# Decision Space Operations: Campaign Design Aimed at an Adversary's Decision Making

**A Monograph**
**by**
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**While the process of operational campaign design recognizes the necessity of understanding the adversary, it rarely, if ever, addresses his decision making process in depth. This shortcoming must be remedied since the successful conclusion of any conflict (other than one that contemplates complete annihilation of an adversary and all of his sources of power) requires one side to make a conscious decision to capitulate to the other?s will to some extent as a necessary precursor to achieving the desired endstate. The true focus of military operations, then, should be the adversary?s decision making process. This monograph develops a framework for focusing military operations at an adversary?s decision making processes by developing the concept of decision space, analyzing theories pertaining to decision making (specifically, Boyd?s Observe-Orient-Decide-Act Model, the Soviet theory of Reflexive Control, and Klein?s Recognition Primed Decision Making Model) synthesizing the development and analysis to produce guiding principles, and providing recommended necessary actions to implement the findings. An understanding of an adversary?s decision space, the conceptual location where he envisions paths that lead to successful attainment of his military objectives, provides opportunities to exploit vulnerabilities. The necessary analysis is enabled by five identified characteristics of decision space: the decision maker?s imperfect knowledge of the decision space, the near-equivalence of adjacent paths, outcome-based path categorization, the temporally dynamic nature of decision space, and the identification of decision as a necessary precursor to action. Analysis of the decision making process itself reveals additional opportunities to exploit vulnerabilities in four critical sub-processes: orientation to the environment, filtering information from the environment, development of paths in decision space, and path evaluation. General principles (termed Elements of Cognitive Campaign Design), derived from the analysis, provide the tools necessary to design military operations that can exploit these vulnerabilities in an adversary?s decision making process. The four principles are: Robust Simulation, Cognitive Lines of Operation, Timing, and Fluid Execution. In order to implement the framework developed in this monograph, the first and most important requirement is the development of the capability to accurately simulate the decision making processes of potential adversaries. Second, the concepts presented here must be examined, debated, and eventually incorporated into operational doctrine in some form. Finally organizational structures, command and control hierarchies, and training programs must be modified to enable command-by-influence and self-synchronization methodologies on the battlefield that are necessary to fully realize the benefits of decision space operations.**

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# Abstract

DECISION SPACE OPERATIONS: CAMPAIGN DESIGN AIMED AT AN ADVERSARY'S DECISION MAKING by MAJ Erick D. McCroskey, USAF, 64 pages.

While the process of operational campaign design recognizes the necessity of understanding the adversary, it rarely, if ever, addresses his decision making process in depth. This shortcoming must be remedied since the successful conclusion of any conflict (other than one that contemplates complete annihilation of an adversary and all of his sources of power) requires one side to make a conscious decision to capitulate to the other's will to some extent as a necessary precursor to achieving the desired endstate. The true focus of military operations, then, should be the adversary's decision making process.

This monograph develops a framework for focusing military operations at an adversary's decision making processes by developing the concept of decision space, analyzing theories pertaining to decision making (specifically, Boyd's Observe-Orient-Decide-Act Model, the Soviet theory of Reflexive Control, and Klein's Recognition Primed Decision Making Model), synthesizing the development and analysis to produce guiding principles, and providing recommended necessary actions to implement the findings.

An understanding of an adversary's decision space, the conceptual location where he envisions paths that lead to successful attainment of his military objectives, provides opportunities to exploit vulnerabilities. The necessary analysis is enabled by five identified characteristics of decision space: the decision maker's imperfect knowledge of the decision space, the near-equivalence of adjacent paths, outcome-based path categorization, the temporally dynamic nature of decision space, and the identification of decision as a necessary precursor to action.

Analysis of the decision making process itself reveals additional opportunities to exploit vulnerabilities in four critical sub-processes: orientation to the environment, filtering information from the environment, development of paths in decision space, and path evaluation.

General principles (termed Elements of Cognitive Campaign Design), derived from the analysis, provide the tools necessary to design military operations that can exploit these vulnerabilities in an adversary's decision making process. The four principles are: Robust Simulation, Cognitive Lines of Operation, Timing, and Fluid Execution.

In order to implement the framework developed in this monograph, the first and most important requirement is the development of the capability to accurately simulate the decision making processes of potential adversaries. Second, the concepts presented here must be examined, debated, and eventually incorporated into operational doctrine in some form. Finally, organizational structures, command and control hierarchies, and training programs must be modified to enable command-by-influence and self-synchronization methodologies on the battlefield that are necessary to fully realize the benefits of decision space operations.

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CHAPTER ONE

# INTRODUCTION

> Since the emergence of the 1986 version of operational art, the Army has continued to study the theory, history, and practice of war. Analyses of these three areas, along with an understanding of the future operating environment and the difficulties of designing campaigns over the last decade, suggests a need for a new construct of operational design. That is, the current elements of operational design might no longer be sufficient to enable the effective planning and execution of campaigns and major operations across the full spectrum of operations.
>
> James Greer, *Operational Art for the Objective Force*[1]

> One of the prime goals for a commander in warfare is to interfere with the decision-making process of an enemy commander…For Russia, one of the primary methods is through the use of the theory of reflexive control.
>
> Tim Thomas, *Russia's Reflexive Control Theory and the Military*[2]

The Prussian military theorist Carl von Clausewitz asserted that the purpose of war is to "force the enemy to do our will."[3] Increasingly, the idea of compelling an opponent through measures short of decisive combat seems to be gaining preeminence. One has only to look at the NATO coalition strategy in the Kosovo war to realize that modern military forces will likely be called upon to force an enemy to make a particular choice, rather than to impose that choice on him through utter defeat on the battlefield. Since the successful conclusion of any conflict (other than one that contemplates complete annihilation of a society, culture, or existing power base) requires one side to capitulate to the other's will to some extent, the conscious decision of the adversary to capitulate is a necessary precursor to achieving the desired endstate. Therefore, regardless of the nature of a military campaign against an adversary, be it coercive, annihilative, attritional, psychological, etc., the true focus of operations should be the adversary's decision making process.

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[1] James K. Greer, "Operational Art for the Objective Force," *Military Review*, (Sep-Oct 2002): 24-25.
[2] Timothy L. Thomas, "Russia's Reflexive Control Theory and the Military," 2003, TM (printed copy), 1. Accepted for publication, *Reflexive Processes and Control*, July-December 2003.
[3] Carl von Clausewitz, *On War*, ed. and trans. Michael Howard and Peter Paret (Princeton, NJ: Princeton University Press, 1976), 90.

This paper describes a framework for understanding and attacking an adversary's decision making process. It first describes the concept of decision space, the conceptual location where a decision maker visualizes his options and decides on a course of action that will achieve his objective. Next, the structure and vulnerabilities of decision making are examined using Boyd's Observe-Orient-Decide-Act (OODA) Loop concept, the Soviet theory of Reflexive Control, and Klein's Recognition Primed Decision Making Model. Finally, the paper provides the tools, in the form of elements of campaign design, necessary to implement attacks in the cognitive realm.

Properly understood, the theory described in this paper does not supplant existing methodologies or warfighting constructs; rather, it subsumes them into a higher concept of conflict aimed at "compelling the enemy to do our will." The emerging models of Rapid Decisive Operations, Effects-Based Operations, and Network Centric Warfare, among others, all find a useful place within a broader-based theory designed to attack the adversary's true decisive point: his decision making process.

Although this paper is intended to provide guidance for campaign design at the operational level of war against a consciously-opposed adversary, an attempt has been made to limit the use of language that would imply the concepts described are limited only to these circumstances. The ideas presented herein seem to have equal utility at the theater strategic and strategic levels of war and perhaps at the tactical level as well. Nor is the theory constrained to operations against an adversary—influencing an ally's decision making process is equally feasible and could lead to strengthening of alliances or garnering of critical coalition support, and the potential for success of stability and/or support operations could be dramatically enhanced by the proper shaping of non-aligned, neutral, or non-governmental organizational decisions. The theory can provide direction in crafting strategies for application of the other elements of national power (diplomatic, informational, and economic) as well. Ultimately, the theory described in this paper potentially has utility in *any* situation in which it is desirable to influence the decisions of an external entity.

CHAPTER TWO

# THE CONCEPT OF DECISION SPACE

> Information warfare waged without regard for the architecture of decision making is no better than a shot in the dark.
>
> Martin Libicki, *What is Information Warfare?* [4]

Any military operation must necessarily address the environment in which it occurs if it is to have any hope of success. It follows that a commander executing an operation to compel an adversary to do his will, or equivalently, to make the decisions he wishes him to make, must first clearly understand the environment in which this action is going to take place. This chapter provides this understanding by describing this environment, termed *decision space*, and by specifying characteristics of decision space that are not only critical to understanding it but also provide insight into effective campaign design within it.

## Description of Decision Space

An understanding of decision space must be firmly rooted in a real, tangible physical reality. Therefore, it is necessary to first define the concept of configuration space.[5] The constituents of this space are all the possible states, or physical configurations, that the system under consideration can assume over the period of interest. At the macroscopic level, it is theoretically possible to uniquely identify each state by specifying a value for every possible variable used to describe the state. Where the system of interest is the battlespace determined by the operational commander, these variables would completely describe friendly and enemy force dispositions,

[4] Martin C. Libicki, *What is Information Warfare?* (Washington D.C.: U.S. Government Printing Office, 1996), 100. Libicki's title might lead one to believe that he intends this statement only to apply to Information Warfare; however, he goes on to say (p. xi) that "Information is not in and of itself a medium of warfare, except in certain narrow aspects," the implication being that the statement has validity across the full spectrum of military (or at least, war) operations.

[5] The inspiration for decision space and its relation to configuration space came from the author's familiarity with graduate-level physics, specifically Richard Feynman's Nobel Prize-winning Path Integral Formulation of quantum mechanics.

terrain conditions, data and information, civil conditions, and anything else that has a physical location or property. The configuration space then contains the initial state, a continuum of intermediate states, and all the possible final states the system can assume for the time specified. The key to relating configuration space to decision space is the commander's selection of one possible final state (or any one of a number of equally acceptable final states) as his desired end state.

Doctrinally, the end state is defined as, "the conditions that, when achieved, accomplish the mission."[6] The commander's role in simple terms is to understand the initial state and *make decision*s on how to attain a final state that meets the "end state" requirements. **Decision space is the conceptual location where the commander chooses a "path" to follow that he believes will evolve the initial state through the continuum of intermediate states to his desired final state over the specified time period; this path, once articulated, becomes a course of action for his force to follow. The constituents that comprise a complete, ideal decision space are *all* the possible paths that evolve the system from the initial state to *any* possible final state.**[7] This definition implies that, when initially selecting a path, the commander foresees the system evolving sequentially from one intermediate state to another and recognizes that decisions points exist at which certain choices must be made in order to remain on the desired path. Not only does Figure 1 illustrate this concept, it also depicts the possibility that paths can merge as well as branch. Additionally, the definition implies that there is a difference between an *ideal* decision space and the one that exists within the mind of the commander; this is certainly true and will be explored in the next section. What is *not* implied in this definition is how the commander decides

[6] *FM 3-0, Operations* (Washington, D.C.: Headquarters, Department of the Army, 14 June 2001), 5-6.
[7] See Tom Czerwinski, *Coping With the Bounds*, 1998, available online at http://www.dodccrp.org /copind.htm., Ch. 2, p. 3. He provides support for my definition where he states: "In the generalized 'game' of nonlinearity, the playing field is marked off in bifurcation points… Each bifurcation, or 'splitting into twos,' is a fork in the road, or a branching representing choices, possibilities, or paths." Although a decision point with several possible paths can be analyzed in terms of a series of binary choices, or bifurcations, *in general* no reason exists to privilege one choice over any of the others by making it first; therefore, I have depicted decision points as a branching of two *or more* paths. (emphasis added)

which path to choose; mechanisms for choice will be addressed in Chapter Three. Using this model however, it is possible to draw additional conclusions about the properties of decision space that can lead to useful, practical results. These characteristic properties of all non-ideal, or *real*, decision spaces are the subject of the next section.

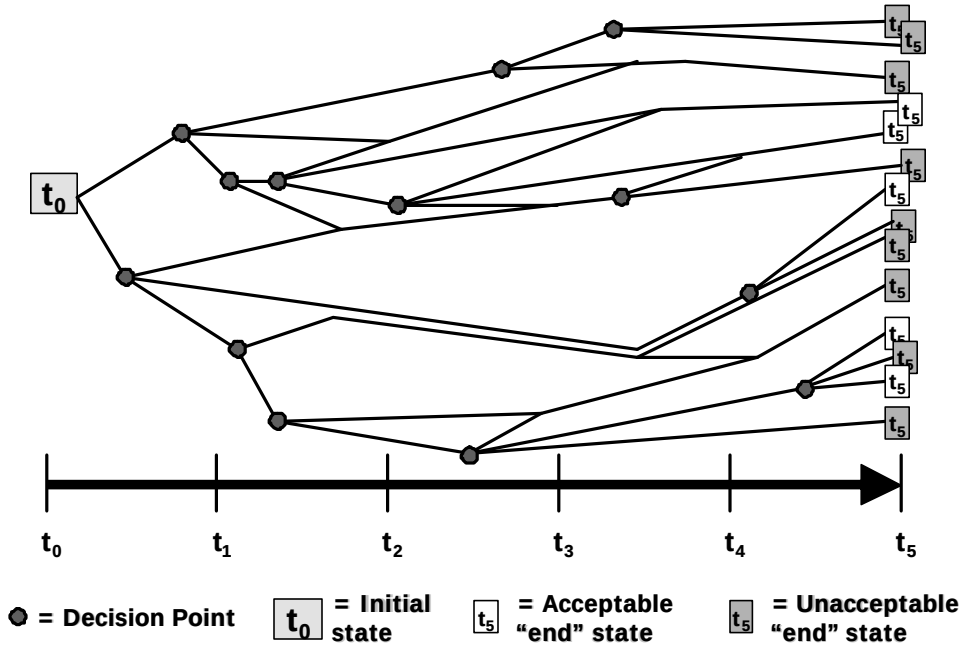


**Figure 1: Representation of a hypothetical decision space**

## Characteristics of Decision Space

It is possible to conceive of a perfectly defined configuration space in which the commander has absolute and perfect knowledge about the initial state of the entire system. It would be a mistake, however, to then extrapolate from this configuration space an *ideal* decision space and assert that this is where the commander operates. The *real* decision space, the one the commander actually operates in when making a decision, is necessarily a subset of the ideal decision space; it shares many of the same characteristics of the ideal space, but since it exists in the mind of the commander, these characteristics can take on added dimensions of complexity

that spring from the commander's perception of the situation.[8] An understanding, then, of the following characteristics is critical to designing operations within decision space.

## Imperfect Knowledge

The first characteristic of decision space is that **the commander cannot be aware of all of the paths available** since it is impossible for him to have a perfect understanding of the initial state in a complex configuration space—he will misunderstand one or more elements, or will have limited or no information on certain elements, or will fail to realize that additional elements exist, or some combination of all three possibilities. Since all paths start from this demonstrably imperfect conceptualized initial state, there will be paths that differ from those that the commander is able to extrapolate. It is this characteristic that necessarily differentiates the idealized decision space based on complete, perfect knowledge of the initial state and known future interactions from the limited, incomplete decision space that exists in the mind of the commander. This incompleteness suggests possible practical applications.

The fact that an adversary will be unaware of the existence of one or a number of paths in decision space, or that these paths will not evolve the way he expects due to an error in his conceptualization of the initial state, can be capitalized on by the friendly commander with superior knowledge of the initial state and an understanding of where his adversary's decision space is in error. The friendly commander can gain an advantage by forcing the adversary to follow a path that he wasn't aware existed and consequently didn't prepare for. An even more effective mode of operation envisions the adversary operating on a disadvantageous path rather than the one he had intended to operate on and not even realizing it (until it is too late to take

[8] As previously stated, the ideal decision space contains all possible paths leading to all possible final states. The real decision space contains only those paths the commander can envision. The *solution space* contains those paths that evolve the system to an *acceptable* final state. The solution space is contained completely within the ideal decision space, but only a portion of it will be found in the real decision space. I am indebted to Dr. James Schneider for suggesting this line of reasoning.

corrective action), due to the similarities between the paths and his inability to recognize their differences.

However, it *may* not be necessary for the commander to concern himself with the differences in these paths, especially if his conceptualization of the initial state is very good, because of the next characteristic of decision space.

