditional means of aggregating policy advice in the U.S. system do not generally go much beyond the stereotype of "BOGSAT" methodologies—that is, a convocation of a "Bunch of Guys Sitting Around a Table." If the American foreign and national security policy decision-making process is to evolve beyond mere BOGSAT approaches, however, we will need much more sophisticated ways to assess and describe our strategic environment, to understand key patterns and dynamics therein that affect U.S. interests, to evaluate possible courses of action (COAs) in response to developments, to identify ways to wield coordinated American levers of national power in response to strategic challenges, to monitor the impact of policy interventions upon that environment, and to *repeat* such analysis and COA evaluation on a timely and iterated basis so as to ensure that U.S. responses remain appropriate to the situation. This, of course, will be no small task.

Complexity and Policy

Complexity and the "Policymaker's Paradox"

Make no mistake, however: to advocate for more "holistic" and systemically-minded approaches to holistic strategy should *not* be seen as presuming that it is actually possible to engineer foolproof policy interventions that—in stereotypically conceptually linear policy community fashion—will reliably lead to specific policy outcomes. As will be explained below, modern understandings of Complexity Science in the complex adaptive systems of the international arena suggest that such linearity is not possible, neither in practice nor perhaps even in theory.

There are various ways of defining complexity, but for present purposes perhaps the most useful is that offered by the University of Michigan's Scott Page:

> "Complex systems are collections of diverse, connected, interdependent entities whose behavior is determined by rules, which may adapt, but need not. … A complex system consists of *diverse* entities that interact in a *network* or *contact structure*—a geographic space, a computer network, or a market. These entities' actions are *interdependent*—what one protein, ant, person, or nation does materially affects others. In navigating within a complex system, entities follow rules, by which I mean prescriptions for certain behaviors in particular circumstances."[18]

The interdependence between the constituent elements and sub-systems of a complex system can create powerful feedback loops, both positive (*i.e.,* self-reinforcing) and negative (*i.e.,* dampening), which often makes system behavior notoriously nonlinear. Combined with such systems' sensitivity to initial conditions—that is, the degree to which even only very slight differences in an initial starting point can result in enormously different outcomes—these dynamics can make the behavior of complex systems highly unpredictable over anything but almost trivially short timespans.[19]

FEW SYSTEMS ARE SURELY AS COMPLEX AND ADAPTIVE AS THOSE MADE UP OF *HUMANS*, WHO TEND TO BE "DIVERSE, SOCIALLY INFLUENCED, MISTAKE-PRONE, PURPOSIVE, ADAPTIVE, AND POSSESSED OF AGENCY."

One can, furthermore, distinguish between *complex systems*, in which the entities follow fixed rules, and complex *adaptive systems*, in which the entities themselves adapt their behavior in reaction to their environment on an ongoing basis.[20] And few systems are surely as complex and adaptive as those made up of *humans*, who tend to be "diverse, socially influenced, mistake-prone, purposive, adaptive, and possessed of agency."[21] In the complex adaptive systems of human society, it is thus not merely that actors react and learn in response to what they encounter in their operational environment; it is also that the social environment itself is not stable, for it changes constantly as a result of such ongoing reactive and anticipatory choices.

Complexity of this sort "cannot be easily described, evolved, engineered, or predicted."[22] Such complexity therefore presents considerable challenges for public

policymakers professionally concerned with devising and implementing *interventions* in the complex adaptive systems of human society in order to achieve desired policy outcomes. As Göktug Morçöl puts it, for instance, "[t]he most general implication of the emergence of complex policy systems is that there is no direct and linear causal link between governmental policy actions and outcomes," and this essentially invalidates traditional linear conceptions of the policy art: "the notion that there is a direct causal relation between policymakers' decisions and their outcomes is 'in direct contrast to the complexity concept.'"[23] Strong nonlinearity in system behavior, in other words, is

> "profoundly subversive of how we have traditionally understood public policymaking … because it seems to explode the very idea that the complex adaptive social systems of the human world may be purposefully manipulated in order to bring about specific desired situational outcomes."[24]

Such problems are compounded by the fact that one cannot "direct" what one cannot sense or is not aware of. Complexity means that something happening in an area not seemingly relevant to what one is considering can perhaps have profound effects on the issue under consideration nonetheless. Complexity dynamics and the data and analytical difficulties of holistic situational awareness thus exacerbate our challenges.

The implications of Complexity Science for human social systems, therefore, may provide an even more elementary foundation for Friedrich Hayek's insight that economic systems (for instance) are inherently unknowable and uncontrollable by central planners than Hayek's own focus merely upon the radical disaggregation of the knowledge necessary to do effective planning. In effect, Complexity Science suggests not merely that direct control is impossible *in practice*, but that it is also impossible *in theory*.[25]

COMPLEXITY … PRESENTS CONSIDERABLE CHALLENGES FOR PUBLIC POLICYMAKERS PROFESSIONALLY CONCERNED WITH DEVISING AND IMPLEMENTING *INTERVENTIONS* IN THE COMPLEX ADAPTIVE SYSTEMS OF HUMAN SOCIETY IN ORDER TO ACHIEVE DESIRED POLICY OUTCOMES."

