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Control warfare is an emerging concept for attacking the command structure that controls a state?s instruments of power. It differs from command and control warfare in its independent focus for fighting war; it is not necessarily an adjunct to conventional attrition warfare, it is potentially a replacement for it. Currently, control warfare suffers from a lack of definition, especially regarding aspects of human and organizational behavior. This paper proposes that John Boyd?s OODA Loop model is an accurate depiction of both behavior and the command and control process. As such, it serves as the foundation for prosecuting control war. The OODA Loop also suffers from a lack of definition, however. This exposition outlines the psychological and behavioral support for the OODA Loop, and then examines some of the ways in which Boyd believed it could be used in war.

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CONTROL WARFARE:
INSIDE THE OODA LOOP

BY
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The conclusions and opinions expressed in this document are those of the author. They do not reflect the official position of the US Government, Department of Defense, the United States Air Force, or Air University.

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ABSTRACT

Control warfare is an emerging concept for attacking the command structure that controls a state's instruments of power. It differs from command and control warfare in its independent focus for fighting war; it is not necessarily an adjunct to conventional attrition warfare, it is potentially a replacement for it. Currently, control warfare suffers from a lack of definition, especially regarding aspects of human and organizational behavior. This paper proposes that John Boyd's OODA Loop model is an accurate depiction of both behavior and the command and control process. As such, it serves as the foundation for prosecuting control war. The OODA Loop also suffers from a lack of definition, however. This exposition outlines the psychological and behavioral support for the OODA Loop, and then examines some of the ways in which Boyd believed it could be used in war.

Contents

Chapter 1

Introduction

War is thus an act of force to compel our enemy to do our will.

– Carl von Clausewitz

Control warfare is at once a popular and overlooked topic of discussion in the United States military. Few published works deal exclusively with the subject. One can find expositions regarding information warfare, command and control warfare, network-centric warfare, and a host of other information-age topics in almost every issue of the professional military journals. Discussion of control warfare and the decision loop, which together represent the foundations of modern military strategy in the information age, is, however, virtually absent from the literature.

The dearth of material concerning control warfare most likely stems from two causes. First, the theorist who gave structure and definition to the concept of the decision loop upon which control warfare is based recently died without formally codifying his intellectual construct.[1] Second, his construct is so intuitively obvious that it has permeated the realm of military doctrine quite rapidly. Embraced *in toto*, often without attribution or further examination, the *Observe-Orient-Decide-Act* (OODA) Loop exists ubiquitously throughout the branch-specific and Joint doctrinal publications of the United States military.

The instant appeal and rapid assimilation of John Boyd's OODA Loop within the United States military has hampered closer inspection of the theory itself. The U.S. Joint Chiefs of Staff Publication, *JP 3-13.1, Joint Doctrine for Command and Control Warfare (C2W)*, exemplifies this contention. In Appendix A, the publication describes the

[1] Frank C. Spinney, "Genghis John," *U.S. Naval Institute Proceedings* July 1997, 46.

decision loop, briefly explaining each of its four components.[2] It does not mention or cite John Boyd; neither does it explore opportunities for exploiting the decision loop outside of those that support conventional attrition-style warfare.

Other works have set the stage for a deeper analysis of the decision loop and control warfare, however. In a brilliant and penetrating analysis, David S. Fadok contends that modern airpower theory—long predicated on the concept of strategic paralysis—has shifted its emphasis from economic warfare to control warfare. Under the old paradigm, the application of airpower at the strategic level was "a form of economic warfare based upon industrial targeting." The new model asserts that the strategic use of airpower is a form of "control warfare based upon command targeting."[3] In short, whereas airpower formerly concerned itself with paralyzing an opposing state's ability to *produce* its military means of power, it now concerns itself with paralyzing the adversary's ability to *control* its means of power.

To the extent that Fadok's thesis describes and expands on John Boyd's seminal theory of the decision making loop, it serves as an elegantly argued point of departure for a deeper discussion of control warfare itself. While others have examined the nuances of economic warfare in exquisite detail, few have come to grips with what appears to be the new methodology for the application of aerial power.[4] The most analogous works to control warfare emerge from the burgeoning field of information warfare.[5] Interestingly, the continuing affinity of airpower and information that began with the use of balloons and aircraft for reconnaissance appears to be resulting in a convergence of thought at the level of strategic employment. Although this paper is not a discussion of information warfare *per se*, those who are conversant with the salient issues that inform the concepts of netwar, cyberwar, and network-centric warfare should find many similarities to ponder regarding the application of airpower in the prosecution of control warfare.

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[2] U.S. Joint Chiefs of Staff, *JP 3-13, Joint Doctrine for Command and Control Warfare (C2W)*, 7 February 1996, A-1.

[3] David S. Fadok, "*John Boyd and John Warden: Air Power's Quest for Strategic Paralysis* (Maxwell AFB, AL: Air University Press, 1994), 3. This work has also been reprinted in *Paths of Heaven: The Evolution of Airpower Theory*, Phillip S. Meilinger, ed. (Maxwell AFB, AL: Air University Press, 1997).

[4] A small selection of works on economic warfare includes Mancur Olson, *The Economics of the Wartime Shortage* (Durham, NC: Duke University Press, 1963), Alfred Mierzejewski, *The Collapse of the German War Economy* (Chapel Hill, NC: The University of North Carolina Press, 1988), and R. J. Overy, *Why the Allies Won* (NY: W.W. Norton and Co., 1995).

[5] See especially John Arquilla and David Ronfeldt, *In Athena's Camp* (Santa Monica, CA: RAND, 1997).

Control Warfare Defined

In general, control warfare is a broad classification that encompasses all types of warfare that seek to achieve victory over an adversary by attacking his decision processes at the national level, or at any level. This is done in order to reduce the adversary's freedom of action. Theoretically, if done well, control warfare reduces the enemy's available courses of action to one: capitulation.

As a practical matter, control warfare purports to achieve victory by severely impairing the enemy's ability to control its forces. Understanding how people and organizations detect, process, and act upon changes in their environment forms the basis from which control warfare emerges. Fundamentally, it is informed by numerous theories of psychology, behavior, and decision making, all of which support John Boyd's theory of the OODA Loop. To achieve success, control warfare relies on coercing the enemy into capitulating. Although it supports conventional warfare, it is not classical attrition-style warfare. In fact, as stated earlier, its pedigree most closely resembles the economic warfare that the Allies employed against Germany in World War II.

Background

War is essentially a struggle for control between adversaries. In its most basic form, war consists of some level of disagreement between nations that results in armed conflict in which each side attempts to compel the other to do its will. In short, the opposing sides try to control each other's behavior through the use of force. The contest continues until one side agrees to change its behavior to conform to the other side's demands.

Historically, the clash of military or maritime forces decided the outcome of wars. The defeat of an army or navy often resulted in the capitulation and subsequent behavior modification of the conquered adversary. In fact, defeating an opposing nation's armed forces was practically the only way to substantively modify its behavior.

The advent of the airplane restructured this centuries-old paradigm. With this new weapon of war came new theories for using it in the struggle for control. The most revolutionary theories were those that advocated striking directly at the heart of an opponent's country, bypassing the forces in the field.

Chief among the new theories of war enabled by airpower was "strategic paralysis." Embodied by the U.S. Army Air Corps Tactical School's (ACTS) doctrine of High Altitude Precision Daylight Bombing in the 1930s and codified in Air War Plans Division (AWPD) Plan 1, the Allies' strategic bombing campaign in World War II sought to destroy the Axis Powers' will to resist by disrupting or paralyzing their industrial and economic systems.[6] Although many still debate the efficacy of strategic bombing more than 50 years later, few can deny its paralytic effects on German mechanized and aviation forces due to the destruction of oil and fuel supplies.

Control warfare emerges from this legacy of strategic paralysis; however, rather than striking at the industrial and economic bases of an adversary, it advocates striking the command structure that controls the military, industrial, and economic bases.[7] While not a new concept—the Chinese military theorist Sun Tzu first expressed the rudiments of control warfare more than 2,500 years ago—it is still rather nebulous and ill defined.

The greatest impediment to defining control warfare is an incomplete understanding of human behavior. Personality, environment, intelligence, culture, past experience, and a host of other factors coalesce to influence the way people act. Nowhere is this more apparent than in the conduct of war—two or more groups of people in opposition, each trying to force the other to do its bidding.

If war were simply the collision of two insensate masses, the outcome would be fairly predictable. Physics has a number of well-defined laws and formulae for dealing with such occurrences. War is more than a physical engagement, however; it is a contest between the wills of opposing peoples, leaders, and militaries. It is a series of battles fought primarily on the physical level and generally won on the mental level. The mental and physical interaction between opposing, sentient forces creates unpredictability during war. This is one of the reasons why warfare is such a difficult enterprise to master. By its very nature, it resists prediction. Theories of warfare that rely on determinism and absolute predictability quickly fail and fall into disuse.

Skeptics might label control warfare as a call for determinism in the conduct of war. It is not. Instead, control warfare seeks to establish a broad understanding of the

[6] Peter R. Faber, "Interwar US Army Aviation and the Air Corps Tactical School: Incubators of American Airpower," in *Paths of Heaven: The Evolution of Airpower Theory*, Phillip S. Meilinger, ed. (Maxwell AFB, AL: Air University Press, 1997), 219.
[7] Fadok, 39.

way in which humans and organizations turn information into action, and then searches for ways to disrupt that process in order to achieve victory in war.

Methodology and Purpose

Ultimately, this paper seeks to bring further definition to the concept of control warfare by examining the fundamental tenets of human and organizational behavior that guide the employment of force. Understanding how people act, react, and interact within the constraints of their environment is a prerequisite for comprehending their actions. Since leaders do not make decisions in a complete intellectual vacuum, knowing how they gather, process, and use information is critical if one intends to affect their behavior.

This exposition accepts John Boyd's description of human behavior as valid and uses it as the basis for refining the concept of control warfare. Unfortunately, outside of an amorphous mass of briefing slides and one short paper, Boyd never formally codified his interpretation of behavior, decision making, and warfare.[8] Because of a dearth of published material chronicling the evolution of Boyd's theory, this paper first undertakes the challenge of establishing its intellectual and academic credibility. Next, it inspects the OODA Loop in detail, presenting two distinct views of the decision-making process. Finally, the discussion concludes with an examination of how best to use this theory in the struggle for control between nations.

[8] John R. Boyd, from the unpublished collection of briefing slides entitled "A Discourse on Winning and Losing," (Maxwell AFB, AL: Air University Library, Document No. M-U 43947, August 1987) 4-5.

Chapter 2

Human Behavior

This difference between coercion and brute force is as often in the intent as in the instrument.

—*Thomas Schelling*

Introduction

As the first chapter noted, John Boyd's theory of the OODA Loop passed directly into military doctrine with little examination of the theory itself. It was such an intuitively obvious expression of human decision and action that few commented on it, much less explored it in depth. This chapter, along with the one that follows, examines the basis for the OODA Loop: human behavior. Since the ultimate goal in war is altering the enemy's behavior so that it aligns with one's demands, establishing the legitimacy of the OODA Loop as a behavioral model is an important first step in defining control warfare

Describing Behavior

Human behavior is a complex phenomenon that is difficult to describe, let alone predict. The fields of psychiatry, psychology, philosophy, and behavioral science all attest to the difficulty inherent in determining why people act the way they do. Some claim that behavior is primarily dependent on genetic predisposition while others maintain that environmental shaping is the chief determinant—this is the classic "nature versus nurture" argument regarding personal conduct that is still debated today.[9]

In truth, the sum of human behavior is not simply the result of either hereditary or circumstantial factors, but rather it is the resultant of both inherited and learned traits. Some people are shy, some gregarious; some are happy, while others are sad or angry—at times, everyone displays all of these attributes. Nonetheless, each individual has a predominant personality type that has little to do with environmental factors.[10] Even so, people still engage in

[9] William C. Jeffries, *True to Type* (Norfolk, VA: Hampton Roads Publishing Company, Inc., 1990), 19.

