Seeing through the Fog

Developing Fog of War Resistant Visualization

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Gary Klein, the decision-making expert, once did an interview with a fire department commander in Cleveland as part of a project to get professionals to talk about times when they had to make tough, split-second decisions. The story the fireman told was about a seemingly routine call he had taken years before when he was a lieutenant. A fire was in the back of a one-story house in a residential neighborhood, in the kitchen. The lieutenant and his men … "charged the line," dousing the flames in the kitchen with water. … The fire should have abated. But it didn't. … The firemen retreated. … Suddenly the lieutenant thought to himself, there is something wrong. He turned to his men. "Let's get out, now!" he said, and moments after they did, the floor on which they had been standing collapsed. The fire, it turned out, had been in the basement. "He didn't know why he had ordered everyone out," Klein remembers. He believed he had ESP (extrasensory perception). He was serious. He thought he had ESP, and he felt that because of that ESP, he'd been protected throughout his career.

—Malcolm Gladwell

A soldier assigned to the 3rd Battalion, 67th Armored Regiment, runs back to a Bradley Fighting Vehicle 16 June 2020 during exercise Allied Spirit at the Drawsko Pomorskie Training Area, Poland. (Photo by Spc. Erikah Schaible, U.S. Army)

For an extended version of this article, including annexes describing how to build Major Event Scenario Lists (MESLs), visit https://call2.army.mil/toc.aspx?document=17879 and download professional reading supplement (CAC access required).

In the above gripping account from Malcolm Gladwell's book, *Blink*, a leader recounts his experience with visualization in the uncertain and dangerous environment of a house fire. He and his firefighters were in real danger while gaining understanding of a rapidly unfolding situation. Gladwell goes on to describe Klein's analysis of the incident. The lieutenant did not have ESP, but one could understand why he might believe he did. This leader made a habit of keeping the ear flaps on his fire helmet up so he could hear the fire. This act enabled him to realize that the fire was both very hot and very quiet. These clues triggered both intuitive and cognitive conclusions in the lieutenant's mind that prompted him to order all his firefighters out of the house before they all fell through the collapsing floor. This leader was able to perform this vital visualization because of a combination of intuition and training that he had acquired over years of experience. Such visualization combines mental processes with physical senses assisting decision makers as they attempt to make sense of unfolding situations when lives may be at stake.

Although firefighting is a different discipline from combat leadership, both must quickly interpret unfolding situations, assign meaning to what is observed, and make the best choice in the limited time allowed. Thus, the introductory story illustrates an important notion, which is that visualization is important for military professionals and organizational leaders to cultivate both in themselves and in their subordinates, but that alone is not enough. Leaders must be able to perform visualization in the uncertain environment of combat. Put simply, their visualization must enable them to be able to see through what Carl von Clausewitz coined the "fog of war." Visualization may be influenced by stress, uncertainty, heightened stakes, and variations in operations tempo. Therefore, leaders engaged in improving visualization skills must find ways to introduce these stressors to visualization exercises to develop resilient visualization skills. It is the idea of developing resilient visualization that will serve as the focus of this article. As defined in previous articles in this series, "Visualization is both an individual and a collective process. Our ability to visualize has a direct correlation to the quality of our plans and helps us anticipate some of the possibly unexpected events and then take steps to minimize their effects."[1] But before we can discuss how to make visualization skills more resilient, it is important to discuss the nature of visualization as well as the thinking that underpins it.

