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MASTER OF MILITARY STUDIES

**ASSESSING THE REQUIREMENT FOR OPERATIONAL DESIGN IN THE
FACE OF NONLINEARITY**

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Title: Assessing the Requirement for Operational Design in the Face of Nonlinearity

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Thesis: Adoption of operational design by the U.S. military will provide an approach to functioning effectively within a complex environment in the near-term, while serving as a catalyst for a more comprehensive understanding of systems thinking in the long-term.

Discussion: Complexity is not a new phenomenon. Throughout time people have wrestled with complex problems and situations and have met with varying levels of success in their achievement of an acceptable solution. The relatively new science of complexity has facilitated our understanding of different types of complexity and has enhanced our ability to develop solutions to the problems that exist within such environments. A logical part of operating in environments of complexity is the conduct of operational design or "the conception and construction of the framework that underpins a campaign or joint operation plan and its subsequent execution." As an increasing number of leaders realize the importance of design the inadequacy of our current joint and service publications has become apparent. Absent of an acceptable doctrinal foundation, design has been less than effective in providing an approach to effectively function within a complex environment. While it is certain to meet resistance, the implementation of properly developed design that is based on systems thinking will have far-reaching impacts on individual services and the joint force.

Conclusion: Even with immediate revision of doctrine and corresponding implementation of design across the joint force services the inherent difficulties associated with warfighting and other military action would remain. However, adopting and embracing design does provide an additive capability to our existing planning processes and more importantly provides a tangible means for further integration of nonlinear/systems thinking within our military.

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Preface

Operational design has been a topic that has touched nearly every planner from the battalion/squadron level and higher since our involvement in Operation Enduring Freedom and Operation Iraqi Freedom commenced. For many like me, an introduction to operational design after deployments left feelings of disbelief that we had not been introduced to this process earlier and that it had not been applied by higher headquarters. After a brief exploration into operational design I began to see the glaring insufficiencies in our doctrine, education, and training with regards to operational design.

Compounding my studies of operational design with an introduction to nonlinearity and systems theories provided by Colonel Dan O'Donohue, USMC and Lieutenant Colonel John McDonough, USMC, I was able to observe that our ability to design and plan effectively went beyond the implementation of a design process. I came to the conclusion that our military as an institution operates within a linear paradigm. Operational design appears to me as I observe the work being done chiefly by the U.S. Army as a potential vehicle for adoption of a new, nonlinear paradigm within the joint force.

Introduction

Complexity is not a new phenomenon. Advances in technology over the past century have enabled engineers to assemble systems with increased structural complexity at the macro-level. These same technological increases have also assisted scientists and mathematicians in observing complexity at the micro-level. When considering complexity our minds easily conjure such examples as space exploration or nuclear energy, however it is necessary to continually remind ourselves that complexity exists at all levels, from the sub-atomic to the entirety of the universe. In light of the complexity that pervades our world, it is no surprise that throughout time, people have wrestled with complex problems and situations and have met with varying levels of success in their achievement of acceptable solutions.

The study of complexity in comparison to more traditional sciences is, however, more recently developed. This “new science” has provided a method of examining complexity in ways that previously had simply not been comprehended. The science of complexity has facilitated our understanding of different types of complexity (structural and interactive) and has enhanced our ability to develop solutions to the problems that exist within such systems. This new understanding has had implications in science and industry over the past century and has only recently begun to receive attention and at some levels acceptance within the military.

A logical part of operating in environments of complexity is the conduct of design prior to engineering. Joint Publication 3-0, *Joint Operations*, defines operational design as “the conception and construction of the framework that underpins a campaign or joint operation plan and its subsequent execution.”¹ Within industry the functions of design and engineering are divided into different professions (consider the relationship between an industrial designer and

an industrial engineer), however, within the military, planners are required to “perform the cognitive functions of both designers and engineers.”² The United States Army and Marine Corps have recently demonstrated a newfound appreciation for design as evidenced in several doctrinal publications and lesser service publications, however, an institutional understanding of design and a corresponding change in education and training have yet to occur. Accepting that the U.S. military acknowledges the complexity of war, the integration of operational design into the professional education and training of our military is a logical and necessary progression. Adoption of operational design by the U.S. military will provide an approach to functioning effectively within a complex environment in the near-term, while serving as a catalyst for a more comprehensive understanding of systems thinking in the long-term.

