TRENDS IN MODERN WAR GAMING

The Art of Conversation

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> *Now the great secret of its power lies in the existence of the enemy, a live, vigorous enemy in the next room waiting feverishly to take advantage of any of our mistakes, ever ready to puncture any visionary scheme, to haul us down to earth.*
>
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Lieutenant William McCarty Little—a war-gaming visionary—was truly a man ahead of his time.[1] Although physically sight impaired and medically retired from active naval service, he opted to use his ideational vision and keen mind to support the Naval War College, in Newport, Rhode Island, during its first few years of operation after its founding in 1884. Initially an unpaid volunteer, he was appointed in 1887 as a member of the faculty, where he developed two-sided war gaming at the College—a construct that is still in use at the state-of-the-art facility that today bears his name.

Often touted as the father of modern war gaming, McCarty Little, who served on the faculty until 1915, understood that meaningful force-on-force gaming can occur only if two conditions are satisfied.[2] First, decision makers must be provided with a suitable environment (referred to in the language of fields theory as a "safe container") within which to develop strategies and contingencies.[3] This container (i.e., a "setting in which the intensities of human activity can safely emerge") must be more than simply a secure physical gaming space.[4] Indeed, it must afford players intellectual security—a mechanism for sharing ideas and perspectives in a nonjudgmental, attribution-free environment, whatever inner contradictions and inconsistencies may arise during the decision-making process.[5] Second, he set out to clarify and expand issues beyond the content of a particular game to garner deeper insights into complex problems. McCarty Little appreciated the power to that end of dialogue, as well as the role of group processes in both micro-level systems (for example, tactical unit actions) and operational-level systems, such as battle fleets.

Like modern-day systems thinkers, working both intuitively and intellectually, he knew that it was important to understand the pieces that contribute to the whole system, not by dissecting them into individual parts and seeking to reaggregate them, but rather by considering the entire messy, often obfuscated processes that characterize systems such as naval warfare taken as a whole.[6] For example, although much of his initial work was highly detailed and tactical, McCarty Little introduced innovations in broader thinking, such as visual blocking screens "to restrict the fields of view of the players to those portions of the area of operations that corresponded approximately to real-world conditions."[7] McCarty Little's development of two-sided gaming emerged from a desire to foster broader thinking and discussion while retaining detailed records of ship positions and statuses at the end of each move for further study and discussion.

Both McCarty Little and Nimitz understood that the value of war gaming resides neither in its predictive abilities nor in its tangible move outcomes. Rather, the true power of gaming may be found . . . in the dialogue that occurs within the . . . game cell.

His ability to look beyond the notion of reductionism—the preeminent philosophy in scientific thought during his lifetime—and consider broader complex problems without breaking them into pieces is remarkable, especially when one considers the sociopolitical environment in which his holistic concept emerged—the latter portion of the Industrial Revolution. In the late nineteenth and early twentieth centuries, naval culture was at a crossroads. Although steeped in the traditions of the age of sail, navies had already begun trading their rich lore for the technological discipline of steam power and battleships. The last of the U.S. *Sabine*-class sailing frigates had been built. America's navy had begun to embrace a new paradigm, firmly entrenched in the machine world, as well as a stalwart desire to seek more technologically focused solutions, such as enhanced communications and command and control.[8]

McCarty Little understood the importance of examining the deliberative processes of an adversary. He considered the dialogue involved in two-sided gaming to be an essential component in achieving victory at sea.[9] Long after his time, however, beginning with the Navy Electronic Warfare Simulator in 1959 and extending into the highly technical, simulation-dependent Global War Games of the 1980s and 1990s, Naval War College gaming tended to focus on the analytical outcomes of player actions rather than on pursuit of McCarty Little's view that an understanding of the deliberative processes employed by adversaries is at least as important as the objective data that games generate.[10] Today McCarty Little's emphasis on exploring adversary thinking and decision

making remains a most appropriate but, as a result, perhaps inadequately considered mechanism for informing decision makers in today's decidedly more complex warfare environment.