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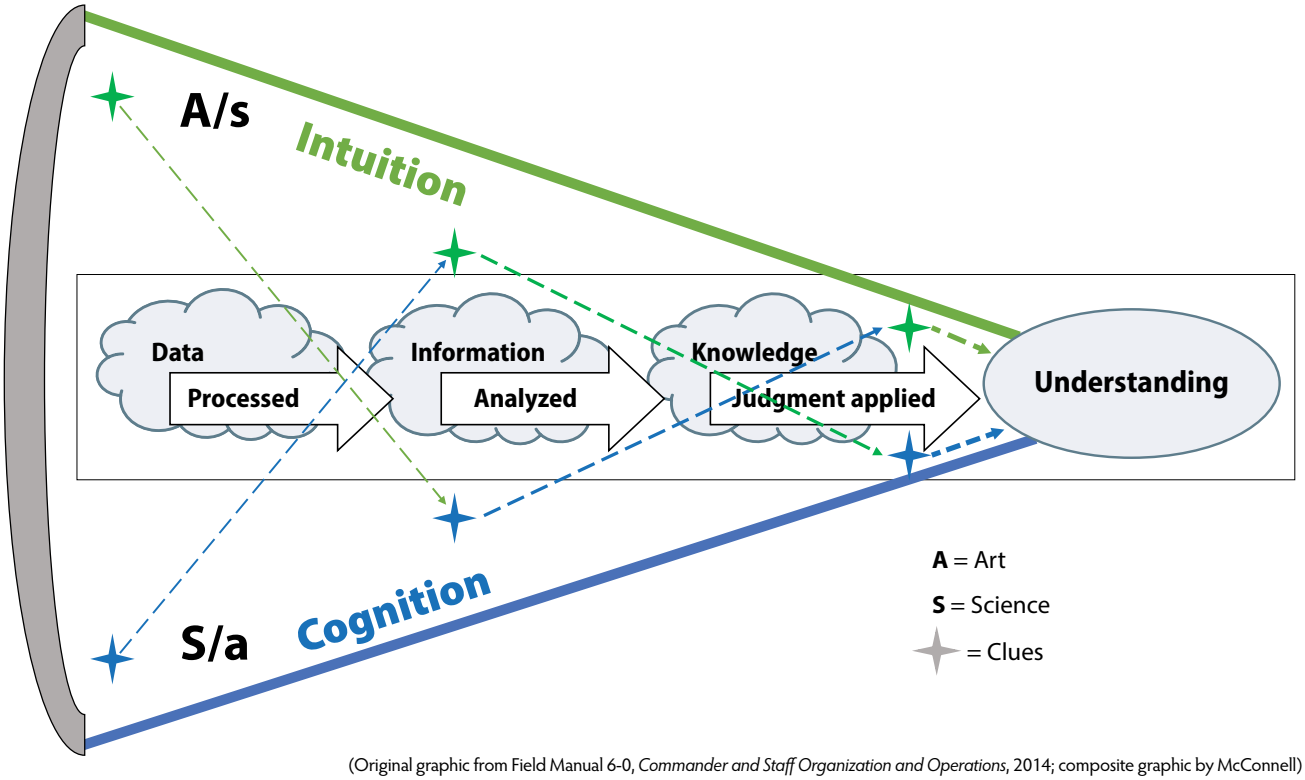


(Original graphic from Field Manual 6-0, *Commander and Staff Organization and Operations*, 2014; composite graphic by McConnell)

Figure 1. Intellectual Bracketing

Achieving Understanding through Cognition and Intuition

Some leaders who are good at visualization are not particularly good at explaining how they did it. What follows is a possible explanation.

Leaders use visualization to enable them to garner clues from the environment and predict what will happen next. This is more than just physically seeing; it is also the ability to interpret and apply meaning to what is seen. Figure 1 depicts a modified model from U.S. Army doctrine describing how leaders achieve understanding through an iterative process of determining meaning from clues in the environment until a decision can be made.[2] This model has been modified by the authors to describe the kind of thinking that supports effective visualization.

There is a kind of thinking described as intellectual bracketing, and the following is an example of how it works. Leaders achieve understanding by taking data and processing it into information, analyzing the information to turn it into knowledge, and then applying judgment to create understanding. This process usually starts with data points that serve as clues either in the intuition or cognition realms. These realms are expressions of a blend of art and science. Specifically, cognition uses more science than art, and intuition uses more art than science.

