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Streamlining the MACCS for Rapid Cognition Decision-Making
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In Transformation Ballyhoo, LTCOL Brian Hanley states the obvious, that much needed transformation in the military should be based on intelligent study and focus on the human element rather than relying on what new technologies we can acquire. Yet his article is refreshing and much needed in the current military culture, even to the Marine Corps. Marines take pride in being students of warfare, the poor children of the DoD who must use their brains rather than their pocketbooks to win battles. Yet our current culture is as guilty of this "capabilities-based thinking" as any other service. Having seen many changes within my own command and control community, I can say candidly that we seem to think that new computer programs and equipment will somehow make us better at command and control.

From my own experience in OIF and OEF, as well as the accounts of my fellow company grade officers, I've found that many of the same advances that have allowed us to work faster have been double-edged swords that enable our superiors to watch our every move and be involved in every decision we make. Nothing is more frustrating than having a colonel's oversight on every minute decision, especially when you're a lieutenant. Yet this frustration is a common experience between many officers of different deployments, operations, and services.

This is exactly the type of problem through which LTCOL Hanley's request for transformational study applies. We must ask ourselves why this friction is occurring, and whether it can be solved or at least mitigated. I believe it can, and it requires a deeper study of the types of thinking involved in combat. We need to separate current operations, future operations, and the commanding officer or senior watch officer into separate dislocated agencies. Current operations staff are rapid cognition thinkers, while future operations staff are comprehensive analysts and planners. Like oil and water, these two types of thinking do not go together. In addition, the commanding officer or senior watch officer, who must ultimately make force-tasking decisions, must be an impartial judge able to mediate between both types of thinking, and make "tie-breaker" calls when concurrent requests arise between the two subordinate agencies.

What is Rapid Cognition?

"I see only one move ahead, but it is the correct one."
-Jose Raul Capablanca, Chess Grandmaster[1]

The conventional wisdom is that the best decisions are made from considering every possible option in an ordered process to make the decision through logical comparisons. This is comprehensive analysis, and is a completely valid decision-making process . . . when you have the time to do it. Scientists have found that high-stress, quick reaction jobs like firefighting, police officers, ER nurses, paramedics, stock-market traders, and lo and behold, military personnel in combat situations use a different type of thinking, one that involves less of conscious thought and more of our unconscious to solve problems.[2] Rapid cognition decision-making is "on the fly" and is not only constrained by time, but also by limited information. One must "size up a situation," immediately locate the crux of the problem, and choose the perfect solution, all within

[1] Ross, Philip E. "The Expert Mind." Scientific American, August 2006, 64
[2] Gladwell, Malcolm. Blink. New York: Little, Brown and Company 2005, 107.

seconds. Yet these professionals are expected to make the correct decision, and they do so time and time again.

What separates experts from amateurs is the first few seconds of thought.[3] Some think it relies on some "talent" or intuition, but intuition is a vague misnomer for the type of thinking that is actually going on. It may be spontaneous decision-making, but spontaneous does not imply random. Nor is it some wrote memorization or reflex. There is actually complex thought going on, but it is happening in a place that we don't have access to monitor—our unconscious. The unconscious can process more information faster than our conscious thought, but it is by no means inherently ready or infallible. The unconscious must have the proper practice and information to draw from, or it could be fooled. To be successful at rapid cognition decision-making, one's skills must be honed through practice, as well as building a library of job-specific knowledge and experience to draw from.

To see clear examples of rapid cognition, scientists had to study both cases that involved no expertise, and experts performing their jobs. In one case scientists used a card game in which subjects bet on two different decks, one of them rigged to lose money at a faster rate than the other deck. By monitoring the physical reactions of the subjects, the body registered the apprehension at betting on the losing deck by sweating, increased heart beat, and blood pressure 40 cards before the subject was able to rationally explain what was happening.[4] The study showed that our unconscious works at a faster rate than our conscious thought, even if we have not been specifically trained.

