Wargaming Development Series
Developing Impactful Wargame Narratives through Storytelling

Stephen M. Gordon; Colonel Walt Yates (Ret), USMC; and Andrew Gordon

Abstract: Nothing connects people more powerfully than well-told stories. Humans have been telling each other stories since long before they could write them down. Sharing stories is a critical part of building trust with others, and that trust is essential to creating meaningful connections with people. Great stories have structure and purpose; they appeal to our deepest emotions and are most compelling when they challenge or change our perceptions of reality. There are rules to the methods and techniques that create great stories. This article explores the benefits and challenges of applying successful storytelling techniques to designing wargame narratives that balance creative ambitions with achievable timelines. Wargames that incorporate such techniques will surface new trends and better inform future conflict planning.

Keywords: wargaming, storytelling, brain-trust, creative, military, transformation

> Storytelling is a team sport that requires extraordinary people.
> Storytelling is like trying to climb a mountain with a whole

Col Walt Yates retired in 2018 from 27 years on active duty. He is a consultant for companies developing M&S technology for military applications. He has a BS in mechanical engineering technology from Texas A&M University and an MS in modeling, virtual environments, and simulation from Naval Postgraduate School. Stephen M. Gordon is a software industry innovator, creating global services practices and software businesses at Microsoft, Salesforce, Red Hat, and IBM focused on defense and commercial sectors. He holds a history degree from the University of Arizona, an executive MBA from MIT, and is a fellow at the Institute for the Study of War. Andrew Gordon spent 20 years at Pixar animation studios as an animator, directing animator, supervising animator, and director of promotional content on films like *Toy Story 2* and *3*, *Monsters, Inc.* and *Monsters University*, *Finding Nemo* and *Finding Dory*, *Cars*, *WALL-E*, *Incredibles 1* and *2*, and *Ratatouille*. He left in 2017 to act as codirector on *Minions 2: The Rise of Gru* and is now in London as the head of character animation for DNEG. He is a a Visual Effects Society Winner for *Finding Nemo*.

party of people, with a lot of stuff to bring up the mountain—one person can't do it alone.

~ Steve Jobs[1]

Introduction

Great stories take people through a transformation, a journey that is memorable, personal, and impactful. All great military transformations have had stories to shape and explain them. The adoption of the railroad in the nineteenth century, of tanks and airplanes in the early twentieth century, of nuclear weapons in the 1950s, and of information and cyber capabilities more recently were all built on persuasive stories about how each could change warfare. Those stories in turn permeated the wargames and experiments that tested, validated, and refined the transformations. The common definition for wargaming is outlined in the 2013 *Joint Planning*, Joint Publication (JP) 5-0: "Wargames are representations of conflict or competition in a synthetic environment, in which people make decisions and respond to the consequences of those decisions."[2] Wargames help commanders examine warfighting concepts, train and educate military leadership and analysts, explore various conflict scenarios, and assess options for future force planning and posture choices. Wargame narratives, worlds, and characters using techniques adapted from successful storytelling will open up a range of new thoughts and ideas as these stories unfold.

Great stories can live on forever but technologies have limited life spans, periods after which they simply become parts of the sediment layer on which other new things are built. A well-told story can live for thousands of years, inspiring new thoughts, creative interpretations, and fresh perspectives—fuel for new stories to take shape. There is a long history of technology's presence in storytelling, fused in hybrid science fiction and fictional narratives, inspiring innovation and invention that travels from the written page or screen to real-world use. Arthur C. Clark's *2001: A Space Odyssey* and Phillip K. Dick's *The Minority Report* and *Do Androids Dream of Electric Sheep?* (retitled *Blade Runner*) have influenced future applications for artificial intelligence, video game design, voice-activated assistants, vehicle heads-up displays, virtual reality, gesture recognition, and computer vision.