This does not necessarily mean, however, that complexity-informed approaches to public policymaking are futile. This author, for instance, suggested more than a decade ago that precisely because human complex adaptive systems are made up of humans—whose individual and collective behavior can at least to some degree be powerfully shaped, and at scale, by the transmission of ideas from mind to mind—the creation and deployment of conceptual, ideational, emotive, or ideological mental constructs may remain a useful form of policy intervention notwithstanding such systems' nonlinearity and degree of unpredictability.[26]

David Colander and Roland Kupers, moreover, have argued that even though the complex adaptive system of the policy arena "cannot be controlled, it can be influenced, and policymakers have to continually think how to work with evolutionary pressures, and try to guide those pressures toward desirable ends." To this end, they urge policymakers pay attention to shaping the "ecostructure" in which actors in the system make their own adaptive choices: "We call the policy that follows from taking a complexity frame *laissez-faire* activism."[27]

> "Complex systems are not amenable to control, and we should give up the ambition to control the economic system. While we cannot control the system, [however,] we can influence it in a myriad of ways …."[28]

In this conception, policymakers are likely to fail if they attempt direct, detailed control, but may yet retain a "'norm influencing' role" in which government "metapolicy" helps create "an evolving ecostructure"—that is, when it acts more as "a midwife [for desired policy outcomes] … than a controller."[29] This view is also consistent with other treatments of the implications of complexity for policymaking, such as those that "highlight[] the importance of [seeking results through] influence and likelihood" rather than simply upon "designing and building fixed institutions"[30]

As noted, some contemporary Western scholars have attempted to develop such ideas in order to draw out the implications of complexity dynamics for the policymaker's art, and perhaps thereby to salvage something of the ameliorative potential that governance has long been assumed to have in providing security, a social safety net, public goods, and economic opportunity for human populations. For present purposes, however, the key point is that if national leaders hope to *influence*—vice "direct"—policy outcomes in the complex adaptive social system of the global security environment, their decision-making must be informed by "systems"-based analyses and an appreciation for the dynamics and patterns that manifest in that environment.

In any such complex context, it would be futile to assume a direct, one-to-one linkage between policy interventions and environmental outcomes. (In complex adaptive systems, nonlinearity and path-dependencies generally preclude such assumptions.) Nevertheless, the more challenging task of devising effective *systemic interventions* that are likely to have the effect of "nudging"[31] the system in a more congenial direction is likely to be all but impossible without considerable improvements in holistic situational awareness and complexity-informed analytics and COA evaluation.

Analytical Responses to Complexity

So how might it be possible to develop such a holistic perspective? As suggested above, one of the major challenges for U.S. policymaking today is somehow to aggregate the inputs of an otherwise perplexingly diverse ecosystem of policy experts into some digestible form that permits decision-makers to:

 a. see and evaluate the causal connections that a broad *collection* of relevant Subject-Matter Experts (SMEs) thinks are most relevant to the question at hand;

 b. assess the security environment in ways alive to the relationships between these policy elements and any relevant patterns and dynamics that such a "systems" perspective will suggest;

 c. test and evaluate alternative COAs against complicated causal pathways in order to assess potential or likely systemic impact; and

 d. devise policy interventions that orchestrate multiple levers of national power in order to maximize the likelihood of salutary effects in support of national strategy.

The MITRE Corporation's Center for Strategic Competition[32] has been working to develop and refine methodologies for doing these very things. These efforts revolve around two primary lines of effort: (1) finding ways to aggregate the input of multiple SMEs in a scalable way; and (2) looking at aggregated causal maps in ways that identify characteristic patterns therein in order to focus policy deliberations upon the development of effective interventions designed to break, impede, or redirect such systemic dynamics in more salutary directions.

Aggregating Qualitative Input

With respect to the first of these challenges, MITRE has been developing a methodology for aggregating SME input on a repeatable, scalable basis in order to permit decision-makers to have access to a collective model of those SMEs' assessments of the most likely causal connections between systemic elements. As this author attempted to explain in a prior paper on MITRE decision-support methodologies,[33] there are ways to bypass the limitations of BOGSAT approaches by canvassing large—and potentially very large—numbers of SMEs and aggregating their assessments into a system of casual maps that allow decision-makers to see the collective input of these SMEs in a glance. Such methodologies also permit them to "unpack" this advice in detail,

> "allowing leaders to assess its plausibility, identify its underlying assumptions, spot the areas of relative consensus or contestation encoded therein, test counterfactuals against received wisdoms, … [and] explore the merits and demerits of alternative policy interventions in a rigorous and systematic way[.]"[34]

One tool that can be used in this regard is the software application known as "Loopy," which exists in open-source form and has been adapted by MITRE experts in order to permit networks of substantive causal SME assumptions not only to be plotted individually—that is, as cognitive maps developed on the basis of input provided by individual SMEs—but also to be combined automatically into Loopy map plots that represent the *summation* of SME inputs.

Significantly, this approach does *not* involve asking SMEs to recommend specific courses of action. Rather,

> ""it restricts its queries to highly granular questions about those areas in which a SME is likely most authoritative and reliable: what factors are likely to affect what factual outcomes, in what ways, and to what degree."[35]

As this author has explained elsewhere, this approach offers promise

> "not only by capturing [each] expert's best assessment of the situation but also by (1) forcing assumptions to be articulated as explicitly and clearly, and with as much granularity, as possible and (2) providing a mechanism through which insights from a very large number of additional SMEs can be captured and made simultaneously available to inform decisions.

