

Learning Over Time: Using Rapid Prototyping, Generative Analysis, Experts, and Reduction of Scope to Operationalize Design

**A Monograph
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Abstract

LEARNING OVER TIME: USING RAPID PROTOTYPING, GENERATIVE ANALYSIS, EXPERTS AND REDUCTION OF SCOPE TO OPERATIONALIZE DESIGN by LTC John J. Marr, United States Army, 59 pages.

Based on experiences with long-duration operations in Iraq and Afghanistan, the United States Army recognizes the need for commanders and their staffs to have new tools and ways of thinking to deal with complex problems. The specific approach the Army is advocating, as outlined in the capstone *Field Manual FM 3-0, Operations* and the soon-to-be released *FM 5-0, The Operations Process (FINAL APPROVED DRAFT)*, is design. However, design solutions take time to build and implement (frame-test-reframe), while leaders at all levels are often under incredible pressure to act quickly. Additionally commanders and staffs are increasingly confused as to where design fits within the planning continuum.

This monograph proposes that design provides commanders with an exceptional tool for military problem-solving, if focused and applied correctly. This means applying a design process as more than just a ‘better way’ to do mission analysis or a methodology for developing situational understanding. In short, a design approach, applied as a methodology that emphasizes a deliberate learning process to build understanding over time, instead of a process of in-depth analysis in support of decision-making, enables commanders to simultaneously prepare for the direction of immediate actions and begin the more time-intensive techniques required for problem-management. Using design properly provides a meta-process that supports military planning by defining and continually re-defining problems so that military staffs can build better plans.

This research argues that four critical factors, or ‘starting blocks,’ help characterize a design approach as emphasizing learning over analysis. A broad review of design theory suggests that four techniques - rapid prototyping, generative analysis, use of experts, and deliberate limitation of scope – are particularly useful. Since a commander’s dilemma of action versus analysis is most acute at the outset of an operation, these concepts would necessarily be applied from the beginning of a design approach; hence the label ‘starting blocks.’ Proving the validity of this argument entails an objective measurement of each of these techniques against some foundational principles of design. Comparison of rapid prototyping, generative analysis, use of experts, and deliberate limitation of scope against the foundational design tenets of *formulating, moving, representing, evaluating, and reflecting*, demonstrates the usefulness and applicability of the four ‘starting blocks.’

Finally, this research began with the assumption that design is not a new concept in military planning. Acute analysis of a significant planning activity from World War II – the efforts of the combined staff that planned Operation OVERLORD – demonstrates the validity of this assertion. Furthermore, examples from the Operation OVERLORD effort provide clarifying insights of the applicability of the four ‘starting blocks.’

This monograph concludes with specific recommendations for the expansion of current design doctrine. Specifically, the four ‘starting blocks’ should be integrated into a more comprehensive manual for applying the design approach to the development of long-duration operations (campaigns). Additionally, design should be more explicitly linked to the development of Commander’s Critical Information Requirements (CCIR). Both of these recommendations imply that a more deliberate articulation of when and how design should be applied is appropriate and necessary.

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Introduction

On the 5th and 6th of June, 1944, Allied Forces under the supreme command of General Dwight Eisenhower initiated Operation Overlord. The combined air/sea assault that commenced Overlord involved more than five thousand landing craft (protected by over seven hundred warships) carrying five Allied divisions, and the insertion of three parachute divisions by over one thousand transports and gliders, all of which was supported by over four thousand fighter and bomber aircraft. The nearly one hundred and thirty thousand Soldiers, Airmen, Sailors, and Marines of seven nations that conducted this assault represented the vanguard of a force that would eventually number more than four million and, in less than a year, prove capable of defeating Nazi Germany.¹ The orchestration of the tactical missions, logistical preparations, sea-borne movement, establishment of air superiority, preparatory bombardment and fire support, and indirect control of partisan forces inherent in Operation Overlord represented an immense and complex undertaking, and set the stage for a campaign that would require eleven months.

In January of 1943, one year before General Dwight Eisenhower or Field Marshal Bernard Montgomery began to consider the problem-set of Normandy, the Combined Chiefs of Staff (CCS) of the United States and United Kingdom decided “the time had come to begin the detailed development of the Overlord plan.”² Subsequently, the CCS appointed British Lieutenant General F.E. Morgan as Chief of Staff, Supreme Allied Commander (COSSAC), and tasked him to build and lead a team to provide “the basis for the subsequent development of

¹ Francis Trevelyan Miller, *History of World War II*, (Philadelphia: John C. Winston Company, 1945), 726 and Cesare Salmaggi and Alfredo Pallavisini, *2194 Days of War*, (New York: Windward, 1977), 529-532.

² Frederick Morgan, *Overture to Overlord*, (Garden City, NY: Doubleday and Company, Inc. 1950), 129.

detailed plans.”³ Morgan quickly realized that an effort to build a campaign as wide-ranging as an assault on Germany through northwest Europe, thus bringing an end to the war, required something more than traditional military planning. In modern parlance, the efforts of the COSSAC staff and their relationship to the subsequent preparations made by Eisenhower and his staff can be viewed as the development of a ‘campaign design’ that was operationalized through detailed planning.

