MASTER OF MILITARY STUDIES

TITLE:

<u>Shaping and Adapting</u>

Unlocking the power of Colonel John Boyd's OODA Loop

SUBMITTED IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF MILITARY STUDIES

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Executive Summary

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Thesis: A common misunderstanding and over-simplification of Boyd's ideas has crept in over time, leading to an increasing emphasis on absolute speed and efficiency over relative speed and effectiveness. This emphasis creates a mismatch between institutional training goals on the one hand, and individual mastery on the other. If this mismatch is not re-aligned, efforts to improve decision-making in general, let alone adaptability and innovation initiatives may miss the mark; despite millions of dollars and labor hours invested. Shaping and adapting will continue to occur, however, it may be in spite of, rather than because of, the Marine Corps' institutional efforts.

Discussion: This paper aims to clarify and reinforce Colonel John Boyd's Observe, Orient, Decide, and Act (OODA) framework that General Krulak referred to in *Cultivating Intuitive Decision-making* and what General Dunford infers in *2015 Commandant's Planning Guidance* in an effort to expand on and improve the collective understanding of this crucial idea. This framework, known to some as the Boyd Cycle, is widely recognized as the OODA "loop." The necessity for this clarification is two-fold. First, the OODA loop is a widely accepted decision-making framework in the United States Department of Defense and beyond. However, its depiction as a four stage cyclical model in many, if not all doctrinal publications and professional venues is not only incomplete but also highly misleading. The components themselves are accurate; however, the lack of context combined with the graphical depiction of an orderly, linear sequence misrepresents his theory and has led to training and education shortfalls. Second, by exploring the complexity and dynamics of Colonel Boyd's final depiction of the loop, one will appreciate the detail, focus, and depth required to understand, shape, and adapt at the individual level. This understanding can then be scaled to the unit, organizational and institutional levels; fostering an even greater understanding and appreciation of the remaining doctrinal publications. Finally, this improved understanding will help shape future Marine Corps training, education, and command climates.

Conclusion: To accomplish what General Dunford calls for in his guidance: the ability to innovate and adapt in "increasingly uncertain, complex, and decentralized operating environments" leaders at all levels must embrace how individuals actually interact with their environments. Studying the full version of the OODA loop rather than simplifying it to a linear process is the first step in appreciating the complexity of this interaction. This renewed understanding and appreciation will enable Marines, young and old, to expand their individual capacity for desired action, nurture new and expansive patterns of learning and thought, and harness the true power of the idea. The ability to innovate and adapt *effectively* in increasing uncertain, complex, and decentralized environment requires *excellence* in thought and in deed. Excellence in thought requires both intuition and insight. Excellence in deed is acting on that intuition or insight; not simply acting for the sake of acting.

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Preface

My journey to understand Colonel John Boyd's ideas began while I was an instructor at the Infantry Officer Course in Quantico in 2008. As the small unit training primary instructor, I became increasingly interested in and how the mind, body, and environment interact. The director of the course at that time, Lieutenant Colonel Gil Juarez, handed me Robert Coram's book *Boyd: The Fighter Pilot that Changed the Art of War* to read while on a flight to Twenty-Nine Palms. From that moment on, I have tried to make sense of the ideas that have shaped and adapted the United States Marine Corps in countless ways; ideas that perfectly described exactly what I wanted and needed to know.

I must acknowledge the significant contributions to my growth and understanding of this particular subject by the following individuals: Mr. Robert Coram, for the trust and foresight to put me in touch with Colonel Boyd's closest friends. Colonel Christopher Douglas, USMCR, Lieutenant Colonels Alvino Mendonca, USMC, Michael Lewis, USA (ret) and Greg Wilcox, USA (ret), as well as Majors Don Vandergriff, USA (ret), Dan O'Connor, USMC (ret), Ryan Gordinier, USMC, and Jon Frerichs, USMC, for their continued guidance, passion, and dialog. Lieutenant General Paul Van Riper, USMC (ret) and Dr. Benjamin Jensen for broadening my systems theory understanding. Dr. Bradford Wineman and Dr. Joseph Ryan, for the countless hours making sense of my chaotic writing. Dr. Paul Gelpi and Lieutenant Colonels Michael McMellon, USAF, and Jeffery Tlapa, USMC, for your probing thoughts, questions and perspectives. Finally, and most importantly, to Franklin "Chuck" Spinney, for your devoted mentorship, patience, editing skills and example. Your willingness to indulge me, after all these years, is both humbling and inspiring. I would certainly not have been able to complete this project without all of your support. Semper Fidelis.

REPORT DOCUMENTATION PAGE			*Form Approved* *OMB No. 0704-0188*

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing this collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. **PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.**

1. REPORT DATE *(DD-MM-YYYY)* 09-04-2015	2. REPORT TYPE Master of Military Studies Research Paper	3. DATES COVERED *(From - To)* September 2014 - April 2015	
4. TITLE AND SUBTITLE Shaping and Adapting: Unlocking the Power of Colonel John Boyd's OODA Loop.		**5a. CONTRACT NUMBER** N/A	
		5b. GRANT NUMBER N/A	
		5c. PROGRAM ELEMENT NUMBER N/A	
6. AUTHOR(S) Tremblay, Paul D., Major, USMC		**5d. PROJECT NUMBER** N/A	
		5e. TASK NUMBER N/A	
		5f. WORK UNIT NUMBER N/A	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) USMC Command and Staff College Marine Corps University 2076 South Street Quantico, VA 22134-5068		**8. PERFORMING ORGANIZATION REPORT NUMBER** N/A	
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES) N/A		**10. SPONSOR/MONITOR'S ACRONYM(S)** N/A	
		11. SPONSOR/MONITOR'S REPORT NUMBER(S) N/A	

12. DISTRIBUTION / AVAILABILITY STATEMENT

Approved for public release; distribution is unlimited.