> "Because users can explicitly identify and (if they wish) adjust the SME assumptions encoded in the model to evaluate how specific changes might affect outcomes, a range of hypothesized models can be compared. Moreover, if there is curiosity or disagreement about whether a particular causal connection exists, about its directionality, or about its strength (i.e., the probability weight given it), the model(s) provide a useful platform for articulating differences of opinion and perhaps reaching a consensus. … This methodology [also] … permit[s] experimental counterfactual analytical 'probes,' as it were, that may cast light upon how alterations in underlying assumptions may produce alternative outcomes."[36]

The method looks complicated and can be time-consuming, but it permits every element, assumption, and linkage to be explicitly identified—and for each to be explained, or perhaps second-guessed, if questioned.

Seeing Complex Patterns

Another benefit of such causal mapping—such as through MITRE's adapted Loopy tool—is that it allows sometimes extraordinarily complicated data sets to be collected and displayed in human-intelligible form. After all, higher-order interactions of multiple actor and effects can be overwhelming for the human mind to digest even in a narrative form, making it necessary to convey such information through various forms of decision-support tools. System maps—specifically, in the form of causal flow diagrams that show the positive and negative

relationships between actors, factors, activities, and outcomes—can help do this.

Using such tools, it is possible to discern and visualize the most significant sub-system interrelationships in a complex system such as that of PRC global strategy. Such causal diagrams can be very valuable in suggesting insights, identifying knowledge gaps and collection opportunities, and in flagging areas for further analytic attention. Such qualitative maps can also be a first step toward developing numerical models that can help quantify the aggregated qualitative judgments of multiple SMEs and evaluate the likelihood of success for various explicit courses of action.[37]

IDENTIFYING CHARACTERISTIC CONFIGURATIONS AND THE DYNAMICS THAT MAY LIE BEHIND SYSTEMIC BEHAVIOR CAN HELP OPEN UP IMPORTANT NEW INSIGHTS INTO STRATEGY AND POSSIBILITIES FOR POLICY INTERVENTIONS.

Though graphic presentations can help simplify for display relationship patterns that might be too cumbersome to display in written descriptive form, large system maps can still sometimes be overwhelming in their detail and complexity. Qualitative maps can thus also be useful when initially attempting to understand the general contours of a system—such as its main structures, behavior over time, and potential leverage points—to help policymakers grasp its essentials before investing resources into complicated, slower, and perhaps more cumbersome quantitative modeling. System maps are also an efficient means of eliciting and explicating expert judgment.[38]

Though doing so is not difficult, however, readers accustomed to more narrative presentation still need to learn to "read" system maps. To read a system map, one needs to look at the various "nodes" that are described, and see their immediate connections. An experienced system map-reader looks for "archetypical configurations"—characteristic patterns that can occur in complex systems, such as positive feedback loops (which can cause exponential growth over time, like compound interest) or negative feedback loops (which may imply limits to growth, convergence, or oscillation)—because this can help identify critical aspects of that system's behavior. One should thus, for instance, examine the "neighborhoods" around key nodes, paying special attention to the most powerful or persistent relationships that are displayed, in which causal forces converge.

Identifying characteristic configurations and the dynamics that may lie behind systemic behavior can help open up important new insights into strategy and possibilities for policy interventions. The following pages will explore an illustrative example of applying this kind of causally-mapped "systems" analysis to an entirely imaginary hypothetical case of business strategy. The case study is a rather fanciful and considerably simplified example, of course, but it should nonetheless help suggest the type of approach that can be taken when applying systems thinking to the understanding of competitive strategy.

A (Hypothetical) Case Study

So how might this look in action? I would suggest that there are at least five basic steps, as follows:

1. Begin by recognizing that one probably faces a problem of complexity—that is, one in which the various aspects of the challenge are not independent variables, but in fact affect each

other in ways that make their potential impact greater than simply the sum of their discrete, individual effects and that could give rise to higher-order patterns not obvious at first glance.

2. Assemble an appropriate group of SMEs capable—collectively, rather than necessarily individually—of providing useful insight into all the relevant questions. How many SMEs and how "deep" one will wish to "dive" will depend upon the time and resources available. (Some problems will surely impose tighter timelines than others, for instance. If you need an answer quickly and are willing to accept the lessened authoritativeness associated with more quickly querying smaller numbers of experts this methodology can indeed be used in a "light" form relatively quickly, with less comprehensiveness and greater speed. Alternatively, for slower-developing and/or more important questions, it can scale to considerable size if one is willing to invest the time and effort.)

3. Group these aggregated SME inputs into whatever clusters they might happen to "fall"—assuming that they do, for it is at least theoretically possible that you don't actually have a technically complex problem after all, and the system is more random or "chaotic"— and treat any such major groupings that appear as the key "nodes" of the system.

4. Combine the various SMEs' assessments of causal connections between these key nodes and other nodes of the system (*e.g.,* X tends to increase Y, or P tends to lessen Q), in order to capture and permit visualization of the structure of the system and the connections and feedback loops between its elements.

5. Assess: (a) which elements and relationships within the system are most *systemically*

important; (b) whether the system displays any specific higher-level patterns (*e.g.,* corresponding to well-understood "archetypes" of complex system behavior); (c) which of these causal linkages and/or connections present the most significant threats or opportunities; and therefore (d) which nodes or connections should be the most important foci for purposes of identifying interventions designed to impede threatening dynamics and reinforce beneficial ones.

This all sounds quite abstract, of course. To help concretize it, I offer a highly simplified and somewhat lighthearted example.