The example provided by Morgan and the COSSAC staff has particular significance to today’s Joint Force. The U.S. Army is currently wrestling with the concept of “design” as an advanced application of problem management. As an institution, the Army recognizes the need for commanders and their staffs to have the logic, tools, and ways of thinking to deal with complex problem situations through a systemic, learning-centric approach.

The specific methodology, or approach, the Army is advocating, as outlined in the capstone *Field Manual FM 3-0*, is design.⁴ In response to the specific complexities of long-duration operations that characterize the current ‘long war,’ the Army began experimenting with design as “a methodology for applying critical and creative thinking to understand, visualize, and describe complex, ill-structured problems and develop approaches to solve them.”⁵ Design is more than just a ‘better way’ to do mission analysis or a methodology for developing situational understanding. It is a meta-process that supports military planning by defining (“framing”) and continually re-defining problems so that military staffs can build plans.⁶ However, done

³ United States Forces - European Theater, “Report of the General Board: Strategy of the Campaign in Western Europe, 1944-1945 (General Board Study Number 1),” (Washington D.C.: Headquarters, Department of the Army, circa 1946), 10.

⁴ United States Army, *Field Manual 3-0, Operations*, (Washington D.C.: Government Printing Office, January 2008), 1-10.

⁵ United States Army, *Field Manual 5-0, The Operations Process (FINAL APPROVED DRAFT)*, (Washington, D.C.: Government Printing Office, February 2010), 3-1. Note: the capitalization of the parenthetical name is original to the title.

⁶ *Field Manual 5-0 (FINAL APPROVED DRAFT)*, 3-2.

properly, a design solution takes time to build and implement (frame-test-reframe), while strategic and operational-level leaders are often under incredible pressure to act quickly, especially in crisis-action situations. In short, these problems can make leaders ‘time-intolerant.’

Design, focused and applied correctly, provides commanders with an exceptional tool for military problem-solving, especially at the campaign-level. Specifically, this paper establishes the thesis that a design approach, applied as a methodology that emphasizes a deliberate learning process to build understanding over time, instead of a process of in-depth analysis in support of decision-making, enables commanders to simultaneously prepare for the direction of immediate actions and begin the more time-intensive techniques required for problem-management. A design approach emphasizing learning over analysis is characterized by four critical factors, or ‘starting blocks:’ rapid prototyping, generative analysis, the inclusion of experts, and the deliberate limitation of problem-solution scope.

Demonstrating how these ‘starting blocks’ correctly focus a design approach necessitates an understanding of the applicability of design to military campaign development and comprehension of the essential elements that make a design approach successful. Therefore, this paper is organized into three sections; the first examines the COSSAC staff as an example of the application of a design approach. An appreciation a design approach, in the context of military operations, is fundamental to understanding how an emphasis on learning, vice analysis, is important. In short, an explanation of what design “is,” what design “is not,” and how design fits into the overall military planning and decision making system is critical. This paper will argue that design is best applied as a problem management tool for shaping and guiding campaigns – long-duration military operations – and for setting the parameters of normal planning utilizing the Military Decision Making Process (MDMP) or Joint Operational Planning Process (JOPP). Allied preparation for the invasion of Europe in World War II provides an example of the application of a design approach and illustrates the interrelation between design and planning.

The second section of the paper explains the essential elements of successful design – *formulating, moving, representing, evaluating, and reflecting*. These criteria, attributable to the design-instruction expert Bryan Lawson, represent a baseline standard: a summarization of the most important concepts found in successful design.⁷ As examples of successful design, these essential elements are a useful set of criteria for evaluating design techniques. Although Lawson developed these criteria based on research in the field of architectural design, the applicability to a military design approach and the manner in which each concept supports an emphasis on learning are made manifest through detailed description.

The third section of the paper examines the four ‘starting blocks’ that support a learning-emphasis in a design approach through the lens of these essential attributes. Evaluation of these processes as ‘starting blocks’ against the criteria from section two will validate this thesis. Rapid prototyping is important because it speeds up the overall learning process and enables refinement to the solution of a problem set before full implementation of planning. Generative analysis is important because it leverages informed intuition to set the baseline and initial direction for subsequent, deeper analysis. Inclusion of experts increases the ability of the design team to start the process of environmental and problem framing in the right direction. Finally, a deliberate limitation of scope is critical because it maximizes time by focusing the majority of effort on future learning. The conclusion of this section includes a set of recommendations for the application and implementation of the ‘starting blocks.’”

Although the U.S. Army is struggling with how best to incorporate design into its doctrine and planning methodologies, the foundational principles of the design approach are not necessarily new.⁸ Design, as an approach to problem management, is a streamlined packaging of

⁷ Bryan Lawson, *How Designers Think: The Design Process Demystified*. 4th ed. (Oxford: Architectural Press, 1980, 2008), 291.

⁸ Stefan J. Banach, “Educating by Design: Preparing Leaders for a Complex World,” *Military Review* (March-April 2009): 98.

critical and creative thinking techniques that commanders and leaders have applied for many years. Application and emphasis of the ‘starting blocks’ outlined in this monograph may help resolve the institutional resistance and criticism that design elicits.