13. SUPPLEMENTARY NOTES

N/A

14. ABSTRACT

A common misunderstanding and over-simplification of Colonel John Boyd's ideas has crept in over time, leading to an increasing emphasis on absolute speed and efficiency over relative speed and effectiveness. This emphasis creates a mismatch between institutional training goals on the one hand, and individual mastery on the other. If this mismatch is not re-aligned, efforts to improve decision-making in general, let alone adaptability and innovation initiatives may miss the mark; despite millions of dollars and labor hours invested. Shaping and adapting will continue to occur, however it may be in spite of, rather than because of, the Marine Corps' institutional efforts. The ability to innovate and adapt effectively in increasing uncertain, complex, and decentralized environment requires excellence in thought and in deed. Excellence in deed is acting on that intuition or insight; not simply acting for the sake of acting.

15. SUBJECT TERMS

OODA, Boyd, Decision-making, Klein, Intuition, Insight, Complexity, Observation, Orientation, Decision, Action, Education.

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON Marine Corps University/CSC
a. REPORT Unclass	b. ABSTRACT Unclass	c. THIS PAGE Unclass	UU	40	19b. TELEPHONE NUMBER *(include area code)* (703) 784-3330 (Admin Office)

"To flourish and grow in a many-sided uncertain and ever changing world that surrounds us, suggests that we have to make intuitive within ourselves those many practices we need to meet the exigencies of that world. The contents that comprise this 'Discourse' unfold observations and ideas that contribute towards achieving or thwarting such an aim or purpose." Colonel John Boyd, USAF (deceased).[1]

Introduction

In January 2015, the 36th Commandant of the Marine Corps, General Joseph Dunford Jr, published his *2015 Commandant's Planning Guidance*.[2] On the cover, the words innovate, adapt, and win highlight the pictures and doctrinal ideas placed above them: images that have shaped the Corps since its inception. Within the first few lines of text, the guidance references General Alfred Gray, the 29th Commandant who said, "Like war itself, our approach to warfighting must evolve. If we cease to refine, expand, and improve our profession, we risk being outdated, stagnant, and defeated." General Dunford goes on to explain how he plans to set the conditions required to fight and win against future enemies. He specifically states, "As a Corps, we also remain committed to constantly improving the quality of our manning, training, and equipping efforts and our resultant warfighting capability."[3]

This focus and surge of related ideas is not a new phenomenon. In 1997, The 31st Commandant, General Charles Krulak, championed a similar message, calling for the creation of "Marines and their leaders who have superb tactical judgment and are capable of rapid decision-making under physical and emotional duress." [4] Krulak followed up this guidance with an article in the *Marine Corps Gazette* in May 1999 titled *Cultivating Intuitive Decision Making.* In it, he highlighted character, repetitive skills training, self-study and command climate as the foundational ingredients necessary to develop these qualities. Krulak also emphasized the importance of Colonel John Boyd's ideas and theories.

The impact of John Boyd's theories on the Marine Corps cannot be overstated. They have shaped and influenced doctrine, operations, and numerous Commandants. These ideas have also shaped countless Marines and sister services in recent decades. Unfortunately, a common misunderstanding and over-simplification of Boyd's ideas has crept in over time, leading to an increasing emphasis on absolute speed and efficiency over relative speed and effectiveness. This emphasis creates a mismatch between institutional training goals on the one hand, and individual mastery on the other. If this mismatch is not re-aligned, efforts to improve decision-making in general, let alone adaptability and innovation initiatives may miss the mark; despite millions of dollars and labor hours invested. Shaping and adapting will continue occur, however it may be in spite of, rather than because of, the Marine Corps' institutional efforts.

This paper aims to clarify and reinforce Colonel John Boyd's Observe, Orient, Decide, and Act (OODA) framework that General Krulak referred to in *Cultivating Intuitive Decision-making* and what General Dunford infers in *2015 Commandant's Planning Guidance* in an effort to expand on and improve the collective understanding of this crucial idea. This framework, known to some as the Boyd Cycle, is widely recognized as the OODA "loop." The necessity for this clarification is two-fold. First, the OODA loop is a widely accepted decision-making framework in the United States Department of Defense and beyond.[5] However, its depiction as a four stage cyclical model in many, if not all doctrinal publications and professional venues is not only incomplete but also highly misleading.[6] The components themselves are accurate; however, the lack of context combined with the graphical depiction of an orderly, linear sequence misrepresents his theory and has led to institutional biases and shortfalls.[7]

Second, by exploring the complexity and dynamics of Boyd's final depiction of the loop, one will appreciate the detail, focus, and depth required to understand, shape, and adapt at the

individual level. This understanding can then be scaled to the unit, organizational and institutional levels; fostering an even greater understanding and appreciation of the remaining doctrinal publications. Finally, this improved understanding will help shape future Marine Corps training, education, and command climates.

Misunderstanding Boyd

One of the most unfortunate aspects of Boyd's OODA loop is that despite the tremendous amount of time, research, and energy he and his closest confidants put into its development, it is misconstrued, misunderstood, and oversimplified by the majority of those who discuss it. This phenomenon is not modern nor is it peculiar to the Marine Corps. Many people, including some of those who actually knew and worked with Boyd did not fully grasp the totality of what he meant, a problem that has only become worse after his death.[8] One of the main reasons for this lack of understanding is that Boyd never codified the majority of his thoughts in clear prose; he preferred the dynamic give and take of a multifaceted verbal briefing.[9] He left several hard copy versions of his briefing slides, but not a transcription of the interaction. His only attempt at writing was an essay entitled *Destruction and Creation.*[10]

Furthermore, those who saw Boyd's presentations came away with only a snapshot of his personal development. His ideas and perspectives were constantly evolving, including during the act of presentation. Consequently, the final iterations of his many briefs contain a far more developed understanding of the concepts presented than those he presented initially.[11] After Boyd died in 1997, anyone interested in learning about these briefs either sought out those who were closest to Boyd, such as Dr. Chet Richards, Colonel, USAF (retired), or Franklin "Chuck" Spinney, or traveled to Marine Corps Base Quantico, where Boyd's personal collection is held.