[10] Isabel Briggs Myers, *Introduction to Type* (Palo Alto, CA: Consulting Psychologists Press, Inc., 1998), 6.

an enormous variety of learned behaviors. Often, these actions are independent of personality type—one can see shy and gregarious individuals alike stopping at red traffic lights, or looking both ways before crossing streets, or performing any of a multitude of like tasks. Similarly, all types of people blink when something approaches their eyes, or jerk their hands away from a hot surface. Behavior, then, is a function of both genetic predisposition and environmental shaping, of innate and learned behavior.[11] As important as this determination is, it says little about what induces people to act in the first place—what actually precipitates human action.

Behavior itself can be broadly described as falling into one of two categories: reflexive or cognitive. Reflexive actions are those that occur in response to specific events. Reflexes are usually involuntary and automatic—they are adaptations to changes in the surrounding environment.[12] Cognitive actions, on the other hand, are intentional—they are often predicated on external events and can be influenced by reflexes, but they represent deliberate, thoughtful behavior nonetheless.

The challenge in describing human conduct lies primarily in explaining why an individual, or a group of individuals, deliberately performs a particular action. Reflexes are fairly well understood and are generally amenable to the scientific method to determine what types of events produce certain outcomes. Cognitive behavior is not as transparent to such inspection—understanding why that is so lays the foundation for control warfare.

Reflexive Behavior

In its simplest form, reflexive behavior is a process of stimulation and response. Most commonly known as a reflex, this stimulus-response function explains a wide variety of human and animal behaviors.[13] In general, reflexes provide a quick reaction to a specific environmental event.[14] Interestingly, different animals can have radically different responses to similar events. If a dog steps on a sharp object, it withdraws the injured limb while extending the opposite leg to maintain balance—a tree-dwelling sloth, on the other hand, extends the injured limb, while

[11] William C. Gordon, *Learning and Memory* (Pacific Grove, CA: Brooks/Cole Publishing Company, 1989), 3.

[12] Gordon, 2.

[13] Michael Domjan and Barbara Burkhard, *The Principles of Learning and Behavior* (Monterey, California: Brooks/Cole Publishing Company, 1982), 22.

[14] Ibid., 23.

grasping tighter with the opposite leg.[15] The environment shapes the response of each animal to the same type of event, producing actions that are diametrically opposed but wholly appropriate for each.

Inherent in the stimulus-response construct is an assumed perception of the stimulus. Many things occur in the environment, but without some perception of these events there can be no response to them. Figure 1, below, expresses the concept. Since events A and C are not perceived, they do not function as stimuli and do not generate a response. This implies nothing about the importance of these unobserved events, or whether the organism would respond to them even if they were perceived—it simply reflects the fact that not every event in the environment is observed by an individual.

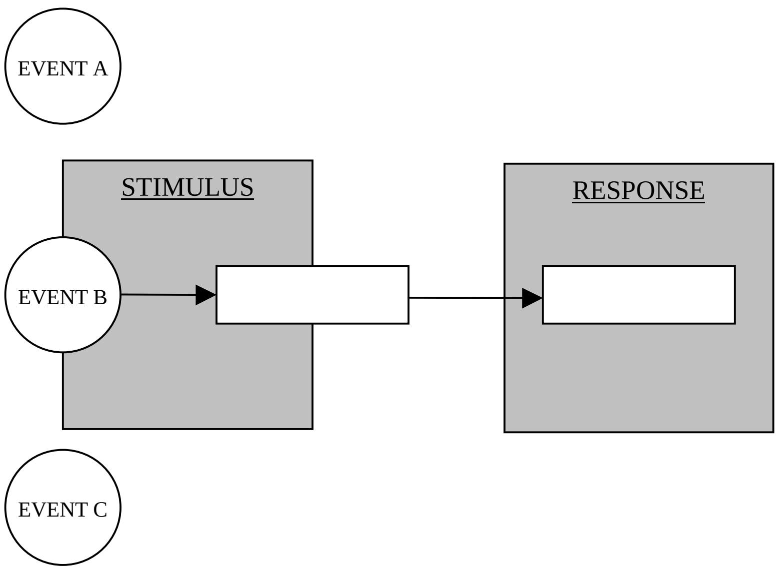

Figure 1. Reflexive Behavior.

In describing reflexive behavior, Figure 1 is still vaguely unsatisfying. It leaves one with the impression that a reflex is very deliberate behavior. Reflexes are normally described as good or fast, implying some element of time that is not reflected very well in the diagram. The truth is that no matter how quick reflexes are, they are not instantaneous. There is some delay between an event and its perception as a stimulus, and between this and the concomitant response. In humans, and other vertebrate animals, the shortest pathway between certain stimuli and their

[15] Ibid., 23.

elicited responses is called the reflex arc.[16] Fast as it may be, the reflex arc still takes time to complete.

The arrows between the circles and boxes in Figure 1 represent the delay inherent in completing the reflex arc. This is an acknowledgment of the time it takes to recognize a stimulus and respond to it. Typically, it is a very short period of time for reflexive behavior. For more deliberative behavior, the delay between an event and any subsequent action is usually much more substantial.

Cognitive Behavior

The difference between cognitive and reflexive behavior is one of kind as much as degree. Reflexive action is an involuntary, adaptive response to external events, while cognitive action is a deliberate, usually goal-directed, response to external or internal events. The difference lies in the type of information gathered from the environment and what is subsequently done with it.

Psychologists Richard C. Atkinson and Richard M. Shiffrin posit that humans process information in much the same way as computers process data. Their model, shown in Figure 2, captures the same sequence of event, perception, and response that characterizes reflexive behavior; however, it also incorporates the more advanced concepts of memory and decision making that are not required for reflexive behavior, but which are crucial for any deliberative action.

[16] Domjan and Burkhard, 22.

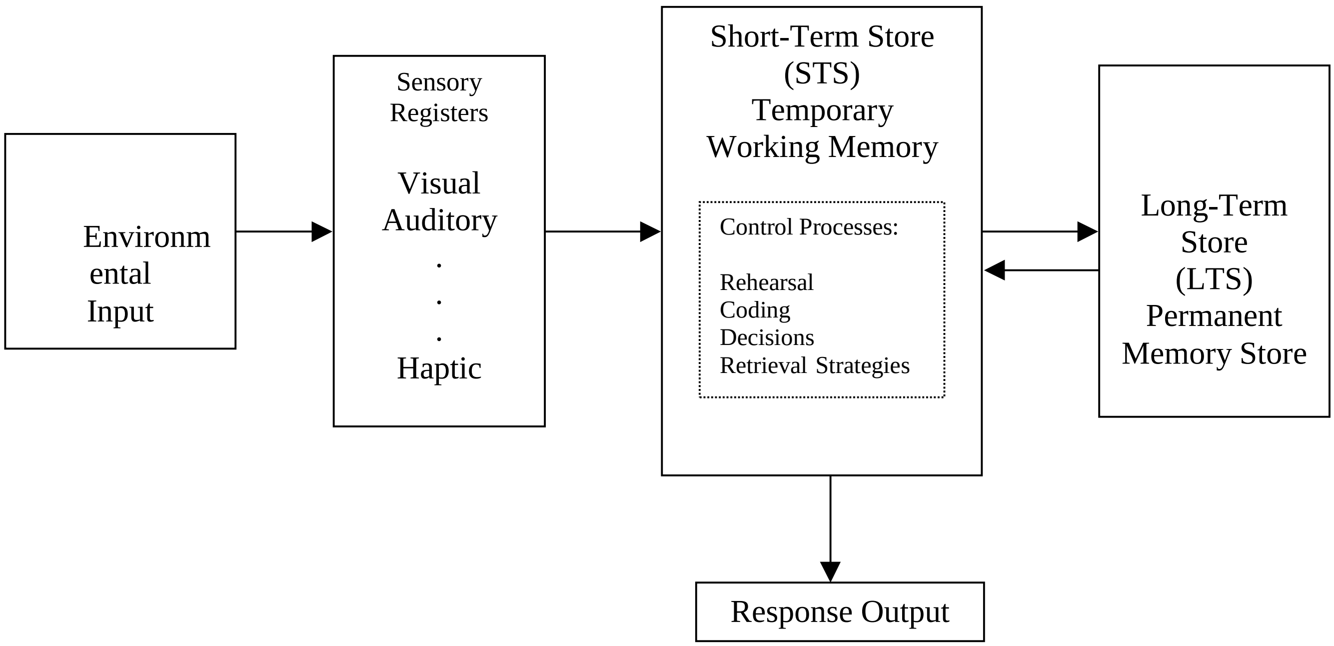

Figure 2. The Atkinson-Shiffrin Information Processing Model.
Source: Richard C. Atkinson and Richard M. Shiffrin, "The Control of Short-Term Memory," *Scientific American*, Vol. 225, No. 2, August 1971, 82.

Nevertheless, Atkinson's and Shiffrin's model is a better descriptor of information flow than it is an explanation of behavior production. It does not adequately account for the unprocessed reflexive behavior described in the earlier section, and it relegates the actual development of cognitive action to a sub-component of short-term memory. Thus, although gathering and processing information are critical aspects of how people interact with their environment, they do not adequately reveal the mechanisms that transform environmental events into human action.

A more robust model for depicting deliberate human behavior expands on the information processing description by examining the control processes contained within Atkinson's and Shiffrin's short-term memory module, while also accounting for the existence of reflexive actions. In Figure 3, memory, thought, and comparison all interact with the perception of external occurrences to produce behavior.

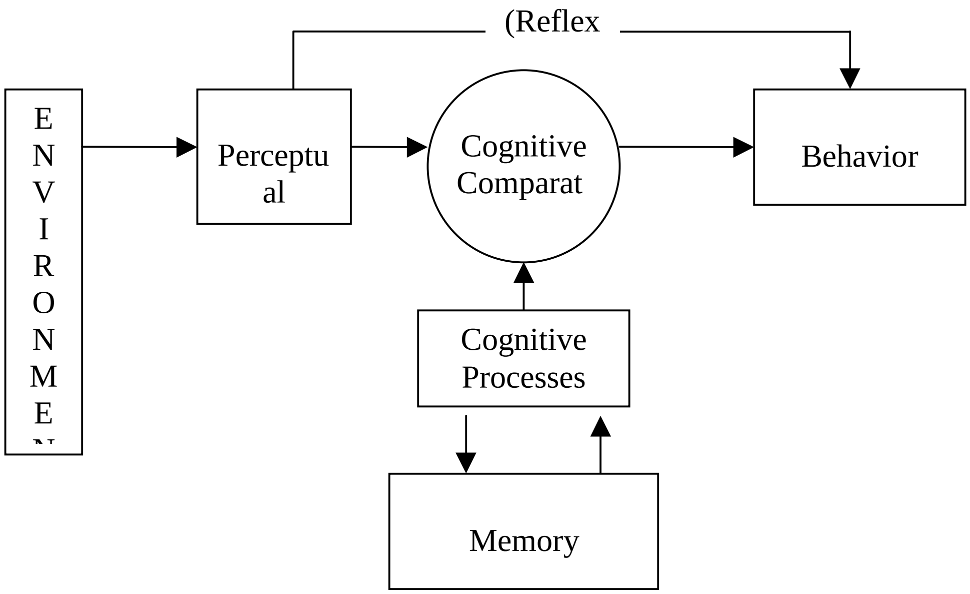

Figure 3. Cognitive Behavior Model.
Source: Adapted from Peter H. Lindsay and Donald A. Norman, *Human Information Processing* (NY: Academic Press, 1977), 689.

The most substantive differences between Figures 2 and 3 are the placement of memory in each model and the accommodation of reflexive behavior. [17] Logically, one must remember an event before one can act on it or compare it to anything else. In this regard, the earlier figure seems to have memory in the proper location. However, Figure 3 provides a much more explicit rendering of the role of comparative, thoughtful processes in the production of deliberate action, while also accounting for reflexive action.