But more importantly, when scientists studied professionals, they found that although at first they were not able to explain their decision-making process, with further repetition of the experience, the scientists could glean a perfectly logical thought process—that had taken place in seconds unbeknownst to the subject. The example they used was of a firefighter who had been fighting a particularly stubborn kitchen fire.[5] When the fire would not abate, he inexplicably ordered everyone out of the building. Seconds later, the floor collapsed. When scientists teased out his story, they found that he had registered certain specific clues that led him to make the decision, all of which he was unable to identify both at the incident, as well as the first telling of the experience. He had registered that the fire was hotter than normal despite its small size, it was unusually quiet, and it did not respond to their efforts. All these clues were understandable in that the fire was actually in the basement, under their feet. The fireman's unconscious had pieced it together.

The important point to glean from his experience is that if he had been an amateur, his unconscious may have sensed something wrong, like the card players, but been unable to make the correct decision. Because he had experiential knowledge from fighting numerous fires over the years, his unconscious was able to pull the appropriate comparisons and conclusions. He was trained to make the right decision.

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[3] Ross, 64.
[4] Gladwell, 8-11.
[5] Gladwell, 122-123.

Training Rapid Cognition Decision-Makers

"Yet this belief in the importance of innate talent, strongest perhaps among the experts themselves and their trainers, is strangely lacking in hard evidence to substantiate it. . . The preponderance of psychological evidence indicates that experts are made, not born." -Philip E. Ross[6]

The situational-dependency of rapid cognition decision-making can lead to a faulty assumption: that because we cannot train for any one specific decision, we cannot train at all. This is far from true. When we prepare the components of rapid cognition, we in turn prepare rapid cognition. The components we must train are building a knowledge base, with both factual and experiential knowledge, and practice using that knowledge in situational decision-making.

The first piece of training is fairly straightforward. Intensive study is needed to create the "knowledge bank" necessary to pull from. Each subject of expertise will have different determinations of what knowledge should be put in the bank. Sports teams like basketball, football, or soccer put plays in, chess players will put board positions and entire games, pilots put emergency procedures and aircraft components, to give a few examples. This knowledge is in fact cumulative, and must be grown properly from the elementary level. The old adage of "perfect practice makes perfect" serves well to illustrate that before basketball players learned plays, they learned how to run, shoot, pass, dribble, and play a position first. Likewise, these skills are not left untouched; they are reiterated at every practice both within the plays as well as drills isolating each skill. Again, each subject of expertise will have different needs for what information is elementary and what is advanced. In my own aviation C2 community, as well as the aviation community, we have already made Training and Readiness (T&R) standards that include factual curriculum. However, through either decreased training time due to high operational tempo or because it is sometimes dismissed by those who feel that experiential knowledge is more important, an injustice is done to our Marines. Factual or "book knowledge" is the basis for practical or "experiential" knowledge, and without which, the experiential knowledge is either not properly understood, or hard won through mistakes. Studying the book knowledge makes the experiential knowledge more meaningful, and therefore more beneficial.

Experiential knowledge is by no means of lesser importance. We need situational training to tie the pieces of knowledge together and organize them. Everyone logically thinks that experts will have vastly larger banks of information to pull from than amateurs. But what separates the average from the experts is not the amount of knowledge—it is how they organize and access it. The human mind can only consider 5-7 pieces of information at one time; experts as well as amateurs are subject to this biological phenomenon.[7] For amateurs and average players, 5-7 pieces may be either moves or chess pieces. But for the grandmasters, as mentioned above, they may be 5-7 entire games. Anyone who has used a pneumonic device has used this very principle. It allows the mind to access information in a well-organized, ever-branching format. Through this organization, grandmasters are able to access anywhere from 50,000 to

[6] Ross, 71.
[7] Ross, 68.

100,000 chunks, navigated and analyzed by the unconscious, to select the most appropriate information. Strangely enough, mere study of situations may be enough to build this bank. This is good news in that there can be fruitful "passive" study instead of a need for nonstop, labor-intensive simulations.[8] By taking this process into account when instructing personnel, we can aid the process instead of teaching blindly.