The Ballad of Jack and Marco

Assume, for instance, that our protagonist, Jack, runs a martial arts gym in the small, isolated Midwestern town of "Centerville." Jack has been doing this for years, and is a well-regarded practitioner of Kung Fu and T'ai Chi and a talented teacher, is regarded as a pillar of the Centerville community, and his business has been highly successful for many years. But recently, Marco has moved to town and founded a competing establishment, Marco's Fight Club, dedicated to a syncretic and competitive, combat-focused style of mixed martial arts (MMA). Marco's business is thus deliberately disruptive of Jack's position and business model, and since Centerville is a small and remote location, his success in attracting students and gaining market share in the community represents a threat not merely to Jack's traditional dominance but perhaps also to the viability of his basic business model in the first place.

Jack, however, is a well-read martial artist, and once came across a paper on MITRE's Center for Strategic Competition and its work to help policymakers better cope with the "complex systems" aspects of strategic competitiveness. Inspired by that analytical framework, he decides to apply this methodology to his business

competition problem with Marco. He assembles a group of experts of his acquaintance (*e.g.,* some other martial arts stylists, an accountant, a lawyer, a doctor, and a friend who used to work in advertising), and gathers the insights they offer him—as well as those he has gained from his own long career in Centerville—into the various facets of his "Marco challenge." For present purposes, it matters not what these insights actually are, but it would not be hard to imagine that in "node-connection" terms they articulate to him things such as: "If you get more students, you bring in more revenue"; "Higher liability insurance cuts into profits"; "Students who win awards and competitions are good advertising"; "Better instructors attract more students"; "Additional dojo floor space is expensive in downtown Centerville"; and "Crowded classes cut into quality instructor time with your students." Together, they build a causal map of Marco's strategy and its relationship to Jack's.

The "spaghetti spread" of the resulting causal map is depicted—notionally, rather than actually—in Figure 1 below. Each circle represents a facet of Marco's strategy or a step that Jack could try to take, and each arrow represents a causal connection between them. The larger, colored circles represent the most important nodes in the system, which have the most direct significance for Jack's Kung Fu and T'ai Chi competitiveness vis-à-vis Marco's Fight Club. The directionality of each arrow indicates causal direction, and whether it is positive ("+") or negative ("-") signals whether this causality is accelerating or impeding.

This may look like a bowl of spaghetti, but you'll also notice that three pattern relationships stand out therein, which for convenience have here been given extra graphic weight. As it turns out, these three emergent patterns correspond to system-behavioral archetypes that are well understood in the complex systems literature. Each of them, moreover, represents a specific type of risk that this causal map analysis suggests that Jack faces in his competition with Marco.
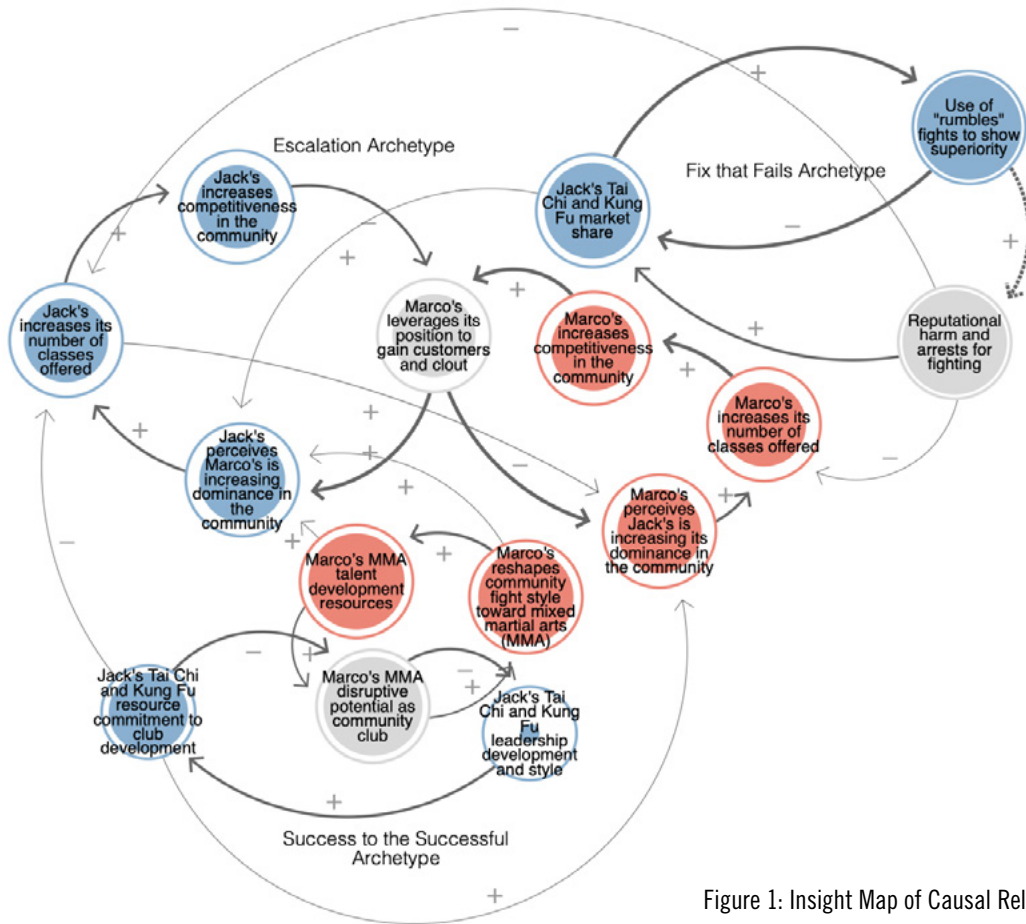
Figure 1: Insight Map of Causal Relationships

Success-to-the-Successful

In this pattern, depicted notionally in Figure 2—which draws this patten out of the broader mess of "spaghetti" causalities—two or more actors vie for resources, and as one achieves success, this very success makes *further* success more likely. In colloquial terms, one may hear this dynamic referred to as a "virtuous circle" or a "vicious circle," depending upon whether one is the player who is able to leverage his initial advances into accelerating advantage or the one who finds himself falling ever further behind.