WAR GAMING IN THE AGE OF REDUCTIONISM

Much of war gaming's pedigree is to be found in the Enlightenment thinking of Francis Bacon, René Descartes, Isaac Newton, and Immanuel Kant—specifically, in the reductionist premise that the world functions as one great machine. This perspective contends that complex organisms or processes can be "taken apart, dissected literally or figuratively, and then put back together without any significant loss. The assumption is that the more we know about the workings of each piece, the more we will learn about the whole."[11] One early example can be found in a rudimentary war game developed by Dr. C. L. Helwig in 1780. His chess-like board comprised multicolored squares representing various types of terrain. It was coupled with a single piece representing "a large body of soldiers or organized combat units."[12] Helwig's game also included a referee, or umpire, in an effort to assess impartially the players' moves. His process was the precursor of far more complex war-game adjudication processes that are used in two-sided gaming today.

Moving beyond this form of military chess, a Scotsman, John Clerk, developed a demonstrative process for exploring the arrangement of ships, fleets, and lines of battle, a scheme that he ultimately published in both preliminary and revised forms, in 1779 and 1782, respectively. Although Clerk was not a naval officer (indeed he had never been to sea), his efforts were well received by the military establishment. Especially welcome was his analysis of game data pertaining to the relationships between wind and ship maneuvers and his assessments of battle damage resulting from naval guns.[13] While some specialists today contend that Clerk's work was not war gaming per se but essentially a modeling or simulation tool, his findings did make their way into actual combat operations; they were used by Lord Nelson himself during the British victory at Trafalgar in 1805.[14]

More importantly, Clerk's efforts were grounded in linear, deductive thinking and in the application of mathematics and quantitative analysis to military problem solving. By the 1820s, such military thinkers as the Prussian war counselor Baron von Reisswitz and his son Lieutenant Georg H. R. J. von Reisswitz had developed game boards, featuring realistic terrains and ranges, and employed complex adjudication tables and umpire-initiated dice rolls to assess the efficacy of player actions and the infliction of battlefield casualties.[15]

The perceived value of these games often stemmed from military leaders' desire to provide experiential opportunities for their officers without encumbering themselves with the expense and liabilities normally associated with field

training. Moreover, to enhance the perceived accuracy of outcomes, new quantitative tools (that is, simulations) were developed.[16] These tools were pursued by the West in the ever-more-technology-driven world of the Industrial Revolution; the result was the use of games more detailed and restrictive than strategy games of the past.[17] For example, in the past, chess players had ultimately relied on their own cognitive thinking processes—experience, imagination, and creativity—to defeat an opponent. Quantitatively derived efforts at modeling, simulation, and adjudication rapidly overtook, and in some cases replaced, these thought processes. As Jung aptly noted, "in the West, consciousness has been developed mainly through science and technology—not through art, social interaction, cultural development, or spirituality."[18] Imagination was rapidly replaced by technological prowess.

Indeed, failure to distinguish between the utility of game theory and that of war gaming may result in the conflation of qualitative problems with quantitative solutions—a possible recipe for strategic disaster.

The use of Lanchester equations at the height of the First World War made clear the inherent flaws of seeking to reduce human conflict to the sum of its parts. In 1916, Frederick Lanchester, a British mathematician, sought to apply two equations—the *law of squares* to "'aimed fire' (e.g., tank versus tank) and the *linear law* to 'unaimed fire' (e.g., artillery barraging an area without precise knowledge of target locations)."[19] As is the case with many simulations, Lanchester's equations failed to consider qualitative factors, such as "the effects of terrain or the differences in competence between equally sized and equipped forces of different nations."[20] This tendency to avoid qualitative inputs or, worse, mask them as seemingly numerically weighted (i.e., quantitative) data sets is an example of what has proved to be a recurring problem throughout the history of linear deductive thinking.[21]

In fairness, some linear, deductive processes rooted in Western thought can be useful in thinking through complex problems, especially when such a thinker is confronted with another Western adversary or one who is simply willing to play by a Western-bounded rule set. However, as Ian McGilchrist notes in a treatise on the differences between the Western and non-Western brain, "People in the West characteristically overestimate their abilities, exaggerate their ability to control essentially uncontrollable events, and hold overoptimistic views of the future."[22] Indeed, in such circumstances, there is actually very little difference between formal war gaming and engagement in such modeling and simulation processes as game theory.

