# ADJUDICATION: The Diabolus in Machina of War Gaming

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**Abstract:** Commonly used war-game adjudication methods break down and create unreliable results when addressing novel operational or strategic problems. The definition of a war game given by Peter Perla -- a warfare model or simulation that does not involve the operations of actual forces -- can be used to game novel operational and strategic situations, focusing on human players and relegating technology to labor-saving devices. Meanwhile, Newtonian physics and the statistics of small-unit actions provide adjudication rules for determining the possible outcomes of interacting player decisions when war-gaming tactical-level attrition warfare. The adjudicators either "roll dice" during deductive games, or during inductive games decide themselves which one occurred so as to force the players into situations that best address the sponsor's objectives for the game. In these cases the adjudicators have first to decide the possible outcomes of interacting player decisions then decide which one occurred, and what information to give to the players.



**Full text:** C ommonly used war-game adjudication methods break down and create unreliable results when addressing novel operational or strategic problems for which we have little experience or data (for example, information warfare or a regional nuclear conflict) and when we wish to explore situations rather than educate officers about well-understood situations. The primary causes of this breakdown are, first, the incorrect assumption that adjudicators are impartial controllers instead of dominant players and, second, the design choice to make the players' decisions the game's primary output. Among the many reasons for war gaming (such as research and analysis, training, education, and discovery), this article focuses on "discovery" war games, where the objective is to find out something previously unknown about a novel operational or strategic problem, something that cannot be better discovered by other methods, such as seminars, work groups, modeling and simulation, or operations research.

There exists a wide variety of definitions of war gaming, leading to different kinds of games, including field exercises, technology-enhanced "man in the loop" arrangements where players interact with and via computer models or simulations, stand-alone computer models or simulations, and closed-form mathematical equations.1 These categories are either too broad to be useful or focus on simulations or mathematical models that assume by definition that we understand enough about the situations being gamed to model them. They preclude the discovery of insights into novel situations by the open-ended exploration of competing interests. In contrast, the definition of a war game given by Peter Perla-"a warfare model or simulation that does not involve the operations of actual forces, in which the flow of events affects and is affected by decisions made during the course of those events by players representing the opposing sides"-can be used to game novel operational and strategic situations, focusing on human players and relegating technology to labor-saving devices.2 While traditional game design focuses on player decisions, there is reason to think there are problems with treating player decisions as constituting the game's primary output and therefore the primary input data for analysis. I will argue that because of research indicating that human decisions during a game are not reliably indicative of the decisions they would make in other circumstances (no matter how similar), other approaches are necessary to extract value from research games.

Newtonian physics and the statistics of small-unit actions provide adjudication rules for determining the possible outcomes of interacting player decisions when war-gaming tactical-level attrition warfare. The adjudicators either "roll dice" (i.e., use a statistical model of some form) during deductive games to pick randomly one of

those possible outcomes as the one that actually occurred, or during inductive games (described below) decide themselves which one occurred so as to force the players into situations that best address the sponsor's objectives for the game. However, for novel operational and strategic problems, we do not have the equivalent adjudication rules. In these cases the adjudicators (who usually are no better informed about the problem domain than the players) have first to decide the possible outcomes of interacting player decisions, then decide which one occurred, and then decide what information to give to the players.3 Research shows that "people are not aware of the reasons that move them; even an introspective person with incentives to estimate how he or she would have behaved with different information cannot do this." 4 This implies that decisions made during a war game by players and adjudicators are unreliable predictors of decisions that would be made in the external (and future) real-world situation the game is attempting to explore. However, research also indicates that human beliefs are robust even in the face of contradictory evidence.5 On the basis of this research, I will argue that beliefs that surface during a game, indicated by the decisions made by the players, should be examined as possibly more reliable predictors of what would be believed in the external world than the commonly held belief that decisions in a game can be used as predictors of what decisions would be made in the external world. Since adjudicators make decisions not only on the possible outcomes of interacting player decisions but also on which one occurred and on what information to give to the players, they are thus in fact not only players but dominant players-diaboli in machina-whose beliefs and consequent actions drive the game but whose decisions (like those of the other players) are unreliable predictors of what decisions would be made in the external real world the game is attempting to explore.6 Unless these factors are explicitly handled in design, execution, data collection, and analysis, the game will produce results that may be seductively compelling but are ultimately unreliable.