In the article's opening scenario, the fire lieutenant initially noticed the heat intensity of the fire as well as how quiet it was in the intuition realm (i.e., his experience told him something was wrong). It was not until Klein processed and analyzed this information using cognitive abilities that he was able to make sense of this data/information. Similarly, some leaders might start in the cognitive realm with a data point that might lead them to apply intuition and judgment to make sense of and support their visualization (measuring sound/temperature levels of the fire and comparing to historical trends). Leaders may differ on how they prefer to proceed when assigning meaning to the clues they find in the environment, but understanding how to combine intuition and cognition improves visualization by iteratively building understanding. Knowing how

this process works in establishing understanding and supporting visualization can help leaders create visualization exercises that will increase subordinate visualization skills through deliberate practice.

For example, intuition grows with time and experience. The fire lieutenant had several years of field experience that enabled him to interpret intuition clues. What if the people involved in visualization exercises do not have that kind of experience? Is there a way to use the above model to improve visualization through iterative experiences? We believe there is. Leaders using intellectual bracketing to deliberately educate their subordinates to improve their visualization can accelerate the rate at which subordinate leaders improve their visualization skills.

Since inexperienced leaders lack developed intuition skills, experienced leaders can help them polish their cognitive skills to lead them to clues that then can be interpreted through intuition. By using the model depicted in figure 1, leaders can understand the kind of thinking that underpins visualization and can therefore instill that kind of thinking in their subordinates. We will provide cases that illustrate this process through the following brief literature review. Following the literature review, we will make recommendations for techniques to instill resilient visualization in leaders who can be employed in stressful and uncertain environments such as combat. We will also provide a link to a Center for Army Lessons Learned site where further tools for creating resilient visualization may be located.

The Battle of Midway, 4 June 1942. A mere six months after the attack on Pearl Harbor, the United States and Japan were poised for one of the most significant naval battles of World War II.[3] Being able to visualize and predict/forecast opponent actions would become crucial in this battle. The Imperial Japanese Navy needed to destroy the American aircraft carriers if it hoped to win the war. By attacking Midway, the Japanese hoped to lure the American carriers into an ambush and destroy them. Visualization became key in identifying the Japanese code name for Midway.[4]

Joseph Rochefort oversaw the cryptologic section for the Pacific Fleet in Hawaii, and the fleet had intercepted a Japanese aircraft radio transmission in early 1942 referring to a location known as "AF." Rochefort was convinced that "AF" had to be Midway. Initially, Rochefort's intuition was the key reason he believed this, and he struggled to explain to his superiors how he knew this to be true. Adm. Chester Nimitz needed proof of this conclusion before he could reposition portions of the Pacific Fleet from the Coral Sea. The identity of the "AF" location became important because subsequent messages later in the spring of 1942 indicated an invasion of "AF." If Nimitz could determine the identity of "AF," he could set a trap for the Japanese fleet rather than fall victim to the apparent ambush the Japanese were setting for the U.S. Navy. Rochefort and his colleagues decided to have Midway send a false radio transmission indicating that its water purification equipment had malfunctioned. The cryptologic section was subsequently able to intercept a Japanese radio transmission indicating that "AF" was experiencing water shortages, confirming the identity of "AF" as Midway. Nimitz now had the confirmation of his opponents' intentions he needed to set his trap for the Japanese fleet.

This visualization process started with intuition but had to transition into cognition to entice the Japanese to confirm the identity of "AF" to prove the conclusions reached through intuition. The Battle of Midway is an example of the interplay between intuition and cognition in creating understanding so senior leaders can make decisions through affective visualization. This process can also be useful in accelerating the time needed to get inexperienced visualizers to gain confidence in their intuition in an accelerated time frame through deliberate practice. One of the challenges in this process is to help people who must visualize in situations of stress and uncertainty. It is one thing for Rochefort to visualize affectively while located at the headquarters in Hawaii. It is another thing for a fire lieutenant to visualize during a life-and-death struggle. That is where resilient visualization becomes important.

