Metacognition: The Cognitive Connector

Educating the knowledge-based staff officer to meet the demands of the future operating environment

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In the conduct of maritime operations in the littorals, surface connectors are a critical component in the transport of personnel, supplies, and equipment in support of Naval Expeditionary Force operations. Similarly, metacognition—thinking about thinking—serves as a cognitive connector between knowledge worker performance and organizational design. For this article, we will discuss the concept of metacognition as a "cognitive connector" between the staff officer and efforts to prepare the Marine Corps to meet the demands of the future operating environment.

The *Commandant's Planning Guidance* outlines Gen Berger's strategic direction for the Marine Corps, explicitly identifying force design as the top priority. *Force Design 2030* aims to develop a purpose-built force in partnership with the Navy to support the maritime campaign and other joint operations.[1] Complementing *Force Design 2030*, Training and Education Command's (TECOM) *Vision & Strategy for 21st Century Learning* seeks to shape the way the Marine Corps approaches the human dimension and the science of training and education. Specifically, TECOM's *Vision & Strategy for 21st Century Learning* outlines three focus areas: developing adaptive and decisive Marines, achieving interoperable units capable of decisive effect, and developing a foundation for information age learning and assessments focused on outcomes.[2]

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But are *Force Design 2030* and TECOM's *Vision & Strategy for 21st Century Learning* adequate to cognitively prepare the Marine staff officer to meet the demands of the rapidly evolving future operating environment? Preparing the Marine Corps for future threats requires more than a reorganization of combat formations, a focus on the Naval Expeditionary Force, and a new vision for learning. As the Marine Corps organizes, equips, and trains a more modern force to meet future threats, force designers must remember that organizations are knowledge-based and cognitively driven.

The Impact of the *Fourth Industrial Revolution* on the Future Operating Environment

The first two industrial revolutions introduced the steam engine, railroad, electricity, and telecommunication. The third industrial revolution brought into being digital globalization through computers and the Internet.[3] The culmination of the first three industrial revolutions was evident in the speed and lethality of coalition forces during Operation DESERT STORM. Throughout the execution of DESERT STORM, coalition forces leveraged technology and fully integrated air, ground, naval, and space operations. From 17 January 17 to 28 February 1991, coalition forces flew over 116,000 combat sorties and dropped over 88,500 tons of ordnance. The air phase was followed by a 100-hour ground operation that combined maneuver, deception, and technology. Some argue that DESERT STORM was a tactical success but a strategic failure. But what cannot be debated is that in 43 days the U.S. led coalition defeated the largest military in the Middle East and the fourth in the world.[4]

Today, the *Fourth Industrial Revolution* is blurring the biological, physical, and digital domains.[5] Air, maritime, ground, space, and cyber sensors have increased the availability of data on the battlefield, complicating human analysis and synthesis. Through the fusion

of human intelligence with disruptive technologies—e.g., data-enabled artificial intelligence and machine learning—the Fourth Industrial Revolution has the potential to alter the way Marines think about the future operating environment. More importantly, as technology advances, the staff officer's responsibility is evolving from platform-centric warfare (collection of data and information) to knowledge-based operations (actions in the cognitive domain).

Review of Marine Corps Doctrine in support of Knowledge-Based Operations and Decision-making

The foundations of Marine Corps doctrine on operations and decision making are grounded on *MCDP 1, Warfighting*; *MCDP 6, Command and Control*; and *MCDP 7, Learning*. *Warfighting* describes the Marine Corps' philosophy of war and the conduct of warfare. *Command and Control* addresses the implications of the Information Age on leadership, information management, and decision making. *Learning* describes the Marine Corps' learning philosophy, particularly how Marines think about the human dimension and the science of learning. Although *Warfighting*, *Command and Control*, and *Learning* stress the importance of the human-element in the conduct of warfare, the Marine Corps lacks a consolidated doctrinal publication on human-centered, knowledge-based operations and knowledge-based decision making.