If those options were not feasible, one was simply limited to second hand interpretations; the latter of which appears to be the most prominent.[12]

The totality of Boyd's work resides in a series of presentation overlays, all of which have been converted to PowerPoint slides by Dr. and Mrs. Richards with occasional assistance from Mr. Spinney. The links to these presentations are listed in the attached bibliography. These briefs range in topic from "Patterns of Conflict" to "The Conceptual Spiral." This collection, known as "A Discourse on Winning and Losing," traces the evolution of Boyd's thoughts and perspectives on surviving and thriving in a competitive environment.[13]

Another aspect of the common misunderstanding and oversimplification of Boyd's ideas is that very few of those charged with teaching them have the time or the access to work their way through the presentations in their entirety before they have to do so. Consequently, the majority of what is passed down from generation to generation of Marines in the hierarchy of formal school instruction in the Marine Corps is a superficial echoing of General Krulak's emphasis on speed and tempo from *Cultivating Intuitive Decision Making* and the following simplified illustration of the cycle from MCDP-1 *Warfighting:*

Figure 1

This misleading model of the OODA loop has been and continues to be discussed not only in military circles, but also in business circles, such as *Forbes* and the *Harvard Business Review*.[14] In both popularized interpretations, the image and its interpretation suggest that success in a competitive environment depends on the ability to out-pace and out-cycle the opponent, inferring that the individual has to cycle through all phases of the OODA loop faster than the opponent does. To illustrate this perspective, in 1997, Dr. Phillip Meilinger, USAF (ret) wrote, "According to Boyd, the key to victory was to act more quickly, both mentally and physically, than your opponent. He expressed this concept in a cyclical process he called the OODA Loop. As soon as one side acted, it observed the consequences, and the loop began anew."[15]

The final aspect of why most individuals misunderstand or oversimplify Boyd's work is that "A Discourse on Winning and Losing" is overwhelming. Boyd's discourse is itself a constant back and forth interplay between analyzing and synthesizing of information from major battles, scientific theory, strategic thought and personal impressions that can lead one astray quickly. Furthermore, without access to any speaker notes or video recordings of the final versions of these presentations, significant portions of its richness and points of emphasis are lost to the reader.[16] All of these constraints and ambiguities severely limit comprehension and have led to the current misinterpretation predicament. However, like the aphorisms of Sun Tzu, the ambiguities in the discourse open up an opportunity for an ever-enriching dialogue with the reader – if one chooses to make the effort.

Understanding the Context

In 2001, Dr. Grant T. Hammond published *The Mind of War: John Boyd and American Security.* In 2002, Robert Coram published *Boyd: The Fighter Pilot Who Changed the Art of War.* Both pieces detail the life, experiences, and ideas of Boyd in a way that provides a much-needed context for understanding the man behind the theories as well as an introduction to the theories themselves. Shortly thereafter in 2005, Frans Osinga, an F16 fighter pilot from the Netherlands, presented his doctoral dissertation, *Science, Strategy and War: The Strategic Theory of John Boyd*, taking an in-depth look at "A Discourse on Winning and Losing" and providing a thorough analysis and commentary on the timeless, complex and incredibly well researched thoughts and ideas. Dr. Osinga is now a professor of Military Operational Art and Sciences at the Netherlands Defense Academy and turned his dissertation into a book in 2007 under the same title. For anyone interested in understanding the epistemology of Boyd's personal development, these three books are an excellent place to start.

While it is beyond the scope of this paper to trace the many years and thousands of hours, that went into Boyd's theory, it is important to mention that Boyd developed the OODA loop based on a lifetime of experiences, analysis, synthesis, study, and professional interaction. It was a tremendously taxing and creative process, with roots in not only experiences as a fighter pilot and aircraft designer, but also later as a student of history, science, and philosophy. His study covered multiple strategists from Sun Tzu to Vo Nguyen Giap and hundreds of military commanders, scientists, engineers, manufacturing moguls, and systems thinkers in between. That is why those closest to him believe that his final drawing of the cycle represented far more than just a theory on decision-making. It was a framework for understanding the nature of

human interactions with the environment to enable the survival and growth of individuals and groups including uncovering tactics, operations, strategy, learning, and moral values.[17]
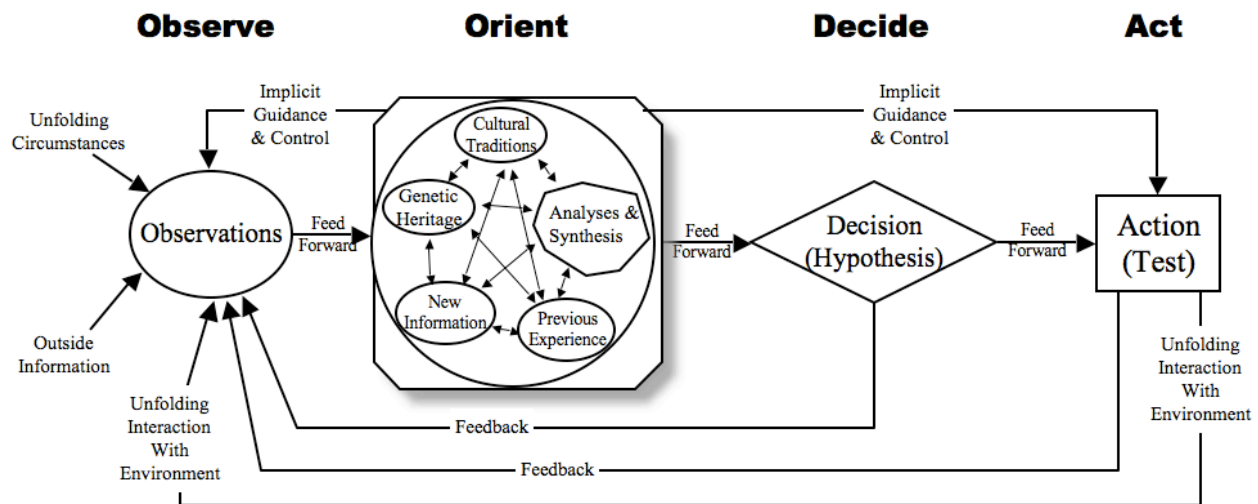
The Actual OODA "loop"

Figure 2

Figure 2 is how Boyd depicted the OODA loop in early 1993. He viewed the entire "loop" as an ongoing, multi-faceted cross-referencing process. To assist in conceptual understanding, the following analysis will begin with a description of Observation and continue from left to right.