This article proposes an approach to discovery war-gaming of novel operational and strategic problems and offers a partial example from an actual strategic deterrence and escalation war game, played in 2009. The approach is twofold: first, treat the adjudicators as players whose behavior provides critical information for analysis; second, focus design and analysis not on the decisions of the game players but on the beliefs of the players and adjudicators and on how those beliefs drive decision-making behaviors. Decision making by players in the larger sense, including adjudicators, is what engages and motivates the participants; the value of their decisions is in the insights they provide as to the participants' beliefs, how those beliefs drive behavior, and how the players, adjudicators, and analysts interpret and attribute importance to the situations that arise from the players' competing decisions.

Since war gaming is founded on information flows between players and adjudicators, there is significant and useful overlap in the psychology of decision making used for novel situations when adjudicating the outcomes of inductive-war-game interactions and that used when assessing live information operations. Adjudication and operations assessment both require the operator to make decisions in order to create a desired future (or avoid an undesirable one) and to anticipate future outcomes and decisions by others. The arguments in this article therefore draw heavily on those made in "Assessing COIN Information Operations Aimed at the Local Population" and on references contained therein.7

## Adjudicators Are Dominant Players

Traditional attrition warfare is relatively simple to game and adjudicate. The outcomes of interactions of the decisions of game players are driven by physics (for example, external ballistics, logistic flows, time and space factors, etc.) and the statistics of millennia of small-unit actions. We know these physics- and statistics-based rules, and adjudicators use them to identify the range of what could happen as a result of interacting player decisions. Adjudicators consider moral effects to be contained within the statistics if the game is a deductive one (that is, aimed at specific implications of a general situation) and decide the moral factors themselves if the game is inductive (exploring, for instance, the operational or strategic ramifications of given specifics). In deductive war games, adjudicators essentially roll the dice using established statistics to determine from the

identified range of possible outcomes of interacting player decisions the specific outcome that will be considered to have occurred in order to place the players into a new but valid situation in which to make their next moves. Among the roles of adjudicators is that of umpires, ensuring the players do not break the laws of physics or statistics. For inductive games, however, instead of rolling the dice the adjudicators choose from the range of possible outcomes one that forces players to deal with problems related to the objectives of the sponsors. In either case, deductive or inductive, the adjudicators also decide what information about the outcome to provide each of the player teams.

Many of the novel operational and strategic problems in which we are interested do not have associated bodies of physics, case studies, or statistics on which to base adjudication. For example, what are the rules (the equivalent of "physics" and "statistics") governing outcomes of information warfare waged during a regional nuclear conflict? How many such campaigns have been fought? A reasonable answer for most of the problems in which we are interested is zero or near zero, and this means that traditional adjudication techniques, based on traditional game designs, are inadequate for them. But it is precisely such novel, dangerous operational and strategic problems that it is most important to game, given the potential costs of not understanding them as well as possible. Modern novel operational- and strategic-level problems are driven by complex interacting political, military, economic, social, ideological, and infrastructure (PMESII) effects, most of which we do not understand, or at best grasp only intuitively, and for which we certainly have no statistically valid sample set of previous situations on which to draw.

A common approach is to make available to the adjudicators advisers who are subject-matter experts in the appropriate PMESII areas. These experts draw on the established base of political-science theory and modeling to provide the best judgments possible about issues relevant to the problem being war-gamed. Even given the existence of quantitative political-science models, deductive game design makes little sense for novel operational and strategic conflict situations; there are insufficient past examples and therefore statistics to inform adjudication. These situations call exclusively for inductive gaming, in which adjudicators draw on subject-matter experts to identify the range of possible outcomes. They then decide which of these outcomes did occur, so as to place the players into situations relevant to the game's objectives, and finally what information to provide to the players.8

Note, however, that to force the players to solve problems of interest to the sponsors, the adjudicators have to forecast what those players might do with the information they receive. That is, the adjudicators (with their advisers) attempt to forecast likely futures using current information. But the reason we are wargaming in the first place is that we do not understand the problem or the rules that drive the situation. In a traditional war game it is the players' job to illuminate the problem with insight and understanding, not that of the adjudicators. Adjudicators and their advisers, then, make subjective professional decisions as to the range of what could happen as a result of player decisions, make subjective professional forecasts about what players might do in the future, and make subjective professional decisions about what information to provide the players. They do all this from a knowledge base that is as flawed and sparse as that of the players in the game cells. At best, the adjudicators may have better subject-matter advisers than do the players-which if true raises the question of why the experts are not playing the game but instead are advising the adjudicators.9

