Building Strategies for Long-Term Competition: Infinite Games and Adaptive Planning

Chapter Six

AARON B. FRANK, RAND CORPORATION

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CHAPTER SIX

Building Strategies for Long-Term Competition: Infinite Games and Adaptive Planning

Aaron B. Frank, RAND Corporation

The concept of undergoverned spaces (UGS) and the motivations for intervening in them have been discussed in previous chapters. This chapter examines new frameworks for engaging in UGS. For many in the U.S. Department of Defense (DoD) and broader National Security Enterprise (NSE), the joint phasing construct (JPC) has provided a logical point of departure for thinking about engaging in a wide variety of UGS. However, the JPC has proven to be problematic as an approach to planning and engagement in UGS. This chapter discusses alternative approaches for conceptualizing engagements in UGS and discussing the concepts of infinite games, the Act-Sense-Decide-Adapt (ASDA) cycle of adaptive campaigning, problem-centric governance, adaptive governance, and alternative modalities of governance and exchange. Although these do not represent an exhaustive set of concepts for engaging in UGS, they illuminate features of what effective approaches might look like.

Engaging in Undergoverned Spaces

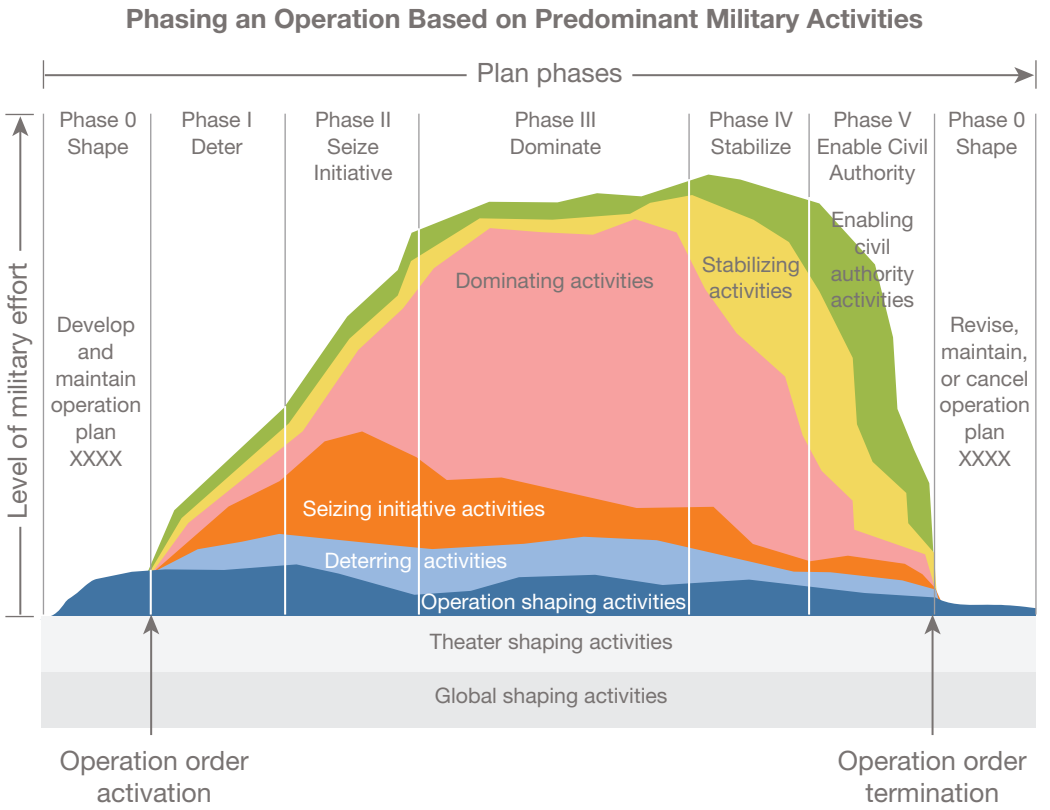
The protracted conflicts in Afghanistan and Iraq focused attention on the need to understand conflict in its many dimensions and view warfare as a long-term process.[1] This reasoning was codified in the mid-2000s with the development of the JPC, which divided conflict into a cycle of six phases labeled 0 through V, covering the following activities: shape (0), deter (I), seize the initiative (II), dominate (III), stabilize (IV), enable civil authority (V), and shape

[1] U.S. Department of Defense, *Quadrennial Defense Review Report*, Washington, D.C., February 6, 2006, pp. 9–15.

(0) once again.[2] These phases are depicted in Figure 6.1, along with a notional depiction of the level of effort that a particular approach to engagement might require in each phase.

In recent years, the JPC has been scrutinized for several reasons, and alternatives for thinking about the operational environment are emerging. New frameworks that emphasize continuous, fluid, and nonuniform movement among conflict, competition, and cooperation have developed as alternatives to guide military planning, operations, and NSE activities

FIGURE 6.1
Example of Joint Phases of Conflict



- The six general groups of activities provide a basis for thinking about a joint operation in notional phases.
- Phasing can be used in any joint operation regardless of size.
- Phasing helps joint force commanders and staffs visualize, plan, and execute the entire operation and define requirements in terms of forces, resources, time, space, and purpose to achieve objectives.

SOURCE: Joint Publication 3-0, *Joint Operations,* Washington, D.C.: U.S. Joint Chiefs of Staff, October 22, 2018, p. V-13.
NOTE: The *XXXX*s in the descriptions for Phase 0 would refer to a plan name/number.

[2] Center for Global Development, "Phase Zero: The Pentagon's Latest Big Idea," July 20, 2007; Lauren Fish, "Painting by Numbers: A History of the U.S. Military's Phasing Construct," *War on the Rocks*, November 1, 2016.

more broadly. This section discusses how perspectives on the JPC have evolved, while subsequent sections in this chapter present several alternatives that emphasize continuous learning through engagement.[3]

Evolving Views on the JPC

From its inception, the JPC faced criticism. Although it situated military planning in a longer time line of competition that involved noncombat operations and broader national engagement, critics argued that it militarized conflict between states by placing the military at the center of planning and interventions that were best performed by nonmilitary organizations. In addition, critics observed that the JPC divided engagements into discrete phases in which different members of the NSE might have more or less prominent roles.[4]

As time passed, additional concerns emerged over the JPC's utility as a framework for organizing military operations because complex, real-world engagements did not move among conflict phases in a linear, stepwise fashion.[5] Moreover, although the JPC broadened temporal dimensions of military planning, it did not automatically encourage the commitment of resources, energy, and imagination to all the activities that could be performed across each phase. Detractors argued that Phase 0 shaping actions were simultaneously and contradictorily viewed as both the responsibility of non-DoD agencies (to prevent escalation) and an opportunity for the military to take steps to ensure advantages in later phases because of the belief that open, violent conflict was the inevitable, natural state of the international system. Exercises, experiments, and scenarios showed that military operators viewed the early phases as a "race to Phase III" in pursuit of the opportunity to decisively gain control over the conflict.[6]

These limitations became especially acute as Russia and China each developed broad capabilities and the will to advance their interests in the conceptual space between Phase 0 and Phase I, in which aggressive actions were subtle, diffuse, and below the thresholds that would prompt a military response and meet criteria for armed attack according to international law, treaties, and plans.[7] As Antullio Echevarria has noted:

> Moscow and Beijing have exploited the West's conception of, and long-standing aversion to, armed conflict to accomplish what some Pentagon observers describe as "wartime-like" objectives. Thus far, these objectives have remained outside the scope of what mili-

[3] Head Modernisation and Strategic Planning—Army, *Army's Future Land Operating Concept*, Canberra, Australia: Australian Army Headquarters, 2009.

[4] Center for Global Development, 2007.

[5] Paul Scharre, "American Strategy and the Six Phases of Grief," *War on the Rocks*, October 6, 2016a; Gustav A. Otto, "The End of Operational Phases at Last," *InterAgency Journal*, Vol. 8, No. 3, 2017.

[6] Otto, 2017, p. 83.

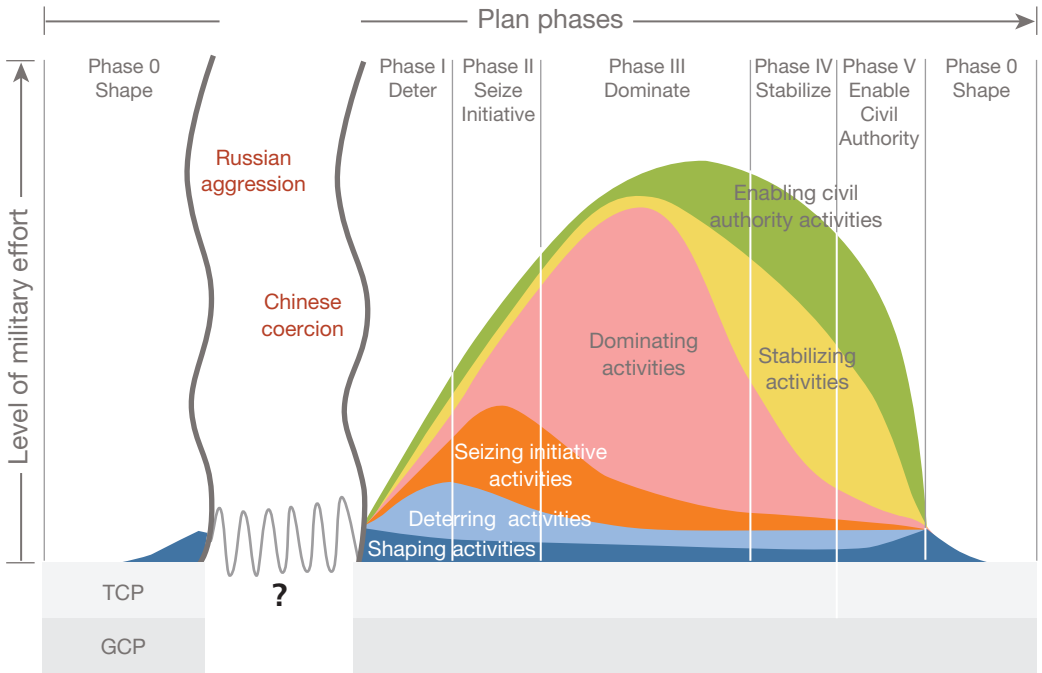
[7] Antullio Echevarria II, *Operating in the Gray Zone: An Alternative Paradigm for U.S. Military Strategy*, Carlisle, Pa.: U.S. Army War College Press, 2016.

tary strategists and campaign planners are legally authorized or perhaps professionally trained to address.[8]

He argued that a gap exists between the phases that make these approaches to conflict both conceptually interesting and organizationally challenging, as illustrated in Figure 6.2.

