Wargaming Strategic Linkage

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Summary

What's the problem?

Currently, there is no consensus and no established methodology at the Naval War College (NWC) about how to conduct wargames that link the strategic, operational, and tactical levels of war—what we call multi-level wargaming. This is a real problem today because those three levels of war are linked in complex ways, especially in the current global environment. The War Gaming Department (WGD) of the NWC is looking for ideas that will help improve the way it designs and produces wargames that cut across those levels of war more efficiently and effectively than heretofore. The NWC asked CNA to identify key game-design issues and to develop some recommendations for more effectively representing the linkage between the strategic, operational/strategic, and operational levels of war, especially as applied to future Navy Title X Global War Games (GWG).

What we did

Our approach had three main components. First, we based our research on the project team's first-hand experience with wargaming, as both game designers and game analysts.[1] Second, we researched existing wargame systems and interviewed leading wargaming practitioners, both in government and in industry. This allowed us to learn how others have conducted multi-level games in the past and to discuss their ideas about how to improve techniques in the future. Third, we synthesized our research and experience into specific recommendations for the design of a game structure and processes that the NWC could use as a starting point for designing future GWGs.

1. See the bibliography for a compendium of research papers and game designs by the authors of this paper.

What we learned

Designing a successful wargame is a specialized skill.[2] Designing successful multi-level wargames poses its own set of specific challenges. The wealth of experience of current practitioners points to some basic insights about how to meet those challenges.

Most important challenges

We concluded that the most important challenges to more efficient multi-level game designs are in three interrelated aspects of design.

- Representing the flow of time and decision processes at different levels of war and different echelons of command
- Building an organizational structure that efficiently integrates players and Control
- Defining dynamics of the flow of game play to give the players greater freedom to identify creative decision options and explore their possible outcomes and effects without demanding large numbers of personnel to manage.

Main insights

The WGD should adopt the following practices in its future multi-level game designs:

- Start with a melded seminar game
- Use time-step, move-based play
- Use decision waves to integrate a next-event sequence of play
- Use collaborative control
- Use aggregated models and pre-adjudication of events
- Use realistic information flows for all sides.

2. Peter P. Perla, Michael C. Markowitz, et al. *Wargame-Creation Skills and the Wargame Construction Kit,* Dec 2004 (CNA Research Memorandum D0007042.A3/Final).

What we recommend

CNA recommends that the Wargaming Department of the Naval War College use the prototypical structural design presented in figure 1 as the starting point for its design of the next Navy Title X Global War Game. The key elements of this recommended design are:

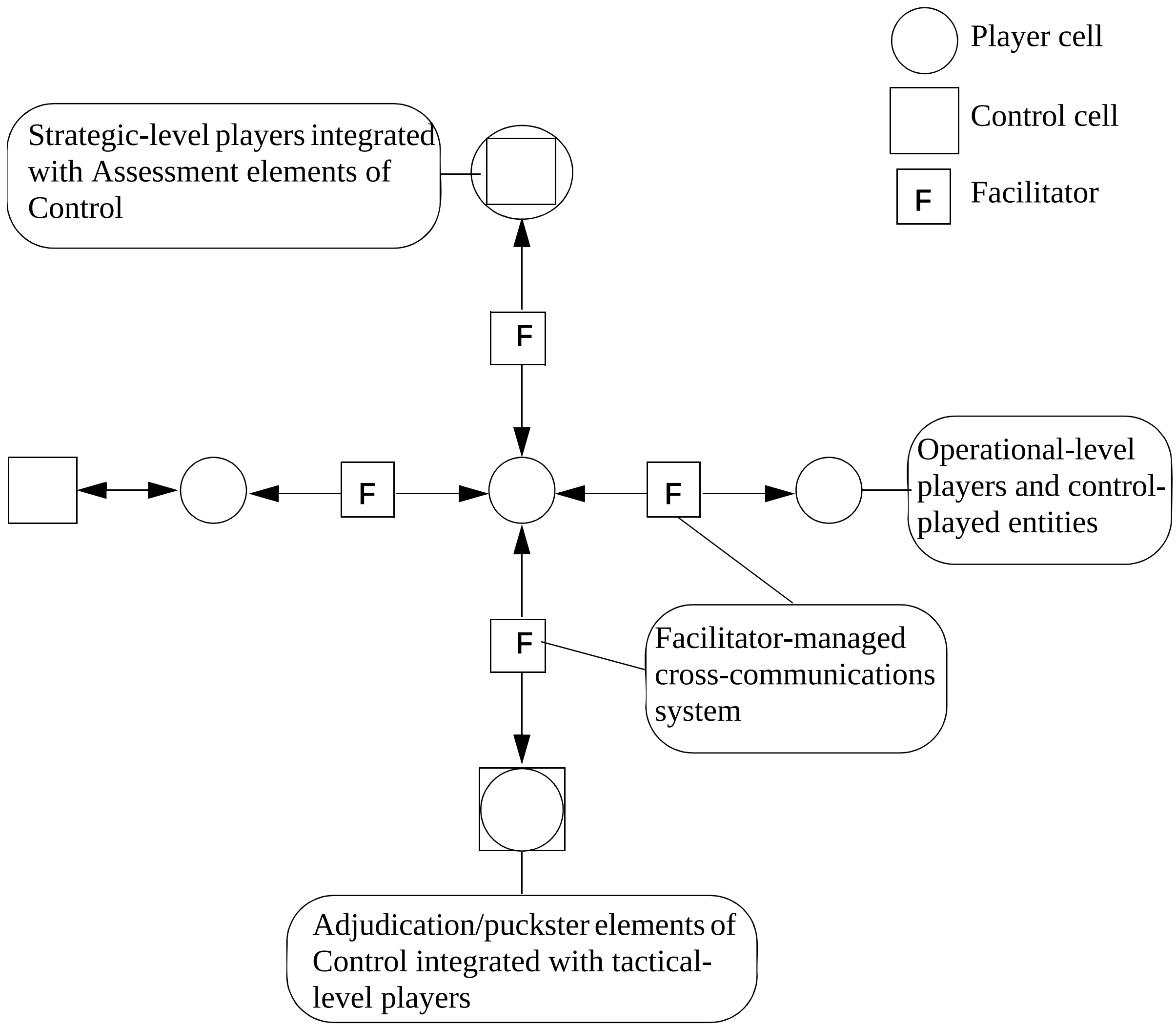
- Strategic players, supported by an overall Game Director and a Director of Assessment, address the overall strategic situation and specify their assessments, objectives, and intent in closed planning and open adjudication and assessment sessions. Strategic players provide assessments, objectives, and intent to their operational-level subordinate players, as well as to any Control-played operational entities, using procedures and documentation as close as possible to those used in the real world (for example, warning, alert, and execute orders).

- Operational-level players, supported as needed by Facilitators managed by the Director of Assessment, also work in a closed planning/open adjudication environment. They respond to tasking from strategic players to develop operational plans, and provide direction and final operational execution orders to the subordinate tactical-level players using procedures and documentation as close as possible to those used in the real world.

- Tactical players work in collaborative control structure with the game pucksters managed by the Director of Adjudication. Tactical-level players embody their own closed planning/open adjudication environment, agreeing on game outcomes based on a game engine scoped and scaled to provide the necessary balance of detail and aggregation to achieve the goals of the game.

- Feedback of game events and outcomes generally occurs through communications from one level or echelon of the players to another. (Control facilitates this communication process but does not directly intercede in it except in specific and exceptional circumstances). Information availability and flow are based on the same level of detailed representation of real-world capabilities available to all sides.

Figure 1. Recommended structure for a Global War Game



Setting the stage

Before proceeding to discuss the details of our explorations during this project and the reasoning behind our recommendations, it is necessary to bound the scope of our interest. The kinds of multi-level games we are talking about in this study are primarily the classic type of seminar games and computer-assisted seminar games traditionally carried out at the Naval War College and most other Service schools and research organizations.[3] Such games include player cells manned by one or more decision makers (military officers or civilians) and representing either abstract command levels or specific command organizations. They are supported and "controlled" (more on that later) by other officers and civilians, typically those assigned to the gaming facility that is managing or hosting the play of the game, augmented as needed by outside organizations. Our focus is on what is commonly called high-level games. These are games in which players represent decision makers at the strategic and operational levels of war, with possible excursions into some tactical-level play. Unfortunately, the definitions of these levels of war and which decision makers populate each, can be vague and variable. For most purposes, however, we make the following connections between level of war and level of command.

- Strategic level: The National Command Authorities (NCA), Joint Chiefs of Staff (JCS), and theater combatant commanders
- Operational level: Theater combatant commanders, joint force commanders, and numbered fleet, air force, and army commanders
- Tactical level: Numbered fleet, air force, and army commanders, and lower-level commanders at corps, division, wing,

3. For a detailed discussion of these types of games, see Perla, Peter P. *The Art of Wargaming*. Annapolis: Naval Institute Press (1990).

strike-group or even lower, down to individual operators and weapon systems.

Originating idea

As the Navy places more emphasis on learning how to think and act at the "operational level of war," the Naval War College is reinvigorating its Global War Game (GWG) Title X wargaming program. The NWC hosted a series of Global games annually from 1979 through 2001. These games explored future force structure in the light of postulated scenarios. The GWG series was characterized as "Title X games" because the games focused on issues inherent in the requirements imposed on the Navy by Title 10 of the U.S. Code to organize, train, and equip naval forces. The introduction of a new maritime strategy in late 2007 triggered renewed interest in the idea of a Global War Game.[4] The new series of games, while still in development, is likely to include significant game play at both the strategic and operational levels. The first game in this new series, *Global '08*, conducted in the summer of 2008, took the form of a facilitated workshop focused on strategic-level issues. In future Global games, the Navy plans to begin incorporating serious operational-level play in the context of a strategic game.

During the heyday of the GWG, the NWC used a hundred or more mostly uniformed controllers and facilitators to manage play and maintain the linkages between levels. With increasingly reduced uniformed manning at the college, such a brute force method is no longer practical. As a result, the NWC asked CNA to work with them to explore possible approaches and adapt and develop a methodology that will allow the Naval War College to design and carry out multi-level Title X (and possibly other) wargames in an economical manner, without having to use a "cast of thousands."

4. See *A Cooperative Strategy for 21st Century Seapower*, United States Navy. Oct 2007. Available on-line at http://www.navy.mil/maritime/MaritimeStrategy.pdf.

Our approach

The study team used a two-step approach of research and synthesis, based on our prior experience and expertise with different types of gaming. Our primary research took the form of interviews with several leading individuals and organizations involved in wargaming for the Department of Defense (DoD), and reviewing documentation they provided us. The participants in this investigation were:

- Mr. Mark Herman and Mr. Richard Phares, Booz–Allen–Hamilton
- The director and senior staff of the USMC's Wargaming Division of the Marine Corps Warfighting Laboratory (MCWL) at Quantico
- Christopher Carlson, Captain, USN (Ret.), senior analyst at the Defense Intelligence Agency
- The director and senior staff of the Army War College's Center for Strategic Leadership (CSL)
- Erik Kjonnerod, Advisor to the President, National Defense University (NDU)
- Scott Simpkins and other wargaming experts at Johns Hopkins University Applied Physics Laboratory (JHUAPL)
- Matthew Caffrey, Colonel USAF (Ret.), and Mr. Terry Christian, U.S. Air Force Applied Research Laboratory
- Colonel Russ "Rudder" Smith, USAF, the Director, Warfighting Applications, LeMay Center for Doctrine Development & Education and other senior staff of the Air Force Wargaming Institute (AFWI)
- Mr. Thomas Allen, the director of the Simulations Center of the Institute for Defense Analyses (IDA), and other members of the IDA staff.

We have documented in detail the discussions that took place during our interviews under separate cover.[5]

5. Peter P. Perla and Michael C. Markowitz. *Conversations with Wargamers*, Jan 2009 (CNA Research Memorandum D0019260.A2/Final).

The challenges

Our conversations with the experts showed a remarkable degree of consensus on the key challenges associated with designing and playing wargames at more than one level of war or echelon of command. Although different individuals and organizations raised specific issues and concerns based on their own unique experiences, three primary challenges stood out across all of our discussions. These challenges were:

1. Coordinating activities at the different time scales of the decision processes at different levels of war and echelons of command and the resulting challenge of managing the flow of time during a game to allow for both low-level (tactical) play sufficiently detailed to support higher level decisions, while allowing the game to cover the extended period of time usually necessary to meet higher level (strategic) objectives.

2. Establishing and maintaining a game-organization framework to facilitate the flow of information and direction among the different player levels and echelons necessary to keeping their different decision cycles coordinated in a realistic fashion. The key element of this challenge is how to integrate the actual "players" of the game (those whose decisions form the basis for meeting the game's objectives and defining its results) and what are often called the "pucksters," those whose responsibility it is to facilitate and "control" play.

3. The closely related challenge of designing a dynamic system of game mechanics and procedures to translate player decisions and actions into outcomes that affect the state of the game universe in which the players must operate in such a way that the players can understand and take ownership of the outcomes.

All of these challenges reflect issues associated with what we may call synchronization—not only synchronization in a chronological sense among the actions and decisions of the different command levels, but also synchronization of game processes and mechanics with the dynamics that drive real-world activities and outcomes. A major element of this synchronization issue is to provide both (or all) sides in a game the information they are “entitled” to—entitled to in the sense that the players would certainly have such information available to them in a real situation and according to a realistic representation of the time delays and inaccuracies inherent in their information processes. (For example, if two surface ships pass within 500 yards of each other in clear visibility, they would certainly know of their mutual presence in real time.) Because so much of the information required at higher levels of a game’s command hierarchy stem from the actions and outcomes of events at the lowest level of game play, it follows that even in a game with a high-level strategic focus, the management and reporting of tactical results are critical to creating a credible decision-making experience at the strategic level as well.

Organizing our ideas

In the remainder of this paper we discuss in detail those three fundamental challenges. First, we discuss the issues of time and decision processes, where we outline our notion of different and variable decision processes and how the intricacies of their interactions can affect the flow of game play. We then consider two broad approaches commonly used to deal with some of the resulting issues: the *multi-game approach* and the *melded-game approach.*

Second, we consider the structure of and relationships between game players and game control (sometimes colloquially referred to as the pucksters), and how those relationships interact with the processes of adjudication and assessment. We discuss some ideas about how the structural relationship contributes to the success or failure of multi-level games.

Third, we explore alternatives mechanics and procedures for managing the dynamics of player interactions, particularly the processes of planning, adjudication, and assessment.

We then discuss some speculation about what the future may hold. This discussion considers the nascent changes in how we think about conflict and how we represent it in games, and about the potential role technology might play in improving the conduct of multi-level games.

Finally, we conclude with an overall summary of insights we derived from this research. Based on these insights, we propose several recommendations, expanding on those described above in the summary, and including some additional, less central ideas for the Naval War College to consider applying in future multi-level wargames.

Time and decision processes

Seminar-style wargames have two primary methods of dealing with time and player activity. One method uses a device commonly called moves. A single move can represent any amount of time, and different moves can represent different amounts of time. The second method uses a game clock, which runs at either real time or at some scaled version of real time, either faster or slower. Again, the speeds of the clock can vary over the course of the game.

Despite the apparent differences in these approaches, they are essentially the same. Think of a move as a single tick of game-clock time, albeit a tick that can last for a potentially very large number of minutes, hours, days, weeks, or months. The key idea is that the game must manage the activity of the players over some span of time in such a way that what the players can do during that span of game time is a realistic, if abstract, representation of what real-world commanders and forces can do in the corresponding span of real time.

This "mapping," as it were, from the model universe of the game (what we will call the gameverse) to the real universe is one of the fundamental tasks of game design and game execution. Our focus here is on how the representation of time in the game interacts with and drives the representation of the decision processes of the players, particularly those at multiple levels of war (strategic, operational, and tactical) and at different echelons of command. This interaction is critical to the success of any game because it is only in the decision processes of the players that the substance of the game may be found.

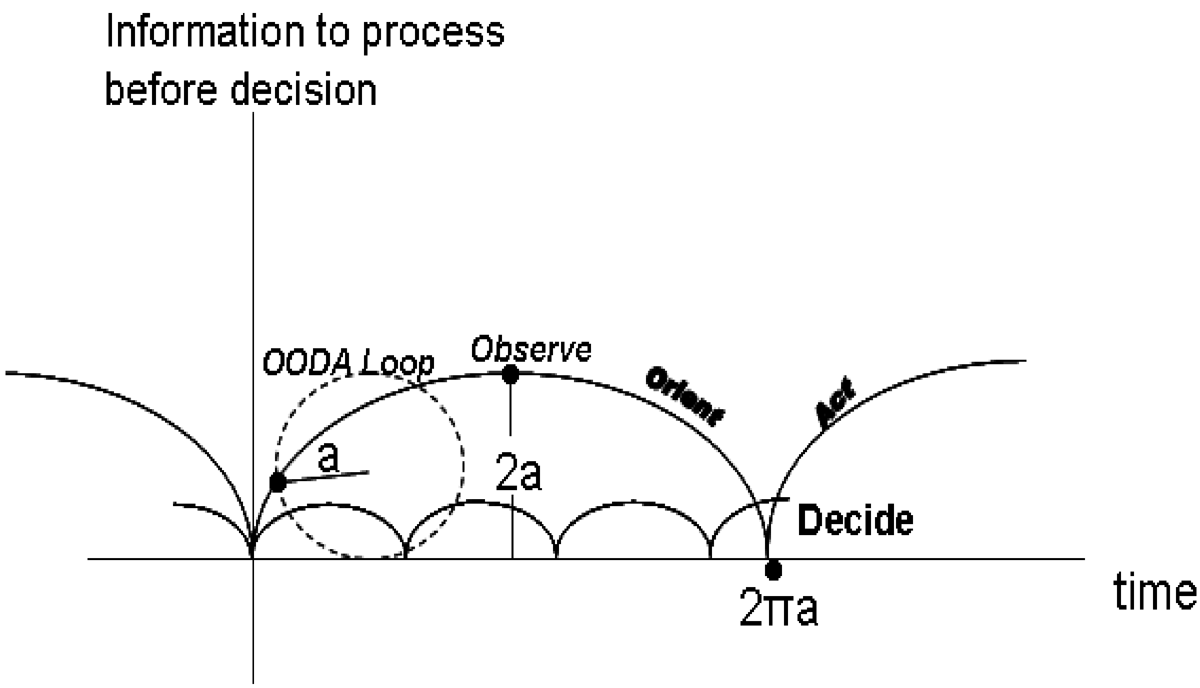
OODA loops and decision waves

One of the most challenging aspects of designing and producing multi-level wargames arises from the different and variable timescales associated with the decision processes of different command organizations at different levels of war or command hierarchies. Such decision processes are often referred to as decision cycles; the most famous model of such decision cycles is the OODA loop, a term coined by USAF colonel John Boyd.[6] OODA stands for Observe, Orient, Decide, Act. The decision maker observes his environment by gathering information; orients himself in that environment by understanding both its nature and its implications and by comparing its current state to the desired state; decides on a course of action based on this understanding; and finally acts to implement this decision. We would argue, however, that thinking of the decision process merely as a rotating loop misses an important aspect of the situation—the environment is constantly changing and so the cycle or loop is actually rolling along a time line, producing what we will call a decision wave.

Figure 2 shows a graph of the mathematical figure formed by the trajectory of a point lying on a circle of radius a rolling along the x-axis. Here, we define that axis to represent time. The resulting curve or wave (in mathematical terms, it is a cycloid) has a wave length (here, $2\pi a$) along the time axis and an amplitude along the y-axis, which we will define as some arbitrary measure of the amount of information the decisionmaker must collect and process before making a decision. We—again arbitrarily—define the high point of the wave to be the point at which the decision maker observes the outcomes of his action. The following downward arc of the curve represents the process of orienting to the new environment by processing the maximum amount of information, $2a$. This leads to the decision point at the base of the curve. Once the decision is made, the rising part of the curve represents the process of acting on the decision, which generates new information to be processed before the next observation, orientation, and decision points.

6. John R. Boyd never produced a formal text embodying his ideas. His major work is a long set of briefing slides, titled *Patterns of Conflict*. A photostatic copy of his original briefing slides is available in pdf form on-line at http://www.d-n-i.net/boyd/pdf/poc.pdf.

Figure 2. From OODA loop to decision wave



Different levels of war, different echelons of command, and even different organizations at the same level or echelon have decision waves that vary in frequency and amplitude. The lower-amplitude curve in figure 2 represents such a lower-level decision wave. Think of the frequency of the wave (the inverse of the wave length, or $1/2\pi a$) as reflecting the speed with which new decisions must be made, and the amplitude as the amount of information the decision maker must consider before making the decision.

The interaction of different decision waves generates profound challenges in designing a multi-level game to handle effectively both time and information. These challenges manifest themselves most clearly in the interplay of the lowest level of player activity (let's call this the tactical level) and the highest level of player activity (let's call this the strategic level).