It is clear that for practical purposes not only are the adjudicators (and their subject-matter-expert advisers) actually decision-making players but they in fact dominate the war game, given their control over who gets to know what and when. In addition, logic offers significant grounds for suspicion as to whether their expertise is or even can be adequate to adjudicate games addressing novel situations. Adjudicators and their advisers make their decisions on the basis of how they believe "the world works"-beliefs that become by definition the rules for adjudication. So the adjudicators get to decide the rules of the war game dynamically, starting from a position of ignorance, as game play proceeds. All this seems to justify a rethinking of how we game novel operational and strategic problems.

Player Decisions Are Unreliable

A discovery war game must produce results or insights that are relevant to the external, possibly future, world. The game cannot be primarily educational or training, since for a novel situation we do not have enough information to teach or solutions to train. Therefore we look to the discovery game to provide reliable proxies of the external real-world situation. Unfortunately, research indicates that game decisions do not provide reliable predictors of the decisions the players or others would make if the situation were real.

People Cannot Predict Their Own Decisions-Let Alone Other People's. Psychology and decision-science research into the "adaptive unconscious" theory of mind indicates that even reflective people are poor at predicting the decisions they would make under different information circumstances.10 Decisions are driven for most people in great part by the (adaptive) unconscious, which-because it is not directly observable by the decision maker-means that decision makers' ability to predict or explain how they would make decisions under different circumstances is doubtful at best. Although people tend to recognize cognitive biases in others and to take these into account, they also tend to be convinced that their own perceptions directly reflect reality and to fail to take into account their own biases.11 Experimentation shows that this often results in people providing incorrect explanations for their decisions while simultaneously being convinced those reasons are correct.12 Given that the circumstances and information context of some future real world that the game is attempting to explore will inevitably be different from those of the game, it is thus at best unreasonable to assume that decisions made in a war game would be reflective of decisions made by the same people in some real-world scenario or to take seriously the reasons given by the players for their decisions, since we know that people tend to confabulate when providing reasons for their decisions. But this is precisely what we ask players to do-to imagine, knowing they are in a "war game," with the real present all around them, that instead they are in some future (or other) environment and to make decisions as though the artificial game world in which they are playing is real and to provide reasons justifying their decisions.13 Analysts and sponsors then try to draw from the decisions made in the game conclusions about decisions that would be valid in such a future (or other) environment.

Further, if decisions made in a game are unreliable predictors of decisions made in some future world, the situation becomes worse when attempting to use game decisions as predictors of other people's decisions-that is, those made in a realworld situation by the actual friendly or enemy decision makers whose roles the players occupied in the game. War-game "red cells" (playing the opposition) have serious problems when they are supposed to represent other cultures. Mirrorimaging does not matter when we are interested in "Blue" (friendly) decisions in the face of Red capabilities; in such a case Red simply takes the actions most dangerous to Blue within the context of game objectives, without regard to real cultural proclivities. But mirror-imaging does matter when we are interested in Blue decisions in the face of Red intentions or in Red decision-making behaviors. Obtaining experts in Red thinking brings several problems. Expatriates from countries of interest often have political agendas, are not necessarily expert in their own countries' political and military decision-making styles (how many disgruntled Americans are truly expert on the political and military cultures of the United States?), and face security-clearance issues. U.S. citizens who both are genuinely expert in foreign cultures and can obtain clearances are rare; we can only assume-not know-that their interpretations of foreign cultures are accurate.

Unskilled People Are Unaware of It, and Skilled People Are Overconfident. Adjudicators and their expert advisers are by definition, as we have seen, unskilled at war-gaming novel operational and strategic problems, precisely because they are novel, with no statistics and case studies are few and analogical. Two effects demonstrated by psychology research combine to make this a serious problem for adjudication. First, people in the lowest quartile of actual competence tend to self-assess themselves as in the second-to-highest quartile; their incompetence is so great it robs them of the ability to realize they are incompetent. People in the highest quartile of actual competence tend to self-assess themselves within the highest quartile but slightly lower than is

actually the case; they inflate their colleagues' competence compared to their own.14 Second, research shows that older and more experienced people tend to be vastly overconfident about their ability to control events that involve chance.15 Their successes in past situations, many of which involved elements of chance, lead them to underestimate the role of luck and to overestimate their ability to handle contingent situations.16 This is especially true in competitive situations, where competence at bluffing can mask actual incompetence.17 So war games addressing novel concepts get flooded with players, adjudicators, and subject-matter advisers who are not expert but confidently believe they are.

