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Computer Games and the Military: Two Views

by J.C. Herz and Michael R. Macedonia

Overview

Simulations are a critical aspect of U.S. military training. Commercial computer games are a growing part of our entertainment industry. The two fields have much in common, and the military can learn from the successful experience of the commercial sector. J.C. Herz provides an industry look at gaming technology and culture and suggests ways in which commercial experience can be applied to the military. Michael Macedonia responds to Herz's analysis and provides a military gamer's perspective on computer games and the military.

Despite their common antecedents, the commercial gaming and defense simulation industries have developed differently since the 1970s. Once much smaller and weaker, commercial computer gaming has grown into a $7 billion industry and has outpaced military simulations in terms of technology and innovation. Herz attributes this growth to user-driven innovation in software design and the social ecology driving online multiplayer games. The commercial gaming industry encourages player innovation by soliciting feedback in the design and development phases of new products and by incorporating player modifications into the next iterations of established products. User-driven innovation is successful because it is inherent in the industry's cultural infrastructure, which can leverage interpersonal dynamics of competition, collaboration, hunger for status and peer acknowledgement, and tendency to cluster. This social ecology that drives online multiplayer games invests players in games and compels them to play. As the military attempts to incorporate information technologies into simulation, Herz suggests that it will require not only hardware and software infrastructure but also the cultural infrastructure to leverage these resources.

Macedonia recognizes the role that the commercial game industry has played in military simulations over the past 25 years. The military has readily adopted commercial simulations for use in strategy and tactics games in school curricula and for developing individual and collective skills in unit training. These efforts have resulted in stimulating collaborative activities, either with military modifications of commercial games or commercial simulations developed for the military. The military further recognized the importance of commercial entertainment technology with the creation of the Institute of Creative Technology, which brings together the defense and commercial industries to produce a revolution in how the military trains and rehearses for upcoming missions and to prepare for the challenges of the 21st century.

An Industry View

by J.C. Herz

Computer games and military simulation are like siblings separated in infancy. Although they share the same technological parentage, the commercial game and defense simulation industries have

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been nourished differently over the last 25 years and developed differently. Military simulation, the older sibling, evolved in a focused, formal, hierarchical environment, as contractors built specific, costly applications on powerful workstations. Military simulation projects were fewer in number but were long-term projects implemented within large organizations in a coordinated fashion.

Commercial game development, the younger sibling, initially was much smaller and weaker. Without access to large financial resources or institutional support, commercial games were fly-by-night affairs—floppy disks in Ziploc bags peddled by enthusiasts. Gamers programmed their products hastily, played them enthusiastically, and then deleted them to save space on hard drives. Because games were processor-intensive and consumer computers were slow, resourceful game designers used every known loophole to squeeze extra processing cycles out of slow computers, such as the TRS–80 and Commodore Amiga. These small machines were inferior to military supercomputers in every respect.

Between programmers and gamers (two groups that overlapped considerably), a community took root and flourished, informally and organically. When the Internet became accessible to nonacademics in the early 1990s, the computer game community embraced it, and the already robust bulletin-board, magazine, and modem culture burst onto file transfer protocol (ftp) sites and, later, the World Wide Web. After Id Software open-sourced the Doom level editor in 1994, there was an explosion of player modifications, as gamers took three-dimensional (3–D) engines and editing tools into their own hands.[1] As in any Darwinian environment, the fittest survived, garnering fame (and gainful employment) for their creators along the way.

By the end of the decade, nearly every strategy and combat game on the market came with a built-in level editor and tools to create custom characters or scenarios. Nourished by the flexibility of these tools and the innate human desire to compete and collaborate, a dynamic, distributed ecosystem of official sites, fan pages, player matching services, and infomediaries flourished—and continues to grow in an unrestrained fashion, on a global basis. As the player population expands, so does the game industry, which now rivals the Hollywood box office, exceeding $7 billion in annual sales.

Meanwhile, computers keep getting faster. As Moore's law kicks in and hard drives grow in capacity and shrink in price, commercial games get better looking and more sophisticated. Graphic accelerators smooth out the edges and goose the frame rate. Faster chips process real-world physics. High-bandwidth connections throw distant opponents into virtual arenas. The technological discrepancy between a military simulation and a commercial PC game has all but vanished. Nevertheless, in many respects, commercial games are superior, both in single-player mode and as networked multiplayer platforms. Everquest, Sony's massively multiplayer online world, hosts 350,000 players (each of whom pays $10 per month for the privilege), with over 100,000 simultaneous players at prime time.