Contemporary planning concepts are seeking to redress the notion of conflict progressing through ordered phases and the prospects that aggressors might seek to avoid crossing phase boundaries. Doing so requires a more nuanced view of the international system where actors, both states and nonstates alike, simultaneously engage along a continuum of cooperation, competition, and conflict.[9] Alternatives to the JPC seek to increase the sensitivity of policymakers, military planners, and operators to the strategic realities that many competitors desire to advance their interests through ways that are beneath the thresholds of open and direct conflict. Terms for these challenges are varied, nuanced, and contested because of the history and context of their use—they include *gray-zone conflict*, *hybrid*

FIGURE 6.2
Depiction of Exploited Gap Between Phase 0 and Phase 1



SOURCE: Echevarria, 2016, p. 13.

[8] Echevarria, 2016, pp. 12–13.

[9] Joint Doctrine Note 1-19, *Competition Continuum*, Washington, D.C.: U.S. Joint Chiefs of Staff, June 3, 2019.

warfare, *unrestricted warfare*, *irregular warfare*, *nonlinear warfare*, *virtual societal warfare*, and *next-generation warfare*.[10]

Finite Versus Infinite Games: Open-Ended Engagement

One way of rethinking the JPC's cyclical model of conflict is to emphasize the long-term, open-ended nature of strategic interaction—cooperation, collaboration, coordination, contestation, competition, and conflict. Game theorists have noted that repeated interactions—iterated games—among players can create new motivations for actors to cooperate with one another.[11] James Carse elaborated on this logic by examining the differences between what he termed *finite* and *infinite* games, which explored how the idea of long-term contests and interaction required a different mode of thinking than finite games in which victory could be achieved.[12]

Carse differentiated between finite and infinite games by noting that each proceeded from a different foundation that motivated players' choices and actions. Finite games are entered into voluntarily, because players cannot be compelled to play even though they might believe that they need to play. Finite games are bounded by time, space, and rules regarding what is permitted and prohibited. Finite games have agreed-on systems for scoring and allow players to be ranked and ordered in terms of their performance against one another; thus, there exist unambiguous conditions for terminating the game and accepting its outcome. As Carse noted,

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[10] Williamson Murray and Peter R. Mansoor, eds., *Hybrid Warfare: Fighting Complex Opponents from the Ancient World to the Present*, New York: Cambridge University Press, 2012; Mark Galeotti, "The 'Gerasimov Doctrine' and Russian Non-Linear War," *In Moscow's Shadows*, blog post, July 6, 2014; Peter Pomerantsev, "How Putin Is Reinventing Warfare," *Foreign Policy*, May 5, 2014; Adam Elkus, "50 Shades of Gray: Why the Gray Wars Concept Lacks Strategic Sense," *War on the Rocks*, December 15, 2015; Echevarria, 2016; Paul Scharre, "Losing the Peace Is Still Losing," *War on the Rocks*, October 17, 2016b; Christopher S. Chivvis, "Understanding Russian 'Hybrid Warfare': And What Can Be Done About It," testimony presented before the House Armed Services Committee on March 22, 2017, Santa Monica, Calif.: RAND Corporation, CT-486, 2017; Mark Galeotti, "I'm Sorry for Creating the 'Gerasimov Doctrine,'" *Foreign Policy*, March 5, 2018; Mark Galeotti, "The Mythical 'Gerasimov Doctrine' and the Language of Threat," *Critical Studies on Security*, Vol. 7, No. 2, May 4, 2019; Michael J. Mazarr, Ryan Michael Bauer, Abigail Casey, Sarah Anita Heintz, and Luke J. Matthews, *The Emerging Risk of Virtual Societal Warfare: Social Manipulation in a Changing Information Environment*, Santa Monica, Calif.: RAND Corporation, RR-2714-OSD, 2019; Lyle J. Morris, Michael J. Mazarr, Jeffrey W. Hornung, Stephanie Pezard, Anika Binnendijk, and Marta Kepe, *Gaining Competitive Advantage in the Gray Zone: Response Options for Coercive Aggression Below the Threshold of Major War*, Santa Monica, Calif.: RAND Corporation, RR-2942-OSD, 2019; Ben Connable, Stephanie Young, Stephanie Pezard, Andrew Radin, Raphael S. Cohen, Katya Migacheva, and James Sladden, *Russia's Hostile Measures: Combating Russian Gray Zone Aggression Against NATO in the Contact, Blunt, and Surge Layers of Competition*, Santa Monica, Calif.: RAND Corporation, RR-2539-A, 2020; Herbert R. McMaster, *Battlegrounds: The Fight to Defend the Free World*, New York: Harper, 2020.

[11] Robert Axelrod, *The Evolution of Cooperation*, New York: Basic Books, 2006.

[12] James P. Carse, *Finite and Infinite Games*, New York: The Free Press, 1986, pp. 1–31; Simon Sinek, *The Infinite Game*, New York: Portfolio, 2019.

> We know that someone has won the game when all the players have agreed who among them is the winner. No other condition than the agreement of the players is absolutely required in determining who has won the game.[13]

Given these properties, the goal of a finite game is to win—to achieve unambiguous victory over competitors according to the rules and purpose of the game.

By contrast, infinite games are also entered into voluntarily, but they are unbounded because players are free to change the time, the space, and the rules of play as they wish. As a result, players cannot determine when the game begins, when it ends, or how it is scored. Because the game is open—participants, times, locations, rules, and ways of keeping score might change—victory conditions cannot be known, nor can the ranking of the players be made in an unambiguous fashion. As a result, infinite games are not played in the pursuit of victory; rather, they are played for the purpose of continuing to play. Or, as Carse stated, "A finite game is played for the purpose of winning, an infinite game for the purpose of continuing the play."[14]

Finite games might be played within infinite games. Although infinite games might be unbounded and open, players can agree to conduct themselves according to rules that dictate interactions among them. Thus, players engaged in long-term, open-ended competition might nevertheless create limited, bounded, and ultimately managed contests among them, yet the results of finite games cannot settle the larger infinite game within which they occur. As Carse concluded,

> Finite games can be played within an infinite game, but an infinite game cannot be played within a finite game.
>
> Infinite players regard their wins and losses in whatever finite games they play as but moments in continuing play.[15]

The differences between finite and infinite games are profound. Surprise, death, and power—three of the most-consequential elements of gameplay—are discussed next.

Surprise in Finite and Infinite Games

Finite and infinite games each locate the sources of surprise in different places. In finite games, surprise occurs as a result of one player not being fully aware of what actions are allowable under the game's rules.[16] Thus, being surprised within a finite game reveals a lack

[13] Carse, 1986, p. 3.

[14] Carse, 1986, p. 3.

[15] Carse, 1986, p. 7.

[16] It might be argued that surprise in a finite game could result from one player cheating, violating the agreed-on rules of the game. However, such a circumstance, in which one player abides by the agreed-on rules of the game while the other does not, more closely aligns with the playing of an infinite game, in which one player has altered the rules.

of mastery over the rules and the permitted actions. Players demonstrate their expertise by knowing what actions are possible, anticipating their use, and deterring or countering their opponent's moves. In doing so, players use their past knowledge to shape the future:

> It is the desire of all finite players to be Master Players, to be so perfectly skilled in their play that nothing can surprise them, so perfectly trained that every move in the game is foreseen at the beginning. . . . A finite player is trained not only to anticipate every future possibility, but to control the future.[17]

By comparison, because infinite games are open and malleable, surprise does not occur as a result of unfamiliarity with the rules but rather because of unfamiliarity with the other player and the variety of actions they might perform. However, because infinite games are open and subject to change, players expect to be surprised. Put another way, in finite games, strategies emerge as a result of the game's structure, while in infinite games, the games themselves arise from the strategies of the players.[18] Therefore, being surprised is not seen as a lack of skill; rather, skill is expressed in the ability to adapt and change depending on what others do:

> Because infinite players prepare themselves to be surprised by the future, they play in complete openness. It is not an openness as in candor, but an openness as in vulnerability. It is not a matter of exposing one's unchanging identity, the true self that has always been, but a way of exposing one's ceaseless growth, the dynamic self that has yet to be.[19]

Different perspectives on surprise shift how players should examine their understanding of the game and competition. If surprise is a matter of failing to understand the system and the legality of possible moves and their countermoves, then players might find it fruitful to commit analytic resources to exploring possibilities within the space of interactions constrained by the game's rules. Although such games as Chess, Go, and Starcraft have massive state spaces, they remain closed conceptually, even though realism limits the extent to which human and machine computing resources can exhaustively search the space and identify an optimal strategy.[20] By comparison, if the source of surprise is found in the motivated reason-

[17] Carse, 1986, pp. 17–18.

[18] These differences manifest in contemporary research methods. Game theory seeks to discover optimal strategies for players given a structure of allowable moves and payoffs. Agent-based models seek to discover what kinds of interactions or moves result when agents with specified strategies interact. Although contemporary models often blend these approaches, the core differences between searching for what strategies emerge given a game structure and observing what interactions emerge given a set of strategies reveal fundamentally different research motives.

[19] Carse, 1986, p. 18.