Observation

Boyd described Observation as the act of sensing yourself and the world around you. Sensing is the use of some sort of internal organ or technology – e.g., of touch, taste, smell, sight, and hearing or a radar, infrared, communications intercept, etc.; through which one receives stimuli from the external environment.[18] The diagram above shows that observations relative to

the OODA loop have multiple facets or inputs. He characterized these inputs as unfolding circumstances, outside information, one's unfolding interaction with the environment as well as two distinct types of internal feedback loops. Unfolding circumstances represent those sensory inputs that one can directly sense but are seemingly random or independent of one's own actions. An example would be if a Marine was on patrol in Afghanistan and a farmer in the distance was tending to his field. The Marine is in a position to directly sense the circumstance, however that Marine's action did not directly cause it nor is it directly involved with it. Such circumstances may or may not be relevant or threatening initially; that depends on how one's interaction evolves.

Outside information are sensory inputs that describe either unfolding circumstances or an unfolding interaction from someone else's perspective. An example would be if while that same Marine is on patrol, he heard some say over the radio that "there are local nationals up ahead." That observation could be a random or entirely unrelated event from the Marine's specific activity (i.e. there could be a wedding party forming oblivious to the Marine on patrol) or that observation could be identifying events directly unfolding in response to the approaching Marine.

Unfolding interaction with environment is the actual effect of one's personal actions on the environment, which one can directly sense. If the Marine raised his weapon in the direction of one of those local nationals and that person saw the Marine do this, the responding behavior would be a direct result of the unfolding interaction with the environment. It may be as simple as freezing, or as elaborate raising his hands while women and children wail in anguish. A similar example is if a Marine fired his weapon. The unfolding reactions could be singular, such as only the sound of the gun is perceived or it could also be plural, such as people taking cover in

all directions, the sound emanating from the rifle, the recoil felt on the shoulder, etc. This type

of sensory input represents the direct sensing of the action. The internal feedback loop from

Action is different from the unfolding interaction input to observation.

<u>Feedback Loops</u>

A feedback loop describes causally connected elements.[19] Although it was initially

introduced under the banner of *Cybernetics* in 1948, this idea, along with systems thinking, has

grown to explain balancing and self-regulation at the neurological level in terms of how the

human body prepares for what it *expects* to observe and how it actually interacts with the

environment. Dr. B. F. Skinner based his model of "stimulus-response" on it, which forms the

heart of the behavioralist school of psychology.[20] As Dr. Vladimir Kosonogov wrote in *The*

Neurophysiology Journal, "at first, goals, and intentions of the executor's action are

coded *outside* the mirror neuron system. If the action is important for the observer and can be

useful in his own motor repertoire, his mirror neuron system implicitly reproduces the action,

retrieving the kinematics and sensory consequences the observer experienced in the past while

executing the same action. Thus, the implicit reproduction facilitates the observer to execute this

action either immediately or in the future."[21]

Cognitive psychologists have articulated the difference between direct outside

observations and indirect causal loops as the difference between "top down" processing and

"bottom up" processing of perception. While "top down" processing refers to a person's

expectations of what is likely to occur based on previous experiences and inherent mobilization

of selective mechanisms that influence focus and attention, the "bottom up" processing are the

actual observations sensed. In this case, the feedback loops from Decision and Action are the

body's preparation to receive *expected* feedback from top down perception. The bottom up

perception would come from the *actual* interaction with the external environment. Both of these descriptions allude to the incredible level of complexity involved in the human body's interactions within itself and with its external environment. This process is multifaceted and simultaneous; it is not linear or sequential.

Why Observations matter

While sensory input (what one can see, hear, smell, taste and feel) ultimately travels to the brain, it is important to remember that the brain is but a small part of the overall nervous system. As Dr. Margaret Polski recently articulated in her book *Wired for Survival: Rational (And Irrational) Choices from the Gas Pump to Terrorism:* "the nervous system is a bio-electro-chemical signaling and information system that links all sensory, mental and physical activity at cellular, molecular, and neural levels." She goes on to state that this incredibly complex system influences behavior through four main mechanisms: "voluntary actions of the muscles (somatic systems), involuntary actions of the smooth muscles, heart and glands (autonomic systems), the endocrine system and the immune system."[22]

The nervous system is comprised of the central nervous system (the brain and spinal cord) and the peripheral nervous system (a supporting collection of spinal and cranial nerves). The inputs and outputs of the central nervous system are influenced by incoming sensory information conveyed by the peripheral nervous system. This is to say that our thoughts, choices, and actions are inextricably linked to the outside world.[23] This physiological description is another way to view the difference between outside inputs to observation (those that are picked up by the peripheral nervous system) and those implicit inputs such as feedback loops (those mobilized by central nervous system in preparation and anticipation) of expectant observations.

The multiple inputs to observation depicted on the above diagram are a critical

representation of the complexity involved in neurobiological sensing and signaling.[24] The dense

network of neurons in the body that enables attention and sensory perception, learning, emotion,

problem solving, memory and motor control are not simply reactive or even conscious in most

instances. They are constantly working, whether we realize it or not. This point is especially

critical when considering that unfolding circumstances, outside information, unfolding

interaction with the environment and various feedback loops are constantly being sensed by the

nervous system; whether we want them to be or not.