## Near-Equivalence of Adjacent Paths

**Paths in decision space that are sufficiently similar to each other are not considered to be different paths by the commander, but instead are looked at in an aggregate sense as just one path.** Although all paths are, by definition, specific and distinguishable down to the smallest detail, when they are essentially similar in their relevant details (i.e., adjacent to each other in decision space) they are necessarily treated as indistinguishable. This occurs when their differences fall below a certain detail threshold. An alternative way of stating this is **adjacent, sufficiently similar paths result in nearly identical course of action articulations** with only minor differences in intermediate states in configuration space. Because an operational-level commander may not care, for instance, which company within a particular battalion seizes a bridge, he will treat the two paths (one with B Company seizing the bridge, the other with C Company accomplishing this action) as one aggregate path. Klein refers to the case where options are very close together as the zone of indifference and states, "the closer together the advantages and disadvantages of competing options, the harder it will be to make a decision but the less it will matter."[9] This aggregation of similar paths occurs because it results in the reduction of the number of paths that must be considered by many orders of magnitude, hence greatly simplifying the decision making process without loss of functionality. However, this aggregation contains within it the seeds of potential disaster that can be used against an adversary.

[9] Gary Klein, *Sources of Power: How People Make Decisions* (Cambridge: The MIT Press, 1998), 103.

In aggregating paths to simplify his decision, the adversary essentially surrenders control over which path he follows—to him, the small differences in intermediate configuration simply don't matter. However, the friendly commander with a better conceptualization of the configuration state (and a concomitantly lower detail threshold) may realize that the minute differences being ignored by the adversary can have dramatic operational impact (for want of a nail the horse was lost…) and subsequently choose to direct the enemy down a specific path without encountering any resistance in return. Of course, the willingness of the adversary to follow this path is related directly to his perception of the value of the end state it leads to. This value is addressed by the next characteristic.

## Outcome-Based Path Categorization

**Paths in decision space fall into one of two categories: acceptable and unacceptable.** Acceptable paths are those that, in the commander's perception, lead to a final state that accomplishes the mission, i.e., attain the desired end state condition. Implicit in this characteristic are **two key concepts—the idea that there may be a multiplicity of final states that are acceptable end states, and the idea that the commander's perception plays a primary role in determining whether a final state is acceptable or not.** Each of these ideas merits further discussion.

The existence of a multiplicity of final states is obvious when looked at in terms of configuration space: very similar yet distinguishable final states are guaranteed to exist by virtue of the fact that even a small change in any one variable of the system results in a different state. Less obvious, but more important, is the observation that even widely disparate states can be acceptable. For instance, if an adversary's aim is to maintain his regime, and the survival of large parts of his conventional force, or of a large percentage of his population, is of secondary importance, he may be willing to follow any one of several paths, each with an final state quite different from the others, but all meeting the end state condition of regime maintenance. As a

corollary, it also possible to imagine a path that leads to an acceptable final state but passes through an unacceptable intermediate state; this represents the situation where the commander doesn't feel that "the ends justify the means." For instance, use of a tactical nuclear weapon might achieve the desired endstate, the defeat of the adversary's fielded forces, but would most likely be unacceptable politically. This discussion of acceptable final states is inextricably linked to the commander's perception of those states.

The commander's perception of whether a particular final state meets the minimum desired end state conditions he has set is the primary determinant in his categorization of the corresponding path as acceptable or unacceptable. The commander may believe (due to his experiences, personality, understanding of doctrine, application of the elements of operational design, characteristics of the system within which he exists, or other factors) that a particular path leads to an acceptable final state when it actually is more likely to lead to an unacceptable one or vice versa, especially since this perception is based on his imperfect knowledge of the initial state. However, regardless of where a path is most likely to lead, the salient feature is that the commander, aided by his staff, makes decisions based on how he has categorized paths according to his perceptions. It is exactly this feature that provides great leverage against an adversary.

Arguably the easiest way to compel an adversary to do one's will is to convince him that it is really his own ideas that he is implementing. The capability to influence the adversary's acceptability categorization of a path or to deny him the resolution required to make that categorization is the essence of operations in decision space. Of course, one might argue, based on the ideas presented thus far, that once a commander has decided on a path nothing more can be done, and so operations in decision space are limited in their utility to preparatory actions. However, this is not the case because, up to this point, the discussion has been intentionally simplified by considering only the decision space that exists at the outset of an operation; the reality is much more complex, as described next.

## Temporally Dynamic

The **decision space is a dynamic, time-dependent environment: each of the previous characteristics listed above actually applies to every point along every path as the configuration space evolves in time**. Each intermediate state becomes the new initial state once reached, and all the aforementioned complexities apply. Since nearly all real physical processes are now recognized to be nonlinear[10] (which means that outputs or system changes are decidedly not proportional to inputs, and in fact are in many situations unpredictable), the configuration space and hence decision space are certain to evolve over time in unexpected directions. The clear implication is that the commander will have to modify (to a greater or lesser degree) his enunciated course of action as the operation progresses. This is the kernel of truth in the old saw, "No plan survives contact with the enemy." In order to modify his course of action, the commander will have to search through this updated, time-evolved decision space for another acceptable path. This fact suggests that operations in decision space, if conducted correctly, can become more rather than less effective.

The simple tautology that the commander resides in the here-and-now, in a current configuration state from which all potential future states must evolve, means that he continually finds himself in a new initial state of which he has imperfect knowledge. Since uncertainties and errors in nonlinear systems are likely to perpetuate themselves and grow over time, the commander is almost sure to have an even less accurate representation of the configuration space and hence a more skewed decision space in the future. In his research on decision making, Klein found that "a stable environment permitted more precise and complex plans. A rapidly changing environment favored modular plans because these permitted rapid improvisation. A resource-limited environment favored integrated plans that were more efficient. Time pressure and

[10] See Czerwinski, *Coping With the Bounds* for a discussion of nonlinearity and complex adaptive systems that is readable, although not extremely rigorous.

uncertainty made it more difficult to construct integrated plans."[11] Hence, the time-evolution of an adversary's decision space in a fast-moving, unstable, complex military environment, if understood correctly, is actually an enabler of all the other potential advantages listed thus far, since the adversary will not have the luxury of extrapolating from a stable initial state. Although this time dependence draws the previous three characteristics together somewhat, it is the last characteristic that provides a firm link back to configuration space.

## Decision as a Necessary Precursor to Action

The final characteristic of decision space I will discuss is that **success in discovering an appropriate path through decision space is a necessary precursor to success in configuration space**: a commander cannot articulate a course of action for an operation unless he is able to first identify a path through decision space that connects the initial state with an acceptable final state. In U.S. Army parlance, the commander cannot Describe the operation and effectively Direct his forces unless he can first Visualize a means to achieve the desired outcome.[12] In order to articulate an appropriate course of action therefore, the commander must: 1) be aware an appropriate path exists and understand it, 2) have the freedom to choose a path that he perceives to be acceptable, and 3) be able to search through decision space in a dynamic environment and find an acceptable path that is relevant within the time-constraints imposed by the situation. The inferences that can be drawn from these observations also can be applied directly to operations to enhance success.

First, as has been alluded to before, the invisible or incomprehensible path represents a blind defile in the adversary's decision space; if it leads to an acceptable final state and can be kept hidden from him, he is denied an opportunity to achieve success. Likewise, if it leads to unacceptable results and he can be maneuvered down it, he can be induced to direct his efforts

[11] Klein, *Sources*, 145.
[12] *FM 3-0*, 5-4.

towards a course of action that leads to failure. Next, if the adversary can be denied the freedom to choose certain paths, either through the establishment of real constraints, or the effective portrayal of the existence of constraints that aren't really there, he will once again be barred from opportunities to reach his end state; correspondingly, if the adversary perceives a path as acceptable because constraints have been hidden from him, he may embark on a detrimental course of action. Finally, if the adversary is unable to effectively conceptualize, categorize, and choose from among the paths available, he may be forced to either choose at random or to make no choice at all, both of which can lead to disastrous consequences.

This chapter described the framework of decision space as the conceptual location where a commander makes decisions. It then described five characteristics of this location and suggested insight into how these characteristics could be used to gain an advantage over an adversary. With these characteristics identified, it is now important to describe how the commander chooses a path through decision space. This is the purpose of the next chapter.

CHAPTER THREE

# DECSION MAKING STRUCTURE AND VULNERABILITIES

> A decision, therefore, is not a problem of simple arithmetic, but a creative act…the process by which a decision is reached is, in the final analysis, nearly always a secret which, in most instances, remains insoluble even to the person who has arrived at the decision.
>
> Lothar Rendulic, *The Command Decision*[13]

> In fact, wars through history have been fought to change (or change the mind of) the command structure…or, put in other words, to induce the command structure to make concessions or to make it incapable of leading.
>
> John Warden, *The Enemy as a System*[14]

Understanding how an adversary makes decisions is absolutely vital to being able to attack that process. Even if a military operation is well-grounded in terms of how it addresses the environment (as was done for decision space operations in the previous chapter), it must still address how the adversary is able to operate in that environment. Van Creveld provides a place to begin: "…it may be said that in order to classify and arrange (that is, 'understand') information reaching us we rely on a mental matrix consisting of concepts and the relationships between them. 'Understanding' means arranging the information in accordance with the matrix, while information that cannot be so fitted appears 'illogical.'"[15] In order to further comprehend how an adversary "understands," Leonhard suggests investigating battlefield psychology "as a foundation to tactics."[16] The first three sections in this chapter explore the Observe-Orient-Decide-Act (OODA) Loop concept, Reflexive Control Theory, and the Recognition-Primed Decision Making model as a foundation for understanding how an adversary makes decisions within decision space. The last section analyzes the concepts presented in the first three to

[13] Lothar Rendulic, *The Command Decision* (Washington, D.C.: Office of the Chief of Military History, 1958), 17.
[14] John Warden, "The Enemy as a System," *Airpower Journal* (Spring 1995): 49.
[15] Martin Van Creveld, *Command in War*. ( Cambridge, MA: Harvard University Press, 1985), 278.
[16] Robert Leonhard, *The Principles of War for the Information Age* (San Marin, CA: Presidio Press, Inc., 2000), 215.

discover how and where weaknesses exist in a potential adversary's decision making process and describes how these weaknesses might be exploited.

## Expansion of the OODA Loop Concept

John Boyd's OODA Loop Concept, well known in military circles, is often conceptualized in its simplified format, which is best described in Boyd's own words: "[The] idea of fast transients suggests that, in order to win, we should operate at a faster tempo or rhythm than our adversaries—or, better yet, get inside adversary's [sic] Observation-Orientation-Decision-Action time cycle or loop…Such activity will make us appear ambiguous (unpredictable) thereby generate confusion and disorder among our adversaries—since our adversaries will be unable to generate mental images or pictures that agree with the menacing as well as faster transient rhythm or patterns they are competing against."[17] (underlining in the original) The cycle itself is often represented graphically as shown in Figure 2.

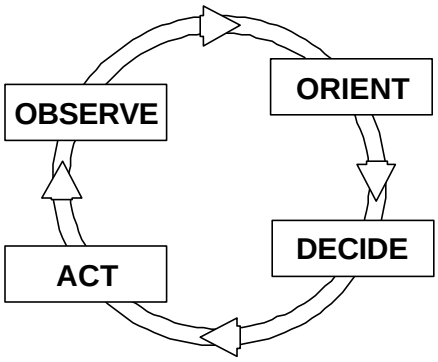


**Figure 2: Boyd's OODA Loop**

[17] John Boyd, "Patterns of Conflict," *A Discourse on Winning and Losing*, 1987, TDs, p. 5. Archive, Combined Arms Research Library, Ft. Leavenworth, KS.

Control theory supports this idea of increasing confusion and disorder as tempo increases. A system under control (defined as "purposive influence toward a predetermined goal"[18]) requires programming; that is to say, "it depends on physically encoded information, which must include both the goals toward which a process is to be influenced and the procedures for processing additional information toward that end."[19] These programs "require inputs of information… which incur costs in terms of increased entropy [disorder]."[20] Furthermore, as an organization or system increases in physical power (and hence increases its capability to conduct more actions in a more complex manner), this power is progressively translated into "increasing speed with which matter, energy, and information moved through the system. All else being equal, increases in power will always result in increases in speed, which in turn increases the need for control and hence for communication, information processing, programming, and decision."[21]

The obvious connections between these "needs" and the component phases of the OODA Loop (communication/information input with Observing, information processing with Orientation, programming with both Decision and Action, and of course, decision with Decision), and the fact that satisfying these needs, especially that for increased information input, necessarily leads to some degree of disorder, supports Boyd's thesis. Although the idea of establishing and maintaining a faster rhythm than the adversary was Boyd's main focus, he did not limit himself to this sole application.

**A little-appreciated and rarely-referenced implication of the OODA Loop concept is the possibility of operating at a faster tempo, not simply to overwhelm an adversary with a constantly changing situation and force him into paralysis, but to creatively exploit the way he orients himself to his surroundings in order to force him to act the way one wants.** Boyd believed that one could diminish an adversary's freedom-of-action by exploiting and subverting

[18] Beninger, *The Control Revolution* (Cambridge, MA: Harvard University Press, 1986), 35.
[19] Ibid., 40.
[20] Ibid., 48.
[21] Ibid., 202.

(rather than disrupting or destroying) those weaknesses and critical connections within an adversary organism that permit it to cycle through its OODA Loop in a coherent manner.[22] Furthermore, he suggested that this type of activity attempts to "create a variety of impressions of what is occurring and what is about to occur [and] generate mismatches between what seems to be and what is."[23] He proposed that the focus of what he called "Grand Tactics," which equates to the operational level of war in the current doctrinal hierarchy, is to "operate inside adversary's [sic] observation-orientation-decision-action loops, or get inside his mind-time-space, to create tangles of threatening and/or non-threatening events/efforts as well as repeatedly generate mismatches between those events/efforts adversary observes, or imagines, and those he must react to, to survive."[24] Perhaps most telling, Boyd asks, "How do we want our posture to appear to an adversary—or put another way, what kind of mental picture do we want to generate in his mind?"[25] This idea of systematically generating a mental picture in the mind of the adversary has great utility and will be explored further in the next section. While this kind of "attack" must necessarily introduce a skewed view of the "facts" of a situation into the opposing decision maker's mind, it must also consider how to produce the proper emotional state desired.

Boyd clearly understood the moral domain of conflict and that advantages that could be gained by acting to influence it. His comments that "…moral effects are related to menace and uncertainty", his emphasis on the importance of trust for cohesion, and his conclusion that "…moral strength represents mental capacity to overcome, menace, uncertainty, and mistrust," (underlining in the original) show that he placed importance not only on the adversary's actual perceptions of reality and the components of the OODA Loop within which he processed them, but also on the accompanying (emotional) mental states that influenced the overall process.[26] All

[22] Boyd, "Patterns of Conflict," 128.
[23] Ibid., 129.
[24] Ibid., 134.
[25] Ibid., 148.
[26] Ibid., 128.

three of these elements, perception, process, and emotions, Boyd contended, were primarily dependent on the orientation phase of the cycle.

Orientation, in Boyd's view, is both a process and a result. As a result, it "represents images, views, or impressions of the world shaped by genetic heritage, cultural traditions, previous experiences, and unfolding circumstances."[27] (underlining in the original) As a process, Boyd contends that, **"Orientation is the schwerpunkt. It shapes the way we interact with the environment—hence orientation shapes the way we observe, the way we decide, the way we act. In this sense, Orientation shapes the character of present observation-orientation-decision-action loops—while these present loops shape the character of future orientation."**[28] (underlining in the original) These quotes reveal three interesting implications. First, an adversary's orientation is the schwerpunkt, the *balance point* or *center of gravity*, of his decision-making cycle; this closely parallels the assertion, introduced in the control theory discussion, that control is dependent on information processing. Second, understanding how an adversary orients himself only comes from understanding all those factors that have shaped and are shaping how he processes information about his environment. The third implication relates to the dynamic time-dependent characteristic of decision space.