[20] This issue is addressed in Chapter Seventeen of this report (Justin Grana, "Difficulties in Analyzing Strategic Interaction: Quantifying Complexity," in Aaron B. Frank and Elizabeth M. Bartels, eds., *Adaptive Engagement for Undergoverned Spaces: Concepts, Challenges, and Prospects for New Approaches,* Santa Monica, Calif.: RAND Corporation, RR-A1275-1, 2022).

ing and innovative behaviors of other players, then an alternative posture is warranted—one based on seeking robustness and resilience and developing the capabilities to recover from surprise and adapt to changes in the game.[21]

Death in Finite and Infinite Games

In finite games, a player's death or removal as a competitor ends their ability to win the game. Victory is often achieved by a terminal move that renders the opposing player unable to compete any longer: "A terminal move results in the death of the opposing player as player. The winner kills the opponent. The loser is dead in the sense of being incapable of further play."[22] Under such conditions, death is synonymous with defeat.

In infinite games, a different circumstance arises in which death, or the inability to compete further, is an achievement if it enables the game to continue. Carse regarded this as "life in death," resulting when the deaths of some players allowed others to continue the game.[23] Using warfare as an example of an infinite game, he noted that soldiers achieved immortality by sacrificing themselves to allow others to continue to fight:[24]

> Soldiers commonly achieve a life in death. Soldiers fight not to stay alive but to save the nation. Those who do fight only to protect themselves are, in fact, considered guilty of the highest military crimes. Soldiers who die fighting the enemy, however, receive the nation's highest reward: They are declared unforgettable. Even unknown soldiers are memorialized—though their names have been lost, their titles will not be.[25]

The importance of death, or the removal from the game, carries different meanings in finite and infinite games. In finite games, being killed or removed from the game is framed as a loss or lack of success. Alternatively, in infinite games, death signals not weakness but strength—a costly sacrifice demonstrating commitment and investment in competitiveness.

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[21] Jack Davis, "Strategic Warning: Intelligence Support in a World of Uncertainty and Surprise," in Loch K. Johnson, ed., *Handbook of Intelligence Studies*, New York: Routledge, 2007; Aaron Benjamin Frank, Margaret Goud Collins, Simon A. Levin, Andrew W. Lo, Joshua Ramo, Ulf Dieckmann, Victor Kremenyuk, Arkady Kryazhimskiy, JoAnne Linnerooth-Bayer, Ben Ramalingam, J. Stapleton Roy, Donald G. Saari, Stefan Thurner, and Detlof von Winterfeldt, "Dealing with Femtorisks in International Relations," *Proceedings of the National Academy of Sciences*, Vol. 111, No. 49, December 9, 2014; Vincent A. W. J. Marchau, Warren E. Walker, Pieter J. T. M. Bloemen, and Steven W. Popper, eds., *Decision Making Under Deep Uncertainty: From Theory to Practice*, Cham, Switzerland: Springer, 2019.

[22] Carse, 1986, p. 20.

[23] Carse, 1986, p. 21.

[24] Carse's view is consistent with research on identities that are achieved based on pain, suffering, and sacrifice, including those that can only be accomplished in death, such as sainthood and martyrdom. See Steph Lawler, *Identity: Sociological Perspectives*, Malden, Mass.: Polity, 2014, pp. 23–44; and Richard Jenkins, *Social Identity*, New York: Routledge, 2014, p. 17.

[25] Carse, 1986, p. 22.

Power in Finite and Infinite Games

Another important difference between finite and infinite games concerns how power manifests. Carse argued that conceptions of power in finite games revolve around the ability to compel others to do as directed (i.e., to act in ways that they would otherwise not). This accords with traditional definitions of power employed in international relations, such as conceptions of military deterrence (to prevent others from acting), compellence or coercion (to make others take an action), and economic or institutional leverage (to adopt practices to participate in markets or governance).[26]

Carse believed that in finite games, measurements of power are historical—they are based on demonstrations of what the player has already done. Therefore, power is attained or achieved. As Carse concluded,

> To speak meaningfully of a person's power is to speak of what that person has already completed in one or another closed field. To see power is to look backward in time.
>
> Inasmuch as power is determined by the outcome of a game, one does not win by being powerful; one wins to be powerful. If one has sufficient power to win before the game has begun, what follows is not a game at all.[27]

Because power is historical and exists in the context of an established game, it has no meaning in an infinite game played in a nonstationary environment. Instead, Carse argued that the concept of strength is more appropriate. *Strength*, according to Carse, is defined as what a player can allow others to do. Strength defines the boundaries within which players believe that they have the capacity and adaptability to cope. As Carse summarized,

> Strength is paradoxical. I am not strong because I can force others to do what I wish as a result of my play with them, but because I can allow them to do what they wish in the course of my play with them.[28]

In contemporary terms, strength might be regarded as robustness or resilience—robustness in that a player might be insensitive to a large number of actions others might take, and resilience in that a player might be able to adapt to what others have done.

The differences between power and strength might be evident in the construction and persistence of institutions of international governance. Although the development and balance of power has been a central concern of international relations theory and practice, mat-

[26] Kenneth N. Waltz, *Theory of International Politics*, Reading, Mass.: McGraw Hill, 1979; Robert J. Art, "To What Ends Military Power?" *International Security*, Vol. 4, No. 4, Spring 1980; Robert O. Keohane, *After Hegemony: Cooperation and Discord in the World Political Economy*, revised ed., Princeton, N.J.: Princeton University Press, 2005; Thomas C. Schelling, *Arms and Influence*, New Haven, Conn.: Yale University Press, 2008.

[27] Carse, 1986, p. 29.

[28] Carse, 1986, p. 31.

ters of strength have been evident—though not explicitly identified—in the terms put forward by Carse. For example, the development of order after great-power conflict has been seen as the moment at which victorious great powers have the opportunity to cement privileged positions in the international system through such institutions as military alliances, trading rules, and international law. Yet the international order that has endured for more than seven decades was based on decisions made by the United States in the aftermath of World War II to voluntarily bind itself to rules that constrained its use of power and created avenues for others to assert their national interests.[29] In this context, the building of the international system was not an exercise of U.S. power, but rather a sign of U.S. strength that created a framework in which weaker states could act.[30]

Strategy, Operations, and Finite and Infinite Games

One of the most vexing and enduring strategic challenges that DoD and the NSE face involves linking tactics, operations, and strategy. Consideration of different perspectives on surprise, death, and power versus strength in finite and infinite games might provide insight into these difficulties. For example, Harry Summers noted that the U.S. commitment to winning battles—discrete engagements bounded by space, time, and participants—could not translate into political success in the Vietnam War and was best summarized by a conversation between belligerents in Hanoi after the termination of combat operations in April 1975:

> "You know you never defeated us on the battlefield," said the American colonel.
>
> The North Vietnamese colonel pondered this remark a moment. "That may be so," he replied, "but it is also irrelevant."[31]

Many of the problems in conducting the Vietnam War stemmed from the limited and counterproductive way of keeping score in the conflict—or what researchers have characterized as *dominant indicators* that organizations and decisionmakers employ to guide strategy and operations.[32] Among the most prominent indicators was the use of North Vietnamese combat casualties or body counts as a measure of success, which was problematic because, as Carse noted, death and casualties take on different meanings when viewed through the lenses of finite or infinite games. Thus, although the U.S. military relied on this indicator out of the belief that it was waging a war of attrition, others noted that it had misinterpreted Vietnamese

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[29] G. John Ikenberry, *After Victory: Institutions, Strategic Restraint, and the Rebuilding of Order After Major Wars*, Princeton, N.J.: Princeton University Press, 2000.

[30] Such a formulation is certainly an incomplete one because the origins of the modern, liberal rules-based order were not exclusively determined by the enlightened self-interest of the United States, nor has the United States necessarily or unequivocally adhered to the bounds on its power.

[31] Harry G. Summers, *On Strategy: A Critical Analysis of the Vietnam War*, New York: Presidio Press, 1995.

[32] Scott Sigmund Gartner, *Strategic Assessment in War*, New Haven, Conn.: Yale University Press, 1997.

battle deaths as a sign of weakness. Rather, this was a variable that the Vietnamese controlled and manipulated to signal their resolve, commitment to fight, and other political factors, such as domestic concerns of bringing a defeated army home from the field.[33]

A continent away and a century earlier, the final war on Prussia's path toward German unification, the Franco-Prussian War of 1870 to 1871, revealed a similar mismatch between imagining war as a bounded contest between the formal, organized armed forces of states and experiencing the unbounded violence unleashed by mass participation in conflict. Following the swift defeat of the French military, Prussian soldiers expected a rapid peace, consolidating their territorial claims according to the traditions of interstate, limited war or *Kabinettskriege* (cabinet war).[34] Instead, after the defeat of the French army, France's civilian population engaged in a protracted campaign of violent resistance in which irregular forces, including women and children, attacked Prussian soldiers in contradiction to previously established norms of warfare by engaging in *Volkskriege* (popular war).[35]

The notion that the population would fight a foreign army was regarded as such a violation of the established international order that Karl Marx noted, "[i]t is a real Prussian idea that a nation commits a crime when it continues to defend itself after its regular army has lost."[36] Following the conflict, German military thinkers hoped to reinforce the norms of limited war through the achievement of rapid, decisive victories over their rivals to avoid running the risk of having to match the strategic depth of opponents that could mobilize their citizenry. If the rules of war collapsed, the results would cease to resemble the finite games that military organizations and planners had prepared for. As Marcus Jones noted,

> Instead of one or two decisive battles that forced an opponent to confront the bitter calculus of decreasing returns for risk, the resources and willpower of entire peoples would be mobilized and subjected to an endurance contest. Outcomes would most probably not consist of terms dictated on the basis of unconditional surrender. Exhaustion on both sides would lead, it was thought, to ambiguous settlements without unequivocal winners and losers.[37]

The examples of Vietnam and the Franco-Prussian War show that the inability to translate military victory into desired political outcomes is a persistent strategic problem and that many of these difficulties align with Carse's arguments about playing in finite games or infi-

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[33] Brian Michael Jenkins, *Why the North Vietnamese Keep Fighting*, Santa Monica, Calif.: RAND Corporation, D-20153-ARPA/AGILE, April 9, 1970.