Resilient Visualization

> We all know resilient people. They inspire us. They seem to soar in spite of the hardship and trauma they face. In fact, the most resilient people seek out new and challenging experiences because they have learned that it is only through struggle, through pushing themselves to their limits, that they will expand their horizons. They are not danger seekers, yet they do not wither when confronted with risky or dangerous situations. Resilient people understand

that failures are not an endpoint. They do not feel shame when they do not succeed. Instead, resilient people are able to derive meaning from failure, and they use this knowledge to climb higher than they otherwise would.[5]

Resilience. For military leaders, the ability to bounce back from adversity and still perform at a high level is a vital trait for success in combat. If leaders are overwhelmed by adversity, their ability to think through multiple data points using cognition and intuition may be degraded. Therefore, senior leaders attempting to improve subordinate visualization skills must find ways to develop skills while incorporating stressors that will build resilient cognitive skills that support visualization. This source is relevant to the discussion of resilient visualization because it not only describes the fundamentals of resilience but also serves as the foundation for a discussion on improving fog of war resistant visualization. A key concept to improving visualization starts with situation awareness.

Lt. Cmdr. Joseph J. Rochefort, U.S. Navy, was a Japanese linguist and trained cryptanalyst who handpicked and led many of the key codebreakers at Pearl Harbor's Station Hypo. In 1985, Rochefort was posthumously awarded the Navy Distinguished Service Medal. (Photo from the U.S. Naval Historical Center via *A Glorious Page in Our History: The Battle of Midway*, Robert J. Cressman, 2001)

Forecasting. In their article "Creating the Environmentally Aware Organization," Gregory Dess, G. T. (Tom) Lumpkin, and Alan Eisner discuss "the role of scanning, monitoring, competitive intelligence, and forecasting" and their contribution to building awareness and ultimately understanding (i.e., visualization).[6] In other words, without situational awareness, leaders struggle to gain understanding of what is happening around them. This unawareness then affects their ability to anticipate the unexpected, a key activity in visualization. In scanning, organizational leaders become aware of emerging trends that may develop into precedents. Environmental monitoring occurs when organizational leaders attempt to further observe and analyze what they identify during environmental scanning to confirm or deny if anything consists of emerging threats or opportunities. Competitive intelligence is the part of building resilient visualization that begins to resemble anticipation as organizational leaders attempt to "avoid surprises by anticipating competitors' moves and decreasing response time."[7] Environmental forecasting, scanning, monitoring, and competitive intelligence provide vital inputs to enabling organizational leaders to predict what is coming next and make decisions to maximize the positive outcomes for their organizations. The Dess, Lumpkin, and Eisner article is relevant to the discussion of resilient visualization because it demonstrates some of the key

parts of visualization and also where senior leaders might focus their efforts in building subordinate resilient visualization. Among the most important skills supporting visualization is "forecasting," which is predicting future states that require a future orientation.

Future orientation. In his book *Farsighted*, Steven Johnson describes how leaders making decisions in complex situations must have the ability to look to the horizon and be future oriented.[8] Such skills are vital if a leader is to be able to gain understanding and make choices. Johnson acknowledges that with all the uncertainty in the world, the need for prediction is vital. He uses a common example of how "daydreaming" enables leaders to envision future events. He also points to the increase in media that produces less value in predictions. However, if decision-makers embrace a wide range of uncertainty, it may lead to better predictions. Decision-makers must be open to new experiences. This is relevant because military leaders are not generally open to new experiences when making decisions.

Johnson uses the example of the earliest efforts to predict the weather.[9] Over time, the measurements and understanding of weather phenomena became more accurate as technology increased the ability to predict future weather patterns. Johnson additionally uses examples of simulation, wargaming, kriegspiel, storytelling, "rehearsing uncertainty," and the use of premortem techniques (how will our plan die?) to increase the accuracy of predictions. These examples are relevant to resilient visualization because even though decision-makers will never be able to see into the future, with better predictive models and information, these kinds of examples should contribute to better decision outcomes. How helpful would such a future orientation have been for decision makers during the COVID-19 pandemic? Before leaders can instill resilient visualization into their subordinates, they must create the kinds of organizations where learning new things are encouraged.