COSSAC and the Military Application of Design

The U.S. Army’s thinking about design is still evolving, and is not yet completely codified in military doctrine.⁹ However, the primary underlying theme is that military problem-solving requires an appreciation of the complex and adaptive nature of the operational environment and of the endless variety of existing threats. After an initial period of experimentation with the design approach, the U.S. Army’s Training and Doctrine Command identified a common denominator within the dialogue of how best to apply design: the need to focus “on learning about an unfamiliar problem and exploit that understanding to create a broad approach to problem solving.”¹⁰ In short, the purpose of design is to “organize the activities of battle command” by developing adaptive and learning organizations capable of mastering the activities of the “operations process” - planning, preparation, execution, and assessment.¹¹ Military application of design incorporates continual questioning of purpose and understanding (framing), learning through action, emphasis on the conceptual, and development of a broad (vice

⁹ For the purposes of this monograph, *Field Manual 5-0, The Operations Process (FINAL APPROVED DRAFT)*, February 2010 is used as the primary source for explaining the Army’s current conceptualization of the design approach. Closely aligned with *TRADOC Pamphlet 525-5-500, Commander’s Appreciation and Campaign Design* (January 2008) and *Field Manual (Interim) 5-2, Design*, which first outlined the application of a design approach applied to a military context, the final approved draft of *FM 5-0* provides the most current description of practical design methods. Although the new *FM 5-0* is not yet official doctrine, at the time this monograph was prepared no other single-source description of design had been approved. However, portions of design have already been incorporated in *FM 3-0 Operations*, *FM 3-24 Counterinsurgency*, and *FM 3-07 Stability Operations*. For further explanation, see footnote 34.

¹⁰ United States Army, *TRADOC Pamphlet 525-5-500, Commander’s Appreciation and Campaign Design*, version 1.0. (Washington: Government Publishing Office, 28 January 2008), 13.

¹¹ *FM 5-0 (FINAL APPROVED DRAFT)*, 3-1 and 1-9.

detailed) approach.¹² The efforts of Lieutenant General Morgan and the COSSAC staff represent a design approach to campaign development that aligns with the U.S. Army's current thinking about the application of design to military problem management.

Designing the Victory in Europe

In the words of General Eisenhower, the COSSAC staff was charged with the “development of the Overlord Operation from a strategic conception into a final attack plan.”¹³ From the initial formation of a fully-integrated, combined staff until they handed over their plan to General Eisenhower, the prime directive of COSSAC was to self-structure to maximize learning. This learning was facilitated by conducting multiple iterations of framing and re-framing of the problem-set incorporated in moving over 1 million soldiers across the Atlantic and the English Channel onto the European continent. Although much of the analytic effort resulted in finite, definitive planning information, the COSSAC staff strove to build a conceptual framework that future subordinate staffs could flesh out with detailed plans. This reflected their general understanding that the eventual goal of their effort should be a broad approach that would set the conditions for a subordinate land component commander.

Established by order of the CCS in March of 1943, the COSSAC staff was structured to facilitate learning by combining officers of the British and United States Navies, Armies, and Air Forces in a fully integrated, Joint staff.¹⁴ Over time, this staff was rounded out to include experts including “ambassadors, microfilm operators, bankers, agriculturists, newspapermen, lawyers, foresters, and a host of others, each the master of some technique.”¹⁵ Initially structured under a

¹² See further: *TRADOC Pamphlet 525-5-500*, pp 7-9 and *FM 5-0, (FINAL APPROVED DRAFT)* pp. 3-2 to 3-6.

¹³ Morgan, vii.

¹⁴ Supreme Headquarters, Allied Expeditionary Force (SHAEF), *History of COSSAC*, File 8-3.6A CA, (Washington: Chief of Military History), 3-4.

¹⁵ Morgan, 44.

British model with three directorates (Intelligence, Operations, and Administration (logistics)), every element of the staff was fully integrated with both British and American officers from every service. The stated objective of COSSAC was to begin the formal planning for three operations: deception operations in 1943 (COCKADE), a rapid return to the continent in the event that Germany surrendered (RANKIN), and a “full scale assault against the continent in 1944 (OVERLORD).”¹⁶ During the entire nine months that COSSAC existed, the CCS steadfastly refused to appoint a commander or deputy commander, enabling the COSSAC staff to selectively expand or limit the scope of the problem as they saw fit.¹⁷

Over the course of 1943, the COSSAC staff demonstrated a focus on learning through a cyclic process of problem refinement. Engaging in no less than six distinct iterations to refine the plan for Operation Overlord, the COSSAC staff started with a thorough review of the work completed by previous planning efforts and then continually framed and re-framed the problem, questioning every assumption and planning limitation from the mission assigned by the CCS to the minimum required forces for a successful operation.¹⁸ A significant example was the realization of the need to expand the amphibious landing area, in order to facilitate the capture of more than one port. Another significant refinement determined through re-framing came during the fourth iteration, which reduced the scope of COSSAC's efforts to the advanced-guard mission of crossing the channel. This “supplementary directive” gave the COSSAC staff “a more tangible object, namely, to secure a lodgment on the Continent from which further offensive operations

¹⁶ SHAEF, 3 and 5.