[34] Marcus Jones, "Fighting 'This Nation of Liars to the Very End': The German Army in the Franco-Prussian War, 1870–1871," in Williamson Murray and Peter R. Mansoor, eds., *Hybrid Warfare: Fighting Complex Opponents from the Ancient World to the Present*, New York: Cambridge University Press, 2012, p. 175.

[35] Jones, 2012, p. 175.

[36] Jones, 2012, pp. 187–188.

[37] Jones, 2012, p. 197.

nite games. The centrality of this issue has remained at the forefront of thinking about grand strategy and the connection between strategy, operations, and tactics. The continuing relevance of this problem—particularly for the U.S. NSE given its difficult experiences in the post–Cold War international system—was shown by Chad Buckel, an aide-de-camp on the International Military Staff of the North Atlantic Treaty Organization, who asked in 2021,

> Why, then, with so many tactical victories, is the American record of strategic success so dismal? What has prevented us from turning our battlefield successes to strategic victories, and why have we struggled so much in attaining our stated political goals?[38]

Repeated efforts to approach competition and conflict through the lens of finite games rather than infinite games might offer a partial explanation for the consistency of strategic disappointment. By focusing on a game's conclusion, strategists have emphasized the desired end state they seek and have proceeded with planning from a "theory of victory." By contrast, if games are infinite, the planning emphasis shifts from the game's end to its conduct, focusing on the body of causal models and hypotheses that connect actions and consequences, or what has recently been called a "theory of success."[39]

The theory of finite and infinite games provides a point of departure for thinking about long-term competition and engaging within UGS. Although it is not a complete theory for guiding international engagement, it offers a framework for thinking about how persistent competition, motivated by the desire to continue to compete rather than to achieve unambiguous victory, might guide decisionmaking. Such a formulation might assist decisionmakers in discovering engagement options that exist between implausible and undesirable end states, where the former is defined by outcomes that the United States lacks the resources, will, and technical acumen to produce and the latter is abandonment at the risk of ceding spaces to competitors, diminished credibility and influence, a loss of access, and the potential unraveling of international governance more broadly.

The Act-Sense-Decide-Adapt Cycle

One model for managing competition within UGS is the ASDA cycle. Initially developed by the Australian Army, the ASDA cycle provides a complex adaptive systems (CAS) approach to operational design and adaptive campaigning.[40] The ASDA cycle is particularly important

[38] Chad Buckel, "A New Look at Operational Art: How We View War Dictates How We Fight It," *Joint Forces Quarterly*, No. 100, January 2021, pp. 94–95.

[39] Frank G. Hoffman, "The Missing Element in Crafting National Strategy: A Theory of Success," *Joint Forces Quarterly*, No. 97, April 2020.

[40] Head Modernisation and Strategic Planning—Army, 2009; Huba Wass de Czege, "Systemic Operational Design: Learning and Adapting in Complex Missions," *Military Review*, February 2009; Justin Kelly and Mike Brennan, "OODA Versus ASDA: Metaphors at War," *Australian Army Journal*, Vol. 6, No. 3, Summer 2009.

for framing planning and action in UGS because of its foundational motivation to address strategic and operational needs.

At the strategic level, the ASDA cycle was introduced as a prescriptive step toward meeting the Australian Army's needs to operate in environments that did not resemble high-intensity conflict between similarly structured military forces. Addressing debates on the appropriate orientation of military forces—and echoing the same dilemmas that have occurred within the United States—Lieutenant General D. L. Morrison, the Chief of Army, noted,

> Unlike some, who continue to suggest that our deployment of forces to East Timor, the Solomon Islands, Iraq and Afghanistan have been an aberration, I am convinced they are symptomatic of the changing character of war.[41]

Thus, the ASDA cycle is motivated to manage decisionmaking processes in environments affected by the interplay of state and nonstate actors, all competing to influence the allegiances and behaviors of individuals, groups, and societies while operating at and below thresholds of conflict.[42] The result is to successfully

> influence and shape the overall environment to facilitate peaceful discourse and stabilise the situation, noting that there may be no end state to an operation but rather an enduring set of conditions conducive to Australia's national interests.[43]

At the operational level, the ASDA cycle emphasizes linking organizational action and learning. Given the expectation that the environment will continuously change, the ASDA cycle emphasizes five organizational and decisionmaking tenets, each representing some version of adaptive behavior on the part of military organizations, operations, and staff. These five tenets are as follows:

- **Flexibility**—the ability to maintain effectiveness across a range of tasks, situations and conditions within a single line of operation. For example, the structure and capability of the force can be reconfigured in different ways, to do different tasks, under different sets of conditions.
- **Agility**—the ability to dynamically manage the balance and weight of effort across all lines of operation in time and space.
- **Resilience—**the capacity to sustain loss, damage, and setbacks and still maintain essential levels of capability across core functions.
- **Responsiveness**—the ability to rapidly identify, and then appropriately respond to, new threats and opportunities within a line of operation.
- **Robustness**—the ability to achieve and sustain a critical mass of forces in relation to both population density and adversarial group capabilities, thereby achieving

[41] Head Modernisation and Strategic Planning—Army, 2009, p. i.

[42] Head Modernisation and Strategic Planning—Army, 2009, p. iii.

[43] Head Modernisation and Strategic Planning—Army, 2009, p. iv.

> sufficient control of the environment to account for *Operational Uncertainty* and respond across the five lines of operation.[44]

The ASDA cycle differs from the more popular Observe-Orient-Decide-Act (OODA) loop, which is based on fundamental beliefs about the character of competition. Specifically, the OODA loop principally emphasizes the attainment of competitive advantage through being able to orient and decide faster than rivals. By contrast, the ASDA cycle emphasizes learning and adaptation, building competitive advantage through the ability to rapidly reframe situations according to experience gained:

> The OODA loop is a model of decision-making that emphasises the importance of orientation for making sense of the observed situation, which is the basis for decision and action. . . . The Adaptation Cycle emphasises understanding a problem through experience, knowledge and planning, enhancing that understanding through interaction and explicitly drawing out the requirements to learn and adapt, individually and organisationally.[45]

The depth to which the ASDA cycle emphasizes learning and change is extensive. Its prescriptive guidance reaches beyond changes in tactics and operational concepts and extends to the highest levels of strategy. In doing so, the cycle seeks to assist decisionmakers in learning not only whether the ways of competing need to change but also whether the ends being pursued should be altered. The emphasis on learning and change follows the logic of a theory of success discussed earlier, in which the causal structure of the system over which competition occurs is discovered through the process of developing causal hypotheses and their tests:[46]

> Modern combat can therefore be characterised as competitive learning in which all sides are constantly in a process of creating, testing, and refining hypotheses about the nature of the reality of which they are a part. The resulting adaptations might need to be extensive, extending beyond forms of tactical action to possibly encompass previously sacrosanct areas such as the force's mission. The underlying premise [is] that the original mission, objectives, and plan were based on conjecture about the enemy system's elements and internal relationships, and subsequent action will have modified the applicability of that conjecture.[47]

The proposed depth of adaptation and discovery is important. Just as the shift from finite to infinite games discussed earlier changes the decisionmaking focus from the end state or conclusion of a game to an endless process of interaction and discovery, the ingrained expectation to adapt at all levels of decisionmaking accords with models of CAS and organizational

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[44] Head Modernisation and Strategic Planning—Army, 2009, p. 30.

[45] Head Modernisation and Strategic Planning—Army, 2009, p. 31.

[46] Hoffman, 2020.

[47] Kelly and Brennan, 2009, p. 47.

behavior, which accepts that decisionmakers might be unaware of their goals and priorities until they are challenged. The *garbage can model* of organizational decisionmaking posits that organizations operate under conditions where (1) preferences are not universally shared by stakeholders and might even be unknown to them; (2) technology, inclusive of artifacts and processes, for connecting actions with outcomes is uncertain and often must be discovered through trial and error; and (3) stakeholder participation in decisionmaking processes is fluid, given that decisionmakers have limited time, attention, and resources to commit to problems.[48] The garbage can model has repeatedly shown how decisionmaking does not align with the ideals set forth in explanations of rational strategic action and that well-governed strategy, particularly decisionmaking conducted at the highest levels of governance from which tactical and operational choices flow, is often made to appear more deliberative and rational than it is.[49]

The empirical conditions characterized by the garbage can model are well served by the ASDA cycle's commitment to learning and adaptation. Like the popular OODA loop, the ASDA cycle, shown in Figure 6.3, is a repeated model that is intended to support iterative and open-ended decisionmaking in strategic circumstances.

Each step in the ASDA cycle is part of a learning process that commits organizations and individuals to challenge their beliefs, make new discoveries, and change their thinking and behavior as a result of new information. Each phase of the ASDA cycle and its role in the adaptive process is discussed next.

Act

The *act* phase of the cycle begins with actions intended to stimulate the system—whether a specific adversary, population, or environment. Actions might be taken to confirm an understanding of the target system (i.e., a form of hypothesis test, referred to as *discovery actions*). Alternatively, actions might be driven by the belief that a cause will have an effect, which is

[48] Michael D. Cohen, James G. March, and Johan P. Olsen, "A Garbage Can Model of Organizational Choice," *Administrative Science Quarterly*, Vol. 17, No. 1, 1972.

[49] B. Guy Peters, "Governance: A Garbage Can Perspective," in Edgar Grande and Louis W. Pauly, eds., *Complex Sovereignty*, Toronto, Canada: University of Toronto Press, 2007; Stephen D. Krasner, "The Garbage Can Framework for Locating Policy Planning," in Daniel W. Drezner, ed., *Avoiding Trivia: The Role of Strategic Planning in American Foreign Policy*, Washington, D.C.: Brookings Institution Press, 2009; Mie Augier and Jerry Guo, "Geopolitics and Garbage Cans: Understanding the Essence of Decision Making in an Interdisciplinary and Psycho-Cultural Perspective," in Alessandro Lomi and J. Richard Harrison, eds., *The Garbage Can Model of Organizational Choice: Looking Forward at Forty*, Vol. 36, Bingley, United Kingdom: Emerald Publishing Group, 2012; David R. Gibson, "Turn-Taking and Geopolitics in the Making of Decisions," in Alessandro Lomi and J. Richard Harrison, eds., *The Garbage Can Model of Organizational Choice: Looking Forward at Forty*, Vol. 36, Bingley, United Kingdom: Emerald Publishing Group, 2012; Richard K. Betts, "The Grandiosity of Grand Strategy," *Washington Quarterly*, Vol. 42, No. 4, October 2, 2019.