<u>Orientation</u>

Without the context of orientation, Boyd believed that all observations would be

meaningless. He was particularly detailed about the components of orientation as a complex set

of filters and shaping mechanisms of genetic heritage, cultural predispositions, personal

experience, and knowledge.[25] Orientation both shapes Observations and is the lens through

which one makes sense of Observations. Genetic heritage represents the physical makeup of

one's body, particularly the brain; it includes those structural characteristics that evolved through

an interaction with the environment and were passed down through millions of years of trial and

error, selection, and reinforcement. It both wires together the common nature of one's body and

mind, and shapes the uniqueness of each person's capabilities and limitations. Cultural

predispositions refer to the set of learned behaviors during the formative years of life resulting

from one's place and position in the world. Personal experience represents a catalog of all of the

learned behavior since the formative years peculiar to each individual. Knowledge represents

information, understanding, or skills acquired throughout a collective awareness of associations,

and knowledge can also be synonymous with memory.[26]

In his dissertation, Dr. Frans Osinga summarizes Boyd's initial thoughts on the importance and distinction of orientation:

> To survive and grow within a complex, ever changing world of conflict, it is necessary to have insight and vision, focus and direction. To that end, Boyd posits, we must effectively and efficiently orient ourselves; that is, we must quickly and accurately develop mental images, or schema, to help comprehend and cope with the vast array of threatening and non-threatening events we face.[27]

According to Dr. Dietrich Dörner, the emeritus professor for General and Theoretical Psychology at the Institute of Theoretical Psychology at the Otto-Friedrich University, this idea has tremendous importance. He has found through years of research that people interpret the world around them and make sense of the constant barrage of stimuli via mental models. He has also found that individuals create and modify such models based on the collective interaction of their experiences, cultural norms, and beliefs. He emphasized that all models are merely a personal interpretation and thus a biased simplification of what actually exists. They are not a perfect picture of reality. This insight reinforces Boyd's ideas and explains the differences among the elements of orientation and their collective interaction. It also explains why individual orientation is a highly specialized phenomenon.[28]

In their joint research paper *Conditions for Intuitive Expertise: A Failure to Disagree,* cognitive psychologists Dr. Daniel Kahneman and Dr. Gary Klein also reinforce the concept of orientation as the interaction of lenses, models, or schemata. Their initial focus was to contrast the differences between their two approaches to intuition that are often viewed as conflicting. In the process they discovered that they were in fact contrasting to different elements of orientation; both of which are present at all times during decision-making and each of which have built in limitations. Dr. Klein's approach *Naturalistic Decision Making (NDM)* focuses on the ability to

compare relevant cues with the available repertoire of images in the mind; based on experiential learning. Dr. Kahneman's approach *Heuristics and Biases,* was originally skeptical of experience as his research found that in certain situations individuals will rely solely on memory if they do not have access to appropriate cues; and that memory is inconsistent at best.[29]

Dr. Kahneman later differentiated between personal experience and personal memory. *The Riddle of Experience vs. Memory* is a Technology, Education, and Design (TED) presentation that has been viewed over two million times at the time of this writing. During this lecture, Kahneman illustrated the distinct differences between the mental model of experience and the mental model of memory in numerous ways. The first was through the comparison of an individual's experience with the same individual's memory of a symphony. The individual stated that he had been listening to a symphony, and it was glorious music. However, at the very end of the recording, there was a dreadful screeching sound. The individual then added, with significant emotion, that this one event ruined the whole experience. Kahneman contends that the screeching sound did not ruin the experience. The individual had listened to and enjoyed twenty minutes of glorious music. The screeching sound had ruined the memory of the experience. Kahneman concluded that this is an example of direct conflict between the experiencing self and the remembering self and thus an example of the uniqueness of the two mental models.[30]

This research illustrates that Orientation, as depicted in Figure 2 is a graphical representation of abstract reality; mental images one constructs are not only shaped by personal experience, genetic heritage, cultural traditions and memory, they are also compared and contrasted to new information to validate or invalidate existing schemata. If the entire OODA loop represents a multifaceted learning and feedback framework, Orientation in and of itself

represents the heart of this multifaceted learning and feedback framework.[31] According to Boyd, the way Orientation changes and evolves to ensure the matchup of the entire loop to its environment is through the process of analysis and synthesis: the destruction of existing mental images and the creation of new ones.

Analysis and Synthesis

Analysis is a careful study of a *whole* by studying its *parts*, to understand what they do, and how they relate to each other. Alternatively, one can think of analysis as an effort to explain the nature and meaning of something through resolving complex expressions into simpler or more basic ones.[32] Boyd likened this process to deduction, differentiation, and destruction in his essay *Destruction and Creation*. He described a systematic process of moving from general to specific. Analysis is related to understanding. Synthesis, on the other hand is defined as the composition or combination of parts or elements so as to form a whole. It also leads to an explanation of the nature or meaning of something through creating complex expressions from simpler or more basic ones.[33] Boyd referred to this process as creation in the same essay, moving from specific to general, the same way that information leads to knowledge, and then to wisdom. Synthesis is related to creativity.

Boyd summarized the importance of this process in the abstract in his paper *Destruction and Creation.* He stated that the destruction of existing and the creation of new mental patterns permit one to both shape and be shaped by a changing environment. He also stated why one cannot avoid this activity if one intends to survive on one's own terms.

Decision

Boyd's idea of decision is a review of alternative courses of action and the selection of the preferred course as a hypothesis to be tested. Dr. Klein's research, mentioned previously in

the Orientation section, supports Boyd's theory. Klein has found that people draw on a large set

of abilities in order to make decisions; abilities termed by some researchers as *sources of power*:

> The conventional sources of power include deductive logical
> thinking, analysis of probabilities, and statistical methods –
> clearly defined procedures used primarily in laboratory settings.
> Yet the abilities that are needed in natural settings; those settings
> that include time pressure, high stakes, inadequate information,
> dynamic conditions, and team coordination, are usually not
> conventional at all. Natural decision-making is defined by
> *poorly defined procedures*, where one has to invent or modify
> procedures.[34]

Klein studied firefighters, police officers, nurses, emergency room physicians, and

military officers, and was fascinated with how they made split-second decisions that saved lives.

