

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to Washington Headquarters Service, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188) Washington, DC 20503.

PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.

1. REPORT DATE (DD-MM-YYYY) 01-05-2012		2. REPORT TYPE Master of Military Studies Research Paper		3. DATES COVERED (From - To) September 2011 - April 2012	
4. TITLE AND SUBTITLE Simplifying Operational Design				5a. CONTRACT NUMBER N/A	
				5b. GRANT NUMBER N/A	
				5c. PROGRAM ELEMENT NUMBER N/A	
6. AUTHOR(S) Horton, Terry W. Major, USMC				5d. PROJECT NUMBER N/A	
				5e. TASK NUMBER N/A	
				5f. WORK UNIT NUMBER N/A	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) USMC Command and Staff College Marine Corps University 2076 South Street Quantico, VA 22134-5068				8. PERFORMING ORGANIZATION REPORT NUMBER N/A	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) N/A				10. SPONSOR/MONITOR'S ACRONYM(S) N/A	
				11. SPONSORING/MONITORING AGENCY REPORT NUMBER N/A	
12. DISTRIBUTION AVAILABILITY STATEMENT Unlimited					
13. SUPPLEMENTARY NOTES N/A					
14. ABSTRACT This paper provides a contextual background for operational design to provide a basic understanding of systems theory. The paper explains operational design's development and evolution, and provides an explanation of the Marine Corps' apprehension towards wholly adopting operational design within its planning process. Many of the adopted operational design models are incredibly difficult to practice and thus inaccessible and too complicated for the majority of military planners. This paper reintroduces John Schmitt's simplified design process and provides a link between the design process and the operational approach as a recommended methodology for the Marine Corps.					
15. SUBJECT TERMS Operational Design; Systemic Operational Design; Effects Based Operations;					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT UU	18. NUMBER OF PAGES 34	19a. NAME OF RESPONSIBLE PERSON Marine Corps University / Command and Staff College
a. REPORT Unclass	b. ABSTRACT Unclass	c. THIS PAGE Unclass			19b. TELEPHONE NUMBER (Include area code) (703) 784-3330 (Admin Office)

INSTRUCTIONS FOR COMPLETING SF 298

1. REPORT DATE. Full publication date, including day, month, if available. Must cite at least the year and be Year 2000 compliant, e.g., 30-06-1998; xx-08-1998; xx-xx-1998.

2. REPORT TYPE. State the type of report, such as final, technical, interim, memorandum, master's thesis, progress, quarterly, research, special, group study, etc.

3. DATES COVERED. Indicate the time during which the work was performed and the report was written, e.g., Jun 1997 - Jun 1998; 1-10 Jun 1996; May - Nov 1998; Nov 1998.

4. TITLE. Enter title and subtitle with volume number and part number, if applicable. On classified documents, enter the title classification in parentheses.

5a. CONTRACT NUMBER. Enter all contract numbers as they appear in the report, e.g. F33615-86-C-5169.

5b. GRANT NUMBER. Enter all grant numbers as they appear in the report, e.g. 1F665702D1257.

5c. PROGRAM ELEMENT NUMBER. Enter all program element numbers as they appear in the report, e.g. AFOSR-82-1234.

5d. PROJECT NUMBER. Enter all project numbers as they appear in the report, e.g. 1F665702D1257; ILIR.

5e. TASK NUMBER. Enter all task numbers as they appear in the report, e.g. 05; RF0330201; T4112.

5f. WORK UNIT NUMBER. Enter all work unit numbers as they appear in the report, e.g. 001; AFAPL30480105.

6. AUTHOR(S). Enter name(s) of person(s) responsible for writing the report, performing the research, or credited with the content of the report. The form of entry is the last name, first name, middle initial, and additional qualifiers separated by commas, e.g. Smith, Richard, Jr.

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES). Self-explanatory.

8. PERFORMING ORGANIZATION REPORT NUMBER. Enter all unique alphanumeric report numbers assigned by the performing organization, e.g. BRL-1234; AFWL-TR-85-4017-Vol-21-PT-2.

9. SPONSORING/MONITORS AGENCY NAME(S) AND ADDRESS(ES). Enter the name and address of the organization(s) financially responsible for and monitoring the work.

10. SPONSOR/MONITOR'S ACRONYM(S). Enter, if available, e.g. BRL, ARDEC, NADC.

11. SPONSOR/MONITOR'S REPORT NUMBER(S). Enter report number as assigned by the sponsoring/ monitoring agency, if available, e.g. BRL-TR-829; -215.

12. DISTRIBUTION/AVAILABILITY STATEMENT. Use agency-mandated availability statements to indicate the public availability or distribution limitations of the report. If additional limitations/restrictions or special markings are indicated, follow agency authorization procedures, e.g. RD/FRD, PROPIN, ITAR, etc. Include copyright information.

13. SUPPLEMENTARY NOTES. Enter information not included elsewhere such as: prepared in cooperation with; translation of; report supersedes; old edition number, etc.

14. ABSTRACT. A brief (approximately 200 words) factual summary of the most significant information.

15. SUBJECT TERMS. Key words or phrases identifying major concepts in the report.

16. SECURITY CLASSIFICATION. Enter security classification in accordance with security classification regulations, e.g. U, C, S, etc. If this form contains classified information, stamp classification level on the top and bottom of this page.

17. LIMITATION OF ABSTRACT. This block must be completed to assign a distribution limitation to the abstract. Enter UU (Unclassified Unlimited) or SAR (Same as Report). An entry in this block is necessary if the abstract is to be limited.

United States Marine Corps
Command and Staff College
Marine Corps University
2076 South Street
Marine Corps Combat Development Command
Quantico, Virginia 22134-5068

MASTER OF MILITARY STUDIES

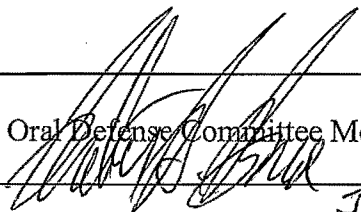
TITLE:
Simplifying Operational Design

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

AUTHOR:
Major Terry W. Horton Jr., USMC

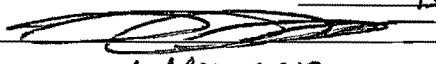
AY 11-12

Mentor and Oral Defense Committee Member: Robert B. Bruce, Ph.D.

Approved: 

Date: 30 April 2012

Oral Defense Committee Member: Bradford A. Wilmers Ph.D.

Approved: 

Date: 1 May 2012

Executive Summary

Title: Simplifying Operational Design

Author: Major Terry W. Horton Jr., United States Marine Corps

Thesis: Operational Design offers Marine Corps planners with a holistic and systemic framework necessitated by the complexity of future war and conflict.

Discussion: The current Marine Corps Planning Process is intended to provide a universal method to planning military operations. However, MCPP has limitations within complex and ill-structured operational environments. Operational Design complements both functional and detailed planning, by providing a holistic conceptual framework that informs the process. While versions of operational design methods have been around for a long period of time, the different versions to include Israeli Systemic Operational Design and TRADOC's version have proven too complicated and procedural for time constrained environments. Systems Theory and systems-thinking application aid planners to better understand the interconnected and complex environment of today and the future. The introduction of John Schmidt's simplified and adaptive Operational Design methodology bridges the gap between the limitations of MCPP and future complex environments.