Storytelling and Wargaming

The U.S. Army Training and Doctrine Command (TRADOC) Mad Scientist Science Fiction Writing Contest, launched in 2016, embraces storytelling techniques as a pathway to fuse science fiction writing with reality, contributing to ideas and expanding the Army's thinking about future challenges in conflict. For warfighters, these stories challenge conventional thinking and help

illustrate a grounded projection into the future by crowdsourcing new ideas that help the Army envision potential scenarios in a future operational environment. Through a range of storytelling examples, the narratives developed through the Mad Scientist writing contests and initiatives blur the line between fiction and science fiction to imagine a not-so-distant future world of conflict, the characters that inhabit these worlds, the technological advancements not previously considered, yet possible, and how things could potentially play out. These stories are set within worlds that explore future conflict in multidomain operations (MDO), including space, cyber, sea, land, electronic warfare, and emerging threats of all sizes and shapes—all of which are important topics for Army leadership.[3]

Whatever their form, wargames provide command, staff, defense, and national security experts with a synthetic environment to experiment with future conflict concepts. Whether for education, training, operational planning, force design, future force investments, or answering pure research problems, wargames engage participants to think through all the complexities of bringing their imagination into a useful reality. To make the creative process work by gaining insights from outside-the-box thinking, there needs to be a framework in place—a playbook that, when followed, can draw out important trends and reveal new insights. Training and preparing for an outdated adversary risks missing the "high concept," the main premise and focus of the exercise, the big idea. The *high concept* is a term borrowed from the film industry that describes a story with a unique and concise premise, usually told in three sentences or less. This is not exclusively a military or national security dilemma. A high concept story has three key elements: it is easily explained, it is intriguing, and it is event driven. The "big idea" is another phrase adapted from film and story development, representing the central point and big picture concept that the reader should walk away with. In a wargaming narrative, for instance, the big ideas are the lessons, core concepts, principles, themes, and theories that the wargame will explore.

Innovation Is Essential

Corporations face similar challenges competing in a modern economy. A corporation's ability to digitally transform its organization, out-innovate its competition, and constantly accelerate its decision making are major determiners of success. The greatest responsibility of the chief executive officer (CEO) of a large organization is to recognize when a major change in direction becomes necessary. No bold new course of action can happen without the CEO giving the green light, yet their power and privilege leaves them insulated—perhaps more than anyone else in the organization—from information and ideas that might challenge their assumptions and allow them to perceive a looming threat

or opportunity. Deliberately seeking out environments where they are more likely to encounter new ideas, for instance spending time understanding problems faced in other industries or countries, opens up a range of potential new concepts for consideration. Watching the way an animated feature at Pixar is created, for instance—from the original idea through the ups and downs of crafting a story, types of tools and technologies used, how to improve the story, resolve conflict, create memorable characters—many of these processes have incredible value transferable to any industry. Stephen M. Gordon believes that, while leaders may not formulate brilliant ideas on command, they can increase the chances that flashes of insight that will occur by understanding the conditions that give rise to transformation by pursuing those concepts further. As Amazon CEO Jeff Bezos said, "One of the only ways to get out of a tight box is to invent your way out."[4]

The Marine Corps has recognized that transforming the way it fights requires transforming the way it wargames. Its commitment to transformation means ensuring modern wargames provide greater analytical support, better prepare for future force design scenarios, and enhance ongoing training and learning through immersive experiences. General David H. Berger, 38th Commandant of the Marine Corps, highlighted in the *2019 Commandant's Planning Guidance* the need for enhanced wargaming as "essential to charting our course in an era of strategic fluidity and rapid change."[5] But a wargame is only as good as its scenario, and a scenario is a story. That story sets the context and the challenge and shapes the flow of events throughout the wargame. It powerfully shapes the lessons the game yields. Improved wargames will produce new ways of problem solving by creating stories that are progressively complex, thereby accelerating the transformation of the Marine Corps vision and ideally setting new standards across the rest of the American national security establishment.

Like an effective wargame premise, a well-told story and hook must inspire participants to engage and think. The story engine powers the narrative, setting up an emotional hook that grabs the audience's attention. The hook introduces something shocking or unexpected into the story and typically has distinct sets of stakes: internal, external, and philosophical.

Development of Wargaming Stories

A survey of literature on the conduct of wargames provides support for an increased emphasis on the development of a story. The *Art of Wargaming* by Peter Perla is a foundational book on the subject that identifies seven elements of a wargame, one of which is the scenario.[6] The scenario encompasses the story narrative leading up to the commencement of the wargame and explains how the friendly and enemy forces are arrayed. *The Art of Wargaming* says the following about the role that a well-developed scenario plays in a wargame:

> The scenario sets the stage for the game by placing players in specific situations and giving them a context for their decision making. The scenario can have a significant, if not overwhelming, effect on the decisions players are able to make.[7]

The *Craft of Wargaming* by Jeff Appleget, Robert Burkes, and Fred Cameron published in 2020 also emphasizes the importance of the scenario and terms it as "the most critical element of the measurement space."[8] Appleget breaks the wargame creation process into five distinct phases: initiate, design, develop, conduct, and analyze. He also uses examples to demonstrate how the analytical wargaming framework can be used to create relevant and useful wargames. The authors caution that "a scenario that is not compelling to the players almost always dooms the wargame to failure."[9]