Finally, actual practice in simulations or exercises is also necessary. Partly the need stems from experiential knowledge, but surprisingly, the simulation is needed for other reasons. Scientists found that exercise does not necessarily contribute to progress in decision-making as much as "to point up weaknesses for future study."[9] In addition, scientists point out the need for the exposure to stress and pressure. People's first exposure to high-stress situations can produce a cognitive shut-down, in which they experience a sort of "temporary autism."[10] Repeated exposures to these same situations allow the subjects to feel more comfortable and calm themselves to a point where they can function, and more importantly think. This type of exposure cannot be gained from passive study, it can only come from active experience. This brings to light the necessity for controlled yet realistic simulations. As advances in technology have allowed simulations to become more complex and realistic, I believe advances in networking may have the most productive effect on the aviation C2 community. The fledgling Aviation Training System will allow aviation C2 to interact with real pilots, as well as practice situational decision-making with out the imposing logistical footprint usually associated with exercises.

The most humbling idea from these studies was that experts agree that it takes about ten years of intensive, effortful study to become an expert.[11] Scientists specifically pointed out that time spent in half-hearted study did not count. Most people reach a plateau in any one subject and tend to become complacent with their level. Experts were differentiated by their voracious study of new and different concepts, constantly challenging themselves. Not only did I realize how far I had to go, but it made me wonder how many experts we are really producing in the Marine Corps in both aviation C2 as well as officership in general.

Getting Back to Basics—Enabling the Executors

"You've got to let people work out the situation, and work out what's happening. The danger in calling is that they'll tell you anything to get you off their backs, and if you act on that and take it at face value, you could make a mistake. Plus, you are diverting them. Now they are looking upward instead of downward. You're preventing them from resolving the situation." –Paul VanRiper[12]

It's no secret that the Marine Corps embraces small unit leadership and centralized command and decentralized control. Yet every SNCO or junior officer has had the temptation to quote some of our doctrinal pubs to our superiors, to "remind"

[8] Ross, 69.
[9] Ross, 69.
[10] Gladwell, 222.
[11] Ross, 69.
[12] Gladwell, 117.

them. It's a constant battle for senior leadership to practice what we preach, yet it is crucial to our success. Letting subordinates make decisions is risky—what if they get it wrong? It's even more risky when the decisions involve rapid cognition. At least when the decisions involve comprehensive analysis the senior leadership can receive operation orders and confirmation briefs to monitor their subordinates' progress. They can see how their subordinates are thinking and whether it is up to their standards. But rapid cognition decision-making offers none of this. Senior leadership can't see the information they're working off of, they can't see how they are thinking, and sometimes they can't even see the decision until after it has been made. That's scary, it's also decentralized control. So senior leadership does the only thing it can do, asks for an explanation. As in the quote above, that's the danger.

There is no problem with explanations in comprehensive analysis. In fact, it can be helpful in solving problems at impasses. However, asking people to explain their rapid cognition decisions or requiring them to follow a regulated comprehensive analysis process for a rapid cognition decision degrades or even disables their ability to make subsequent rapid cognition decisions. A simple example of this is recognizing someone's face out of a lineup vs. writing a description. When you pick the face out of the lineup you are able to do it rather easily. However, when you write the description, you find it much harder and end up using broad phrases that make it difficult to distinguish a particular face. Any number of people can have a large nose and a broad forehead, but it is the other nuances registered in the unconscious that make the face you are thinking of unique. If you were then asked to pick the person out of a lineup, your brain would use your broad verbal description rather than the face you had actually seen.[13] This isn't just a parlor trick; you forced yourself to switch hemispheres of the brain. The take-away is that rapid cognition is a fragile process that is vulnerable to getting "switched off" merely by thinking in another manner. We not only need to give our own unconscious room to work, we need to give our subordinate's unconscious room as well.

The difficulty of accepting the concept of rapid cognition is one of pride. We do not want to give authority over to a part of thought in which we have no control. It is hard enough to hand the authority to our own unconscious, even more difficult to hand it over to someone else's. We as leaders set our subordinates up for failure and therefore make a self-fulfilling prophecy when they are unprepared for rapid cognition decision-making. But likewise, misplaced trust is just as dangerous. If a subordinate is not prepared or, more importantly, capable of rapid cognition decision-making, any authority conferred to them would be foolhardy on the part of the superior. Leaders' trust must be earned, and therefore subordinates must be given the opportunity to earn it prior to combat operations. This, unfortunately, means more work on the leader's part. Rapid cognition calls for strict leadership prior to execution. Leaders must ensure proper training, must be available to observe subordinates during training, must spot problems and correct, and most importantly, have the moral courage to relieve subordinates that are not capable.