While it should be considered a valuable decision-making tool, game theory is in fact the ultimate expression of Cartesian-Newtonian thinking. It is an effort to

resolve on a quantitative basis often highly complex problems involving multiple stakeholders and outside interests. Nowhere is the use of game theory more subject to bias than in situations where a Western-thinking player is confronted with a non-Western-thinking opponent.[23] There are essentially two types of game-theory models: the simple-form game (SFG) and the extensive-form game (EFG). SFGs have two players, each of whom seeks the highest possible payoff at the end of a simultaneous move. These payoffs are numerically weighted and must be the same for both players. EFGs, in contrast, consist of at least two players engaged in multiple move-for-move exchanges. In an EFG, because each player's preferred payoff can be achieved only at the conclusion of the game (as opposed to after just one move in the SFG), participants are generally less concerned with intermediate payoffs than with the ultimate one.[24]

Of course, defining mutually agreed payoffs in the EFG is far more complicated than in the SFG, because the players must consider both short-term and long-term payoff values. Compounding this challenge are differences in how players perceive the values of these payoffs—especially, again, when a Western player is engaged in a game against a non-Western player.[25] Moreover, as time progresses the EFG becomes susceptible to influences from outside forces. These forces affect the willingness of both players to adhere to previously established rules. Therefore, the overall stability of the game may be decreased. Eventually players may engage in corrupt practices, such as offering side payments to other players in an effort to conclude the game.[26]

MISTAKING GAME THEORY FOR WAR GAMING

During the interwar years, from 1919 to 1939, the U.S. Naval War College, in Newport, Rhode Island, engaged in a variety of war games and exercises against a variety of named adversaries and near-peer competitors. These games underpinned the development of a series of planning documents referred to as the "rainbow plans."[27] The most famous was Plan ORANGE, which explored possible strategies and contingencies in a protracted conflict with Japan. By 1930 the Naval War College had "made its exercise a grand production that included navy and marine faculty and student officers from Newport and Quantico."[28] The data garnered from the games and exercises (along with those from other activities) associated with the rainbow plans made them collectively one of the most successful applications of naval war gaming in American history.[29] Indeed, Fleet Admiral Chester Nimitz remarked in 1960 that the myriad explorations of Japanese tactics, maneuvers, operations, and strategies identified through gaming Plan ORANGE were to prove incredibly valuable to senior decision makers.

Unfortunately, Nimitz's comments were misconstrued at the time and continue to be misunderstood to this day.[30] While Plan ORANGE undoubtedly assisted

the United States and its allies in planning and execution during the Second World War, its value did not lie in its quantitative nature.[31] War games are not experiments. Even if such events are repeated, they lack sufficient controls to be generalized. Neither are they models or simulations yielding predictive behavioral outcomes. If they were, game-theoretic models (such as SFGs or EFGs) could be used instead. Toward this end, one scholar of game theory notes, "There are fundamental reasons to be concerned about the possibility of accurately describing realistic situations exactly by [game theory] models [because] practical modeling difficulties arise when players' beliefs are characterized by subjective probabilities."[32]

Although descriptive quantitative techniques—for example, such basic statistical tools as *t*-tests and analyses of variance (ANOVAs) on Likert-style, survey-based responses to determine participant cohesion or disparity between player cells—may be used in analyzing players' decision-making processes, the bulk of data generated from war games is qualitative. Qualitative data can be grouped, binned, and discussed, but they are not amenable to the kind of quantitative modeling used for predictive purposes in the natural sciences. As Dr. Kenneth Watman, a former director of the War Gaming Department at the Naval War College, writes, "War games can be a powerful way of developing questions, issues, and provisional insights that must then be analyzed more vigorously with different methods. In this sense, war games can be an essential precursor to the process of [quantitative experimentation]."[33] Thus, it is important to understand the differences in appropriateness between basic quantitative modeling tools (like game theory) for considering stable, readily quantifiable problems and qualitative decision making for the far more complex issues found in many war games.