Overconfident People Believe They Already Know the Answer. In nearly all cases of scientific fraud, three risk factors have been identified as present: the perpetrators "knew, or thought they knew, what the answer to the problem they were considering would turn out to be if they went to all the trouble of doing the work properly; were under career pressure; and were working in a field where individual experiments are not expected to be precisely reproducible."18 In war games, the first factor is likely present for senior, more experienced people-precisely the sort of people invited to be adjudicators or expert advisers-given the results of the psychology research just presented, that older and more experienced people tend to be unaware of their lack of skills in novel situations and to be overconfident. The second factor is often, though not always, present among players; the third factor is clearly characteristic of war gaming. The three risk factors for (perhaps unintended) intellectual fraud must be considered likely to be present when war-gaming novel and important operational and strategic problems using senior officers and civilians as players, adjudicators, and experts.

Beliefs Are Robust in the Face of Contradictory Evidence. Amplifying the overconfidence problem is the effect demonstrated by research that "beliefs can survive potent logical or empirical challenges. They can survive and even be bolstered by evidence that most uncommitted observers would agree logically demands some weakening of such beliefs. They can even survive the total destruction of their original evidential bases."19 Asking someone to generate an explanation of why something is true often will strengthen belief in that "something" even after contradictory evidence is provided.20 In addition, corrections to erroneous evidence may actually strengthen misperceptions under some circumstances.21 This is especially troubling when the war-game designer and analyst consider asking players for their explanations of why they and their opponents made decisions. The Central Intelligence Agency analyst community suggests four reasons for the persistence of (even discredited) beliefs; "We tend to perceive what we expect to perceive; mind sets tend to be quick to form but resistant to change; new information is assimilated to existing images; and initial exposure to blurred or ambiguous stimuli interferes with accurate perception even after more and better information becomes available."22 Therefore I propose that beliefs identified during a war game should be used as predictors for how players (including adjudicators) would interpret information in the real world, and I suggest that it is these (and not the decisions themselves) that give us insight into what behaviors might occur in the real world.

Player Decisions Generate Situations of Interest in Discovery Games. An argument for the importance of situations generated by interacting decisions can be made. What if a series of player decisions creates a novel situation that can be examined to identify incentives for action?23 Although players' decisions are unreliable predictors of future decisions in the real world and are thus not intrinsically of interest, since they cannot be used to predict real decisions, the situations that interacting player decisions generate can be of interest in a discovery game at the operational and strategic levels.24 Consider the Japanese pre-Midway war games.25 During these games the contingency of a U.S. carrier task force appearing on the flank of Admiral Chuichi Nagumo's force was discounted.26 The war-game decision to posit a flanking force could not be used by the Imperial Japanese Navy (IJN) staffto predict that the United States would indeed carry out such an action. It was the contingency itself that was important, but it was the beliefs and cognitive biases of IJN leadership that dictated that this contingency was not to be considered interesting.27 The fact that the U.S. carrier task force did indeed turn up on the flank was independent of the IJN war-game decision. The beliefs and biases that led to the contingency's being ignored should have been identified and challenged by the war-game designers and

analysts, but they were not, due to the seniority of the officers holding those beliefs and suffering those biases. As research indicates, beliefs are robust even in the face of contradictory evidence, and the failure or inability to take this factor into account when dealing with senior officers during war games can have unfortunate consequences.

What Is to Be Done?

There exists a requirement to war-game novel operational and strategic problems for exploratory and discovery purposes. However, using traditional game design for this purpose generates two significant risks. First, adjudicators will be overconfident and underqualified and their behaviors, though critical to the game's outcome, will be neither collected nor analyzed, and second, there will be an overreliance on game decisions made by players and adjudicators in drawing conclusions about the real world under investigation, despite the evidence that such decisions are not good predictors of decisions made in the real world. Such a game is likely to produce unreliable, even deceptive conclusions.