The strategic level of decision making has the responsibility for deciding what the objectives of the struggle are and what state of the universe is desired at the end of the conflict. The tactical level of conflict is where the opposing forces interact directly in the zone of conflict and competition. It is what we call the engine of change. The operational level lies below the strategic and above the tactical, and connects the goals of change with the engine of change. It is at this level that decision makers evaluate the changes that have occurred and assess the means to fuel the engine to make new changes in desired directions—who and what can contribute to the tactical outcome, and how best the available tools and resources can be used to achieve the changes desired by the strategists.

In the real world, tactical decisions tend to occur at a rapid pace. At the very lowest tactical level, that of individuals—such as the soldier on the ground or the pilot in the air—the pace is at the rhythm of the heartbeat. At the highest strategic level, such as that of the National Command Authorities, the rhythm is defined by the rate at which vast quantities of information can be collected, collated, and disseminated—usually through a series of meetings and briefings proceeding up the chain of command until ultimately reaching the supreme decision maker. (Of course, there are exceptions—such as during a nuclear attack—in which strategic decisions must be made at a much higher speed than normal!)

Though the levels of war operate in somewhat different spheres and use different methods, the decision processes are similar in their fundamental structure. Indeed, at all echelons of command there is a process of defining the situation (*observe*), strategy formulation (what goals do I want to achieve in this situation; *orient*), operational planning (how should I position and coordinate my available resources; *decide*), and tactical execution (how can I use those resources to effect the changes in my environment that will bring me closer to my goals; *act*). Thus we can envision the decision processes at different levels as an intricate ballet of overlapping and interwoven decision waves.

This vibrating and oscillating system of waves can become very complex. Intersections of the processes at the different levels can occur nearly everywhere. Some tactical outcomes can have profound effects on strategic decisions; some operational choices will dramatically alter tactical circumstances. At some points along the time line information may flow primarily from lower levels to higher, while at others the flow is reversed. A tactical outcome results in the need to reevaluate (*orient*) at higher levels before defining available choices (*decide*) at the lower levels. Meanwhile, the dynamics are forcing the lower levels to conduct their own internal process based on existing guidance from above and their own local situations.

This complex interweaving of processes generates a latency issue with regard to time. While the higher levels and echelons work through their processes to provide guidance and direction to the lower levels, the situation at the lower levels is evolving, and in some ways that evolution feeds into and changes the ongoing higher level processes.

In game terms, the structure of the player positions and organizations needs to reflect the realities of these interacting processes. It is relatively easy to feed low-level information up the chain of command. It is more difficult to decide at what point higher level direction should reach the lower levels.

Solving this problem is made more complicated by the fact that in the real world things don't follow a single pattern, and decision waves are far from stationary in either frequency or amplitude. In some cases tactical actions may go on for days with little interconnection with higher level echelons. (Consider the various conferences between Churchill and Roosevelt during World War II, which often decided critical new strategic directions while large-scale combat continued on the basis of previous direction. For example, the decision to invade Sicily once North African operations were concluded was made while combat in Tunisia was still under way against significant Axis forces.) In other cases, of course, the opposite is true, and higher commanders may even intervene directly in tactical matters in real time—especially when facilitated by modern global communications.

To represent these complex and varying dynamics using a turn-based or time-step system for controlling game time requires the use either of very small time steps or time steps of adjustable length. But the more steps—the more moves—available to the players to run through their decision waves, the longer the game must run (in real-world time) to cover significant spans of game-world time.

Suppose, for example, that a game must represent 3 strategic decision cycles, representing an average of 30 days each, for a total of 90 days of conflict. Suppose further that the level of aggregation required to support that game play dictates a minimum of one hour of game play to represent the action for each day of conflict. Such a game would need a minimum of 90 hours of game play to cover 90 days of war—unless there is some rationale and technique available to avoid playing each day of the operation at that level of detail.

What's worse, attempts to speed play of games by manning multi-level games with large staffs (the "cast of thousands" approach) does not solve this problem—indeed, it may aggravate it because of the inherent inefficiencies and intricacies that result as more players become involved.

There is no apparent technical solution to this issue as long as you expect human beings to play the roles at multiple command levels. As one of our sources described it, this is not a technical problem; it is a "way the world works" problem.

Thus, the structure of the decision making processes and of the corresponding processes for adjudicating the outcomes of game actions drives how the game can treat time. Conversely, defining the game's treatment of time, through the action of the game's decision waves, constrains the structure and processes players can use to make decisions—the ultimate raw material the game produces to allow it to achieve its substantive objectives.

There are several approaches gamers have used to deal with these issues of time and the different decision waves at different levels of war and echelons of command. In the remainder of this section, we will describe some of these approaches. Two of the most frequently used are what we will call the *multi-game* approach, and the *melded-game* approach. Less often employed is a technique that we can best describe as a *hybrid* or *asynchronous* approach. Finally, we'll take a look at some possible applications of technology to help address these issues, remembering all the while that technology alone is not the "answer."

The multi-game approach

The basic idea of a multi-game approach, is to carry out the game (or at least its opening actions) in two (or more) stages. The stages may be played in either high-then-low (top-to-bottom) or low-then-high (bottom-to-top) order.

High then low

The first approach is to play the highest level game in the first stage, in which relatively senior officers and officials are confronted with a strategic level situation to be explored. During this first pregame, the strategic players typically define rules of engagement (ROE) and create top-level strategic and operational guidance (or "commander's intent") for subsequent game stages. The resultant ROE then becomes a critical control tool for managing the operational game and any lower level tactical games, which require the operational and tactical players to follow the ROE and intent unless they ask for and receive relief from, or changes to them. Army and Air Force games, as well as many conducted by NDU, frequently took the form of such multi-games.

For example, the Air Force Research Laboratory (AFRL) has used this multi-game approach in their Future Long-Term Challenges (FLTC) game. This game plays out in two distinct phases. During phase 1, the players focus on deliberate planning, and they may articulate system and force requirements to deal with possible contingencies several years in advance of the game's designated time period. During phase 2, many of the same players play similar or identical roles, but now they must deal with crisis-action planning and response. The multi-phase design allows the multi-levels of play to proceed at their own natural decision-cycle speed, without forced interaction, and so can avoid many of the problems associated with the incommensurate decision cycles.

One of the disadvantages of the multi-game approach is that there is not as much interaction among all the players, of different organizations and different command levels, as there would be if the game were played as an integrated whole. The FLTC games retain some of that flavor by using a high proportion of the same players to play both games, even though the different phases dealt with different pieces of the problem.

The most common multi-game technique uses the high-level game to establish the scenario baseline and strategic guidance for the lower level game in a more or less traditional manner. Once the lower-level game begins, if any of the high-level players remain involved in their original roles, they seldom do more than respond to requests for guidance or ROE changes from the lower-level players. Most often, Game Control simply assumes the roles of the higher-level players and responds to such requests in a manner they believe will drive the game in the direction they want it to take, according to the game's objectives. On rare occasion, the original higher-level players (or a subset of them) may reassume their roles, often in an asynchronous way, to deal with the game requests. (For example, a player representing a theater commander may only "check in" to the game at the end of his day-to-day real-world job, and respond to player requests that will take effect the following day.) Meanwhile, the play of the low-level game may be continuing along its own path.

Table 1 summarizes the high-then-low stage of the multi-game approach.

Table 1. High-then-low multi-games

Senior players focus on strategic situation	Lower level players focus on execution
• Deliberate planning • Define ROE • Promulgate intent • Identify forces and systems	• Crisis-action planning • Implement intent and ROE • Request changes to intent and ROE in response to evolving operational/tactical situation
Advantages	**Disadvantages**
• Focus senior players on strategy and policy • Demands less time from senior players than melded game • Defines a common strategic framework for subsequent exploration of operational and tactical alternatives	• Reduced interaction among player levels • Potential disconnects when lower level requests ROE or intent changes and senior players not available for timely decision (but may reflect real-world issue!)

Low then high

The opposite take on the multi-game approach uses low-level tactical games as precursors for the higher level operational and strategic games. The low-level games are played some time ahead of the higher level game and provide inputs to the higher level game. This approach allows details to be fed into the later game without the usual time lags necessary to generate such inputs on the fly from playing detailed tactical games to produce such outcomes while the higher level players wait around for the results. In essence, the lower level games provide "look-up tables" of results for the use of the umpires in the higher level ones. This is a tricky proposition, of course, because the lower level games can seldom anticipate all the details and nuances of situations that might arise during the higher level game. Nevertheless, such precursor games can provide a useful set of guidelines off which the control organization of a higher level game can play to speed up the latter game.

One example of this sort of approach is a crisis-response game CNA designed and executed as part of a conference on complex humanitarian emergencies.[7] During the design of this game, we proposed to the players, a group of about a dozen senior active and retired government and international officials, a scenario depicting a complex humanitarian emergency in a middle eastern Arab nation. Prior to the play of the game we outlined several possible broad courses of action the players could take in the first move of the game. We then "played out" (in an admittedly informal way) the possible outcomes of each of these courses of action along a time stream that we would use to establish the conditions for the second move of the game. We were confident (or at least hopeful) that whatever decision the players arrived at during play of the first move would be close enough to one of our predefined COAs that we could make a few simple adjustments as needed to one of our predefined outcomes and use it to

7. Anne M. Dixon and Maureen A. Wigge, eds. *CNA 1995 Annual Conference: Proceedings: Military Support to Complex Humanitarian Emergencies: From Practice to Policy*, 1996. (CNA MISC 9602010000/Final).

update the situation prior to the second move. In the event, this approach proved successful and we were able to advance the game clock several months with a fully explained and believable course of events stemming from the moves taken by the players. Table 2 summarizes the low-then-high stage of the multi-game approach.

Table 2. Low-then-high multi-games

Low-level games produce input to high-level	High-level players focus on strategic decisions
• Must game out a range of credible alternatives • Results embodied in a "look-up" table • Also provide guidance for control of high-level game	• Requires flexible and adaptable control to ensure consistency of high- and low-level assumptions and actions • Works best when strategic options can be limited realistically to only a few major alternatives that can be defined ahead of time to bound low-level games
Advantages	**Disadvantages**
• Low-level games may explore a wider range of situations in greater detail than usually available in other game types • High-level play is faster because of preplayed low-level outcomes	• Constrains freedom of action of high-level players • May require off-the-cuff adjudication when high-level play goes outside the bounds of the preplayed lower-level options

The melded game approach

The Navy Global Wargames of the 1980s and early 1990s are good examples of what we call melded games. Melded games integrate play at several levels into a single event and, usually, a single venue. The Global series incorporated the full range of strategic, operational, and tactical considerations as the multi-games of the time, but the main game activity usually took place in a single location (Sims Hall at the Naval War College) over the course of a single, two- or three-week span of time. There were some elements of the Global game that various participating groups would prepare for in pre-game activities, but these were not usually considered a formal part of the GWG itself. Even in those cases when preliminary events took place to provide some initial conditions and guidance, the on-site play at the strategic level, using an active cell for the NCA, produced a more complex and dynamic play experience than the multi-games because "real players," not just subgroups of the Control cell, assumed the leadership roles during the play of the entire game.

Melded multi-level games must deal directly with the issues associated with managing time and the decision processes of different command elements. As we have already discussed, the different levels of decision and action (strategic, operational, and tactical, for example) frequently have different amplitudes and frequencies associated with their different decision waves, as well as distinct "time constants" driving their information feedback loops. Think of this as the amount of time typically required for information about the outcomes of actions taken to flow back to the commanders who will make decisions about what to do next, plus the amount of time required for them to make that decision and communicate orders to their subordinates. (In figure 2, this time constant is symbolized by the wave length of the decision wave, $2\pi a$.)

At the lowest tactical levels, for example, real-world forces in contact may have to make split-second decisions and usually receive immediate feedback on the effectiveness of their actions or the imminence of the threat. At the highest strategic levels, the NCA may normally make routine decisions on the basis of a daily briefing schedule. On the other hand, significant decisions about changing the overall course of operations may only occur every few weeks or months. (Again, recall the example of the U.S. and British strategic conferences during WWII.) The strategic effects of such broad decisions about resource allocation and theater-level objectives and operations may take months or even years to become manifest.

Time and the game clock

When the tactical and strategic levels are melded into a single coherent game construct, the issue of time and its management in game terms is a real challenge. Some games shift clock speeds (and so activity types and levels) as the emphasis of play shifts from one level to another. We call this technique *telescoping time*. Other games force everyone—regardless of level of command—to play at some common "clock speed" (usually real time or real time accelerated by a factor of two or more; that is, 1 hour of game play represents 2 hours of time elapsed in the game world). We call this technique the *common time* approach. Both of these approaches may also make use of time jumps to facilitate play of extended periods of time, particularly when there is a natural pause in the pace of operations. We will look at each of these ideas in more detail below.

Telescoping time

The telescoping-time technique typically involves telescoping space as well. This approach is especially useful when the same group of players assumes decisionmaking roles at multiple levels of war. In this case, the players first assume one level of decision making and its corresponding space-time scale, but when certain events occur (such as tactical contact of deployed forces) they zoom in to a new level of decision making and a more or less compressed space-time scale. This technique is frequently useful for relatively small seminar games in which the players first discuss issues and make decisions at the theater or fleet level and then descend into the tactical level to explore the implications of those decisions for task groups operating at the tactical level.

Civilian games have used this technique for decades. In the game *Jutland*,[8] which simulates naval operations in the North Sea during the First World War, the players begin play at the operational level. At this level, they direct the movements of naval fleets and squadrons across a map of the entire North Sea and its littoral, playing in time steps measured in hours. Once contact occurs. however, play shifts to the tactical level. The players then assume tactical control of the individual ships comprising the various squadrons in contact, and maneuver and fight them at a scale measured in hundreds of yards to the inch. Time shifts to only a few minutes a move and the tactical action is resolved until the next tick of the operational clock should have occurred. Players then revert back to the operational scale

8. Dunnigan, James F. *Jutland.* Boardgame. Baltimore: The Avalon Hill Game Company. (1967).

temporarily to resolve higher level activity that takes place while the tactical action unrolls, once again returning to the tactical level should that action be continuing.

Common time

The use of common time (or a common clock) across the various levels of play is an approach that has been used during many of the past Global War Games. The challenges involved in using this technique result primarily from the potential for creating unproductive down time among some players while generating frantic paces of activity among others.

At high-level strategic play, much of the action is embodied in briefings and discussions among the senior players about what overall course of action to take. For example, a common strategic decision during the GWGs of the 1980s involved the deployments and redeployments of carrier battle groups in the various theaters of war. Participants sat through many such briefings as the various theater commanders tried to convince the NCA to send the carries to reinforce their theater rather than some other. Briefings and discussions play out in real time, no matter what the designated clock speed might be. As a result, the pace of the game either adapts to the pace of the briefings or the time streams at the different levels begin to come apart.

For example, suppose one theater goes ahead with its plans assuming it has two CVBGs available. During strategic discussions, however, the NCA decides to take one of them away and redeploy it to a different theater. If that NCA decision is late getting to the theater players, and the latter submit their action plans and orders to Control on the basis of the availability of two carriers, internal inconsistencies in the game can easily result. Either the players will be surprised (and rebellious) after Control adjudicates their action using one carrier rather than two, or their orders will have to be canceled and new ones created, causing further time delays in game play. So, while the NCA dithers, the tactical play can slow to a crawl.

On the other extreme, once the battle is well and truly joined, resolving a string of several tactical encounters may actually require slowing the common clock speed to less than real time to allow for adjudicating many such encounters before updating the operational and strategic situations. The resulting “hurry up and wait” effects may be too realistic for comfort, as first one level then another sits around with little productive work to do. This effect can be reduced dramatically in situations that do not require the higher level players to be actively involved in game play full-time.

It is sometimes the fortunate case that once the game begins the high-level players provide initial strategic guidance and then restrict their activities to receiving periodic update briefings or urgent real-time communications only when needed. In that case the down-time issue can be managed more easily. (In essence, it is as if play were really divided into a multi-game approach within the context of a single game.) In such cases, the lowest level of play will dictate the game's speed, with small numbers of fixed points of synchronization occurring when the higher levels of command receive situation updates. In addition, time jumps of some magnitude can be useful for advancing play between operationally or strategically significant time periods or events without having to “run the game clock” at the lower speed to conduct detailed tactical transitions. More on this later.

To make the common time approach work smoothly, it is critical that the game design incorporates an efficient technique for managing and maintaining consistency of clock speeds across the various command levels, especially when the speed must be changed. This is relatively easy to do with the members of Control; it is a bit more challenging to help the actual players grasp the meaning and effects of such changes, especially those players who may not be familiar with the fundamental abstractions of time involved in virtually any gaming. Suppose, for example, that the first 2-hour game move is played in real time (that is, it represents 2 hours of activity in the real world). But then the second 2-hour game move is scaled to represent 2 days of real time rather than 2 hours. Some players may need help adjusting to the implications of this move’s higher clock speed. This cognitive challenge—sometimes forgotten by gamers experienced with this abstraction—can be dangerously disruptive to the productive play of the game, causing confusion and disgruntlement among players who are bewildered by the changing clock speeds.

To deal with such issues, one of the most important ideas that we came across stems from work done by the Wargaming Division of the Marine Corps Warfighting Laboratory at Quantico. In their experience, you can maintain a constant game clock across all levels of play, even at speeds faster or slower than real time, but to make that sort of game work, the lowest level of play must be preparing ahead of time the most important events they can foresee as likely results of the higher level plans and decisions. This requires that the "players" at the lowest level be subsumed into what is normally considered a function performed by control. Players from both sides then work together to create the storyline that flows from and feeds back to the higher levels. This storyline or storyboard must be synchronized to a series of specific events, which occur at particular times according to the running clock. To use this technique successfully requires collaborative planning tools and a means of creating and displaying the common picture which all the players and control can play off. In large games, like past Globals, the "game floor" (the location in which ground truth is displayed and interactions adjudicated) must stay at least a couple of days ahead of the play at the next level up—that is, the operational level.

During GWGs 2000 and 2001, the last couple of GWGs held before GWG 2008, the display for that storyboard was a physical, or analog, one—a long whiteboard or paper display showing the upcoming sequence of events (similar in concept to displays of battlefield synchronization used by the U.S. Army). Such a display allows the entire group of player/umpires to maintain their situational awareness and determine with whom they need to cooperate to drive the game's events. To build and maintain it, those players must talk face-to-face; computer technology is not yet up to managing such an intricate dance automatically without human interaction.

Instead, the computer systems are best used for their primary strengths—to keep track of the "mechanical" information and physical interplay of systems and units. Just as real orders flow from human commanders at one level to their human subordinates at lower levels, game commands must be acted upon by human players and umpires at the lowest levels. By imposing real-world command and control disciplines, such as the system of warning orders, alert orders, and execute orders, the operational and strategic decision makers can give the tactical players and umpires the required lead time to build the story and manage the collisions of forces the orders initiate.

Time jumps

Another tool for dealing with time is the use of the time jump. Not merely a change in clock speed, a time jump makes a usually large leap across a significant span of time from the current time in which the players find themselves to several days or weeks later. Time jumps are not restricted to common-time games, but they are often most useful in that setting.

One example of a game employing time jumps is a Naval War College game called NORWESTPAC. This is a game played with, and designed by, the Japan Maritime Self-Defense Force. It is run using the "real time with time jumps" technique. Time-jump games can add a new responsibility to the standard responsibilities of Control. If player cells can communicate only with other player cells in their vertical chain of command (strategic—operational—tactical) via control, then one of the real-time adjudication functions of control becomes the responsibility to set the time jumps for the lower level cell. That is, the upper level cell runs continuously, but the lower level cells have time jumps imposed on them by control to play out the upper level equivalent of "critical events."

The dangers of using the time-jump technique are illustrated by a story related to us by one of our Air Force contacts, and which we heard directly from the protagonist ourselves. Major General Link, USAF, liked to tell about his participation in a large, computer-driven game of a major contingency. At the end of one day, the air players gave direction to the controllers to continue to pound the enemy in certain locations. When the players returned, they discovered that the game controllers had made a multi-week time jump from the end of the previous day's play. What was worse, the enemy activity allowed during this time jump was dramatic; they completely altered their axis of advance on the key friendly capital. Control judged this change of axis to have been successful, leading to severe consequences for Blue forces. When General Link asked them what Blue airpower had been doing during all this time, the controllers said that they had been pounding the now-empty enemy positions, according to the last strategic direction provided by the players! This is a good example of how not to manage a time jump.

Another of our interviewees recalled a technique used by the Naval War College some years ago, which the NWC gamers termed "sprint and drift."[9] This technique attempted to compromise between the mechanical need for much of a game's play to be at near-real-time speeds, with the substantive need to cover longer-than-real-time spans of game play. The technique involved the use of the Joint Semi-Automated Forces (JSAF) computer simulation system to provide for near-real-time control and communications among the various game commands and entities during the working day. Overnight, however, the situation from JSAF would be handed off to the NWC's own gaming system. The "pucksters" (the control cell and computer technicians who ran the system) would then run an extension of the JSAF situation for several days of game time to help move play along and present the players with an updated and advanced situation the next morning. Despite this disparity in time scales, the pucksters could not keep up with the pace of the real-time game.