The elements of cognitive behavior emerge from the preceding three figures. In general, there is a precipitating event within the external environment. The individual perceptually processes the event if it is detected. Some events correspond to a specific stimulus-response pair and the person behaves reflexively: blinking to shield the eye from a foreign object, or ducking to protect the head. Other events do not trigger a reflex and either are discarded after perceptual processing or are transferred to short-term memory. From short-term memory, events are

[17] Peter H. Lindsay and Donald A. Norman, *Human Information Processing* (NY: Academic Press, 1977), 689. Lindsay and Norman also include sensorimotor memory schema between cognitive comparison and behavior. While important for describing the more physical aspects of behavior, these schema are less important for describing the mental aspects of decision making behavior and are excluded from the diagram in the interest of clarity.

compared with expectations regarding the environment.[18] After this comparison, the individual continues his or her current behavior or engages in a different behavior. Finally, the person attempts to monitor the results of the behavior in an effort to confirm present and future expectations regarding the surrounding environment. Thus, combining Figures 1, 2, and 3 yields a fairly complete description of cognition.

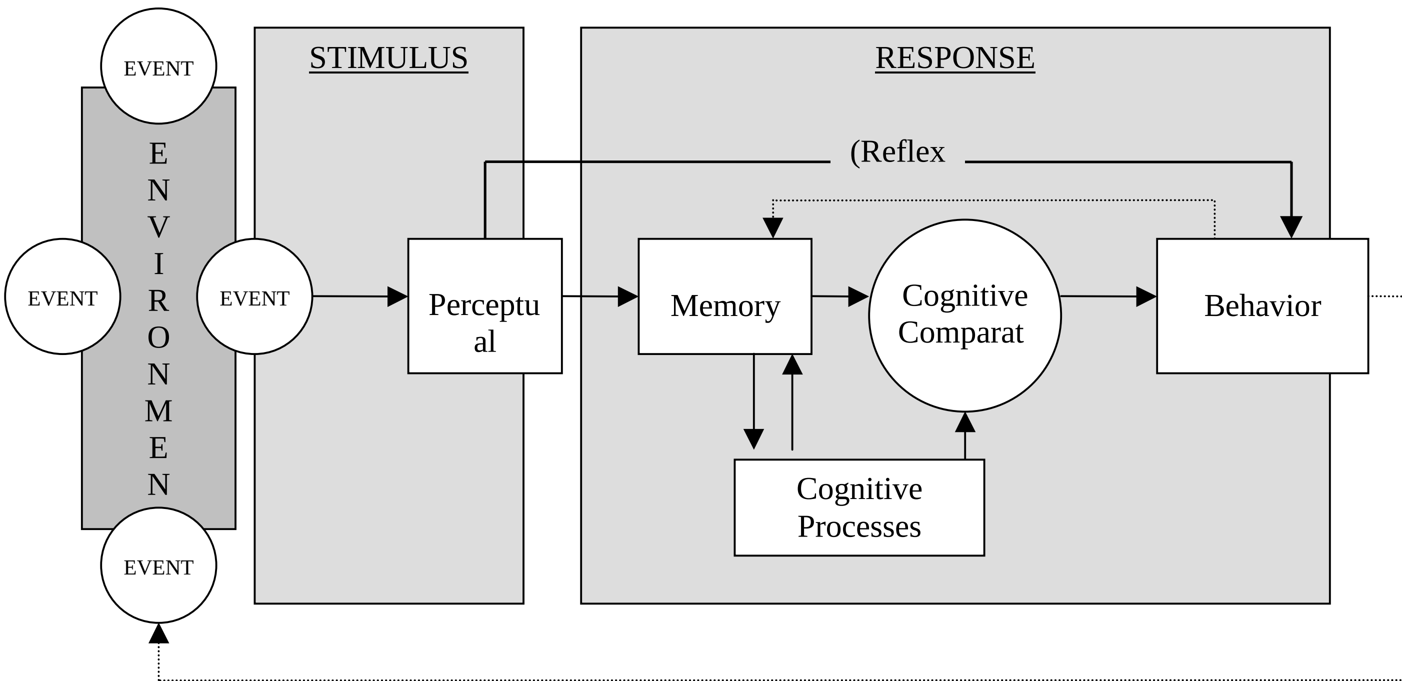

Figure 4. Modified Cognitive Behavior Model.
Source: Adapted from Lindsay and Norman (See Figure 3).

[18] Lindsay and Norman, 688.

This model describes the relatively quick, unfiltered nature of reflexive behavior while also capturing the tasks involved in generating deliberate, cognitive action. It preserves the temporal component of action as reflected in the number of connections between the perception of an event and the ultimate behavior. Thus, for reflexive action, only two steps exist: the perception of a stimulus, and the action taken in response to the stimulus. For cognitive action, many connections exist, some of which may be traversed more than once. Each connection requires a definite, if undefinable, period of time contributing to the more lengthy cycle time of conscious action.

Furthermore, since humans are also learning creatures, Figure 4 incorporates feedback between behavior and memory as well as between behavior and the environment. People generally remember what they do, and they observe the impact of those actions on the surrounding environment. This type of feedback defines learning and is an integral part of human behavior and response.[19]

[19] Gordon, 5.

Chapter 3

The OODA Loop:

A Behavioral Model

Introduction

The preceding chapter shows that conscious human action occurs through the interaction of five factors: events, perception, comparison, cognition, and responses. For the most part, behavior consists of an external event and four subsequent internal tasks. This view is congruent with a popular military model for describing decision making known as the OODA Loop. This noteworthy construct for charting the metamorphosis of environmental events into human action comes from the late John Boyd, a retired Air Force officer turned military theorist.

Boyd's theory evolved out of his experience as a fighter pilot in the Korean War, where he observed the effect that "fast transient maneuvers" had on enemy pilots.[20] With the fully hydraulic flight control system and better cockpit visibility of the F-86 Sabre, American fighter pilots outmaneuvered their Communist adversaries who were flying the technically superior MiG-15 aircraft. In combat, the US pilots would begin a maneuver, wait for the enemy to react, and then perform subsequent maneuvers that the enemy pilots could not counter.[21]

This realization led Boyd to develop a model which stated that all human behavior could be described as a continuous, interactive process of Observation, Orientation, Decision, and Action—commonly known as the OODA Loop.[22]

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[20] Boyd, 4-5.
[21] Spinney, 46.
[22] Boyd, 5.

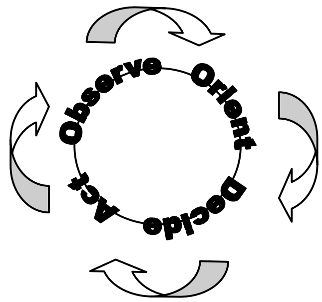

Figure 5. The OODA Loop.

Using this model as a template, Boyd explained the success of the American F-86 pilots in Korea in terms of their ability to complete the OODA Loop faster than their opponents.

Much like Figure 4 in the previous chapter, the OODA Loop shown in Figure 5, above, represents deliberate behavior as a series of four inter-related tasks. In fact, the tasks are practically identical in the two models. In place of events and perception, Boyd's theory uses the more inclusive term of Observation. Orientation is synonymous with the all-important process of memory and cognition—the activity that supplies environmental context and individual expectations. In describing the process of cognitive comparison, the OODA Loop uses the term Decision. Finally, the resulting behavior is simply called Action. Grafting Figures 4 and 5 together shows how congruent they are.

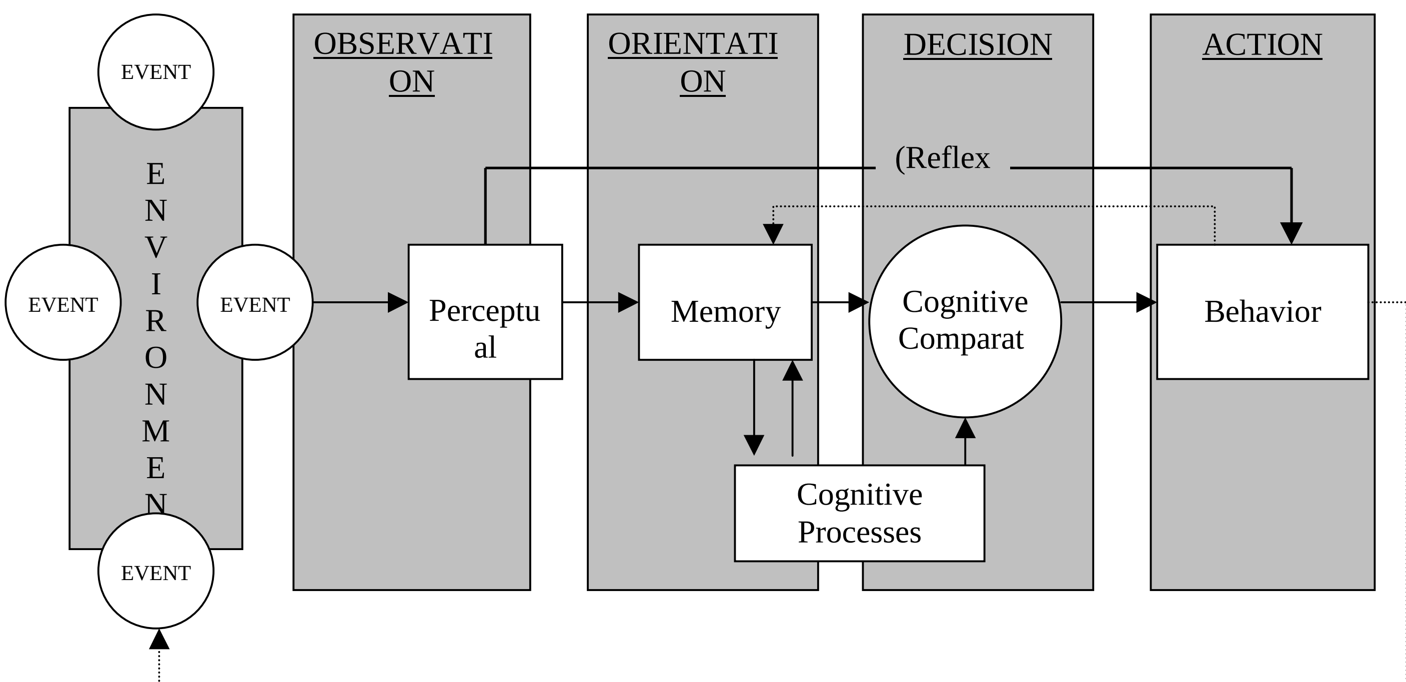

Figure 6. The OODA Loop and Modified Cognitive Behavior Models.
Source: Adapted from Lindsay and Norman (see Figure 3).

In developing this theory, Boyd did more than merely explain the combat success of one group of fighter pilots over another. He created a simple, yet elegantly robust description of all human behavior.[23] Furthermore, Boyd's model not only describes individual human behavior, but also mirrors organizational behavior as well. This is significant because decisions are often the product of group interactions as well as individual behavior.

Organizations, like people, are systems that collect, process, and use information. The comparatively new field of cybernetics concerns itself with the study of information, communication, and control within these, and other, systems.[24] Its principles closely parallel those contained within the OODA Loop. In fact, cybernetics stresses the same four tasks found in the model of cognitive behavior as well as in Boyd's theory:

> Cybernetics thus leads to a theory of communication and learning stressing four key principles. First, that systems must have the capacity to sense, monitor, and scan significant aspects of their environment. Second, that they must be able to relate this information to the operating norms that guide system behavior. Third, that they must be able to detect significant deviations from these norms. And fourth, that they must be able to initiate corrective action when discrepancies are detected.[25]

A system—whether it be an individual person, a machine, or an organization—that gathers information from, and interacts with, the surrounding environment performs a well-defined and generally accepted set of tasks. The OODA Loop models these tasks, allowing one to trace the flow of information from the initial precipitating event to the final resultant action.