FIGURE 6.3
The ASDA Cycle

SOURCE: Head Modernisation and Strategic Planning—Army, *Army's Future Land Operating Concept*, 2009, p. 31. Used with permission.

rooted in the belief that a suitable causal model of the system has been discovered (i.e., a decisive action).[50]

Sense

The *sense* phase has two interrelated purposes. First, the response to the action reveals new information about the system. Such information might be regarded as providing feedback that has both qualitative and quantitative properties. Qualitative information might be the type of response produced by the stimulus and its source. Quantitative information might be the intensity of the response. Importantly, proponents of the ASDA model note that sensing itself is a learning process, where actors might need to discover how to detect, characterize, and measure feedback produced by stimulating actions.[51]

[50] Head Modernisation and Strategic Planning—Army, 2009, p. 33.

[51] Head Modernisation and Strategic Planning—Army, 2009, pp. 33–34.

Decide

The *decide* phase consists of making two types of choices. The first type is diagnostic. Diagnostic choices are determinations about the significance or consequences of sensed feedback. The second type is prognostic. Prognostic choices are determinations about what should be done.[52]

Adapt

The final phase of the cycle is *adapt*. This phase consist of three types of learning. First, the phase emphasizes learning how to learn, which involves communication, the sharing of lessons learned, and incentivizing risk-taking. Second, adaptation identifies specific knowledge or lessons to pursue. This shapes future action by prioritizing what discoveries should be pursued to inform the timing and direction of additional actions. Finally, adaptation challenges the entrenched understanding of the system to ensure that organizations do not grow complacent and retain outdated or flawed beliefs about the system and themselves.[53]

The ASDA Cycle and Governance

When viewed holistically, the ASDA cycle is intimately related to the challenges of governance in at least two ways. The first is instrumental. Because the ASDA cycle and the larger adaptive campaigning premise begins long before the initiation of violent conflict and lasts long after its termination, issues associated with building and maintaining capable and legitimate governance play an important role in the operational and organizational toolkit. Addressing matters of governance and building the capacity to manage resources and allocate services effectively and legitimately are seen as opportunities to forestall crises and inhibit the escalation of competition into conflict. For example, the *adaptive campaigning* concept noted that building indigenous capacity for governance provided an opportunity to forestall the outbreak of conflict before the commitment of military resources. Indigenous capacity building involves

> actions to nurture the establishment of capacity within civil communities whilst simultaneously working to establish longer term governance and socio-economic capacity that meets the needs of the people. This may include; micro financial initiatives, local and central government reform—security, police, legal, financial and administrative systems.[54]

The second touchpoint between the ASDA cycle and governance is abstract yet reveals a shared set of ideals on adaptive behavior and the pursuit of processes that limit the extent

[52] Head Modernisation and Strategic Planning—Army, 2009, p. 34.

[53] Head Modernisation and Strategic Planning—Army, 2009, pp. 34–35.

[54] Head Modernisation and Strategic Planning—Army, 2009, p. 28.

to which momentum drives decisionmaking, planning, and organizational behavior more broadly. Two particular models of governance—*problem-centric* governance and *adaptive* governance—offer complementary perspectives on how to engage with populations on complex issues. They provide guidance about how to limit the propensity for governing organizations to allow their own internal preferences and processes to overwhelm the need to adapt to the specifics of the external environment. Likewise, shifts in the nature of governance itself, specifically the transition from authoritative and market-based allocation systems toward networks of exchange, offer additional perspectives on the strategic and adaptive benefits of cooperation as a means for achieving security in the face of unpredictable threats. Together, these perspectives offer preliminary speculations about how the ASDA cycle might be aligned with contemporary perspectives on governance and adaptation.

Problem-Centric Governance

Problem-centric governance approaches policy with the expectation that governing organizations and processes must be adapted to the features of the problems they encounter. Much like the idea of problem-centric research that seeks to tailor and develop new research methods based on the problem being investigated as opposed to seeking problems that are well suited for specified methods, problem-centric governance emphasizes the minimization of internal constraints from within organizations to maximize the use of available information and capabilities.[55] Problem-centric governance is particularly important in cases where problems are complex and involve multiple stakeholders. It is also crucial in cases where traditional coordination processes across organizational elements produce gaps and seams that limit the effectiveness of established engagement frameworks:

> Problem-oriented governance is an approach to policy design and implementation that emphasizes the need for organizations to adapt their form and functioning to the nature of the public problems they seek to address. This approach is fundamentally outward-looking in its effort to shape both long-term strategy and day-to-day working arrangements around problems as they manifest themselves. An underlying premise is that no single organization is able by itself to take on complex problems. . . . In essence, it is radically committed to prioritizing the problem-solving challenge over the comfort and convenience of preserving existing organizational practices and institutional arrangements. Learning about problems, and how they evolve over time, is at the heart of this approach. This involves challenging assumptions, developing new hypotheses, and gathering evidence to guide thinking and action. Adaptation is the logical consequence of this

[55] Rudra Sil, "Problems Chasing Methods or Methods Chasing Problems? Research Communities, Constrained Pluralism, and the Role of Eclecticism," in Ian Shapiro, Rogers M. Smith, and Tarek E. Masoud, eds., *Problems and Methods in the Study of Politics*, Cambridge, United Kingdom: Cambridge University Press, 2004.

> learning: problem-oriented organizations are committed to correcting actions that fail to address the problem and double down on remedies that work.[56]

Problem-centric governance requires a commitment to information collection, assessment, problem framing, and organizational reform. It emphasizes processes and resource commitments that sustain the continual search for new organizational forms and problem frames, accepting that the organization has never reached an optimal design and that artifacts from prior decisions and forms are persistent.[57] Creating fluid governance structures that can be corrected through the use of feedback rests on (1) a reflective-improvement capability that simultaneously develops and tests alternative causal models of the problem that can guide policy action and organizational oversight that holds leaders and operators accountable for their actions and commitment to learning processes; (2) a collaborative capability that emphasizes cross-silo, cross-sector, and state-society relationships and interaction; and (3) a data-analytic capability that collects, processes, analyzes, and, ultimately, learns from both formally collected and tacitly present information available to those participating in the governance process.[58]

Like the ASDA cycle, problem-centric governance imagines that governing organizations have the best opportunities to achieve their goals by maintaining flexibility and openness. Such commitments diverge from governing strategies that seek to impose uniformity and regular order on the world by seeking efficiencies through the ability to regulate systems and routinize engagements. Such efforts to "see like a state" have often produced illusions of control, order, and success in the short term, only to create long-term problems and instabilities in the very systems they seek to secure.[59] Problem-centric governance challenges organizations to be more flexible, adaptive, and, ultimately, responsive to the world.

Adaptive Governance

Adaptive governance complements problem-centric governance. Whereas problem-centric governance seeks to make organizations more flexible, adaptive governance seeks to make them more open. Specifically, adaptive governance was developed to correct the practices of scientific management and classical organizational theory that emerged a century ago; it was based on the premise that science could optimize organizational performance and separate decisionmaking into science-based and judgment-based decisions—the former belonging to

[56] Quinton Mayne, Jorrit deJong, and Fernando Fernandez-Monge, "State Capabilities for Problem-Oriented Governance," *Perspectives on Public Management and Governance*, Vol. 3, No. 1, 2019, p. 34.

[57] Daniel A. Levinthal, "Adaptation on Rugged Landscapes," *Management Science*, Vol. 43, No. 7, 1997.

[58] Mayne, deJong, and Fernandez-Monge, 2019, p. 34.

[59] Brian Walker and David Salt, *Resilience Thinking: Sustaining Ecosystems and People in a Changing World*, Washington, D.C.: Island Press, 2006; James C. Scott, *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed*, New Haven, Conn.: Yale University Press, 1999.

expert technocrats and the latter to leaders entrusted with defining organizational goals.[60] This approach to problem-solving was inspired by a worldview in which organizations stood apart from their environments and scientists were independent of their subjects. That separation supported the idea that objective truths could be determined by exploring carefully planned interactions between subjects—be they consumers of services, governed populations, or physical particles under examination.[61]

The problems posed by scientific management echoed those that emerged contemporaneously in the broader scientific community. For example, in the organizational world, hard boundaries between organizations and environments became increasingly fuzzy as new theories recognized that organizations were composed of their formal members and also suppliers, consultants, partners, consumers, and so on—each affecting market position and access to resources.[62] This mirrored developments in science, such as the recognition that organisms not only adapted to their environment but altered their environment to serve their purposes, engineering changes to the landscape that altered the flow of energy and resources to their benefit and thus gave rise to the notion of the extended phenotype or organism.[63]

Likewise, the possibility of objective observation was challenged by developments in management and science. In organizational behavior and social science, this was most acutely demonstrated by the experiments performed at the Hawthorne Plant of the Western Electric Company in Chicago, where workers were placed into groups and subjected to different treatments of lighting conditions to measure how illumination affected productivity. Surprisingly, workers' productivity increased under conditions of increased and decreased lighting. This puzzling outcome was eventually understood to have resulted from workers being observed by their management.[64] The realization that the act of observing workers directly affected their motivation to be productive echoed simultaneous developments in physics, in which

[60] James G. March and Herbert A. Simon, *Organizations*, 2nd ed., Cambridge, Mass.: Blackwell, 1993, pp. 31–52; Ronald D. Brunner and Toddi A. Steelman, "Beyond Scientific Management," in Ronald D. Brunner, Toddi A. Steelman, Lindy Coe-Juell, Christina M. Cromley, Christine M. Edwards, and Donna W. Tucker, eds., *Adaptive Governance: Integrating Science, Policy, and Decision Making*, New York: Columbia University Press, 2005, pp. 11–26; Gareth Morgan, *Images of Organization*, Thousand Oaks, Calif.: Sage Publications, 2006, pp. 22–31; Charles Perrow, *Complex Organizations: A Critical Essay*, Brattleboro, Vt.: Echo Point Books & Media, 2014, pp. 56–58.