These diaboli in machina must be exorcised. I propose that novel operational and strategic problems be gamed following two principles. First, explicitly treat the control cell and its adjudicators as players, whose behavior and demographics are to be collected and analyzed in the same way as those of other players. Second, shape the war game as a "signaling game," in comparing messages sent by players (including adjudication and Control), either explicitly as communications or implicitly in their actions, with how those messages were interpreted by the receiving players.28 Since beliefs drive interpretation of information, the design should include collection of what players believe about themselves and about other players. From a player perspective, decisions serve to engage and motivate the players, but from the war-game sponsor and designer perspective they exist to force the players to confront and interpret (or misinterpret) information through the lens of their beliefs and to send messages back by their decisions or explicit communications. The substantive thread of interacting decisions made by player cells and Control generates one possible story from a huge range of possible outcomes; they are not, in and of themselves, important. However, the contingencies that arise, including decisions not taken, can be important-especially those contingencies of decisions dismissed by adjudicators in their role of dominant players. The players' explanations for dismissing a decision or a contingency cannot be taken seriously in a discovery game; it is the underlying beliefs and biases driving the decisions that are important, as well as the contingency itself.

Analysis of messaging-interpretation, misinterpretation, and intentions- will provide reasonable indications of beliefs and therefore predictors of how information might be interpreted or misinterpreted in the real world, which in turn drives decision making. War-game design should focus not on what decisions were made but on why they were made and not made, what messages the players intended to send by their decisions and what messages were received, what behaviors they wanted to elicit from the other players by their decisions and what behaviors they instead obtained.

The design must require that as information flows into a game cell via the control cell (as the result of adjudication decisions) players answer the following questions (in addition to taking other, traditional player actions) about each of the other teams playing (including the control cell and adjudicators):29

* What are the other cells attempting to achieve, make us do, or make us believe?
* What message are the other cells sending us?
* What do the other cells believe about us?
* What do we believe about the other cells?
* What do we believe about ourselves?

When the control cell answers these questions it is in effect conducting realtime game analysis. Also, as the players (including Control and adjudicators) generate their respective decisions as a result of changes generated by other players and Control they must be required to answer the questions:

* What effect are we trying to achieve (physical effects on the other players, reactions taken by the other

players, changes to their beliefs)?
* What is the message we intend to send to whom by our actions?
* What are the risks and unintended possible consequences of each action?

It has been known for players to reject a game's validity because events in the game did not conform to specific prior beliefs. So in addition to the players' beliefs about themselves and the other cells obtained during the game, it is critical to elicit from the players at the end of the game their criticisms concerning the validity of the game, along with their reasons for these criticisms. Although these are obviously useful for design improvement, the main reason for collecting this information (assuming the game was properly designed and executed in the first place) is to identify players' beliefs and cognitive biases about what they believe should have happened vice what did happen in the game, since these beliefs will in part affect future decision making.

Analysis should examine the disconnects between expectations and results, between players' beliefs about themselves and others' beliefs about themselves, and player responses to the differences between these disconnects, under the hypotheses that the beliefs driving expectations and responses are robust and therefore reasonable predictors of beliefs those players would bring to the real world and that people are poor at identifying their own real beliefs.

Psychology and decision-science research plainly indicates that traditional war-game design, specifically adjudication, puts results in serious doubt in the context of novel operational and strategic problems. The solution is to treat adjudicators (or more broadly, the control cell) as dominant players and to focus design, data collection, and analysis on interpretation and misinterpretation of messages and beliefs instead of on decisions. A partial example of this design-a focus on messaging and beliefs-was successfully used by a war game in 2009 (see the sidebar). Although it may be onerous, time consuming, or difficult to treat adjudicators or the control cell as players and collect information from them it is required if the game is to be valid, and hence it must be part of design and execution.

### Sidebar

Every year the Mahan Scholars (an advanced research project group at the Naval War College) and U.S. Strategic Command sponsor a strategic deterrence and escalation war game. The game, known as DEGRE, is run by the War Gaming Department of the College. In 2009 the game design explicitly followed the second of the two design principles proposed above; that is, it was conducted as a signaling war game (see figure 1) and explicitly analyzed beliefs and messaging so as to fulfill the sponsors' objectives for the game. The war-game design did not explicitly analyze the adjudicators and their subject-matter-expert advisers as players. However, the design could be easily extended to do so; the same "signaling information" could be collected from the adjudicators and their advisers as from the traditional player cells (as in figure 2). (See "NWC Conducts Deterrence and Escalation Game and Review 2010," Naval War College, April 2010, www.usnwc.edu/.)