Terms of Reference

It is useful prior to entering into a discussion on topics that have the potential to be less well understood, to provide a brief description of the professional vocabulary of these subjects. At the foundation of complexity and operational design are systems. In its most simple form systems theory considers the universe as a system, an interactive whole, made up of lesser subsystems which are also interrelated through interaction. The study of systems has developed over the past century and includes, but is not limited to Holism, Information Theory, Chaos Theory, Complexity Theory, and most recently Network Theory. In the same way that a student studying theories of electricity does not go singularly to the work of Georg Ohm, a student of systems does well not to isolate his study or application to only one particular theory. When discussing the elements of these theories it can be accepted that a system is “a functionally, physically, and/or behaviorally related group of regularly interacting or independent elements.”³

When considering the different types of systems that exist within the universe, the work of the late American physicist Heinz Pagels has proven useful, especially as it related to his work with complexity. Pagels identifies essentially two types of systems that have since been labeled structurally complex and interactively complex. Structurally complex systems find their complexity in the number and order of the parts within a system.⁴ While these systems contain great numbers of parts, each part generally finds a set interaction with other parts. This set interaction or “cause and effect” facilitates better understanding of the system by reductive analysis. The same set interaction produces traits of proportionality, additivity, and replication.⁵ Proportionality relates to the size of an input to the system resulting in a proportional output. Additivity is a term used to describe a system when the entire system can be summed by adding the parts together.⁶ Replication simply communicates that a system will continue to perform the same way given the same input and conditions. Most mechanical systems illustrate these traits well (e.g. an automobile) in that inputs and outputs are easily observed and measured. Based on their performance, structurally complex systems are classified as linear systems.

Interactively complex systems can be composed of any number of parts. In contrast to structurally complex system, their complexity is not based on their structure, but rather it is derived from the interaction of the parts and the variation or freedom of interaction that the parts of the system have.⁷ This freedom of action generates numerous, sometimes infinite, outputs when stimulated with a constant input. This variation results in an inability to produce traits of proportionality and replication. To understand these types of systems one must examine them holistically or systemically being that these types of systems are illustrative examples of the adage “The whole is greater than the sum of its parts.” Social networks provide excellent illustrations of interactively complex systems and point to an important observation that nearly

all systems that involve humans are interactively complex. Because of their dynamic interactive process, interactively complex systems are known as nonlinear systems.

A third classification of systems, complex adaptive systems, comes from the study of complexity theory. The nature of a complex adaptive systems differs from other complex systems in that they “exhibit coherence under change, via conditional action and anticipation, and they do so without central direction.”⁸ Because of the impossibility of explaining complex adaptive systems with any degree of fidelity even if the entire length of this monograph were used we will state more simply, that complex adaptive systems remain coherent as they adapt/change and it is unknown how this occurs. Suffice it to say, this system description unleashes an entirely new dimension to our process of functioning within or influencing systems of this nature. The characteristics of these types of systems become important when considering what operational design provides to a military force in the way of contributions to the achievement of their objectives when operating within or against such a system.

The previous discussion on systems is fundamental to the design process as designers will apply systems thinking to gain understanding and a further appreciation for the limits of their knowledge of the operating environment. Design, in both the technical and artistic sense, is the process of creating something new. Constrained by resources available, design boils down to a fundamental understanding of “What-Is-Needed and the world of What-Can-Be-Built.”⁹ This process is founded upon the understanding of the problem and through discourse formulates a generalized approach to solve the identified problem. Design’s correlation to further understanding of nonlinearity will become more evident as this monograph continues, but from a practical standpoint, the value of integrating operational design with our existing service

planning processes can be viewed as simply as whether an expenditure of time and resources to identify the “correct” problem is time well invested.

The Absence of Design or Poorly Applied Design

With a working understanding of complex systems and design we will begin to examine how military planning efforts absent design or with a poorly understood and applied design can produce ineffective and at times counterproductive results in execution. These illustrations are underpinned by the fact that design in itself must be based upon a solid understanding of linear and nonlinear systems.

Marine Corps Doctrinal Publications (MCDP) recognize the complexity that is inherent in war. MCDP 6, *Command and Control*, describes the fundamental point that military action is by its nature a complex system and that our approach to command and control must find a way to cope with its inherent complexity. While MCDP 6 does not use the terms linear/structurally complex or nonlinear/interactively complex, its references to frequent and free interaction and to behavior that is akin to biological organisms make it clear that the complex system of military action is that of a nonlinear system.¹⁰ Having recognized the interactive complexity of war/military action the Marine Corps aligned it with a planning process (i.e. the Marine Corps Planning Process) that by its construct is suited for engineering solutions to linear problems (i.e. those operating within or as structurally complex systems).

The Marine Corps Planning Process (MCP) “focuses on the mission and the threat”.¹¹ In doing so it assumes that the mission received from higher headquarters equates to the true problem being faced by the force. An appreciation for the time involved in the military planning

process combined with an understanding of the dynamic nature of complex adaptive systems allows us to reason how unlikely it is that any problem identified by a higher headquarters remains unchanged by the time that a mission has been received by a subordinate unit. Furthermore, the application of the six step process applies a reductionist approach to problem solving that inhibits a holistic appreciation and understanding of the interactively complex systems that make up either the enemy force and/or the operating environment. Absent design, well intentioned planners exercise a well disciplined, resource intensive process to solve what is most likely the wrong problem.