Boyd emphasizes that the way the adversary will react in the future is shaped by how he perceives the present. Control theory also supports this implication in its assertion that programming (occurring during the decision and action phases of the cycle) must include procedures for processing additional information in future states. Boyd expounds on this idea using verbiage that ties in well with the concept of decision space presented in Chapter Two: "Actions must be taken over and over again and in many different ways. Decisions must be rendered to monitor and determine the precise nature of the actions needed that will be

[27] John Boyd, "Organic Design for Command and Control," *A Discourse on Winning and Losing*, 1987, TDs, p. 13. Archive, Combined Arms Research Library, Ft. Leavenworth, KS.
[28] Ibid., 16.

compatible with the goal. To make these timely decisions imply [sic] that we must be able to form mental concepts of observed reality, as we perceive it, and be able to change these concepts as reality itself appears to change. The concepts can then be used as decision-models for improving our capacity for independent action."[29] Building on this idea, it is easy to see that each decision point in Figure 1 really represents an OODA Loop as depicted in Figure 2. In fact, the argument could be made that at every point along a path in decision space, observation and orientation are occurring; furthermore, since at every point on a path in decision space there necessarily exists the possibility of deviating from that path, if only by the slightest amount, remaining on the path represents a decision to do so and consequently to take no action that would cause deviation.

This expanded analysis of the OODA Loop concept leads to the understanding that a decision maker is constantly cycling through the Observe-Orient-Decide-Act Loop as the system he is controlling evolves through time. Actions taken to affect the orientation phase can be extremely effective, not only at paralyzing the decision making process, but also at shaping any decisions that are made. Discussion on how this shaping can occur is continued in the following section.

## Reflexive Control Theory

The Soviet Theory of Reflexive Control, first developed in the early 1960's by Vladimir Lefebvre, addressed the intense interest the Communist regime had in influencing the thinking and decision making processes, not only of its adversaries, but of its own population. Although an ideational offspring of the concept of deception, or *maskirokva*, the theory proceeds well beyond those humble beginnings to provide a coherent and mathematically robust explanation of how to not only influence but actually control a target's decision making process. Current Russian military leaders still place a good deal of stock in the theory, believing that reflexive control is "an information weapon that is more important in achieving military objectives than

[29] John Boyd, "Destruction and Creation," *A Discourse on Winning and Losing*, 1987, TDs, p. 2. Archive,

traditional firepower."[30] This section defines and describes the theory, provides an overview of some theoretical concepts, and summarizes implications for its implementation. Amplifying theoretical information and means of implementation are provided in Appendices A through D.

## Definition and Description

In the words of the theory's originator, **"reflexive control means conveying to a partner or an opponent specially prepared information to incline him to voluntarily make the predetermined decision."**[31] (underlining in the original) This conveyance of information establishes in the mind of the target motives and/or reasons to make the decision, the nature of which must remain hidden from the target; the target then makes the decision independently, unaware of the influence exerted on him.[32] The formation of these motives and reasons occurs, of course, during the orientation phase of the OODA Loop. Understanding how to make this happen, however, requires a rigorous approach.

To develop a formal mathematical representation of his theory, Lefebvre found it necessary to "construct a reflexive model of an individual who has an image of himself and of his partners, who in their turn have images of themselves and of their partners, etc."[33] The theory's algebraic formulation, although relevant to the actual design of a reflexive control campaign, is beyond the scope of this paper. However, the following figures (Figure 3 to Figure 6) provide insight into the thought process Lefebvre used to develop his reflexive model.

The discussion so far has centered on reflexive control of an individual decision maker, with the implication that the control is exerted by conveying information that is then processed in an existent decision making process. However, the literature suggests that reflexive control can be

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Combined Arms Research Library, Ft. Leavenworth, KS.
[30] Thomas, 3.
[31] Vladimir A. Lefebvre and Victorina D. Lefebvre, *Reflexive Control: The Soviet Concept of Influencing an Adversary's Decision Making Process* (Englewood, CO: Science Applications, Inc., 1984.), 4. Available in hard copy only from John T. Hughes Library, DIA, SAI-84-024-FSRC-E.
[32] Thomas, 3.
[33] Lefebvre, 3.

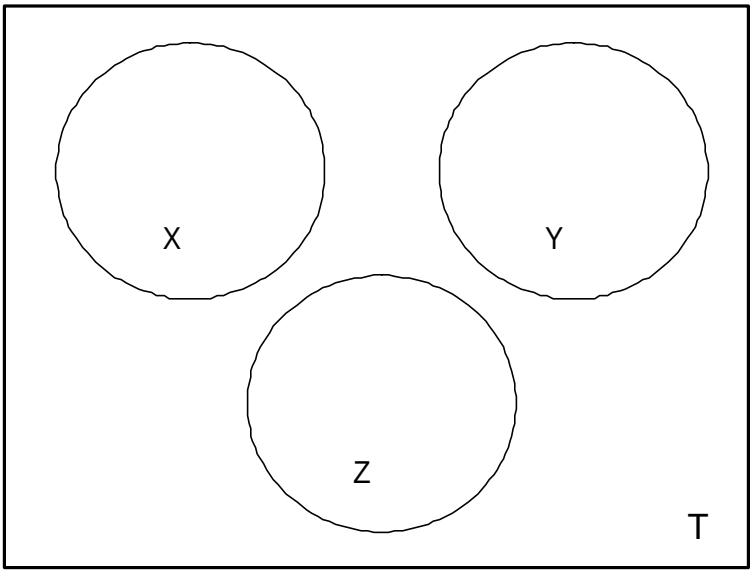


**Figure 3: Reflexive control, Initial situation (physical reality)—Adversaries X, Y, and Z in Area of Operations T[34]**

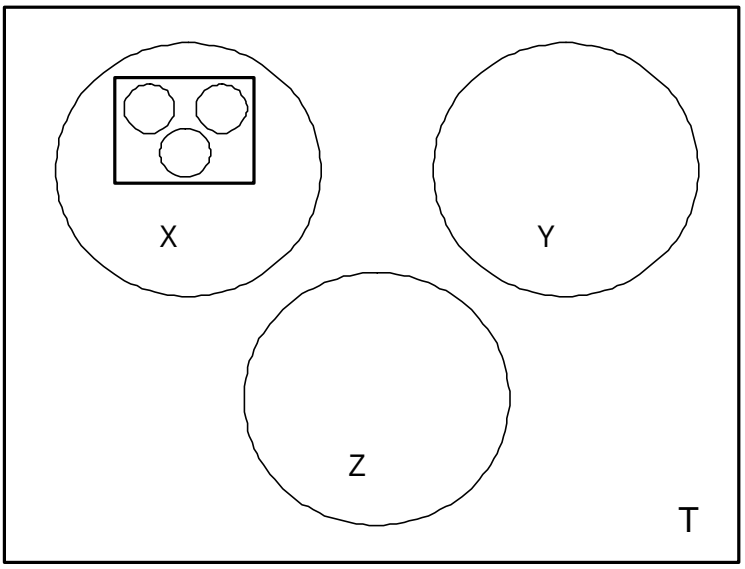


**Figure 4: Reflexive control, reality as X imagines it to be—X creates a mental model of the situation[34]**

[34] Lefebvre, adapted from Figures 2.2 to 2.4, 35-36.

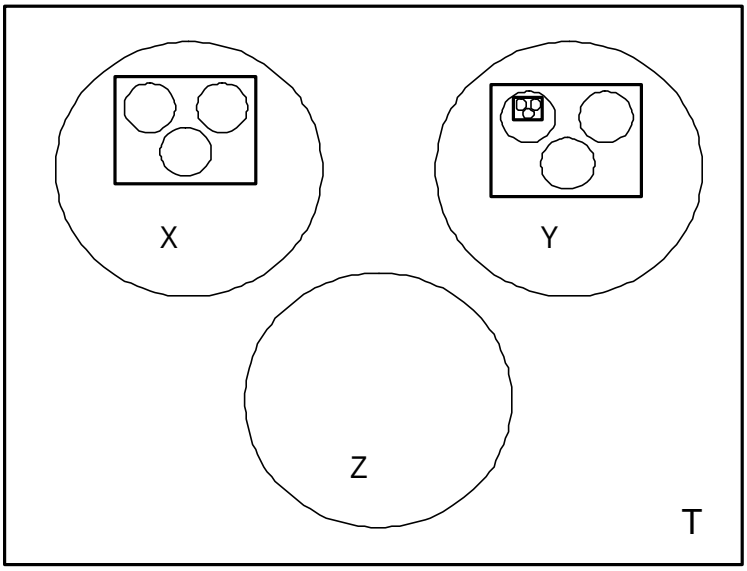


**Figure 5: Reflexive control, reality as Y imagines it to be—Y creates a mental model incorporating X's mental model (how Y imagines that X imagines the situation)**

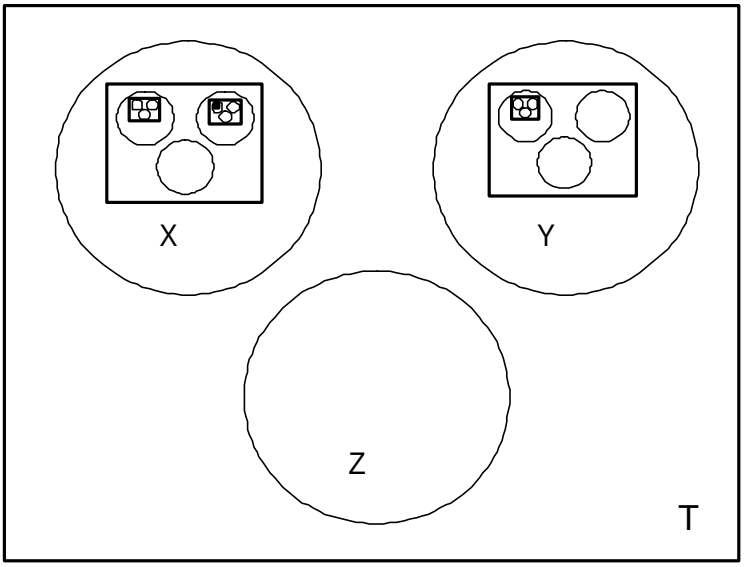


**Figure 6: Reflexive control established—X's refined model includes Y's model of X (how X imagines that Y imagines that X imagines the situation) as well an awareness of X's own modeling process [34]**

directed at two additional targets beyond the decision maker: the decision process or system of decision making, and the cultural complex within which the decision is embedded.[35] The first implies that reflexive control can cause the decision making system to change one or more elements within its own process; this potentially offers an order-of-magnitude greater advantage, since the target would from that point on process *all* information in a way directed by the controller, rather than just the isolated pieces of specially prepared information conveyed under the more limited concept.

The second target, the cultural complex, offers an additional order-of-magnitude advantage, since it implies that not only the decision maker but also the decision making process would be permeated with a level of control so subtle and fundamental as to be nigh well undetectable; the downside, of course, is the difficulty of insinuating such control into an entire culture and the lead time such an insinuation would require. Note that, just as reflexive control against an individual decision maker is directed primarily at his ability to orient, so too are efforts directed against the system and culture aimed primarily at shaping the schwerpunkt of the OODA Loop. Building on the identification of these three target groups and on the understanding of reflexive control, additional concepts can now be introduced.

## Theoretical Concepts

Conducting effective reflexive control requires the understanding and implementation of several concepts, the first of which is the absolute necessity of simulating the adversary's decision making process:

> In order to conduct reflexive control the operating side must be able to: a) construct a model of its enemy, b) construct a model of its influence on the enemy, c) attribute the enemy's model with properties a, b, c. In other words a model of the enemy may have its model of the first side, which has a model of the enemy, and so on. A number of models inserted into a given model is called rank of reflexion. If a given model does not have any insertions, its rank of reflexion is 0; if there is one model inserted, the rank of reflexion is 1, etc. Sometimes the structure of the enemy's inner world includes an image

[35]Diane Chotikul, *The Soviet Theory of Reflexive control in Historical and Psychocultural Perspective: A Preliminary Study* (Monterey, CA: Naval Postgraduate School, 1986), 32. DTIC AD-A170 613.

> of himself which has an image of his adversary, etc. Therefore, the enemy's model is a hierarch[y] of models inserted one into the other. This structure is called reflexive structure...We believe that the enemy's decision making process is determined by his reflexive structure, the specific information he provides for this reflexive structure, and some psychological mechanisms which are not connected with the reflexive structure.[36] (underlining in the original)

Referencing the previous three figures is helpful in visualizing these concepts. In Figure 4, X has a model of the general situation but not of his enemy Y; therefore, his rank of reflexion is zero. In Figure 5 and Figure 6, Y has modeled X's model inside his own, giving him a rank of reflexion of one. Finally, X has a rank of reflexion of two in Figure 6. The inescapable conclusion that follows from the theory is that a necessary precondition to conducting reflexive control over an adversary is having a rank of reflexion one greater than his, thereby guaranteeing an accurate image of his decision making process.[37]

Lefebvre maintains that **not only is an accurate simulation a necessary precondition to conducting reflexive control, it is also a sufficient one**; that is, reflexive control is successful once the side conducting the control "knows its opponent's reflexive structure."[38] He goes on to emphasize that "in general…reflexive control leads to success independently of the 'quality' of the reasoning of the opponent, just as long as this reasoning is imitated completely enough."[39] However, there is a caveat to this statement, as implied by Lefebvre's use of the words "in general."

Although the establishment of reflexive control may be solely dependent on the accurate imitation of the adversary's reasoning, **the maintenance of the control has another necessary condition, the need to keep the existence of the control hidden from the adversary subject to it**. Chotikul unequivocally states that "the appearance of non-threat and non-influence is an important component, in fact probably the principle element, of reflexive control theory."[40]

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[36] Lefebvre, 32.
[37] Ibid., 121.
[38] Ibid., 46.
[39] Ibid., 12.
[40] Chotikul, 98.

(underlining in the original) Lefebvre goes farther: "…the main condition for success of reflexive control is that the controlled party does not realize that there is control. In the opposite case, the controlled side can obtain very important information about the bases on which its adversary (the controlling side) makes its decisions."[41] Therefore, if an adversary becomes aware of a reflexive control effort against him, not only does it arouse his suspicions and cause him to scrutinize the information he receives more closely, thereby lessening the chances that the control will be effective, he also gains insight into the thinking process of the friendly side; in the worst case, the insights the adversary gains may allow him to simulate friendly decision making at a high enough level of resolution to establish his own reflexive control over the friendly side—he will have gained a higher rank of reflexion.

The rank of reflexion in a complex organization, however, is not determined simply by the conceptualization in the ultimate decision maker's mind. "The rank of reflexion of a collective depends on its staff and structure. If a group has a leader (it is not necessary for him to have official power), then the rank of reflexion of the group is equal to the rank of reflexion of the leader or is higher than it."[42] (emphasis added) The implication is that a staff can be the instrument of simulation (with a concomitant rank of reflexion) that conducts the reflexive control, through understanding of the adversary's decision making process and recommending courses of action to the commander. Additionally, in order to establish reflexive control over an organization, one must understand what its *effective* rank of reflexion is. This depends primarily on whose advice is followed, and in what circumstances. In the case of a commander-centric organization where the staff serves only as an advisory body, the organization's rank of reflexion will almost certainly be that of the commander's. In a staff-empowered organization, the staff's rank of reflexion may dominate. **Establishing reflexive control over an organization with distributed responsibility for decision making entails discerning when the decision maker**

[41] Lefebvre, 106.
[42] Ibid., 120.

**will follow the recommendations of his staff and when he will ignore their recommendations in favor of his own internal mental model.** This necessary insight will be much more difficult in an environment where there is no ultimate decision maker, but instead power over various components is shared between several decision makers, as in a coalition. Indeed, "…any coalition of enemy forces represents a far more complex system, the stability of which changes depending upon the nature of the situation in each individual state and the condition of the coalition."[43]

This understanding of the importance of the decision making structure within an organization, and the elaboration of the necessary and sufficient conditions of accurate simulation and concealment of that simulation, allows a progression from the previous section's description of Reflexive Control Theory to an investigation of the implications in implementing it.