He found that:

> The powers of intuition, mental simulation, metaphor and
> storytelling are what experienced decision makers leverage in
> natural settings that have a series of decision points…The power
> of intuition enables us to size up a situation quickly. It depends
> on the use of experience to recognize key patterns that indicate
> the dynamics of the situation. The power of mental simulation
> lets us imagine how a course of action might be carried out. The
> power of metaphor lets us draw on our experience by suggesting
> parallels between the current situation and something else we
> have come across. The power of storytelling helps us consolidate
> those details in order to make them available in the future, either
> to ourselves or to others…Expertise in recognition prime
> decision-making depends on perceptual skills.[35]

Recognition primed decision-making model posits that experienced decision-makers focus on

how their assessment of the situation compares to previous experiences. From there, the first

workable option that comes to mind is quickly evaluated by imagining how it will be carried out,

not by a formal analysis or comparison. The first option they consider is usually workable; they

do not have to generate a large set of options. As this process evolves, experienced decision-

makers can discern weaknesses in stride and make timely corrections on the spot, thereby

making their option stronger and more effective. Recognition prime decision makers emphasize being poised to act rather than waiting until all the evaluations are completed.[36]

These observations are directly in line with Boyd's theory that the analysis and synthesis of new information compared to existing mental models produces a hypothesis that must be tested and further refined through continuous feedback. These observations are also directly in line with his ideas of implicit guidance and control depicted by the lines directly connecting Orientation to Action and Observations in Figure 2.

Action

Boyd described the final part in the loop as "action:" the testing of the decision selected by implementation. It is the culmination of the interactive process of observation, orientation, and decision. Using a scientific analogy, it is the experiment designed to test the hypothesis, the results of which produce more observations that are then fed back and compared to expected observations. Actions either prove or disprove the validity of the decision.

Implicit Guidance and Control

At this point in the discourse, the only aspects remaining in the detailed Boyd Diagram (Fig 2) are the implicit guidance and control loops going from Orientation to Observation and from Orientation to Action. Paradoxically, understanding implicit guidance and control is the most important part of understanding the OODA loop as an aid for evolving tactics, operations, and strategy: the idea of intuitive decision-making as outlined by General Krulak. Out of these implicit connections flows both advantage and disadvantage. If action flows nearly instantaneously from orientation, the *quickness* of the overall loop is accelerated. This relative acceleration will shorten, or seemingly *compress* the time an adversary has to reorient in response to what is happening in his environment. Boyd contented that in competitive situation,

be it combat, sports or debate, the opponent with the relatively quicker loop will, at times, have a

more relevant picture of the unfolding situation because he or she is *shaping* it rather than being

forced to *adapt* to it.. This mismatch in orientation can provide a fleeting opportunity for the

quicker side to continue to act to exploit the effects of the first move, before the slower side

understands what is happening. If the quicker side can maintain this mismatch, the slower side

will become increasingly disconnected from the environment and their actions will become

increasingly unrelated to the actual situation. They will be driven solely by *perception*. As this

process continues, the relatively slower side continues to generate increasingly irrelevant

observations, leading to more disconnected decisions, and so forth. The relatively slower side's

loop will fold back in on itself as confusion and disorder increase; generating an internally

focused close loop.

If this mismatch is combined with menacing pressure of a life or death situation, the

relatively slower side's loop quickly degenerates into chaos, panic, and ultimate collapse.[37] This

mismatch is what Boyd referred to as "operating inside their OODA loop." Miyamoto Musashi,

the expert Japanese swordsman and rōnin referred to this mismatch as the necessity to "act and

react without thinking" in his 17th century treatise *The Book of Five Rings.*[38] Dr. Klein's

research confirms that intuition: depending on the use of experience to recognize key patterns

that indicate the dynamics of a situation, is the source of power that participants in all time

sensitive situations leverage the most.[39] The phenomenon Boyd was describing did not derive

from absolute speed but relative speed, and that is a vital distinction.

As noted above, implicit connections can also lead to a disadvantage. If an individual

does not have a well-developed orientation and therefore cannot perceive the relevant cues,

patterns and leverage points of a particular situation, that individual may feel pressured by the

situation to enact *preconceived* notions and actions; regardless if they are relevant or not. The danger manifests when individuals are repeatedly conditioned to respond to stimuli based on a script regardless of relevant cues or pattern recognition in a bias for action culture. Boyd named this condition incestuous amplification, and when it occurs, the decision-maker's OODA loop becomes increasingly distorted and disconnected from its environment. Psychologists refer to this phenomena as cognitive dissonance exacerbated by confirmation bias.

Incestuous amplification occurs when one's preconceptions misshape the observations that one is sensing. These misshapen observations then blur the true connection between the individual and the environment because the brain begins to synthesize cues and preconceived responses. Viewed abstractly, incestuous amplification hijacks the orientation of an individual's OODA loop by overriding actual observations to a point where the subsequent orientation induces the individual to perceive and act on what he or she wants to see rather than what actually is. First order effects of this disconnect may be initially too small to measure thanks in part to luck, chance, or ambiguity. However, if the cycle continues unabated, subsequent actions continue to induce dysfunctional behavior back into the entire OODA loop, which then folds back on itself to magnify the mismatch. The cycle not only repeats itself but mutates by amplifying itself — the effect, as Chuck Spinney pointed out in his recent article on the subject stated "it is a little like placing a microphone next a speaker when recording, only much more dangerous."[40]

This kind of positive feedback loop essentially forms a *closed system*. Left uncorrected, the individual exhibiting an incestuously amplifying OODA loop becomes increasingly disconnected from his or her environment, yet continues to increase internal *entropy*. As Mr. Spinney continues:

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Put another way, all living systems can be viewed as open thermodynamic systems that must process a flux of matter, energy, and information to maintain their coherence. To do this, they must communicate effectively with their environments. Incestuous amplification has the effect of closing off the system from its environment, and any activity in a closed system always generates entropy, thereby making it impossible to maintain that system's coherence. Therefore, without a correction or change that opens the decider's OODA loop to an effective communication with the real world, the only uncertainty in the outcome is how long an OODA loop driven mad by incestuous amplification can last before it degenerates into chaos, confusion, and disorder.[41]