While the absence of a design process can lead to uninformed planning, the lack of a proper level of knowledge concerning systems theory can lead to equally uninformed planning efforts and potentially even more counterproductive execution. The adage of having “enough knowledge to be dangerous” has full application in this sense. While the reasons for ill-suited results vary more with the misapplication of design than with the absence of design, the results can be equally detrimental.

Misapplication of design will often center on the improper construction of the mental models of the systems being encountered. One of the most common errors in design involves the identification of nodes and links. Joint Publication 3-0, *Joint Operations*, defines *nodes* as the tangible elements within a system that can be “targeted” for action, such as people, materiel, and facilities and *links* as the behavioral or functional relationships between nodes, such as the command or supervisory arrangement that connects a superior to a subordinate, the relationship of a vehicle to a fuel source, and the ideology that connects a propagandist to a group of terrorists.¹² While this definition and the accompanying figure (Figure 1) seemingly provide a

useful tool to develop models of the systems being dealt with in the design process they are misleading.

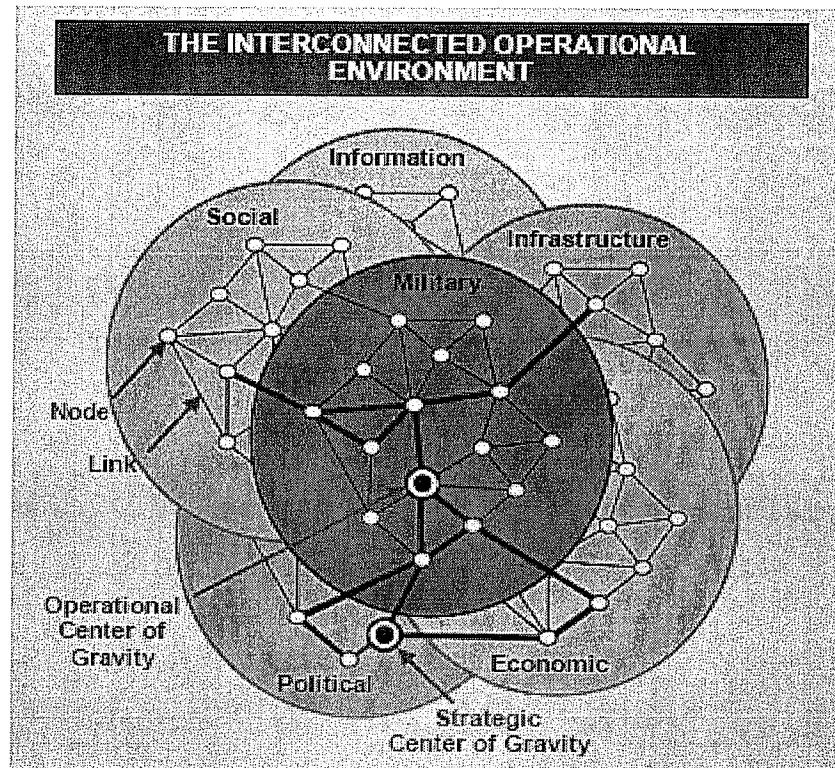


Figure 1

In reality, the model of any nonlinear system is a hypothesis, a guess as to what we as planners think the system may look like. Any interactively complex situation has, by its definition, a level of complexity in its interaction that cannot be fully understood based on the freedom of interaction that exists. This coupled with elements of an adaptive system produce a system that has randomly changing nodes with links that possess an inherent level of freedom of action. Simply put, designers who attempt to provide this level of granularity to the understanding of an interactively complex adaptive system have failed to understand the nature of such systems. John H. Holland, writing about complex adaptive systems, hypothesizes that complex adaptive systems would appear to have "lever points" wherein small inputs produce

large changes. Uncovering these “lever points” through an understanding of general principles that govern the dynamics of complex adaptive systems would seemingly produce guidelines for effective approaches to problems based on complex adaptive systems.¹³ The key point of this information is that these general principles governing complex adaptive systems are to date unknown and while not a purposeful distortion of the system’s nature, the application of templates such as those illustrated in Figure 1 demonstrates a common shortcoming when dealing with complexity which is to insert elements of linearity where gaps exist in our nonlinear model.