¹⁷ Morgan, 131. Upon designation of General Eisenhower as the Supreme Commander, Allied Expeditionary Force, the COSSAC staff became the foundation of the SHAEF staff.

¹⁸ Ray S. Cline, *Washington Command Post: The Operations Division. U.S. Army in World War II Series (The War Department)*, (Washington D.C.: Department of the Army, 1951), 156-159. The planning efforts that eventually became OPERATION OVERLORD originated under U.S. Army Chief of Staff, General Marshall (and then Brigadier General Eisenhower) in the War Plans Division of the Army staff. This initial "outline of operations" advocated a three-phased plan for an amphibious assault in April of 1943 and built a series of assumptions that shaped COSSAC's iterations of the design of Operation Overlord. These efforts were "designed to govern deployment and operations" within a strategic framework that envisioned the British Isles as a forward marshalling and training area.

could be carried out."¹⁹ Also notable was the fifth iteration, an operational test of the design at the British Staff College in Largs, Scotland.²⁰

In addition to the iterations on the Overlord plan, the COSSAC staff applied the same process to the development of Operation RANKIN, the response of the Allies to an unforeseen surrender or disintegration of Germany. The detailed work done to outline the three separate Operation RANKIN plans served as models useful for initial framing of post-hostility planning as “the unconditional surrender of Germany, represented in actuality the culmination of Operation OVERLORD.” As Lieutenant General Morgan observed: “although Operation Rankin never took place, it provided “COSSAC with a great amount of invaluable experience and information that was indispensable to other activities.”²¹

The COSSAC staff strove to avoid the detailed planning that they foresaw as the responsibility of the land, sea, and air elements charged with executing the actual operations.²² This led them to focus their efforts on the conceptual level by devising ways to facilitate future learning. Constantly returning to the analysis of previous efforts, the COSSAC team actively sought to identify things they needed to learn about, and devise ways to establish a learning environment. This included sending team members “to look over the preparations for Operation Husky to learn therefrom what would be of use to us.”²³ It also included making a full analysis of previous historical examples, including every military crossing of the English Channel from the 11th Century to the 1942 raid on the port of Dieppe. These efforts to learn also resulted in experimental modeling to solve particular facets of the problem set, and resulted in numerous

¹⁹ Morgan, 66. See also pages 55 and 135.

²⁰ Morgan, 144.

²¹ Morgan, 118 and 123.

²² Morgan, 151. The COSSAC team recognized from the outset that their efforts were “a means to an end...The assault would be the affair of the advanced-guard commander to whom in due course would pass the responsibility for detailed planning (151).”

²³ SHAEF, 7 and Morgan, 68.

spin-off prototypes, including the Mulberry artificial harbors, a petroleum pipeline across the Channel, the DUKW, and the Bailey Bridge.²⁴

The controlling idea that enabled the COSSAC staff to forego the traditional techniques of military planners and adopt a more design-centric approach was a recognition that their proper role was to set conditions for future planning efforts. As Morgan himself identified early in the process, the methodologies of the COSSAC staff needed to be different from a typical planning effort.²⁵ Specifically, a separation from detailed planning enabled the COSSAC staff to view the problem more holistically, and to actively seek out opportunities to learn from ongoing operations. For example, Morgan viewed the execution of the 1943 deception operations (Operation COCKADE) as “a reasonably realistic rehearsal in the course of which we would be able to overhaul the procedures that we would need to use for the great campaign.”²⁶ More importantly, the detached perspective of the COSSAC staff enabled a broader approach to problem solving than could have been achieved by a staff accountable to both a commander and to assigned forces.

Throughout its nine-month existence, the COSSAC staff focused on learning through action, utilized iterative framing and re-framing, and emphasized conceptual, broad approaches rather than detailed solutions. These actions distinguish the efforts of the COSSAC team as a design approach as opposed to a traditional military planning effort.

²⁴ Morgan, 132. For a detailed explanation of the idea genesis and subsequent development of these inventions see: Morgan, 263-274. The designation of DUKW is not an acronym – the name comes from the model naming terminology used by GMC.

²⁵ United States Forces - European Theater, “Report of the General Board: Study of the Organization of the European Theater of Operations (General Board Study Number 2),” (Washington D.C.: Headquarters, Department of the Army, circa 1946), 11.

²⁶ Morgan, 84. See also SHAEF, 18.

Design and Current Army Doctrine

Analysis of current U.S. Army planning doctrine demonstrates that there is a "void," at the campaign-planning level, that a design approach could fill.²⁷ A review of the U.S. Army's short history with the design approach demonstrates a self-recognition that planning at the operational-level needs to be revitalized. An understanding of what the U.S. Army currently means by a 'design approach' and an examination of both the current state of design-doctrine and design-instruction provides proof of this self-recognition. Additionally, a review of current planning doctrine highlights the doctrinal-gap, or mismatch between the Military Decision Making Process (MDMP) and the demands of problem-management at the operational (campaign/ sustained operations) level. In short, this section establishes the importance of the thesis under review by explaining what the design approach means in a military context and why the U.S. Army needs this problem-management tool.