Technologically, the commercial game industry has superseded its military sibling (in the past few years, the military has attempted to leverage commercial game technology for military applications, providing the impetus for programs such as the Institute for Creative Technologies at the University of California, as well as more limited applications such as Marine Doom). But in terms of innovation, the commercial game industry remains leagues ahead because of its development process and cultural infrastructure: extensible applications, constantly modified and improved by the player base, a highly motivated, globally networked, self-organizing population of millions, all striving to outdo one another.

Just as the American military emphasis on wargaming scenarios and simulation gives it an organizational edge (for example, decisionmaking and analysis versus sheer firepower), the ability of the computer game industry to innovate quickly is a product of its organizational structure and culture. A player-driven culture of continuous, relentless, distributed innovation is the industry's greatest asset, far more valuable than the technology-driven popular games.

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As the U.S. military seeks to transform itself via information technology (specifically networked simulation), it must examine not only the hardware and software infrastructure necessary to achieve that transformation but also the cultural infrastructure necessary to leverage those resources: continuous, user-driven innovation as a conscious principle of software design and a social ecology that drives online multiplayer games. To this end, it is useful to consider the knowledge economy that drives commercial games. In certain respects, the computer game culture may serve as a template for rapid adaptation of virtual environments in response to shifting conditions and constant technological flux.

User-Driven Innovation in Software Design

In 2001, the typical development cycle for a computer game was 18 months from the genesis of the design specification to the release of the product (production typically involves 12–20 people, with costs ranging from $5 million–$7 million dollars). But for many games—particularly the stronger-selling PC titles—that process begins before the official development period and extends beyond it, with a continuous two-way stream of feedback between developers and players.

Perhaps the most extreme example of front-loaded game design is the forthcoming multiplayer online world based on the Star Wars movies, which is being built by Verant, the leading developer in this genre, and LucasArts. When it is launched in 2003, Star Wars Galaxies is expected to attract more than a million subscribers—more than 300,000 simultaneous players at peak usage. The environment is massive—it will take weeks or months to traverse without "hyperspace" shortcuts—and will support a full-fledged economic and

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political system. Players will develop their characters by scaling a number of intersecting skill trees (such as engine mechanics, armor production, combat, and specific environmental knowledge). As a design and engineering challenge, Star Wars Galaxies rivals the construction of a space station in its sheer scale and complexity.

But even while the basic technology is built and the game mechanics are still conceptual, players are a vital part of the design process. Immediately after the development deal was signed, Verant set up a message board to communicate news about the game in progress and to solicit feedback from a player population with over 10 million hours of collective experience with games in this genre.[2]

In a virtual environment as complex as a massively multiplayer online world where success depends entirely on player interaction, developers recognize a player base as a strategic asset. The dynamics of these games are rapidly evolving, and many of the parameters have yet to be defined. When in doubt, designers turn to online message boards to tap player perspectives on the pros and cons of specific features and on aspects of massively multiplayer game play that could be improved. The game belongs to the players, who are going to inhabit this virtual environment when the product is launched and will determine its success, as much as it does to the developer. Therefore, developers find it in their interest to keep players in the loop as the game takes shape and to exploit their experience. This effort is part of the core design process on the bleeding edge of networked simulation.

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Within existing technologies in well-established genres, the player base is even more actively involved in the design and evolution of computer games. First-person shooters such as Quake 3 Arena and Unreal Tournament[3] are built on engines that have evolved for years, passed between programming teams and a population of gamers who customize and often improve the game even as its sequel is being planned. Player innovations are thus incorporated into the next iteration of the product. Perhaps the most salient example of this phenomenon is in-game artificial intelligence (AI), one of the great engineering hurdles in any game, civilian or military. In first-person shooters, as in any combat simulation, a marked difference is evident between real and computer-generated opponents—human opponents are invariably smarter, less predictable, and more challenging to play. There is no comparison between a multiplayer deathmatch (elimination combat with up to eight people on the same 3–D map) and a single-player game with AI opponents. Because of this discrepancy, first-person shooters are, de facto, online multiplayer games; several have dispensed with single-player mode altogether.