## Implementation

**Perhaps the most critical and most difficult task in establishing reflexive control is the necessary condition specified in the previous section, that of simulating the adversary's decision making**, or equivalently, knowing his reflexive structure. In fact, Lefebvre states that "in most cases it is impossible to obtain reliable information about this;" however, he goes on to say, "If the enemy's reflexive structure is unknown, the active side can attempt to form it or at least to limit the number of states in which the enemy can be."[44] This falls into the category of reflexive control directed at the decision making process mentioned earlier. Recalling that the adversary's reflexive structure is a hierarchy of models inserted one within another and that his decision making process is determined largely by this structure and the information that he provides to it, Lefebvre's assertion here that it may be possible to *form or determine* this structure

[43] Thomas, 5-6.
[44] Lefebvre, 46.

provides a key insight into implementing his concept. He amplifies his assertion with what amounts to prescriptive advice when he describes a specific method to accomplish this:

> …the question naturally arises: how can party B direct reflexive control over party A? In order to succeed B has to know A's rank of reflexion, but B does not know it. It turns out that A's rank of reflexion can be predetermined by B. In order to this B has to send A the following information: 'B believes that A has a rank of reflexion equal to k.' If this act of reflexive control is successful in a given interaction, A will have the rank of reflexion k + 1; then B can direct the reflexive control of the 'usual' type assuming that A's rank of reflexion is k + 1. Thus, reflexive control over an adversary has two phases. 1) Forming a certain rank of reflexion in the enemy, more precisely: a 'reflexive structure.' 2) Reflexive control in the framework of the structure which has been formed.[45]

Therefore, by conveying to an adversary our model of the environment, including how the friendly side believes his model works, he constructs a new model which is much more readily understood and hence more readily simulated. Once this rank of reflexion is established in the adversary, and the friendly side has created a reflexive structure with a greater rank of reflexion, reflexive control in the standard sense, by conveying specially prepared information on a regular basis to determine the adversary's decision over time, becomes possible. Of course, as alluded to earlier, if the adversary becomes aware of the reflexive control and has sufficient information to simulate it, his rank of reflexion becomes one higher than the friendly side (k +3 as opposed to the friendly side's k + 2, in the example above) and he becomes the one exerting reflexive control.

It should be noted, however, that merely conveying to the adversary a model of the friendly side is not sufficient enough to establish the reflexive control, since his model also includes (reference Y's situation in Figure 5) how he views himself and the world. The adversary's reflexive structure represents a detailed picture of his inner world; without an understanding of the entire structure, it is impossible to interpret his actions. For instance, the movement of a

[45] Ibid., 122.

particular unit "might be a solution of a purely utilitarian problem but might also be a maneuver aimed at compelling the opponent to react to it and to make a corresponding decision."[46]

Because of these difficulties, the construction of a simulation that can adequately model the complex structure of reflexive processes "necessitate[s] a special apparatus by means of which the processes can be submitted to analysis."[47] This apparatus will almost certainly include an automated component to process large amounts of data and a human component, since reflexive control is a "form of high art founded of necessity on an intimate knowledge of human thinking and psychology, military history, the roots of the particular conflict, and the capabilities of competing combat assets."[48,49] Furthermore, the simulation must generate a set of options for generating reflexive control over the adversary in a dynamic environment, because "any optimal but rigid programs of action offer fewer chances than programs based on methods that are not optimal but are characterized by flexibility."[50]

The requirement that the simulation and modeling of an adversary be able to deal with the dynamic nature of decision space does not, however, necessarily mean that the model must incorporate feedback. In certain circumstances, such as those where the adversary's actions can be predicted with a great deal of certainty especially over the short term, reflexive control may be conducted without feedback.[51] Although feedback can be useful, and may even be necessary, particularly if the adversary changes his decision making process mid-conflict, "in real conflict

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[46] Ibid., 34.
[47] Ibid., 35.
[48] Thomas, 5.
[49] See Edward C. Mann, Gary Endersby, and Thomas R. Searle, *Thinking Effects: Effects-Based Methodology for Joint Operations* (Maxwell AFB, AL: Air University Press, 2002), 86, for additional support: "For those systems where human decision-makers play key roles (e.g., national leadership, military command and control), however, a fundamental change in approach to M&S [Modeling and Simulation] is necessary. Some help appears to be on the way with new M&S concepts like 'agent-based modeling,' which incorporates 'synthetic human' intervention within the model. No matter how sophisticated M&S becomes, however, there is no time in the near future when it can be expected to accurately model complex strategic or psychological effects. Modeling such complex effects will require development of non-algorithmic models, incorporating human judgment for some applications. It will also require great reliance on operational art and the professional judgment of senior operational leaders."
[50] Lefebvre, 12.
[51] Ibid., 4.

the feedback channel is not only expensive but even dangerous since it allows the adversary to organize his own reflexive control."[52] Thus, reflexive control with feedback requires an even greater level of security to ensure the adversary remains unaware of the efforts to control him, lest he turn these efforts to his advantage; the primary danger results from the potential of the adversary conducting unnoticed reflexive control. Rather than "not allowing such control" by the enemy, Lefebvre points out that "…the phrase 'not to allow such control' should not be understood in the sense that the adversary's actions connected with his reflexive control must be thwarted. On the contrary, if the line of one's adversary's reflexive control is discovered, it can provide invaluable information for decision making."[53] Summing up, **if the simulation of the enemy requires a feedback process, special efforts must be made to detect the adversary's possible use of the feedback channels for his own reflexive control purposes and use the information thus gained to maintain reflexive control over him. Furthermore, feedback may not be necessary at all in order to gain and maintain reflexive control.**

Feedback may not be necessary if one is able to model the adversary's decision making process to the extent that his acceptance or rejection of a specially prepared piece of information is a known quantity. Thus, one of the most important components of such a model is the adversary's "filter."

> In fact, the enemy comes up with a decision based on the idea of the situation which he has formed, to include the disposition of our troops and installations and the command element's intentions known to him. Such an idea is shaped above all by intelligence and other factors, which rest on a stable set of concepts, knowledge, ideas, and, finally, experience. This set usually is called the "filter," which helps a commander separate necessary from useless information, true data from false, and so on.[54]

Thomas asserts that "**the chief *task of Reflexive Control* is to locate the weak link of the filter and exploit it."**[55] (italics in the original) Attempts to locate the weak link and prepare

[52] Ibid., 50.
[53] Ibid., 104.
[54] Thomas, 3-4.
[55] Ibid., 4.

information to exploit it must proceed from a study of the adversary's perceptive peculiarities; failure to address these peculiarities may result in futile efforts—information will either be rejected, or the filter will cause the decision maker to not pay enough attention to it.[56] The adversary's perception of reality determines what information will get past his filter.

To be effective, reflexive control "must have some grounding in reality so that it can enter and effect the target's cognitive arena without setting off his alarm systems…[it] is a two-way process in which the relationship and interaction between the purveyor and the recipient is of the essence…The greater the decision maker's understanding of his target's cognitive map, the greater the effectiveness of…reflexive control."[57] Hence, a clear understanding of decision space, the adversary's "cognitive map" within which he operates, is critical in preparing information that will make it past his filter. Ionov states, "The successful use of reflexive control becomes all the more likely if the enemy's original plan is known. This makes it easier for the 'controlling side' to force the enemy into making wrong decisions by employing reflexive control techniques such as intimidation, enticement, disinformation, deception, and concealment and other measures designed to shorten his decision-making time by surprising his decision-making algorithms."[58] However, too much emphasis should not be placed on the means Ionov suggests, especially disinformation.

While disinformation should definitely be used when appropriate, "correct information may serve the purpose of reflexive control. It is worth emphasizing that reflexive control does not mean disinformation, but the actions and information which predetermine an adversary's decision making process or destroy it."[59] The probability that the adversary's filter will accept

[56] Lefebvre, 105.
[57] Chotikul, 58.
[58] Thomas, 5. The last sentence of this quote strongly echoes Boyd's idea of creating a mismatch in the times required to cycle through the OODA Loop between the adversary and the friendly side.
[59] Lefebvre, 108. The possibility of destroying an adversary's decision making process also relates back to Boyd's concept of eventual paralysis of an enemy's decision making process due to cycle time mismatch.

disinformation proportional to how far it differs from his perception of reality, or how much dissonance it causes:

> The relationship between any two cognitive elements must be one of the following: consonant—in agreement with expectations; dissonant—opposed to expectations; or irrelevant—having no bearing on expectations. The magnitude of the dissonance experienced is seen to be directly dependent on the number and/or importance of dissonant cognitions relative to the number and/or importance of consonant cognitions. The greater the number and/or importance of positive attributes (consonant cognitions) associated with a chosen alternative, the less the magnitude of dissonance resulting from a choice.[60]

Further discussion on determining which information an adversary is likely to accept will be presented in the next section. In the context of the current discussion, it is important to emphasize that sometimes it will be necessary to avoid dissonance by sending an adversary true information, albeit slanted in a particular way, in order to predetermine his decision. [61]

Reflexive control, especially through the sending of true information, may be used not only against an adversary but against an ally as well. [62] Although the ramifications of such control being discovered are potentially quite serious, the benefits to be gained may well outweigh the risks, especially if the only evidence to show that reflexive control has been used is that true information has been sent. The Soviet view that a "purposeful manipulation and management of perceptions" to influence the inputs a person receives from his environment is the best means of long-term reflexive control; this leads to the essence of the control when directed at an ally: "The more firmly [beliefs] can be embedded in the cultural context within which decision making occurs, the greater societal control becomes."[63]

Reflexive control, whether over an adversary or an ally, can take one of two operational forms; these forms, which have been implicitly described in this section and suggested in the previous section, need explicit articulation:

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[60] Chotikul, 54.
[61] Lefebvre, 4.
[62] Ibid., 4.
[63] Chotikul, 45. This particularly Orwellian concept of targeting the cultural complex, as described earlier, speaks directly to the ability of the Communist regime to exert control over Soviet society for so long.

> In relation to the decision making process reflexive control can be constructive or destructive. In constructive reflexive control the active side influences the adversary's decision making process in order to sway him to make a determined decision. Destructive control is the influence which disturbs the process of decision making and makes it difficult or impossible. Destructive influence can paralyze or cause spontaneous behavior. The first one leads to not making a decision at all; the second forces the enemy to make random unfounded decisions.[64] (underlining in the original)

The form the reflexive control should take, constructive or destructive, will depend on what the friendly side wishes to accomplish. Further discussion on this point will be provided in the next chapter. The differentiation within the form of destructive reflexive control, between paralyzing and causing spontaneous behavior, appears to be driven primarily by how the adversary reacts to the given situation. Once again, a robust model of the adversary's thought process will shed light on his possible future reactions and more fully illuminate his decision space. A starting point for developing such a model is presented in the next section.

## Recognition-Primed Decision Making (RPD) Model

In the introduction to this chapter, mention was made of Van Creveld's idea of a matrix of organized concepts and the relationships between them; he has more to say on the matter: "The matrix in each person's mind is partly his alone, partly shared with other people. Its origins are partly biological, partly psychological, partly the outcome of training and education, and partly the result of practical experience. The connection between the matrix and the actual world is always problematic. Some of its parts are likely to be true, others false."[65] Gary Klein has developed an explanation of how the origins and connections of this matrix are synthesized in a process to produce decisions; he calls it the Recognition-Primed Decision Making (RPD) Model.

Klein found the development of this model to be necessary because the theories of decision making in existence not only provided prescriptive advice that gave disappointing results in time constrained environments (like combat), and also did not accurately depict how commanders and

[64] Lefebvre, 33.
[65] Van Creveld, 278.

their staffs were actually making decisions in these environments.[66] In contrast, he found his RPD model to be not only more useful, but also much more able to predict how decisions are made: "skilled decision makers generate feasible options as the first ones they think of. Therefore, there is little to be gained by generating and then evaluating lots of options."[67]

In describing a case study using the Recognition-Primed Decision Making model, Klein says the decision maker:

> …used experience to recognize the key aspects of the situation, enabling a quick reaction. Once a decision maker identifies the typical action, there is usually a step of imagining what will happen if the action is carried out in this situation. If any pitfalls are imagined, then the [decision maker] jettisons it and thinks about the next most typical action…the experienced decision makers are not searching for the best option. They only want to find one that works, a strategy called 'satisficing'…The basic thrust of the model is that decision makers handle decision points, where there are several options, by recognizing what the situation calls for rather than by calculating the strengths and weaknesses of the different options.[68]

This description gives a good overview of what the model is all about and provides a conceptual basis from which it can be discussed. Lest the objection be raised that this case study only speaks to individual decision making, whereas most situations in combat involve at least a minimal amount of staff participation, Klein notes that in additional studies of decision making, teams exhibited the same characteristics.[69] Since the model really represents a process describing how decisions are made, it is easiest to understand in graphical format; Figure 7 shows the model in its

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[66] Gary Klein, "Strategies of Decision Making," *Military Review* (May 1989): 56. The full text of Klein's comments is instructive: "It is time to admit that the theories and ideals of decision making we have held over the past 25 years are inadequate and misleading…The culprit is an ideal of analytical decision making which asserts that we must always generate options systematically, identify criteria for evaluating these options, assign weights to the evaluation criteria, rate each option on each criterion and tabulate the scores to find the best option. We call this a model of concurrent option comparison, the idea being that the decision maker deliberates about several options concurrently. The technical term is multiattribute utility analysis. Another analytical ideal is decision analysis, a technique for evaluating an option as in a chess game. The decision maker looks at a branching tree of responses, and counter-responses and estimates the probability and utility of each possible future state in order to calculate maximum and minimum outcomes. Both of these methods, multiattribute analysis and decision analysis, have been used to build decision training programs and automated decision aids…The point for this article is that there are different ways to make decisions, analytical ways and recognitional ways, and that we must understand the strengths and limits of both in order to improve military decision making."

[67] Klein, *Sources of Power*, 167.

[68] Klein, "Strategies," 58-59.

[69] Ibid., 60.

entirety. Klein uses the term "integrated" to indicate that not only does the model provide an explanation of simple matching of appropriate courses of action to given situations, it also accounts for situation diagnosis (indicated by the feedback loop on the left of the diagram) and course of action evaluation (indicated by the feedback loops on the right and bottom).[70]

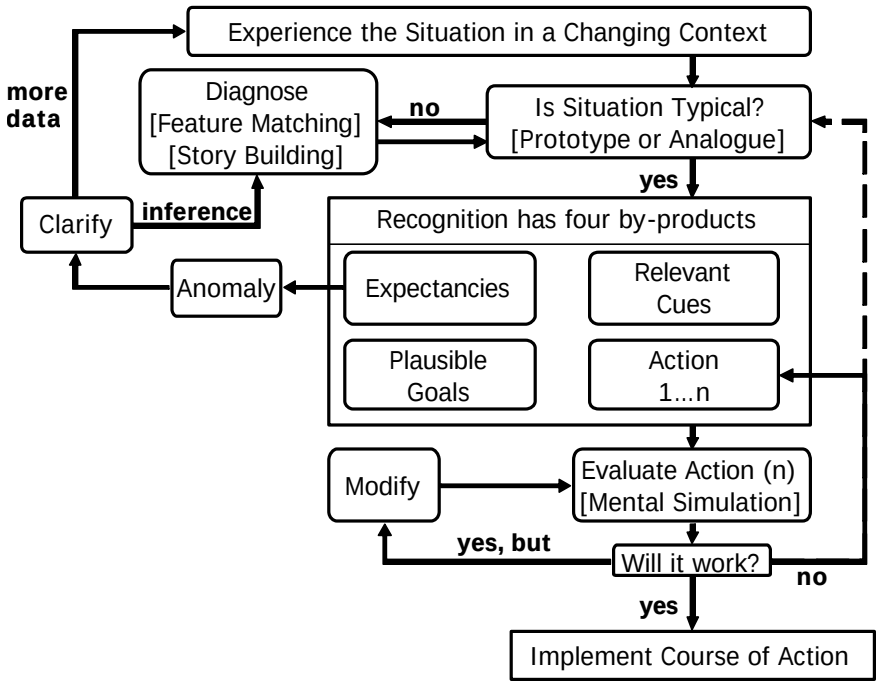


**Figure 7: Integrated Recognition Primed Decision Making (RPD) Model[71]**

Before proceeding to a more in-depth exploration of the model, it is necessary to specify the conditions under which it represents an accurate description of the decision making process. Table 1 succinctly delineates when the Recognition-Primed Decision Making process predominates.

[70] Klein, *Sources*, 25.
[71] Ibid., 27.

**Table 1: Boundary Conditions for Different Decision Strategies**[72]

| Task Conditions | Recognition-Primed Decisions | Rational Choice Strategy |
|---|---|---|
| Greater time pressure | More likely | |
| Higher experience level | More likely | |
| Dynamic conditions | More likely | |
| Ill-defined goals | More likely | |
| Need for justification | | More likely |
| Conflict resolution | | More likely |
| Optimization | | More likely |
| Greater computational complexity | | More likely |

Not surprisingly, Klein found that among the experienced decision makers he studied (many of whom were faced with real life-or-death tasks made under extreme time pressure), the rational choice decision making strategy rarely occurred.[73] Similarly, **an operational-level commander will most likely face an adversary whose decision making process can be described primarily by the RPD model.** Klein elaborates on the conditions listed in Table 1, saying that RPD is most important when an experienced (cohesive) staff or individual is working under time pressure on concrete, contextually dependent tasks in changing environments in an attempt to find a satisfactory rather than optimal solution.[74] This certainly describes the situation in which a friendly commander may attempt to establish reflexive control or attack his adversary's Orientation phase of the OODA Loop; therefore, understanding the characteristics of the RPD model should aid a commander in conducting his operations.