At the end of the Cold War in the 1990s, the U.S. Army and the larger Joint community acknowledged that the "complexity of today's operational environment" demands what LTG Michael Vane, director of the Army Capabilities Integration Center, termed "a different approach to problem solving."²⁸ Attempts to reconcile military planning procedures with the perception of an increasingly complex operational environment initially coalesced into various effects-based approaches, including Effects Based Operations (EBO), Network Centric Warfare (NCW) and System of Systems Analysis (SOSA).²⁹ However, when applied to the situations the U.S.

²⁷ Edward C. Cardon and Steve Leonard, "Unleashing Design: Planning and the Art of Battle Command," *Military Review* (March-April 2010), 2.

²⁸ *TRADOC PAM 525-5-500*, i. See also United States Department of Defense, *National Military Strategy of the United States of America: A Strategy for Today a Vision for Tomorrow*, (Washington D.C.: Government Printing Office, 2004).

²⁹ For an in-depth explanation of EBO and NCW, see: Allen Batschelet, "Effects-based operations: A New Operational Model?" U.S. Army War College Strategy Research Project (Carlisle: U.S. Army War College), 2-6. For further explanation of EBO, NCW and SOSA, see: United States Joint Forces Command, *Effects-based Operations White Paper Version 1.0* (Norfolk, VA: Concepts Department J9, 2001).

military faced in both Operation ENDURING FREEDOM and Operation IRAQI FREEDOM the effects-based processes were found lacking.³⁰

Subsequently, the U.S. Army Training and Doctrine Command (TRADOC) began an examination of "what other disciplines and other militaries [had] learned about dealing with the difficulties of novel and complex challenges."³¹ The focus of this research centered on the unique complexities of the operational level and the difficulties with applying a linear problem-solving methodology to missions of an extended duration.³² The first tangible results of this multi-year process of study and experimentation were the development of a cognitive model termed the *Commanders Appreciation and Campaign Design* (CACD) outlined in *TRADOC Pamphlet 525-5-500*, and the subsequent development of an "interim" Field Manual (*FM-I 5-2, Design*) which was intended to provide a "comprehensive account of design doctrine" and describe a methodology for practical application of design within the larger context of military problem management.³³ Design was officially codified in U.S. Army doctrine in 2006 with the incorporation of a "campaign design" chapter in *FM 3-24, Counterinsurgency*, which was followed-up with references to design in both the U.S. Army's capstone manual, *FM 3-0, Operations* and the revised manual for dealing with post-hostility operations, *FM 3-07, Stability Operations*. The culmination of this period of self-reflection was the inclusion of a chapter outlining the design process in the current revision of the Army's keystone doctrinal reference for planning – *FM 5-0, The Operations Process*.

³⁰ Huba Wass de Czege, "Systemic Operational Design: Learning and Adapting in Complex Missions," *Military Review* (January-February 2009): 2. See also: Banach, "Educating by Design," 96; and James N. Mattis, "Memorandum for U.S. Joint Forces Command; Subject: Vision for a Joint Approach to Operational Design," (Norfolk: United States Joint Forces Command, 6 October 2009).

³¹ Wass de Czege, 3 and *TRADOC Pamphlet 525-5-500*, 13-15.

³² *TRADOC Pamphlet 525-5-500*, 14. See also: Ketti Davison, "From Tactical Planning to Operational Design," *Military Review* (September-October 2008): 33-39.

³³ *FM-I 5-2*, iv.

In summary of this ongoing effort, the U.S. Army views design as a broad problem solving approach that facilitates detailed planning by applying "critical and creative thinking" through an iterative process of problem-framing to generate "a greater understanding, a proposed solution based on that understanding, and a means to learn and adapt."³⁴ Additionally, design requires commanders to "lead adaptive work" and "engage in learning through action" to verify they are solving the right problem, rather than solving the problem right.³⁵ As a cognitive methodology, the design approach examines a problem situation from three perspectives - the environmental frame, the problem frame, and the solution or operational approach (see figure 1).

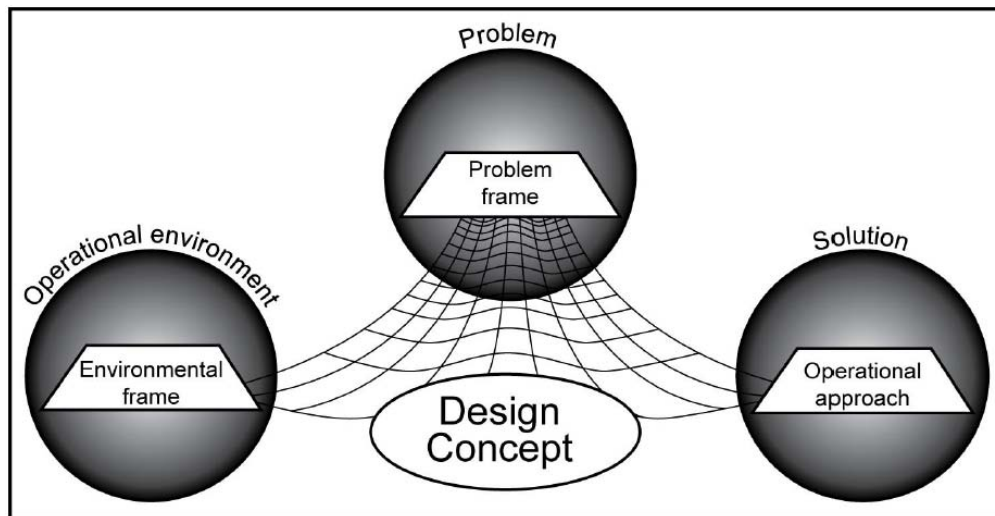


Figure 1 – The design methodology³⁶

Examination of the environmental frame builds common understanding about why the current situation (the "observed system") is different from what the commander intends (the "desired