However, like all engineering challenges, AI is subject to the million monkeys syndrome: put a million gamers into a room with an open, extensible game engine, and sooner or later, one of them will come up with the first-person shooter equivalent of *Hamlet*. In the case of Id Software's Quake II, it was a plug-in called ReaperBot, a fiendishly clever and intelligent AI opponent written by a die-hard gamer. ReaperBot was the best Quake opponent anyone in the software community had ever seen, and the plug-in rapidly disseminated within the million-strong player population, who quickly began hacking away at its bugs, even though such modifications were technically illegal. These improvements in game AI were incorporated into the core technology of first-person shooters, to everyone's benefit, not least the game companies.[4]

The salient point is that the architecture of Quake, the very nature of the product, enables distributed innovation to happen outside the developer's walls. In essence, the user base—trainees and officers in a military context—are transformed from simple consumers into active, vested participants in the development and evolution of the game. Of course, not all players roll up their sleeves and write plug-ins. But if even 1 percent contribute to the innovation of the product, even just by making minor, incremental improvements or subtle tweaks, ten thousand people then are involved in research and development.

Most players who tinker with combat games are not programmers—nor do they have to be—because the editing and customization tools in today's games require no programming skill. Anyone familiar with basic game play can construct levels of combat games in a few hours. Real-time strategy games offer similar capabilities. New maps, with custom constellations of opposing forces, can be generated with a graphical user interface.

Notably, historical and quasi-historical simulations such as Sid Meier's Gettysburg allow gamers to replay military conflicts under different conditions ("What if Stonewall Jackson had been there? What if Pickett hadn't charged?"), which does not mean the software delivers any definitive answer that a military tactician could not. The flexibility of the framework allows and encourages non-expert, individual players to ask the questions, explore the solution space around a particular scenario, and create new scenarios that might not have occurred to the game's designers.

In a commercial context, this tool-based, user-driven activity extends the life of the game, which both enhances the value of the product (at no incremental cost) and increases sales: the longer people play the game, the longer they talk about it, effectively marketing it to their friends and acquaintances. Will Wright, author of the best-selling SimCity series, compares the spread of a product in this fashion to a virus: "Double the contagious period," he says, "and the size of the epidemic goes up by an order of magnitude. If I can get people to play for twice as long, I sell ten times as many copies." Wright's formula bears out on the bottom line—his latest game, The Sims, has spawned two expansion packs and racked up $340 million in sales since its 1998 release.

The Sims, which scales SimCity down to the neighborhood level, is noteworthy because it illustrates the level of engagement a game can achieve when its designers incorporate player feedback and collaboration before, during, and after the product is released. Four months before the game shipped, its developers released tools that allowed players to create customized architecture, props, and characters for the game's virtual environment. These tools spread

rapidly among SimCity players, who began creating custom content immediately. In the months leading up to the game's release, a network of player-run Web sites sprung up to showcase and exchange "handcrafted" Sims objects and custom characters. By the time the game was released, there were 50 Sims fan sites, 40 artists pumping content into the pipeline, and 50,000 people collecting that content. A quarter-million copies sold in the first week. A year later, there are dozens of people programming tools for Sims content creators, 150 independent content producers, half a million collectors, and millions of players reading 200 fan sites in 14 languages.[5] At this point, more than 90 percent of the Sims content is produced by the player population,[6] which has achieved an overwhelming amount of collective expertise. The player population systematically trains itself, generating more sophisticated content as it learns. This is a completely bottom-up, distributed, self-organizing process—none of these people are on the Maxis payroll.

The Social Ecology of Games

Why do players invest hundreds or thousands of hours mastering the minutiae of these games, honing skills, creating new scenarios, and teaching others how to do likewise?

The dynamics that drive mastery and knowledge exchange in and around computer games derive from the social ecology of computer games—the conventions of interpersonal interaction that define status, identity, and affiliation both within the games and in the virtual communities that surround them. Commercial game culture is structured to harness innate human behavior: competition, collaboration, hunger for status, the tendency to cluster, and the appetite for peer acknowledgement. In other words, the forces that hone games, and gamers, have more to do with anthropology than code.

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Beyond the technological infrastructure is a cultural infrastructure in place to leverage these interpersonal dynamics. Tools and editing modes allow players to create assets to extend the game experience. But more important than the standalone benefit of these assets is their value as social currency. The creator of a popular level, object, or plug-in may not receive monetary remuneration, but he garners notice, and even acclaim, from his fellow gamers.