Indeed, failure to distinguish between the utility of game theory and that of war gaming may result in the conflation of qualitative problems with quantitative solutions—a possible recipe for strategic disaster.[34] One such instance involved Secretary of Defense (1961–68) Robert S. McNamara and his quantitatively oriented "whiz kids," whose failed efforts to prosecute a war in Southeast Asia were founded in a vast overextension of the inferentiality and generalizability of the findings of their parametric models of prediction.[35] The whiz kids' models could not account for qualitative differences between the United States and North Vietnam and their respective desired payoffs and end states, because such differences "cannot be comprehended by linear models."[36]

The American physicist and author Fritjof Capra notes that "the process of model making consists of forming a logically consistent network of concepts to interconnect the observed data [and] . . . to gain precision, and to guarantee scientific objectivity by eliminating any reference to the observer."[37] Unfortunately, with respect to military conflicts like the Vietnam War, models fail on

two accounts. First, there are myriad inputs, both qualitative and quantitative, that must be considered in their construction, many of which negate the use of linear equations or parametric statistical techniques. Second, since at least the appearance of Werner Heisenberg's uncertainty principle in 1927, successive generations of quantum theorists have moved well beyond anecdotal claims into the realm of empirical evidence to support the connection between observer and subject, even in the most tightly controlled experiments.[38] If, that is, pure experimentation and predictive modeling are influenced at the micro-level simply by observation, Watman's quoted assertion about war-gaming technique's being a precursor to analysis within the social sciences arena, not an analytical technique in its own right, is wholly appropriate.

War gaming is not about the development of products purely for analysis. Rather, it must also focus on process—the meaningful interactions among and between participants as they wade through waist-high "fields of conversation" and strive for shared meaning.[39] Rather than seeking to deconstruct highly complex problems and processes, gaming should seek to explore a "holistic worldview, seeing the world as an integrated whole rather than a dissociated collection of parts."[40]

CASE IN POINT: THE CURIOUS CASE OF CANS

In March 2011, the Naval War College's War Gaming Department was tasked by an external sponsor with developing an implementation strategy for the U.S. Strategic Command's (USSTRATCOM's) Concepts & Analysis of Nuclear Strategy (CANS) project. USSTRATCOM aspired, through CANS, to develop a quantitative probability tool for exploring issues of nuclear deterrence and escalation.[41] Specifically, the tool had been designed to provide decision makers with predictive values for how strategies and contingencies might fare within the nuclear domain; the meat of the simulations involved was to be garnered through the assignment by modelers of "values to the pair of parameters that show the causal strength . . . for each directed link that connects pairs of nodes."[42]

As discussed above, the transposition of qualitative inputs into seemingly quantitative values is in itself a flawed approach, being subject to the biases of the modeler. However, many senior military decision makers, trained in the natural sciences (e.g., mathematics or chemistry) or engineering, are quick to embrace these outputs as offering more measurement reliability and validity than do "squishier" terms, phrases, and concepts yielded by qualitative techniques, such as grounded theory, ethnography, case studies, or content analysis.[43] CANS, in fact, sought to model complex strategic nuclear deterrence and escalation dynamics with qualitative data that were masked as quantitative and to produce information sets that were portrayed as complete. Ultimately, the result could be

a false sense of security in the value of the tool's predictions of adversary actions in the nuclear arena.[44]