The Cognitive Engine

Every task that comprises the OODA Loop is a necessary component of behavior, but one function seems to surpass the rest in importance—Orientation. It is the critical element of the decision process. Boyd repeatedly asserted that Orientation is the most important aspect of the OODA Loop. "It shapes the way we observe, the way we decide, the way we act."[26]

In fact, in Boyd's model all action is ultimately aimed at the enemy's Orientation with an

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[23] Fadok, 16.
[24] Gareth Morgan, *Images of Organization* (Newbury Park, CA: Sage Publications, Inc., 1986), 84.
[25] Ibid., 87.
[26] Boyd., 222.

eye towards creating confusion, surprise, and disorientation.[27] The goal is to cause one's adversary to become inwardly focused so that his Orientation no longer reflects the current state of reality. Consequently, any resulting enemy Action becomes inappropriate to the unfolding situation.

Extracting the salient points of Boyd's theory, Fadok constructs an expanded diagram of the OODA Loop that clearly shows the importance of the Orientation task. Represented in Figure 7, the expanded OODA Loop model illustrates the interaction among the four tasks of the decision process, while also portraying the importance of the elements of feedback, control, and interaction.

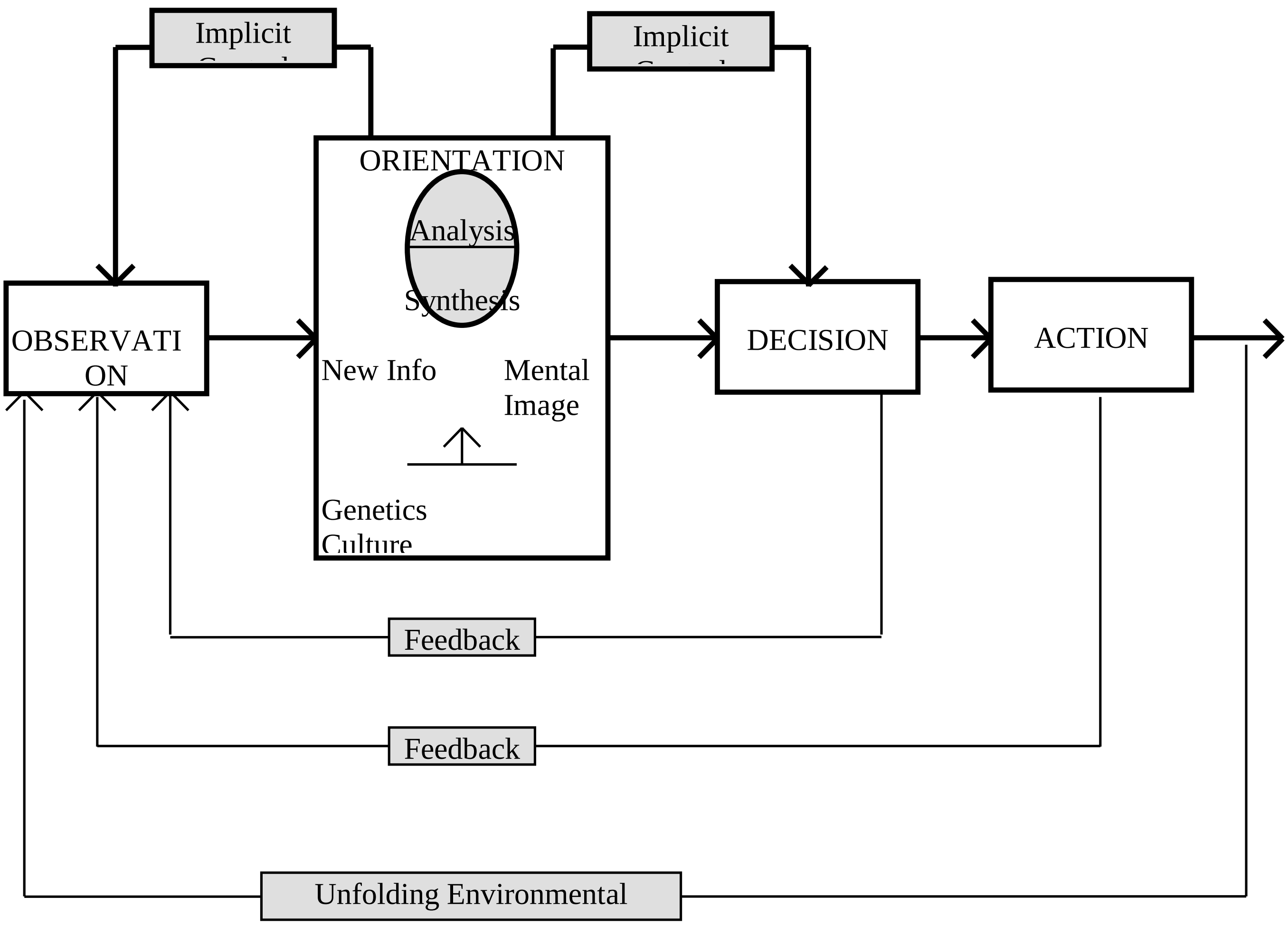

Figure 7. The Expanded OODA Loop.
Source: David S. Fadok, *John Boyd and John Warden: Air Power's Quest for Strategic Paralysis* (Maxwell AFB, AL: Air University Press, 1994), 16. For clarity, the terms "Analysis" and "Synthesis" replace Fadok's original terms of "Destruct" and "Create."

[27] Ibid., 115.

Orientation is obviously the centerpiece of this model, as Boyd intended. This is where the majority of the work that describes cognitive behavior is accomplished. It is where old information combines with new to generate expectations concerning the state of the environment. It is an agglomeration of many of the genetic and environmental factors discussed earlier. Ultimately, it is the cognitive engine for the entire decision process.

Summary

The OODA Loop is a general model that describes human and organizational behavior. Although John Boyd developed its fundamentals from observing air combat in the skies above Korea, it has an applicability that ranges far beyond mere tactical aviation implications. It accurately mirrors the basic principles of behavior described in psychological and behavioral theory, forming a consistent framework with which to describe and examine human action.

This discussion merely outlines the basics of Boyd's theory, however. A closer examination of the structure and components of the OODA Loop reveals more details that describe and affect individual and group behavior. Much work remains to translate this theory of behavior into a theory of war.

Chapter 4

Constructing and Deconstructing the Loop

The first, the supreme, the most far-reaching act of judgment that the statesman and commander have to make is to establish…the kind of war on which they are embarking; neither mistaking it for, nor trying to turn it into, something that is alien to its nature.

— *Carl von Clausewitz*

Introduction

The preceding chapters firmly established the OODA Loop's credibility as a behavioral model. The ultimate goal of this paper goes well beyond that intermediate objective, however. This chapter, and those that follow, examines the OODA Loop in detail, presenting suggestions for how it can be used to the greatest advantage in the execution of control warfare.

Two Views of the OODA Loop

When preparing for war, one can examine the enemy's OODA Loop in two different, but complementary, ways. At the broadest level of abstraction, it is a system through which decision makers at all levels continuously cycle in an effort to accommodate and shape the events in the surrounding environment. This is a systemic approach to evaluating the decision loop. The other method for inspecting the OODA Loop focuses more narrowly on the individual components of the process. At this level, the decision cycle is a set of ongoing tasks that decision makers perform as they interact with the unfolding environmental situation. This is a component-level approach to evaluating the OODA Loop.[28]

At the systemic level, the OODA Loop provides a coherent framework for describing human and organizational behavior. People and groups observe what is occurring around them; they fit these observations into a general expectation regarding the environment; they make decisions as necessary or appropriate; and they take action when needed. Externally, it is a very neat and orderly process.

[28] Some authors have called these two approaches the *form* and *process* views of the OODA Loop, vice the *systemic* and *component*. Although the concepts are similar, the terms *systemic* and *component* seem to be more descriptive and intuitively understandable than *form* and *process*. See Fadok, *v*, and also John I. Pray, Jr., *Coercive Air Strategy: Forcing a Bureaucratic Shift* (Maxwell AFB, AL: Air University Press, 1994).

Unfortunately, such a model is also quite vague.[29] Aphorisms like "operate inside the enemy's decision loop" or "expand the enemy's decision loop" are expressions of the broad strategic tasks that emerge from this general model. They are rich in metaphor and short on meaning, primarily because they say little about what needs to be done. A closer examination of the entire system reveals the true objective of this approach.

The goal of behavioral modification at the systemic level is to reduce the flow of information to the enemy, or to increase the amount of time that it takes the enemy to act on whatever information he possesses. Systemic attacks against an enemy's OODA Loop strive to isolate the various tasks of observation, orientation, decision, and action from one another. Systemic attack is not about getting inside the enemy's head. It is about preventing the enemy's head from getting useful information, and if that fails, preventing the enemy from acting on that information in a timely, relevant manner.

The component-level view of the OODA Loop complements the larger, systemic picture. It describes the activities of each of the four tasks involved in human behavior. It offers explanations for how people and organizations observe, orient, decide, and act. Unlike the systemic depiction of the OODA Loop, it is neither neat nor orderly.

In contrast to the rather parsimonious systemic view, the component approach is extremely detailed. Theories of individual behavior, decision-making, psychology, and group dynamics abound, and these are just a few of the disciplines that inform the component level of the OODA Loop. No single work reconciles all of the theories. The power of the OODA Loop is that it *accommodates* all of these theories. If one believes that the enemy state's decision process results in outcomes determined by the pulling and hauling of politics among various power brokers, the OODA Loop accepts a theory of decision making predicated on that assumption. Alternatively, if one chooses to characterize the enemy's decision process as being ruled by a megalomaniac who has little regard for the welfare of his citizens, the OODA Loop adjusts to that description of the orientation and decision tasks instead.

In short, the component-level approach seeks to get inside the individual components of the OODA Loop. It operates within the processes of observation, orientation, decision, and action. Its goal is to produce a particular type of behavior from the enemy rather than simply

[29] Colonel Stephen Chiabotti wryly observes that the systemic view of the OODA Loop approximates a universal theory of everything with its framework of input, process, and output. This undoubtedly accounts for a great deal of

retarding the enemy's overall behavioral processes.

A Systemic View of the OODA Loop

The preceding chapter substantially presented the systemic view of the OODA Loop; however, the entire construct must be examined with the intent of identifying vulnerabilities that can be exploited in war. When this is done, several issues emerge that affect an array of military and political decision making processes.

To begin, recall the diagram of the OODA Loop shown in Figure 5—it presented the four tasks arrayed in a circle, connected by arrows. It conveyed the intent of the behavioral concept, but it was sparse and nondescript. It lacked a description of the dimension of time that is critical to the systemic view of the process.

Consider the circular depiction of the OODA Loop in Figure 5 unrolled onto the graph of a time line. This produces a relative indication of the time an organization or individual needs to complete a particular behavior from the beginning of the precipitating event at time t_0, to the completion of the final action at time t_1. Figure 8 shows such a graph.

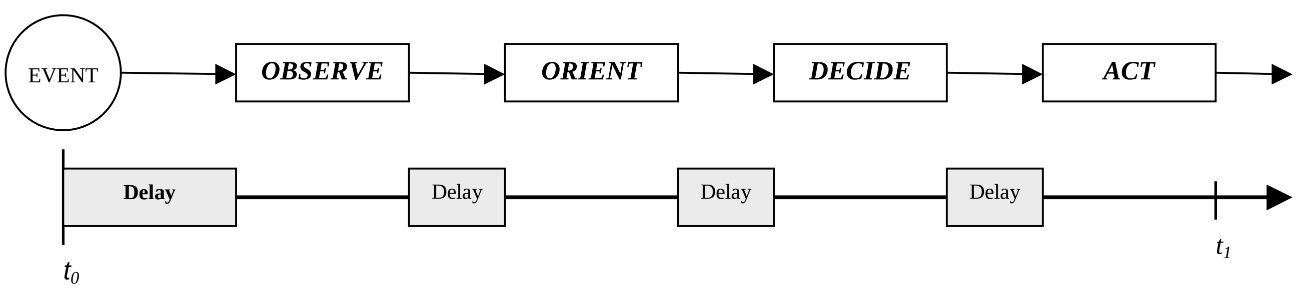

Figure 8. OODA Timeline Diagram (not to scale).