One of the most widely discussed wargames in the public sphere was Millennium Challenge 2002, a wargame conducted by United States Joint Forces Command (USJFCOM), because of its unusually public and contentious outcome.[10] Millennium Challenge was to serve as a validation exercise for Operation Iraqi Freedom that was executed a year later. Millennium Challenge became famous, or infamous, because of the public statements by the Red Force commander, retired Lieutenant General Paul K. Van Riper, which were critical of the USJFCOM after the wargame. The events of Millennium Challenge from Van Riper's perspective are covered in a chapter of Malcolm Gladwell's best-selling book, *Blink*.[11]

Just as the wargame was getting started, Van Riper launched preemptory attack on the assembling invasion force in the Persian Gulf that achieved both surprise and catastrophic damage to the fleet according to the simulations used to adjudicate the weapons effects for the wargame. His account of the decision-making process in playing the role of Saddam Hussein shows clearly that he achieved surprise at the operational level because he had a deeper appreciation for Saddam Hussein's situation and potential risk than did his adversaries on the U.S. Central Command (CENTCOM) staff. By studying recent history, personality profiles of Saddam Hussein, and the intentions of his adversaries as revealed by their actions, Van Riper had a far better appreciation of the risks and consequences facing Saddam Hussein than did his opponents. He constructed the compelling narrative himself and used it to guide his strategy. The CENTCOM staff was shocked because their narrative, or the absence of a narrative, blinded them to the possibility of a massive preemptory attack against them.

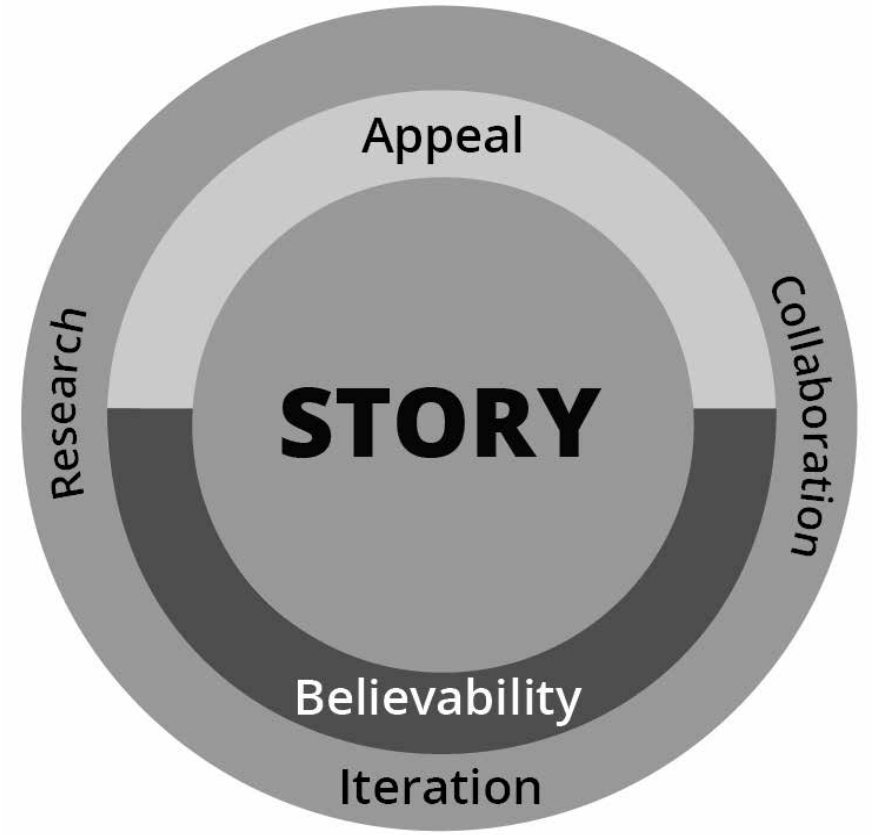
Wargames attempt to solve complex problems by encouraging participants to strive for originality and collaborate and communicate outside their organizational chain of command without fear of failure or apprehension to offer breakthrough concepts. Giving candid feedback, not confusing the process

with the goal, and preparing for the unknown are a few of the seven core creative principles that built the foundation of a creative culture at Pixar, which has produced consistent results, more than 30 academy awards, industry standard software innovation, creative design and cinematic achievement, and a standard by which the art of storytelling is measured.[12] Each of the seven core principles have value in creating, designing, delivering, and analyzing the outcome(s) of a wargame as it strives for originality, fosters problem solving, and pushes wargaming participants to reach new heights. By studying each of these principles, the defense community can better prepare to design concepts with a blueprint that is designed to produce new insights, examines unknown and new pacing threats, and encourages a creative process throughout the entire wargaming process.