Table 3 summarizes the three approaches to time management that we described above.

9. Our NWC sources advise us that, more recently, "sprint and drift" has been used to describe an undesirable pace of game design wherein wargamers and external stakeholders work feverishly during the various planning conferences for the event (sprint) but very little is accomplished between those conferences (drift), especially on the part of external groups supporting the game.

Table 3. Time and clock options

Telescoping time	Common time	Time jumps
• Shift time scales when play shifts decision levels • Often correlated with shift of space scale • Most useful during small seminar games in which players shift decision levels with time and space shifts	• All decision levels play at same clock speed • Clock speed may vary over the course of the game • Can confuse inexperienced game players • Can cause some players to be too active and others too inactive • Problems mitigated by incorporating lowest level players into Control • Use of storyboarding to anticipate actions and computer support to track status is most helpful	• May be used with either telescoping or common time • "Skip over" less active or important spans of game time to focus on most critical events • Occurrence and span of jumps usually driven by highest level of play • Dangers of serious disconnects during a jump when game situations and responses most fluid • Control must anticipate jumps in time to prepare

Hybrid concepts

As you can see from the above discussions, our categorization of approaches as multi-game or melded games; telescoping time or common time; with or without time jumps are actually fairly arbitrary. In fact, most games tend to mix and match elements of the techniques according to the judgment of the designers and sponsors about what will best help them achieve the objectives of the particular game. A few other techniques worth discussing don't fall neatly into those stovepipes. We discuss some of them here under the rubric of hybrid games.

Multi-venue and asynchronous games

Our discussion of multi-level games has largely considered such games to be played either in distinct locations as part of a multi-game approach, or in a single location as part of a melded-game approach. It is possible, however, to manage a multi-level game as a multi-venue melded game. That is, a game in which different players play the game from different locations but over the same span of time. (This technique is commonly used in large-scale command-post exercises (CPXs). CPXs fall on the fuzzy grey boundary between wargames and exercises.[10])

Such multi-venue games may be played either synchronously (all players are active during the same spans of time) or asynchronously. In the former case, difficulties can arise when players occupy widely separated time zones, say Washington DC and Korea. An asynchronous game can sometimes (though not always!) help alleviate some of those problems.

In such an asynchronous game, different player sites, groups, or individuals act on their own time line rather than forcing all players to be "playing the game" at the same times. This approach allows the lower level, tactical players to spend the larger amounts of time required for resolving their efforts while allowing higher level commanders to "check in" to the game for much shorter periods to receive briefings and updates. In some ways, this approach is more realistic than those in which all players are present all the time. For example, in the typical operation of a JFACC headquarters, the ATO planners usually work constantly on building and updating the ATO, but the JFACC himself seldom receives more than one or two short briefings about the process during the day.

When using this multi-venue, asynchronous approach, the higher level players will typically have to provide more realistic (and more concise) guidance to the lower level players. Such guidance would take the form of defined ROEs, commander's intent, or other policy directives. The lower level players would be required to live within the constraints of such orders until they could get relief by appealing up the chain of command.This idea has proven reasonably successful at reducing the problem of one level being overwhelmed with responding frantically to unrealistically rapid events while another level is

10. See Perla (1990) for a comparison of wargames and exercises.

bored by the slowness of their event schedule. One of our discussants raised the interesting point that under certain circumstances, it may also be possible to mitigate this problem by allowing the less active level of players to watch what is happening at the more active level. This might give those players deeper insights into important issues. He described such a case involving Navy surface and subsurface commanders watching tactical play of their subordinates and coming out of the experience with some ideas about how better to manage the integrated ASW battle. The down side of this approach is that it distorts the game's information flow, and so can create misleading insights when that information flow is itself important to meeting the game's substantive objectives.

The added complexities involved in multi-venue and asynchronous games require additional considerations in designing the game's C4I system. Every game must employ some sort of C4I structure, which connects the various levels of players and which allows the human commanders to direct the activities of lower-level units and entities in accord with the player's understanding of the objectives and intent of their higher-level commanders. Similarly, information about the progress and effects of lower-level actions must flow through the C4I system to keep all levels informed about the situation. In-person meetings and briefings fulfill many of these functions during single-venue and synchronous games. Some form of electronic communications (telephone, on-line chat, or video teleconferencing, for example) or written reports (email, bulletin board systems, or even paper "message traffic") become more important during multi-venue and asynchronous games. Game designers and controllers should provide some initial templates to help players conduct such communications, but the players themselves should be encouraged to modify and adapt those templates to meet their own evolving needs as the game progresses.

Stop-action games

Another hybrid approach is what we call the "stop-action" game. In this type of game, Control actually stops the ongoing play of one level of the game to allow another level to catch up. Typically, Control stops the aggregated (high-level) game until the entity-level (tactical) game finishes playing out its current activity. Then the high-level game resumes. That is, the overall game is separated into different time regimes and play in those different regimes is not always active at the same times. This approach appears to be expensive in terms of down-time—especially for senior players who are the ones most usually slowed down.

A system that would allow for individual players or subsets of the game to stop playing temporarily without shutting the game down completely (a truly persistent game environment) is one way around the down-time problem. To implement such a system, however, requires the creation of credible (probably computer) routines to act as artificial commanders to take control of positions abandoned by the human players during their absence and still do an acceptable job of managing game actions. Commercial on-line games frequently embody such a functionality. We will talk a bit more about this when we consider some possible technological contributions.

In all applications of hybrid techniques, the trick is to identify—especially ahead of time—the possibility that your particular case lends itself to these specialized approaches. Ultimately, this question is strongly dependent on the goals and objectives of the game. Not surprisingly, of course, because the whole process of designing and playing multi-level games must stem from the objectives that require such a structure in the first place.

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Building the structure

By their very nature, wargames are limited in what aspects of reality they can simulate with some degree of fidelity. Because the heart of game play is about human players making decisions, nearly all wargames focus more on creating realistic representations of the roles of the different levels of command, rather than on attempting to simulate different levels of activity. (There have been some attempts to link up detailed computer simulations of physical activity by tying them to automated representations of commander's intent; these attempts have usually proven both time consuming and unfruitful.[11])

As a result, the fundamental purpose of any wargame played for serious purposes by DoD organizations is to derive some substantive benefit (insight, training, or research objectives) from the decisions made by the "actual" players of the game, not from the activities of supporting personnel or models—what we usually call Control.[12] Not surprisingly, a critical component of any wargame design is the structure into which the game places the players and Control, and how those two elements interact within that structure. This is especially the case in multi-level wargames, which have the most complex and interwoven structures of all wargame types.

Players: levels and echelons of command

The players of the game are the *sine qua non* of its existence. We can think of the organization of player groups, or cells (as they are most frequently called) into a hierarchy defined by the levels of war and the echelons of command. In its simplest form, the levels of war are

11. See our discussion with the IDA representatives reported in *Conversations with Wargamers.*

12. See Perla (1990) for extensive discussion of the decision-centric nature of wargames.

often defined as strategic and tactical. The strategic level is where high-level officials and officers develop overall plans for what to do. The tactical level embodies the responsibility for figuring out how to achieve the objectives of the plans. This traditional dichotomous definition of war gave way to a tripartite alternative around the time of World War II. Between the strategic level and the tactical level, theorists inserted what they called the operational level of war. This concept has always been a bit murky; just what organizations and activities constitute the operational level of war? Rather than get tangled up in the philosophical debates, we will confine ourselves to a simple set of distinctions among the strategic, operational, and tactical levels of *command*.

The strategic level of command, then, encompasses the responsibilities of the NCA and its senior military and civilian advisors; for example, the Joint Chiefs of Staff, cabinet secretaries, and other senior members of the government and possibly even non-governmental agencies. Their job is to define the goals to pursue during the conflict and to make high-level decisions about the allocation of resources in pursuit of those goals.

The tactical level of command deals with fighting or other direct contact with the enemy, and may concern itself with how to cooperate with allies and others, including those who are not necessarily active in the conflict. In military terms, this level can encompass a wide range of organizations from the very small (infantry squads and fireteams) to the very large (Navy carrier strike forces). The key defining characteristic of the tactical level in our construct is that it is the level that creates and lives most intimately with physical changes in the environment.

The operational level of command links the strategic and the tactical. If the strategic level defines what we seek to accomplish during the conflict, and the tactical level defines how we defeat the enemy when we fight, the operational level has the task of organizing and sequencing actions so that when we fight we win, and when we win the fight we advance toward achieving our goals in the war. This is the most nebulous level of command, and can include everything from the Regional Combatant Commanders (RCC) to service and functional component commanders (like the Joint Force Air Component Commander—JFACC—or Joint Force Maritime Component Commander—the JFMCC), and even lower levels of command such as numbered armies and fleets.

No matter how you slice up the levels of command, you will almost always include more than one level of a command hierarchy in defining those who act at single level of war. For example, you are likely to include the RCC, the JFMCC, and the numbered fleet as participating in the operational level. As a convention, we will refer to these different elements of the chain of command as different *echelons of command* within the chain reaching from the lowest guy hunkering down in a ditch under artillery fire, to the President of the United States making broad political-military decisions in a White House conference room. These distinctions are only important because, although we are generally considering the notion of multi-level gaming in terms of different levels of war, sometimes the existence of multiple echelons of command can create similar problems in gaming a single level of war.

Control: directors, pucksters, and facilitators

There are almost as many ways of structuring the organization that supports and manages the play of a game as there are ways to organize the players. For our purposes, we will discuss this so-called Control function in terms of three different but frequently overlapping elements. Not all of these elements are explicit in all games, but most are present in the complex games of the multi-level variety.

We use the term *directors* to refer to the highest ranking and most responsible level of game Control. It is on the director or directors (if more than one) that the ultimate responsibility for the success of the game will fall. Their job is to ensure the game flows smoothly, to be the ultimate referees in case of disputes about the game procedures and outcomes, and to manage the other elements of Control.

We use the term *pucksters* to refer to the members of the control organization with the primary responsibility for maintaining and running the game engine. The game engine, though frequently thought of as some magical computer system or program, is more accurately defined as the system through which player decisions are translated into physical changes of the game universe—the gameverse, as we will refer to it. Nowadays, the engine almost always includes some sort of computer system, but, especially at the Naval War College, the computer system is not the whole or even the main story. The engine may be the heart of the game, but the pucksters are the rest of the circulatory system that enables all the parts of the game to function in a coordinated fashion.

Finally, the *facilitators* are the operational level of Control, if you will. The facilitators as we define them help players touch the game engine outside the scope of the tactical level of action on which the pucksters focus. Most often, this means that the facilitators deal with administrative and logistical issues, such as mobilization of forces, sending reinforcements from one theater of war to another, or providing ammunition resupply from the United States to the combatant commanders.

Connecting players and control

As we have defined the player levels and echelons and the principal components of the Control organization, the connections between the two, at least at the level of a wiring diagram, are fairly clear. The strategic-level players connect up to the game directors. Indeed, in the capstone games played at the Army's Center for Strategic Leadership (CSL), for example, the directors may even completely represent the highest level of command in the game. By "playing" the top-level leadership, this group, termed High Control, make decisions that are not part of the substance of the game, but rather are designed to keep a tight reign on the strategic directives of play to ensure as best as possible that the game meets its objectives—in this case, its educational objectives.[13]

We see this sort of structure operating to a lesser extent in the first GWG series, that is, the GWGs played up to 2001. (For convenience,

13. See *Conversations with Wargamers* for more detailed discussion of this use of Control.

we will call these games as a whole GWG20 for 20th-century GWGs.) During the games of GWG20, instead of a High Control of the CSL type, active players formed an NCA cell to provide overall strategic direction. In many ways, however, the NCA cells were not completely free play. Control had many direct influences on the senior leadership of the game to help ensure that top level direction did not push the game in undesirable directions. In this way, the GWG20 games avoided the dangers of internal feedback loops among players that led CSL to adopt the player sandwich idea. During the GWG20 series of games, senior game directors were often joined at the hip with the senior NCA-level players, helping them to understand the range of decision options open to them, as well as advising them when a specific option might be difficult for the game system to deal with.

The pucksters are the ones with the critical responsibility for figuring out how to represent the decisions of the players in terms the game engine can employ to adjudicate the outcomes of those decisions. They are the interface and translators essential to making the entire engine of the game run. They must be closely connected to the tactical level players. And here, by tactical we mean the lowest level of actual players, of decision makers. The tactical players work with the pucksters to provide the necessary inputs to the game engine so that the pucksters can, in turn, provide the necessary situation updates. We will discuss this relationship in greater detail in the following section. It is one of the most important elements in making a game work efficiently.

Unlike the pucksters, the facilitators usually tie into the player cells above the tactical level, sometimes including even the strategic level. The facilitators must be organized so that they can connect to the player command echelons at one end of the process, and to the game engine at the other, but their range of interaction with the engine is at a higher level than that of the tactical pucksters.

To bring this discussion down to earth from the rarefied atmosphere of wargame-design theory, let's look a some examples of current player-control structures.

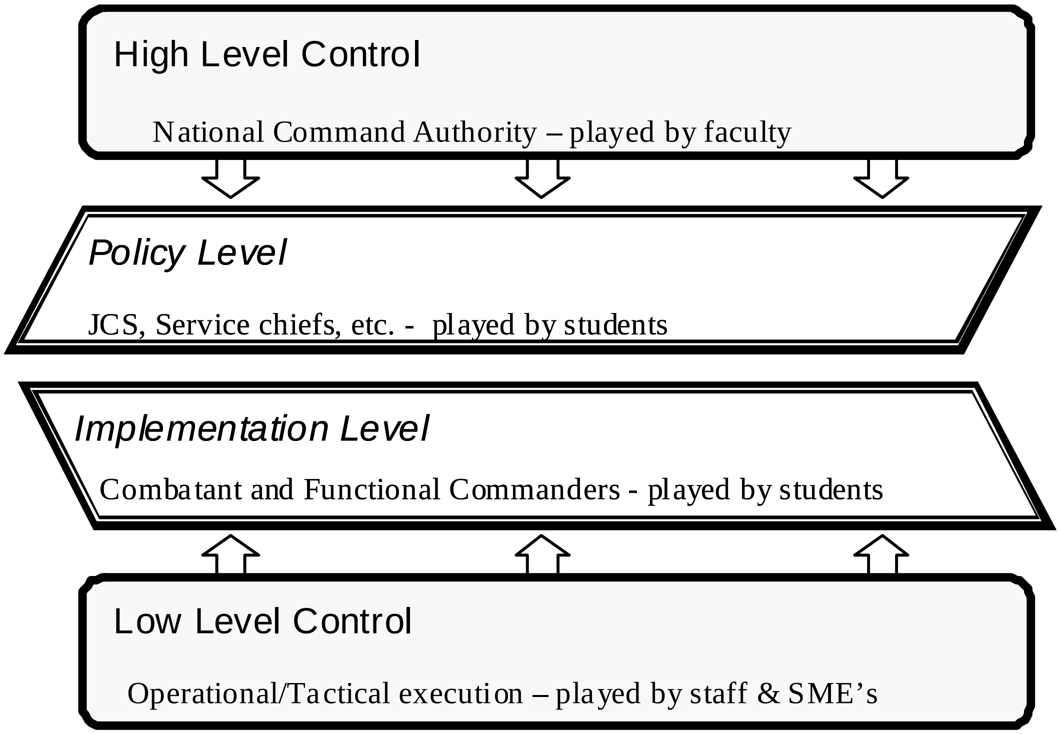
The "player sandwich"

Our first example comes from the U.S. Army's Center for Strategic Leadership. CSL has a very active program of gaming as part of their resident curriculum as well as in distance learning. The capstone game of their academic year is the Strategic Decision Making Exercise (SDME). One of its primary goals is to "pull up" operationally oriented student players two or three levels beyond their current strata in the command hierarchy. The game strives to give the students a chance to apply all the various elements of the courses they have experienced throughout the academic year and integrate them in a single exercise.

The game is played through two "semesters," (a slightly confusing term in an academic environment) each of 3 days, split between the end of one week and the beginning of the next. In addition to creating a natural jump point, the two-semester approach allows the students to be shifted among the player roles from one semester to the next; this gives more players a chance to experience lead and follower game roles. In addition, the game is played in two "worlds" simultaneously, with half the students playing in each world. The worlds start out with the same basic structure and scenario, but evolve separately as players make different decisions.

The key concept of this game, from our perspective, is the philosophy and structure for command levels. There are four such levels represented in the game. The top and bottom levels are actually "played" by Control. "High Control" operates at the strategic level and represents the NCA; it is played by faculty. "Low Control" operates at the level of operational or tactical execution, and is played by gaming staff, subject matter experts (SMEs), and others (see figure 3).

Figure 3. The "student sandwich" at the Army's Center for Strategic Leadership



In the middle of this "student sandwich" are the students themselves, playing two levels of command. The upper student level is referred to as the Policy level. This could represent the military service chiefs, for example. The lower student level is referred to as the Implementation level. These could be the geographic combatant commanders (such as CENTCOM), or functional commanders (such as SOCOM).

The design requires a lot of detailed information to exist at the lowest levels, but free access to that information is usually restricted to Low Control. The higher level players ask the lower level players for reports about what's going on, and the latter seek the details from Low Control. It is thus Low Control that must answer questions from the players in appropriate detail. Note that the staff of Low Control is trained and experienced in dealing with students who want to jump the chain of command and muck about in tactical details beyond their purview. The game design provides a number of avenues for dealing with particularly troublesome players. These include senior mentors at the active or retired three- and four-star levels, NCA direction (including relieving recalcitrant and insubordinate commanders), and embarrassing media interviews and stories used to punish the guilty.

Another critical element of the control philosophy is that Control plays Red—there is no active Red play, nor even a semblance of an independent Red during the SDME. Because the entire purpose of the game is to reinforce and bring to life the key educational lessons the students have studied throughout their courses, Red play is tied tightly to those learning objectives through the simple mechanism of having the faculty play Red.

Thus, coordination of control among the High and Low controllers is essential. Their principal "levers" of influence include the media, Red forces, and the feedback from Low Control (which usually includes the local Country Team, nominally the leading agency for managing the entire politico-military situation). High and Low Control work closely together, with nightly meetings providing the opportunity to develop shared situational awareness and coordinated direction. Every day's activity is prescripted and planned. The necessary scenario inputs are then carefully adjusted as needed, or specific predefined sequences chosen to meet the current situation and directions players are driving events. The most dangerous uncertainties that can lead to serious mismatches between player actions and preplanned storylines are force-on-force interactions; fortunately, most of the SDMEs seldom get into such situations. Similarly, force-on-force situations are the most likely sources of players dropping down into the weeds; by minimizing opportunities for such interactions, the games minimize the opportunities for players to lose lock on their game roles.

Another potentially serious obstacle—and one which we have experienced personally in other games—lays in the interactions of the players at the policy and implementation levels. The latter will often sit around waiting for long and detailed guidance from the former, especially at the beginning of the game. Once the lag develops, it becomes difficult to get players back in some easy flow. To avoid slow startup, one of the techniques the CSL gamers use is what they call a "shotgun start." This approach begins the game in a situation in which some level of operational activity is already underway, based on some pre-existing higher level guidance. Coupled with the detailed descriptions of the game world as provided by the background and scenario information, this approach goes a long way to avoiding the problems of slow startup.