Conclusion: The end of large scale operations in Afghanistan marks an opportunity for the Marine Corps to indoctrinate operational design, further develop the methodology, and codify it within the planning process.

DISCLAIMER

THE OPINIONS AND CONCLUSIONS EXPRESSED HEREIN ARE THOSE OF THE INDIVIDUAL STUDENT AUTHOR AND DO NOT NECESSARILY REPRESENT THE VIEWS OF EITHER THE MARINE CORPS COMMAND AND STAFF COLLEGE OR ANY OTHER GOVERNMENTAL AGENCY. REFERENCES TO THIS STUDY SHOULD INCLUDE THE FOREGOING STATEMENT.

QUOTATION FROM, ABSTRACTION FROM, OR REPRODUCTION OF ALL OR ANY PART OF THIS DOCUMENT IS PERMITTED PROVIDED PROPER ACKNOWLEDGEMENT IS MADE.

Illustrations

	Page
Figure 1. General Systems Theory Diagram.....	5
Figure 2. Systemic Operational Design Diagram.....	10
Figure 2. Effects Based Operations Model.....	13
Figure 4. Working Draft of Afghanistan/Coin Dynamics.....	22

Table of Contents

	Page
EXECUTIVE SUMMARY.....	i
DISCLAIMER.....	ii
LIST OF ILLUSTRATIONS	iii
TABLE OF CONTENTS.....	iv
PREFACE.....	v
INTRODUCTION.....	1
MAIN BODY.....	2
CONCLUSION.....	23
CITATIONS AND ENDNOTES.....	25
BIBLIOGRAPHY.....	28

Preface

In 2010 while was serving as a battalion operations officer I was introduced to the concept of design through the publication of the MCWP 5-1, *The Marine Corps Planning Process*. MCWP 5-1 introduced design as a part of the planning process but left out what it was and how to “design.” I was intrigued by the idea of creative planning and began a cursory study. What I found was confusing and inaccessible, requiring formal training and education.

As I entered Command and Staff College I was interested in developing a deeper understanding of Operational Design so that I could use it as a planning tool. I began researching the topic in September 2011. It wasn’t until enrolling in LtGen Van Riper’s “Systems Theory” elective that I actually pieced together what it is all about. In reality design does not have to be difficult. Operational Design simply put is discourse. It brings together individuals and subject matter experts to collaborate through discussions.

I’d like to thank LtGen Paul Van Riper (ret.) for his guidance and mentorship. I’d also like to thank LtCol Shawn Callahan and David Major who both offered their guidance, expertise and perspectives. I’d also like to express my sincere appreciation to my MMS mentor, Dr. Robert Bruce, whose patience enabled the completion of this study.

Lastly, I thank my loving wife and family for their continued support and for allowing me to turn our dining room into a library.

Introduction:

As the United States emerges from more than a decade of the Global War on Terror, the Department of Defense, to include the Marine Corps, has a unique opportunity to evaluate, document and codify its counter insurgency tactics, techniques and procedures. This opportunity reminds military professionals of the post-Vietnam experience, and as such, presents a shift in the National Command Authority's grand strategy. This in turn requires an examination of the operational approach required to satisfy national objectives. As such, the Department of Defense began posturing its total force to face economic challenges and maximizing capabilities to meet the national strategy. The U.S.'s operational approach extends beyond force structure, but also includes a requirement to conduct intellectual rigor towards the conceptual approach – the operational art – specifically, that future warfare will increasingly include the complexity of interactions between non-state, hybrid, and irregular actors. Operational design provides a holistic framework and methodology for operational planners and commanders to understand the future's complex operating environment future in their effort to build an operational approach. Therefore, operational design is a necessary planning approach for the Marine Corps as it postures itself in preparation for future war and conflict.

This paper will provide a contextual background for operational design, for two reasons. First, to provide a basic understanding of systems theory – a key component of operational design – and secondly to explain operational design's development and evolution as an explanation of the Marine Corps' apprehension towards wholly adopting operational design within its planning process.¹ As will be later discussed, many of the adopted operational design models are incredibly difficult to practice and thus inaccessible and too complicated for the majority of military planners. Lastly, this paper will reintroduce John Schmitt's simplified

design process² and provide a link between the design process and the operational approach as a recommended methodology for the Marine Corps.

Why Operational Design:

In 2012, Department of Defense and Marine Corps senior leadership published their vision and understanding of an increasingly complex operational environment. In 2012, the Secretary of Defense introduced the latest security strategy which stated, “For the foreseeable future, the United States will continue to take an active approach to countering threats by monitoring the activities of non-state threats worldwide, working with allies and partners to establish control over ungoverned territories, and directly striking the most dangerous groups and individuals when necessary.”³ In February 2012, the Commandant of the Marine Corps addressed the House Armed Services Committee testifying that the Marine Corps is posturing itself as the “middle weight” force; capable of responding to crisis within the world’s littorals and across the spectrum of operations.⁴ The Commandant defines the emerging global environment when he describes, “two parallel worlds exist on this planet a stable progressively growing, developing world and an unstable, disintegrating chaotic world. These two worlds are colliding.”⁵ This view is shared with U.S. Army, who anticipates that the future operational environment will present persistent conflict that is complex, multidimensional, and increasingly fought among the people. The operational approach during the Global War on Terror relied upon the U.S. military’s technological advances, specifically precision munitions. The U.S. sought to separate populations from the battlefield equation but instead focused on engaging and destroying our enemies. In order to fight and win future engagements, the U.S. must recognize that people and populations are frequently part of the terrain and their support is a principal determinant of success in future irregular conflicts.⁶

The complex operational environment described in current national security documents does not present itself as a series of problems waiting to be solved. Rather the operational environment challenges operational planners to understand the impact of strategic, operational and tactical decisions and their effects within the operating environment. To do so requires constant review of the situation, developing action as it is relevant to the ever changing dynamics of the operating environment. Gaining a more nuanced and deep understanding of the problems more effective decisions and initial actions, and an effective operational approach which will include the full range of instruments of national power to affect such change.⁷ To further develop an understanding of a complex and highly interactive operational environment, British military historian John Terraine stated that, “Modern warfare resembles a spider’s web -- everything connects, longitudinally or laterally, to everything else; there are no ‘independent strategies, no watertight compartments, nor can there be.”⁸ Terraine’s spider web metaphor reflects the complex, highly interactive operating environment that appropriately should be analyzed through a systems based approach. As previously mentioned, an interwar period presents the Marine Corps the opportunity to advance an organizational understanding of Operational Design and expand incorporation within doctrine.

An Introduction to Design:

Operational Design complements functional and detailed planning. It does not replace these crucial elements of planning, but rather provides the conceptual framework to conduct the latter steps of planning. Operational Design promotes creativity and creative solutions through inclusivity of subject matter experts. Lastly it is an iterative and flexible process which allows planners to return to previous steps or discourses in order to integrate new information as the operational environment develops or changes.