The *Marine Corps Tactical Publication (MCTP) 3-30B*, *Information Management*, acknowledges the importance of knowledge management but falls short in the discussion of knowledge-based operations and decision making. *Information Management* describes creating shared understanding as a pyramid with three tiers:

Tier 1: Managing data and information.
Tier 2: Sharing knowledge and creating understanding.
Tier 3: Making decisions.[6]
Through the availability of technological advancements, knowledge-based organizations are excellent at the management of data and information (Tier 1).

Information Management briefly covers the relationship between information management and knowledge-based staff work—i.e., sharing knowledge, creating understanding, and enabling decision-making (Tier 2 and Tier 3)—as follows:

> Information management facilitates knowledge sharing as it relates to collecting, filtering, fusing, processing, focusing, disseminating, storing, and using information. Information is then internalized by the individual and

The focus of *Information Management* is the management of information (Tier 1: Managing data and information), not knowledge-operations. Thus, it is in the fields of shared understanding (Tier 2) and enabling decision-making (Tier 3) that the Marine Corps needs to evolve, most notably in educating staff officers on metacognition to contend with Fourth Industrial Age technological implications on knowledge-based staff work in support of operations and decision making.

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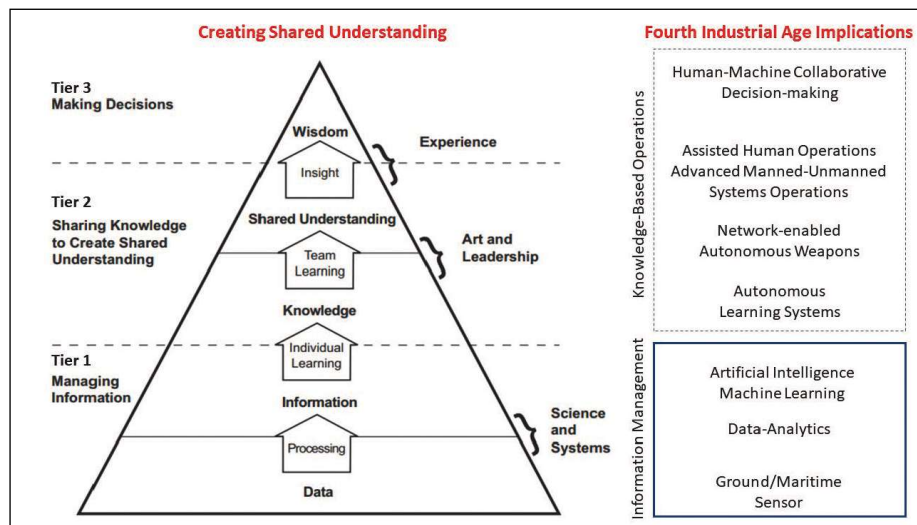
Figure 1. Creating shared understanding and fourth industrial age implications. *(Source: Information Management and Author.)*

fused with personal insights and experiences. As a result, tacit knowledge is brought to bear. Followed by episodes of socialization and collaboration, the free exchange of ideas forms the basis of shared understanding. The products of data, information, knowledge, and shared understanding are merged with the elements of situational awareness to render the wisdom needed to produce sound decisions.[7]

Educating Marines for Knowledge-Based Staff Work

An objective of TECOM's *Vision & Strategy for 21st Century Learning* is to educate and train critical thinkers who can solve complex problems. Specifically, TECOM's *Vision & Strategy for 21st Century Learning* asserts,

> The battlespace upon which Marines fight is much more complex and increasingly hostile, lethal, and chaotic. We must better develop Marines' judgment to successfully address evolving

situations and conditions, rather than simply relying upon practiced replication of predetermined actions from static checklists and rote processes.[8]

There are several problem-solving processes taught in professional military education (PME) and business institutions—e.g., Marine Corps Planning Process, Joint Planning Process, Design, Agile, Waterfall. The utility and application of these planning methods are heavily debated in academic, business, and military literature. This article does not intend to add to the debate. The purpose of this article is to discuss the educational value of metacognition in support of developing adaptive and decisive critical thinkers who can solve complex problems (TECOM *Vision & Strategy for 21st Century Learning*, Focus Area 1; Objective 3), particularly the Five-C's of Metacognition.