From his research, Klein concludes that two "sources of power," or extremely effective techniques of problem solving and decision making, are at work during RPD: pattern matching (the power of intuition) and mental simulation."[75] Roughly speaking, in Figure 7, mental simulation is partially involved in creating courses of action and is the basis for evaluating them.

[72] Ibid., 95. The term Rational Choice Strategy is equivalent to the concurrent option comparison model described in footnote sixty-two. Klein implies on page 261 that the other analytical ideal described, decision analysis (and the use of decision trees that come from it), is also a rational choice strategy.
[73] Klein, "Strategies," 57-58.
[74] Ibid., 61.
[75] Klein, *Sources*, 141-142. See page 294, note 2 for a fuller description of the term "sources of power."

The rest of the diagram (excluding the top block) is dependent on pattern matching, which "provides us with a sense of reasonable goals and their attributes…gives a basis for detecting anomalies and treating them with appropriate seriousness…[helps us] discover relevant analogues, and get a sense of how solvable a problem is [which] is responsible for letting us recognize when we are unlikely to make more progress and that it is time to stop."[76] The central block, labeled "Recognition has four by-products," is the arena where the two "sources" interface and will be discussed later in this section when the filtering concept is addressed. Before discussing linkages to reflexive control concepts, however, it is instructive to observe that the model's sub-processes and the two sources of power that encompass them are directly related to the OODA Loop concept.

In terms of OODA Loop phases, the top block of the diagram, Experiencing the Situation, corresponds with Observation. Orientation is nearly identical to the pattern matching described in the previous paragraph, although it does overlap the top block somewhat (since experiencing implies not merely observing but also forming an intellectual and emotion response) and the Action block somewhat also (because the conceptualization of each course of action, prior to decision, is rooted in the orientation to the conditions). The Decision phase begins in the Action block, but resides primarily in the Evaluation block and the feedback loops originating from it. The Act phase, of course, is synonymous with the last block, Implementation. Having stated these connections, it is appropriate to discuss the linkages between RPD and reflexive control.

The three target sets of reflexive control, as stated previously, are the individual decision maker, the decision making process, and the cultural context within which the decision is embedded. Although the discussion on specific vulnerabilities will be deferred until the next section, some general conclusions can be made here with regards to the differences between these three targeting strategies in light of the RPD model. Targeting of the individual decision maker

[76] Ibid., 142.

would seem to have the greatest impact in the Orientation phase or pattern matching processes. The only way control can be exerted using this strategy is by introduction of information into the process through the top block, Experiencing the Situation. This information must be prepared with thought given as to how it will propagate through the process and what impact it will have. Since the RPD model is experience- and expertise-based, a thorough knowledge of the decision maker's background is required to properly prepare the information. On the other hand, less background knowledge may be required if the decision making process itself is targeted.

Targeting of the decision making process does not imply a change to the structure or processes of the RPD model. What it does imply is a change in how much time and effort is spent on each sub-process or recognition by-product, in who performs which sub-process (when a staff is involved), in the speed and ease with which information travels between sub-processes and in the feedback loops, and perhaps most importantly, in the baseline values used in each sub-process. Once again, the information causing the reflexive control must be introduced into the process from the top block during the Orientation phase. However, in this case the information is not expected to propagate through the system to affect a specific outcome; rather, it is designed to actually change the system as it propagates, shaping the decision making process to handle subsequent information in such a way that reflexive control is established and maintained. For instance, the prescriptive advice of sending a model to an adversary could cause him to see subsequent actions as "typical" (because he believes he knows what the friendly side is thinking, and hence can predict its actions), partially determine which cues he views as relevant, and shape his expectancies; all of these would potentially increase the ability of later information to propagate through to a desired, predetermined outcome. As powerful as this strategy seems, it is dwarfed by the potential resident in the last strategy of targeting the cultural context.

Every sub-process, and therefore the entire decision making process itself, to include the mental model portion, can be influenced by reflexive control directed at the cultural context target. Since the decision maker's experience, expertise, and background knowledge will all have

been gained within his own cultural context, influencing this context can have a dramatic impact on all of the sub-processes within the model. Even if the impact on each individual sub-process may be small (which is by no means required—the impact could actually be very sizeable), the cumulative effect of the reflexive control will most certainly be substantial. As an example, consider an individual born and raised in a Communist nation who uses dialectical reasoning as a baseline, as opposed to a more Western mode of deductive/inductive reasoning: every sub-process will account for the fact that two ideas in tension (thesis and antithesis) will eventually resolve into a new concept (synthesis) that merges factors of both. If for some reason, dialectical reasoning should lose some of the foundation upon which it is factually based (say, a stagnant economy in his nation, compared to a robust and growing economy in the West, in direct contradiction to Marxian predictions), his entire decision making process could transform to the point where he considers actions that we inconceivable previously (such as the overthrow of the Communist regime and the establishment of democracy)[77]. In fact, this example suggests that a culture (in this example, the West) may unconsciously and inadvertently conduct a kind of reflexive control against another, simply by projecting its superiorities and inculcating a feeling of dissatisfaction in the target country; in this way, the target population may modify its belief system, making it more likely to accept information from its "opponent" than it was likely to previously. This predisposition to accept information is directly related to the idea of a filter as a barrier to reflexive control.

Overcoming a filter, or finding its weak link, was previously identified as the main task when attempting to conduct reflexive control. Within the RPD model, diagnosing and typicality categorization (the two blocks directly below the top one) serve not as a filter, but as a framework within which information can be considered for filtering. The actual filtering takes place in three

[77] Chotikul presents a fascinating view of the Soviet cultural context. In addition to dialectical thinking, she discusses reflexive control by the regime against its own population and various theories of psychology as they apply to the Soviet cultural mindset.

other blocks (sub-processes): Relevant Cues (which prevents an overload of information), Plausible Goals (which sets priorities on which information is viewed), and Expectancies (which identifies that a situation has been misinterpreted through expectancy violation and seeks clarification through feedback).[78] In order for reflexive control to overcome an adversary's filter, all of these factors must be addressed to find his vulnerabilities; as noted above in the discussion of targets, the Orientation phase of the OODA Loop, and hence by extension the pattern matching portion of the RPD model, promises to provide the most useful ways of influencing an adversary's decision making. The next section will address this topic in more detail. The concept of mental simulation, however, needs additional treatment here, since it is the link between RPD and the concept of decision space discussed in Chapter Two.

Klein explicitly defines mental simulation as "the ability to imagine people and objects consciously and to transform those people and objects through several transitions, finally picturing them in a different way than at the start. This process is not just building a static snapshot. Rather, it is building a sequence of snapshots to play out and to observe what occurs."[79] The combination of all possible "sequences of snapshots" that the decision maker could conceive of, given his limited understanding of the situation, is what was defined as real decision space (as opposed to the ideal decision space, which contains *all* such possible sequences, conceivable or not); since the decision space is the environment within which the decision maker operates, the importance of this connection to RPD cannot be overemphasized. Klein discovered that these mental simulations seemed to be fairly simple. Specifically, they seemed to rarely involve more than three "moving parts" or independent variables, and they seemed to use a maximum of about six transition states to move from the initial state to the desired final state.[80]

[78] Klein, *Sources*, 24-26.
[79] Ibid., 45.
[80] Ibid., 52.

Additionally, the research found two potential weaknesses in the use of mental simulation. First, mental simulations are difficult or impossible to build without sufficient background knowledge and expertise.[81] Second, the danger of imagining away contradictory evidence exists; in this sense, mental simulation can inadvertently be used against itself.[82] These weaknesses, as well as several of the other key points concerning mental simulation, are summarized in Appendix E.

Even discounting these two weaknesses, decision making that is described by the RPD model may result in poor decisions, as may decision making made by any other process. Within the RPD model, Klein has made several observations relating to poor decisions:[83]

- Decision biases do not seem to explain poor decisions.
- Stress does not result in faulty decision-making strategies but may limit the information we can consider in making the decisions.
- Most poor decisions may result from having inadequate knowledge and expertise.
- Experience does not translate directly into expertise if the domain is dynamic, feedback is inadequate, and the number and variety of experiences is too small."

Given the structure of the Recognition-Primed Decision Making model, its weaknesses, and the observations about poor decisions made within it, it is now possible to integrate the OODA Loop concept and Reflexive Control Theory into an analysis of an adversary's potential vulnerabilities.

## Exploitation of the Adversary's Vulnerabilities

The previous three sections all support the conclusion that an adversary's vulnerabilities to actions against his decision making lie primarily in the Orientation phase, which encompasses the pattern matching activities of the RPD model and offers the most inroads for reflexive control. The end result of such control is, of course, defined by the final state the friendly side wishes the adversary to assume; this outcome-oriented focus is based on the decision space concept

[81] Ibid., 57.
[82] Ibid., 65.
[83] Ibid., 284.

presented in Chapter Two and the mental model activities of the RPD model and will be explored further in the next chapter. This section will concentrate on discovering the vulnerabilities that can be exploited to achieve the ultimate outcome of a reflexive control campaign.

Perhaps the best way to approach the discussion of vulnerabilities is to analyze the adversary in the context of the form of reflexive control being conducted: destructive or constructive. Although the weak links in an adversary's filter may be the same for both forms of control, the way they are exploited will differ. The destructive form is the most familiar to the Western mindset, and so provides a good place to start the discussion.

## Destructive Reflexive Control Operations

Recalling that the purpose of destructive reflexive control is to destroy the adversary's ability to make a coherent decision, an examination of how his vulnerabilities can be attacked to achieve this end should provide insight into the fundamental nature of this form.

An adversary will be unable to make a coherent decision within the RPD model if he is unable to first frame the decision in terms of something he has experienced before. This corresponds to an inability to move past typicality analysis (the second block titled *Is Situation Typical?* in Figure 7). In a time-constrained and complex environment where there is limited or no opportunity to use a rational choice strategy, the decision making process will cycle continuously between typicality analysis and diagnoses, searching for some sort of feature similarities or some "story" that can be constructed to explain away enough of the dissimilarities in the situation. This vulnerability suggests several means of exploitation. First, constantly presenting the adversary with a sufficiently unfamiliar situation will prevent him from making any type of coherent decision. Second, changing the situation so rapidly that the adversary is unable to assess its typicality and/or diagnose it properly will have the same effect: "…as the number of events we must consider increase[s], the longer it takes to observe-orient-decide-act."[84]

[84] Boyd, "Patterns," 72.

Assuming, however, that the adversary is able to recognize the situation as an analogue he is familiar with, he is then subject to actions against additional vulnerabilities.

Within the recognition by-products arena, the first vulnerability a decision maker faces is deciding what information is relevant. This part of the adversary's filter may be overwhelmed with sheer volume of information, especially if the friendly side is able to control some of the information channels the adversary is using. His problem may be exacerbated if his organization exhibits what Van Creveld calls a "high decision threshold." In such an organization, important decisions are only made by senior officials who require "a larger and more continuous information flow than one in which that threshold is low."[85] Furthermore, complexity, specialization, organizational instability, and centralization, attributes that are all likely to be found in a modern military organization, cause an "inordinate increase in the amount of information needed to make any given kind of decision at any given level."[86] The friendly side can increase the adversary's difficulty, not only be attempting to increase the flow of information, which must include true as well as spurious data, but also by finding ways of obscuring the nature of the data so that the adversary must spend more time processing it.

Intentional obfuscation of data, therefore, capitalizes on another weak point, making it harder for the adversary to compare information to his expectancies, thereby causing him to seek additional clarification through diagnosing or obtaining more data. Especially when used in conjunction with an information overload strategy, this will result in an increasing amount of data that the adversary will be unable to process; though he may recognize the situation as typical, he will be unable to sort through the details fast enough to select an appropriate action. Even if the adversary is able to process enough data to decide on a course of action, the intentionally confusing nature of that data (whether in form or content) may prevent him from making a

[85] Van Creveld, 236.
[86] Ibid., 237.

judgment as to the plausibility of his goals, consequently inhibiting his ability to develop a course of action.

An adversary may be unable to choose a relevant course of action because he is unable to determine what types of goals make sense. This vulnerability, the inability to effectively set plausible goals, can arise either from a failure to process enough meaningful information from the environment (so that a plausibility assessment is impossible) or from a failure to select from among competing goals. The second failure option does not imply presenting the adversary with an overwhelming number of courses of action; rather, it suggests that controlling his perceptions of the situation can hinder his ability to decide what his endstate criteria should be. The discussion on decision space in Chapter Two revealed that there is a multiplicity of possible endstates for the adversary; however, all of them must satisfy some basic endstate criteria in order to be acceptable to him. "Without a variety of possibilities [the] adversary is given the opportunity to read as well as adapt to events and efforts as they unfold."[87] (underlining in the original) Confronting the adversary with a variety of potentially acceptable, frequently changing endstate criteria sets can prevent him from assessing the plausibility of any one set, thereby inhibiting his course of action development.

The adversary will be able to develop relevant courses of action if the preceding vulnerabilities are not attacked effectively; that is, if the adversary can view the situation as an analogue to one he has experience with, if he can effectively determine the relevancy of observed cues, if he can compare these cues with his expectancies and clarify any anomalies, and if he can set plausible goals, he will be able to use mental simulation to generate a conceptual way of reaching his endstate. However, since the framework within which the courses of action are evaluated is subject to reflexive control measures, it is possible to exploit this vulnerability to prevent any course of action from being accepted. This results in an endless feedback of course

[87] Boyd, "Patterns," 176.

of action generation without any decision and implementation. Although success against this vulnerability is most likely if the friendly side has overwhelming advantages on the battlefield, destruction of key adversary components upon which many of his potential courses of action depend is a promising avenue of attack for a quantitatively inferior force with greater freedom of action and precision fires. For example, neutralizing the operational mobility of an adversary's lead echelon forces by destroying selected fuel transport capabilities with precision fires may have the same or greater impact as using a large conventional force to fix that echelon; the adversary would subsequently be forced to evaluate all courses of action that required the lead echelon to conduct extensive movement as untenable, regardless of how easily those courses of action were developed.

Action against all of these vulnerabilities is directly dependent on the classically understood OODA Loop mode: operating at a quicker tempo than the adversary to keep him off balance, getting inside *his* loop, and generating confusion and disorder. It appears, then, that Destructive Reflexive Control is closely related to the modern (or at least, post-Desert Storm) Western conception of defeating the enemy by overwhelming him with unexpected actions he can't effectively respond to:

> Nothing so much suggests the imminence of defeat than confused and disoriented commanders…Confusion and disorientation are cognitive as well as emotional states. Commanders make decisions on the basis of unexpected events. If reality is different from the basis used for decisions, it is difficult and time-consuming to reconstruct a cognitive structure (e.g., facts that lead to implications, actions based on conclusions) based on the new reality.[88]

The astute reader may recall at this point that Destructive Reflexive Control can be achieved either by causing paralysis (inability to make a decision at all) or by causing spontaneous behavior (leading to making a decision irrespective of its quality), both of which deny an adversary the ability to make a *coherent* decision. Although an adversary may be effectively paralyzed by friendly actions for a given period of time, he will eventually conclude that, "a

[88] Libicki, 41-42.

decision must be reached, even if it is fully realized that it will be but a shot in the dark."[89] This implies that at some point the adversary will assess the risk of inaction to be greater than the risk taking a random action. Although this random action is very unlikely to be effective or appropriate, just by virtue of its sheer unpredictability it could be quite dangerous to the friendly side. In order to mitigate this danger, the friendly side must understand when the adversary is approaching this point and predetermine his decision. This predetermination, of course, is the essence of Constructive Reflexive Control, which is discussed next.