Defining Operational Design, Systems Theory, and Adaptive Systems:

Operational Design requires a basic comprehension of Systems Theory to include the fundamental aspects of adaptive complex systems. Biologist Ludwig von Bertalanffy proposed Systems Theory in the 1940s.⁹ Bertalanffy introduced this theory for two reasons; first, as a reaction to the trend in reductionism prevalent across the greater scientific community and secondly to unify the disparate disciplines and fields of study as a means to explore and study the natural universe. He emphasized that real systems (like the universe) are open to, and interact with, their environments, and that they can acquire qualitatively new properties through emergence, resulting in continual evolution.¹⁰ Rather than reducing an entity (e.g. the human body) to the properties of its parts or elements (e.g. organs or cells), systems theory focuses on the arrangement of and relations between the parts which connect them into a whole.¹¹ This particular organization determines a system, which is independent of the concrete substance of the elements (e.g. particles, cells, transistors, people, etc.). Thus, the same concepts and principles of organization underlie the separate disciplines (physics, biology, sociology, etc.), and provides a basis for their unification. Figure 1 below provides a basic illustration of Systems Theory, categorizing different examples within the range or levels of complexity and the scientific theory associated with each level.

GENERAL SYSTEMS THEORY				
	Level	Examples	Theory	
Complexity ↑ ↓ Low	High	Symbolic Entities	Math, Grammar	Philosophy, Logic, Art
	Socio-cultural Entities	Governments, Families	History, Sociology	
	Humans	Males, Females	Psychology, Physiology	
	Animals	Mammals	Zoology	
	Complex Organisms	"Plant-like" Organisms	Biology	
	Micro-Organisms	Cells	Genetics	
	Control Mechanisms	Thermostat	Cybernetics	
	Clock Works	Conventional Machines	Newtonian Physics	
	Low	Static Structures	Atoms, Molecules	Chemistry

Figure 1: General Systems Theory¹²

The emerging interdisciplinary science of complex adaptive systems developed from the study of Systems Theory.¹³ A system is defined as a group of independent but interrelated elements comprising a unified whole.¹⁴ A complex system is comprised of multiple actors interconnected and interactive. The interconnected nature of the actors allows semi-autonomous decision making that determines behavior within general guidelines of the system.¹⁵ Complexity arises when these actors interact freely and in unanticipated ways. The result of the interactions and relationships within the system forms an emergent characteristic, making the system different than the sum of its individual parts, forming a higher order system.¹⁶ This environment is non-linear, and requires holistic study of the complete system.¹⁷ Adaptive systems naturally self-organize where individuals freely make decisions.¹⁸ The nonlinear interactions between the actors produce adaptive and emergent behavior and shift the system into a new state.

Design provides a basis to study adaptive complex systems and is an emerging system of logic that falls under modern organizational theories such as General Systems Theory, post-

modern philosophy, complexity theory, and organizational theories.¹⁹ Operational Design is the military application of design as a non-linear and iterative process that does not end once the solution has been identified.²⁰ It allows for a greater understanding of a complex and interactive system to include warfare, and is a logical methodology that should be used to solve the most complex and interactive problems, such as found in irregular warfare.

Decision Making Processes:

In addition to understanding Systems Theory, the basics of decision making processes offer additional reasons to use Operational Design. Cognitive research psychologist Gary Klein introduced in the late 1990s the idea that that problem sets fit within a range of interactive and structurally complex systems.²¹ Klein introduced three approaches to decision making – analytic, intuitive, and systemic approaches – whose application are best suited to either “tame” or “wicked” problems.²²

Klein further posited that the military has idealized an analytic approach formalized within both the Marine Corps Planning Process (MCP) and Military Decision Making Process (MDMP).²³ Klein argued that the analytic approach, “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 score to find the best option.”²⁴ This mirrors the current steps of MCP and MDMP. Klein however, argued that the results of this systematic approach is disappointing as the process is too time consuming and inflexible to changes in the operating environment.²⁵ To Klein, military leaders are wholly suited to coping under time constraints and within dynamic conditions.²⁶ Therefore, rather than reverting to an analytic process, his intent was to provide alternative techniques and a variety of decision strategies based on the situation and type of problem.²⁷

Klein's second approach was based on rationale and described as analytic or systematic (not systemic).²⁸ This approach, like the intuitive approach, applies to well-structured problems. The analytic approach reduces the problem to key components and is linear in nature and introduces multiple courses of action to determine an outcome.²⁹ An example of this is a military commander planning a conventional military operation against a conventional force. In this construct, the commander's lines of operation are physical or geographic in nature, and the commander is seeking to execute an operational maneuver with his force against the enemy. Under this construct, the commander may have multiple options, to include a penetration, maneuvering from the ground, air, or from the sea, or a blend of any of these domains. It is worth noting that this type of operation is complex but not necessarily ill-structured or wicked.

In addition to the analytic model, Klein offered two additional approaches to decision making. The intuitive approach to decision making was based on experience where situational assessment occurs based on a decision that "satisfices" the situation.³⁰ A solution that satisfices is one that is not necessarily the best option but one that satisfies the minimum requirement for a problem.³¹ As Klein pointed out, an example of this is an experienced Brigade Commander examining a map, recognizing and selecting a specific location as an engagement site, despite being offered multiple alternatives by less experienced subordinates. The Brigade Commander quickly dismissed the alternatives, because his skill and experience generated the correct solution without generating additional options.³² In this example, the type of decision making is intuitive or recognition based. The Brigade Commander recognized the correct course of action based on his experience and determined the appropriate solution. Interestingly, Klein offered that the decision maker in this context may not recognize that a decision is being made, but rather the decision maker is merely reacting to the situation.³³ Within the context of Klein's

exhaustive study, he found that eighty-five percent of decisions are intuitive.³⁴ Furthermore, this type of decision making naturally falls within a well-structured problem-set as the decision maker recognizes the situation and can therefore determine a solution based on their skill and experience.

The third decision making approach applies to structurally complex and ill-structured problems and is based on reasoning. Ill-structured or wicked problems are not readily understood. Wicked problems stem from complex and interactive situations. They require a holistic and systemic approach to enhance a more thorough understanding of the situation as a means to too develop potential solutions. This decision making approach is based on naturalistic reasoning.³⁵ An example of this is a commander planning a counter insurgency operation. In this type of model, the nature of the system is non-linear, with vicious cycles of nested networks. For a commander in this environment, he must first recognize that traditional approaches may not necessarily defeat the enemy. This environment may have traditional lines of operations (operational maneuver), logical lines of operations (governance, economic development, essential services), or a mixture of the two. It can be equated to the Three-Block War Concept developed by the Marine Corps in the 1990s. That is, that a military unit may be conducting full scale military operations, peacekeeping operations and humanitarian aid all within the same area of operation. It is within this ill-structured environment that Operational Design provides a structured but holistic approach.

Systemic Operational Design

Former Israeli Brigadier General Shimon Naveh first introduced operational design for military application in his book, *In Pursuit of Military Excellence: The Evolution of Operational Theory*. Naveh examined more than two centuries of historical case studies, tracing the

evolution and development of what was then in 1997 operational theory. Naveh called his methodology Systemic Operational Design (SOD). As a result of his findings, the Israel Defence Force (IDF) stood up the Operational Theory Research Institute (OTRI), a think tank and training center, under the direction of Naveh. The OTRI was responsible for developing SOD as a discipline, and educating the IDF officer corps.³⁶ “Naveh’s interest in the field began with his belief that there was a problem with the manner that the concept of campaign analysis and planning was understood, explained and applied.”³⁷ Specifically, Naveh and the OTRI believed that the successful outcome of the 1973 Arab-Israeli War was a result of Israeli tactical expertise alone, while the Israelis lacked the requisite operational level acumen.³⁸ As a result, Naveh pursued a historic examination of operational art in order to develop the IDF’s capacity toward the operational art of war.