This kind of dynamic can be seen in "network effects" within systems that display notably asymmetric network

topologies, for example—such as social media networks that become ever more attractive to join in part because they already contain such large numbers of members. They can also be seen, in a more "vicious" variety, in the phenomenon of bank runs, in which the more people are suddenly withdrawing their savings from a bank, the more urgent it can seem for others to do so, leading to cascading collapse. (After all, as the saying goes, nothing succeeds like success, and nothing fails like failure.)

In this case, the danger to Jack is that Marco may be able to create such a "success-to-the-successful" dynamic in Centerville's martial arts market. Every student within the town's limited population who

is attracted to switch from Jack's to Marco's, for instance, represents a gain in revenue for Marco that makes it easier for him to afford better instructors and pay for more advertising—thus making Marco's even more attractive to other students—and a loss in revenue for Jack, making it harder for him to invest in competing capabilities and thus reducing his relative competitiveness.
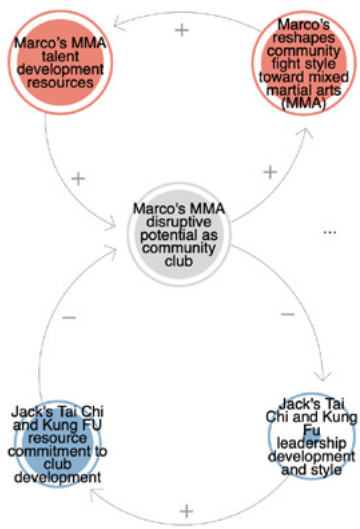

Figure 2. Success to the Successful Archetype

The threat to Jack is thus that Marco's competitive surge could become self-sustaining or self-accelerating. As an analytical framework for developing policy options, this analysis—and an understanding of the more complicated causal patterns sub-relationships notionally depicted in the grey-screened tendrils of "spaghetti" in Figure 1—may help Jack identify specific COAs by which he could perhaps intervene in this dynamic to delay, slow, or even reverse Marco's momentum.

Almost by definition, reversing a "success-to-the-successful" dynamic that is already underway can be difficult, but a good causal map can at least help point Jack to the central contributors to Marco's momentum that he needs somehow to affect, and steer him away

from expending scarce resources of time and energy on interventions affecting things that are less critical to Marco's competitiveness. (Perhaps, for example, the causal map built by Jack's SMEs will suggest that having his students win medals at state-level competitions is likely to be better for business vis-à-vis Marco than simply plastering downtown Centerville with more "Jack's" billboards.)

The Fix That Fails

In this second pattern drawn out of the larger causal map—which is depicted in Figure 3—one party attempts to win competitive advantage vis-à-vis its rival by making a move designed to create dramatic gains. It does so, however, in a way that, after perhaps some delay, ends up undermining the basis of the first party's competitiveness, thus making it damaging and counterproductive in a "net" sort of way. (In everyday parlance, you could think of this as a "cutting off your nose to spite your face" or "shooting yourself in the foot" problem.)
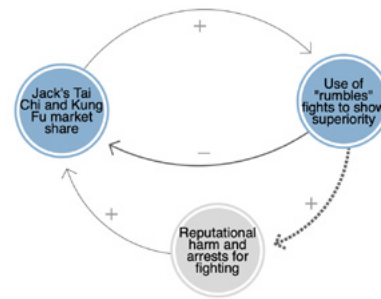

Figure 3: Fix that Fails Archetype

In this fanciful hypothetical, Jack decides that the most effective way to undermine the commercial appeal of Marco's MMA training is to demonstrate—as Jack sees it—that his Kung Fu style is superior to Marco's techniques in actual combat. (Marco has been telling everyone that Jack's methods are just "martial ballet" and "not for real fighting," and Jack is determined to demolish this competitive narrative as definitively as

he can.)[39] Accordingly, Jack sends a group of his best students over to Marco's Fight Club and has them attack the students there and beat them senseless. Assuming that Jack's well-chosen Kung Fu stylists succeed in this, this move may well "succeed" in demonstrating that Jack's methods can be effective in real combat—but in this hypothetical the move is ultimately catastrophically self-destructive, because Jack and his best students are thereupon arrested and his dojo is eventually forced into bankruptcy in the face of disastrously costly tort lawsuits. His fix, in other words, has decisively failed.

Had Jack done and his SME friends done a good job of identifying the causal "spaghetti" of connections involved in this competition, however, he would have had a useful tool with which to evaluate possible COAs before undertaking them. Discerning the causal feedback loop suggested in Figure 3—which suggest a characteristic "fix that fails" pattern—could have alerted him to this danger, allowing him to forestall disaster by shifting his attention to some other, less problematic course.