Both McCarty Little and Nimitz understood that the value of war gaming resides neither in its predictive abilities nor in its tangible move outcomes. Rather, the true power of gaming may be found, both experientially and analytically, in the dialogue that occurs within the "safe container" of the game cell. Plan ORANGE generated a vast series of events during which seemingly disparate elements of the U.S. Navy and Marine Corps (and to a lesser extent Army air and ground forces, through cooperative efforts with Fort Leavenworth, Kansas) worked together to develop common goals and objectives.[45] One scholar of strategic management refers to this process as the "necessity of complicating an organization" so that it can "develop a sufficiently varied account of the outside world that will make signals meaningful and that can be shared among its members."[46] In short, Plan ORANGE fostered group cohesion, which a distinguished psychiatrist contends inevitably yields the most meaningful outcomes.[47]

EXPLORING THE GROUP COHESION PROCESS IN WAR GAMING

In the late 1950s and through the early 1960s, at about the same time that Francis McHugh at the Naval War College was writing about the technical aspects of war gaming in his seminal *Fundamentals of War Gaming,* the social psychologist Edwin Cohen, under contract for the Department of the Army, was examining the role and value of group cohesion. Much of the analytic value obtained from war-gaming data is a function of the safe container provided for the players and the phenomenological event of working together to resolve complex issues. Players cannot be separated from the story of the game as it unfolds, and this shared experience provides them with a common bond.[48]

Cohen defines this bond as group cohesion, "a dynamic process that is reflected in the tendency for a group to stick together and remain united in the pursuit of its goals and objectives."[49] Over time, a group reframes the individual distinct characters of its members into a collective identity that embodies the beliefs of the group as a whole.[50] Factors such as repeated exposure to an event or process influence the degree to which members of a group feel connected as they work toward the common purpose. Group cohesion plays an important role in achieving military objectives: "Those armies that have enjoyed the highest degrees of cohesion and combat effectiveness in the past have achieved such success" in part because members become "personally involved in the group task, and perceive that the team shares a common goal of accomplishing the task, facilitating the cohesion-performance relationship."[51] As the degree to which individuals feel involved in carrying out a task increases, the likelihood of success also increases. As individuals work with one another in a group, members often flourish as they

are positively influenced by surrounding individuals. The more individuals feel involved and needed in the group, the more they will likely invest in helping achieve the group's goal.[52] Indeed, individual specialties must "come together in convocation," and this convocation yields "conversation."[53] It is this conversation that, as McCarty Little discovered more than 125 years ago, is at the heart of the war-gaming experience.

Myriad games conducted at the Naval War College during the past five years have demonstrated that rigidity—marked by highly structured and formally organized relationships—does little to engender conversation or foster cohesion. Whether this rigidity is rooted in an autocratic leader or restrictive policies or instructions, it often proves detrimental to effective working relationships.[54]

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One such case study in the valuable role that cohesion may play in executing a successful strategy can be found in the 2008 Final Destination 2 (FD2) game-design test. Against a background of six, highly complex homeland-security/homeland-defense vignettes, each event building on the one before, FD2 sought to explore two specific issues related to group process and cohesion. The first of these issues was to determine whether a relationship could be identified between the quantity of information provided to a player cell, perceived group cohesion, and the cell's internal decision-making process while countering an asymmetrically thinking adversary. The second issue was to examine possible relationships among the quantity of information provided to a player cell, perceived group cohesion, and the cell's ability to develop courses of action at the operational level of war.

Two player cells were provided the same vignettes, each cell consisting of personnel comparable in terms of age, race, gender, education, occupation, personality style (based on the Keirsey temperament sorter), and years of experience.[55] However, cell number one was provided with all the data it desired, as expressed by its requests for information (RFIs) throughout the game. Cell two was afforded only limited responses to its RFIs. Neither cell was aware that there were differences in the quantity of data being provided.