³⁴ *FM 5-0 (FINAL APPROVED DRAFT)*, 3-1 and United States Army, *Field Manual 3-24, Counterinsurgency*, (Washington D.C., Government Printing Office, December 2006), 4-1. Given the current state of doctrinal development with regards to design, citing a singular, authoritative definition is problematic. Because the U.S. Army has not yet approved a singular, authoritative doctrinal-definition of design, this composite of the aforementioned references highlights the current areas of agreement and congruence. For the purposes of this study, *FM 5-0 (FINAL APPROVED DRAFT)* will be used as the primary descriptor of the design approach.)

³⁵ Banach, "Educating by Design," 96 and *FM 5-0 (FINAL APPROVED DRAFT)*, 3-5 to 3-6.

³⁶ *FM 5-0 (FINAL APPROVED DRAFT)*, 3-7.

system.") Framing the problem entails visualizing the tensions between the "observed system" and the "desired system" in order to determine the specific actions required to transform the system. Considering the operational approach entails developing a "broad conceptualization of the general actions" that "provides the logic" to guide the development of courses of action during (subsequent) detailed planning. In terms of campaign development, the operational approach outlines the parallel and sequential actions, often manifested as lines of effort or lines of operation. As design is meant to supplement or enable detailed planning, the "output" or final result of the process is a design concept that reflects "understanding of the operational environment and the problem while describing the commander's visualization of a broad approach for achieving the desired end state."³⁷

Although the U.S. Army has prompted its School of Advanced Military Studies (SAMS) to take "design from theory to practice" by testing and refining techniques for implementing the design approach, there remains a great deal of institutional resistance to the concept of design.³⁸ In general, the main counter-argument is that a design approach offers nothing new and that a rigorous application of the MDMP accomplishes the same end. However, as *FM 3-24* points out:

It is important to understand the distinction between design and planning. While both activities seek to formulate ways to bring about preferable futures, they are cognitively different. Planning applies established procedures to solve a largely understood problem within an accepted framework. Design inquires into the nature of a problem to conceive a framework for solving that problem. In general, planning is problem solving, while design is problem setting. Where planning focuses on generating a plan – a series of executable actions – design focuses on learning about the nature of an unfamiliar problem.³⁹

Stated another way, the difference between planning and design is a matter of primary focus – planning focuses on the process of decision-making (better-informed actions over time) and design focuses on learning (better-informed understanding over time).

³⁷ *FM 5-0 (FINAL APPROVED DRAFT)*, 3-7 to 3-12.

³⁸ Banach, "Educating by Design," 96.

³⁹ *FM 3-24*, 4-2.

The difference between the focus of planning and the focus of design highlights the unique applicability of a design approach to the development of campaigns. To support sound decision-making, planning must avoid attempts “to forecast and dictate events too far into the future” and “assumptions that the future will be a linear continuation of the present.”⁴⁰ However, in order to orchestrate the actions of military units over extended periods of time, campaigns must directly contravene this planning pitfall. By focusing on learning over time, design provides commanders and their staffs a logical and continually evolving process for successful campaign development. Planning infers providing commanders with the best analysis of the information available right now in order to support timely decision-making. Design infers providing commanders with a deliberate methodology for deepening understanding over time in order to support longer-term, future decision-making.

The newest version of *FM 5-0* supports the idea that by focusing on learning, design is foremost a campaign-development tool, but falls short of making this distinction explicit. By describing design and planning as sub-components of the overarching “Operations Process” (planning-preparing-executing-assessing), the *FM 5-0* currently awaiting publication inculcates processes for learning much more explicitly than previously published doctrine.⁴¹ Furthermore, the manual indirectly justifies the use of design for campaign development by asserting that design is more applicable if the “complexity of the problem” is significant; (the longer the duration, the larger the amount of unforeseen variables, the greater the complexity).⁴² However,

⁴⁰ *FM 5-0 (FINAL APPROVED DRAFT)*, 2-14.

⁴¹ *FM 5-0 (FINAL APPROVED DRAFT)*, 1-9. According to previous planning doctrine (*FM 5-0, Planning and Orders Production* (January 2005)) the MDMP was aimed at pre-executional understanding, choosing best courses of action, and acting faster than an adversary. Although learning was inherent in some of its concepts, time horizons are purposefully kept short as “planning too far into the future may overwhelm the capabilities of planning staffs.” Furthermore, the closest the manual came to a learning cycle was suggesting a need to monitor feedback in order to choose a branch or sequel, and a one-line reminder to continually update estimates. The word “learning” only appeared one time in the entire manual.