With regards to the recognition that any model of an interactively complex system is a hypothesis, it is important to illustrate one remaining misconception that has and will continue to surface amongst military planners. Fundamental to the reasoning that any systems model is a “best guess” of the true conditions of the system is the acceptance that without full knowledge of the initial conditions present in a system we possess no ability to generate a precise picture of the system and consequently no ability to predict the future conditions of that system. This was one of the principle findings of Edward Lorenz known as sensitive dependence on initial conditions or more commonly as the Butterfly Effect. Lorenz’s attempt to model weather drove his understanding of the inability to know the initial conditions of any system, therefore “errors and uncertainties multiply, cascading upward through a chain of turbulent features.”¹⁴

From a military planner’s perspective we can easily accept that no amount of intelligence can ever provide an accurate picture of a situation, even when taken at a single point in time. We must then accept that our assessment of a system or our model will always be flawed. Consequently, when energy is applied to nodes or links within an inherently flawed model it will produce an undeterminable outcome vice a predictable result. Stated in simpler terms,

nonlinearity does not support the development of system models that are either capable of being initially accurate or predictable over time.

Operational Vignette: The Significance of Proper Design

A reader with a mild understanding of systems theory has presumably followed the arguments made thus far, however as is the case in many other attempts to address systems theory in the written form it is reasonable to assume that some readers have become disoriented. To provide clarity to the arguments that have been previously presented, we will examine the following operational vignette:

Twenty-four months ago Major Smith left Expeditionary Warfare School feeling confident that he had received a good education and that he was prepared for his next upcoming tour in the operating forces. His instructors were professional and the course was thorough. He understood MCPP and with some additional practical application, felt that he would be prepared to lead his staff in its execution. Now, two years later, as a battalion operations officer preparing to deploy in support of Operation Iraqi Freedom he finds himself less confident in his education and training.

Major Smith's battalion had been given the all too familiar mission to "Conduct security and stabilization operations in order to facilitate the transition of security and governmental services to Iraqi control." His mission looked identical to that of his parent regiment and the Multi-National Force to which they were subordinate. Given his ambiguous/cookie cutter mission, it soon became clear to him that he had no real understanding of what "problem" actually faced his battalion or how he was going to go about determining it.

Upon a successful relief in place, he understood well the focus of effort (i.e. kill/capture those who oppose coalition/Iraqi efforts) that seemed to have been a common thread amongst all

preceding units and the standing missions associated primarily with the security of coalition and Iraqi forces and officials. Engaged daily by an ultra aggressive enemy, the daily kinetic actions against his forces providing security for key routes and infrastructure consumed his battalion. After two months of reactive efforts, a group of frustrated commanders and staff members collectively voiced their frustrations to one another. "What are we doing here?" "What is going to be different about this place when we leave than it was seven months prior?" Without an acceptable level of understanding of the system in which they were operating and the corresponding nature of the problem they were facing, Major Smith struggled to provide coherent direction to his battalion.

*Through a series of notable efforts on the part of his company commanders and staff members, Major Smith was able to piece together a "picture" of what existed in their area of operations. He had never heard of systems theory, but he had seen a picture in a brief from higher headquarters that appeared to have broken operations down into a sort of 'molecular' structure connecting parts together. He adopted this idea and with the aid of his staff and commanders, **identified** key persons, places and activities and the relationships between these key people, places, and things. All these were organized by "functional areas". Tasks were given to subordinate units relating to the reinforcement of certain key elements and their relationships and to the destruction of others. Having been in the area of operations for three months Major Smith felt relatively confident in this new assessment of the situation. His battalion pursued the "key element-relationship" restructure with vigor for the next four months.*

*Upon the conduct of relief in place with the incoming battalion, Major Smith confidently briefed the "**progress**" they had made in **adjusting the "picture"** in their area of operations. Having reinforced or destroyed key elements and/or relationships appropriately, he was*

confident in handing off the battlespace to the incoming battalion and allowing them to continue the adjustments to the "picture".

While this operational vignette is based on a compilation of experiences, Major Smith's experiences are representative of the situations our forces will face now and in the future. Elements of this vignette that illustrate the need for the knowledgeable application of design at all levels (to include the tactical) are listed below:

- Ill-defined mission statements from higher headquarters that do not accurately or adequately define the problem.
- Little to no understanding of the interactive complexity of the systems that make up the operational environment and enemy forces.
- Development of a systems model that is overly simplistic and rigid in an effort to define the environment.
- Application of linear tools to a nonlinear system via the establishment of direct cause and effect relationships between friendly action and system reaction.
- Failure to reassess the system model in order to gain better understanding of the system and its associated problems.

To develop a sufficient understanding of how operational design can be properly applied will require a parallel effort that generates a wider understanding of nonlinearity. How design can serve as the vehicle for this transformation and what institutional resistance must be overcome to allow this transformation will be the subject of the remainder of this essay.

Design as a Catalyst to Understanding Nonlinearity

While the necessity of the proper application of design as a complementary effort to our existing planning processes is clear, there is an additional and potentially more significant impact

to be gained through the integration of the design process. The thorough integration of operational design into our services' doctrine, training, and education has the potential to serve as an agent that facilitates even further expansion into the study of systems theory, complexity, and nonlinearity within our services. While design in itself has no intrinsic ability to do this, the continued exercise of the design process does have the ability to modify our way of thinking.