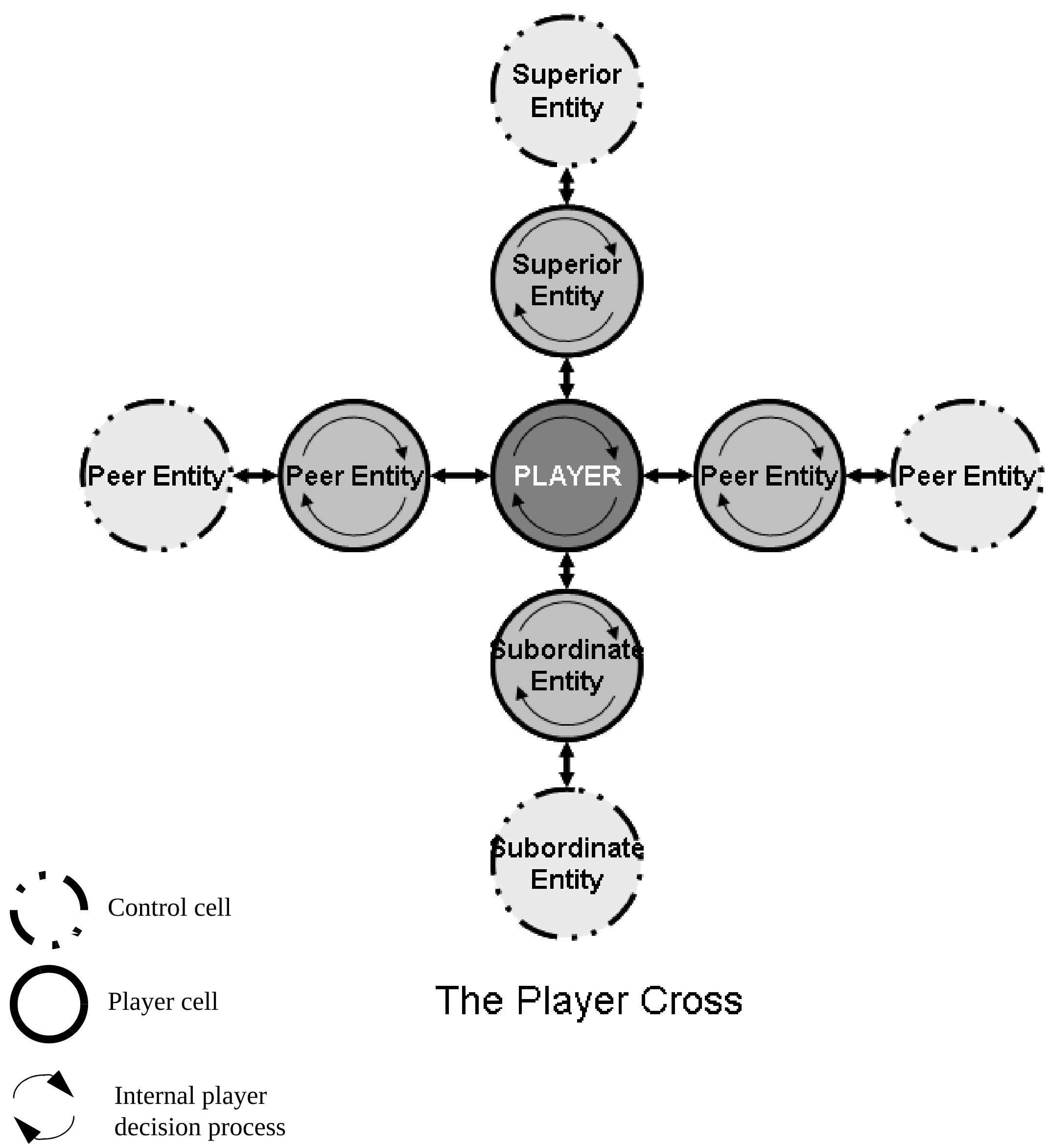
The most thought-provoking point of our discussion of the SDME with the CSL staff came down to the question, "How much is in the middle of the sandwich?" That is, how many layers and how many players make up the levels between High Control and Low Control? The CSL staff expressed an overwhelming consensus that it is impractical to conduct a game of the type the CSL is used to doing if there are more than two levels of command represented by active players. In their fundamental construct, the middle layers are "where the learning takes place;" those layers are not there merely to link the higher and lower levels, but are the essential target audience of the game.

The reason for this limit of two levels is that, in their experience, using more than two levels of players without an intervening level of Control can result in the creation of "internal feedback loops" that can "spiral out of control." That is, if one or more of the player cells interacts only with other player cells and Control has limited or no visibility over their activities, the players may take actions that step outside the bounds of the game and drive other actions in unrealistic or, literally, uncontrolled ways. If the CSL's experience is more broadly applicable, is it possible that truly playing strategic, operational, and tactical games—in which there is free play at all three levels—will prove impractical?

The "Pellegrino cross"

Before attempting to answer the key question posed above, let us first consider a different perspective on the subject of player and Control structures. This perspective takes the form of the Pellegrino Cross (see figure 4), so called because its originator is CDR Peter Pellegrino, one of the wargamers at the Naval War College.

Figure 4. The "Pellegrino Cross"[a]



a. The figure and the paragraph immediately following it are copyright 2008 by Peter Pellegrino and used with permission.

> The "Player Cross" represents the activity and relationship of participants in a game with implicit or explicit hierarchy. The game always is focused on the Player Cell at the center. In most military games, particularly at the operational level, there will be cells or entities subordinate to, superior to, and equal to the Player Cell. While these entities may be additional players in their own right, at some point out on the limbs of the cross these entities will be represented by non-players, i.e. the Control Cell. While it should be self-evident that "All that is not a Player is Control," the implications for game manning; level of activity in the non-player cells needed to support the Players; and the potential problems created by cell-to-cell transactions which completely bypass the Players (i.e. inadvertent Control-to-Control transactions) are often overlooked.

In a subsequent email, CDR Pellegrino expanded on this last, key, point.

> The Cross grew from sponsor meetings where under the banner of "More bang for the buck," or adding more headquarter "realism" the sponsor wanted to add additional "players." But they didn't really mean players, they meant other entities which would interact with the "central" player. Short of getting the entire theater and national level chains of command to play, at some point those entities were going to be acted out/reside in White Cells/Control. So Control was getting crowded and was busy enough already!
>
> The nature of the interaction with these other 'participants' had to be discussed as well. Ok, you think you need a JFACC [Joint Force Air Component Commander] for the JFMCC [Joint Force Maritime Component Commander] to interact with. But do I actually need a full blown CAOC [Combined Air Operations Center] spitting out a 2000 sortie ATO [Air Tasking Order] every 24 hours, or will a Response Cell with a guy on phone watch pushing out more or less canned ATOs do? Maybe yes, maybe no, but I needed a way to graphically show what "add a JFACC," or any other subordinate, superior, or peer group could mean to manning, computer support, game tempo, work load, etc. with clients who thought all this game stuff just fell out of a box, or that we had an infinite number of actors to create artificial worlds for the primary participants to play in.

> Lastly, there was the hazard that with all these "not the player" entities residing in a large, possibly distributed Control group, the Control team as higher headquarters (e.g. CJTF [Commander, Joint Task Force]) would task the non-player cell (e.g. JFACC) with something that was transparent to the JFMCC players (assuming this was a JFMCC game) because (1) it was "realistic," and (2) the cast of participants is so large they've forgotten who exactly is "playing." So now I have somebody at one desk in Control tasking somebody at another desk in Control with no true player involvement! Control is now playing with itself, putting into play injects to be answered by...Control.

In a sense, this problem is the flip-side of that posed in the discussion of the CSL's player sandwich. Rather than players playing the game without monitoring and moderation by Control, Pellegrino highlights the pathology of Control playing the game without reference to or participation by the "real" players. The opportunities for introducing unexpected biases and self-fulfilling prophecies into the game multiply—especially when you consider that Control personnel are most likely to understand how to "game the game" most effectively because they are most familiar with the idiosyncrasies of both the game system and the entire process of game control.

So, we have neatly caught ourselves in a trap:

- Too many levels of players to work directly with each other without monitoring and moderation by Control, the players can create problems by taking actions and—even more dangerously— "resolving" those actions (i.e., making up results!) without reference to Control at all
- But inserting system extenders and dampeners in the form of pseudo-player cells populated by Control can produce substantive problems when Control takes decisions out of the hands of the actual game players.

A way out?

How do we get out of this trap? The Wargaming Division at Quantico provides us one valuable escape route. We call this approach *collaborative control.*

During an extensive wargame that the USMC ran at the Marine Corps Warfighting Laboratory (MCWL) at Quantico prior to Operation Desert Storm in 1990, the Wargaming Division used a commercial-looking boardgame, complete with hexagon-based map and card-board counters (see figure 5), as the basis for a study of possible breaching operations along the Kuwait border with Saudi Arabia. They played that game at three-levels of command.

Figure 5. Example of a commercial hex-map and counter wargame[a]

a. Image from the game *Totensonntag* published by Lock 'n Load Publishing in 2007; used with permission. This game deals with the battle of Sidi Rezegh in November 1941 during the British Operation Crusader campaign in North Africa. The hexagonal grid overlaid on the map regularizes the positions and actions of the combat units. The latter are represented by the colored cardboard squares. These counters contain information detailing the identity and type of unit the counter represents as well as various numerical ratings for its movement and combat capabilities.

At the tactical level, six players/umpires (more on that slash later) managed the tactical level of the fight using the game board. They also used computer aids, which helped them to keep track of logistics, rates of movement, losses, and other statistical information. They often modified and adjusted the raw output of these computer models on the basis of discussion among the players and control.

This tactical game was informed by and fed back to an operational level player group. This group was the largest set of players in the game. They, in turn, responded to and fed back to a strategic level of play. Like the tactical level, this level was represented by roughly six players. These players were, on the whole, more senior than the other players. Furthermore, they had been involved in a pre-game process that established strategic objectives and approaches for the game. They included Blue and Red experts as well as experts in "Green"—allies and neutrals. During play of the game, these experts frequently roamed from cell to cell among the other players, to gather information, provide insights, and elicit feedback from the other players. This strategic cell also had the responsibility of responding to player questions about the previously provided guidance and rules of engagement as well as requests for changes. The players at this highest level were in some sense both players and controllers.

The key interface during this game was that between the tactical and operational levels. The tactical level play was actually a marriage of the tactical "players" with the control "pucksters." It was their joint task to implement operational directives in the mechanical system of the game to enable adjudication of outcomes.

The small size of the tactical player group was important because the critical failure point of this approach lies in a breakdown of coordination at this level. If the tactical level activities get out of whack, then the entire clockwork system of the game can become undone. The process of adjudicating tactical actions and feeding those adjudications back into the operational level players in real time (but not instantaneously!) was the engine that drove play at all the higher levels.

The MCWL wargamers described this technique—their preferred technique for gaming, as it turned out—as a hybrid process of closed planning and open adjudication. Player teams planned in a closed-game format, not seeing the other side's intentions. But the adjudication and assessment processes were open; that is, players from both sides would discuss what they could or could not see or understand, and what the effects of the opposing actions might be. (In MCWL usage, *adjudication* means determining what happens as a result of interactions in the game; the result on the "game board." *Assessment* is the general evaluation of the resulting situation; a primarily qualitative discussion of strengths and weaknesses.)The formal Control team would only be forced to make a call when the two player sides could not agree, in their professional judgment, about what was a reasonable outcome of their mutual activity.

So, in some ways this collaborative-control approach shares some features in common with the "player sandwich" approach we described earlier. The top-level players share some functions that we might normally associate with Control. They are not a truly "free-play" entity because they must maintain focus on the kinds of actions required to meet the objectives of the game. At the lowest level, the marriage of player and puckster was even more explicit. Although the tactical players did not fully assume the role of puckster, they worked hand-in-glove with both the opposing tactical players and the pucksters to create reasonable, realistic, and credible action outcomes to feed back up the chain and drive the rest of the play.

Some structural schematics

Look again at the Pellegrino Cross. The first thing to notice about it is the broken circles that lie at the extremes of the arms of the cross. These circles represent command organizations or entities "played" by Control—or at least with a large element of Control functioning through them.

The second thing to notice is the set of arrows in the figure—the connections among the various game entities. These arrows represent the game's C3 system, the glue holding the entire command organization together. In our discussions with gaming practitioners and our thinking about structures for games, it became clear that embodying and managing this C3 system is a central element of the functions of

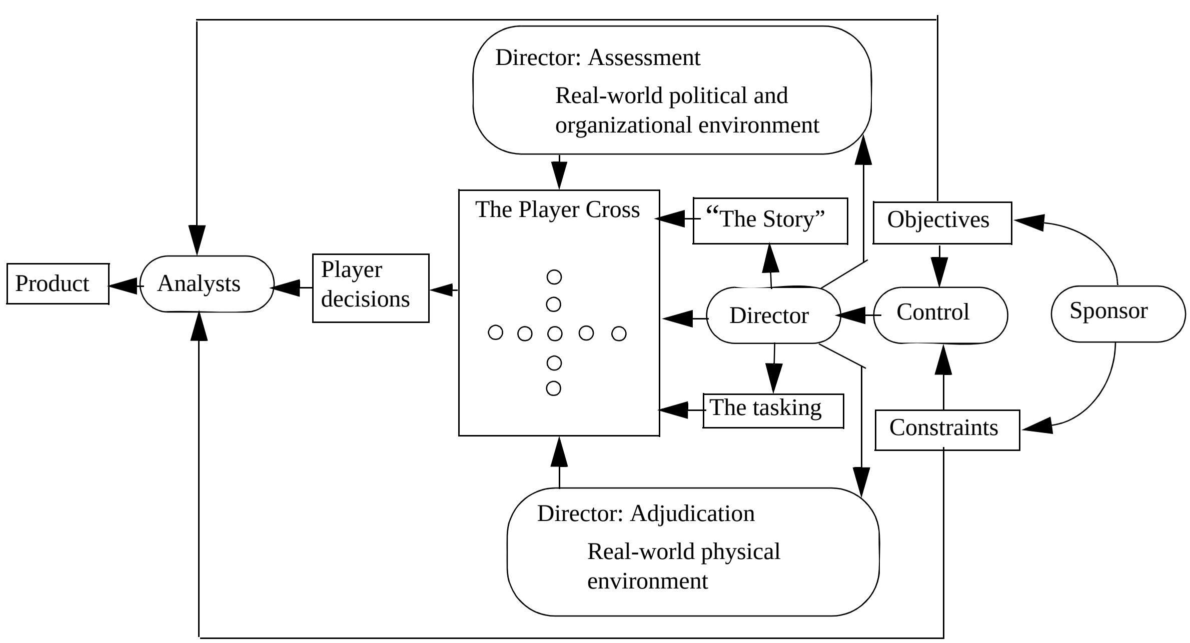
Control in any game. Indeed, Control organizations often can exploit their role in the C3 system of a game both to facilitate its management of the assessment and adjudication processes, and to communicate the results of the processes to the player cells. Balancing and managing all those functions of Control—in coordination with the roles and functions of the players—is essential to a successful game, especially to one played at three or more hierarchical command levels.

So, how can we organize the structure of players and control to enable efficient management of the various roles and functions? There is no one-size-fits-all answer to that question. But there are some broad guidelines and options that we have derived from our research and experience, which can serve as good jumping-off places for building such a structure in any specific situation. Let's start at the highest level and work our way down.

Overall generic game structure

Figure 6 shows a 30,000-foot bird's eye view of a game structure.

Figure 6. Generic game structure



This broad structure can apply to most games, although there are certainly variants depending on the subject matter, objectives, constraints, players, time, and personnel available, and even the physical venue. Many of the roles pictured in figure 6 can be and often are combined, particularly the roles listed as Director, Director: Assessment, and Director: Adjudication, as well as various other jobs in Control.

The Sponsor

The game's sponsor, of course, generally defines the game's objectives as well as any constraints that may apply. Often, of course, the gamers (that is, those responsible for designing, producing, and controlling the game) and analysts will have to work with the sponsor to tailor the objectives to issues that a game can address productively within the constraints imposed. Those objectives and constraints form the basis for Control's management of the game.

The overall Game Director

The overall Game Director has the principal responsibility for communicating the objectives and constraints to the players (as well as to the members of Control). The Director also must communicate the underlying "story" behind the game (the scenario and updates of it), and must articulate and communicate the tasking to the players—that is, what the players are expected to do, how, and why. Usually, the Director is also the manager of the entire Control team—although in some cases the titular Game Director is actually more of a senior mentor for the players and the functional Game Director is accorded a lesser title, but without a reduction in management responsibility. The Director will manage the game through the other key personnel, the Directors of Assessment and Adjudication, and through his personal involvement and intervention in the play of the game. The Director will also need to work closely with any analytical team assigned to collect the data and information produced in the play of the game, analyze that data, and produce the game's output products.

The Director of Assessment

The Director of Assessment has the principal responsibility for introducing and managing the elements of the high-level real-world environment beyond the scope of the game's players. Key among such game elements are political and organizational capabilities and constraints. For example, the activity of allies of one side or the other. For such a purpose, there may even be one or more teams of players (or mixed players and controllers), usually given the color appellation "Green" (the principal sides in the game normally titled Red and Blue, and Control proper designated White). The Director of Assessment also assists the players as they discuss and interpret the meaning and implications of high-level game events. In our construct, the Director of Assessment also has management responsibility for the facilitators supporting the players; we will talk more about the facilitators a bit later.

The Director of Adjudication

The Director of Adjudication has the principal responsibility for adjudicating the physical outcomes and effects of player decisions and actions—and other game events—in accord with the game's representation of the physical environment. The Director of Adjudication thus must manage the pucksters and the game engine, as well as any integration of player elements along with the pucksters, if following the integrated approach advocated by MCWL. (It is sometimes the case that the Director of Assessment and Director of Adjudication are the same person—often known as the "White-Cell Leader.")

The Players and Analysts

The players, of course, reside in the game's central "box." They have the principal responsibility for making decisions and taking actions based on the game's story, constraints, and other inputs and updates from Control. These decisions, and especially the reasoning behind them, are the raw material and data the game produces. The analysts, whom we show in a distinct box for the sake of clarity, really should reside and work closely with the players in order to collect the data produced by, and understand the thinking of the players. Historically, the analysts have had the principal responsibility for producing the core of the game's output product.

Recently, however, the NWC has begun to distinguish among three broad classes of games—which they term Experiential, Player Arrived, and Analyst Derived—to describe the levels of activity associated with game output and its implications for game design. Experiential games require the least analytical effort; participation in the game is the goal. These are events designed to socialize the players or introduce ideas. Player Arrived games are designed to allow the players to arrive at the "answer" through the course of the event; that is, to produce for themselves the game's primary deliverable. For example, a game played by medical professionals responding to a series of vignettes to identify requirements and allow them to "rack and stack" these requirements in a plenary discussion at the end of the game. Lastly, the "traditional" Analyst Derived games are of such scale, scope, and complexity that the game output requires extensive post-game analysis of the data before a meaningful product can be produced. Of course, a single game can share attributes of more than one of these three categories.

A close-up on the player box

Let's take a closer look at the box the players live in. Figure 6 illustrates the players using the Pellegrino Player Cross. In fact, of course, there are several structural options for organizing players.[14] We will look at three of these options, casting all in terms of the Player Cross.

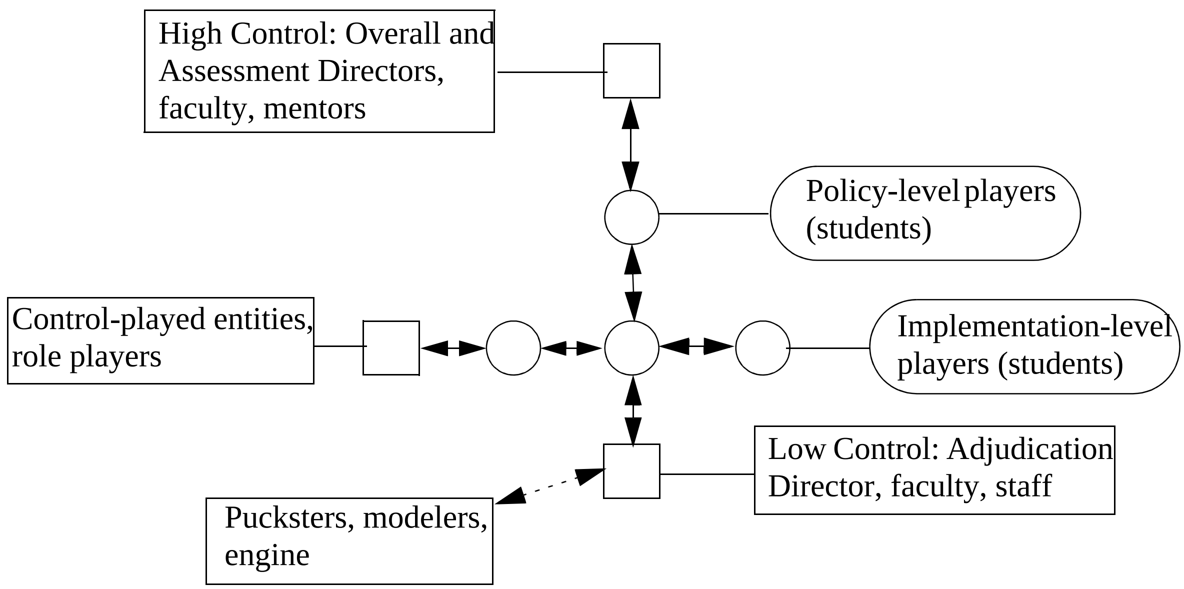
- The CSL "player sandwich"
- A simplified three-level, free play game
- A version of the MCWL three-level structure.

14. For a more in-depth discussion of game design and analysis issues, see Perla (1990).

From sandwich to cross

Figure 7 represents the “player sandwich” structure used by the Center for Strategic leadership in the format of the Pellegrino cross.