Naveh defined Systemic Operational Design as the application of systems theory to operational art. SOD drew upon systemic rational to better understand the increasing complexity of Israel’s struggles with Hezbollah, Palestine, and other Middle Eastern actors. SOD’s holistic approach translated strategic direction and policy into operational level plans. SOD focused upon the relationships between entities within a system to develop rationale for systemic behaviors in an attempt to define the logic of the system. SOD facilitated a planning battle rhythm or cycle of: design, plan, act, and learn. This was accomplished through seven discourses, leading to a holistic design of an operation that would facilitate planning.³⁹

Philosophically, SOD accepts that planners can never fully understand the operational environment which is described as the system. Furthermore it accepts that planners cannot fully map the entire system. Therefore, each engagement between friendly forces and the enemy

offers an opportunity to learn. That is ongoing interactions with the enemy allow a detailed understanding and greater fidelity of the operational environment.⁴⁰

Theoretically, SOD originated from General Systems Theory, as previously described. To the un-initiated, SOD was a highly complicated model that is best summarized by Figure 2 below. To the well versed it is riddled with hundreds of steps and procedures, steeped in epistemological terminology, and remains extremely challenging to comprehend.

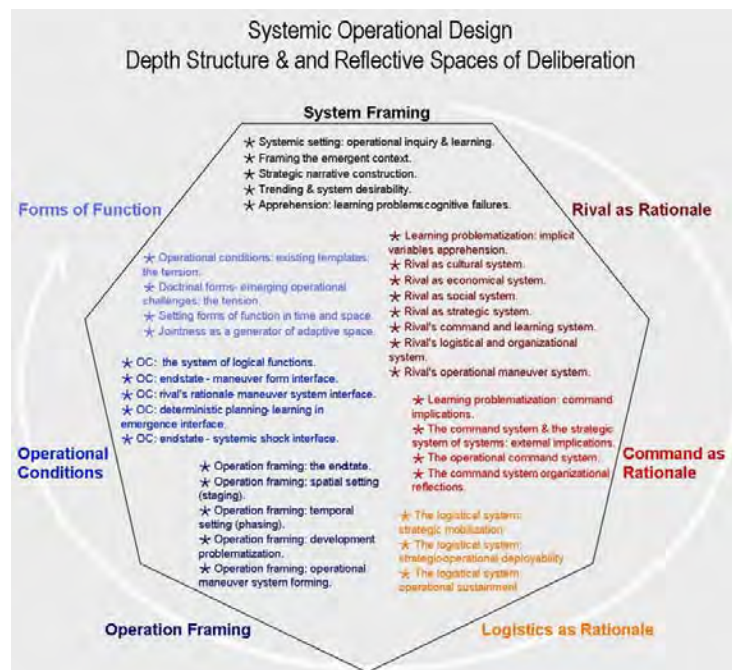


Figure 2: Systemic Operational Design Discourses⁴¹

For American military planners, SOD was tremendously complex, requiring extensive study. As depicted in figure 2, the methodology is comprised of seven sets of structured frames, broken further into interrelated sub-components. To add to its complexity, Naveh's use of epistemology as a basis of terminology further confused the student of SOD. Naveh himself admitted that intellectual rigor is required to understand SOD. As a part of this challenging planning model, Naveh required students of SOD to understand systems theory, chaos theory,

complexity theory as well as the ability to think in both traditional linear terms as well as non-linear and non-conventional terms.⁴²

The U.S. Army and TRADOC:

Colonel Robert Johnson, Director of the Futures Directorate of Training and Doctrine Command's (TRADOC)s Army Concepts Integration Center, initiated the U.S. Army's study of SOD in 2004. As a part of the Army's Title 10 required 2005 planning exercise, Unified Quest, the Army's School of Advanced Military Studies (SAMS) committed six students to study under Naveh. TRADOC began a careful examination and evaluation of Shimon Naveh's ideas on Systemic Operational Design. That endeavor was later informed by a notable article, "Dilemmas in a General Theory of Planning" in *Policy Sciences* (1973), by Horst W. J. Rittel and Melvin M. Webber. The result was a multi-year study and development of a U.S. Army Operational Design process similar to Systemic Operational Design's in its prescriptive number of processes and complexity. It differed however; as it linked Operational Design to the Military Decision Making Process (MDMP) as a way of informing the analytical process of functional and detailed planning. TRADOC provided the next step in the Design lexicon, breaking its methodology into three core areas; the Environmental Frame (describes the operational environment), the Problem Frame (describes the problem) and the Design Concept (possible solutions). TRADOC's "*Art of Design*", was codified as a 331-page student text for the Army's School of Advanced Military Studies (SAMS). Unfortunately this text is not readily accessible or understandable to non SAMS graduates.

The Joint Staff and Effects Based Operations:

During the early 1990's the U.S. military began looking specifically at systems based effects as a means to attack an enemy system. Effects-Based Operations (EBO) traced its origin

back to the Gulf War of 1991, and it is widely credited as the reason for the successful operations in Iraq during 1991. EBO incorporated the ideas of parallel attack, system shock, maneuver warfare and rapid dominance over the enemy.⁴³ As an operational concept it utilized technological advances, to include guided precision weapon systems and highly advanced aerial platforms as a means to knock out enemy command and control and other key nodes in order to achieve rapid success and enemy capitulation.

Similar to SOD, EBO used elements of System Theory. However EBO used System of Systems Analysis (SoSA) which is a departure from SOD's holistic approach. SoSA is an analytical process that examines a potential adversary and/or operational environment as a complex, adaptive system, including its structures, behavior, and capabilities to identify and assess critical factors and system interrelationships.⁴⁴ Figure 3 below, taken from the Joint Effects Based Handbook provides the visual depiction of Effects Based Operations based on the Systems of a Systems Approach. EBO planners built nodal model of the operational environment, determine interconnected linkages which would then provide a center of gravity that would be targeted to achieve a specific effect.⁴⁵

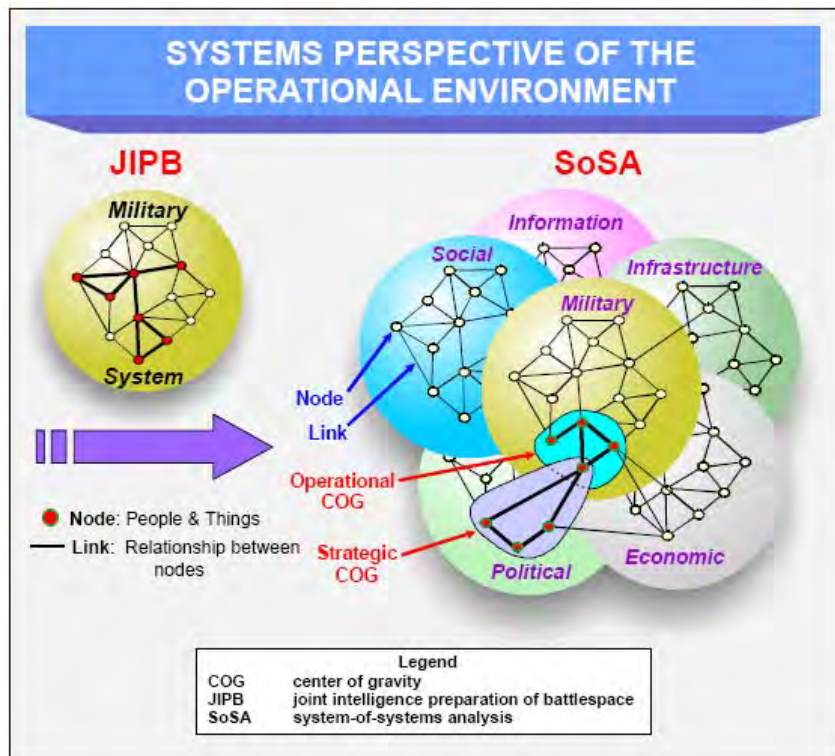


Figure 3: EBO System Perspective⁴⁶

Within this model the planning staff designed the construct of the operational system, within the key areas of a Political system, Military system, Economic system, Social System, Information System, and Infrastructure system (PMESII). Joint EBO planners then focused on nodes and linkages deemed necessary to achieve desired strategic and operational effects. Within this planning construct, key nodes that exert influence in numerous other sub-systems may have many or extremely intense links to other nodes.⁴⁷ By reducing the system and identifying the key nodes, joint forces would direct kinetic action where prescribed with predictive results.