At the heart of operational design is "systems thinking". FM 3-24/MCWP 3-33.5

Counterinsurgency defines systems thinking as that which "involves developing an understanding of the relationships within the insurgency and the environment."¹⁵ More broadly it is the "mental process that seeks to understand and represent subjects as interactively complex wholes functioning within a broader environment."¹⁶ The application of this type of thinking provides a foundation for the thought process necessary to begin to gain an understanding and appreciation for the different theories that fall under the umbrella of systems theory. In effect, the more that an individual exercises systems thinking in the cognitive realm the more he is able to begin to understand the breadth of its application and utility. From a practical standpoint, application of systems thinking will require the development of at least a rudimentary vocabulary in what is likely a foreign language to most. This simple, yet necessary act can assist greatly in developing a further understanding of the concepts.

One of the first fundamental aspects of nonlinearity that will surface as "systems thinking vocabularies" develop is that systems thinking stands in contrast to reductionism or analytical thinking.¹⁷ Reductionism or analytical thinking seeks to break down a whole (e.g. a system) into individual parts and through understanding the individual parts, one can understand the whole. Analytical thinking is counter to systems thinking, but is one of the most prevalent forms of thinking in the scientific community and certainly within the military. Analysis is what we are

taught from our earliest studies in science. We dissect frogs to understand how an organism works. We build charts to show how dominant and recessive genes make straight, curly, or wavy hair. In the military we learn processes and procedures based on reductionist thinking whether it is as simple as disassembly and assembly of a machinegun or as robust as a service's planning process. This is not to question the validity of reductionism or analysis, for scientific history clearly shows its value. What is clear however, is the extremely limited value of reductionism when applied to nonlinear systems. Understanding the individual parts of a nonlinear system not only fails to facilitate an understanding of the system, but it can provide you with a warped view of reality regarding that system because it intentionally or unintentionally neglects the all-important interaction of the parts.

As the continued application of design breaks our officers out of the mold of reductionism, we can expect to see the intuition of our officers begin to exhibit degrees of change along the way. Intuition is that ability to know or understand something immediately without conscious reasoning.¹⁸ Intuition is based on our experiences and training. Consequently, our familiarity with analytical thinking gained through study and practice has resulted in our intuition being linearly based. When faced with nonlinear systems or problems, our linearly developed intuition does not suffice for it is not suited for nonlinearity. Military professionals throughout the ages have espoused intuition as a critical component of effective decision making. For intuition to properly support our decision making in a nonlinear operating environment it must be developed through experiences and training that are in themselves nonlinear based. Our continued exercise of the design process can assist in undoing what has been described as our having "trained our imaginations to be fundamentally linear."¹⁹

Lastly, the application of design as a matter of practice, having assisted our officers in their understanding of the temporal and conceptual nature of the models of the systems will in turn lead to an acceptance of the necessity of a continual process of feedback, assessment, and design refinement. Their acceptance of design as a hypothesis to explain the workings of a system will be a necessary first step that will allow them to see the value in design refinement or in some cases redesign. A continued appreciation for the interactive complexity will facilitate an acceptance of a lack of certainty, an understanding that design is not a function of "getting it right" so much as it is a process of "getting closer to an acceptable representation." Through established feedback loops the picture of observed reality will be enhanced and consequently will provide a better and more meaningful representation of the situation.²⁰

Overcoming Resistance

The previous portions of this work have been dedicated to demonstrating the applicability of design as a precursor to planning and its inherent value in developing a further in depth understanding of nonlinearity. Accepting that there is merit in the application of design and a further understanding of nonlinearity we will now examine what aspects of our military institutions or the systems theories themselves have the potential to provide resistance to their integration into military education and training.

In order to generate meaningful change in an organization there must be at some level a perception that change is required and that what is being offered is in some way better than the status quo. Belief that there is a requirement to adopt design and the underlying thought process of nonlinearity and systems thinking as its foundation is predicated on an admission that our current thought processes and planning processes are insufficient to meet the future operating environment. A principle challenge exists in reaching this state of admission in that the

established thought process amongst our military officers and our educational system is inherently linear. This linearity will serve as a stumbling block to comprehension of systems thinking.