Figure 7. The Player Cross version of the CSL player sandwich

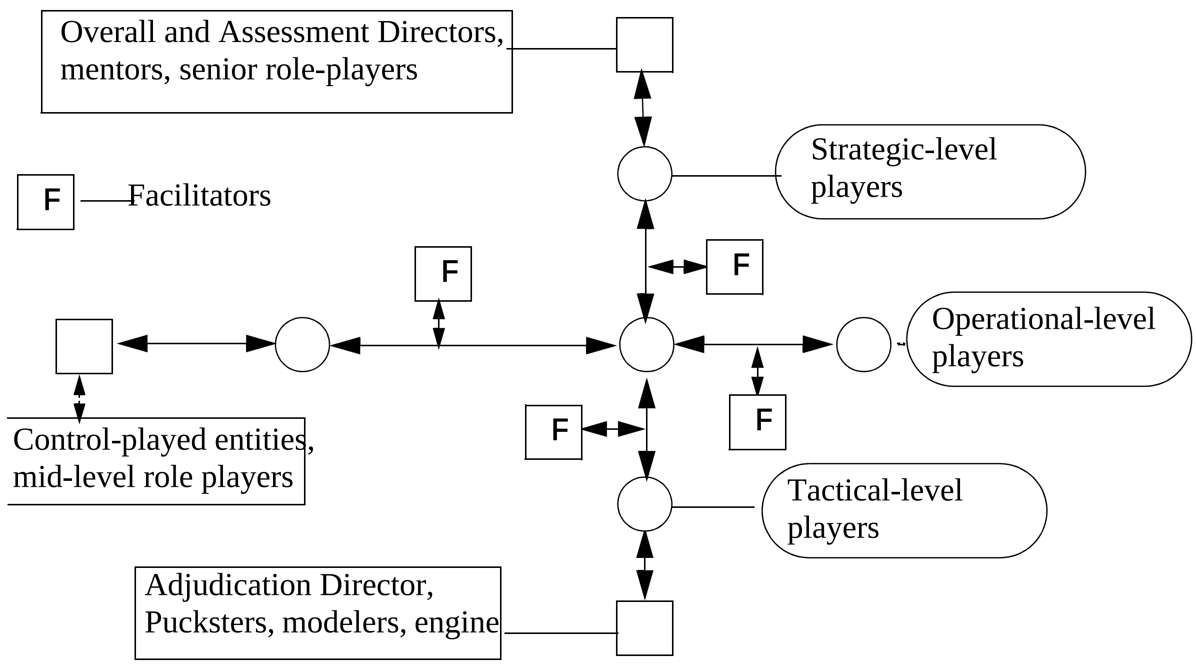


The student players occupy the middle positions at the policy and implementation levels. High-level strategic direction is the province of Control, as are tactical play and management of the game engine. Control also can assume roles at the implementation level. So there is clearly a consistency between the approaches to understanding game structure embodied in the CSL’s player sandwich and Pellegrino’s player cross.

"Standard" strategic-operational-tactical free play games

Now let's see how we can use the Player Cross concept to represent the more or less standard basic structure of a three-level free play game (see figure 8).

Figure 8. Player Cross for a three-level, free play game



Here, we introduce a specific structural position for those members of Control whom we have termed facilitators. The graphic is an overly simple representation of the main idea, which is that there are facilitators who link players to each other and to Control, without actually becoming filters between the players. That is, players can communicate among themselves, but the facilitators stay aware of those communications and can intervene—or request that more senior controllers intervene—when they see the players going outside the box or taking actions that might put the game in jeopardy. The specific location of the facilitators can vary. For example, each player cell can have a facilitator, or each pair of connected cells may share one, as shown in the figure.

The three- (or more-) level, free-play game is perhaps the most difficult to manage and most prone to disconnects because of player actions. This is the case because of the violation of the CSL's rule that no more than two player levels can be adjacent without creating the potential for internal feedback loops among them. The introduction of facilitators, as described above, is a mechanism that can sometimes help to short-circuit such feedback loops.

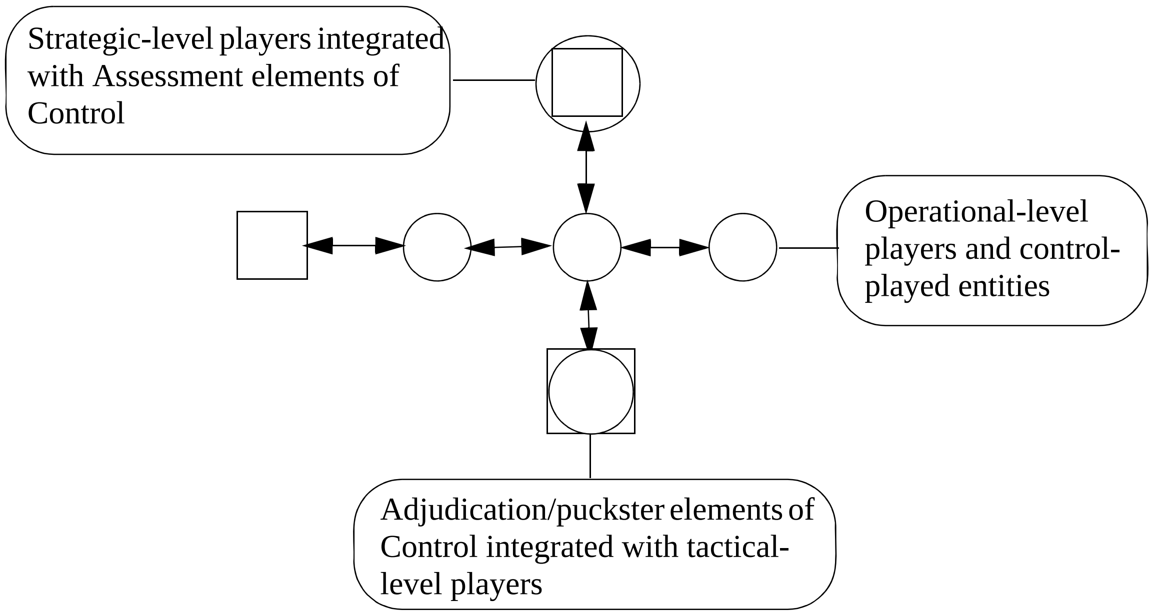
In the experience of the Naval War College, such three-level games are prone to problems that arise from the central player positions—those at the operational level. This level of play tends to be the most free of heavy Control oversight (especially when there are few or no facilitators available). What's more, the operational players may also find themselves with less oversight from the strategic-level players than you would expect. This problem arises most frequently when the strategic play gets tangled up in prolonged briefings and debates and the operational players find (or create) opportunities to do something, anything, rather than just sit around and wait. The facilitators are "sensors" that can help the senior Control staff become aware of these sorts of problems and take action to mitigate them before they proceed too far.

One downside of this structure is apparent from a simple comparison of figures 7 and 8. The latter structure, though already simplified in the figure, is still more complex than that of the former. And complexity in structure of a game almost always means complexity in process and difficulty in management.

Collaborative control

The MCWL approach—or *collaborative control* as we have termed it—has the simplest Player Cross diagram of the three we present here, but its description is a little more subtle (see figure 9).

Figure 9. The Player Cross for collaborative control



Here, the top and bottom elements of the cross show, respectively, the integration of high-level Control into the strategic-level players, and the integration of tactical-level players into the Adjudication elements of Control. Control's major function should revolve around deciding what broad directions the game should take to maximize insight, rather than worrying about what specific outcomes of game play are most "realistic" (as judged on the basis of some rather uncertain definitions of realism). This is particularly the case when the players of the game are recruited largely because they are experts in the field of interest. Such experts are the very people we would normally seek out to help adjudicate the outcomes of the game play, thus removing a major source of an "independent" higher level control.

Integration of players and Control at the highest level is essential for conducting strategic-level free-play wargames—that is, wargames in which the highest level of both Blue and Red command systems are played by real players, not merely by Control. To explore strategic-level issues in depth, a game must allow for strategic-level free play; we believe it is also necessary to create free play at the operational level as well. But the operational-level players must remain all the while under the oversight and command of the high-level players—again, the players, not Control. It is through this integration of Control with the higher-level players that Control can manage the game without allowing the development of the sort of internal player feedback loops that can allow the game to spiral out of control in such a way that it will fail to meet its objectives. Similarly, the integration of Control and players at the tactical level prevents breakdowns from propagating from the bottom up.

These are the principal collaborative aspects of the structure we have defined as *collaborative control*. Because Control is tightly coupled with both the strategic- and tactical-level players, there is less of a requirement for direct Control penetration of the operational level—even through the mechanism of facilitators—although some use of facilitators to ease the mechanical burden on those operational players may be useful.

It is to those mechanical dynamics that we turn next.

Defining the dynamics

Once you have decided on a structure for integrating the players and Control elements of a game, you must address the dynamics of both play and Control.

- What decisions do players make?
- What information do they need to make those decisions?
- Where does the information come from?
- How do the players communicate information, intentions, requests, and decisions among themselves and with Control?
- How does Control use the game system to translate player decisions and actions into the outcomes that change the state of the game?

These and other aspects of what we call game mechanics and game dynamics, must align with the game's objectives and structure. This section of the paper discusses some of the basic ideas designers should consider to create successful dynamics for multi-level games using the kinds of structures we described earlier.

Decisions and information

It is a fundamental tenet of wargaming that the substance of the game derives from the decisions made by the game's players.[15] Understanding what the players decided to do and why is the main source of insights that a game can produce. The actual outcomes of those decisions in the context of the game—that is, the combat results, battle damage assessments, and other changes in the game environment imposed by Control or the game engine—are important primarily as

15. Perla (1990), pp. 163–182.

they reflect the quality of player decisions made on the basis of the information they had available at the time.

When adjudication of such outcomes relies on stochastic mathematical models, or when the goals of the game require that specific outcomes take place, the results of good decisions may turn out to be poor (from the player's perspective), or those of poor decisions may turn out to be good. For example, based on the information available to them at the time, players may decide to launch a major air strike on a ground target. Unfortunately, the computer model used to adjudicate the outcome of the strike may show little damage to the target and severe losses to the attacking aircraft. This poor outcome does not necessarily indicate that the players' decision to make the attack was the "wrong" decision. When analyzing the "results" of a game, placing too much emphasis on outcomes—particularly the detailed physical outcomes of warfare models as in the above example—confuses inputs with outputs.[16]

From the design perspective, the central dynamics of any wargame lie in the flow of information and decisions among the players. This is especially the case in a multi-level wargame, where information and decisions (or direction) flow among the different command entities at different levels of war and echelons of command. Over the course of the game, players will collect information, give orders to subordinates players (or Control) and seek explanations from other players and from Control about what events have occurred, how and why they occurred as they did, and how and why the game environment has changed as a result. Representing and managing this flow of decisions and information is one of the most challenging elements of designing multi-level game dynamics.

Players and Control

The interchange among the various player levels is critical to both the verisimilitude of the game and also to the derivation of insights from its play. Real-world commanders usually must rely on their

16. See Perla (1990) for a detailed discussion of this issue.

subordinates not only to carry out their orders, but also to explain the reasons behind the outcomes of the resulting actions. This is so because the military hierarchy of command usually—though not always—means that the command level closest to the action knows the most about what actually happened and why. As a result, we argue that three fundamental dynamics must be reflected in the interconnections of players and Control during a game.

- First, command decisions are the province of the players; Control should not be making substantive command decisions without direct player involvement and approval.
- Second, all players in the game should receive their information about the effects and outcomes of the actions taken by the players from other players—with one exception. That exception occurs at the interface of players with the game engine (the province of the pucksters, as we described in the earlier sections) or that between players and the facilitators or liaison levels of control, when player decisions require direct intervention into the gameverse above or beyond the level of the game engine.
- Third, that the game engine should, itself, live at one layer or echelon of command below the lowest level or echelon of actual players.

Thus, the game's players at higher levels should rely on the (actual) players at lower levels to explain what is happening during the game, not on Control. And the players at the lowest (tactical) level work hand-in-glove with Control to represent as accurately as possible the detailed execution of actions and the reasons behind their resulting outcomes. This is why it is so important for the tactical-level players to work collaboratively with the Control group at that level (i.e., the pucksters).

Recall the story we described earlier of General Link's unfortunate experience with the misapplication of airpower. In that case, the players described how they wanted to apply airpower in a situation that was similar to, or a linear extrapolation of, the situation in which they found themselves at the end of a game move. Control did a poor job of understanding the underlying intent of the players and the underlying import of their directions about how to use air power should that situation change. Unfortunately, the fundamental situation in the game changed radically during the process of Control's adjudication over night—while the players were not involved in responding to the changes. Control then resolved an extended period of game play by applying the earlier player directions which had not had a chance to change in response to the altered situation on the ground. As a result, the players could not take ownership of the outcome—indeed, they disputed its realism, and with good cause—because the players had not been involved in the critical decisions that affected the outcome. When a game is structured such that what we have called Control is the only, or the primary, source of both the detailed actions in the game and the resultant outcomes of those actions, there are at least a couple of pathologies that develop. These pathologies result almost inevitably when Control has so much influence over the outcomes of game actions that they can overwhelm the effects of the decisions made by the actual players.

Similar Control-Player disconnects are not always a result of Control's "poor understanding of the underlying intent of the players." According to a Naval War College source, he was present at a game during which the players were asked to submit operational level moves that covered significant periods of time (the time-length for each move was determined by Control based on progress of the campaign/game). Adjudication would look at Red and Blue's move designed for say, 4 weeks and look for where and when significant interactions would occur. If, in the example, Red and Blue's plans could have been executed without major deviation up to the 3-week point when a critical decisive point would result, Control would advance the game 3 weeks rather than the planned 4, update the situation, and turn the move back to the players. The players would decide how to respond to the current situation and submit a new move to cover the next chunk of time. The problem occurred when, as a result, not enough time was being covered by each successive move to get to the desired end point in the time available for the game. At that point, Control instructed the Adjudication Cell to play past these "decisive points" as there was not time (i.e., turns left in the game) to keep pushing moves back to the players. Unfortunately, this put the

Adjudication Cell in the uncomfortable position of playing for the players and taking decisions out of the players' hands with predictable player discontent and argument.

The broader pathology stems from player "paranoia" that Control is simply manipulating play for some nefarious purpose, whether to "prove" something in Control's own agenda, or merely to torture and embarrass the players. When all explanations of outcomes must come directly from Control, this suspicion can easily interfere with the dynamics of decision making and result in the players' fighting Control more than playing the game.

The narrower pathology applies to the player reaction to the specific situation that arises as a result of Control's behavior or adjudications. If that reaction is strong enough and negative enough, it can lead to Control's being forced into a "do over." This is not always a Bad Thing, but it can sometimes result in the loss of important insights when the point of contention revolves around too technical a detail, or on the specific situation involved in a particular outcome, and the players miss some deeper operational issue.

One classic example of this latter sort of pathology occurred during the infamous Japanese wargame conducted during their planning for the Midway operation during World War II. At one point during one of the games, the Japanese carrier force was ambushed by Midway-based U.S. B-17 horizontal bombers while its own planes were bombing Midway. Based on a simple die-roll against a combat-results table, the controller ruled that two of the four carriers were sunk in the attack. In response to negative player reactions and his own judgment, however, the game director first revised this outcome to only a single carrier's loss, and then subsequently resurrected even that sunken ship for later stages of the game. In the controversy over the juggling of these model-based outcomes of projected combat actions the main point of the drill was lost.

The Japanese strike force's staff officers were actually cautioned at the end of the game by the same game director who resurrected the carriers. Rear Admiral Ugaki urged the staff to prepare a plan for countering the sort of ambush his ruling had mitigated. It was precisely this sort of American attack (although made by carrier aircraft rather than Midway's B-17s), catching the Japanese in the middle of their confusion about whether to strike Midway a second time or to prepare to attack American carriers, which devastated the Japanese fleet during the battle. A critical insight from the wargame was ignored because of the combination of what the Japanese themselves would later call "victory disease" and what wargamers from time immemorial would recognize as "fighting the game"—particularly, disputing adjudications made by Control without collaboration with tactical-level players.[17]

A basic postulate for multi-level gaming

Based on our research and analysis, we conclude that the best technique for managing play at the tactical level combines closed planning and open adjudication in a collaborative process involving tactical-level players and Control's pucksters working with the game engine. Those lowest level players are the ultimate source of information and explanation for the higher level players.

Furthermore, building on that idea, we propose the following basic postulate of multi-level gaming:

The Player-Puckster Postulate: Player levels and echelons must be arranged such that the information concerning changes in the gameverse—and the reasons behind those changes—comes primarily from other "actual" players (not Control), or from direct player participation in the adjudication process.

This postulate flows directly from our assessment of the ideas proposed by the MCWL wargaming division, our own experience, and the ideas we discussed with all the wargaming experts we met with.[18]

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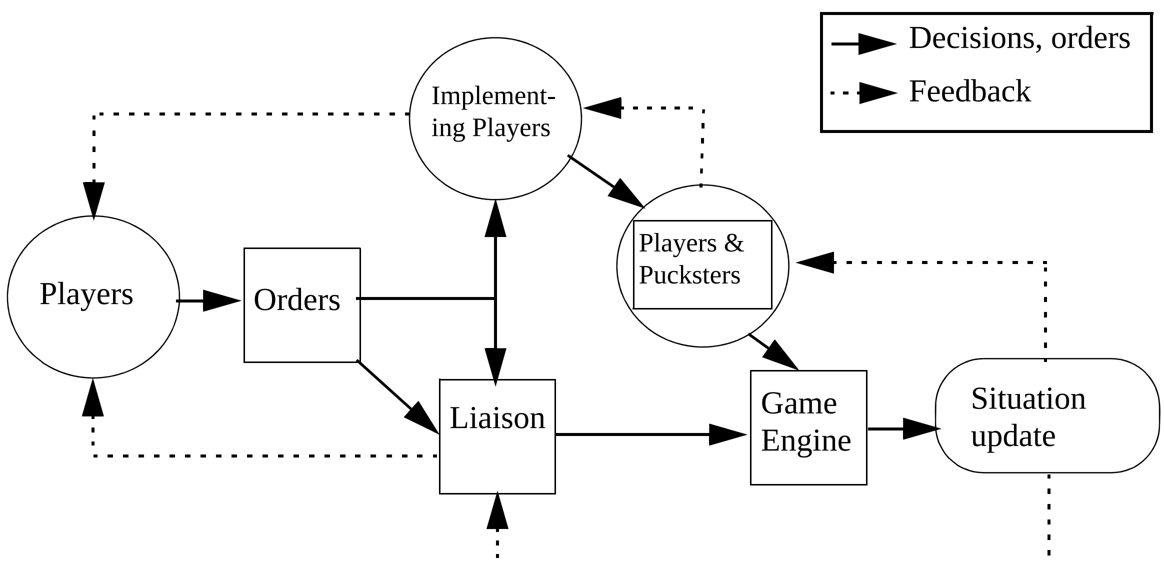
17. See Perla (1990) pp. 46–47 for a discussion of the facts, compared to the mythology, of this case. We use this case as an example here because of its prominence in wargaming mythology. We readily admit, however, that a collaborative adjudication process may well have produced the same sort of technical and tactical adjudication ultimately applied by Ugaki—that is, no carriers sunk by B-17s. But we speculate that a less emotion-laden process than one resulting in retracting the initial outcome may have allowed a more balanced view of the wider threat of ambush and the need for more circumspect contingency plans.

18. See *Interviews with Wargamers.*

A basic implementation structure

To implement this simple idea, we propose an equally simple view of the flow of player orders and implementation actions, and the resultant feedback to the players from the game engine or other mechanisms and procedures used by Control (see figure 10). For the purpose of taking actions (that is, giving orders) the player cells will interact directly with other player cells, or with Liaison elements of Control. In any case, there must be a formal process for ensuring that the appropriate interventions take place and affect the gameverse. The least expensive approach in terms of manpower is to assign a facilitator as liaison to each player cell or level of cells so that this facilitator can link into the game engine.

Figure 10. Flows of orders, actions, and feedback



Once a player cell makes a decision, that decision is embodied in a written order. The order then goes along one of two paths. If the order is directed to a subordinate player cell, then that order goes both to the player cell, for implementation, and to the Liaison, for information purposes. If the order or action does not apply to another player cell (for example, it is a resource-allocation action as described below), it goes only to the Liaison, who will ensure it enters the game engine in the appropriate manner. Except in this latter case, most orders and actions will proceed ultimately to the tactical level, where the collaborating players and pucksters will adjudicate the outcome using the game engine. Once the outcomes of actions are fully adjudicated, situation updates flow back through the system. Wherever possible and applicable, the feedback flows through the player cells; occasionally the flow is through the Liaison network, when the initiating action did not involve subordinate players.

One important objective of these implementing dynamics is to avoid the potential dangers of internal player feedback loops, which are the source of the CSL's philosophy of the player sandwich. In this case, we are trying to prevent the specific danger of two adjacent player cells behaving as if an agreed upon action has taken place without that action's actually having been adjudicated or otherwise resolved by Control. One of the reasons the liaison idea maybe helpful in preventing these internal player feedback loops is that some higher level decisions can affect the state of the game without necessarily entering into the tactical sphere (and thus becoming the purview of the player-puckster team at that level). These decisions are most obvious when it comes to issues of resource allocation. For example, if a theater player convinces the NCA to move a CVBG into his theater, that information must get into the game engine somehow, even though it is not strictly speaking a tactical issue.

In some case, particularly for games with small numbers of participants, the activities that fall outside the game's representation of the chain of command can be predefined, with options and effects listed explicitly, as is often the case with commercial boardgames. For example, if the strategic-level players were to order the release of a CVBG from home port to a forward theater, a simple look-up table could provide the time delay after which the CVBG would become available for the next echelon below to use. Pre-printed forms or simple computer forms should make such administrative matters easy to manage.