As future digital wargames become distributed, adding complexity, this will require out of the box thinking to adapt to a range of scenarios and unknown conditions. A paradigm shift for wargaming is needed to pivot to a more creative process driven by fundamental core principles. Examining the seven core principles in more detail, starting with "quality is the best business plan"—a mindset you must have before you decide what you are setting out to do. For a wargame activity this means do not settle for obvious and easy answers—push yourself to uncomfortable places and do not be afraid to reach for new ideas that may seem outside the lines, but keep iterating, "Failure isn't always a necessary evil"—the cost of preventing errors is often far greater than the cost of fixing them. Uncouple fear and failure; do not be afraid to make mistakes. In a wargame among peers and officers with a range of experience, it can be intimidating to offer new concepts for consideration, especially if there is pressure to keep moving the game narrative forward for the sake of time. This is the time and place to make mistakes: expand thinking and open up the conversation to input and critique. "People are more important than ideas": if you give a good idea to a mediocre team, they will screw it up. But give a mediocre idea to a great team, they will either fix it or come up with something better. That is why people matter.

As artificial intelligence (AI) continues to develop and aid in decision making, we still rely upon people for insights, experience, reasoning, and creative thinking that defies convention. Wargames should generate ideas that have practical and strategic value in a decision-making process, similar to the way an animated feature takes the audience on a journey; it opens your mind to think about what might unfold next. Prepare for the unknown—probably the most glaringly obvious of the core creative principles with application for wargaming. Unforeseen, random events happen. And when they do, this principle advises not to waste time playing the blame game. This guidance is as true in the design phase of a wargame as it is during game play, adjudication, and analysis. Being

Figure 1. Pixar's three main design principles—story, appeal, and believability



Source: courtesy of author, adapted by MCUP.

able to respond to unknown outcomes, adapt, overcome, and figure out ways of solving problems through creative processes will produce more valuable wargaming insights—during play and in any post-game analysis. Communication structures should never mirror organizational structure. A chain of command is essential but making sure that everything happens in the "right" order and through the "proper" channels may limit the valuable insights that a wargame could provide if this restriction were relaxed. This is more of a cultural organizational challenge than a process challenge. Finally, give good notes. Giving feedback adds value to the creative process and should include what is missing, what is not clear, what does not make sense. This is not an attack on an individual or group; rather, it challenges the thinking to become more refined, resulting in sharper concepts. Understanding the process that has made Disney/Pixar successful can also directly assist the Marine Corps in thinking about transformation. The Commandant's transformation vision for tighter integration of people, process, technology, and culture mirrors how Steve Jobs designed Pixar

to be a place of incredible creativity and technological innovation as well as an idea factory for new concepts that attracted and retained talent.[13]

The following pages examine more closely some of the characteristics that made Pixar one of the most successful story studios in the world and explore how the magic, art, and science of storytelling can be applied to wargame design and thinking about military transformation.

Pixar's Storytelling Philosophy

Pixar's story design philosophy emphasizes the story concept as the center of the design model.[14] During an informal lunch conversation with colleagues in 1994 at NeXT Computer, Inc, a company cofounded by Steve Jobs, Steve commented that "the most powerful person in the world is the storyteller. The storyteller sets the vision, values, and agenda of an entire generation that is to come."[15] That insight was profound and important at a studio producing *animated* movies, which are shaped so fundamentally by the effects that technologists can produce. Jobs was reminding Pixar's employees that the technological effects are secondary—the story is primary. The generalized lesson that humans matter most and machines are never the center remains important to the Marine Corps and to the military as it thinks about a technology-based transformation today.