[61] Brunner and Steelman, 2005, pp. 21–24.

[62] March and Simon, 1993, pp. 101–131.

[63] J. Scott Turner, *The Extended Organism: The Physiology of Animal-Built Structures*, Cambridge, Mass.: Harvard University Press, 2002; Richard Dawkins, *The Extended Phenotype: The Long Reach of the Gene*, New York: Oxford University Press, 2016; Philip Hunter, "The Revival of the Extended Phenotype," *EMBO Reports*, Vol. 19, No. 7, July 2018.

[64] Morgan, 2006, pp. 34–38; Perrow, 2014, pp. 79–85.

the Heisenberg uncertainty principle was developing to explain the observer's effects on the measurement of a particle's position and momentum.[65]

The belief that rigorous assessment could cleanly divide decisionmaking between matters of fact and matters of values also eroded, with two profound effects on governance and science. First, such scientists as Herbert A. Simon noted that there was no rule of inference by which a collection of statements about the world as it *is* could answer a question as to how it *should* be.[66] No matter how knowledgeable the researcher or organization was about the empirical world, that knowledge alone was insufficient to answer normative questions. Although such a finding ruled out the prospects of science discovering the objective ends that governments and organizations should pursue, it did appear to support the idealized division of labor between decisionmakers and scientific and technical experts within organizations.

The second effect, however, complicated the boundary between decisionmakers making value judgments and scientists and experts dealing with objective facts. Specifically, Thomas Kuhn's *Structure of Scientific Revolutions* called into question the veracity of idealistic characterizations of scientific method and practice.[67] By emphasizing the actual behavior of scientists, it became clear that science was practiced by real people with real cognitive processes living in real social and organizational circumstances. Science was not practiced in a timeless vacuum, or from "a view from nowhere"; rather, science was practiced in time and space by individuals interested in the outcomes of their research.[68]

The practice of science is infused with human values, rendering observations theory-laden and framed by the mental models and processes of observers.[69] The result of investigations into the boundaries between fact and values has subsequently persisted within the scientific community, calling into question the achievability and utility of objectivity, neutrality, generalizability, and other ideals—an issue that remains unresolved.[70]

Scientific management, and science more broadly, encountered practical challenges associated with the limits of reductionism and analysis (i.e., the decomposition of systems into independent parts), in addition to philosophical matters. Complexity, interdependence, feed-

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[65] Charis Anastopoulos, *Particle or Wave: The Evolution of the Concept of Matter in Modern Physics*, illustrated ed., Princeton, N.J.: Princeton University Press, 2008, pp. 146–197.

[66] Herbert A. Simon, *Reason in Human Affairs*, Palo Alto, Calif.: Stanford University Press, 1982, pp. 6–7.

[67] Thomas S. Kuhn, *The Essential Tension: Selected Studies in Scientific Tradition and Change*, Chicago, Ill.: University of Chicago Press, 1977; Thomas S. Kuhn, *The Structure of Scientific Revolutions: 50th Anniversary Edition*, Chicago, Ill.: University of Chicago Press, 2012.

[68] Thomas Nagel, *The View from Nowhere*, New York: Oxford University Press, 1986.

[69] Ernan McMullin, "Values in Science," *PSA: Proceedings of the Biennial Meeting of the Philosophy of Science Association*, 1982; Larry Laudan, *Science and Values: The Aims of Science and Their Role in Scientific Debate*, Berkeley, Calif.: University of California Press, 1984.

[70] Hilary Putnam, *The Collapse of the Fact/Value Dichotomy and Other Essays*, Cambridge, Mass.: Harvard University Press, 2004; Heather Douglas, "Values in Social Science," in Nancy Cartwright and Eleonora Montuschi, eds., *Philosophy of Social Science: A New Introduction*, New York: Oxford University Press, 2014.

back, and adaptation over time all revealed the limitations of explaining, predicting, and ultimately controlling systems in which these and other properties were present. The scientific challenges posed by complexity have been well documented and do not need to be reiterated at length here.[71] It is sufficient to note that the challenges presented by complexity have exposed theoretical and methodological limitations and exacerbated the issues noted earlier—fluid or porous boundaries within systems, unavoidable participation in the system, and contingent framing of problems within which observations and assessments are made.

The core corrective action taken by adaptive governance is to open the decisionmaking process to stakeholders. In a policy context, scientific management emphasized the roles of political or organizational authorities, scientists, and other technocratic experts. Absent from this approach to governance was the governed population itself—the people that had unique knowledge about the system and were most affected by the government's decisions.

The problems posed by the exclusion of stakeholders from governance processes have been exemplified in the evolution of smart city management concepts and practices. Initial efforts to develop smart cities focused on large-scale, advanced infrastructure and master planning, neither of which provided the expected benefits to city managers or their inhabitants.[72] Instead, later generations of investments emphasized the development of open data infrastructures and processes for increasing citizen participation in governance decisions.[73] These investments include efforts to place the consumers of governance services on the

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[71] The extensive literature on complex systems offers perspectives on how combinations of interdependence and feedback within systems, among other properties, create limitations to what more-traditional scientific approaches can offer. See, for example, Warren Weaver, "Science and Complexity," *American Scientist*, Vol. 36, No. 4, October 1948; Stuart Kaufman, *The Origins of Order: Self-Organization and Selection in Evolution*, New York: Oxford University Press, 1993; Per Bak, *How Nature Works*, New York: Copernicus, 1996; Crawford S. Holling, "Two Cultures of Ecology," *Conservation Ecology*, Vol. 2, No. 2, December 15, 1998; Simon A. Levin, *Fragile Dominion: Complexity and the Commons*, New York: Basic Books, 2000; Herbert A. Simon, *The Sciences of the Artificial*, Cambridge, Mass.: MIT Press, 2003; Joshua M. Epstein, *Generative Social Science: Studies in Agent-Based Computational Modeling*, Princeton, N.J.: Princeton University Press, 2006; John H. Miller and Scott E. Page, *Complex Adaptive Systems: An Introduction to Computational Models of Social Life*, Princeton, N.J.: Princeton University Press, 2007; Mark A. Bedau and Paul Humphreys, eds., *Emergence: Contemporary Readings in Philosophy and Science*, Cambridge, Mass.: MIT Press, 2008; John E. Mayfield, *The Engine of Complexity: Evolution as Computation*, New York: Columbia University Press, 2013; John H. Holland, *Complexity: A Very Short Introduction*, New York: Oxford University Press, 2014; and W. Brian Arthur, *Complexity and the Economy*, New York: Oxford University Press, 2015.

[72] Carol L. Stimmel, *Building Smart Cities: Analytics, ICT, and Design Thinking*, New York: CRC Press, 2016.

[73] Brett Goldstein and Lauren Dyson, eds., *Beyond Transparency: Open Data and the Future of Civic Innovation*, San Francisco, Calif.: Code for America Press, 2013; Stephen Goldsmith and Susan Crawford, *The Responsive City: Engaging Communities Through Data-Smart Governance*, San Francisco, Calif.: Jossey-Bass, 2014; Boyd Cohen, "The 3 Generations of Smart Cities," *Fast Company*, August 10, 2015; Caitlin Harrington, "Direct Your Tax Dollars: Voting Now Open for Participatory Budgeting in District 7," Hoodline, April 15, 2016; CARTO, "40 Brilliant Open Data Projects Preparing Smart Cities for 2018," September 28, 2017; NOMINET, "List of Smart City Projects," webpage, October 10, 2018; Smart City Expo World Congress, *Smart City Expo World Congress: Report 2017*, 2018.

same information communications technology platforms as the providers of those services to create feedback loops between the government and citizens through such systems as 311, smartphone apps, interactive websites, and other platforms for exchanging data.[74] These developments have allowed cities to focus on using timely information about the demand for, and outcomes of, their actions (e.g., when notifications of needed road repairs, garbage collection, health services, etc., start and stop). The result is that city managers have started to govern from a new perspective, shifting their focus from monitoring whether city employees follow correct processes and procedures toward determining whether their actions addressed the needs of the city's constituents.[75]

The example of smart cities illustrates the core ideas of adaptive governance. First, the failures of centrally planned and managed infrastructures repeatedly showed the limitations that resulted from governance decisions based on unrealistic models of the city's inhabitants and their behaviors. Second, although lay people might lack scientific or technical expertise, population members have legitimate stakes and perspectives on problems and should be involved in decisions about policy goals and the measures taken to achieve them. As Ronald Brunner and Toddi Steelman noted, "Adaptive governance includes the adaptation of policy decisions to real people, not the cardboard caricatures sometimes constructed for scientific or managerial purposes. . . . Sound policy is based on people as they are."[76]

From these concerns flows the emphasis on participatory decisionmaking methods, which involve multiple stakeholders in decisionmaking processes and accept that no single authority has the expertise and legitimacy to determine the ends and means of policy alone. Rather than view policy as a puzzle that can be solved by experts and authorities by carefully carving problems into their analytical components, adaptive governance accepts the presence and persistence of immutable uncertainties and surprises.[77] As a result, decisionmaking attention shifts from deeply analyzing policy options and selecting the best one, which relies on a *predict-then-act* method, toward monitoring multiple interventions simultaneously, assessing their effects, and terminating those that fail to deliver desired outcomes.[78] The expectation is that no policy or intervention will permanently settle an issue:

> [I]n the face of uncertainties the burden of decision making shifts to monitoring and evaluating and to terminating policy alternatives that fail. No policy can be a permanent

[74] Goldstein and Dyson, 2013; Michael Bloomberg, "City Century: Why Municipalities Are the Key to Fighting Climate Change," *Foreign Affairs*, Vol. 94, No. 5, 2015; OpenDataSoft, "Give the People Smart City Dashboards!" webpage, October 5, 2016.