## Constructive Reflexive Control Operations

The aim of Constructive Reflexive Control, causing an adversary to make a predetermined decision, is more difficult to accomplish than the simple paralysis inflicted under the destructive form. This is, in part, a matter of perspective, since the constructive form of control relies more heavily on elements commonly associated with deception and the concomitant way of thinking it requires which is much more prevalent in the Russian/Soviet and Eastern mindsets. Additionally, the requirement to specially prepare and convey information in such a way that it penetrates the adversary's filter and has the desired effect on his decision process, rather than having the more indiscriminate effect of simply causing disruption in that process, entails a more robust reflexive control campaign designed to exploit vulnerabilities in particular, specific ways.

The first vulnerability that may be exploited is the propensity within the RPD model to attempt to find, drawing on knowledge and experience, an analogue to the current situation. Although Klein views this as part of the pattern matching source of power, it can be a liability to an adversary if the friendly side understands the likely ways he will attempt to match features and build stories. Purposefully inserting matching features into an otherwise non-analogous situation can cause the adversary to react to it as if it were a familiar situation, even if this reaction is inappropriate. Likewise, providing spurious elements that evoke a "story," a linking of ideas,

[89] Rendulic, 17.

concepts, objects, and relationships[90] from an adversary's previous experience, can cause him to experience the current situation is an analogous context and hence react to it in the same way that the story prescribes. The key point is that the information must be conveyed in such as way that it is perceived to be "typical;" nothing must hint at its subversive nature: "We need to deny adversary [sic] the possibility of uncovering or discerning patterns that match our activity, or other aspects of reality in the world."[91] Thus, the ability to pass information through the filter may be enhanced if it is seen in the context of a typical situation; careful insinuation of the information into a typical environment, crafting sets of mutual-supporting information, and selective use of true information are possible ways to frame the specially prepared "message" within typicality analysis and diagnosing so that it is accepted by subsequent filtering actions.

The first filtering action the information must pass is the test of relevancy. An exploitable vulnerability in this step is that information that is only peripherally relevant to the situation is still likely to be considered to some extent in making a decision but is *not* as likely be subjected to the same level of scrutiny. This filtering action must have a time dependency though: in situations where time is critical, peripherally relevant information is more likely to be discarded and centrally relevant information is likely to come under less scrutiny. Another vulnerability is that relevancy of information is often assessed based on its source rather than its inherent value. Taken together, these vulnerabilities suggest that "conveying specially prepared information" will be most effective when the information is presented through channels the adversary prizes as reliable and when it is of an intermediate level of importance (too relevant to discard, not relevant enough to scrutinize thoroughly); time-critical situations require the relevancy of the information to be increased, though this increase will most likely not increase the risk it will be rejected. Assuming the information is judged to be relevant, that is, having bearing on expectations, it must still pass the consonance/dissonance test of expectancies.

[90] Klein, *Sources*, 177.
[91] Boyd, "Organic Design," 16.

Information conveyed by reflexive control means must be assessed as consonant—in agreement with expectations—in the context of the analogue that the adversary is using to understand his current situation. As stated previously, information, or more accurately a set of information, that has a greater number and/or importance of consonant (positive) cognitions than it does dissonant (negative) ones will be accepted. Otherwise, the adversary's expectancies will be violated and he will perceive the information as an anomaly and seek to clarify it, potentially resulting in its rejection and hence the failure of the reflexive control effort. The adversary is vulnerable, however, to a dissonant piece of information embedded within a larger set that is predominantly consonant; if this embedding is done properly, he will be unable to distinguish the nature of the dissonant information effectively and will therefore accept it as part of the whole. Additionally, as the situation changes its configuration over time, the adversary must update his expectancies to match it. If information can be conveyed during this transition period, it may pass the expectancy test for the previous configuration and be accepted for use in the current configuration without violating expectancies that it otherwise might have. Finally, if an adversary has created an analogue of the current situation that enables him to make decisions coherently, he may be vulnerable to information designed to portray anomalies that don't exist, forcing him to clarify and diagnose his recognition of the situation and possibly adopt another analogue that is not as useful.

While reflexive control strategies designed to attack the adversary's recognition of the situation through relevancy and expectancy may be extremely useful, the ability to determine what goals he considers plausible is even more powerful. In fact, since the goals that are set are used as the standard by which the courses of action developed by mental simulation are evaluated, the adversary's plausibility analysis can be the most lucrative target of reflexive control efforts. Unfortunately, the adversary's goals, and hence his endstate criteria, are predetermined prior to conflict: they must obviously differ in some material degree from the friendly side's goals, otherwise the conflict would not exist in the first place. Since the adversary

obviously must consider his initial goals plausible (else he would have refined them or given way in the conflict), the only way to affect his goals, without resorting to actions in a strategic context, is to convince him that, over the course of the conflict, that the situation has changed. This implies that the adversary must come to realize either that he can't accomplish his goals through any course of action he can conceptualize or that he can potentially accomplish more than he originally thought. Both possibilities, however, are rooted firmly in the concepts of mental simulation and decision space, and will be addressed in the next chapter.

Exploitation of these vulnerabilities is predicated on being able to simulate the adversary's decision making process so that the necessary messages used to exert reflexive control can be prepared and conveyed in the proper way. Additionally, there appears to be utility in creating transient OODA Loop mismatches, in which the adversary's conceptualization of the situation is temporarily out of synch with reality, to enhance the probability of the messages being accepted and having the desired effect.

This chapter has explored three theories that illuminate how an adversary makes decisions within his decision space and has identified vulnerabilities in this process. The next chapter synthesizes the material presented thus far into useable principles for decision space operations.

CHAPTER FOUR

# ELEMENTS OF COGNITIVE CAMPAIGN DESIGN

> When the objective is to change the decisions matrix or behavior of other actors through coercion, however, the measures may be principally system and psychological, rather than physical…These effects are harder to measure than physical effects and measurement may never be done perfectly, but the payoff for even moderate success is very high.
>
> ACC/XP, *Effects-Based Operations*[92]

> [Knowledge] is nonlinear. A small bit of the right information can provide an immense strategic or tactical advantage. The denial of a small bit of information can have catastrophic effects."
>
> Toffler and Toffler, *War and Anti-War*[93]

The traditional elements of operational design "are tools to aid designing major operations. They help commanders visualize the operation and shape their intent…by providing a framework to describe operations in terms of task and purpose."[94] With the advent of effects-based operations thinking currently in vogue, there is a shift in emphasis for which these traditional elements provide little aid in campaign design: "the principal focus is on behavior—human intention and capability. The primary goal is to discover how best to influence or affect potential adversaries and friends, as well as unaligned governments and non-government organizations in order to achieve national policy aims."[95] Building on the previous two chapters, this chapter provides four elements of cognitive campaign design and the attributes that describe them, not to replace the traditional elements which are still eminently useful, but to augment them and inform the design of a campaign against an adversary's decision making process.

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[92]U.S. Air Force, ACC/XP, "ACC White Paper: Effects-Based Operations," 2002, TD (photocopy), p. 15. (hereafter referred to as ACC White Paper)
[93]Alvin Toffler and Heidi Toffler, *War and Anti-War: Survival at the Dawn of the 21st Century (*Boston: Little, Brown and Company, 1993), 148.
[94] *FM 3-0*, 5-6.
[95]U.S. Joint Forces Command, J9, "Effects-based Operations (EBO)," 2003, TD (photocopy) p. 3. (hereafter referred to as JFC EBO)

## Robust Simulation

### Justification

As has been amply demonstrated in the preceding chapter, the ability to develop and use an accurate simulation of the adversary's decision making process is absolutely critical to designing and conducting a reflexive control campaign against him, whether destructive or constructive in nature.

> How likely is the commander's disorientation, and what is it worth in outcomes? The decision to adopt a strategy that trades immediate outcomes for increased confusion depends on how data affects the other side. The attempt to mislead the other side's commander at the operational level is an important part of information warfare. Historically, such deception has worked best when one side has a good idea of what the other side will and will not do.[96]

An accurate simulation specifies: the adversary's mental modeling process, hence determining his decision space; the way he conducts pattern matching, hence determining his vulnerabilities to reflexive control actions; and the synergistic effect of both, hence determining which path he will take at a given decision point. The simulation must have several attributes in order to be useful.

### Attributes

1. **Comprehensive**—The simulation must model the adversary's entire decision making structure and all the actors in it, to include the staff and any coalition decision makers and their staffs. Although the resolution required may differ significantly depending upon how much input a particular actor has into the decision making process, failure to model all actors may result in catastrophic errors in the simulation.

2. **Indiscernible**—As noted previously, an adversary's awareness of the simulation will diminish and possibly eliminate its usefulness.

3. **Dynamic and Adaptive**—Not only must the simulation operate effectively in a rapidly changing environment, it should be able to capitalize on friendly information superiority to make

[96] Libicki, 43.

this the preferred situation. Even though feedback may not be necessary or desirable in some circumstances, in general, "…the ability to anticipate the effect(s) an action will bring about and then measure to see if the anticipation was correct is critical to adaptation, and adaptation is critical to success… Paradoxically, a search for evidence that the plan is failing may be more productive than a search for positively reinforcing evidence."[97]

4. **Distributed**—The simulation, or applicable portions of it, must be available to subordinate units so that they can predict how the adversary will perceive effects that may be created, and hence how the overall friendly effort may be affected.[98]

5. **Secure**—The simulation and the portions of it resident at subordinate levels (as well as other friendly decision making aids[99]) must not become available to the adversary, lest he gain the ability to conduct reflexive control operations in return. Security efforts must therefore include, in addition to standard operations security measures, the means[100] and doctrine[101] necessary to discover such retaliatory efforts while taking particular care of the vulnerabilities friendly information processing systems may present to the adversary.[102]

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[97] *Thinking Effects*, 53-54.

[98] This view of subordinate units as complex adaptive systems, per Czerwinski, (*Coping With the Bounds*, Ch. 1, p. 6), requires that they have "internal models that give them the power to anticipate…An overt internal model is used as a basis for explicit, but internal, explorations of alternatives, a process often called lookahead. The quintessential example of lookahead is the mental exploration of possible move sequences in chess prior to moving a piece."

[99] The implications with regards to the U.S. Army's current analysis of CAPES as a campaign design tool are obvious.

[100] Lefebvre, 116-117: "The primary condition for counteraction is the analysis of each 'piece' of information in order to ascertain whether it is 'natural' or 'artificial,' i.e., prepared by one's adversary and deliberately inserted into one's information system."

[101] Thomas, 12: "A detailed information security doctrine is one of the most important deterrents or defenses against an enemy's use of Reflexive Control or similar processes against Russia, according to many Russian scientists."

[102] Thomas, 7: "…computers could hinder the use of reflexive control by making it easier to process data and calculate options. This is so since an opponent can more easily 'see through' a reflexive control measure by an opposing force simply by using a computer…On the other hand, in some cases this may actually improve the chances for successful Reflexive Control, since a computer lacks the intuitive reasoning of a human being."

6. **Contextual**—In addition to modeling the adversary's reflexive structure, the simulation must embrace the adversary's cultural, doctrinal, personal, and situational elements,[103,104] to include his risk propensity.[105]

## Cognitive Lines of Operation

### Justification

The proper orientation of friendly operations relative to the adversary's decision space and his decision making process is absolutely vital to effective direction of effort and effects in the physical domain in order to achieve the desired friendly endstate.[106]

> While the direct, immediate physical effects are the most observable in the battlespace, they are rarely the most relevant effects to a military campaign. Instead, the attainment of operational behavioral effects is far more likely to lead to campaign success. In short, the combatant commander cannot let the targeting process be driven by physical effects on targets. Instead, the commander should focus on the operational behavioral effects within the battlespace and tailor the military campaign to achieve those effects.[107]

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[103] Chotikul, 9-10: "Westerners persist in seeing the Soviets through a Western cultural prism…[arising from] basic Western ignorance of Soviet history, doctrine, values, and goals, as well as a pervasive tendency to attribute to the Soviet Union the same 'terms of reference' as as [sic] those used by the Western world…assuming external symmetry [when all nonformulated aspects of the opponent are assumed to be equal or symmetric], as Americans tend to do in their dealings with the Soviets, can result in a state of vulnerability. Important factors such as culture, national character, personality traits, and skill level are omitted from consideration, which ultimately leaves the 'player' ill-prepared for unexpected eventualities which may arise in the 'game.'"

[104] Libicki, 98: "Understanding the enemy's culture and the ways in which its society uses information remain important. These days, grasping the way the enemy uses information systems—notably, communications networks, databases, and someday, systematic knowledge algorithms (e.g., neural nets)—is equally important."

[105] James V. Schultz, "A Framework for Military Decision Making Under Risks" " (thesis, School of Advanced Airpower Studies, Maxwell AFB, AL, 1997) 5-6. "Outcomes are not thought of as absolute states but as changes from a reference point. The reference point is determined by the way the decision maker edits and evaluates the decision problem. Editing and framing are dynamic processes, thus reference points can change. The changes in reference point can lead to changes in the decision maker's perception of a given outcome as a gain or a loss. It is domain, gains or losses, that determines the decision maker's risk propensity which in turn influences his decision… A risk averse decision maker will tend to select a sure gain over a smaller chance to gain an equal or larger amount. A risk-seeking decision maker will tend to select a choice that provides a chance to gain a larger amount over a smaller, more certain gain."

[106] Gordon R. Sullivan and James M. Dubik, *Envisioning Future Warfare* (Ft. Leavenworth: U.S. Army Command and General Staff College Press, 1995), 8: "…[a necessary] conceptual shift involves refining the understanding of how to use military force."

[107] JFC EBO, 11.

Additionally, emerging thought on the concept of strategic lockout (see Appendix F) provides added weight to the assertion that cognitive lines of operation should drive physical effects. In order to be effective, these lines of operation must be constructed keeping the following attributes in mind.

## Attributes

1. **Goal driven**—The lines of operation must be selected to force the adversary to assume a particular final state as envisioned by the friendly endstate: "…rational human action begins with the establishment of ends or aims. In warfare this may be the single most important decision a commander can make."[108]

2. **Form**—In general, cognitive lines of operation will be designed to achieve either Constructive or Destructive Reflexive Control, although they may use elements of both. This design will necessarily take place in relation to the adversary's decision space: the destructive form envisions either blocking all of the paths the adversary can conceive of (i.e., portraying them all as unable to attain the endstate) or making him unable to choose which way to proceed from a particular decision point, while the constructive form envisions portraying a certain path or paths as more desirable while simultaneously portraying other paths as undesirable. Elaboration on this concept can be found in Appendix G.

3. **Cognitive Pivots of Maneuver**—Operations in physical space may be designed using the concept of *pivot of maneuver*, "a decisive point the seizure of which will maintain the momentum and so sustain the initiative of an attack. The retention of a pivot of maneuver in defense will exhaust the momentum of an attack and perhaps wrest the initiative."[109] The differentiation of decisive points as physical, cybernetic, and moral often includes the will of the commander in the

[108] James J. Schneider, *Theoretical Paper No. 3, The Theory of Operational Art* (Ft. Leavenworth, KS: U.S. Army Command and General Staff College, 1988), 17.
[109] Ibid., 37.

last category.[110] Within decision space, however, specific decision points or path-specific data that are critical to the eventual outcome of an adversary's decision making process are more appropriately categorized as cognitive, since they relate more specifically to his thinking than his overall will; identification of these cognitive pivots of maneuver provides key insights into design of the lines of operation in decision space.[111]

4. **Strategically Supported**—Since the adversary's decision space is based not just on military factors, but on the whole of his experience and culture, a number of the effects necessary to exert either Constructive or Destructive Reflexive Control may only be available from instruments of national power outside of the military.[112] Cognitive Lines of Operation should be designed to take advantage of the full spectrum of national power to most effectively influence the adversary's decision making process.[113]

5. **Vulnerability Focused**—The Lines of Operation must be designed to ensure that the "specially prepared information" necessary for reflexive control is able to be conveyed efficiently and effectively. This can best be done by analyzing which cognitive pivots of maneuver are accessible through the vulnerabilities and flaws leading to poor decision making, as described in Chapter Three, and focusing the majority of efforts against these.

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[110] Ibid., 28.

[111] Ibid., 38: "The cumulative result [of the seizure of a series of decisive points that are pivots of maneuver] imposes a continuous decision upon the defender…[he] must decide upon some course of action in response to the attacker's initiative as manifested by the seizure of pivots of maneuver. The narrower the choices available to the defender with which to respond, the more the attacker is setting the conditions of the operation…It is not only that the seizure of pivots of maneuver shatters, shapes, and controls the herd of defenders. The important insight is the speed with which this process occurs. In such instances it paralyzes the defender's decision process—his ability to decide."