The arrows between the different modules have arbitrary lengths, but the important point is not only that each of the four OODA tasks requires some period of time to complete by itself, but also that there is a delay when moving from one task to another. Depending on the system that the OODA Loop represents, especially whether it is a single individual or a large organization, these delays can be quite substantial. This is analogous to the earlier discussion regarding the reflex arc as the shortest pathway from stimulus to response in vertebrate animals. No matter how short the pathway is, the period from the initial perception of the event until the

its appeal.

ultimate response still requires some finite length of time, for several reasons.

Perceptual Delay

Perceptual delay is best described as the period of time between the occurrence of an event and awareness that the event has occurred. Since people cannot instantly sense changes in their environment, this delay exists to some degree or another within every decision cycle.

It is caused by a combination of physical constraints and limitations incurred by sensor placement. Fundamentally, the laws of physics impose constraints on the detection of physical phenomena. The speed of light and the speed of sound represent two of the most well known impediments to observation. In addition to these physical laws, the location of sensors within an acting system also affects the length of time required to detect an event.

The impact of physical constraints delays the detection of an event within the environment. If the observation of an event substantially precedes the effect of the event, the impact of physical constraints is negligible. In other words, if the speed of the unfolding event is much smaller than the limit of the physical law that governs the observation in a given medium, then that particular law is not much of a constraint. The speed of light does not pose a significant perceptual delay to those who are watching archers shoot arrows toward them from a distance. On the other hand, the speed of sound poses a significant perceptual delay to someone who is in a foxhole listening to the sound of gunfire. Since a bullet generally travels faster than the speed of sound, the effect of the event occurs before the perception. Thus the old soldier's adage regarding enemy fire: you never hear the one that gets you.

The other source of perceptual delay arises from the position of the observing sensor: whether it is internal or external to the acting system. Delays are generally shortest when an organism observes an event directly with its own internal sensory equipment. They are generally at their greatest when an organism relies on external sensory equipment to supply an indication of an event.

Historically, leaders and nations often have waited for hours, days, or weeks before receiving word of significant events that they did not witness themselves. Hours after the battle of Jena in 1806, Napoleon learned that his nearby III Corps had encountered a vastly superior

Prussian force at Auerstadt and subsequently crushed it. [30] Had the battle gone the other way, Napoleon still would have waited hours before hearing of it. In either case, the separation of his forces and the delay in sending and receiving information prevented him from impacting the distant battle once he gave Marshal Davout his orders.

The introduction and continued maturation of information technology has mitigated the effects of perceptual delay somewhat. From the use of visual observers, telegraph, and wireless radio to the modern-day employment of unmanned aerial vehicles and satellite communications, perceptual delay has decreased from weeks, in the case of transoceanic message flow during the Revolutionary War, to minutes as exemplified by the Allied experience in the Gulf War. Decision makers now routinely expect near-real-time intelligence regarding events anywhere in the world.

Information technology cannot deliver complete intelligence about everything on the globe, however. One need look back only a few years to illustrate an egregious example of perceptual delay in the information age. When India detonated a nuclear weapon in May, 1998 the international intelligence community endured much criticism for not providing evidence and warning of the event before it occurred.[31]

This does not mean that external sensors are bad. Quite the opposite—their ubiquity confirms their utility. External sensors can greatly extend the detection abilities of a person or an organization. In both range and spectrum, mechanical and electronic sensors provide the capability to detect events beyond the ordinary perception of human senses. In this regard, external sensors can also reduce perceptual delay if the observers otherwise would have to make observations with their own sensory equipment, or if they were incapable of detecting the event with their own senses. The minimal, but sufficient, warning that the Chain Home radar stations provided to Fighter Command during the Battle of Britain illustrates this point. These external sensors prevented the Germans from surprising the British with their aerial attacks.[32] Ultimately, this capability enabled England to survive the battle, and thus the Second World War. Without this slim margin, the outcome might have been far different.

In the end, one can see that the aggregate of constraints and limitations prevents the

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[30] John Laffin, *Brassey's Dictionary of Battles* (NY: Barnes and Noble Books, 1995), 61-62.

[31] "While Langley Slept," *The Nation*, June 1, 1998, 6. "...even when the satellites picked up obvious indications that a test was nearing--Langley was dozing, literally. It was late at night; the analysts were in their beds."

instantaneous detection of environmental change by any sensor. Significantly, because people and organizations rely so heavily on external sensors, the perceptual delay is quite probably the most exploitable delay within the OODA Loop at the systemic level.

Information Delays

The other three delays shown in Figure 8 are essentially the same. They represent delays in the distribution of information between the various tasks of the OODA Loop. The nature of the acting system determines the magnitude of the associated delay. When the system is a single individual, the delays are the shortest. When the system is an organization, the delays become longer as it takes time to distribute information to the members and to receive information back from the members. For group decision making, delays can vary widely. Sometimes the body of decision makers has the same general information, and the delays in transmitting information between tasks from observation to decision are not very long. At other times, the decision makers do not have the same amount or quality of data, and the delays in transmitting information between the tasks expands.

One area of information transmission that is particularly vulnerable in both individual and group decision making is the transfer of information between the Decision and Action phases. For decisions that affect large numbers of people or that require the movement of numerous pieces of equipment that are geographically separated, this can be a significant weakness. An almost catastrophic example of this type of information delay occurred during Operation UPHOLD DEMOCRACY in 1994. When negotiations between former president Jimmy Carter, retired general Colin Powell, and Haiti's ruler Raoul Cedras stalled, President Clinton ordered American military forces to invade Haiti and restore the legitimate government of Jean-Baptiste Aristide. Before the US forces arrived, Cedras capitulated to the American diplomatic demands, prompting the President to call off the invasion. Of the four AC-130 Spectre gunships enroute to striking targets in Haiti, only one received the recall order over the satellite communications channel. Fortunately, that crew was able to relay the recall order to the rest of the aircraft.[33]

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[32] Robin Higham, "The RAF and the Battle of Britain," *Case Studies in Air Superiority*, ed. Benjamin F. Cooling (Washington, D.C.: US Government Printing Office, 1994), 116.
[33] Author's personal experience, 18 September 1994.

Effect of Delays Within the OODA Loop at the Systemic Level

The systemic view of the OODA Loop shows that the communications infrastructure is a vital and somewhat overlooked component of the model. Since the OODA Loop is most often applied only to individual behavior, the information distribution function between the tasks is assumed to exist and to be unassailable. When examined in a broader systemic context, the supporting information architecture emerges as a critical, and potentially vulnerable, link between the behavioral tasks. Ultimately, without a transfer of information there would be no action.

The result of delays within the OODA Loop is fairly obvious—it increases the time required from the initiation of an event to any subsequent action taken in response to it. This is commonly referred to as expanding the OODA Loop, and it is something one wants to do to the adversary rather than vice versa. One can expand the enemy's OODA Loop by causing him to take longer to complete the individual processes, or by increasing the information delays between the processes.

A Component-Level View of the OODA Loop

While the systemic approach to the OODA Loop examines the way the four behavioral processes interconnect, the component view examines each of the processes in detail and offers theories to explain how groups and individuals complete each of the tasks. Although there is no single theory that fully explains human behavior, either individually or organizationally, a number of theories do explain components or aspects of behavior in general. It is up to the strategist and intelligence officer to determine which theories best fit the current adversary.

Observation

Observation is the task that detects events within an individual's, or group's, environment. It is the method by which people identify change, or lack of change, in the world around them. While it is not the sole basis for Action, it is a primary source of new information in the behavioral process. Much like the systemic level, the component level of observation contains exploitable delays.

Although every sensor is constrained by the laws of the physical medium in which it operates other factors limit the performance of a sensor and potentially lengthen the delay between an event and its observation. A small sample of these factors includes parametric limits, detection distances, and sensing techniques.

Human sensors have a very limited band of detection compared to the spectrum of possible events within a medium. Within the electromagnetic spectrum, human vision is restricted to a narrow region between 0.4 and 0.7 microns in wavelength; commonly known as visible light from the violet to the red.[34] Other optical or electronic sensors can be more or less restricted. Infrared sensors typically operate in a band that is only slightly larger than human vision at a few microns wide. Radar warning receivers that detect radio frequency signals from radar-guided air defense systems can scan a range that is hundreds of thousands of microns wide. Obvious as it sounds, no sensor can detect every event of interest—something always exists outside of its detection band. Savvy equipment manufacturers develop systems that operate in the interstices of sensor coverage. This is one of many reasons why sensor-operating parameters tend to be classified information.

In addition to the parametric limits of what a sensor can actually detect, a sensor is also limited by how far away it can detect the occurrence of an event within its parametric band. This is primarily a function of the sensitivity of the receiver, but it can also be a discrimination phenomenon depending on the capability of the system to distinguish between true signals and false noise. Once again, obvious as it sounds, not only are sensors limited in what events they can detect, they are also limited by how far away they can detect them. Those who use radar-detectors in their cars are intimately familiar with this effect.

Another source of sensor limitations arises from the sensing technique used to detect events—these techniques are commonly grouped into one of two classes: either staring or scanning sensors. All other things being equal, since a staring sensor's field of view is equal to its field of regard, it has a higher probability of detecting an event within its field of regard than a scanning sensor does. Alternatively, staring sensors generally have a smaller field of regard than scanning sensors, so they cannot detect events over as wide an area as scanning sensors. To explore this phenomenon, consider the driver of a car who only stares straight ahead while driving. This individual probably sees most of the important events that happen in front of him.

[34] Lindsay and Norman, 58.

He does not detect anything that happens beside or behind him. Contrast this driver with one, who scans the area in front of him, as well as beside and behind himself. He detects many more events than the first driver. Occasionally the scanning driver might have to slam on his brakes if the car in front of him slows down while he is scanning a different area—the staring driver would see this right away and be able to react more quickly. On the other hand, the scanning driver can see and avoid traffic that converges from the sides, while the staring driver would remain blissfully unaware until the moment of impact. In the end, there is a tradeoff between the area that can be placed under surveillance and the likelihood of detecting an event of interest within that area. This, too, is a facet of observation that is exploitable.

Ultimately, Observation serves only one purpose: to stimulate the process of Orientation. Although people and groups may consider old information and reach new or different conclusions regarding past events, they are far more likely to unquestioningly accept an old interpretation of old information unless some other event challenges the commonly held belief. The presence of new information stimulates the re-evaluation of older facts and beliefs in a never-ending search for consistency. Reconciling the old and the new is a primary function of the Orientation phase.

Orientation

Along with the Decision task, the process of Orientation is one of the most debatable and least understood elements of human behavior. It is the process that develops context and extracts meaning from the events detected during the Observation task. As such, it is the centerpiece for understanding the way people act. Without the context of Orientation, most Observations would be meaningless.

One of the more popular descriptions of the cognitive processes involved in Orientation is based upon symbology. According to this theory, humans mentally represent the world around them as a collection of symbols. Furthermore, they also represent abstract concepts as symbols as well. In effect, people create "cognitive maps" of their environment that include not only its physical characteristics, but also the abstract concepts that give it additional meaning.[35]

The conceptual content cognitive map (3CM) is one theory of cognition that is symbolically based. The 3CM theory evolves from the belief that "internal representations, or mental objects, reflect the content of one's knowledge and are the basis for cognition."[36] This view closely resembles Boyd's description of the Orientation phase, especially in regard to his emphasis on the formation of the mental image.[37]

The logical outcome of this theory, and Boyd's as well, is that mental images are a highly individualized representation of cognition and decision making. As the developers of 3CM note, "It is thus reasonable to suppose that the cognitive structures of different individuals will show substantial variation."[38] Every individual has different life experiences that shape the way he or she processes, evaluates, and acts upon events in the surrounding environment.

Herein lies the trouble with symbology-based cognitive theories: their lack of universality. Any theory of behavior based on cognitive mapping can only predict the behavior of one person based on any given cognitive map. There is no way to generalize the application of such a theory to more than one individual. To determine what different people would do in the same situation necessitates the development of cognitive maps specific to each person. In fact, "we might expect any predictive theory of the brain to be a theory of just one brain."[39] Provided that it is a theory of the proper brain, or combination of brains, in the decision process, though, the symbolic approach can still be extremely valuable.