They might take the form of alert-, warning-, and execute-orders, or some other realistic construct.

Crucial dynamics: planning, adjudication, and assessment

As we discussed when considering the structures of players and their interconnections with Control, there are at least three crucial dynamics that we must consider when designing the dynamics of a wargame. These are the processes of planning (primarily a function of the players themselves), adjudication (primarily a function of Control but ideally a partnership of Control and players), and assessment (once again, primarily a player function). The dynamic links among these three activities form the core of the game process. In terms of the decision wave as we defined it earlier, planning is the major component of the process of deciding what to do and how (the D of the OODA loop). Adjudication is the process of creating the change of the state of nature, the outcomes of player activities. It embodies the action flowing from player decisions (A) and the initial observation of the outcome of those actions (first O). Finally, assessment encompasses most of the orientation step (the second O) and sometimes the initial stages of the decision step.

To see how these dynamics might play out during the course of an actual game, let's consider an example described to us by the wargamers at Quantico. During a game designed to explore the operations of an Army Stryker brigade, the design made use of multiple levels of play within individual game cells. They had as many as three levels of command in a single cell and the players had ready access to walk back and forth and discuss their actions, facilitating synchronization within a cell. Furthermore, the game employed an open adjudication and assessment style, all within the format of a seminar game. This open nature of play also helped keep the different levels of players synchronized.

When playing a game like this, there are at least a couple of ways to manage the flow of time. One way is with a game clock, tying every activity to specific time hacks. This approach was a common feature of Global War Games in the past. But the technique preferred by the Quantico gamers, and used in the case of the Stryker game, eschewed the game clock and instead focused on broader moves defined by phases and events. The phases of the game were defined ahead of time during the design process. Events within the phases flowed from player decisions and actions. To make such an approach work smoothly requires rapid and realistic adjudication of game events.

In essence, the process must deal effectively with the "three-map problem." This term refers to a classic issue from the earliest days of the Prussian *kriegsspiel*.[19]

Kriegsspiel (simply the German word for wargame) is usually considered the first true wargame, at least as we use that term today. The game was created by a Lieutenant von Reisswitz of the Prussian Army, based on a more complex and cumbersome version created by his father. *Kriegsspiel* achieved some popularity with the Prussian Army in the period immediately following the fall of Napoleon I (the early 1800s). The game was played on topographic maps using flat metal pieces, which represented troops at the company, battery, and squadron level. One player or team represented each side in the battle, and were given the names Red and Blue, based on the color of their playing pieces. A third player or team was the Umpire (what we today would call Control). The umpire managed the play of the game, provided the players with information, and resolved the outcomes of the player actions and combat encounters.

Over the course of its history, the original form of *Kriegsspiel* became known later as *rigid kriegsspiel*; the results of all actions were usually determined by rolling special dice and consulting detailed tables of outcomes. For example, if a battery of 12-pounder artillery fired on a half-battalion of enemy troops for a specific period of time, say five minutes, the umpire would make a dice-roll, modify it for terrain and other factors, and consult a table to determine the number of troops that became casualties from the fire.

19. See Perla (1990) for the history of *kriegsspiel*. The original set of rules and charts has been republished recently as *The von Reisswitz Kriegsspiel: The Prussian Army Wargame*. Originally written by B. von Reisswitz. translated by Bill Leeson. United Kingdom: Too Fat Lardies (2007). See http://www.toofatlardies.co.uk/Kriegsspiel.html.

During the latter part of the 19th Century, the “rigid” tables were replaced by the “professional judgment” of a senior umpire. The umpire would simply determine the outcome of actions on the basis of his own experience and report those results to the players. This form of the game was known as *free kriegsspiel.* [20]

The full-up classic game required three maps—one for Blue, one for Red, and one for the umpire. Only the umpire's map showed ground truth; the player maps showed only what the player could see or had reported to them. In the past, these maps were paper; today, nearly all displays of this type have gone to some electronic format.

The use of computers to keep track of what may literally become thousands of entities, or playing pieces, is a potential boon to wargaming, especially at the tactical level. The danger comes when the third map, ground truth, slides into the background and the processes of the game do not provide for tight control by the umpire over the activities of Blue and Red. When the players only see their own maps, or more broadly speaking their own information, the umpire must be the one to ensure that ground truth dictates actual events and encounters. This can be an overwhelming task for a single umpire or small group, especially if Blue and Red are not single players but tens or dozens, as was the case in GWG 2001.

As we mentioned in the section on game structures, the solution adopted by Quantico for the Stryker game was to consider the Blue and Red tactical-level players to be hybrid beings, at once both actual players (that is, decision makers) of the game, but also elements of Control. During the Stryker game, the principal task of the tactical level players became the creation of a reasonable, plausible and, especially, useful storyline to feed back up the chain to drive operational- and ultimately strategic-level play. The information flow about what happened in the gameverse and why thus came not from Control (at

20. One of the primary texts outlining the methods of free kriegsspiel is that of German General von Verdy du Vernois. His work has been reprinted recently and may be found in Curry, John, ed. *Verdy's Free Kreigspiel, Including The Victorian Army's 1896 War Game.* Lulu.com (2008).

least not alone), but from the tactical players working with the pucksters managing the game engine. This information flowed to the higher level players through the command and control hierarchy represented by the player cells.

Instead of keeping the Red and Blue maps and displays hidden from each other, the approach used in the Stryker game allowed the players to share their displays and to work in a closely coordinated fashion to develop the storyline together. In essence, this approach was a new sort of *free kriegsspiel*, but one driven from the bottom up by the low-level players, rather than the top down by a senior wise man, or mentor. This idea represents what the division director at Quantico terms the "elegance of synthesis;" it converts a three-map problem into a one-map solution. All the tactical players work with ground truth because all are umpires as well as players. Their roles include not only implementing higher order decisions and adjudicating their outcomes, but also reporting those outcomes back up their chain of command in a way consistent with what the two sides would be able to know in the real world.

This latter point highlights another problem that can get in the way of effective multi-level gaming. All command levels of both Red and Blue must be able to know what they should know in the real environment. Too often it is the case that game designs over emphasize Blue systems and capabilities, creating an asymmetry in realism between the representation of the information available to the opposing sides. Less often, there can be a failure to give Blue enough credit for capabilities of fundamental importance to achieving a game's objectives. This problem seems to stem primarily from failing to recognize the importance of matching a game's design parameters or models with the dynamics of real action that must be represented effectively to achieve a game's objectives. The best example is a case in which Blue forces are counting on an asymmetric advantage in intelligence, surveillance, and reconnaissance (ISR) based on technical systems that provide Blue an information advantage. When the game design or game models are abstracted to too high a level, such that the systems for adjudicating and assessing game results are not sensitive to the critical asymmetries, the representation at the tactical level may preclude realistic information and decisionmaking at the higher levels.

Mr. William Simpson, a senior member of the wargaming staff at Quantico, identified those problems as sources for some of the weakest elements of GWG 2000 and 2001. The asymmetry between Red and Blue in detail of representation and action of forces and sensors, and in the amount of game support each side received, handicapped the Red players by preventing them from knowing what they should have known in the real world under similar circumstances. Commanders on both sides must receive the information they are entitled to receive by the play at the lower levels, or the game's representation is fundamentally and fatally flawed where it counts the most—in the decisionmaking processes.

Despite this concern, GWG 2001 was an example of how the "hybrid" technique of closed planning and open adjudication and assessment, can be applied, in a slightly modified form, during a running-clock game rather than during the more usual USMC approach of an event-driven game. Using this approach, the operational and strategic level decision makers can play a closed planning game, while the tactical-level play takes the form of an extended open adjudication session, in which the tactical players work with Control's umpires to develop the storyline to feed up the chain to the operational and strategic players. Without political or bureaucratic imperatives to "play" the "approved" computer simulations or other models, which may well require dozens of bodies to maintain and run them, there is no obvious reason why a small team of such player/umpires (of the right background and temperament, to be sure) could not manage this task. Indeed, the smaller such a team can be, the more likely that all the player/umpires can maintain shared situational awareness of the activities they need to coordinate, and that their resultant storyline is clean, plausible, and understandable to the higher level players.

Aggregation applied to the game engine

The mention of approved models in the preceding paragraph raises the important point of the necessary qualities and qualification of the game engine. We reiterate that the task of the game engine simply is to convert player decisions and actions into physical outcomes in the gameverse. This paper is not the place to discuss the philosophy and engineering behind such game engines.[21] Nevertheless, we do propose a basic principle for designing or selecting such engines for use in multi-level games. This principle is based on the use of tailored aggregation of details to increase the game engine's speed and flexibility of use.

If a game is to adopt the technique of closed planning and open adjudication as we have described it, all the gaming experts we interviewed strongly emphasized the importance of using a system of adjudication that emphasizes ease of use and speed of resolution at the lowest levels. In particular, the speed of reaction and reporting of results is critical to help maintain synchronization and interest at the highest decision levels. CAPT Christopher Carlson, USN (Ret.), one of our interviewees, described to us a general technique based on a system that he has used to conduct multiplayer wargames at tactical and operational scales for both civilian and military wargamers. This Decision Node approach has some elements in common with other systems, as well as some interesting new wrinkles. It holds out the promise of a general approach to building game engines for multi-level games, which hits the happy medium of realism and responsiveness.

The basic idea of the approach is to speed up the resolution process for large tactical engagements. A good example arises in dealing with interactions of dozens to hundreds of tactical aircraft during a scenario recreating the air-sea engagements during the Battle of Midway. If carried out using normal tactical-level game procedures, the actions and capabilities of each individual aircraft would have to be represented in detail. It could take several hours to play out an engagement that would last only a few minutes in the real world. The challenge of the aggregated or node-based approach is to preserve significant tactical decisions without worrying about representing the actions of individual tactical platforms or systems in detail.

The decision node approach instead focuses on the broadly significant decisions of resource allocation and battle management, not on the more readily aggregated maneuvering of individual aircraft. It

21. Again, see *The Art of Wargaming* for one such discussion.

does this using an approach that incorporates storyboards and branches, which the designer can create ahead of time, or generate or modify in real time as player actions trigger new situations. A storyboard of this type could incorporate elements of computer flowcharting techniques as well as schematic displays similar to classic naval maneuvering boards. The approach aggregates time, space, and forces to allow a broad outcome for a series of interrelated small-scale actions without dealing in detail with each one.

There are a number of commercial hobby wargames that include such techniques or displays. Chief among them in our experience are *Hornet Leader* (GMT Games), *Task Force* (Simulations Publications, Incorporated or SPI), and *The Fast Carriers*, also by SPI. Unfortunately, all these games are now out of print, though copies can be found on the secondary market.

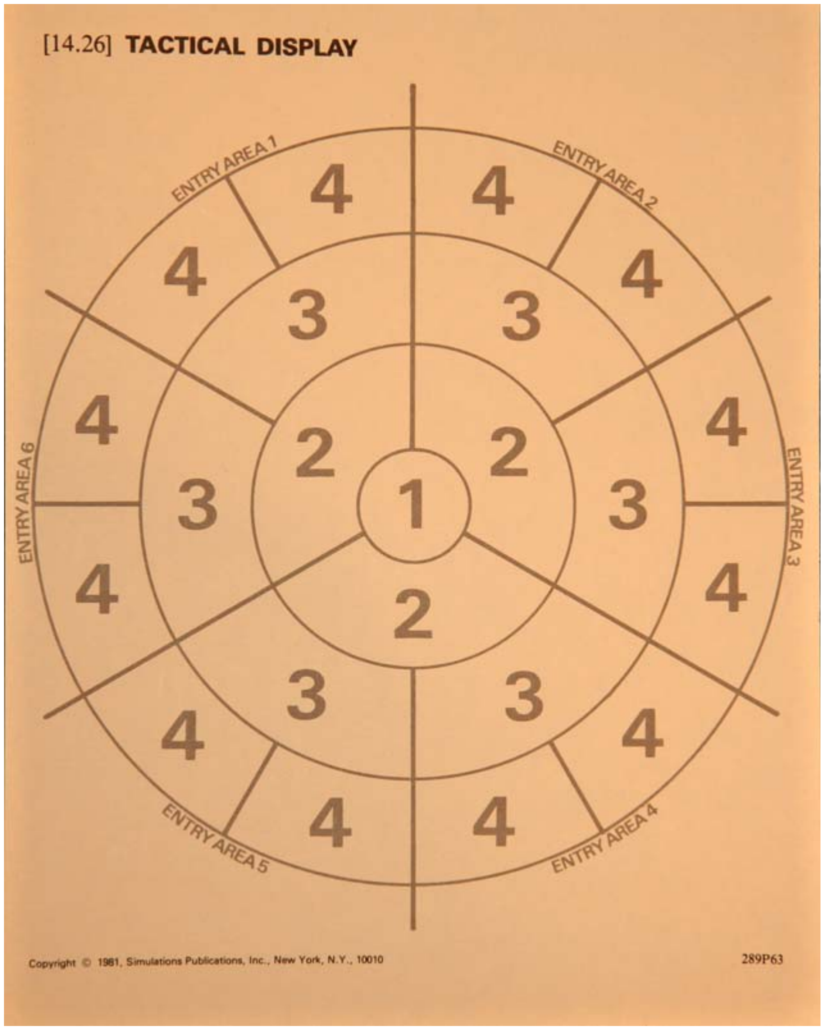
Hornet Leader is a rarity in the wargaming hobby, a game purpose-designed to be a solitaire gaming experience. The player represents the commander of a squadron of carrier-based U.S. Navy F/A-18 Hornet aircraft. During play, the player receives various missions to plan and fly. As the squadron commander, the player must select aircraft, air crew, and weapons and sensor systems to fly the mission. The strike group then proceeds along a "storyboard" from launch to ingress, target area, egress, and recovery. At each step along the way, the player must resolve events and combat actions using dice and various charts and tables (see figure 11).

Figure 11. Hornet Leader game display[a]

a. Photo copyright 2006 Ronald Chavez. Used with permission. Original game components from Verssen, Dan. *Hornet Leader: Strike Fighter Operations*. Boardgame. Hanford, CA: GMT Games. (1991).

Task Force is another hobby gaming rarity: it revolves around a system that allows two players to use hidden movement of their forces on their own map, without the need for an umpire and a third map. Billed as a game of "Naval Tactics and Operations in the 1980s," the tactical-level play was very abstract. Once an engagement occurred, the players deployed their pieces representing ships, submarines, or aircraft on a tactical display (see figure 12) designed to show a schematic of an abstract layered defense. Defending forces could occupy 1 to 12 radial positions in 1 of 4 concentric rings. Attacking missiles, aircraft, or other systems would enter the engagement zone from any of six 60-degree "entry areas."

Figure 12. Task Force tactical display[a]



a. Original game component from Balkoski, Joseph M. *Task Force*. Boardgame. New York: Simulations Publications, Inc. (1981).

The real strength of the game lay in its operational system for hidden maneuvering of task groups coupled with simple but elegant search and command rules. Tactical resolution of combat was simple and straightforward, requiring no detailed resolution tables, relying instead on comparisons of numerical ratings on the playing pieces involved. This approach was both a strength and a weakness; strength in the simplicity, but weakness stemming from the need to "fly" and resolve each individual missile attack (for example) one-by-one, adding to the time required to resolve any large-scale combat action. Overall, the game's aggregated approach to operational maneuver worked better than its more disaggregated approach to combat.

Finally, the oldest of the games mentioned above, *The Fast Carriers*, touted itself as a true multi-level wargame, supposedly placing the players in strategic, operational, and tactical roles.[22] In fact, however, the play is largely at the operational level, with the player taking on the roles of theater commander and task force commander, as well as the task force's air operations commander. Tactical decisions are mainly restricted to allocating defending combat air patrol and anti-aircraft artillery against attacking aircraft, which are allocated to individual ship targets on the combat display. Most of the scenarios in the game revolve around the major carrier battles in the Pacific during World War II, but there are some scenarios for operations during the Korean War and the Vietnam War, as well as a *de rigeur* hypothetical 1970s clash between the United States and the Soviet Union in the Denmark Strait.

Operations displays allow the players to move the aircraft available on each carrier or air base from just landed, to arming, ready, and launched status. Tactical combat played out on a small hexagon board on which the various ships and aircraft moved and fought. Of the three games described here, this one probably had the most complex—and least aggregated—approach to modeling naval operations and tactics. Its complex procedures and resulting slow play also made it perhaps the least popular among hobbyists. *Fast Carriers* overshot on the high end.

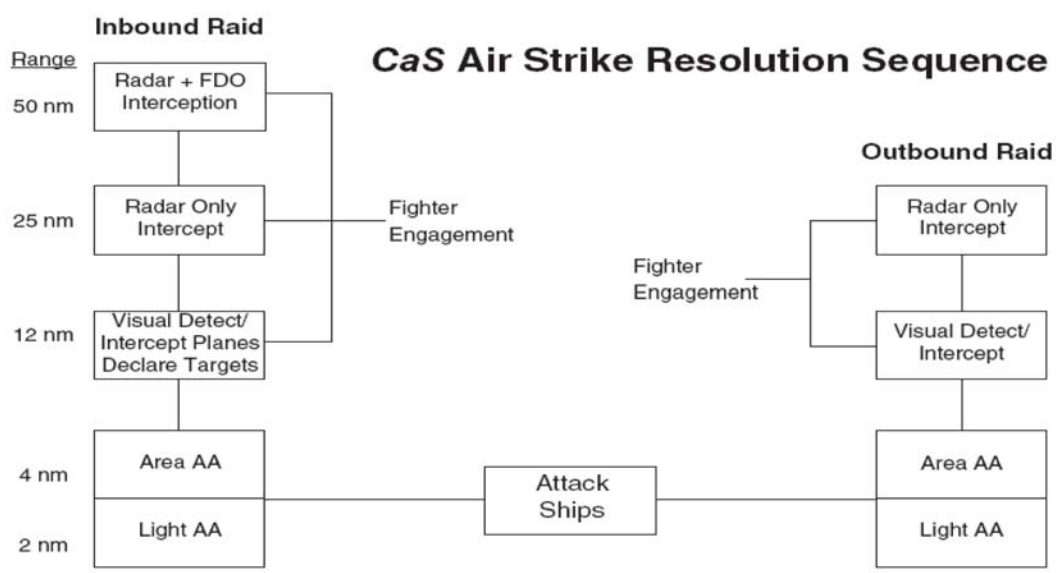
The fundamental idea behind all aggregated approaches to modeling low-level tactical outcomes rests on the recognition that operational level play is about planning, and tactical level play is about procedures. Carlson's decision-node approach seeks to create a middle ground between the two, one that he calls "Grand Tactical Gaming." His emphasis is on preserving key tactical decisions by using an event-driven focus, which requires the players to conduct

22. Dunnigan, James F. *The Fast Carriers: Air-Sea Operations 1941–1977.* Boardgame. New York: Simulations Publications, Inc. (1975).

some operational planning while preventing them from dropping down into the tactical weeds. The approach seeks the golden mean of using aggregated statistical models while avoiding both over simplification and swamping players in details.

It is worth going into some detail about Carlson's approach to provide a concrete example of the idea. Visualize a U.S. carrier-based air strike against the Japanese fleet at Midway. The way the system works is that incoming strike aircraft pass through a series of 10 nodes. At each node, actions are resolved and what's left of the strike group proceeds to the next node (see figure 13).

Figure 13. Carlson's resolution sequence for air attacks[a]



a. From Carlson, Chris, "Resolving Large Air Battles: Midway at Historicon 2006," *The Naval Sitrep*, issue #31, Oct 2006, pp. 25–27.

The bulk of the detailed tactical play revolves around air-to-air engagements. The defending fighters engage the incoming strike group, with the number of actual encounters based on the relative positions and capabilities of the opposing aircraft. Rather than positioning and moving individual aircraft, however, the system aggregates the action at each tactical step to determine overall survivors. Ultimately, after enduring surface anti-aircraft fire, the attacking aircraft engage ship targets using a similarly aggregated procedure for determining the quality and effects of the attacks. This approach greatly shortened the amount of time required to resolve large-scale air battles while retaining many of the key tactical decisions in the hands of the players.

Key conclusions about game dynamics

In DoD wargames, no less than in hobby wargames, unnecessary detail in a game engine costs the players and pucksters heavily, in both time to resolve outcomes and comprehension of the key elements that drive those outcomes. Typically, the greater the level of aggregation in the model, the fewer the number of inputs the model requires and the easier it is for the players to grasp the relationships among those inputs. But how high can we go in this process of aggregation before we lose the details that are important to the goals of the game? There is no one-size-fits-all answer to such a question, but our research leads us to propose a good place to start from when thinking about designing a game engine suitable for multi-level gaming.