[112] Chotikul, 20: "The Soviets thus apply a 'systems approach' believing that '…armed force cannot prevail unless complemented by calculated political, economic, social, and psychological campaigns.'"

[113] Chotikul, 30: "…the Soviets concentrate on a consideration of both military and social factors in developing a 'master plan of combat' in accordance with the objective laws of war and armed combat (as defined dialectically). In the U.S., on the other hand, we exclude 'non-combatant' factors and emphasize procedural considerations and the performance of hardware. In other words, the Soviets have a systems/strategic orientation to military affairs in comparison to the technical/tactical orientation of the U.S."

6. **Simulated System Preservation**—Since the foundation of reflexive control and hence of cognitive campaign design is the ability to accurately and completely simulate the decision making process of the adversary, the system that implements this process must be preserved until the friendly commander judges that there is more benefit to destroying it.[114] Likewise, the channels being used to introduce information into the adversary's decision making process must also be preserved.[115]

## Timing

### Justification

The contextual nature of decision making produces an outcome that is based on the chronological order and speed with which information is processed, since each input becomes part of the environmental context through which subsequent inputs are experienced. The implication for cognitive, as well as physical, campaign design is that "commanders and planners must also anticipate and understand the inherent complexity of effects manifested over time, as well as undesired and unexpected effects."[116] Careful ordering and spacing of effects in time can shape the adversary's filtering process and conceptualization of decision space; the following attributes serve as guides in designing the campaign to achieve the proper shaping.

[114] *Thinking Effects*, 51: "…given a decision between destroying and exploiting enemy command and control nodes, this type of analysis [causal linkages] would also reveal the basic conflict in the two alternatives. For example, destroying a command and control node that is being fruitfully exploited through intrusion could actually impede progress toward the objectives."
[115] Libicki, 17: "C2W may do more good degrading or compromising the enemy's ability to command forces than destroying its ability altogether. For instance, destroying secure channels may induce the use of open ones vulnerable to eavesdropping. Although a destroyed infrastructure may prompt an immediate search for alternatives, one only subtly degraded may not. Finding a way to slow down the other side's ability to react at a precise moment (e.g., the moment of attack) gets the attacker inside the other's OODA loop."
[116] ACC White Paper, 10.

## Attributes

1. **Selective Tempo Variation**—As previously discussed, controlling the tempo of events at the appropriate times during the adversary's decision making process can enhance the probability of success. The campaign design must include an estimate of when the adversary will be making particular decisions and what his decision space will look like at that time, and the tempo must be planned accordingly. Friendly effects must be planned to create a rapid tempo when paralysis or insertion of dissonant "messages" is desired, while a slower tempo may be useful if it is necessary that the adversary have time to fully consider the consequences of friendly effects or to internalize more lengthy reflexive control "messages." Tempo planning must address not only the timing between individual events the adversary perceives, but also between aggregate groups of related events, since reinforcing events within a group often carry a substantially greater perceptual impact.

2. **Bounded Sequential Organization**—The discussion in Chapter Two related the central role Orientation plays in the OODA Loop—it shapes the current cycle, and current cycles shape future cycles. It is critical, then, to organize effects and reflexive control measures in a sequential manner, so that the adversary's decision making process and decision space is proactively shaped to produce the maximum chance of success for the campaign. Although friendly efforts must be ordered in time, they need not be specified absolutely in every case (unless specifically required to create a certain tempo); rather, they often can be ordered *relative* to one another or to a particular occurrence in the adversary's decision making process. In this sense, they may be *bounded*: they can be directed to occur within the bounds set by the previous and subsequent events.

3. **Ubiquity**—*Every* effect and reflexive control measure in the battlespace must be subject to timing constraints, since even one out-of-order event can cause dissonance with the adversary's expectancies and a subsequent failure of part or all of the campaign. However, the constraints may be very nonrestrictive, to the point where they may be more or less ignored, if the effect is

assessed to be of very low relevance to the adversary; therefore, many activities may effectively be unconstrained, meaning that a large portion of friendly forces may be free to prosecute actions at a rate and in an order of their choosing.

## Fluid Execution

### Justification

In a campaign utilizing reflexive control against a constantly adapting adversary with an ever-changing decision space, more familiar means of linear execution cannot work. Much like contemporary Special Forces operations, a campaign based on cognitive elements must empower subordinate units on the battlefield while at the same time ensuring that their actions support the campaign design. The three attributes listed below describe how to do this.

### Attributes

1. **Unity of Effort**—All subordinate units must ensure that *all* of their actions, as evaluated through the simulation resident at their level, support the intent of the campaign.[117] "Several channels of reflexive control are built in interactions with the adversary: between one's own units and the enemy's units, between reconnaissance units, between Headquarters, between commanders, etc. It is important that all of the channels of reflexive control have the same goal."[118] This is especially important in a campaign against the adversary's decision making process, since even relatively minor actions, if observed[119] and processed, can cause dissonance in the adversary and the unraveling of the friendly plan.[120]

[117] Rendulic, 14: "One of the most important fundamental principles underlying a decision is the following: The foremost thought in every decision concerning a strategic or tactical situation must be the main effort."
[118] Lefebvre, 109.
[119] Thomas, 7: "…there is a need to act not only against people but also against technical reconnaissance assets."
[120] Libicki, 45: "As technologies of inspection become increasingly ubiquitous, however, more details must be correct to achieve deception."

2. **Command-by-Influence/Self-Synchronization**—Subordinate units receive the commander's intent that, in accordance with the cognitive campaign design, sets their objectives and bounds their actions, rather than prescribing a limited range of options. These units then self-synchronize, using a common operational picture and the simulation of the adversary's decision making process:

> The introduction of nonlinearity is justified by, consistent with, and compelled by the fact that seemingly random turbulence, such as the chaos inherent to the battlespace, or in whitewater rapids, has been shown to be unpredictable, but within bounds, self-organizing. The commander's mental images, representing his intent, or concept of operations, and captured in synthetic environments constitute (a) those bounds and (b) the means by which deliberately stimulated but controlled chaos is inserted to achieve command-by-influence. The subordinate, freed from the prescriptive qualities of voice and text, is cast in the role of interpreter of the image, which together with his local situational awareness, provides the latitude for slightly chaotic, but self-organizing effects to take hold. The result is the breaking up of Western man's acculturated Newtonian pattern of linear cause-and-effect processes, and their predictability."[121]

> Self-synchronization is perhaps the ultimate in achieving increased tempo and responsiveness. Self-synchronization is a mode of interaction between two or more entities. Figure 8 portrays the key elements of self-synchronization: two or more robustly networked entities, shared awareness, a rule set, and a value-adding interaction. The combination of a rule set and shared awareness enables the entities to operate in the absence of traditional hierarchical mechanisms for command and control. The rule set describes the desired outcome in various operational situations. Shared awareness provides a mechanism for communicating the ongoing dynamics of the operational situation and triggering the desired value-adding interaction.[122]

[121] Czerwinski, Appendix 3, p. 5.
[122] David S. Alberts, John J. Garstka, and Frederick P. Stein, *Network Centric Warfare: Developing and Leveraging Information Superiority* (Washington, D.C.: DoD Command and Control Research Program, 2002), 175-176. (hereafter referred to as *NCW*)

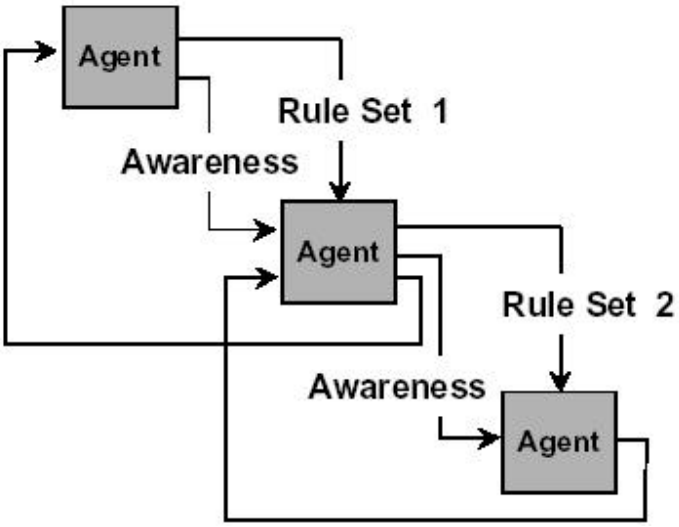


**Figure 8: Self-Synchronization Interaction**[123]

3. **Random Unpredictability**—Subordinate units, enabled by self-synchronization, must intentionally insert unpredictable actions at random times into their overall behavior on the battlefield; this practice of non-repeated techniques, or variegated response, keeps the adversary disoriented by his inability to establish patterns.[124] This supports the attribute of Unity of Effort in the most fundamental way—it helps prevent the enemy from seeing patterns in friendly responses to his actions, thereby keeping him from realizing he is being reflexively controlled and so preserving the integrity of the entire cognitive campaign construct. In fact, conveying to the adversary the idea that random unpredictability is an element of friendly doctrine may be an additional way of reflexively controlling him: his perception of chaotic, independently-operating subordinate units that don't always directly support the higher commander's intent may enable friendly units to openly perform tactical actions that contribute directly to the mission without him realizing it.

This chapter has presented four elements of cognitive campaign design that arise out of the analysis of the previous two chapters. In the concluding chapter that follows, specific

[123] *NCW*, 176.
[124] Chotikul, 75.

recommendations for implementation of the concepts presented in this paper are suggested and the main points of this paper are summarized.

CHAPTER FIVE

# RECOMMENDATIONS AND CONCLUSION

> What we already see, therefore, is the progression of military thinking beyond its early conceptions of electronic warfare, beyond the current definitions of "command and control warfare," and even beyond the more general notion of "information warfare." For decades to come, therefore, many of the best military minds will be assigned to the task of further defining the components of knowledge warfare, identifying their complex interrelationships, and building "knowledge models" that yield strategic options. These will be the womb out of which full-blown knowledge strategies will be born.
>
> Alvin and Heidi Toffler, *War and Anti-War*[125]

The previous three chapters developed the concept of attacking an adversary's decision making process, starting with a description of decision space, followed by an analysis of the structure and vulnerabilities of decision making, and ending with the development of principles that inform cognitive campaign design. This final chapter provides recommended actions required to implement the concept and concluding remarks.

## Recommendations

### Prioritize Efforts to Develop Simulation Capability

As has been amply demonstrated in the body of this paper, the ability to simulate an adversary's (or ally's) decision making process is critical to implementing the concepts presented. The capability to conduct this simulation can only be gained by providing resources (money, personnel, and effort) to develop the necessary required assets.

Huge volumes of information must be collected and organized to provide an instantly accessible intelligence database containing relevant cultural, doctrinal, historical, and personal information applicable to all potential theaters of operation. Such an effort has already been suggested for the strategic level[126], but it must also be developed at the operational level,

[125] Toffler, 152.
[126] See *Thinking Effects*, 58-68.

particularly with the aim of giving insight into the state of mind of the adversary's operational-level commanders and staffs. The task of collecting this information entails a drastic increase in Human Intelligence (HUMINT) assets and funding, since much of the information of greatest utility is of a personal nature that can't be collected by other means. A database like the one described would provide the raw materials with which friendly operational planners could design a cognitive campaign.

Operational planners comfortable with the theory described in this paper, possessing a solid foundation in the operational art of war, and intimately familiar with the adversary's culture are absolutely critical to designing a cognitive campaign.[127] The implication is that planners must be drawn from a group of cultural specialists (such as the US Army's Foreign Area Officers, or FAOs), must become experts on particular individuals in the adversary's chain of command, and must be given the appropriate training, including advanced planning courses (SAMS, SAASS, or SAW) and other methods not yet developed. These planners would then be equipped to use a comprehensive database to simulate the adversary's decision making process.

A robust, survivable information/intelligence/knowledge distribution and processing network resident in all echelons must be developed and fielded to enable the propagation of the simulation to all units at all echelons. The individual components of the network must be able to run the simulation locally to support tactical and operational decisions while simultaneously recognizing and providing feedback on events that impact the simulation as a whole; they must also include a high degree of security to mitigate negative consequences if they become compromised.

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[127] Lefebvre, 141-143: "The ability to model the enemy and predict his decisions is essentially limited by the fundamental uncertainty of human thinking. Therefore, the main part of modeling the enemy's thinking activity is a reconstruction of his ways or reasoning during decision making, which is easer to model than the decisions themselves…**The main problem in this method of decision making is selecting and training the officers simulating the enemy.** They must know the formal capabilities of the enemy's troops, realize national and cultural peculiarities of the enemy's mind, and personal features of the enemy's commander. Special methods of training must be used. Some interesting research has been conducted…on methods of using hypnosis to teach a person to adopt another personality…Similar methods might be used for playing the role of the enemy's commander, and this would revolutionize the process of simulating the enemy's decision making and finding effective forms of controlling his decisions." (emphasis added)

Simply developing a simulation capability is not enough, however. In order to be operationally useful, the application of a simulation must be governed by appropriate doctrine. This subordinate doctrine can only be developed if the overarching theory that informs it is also developed into accepted doctrine.

## Incorporate Cognitive Campaign Design into Operational Doctrine

The theory described in this paper has the potential to revolutionize campaign design, or at the very least bring to it clarity and focus so that emphasis is placed where it belongs: compelling the enemy to make the decisions we wish him to make. However, the concepts must be incorporated into current operational doctrine or they will not be read or used. The operational doctrine (especially service and joint 3-series capstone publications) is where planners turn for guidance; the theory can mature and come to fruition only through intellectual debate and discussion with the aim of incorporating it into 3-series doctrine.[128] Although this debate will most likely result in significant changes to the theory, it is highly likely that some benefit will be realized:

> [O]ne distinct advantage of thinking in terms of reflexive control—whether or not it can ever be developed into a perfect science of control—is that it forces the potential user to develop a mindset in which understanding the enemy, thinking through moves and countermoves, and attempting to develop a rigorous methodological approach to analyzing strategic problems and making optimal decisions is of utmost importance…The orientation toward reflexive control may be as potentially dangerous as the execution of the theory itself.[129]

In any event, the refinement of current doctrine to include the concepts of decision space, reflexive control, and cognitive campaign design can guide the education of future planners as well as the development of operational methodologies necessary to implement the concept.

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[128] Chotikul, 38: "Reflexive control appears to be a theory from which the United States could most assuredly derive a dual advantage. It is of utmost importance that we understand this powerful technique in order to focus on developing effective countermeasures. At the same time, it is a technique which may prove invaluable to our cause if we devote sufficient study and attention to it, thereby enabling us to learn how to effectively adapt and utilize it for our own purposes and to our own advantage."

[129] Ibid., 96.

## Develop and Implement Enabling Operational Methodologies

In order to execute campaigns based on a cognitive design concept, certain operational capabilities are required. The requirement for a robust knowledge network was addressed in a previous section; an appropriate network would also serve as a necessary enabler for the Command-by-Influence/Self-Synchronization requirement described in Chapter Four. However, merely fielding the network and designing the appropriate protocol would not be sufficient to ensure fluid execution as previously described.

Organizational structures, command and control hierarchies, and training programs must be modified to fully implement fluid execution. The ability to operate with a greater degree of autonomy in the battlespace is an essential characteristic that not only allows units to execute actions furthering the operational commander's intent based on the results of a locally resident simulation, but also allows those same units to present an unpredictable picture to the adversary through seemingly randomized actions. Units must become more self-sustaining and capable of independent action to gain the required increase in autonomy. Likewise, the commanders and soldiers of units must be trained to take advantage of this increase in freedom while still ensuring that constraints on action are not violated. Finally, units will gain freedom of action only if it is allowed by the chain of command: operational orders that are directive in nature must give way to new means of promulgating intent and constraints to the force while maximizing freedom of action.

Freedom of action must be maximized at all echelons by automating routine tasks and allowing commanders and their soldiers to focus on affecting the adversary's decision space in the appropriate way. However, caution should be used when introducing these "battlespace agents"—automated processes are much more easily simulated than human decision making and therefore offer an adversary a greater chance to establish reflexive control over friendly forces.[130]

[130] See *NCW*, 124-126 for a good discussion of battlespace agents and their uses.