An alternative theory proposes that cognition is not based on symbology, but rather that it is the product of complexity and chaos within human thinking. The implication of this theory is that human behavior is not inherently predictable. Those who subscribe to this explanation focus on narrative approaches to describing behavior rather than predictive approaches.[40] While this methodology might hold the promise of more universal applicability, it abandons any attempt at forecasting human actions.

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[35] Anne R. Kearney and Stephen Kaplan, "Toward a Methodology for the Measurement of Knowledge Structures of Ordinary People: The Conceptual Content Cognitive Map (3CM)," *Environment and Behavior*, September 1997, 583.
[36] Ibid., 587.
[37] Boyd, 5.
[38] Kearney and Kaplan, 591.
[39] James W. Garson, "Cognition Poised at the Edge of Chaos: A Complex Alternative to a Symbolic Mind," *Philosophical Psychology*, Vol. 9, Issue 3, September 1996.
[40] Ibid.

The conclusion for military planners is as old as it is obvious—one must strive to understand how each enemy commander thinks. This applies at every level of war from the strategic to the tactical. At the strategic level, one must understand what factors shape the orientation of the enemy's national command authority as well as what the enemy hopes to gain through the conduct of war. Likewise, one must have a similar level of knowledge regarding operational and tactical commanders in order to anticipate what they are likely to do.

Decision

Not surprisingly, the field of study that examines how people and organizations make decisions is as fragmented and convoluted as the field that studies how they think. The two tasks are closely, and probably inseparably, linked. Nonetheless, decision making has distinct characteristics of its own, many of which depend upon the nature of the entity making the decision.

One of the most well known constructs for explaining national-level decision making asserts that one can view the resulting actions through any one of three different lenses—in essence, decisions can be:

1) A value-maximizing choice by a rational, unitary actor;
2) The output of organizational processes, or;
3) The resultant outcome of political bargaining.[41]

Graham T. Allison, the political scientist who developed this theory, prefers to call these Model I, Model II, and Model III behaviors.[42] His convention is used widely for standardization and convenience. Thus, Model I behavior refers to the actions of a rational, unitary actor. Similarly, Model II refers to organizational behavior, while Model III is synonymous with the outcome produced by the bargaining among various players in the political milieu.

Simply characterizing behavior as Model I, II, or III does not say enough regarding the manner in which individuals or groups make decisions, however. Many scholars devote themselves to an examination of only a small portion of one of these three models. A brief discussion of some of the better-known theories illustrates the diversity of thought concerning decision-making concepts. It also highlights the inherent difficulty and danger in attempting to

[41] Graham T. Allison, *Essence of Decision* (NY: Harper Collins Publishers, 1971), 4-6.
[42] Allison, 5.

forecast the actions of individuals and groups since there is no consensus on a universally applicable theory for predicting behavior.

One of the most popular areas of study is individual choice, often referred to as classical Model I behavior. Since people make choices regarding a wide variety of issues, this field receives attention from economists, behavioral scientists, and a host of other scholars who are interested in why and how people make decisions. Such wide scrutiny encourages diverse opinions concerning the mechanics of choice.

In 1978, the 12th Annual Conference on Human Judgment convened to discuss efforts at integrating the most prominent approaches to judgment and decision making—it considered six distinct theories. Three of them were developments from the field of economics and were concerned primarily with how people *choose*. The other three evolved from a psychological basis and were concerned mainly with how people *know*.[43] Kenneth Hammond, Gary McClelland, and Jeryl Mumpower collated the results of this conference in a work entitled, *The Colorado Report on the Integration of Approaches to Judgment and Decision-Making*.

In *The Colorado Report*, as in many works, the baseline for discussions of economic choice is Decision Theory. Perhaps the best-known expression of this theory is Multiattribute Utility (MAU) Analysis. The problem for the decision-maker, as defined by MAU, is one of choosing among several competing alternatives with multiple attributes. The guiding principles for this theory are probability, rationality, and utility.[44] Under this theory, people are strictly rational beings who make decisions based simply on the expected benefit of their possible choices.[45] The option that maximizes the expected utility becomes the choice.

This theory sounds familiar because it is the unstated assumption for most explanations of Model I behavior. Since Allison characterizes decisions based on this model as value-maximizing choices made by rational, unitary actors, he describes Model I decision-making as the result of making the optimum choice among many alternatives. In short, the description of Model I behavior is a restatement of Multiattribute Utility Analysis.

The assumptions inherent in MAU, including complete knowledge of the available

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[43] Kenneth R. Hammond, Gary H. McClelland, and Jeryl Mumpower, *The Colorado Report on the Integration of Approaches to Judgment and Decision Making* (N.p.: N.P., 1978. Center for Research on Judgment and Policy, Institute of Behavioral Science, University of Colorado. Report No. 213), I/13-I/16 and II/B/9.
[44] Hammond, et al., I/13-I/14.
[45] Ibid., II/B/2. "Mathematical terms [in MAU] are based in expected utility theory."

alternatives and perfect human rationality, leave some scholars unsatisfied, however. They are too idealized and do not account for the panoply of observed human behavior. The primary flaw resides in the characterization of the action. MAU prescribes what human behavior should be; other theorists desire descriptions of what it actually is.[46]

Considerations of actual, observed behavior prompted the emergence of two more theories of economic choice: behavioral decision theory and psychological decision theory. Each of these theories modifies the assumptions of standard decision theory to account for sub-optimal or less-than-fully rational actions. In the case of behavioral decision theory, Ward Edwards proposes that people make choices based upon subjective expected utility, rather than the more idealized concept of expected utility.[47] Similarly, in developing the tenets of psychological decision theory, Daniel Kahneman and Amos Tversky depart from the standard assumptions of pure rationality in search of a "systematic theory about the psychology of uncertainty."[48]

The various theories of economic choice encompass only one aspect of decision making, however. One of the most salient criticisms of examining decision making in this fashion is that it is a one-dimensional, laboratory approach. Researchers typically express their results as an aggregate of many individual tests. Thus, their predictive ability even for a single individual is suspect. Declaring that eighty percent of the subjects studied would choose option A rather than option B does not predict anything about the way in which a particular subject will choose—it merely states that one option is four times as likely to be chosen as the other.

Diverging from the theories of economic choice, the other three approaches to decision making studied by *The Colorado Report* minimize the motivational component of judgment and center on the "study of 'knowing' rather than 'getting'."[49] The concept of the value-maximizing choice fades away in these theories. Instead, "focus" rather than possession represents the concept of intention. These theories revolve around the ambiguity in a situation, and how an

[46] Ibid., I/14.
[47] Ibid., II/B/3.
[48] Ibid., II/B/5.
[49] Hammond, et al., II/B/6.

individual uses judgment or inference to arrive at a decision.[50] In this regard, these theories do not fall neatly into Allison's framework of Model I, II, or III behavior.[51]

Although *The Colorado Report* discusses an impressive array of decision-making theories, it is by no means an exhaustive compilation. Other theories of individual choice exist that challenge the assumptions inherent in the previous works.

By far the most important assumption is between "comprehensive" and "bounded" rationality. Comprehensive rationality is an extremely strict, perhaps unattainable, standard in which the decision maker possesses all of the relevant information regarding an issue, considers all of the possible alternatives, and then makes the optimum choice. Bounded rationality, on the other hand, decries the existence of perfect knowledge, accepts that humans are limited in their capacity to generate and consider alternatives, and embraces the fact that people are often satisfied with a decision that is good enough rather than one that is optimum.[52] This type of behavior is known as "satisficing" in contrast to the more exhaustive concept of optimizing. The difference between behavior that is optimizing and behavior that is satisficing is quite important. Given enough time and perfect information, many different people would probably arrive at the same optimum solution to a problem. They would consider all of the information as long as they wished, generate all of the possible alternatives, weigh them against each other, and choose the one that promised the greatest benefit. An independent observer would consider their behavior quite predictable if he had access to the same information.

Unfortunately for those seeking to understand the actions of others, satisficing behavior is much less predictable than optimizing behavior. In the search for a satisfactory decision, any solution that is "good enough" can be implemented. In fact, the first solution that passes the threshold of being "good enough" satisfies the requirement and will be implemented.[53] If the range of acceptable possibilities is large, the range of possible actions will be correspondingly large. The order in which the decision maker considers the possible alternatives also becomes a major factor in determining the final outcome.[54] In this regard, satisficing behavior can be

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[50] Ibid., II/D/10-II/D/17.

[51] Ibid., II/D/26. Research in these areas appears to form the basis for a "theory of knowing *from* which a theory of decision is produced." [Emphasis in original]

[52] Allison, 71-72.

[53] James G. March, *A Primer on Decision Making* (NY: The Free Press, 1994), 18. March goes so far as to say that, "satisficing is less a decision rule than a search rule." (p. 27) When the target level is achieved, search stops and that alternative becomes the de facto decision.

[54] Robyn M. Dawes, *Rational Choice in an Uncertain World* (NY: Harcourt Brace College Publishers, 1988), 51.

extremely unpredictable.

Nevertheless, satisficing behavior appears to be quite common. Insofar as this behavior conforms to "bounded rationality" it still imitates Model I behavior, although the focus is no longer on value-maximizing choice. Instead, the focus shifts toward criterion-satisficing search.[55] This type of behavior extends to groups as well as individuals. Organizationally, satisficing behavior is quite prevalent and is a natural adjunct to Model II behavior. Organizations are obsessed with output, and satisficing allows more output because less time and effort is spent in generating each instance of output. Furthermore, satisficing is also an accurate descriptor of Model III behavior. In fact, it is almost a definition for the type of bargaining that creates these decisions.

One of the more interesting theories regarding satisficing behavior centers around a concept known as recognition-primed decision making (RPD). RPD is an experiential-based approach to satisficing. Rather than stepping through the possible alternatives in a more-or-less random fashion, RPD claims that effective decision makers "prime" their decision process by reference to past experience. The experience that most resembles the current situation becomes the template for making the current choice. If it provides a satisfactory solution, it becomes the decision. If not, the decision maker continues to search for an acceptable alternative based on other analogous situations.[56] This is a particularly useful methodology when faced with time-critical decisions. For decisions where an optimal choice is more important than the fastest, satisfactory choice, the more analytical methods of multiattribute utility analysis are appropriate.[57]

<u>Action</u>

Freedom of action is one of the most desirable of all military capabilities. Marshal Ferdinand Foch, the commander-in-chief of the Allied Armies on the western front in World War I, considered it to be a fundamental principle of war.[58] Regardless of whether one thinks that freedom of action creates military success or that military success creates freedom of action, the fact remains that restricting an individual's, or group's, capacity to act is one method for controlling the behavior of that person or organization.

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[55] March, 27.
[56] Gary A. Klein, "Strategies of Decision Making," *Military Review*, May 1989, 58-60.
[57] Ibid., 61.
[58] Ferdinand Foch, *The Principles of War*, J. de Morinni, trans. (NY: AMS Press, 1970), 13.

At the component level, the instruments of action are practically innumerable. Every corps, battalion, and soldier, every tank, airplane, ship, missile, or gun is potentially an instrument of action. To some extent, the strategic, operational, and tactical levels of war exist to classify not only goals and objectives, but also to classify the instruments of action used in pursuit of those goals. The distinction between the levels of war is important because it allows one to craft a coherent plan for achieving national objectives by translating political goals into discrete military aims that can be pursued through operational and tactical action.

Throughout history, the instruments of action are the single component of human behavior that has been effectively and repeatedly attacked. By destroying another country's armed forces, one state restricts the ability of the other to act in its own continued defense. Once defenseless, that country is at the mercy of the victor.