Implications

As outlined above and contrary to the commonly simplified version, the OODA loop does not represent a linear process developing chronologically. It is a multidimensional, complex, and dynamic framework that operates in both time and space. This deceptively simple idea, when graphically depicted in the way that Boyd intended it to be depicted – i.e., Figure 2, summarizes the complexity of interactions and interrelationships involved in critical thinking, decision-making and learning processes. It describes how orientation shapes our interpretation of observations. It highlights the correlation between previous experience, cultural heritage, and traditions and recognizing key patterns that indicate the dynamics of the situation; suggesting parallels between the current situation and something previously encountered. It speaks to how mental simulation lets us imagine how a course of action might be carried out, and how that might shape future observations and actions. It also describes how details are synthesized in order to make them available in the future, either to ourselves or to others."[42]

The actual OODA loop also describes how actions based on these processes, together with other external, inputs affect the environment, which in turn generates new information, new orientations, and new experiences. It simply and eloquently describes emergence, learning, and

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growth. It graphically depicts how actions within the loop can be simultaneous as well as sequential; showing how decisions and actions do not relieve one from the need to continue to observe and re-orient continuously. It also shows how one can skip the decision stage implicitly or even go backward for the sake of increasing clarity and focus.

The narrow interpretation of the OODA loop (i.e., Figure 1) also suppresses another essential feature of Boyd's theory: developing, maintaining and reshaping one's orientation, the box around which the loop revolves. Absolute speed is not very useful if one cannot adequately react on incoming information or one's interpretation of events is flawed. Orientation shapes the way one interacts with the environment. It is the amalgamation of lenses thru which one sees the world. It determines how and what one observes, decides and acts. It determines the character of the present cycle while shaping the character of future orientations. It feeds forward and backward. Orientation is the most important part of the OODA loop. Brave decisions and heroic actions are pointless if the observation was inaccurate because of an inadequate or dysfunctional orientation.

This is an incredibly important distinction from the absolute speed and tempo narrative that has shaped mental models and the common decision-making dialog. While one aspect and application of it is certainly reaction time; specifically how quickly one can make *sense* of the observations presented, if one's adversary never *observes* what one is doing, then one may be expending a tremendous amount of energy for no strategic or tactical purpose. Furthermore, if one's actions are exactly what ones adversary thinks or wants one to do, then if absolute speed is one's only driving force, then one is simply falling into the trap at high speed.

Essentially, the OODA loop is dependent on individual orientation. He who has the ability to keep their orientation closely matched to reality while attempting to disrupt or detach their opponent's with multiple actions has the advantage.[43]

Conclusion

Recent combat experiences in Iraq and Afghanistan highlighted the power of small unit decision-making on the battlefield. In response, multiple articles, symposiums, and programs of record have saturated the discussion with disparate and often counterproductive ideas on how to inculcate and enhance that decision-making through creativity and adaptability. Rather than create another center of excellence or add another skill to an already saturated system, the United States Marine Corps could go far in simply articulating how it views decision-making, what the elements of it are, and how to improve them over time. From there, they can evaluate training and education and identify where the redundancies are and where individual responsibility lies. In the process, the Marine Corps may be surprised by what it finds.

Colonel John Boyd's detailed OODA loop diagram facilitates this discussion, highlighting that decision-making is a combination of both implicit and systemic modalities – each of which requires both individual insight and intuition. Decision-making is more than a simple four-stage model anchored by absolute speed and efficiency. When compared to the latest research on systems thinking, evolution and cognition, the detailed model of the OODA loop highlights the vitality of individual orientation above all other components. It is through this critical series of lenses that individual Marines must observe, decide, and act in complex environments. They must be prepared to shape and be shaped by that process, to innovate and adapt accordingly. Whether that action is emergent, novel or is in accordance with best practices

or lessons learned is irrelevant. What is essential is whether or not that action was relevant to the particular situation and why.

This renewed understanding brings clarity to how the Marine Corps can shape and influence future generations of combat leaders; what General Krulak intuitively knew based on his personal relationship with Boyd and what has been lost over time. The question is not how to develop intuitive or analytical decision-making, the question is how to maximize the relevancy of both skills through the development of individual orientation. An authoritarian culture that is conditioned by a systems approach to training and education is optimized for compliance and efficiency. While this methodology has many benefits, it does not foster innovation and creativity, nor does it develop individual orientation; it actually stifles it. As Dr. Gary Klein recently stated in his new book *Seeing What Other's Don't: The Remarkable Ways We Gain Insights*, "Organizations inadvertently suppress the insights of their workers, and they do so in ways that are ingrained and invisible. They value predictability, they recoil from surprises, and they crave perfection: the absence of errors. Unfortunately, actions that are taken to reduce errors and uncertainty can get in the way of insights. Therefore, organizations are faced with a balancing act."[44]

"The answer lies not in restricting human endeavors," wrote Dr. Edward T. Hall in *Beyond Culture*, "but in evolving new alternatives, new possibilities, new dimensions, new options, and new avenues for creative uses of human beings based on the recognition of the multiple and unusual talents so manifest in the diversity of the human race."[45] A way to do that, at least in the short term, is to view education as the antithesis of training from an institutional perspective. If training must be a closed, mechanistic model of efficiency due to resource and fiscal constraints, education must then become an open, organic exchange of ideas to provide

balance; to enable intuition and insight to spring from collective experience. This exchange can be facilitated in a variety of cost effective and easily accessible ways.

Dr. Bruce Gudmundsson, the Case Method Chair at Marine Corps University, recently published a paper on *The Modular Marine Corps University* concept. In it, he describes a flexible, individually focused and adaptable system that "would foster continuous education, both military and general, throughout the Marine Corps; document the skills, accomplishments, capabilities, and attainments of Marines in a way that makes sense to the outside world; and improve access to education, both military and general, for all Marines, particularly those with duties that prevent them from taking advantage of existing educational opportunities."[46] This modular system is as simple as providing access to video recordings of Marine Corps University lectures for all Marines to view at their leisure, or can be as elaborate as providing a venue for all Marines to work with university professors on individual study projects; accredited by the university. Approaching this topic conceptually opens the aperture for ideas in keeping with Dr. Hall's observations. Ideally, this process, over time, will become less focused on the historical training versus education debate and more in tune with providing efficient access to information and reinforcing positive learning experiences; sustaining the transition above and beyond entry level schools.