Mitigation efforts, such as intentionally randomizing portions of the agent's decision making algorithms, restricting access to decision making tools (such as CAPES, a US Army planning computer program) on a need-to-know basis, and developing more stringent operational security procedures, must be implemented concurrently to eliminate potential vulnerabilities. In spite of the vulnerabilities they create, battlespace agents will serve as critical force multipliers, accessing the robust database of knowledge about the adversary and integrating it into the resident simulation to maintain a current picture of the adversary's decision space and to suggest possible cognitive lines of operation. As Lefebvre presciently observed, "Builders of automata will soon plan and equip them with the capability of reflexive control. Assuming equal technological sophistication, the side which creates automata with the capability for more refined methods of reflexive control will win."[131] Without automation to aid well-trained planners and commanders, processing the amount of data necessary in a reflexive control operation will not be possible.

The recommendations presented above, while necessary to implement the concepts in the preceding chapters, can serve an even broader purpose. Each and every one of them has the potential to contribute materially to the success of campaigns designed and executed using contemporary concepts and methods. Their full potential will only be realized, however, if all of them are implemented.

## Concluding Remarks

Alvin and Heidi Toffler have noted "when systems are 'far from equilibrium' they behave in bizarre ways that violate the usual rules. They become nonlinear—which means that small inputs can trigger gigantic effects."[132] Reflexive control measures, applied in accordance with a cognitive campaign carefully crafted to attack the decision making process, can drive an adversary into the nonlinear regime and subsequently determine how and where smaller and

[131] Lefebvre, 137.
[132] Toffler, 250.

smaller inputs should be applied to have increasingly greater desired effects. The goal of most practitioners of operational art is to upset the adversary's system, to put it into a state of shock so that it is unable to function. Not only does the theory proposed in this paper fulfill this objective, it goes beyond it by controlling the adversary rather than merely rendering him temporarily ineffective. Reflexive control appears to have "the flexibility and ability to incorporate (thereby decreasing the shortcomings inherent in) other forms of influence such as informational and referential and thus should be considered a potentially much stronger and more foolproof method of exercising control than the majority of older and more widely understood methods."[133] The potential inherent in this method can be harnessed using the concepts presented here.

The concepts presented in this paper describe how to attack an adversary's decision making process. The methodology began with an understanding of his decision space in which he conceptualizes potential courses of action. Next, a description of the adversary's decision making process and vulnerabilities was presented from an analysis based on the Observe-Orient-Act-Decide (OODA) Loop model, the Soviet theory of Reflexive Control, and the Recognition Primed Decision Making model. Finally, Elements of Cognitive Campaign Design were developed as tools to guide the planner and recommendations on how to implement the concepts were provided. Taken as a whole, this paper provides a framework to move the focus of military campaign design at the operational level from destruction to control, from massing overwhelming force to selective application of effects, and from physical centers of gravity to the true center of gravity—the adversary's decision making process.

[133] Chotikul, 96.

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# APPENDIX A

## Lefebvre's Theses on the Concept of Reflexive Control[134]

[The] concept of reflexive control…is based on a few very clear theses:

1. Informational influence on the enemy's decision making process must be planned.
2. A special model of the enemy must be constructed.
3. This model has to be reflexive, that is, it has to contain models of itself and of its adversary, which in their turn may have models of themselves and of their adversaries and so on.
4. Modeling of the enemy can be done using natural human mental activity, or a computer, or a combination of the two.
5. Man should not be eliminated from the decision making process since a truly creative decision in conflict can be made only by a human being (in the foreseeable future).
6. However, all routine functions in the decision making process should gradually be transferred to computers, and in such a way that the human creative potential can be realized most efficiently.
7. Reflexive control can be of two types, constructive or destructive. Constructive reflexive control is an influence under which the enemy voluntarily makes a decision favorable for the controlling side. Destructive reflexive control destroys or neutralizes the procedures and algorithms of the enemy's decision making.
8. Reflexive control can be conducted in two ways:
    i. reflexive control through transformation of the enemy's processing of information in a technical or human link (cognitive)
    ii. reflexive control by selecting the messages (informational)

[134] Lefebvre, p. 144-145.

# APPENDIX B

## Ionov's Basic Methods for Information Transfer[135]

- **Power pressure**
  - the use of superior force
  - force demonstrations
  - psychological attacks
  - ultimatums
  - threats of sanctions
  - threats of risk (developed by focusing attention on irrational behavior or conduct, or delegating powers to an irresponsible person)
  - combat reconnaissance
  - provocative maneuvers
  - weapons tests
  - denying enemy access to or isolating certain areas
  - increasing the alert status of forces
  - forming coalitions
  - official declaring war
  - support for internal forces destabilizing the situation in the enemy rear
  - limited strikes to put some forces out of action
  - exploiting and playing up victory
  - demonstrating ruthless actions
  - showing mercy toward an enemy ally that has stopped fighting

- **Influencing the enemy's decision-making algorithm**
  - systematic conduct of games according to what is perceived as routine plans
  - publishing a deliberately distorted doctrine
  - striking control system elements and key figures
  - transmitting false background data
  - operating in a standby mode
  - taking actions to neutralize the enemy's operational thinking

- **Measures to present false information about the situation**
  - concealment (displaying weakness in a strong place)
  - creation for mock installations (to show force in a weak place)
  - abandoning one position to reinforce another
  - leaving dangerous objects at a given position (the Trojan Horse)
  - concealing true relationships between units or creating false ones
  - maintaining the secrecy of new weapons
  - weapons bluffing
  - changing a mode of operation
  - deliberately losing critical documents
  - forcing the enemy to find a new target by:
    - conflict escalation/de-escalation
    - deliberate demonstration of a particular chain of actions
    - striking an enemy base when the enemy is not there
    - acts of subversion and provocation
    - leaving a route open for an enemy to withdraw from encirclement
    - forcing the enemy to take retaliatory actions involving an expenditure of forces, assets, and time

- **Altering the decision-making time**
  - unexpectedly starting combat actions
  - transferring information about the background of an analogous conflict so that the enemy, when working out what seems feasible and predictable, makes a hasty decision that changes the mode and character of its operation

[135]Thomas, p. 6.

# APPENDIX C

## Komov's Basic Elements of an "Intellectual" Approach to IW[136]

- **Distraction**, by creating a real or imaginary threat to one of the enemy's most vital locations [flanks, rear, etc.] during the preparatory states of combat operations, thereby forcing him to reconsider the wisdom of his decisions to operate along this or that axis
- **Overload**, by frequently sending the enemy a large amount of conflicting information.
- **Paralysis**, by creating the perception of a specific threat to a vital interest or weak spot
- **Exhaustion**, by compelling the enemy to carry out useless operations, thereby entering combat with reduced resources
- **Deception**, by forcing the enemy to reallocate forces to a threatened region during the preparatory stages of combat operations
- **Division**, by convincing the enemy that he must operate in opposition to coalition interests
- **Pacification**, by leading the enemy to believe that pre-planned operational training is occurring rather than offensive preparations, thus reducing his vigilance
- **Deterrence**, by creating the perception of insurmountable superiority
- **Provocation**, by force [sic] him into taking action advantageous to your side
- **Overload**, by dispatching an excessively large number of messages to the enemy during the preparatory period
- **Suggestion**, by offering information that affects the enemy legally, morally, ideologically, or in other areas
- **Pressure**, by offering information that discredits the government in the eyes of its population

[136] Thomas, p. 8-9.

# APPENDIX D

## Reid's Categories of Russian Reflexive Interactions[137]

- Transfer of an image of the situation: providing an opponent with an erroneous or incomplete image of the situation.
- Creation of a goal for the opponent: putting an opponent in a position in which he must select a goal in our favor (for example, provoking an enemy with a threat to which he must rationally respond).
- Form a goal by transferring an image of the situation: feigning weakness or creating a false picture.
- Transfer of an image of one's own perception of the situation: providing an opponent with false information or portions of the truth based on one's own perception of the situation.
- Transfer of an image of one's own goal: a feint by a basketball player is a classic example where you change the enemies [sic] perception of where he thinks you are or are going.
- Transfer of an image of one's own doctrine: giving a false view of one's procedures and algorithms for decision-making.
- Transfer of one's own image of a situation to make the opponent deduce his own goal: presenting a false image of one's own perception of the situation, with the accepted additional level of risk.
- Control of a bilateral engagement by a third party.
- Control over an opponent who is using RC: exploiting opportunities identified as imitation of the initiators own process of RC.
- Control over an opponent whose doctrine is game theory.

[137] Thomas, p. 9-10.

# APPENDIX E

## Key Points on Mental Simulation in the RPD Model[138]

- Mental simulation lets us explain how events have moved from the past into the present.
- Mental simulation lets us project how the present will move into the future.
- Constructing a mental simulation involves forming an action sequence in which one state of affairs is transformed into another.
- Because of memory limitations, people usually construct mental simulations using around three variables and around six transitions.
- It takes a fair amount of experience to construct a useful mental model.
- Mental simulations can run into trouble when the situation becomes too complicated or when time pressure, noise, or other factors interfere.
- Mental simulation can be misleading when a person argues away evidence that challenges the interpretation.

[138] Klein, *Sources*, 73-74.

# APPENDIX F
## The Concept of Strategic Lockout

"Closely associated with these ideas is the concept of strategic lockout. Lockout refers to the situation that exists when an adversary's strategic objectives have been locked out because he has no remaining viable courses of action. This relationship is portrayed in Figure 9. Although the hypothesis is still unproven, the underlying logic is that focusing on strategic lockout can play a key role to enable a warfighting force to achieve a rapid termination of hostilities."[139]

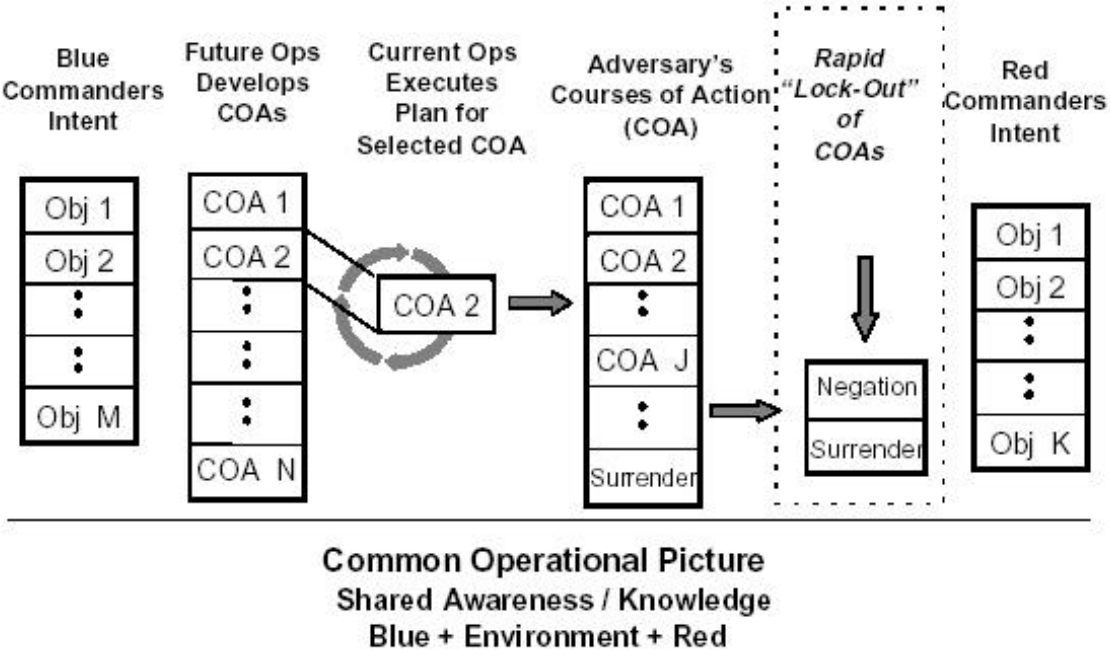


**Figure 9: Strategic Lockout**[140]

[139] *NCW*, 165.
[140] *NCW*, 166.

# APPENDIX G
## Elaboration on Construction of Cognitive Lines of Operation

One attacks the opponent's decision space to cause him to choose a path favorable to one's own plan. Attacks are designed to accomplish one or more of the following effects: 1) deny the use of certain paths, 2) reinforce the use of certain paths, and 3) disrupt the ability to choose between paths. Each of these effects will be treated in turn in subsequent paragraphs. The instrument of attack can vary, and in fact, the most effective attack plan will include multiple instruments. These instruments are only limited by the imagination, but can include diplomatic pressure, physical destruction of assets, information operations, civil/military operations, and stability and support actions; in fact, any way to influence a factor that the enemy commander must consider when making his decision can be a potential method of attack. The key to constructing the attack plan is in understanding what paths are available to the enemy commander, what the desired effects on those paths are, and what available instruments can be used effectively. This understanding is rooted in comprehension of the characteristics of decision space enunciated in Chapter Two. The following elaborations on effects will serve to clarify these concepts.

First, consider a hypothetical case of path denial. Assume that the adversary's objective is to conduct peacekeeping operations in a particular region in order to increase his diplomatic influence there; in order to do so he must get his forces across a river. The friendly commander desires the opposing land forces to cross at only one point, a major bridge under friendly control, so that he can keep track of exactly what is entering the region; in effect, he wishes to deny the opponent any path in decision space that would enable land insertion of forces by other than that particular bridge. He could do this by physical destruction of assets (sabotage of bridging assets), information operations (deception as to the suitability for bridging or forging the river, perhaps using a public media outlet as showing the river at flood stage), diplomatic means (the country

down-river from the proposed operation could be induced to protest the potential ecological hazards any crossing at other than an established bridge could pose to the river), and even by emphasizing certain key relationships between the current situation and the enemy's doctrine (by ensuring that the enemy knows that the other bridges over the river won't support his mechanized forces, and understanding that the enemy's doctrine calls for a mandatory mechanized presence with light forces during peacekeeping operations, for example). Of course, employing more than one of these instruments has a synergistic effect that increases the probability of success. Likewise, each distinct path in decision space, corresponding to a particular crossing site, should be attacked with at least one, and preferably more, instruments.

Next, consider a potential case of path reinforcement. In this case, the adversary must believe that the path or paths the friendly force wishes him to choose will lead to achieving his endstate criteria. In some cases, these paths may actually do so if he is allowed to follow them to completion, but his choosing them will allow friendly forces a greater probability of defeating him than other paths may afford. For instance, assume that the friendly commander wants the adversary's forces to defend in the open desert near international borders rather than near major urban areas. To reinforce this path (or actually, aggregation of paths, since many different configurations are possible for the open desert defense), the friendly commander conducts military deception operations to portray lack of sufficient forces to mount a conventional attack in the open (by suggesting a delay in placing forces in theater or a pull-out of forces to take part in an exercise elsewhere, for example), conducts psychological operations to create the opinion that failure to defend the border is a sign of weakness, uses political deception to suggest that an attack is not imminent (due to lack of domestic unity and focus on national elections in the friendly country and lack of international coalition support), and perhaps even arranges for the loss of a laptop computer from headquarters containing information that shows friendly forces would have a low probability of success in an attack prior to a certain date. Once an attack in the open begins, the friendly commander could selectively attack key bridges physically, actively

deceive the enemy as to the success of the defense, jam reports of friendly penetrations, and disrupt POL supply lines necessary for force repositioning in order to provide additional reinforcement to the forward defense decision path.

Finally, consider a situation where the enemy commander is unable to choose between paths. He can find himself in this situation as a result of: a) inability to gain or process information necessary to decide between paths, b) inability to adequately decide between an overwhelming number of paths or a smaller number of paths with a large set of subsequent consequences, or c) inability to decide on a path quickly enough to implement the decision in the time available. This situation is closely associated both with John Boyd's OODA Loop theory (discussed in Chapter Three) and with current U.S. Air Force strategies of nodal analysis, system attack, and strategic paralysis. As an example, suppose that the friendly commander expects an insurgent adversary to attack a supply convoy if it travels down the major highway following standard procedures. To counter this, the commander breaks the convoy up into smaller sections, sending each off on different secondary routes with different departure directions and times, while sending out armed patrols disguised as convoys. In order to attack even one smaller convoy successfully, the enemy must obtain information on the convoys, process this information to decide which convoy to attack while ensuring that it is not a decoy, and choose his decision space path rapidly so that he can articulate it as a course of action and cause his forces to be repositioned properly within the time constraints of the situation. The friendly commander can further complicate the opponent's dilemma by practicing good OPSEC, conducting PSYOPS designed to inculcate fear of the insurgents in the local populace and discourage passing of information, and jamming enemy radio and cellular phone transmissions.

These three different examples briefly illustrate the application of concepts discussed in the body of this paper.