Summary

The OODA Loop describes human behavior on two different levels: the systemic and the component. At the systemic level, the OODA Loop focuses on the communications pathways that link the four tasks of observation, orientation, decision, and action together. Each of these tasks requires some period of time to complete, and there is a delay between the tasks that corresponds to the length of time that it takes for information to pass between the processes. With the systemic approach, one tries to reduce the quantity of information that the enemy has available for making decisions. Alternatively, one also tries to increase the quantity of time that the enemy needs in order to complete the decision process—this is commonly referred to as expanding the enemy's decision cycle.

At the component level of the OODA Loop, one delves into the individual modules that create behavior. A brief foray into the fields of cognition, judgment, and decision making reveals that no single, comprehensive theory explains how people think, know, or decide. The literature is equally fragmented for organizational and group behavior. The greatest challenge at the component level is developing a coherent theory of cognition and choice that accurately predicts individual or group behavior. Several theories exist that accurately describe past behavior. No theories exist that accurately predict future behavior.

Ultimately, the goal for both the systemic and component approaches toward attacking the enemy's decision loop is the same—to compel the enemy to do our will. Where the two OODA Loop approaches diverge is the manner in which they pursue this objective. The next chapter outlines different theories that emerge from these two views of the OODA Loop, identifying those that hold the most promise for effectively engaging in control warfare.

Chapter 5

Going To War With The OODA Loop

Introduction

The preceding chapters depicted the OODA Loop as a behavioral model, operating at two different levels, affected by intrinsic delays. While it is a robust description, John Boyd did not develop this theory for psychologists. Instead, he developed it for warfighters. To him, it was a descriptive model for achieving battlefield success. This chapter examines some of the possibilities for using the OODA Loop in war. Although the psychological and behavioral implications of the OODA Loop are compelling, the theory emerged from wartime observations and must be viewed as such.

Befitting its general nature, the OODA Loop supports a variety of warfighting methodologies and their attendant theories of victory. Not surprisingly, the systemic and component views of the OODA Loop discussed in Chapter 4 describe at least two different methods for engaging in warfare. One is consistent with physical effects, concerned with destroying an adversary's military means of resistance. The other is more psychological in nature, concerned with disrupting the enemy's will to resist. This is readily apparent when one examines its use within the United States military. In the Air Force, the OODA Loop is associated mainly with psychological effects. It supports the application of airpower leading to victory through strategic paralysis.[59] The Marine Corps, on the other hand, associates it with physical effects. For the Marines, the OODA Loop supports the use of ground forces leading to a more conventional, attrition-based victory.[60]

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[59] Fadok, 2.
[60] U.S. Marine Corps, *FMFM 1, Warfighting*, 7 February 1996, 10.

Clearly, Boyd's work expresses an affinity for the psychological component of warfare. Nevertheless, tension exists between the physical and mental effects of war even within his amorphous collection of briefing slides. Inconsistencies emerge as he explicitly states his preference for psychological effects against the adversary's leadership, while presenting logic that supports the rationale for physical attack. In truth, success in war comes from a blend of both psychological and physical effects. The salient question for this analysis is whether the OODA Loop and control warfare primarily support an attack on the adversary's physical means of resistance or upon his psychological will to resist. The answer to this question requires a closer examination of the ways in which nations fight and win wars.

Theories of Victory

Just as there are many different concepts for fighting war, there are many different ideas about how to win wars. Most strategists and policymakers subscribe to one of two major beliefs when it comes to winning wars: one either beats the enemy, or makes the enemy quit.

The first category concerns itself with rendering an adversary militarily defenseless. This is an age-old paradigm for winning wars. Taken to the extreme of pure violence, warfare requires one nation to completely disarm the other before it can be certain of victory. [61] This is the brute-force approach to fighting and winning wars.

The second category shifts the focus of military effort from the complete annihilation of the opposing nation's armed forces to a more constrained level of violence that persuades the enemy to make peace rather than continuing to make war—this is the province of coercion. No longer is one trying to beat the enemy *per se*, rather one is trying to make him quit. Military force is still involved, but the goal is not to destroy the opponent's ability to fight *in toto*. The objective is to make the adversary capitulate to one's demands short of outright and complete military defeat. Force is simply the political means to manipulate the costs and benefits of the enemy's behavior.[62]

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[61] Clausewitz, 77.

[62] Robert A. Pape, *Bombing to Win* (Ithaca, NY: Cornell University Press, 1996), 4. Also see Thomas C. Schelling, *Arms and Influence* (New Haven: Yale University Press, 1966), 6.

In practice, coercion has a positive as well as a negative component. With positive measures, one state attempts to coerce another by providing a benefit, or reward, for complying with its demands. While they are an important facet of diplomacy and inter-state discourse, positive actions generally are not amenable to the employment of military force. Transportation, humanitarian assistance, and other types of military operations play a valuable role in this regime, but it is an ancillary one at best. This analysis focuses on the other, more forcible, aspect of coercion instead.

Military force is well suited to the application of sanctions in coercion. The terms that best describe this type of activity are *deterrence* and *compellence*.[63] Since this discussion focuses on winning wars after they have started, rather than preventing them from beginning, it does not address theories of deterrence. One can easily see how deterrence theory and the opposing leadership's orientation are intimately related, however; thus, this relationship provides a rich opportunity for further study. Rather than examining the use or show of force to prevent undesirable behavior, this exposition investigates the concept of using force to compel an adversary to perform, or cease, a particular behavior. This use of force, as an act of political will, is a classical definition of warfare.[64] When executed against the adversary's command structure that controls its forces, it is an accurate definition of control warfare.[65]

Ultimately, compellence, as a subset of coercion, is an attempt to influence "the adversary's calculus for decision making."[66] Significantly, the factors that affect this calculus can differ widely from nation to nation. They certainly vary among individual leaders. In this regard, Boyd's OODA Loop provides a powerful, descriptive tool for examining the use of force as a method of coercion.

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[63] Thomas C. Schelling, *Arms and Influence* (New Haven: Yale University Press, 1966), 71.
[64] Clausewitz, 75. "War is thus an act of force to compel our enemy to do our will."
[65] Fadok, vi.
[66] Pape, 4.

Boyd's Vision of Warfare

John Boyd's personal vision of warfare is somewhat dichotomous. On the one hand, he advocates victory through the psychological dislocation of the enemy's command and control process.[67] On the other hand, he extols the virtue of creating "non-cooperative centers of gravity" among the opponent's forces. Doing so, he claims, denies the enemy the opportunity to expend effort in a directed fashion.[68] These approaches to warfare are not entirely consistent. There is a tremendous difference between disorienting the adversary's leadership so badly that it collapses, and disrupting the enemy's means of military resistance to the point that they can no longer mutually support each other. Nevertheless, these conflicting ideas form the basis for Boyd's theory for paralyzing an adversary in war.

Psychological Disorientation

Boyd himself clearly favored the creation of psychologically damaging effects within the enemy's command and control loop, which he considered synonymous with the OODA Loop.[69] He believed that a sufficiently severe level of disorientation would cause the adversary's leadership to collapse and capitulate. In essence, everything that was done to the enemy's OODA Loop was done with the intent of degrading the adversary's ability to command and control military forces.

Boyd thought that one could "collapse the enemy's system into confusion and disorder by causing him to over- and under-react to activity that appears simultaneously menacing as well as ambiguous, chaotic, or misleading."[70] Ultimately, one questions the efficacy of such a strategy by asking *how* the enemy's system collapses. In boxing, a fighter has a manager to throw in the towel when it becomes apparent that he is stunned and disoriented. In the international political system, there is no manager with this degree of power. Instead of throwing in the towel, the disoriented leadership, much like the disoriented boxer, is liable to continue to strike out blindly and wildly at whatever target presents itself, whether it be opponent, referee, or bystander. This type of behavior is thus more epileptic than paralytic, containing a high degree of risk for unintentional injury and damage to combatants and non-combatants alike.

Unfortunately, Boyd's work provides no clear answer regarding how he expected the

[67] Boyd, 280.
[68] Ibid., 41-42.
[69] Ibid., 222.

psychological disorientation of an opposing state's leadership to translate into capitulation. The promise of psychological disorientation as a means of achieving victory in war appears to be, if not unfounded, at least unexplained and unproven.

Non-Cooperative Centers of Gravity

More promising than sheer psychological disorientation is Boyd's belief in creating "non-cooperative centers of gravity" among the enemy's forces. He believed that "non-cooperative centers of gravity are created by striking at those vulnerable, yet critical, tendons, connections, and activities that permit a large center of gravity to exist."[71] Although he does not explicitly define the constituent tendons, connections, and activities, they are generally represented by his description of the OODA Loop.

Recalling the systemic description of the OODA Loop in Chapter 4, one can easily view the vital tendons and connections as the information pathways that connect the various tasks of the decision loop. Similarly, the critical activities are the tasks themselves. Creating non-cooperative centers of gravity could then be a product of severing the lines of information transfer among lateral and vertical echelons of command. If the forces in the field do not know what their superiors want them to do, and if they do not know where their fellow units are or what they are doing, then they cannot act in any coordinated fashion. A large, strong force is thus reduced to a collection of smaller, individually vulnerable forces.

Much like his theory of psychological disorientation, Boyd does not explain the ultimate mechanism for achieving victory over an enemy through the creation of non-cooperative centers of gravity. Even separated from a larger host, smaller units still retain the capacity for independent action. One suspects that these isolated forces must be defeated in detail, a process presumably facilitated by the lack of centralized control.

Operating Inside the Adversary's OODA Loop

Boyd's final and most familiar approach to making war with the OODA Loop concerns the significance of completing the decision cycle faster than one's enemy. This, too, is an appeal to the benefits of psychologically disrupting the enemy.

> The ability to operate at a faster tempo or rhythm than an adversary enables one to fold [an] adversary back inside himself so that he can neither appreciate nor keep up with what's going on. He will become disoriented or confused…which will

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[70] Ibid., 7.
[71] Boyd, 41.

eventually result in a collapse of his ability to carry on.[72]

Tactically, one can easily envision the necessity for taking and completing action before the enemy can take and complete action. Objectives are generally clear: protect a strike package, take a hill, hold a position. Likewise, the methods for accomplishing the objectives are relatively clear as well and usually involve the clash of opposing forces: shoot down enemy fighter aircraft, destroy enemy tanks or infantry, interdict ammunition, fuel, and other supplies.

This tactical paradigm holds true at the next higher level as well. Operationally, war is a matter of mass, maneuver, and sustainment, among many other factors. One side gains marked advantages over the other by acting and reacting more quickly to unfolding events. Nevertheless, much like tactics, both sides act and react to similar kinds of events at the operational level of war. One side tries to counter the other's army, air force, or navy, while pursuing objectives with its own army, air force, and navy.

In short, at the tactical and operational levels of war, operating inside the enemy's decision loop creates the synergy conferred by the traditional principles of war. Acting and reacting faster than the adversary allows one to out-maneuver, out-mass, and generally out-fight the enemy. It enhances the efficacy of force-on-force engagements. However, strategy is no more a collection of operations than it is a compendium of tactics.

This is where the concept of operating inside the enemy's decision loop begins to erode: at the strategic level—the place where it professes to do the most good. The difference lies in the types of events that each side considers as stimuli for action or reaction. Strategically, one side can decide faster than the other every time, but if each side is making decisions regarding different events there is little point in the comparison.

The Chinese Civil War highlights this issue very well: It began in 1924 and continued for more than two decades, finally ending with the success of the Chinese Communist Party (CCP) in 1949. Throughout this period, Mao Tsetung stated that the revolutionary forces of the CCP must grow in strength until they were able to defeat the Kuomintang Army under Chiang Kai-shek.[73] In fact, Mao advocated that, "To proceed from this point in formulating our strategy of long-term warfare is one of the important principles guiding our strategy."[74] Thus, while Chiang

[72] Boyd, 280.
[73] Mao Tsetung, *Six Essays on Military Affairs* (Peking: Foreign Languages Press, 1972), 23/
[74] Ibid., 118.