FD2 informed the Naval War College's war-gaming faculty that player access to as much information as desired might not be optimal. For example, cell two (which did not receive responses to all its RFIs) conducted moves at a broader operational level than cell one and was more effective in using inductive thinking to counter the seemingly disparate threats presented in the game. Moreover, cell two's individual responses for both the open-ended and Likert-scale (i.e.,

"strongly disagree" to "strongly agree") qualitative surveys suggested a greater level of group cohesion than in cell one. This trend appeared immediately after the first move and continued throughout game play. For its part, cell one focused its moves tactically and emphasized deductive thinking (even when its hypotheses were not bearing fruit); its members, as indicated by survey responses, perceived that they had achieved little group cohesion throughout game play.

This game did not *prove* that there is a relationship between quantity of information desired, group cohesion, and success in combating asymmetrical threats. Rather, it provided decision makers with useful insights into processes and practices in a way that would not have been possible using game theory or linear modeling.

GAMING COMPLEX ISSUES

The modern U.S. Navy carries out the most diverse missions of any maritime service in the world.[56] Given the complexity of these assignments, an ability to function within a large, systemic network comprising micro-level groups is essential. On a daily basis, the Navy not only works in the Joint Staff environment but cooperates with the Department of State, nongovernmental organizations, and numerous international stakeholders. Therefore, it is imperative that decision makers move beyond traditional, quantitative product–driven, symmetrical force-on-force games toward qualitative, process-oriented games—toward games that will allow "interested parties to work *on* the system, and [allow] everyone to recognize how they fit *in* the system."[57] Games must explore big, multifaceted, messy problems without external pressure to distill them down to their simplest parts. Such games are indeed possible, as evidenced by the success of the July 2010 Irregular Challenges game conducted at the Naval War College.

The overarching purpose of the 2010 Irregular Challenges game was to help the Navy better understand the complexity of problems it could one day face in unstable maritime regions and address better how it might respond. Unlike in the games of the nineteenth and twentieth centuries, which reduced issues to their essence (taking, that is, a reductionist approach), both the game designer and lead analyst for Irregular Challenges were tasked with exploring conditions such as economic strain, public health issues, population increases, natural resource scarcity, and climate change. The game team was further directed to examine how these variables could potentially stress littoral regions and coastal environments around the globe. In addition, "prospective catalysts of instability" (crime, piracy, drug and human trafficking, extremism, and so on) were examined relative to these conditions.[58]

A wide range of academicians, researchers, nongovernmental organization officials, military personnel, and interagency individuals (from the Department of

State, the U.S. Agency for International Development, and the like) were provided "with an environment to explore and appreciate the complexities of decision-making when faced with maritime instability–oriented irregular challenges."[59] The Irregular Challenges 2010 game afforded participants a systems-thinking perspective focused on decision-making processes rather than specific outcomes in areas such as movement of forces, acquisition, and logistics. It offered them an opportunity to view the world differently, "to move from a reactive stance—in which [navies] merely respond to events—to an intentional or creative one, in which [they] can design systems that produce sustainable results."[60] It also fostered cohesiveness among the participants (based on Likert-scale and open-ended survey responses), along with, at the completion of the game, a sound analytical product. In short, it was both an experiential and an analytic success.

Like modern-day systems thinkers, [McCarty Little] . . . knew that it was important to . . . [consider] the entire messy, often obfuscated processes that characterize systems such as naval warfare taken as a whole.

The 2010 Irregular Challenges game was a one-sided activity in which players addressed security issues in a fixed scenario, but it set the stage for the two-sided Maritime Stability Operations Game (MSTOG) the following year. Held at the Naval War College in December 2011, the MSTOG "explore[d] how to conduct maritime stability operations (MSTO) in order to prevent and respond to instability."[61] Building on the 2010 Irregular Challenges event, the MSTOG focused on three research areas: emerging MSTO doctrine, future force structure, and the overall maritime strategy relative to MSTO.