⁴² *FM 5-0 (FINAL APPROVED DRAFT)*, 2-8.

the applicability of design to campaigns is not made explicit. Additionally, although the manual highlights the criticality of design to “understanding ill-defined problems” and “anticipating change,” it fails to establish a direct-linkage between design and the commander’s primary tool for directing and prioritizing learning – the Commander’s Critical Information Requirements.⁴³ These two omissions demonstrate a ‘gap’ in doctrine that design is capable of filling.

The presence of this doctrinal gap is not new; the challenges the COSSAC staff faced when developing Operation OVERLORD highlight the U.S. Army’s long-standing need for an overarching campaign-design methodology. Working without the benefit of a doctrinal template, the COSSAC staff demonstrated that a design-like approach can work for military professionals contemplating long-duration campaigns. The adoption of design, as outlined in *FM 5-0 (FINAL APPROVED DRAFT)* is an excellent starting point, but an explicit emphasis on applying a design approach to long-duration operations is still missing. The U.S. military’s Joint community, which has primary responsibility for the operational (campaign) level appears to understand this, but depends on the Army to continue to lead this effort.⁴⁴ A design approach, focused on the campaign-level will enable military professionals to “resolve the tension between the formulation of strategy and planning for its implementation.”⁴⁵ Reconciling this tension – the focal point of this study - requires balancing immediate needs with long-term needs; it also requires a set of tools that corresponds with the foundational principles of design. The next section outlines these principles.

⁴³ *FM 5-0 (FINAL APPROVED DRAFT)*, 3-2. Commanders emphasize the most important relevant information they need by establishing CCIRs. At the outset of any problem-management approach there are generally numerous information requirements; establishing CCIR is a means of prioritization. Initial CCIRs focus on decisions the commander needs to make to focus planning.

⁴⁴ Mattis, 1-2 and 1-7. Mattis points out that the efforts of the Army have moved the development of Joint design doctrine “beyond concept development in this important area,” and that he intends to continue to “tap the Services’ efforts.”

⁴⁵ *TRADOC Pamphlet 525-5-500*, 16.

The Essential Elements of Effective Design

To summarize the thesis under review in this paper: a design approach, applied as a process that emphasizes learning, is characterized by four critical factors, or 'starting blocks': rapid prototyping, generative analysis, the inclusion of experts, and the deliberate limitation of problem-solution scope. The inclusion of these four starting blocks is what enables commanders to simultaneously prepare for both the direction of immediate action and the initiation of time-intensive analysis. Proving the validity of this argument requires an objective measurement of each of these 'starting blocks' against some foundational principles of design. Specifically, if the 'starting blocks' are congruent with the tenets of *formulating, moving, representing, evaluating, and reflecting*, then they are solid design concepts and validate the thesis. This section will explain these foundational principles, the essential elements of design.

The underlying importance of "formulating, moving, representing, evaluating, and reflecting" to design is the assertion of Bryan Lawson, a respected design-educator and theorist and former Dean of the School of Architecture at the University of Sheffield, England. After years of research and instructional experience, Lawson concluded that design was "far too complex a phenomenon to be describable by a simple diagram" given its application to an "extraordinarily wide range of activity." Instead, he turned his efforts towards constructing a "looser model" of the critical elements common across all disciplines of design. The culmination of this intensive effort was the identification of five foundational principles: the essential design elements of *formulating, moving, representing, evaluating, and reflecting*.⁴⁶

A noteworthy aspect of these foundational principles is that each criterion is a measurement of how much or how little a "set of skills" is present in the design process; this is completely congruent with the concept of design. The identification of skill-sets is a common

⁴⁶ Lawson, 289-291.

aspect of design-theory literature, and even Lawson described his model as “groups of activities and skills that are all needed” for “successful design.”⁴⁷ In other words, the simple presence (or absence) of a ‘set of tools’ can determine whether a particular technique reflects the essential elements of a design approach.⁴⁸

A final prerequisite to comprehending these evaluation criteria is a refined understanding of 'design problems.' Simplistic labels such as “wicked” or “ill-structured” are unhelpful.⁴⁹ In the words of another preeminent design-theorist, Kees Dorst, "to determine the merits and scope of application of [design] methods we will need to know more about the structure of design problems.”⁵⁰

Design problems can be characterized as having a "threefold nature: they are partly **determined** by 'hard' (unalterable) needs, requirements and intentions;" they are partly **undetermined** "in the sense that the designer is to a large extent free to design according to his own task, style, and abilities;" and they are partly **underdetermined** because there is no direct causal linkage between a problem-situation and a potential solution.⁵¹ The underdetermined aspect of a design problem means that finding a solution requires "non-deductive reasoning," and is therefore dependent on the subjective valuation, perspective, and ability of the designer or

⁴⁷ Lawson, 291.