The following is a brief introduction to the Five-C's of Metacognition: critical thinking, complexity theory, creativity,
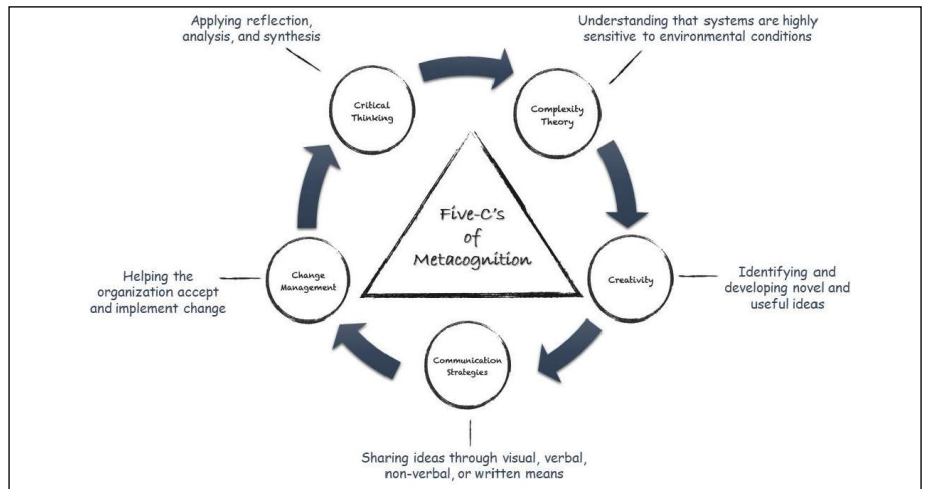

Figure 2. Five 5 C's of Metacognition. (Figure provided by author.)

communication strategies, and change management.

First, critical thinking is metacognition through the application of reflection, analysis, and synthesis. The recognition of how heuristics can influence decision making—specifically availability heuristics, representative heuristics, and anchoring heuristics—is an essential component of staff officer critical thinking. A practical framework of critical thinking is the application of Sakichi Toyoda's "5-Why's" analysis methodology.

Second, understanding of complexity theory is critical step of metacognition. The study of complex systems is grounded on the premise that small changes in the environment can have compounding effects, and the interconnected parts complex systems exhibit characteristics that differ from the properties of its components. The following elements are critical to the understanding of complex systems. Open systems are systems in a state that continuously interacts with its environment. Emergence is the appearance of novel properties of the whole that may not be identifiable in the subcomponents in isolation.

Third, creativity is the identification and development of novel and useful ideas. Preparation, incubation, illumination, and verification are the most recognized stages of the creative process. The most identifiable stages of the creative process are preparation and verification, as both are conscious and intentional efforts. The incubation and illumination stages are more difficult to evaluate. During the incubation stage, two activities occur. The first activity is the voluntary act of not consciously thinking about the problem. The second activity is the unconscious or involuntary cognitive actions that occur toward problem definition. The illumination stage is often associated with the "aha-moment" of idea generation.

Fourth, effective communication allows you to share ideas with others in a manner that increases understanding. Communications can be visual, verbal, non-verbal, or written. A prevalent use of visual communication today is the use of imagery and presentations. Verbal communication is the use of spoken language to transfer information between individuals, while non-verbal communication is the use of body language to express ideas through sentiment. Written communication is perhaps the most lasting of the four communication methods and includes the use of letters, numbers, and figures.

The fifth element of metacognition is change management. There are three steps to change management: unfreeze, change, and refreeze. Unfreeze is the step where the change agent prepares the organization. Once the organization has implemented the change, the change agent must refreeze the new process and ensure adherence to the new way of doing business. To effectively implement change, John Kotter identifies an eight-step process: create a sense of urgency, build a guiding coalition, form a vision and strategy, enlist support, enable action by removing obstacles, generate short-term wins, sustain the change, and institute the change.