[75] Goldsmith and Crawford, 2014.

[76] Brunner and Steelman, 2005, p. 19.

[77] Brunner and Steelman, 2005, pp. 21–25.

[78] Robert J. Lempert, Steven W. Popper, and Steven C. Bankes, *Shaping the Next One Hundred Years: New Methods for Quantitative Long-Term Policy Analysis*, Santa Monica, Calif.: RAND Corporation, MR-1626-RPC, 2003, pp. 26–27.

> solution because interests, knowledge, and other significant details of the context are subject to change.[79]

Table 6.1 compares the traditional approach to scientific management with adaptive governance. The table shows that each approach formulates policy and rationalizes decisions in different ways. Adaptive governance embraces approaches to governance that, much like the ASDA cycle, accept that decisionmakers cannot stand apart from the system and must rely on experimentation, learning, and local context to continuously align and realign governance decisions and population needs. In this regard, adaptive governance most closely resembles the *act*, *sense*, and *decide* phases of the ASDA cycle, in which actions are taken to probe the system and new sources of inputs, especially stakeholders themselves, are sensed to inform decisionmaking.

Hierarchies, Markets, and Network Models of Governance

Shifting attention from governments to governance reveals alternative modes for organizing how social systems allocate resources and coordinate the behavior of members. For some observers, such a change presents an alternative to studying the role of government in society by looking at the design and activities of other organizations, such as commercial firms and civic groups.[80] For others, the shift to governance places the entire study of social organization into the broadest possible context, putting governments, private-sector firms, civil society, religious institutions, and more on a continuum of interacting organizations that have managed the flow of information and resources within society, maintained the continuity of social life, and enabled society's transformation or collapse when challenges arise.[81] From the perspective of governance, three modes of social organization warrant attention—hierarchies, markets, and networks—each motivating action within social systems and organizations in different ways.

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[79] Brunner and Steelman, 2005, p. 24.

[80] Mark Bevir, *Governance: A Very Short Introduction*, illustrated ed., New York: Oxford University Press, 2012, p. 15.

[81] Kent V. Flannery, "The Cultural Evolution of Civilizations," *Annual Review of Ecology and Systematics*, Vol. 3, 1972; Joseph A. Tainter, *The Collapse of Complex Societies*, New York: Cambridge University Press, 1990; Hendrick Spruyt, *The Sovereign State and Its Competitors*, Princeton, N.J.: Princeton University Press, 1994; Gary M. Feinman and Joyce Marcus, eds., *Archaic States*, Santa Fe, N.M.: School for Advanced Research Press, 1998; Joel S. Migdal, *State in Society: Studying How States and Societies Transform and Constitute One Another*, New York: Cambridge University Press, 2001; Alfred D. Chandler and Bruce Mazlish, eds., *Leviathans: Multinational Corporations and the New Global History*, New York: Cambridge University Press, 2005; Claudio Cioffi-Revilla, "A Canonical Theory of Origins and Development of Social Complexity," *Journal of Mathematical Sociology*, Vol. 29, No. 2, April 1, 2005; J. Stephen Lansing, *Perfect Order: Recognizing Complexity in Bali*, Princeton, N.J.: Princeton University Press, 2006; Edward Glaeser, *Triumph of the City: How Our Greatest Invention Makes Us Richer, Smarter, Greener, Healthier, and Happier*, New York: Penguin Press, 2011; Jerry A. Sabloff and Paula L. W. Sabloff, eds., *The Emergence of Premodern States: New Perspectives on the Development of Complex Societies*, Santa Monica, Calif.: Santa Fe Institute Press, 2018; Scott, 1999.

TABLE 6.1

Comparison of Scientific Management and Adaptive Governance

Scientific Management[a]	Adaptive Governance
Science	
Relationships underlying observed behaviors are stable if not universal (reductionist).	Relationships evolve; the behaviors of living forms depend on the context (contextual).
Relationships are tested by experimental, quantitative, and other "hard" methods.	Multiple methods are necessary, including qualitative, interpretive, and integrative.
Verified relationships are independent of any particular context or point of view.	Verifiable explanations of behaviors differ from one particular context to the next.
Knowledge of closed (experimental) systems is unambiguous but fragmentary.	Knowledge of open systems is contingent and incomplete; surprises are inevitable.
Policy	
Goals are single targets to be realized efficiently; they are fixed, given, or assumed to separate science from nonscience, and progress is measurable.	Multiple goals are to be integrated if possible or traded off if necessary; they depend on judgments in the particular context and are subject to change.
Problem definition depends on scientific assessments within procedures and boundaries established by higher authority.	Problem definition depends on human interests and other contextual considerations, including law and policy.
Science-based technologies are prerequisites for solving problems and gaining support.	Local and scientific knowledge are both relevant to solving policy problems.
Policy alternatives focus on how to realize the target, discounting uncertainties.	Modest incremental steps minimize the unintended consequences of policies.
Planning is the priority in policy process; monitoring and evaluating are not.	Policy process often depends on monitoring, evaluating, and terminating failed policies.
Decisionmaking	
Management proceeds from the top down under a single, central authority.	Policy integration proceeds from the bottom up under fragmented authority and control.
Only the experts are qualified to make and implement sound management plans.	Participation is open to almost any person or group with a significant interest in the issue.
Bureaucracies are necessary to enforce uniform rules and regulations.	Community-based initiatives can compensate for the limitations of bureaucracies.
Expertise and authority to enforce rules and regulations are the necessary resources.	Local knowledge, respect, and trust are a few of many resources necessary for success.
Plans and planning processes are standardized and stabilized over long periods of time.	Successful policies are diffused and adapted elsewhere, at the same and higher levels.
Science replaces politics through clear policy direction from elected officials.	Politics are unavoidable and are commendable when they advance the common interest.

SOURCE: Brunner and Steelman, 2005, p. 34.

[a] The information in the table is quoted from the source.

Hierarchies

Hierarchies are among the most-common forms of organization. In governance, hierarchical arrangements are identified in two interrelated ways. The first and most common is the distribution of authorities that establish the chain of command within organizations. For example, March and Simon noted that an individual's participation in formal organizations cannot be adequately characterized by a series of independent transactions between an employee and employer. Instead, employment implies the acceptance of a role that obligates employees to accept the legitimacy of the employer's authority and prescriptions regarding what actions are permitted and prohibited:

> In joining the organization, he accepts an authority relation, that is, he agrees that within some limits (defined both explicitly and implicitly by the terms of the employment contract) he will accept the premises of his behavior orders and instructions supplied to him by the organization . . . Acceptance of authority by the employee gives the organization a powerful means for influencing him—more powerful than persuasion, and comparable to the evoking processes that call forth a whole program of behavior in response to a stimulus.[82]

In this formulation, hierarchical relations are characterized by power relations between actors. Within organizations, this is accomplished through employment contracts and job definitions and the titles they carry. In society, having a monopoly over the legitimate use of force to manage inhabitants within a bounded territory or domain is often taken as the basis for defining the state.[83] In either case, exchange occurs as a result of the coercive power that one actor possesses over another.

A feature of hierarchies in governance is that as the scale of the governed population grows, the performance of authoritative roles can become increasingly depersonalized and routine. The emergence of bureaucracies, which emphasize professionalization and well-defined, routinized organizational processes, further differentiates states from other forms of governance, most notably bands, tribes, and chiefdoms that rely on patronage and personal relationships between actors.[84] Importantly, anthropologists have noted that both states and complex chiefdoms can govern large swaths of territory and large populations, but they do so through different organizational mechanisms, as will be discussed later.[85]

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[82] March and Simon, 1993, p. 110.

[83] Max Weber, *Economy and Society*, Vol. 1, eds. Gunther Roth and Claus Wittich, Berkeley, Calif.: University of California Press, 1978, pp. 54–56.

[84] Flannery, 1972.

[85] Elizabeth M. Brumfiel and Timothy K. Earle, eds., *Specialization, Exchange, and Complex Societies*, New York: Cambridge University Press, 1987; Feinman and Marcus, 1998; Richard E. Blanton, Stephen A. Kowalewski, Gary M. Feinman, and Laura M. Finsten, *Ancient Mesoamerica: A Comparison of Change in Three Regions*, New York: Cambridge University Press, 1993, pp. 13–19.

An alternative formulation of hierarchical relations is based on specialization as opposed to power and serves as the basis by which systems grow in complexity.[86] It is the process of specialization and division of labor or functions within groups that gives rise to inequalities, of which the power to make decisions is just one of many distributional properties. For example, Adam Smith noted that economic productivity dramatically increased as groups producing pins divided into subgroups with specialized roles.[87] Likewise, biologists have noted that organisms have become increasingly complex through a series of evolutionary transitions in which individuals—whether genes, gene networks, or cells—specialized by shedding some functions to advance others. Next, they formed federations that resulted in higher levels of competitive fitness (e.g., with the transition from single-celled to multicellular organisms).[88]

From the perspective of specialization, hierarchies are maintained by the performance of roles, and the exercise of power within the system is part of the regulatory process. The coordination of one unit's inputs with another's outputs and the emergence of boundaries on their freedom of action creates reliable systems from unreliable parts.[89] Thus, governance within hierarchical systems might appear to be coercive, but it is not arbitrarily so. Force is used to maintain homeostasis and ensure that units adhere to their specialized roles to enable the collective pursuit of goals set by those units that are endowed with executive authorities. Therefore, hierarchical organizations appear as top-down and centrally managed, whether they are found in the public or private sector, because clearly defined authorities can enable increasing specialization to develop in performance of increasingly complex tasks:

> Hierarchies are thought to work best when an organization has a fairly clear purpose. Bureaucracies in the public sector are meant to pursue the public good. Firms in the pri-

[86] Howard H. Pattee, ed., *Hierarchy Theory: The Challenge of Complex Systems*, New York: George Braziller, Inc., 1973; Robert V. O'Neill, Donald Lee DeAngelis, J. B. Waide, and Timothy F. H. Allen, *A Hierarchical Concept of Ecosystems*, Princeton, N.J.: Princeton University Press, 1986; Valerie Ahl and T. F. H. Allen, *Hierarchy Theory*, New York: Columbia University Press, 1996; Philip E. Agre, "Hierarchy and History in Simon's 'Architecture of Complexity,'" *Journal of the Learning Sciences*, Vol. 12, No. 3, July 2003; Simon, 2003, pp. 183–216.