Transformation also requires an openness to ideas and criticism that can be just as hard to sustain in a successful company as it is in the hierarchy of a military organization. Ed Catmull, cofounder of Pixar, made it a practice to give an address to new employees in which he would declare openly that he did not have all the answers. In a 2008 *Harvard Business Review* article, Catmull explained:

> I talk about the mistakes we've made and the lessons we've learned. My intent is to persuade them that we haven't gotten it all figured out and that we want everyone to question why we're doing something that doesn't seem to make sense to them. We do not want people to assume that because we are successful, everything we do is right.[16]

The physical environment in which imagination, storytelling, and the development of concrete outcomes occur is also important. In the early days of Pixar, the main campus was located inside a corporate park in Point Richmond, California, a small industrial town surrounded by giant Chevron oil refinery storage tanks, stacks, and large gas trucks winding their way around the narrow streets. As Andrew Gordon observed working at Pixar's Point Richmond office, the industrial setting inspired Pixar's story designers to work the environmental settings into a couple of Pixar's films and stories like *Cars* and *WALL-E*. Pixar's current location in Emeryville, California, is a modern, gated campus, yet it

retains an industrial loft design featuring large steel beams with hand-pounded rivets (Steve Jobs insisted on this detail) reminiscent of the industrial warehouse look of the area from the 1920s. Jobs designed the building's interior to be an extension of the creative process with an open and bright space, wide hallways with almost a garage-like feel, which employees refer to as "the atrium" with snack and coffee areas for conversations, and an amazing screening room where guest lectures and screenings are hosted. The main building is organized like parts of Manhattan, with sections called the Upper West Side and the Lower East Side. An annex building for overflow staff two blocks away, meanwhile, was appropriately named "Jersey," a subtle jab at how New Yorker's refer to New Jersey.[17]

The creative process happens anywhere and everywhere, enabling natural interactions and mingling among employees is an intentional part of the magic behind Pixar's story process. For more structured meetings, screening rooms in the building provide a connected, collaborative environment to review work in progress. These interactions facilitate feedback, help iterate the story development process, reimagine storyboards, and bring a tactile element to the creative process. For example, a designer may bring a swatch of fabric or a clay model for a tactile study of a character or story element before moving the process into digital form.

In a productive story design meeting, anyone can be completely candid, share their feedback on any topic, and give notes aimed at achieving a more impactful story. Pixar cofounder and President Ed Catmull argues that early versions of Pixar movies are usually bad; in Catmull's words, "early on, all of our movies suck."[18] Early versions of ideas and stories can be so discouraging that there is pressure to cut your losses if an idea is not proving itself quickly. At Pixar, Catmull offers some counterintuitive advice, to "protect your 'ugly babies'—your unsightly ideas. Think of how a movie starts out. It's a baby. It's like the fetus of a movie star; we all start out ugly. Every one of Pixar's stories starts out that way. A new thing is hard to define; it's not attractive, and it requires protection." Catmull adds,

> When I was a researcher at [Defense Advanced Research Projects Agency] DARPA, I had protection for what was ill-defined. Every new idea in any field needs protection. Pixar is set up to protect our director's ugly baby. Of course, you can't protect the baby forever. At some point, it has to grow up and change into something, because the beast is still there. That's a positive thing. Because sometimes the ugly baby would rather play in the sandbox forever.[19]

Collaboration, iteration, and continued refining of stories until they feel

right is a key part of the blueprint that has produced Pixar's repeated success. Iteration plays a big role in story development. From initial idea to finished product, an animated feature can take four years or more to produce. Pixar's success—more than 30 Academy Awards, Golden Globe Awards, Grammy Awards, and numerous nominations and industry recognition for sound editing, animation, short films, and others—are rooted in their dedication to great storytelling. This approach offers great value to the craft of wargame design.[20]

Wargames Can Reveal Unanticipated Risks

Wargames aim in part to reveal unanticipated risks. Former U.S. Secretary of Defense Donald H. Rumsfeld noted in 2002: "There are known *knowns*; the things we know we know. We also know there are *known unknowns*; that is to say we know there are things we do not know. But there are also *unknown unknowns*—the ones we don't know we don't know. It is the latter category that tend to be the difficult ones."[21] Wargames can help identify "unknown unknowns" if the stories on which they are based propel wargamers to explore new ideas.

Threats to warfighters that seem to come out of nowhere can be the most difficult to simulate. The worst disruptions happen when warfighters are blindsided by innovations and new threats that they never even imagined were possible. Identifying such unknown unknowns requires an expanded imagination outside of one's comfort zone. Joseph Campbell famously wrote, "where you stumble, there lies your treasure. The very cave you are afraid to enter turns out to be the source of what you are looking for. The damned thing in the cave that was so dreaded has become the center."[22] Both wargaming and storytelling must proceed from this basis.