It is necessary to examine Effects Based Operations as a part of the development of operational design. EBO drew from systemic rationale, however distorted the intended purpose of operational design, developing creative solution sets using a holistic method of understanding

a wicked problem within a complex environment. Additionally, EBO served as the Joint community's planning model and principle Joint operational concept for more than twenty years. The primary problem with this model of design is its inherent reductionist basis. It suggests planners have the ability to reduce a system or operating environment to its core elements (political, military, economic, social, information, infrastructure), then assumes a particular action will have determined effects. This denies the basic principles of systems theory and more importantly denies an understanding of how an irregular environment behaves. Artificially bounding a system into a PMESII model and only analyzing its reduced subcomponents does not provide a holistic view of interactions. The system itself is non-linear and more complex than the artificial PMESII mental model. Furthermore, the joint EBO model ignores culture, language, religion, and geography; are all key components of any complex operating environment.

Reducing the enemy's system to this narrow view may result in ignoring significant factors that do not neatly fit into these reduced factors. The driving criticism of this type of reductionism design process is that all actions create second and third order effects cascading within and across the overall system. Additionally, as system theory describes, systems are sensitive to initial conditions. Therefore, incorrect initial assumptions – even in minutia – may result in distinct and large differences in results.⁴⁸ Lastly, this operational concept's applicability only resonates within conventional warfare and fails to answer an IW environment to include COIN.

Operational Design prescribes creating mental models as a visual tool to help better understand an ill-structured problem, whereas SoSA and EBO create a nodal model as the

solution itself. The logical problem with this is that the model is truly artificial and thus does not accurately reflect the actual system or operational environment.

The Joint Staff moves to Design:

A year after assuming command of Joint Forces Command in 2008, General James Mattis issued a directive to his staff stating that: “Effective immediately, USJFCOM will no longer sponsor or export the concepts related to EBO, ONA and SoSA in our training, doctrine development and support of JPME.”⁴⁹ Understanding design and its iterative nature, General Mattis directed a complete overhaul in operations, tasking Joint Forces Command to further develop design and incorporate it within joint doctrine. As a result, in September 2010, Joint Forces Command published *Pamphlet (PAM) 10: Design in Military Operations, A Primer for Joint Warfighters*. In its opening message to the reader, PAM 10 quotes General James Mattis, “Standard planning processes...have served us well to this point,” but qualifies, “commanders and staffs generally tend to use these processes mechanically, with a focus on procedural steps and details that obscure the importance of the underlying creative process required for design.”⁵⁰ The publication provides a thorough design framework for a future Operational Design Planner’s Handbook that would be published at a later date. PAM’s authors incorporated parts of SOD and EBO but in no way endorsed either method.⁵¹ Specifically PAM 10 provided the following design components:⁵²

- Frame the environment
- Frame the problem
- Develop the operational approach
- Document the results
- Reframe as required

These components combine the essence of operational design and meet the needs of planners. As PAM 10 described, the publication's intent was to, "make sense of a complex environment, to aid in identifying and understanding problems in that environment, and to develop an approach that addresses those problems."⁵³ Furthermore, PAM 10 signaled a shift towards operational design as a lynchpin to planning throughout the services. This led to the Marine Corps' 2009 review of operational design within the Marine Corps Planning Process.

The Marine Corps and Design:

The Marine Corps MAGTF Staff Planning Team (MSTP) integrated portions of design during the most revision of MCWP 5-1, *The Marine Corps Planning Process*. Within it, MSTP transitioned the first step of planning from Mission Analysis to Problem Framing while introducing that design is the *Marine Corps Planning Process*.⁵⁴ MCWP 5-1 committed one page to Operational Design, describing it as, "not prescriptive or a checklist, design is based on critical thinking, conceptual planning, visualization, emergence of a hypothesis, and continuous activity."⁵⁵ For Marine planners, MCWP 5-1 provided the first glimpse of design, but failed to provide a meaningful guide of a design process.⁵⁶

During the revision of MCWP 5-1 in 2009, Lieutenant General Paul van Riper (ret.) was requested to critique the new publication. His critique noted that the Marine Corps' over reliance on a mechanical, step-by-step process, that seeks multiple courses of action, fails to properly design or understand the situation that would require the planning process to be used. Furthermore, his critique sharply describes that the authors of MCWP 5-1, merely "tacked on half formed ideas of the design process."⁵⁷

Conceptually, the requirements for operational design is found within Marine Corps doctrine. Doctrinal publication MCDP 5, *Planning* describes:

When the problem is more complicated—involving a variety of factors—planning becomes essential. This is even more crucial when the problem is actually a complex set of interrelated problems, the solution to each of which affects all the others. If the situation is complex enough, planning may offer the only opportunity to deal with the complete set of problems as a whole.⁵⁸

Although MCDP 5 describes that operational design is needed only a minor inclusion were incorporated within the newly revised MCWP 5-1. The reason for this may be found in the numerous criticisms of operational design.

Criticisms of Operational Design:

One of the major cases against operational design is the IDF's application of SOD in 2006 against Hezbollah in Lebanon. While many blamed Israel's lack of success on the poor translation of SOD into operations, the IDF overly relied on airpower, high technologies, and the application of Effects Based Operations similar to the former U.S. Joint operational concept.⁵⁹ Proponents of SOD, specifically Naveh concluded that the IDF inappropriately blurred EBO and SOD.⁶⁰ Naval War College Professor Milan Vego, a critic more so EBO than SOD, argued that the IDF fully embraced EBO at the expense of SOD. As a result the Israelis confronted the crisis in Lebanon with precision strikes against key infrastructure without fully appropriating the requisite ground forces.⁶¹ The Israelis essentially relied on targeting and their technological advantage (EBO) whereas the situation was more complex and ill-structured requiring a more holistic approach. Naveh himself explained the problem, indicting his own methodology in the process when he stated, "It is not easy to understand; my writing is not intended for ordinary mortals."⁶² Regardless, the reputation of Naveh's SOD doctrine suffered as its principles and concepts were perceived as failures in a real world operation. This in turn discredited operational design in general, as the multiple versions or brands of design are frequently

confused.⁶³ In reality, the IDF executed EBO operations, but operational design was the perceived culprit.