Escalation

In this third pattern, depicted in Figure 4 below—two parties compete with each other for a finite resource, or for more than one of them, in a context in which: (a) their competition is a "zero-sum" game in which one party's degree of access necessarily entails the other's denial; (b) the resources in question are perceived to have existential importance to each party; and (c) each perceives the other as having malign intent such that the *theoretical* ability to cut off access to existentially important resources is assumed to have an unacceptable likelihood of translating into *actual* deprivation. This pattern can tend to produce a sort of escalatory spiral, because each party attempts to protect itself against the threat presented by the other party by securing leverage in the form of greater control over exactly what the other most needs and what it most fears that the first party intends to deny it. Such escalatory dynamics, of course, may easily cross into outright conflict in the presence of some kind of
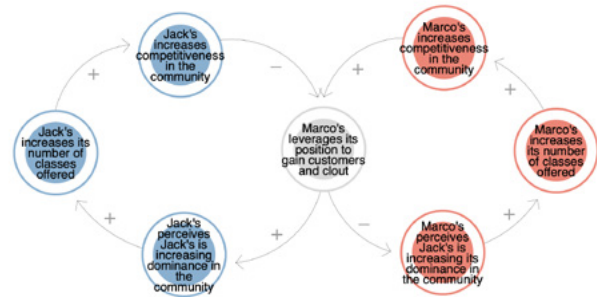

Figure 4: Escalation Archetype

circumstantial "spark," for each comes to feel more and more threatened.

Such unstable and escalatory patterns can be seen, for instance, in stereotypes of classical "arms race" competition. Here, one might hypothesize within the terms of my very simple illustration, Jack and Marco exist in a presumptively zero-sum competition to attract the finite number of students in the small and isolated Centerville market, each facing the risk that the other's competitive gains could push him across the threshold below which maintaining a gym becomes financially unsustainable.

While one might imagine some kind of equilibrium or *modus vivendi* being reachable in theory, an escalatory spiral might nonetheless result if, for instance, something propels one of them into a sudden "surge" of competitive advantage, threatening the other with the prospect of finding himself on the losing end of a "success-to-the-successful" dynamic. Alternatively, or additionally—also illustrating the importance of perceptions within this pattern—the system could tip into escalation if the parties come to perceive each other as aiming not merely to prosper in the Centerville market but in fact each to drive the other into bankruptcy. (This also suggests the relationship between the patterns I have drawn out of the larger spaghetti map: "success-to-the-successful" dynamics can contribute to "escalation" scenarios, which can in turn perhaps make one of the parties more liable to gamble on "fixes that fail.")

Awareness of this pattern—which could perhaps have been discernible by Jack and his friends as they pored over the causal map of their competition with Marco *before* deciding what to do—might help Jack avoid missteps. It might, for instance, make Jack more willing to explore some kind of negotiated condominium with Marco, to seek an agreement upon "confidence building measures" to forestall or at least delay escalatory disaster, to identify alternative means of competitive advantage less likely to feed Marco's worst fears, or at least to be more careful to not inadvertently create the kind of "spark" that could tip things over the edge into something worse between them.

My point is not to persuade you of anything specific with regard to Jack or Marco, or any aspect of their relationship. I aim merely to use their simple storyline as an illustration of how causal mapping informed by "systems thinking" can help decisionmakers better understand the strategic problems they face and perhaps devise better policy interventions in response to such challenges.

"Systems" and Strategy

This exploration of Jack's mapping of Marco's strategy makes clear both that one *can* actually make a "strategic map" that permits new insights into systemic behavior, and that such approaches have the potential to help identify threats—as well as opportunities for policy intervention—that might not have been apparent otherwise. This particular illustrative hypothetical, of course, was simple enough that the patterns identified therein may not *actually* have been surprising to the reader. When applied to the myriad pieces of an entire *country's* approach to "whole of nation" strategic competition, however, such causal mapping and systems analysis may offer considerable advantages in drawing out patterns and dynamics that might indeed be much

more difficult to discern among a blizzard of data and interrelated variables.

There are various ways that Complexity Science and "systems"-type analysis can enrich understandings of strategic competition and policy development, as well as COA evaluation therein. It is today increasingly appreciated that systems dynamics are important aspects of international behavior, and that they can have a significant impact upon the threats facing and opportunities available to states in a competitive security environment—particularly in areas of economic statecraft.

In a seminal recent paper, for instance, Henry Farrell and Abraham Newman point out the degree to which network effects can in certain circumstances create powerful opportunities for economic coercion.

> "Asymmetric network structures create the potential for 'weaponized interdependence,' in which some states are able to leverage interdependent relations to coerce others. Specifically, states with political authority over the central nodes in the international networked structures through which money, goods, and information travel are uniquely positioned to impose costs on others. If they have appropriate domestic institutions, they can weaponize networks to gather information or choke off economic and information flows, discover and exploit vulnerabilities, compel policy change, and deter unwanted actions."[40]

Not all networks in the international environment create opportunities for such weaponization, but some—such as the information-flow networks of the current World Wide Web and global financial system—do seem to "generate ever more asymmetric topologies in which exchange becomes centralized, flowing through a few specific intermediaries."[41] The CCP may *wish* to create a globalized "leverage web" of asymmetric dependencies that will help it bend other countries to the Party's will in building a Sinocentric global

system, but not all networks lend themselves to such exploitation. Some that do, moreover—including the aforementioned global information and financial networks—are also ones in which it, the United States (rather than China), presently enjoys the primary advantages of network effect asymmetries.[42]

Nor are all actors in positions of potential power over key nodes that form topological "hubs" in such asymmetric systems necessarily able or willing to weaponize them. "If states are to exploit hubs," Farrell and Newman note, "they require appropriate legal and regulatory institutions." Accordingly,

> "states' variable ability to employ these forms of coercion will depend on the combination of the structure of the underlying network and the domestic institutions of the states attempting to use them."[43]

As an example, longstanding network hub dominance in Internet traffic has apparently permitted U.S. authorities some powerful advantages in information-gathering, but for lack of domestic legal frameworks, institutions, and policy commitment taking such a course, the United States has not fully weaponized that asymmetric network structure in terms of being able to cut others off from it.[44] By contrast, because of the CCP's powerful authoritarian tools of societal control within China,[45] any hub-and-spoke-type network in which the PRC is able to acquire a dominant position is likely to be—in political and institutional terms—quite easy for the CCP to exploit both for informational advantage and coercive denial.