Kai-shek's army was engaged in the business of killing revolutionary communist soldiers, the CCP was engaged in the business of recruiting soldiers and gaining popular support *enroute* to defeating the Kuomintang Army. Ultimately, the benefit of acting and reacting quickly at the strategic level against an enemy who is waging a slow, protracted war is questionable. The historical record shows that attempts to accelerate this type of war usually do work—against the side that is trying to speed up the conflict.

Thus, while speed is a critically important attribute at the tactical and operational levels of war, it is not always as important at the strategic level of war. What is more important is understanding the nature of the war. Every war is different. Even when the countries are the same, the leaders are often different. Even if the leaders are the same, the issues are at least somewhat different. These small differences interact in chaotic ways to ensure that no two wars are ever exactly alike.[75]

Again, one must question the mechanism whereby Boyd anticipates that the enemy's confusion and disorientation strategically will result in "a collapse of his ability to carry on." While Orientation is undoubtedly the most crucial element of the decision process, leaders can still make decisions with old or inappropriate information. Disorientation does not equate to paralysis. It does not necessarily result in an inability to take action. There appears to be little support for the contention that simply completing the OODA Loop faster than the enemy results in strategic victory.

What a speedy decision loop does confer is flexibility and freedom of action. One can pursue one's own goals in consonance with the unfolding tactical, operational and strategic situation if one has a faster decision cycle than the enemy. The opponent can still act and react with a slower OODA Loop, but those actions may no longer be relevant to the situation. A speedy OODA Loop is simply a facilitator for continued action—it is not a recipe for success if one's own actions are inappropriate to the situation.

Ultimately, many theorists are not as sanguine as Boyd regarding the applicability of the OODA Loop above the tactical level. They accept the proof of a 10-to-1-kill ratio in the skies over Korea. They understand the utility of inducing the enemy to move in a certain direction on

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[75] Alan Beyerchen, "Clausewitz, Nonlinearity, and the Unpredictability of War," *International Security* Vol 17 No 3, Winter 1992-1993, 80.

the battlefield and then attacking him from a totally new or unexpected direction.[76] These are sound tactics and they win battles. But strategy is more than tactics writ large, or at least it should be if one intends to win a war.

Much of the discomfort of Boyd's critics rightfully stems from an inability to visualize the mechanism for, and significance of, operating inside the adversary's OODA Loop at the slower-paced, higher levels of war. How does one country create and maintain signals that are so ambiguous and menacing that they cause a rival nation to "fold back in on itself" and subsequently collapse? For that matter, what does it mean for a country to "fold back in on itself?" Does that guarantee victory by itself, or does it require further action?

Control Warfare

Although Boyd would probably disagree, the key to employing his theory at the strategic level of war does not seem to rest solely in the whirling, relative motion of two adversaries executing their own OODA Loops. Neither does it reside solely in psychological disorientation or in the creation of non-cooperative centers of gravity. While these concepts are intriguing and do provide the promise of quicker, cheaper wars, they are also unattainable with today's understanding of human and organizational behavior. Instead, success appears to remain with more mundane aspects of coercion and warfighting: making the enemy's cost of resisting compellence greater than his cost of surrendering the issue.

For the time being, control warfare must remain a methodology for achieving conventional coercive victories. In this regard, the systemic approach to attacking an enemy's decision process appears to hold the greatest promise for rapidly degrading the opponent's military and political leadership. Focused on increasing delays between the tasks of the decision loop, systemic attacks expand the adversary's OODA Loop allowing friendly forces to operate at a faster tempo than their counterparts. The significance of this increased pace manifests itself by enhancing the effectiveness of conventional coercive efforts.

Component-level attacks against an enemy's decision loop are still useful; however, they do not appear to be the primary determinant of victory for the foreseeable future. Psychological operations and other efforts directed at affecting a specific enemy belief continue to retain their utility. What does not seem possible at this juncture is a disorientation of the enemy's leadership

[76] This is reminiscent of Liddell Hart's theory of the indirect approach. See Basil H. Liddell Hart, *Strategy*, 2d

that is so complete that it causes outright capitulation.

Command and Control Warfare

The present incarnation of control warfare does not appear much different from the traditional notion of command and control warfare (C2W). Where the two will ultimately diverge is in their approach to the achievement of victory. C2W is a tactical and operational methodology for degrading the enemy's ability to command and control its forces. In essence, it "implements information warfare on the battlefield."[77] Control warfare, on the other hand, retains the promise of achieving strategic-level effects, providing that behavioral scientists and psychologists can more accurately divine the component-level nature of human and organizational behavior.

Summary

Apparently, Boyd's theory of war—although it claims that psychological disorientation results in physical disruption and paralysis—is predicated on good, old-fashioned violence serving the *coup de grâce* to a disoriented enemy. Instead of being the cause of paralysis, disorientation is merely an intermediate and facilitating step towards physical destruction. The very example of F-86 pilots shooting down MiG-15 pilots in Korea illustrates this point. Although the superior hydraulic flight controls of the Sabre enabled the Americans to outmaneuver the communists in air-to-air combat, dogfights did not end with the simple "disorientation" of the opposing pilot. In general, the disoriented MiG pilots did not crash into the ground, bail out of their aircraft, or vanish in a puff of smoke. Eventually they might do all three, but only after American pilots took advantage of the situation to deliver the fatal, physically destructive blow.

This tactical example points to a fundamental truth regarding human nature: people seldom give up while they still have reasonable means of resistance. Expecting different behavior at the operational or strategic level is somewhat fantastic and self-deluding. No American pilot or tank commander would seriously consider abandoning his or her equipment simply because the unfolding reality did not correspond to prior expectations. Likewise, no Army commander, JFACC, CINC, or national leader should be expected to abandon a war

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Revised Ed. (NY: Meridian, 1991), 146-147.

merely because of a mismatch between expectations and reality. As Clausewitz once remarked, "War is the realm of uncertainty and chance."[78] Those who are most successful at waging it find ways to cope with the uncertainty and capitalize on the chance. We should not egocentrically assume that our adversaries are incapable of either. Instead, we should acknowledge that commanders at all levels from the tactical to the strategic seek to reduce their levels of uncertainty so they can operate effectively within the circumstances they face.

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[77] Norman B. Hutcherson, *Command and Control Warfare: Putting Another Took in the War-Fighter's Data Base* (Maxwell Air Force Base, AL: Air University Press, Research Report No. AU-ARI-94-1, 1994), 21.
[78] Clausewitz, 101.

Chapter 6

Conclusion

Airpower has frequently been evaluated against its promises rather than on its actual achievements.

—Air Vice Marshal Tony Mason

Summarizing Control Warfare

Control warfare emerges from a legacy of economic warfare developed in the years leading up to and through World War II. Appalled at the carnage created by the conventional force-on-force approach to attrition warfare in the First World War, airpower theorists sought to use their new weapon of war in a fundamentally new way. The Second World War heralded the advent of economic warfare through aerial attack upon an enemy's means of producing the weapons of war. Control warfare represents another step in the evolution of aerial warfare away from pure attrition-style attacks.

Control warfare is predicated upon attacking the command structure that the enemy uses to control its means of war. Central to this method of warfare is an understanding of how people control organizations and direct them to act. This, in turn, is the province of human and organizational behavior.

John Boyd created an enduring legacy for those involved with describing, affecting, and compelling the behavior of others. Encapsulated in his model of the OODA Loop, Boyd's framework represents the foundation for examining, and affecting, the actions of people, groups, and nations. It is also the foundation for describing the command and control process.

Consequently, Boyd's OODA Loop informs any approach to control warfare. Those who would understand the capabilities and limitations of control warfare must first understand what constitutes the enemy's command and control structure. The OODA Loop is the simplest, yet most robust, construct for doing this.

Close examination of the OODA Loop reveals that it describes behavior on two different levels: a macro-scale systemic level, and a micro-scale component level. The systemic level is a broad expression of the tasks inherent in human and organizational behavior. It is a general framework that describes how people and organizations interact with their environment and take action based on the unfolding events around them. The component level, on the other hand, provides a specific description of how individuals or groups perform the tasks described by the overarching OODA Loop model. It describes how information is actually collected, processed, evaluated, and acted upon.

Viewing individual and organizational behavior from a systemic perspective ultimately leads one toward the pursuit of physical objectives in control warfare. One seeks to reduce the amount of information available to the opposing decision makers, or one strives to increase the time that the adversary requires to complete the decision process. This method encompasses both decapitation-style attacks and traditional command and control warfare. One frequently focuses on “operating inside the enemy's OODA Loop.” Accomplishing this requires one to exploit and expand the inherent delays in the adversary's decision loop while also controlling and minimizing the intrinsic delays in one's own decision loop. The most promising method for accomplishing this appears to reside in physically attacking the enemy's information infrastructure, while also protecting one's own. Thus, victory results from physical actions that convince the enemy that the war is lost.

Conversely, approaching personal and group behavior from a component-level perspective leads one toward the pursuit of psychological objectives in control warfare. One seeks to affect the adversary's decisions by manipulating the information that he uses to orient in the surrounding environment. By presenting the enemy with ambiguous but menacing environmental cues, some believe that the opponent will become so disoriented that his entire system will collapse, leading to capitulation and victory. Thus, success is a result of psychological actions that convince the enemy that the war is lost.

Boyd’s own theories regarding the use of the OODA Loop in war are curiously inconsistent. Although he continually stresses the importance of attacking the enemy’s orientation as the key to success, Boyd consistently offers physical methods to achieve psychological effects without describing the mechanism that links the two. The best example of this is his contention that operating at a faster tempo than the enemy results in the disorientation and subsequent collapse of the adversary’s system. He does not explain what causes this collapse, how much disorientation is necessary to achieve this collapse, or how much faster one’s tempo must be than the enemy’s to generate a sufficient degree of disorientation. In short, there is no threshold against which one can measure progress toward this goal.

Even when Boyd does consistently apply psychological means in the pursuit of psychological ends, he still does not explain the method whereby his methods result in the desired effect. Disorienting the enemy is useful for putting him off balance, but it does not necessarily translate into the achievement of victory. Rather, the application of physical force seems necessary to ultimately topple a disoriented enemy.

These criticisms aside, Boyd's OODA Loop represents the seminal construct for those who would engage in control warfare. By describing the behavioral and decision-making process, his theory establishes the framework for conducting future operations against an opponent's command structure. Perhaps more than any other theory, the OODA Loop illustrates the necessity for understanding one's adversary.

If one desires to beat the enemy with physical methods, one must know how the enemy's information infrastructure supports his decision process. Armed with this knowledge, one then attacks the most valuable and vulnerable components. In this respect, control warfare is virtually indistinguishable from current command and control warfare.

If, on the other hand, one wishes to beat the enemy with psychological methods, one must have a very detailed understanding of how the adversary actually performs the functions of observation, orientation, decision, and action. Unfortunately, the current state of psychological and behavioral theory does not offer any unified, predictive theories to populate the component tasks of the decision loop. Without this level of detail, one cannot truly predict and accurately manipulate the actions of others.

For the present, the most promising use of control warfare appears to be one that is congruent with the current methods of command and control warfare. Boyd's concept of non-cooperative centers of gravity looms especially large in this realm. By severing the lines of information that connect horizontal and vertical echelons of command, one can fragment a large, cohesive enemy center of gravity into many smaller, non-cooperative centers of gravity. Although Boyd intimates that this action, by itself, disorients the enemy and leads to victory, the more probable route to success seems to lie down a path of subsequent physical destruction, rather than the hope of psychological disorientation and capitulation.

Implications

The field of control warfare is in its infancy—its potential is exactly that: potential. Although its power is currently immature and, as yet, unrealized, it seems to offer the promise of great things to come. Much of the work that remains to bring this concept to fruition falls to social scientists, psychologists, and intelligence personnel. Military theorists from Sun Tzu to Clausewitz have long recognized the value and necessity of understanding one's enemy. Capitalizing on the potential of control warfare to achieve less costly wartime victories through the psychological disorientation of one's enemies requires an extremely keen understanding of how the opposing leadership gathers, processes, and evaluates information about the unfolding environment. Until that time, however, the OODA Loop and control warfare still provide a valuable means of facilitating the success of conventional warfare.

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