Game modifications are reviewed on thousands of game sites, from fan pages to high-traffic news destinations like GameSpy. These rotating showcases serve dual functions in computer gaming's attention economy. Gamers looking to download new content sift for quality, and content creators get widespread exposure. Because game culture is global, well-designed modifications are lauded by an international array of Web sites in half a dozen languages. Even game levels and character models (known as skins),[7] which require less time and skill, are circulated around the world. But even on a more local, limited basis, player-generated content circulates among peer groups, particularly among high-school and college-aged males, for whom games are a nexus of friendly rivalry and bragging rights. Competition (formal and informal) is the keystone of computer game culture and motivates casual and hardcore gamers alike to hone their skills and evolve new strategies. Online game tournaments have grown into quasi-professional events, with top gamers earning substantial cash prizes.

In computer game culture, status is easily established, readily compared, and (perhaps most importantly for this demographic group) quantifiable. Every game ends with a winner and losers. Tournament players are ranked. Player-created content is not only reviewed but also downloaded and therefore measurably popular. The author of a game level may have an internally driven sense of accomplishment, but he also knows that thousands of people are playing his song—a big deal for a teenager, particularly when fan sites start pointing to his home page.

This web of relationships between players—competitive, cooperative, and collegial—sustains the computer game industry, no less than the latest 3–D engine, facial animation algorithm, or high-speed graphics card. Game code disseminates and thrives because it is an excellent substrate for human interaction, not because it is technologically impressive. Behind every successful computer game, there is a surge of interpersonal dynamics, both on an individual level and on a group level; games elicit and enable the most basic kinds of human pack behavior.

These group dynamics are best represented by the vast network of self-organized combat clans that vie for dominance on the Internet. No game company told players to form clans—they emerged by the thousands in the beta test for Quake and have persisted for years. The smallest have five members; the largest have hundreds and have developed their own politics, hierarchies, and systems of governance. They are essentially tribal—each has a name,[8] its own history, monikers, and signs of identification (logos and team graphics). Clans occasionally cluster into transnational organizations, adopting a shared moniker across national boundaries and adopting a loose federalist structure. Generally, however, clans are comprised of players in the same country because proximity reduces network lag—a real factor in games that require quick responses.

Although most clans revolve around first-person combat games, there are hundreds of clans plotting against one another in real-time strategy games like Age of Empires, HomeWorld, and Space Empires—Starcraft alone has 165 competing clans.[9] Because strategy games are more nuanced than squad-based combat, clans in this genre tend to maintain more elaborate Web sites that go into some detail about clan history, rules, chain of command, custom maps, and treaties with other clans (some clans even create password-protected areas for their allies to access strategic and diplomatic communication—the smoky back rooms of strategy gaming).

The clan network may seem anarchic—it is fiercely competitive and has no centralized authority. But beneath the gruesome aesthetics and intermural bravado, it is a highly cooperative system that runs far more efficiently than any "official" organization of similar scale because clans, and the players who comprise them, have a clear set of shared goals. Regardless of who wins or loses, they are mutually dependent on the shared spaces where gaming occurs, whether those spaces are maintained by gamers for gamers, such as ClanBase, or owned and operated by game publishers, such as Sony, Electronic Arts, or Blizzard Entertainment, the developers of hit games like StarCraft, WarCraft, and Diablo II, respectively.

Blizzard is a salient example for networked simulation mavens because the company dedicates as much attention to nurturing competition between groups and individuals as it does to developing hit titles. A customer who buys a copy of Diablo II also gets access to Battle.net, a huge multiplayer gaming platform that Blizzard maintains for its customers at no additional charge. Players simply select the Battle.net option from within the game and are instantly connected to a worldwide network where they can chat,[10] challenge opponents, initiate multiplayer games, download new maps, exchange ideas, strategies, and tactics with other gamers, and participate in online tournaments.

the computer game industry should prompt a military evaluation of the communications structure around defense simulation

Compared to the code that drives the game itself, Battle.net is not hugely sophisticated. But it is the cultural infrastructure that invests players in the game and keeps them playing. This infrastructure is built into the experience and is recognized as a huge factor in Blizzard's success. The Battle.net ecosystem is actively nurtured as an integral aspect of corporate strategy. The "soft stuff" is not dismissed as nonprocurable. It is budgeted, staffed, maintained, patched, and extended, no less than the underlying game engine. Blizzard's products are computer games, but the social dynamics of a networked player population are the backbone of its business.