Systems thinking, while not new to the military, has yet to gain true acceptance. Contributing in no small degree to this and directly related to our institutional linearity is the inherent difficulty in comprehending systems thinking. Put simply, systems theory and nonlinearity are complicated subjects that require a significant investment of study before the "light bulb comes on." Our service educational systems will be challenged to facilitate an in depth study of systems thinking and nonlinearity. True learning on this subject will not come from lecture, but from a purposeful study/reading program that is supported by open discourse within seminar groups led by knowledgeable faculty advisors. Upon establishing this baseline, this study can then be further developed through the application of operational design during the practical exercises which are now dedicated exclusively to planning.²¹

The integration of design and systems thinking into our professional education system will face two fundamental and related problems: First, while linearity is easy to teach and present in an academic setting, nonlinearity is not. James Gleick reflects that "Linear relationships are easy to think about...Linear equations are solvable which makes them suitable for text books."²² This has a direct correlation to the second difficulty that will be faced when integrating systems thinking into our professional education system: the requirement to have faculty members who possess sufficient understanding of systems theory to facilitate meaningful discourse and necessary mentorship during practical application. Gerhard Scharnhorst, the key instrument in the reform of the Prussian Army following Jena, detailed the importance of the instructor. His words find applicability today when considering the less sizable, but no less important reform of

our military's perspective on nonlinearity. Scharnhorst's emphasized "The most significant person for the accomplishment of this goal is without question the teacher." "The reputation of the Institute rests upon his ability and judgment, his energy and esteem in the Army".²³

Integration of design will also require an acceptance of discourse or debate as the means to accomplish the task. As it is in conflict with the structured and linear methods currently employed by the military in its planning processes, discourse will require a disciplined implementation if it is to gain acceptance. The discourse required for design is more than a debate or conversation; it is a "rigorous, structured discussion with a group of stakeholders" that a commander initiates.²⁴

While pursuing a design process that begins with the first step of "understanding the problem" it must be accepted that this cannot be accomplished through a one-time effort. Studies and experiences indicates that while seemingly counterintuitive, it is through a running interactive process (i.e. a discourse) that the problem at hand begins to be understood. A study on how people solve problems was conducted at the Microelectronics and Computer Technology Corporation during the 1980s. This study found that when attempting to solve a complex problem that rather than following an orderly or linear process, the designers executed an inherently nonlinear pattern that when plotted gave the appearance of disorder.²⁵ Pursuing this process that is nonlinear and at times disorderly will prove challenging as it is intended to precede our current planning and decision making processes that follow a chiefly linear form.

Lastly, with regards to institutional resistance, there will be some amongst us who will not see the need for change. This resistance will likely be driven by poor understanding of systems theory that translates into a distorted view of its application. Dr. Milan Vego's article "Systems versus Classical Approach to Warfare" provides an illustrative example of how a poor

understanding of systems theory can result in unnecessary resistance towards systems thinking. In this article, Dr. Vego provides an accurate description of some of the shortfalls that exist within Joint doctrine's approach to systems description and application, specifically the attempt to apply linear system characteristics (i.e. demonstrability of cause and effect and proportionality) to war which Dr. Vego recognizes (although not in name) as a nonlinear system. However, rather than illustrating this as a discrepancy in application of systems theory, he utilizes it as a means to pit systems theory against a classical approach to which he places Clausewitz as the center piece.²⁶

With an acceptable understanding of both Clausewitz and Systems Theory it is not difficult to comprehend what Dr. Alan Beyerchen summarizes well at the conclusion of his essay "Clausewitz, Nonlinearity and the Unpredictability of War" by stating "Clausewitz understands that war has no distinct boundaries and that its parts are interconnected...The work of Clausewitz indicates that knowing how the system functions at this moment does not guarantee that it will change only slightly in the next."²⁷ Simply put, Clausewitz understood and embraced the nonlinearity that war and military action provide. To that end, Clausewitz can potentially serve as one of the best vehicles to integrate systems thinking and nonlinearity into our military's existing professional military education systems.

Implications

Acceptance of the two fundamental tenets that have been demonstrated in the preceding pages has several implications for the individual services within the Department of Defense, but also to the Joint Force. While some of the issues discussed in the previous section concerning overcoming resistance allude to some of these, the implications to doctrine as the foundation to all training, education, and execution are included in this section for consideration.

As illustrated in various portions of this monograph, Joint Doctrine that addresses operational design fails to adequately communicate the significant differences between structurally complex and interactively complex systems. This fundamental failure has contributed to misunderstanding of systems theories and their application that has in turn led to unnecessary resistance to the application of systems thinking as well as an improper application of design (as illustrated previously).

Joint Publications 3-0, *Joint Operations*, Joint Publication 5-0, *Joint Operations Planning*, and Field Manual 3-0, *Operations* require revision by persons with sufficient knowledge of systems theories and nonlinearity. Part of this revision of Joint doctrine should be an expansion of the current description of the application of design to provide sufficient details on an actual process for conducting design. Many recent service efforts (specifically the U.S. Army's, evidenced in its recently published *Commander's Appreciation and Campaign Design*) have further developed a means to transition operational design from theory to practice. However, our foundational joint publications for planning and operations are at present an unacceptable doctrinal foundation. These publications leave the reader confused at best and more often misled due to the author's poor understanding and communication of systems theory and the continued use of generalized depictions (Figure 2) of the design process. Resisting prescriptive, detailed solutions, and employing persons with a credible base of knowledge in systems theories, these two fundamental Joint Publications must be revised. Lastly, resistance encountered during the staffing process of these documents should be anticipated and those members of the Joint Staff responsible for adjudication of comments should be prepared to dismiss comments that attempt to apply linearity to the process based on an ignorance of systems theories and nonlinearity.