[87] Adam Smith, *The Wealth of Nations*, ed. Kathryn Sutherland, New York: Oxford University Press, [1776] 2008, pp. 12–13.

[88] Richard E. Michod, *Darwinian Dynamics*, Princeton, N.J.: Princeton University Press, 2000; Samir Okasha, *Evolution and the Levels of Selection*, 1st ed., New York: Oxford University Press, 2009; Peter Godfrey-Smith, *Philosophy of Biology*, Princeton, N.J.: Princeton University Press, 2014; Samir Okasha, "Units and Levels of Selection," in Jonathan B. Losos, David A. Baum, Douglas J. Futuyma, Hopi E. Hoekstra, Richard E. Lenski, Allen J. Moore, Catherine L. Peichel, Dolph Schluter, and Michael C. Whitlock, eds., *The Princeton Guide to Evolution*, Princeton, N.J.: Princeton University Press, 2017.

[89] John von Neumann, *Lectures on Probabilistic Logics and the Synthesis of Reliable Organisms from Unreliable Components*, Pasadena, Calif.: California Institute of Technology, January 1952; John von Neumann, "Probabilistic Logics and the Synthesis of Reliable Organisms from Unreliable Components," in C. E. Shannon and J. McCarthy, eds., *Automata Studies (AM-34)*, Princeton, N.J.: Princeton University Press, 1956.

> vate sector are meant to pursue profit. The existence of a clear purpose means that hierarchies can divide their activities into a clear set of functions that can be assigned to different units. Further, the function of each unit can be divided into sub-sets that can be assigned to sub-units. The result is a nested or pyramidal structure of units, each consisting of sub-units all the way to the bottom. There might be twenty units at the bottom, overseen at the next level up by seven units, overseen by three, which are then controlled by the one unit at the apex of the organization.[90]

Markets

Markets provide an alternative model for allocating resources within systems. As opposed to relying on centralized and authoritative decisionmaking, markets offer a means for distributed actors to exchange goods and services according to prices. When markets are efficient, and actors have the information they need, an optimal allocation of resources can be found such that no actor can be made better off (i.e., no actor can acquire an alternative allocation of goods that they would prefer without making other actors worse off).

Information is essential to support governance through markets. Uncertainty and asymmetries in information might limit the willingness of actors to fully use their endowments and enter into mutually beneficial exchanges.[91] The basis for forming institutions of governance is to address market failures that occur when actors lack the trust to transact with one another.[92] This can be overcome by depersonalizing trade and transferring trust from the individuals involved in the transaction to the rules for participating in the market itself (i.e., creating trust in the institutions that oversee markets provides participants with confidence that others will abide by its rules, including rules that manage disputes between actors). Depersonalization is a critical step along the path to commoditization that can be achieved through standardized weights, measures, and scales (e.g., determinations of the quality of beef or wheat) that allow exchange to occur between producers and consumers that are indifferent to each other's identity.[93]

Although there are many alternative theories of how markets work, there is broad consensus that participation and exchange is motivated by self-interest and competitive pressures:

> The dominant neoclassical view [of markets] emphasizes perfect competition. In this view separate firms try to maximize their profits by responding to changes in prices. . . . The alternative view of the neo-Austrian school emphasizes the competitive process. . . . Neo-

[90] Bevir, 2012, p. 18.

[91] Ian Molho, *The Economics of Information*, Malden, Mass.: Blackwell Publishers, 1997.

[92] Douglass C. North, "Institutions," *Journal of Economic Perspectives*, Vol. 5, No. 1, March 1991.

[93] Donald Mackenzie, *An Engine, Not a Camera: How Financial Models Shape Markets*, 1st ed., Cambridge, Mass.: MIT Press, 2008.

> Austrian economists think of the market as a process of selection occurring in changing and tumultuous conditions.[94]

The effectiveness of markets, then, rests on two important properties that are rarely stated explicitly. The first is coercive power to limit participation to trusted parties, enforce agreements made between parties, or both. Second, although actors in markets might engage in mutually beneficial trades of goods and services, the structure of exchange is fundamentally competitive because each actor benefits from offering less of what they possess to get more of what they desire. Thus, although markets are considered distinct from hierarchical, authoritatively controlled systems, coercion and competition remain central to their function, even if violence is not required to motivate exchange.

Networks

While hierarchies and markets represent depersonalized modes for allocating resources, networks provide a personalized alternative. Rather than rely on coercive or competitive influence to motivate decisions and action, exchange in networks proceeds based on cooperation, reputation, and the expectation of reciprocity:

> Networks consist of multiple actors who are formally separate but depend on one another for key resources and so build long-term relationships to exchange resources. On the one hand, networks differ from hierarchies because they do not usually contain an authoritative centre to resolve disputes among the actors. On the other, they differ from markets in that the actors engage in repeated and enduring exchanges, often relying on trust and diplomacy rather than prices and bargaining. Examples of network relationships thus can include cooperative set-ups, coalitions, relational contracting, partnerships, and joint ventures.[95]

The differences among networks, hierarchies, and markets are profound. Whereas increases in power, the centralization of authorities, and the ability to provide goods and services at lower prices might increase an actor's ability to access and allocate resources in markets, these factors might fail to benefit actors in networks. Instead, in systems that rely on trust and reciprocity, access to resources and the ability to control their allocation depends on earning the trust of other actors, developing commitments, and positioning oneself to become indispensable within the system. Such objectives are often accomplished through exchanging more than the minimum of what is desired or required with the expectation of creating commitments to future interaction and exchange. Cooperative interactions have been regarded as an essential element of biological survival and the ability to cope with uncertain and novel threats. For example, Geerat J. Vermeij noted the central role that cooperative relations have played in biological evolution and the ability of species to cope with uncertainty:

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[94] Bevir, 2012, p. 23.

[95] Bevir, 2012, pp. 26–27.

> The organizational properties that enable biological entities to cope with unpredictable circumstances may likewise have originated as adaptations to everyday problems, but they more directly transform unpredictable phenomena to predictable ones. They do so by cooperation, creating multiple novel combinations of preexisting components, preventing threats from spreading, or creating larger biological units that have a longer life span and therefore the means to retain and accumulate information about rare events. Redundancy and adaptability emerge as modules multiply, cooperate, and forge larger stable evolutionary units.[96]

The networked form of governance poses a significant challenge for engaging in UGS. First, the dominant experiences and expertise resident within DoD and the NSE are based on the image of organizations competing, whether by violently asserting their will or by engaging in nonviolent, market-based exchange within the shadow of competition and conflict. Viewing governance through the lens of layered obligations and commitments challenges institutions built to compete for more-abstract and diffuse pursuits, such as the national interest. Second, cooperating in networks is just as strategic as competing within them. Strategically minded cooperation is simply an alternative approach to ensuring access to resources (material, financial, ideological, etc.) through the creation of social, deontic bonds of rights, roles, permissions, and obligations.

The ASDA cycle is fundamentally agnostic to developing expertise to engage with governance structures of all types—its emphasis on learning through interaction can be directed toward discovering patterns of authority and exchange within the international system. However, networking expertise might be better suited toward competing in infinite games because of the games' unbounded characteristics. Whereas hierarchies might cease to operate if coercive power is lost, and markets-based exchanges are bounded by the honoring of contractual agreements, relations in networks reward the accumulation of reciprocal commitments that are forward-looking—exchanging goods or services now in return for unspecified future transactions. This allows a level of robust interaction under uncertainty that would otherwise require elaborate efforts to avoid or convert uncertainty to risk under alternative frameworks.[97]

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[96] Geerat J. Vermeij, "Security, Unpredictability, and Evolution: Policy and the History of Life," in Raphael D. Sagarin and Terence Taylor, eds., *Natural Security: A Darwinian Approach to a Dangerous World*, Berkeley, Calif.: University of California Press, 2008, p. 36.

[97] For a discussion of the challenges posed by such conversions, see Francis X. Diebold, Neil A. Doherty, and Richard J. Herring, eds., *The Known, the Unknown, and the Unknowable in Financial Risk Management: Measurement and Theory Advancing Practice*, Princeton, N.J.: Princeton University Press, 2010; and Chapter Eleven of this report (Steven W. Popper, "Designing a Robust Decision–Based National Security Policy Process: Strategic Choices for Uncertain Times," in Aaron B. Frank and Elizabeth M. Bartels, eds., *Adaptive Engagement for Undergoverned Spaces: Concepts, Challenges, and Prospects for New Approaches,* Santa Monica, Calif.: RAND Corporation, RR-A1275-1, 2022).

Concluding Thoughts

New perspectives on long-term competition might be realized by viewing decisions to engage in and manage UGS as infinite games. Pairing the ASDA cycle—with its emphasis on learning at a faster rate than competitors (as opposed to deciding at a faster rate)—with infinite games might provide a new basis for engaging in UGS without the meta-framing of a "cycle of conflict" that is codified in the JPC. In this context, problem-centric governance, adaptive governance, and alternative modes of governance based on hierarchies, markets, and networks all offer perspectives that can inform how DoD and the NSE might engage in UGS. Together, these frameworks offer insights into how to (1) reduce internal barriers to adaptation, (2) engage with local populations to develop and implement engagement strategies that are more likely to be accepted, and (3) offer a basis for reducing uncertainty and enhancing competitiveness through the development of networks built from personalized, reciprocal exchange.

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Abbreviations

ASDA	Act-Sense-Decide-Adapt
CAS	complex adaptive systems
DoD	U.S. Department of Defense
JPC	joint phasing construct
NSE	National Security Enterprise
OODA	Observe-Orient-Decide-Act
UGS	undergoverned spaces

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