Persistent Worlds

This awareness of cultural importance is even more true of companies like Electronic Arts, Sony, and Microsoft, which maintain persistent multiplayer worlds for nearly half a million gamers on a subscription basis. Unlike most games, for which playing fields exist only while participants are actively engaged, multiplayer online worlds like Everquest, Ultima Online, or Asheron's Call persist regardless of whether an individual player is logged on. The virtual environment does not vanish when a player logs off—there are forces (some internal, some resulting from other player's actions) continuously at work. This sense of persistence gives the game depth and is psychologically magnetic: the player is compelled to return habitually (even compulsively) to the environment, lest some new opportunity or crisis arise. The experience is qualitatively different from that of transient multiplayer environments (for example, combat and strategy games). The world is dynamic and therefore less predictable. More importantly, a single game can continue for days, weeks, or months. Players arrive in an environment knowing that action may flare and subside but that the game is not going to be over in a few hours, and they gain a sense of being embroiled in a set of circumstances on a daily basis—a human experience that is almost impossible to simulate in accelerated time.

The persistence of the virtual environment allows players to develop character identities within these worlds, which all hew to the conventions of role-playing games. In these games, player progress is represented not by geographical movement (as in console adventure games, where the object is to get from point A to point B, defeating enemies along the way) but by the development of his character, who earns experience points by overcoming in-game challenges. At certain milestones, the character is not only promoted to a new experience level, gaining strength, skill, and access to new weapons and tactics, but also attracts more powerful enemies. The better the player becomes, the more challenging his opponents become. Thus, the player scales a well-constructed learning curve over several months while building the initial character into a highly skilled, fully equipped powerhouse.[11]

While acquiring experience and skill, the player is also networking on a number of levels. The hazards of the environment in these games necessitate player formation into small foray groups, or parties of four to six players. In addition, larger groups of players agglomerate into guilds ranging from a few dozen to upwards of 100 affiliated characters. Like clans in the combat and strategy genres, these groups are tribal. They evolve their own customs and leadership structures. They form alliances and declare wars with other guilds. Some are peaceful and welcome new members. Others are roving bands of thugs who relish the opportunity to annihilate beginners should they mistakenly wander into parts of the game world where player killing is allowed.

On a basic level, this interaction is what drives the massively multiplayer online world—the standard societal tensions that inform any city-sized population (Everquest has a bigger population than Miami, Pittsburgh, or Cincinnati). There is crime—and a collective response to crime. There are politics, and the complex web of rivalries, obligations, and conflicts that implies. In a persistent online world, players build not only skills but also reputations. Veteran characters have status by virtue of sheer strength and experience. But beyond that, long-time players have built reputations and connections—bonds of cooperation and friendship keep them rooted in the environment long after they have mastered the intricacies of game play.

From Industry to Military

On the most basic level, the computer game industry should prompt a military evaluation of the communications structure around defense simulation. How is information shared? After a group of soldiers has fought a virtual tank battle, what sort of media (for example, screen-captured video or logs) exists to document that experience? Are they given on-demand access to that media, and are

they able to maintain it as a group forum? Does the status of that unit rise or fall in relation to other units, based on performance in virtual combat? If so, how is that status represented, and does the competitive pool consist only of soldiers at a particular facility at a particular time, or every unit that has ever logged on to the simulator? Run a group of soldiers through a simulator, measure their progress, and the process is called *training*. But pit them against units across the corps, and the process becomes personal.

How easy is it to modify scenarios in strategic or tactical simulations? Is it possible for those modifications to be exchanged between officers on a network, replayed in parallel, and discussed? What sorts of shared online forums exist to disseminate best practices and new ideas in real time. If they exist, do people use them? And if not, why?

Concentrating on the technical aspects of simulation is easy: how faithfully the terrain is reproduced, the modeling of weapons, the resolution, the frame rate, and the physics. These are merely engineering challenges, and they are explicit: processing power, bandwidth, memory. Even more sophisticated processes such as supply chain simulation, statistical casualty projections, and the parameters that define enemy decisionmaking are self-contained design decisions—they are easy to control, and the effects of changing them are measurable. It is easy to demonstrate progress, and therefore to justify one's budget, by addressing these challenges.