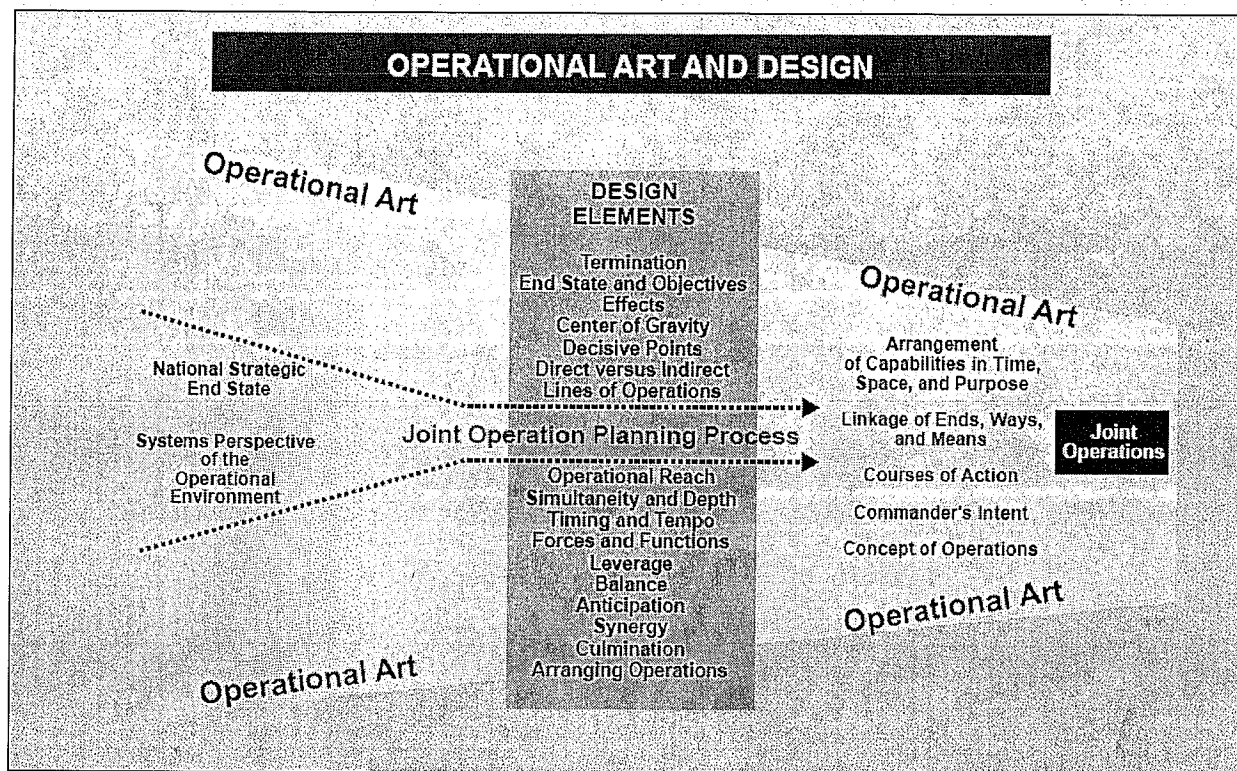


Figure 2

Conclusion

To be certain, operational design is no panacea. Full acceptance, immediate revision of doctrine, and implementation of design across our services for application at each level of war would not remove the difficulties that are inherent in warfighting and other military action. Adoption of operational design by the U.S. military will provide an approach to functioning effectively within a complex environment in the near-term, while serving as a catalyst for a more comprehensive understanding of systems thinking in the long-term.

Our military's experiences in Operation Iraqi Freedom and Enduring Freedom have left military professionals at all levels wrestling with our current doctrine and processes. Questions as to the applicability of our education, training, manning, and equipping that was ostensibly designed for wars of fire and maneuver continue to be raised. Voices of moderation and

experience call for restraint in making large “corrections”, suggesting that our force does not need to change its capabilities, but rather that we simply need to expand them. An uncommitted observer of our situation might suggest that we are developing a new paradigm and potentially are on the verge of a paradigm shift.

Considering a paradigm as a “the way that we perceive the world: water to the fish”²⁸ we might deduce that our military as an institution has operated in a paradigm of linearity since its inception. Without arguing that there have been instances and individuals who have operated in another paradigm, the question arises as to whether or not a nonlinear paradigm is beginning to form institutionally and more importantly whether the institution is able to recognize its existing paradigm and a corresponding need for change. Werner Erhard commented that paradigms “are so much a part of who we are that it is difficult for us to separate ourselves from them enough to be able to talk about them. We do not think these assumptions, we think from them.”²⁹ Considering this idea while reflecting on Thomas Kuhn’s view that the search for a replacement paradigm is driven by the failure of the existing paradigm to solve certain important anomalies,³⁰ it is reasonable to believe that a continued exploration of nonlinearity by the Department of Defense and its subordinate institutions might find us more prepared to solve anomalies that begin to present themselves more as regularities in the not so distant future.