Pixar's approach to telling stories in its movies is focused on engaging the audience. A scene in the movie *Up* captures this principle well.[23] The writing, acting, and gestures of a character struggling to build a tent convey the idea that his home life is poor, drawing empathy from the audience. Simply telling the audience flat-out that things are not so good at home would have elicited little or no emotion. Storytellers should want their audiences to pick up on nuances rather than handing them everything. This type of storytelling is the opposite of exposition, which simply feeds the audience exactly where the story is headed. It is much better to show and not tell in order to engage.

Pixar Director Andrew Stanton coined the concept "the unifying theory of 2 + 2." Storytellers should not simply tell the audience that the answer is four, but rather should give them two and two and let them work it out for themselves. Great storytelling is akin to solving a puzzle. With every step in the story progression, the audience should be trying to solve the puzzle before the

next scene occurs, anticipating where it is headed, and how the journey is going to unfold. The task of commanders and staffs in combat—or wargames—is similar.

As described earlier in this article, during the construction of a wargame, the problem-scoping phase details the problem as it is explained by the sponsor. The scoping exercise clarifies and confirms the wargame's intention and objectives. This important phase is where the central story is established, worlds are created, and characters who live in these worlds are populated. These elements set up the order of battle, articulate the known friendly forces and the adversary, set the underlying tensions, and establish an inciting incident that provokes the launch of the game. The result is a synthetic design with characters, plot, conflict, high points, and low points—the core elements of a story. This is commonly referred to in the wargaming community as "The Road to War" brief.[24] Walt Yates argues that, in most wargames, the Road to War brief does not receive adequate effort and emphasis.

The Narrative Development Process

The narrative development process for a wargame is very similar to the story design of an animated film at Pixar; it begins with a logline or controlling idea. The logline is a roughly 25-word statement that includes four major elements: the main character, the conflict, the way the character changes by overcoming something, and a hint of the character's world. Once the creators have the skeleton of a story and some art, the project transitions to "the pipeline," where technical experts figure out how to create the story on a computer. Every story project presents new technical challenges, which lead to new ideas, referred to as *plussing*, the process of iterating and building on ideas to make good ideas great.

Most good films go through at least one giant crisis—a moment where the film blows up. Rewrites are an essential part of trusting the process, and creators must have faith that changes to their work represent progress, not setbacks. During Andrew Gordon's 20 years at Pixar, the studio's overriding goal was to craft "diamonds." The whole company consisted of people who wanted to do the best work possible and make films they loved. The thought was: if the studio made films the creators liked, then audiences might like them as well. Pixar's president, Ed Catmull, defined the two guiding principles he thought would guide the company to success: "story is king" and "trust the process."[25] While these mottoes were inspirational, Catmull soon discovered they fell apart when put to the test. Catmull thought *Toy Story 2* would be an easy win for the studio if the creative team just remembered these guiding principles. Proving too rigid for a creative studio, while "trust the process" is still etched into the brick facade

of the Steve Jobs building at Pixar's Emeryville, California, campus, these two guiding principles have evolved into the seven core creative principles ever since *Toy Story 2* in 1999.

To provide a mechanism for feedback and problem-solving during the story process, Pixar created the "Brain Trust." The Brain Trust, later brought to Disney and called the "story trust," is a small group of people with a deep understanding of storytelling, convening to give candid notes to the director on the latest screening of a movie. Editors, heads of story, directors, screenwriters, color experts, sound engineers, and all other manner of talent are involved in Brain Trust meetings.

For the Brain Trust to function properly, four principles must be met:

- First, nobody can override the director. In a Brain Trust session, the director takes feedback but does not have to accept the notes provided in the meeting. These notes are suggestions that are openly discussed, but at the end of the day it is up to that director to understand the "spirit of the note."
- Second, the power structure must be removed from the room. Steve Jobs was not in Brain Trust meetings because, as one animator put it, "Steve's presence would take all the oxygen out of the room." The idea was to build a safe space where people could give and receive notes on the work without fear of saying something embarrassing and looking bad, offending someone, or being intimidated.
- Third, everyone must have a vested interest in one another's success.
- Fourth, everyone must give and receive honest notes. Brain Trust meetings have no authority to make changes but instead seek to get a director to address problems they cannot see.