But the more acute challenges are not so explicit. How does a large, hierarchical organization adapt rapidly to face changing conditions? How does it leverage technology to make itself smarter and more effective? These are not straightforward engineering challenges. They require hardware and software infrastructure. But they also require cultural infrastructure to leverage those resources. The difference between a population that can effectively coordinate on a network and one that cannot is cultural. The lesson of computer games, for the military simulation and wargaming community, is that this cultural infrastructure is integral to the rapid technological evolution of multiplayer virtual environments and that it can be implemented by design. People in the computer game industry get paid to build these dynamics into commercial products and to integrate player-driven processes into the core technology. It is a functional requirement in a brutally competitive market whose customers are online, everywhere, all the time.

Game industry customers may be the future officers and enlisted recruits of the military. The current generation grew up playing online. The social ecology of computer gaming is what they have grown to expect from networked simulations and multiplayer virtual environments. This ecology drives them as gamers and as learners. The question is whether the military will harness those dynamics to transform itself, or whether this generation of soldiers will transform the military, over a longer of period of time, despite itself.

A View from the Military

by Michael R. Macedonia

J.C. Herz provides insight into how computer games are changing our culture and influencing technological development. Consequently, commercial simulations are having a major impact on military training. For over two decades, the military has demonstrated interest in commercial games, beginning with the introduction of Mech War by Jim Dunnigan in the late 1970s to the Army War College.

However, several factors have raised the importance and visibility of game technology and content to the Department of Defense (DOD) community. First, simulation technology is now a major strategic capability for the United States, and no other country has invested in this capability as much as we have. For example, wargaming and simulation are part of the curriculum of every U.S. war college and the operations of every command headquarters.

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Moreover, modeling and simulation are considered essential to transformation, the remaking of the Armed Forces for the new realities of the 21st century. These tools present a powerful way for military leadership to visualize the future and assess the needs for the new forces. The U.S. military is also exploiting commercial simulation to revolutionize training and education—with dramatic effect.

Technology

The Web and commercial entertainment technology offer innovative and relevant methods for enabling students and staffs to learn their jobs and fight together as teams in complex virtual environments. *Relevant* denotes taking advantage of the powerful graphics and multimedia that young soldiers and officers have grown up with and understand. As a public institution, the military cannot ignore the fact that 73 percent of American teenagers are surfing the Web each week. This activity is made possible by the presence of personal computers and the Internet in virtually every school in the United States and in many households.

Personal computers have the same capabilities as supercomputers had less than a decade ago. Furthermore, 70 million game consoles in the United States have transformed the expectations of the generation coming of age in the military in this century. Game consoles are no longer mere toys and far surpass the capability of 1980s minicomputers, such as Digital Equipment Corporation VAXes still used in many military simulation facilities. The performance numbers of the latest game machines, for instance, the Microsoft X-Box, provide proof that we are in an era of ubiquitous supercomputers. According to Microsoft, X-Box performance is an order of magnitude greater than the Sony Playstation 2 to 146 gigaflops. This performance is achieved by huge investments by such firms as IBM, Sony, and Microsoft. Microsoft has spent over $2 billion in the development of the X-Box, far surpassing the Army's annual $1.6 billion

science and technology budget. Hence, DOD has sought to leverage these capabilities and investments in its simulations.

In this environment, the military has readily adopted a number of commercial simulations for its school curriculums and unit training. These simulations are used for a variety of purposes, such as understanding political strategy, exploring unit tactics, and learning command and control (C^2) concepts. Moreover, several of the services are investing in research to add new capabilities to these simulations—albeit on commercial platforms such as the Sony Playstation II—to provide more realism and explore new methods of pedagogy.

Strategy and Tactics Games

Strategy and tactics games have been particularly popular with the service colleges. For example, instructors at the Naval War College use the commercial fleet tactics game, Jane's Fleet Command. Sonalysts, a defense contractor that exploited its expertise in naval tactics and technology by developing commercial games distributed by Electronic Arts, developed Fleet Command. According to Sonalysts, the Royal Navy has asked for a license to modify the game for operational planning. Sonalysts has recently released the multiplayer game Sub Command, which lets users command 688(I), Seawolf, or Akula submarines in extended campaigns. This includes the planning for Tomahawk cruise missile operations.