[13] Gladwell, 120.

Why It Matters What Our Architecture Looks Like

"Networks have properties hidden in their construction, that limit or enhance our ability to do things with them." Albert-Laszlo Barabasi[14]

But if units make a concerted effort to train for and enable rapid-cognition thinking, isn't that enough? Why the call for the radical change in agencies? The answer comes again from recent scientific discoveries. A new science has literally appeared in the last few years, the science of networks. To the majority of the military, the word network simply signifies computers and equipment, the realm of communications and data personnel. But the work of mathematicians and theoretical physicists has revealed that the word "network" actually applies to much more. Just as the actual definition of "machine" applies both to the entire factory including the assembly line workers and their assembly lines as well as the automobiles they produce; so the word "network" not only applies to our communications architecture, but also to the complex structure of our C2 agencies. Our old definition of network told us that nodes were computer terminals or IP addresses and the links were the cables between them, and this all makes up the LAN (local area network) or WAN (wide area network). But network science tells us that the Marine Aviation Command and Control System (MACCS) itself is a network with the nodes composed of agencies, and the links composed of the interactions via communications net, regardless of whether the interaction occurred over a computer, a phone, a radio, or even face to face conversation.

It is most appropriate to view the MACCS not as a hierarchy in a traditional sense, but rather as a hierarchy of fractals. Each agency itself is a network with each operator as a node. Each of these sub-networks connects to the larger network of the MACCS where each agency is a node. Even the MACCS is really a sub-network to the larger Joint Theater Air Ground System (TAGS). In this way the MACCS differentiates itself from the rest of the command and control structures in the Marine Corps. While there may be several Fire Support Coordination Centers (FSCC), Squadron or Group Headquarters, there is only one MACCS for the Marine Corps and therefore only one agency each to perform the prescribed functions of Marine Aviation. The MACCS may be a part of the Air Combat Element (ACE) but it serves the entire MAGTF.

The second discovery of note for military purposes, is that "networks have properties hidden in their construction, that limit or enhance our ability to do things with them." A simple example comes from the problem that was the genesis for graph theory. A Prussian city had seven bridges arranged in a certain way, and Hungarian mathematicians found that there was no path over all bridges that only crossed each bridge once.[15] The novelty of the discovery was that they a) found a definitive answer: no and b) were able to produce a formula to support it: no unbroken non-repetitive path will exist between the nodes when there are an odd number of links. No amount of intelligence *would* find a non-repetitive path because no path *could* be found.

Obviously complex command and control networks do not lend themselves to oversimplified properties such as this, but this does not negate the fact that there are properties that exist unique to our network. Rather, the character of the properties is

[14] Barabasi, Albert-Laszlo. Linked. New York: Penguin Group, 2003, 12.
[15] Barabasi, 11-13.

directly related to the types of nodes and links. Since the nature of the nodes in our network derives from the human factors of the military, it is not surprising that we may find our network's inherent properties are very different from the equipment-centric computer networks. Therefore, we can begin to look for properties in previously unthinkable areas. In addition, because our network is a hierarchy of fractals, there are many levels of nodes and links that can affect the properties.

Leadership as a Network Property

"This is not to say that individual qualities are not important, but rather that sustainable and replicable qualities of leadership are treated here as a network property, made possible by the combination of the social network and the individuals themselves." –Dr. John H. Clippinger[16]

If leadership is central to the military and command and control, then it is fair game to consider as a property of a network. Just as Malcom Gladwell had the audacity to challenge the "unknowable" unconscious part of decision-making, or Barabasi the "unknowable" complexity in networks, so Dr. John H. Clippinger challenges that "leadership is not regarded as the random occurrence of great men at moments in history, but rather as a network effect, the interaction of innate traits, themselves long nurtured and refined by evolutionary forces and the organizational context in which these traits are expressed."[17] The key terms for the military are mentioned in the opening quote: "sustainable and replicable." There may be an initial repugnance by military officers at the supposition that leadership could be pre-packaged and mass-marketed, rolling second lieutenants off aforementioned assembly lines. But this is far from what Clippinger is proposing. Not all qualities of leadership are sustainable and replicable, but some are. And it is certainly worth the effort to identify which ones are.