Imagine a day where a squad leader in Camp Lejeune can watch both an Infantry Officer Course lecture on human factors in combat and Dr. Sebastian Gorka discuss the Islamic State from his room in the barracks in preparation for an upcoming training event. Those insights could also come from or be reinforced via an online discussion through a Marine Corps University sponsored venue or with members of his unit who have been exposed to the same information. When this professional exposure leads to a true professional discourse, especially

when it is generated from the bottom up, the same squad leader may be forced, just by the nature

of a rapidly evolving situation to, at a minimum, repeat the same process in order to remain

relevant. Ideally, the squad leader inevitably comes to the realization that to truly teach, coach

and mentor rather than simply expose and discuss, one must invest just as much intellectually as

one does physically; if not more. This evolution and self-actualization is the very behavior the

Marine Corps is trying so hard to systematically instill.

Unfortunately, as Dr. Hall noted again in *Beyond Culture*, "part of the problem lies in the

tension between creativeness and diversity and the rather specific limiting needs of institutions.

Most cultures and the institutions they engender are the result of having to evolve highly

specialized solutions to rather specific problems."[47] He continued "many people's sense of

worth is directly related to the number of situations in which they are in control" and therefore

the number of specialized solutions can be assimilated with control. The problem lies in when a

specialized solution does not control the situation. This feeling of powerlessness and limitation

of control naturally leads to increased aggression. Dr. Hall concluded that the only way to

escape from this vicious cycle is to "involve ourselves actively and consciously in the very parts

of life that we take most for granted." This movement cannot be imposed, but has to "spring

from within" the individual.[48]

Dr. Karl Popper also reinforced this idea in *The Open Society and Its Enemies*:

> The secret of intellectual excellence is the spirit of criticism;
> it is intellectual independence. And this leads to difficulties
> which must prove insurmountable for any kind of authoritarianism.
> The authoritarian will in general select those who obey, who believe,
> who respond to his influence. But in doing so, he is bound to select
> mediocrities. For he excludes those who revolt, who doubt, who dare
> to resist his influence. Never can an authority admit that the intellectually
> courageous, i.e. those who dare to defy his authority, may be the most
> valuable type. Of course, the authorities will always remain convinced
> of their ability to detect initiative. But what they mean by this is only

a quick grasp of their intentions, and they will remain forever incapable of seeing the difference.[49]

Dr. Peter Senge argues in *The Fifth Discipline*, "Personal mastery is the discipline of continually clarifying and deepening our personal vision, of focusing our energies, of developing patience, and of seeing reality objectively."[50] Focusing one's energies on improving observation, recognizing patterns, understanding the difference between implicit and explicit decision-making and embracing feedback is, as Dr. Senge suggests, "the essential cornerstone of the learning organization. An organization's commitment to and capacity for learning can be no greater than that of its members."[51]

This insight is important when one scales the OODA loops to the unit level and reinforces what General Krulak referred to in *Cultivating Intuitive Decision-Making*; the importance of command climate. The cultivation of intuitive decision-making requires a significant culture shift from highly mechanized, control based environments. Leaders must be viewed based on their ability to *facilitate* development – not compliance. Units have to become a collective of unique individuals – each at a different level of personal and professional development – not a homogenous whole only able to respond to stimulus in scripted ways.

In order to develop individual cognition to a level of proficiency required for battlefield innovation and adaptation, the right pedagogy and mentorship is crucial during the formative years and beyond. Major Don Vandergriff, USA (ret) has published a series of books outlining his argument for why now, more than ever, a change in the training and educational paradigms of the past are required. His books, *Path to Victory, Raising the Bar,* and his latest work *Adopting Mission Command: Developing Leaders to Operate in a Superior Command Culture,* are filled with detailed descriptions of how to evolve current programs of instruction in order to maximize individual orientation growth and collective outcomes.

Vandergriff's methods are being used by numerous organizations and militaries around the world with great success. Some of the Marine Corps premiere training institutions have already implemented this transition, on their own initiative, and are seeing immediate results. These transformational efforts garnered tremendous support during General Gray's tenure as Commandant. Reading through Vandergriff's well researched and thorough texts reinforce what previous generations of Marines were arguing for and implementing over two decades ago; Marines like General Charles Krulak, Lieutenant General Paul Van Riper, Colonel Michael Wyly, and Major John Schmitt. The genesis of these ideas can be found in Carl von Clausewitz's treatise *On War.*

It seems that over the last three decades, as the Marine Corps has tried to improve institutional efficiency, Marines have been taught to think linearly rather than comprehensively.[52] This linear thinking is reinforced with training that conditions immediate and scripted responses to stimuli; regardless of the initial conditions. This way of thinking is based on an illusion that the world is created from individual pieces, all abiding by universal laws. As physicist, Dr. David Bohm concludes, "this sets up a futile task – similar to trying to reassemble the fragments of a broken mirror in an attempt to see a true reflection."[53]

To accomplish what General Dunford calls for in his guidance: the ability to innovate and adapt in "increasingly uncertain, complex, and decentralized operating environments" leaders at all levels must embrace how individuals actually interact with their environments. Studying the full version of the OODA loop rather than simplifying it to a linear process is the first step in appreciating the complexity of this interaction. This renewed understanding and appreciation will enable Marines, young and old, to expand their individual capacity for desired action, nurture new and expansive patterns of learning and thought, and harness the true power of the

idea. The ability to innovate and adapt *effectively* in increasing uncertain, complex, and

decentralized environment requires *excellence* in thought and in deed. Excellence in thought

requires both intuition and insight. Excellence in deed is acting on that intuition or insight; not

simply acting for the sake of acting.

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