The Army has also adopted commercial strategy games for its officer and noncommissioned officer training. The Armor Center at Fort Knox has licensed TACOPS, a commercial clone of Janus (a noncommercial military simulation), for company and battalion wargaming. The Army Command and General Staff college uses a turn-based strategy game called Decisive Action, originally developed by one of its instructors, James Lunsford, for a corps-level operations course. In a twist, Lunsford commercialized the game and is distributing it through HPS Simulations.

DOD has also begun to use some commercial games for developing individual and collective skills

The use of these types of games has become so widespread that for the past several years, the Air University has sponsored an annual conference that brings together the military and commercial wargaming community for both technical interchange and concept exploration.[12]

Skill and Team Building

In the last two decades, DOD has also begun to use some commercial games for developing individual and collective skills. Though the Army had used some arcade games as skill-enhancers in the early 1980s, they generally were not part of a specific training regime. For example, the Army briefly experimented with the Atari tank battle game Battlezone, which introduced the idea of the first-person shooter, on the theory that it would enhance eye-hand coordination of armor crews. The Army modified Battlezone, a futuristic tank battle game, to have gunner controls similar to a Bradley Infantry Fighting Vehicle. Probably the first 3–D video game to be used for collective training was Marine Doom. This was accomplished by editing the commercial version of Doom to create an environment akin to an urban combat scenario. Nonplayer characters (the AI bad guys) were transformed from monsters to opposing forces. Marine Doom was a project of the Marine Corps Modeling and Simulation Management Office, which adapted the game Doom II in 1996 for training four-man fire teams. These games ostensibly taught concepts such as mutual fire team support, protection of the automatic rifleman, proper sequencing of an attack, ammunition discipline, and succession of command.

Though much hype surrounded these efforts, their primary impact was in stimulating the development of noncommercial military training simulations such as SIMNET, the first networked armor combat simulation (as was the case of Battlezone), or in heightening interest in commercial games by the military. For example, the program manager for Soldier Systems commissioned game company Novalogic to modify its popular Delta Force 2 to include features found in the Army's Land Warrior system to familiarize soldiers with the system. Land Warrior is a complex, integrated system that includes a self-contained computer and radio system; a global positioning system receiver; a helmet-mounted LCD display; and a modular weapons system that adds thermal and video sights and laser ranging to the standard M4 carbine or M16A2 rifle. The Army is evaluating how this realistic game can improve soldier performance with the system.

Recently, Ubi Soft Entertainment has agreed to allow LB&B Associates, Inc., to adopt the game engine used in the best-selling Red Storm game, Tom Clancy's Rainbow Six Rogue Spear, to help train U.S. soldiers. The company says the game engine will enable DOD to train military personnel in how to conduct military operations in urban terrain. *USA Today* reported that Ubi Soft claims that the U.S. military is using the game to train against terrorists.[13]

Perhaps the most successful use of commercial games for training has been with Microsoft Flight Simulator. The Navy issues a customized version of the software to all student pilots and undergraduates enrolled in Naval Reserve Officer Training Courses at 65 colleges. The office of the Chief of Naval Education and Training has also installed Flight Simulator at the Naval Air Station in Corpus Christi, Texas, and plans to install it at two other bases in Florida.

An extensive Navy study on the training value of Flight Simulator found that students who use microsimulation products during early flight training tend to have higher scores than students who do not use the software. In fact, 54 percent more of these students received above-average flight scores. This revelation also came after the realization that most Navy flight training students were using Flight Simulator at home.

New Research

These experiences have encouraged research efforts by the services to explore the use of commercial entertainment technology and content for training and education. In 1999, under the direction of Michael Andrews, the Deputy Assistant Secretary for Research and Technology, the Army established the Institute for Creative Technology (ICT) at the University of Southern California.

The focus of ICT is to develop the art and technology for synthetic experiences that are so compelling that participants will react as if they are real. Participants will be fully immersed physically, intellectually, and emotionally in situations. They will be capable of full three-dimensional mobility. Their behavior will be propelled through engrossing stories stocked with engaging characters who may be either automated or manned. The high quality of the automated characters will make it impossible to distinguish them from manned characters. The goal is to produce a revolution in how the military trains and rehearses for upcoming missions. It could provide a quantum leap in helping the Army prepare for the world, soldier, organization, weaponry, and mission of the future. For example, ICT is exploring the development of synthespians (synthetic actors) and intelligent tutors: simulations that represent smart opponents, allies, friends, and even robots in the future.