Growth mindset. In her book *Mindset*, Carol Dweck describes the difference between fixed and growth mindsets.[10] Fixed mindset people believe they cannot grow their intelligence, that it is fixed (i.e., I am either smart or not and I cannot change that). Growth mindset people believe they can grow their intelligence with effort (i.e., if I work at it, I can get better at thinking and planning). Dweck then applies the fixed versus growth mindset to organizations, arguing that like people, organizations can have fixed or growth mindsets as expressions of their culture.[11] Organizational leaders temper this culture, but over time, fixed or growth mindset beliefs can take root either positively or negatively, affecting everything the organization does. If an individual is in an organization where he or she believes in genius leaders who come to the organization preformed and everyone else just supports the genius, that individual may be in a fixed-mindset organization. If an individual is in an organization that seeks input from all quarters, believes that anyone can potentially contribute good ideas, and expends effort to make everyone better at thinking and making recommendations, that individual may be in a growth-mindset organization. Dweck's work is relevant to the discussion of developing resilient visualization because organizational leaders who desire to improve visualization skills must endeavor to foster a growth-mindset organization to make those skills a reality. Such organizations may be able to access subordinate intrinsic motivations.

Intrinsic motivation. In his book *Drive*, Daniel Pink discusses the difference between extrinsic and intrinsic motivations and how these motivations are displayed in people.[12] Extrinsically motivated people respond to rewards and punishments (i.e., if they get enough pay, they will be happy regardless of the nature of the work). Intrinsically motivated people respond to their work through the lens of "autonomy, mastery and purpose."[13] In short, intrinsically motivated people like to direct themselves, want to get better at what they do, and want their work to be oriented toward a higher purpose. Pink's work is relevant to the discussion of resilient visualization because effective visualizers tend to be independent thinkers, are driven to get better at what they do, and usually are drawn to work that matters in pursuit of a higher purpose. Leaders who wish to improve resilient visualization skills must be willing to foster autonomy, mastery, and purpose in how their organizations approach problems so that resilient visualization skills can blossom. One way to encourage intrinsic motivation is to understand how to formulate meaningful problem statements. There is nothing more frustrating to an intrinsically motivated person than to engage in an apparent Sisyphean effort to solve an ambiguous problem.

Understanding the problem. In previous articles written by Command and General Staff College faculty members, problem statement formulation has been identified as a challenge for military professionals.[14]

Part of this confusion derives from the fact that Army doctrine is not explicit on how to form problem statements that would be meaningful during planning, execution, and assessment. In contrast to military planners, scholarly researchers focus first on the problem statement and then align everything that they discover through the research process with that problem. As a result, research can be meaningfully assessed on how well it addresses the problem. The inability to accurately identify a problem can undermine resilient visualization and make everything less clear. To address this problem, we have combined a military doctrinal model with concepts from academia that might be helpful. This is Army design methodology combined with John Creswell's work describing dependent, independent, and intervening variables.[15] Figure 2 (on page 65) depicts this model intended to assist planners in creating useful problems statements, which will enable visualization.

The design portion of this model is simply the comparison of the current state to the desired end state, determining obstacles between those two states, formulating a problem statement, and developing an operational approach. Where Creswell comes in is in the explanation of the variables that influence those states. The independent variable is the current state, but the desired end state is the dependent variable (DV). Our ability to achieve the desired state may be influenced by intervening variables (INTV). To mathematically express this would be problem statement = DV/INTVs. Therefore, a meaningful problem statement can be formulated as a question or an assertion depending on how the planners see fit. Army design methodology is usually seen as a conceptual planning approach for ill-structured problems. We assert that the design approach should be applied as a philosophy relevant to any kind of problem, whether ill-structured or otherwise. What follows is an example of a well-structured problem to illustrate this point.