As a result, systems-informed analysis and network structure evaluation is likely to be of increasing importance to the policy community as Western leaders struggle with competitive strategy challenges vis-à-vis the PRC in the years ahead. It will be necessary, for instance, to: (i) identify which networks do (and which do not) give rise to topologies conducive to purposive manipulation by key node-holders; (ii) track which actors have what degree of influence over relevant potentially advantage-producing nodes, and whether and how these dynamics change over time; and (iii) ascertain

what factors affect the development of such topologies or loci of control and whether, the degree to which, and *by whom* such factors could potentially be manipulated.[46] (Such analytics might also be valuable in pointing to ways in which it might *not* be a good idea to try to weaponize interdependence—such as if using, or at least *overusing*, coercive economic tools might lead to the dissolution of the very network advantages that such a strategy took as its starting point.[47])

As noted, the ability to implement a "weaponization" strategy will also depend upon who has the *capacity* to play such a game even where network topologies permit. It will thus also be necessary to understand which actors have the institutional capabilities and authorities needed for this, or how they might acquire them if needed.

ANY HUB-AND-SPOKE-TYPE NETWORK IN WHICH THE PRC IS ABLE TO ACQUIRE A DOMINANT POSITION IS LIKELY TO BE—IN POLITICAL AND INSTITUTIONAL TERMS—QUITE EASY FOR THE CCP TO EXPLOIT BOTH FOR INFORMATIONAL ADVANTAGE *AND* COERCIVE DENIAL.

Yet one's effectiveness in weaponizing interdependence isn't simply a question of potential capacity or even willingness, however: it also has to do with whether and how directly the actual policy steps one is taking conduce to such effects. (In strategic competition, this is true for oneself and one's adversary.) And it is here that it may be particularly useful to refine our skills with the kind of causal mapping analysis suggested in the previous section of this paper.

The sort of network-topological analysis suggested by Farrell and Newman can certainly help identify structural opportunities for "weaponized interdependence" in arguably its most powerful, systemically-facilitated forms within the international environment. But coercive economic statecraft occurs—and can be quite important—in other contexts as well, and while the kind of strongly hierarchical network dominance Farrell and Newman discuss may provide opportunities for even more powerful interventions,[48] it is possible for essentially *any* form asymmetric dependence to be exploited.

This makes it very important to understand how potential adversaries may be seeking to construct and manipulate such dependencies.[49] It is always relevant what key actors are actually *doing* in the environment as they attempt to employ the tools available to them for one form of advantage or another.

Systems-informed analysis can thus also be an important tool for helping understand adversary strategy—as well as the potential implications of that strategy, not to mention assess possible counter-moves—even *outside* areas that network topologies would suggest are likely to give rise to the dynamics studied by Farrell and Newman. As suggested in my highly simplified example of causal map analysis, it is possible to understand an adversary's strategy *itself* as being a sort of complex system, with conceptually discrete elements or nodes connected by a web of causal inter-relationships, and that may as a whole give rise to higher-level behaviors in characteristic patterns.

Causally mapping an adversary's strategy and analyzing it from a complex systems perspective—thus approaching it as a *policy system*, as it were—can allow one to understand its dynamics in order to help identify:

    a.   where the adversary's activities present the greatest threat;

    b.   where one's own policy interventions may have the greatest chance of impeding, delaying, or reversing his successes by affecting the behavior of that system as a *whole*; and

    c.   how to make oneself more resilient in the face of the adversary's efforts to use his own policy instruments for competitive advantage.

Systems-focused analysis, for instance, can help identify possibilities for changing the structure of the adversary's policy system, via policy interventions that could add new causal connections among key actors, or that impede, delay, or alter positive feedback dynamics, introducing negative feedbacks or buffers that could dampen "runaway system" dynamics. Such an "effects-based and systems informed" approach to framing the questions one asks oneself in the course of developing and implementing policy can add valuable new perspectives, and may indeed point to important new possibilities for effective intervention.

Conclusion

In this paper, I have explored the formidable cross-cutting analytical needs of "whole of nation" competitive strategy—particularly against a strong economic and technological state that is ruled by a totalitarian regime—as well as the significant challenges presented for traditional, linear forms of policymaking, by the character of the international security environment as a complex adaptive system. I have also suggested a useful methodology for using causal mapping approaches and systems-informed analysis to visualize the complicated interconnections of such a policy environment, discern patterns therein, and use such assessments as the basis for devising policy interventions.

Given the nonlinearities, path-dependencies, multiplicity of timescales, and sensitivity to initial conditions that characterize complex adaptive systems, it would be too much to expect any such analysis to provide foolproof ways to produce desired policy outcomes (e.g., in decisively "breaking" an adversary's

competitive momentum, or in galvanizing one's own). Nevertheless, systems-focused analysis—informed by causal maps of adversary strategy that are built (as described hereinabove) through the scalable aggregation of SME input—can provide models with which to help evaluate potential COAs in a relatively rigorous and "explainable" fashion.