Former Marine Corps School of Advanced Warfighting director Colonel Alex Vohr discussed operational design's shortcomings in the *Marine Corps Gazette* in 2010 where he offered, "If design is practiced as a stand-alone effort, it appears to have the greatest application at the strategic level of war but is difficult to translate to tactical tasks or action."⁶⁴ He further describes that current warfare and planning revolve around time cycles to include fires and aviation cycles.⁶⁵ Therefore from his perspective, the application of operational design does not lend itself well within a time constrained environment, nor does it fit within Marine Corps tactical or operational application.⁶⁶ This argument has merit if the operational design process cannot be simplified to enable more rapid planning and reduce procedural steps that require technical expertise.

Another critique of Operational Design is the high level of education and training required to understand the procedural steps. Critics argue that there is a requirement for designers to understanding complex scientific theories, and consequently it "may not be accessible for those not well educated to employ it effectively."⁶⁷ Again, this critique has merit when looking at the lengthy and complicated versions found in SOD and TRADOC's Operational Design methodology.

The Way Ahead:

The criticisms against Operational Design have merit and must be addressed for organizational acceptance within the Marine Corps. Simply stated, the Marine Corps needs a methodology that proves useful to the commander in a complex operating environment. Therefore, recommendations for the Marine Corps must address and introduce a simplified

methodology. In addition, education and codification within Marine Corps doctrine is required for organizational endorsement.

Planners using the Marine Corps Planning Process for are hindered by using analytic approaches alone. They require a more holistic and unconventional method to enhance their understanding of a complex situation and environment prior to conducting their detailed planning. The current conventional approach to war is reductionist and linear and is better suited for conventional warfare between states.

Technological innovations have emphasized the “science,” rather than the “art” component of warfare, touting that wars can be won using deterministic Newtonian cause-and-effect approaches that are enforced through technologically networked centrality.⁶⁸ This is not the case. War, like ecosystems and economies, is a complex adaptive system. The interactive complexity that comprises such systems produces undeterminable outcomes and makes linear understanding impossible for the human mind.⁶⁹

Success in complex adaptive war requires understanding of systems thinking and the ability to see wholes that result from interactive complexity – “seeing interrelationships...and processes of change rather than snapshots.”⁷⁰ Without a systems thinking approach, military problem solving is largely based upon a linear cause-and-effect construct. This approach is suitable for problems “tame” in nature. That is, problems that lends themselves to predictive analysis result in a recognizable resolution to the problem. Unfortunately, without understanding the impact on the complete system as a whole, this type of linear problem-solving may lead to graver consequences.

If we accept that new, complex, and ill structured problems are likely to be found in future operational environments, we must acknowledge that they require holistic planning and

creative solutions. Fortunately, a simplified design model exists and has existed since 2004 when John Schmitt introduced an operational design methodology to the Marine Corps Combat Development Command.

Design “Light”⁷¹

In 2004, the Marine Corps Combat Development Command contracted former Marine Officer and author John Schmitt to develop a conceptual approach to design.⁷² He submitted, “A Systemic Concept for Operational Design,” that provided an operational design methodology less prescriptive than SOD.⁷³ Schmitt’s simplified approach incorporated key aspects of SOD, without mirroring the lock-step processes. Specifically, his methodology embraced discourse, using framed discussions as the means to enable an operational planning team to develop a better understanding of complex and ill-structured problems, and to develop better informed solutions. This methodology defined operational design as “the candid exchange of ideas without fear of retribution that results in a synthesis and a shared understanding.”⁷⁴

Schmitt further defined design as a “structured reasoning process.”⁷⁵ The design process is creative by nature, and relies on open and interactive discussions (discourses) amongst the commander, subordinate commanders, planners and subject matter experts.⁷⁶ Furthermore, this model requires mental agility, debating ideas within the planning team in order for the commander, his subordinate commanders and the staff to better understand the environment, interactive complexity, and subsequently determine an operational approach. The operational approach will inform the commander’s lines of operation (LOOs) conceptually, as the staff and subordinate commands conduct functional and detailed planning to flush out and the concepts into applicable tasks.

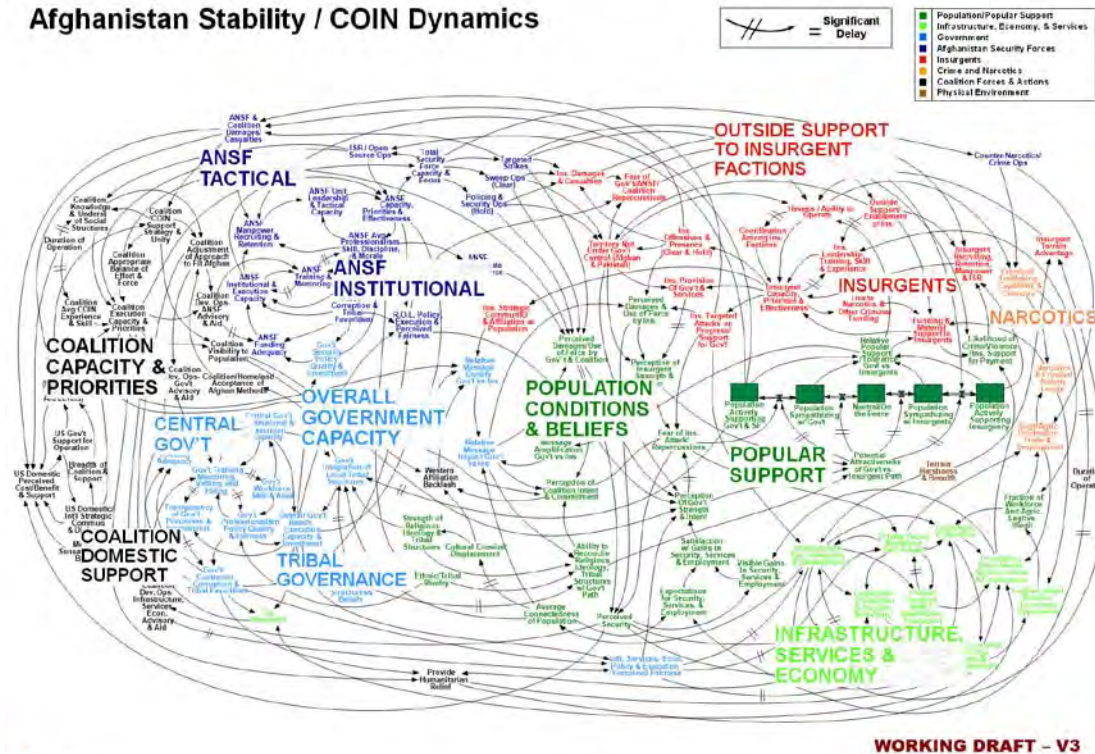
To do this, four discourses or discussions occur:⁷⁷

- Discourse 1: Develop an Understanding of the Situation
- Discourse 2: Develop a systems model(s)
- Discourse 3: Use the model(s) to gain additional insight
- Discourse 4: Propose Action

The first step includes developing a rich understanding of the situation from various perspectives. The next step includes developing system models to explain the existence and dynamics of the situation. The third step uses the models to gain additional insights into the situation. Again, this is another structured discussion based on the system models. The last step in this model of design is the proposal of actions to improve the situation again through meaningful group collaboration and discussion based on the system models. What emerges from the discourses is a meaningful understanding of the operational environment, translated as the commander's narrative of the operation. The narrative informs the operational approach by the providing the commander's conceptual understanding of the environment, his vision and proposed actions. The operational approach translates as the lines of operations, either functional or physical or potentially a combination of the two.