As indicated in red in figure 2, if planners are trying to solve the problem of poor academic performance for a student, the current versus desired end state and intervening variables might be expressed in the following way. The student has poor grades (independent variable GPA <2.0), and improved grades are desired (dependent variable GPA >3.0). After observation, it is determined that the intervening variables include poor study habits, insufficient sleep, and poor diet (caffeinated/sugary drinks prior to bed). These intervening variables can then become lines of effort in an operational approach. Planners can even prioritize lines of effort to get quick wins by making diet the initial main effort. Such a protocol might presume that reduction in sugary drinks late at night might improve sleep, thus improving study habits.

This problem statement and operational approach can serve as an initial protocol for problem solution that can be adjusted during execution. For example, after attempts to adjust the diet of the student, perhaps planners do not obtain an initial quick win. Perhaps they modify that line of effort to also include exercise. In this way, a design mentality throughout planning regardless of level of complexity of the problem might serve as a way to improve visualization by initially assessing what is really going on in the environment right now, what it really needs to look like later, and what is preventing us from getting the outcomes we want. Such a philosophical approach will empower visualization and continual reframing of our view of the problem as necessary.

What is been discussed so far are portions of existing literature that discuss visualization and suggest avenues of inquiry to improve it. What follows are some suggestions on how to grow resilient visualization at an accelerated rate in the skill sets of inexperienced visualizers.

Creating Fog of War Resistant Visualization in Others

It has been argued in previous articles on visualization that it is not some kind of magical power but is a cognitive skill that can be improved through deliberate practice and multiple repetitions.[16] Additionally, some suggestions were proposed for instilling a red teaming mindset, for building Major Event Scenario Lists (MESLs), and to incorporate them in daily command-post battle rhythms.[17]

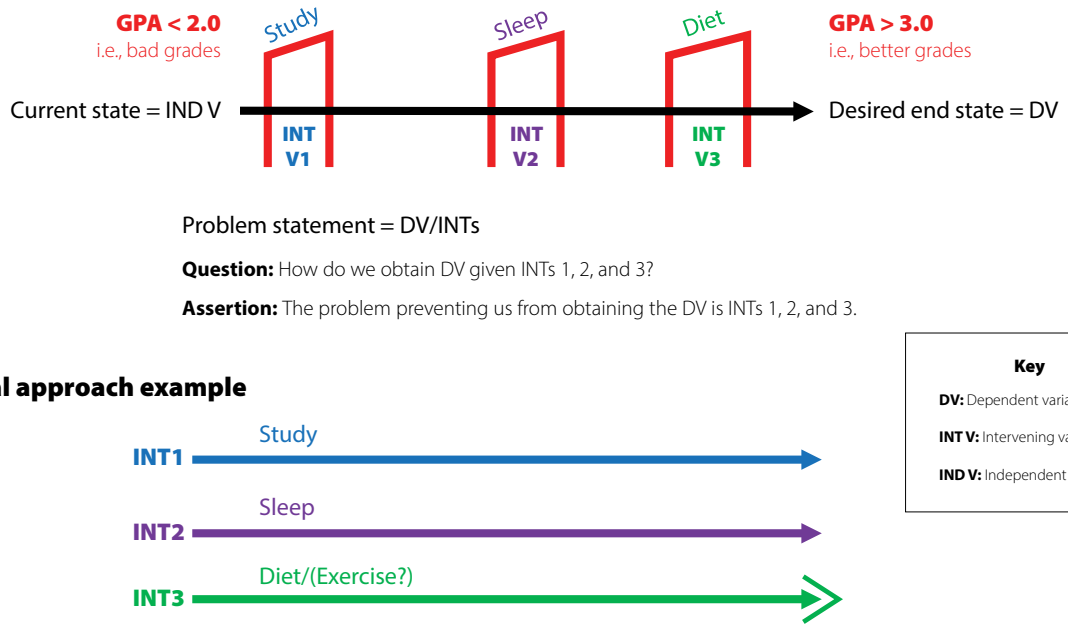
Although helpful, additional tools for improving visualization are still needed. What follows are some suggestions on how to build individual and organizational skills to support resilient visualization. A good place to start is how individuals deal with the stressful conditions of combat