The use of such maps and associated systemic models with methodologically sound and repeatable COA development processes, moreover, can help facilitate the sort of economic statecraft *campaigning* that is likely to be crucial in strategic competition. In sustained competition, after all, successful COAs are much less likely to involve "one-off moves" than iterated engagements; this makes it important to assess candidate interventions quickly by "test-driving" them through a causal map structure while adjusting input assumptions and possible causal weightings, to do so for potential adversary counter-moves, and then to be able to do this again, repeatedly. (Attempting such "campaigning" analysis by means simply of iterated BOGSAT sessions may not be strictly *impossible*, but it would seem likely to degenerate rapidly into a policy-development "hunchocracy" dominated by unquestioned assumptions and cognitive biases.)

For all these reasons, the conceptual rigor of a causal mapping methodology informed by complex systems theory represents a significant qualitative improvement upon traditional methods of competitive strategy development. It is also an approach to foreign and national security policy development that I believe would be likely to improve the chances of salutary impact upon the complex systems of the international policy and security environment.

About the Author

Dr. Christopher Ford is a MITRE Fellow and Director of MITRE's Center for Strategic Competition, as well as a Visiting Fellow at Stanford University's Hoover Institution. He formerly served as U.S. Assistant Secretary of State for International Security and Nonproliferation, also fulfilling the duties of the Under Secretary for Arms Control and International Security. Dr. Ford has served in multiple executive branch and U.S. Senate committee staff positions, as a think tank scholar, and as an intelligence officer in the U.S. Navy Reserve. He is the author of *The Mind of Empire: China's History and Modern Foreign Relations (2010)* and *China Looks at the West: Identity, Global Ambitions, and the Future of Sino-American Relations* (2015). (He has trained in Japanese Jujutsu, Hapkido, and Muay Thai, but has never met Jack or Marco.)

Endnotes

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[25] Cf. Morçöl, *supra*, at 11 & 17 ("An actor may not be able to control a system using linear mechanisms and tools, because the relations among actors and between actors and policy systems are mostly nonlinear. … Complexity theory challenges the Newtonian/positivist assumptions that the universe is an entirely deterministic system and that it is entirely knowable, at least in theory.").

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36   *Id.* at 8.

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38   Sterman, John. (2000). Business Dynamics: Systems Thinking and Modeling for a Complex World. Boston: Irwin/McGraw-Hill.

39   We hope no actual martial arts practitioners take offense at this invented story, whether they are stylists of MMA, Kung Fu, T'ai Chi, or any other school. The author—one of whom has trained in styles different from those hypothesized here—take no position here on the relative merits or demerits of any of the various schools discussed.

40   Henry Farrell & Abraham L. Newman, "Weaponized Interdependence: How Global Economic Networks Shape State Coercion," in *The Uses and Abuses of Weaponized Interdependence*, Daniel W. Drezner, Henry Farrell, & Abraham L. Newman, eds.) (Washington, D.C.: Brookings Institution, 2021) [hereinafter "*Uses and Abuses*"], at 21.

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44   See *Id.* at 22 & 44-47.

45   *See, e.g.,* 2021 Report to Congress of the U.S.-China Economic and Security Review Commission: Executive Summary and Recommendations," 117th Congress, 1st Session (November 2021) [hereinafter "China Commission, *2021 Executive Summary*"], at 16, *available at* https://www.uscc.gov/sites/default/files/2021-11/2021_Executive_Summary.pdf.

46   *See, e.g.,* Stacie E. Goddard, "The Road to Revisionism: How Interdependence Gives Revisionists Weapons for Change," in *Uses and Abuses, supra,* at 93 (urging analysis of networks and state positions within them in order to ascertain the ability of potential adversaries to exploit weaponization possibilities); *cf.* Natasha Tusikov "Internet Platforms Weaponizing Choke Points," in *Uses and Abuses, supra,* at 136 ("States' ability to secure the cooperation of these nodes [in private sector Internet platforms] varies widely, as does the nodes' capacity and desire to resist attempts to compel cooperation."); *see also Id.* at 138-39. For a discussion of possible factors affecting whether interdependence is "weaponizable," *See, e.g.,* Drezner, *supra,* at 11 (comparing impact of whether or not network is vulnerable to technological disruption versus being characterized by large fixed-cost investments); Florian David Bodamer & Kaija E. Schilde, "Weaponized Weapons: The U.S. F-35 and European Eurofighter Networks," in *Uses and Abuses, supra,* at 203 & 213-14 (discussing need for analysis of degree of hierarchical structure in network, presence of fixed-cost investments, and degree of state control of particular network nodes in whether an arms supply network can be weaponized).

47   Harold James, "Weaponized Interdependence and International Monetary Systems," in *Uses and Abuses, supra,* at 101 & 113 (warning against "abuse" of network centrality, which can lead to its loss, and of the benefits of network connectivity); Daniel W. Drezner, supra, at 5 (same).

48   *See, e.g.,* Drezner, *supra,* at 8 (comparing dyads of asymmetric dependence to strongly hierarchical network dominance).

49   *See, e.g.,* Goddard, *supra,* at 89 (urging attention to "[h]ow revisionist states build and disrupt the existing order, and which revisionists are more equipped to do so"); Tusikov, *supra,* at 143 (urging study of China's ability to weaponize network choke points and interest in doing so).