A particular problematic component of a story may not become apparent until the very end of the project, perhaps when the film is a mere five months from release and an audience screening yields less-than-stellar results. An audience member might say, "I don't understand the main character." In the case of the film *Inside Out*, test audiences perceived the character Joy, a main character who personified her eponymous emotion, as being "snarky" in her interactions with the other inner thought voices (sadness, fear, disgust, and anger).[26] A few tweaks to the writing and delivery of Joy's lines improved the entire story; subsequent audiences connected to and rooted for her.

Places like Pixar work because they embrace collective knowledge and the understanding that they are always course correcting, always questioning. Once

a creator stops questioning or self-reflecting, their work is in trouble. Creators must maintain a student-like quality of always questioning and learning.

Character definition matters for military transformation and wargaming because it engages and harnesses the imagination and the intellectual and emotional engagement of the audience.

Human Behavioral Characteristics in Wargames

Human behavior has significant effects at the military unit and organizational level, according to Ben Connable and a team of Rand researchers studying behavioral factors influencing the will to fight.[27] In 1996, Microsoft published *Close Combat,* a video game that used a psychological morale model for each individual combatant, with behavioral characteristics including mental condition, stamina, and panic. These were the themes presented during Digital Transformation of Wargames, a digital event held by the Georgetown University Wargaming Society in partnership with the Institute for the Study of War.[28]

Dr. Barry Silverman's *NonKin Village,* developed at the University of Pennsylvania's School of Engineering and Applied Science, simulates cognitive conditions that do not deal with seizing and owning geographic space, or employment of weapons, or achieving objectives through armed conflict.[29] The name *NonKin* is derived from the concept of nonkinetic interactions between operating forces and the populace in an area of operations. The software simulates interactions across a socially dynamic environment to model battles over "the human terrain." The Human Terrain System was an experimental effort to embed academic and social scientists with Army and Marine Corps units to dramatically increase local sociocultural knowledge of the battlefield.[30] An objective in this simulation may be simply peaceful commerce or supporting a prosperous economy under the rule of law. The AI characters in this simulation care about social interactions such as observance of socials customs and gestures. For example, an AI character will react to a player raising a weapon toward them. These AI characters also have connections between one another, forming a social fabric that mirrors those seen in real communities. Changes to this social fabric can lead to other changes to the simulation environment. For example, a local tribal leader skimming money may cause the local population to become poorer, eventually to the point that members of the population fall victim to recruitment by a local jihadi network and take money to kill Americans.

These realistic human conditions provide great insights by pioneering authentic simulated human behavior—a core ingredient in powerful storytelling that is portable to wargames. It is even easier in the realm of military futurology than in Pixar's studios to become fascinated by technology and lose sight of the centrality of human conception and comprehension. Getting the technology right is not the hard part. The hard part is getting the ideas right. The details

of the Pixar process offer useful starting points for the process of generating wargaming scenarios, but the core lesson is more important than those starting points. In the realm of military transformation, getting the ideas right means getting the imagination right—that is where the storytelling approach helps most.

The technologies already exist to transform military wargaming. Digital technologies will continue to revolutionize wargames that push problem-solving beyond two-dimensional tabletop exercises. Automating manual tasks using artificial intelligence and machine learning algorithms makes it possible to sift through and analyze terabytes of documents, pictures, audio, and sensor array data to create correlations in seconds that would otherwise take weeks or months. Voice assistants will execute complex instructions using the current methods of communication between command staff and subordinate units. Technology supporting the wargame can and should be as transparent and naturally integrated as possible, not distracting participants from the core objectives of the exercise. These assistants can provide real-time, data-driven confidence scores showing the likelihood of success or failure for a planned maneuver or strategy and make suggestions or alternatives for consideration.

Software, hardware, and other devices originally developed for consumer gaming are already accelerating the digital transformation in military applications and simulations. The USS *Colorado* (SSN 788), the U.S. Navy's latest *Virginia*-class attack submarine, went into service in 2018 from the Naval Submarine Base New London in Connecticut. It comes with an unconventional piece of equipment: an Xbox controller, to raise, turn, and lower the submarine's photonic mast, according to *USA Today*.[31] The U.S. Army Synthetic Training Environment, together with the University of Southern California Institute for Creative Technologies, has developed One World Terrain (OWT).[32] OWT is an authoritative, geospecific representation of the planet for next-generation modeling and simulation that uses some of the same technology and interactive user experiences found in commercial simulation experiences like Microsoft's *Flight Simulator*.[33] The Army's Program Executive Office Soldier has developed an Integrated Visual Augmentation System that integrates next-generation 24/7 situational awareness tools, cloud services, and high-resolution simulations to deliver a single platform that improves soldier sensing, decision making, target acquisition, and target engagement based on Microsoft's commercially available ruggedized, augmented-reality lens.[34]