Prebattle veterans, stress inoculation, and tactical breathing. In his book *On Combat,* Lt. Col. Dave Grossman wields the standard, "forewarned is forearmed."[18] Grossman proposes that today we have the tools to create what he has termed "pre-battle veterans," who are individuals with the survival skills

of a veteran warrior but without the tragic cost of real combat.[19] Stress inoculation assumes the form of two key influencers of optimal cognitive functioning: sleep deprivation and tactical breathing, which are indispensable aspects of Grossman's comprehensive training philosophy. Most military professionals are familiar with sleep deprivation, especially at the combat training centers. However, how deliberate are leaders at administering stress inoculation that goes beyond sleep deprivation to include tactical breathing and investigating its influence on cognitive function?

Breathing and blinking are the only two actions of the autonomic nervous systems that can be brought under conscious control at any time. When a person controls his or her breathing, he or she controls the whole autonomic nervous system. To accomplish control of the autonomic nervous system, Grossman recommends a modifiable four-count breathing rhythm: tactical breathing is a "breathe-in through the nose for four counts, hold for four counts, and exhale through the lips for four counts" exercise. The more soldiers practice the breathing technique, the quicker the effects kick in because the effects are the result of the powerful classical and operant conditioning mechanisms.[20]

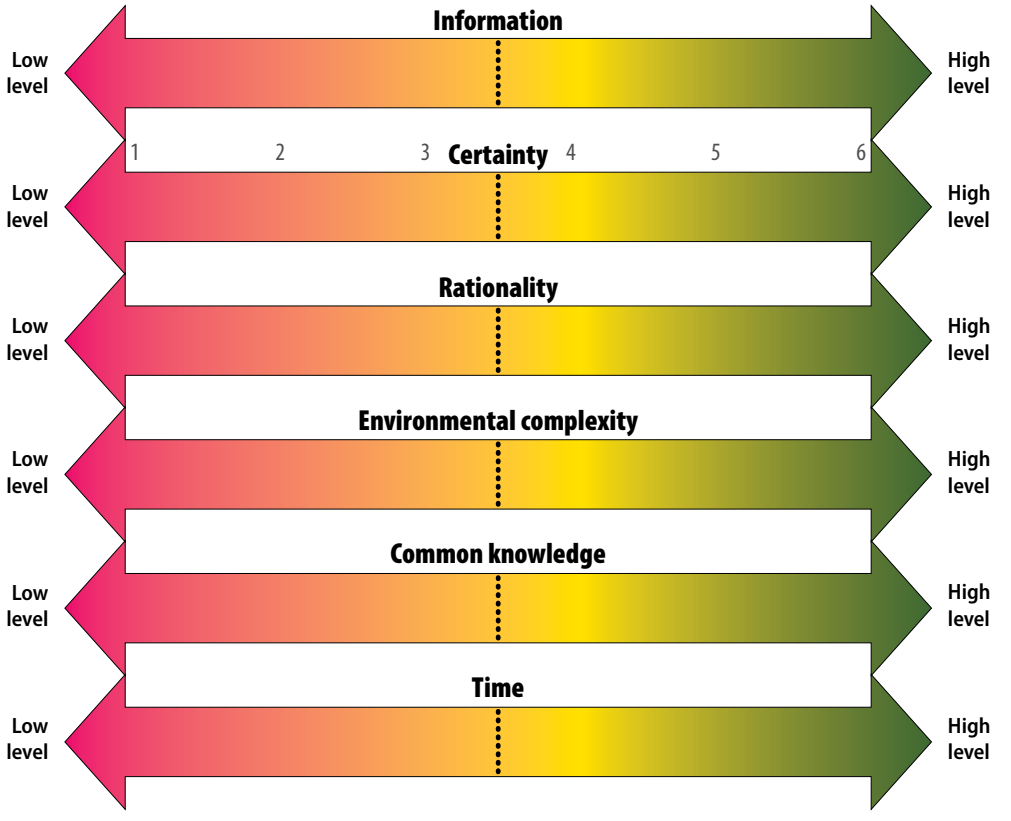
This source is relevant to the discussion of resilient visualization because maximum cognitive efficiency is required to bring data to understanding. For the unit commander designing opportunities to model visualization skill development, a twenty-four-hour training exercise or a dusk-to-dawn event increases stress on the participants. Employing tactical breathing during high-intensity decision-making increases reliability in cognitive processing. What is also needed is a protocol for building events into exercises that will provide a variety of challenges to improve visualization based on the needs of the training audience. In other words, exercises should be tailored to the experience level of the individuals involved and scaled up in difficulty as individuals improve.