The two main divisions in leadership are the innate traits and the organizational context. Decision making in a combat environment is a leadership task that military personnel are expected to accomplish, and should not be confused with an innate trait. Innate traits are used to make decisions, and that is why I advocate honing those traits which assist us. But the organizational context is just as important. Because changing the architecture of a network changes its properties, even small changes within or between agencies will have far reaching effects.[18] Even the most naturally competent and expertly trained officer will have difficulty performing rapid cognition decision making if the architecture of the network causes his superiors to constantly make him explain himself and therefore constantly switch brain hemispheres. His ability to lead is impaired by his organizational context.

As long as combat involves time sensitive decisions and limited information, it will require rapid cognition decision-making. But this is not to disparage comprehensive analysis. Neither is "wrong," they can only be "inappropriate" in certain circumstances.

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[16] Clippinger, Dr. John H. "Human Nature and Social Networks." <http://www.socialphysics.org/images/Human_Nature.pdf> (28 March 2006), 4.

[17] Clippinger, 26.

[18] Barabasi, 12.

The problem that has grown in the relationship between rapid cognition agencies like the Direct Air Support Center and our senior agency the Tactical Air Command Center is not just one of an ignorance of the differences in types of thinking; it is one of environment. The Tactical Air Command Center has both Current Operations and Future Operations, as well as the Air Combat Element Commander (ACE CO). What occurs is a bleed-over of comprehensive analysis from its rightful place of Future Operations to Current Operations, and also to the ACE CO. The ACE CO is essentially the arbiter of both types of thinking, and makes the final call when there is a conflict between current and future needs. At times, he or his proxy, the Battle Captain, can delegate authority to lower levels, but this forces the consideration of both types of thinking onto personnel that were meant to be advocates for current needs. The fragility of rapid cognition thinking is overpowered by the more accepted and dominant comprehensive analysis. In addition, rapid cognition agencies like the DASC or the Tactical Air Operations Center (TAOC) lose the collocated advocate.

The physical dislocation of the senior decision-making authority from both current operations and future operations changes the nature of the link from face to face contact to digital or phone. This has the two-fold effect of reinforcing to the senior-decision-maker his impartiality as well as evening the playing field for both agencies. The physical dislocation of the current operations from future operations prevents the bleed-over of decision-making styles by forcing most contact to go through the impartial senior decision-maker.

Though most commanders would bristle at the idea of being "quarantined" to their own area rather than being "where the action is," there is something to be said for physical dislocation. Clippinger astutely observes that "in hierarchical and bureaucratic organizations, leadership is often confused with scope of control and authority—power. In such organizations, leaders are given the latitude, even the expectation, to exercise significant control at all levels of the organization."[19] The MACCS has never been a completely hierarchical or bureaucratic structure, but with the increased technological advantages of communication by digital links, the gap between self-organizing networks and hierarchical or bureaucratic structures becomes a chasm. In contrast, in networks like the MACCS, "the transecting of layers by a supra-ordinate to a subordinate, in effect, micromanaging and second-guessing is dangerous for the well-being of the network."[20] Commanders are not robbed of their ability to lead, but are forced to acknowledge the reality of the network and lead in an appropriate manner.

[19] Clippinger, 14.
[20] Clippinger, 15.

In conclusion, technology and scientific discoveries are not enemies to military organizations. Yet they are not cure-alls either. The correct application of technology to military agencies must come with study of how it affects human behavior as well as updated education and procedures. Military leadership is by no means an exact science, however, the application of science to military organizations can help us understand our personnel and the effects of technology. Technology can be a force-multiplier only with the proper preparation on the part of leaders. And these advances in both science and technology could not come at a better time. Our enemies are increasingly decentralized in nature, and this forces us to adapt to a new playing field. Though it would be unrealistic and unnecessary to attempt to mirror their decentralization, we can improve and update our networks to better serve our current and future situations.

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