What is important to note is that the system model is simply a visual representation of how the planning team views and understands the system. It is artificial as it is impossible to perfectly represent the system, but it is a useful visualization tool for developing an understanding of actors and inter-relationships. Due to their complex visual representations, mental models such as the one provided in Figure 4 below are not easily translated to those outside the planning team.

Afghanistan Stability / COIN Dynamics



WORKING DRAFT - V3

Figure 4: Working Draft of Afghanistan/Coin Dynamics⁷⁸

What is important about creating the mental model is that it provides a visual representation of the operational environment as well as what was learned during the discourse.

Operational design provides is the holistic view of the operational environment, enabling synchronization across physical and logical lines. The iterative nature of operational design also provides the feedback mechanism to determine how the system (operating environment) reacted to effort, and re-designing as necessary. Furthermore, its less formal structure allows introduction of interagency partners and subject matter experts to the design in order to provide a deeper understanding of the problem and a synchronization or unity of interagency efforts along the logical lines of operation. This requires the Marine Corps' to commit to reengaging this

topic with intellectual rigor and incorporate a thorough and descriptive design method within the *Marine Corps Planning Process*.

As a part of introducing a simplified and flexible operational design method, such as Schmitt's model of operational design within doctrine, the Marine Corps needs to educate its officer Corps. In keeping with the Commandant's priority for education;⁷⁹ the introduction of systems theory and operational design should be included in Career and Intermediate level schools. In 2012, the Marine Corps' Intermediate Distance Education program codified a course lesson on operational design as a component of the Operational Art curriculum. This is a step in the right direction. The resident Command And Staff College curriculum currently provides Systems Theory (and operational design) as an elective as well as introduced Design as a method of planning as a part of its 2012 Counterinsurgency Exercise. However, formal instruction on operational design should be introduced within the Expeditionary Warfare School's Marine Corps Planning Process courseware, and expanded at the Command and Staff College. Such instruction will better prepare company and field grade officers to use operational design as a part of the planning process.

Conclusion:

The current Marine Corps Planning Process is intended to provide a universal method for planning military operations. However, MCPP has limitations within complex and ill-structured operational environments. Operational design complements both functional and detailed planning, by providing a holistic conceptual framework that informs the process. While versions of Operational Design methods have been around for a long period of time, the different versions to include Systemic Operational Design and TRADOC's version are too complicated and procedural for military officers and planners. It is important to understand that the recommended

operational design approach for the Marine Corps is not the Israeli Systematic Operational Design, TRADOC's Operational Design, nor is it Effects Based Operations. The introduction of a simplified and adaptive operational design methodology bridges the gap between the limitations of MCPP and future complex environments. It is based on systems theory and systems-thinking aids planners in better understanding the interconnected and complex military environment. The end of large scale operations in Afghanistan marks an opportunity for the Marine Corps' to indoctrinate Operational Design, further develop the methodology, and codify it within the planning process.

Endnotes

¹ The author recognizes the distinction between operational design as a concept as well as Operational Design as a distinguishable process developed by the U.S. Army. When capitalized the author is referring to the Army's design model as compared to capitalized which is the concept.

² John Schmitt authored the paper, "A Systemic Concept for Operational Design" in 2004 for the Marine Corps Combat Development Command. MCDP 5-1, the Marine Corps Planning Process" incorporated Design as a minor piece of its first step, providing limited information or background information on Operational Design. MCDP 5-1 replaced Mission Analysis with Problem Framing as the beginning step of the Marine Corps Planning Process. .

³ Secretary of Defense Guidance; Sustaining U.S. Global Leadership: Priorities for 21st Century Defense. January 2012: 1

⁴ CMC 2012 HASC Posture Statement, 2, 7-8

⁵ CMC testimony to House Armed Services Committee, November 2, 2011.

⁶ FMI 5-2, 1

⁷ Ibid

⁸ John Terraine, *A Time for Courage*, 515.

⁹ Ludwig von Bertalanffy, *General System Theory: Foundations, Development, Applications*, (New York: George Braziller, 1968), 19.

¹⁰ Bertalanffy, 37

¹¹ Bertalanffy, 37

¹² Effects Based Handbook Sup 1, 2006:3

¹³ The term complex adaptive system was coined at the interdisciplinary Santa Fe Institute, established in 1984, by John H. Holland. The institute was founded with the belief that an understanding of complex adaptive systems is critical to addressing key environmental, technological, biological, economic, and political challenges. Morowitz, Harold J. and Singer Jerome L. *The Mind, The Brain, and Complex Adaptive Systems* (Reading: Addison-Wesley Publishing Company, 1995).

¹⁴ Kilcullen, David. *Irregular Warfare: A systems Assessment* (Canberra: Australian Army Headquarters, September 2004), 5.

¹⁵ Bennet, Alex and David. *Organizational Survival in the New World: The Intelligent Complex Adaptive System* (Burlington, MA: KMCI Press, 2004), 290.

¹⁶ Ibid

¹⁷ Schmitt J.F. "Command and (out of) Control: The Military Implications of Complexity Theory" in *Complexity, Global Politics and National Security*, (Washington: National Defense University, 1997), 224.

¹⁸ Ibid

¹⁹ Ludwig von Bertalanffy, *General System Theory; Foundations, Development, Applications*, (New York: George Braziller, 1968) 19. Ludwig von Bertalanffy describes open systems in *General System Theory* as entities consisting of "parts in interaction. The prototype of their description is a set of simultaneous differential equations which are nonlinear in the general case." See also: Gilles Deleuze, Felix Guattari, (translated by Brian Massumi) *A Thousand Plateaus; Capitalism and Schizophrenia* (Minneapolis: University of Minnesota Press, 1987) 398.

-
- ²⁰ Stephan Banach and Alex Ryan, “The Art of Design: A design Methodology”, Military Review, March-April 2009: 106
- ²¹ Gary Klein, “Strategies of Decision Making” Military Review, May 1998, 58
- ²² Nigel Cross, “Forty Years of Design Research”, Design Research Quarterly, December 12 2006: 4 As a component of LtGen Paul Van Riper (ret) elective course on Systems Theory, he introduces the linkage between Klein’s three approaches to Rittel and Weber’s wicked and tame problem. David J. Snowden and Mary E. Boone, “A Leaders Framework For Decision Making”, Harvard Business Review 2007 also introduce simple and complex contexts as a determining factor of what type of decision making process should be utilized.
- ²³ Klein, 56
- ²⁴ Klein, 56
- ²⁵ Ibid
- ²⁶ Klein, 63
- ²⁷ Ibid
- ²⁸ Klein, 62
- ²⁹ Ibid
- ³⁰ Klein, 59
- ³¹ Ibid
- ³² Klein, 58
- ³³ Ibid
- ³⁴ Ibid
- ³⁵ This strategy was labeled the “Third strategy” by LtGen Paul Van Riper (ret) building upon the work of Gary Klein. It is taught in LtGen Van Riper’s “Systems Theory” elective at the USMC Command and Staff College as a part of his curriculum.
- ³⁶ Art of Design Student Text Version 2.0, School of Advanced Military Studies 2008: 1
- ³⁷ Sorrells and others, An Introduction to Systemic Operational Design 2005:8
- ³⁸ Ibid: 8
- ³⁹ Sorrells and others, An Introduction to Systemic Operational Design 2005:iv
- ⁴⁰ Ibid: 12
- ⁴¹ Ibid: 23
- ⁴² Ibid
- ⁴³ Deptula; 2006
- ⁴⁴ EBA Handbook 2006:GL-8
- ⁴⁵ Dr Joe Strange defined the Center of Gravity (COG) as “Primary sources of moral or physical strength, power and resistance.” His predictive analysis is derived from the COG that in turn determines Critical Capabilities (CC), Critical Requirements (CR), Critical Vulnerabilities (CV), which leads to “decisive results” if attacked. A complete explanation is contained within, *Centers of Gravity & Critical Vulnerabilities: Building on the Clausewitzian Foundation So That We Can All Speak the Same Language* (Quantico: Marine Corps University, Perspectives on Warfighting, Number Four, Second Edition, 2002), 43.
- ⁴⁶ EBA Handbook 2006:II-2
- ⁴⁷ EBA Handbook 2006:II-3,4
- ⁴⁸ Sorrells and others, An Introduction to Systemic Operational Design 2005:63
- ⁴⁹ William J. Gregor, Military Planning Systems and Stability Operations, PRISM; 100