### Footnote

Notes

Dr. Downes-Martin presented an earlier version of this article to the Annual Connections Wargaming Conference, in August 2011, at the National Defense University, Washington, D.C. He would like to thank Hank Brightman, Jonathan Compton, Peter Perla, Robert Rubel, Paul Vebber, Christopher Weuve, and Yuna Wong for helpful comments and discussions during the development of this article. See diagram, "Framework for Adjudicating Discovery War Games."

1. The Joint Semi-Automated Forces (JSAF) system is an example of a distributed simulation where people interact with each other and with simulations. JSAF is sponsored by the Joint Chiefs of Staffand its program office is the Navy Warfare Development Command. The "Navy Simulation System," developed by Space and Naval Warfare Systems Command and sponsored by CNO (N6) (Support to Operations), is an example of a stand-alone Monte Carlo computer simulation system used for war gaming. For closed-form mathematical equations, see, for example, James G. Taylor, Lanchester Models of Warfare (Arlington, Va.: Ketron for the

Operations Research Society of America, 1983), vols. 1, 2.
2. Peter Perla, "The Nature of Wargames," chap. 4 in The Art of Wargaming: A Guide for Professionals and Hobbyists (Annapolis, Md.: Naval Institute Press, 1990).
3. The control cell (in which the adjudication function resides) is responsible (among other tasks) for selecting a preferred outcome during inductive games, deciding how to respond to game cell player requests for information, and deciding what and when information is given to players.
4. R obert Jervis, "Reports, Politics, and Intelligence Failures: The Case of Iraq," Journal of Strategic Studies 29, no. 1 (February 2006), pp. 3-52.
5. L ee Ross and Craig A. Anderson, "Shortcomings in the Attribution Process: On the Origins and Maintenance of Erroneous Social Assessments," in Judgment under Uncertainty: Heuristics and Biases, ed. Daniel Kahneman, Paul Slovic, and Amos Tversky (Cambridge, U.K.: Cambridge Univ. Press, 1982), pp. 129-52; Lee Ross, Mark R. Lepper, and Michael Hubbard, "Perseverance in Self-perception and Social Perception: Biased Attributional Processes in the Debriefing Paradigm," Journal of Personality and Social Psychology 32, no. 5 (1975), pp. 880-92; Craig A. Anderson, Mark R. Lepper, and Lee Ross, "Perseverance of Social Theories: The Role of Explanation in the Persistence of Discredited Information," Journal of Personality and Social Psychology 39, no. 6 (1980), pp. 1037-49.
6. The argument might be made that adjudicators' decisions relate solely to the game and not to the simulated real world and are thus fundamentally different from the decisions of traditional players. However, if the design for a discovery game of a novel situation has done a good job of recruiting the best subjectmatter experts either to advise or be the umpires for that game, one might reasonably expect similar experts to be called on in some novel real-world situation as advisers. Their beliefs and actions during a game are relevant to the real world.
7. See Stephen Downes-Martin, "Assessing COIN Information Operations Aimed at the Local Population," IOSphere, May 2012, pp. 16-20.
8. As pointed out by Jon Compton and Yuna Wong at the 2011 Connections war-gaming conference, it is a professional requirement for war-game designers to be familiar with the political-science theory base and models in order to provide adjudicators with the range of possible outcomes and provide the adjudication cell with advice on which outcome to choose to support the sponsor's objectives.
9. There are sound reasons for placing in the control cell subject-matter expertise that is not present in the player cells. An example suggested by Robert Rubel during discussion (24 January 2013) is when one wishes to represent realistically issues (such as information operations, cyberwarfare, or logistics, for example) in the game that are not central to the problems being investigated. Given the core objectives of the game and the limited procedural and intellectual bandwidth available to the players due to the time compression of most games, expertise in these ancillary issues is deliberately restricted to the control cell in which the adjudication function is executed. The danger now, however, is that since the adjudicators are dominant players the game is now overly influenced by these ancillary issues that then dominate the core issues being explored by the players.
10. For a summary of the literature on this subject, see Timothy Wilson, Strangers to Ourselves: Discovering the Adaptive Unconscious (Cambridge, Mass.: Harvard Univ. Press, 2002), and Robert Jervis, "Understanding Beliefs," Political Psychology 27 (Fall 2006).
11. See, for example, Emily Pronin, "Perception and Misperception of Bias in Human Judgment," Elsevier Trends in Cognitive Sciences 11, no. 1 (January 2007), pp. 37-43.
12. R ichard E. Nisbett and Timothy D. Wilson, "Telling More than We Can Know: Verbal Reports on Mental Processes," Psychological Review 8 (1977), pp. 231-59.
13. I claim that however realistic an operational or strategic war game, players will be aware it is not real and that awareness increases as the importance of the situation being explored by gaming increases.
14. Justin Kruger and David Dunning, "Unskilled and Unaware of It: How Difficulties in Recognizing One's Own