ICT is working closely with the game community to develop two games for the Microsoft X-Box that will incorporate some of these concepts. C–FORCE will be an X-Box title by Sony Imageworks/Pandemic Studios. The story line puts an infantry squad leader in a hostile urban environment. His squad's survival depends on his quick decisions and careful tactics. Combat Systems XII will be a PC title by Quicksilver Software. Focused on company command, the game will emphasize strategy, communication, and careful resource management, which can mean the difference between success and disaster for the company.

Future

The military is undergoing a major cultural shift in its approach to simulation. The use of entertainment technology is not a new phenomenon in the military. Ironically, computer games owe much to the military and the developer of the first pilot training simulator, Edwin Link. Link initially sold the trainer to amusement parks while he awaited contracts with the Navy. During World War II, the Link Trainer proved the training value of flight simulation and convinced the U.S. Navy to ask the Massachusetts Institute of Technology to develop a computer that eventually would drive the development of the first computer graphics technology.

What is different today is the emergence of a culture that accepts computer games as powerful tools for learning, socialization, and training.

Notes

[1] Doom was a milestone in the history of software distribution—the first level was released as shareware, uploaded to the University of Wisconsin server on December 10, 1993. Crumbling under the network traffic bearing down on its ftp site, the system crashed twice. But Doom spread like wildfire—and generated millions of dollars for Id when gamers purchased the full version.

[2] This is a conservative estimate: Ultima Online was launched in 1997, and its average monthly usage is 85 hours (yes, that is *average*). If you define "hardcore" as the most dedicated 1 percent of the massively multiplayer online game population, which exceeds 400,000, that's over 16 million man-hours logged by hardcore players since UO launched.

[3] A history of first-person shooters can be found at <www.netgamingnow.com/features/bhofps1.asp>.

[4] For further discussion on the development of 3–D game engines as licensable assets, see J.C. Herz, "For Game Makers, There's Gold in the Code," *New York Times,* December 2, 1999. Archived at <http://www.nytimes.com/library/tech/99/12/circuits/articles/02game.html>.

[5] While most of these sites are labors of love, a few are profitable. The guy who runs "Mall of the Sims" (www.mallofthesims.com) is self-sufficient on ad revenue.

[6] For further discussion of The Sims, see "Learning from the Sims," *Industry Standard,* May 26, 2001, <http://www.thestandard.com/article/0,1902,22848,00.html>.

[7] In some cases, game skins become cult phenomena unto themselves. Witness the Half-Life Hockey League <http://www.planethalflife.com/hockey/>, a labor of love by one very dedicated aficionado, who has modeled the entire National Hockey League (current stars and past legends) as a roster of Half-Life characters. Not only can you replace Half-Life's generic soldier character with Mario Lemieux, but it is also possible to recast a multiplayer death match as an Eastern Conference face-off between the Boston Bruins and the New York Rangers. (Picture Mark Messier and Ken Belanger, running down the halls with automatic weapons, out for blood—it was only a matter of time.)

[8] Clan monikers tend toward the flamboyant: The Enterprise Wrecking Crew, The Dangerous Armed Warfare Guild, Pimps With Grenades, Desert Storm Troopers (from Romania), Belgian Armed and Dangerous, TNT Gamer Clan from the People's Republic of China, and the Army of 12 Monkeys (ranked #1 on the Bosnia-Herzegovina CounterStrike tournament ladder).

[9] <http://directory.google.com/Top/Games/Video_Games/Genres/Strategy/Clans_and_Guilds/>.

[10] Gamers actually spend more time with pre- and post-game banter in the chat lobby than playing the game itself, and Battle.net's messaging system is designed to foster many levels and varieties of group communication. In addition to loitering in the public chat lobby, players can cluster in private communication channels. Each player can also designate up to 25 Battle.net members as "friends" and keep track of whether they are logged onto the system. If players designate each other as friends, the system gives them a higher level of information about each other's whereabouts and activities.

[11] Not surprisingly, players are highly invested in the characters they have built up. On a purely pragmatic level, those virtual personas represent hundreds of hours of invested time (which is why high-level Everquest characters sell for thousands of dollars on eBay).

[12] <http://www.cadre.maxwell.af.mil/wgweb/wgn/connections/default.htm>.

[13] Mark Saltzman, "Army Enlists Simulation to Help Tackle Terrorists," *USA Today,* October 2, 2001.

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