Look at the lowest level of command represented by actual players of the game. In our recommended structure centered on the concept of collaborative control, this is the collaborative "tactical" level, at which the players and pucksters work together to adjudicate the outcomes of actions. Then use a model that represents behaviors, actions, and outcomes no more than one level below that level of command. In Carlson's terms, if the tactical players represent strike leads and air-battle managers, the model should aggregate at the level of groups of attacking and defending aircraft, not at the level of individual pilots.

The resulting model or game engine will allow the tactical players and control pucksters to implement most rapidly and efficiently the process of closed planning and open adjudication at the tactical level, which is the central element of the system of collaborative control as we defined it in the earlier section dealing with game structures. In addition, this approach allows the tactical players to provide appropriate feedback up the chain of command, and will reduce the dangers of players falling too far into the weeds in their quest for explanations of outcomes—through the simple expedient of not creating lower level outcomes for them to probe and report. Of course, the choice of level of aggregation must take into consideration the realities of the situation and the game's objectives so as to provide just the right level of information, no more and no less. Easier said than done, to be sure.

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Speculation about the future

Before summarizing our conclusions and recommendations about how to think about designing future multi-level wargames in new ways, we first want to take a more speculative view of that future than we have heretofore in this paper. In our various discussions over the course of our research, one in particular (that with representatives of NDU and Johns Hopkins APL) raised several points that went beyond our near-term focus on ways to improve current multi-level wargaming practices and speculated more extensively on the turmoil associated with recent global events and the implications that future trends may have for even our fundamental thinking about such wargames. Some of those points merit our discussing here.[23]

Are the "levels of war" giving way to newer concepts?

When we described our basic task as one of exploring linkages between strategic, operational, and tactical gaming, Professor Erik Kjonnerod of NDU opined that this specific tripartite division of the levels of war may be "old hat" in the new world of the 21st Century. Instead, he suggested thinking about the problem in more generic terms for the division of labor: policy, planning and execution/implementation. He pointed out that within our traditional views of the strategic, operational and tactical "levels" there were actually multiple "echelons" within each. For example, at the highest levels we are all pretty familiar with the National Security Council, and are becoming increasingly familiar with the Homeland Security Council. But we seldom include the Economic Security Council in our gaming, despite the critical role that economic security plays in overall security. As Mr. James Hillman of JHUAPL characterized it, the problem is increasingly one of dealing with multi-level, multi-echelon, and multi-organizational issues.

23. For the full set of related notes, see *Conversations with Wargamers.*

Indeed, the course of our discussion pointed out that the old way of thinking about command systems is outmoded. Because of the increasing importance of networks of information flow, command, and coordination that cross not only echelons, but also levels of command, we can no longer accurately represent player roles as simple jobs placed within a stovepipe or a box. Modern decision makers operate in the context of networks, and so must modern game players.

These changes in the way real command and game roles work may lead to some difficulties because they may run counter to the ways we are used to defining and perceiving the results of game play. Indeed, they may well produce insights in a form very different from what we expect. If these observations are correct, multi-level gaming's definition of boundaries between strategic, operational, and tactical may be blurring to such an extent that, in reality, we are no longer in a multi-level environment at all. We are really in what we characterized in technical terms as a "mish-mash." The challenge for the designer, then, is to figure out how to represent that mish-mash; how to design the game event to immerse the players in such a non-traditional environment.

Games without moves?

In the commercial world of on-line, real-time (or continuous-time) games, players are increasingly unconstrained by fixed sequences of game moves or actions. The players simply "act and do," as they would in the "real world," rather than "make moves" in a rigidly structured game, such as those we have described from the MCWL perspective. This type of gaming is evolving away from considering time and space as boundaries. Instead, players are immersed in time and space, and act within that context as they might in the real world—without artificial restraints or rigid frameworks for action different from those constraining actual commanders.

Indeed, some of the most recent attempts to characterize real conflict in terms of phases may be losing their cachet. Professor Kjonnerod expressed his own surprise that the relatively new concept of the "six phases of warfare" already seems to be going away. Many of the underlying constructs involved in that framework (the relatively clear distinctions between phases) had always been a bit blurred at the tactical and operational levels—for example, the USMC's concepts of the “three-block war” argued that the “phases” were not sequential but rather simultaneous—but now we may be seeing a similar blurring at the strategic/policy level as well.

One of our discussants described the resulting gaming imperative in terms of moving the underlying conception of a game beyond the notion of assessing the capabilities of the players or their game-world entities— a process often characterized as defining the box the players must live in—and emphasizing instead that the purpose of the game is to explore the edges of that box. Indeed, these ideas share much in common with the approach we described as The Artist in our earlier work for the NWC.[24]

Despite this change in structure and focus, however, games must still be about more than merely player beliefs and attitudes. To have meaning in the real world, as well as the game world, the games still must show players the possible—and even the unlikely—consequences of their decisions and actions. Such feedback and consequences are essential for the players to play the game, not only for the analysts who try to extract takeaways from the game play.

Dynamic control for future gaming?

One of the reasons these incipient ideas are worth further consideration is that we face new challenges for analysis and gaming to address. Mr. Hillman argued that over the course of the Cold War we had developed a reasonably good understanding of the nature and extent of issues associated with a conventional war in Europe against the Soviets and the Warsaw Pact. We were able to structure analysis of those issues in terms of a hierarchy of levels and associated problem

24. See Peter P. Perla, ED McGrady, and Michael C. Markowitz. *21st Century Wargaming: Returning to Our Roots*, Oct 2007 (CNA Research Memorandum D0016876.A1/Final).

sets for each level. As we look to the future, however, we face some "wicked problems"[25] in which the overlap of various political, social, economic, military and other types of issues creates a denser thicket of uncertainties that we have to sort through before we can achieve similar levels of understanding. Even if we disagree with Hillman's assessment of how well we actually understood the issues associated with conventional warfare (as opposed to our ability to convince ourselves that we understood it), it is not hard to agree that our understanding of irregular, or asymmetric, or fourth-generation warfare is lagging behind our need to know more about it.[26]

How are dynamics changing?

How do these considerations affect what we need to do to provide for dynamic control of a game? Many of our discussions implied that multi-level gaming in the future must move beyond the old paradigm of strategic-operational-tactical player cells. Nevertheless, the substantive content of the games remains grounded in the decision processes of the players. What did the players think and do and why? These issues of the "whys" are, if anything, more important today than during the Cold War. Controlling the game, in the sense of far too many rigid, scripted DoD games, should be more about ensuring the game produces useful insights from the processes of play than about ensuring the players don't escape the box the sponsor might like to imprison them in. The "solution space" of a game used to have fairly clear boundaries based on our (supposedly) deep understanding of the dynamics of conventional warfare. Now, however, those boundaries are in darkness and the play of the game is all about shedding light on those darkened edges of the game environment.

25. See, for example, Conklin, Jeff. "Wicked Problems and Social Complexity." *CogNexus Institute*. [Online] (2001). Available at http://cognexus.org/wpf/wickedproblems.pdf.

26. See Albert A. Nofi. *Recent Trends and Thinking about Warfare*, Sep 2006 (CNA Research Memorandum D0014875.A1/Final) and Peter P. Perla, Albert A. Nofi, and Michael C. Markowitz. *Wargaming Fourth-Generation Warfare*, Sep 2006 (CNA Research Memorandum D0014752.A2/Final)

Mr. Hillman described some of the ideas behind the Asymmetric Wargame conducted at JHUAPL in January 2008.[27] That game used a deliberately non-traditional approach to Red play. Instead of the more usual technique in which Red takes some action that immediately confronts Blue with a situation, in this game Red calculated that the effects of its actions would emerge over an extended period of time. One unexpected effect of this approach was that the players at the "tactical level" representing the nascent U.S. Africa Command (AFRICOM) began to take more initiative to develop innovative approaches to dealing with threats, partially because they were not jumping through hoops responding to nuisance actions. Unfortunately, many of these innovative ideas did not receive the full attention they deserved from the operational level Blue commander, who also had "one foot in Control." The tactical staff were "getting off the reservation" and had to be reigned in. The result of this "conventional" way of thinking proved to be missed opportunities for exploring new ideas, one of the game's goals. Instead, the higher level command ended up by forcing the lower level players to conform to a more conventional command and control construct that required them to brief and get approval up the chain before they could implement low-level actions. Unfortunately, this is an accurate depiction of what would probably happen in a real-life situation, and the game missed an opportunity to delve into the implications of the contrast between old and new ideas.

Another interesting game the APL contingent described was a boardgame they had designed for the Defense Threat Reduction Agency (DTRA). This game was titled Campaign X and was a multi-level, multi-echelon game. The focus of the game was on employing new technologies at the theater (operational) level and extending to the tactical level. The game system incorporated technical engineering level assessments of the effects of individual devices.

They presented several of the physical components of the game. The main game board was a large map of the Mediterranean and eastern

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27. Asymmetric Operations Working Group (AOWG). *Al Qaeda and Associated Networks (AQAN) Vulnerability Validation War Game: Final Report of Analysis and Finding*), Unclassified, For Official Use Only, 28 May 2008.

Atlantic littoral. This map was supplemented by several smaller scale, tactical maps of key choke points, the example they showed being centered on the Bosporus. Other components included hundreds of playing pieces made out of squares of light wood with labels on one side showing the nature of the unit or entity represented by the piece. It was perfectly recognizable by any recreational wargamer as deriving from the traditions of that hobby. (Look again at figure 5 for a basic visual reminder of the hobby style.)

In executing the game, several groups of a small number of players (four to six players per game) played the game twice each over the course of a single day. The designers expected that the players could get through a move of the game in about an hour; in the event, it took more like four hours. One of the problems they encountered is important to recognize as an inherent limitation in any attempt to reduce the "administrative overhead" of playing a game by offloading more of the "game mechanics" to the players.

In this game, as in many others we have seen, players inexperienced with gaming had a great deal of trouble managing the physical components of a boardgame while staying focused on the cognitive processes of deciding what to do. The difficulties stemmed from both the large amount of information the game presented the players and the large number of playing pieces the players had to manipulate physically to implement their orders.

Who should interact with the game engine?

This experience highlights one of the issues we have tried to get at during our research on this project. Who—players, controllers, both?—should have the responsibility of making the connection between the decisions and actions of the players and the game engine that transforms those decisions and actions into outcomes for the gameverse? We at CNA have witnessed (and perpetrated) more than one occasion in which the processes and conventions that seem so natural and easy to follow for a "gamer" prove impenetrable and unmanageable to a non-gamer cast as a player in a game. Under what circumstances should we restrict access the game engine itself to the experienced gamers/facilitators that form part of Control, and when should we allow the players themselves to manipulate that instrumentality?

Several of the APL experts correctly pointed out that the emphasis of modern computer game technology (and boardgame technology as well, to be fair) is all about "playability." Modern games for platforms such as *Playstation 2* or *Wii* all tout their "natural" interfaces and "intuitive" game play. Not all live up to their claims. Nevertheless, the electronic game industry had made great strides in these directions, and current and future generations of leaders, analysts, and experts are more and more familiar with the conventions of the electronic game environment. This evolution might argue for developing future game designs that take responsibility for directly connecting to the game engine away from the pucksters and move toward giving all (or most) of the players themselves access to the underlying game system. Not only would such an approach reduce the overhead of large numbers of support personnel required to run the games, but also it would give the players a more realistic experience as command and control systems evolve in the same direction.

The price of admission to such games may be that players would have to spend a couple of days training on the game system before beginning game play. Optimists will argue that the new generation of players should be able to become sufficiently proficient in that short time to dispense with the need for numerous support staff. Even more important, so the argument goes, this approach may well become essential as gaming moves away from a rigidly managed move-based system to a more organic turnless game.

But there is another side to this argument. One of the biggest dangers of setting game players in front of a computer is the tendency for them to shift into "game focus" rather than "think focus," which is where we really want them. Many of our interviewees, from more than one organization, have experienced the dangers of this shift—players, especially those with direct access to the game engine, begin playing to "win the game" rather than meet the game's objectives. Their emphasis becomes the game, not the underlying reality the game represents. Idiosyncrasies and artificialities of the game system become elements to exploit in the name of winning the game, regardless of their potentially negative consequences for meeting the real objectives of playing the game.

One of our APL experts, Paul Shelton, provided a particularly poignant example of the issue. One of the most prominent aspects of the kind of conflict we are involved in now with middle-eastern cultures highlights Clausewitz's famous dictum: "War is an extension of politics with other means." There has been a long tradition of Western warfare that saw much of the political means ("talk") give way to the military means ("fight") until one side decided it had lost the fight and had to talk its way to a least damaging resolution of the conflict. In the current middle-eastern and south-Asian struggles, we are less in the mode of "talk-fight-talk" than "talk-talk-fight-talk-fight-fight-talk…" We are learning that doing nothing can be every bit as critical an action as launching an air strike. Our enemies are living in an inherently multi-level culture, one in which individual humans at each echelon are less cogs in a Western-style hierarchy than they are independent actors in a network of dyadic relationships.[28] Nor are our enemies as focused on "kinetic" solutions as we have been traditionally. As Shelton pointed out, "Hizbollah's most important successes are not kinetic—though they have had some—but rather are social." What, then, are the "rules" of adjudication for societal, rather than kinetic, effects?

An eloquent counterpoint to such arguments is provided by Commander Peter Pellegrino (of Pellegrino Cross fame). Commander Pellegrino disagrees with the idea that players playing to "win the game" is a negative thing.

> I would argue that playing to win is the core motivation for any player. The competitive nature and desire to win is what McCarty-Little identified as a core driver behind war gaming against another human adversary. Who plays to lose? The goal of "meeting the game's objective" is not the players' problem, it's the game designer's problem. Game designers are charged with translating game purpose and objective into gameable victory conditions for players to

28. See our discussion of the book, *The Tent and the Pyramid* in *21st Century Wargaming*.

> attempt to achieve. In how they attempt to reach said goal we hope to learn something about the game objective. We should avoid the temptation to quickly blame "bad outcomes" on the players for doing what players do, vice looking to see if the game design itself was flawed. "There was nothing wrong with the game, the players just didn't play it right," sounds way too much like a petulant rant....
>
> The problem comes when the player activity (often an abstraction or distillation of another process) no longer relates to the original activity it was derived from and intended to generate the data needed to satisfy the game's outer objective. Players tend to care about more proximal conditions (like winning this week) than longer term goals (like the post-game findings in a report to the sponsor a month from now.)

What might technology contribute?

During our research and interviews, we were interested to discover two fundamentally different attitudes related to the potential contributions technology might offer to improve our ability to play multi-level games with less human overhead and more substantive output. The U.S. Air Force's wargaming community places a lot of emphasis on technology, particularly on advances in artificial intelligence (AI) and immersive learning environments (ILES). The U.S. Army gamers we spoke with, with their educational mindset, saw much value in technology for facilitating distributed learning. Our own Navy experience and conversations with Navy experts firmly placed technology in a support role. We cannot delve deeply into all the technological arguments and counter arguments here. Instead, we will touch on just of few ideas we think may hold out the most promise for the future.[29]

Use of AI technologies

Several of the USAF wargamers, particularly Colonel Matthew Caffrey, USAFR (Ret.), of AFRL, argued that the ultimate solution to the

29. See *Conversations with Wargamers* for additional discussion about the potential for technology as applied to future wargaming.

problem of multi-level gaming is to create models with artificial intelligence routines to replace lower level tactical commanders. They cite at least three advantages of using such an AI technique.

- First, by designing the AI in such a manner as to allow the human players to establish certain key parameters for the AI, the approach enhances the credibility the players attribute to the AI routines because, after all, the AI is simply following the orders and priorities established by the players.

- Second, because the AI can act at computer speeds and interface directly with a computer-driven adjudication system, the speed with which higher level commands can be carried out increases dramatically. Instead of waiting for human players to take higher level orders and attempt to implement them by playing out the lower level activities at human speeds, the AI could implement and resolve the actions nearly instantaneously.

- Third, by replacing human players at the lower levels of play, using AI increases the possibility for introducing and controlling the effects of camouflage, concealment, and deception. Again, such effects could be built into the assessment routines of the computer model itself, providing the AI with only the information the designers deem appropriate.

By taking advantage of these capabilities, AI technology offers two levels of innovative possibilities: (1) it could allow us to do game control and assessment more effectively; (2) it could allow us to envision a new application of wargaming. Because the AI technique can implement decisions so much faster than human players, it opens up the possibility of using gaming technologies to set up and play games during the course of an actual operation, not only before the fight begins. Col. Caffrey used the analogy of an inertial guidance system: once you get the game started, you can continue to observe its trajectory, making course changes to respond to changes in the real world, and so allowing you to track and test out alternatives before taking action.

Another benefit of using computer-based AI is to allow games to explore much longer periods of time than is typically the case with in-person games. Using a well-designed AI system, the nights and weekends could become active operating times during which the AI can model the battlespace more thoroughly, extend the time span of the game to cover longer periods of time, or explore alternative tactics and strategies.[30]

Colonel Smith described a project that Air University schools and the Air Force Research Laboratory (AFRL) cosponsored with the software and AI contractor Stottler Henke. He mentioned a software tool named SimVentive developed by Stottler, which they used to build software applications of increasing complexity up to a theater-level simulation.[31]

Stottler's technology is designed to help overcome a typical problem of gaming in an academic environment. Many academic games are played in the context of individual class seminars led by different instructors. Not all such instructors are talented or experienced with the skill sets necessary to create or conduct successful wargames. Using the gaming technique to tell compelling educational stories is not a universal skill among service-school faculty. By applying the Stottler technology, AFWI believes that it can help instructors at all levels of Air University—and other Air Force educational organizations—to create a wide range of tailored and effective educational games quickly and easily, without actually having to learn complex programming languages. The tool has been applied to other environments as well.

Immersive learning environments (ILES)

In a related technical approach, both Northern Command (NORTHCOM) and Joint Forces Command (JFCOM) have been working to

30. For an extended discussion of some of the AI-related issues just touched on here, see *Conversations with Wargamers*.

31. For more details on this software, see *Conversations with Wargamers* and the Stottler Henke web site, http://www.stottlerhenke.com/index.htm.

develop what has come to be known as ILES. The ILES arose in response to a NORTHCOM requirement to deploy an education, training, and mission rehearsal capability. The Office of Training Transformation of OSD (the Office of the Secretary of Defense) sponsored the development of ILES as a complete solution for building an exercise structure, from defining training objectives to producing after action reviews (AARs) and lessons learned. ILES allows users to build event timelines, populate them with various types of simulated entities (called Reusable Training Objects), and integrate the user's own computer applications (such as mapping software) into server-client or web-based environments for use during play. The system provides automated tracking of learner performance and progress, as well as other administrative tools. Of great interest to the AFWI is the capability of this system to allow instructors or other mentors to intervene in the execution of the exercise to conduct dynamic experimentation and exploration of hypotheticals and decision options.

Using a system like ILES, an instructor can develop a game based on a core timeline of key events, monitor the decision making of each individual player, and drive the action in the game using either a predefined decision matrix or direct input. The AFWI staff is particularly excited about the possibilities offered by existing or projected advanced features, including the use of avatars to handle prescripted events and actions, as well as an ability to create new inputs on the fly. Colonel Smith commented that AI-based approaches such as these have the great advantage of removing or reducing the effects of personality (particularly of instructors) from the execution of a game. It helps to bring the baseline of expertise up to a higher level because it reduces the variation of expertise and storytelling talent across instructors and other game SMEs. Lieutenant Colonel Watkins pointed out also that using a system such as this allows expert game designers to script more realistic lines of scenario events based on a broader range of expertise than is available to individual instructors, and then provide those event lines to the instructors for their uses and adaptation.

Other technologies

Management of game time is always a challenge, whether the game is played in common time or if a more complex structure is adopted. One of these complex structures allows the play of the game at different decision levels to run at their own individual clock speeds until events from one level impinge on another. In order to assure correct management of the game clock in these circumstances, it is sometimes necessary to use what is known as a "run-time manager." This term is usually applied to a computer control system whose task it is to monitor the various time streams in multi-level games to make sure that actions at each level are coordinated to occur in the correct sequence across levels. For example, suppose a game is being played at both the tactical and operational levels. Each move, or tick of the clock at the tactical level represents, say, five minutes of actual time; each move at the operational level represents one hour of actual time. If an air strike takes 50 minutes to reach its target—that is, 10 tactical time steps—the run time manager would ensure that its effects show up at the operational level at the correct point of the operational time steps.

Our contacts at Booz—Allen—Hamilton, one of the leading wargaming contractors, opined that technology would be exploited more completely to conduct more and more multi-level games in a virtual environment—that is, using networked computer systems to allow players from different levels of command and diverse organizations to play together from geographically dispersed locations. There is not much practical difference between player interactions when they are confined to separate rooms within a common facility as compared to operating from separate facilities. (On the other hand, there may well be a practical problem of observing, controlling, and analyzing a more widely dispersed game when control and data collection functions have a limited number of personnel available to support them.)

In addition, such games can also take advantage of current computer capabilities to create both persistent gaming environments (those in which the game never stops, though some players may stop playing to rest or sleep) and "freeze-state" environments (those in which the game state is stopped at specific times so that players may step out of the game and pick it up later without any changes in state).