- ¹ U.S. Joint Chiefs of Staff, *Joint Operations*, JP 3-0 (Washington, DC: U.S. Joint Chiefs of Staff, 17 September 2006, incorporating Change 1, 13 February 2008), xix.
- ² U.S. Department of the Army, *Commander's Appreciation and Campaign Design*, TRADOC Pamphlet 525-5-500, Version 1.0 (Fort Monroe, VA: U.S. Department of the Army, Training and Doctrine Command, January 28, 2008), 13-14.
- ³ U.S. Joint Chiefs of Staff, *Department of Defense Dictionary of Military and Associated Terms*, JP 1-02 (Washington, DC: U.S. Joint Chiefs of Staff, 12 September 2001, amended through 03 May 2008), 534.
- ⁴ Heinz, Pagels, *The Dreams of Reason: The Computer and the Rise of the Sciences of Complexity*, (New York, NY: Bantam Books, 1989), 40-41.
- ⁵ Alan D. Beyerchen, "Clausewitz, Nonlinearity and the Unpredictability of War," *Coping with the Bounds: Speculations on Nonlinearity in Military Affairs*, Tom Czerwinski (Washington, DC: National Defense University, 1998), 165-166.
- ⁶ Tom Czerwinski, *Coping with the Bounds: Speculations on Nonlinearity in Military Affairs*, (Washington, DC: National Defense University, 1998), 8-9.
- ⁷ Heinz, Pagels, *The Dreams of Reason: The Computer and the Rise of the Sciences of Complexity*, (New York, NY: Bantam Books, 1989), 41.
- ⁸ John H. Holland, *Hidden Order: How Adaptation Builds Complexity*, (New York, NY: Helix Books, 1995), 38-39.
- ⁹ Jeff Conklin, *Dialogue Mapping: Building Shared Understanding of Wicked Problems*. (West Sussex, England: John Wiley & Sons, 2006), 18.
- ¹⁰ Headquarters U.S. Marine Corps. *Command and Control*. MCDP 6. (Washington, DC: Headquarters U.S. Marine Corps, 04 October 1996), 45.
- ¹¹ Headquarters U.S. Marine Corps. *Marine Corps Planning Process*. MCDP 5-1. (Washington, DC: Headquarters U.S. Marine Corps, 05 January 2000), 1-1.
- ¹² *Joint Operations*, IV-4.
- ¹³ Holland, 39-40.
- ¹⁴ James Gleick, *Chaos: Making a New Science*. (New York, NY: Penguin Group, 1988), 20.
- ¹⁵ U.S. Department of the Army, *Counterinsurgency*, FM 3-24/MCWP 3-33.5 (Washington, DC: U.S. Department of the Army, December 2006), 4-3.
- ¹⁶ John F. Schmitt, "A Systemic Concept for Operational Design," Manuscript, Marine Corps Combat Development Command, http://www.au.af.mil/au/awc/awcgate/usmc/mcwl_schmitt_op_design.pdf, (accessed February 3, 2009), 23.
- ¹⁷ Schmitt, 25.
- ¹⁸ *Oxford Dictionary of Modern English*, 4th ed, s.v. "Intuition."
- ¹⁹ Beyerchen, 200.

²⁰ Schmitt, 25-26.

²¹ Mike Ronza, Marine Corps Command and Staff College, January 28, 2008. An inquiry was made to Mr. Ronza regarding whether the Marine Corps Command and Staff College curriculum had established educational objectives or formalized instruction on operational design to which a negative reply was given.

²² Gleick, 23

²³ Charles Edward White, *The Enlightened Soldier* (Westport, CT: Praeger Publishers, 1989), 5.

²⁴ Schmitt, 18.

²⁵ Conklin, 4-5.

²⁶ Milan Vego, "Systems versus Classical Approach to Warfare." *Joint Forces Quarterly*, Issue 52, 2009, 40-48.

²⁷ Beyerchen, 205.

²⁸ Adam Smith, *Powers of the Mind*

²⁹ Debra Feinstein, "Breaking Out of the Box: A Crash Course in Paradigm Thinking" *Benchmark, A Quarterly Magazine for Xerox Customers* (Fall 1989 Edition), 1.

³⁰ Alexander Bird, "Thomas Kuhn", *The Stanford Encyclopedia of Philosophy* (Fall 2008 Edition), <http://plato.stanford.edu/entries/thomas-kuhn>, (accessed February 3, 2009), 5.

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