(Original graphic from Army Doctrinal Publication 5-0: *The Operations Process*, July 2019; modified by McConnell)

Figure 2. Problem Formulation

Game theory variables and MESL formulation. In the seminal research study on wargaming, a game theory variable instrument was employed to measure participant comfort at making decisions based upon participant visualization.[21] This same instrument can be repurposed for use in creating MESLs that can incrementally increase or decrease exercise difficulty for potential



(Figure by McConnell)

Figure 3. Game Theory Protocol for Visualization Improvement

visualizers based upon their abilities. Before proceeding into the use of this instrument, perhaps a reiteration of the definitions of terminology would be useful.

> As decision-makers engage in a process deciding how to address threats and opportunities within their environment, they examine numerous variables that might influence the level of depth and breadth they might seek for understanding their environment before acting. According to game theory, these variables include but are not limited to the completeness of information, the level of certainty, rationality, given the level of environmental complexity, level of common knowledge required to act, and time.[22]

Visualizers may wonder if they have enough information, certainty, rationality, and time to act. They might grapple with the level of environmental complexity and whether acting falls in the realm of common knowledge. If these are the variables with which visualizers wrestle, those who are designing exercises can use these variables to adjust challenges to improve visualization skills over multiple iterations. These game theory variables can be employed as a sliding scale between extremes for formulating challenges during exercises. Figure 3 depicts those variables and can serve as a protocol for constructing meaningful challenges that will improve visualization.

For example, exercise designers could use these six game theory variables as a foundation upon which they could design training objectives. The MESLs could be designed to support those training objectives and then use the individual game theory variables to "dial up or down" the challenges under each variable. In the information realm, providing a great deal of information might create challenges versus designing exercises wherein very little information is provided and planners must fill in the blanks. In the certainty realm, challenges might test planners' preconceived notions of what might unfold (e.g., surprises and variables that ramp up or down those surprises). In the rationality realm, events could include the amount of rational or irrational actors/variables in the environment. Under the environmental complexity realm, events could reveal simple challenges all the way up to ill-structured problems that might not have been expected. Under the common knowledge realm, events could be shaped to incorporate what the training audience might be expected to know how to do and insert

challenges with which the training audience would be unfamiliar. Under the time realm, expanding versus contracting the amount of time for exercise participants to act could stress their ability to visualize.

Conclusion

Leaders ignore or misinterpret the emergence of exceptional information at their own peril. History is replete with examples of leaders who were experts at visualization and who used that skill to anticipate competitor actions and poise their forces to achieve victory. Most of these leaders had these skills due to their own personal experience and education. They gathered subordinate leaders who could effectively support their visualization. Much of this may have been not by design but by providence (i.e., senior leaders do not always have control over the skill sets of the people they get). Therefore, leaders should endeavor to improve subordinates' visualization skills regardless of the visualization skill levels with which their people arrive.

We face an uncertain future. Environments of uncertainty can generate threats and opportunities at an accelerated rate. Senior leaders will need subordinate leaders whose visualization is fog of war resistant. Creating organizations that can achieve corporate visualization can be accomplished through deliberate practice and multiple repetitions. If senior leaders could instill visualization skills in their subordinate leaders at an accelerated rate that could stand up under the uncertain environment of combat, why wouldn't they? ■

Notes

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