These and other techniques used in the civilian on-line gaming market can be applied readily to allow DoD games to be played in a virtual environment by connecting players with real-world command centers and systems. This notion is an extension of the concepts that were incorporated in the Battle-Force In-Port Training (BFIT) program during the late '80s and early '90s.

> In a BFIT exercise naval staffs respond to wargaming scenarios and developing situations using the same systems and procedures employed in actual operations. Typically, participants man their normal duty stations ashore and aboard ship and receive the gaming inputs through the actual sensors and communication systems. Such an approach to gaming requires careful and specialized preparation of data to insert into real systems as opposed to simplified gaming systems.
>
> When successful BFIT is the most effective form of wargaming because it allows players to accomplish real-life functions in a realistically simulated artificial environment. Emphasis is put on commanders and their decisions, not on fancy virtual reality systems and exotic computer graphics. Technology is the servant of the players, helping them experience a realistic environment at a level of detail expected during an actual operation. This is the key to a truly great wargaming system.[32]

As more and more command systems and processes become dominated by electronic means of communicating and displaying information, such virtual-reality gaming approaches more and more closely to the ideal of having decisionmakers use the actual systems they would employ in real-world action for playing the game—at least at the levels of command above those in which the use of physical senses to encounter physical realities still dominates. If any of those latter are even left to us.

32. From Perla, Peter P. "Future Directions for Wargaming," *Joint Force Quarterly*, Number 5 (Summer 1994), pp. 77–83.

Some cautions

Our interview with representatives of the Simulations Center of IDA raised some caution flags about the apparently limitless prospects for technologically dominated future wargaming. One tale of horror recounted a JFCOM attempt to connect two automated gaming systems focused on different levels of warfare. The goal was to coordinate automatically a real-time system and a faster-than-real-time system. The project involved connecting the JCATS system (the Joint Conflict and Tactical Simulation) to a predecessor to JWARS (the Joint Warfare System).

One of the pathologies that arose during this process stemmed from the attempt to link up a "command level" system (played at aggregated unit scales and faster than real time) to a unit- or entity-level, real-time system. It proved very difficult for the programmers to come up with an automated technique for "passing intent;" that is, for the senior player at the command level to specify his commander's intent to the next level of command in such a way that the units or entities at the lowest level of resolution would act intelligently or doctrinally in accord with that intent. They needed to develop an interface to parse the intent from the aggregate level into commands understood by the lower level. This required many iterations of a process involving human players interpreting guidance and directing the actions of the lower level entities in response.

Commercial hobby games have also faced this issue. Boardgames and table-top miniature games require human players to carry out not only all command but also all adjudication functions. Computer games, on the other hand, deal with the same sorts of issues associated with programming models and artificial intelligence (AI) routines that DoD computer systems do, even if their scope is (usually) somewhat smaller.

Indeed, computer games such as *Conquest of the Aegean* (*COTA*) are sophisticated enough in their approach that their underlying game engines can compete for military contracts.[33] The game system used in *COTA* allows the human player to choose (and change) what responsibilities to allocate to the computer subordinate and what to retain under human control. The computer AI is programmed to handle combat formations from companies to regiments in a competent (at least it seems competent) if not necessarily brilliant, manner. If you order your paratroop battalion to attack an objective, don't be surprised to see the silicon battalion commander use a "two-up, one-back" attack formation rather than simply sling every available man into the front line.

The design and technical solutions applied in such hobby games often create such reasonable-looking behaviors, especially for historical situations. As with all complex programming endeavors, however, there may still be times when the computer troops seem to do totally random things. Such glitches during the play of a serious military game could raise concerns in the minds of the players about the fidelity of the game's computer models. And it is difficult to get an AI battalion commander to explain why exactly his attack failed to achieve its objective despite what appeared to be overwhelming local superiority.

All of these stories indicate strongly that human players are fundamentally important assets at the command levels above the mechanical operation of the game system or computer simulation that drives the production of combat—or other important—interactions. This is, of course, an expensive proposition in terms of the numbers of players—and experienced players at that—required to represent the command levels in a multi-level wargame—which is precisely the issue that we are attempting to wrestle to the ground in this project.

Technology alone is not going to solve the basic problem, despite its unquestioned potential for making significant contributions to improving matters.

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33. Panther Games, developer. *Conquest of the Aegean.* Computer game. Matrix Games (2006). The Panther Games web site announced that the "Australian Defence Simulations Office (ADSO) of the Department of Defence has contracted Panther Games Pty Ltd to provide a Defence wide license for the use of their operational warfare simulation, Conquest of the Aegean (COTA)." See http://www.panthergames.com/.

Conclusions and recommendations

Our research, discussions, and analysis covered a wide range of topics and elicited a large number of ideas related to the state of the art of multi-level wargaming both today and in the future. The preceding section's foray into the latter touched on both technological and process issues. In this concluding section, we will address those speculations no further; instead, we focus on ideas that the War Gaming Department of the Naval War College should consider applying to games they conduct in the near term. Based on our research and discussion with experts, we have arrived at some basic conclusions about where the War Gaming Department might constructively begin thinking about future multi-level, strategic-operational-tactical wargame designs.

In this concluding section of the paper, we summarize our critical insights relevant to the three broad challenges we addressed in this work and we conclude by recommending a framework that the WGD can use as the basis for designing the near-term Global War Games.

Our recommended framework is, of course, only a starting point. Designers of future Title X/Global War Games will have a set of complex factors to consider before creating the final design for any individual game, not the least of which is the specific objectives that game is intended to achieve. Our recommended framework is simple enough and basic enough to adapt to most design concepts. At the same time, it contains the main elements that our research indicates are most useful for incorporating into such multi-level game designs.

Critical insights

Certain basic ideas are fundamental. Primary among these is the notion that, because valid insights from wargames depend primarily upon the decision processes of the players, the game should incorporate free play at all of the levels of war important to deriving those insights required to meet the game's objectives.[34] Beyond such basics, our analysis of the issues broke the challenges down into three broad categories. These were challenges related to:

- Representing the flow of time and decision processes at different levels of war and different echelons of command.
- Building an organizational structure that efficiently integrates players and Control.
- Defining dynamics of the flow of game play to give the players greater freedom to identify creative decision options and explore their possible outcomes and effects without demanding large numbers of personnel to manage.

In practice, of course, it is difficult to separate the critical elements of a game into such neat, self-contained packets. As a result, our insights are all tied to these various challenges, but in many cases deal with more than one challenge and may also address details not specific to any one challenge.

The list of our principal insights, cast in terms of advice to the designers of future GWGs, is as follows:

- Start with a melded seminar game
- Use time-step, move-based play
- Use decision waves to integrate a next-event sequence of play
- Use collaborative control
- Use aggregated models and pre-adjudication of events
- Use realistic information flows for all sides.

We discuss each of these in more detail below.

34. See Perla (1990) a discussion of this fundamental notion.

Start with a melded seminar game

Historically, the NWC's strong suit in wargaming has been its emphasis on the players over any technology or gaming system used to support them. If the WGD were to have a motto, our candidate would be, "The game is in the minds of the players." Although there is much technology available to the WGD to support their gaming, for the near-term, we strongly suspect that the vast majority of WGD wargames will remain of the seminar variety. That is, the bulk of interactions among the players, control, and the game engine will be driven by face-to-face discussion (supplemented in some cases by electronic communications). This is a Good Thing.

Similarly, although there is precedent and value for conducting a multi-level game using a multi-game approach, the NWC has a tradition of using a single game event—what we have called the melded game—as the venue for its most important games, including the Global War Game. All the command levels are present and acting at the same place and over the same time span.

When managing such a melded seminar game, the Control group's principal tasking should focus on facilitating the decision and adjudication processes of the players. One of the most productive ways of incorporating Control into a game's structure and processes is to think of Control as embodying the C3 system through which information and directives flow up, down, and across the various command levels and echelons. In this way, members of Control can often represent either individuals within the command system (such as a chief of staff), or liaison elements (such as an Air Force liaison within a Navy staff, whose job is to coordinate with the air-tasking process).

Key members of the Control organization include:

- The overall Game Director, who:
  - — Provides the players the background story of the game and any updates to that story as time and game play proceeds
  - — Provides the players with the specific taskings they need to accomplish to meet the objectives of the game

— Oversees the operations of the entire Control organization through his principal subordinates, the Director of Assessment, and the Director of Adjudication.

- The Director of Assessment, who:

  — Introduces and manages the elements of the high-level real-world environment beyond the scope of the game's players, such as political and organizational capabilities and constraints, and the activity of allies

  — Assists the players as they discuss and interpret the meaning and implications of high-level game events

  — Manages the facilitator organization, which supports the players with their interactions with the game engine and adjudication process.

- The Director of Adjudication, who:

  — Has the principal responsibility for adjudicating the physical outcomes and effects of player decisions and actions, and other game events, in accord with the game's representation of the physical environment

  — Manages the pucksters and the game engine, as well as any integration of player elements along with the pucksters in the process of collaborative control.

Use time-step, move-based play

Most of the personal experiences the current authors have had, and our analysis of what we heard from most of our interviews, indicates that using a continuous clock to drive the play of a melded, multi-level seminar game is a not the best approach for most tasks. Instead, we strongly urge that the games make use of a turn- or move-based system in which all player cells address issues associated with a well defined time step or time period and then move on to the next.

The structure of such moves will, of course, depend on the details of the game and its objectives. But for our purposes, considering a game played at the strategic, operational, and tactical levels, we recommend that the game's moves be defined in terms of a common intellectual construct familiar to the players. At the moment, a useful construct is the notion of "Phases of Conflict." Joint Doctrine[35] defines six phases:

0. Shape
1. Deter
2. Seize initiative
3. Dominate
4. Stabilize
5. Enable civil authority.

If using this construct, the game would be played in at least six moves. In this case, each move would represent all the activity associated with a single phase of conflict. In many cases, however, the scope and scale of play at different levels for different moves may make it expedient to divide a single phase into multiple moves.

Use decision waves to integrate a next-event sequence of play

Within each move, the play should proceed at the pace directed by the player level or echelon of command requiring the most time to resolve its actions. The phases and moves can be defined ahead of time during the game-design process, but once play begins, the unit of measure for time becomes the event. Events flow from player decisions and actions. Each set of decisions and actions can define the sequence of events that will flow from them. Play then proceeds from event to event in an approach similar to that used in classic "next-event simulations."

The idea of decision waves allows the game designer to posit a basic framework that the events flowing from player decisions at different levels and echelons can fit into. The events arise from—and generate the flow of—player decision waves, as we described earlier. Those

35. *Joint Publication 3-0: Joint Operations*. Washington: Joint Chiefs of Staff (17 September 2006; Incorporating Change 1, 13 February 2008). Available at http://www.dtic.mil/doctrine/jel/new_pubs/jp3_0.pdf.

decision waves become the heartbeat of the moves, as first one level then another goes through the OODA steps, and links into the decision processes at other levels and echelons.

Use collaborative control

To make the process of interweaving decision waves work smoothly requires rapid and realistic adjudication of game events. This, in turn, entails what the Quantico gamers defined as a hybrid process of closed planning and open adjudication—particularly at the lowest tactical level.

The basic mode of game play should incorporate closed planning within both the vertical and horizontal dimensions of the opposing command systems. That is, the players on different sides will generally plan their own actions without knowing what the other side is planning. However, when the objectives of the game do not preclude it, the game should also incorporate an open adjudication process at all levels where adjudication must take place. This process should involve both control and the players from both sides to the extent that they can contribute their expertise without letting the proverbial cat out of the bag where surprise and uncertainty are critical to deriving insights.

Once the planning for both sides is completed, the players of both (or all) sides come together to adjudicate the outcomes of their competing actions. This is the key idea, which we have termed *collaborative control.*

Working with the formal Control organization, which only intervenes directly when the players cannot agree (or when Control has good reason to alter the consensus view), the players collaborate to develop the combined outcome and also agree upon what they would be able to communicate to higher level players in their respective command chains. Player levels and echelons of command should be arranged such that the primary information sources for the players about game outcomes are either other “actual” players (not Control), or direct player participation in the adjudication process. Thus, the higher level players learn about the outcomes of actions from other players, not from Control, which creates a more realistic representation of real-world information flows.

This single step can go a long way toward reducing the required manning levels of Control personnel. However, it will require tailored training of the NWC's Control group in the new philosophy and technique for this sort of process. The USMC's Wargaming Division of MCWL can serve as a critical resource for learning more about how to carry out such a collaborative process.

Use aggregated models and pre-adjudication of events

To allow for the required speed of resolution to make the system of collaborative control work efficiently, several techniques are available. A fundamental approach is to aggregate any inputs and outputs of the game engine or model to as high a level as possible while still providing the players the detailed feedback they could expect to get routinely during real-world operations. The game engine or model should be designed to translate player decisions and actions into effects on the gameverse at the highest level of aggregation consistent with the objectives of the game.

Another useful technique is for Control to take advantage of the inevitable down-time at all levels of play to encourage and help the players think and plan ahead for possible contingencies. Creating and preparing for a variety of contingency plans—coupled with some amount of pre-adjudication of such plans—will not only expand the substantive content of game play, but also speed the process of resolving outcomes once final decisions are made about which options to pursue. To oversee the management of this process, Control must designate specific individuals. In our construct, we designate the head of this section of Control the Director of Adjudication.

Use realistic information flows for all sides

Providing realistic information flow to ALL players is one of those things that "goes without saying" so often that people tend to forget about its importance once the design process or game play is underway. It is of obvious and fundamental importance that all players must be able to know what they should know in the real environment—and not know what they could not know in the real environment. As we discussed earlier, too often game designers over emphasize the realistic (if not optimistic) representation of Blue systems and capabilities at the expense of Red. (Less often, there can be a failure to give Blue enough credit for capabilities of fundamental importance to achieving a game's objectives.)

The asymmetry between Red and Blue in detail of representation and action of forces and sensors can handicap the Red players by preventing them from knowing what they should have known in the real world under similar circumstances. Commanders on both sides must receive the information they are entitled to receive by the play at the lower levels, or the game's representation is fundamentally and fatally flawed where it counts the most—in the decisionmaking processes. This mistake creates an asymmetry in realism between the representation of the sides, which can skew the outcomes of the player decisions in subtle ways that are often undetectable from outside the game or the player cells involved.

The design of the game must match its representation of information flows to the dynamics of real-world capabilities and processes wherever those effects must be represented in order to achieve a game's objectives. This requirement sometimes can beat against the desire to aggregate models to speed adjudication. Consider a case in which Blue forces are counting on an asymmetric advantage in intelligence, surveillance, and reconnaissance (ISR) based on technical systems that provide Blue an information advantage. If the game design or game models are abstracted to too high a level, such that the systems for adjudicating and assessing game results are not sensitive to those critical asymmetries, the representation at the tactical level may preclude realistic information and decisionmaking at the higher levels.

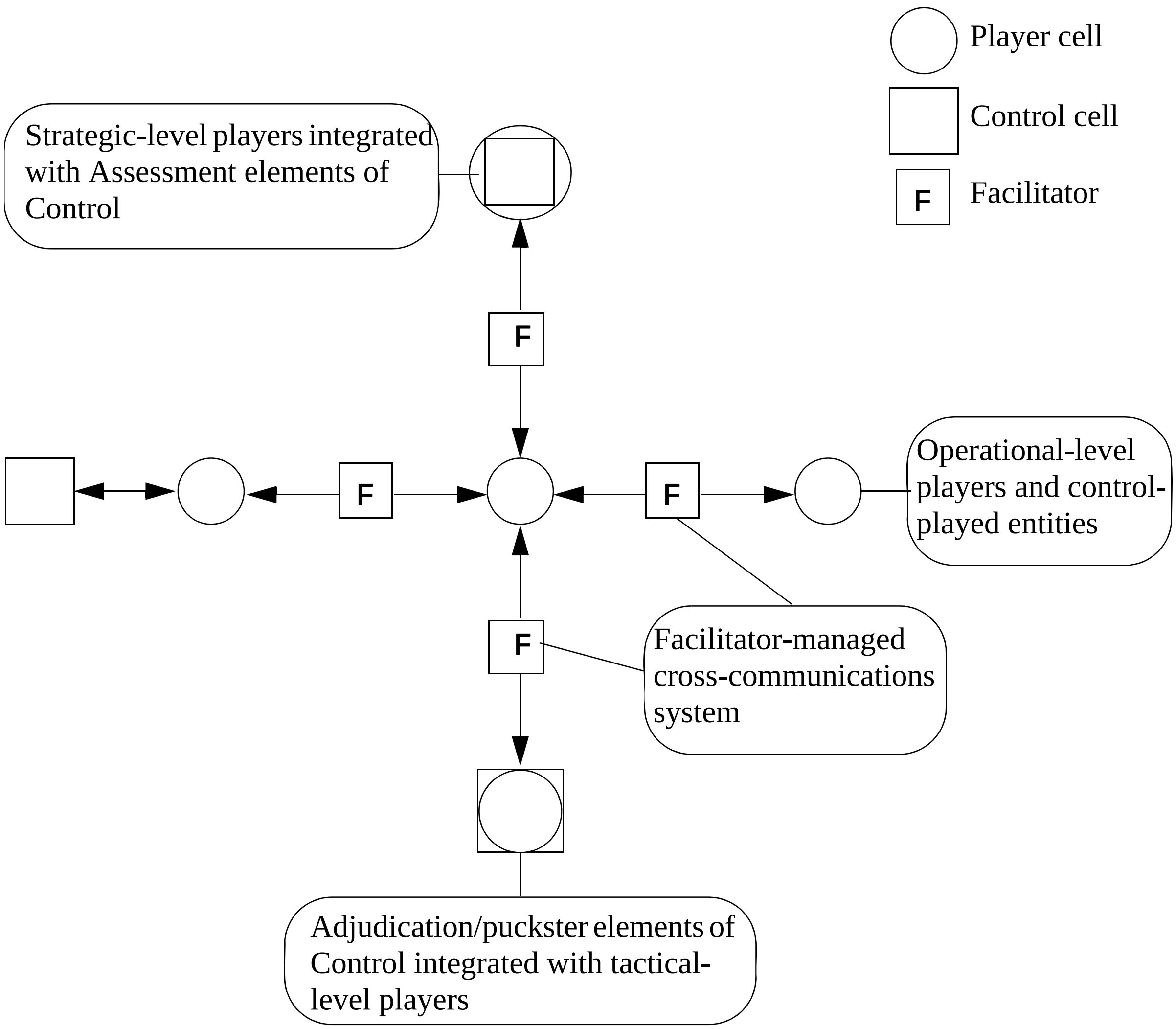
The critical flows of information that take place among the players and which, in some cases, are also managed by Control's facilitator organization, fall into the management purview of the Control leader we have called the Director of Assessment. This Director, responsible to the overall game Director, is also the leader of the high-level assessment process through which the senior players interpret the meaning and implications of game outcomes at the highest levels.

Recommended framework for the Global War Game

We have synthesized the insights and ideas derived over the course of this research into a design framework for the structure and processes of a Global War Game. Figure 14 shows the recommended design structure. We discussed the key elements of this design earlier. They include the following:

- Strategic players, supported by an overall Game Director and Director of Assessment, address the overall strategic situation and specify their assessments, objectives, and intent in closed planning and open adjudication and assessment sessions. Strategic players provide assessments, objectives, and intent to their operational-level subordinate players, as well as to any Control-played operational entities, using procedures and documentation as close as possible to those used in the real-world (for example, warning, alert, and execute orders).
- Operational-level players, supported as needed by Facilitators managed by Director of Assessment, also work in a closed planning/open adjudication environment. They respond to tasking from strategic players to develop operational plans, and provide direction and final operational execution orders to the subordinate tactical-level players using procedures and documentation as close as possible to those used in the real-world.
- Tactical players work in a collaborative control structure with the game pucksters managed by the Director of Adjudication. Tactical-level players embody their own closed planning/open adjudication environment, agreeing on game outcomes based on a game engine scoped and scaled to provide the necessary balance of detail and aggregation to achieve the goals of the game.
- Feedback of game events and outcomes generally occurs through communications from one level or echelon of the players to another. (Control facilitates this communication process but does not directly intercede in it except in specific and exceptional circumstances). Information availability and flow is based on the same level of detailed representation of real-world capabilities available to all sides.

Figure 14. Recommended basic design structure for a Global War Game



Using this overall basic structure and the system of dynamics we described in detail earlier, the insights from the game flow naturally from the interactions of opposing players—not just from opposing moves—at all levels. As a result, the players themselves are more likely to take ownership of the play and of the insights it generates because those both flow more clearly from their own decisions and actions and are not as likely to be perceived as imposed on the players by control.

Based on our research, CNA believes that using the approach described in this paper, and illustrated in a basic way in figure 14, will enable the NWC and its sponsors to explore the linkages among strategic, operational, and tactical levels of war and echelons of command more efficiently and more effectively than heretofore. CNA recommends that the Wargaming Department of the Naval War College use this prototypical design as the starting point for its design of the next Navy Title X Global War Game.

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