Within the safe container of the gaming environment, players were afforded the opportunity to engage in dialogue about a notional, complex, and dynamic security environment requiring "a range of maritime capabilities for contributing to stability and responding to instability."[62] Through their participation in shared phenomenological experience, players reported that they were better able to understand processes including transitioning from steady-state engagement to crisis response while building host-nation capabilities, deterring near-peer challenges, and addressing a range of irregular threats. As group cohesion built up, players identified innovative ways to improve Navy interoperability with U.S. Marine Corps, Coast Guard, special forces, and multinational partners and to foster better practices for collaborative planning and coordination with country teams, multinational partners, and nongovernmental organizations.

Postgame analysis of allied and adversary comments and actions was performed using a variety of established, qualitative techniques (i.e., grounded theory, content analysis, and survey research) to "triangulate" the game's findings.

It determined that forward presence represented a critical requirement in three mission areas: maritime governance and participation, foreign humanitarian assistance, and deterrence. It is unlikely these insights would have emerged had reductionist, quantitative gaming processes been employed rather than the two-sided approach, marked by exploration of complex "systems of systems," developed for this event.

Fields theorist Kurt Lewin urges that we not be "blinded by philosophical considerations, an atmosphere which recognizes only physical 'facts' as existent in the scientific meaning of that term which has now outlived its usefulness."[63] Games such as Final Destination 2, Irregular Challenges, and the Maritime Stability Operations Game point out for war-gaming professionals a path that will return them to the explorative power of gaming envisioned by McCarty Little in the late nineteenth century—a perspective that values both experiential processes and analytical outcomes and understands that these domains are not mutually exclusive.

Gaming complex issues involves the realization that despite well-intentioned efforts to create empirical boundaries between outside forces, players, and the analytic products generated during events, war gaming is not experimentation; there is a continual cycle of influencing others and being influenced. Indeed, as McCarty Little understood, it is talking and listening at the edge of the players' boundaries and resistances, the "gestalts"—emergences of new patterns from new inputs—at which shifts in beliefs, judgments, or actions occur, that prove the most valuable in garnering insights useful to senior decision makers.[64]

NOTES

1. Epigraph from *War Gaming Department Brochure* (Newport, R.I.: Naval War College, 2009), p. 1.
2. For the purposes of this article, a war game is defined as a simulation involving two or more opposing forces using rules, data, and procedures designed to depict an actual or assumed real-life situation. Joint Chiefs of Staff, *DOD Dictionary of Military and Associated Terms,* JP 1-02 (Washington, D.C.: 1987, amended through 15 April 2013), p. 393.
3. For "safe containers," Kurt Lewin, *Resolving Social Conflicts & Field Theory in Social Science* (Washington, D.C.: American Psychological Association, 2008), pp. 245–80.
4. For the quoted phrase, William Isaacs, *Dialogue and the Art of Thinking Together* (New York: Doubleday, 1999), p. 242.
5. Ibid., p. 244.
6. Margaret J. Wheatley, *Leadership and the New Science* (San Francisco: Berrett-Koehler, 2006), p. 10.
7. Francis J. McHugh, *The United States Naval War College Fundamentals of War Gaming* (Newport, R.I.: Naval War College, 1966; repr. Naval War College, 2012) [hereafter McHugh, *Fundamentals of War Gaming*], pp. 102–103.
8. William H. McBride, review of *Command at Sea: Naval Command and Control since*

the Sixteenth Century, by Michael A. Palmer, *Journal of Military History* 71, no. 1 (January 2007), pp. 275–76. For the "machine world," Margaret J. Wheatley, *Finding Our Way: Leadership for an Uncertain Time* (San Francisco: Berrett-Koehler, 2007), pp. 16–21.