Incompetence Lead to Inflated Self-assessments," Journal of Personality and Social Psychology 77, no. 6. (1999), pp. 121-34.
15. M ost people tend to interpret "most people tend to" as meaning "everyone else but not me." This is especially true of senior, experienced, and successful people, precisely because they have been successful in the past.
16. E llen J. Langer, "The Illusion of Control," Journal of Personality and Social Psychology 32, no. 2 (August 1975), pp. 311-28.
17. D ominic D. P. Johnson, Richard W. Wrangham, and Stephen Peter Rosen, "Is Military Incompetence Adaptive? An Empirical Test with Risk-Taking Behaviour in Modern Warfare," Evolution and Human Behavior 23 (2002), pp. 245-64. See also Eliot Cohen and John Gooch, Military Misfortunes: The Anatomy of Failure in War (New York: Free Press, 1990), and Malcolm Gladwell, "Cocksure: Banks, Battles, and the Psychology of Overconfidence," New Yorker, 27 July 2009.
18. D avid Goodstein, On Fact and Fraud: Cautionary Tales from the Front Lines of Science (Princeton, N.J.: Princeton Univ. Press, 2010). (Goodstein is vice provost of the California Institute of Technology.) See also Michael Shermer, "When Scientists Sin," Scientific American 303, no. 1 (July 2010), p. 34, available at www.scientificamerican.com/.
19. R oss and Anderson, "Shortcomings in the Attribution Process."
20. M artin F. Davies, "Belief Persistence after Evidential Discrediting: The Impact of Generated versus Provided Explanations on the Likelihood of Discredited Outcomes," Journal of Experimental Social Psychology 33, no. 6 (November 1997), pp. 561-78.
21. Brendan Nyhan and Jason Reifler, "When Corrections Fail: The Persistence of Political Misperceptions," Political Behavior 32, no. 2 (June 2010), pp. 303-30.
22. R ichards Heuer, Jr., "Perception: Why Can't We See What Is There to Be Seen?," chap. 2 in Psychology of Intelligence Analysis (Washington, D.C.: Center for the Study of Intelligence, Central Intelligence Agency, 1999), available at www.cia.gov/. See also Jervis, "Understanding Beliefs."
23. Question asked by Robert "Barney" Rubel, dean of the Center for Naval Warfare Studies at the Naval War College, 14 December 2012.
24. O ne must, however, be careful about what defines a discovery game at the operational and strategic levels, using the definition of discovery used in this article. A tactical rehearsal that seeks to discover unpleasant downstream effects of a plan does not qualify, since the rules both for playing the game and for adjudicating the results of tactical kinetics are well established and are not subject to discovery.
25. R obert Rubel suggested this example in the cited conversation of 14 December 2012.
26. M itsuo Fuchida and Masatake Okumiya, Midway: The Battle That Doomed Japan (Annapolis, Md.: Naval Institute Press, 1955), p. 97; Jonathan Parshall and Anthony Tully, Shattered Sword: The Untold Story of the Battle of Midway (Dulles, Va.: Potomac Books, 2007), p. 410.
27. Parshall and Tully, Shattered Sword, p. 410.
28. All actions send a message with the intention of that message being received and interpreted, and so when war-gaming the operational and strategic levels of war, players must design their decisions around two types of desired effect: the physical effect of an action and the cognitive effect in the minds of the other players.
29. Players usually attempt to "game," or manipulate, the control cell; game design should explicitly capture this behavior and not simply assume it away.

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Dr. Stephen Downes-Martin, research professor at the Naval War College, has over thirty years of experience war-gaming tactical, operational, and strategic national security problems. His research focus is on how decision support and assessment methods, including war gaming, can be manipulated to deceive decision makers, how decision makers misuse such methods to deceive themselves, and how to detect such attempts

and protect from them. He has a PhD in physics from King's College, University of London, was a reserve military intelligence officer in the British Army, and is now a U.S. citizen. He can be reached at stephen.downes-martin@usnwc.edu.

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