-
- ⁵⁰ JWFC PAM 10, 2010, 1
- ⁵¹ JWFC PAM 10, 3
- ⁵² JWFC PAM 10, 4
- ⁵³ JWFC PAM 10, i
- ⁵⁴ MCWP 5-1, Figure 1-1 introduces design as the Marine Corps Planning Process. 1-1.
- ⁵⁵ MCWP 5-1, 1-3
- ⁵⁶ The author was introduced to MCWP 5-1 and design when it was published in 2010. During this time I was serving as an operations officer and planner.
- ⁵⁷ LtGen Paul VanRiper, Unpublished critique of MCWP 5-1 provided to the author.
- ⁵⁸ John Schmitt, MCDP 5 Planning: 13
- ⁵⁹ Milan Vego, A Case Against Operational Design, JFQ March 2009: 72
- ⁶⁰ Yotum Feltam, Dr. Naveh or How I learned to Stop Worrying and Walk Through Walls, October 25, 2007
- ⁶¹⁶¹ Vego, A Case Against Operational Design, JFQ March 2009:72
- ⁶² Yotum Feltam, Dr. Naveh or How I learned to Stop Worrying and Walk Through Walls, October 25, 2007
- ⁶³ This is the author's assessment of a possible reason of apprehension towards Operational Design that was developed during multiple discussions with LtGen Van Riper.
- ⁶⁴ Alex Vohr, Design in the Context of Operational Art, Marine Corps Gazette Jan 2010; 41
- ⁶⁵ Ibid
- ⁶⁶ Vohr, 42
- ⁶⁷ Ibid
- ⁶⁸ John Schmitt, Command and (Out of) Control: The Military Implications of Complexity Theory, 179
- ⁶⁹ Bennet, Alex and David. *Organizational Survival in the New World: The Intelligent Complex Adaptive System* (Burlington, MA: KMCI Press, 2004), 295.
- ⁷⁰ Senge, Peter M., *The Fifth Discipline: The Art & Practice of the Learning Organization* (New York: Doubleday, 1990), 73.
- ⁷¹ John Schmitt introduced his operational design approach as a guest instructor to Command And Staff College's "Systems Theory" elective. As a part of his course, he led a design exercise with the student officers in which the four discourses were exercised. He referred to this design approach as "Design light".
- ⁷² John Schmitt, is a former Marine Captain. While on active duty, authored the Marine Corps' keystone doctrinal manuals *Ground Combat Operations*, *Warfighting* and *Campaigning*. He later authored the Marine Corps Doctrinal Publications *Command and Control* (MCDP 6), *Planning* (MCDP 5), and *Expeditionary Operations* (MCDP 3), as well as the revision of *Warfighting* (MCDP 1).
- ⁷³ John Schmitt, "A Systemic Concept for Operational Design," 2004, 1
- ⁷⁴ Field Manual-Interim 5-2 *Design*, 8.
- ⁷⁵ Schmitt, A Systemic Concept for Operational Design, 2
- ⁷⁶ Schmitt lecture.
- ⁷⁷ Ibid
- ⁷⁸ <http://blogs.mcclatchydc.com/kabul/2009/12/the-great-afghan-spaghetti-monster.html>
- ⁷⁹ CMC HASC Testimony, 21

Bibliography

Amos, James F., "The Future of the Military Services and the Consequence of Sequestration," Testimony to the United States House of Representatives, Committee on Armed Services, November 2, 2011.

Commander's Handbook for Effects Based Approach to Joint Operations. Joint Forces Command. 2006

Cross, Nigel, "Forty Years of Design Research", *Design Research Quarterly*, December 12 2006: 3-5

Connable, Ben., "Culture Warriors: Marine Corps Organizational Culture and Adaptaion to Culture Terrain" *Small Wars Journal* (X, 2008): 55-65

Deptula, David A. "Effects-Based Operations" *Air and Space Power Journal*, XX: Foreword (Spring 2006). 8 May 2006
<http://www.airpower.maxwell.af.mil/airchronicles/apj/apj06/spr06/spr06.html>

Feldman, Yotam "Dr. Naveh, or, How I Learned to Stop Worrying and Walk Through Walls," Haartz on-line magazine. October 25, 2007
<http://www.haaretz.com/weekend/magazine/dr-naveh-or-how-i-learned-to-stop-worrying-and-walk-through-walls-1.231912>

Huba Wass de Czege, "Systemic Operational design: Learning and Adapting in Complex Missions," *Military Review* (January-February 2009): 2-16

Commander's Handbook for an Effects-Based Approach to Joint Operations. US Joint Forces Command: 24 February 2006.

Kuhn, Thomas S., *The Structure of Scientific Revolution*, 3rd ed. (Chicago University Press, 1996)

Naveh, Shimon. *In Pursuit of Military Excellence. The Evolution of Operational Theory*. London: Frank Cass Publishers, 1997.

Schmidt, John F. *A Systemic Concept of Operational Design*; Marine Corps Combat Development Command, 2004

Schmitt, John F., *Fleet Forces Manual 1: Warfighting*. United States Marine Corps, 1989.

Senge, Peter M., *The Fifth Discipline: The Art & Practice of the Learning Organization*, New York: Doubleday, 1990

Sorrells, William T., Glen Downing, Paul Blakesley, David Pendall, Jason Walk, Richard

Wallwork. "Systemic Operational Design: An Introduction." Unpublished monograph. School of Advanced Military Studies, US Army Command and General Staff College. Fort Leavenworth KS, 2005.

Sustaining Global Leadership: Priorities for 21st Century Defense; Department of Defense, January 2012.

Terriff, Terry, "Innovate or Die: Organizational Culture and the Origins of Maneuver Warfare in the United States Marine Corps," *Journal of Strategic Studies* (June 2006): 475-503

Terraine, John. *A Time for Courage: The Royal Air Force in the European War, 1939-1945*. New York: Macmillan Publishing Company, 1985

Vega, Milan N., "A Case Against Operational Design" *Joint Forces Quarterly* (Issue 53: 2nd Quarter 2009): 69-75

Vohr, Alex J., "Design in the Context of Operational Art" *Marine Corps Gazette* (January 2010): 39-43

Zweibelson, Ben, "Design Theory and the Military's Understanding of Our Complex World" *Small Wars Journal* (August 7,2011):