So how does metacognition prepare the knowledge-based staff officer to meet the demands of the future operating environment? Through the application of the Five C's of Metacognition, the staff officer will be able to leverage technology in support of decision mak-

> ***... how does metacognition prepare the knowledge-based staff officer to meet the demands of the future operating environment?***

ing. For instance, the Fourth Industrial Revolution is advancing the development of autonomous learning systems, human-machine collaborative decision making, assisted human operations, and advanced manned-unmanned systems operations. Developments in cognitive technologies will increase the speed and availability of data the decision maker will need to process. In this "big-data" environment, it is operationally crucial that the staff officer applies critical thinking—reflection, analysis, and synthesis—to ensure the human remains paramount in the decision chain. Also, to ensure ethical standards are maintained, it is necessary to create a symbiotic relationship between humans and computers, especially with the advent of autonomous learning systems and network-enabled autonomous weapons. The staff officer will also be required to analyze the data through the lenses of complex adaptive systems thinking and recognize that systems are highly sensitive to environmental conditions. Failure to do so may lead to an inaccurate assessment based on "big-data" and availability heuristics and not the causes that led to the emergence of a given data point. Autonomous learning systems and human-machine collaboration will also enhance the development of novel and useful creative ideas through the availability, collection, analysis, and synthesis of divergent data. Lastly, the Fourth Industrial Revolution will require a change implementation plan communicated through human-machine collaborative decision support systems that leverage visual, verbal, non-verbal, or written means.

Recommendations

First, the Marine Corps should incorporate the Five-C's of Metacognition through all levels of PME programs—formal and informal. Similar to the *11 Marine Corps Leadership Principles* and *14 Leadership Traits*, the Five C's of Metacognition apply to all Marines, regardless of rank, military occupation, or echelon of command.

> *"Through progressive learning and experience, Marines at all levels develop a bias for action enabled by adaptive, rapid decision-making. The more Marines learn and exercise this bias for action, the better it becomes."*
> **—MCDP 7**

Integrating the Five C's of Metacognition—critical thinking, complexity theory, creativity, communications strategy, and change management—as part of the PME learning continuum will set conditions for lifelong learning

Cognitive Field	Elements	Goal
Focus 1. Critical Thinking	1.1. Logic and Reasoning 1.2. Argument Analysis 1.3. Cognitive Biases and Heuristics	The learner will be able to analyze a situation and/or problem by examining the argument and challenging assumptions.
Focus 2. Complexity Theory	2.1. Chaos Theory 2.2. Non-Linear Systems 2.3. Complex Adaptive Systems	The learner will be able to examine the situation and/or problem to gain an appreciation of the environmental causal relationships.
Focus 3. Creativity	3.1. Creative Process 3.2. Divergent and Convergent Thinking 3.3. Design Thinking and Innovation	The learner will understand the steps and barriers to developing new and novel ideas. Additionally, the learner will develop a plan to transition the idea to action.
Focus 4. Communication Strategy	4.1. Rhetoric 4.2. Presentation Skills and Story Telling 4.3. Listening and Feedback	The learner will know how to package and present information in a manner that supports the leader/supervisor's processing mental model.
Focus 5. Change Management	5.1. Change Process 5.2. Change Agents and Strategic Sponsors 5.3. Barriers to Change	The learner will understand how to develop a change implementation plan that supports actions beyond the initial approval.

Figure 3. Five-C's of metacognition curriculum framework. (Figure provided by author.)

and the introduction of more complex and deep-thinking concepts in the future. Table 1 provides a metacognition curriculum framework for consideration.