9. McHugh, *Fundamentals of War Gaming,* pp. 56–61.
10. Ibid., pp. 2–3.
11. Wheatley, *Leadership and the New Science,* p. 10.
12. Peter P. Perla, *The Art of Wargaming* (Annapolis, Md.: Naval Institute Press, 1990), p. 18.
13. Ibid., pp. 19–21.
14. For the contentions of gaming professionals, ibid., p. 21.
15. Lewin, *Resolving Social Conflicts & Field Theory in Social Science,* pp. 270–80.
16. McHugh, *Fundamentals of War Gaming,* pp. 101–103.
17. Ibid., pp. 104–11.
18. Carl G. Jung, *The Earth Has a Soul: C. G. Jung on Nature, Technology & Modern Life,* ed. Meredith Sabini (Berkeley, Calif.: North Atlantic Books, 2008), p. 11.
19. Paul K. Davis, *Aggregation, Disaggregation, and the 3:1 Rules in Ground Combat* (Santa Monica, Calif.: RAND, 1995), p. 29 [emphasis supplied].
20. Ibid., p. 31.
21. George B. Vold, Thomas J. Bernard, and Jeffrey B. Snipes, *Theoretical Criminology,* 4th ed. (New York: Oxford Univ. Press, 1998), p. 6.
22. Ian McGilchrist, *The Master and His Emissary* (New Haven, Conn.: Yale Univ. Press, 2009), p. 456.
23. See Hank J. Brightman, "Nash in Najaf: Applying Game Theory to the Iraqi Conflict," *Air & Space Power Journal* 21, no. 1 (Fall 2007), pp. 35–41.
24. See ibid., pp. 35–37.
25. McGilchrist, *Master and His Emissary,* pp. 389–427.
26. Morton D. Davis, *Game Theory: A Nontechnical Introduction* (Mineola, N.Y.: Dover, 1983), pp. 104–105.
27. Michael Vlahos, *The Blue Sword: The Naval War College and the American Mission, 1919–1941* (Newport, R.I.: Naval War College Press, 1980), pp. 113–30.
28. Williamson Murray and Allan R. Millet, *Military Innovation in the Interwar Period* (London: Cambridge Univ. Press, 1988), p. 74.
29. Vlahos, *Blue Sword,* pp. 147–51.
30. For challenges posed by strategic modeling, see ibid., p. 155.
31. Ibid., pp. 9–18.
32. Roger B. Myerson, *Game Theory: Analysis of Conflict* (Cambridge, Mass.: Harvard Univ. Press, 1991), p. 74.
33. Kenneth Watman, "War Gaming and Its Role in Examining the Future," *Brown Journal of World Affairs* 10, no. 1 (Summer/Fall 2003), pp. 52–53.
34. Ben Gilad, *Business War Games* (Franklin Lakes, N.J.: Career, 2009), p. 20.
35. The authors capsulize these terms as efforts to apply the findings of a small population to the broader world around us—especially for predictive purposes.
36. Thomas J. Czerwinski, *Coping with the Bounds: Speculations in Nonlinearity in Military Affairs* (Washington, D.C.: National Defense Univ., 1998), p. 263.
37. Fritjof Capra, *The Turning Point: Science, Society, and the Rising Culture* (New York: Bantam Books, 1982), p. 376.
38. Leonard Mlodinow, *The Drunkard's Walk: How Randomness Rules Our Lives* (New York: Vintage Books, 2009), pp. 94–103.
39. Isaacs, *Dialogue and the Art of Thinking Together,* pp. 252–90.
40. Fritjof Capra, *The Web of Life* (New York: Anchor Books, 1996), p. 6.
41. More technically, CANS was intended to employ a variety of probabilistic belief nets, or "Bayesian networks," abstracted into "timed influence nets" to represent random variables and causal relationships.
42. Alexander H. Levis, "Time Sensitive Course of Action Development and Evaluation," in *Symposium on Human Modeling for Military Applications, Amsterdam, The Netherlands, 18–20 October 2010* (n.p.: n.d.), p. 4.

43. For "senior military decision makers," Mlodinow, *Drunkard's Walk,* pp. 124–45.

44. Rufus Isaacs, *Differential Games* (Mineola, N.Y.: Dover, 1999), pp. 307–29.

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