IBM, Red Hat, and the Overwatch League (an international e-sports league) developed a cloud-based platform where AI algorithms objectively rank teams and players across the league—providing performance statistics, handling more than 20 teams competing simultaneously from all over the world. In a wargaming context, these types of technologies are valuable in reinforcing learning

and competency concepts, distributed wargames that span time zones and an AI that provides dynamic confidence scores from decisions, maneuvers, and wargame tactics, potentially reducing the time for a wargame analysis after action report to a near real-time data stream.[35] These and many other commercial gaming tech design tools and solutions offer portability, rich visualizations, and sophisticated physics engines and can be readily repurposed for analytical wargame scenarios. Integrating commercial game titles into education and training scenarios adds value to classroom training, reinforcing learning concepts and encouraging collaboration through immersive gameplay of modern and historical battles. With modern software, a range of endpoints, from touch screens to augmented and virtual reality lenses integrated with business processes and a trusted story framework, wargame developers can develop past, present, and future worlds. There is boundless artistic freedom.

The data to feed these technologies is also more readily available than ever because the world is deep into the era of overwhelming data. Digitally enabled wargames can harness this data using AI to speed through content and find patterns, anomalies, and insights useful for human decision making. New wargames in digital form can be generated rapidly and streamed to participants with the ease of signing into a Netflix or Disney+ account. Data is the fuel that powers a digitally enabled wargame and as wargames grow in complexity into areas where there is limited data, the need for continued innovation in areas like edge computing, 5G (fifth generation broadband) unmanned sensors, video processing, immersive visualization tools, etc. will be important for representing conflict domains accurately. Edge computing and 5G are terms developed from the technology and telecommunication sectors that define new capabilities to push computing and connectivity beyond the datacenters, out to the tactical edge where decision making requires low-latency, intense graphics processing. For instance, operation in the high Arctic and the deep ocean present unique challenges to current simulation tools and models as there are limited data sets available. Synthetic representations of terrain and environments, augmented with actual telemetry from a range of sensors, both open source and sensitive, provide the data needed to run realistic wargames that attempt to replicate real-world conditions. The ocean, despite covering more than two-thirds of Earth's surface, remains largely unexplored. The deep ocean extends from 1,000 to 6,000 meters (20,000 feet) and constitutes most of the ocean's volume as well as the largest living space on Earth. For context, 12 people have spent a total of 300 hours exploring the surface of the moon, whereas only 3 people have spent less than 3 hours exploring the deepest spot in the ocean.[36]

As commerce, transport, food, economies, and conflict increase interaction with the ocean, more detailed models of the ocean from its surface to its lowest depths are needed to simulate conditions based on real, reliable data. New

unmanned sensors built from lightweight materials and longer battery life will soon reach every layer of the water column and collect and stream live terrain data, atmospheric conditions, and other details fed into a live wargame, freeing ocean modelers from the data constraints of legacy ocean sensing platforms, allowing wargame designers new data modules that can be added instantly or applied to a previously recorded wargame for new insights, where a decision maker may want to replay only the highlights of significant interest. Building story narratives that use scientifically accurate representations of the warfighting domains reduces risks and has value beyond the wargame.

Conclusion

Simply applying new tools and technologies to current wargaming procedures, without also adopting a storytelling mindset and approach that made those technologies effective in a commercial space, will not lead to improved value of wargaming products. Without participants investing in and understanding the structure of the story, its characters, and motivations, the outcome of a wargame likely will not yield desired results. Software and technological advances may generate an evolution in capability but not a revolution in the utility of future wargames; therein lies a great danger to American national security.

The United States can ensure that its armed forces are ready to defeat any adversary if U.S. leaders can imagine how that adversary might attack, defend, or otherwise seek to advance its interests at the expense of American security. But how can U.S. leaders and organizations avoid being surprised? How can they and their experts imagine ways in which America's potential adversaries might approach war now and in the future? How will military thinkers keep their imagination grounded enough in reality that they do not pour their research and development dollars into defending against fictional threats while still letting their minds roam freely enough to escape the trap of seeing only what they expect to see? Those are the challenges that all good storytellers must overcome. The storytelling process is the essential missing component to transforming the U.S. approach to wargaming and warfare. Drawing conclusions from the output and data collected during wargames is best achieved by improving story design.

Endnotes

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