Second, *Force Design 2030* and TECOM's *Vision for 21st Century Learning* are monumental efforts in preparing the Marine Corps to meet current and future threats. The February 2020 publication of the Marine Corps' philosophy for learning, *Learning*, and plans to build a new Marine Corps Wargaming and Analysis Center in Quantico, VA, by 2024 are tangible examples of the Marine Corps' commitment to advance knowledge-based thinking. However, to meet the demands of the rapidly evolving operational environment, the Marine Corps should consider a publication on knowledge-based operations—perhaps titled *On Thinking*—to complement *Warfighting*, *Command and Control, Learning*, and *Information Management*. This new publication should focus on the importance of knowledge-based operations briefly highlighted but not deeply addressed in. *Information Management*. Expressly, the areas of gaining a competitive advantage to enable *Warfighting*, Leadership and Decision Making to enhance *Command and Control*, and Learning to complement *Learning* (highlighted in red by the author in Figure 3).

> *... the knowledge-based staff officer can operate more efficiently in uncertainty ...*

Conclusion

In the Fourth Industrial Revolution, if properly educated and trained, the knowledge-based staff officer can operate more efficiently in uncertainty and ultimately create and transfer knowledge that enables better decision making. Educating Marines on the Five-C's of Metacognition will achieve three purposes: serve as a cognitive connector between the Marine staff officer and *Force Design 2030* and TECOM's *Vision & Strategy for 21st Century Learning*, leverage Fourth Industrial Revolution technology in support of knowledge-based operations and decision making, and prepare the Marine knowledge-based staff officer to meet the demands of the rapidly evolving future operating environment. If we fail to adjust the way we educate and prepare Marines for knowledge-based operations and knowledge-based decisionmaking, we will not fully capitalize on *Force Design 2030* efforts aimed at competing and winning in the *gray zone* of conflict.

Notes

1. Gen David H. Berger, *Force Design 2030*, (Washington, DC: 2020)

2. Training and Education Command, *Vision & Strategy for 21st Century Learning*, (Quantico, VA: 2020).

3. Klaus Schwab, "The Fourth Industrial Revolution," *World Economic Forum*, (2016), available at https://www.weforum.org.

4. Shannon Collins, "Desert Storm: A Look Back." U.S. Department of Defense, (2019), available at https://www.defense.gov.

5. Ibid.

6. Headquarters Marine Corps, *MCTP 3-30.B, Information Management*, (Washington, DC: 2016).

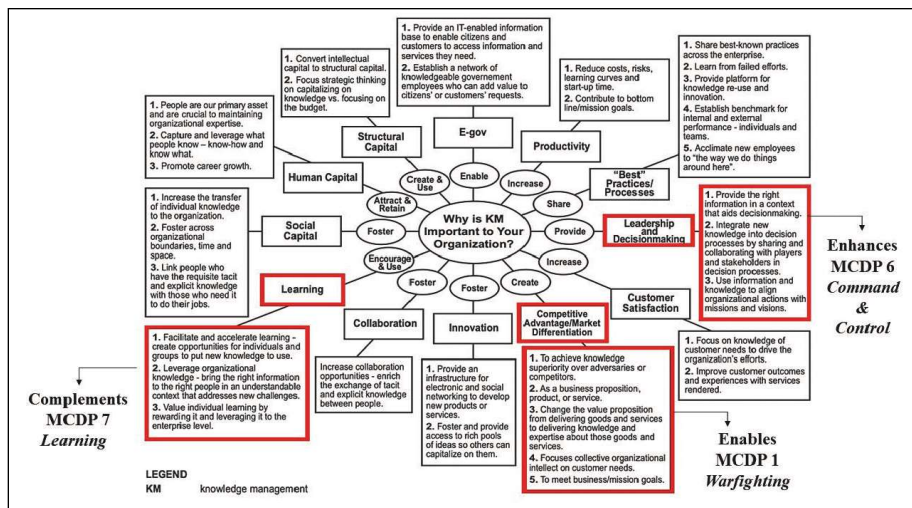7. Ibid.

8. *Vision & Strategy for 21st Century Learning.*

Figure 4. Knowledge management importance. (Source: MCTP 3-30B.)