⁴⁸ For additional examples of the emphasis on skills in design see: Nigel Cross, “The Nature and Nurture of Design Studies.” *Design Studies*, Vol. 11, No. 3 (1990) 127. The emphasis on building and applying "skills" and "tools" is a dominant theme in design processes that are applied to human-centric, social systems. For example, the IDEO company developed the “Human-Centered Design” methodology for International Development Enterprises (IDE) as “a toolkit for...difficult challenges within communities of need.” Likewise, the “Impact Planning, Assessment, and Learning (IPAL) methodology,” developed by the non-profit group Keystone Accountability, is labeled as a “tool suite.” (IDEO webpage, <http://www.ideo.com/work/item/ide-and-gates-foundation-human-centered-design-toolkit> (page accessed 2 February 2010).

⁴⁹ *TRADOC Pamphlet 525-5-500*, 9.

⁵⁰ Kees Dorst. "The Problem of Design Problems." A research paper presented at Design Thinking Research Symposium 6, (Sydney, Australia, November 17-19, 2003), 1. <http://research.it.uts.edu.au/creative/design/acceptedPapers.html> (accessed 13 September 2009).

⁵¹ Dorst, 1-1.

design team. As Dorst summarized: “the design problem as such does not really exist as an objective entity in the world. There is an amalgamate of different problems [that is] partly there to be discovered by the designer in the design process and part of it has to be MADE by the designer.”⁵² In other words, there is no 'right way' to define or to solve complex problems.

The implications of underdetermination for a design approach are twofold. First, because there is no "well-structured problem [that] leads the designer, through deduction" to an objective understanding, "an ill-structured problem requires something like a framing action" to provide context and subjective understanding. Second, the subjective nature of a design approach highlights the importance of the designer's (or design-team's) expertise. These implications prompted Dorst to conduct numerous studies of designers and led him to conclude that a "competent problem solver works in a radically different way" through a design process that "takes on a trial-and-error character [that demonstrates] a clear need for learning and reflection."⁵³ The following sub-sections describe how – ideally – a design approach should account for these implications by employing ‘sets of skills’ or ‘tools’ as a part of a process.

Formulating

The concept of *formulating* evaluates the degree of emphasis a ‘starting block’ places on framing complex problems with the goal of making them more explicit, understandable, and relevant. Lawson describes *formulating* as building a “window on the problem-space,” through the “reformulation of problems or the identification of elements, making them explicit and developing [a problem set’s] characteristics.”⁵⁴ A ‘starting block’ of a design approach that

⁵² Dorst, 3-2.

⁵³ Dorst, 3-0 to 3-3.

⁵⁴ Lawson, 292-293.

aligns with the *formulating*-criteria would emphasize skills used to frame and deepen understanding of problem sets in order to make the problem management process manageable.

The first skill-set of *formulating*, and the hardest to accomplish, is framing.⁵⁵ Framing a problem-set means “selectively viewing the design situation in a particular way” in order to provide a useful, subjective context, which enables a design team to “handle the massive complexity and the inevitable contradictions” inherent in a complex problem.⁵⁶ The key to framing is continual questioning and re-questioning; design expert Barry Wylant describes framing as a “process of raising several good questions versus one for finding the right answers.”⁵⁷ The goal of framing is to deepen a design-team’s understanding.

The second skill-set of *formulating* is facilitating deeper understanding through the identification of critical aspects of the problem. To accomplish this, design teams must iteratively question what they think they know about a problem with the purpose of identifying relevant actors and seeing patterns, “to parse the important information from the less important.”⁵⁸ This enables a design team to define a problem in understandable terms and to articulate the differences between the current state and the desired one.⁵⁹ The key to this set of skills is understanding the need for continuous learning; like framing, facilitating deeper understanding requires iterative questioning as the design team continues to learn about the problem.

Numerous examinations of design expertise highlight the importance of *formulating* and identify “a deliberate effort to frame the problem” as critical to deepening understanding of

⁵⁵ Michael Barry and Sara L. Beckman, "Innovation as a Learning Process: Embedding Design Thinking." *California Management Review*, Vol. 50, No. 1 (Fall 2007), 39.

⁵⁶ Lawson, 292.

⁵⁷ Barry Wylant, "Design Thinking and the Experience of Innovation." *Design Issues*, Vol. 24, No. 2, (Spring 2008), 14.

⁵⁸ This cannot be accomplished (well) ‘all at once’ at the beginning of a design process. See further: Barry and Beckman, 39.

⁵⁹ Horst W.J. Rittel and Melvin M Webber, "Dilemmas in a General Theory of Planning." *Policy Sciences*, No. 4 (1973), 159.

problem-sets.⁶⁰ Design approach techniques built specifically for use in human-dominated systems, such as the IDEO Company's "Human-Centered Design" (HCD) process, connect framing with formulating through continuous questioning.⁶¹ As the HCD Process Guide points out, continuous questioning moves a design team "from concrete observations...to abstract thinking...then back to the concrete with tangible solutions."⁶² This linkage also highlights the importance of the second foundational principle, the criteria of *moving*.

Moving

Moving measures the degree to which learning and the generation of ideas is maximized through active processes by a 'starting block.' As Lawson points out, "in design, problems do not necessarily precede solutions in the way normally expected."⁶³ This irony is a by-product of the 'under-determined' nature of complex problems noted above; definitions of 'problem' and 'solution' are subjective judgments. Design teams base their subjective judgments on experience. This is problematic in complex situations where experience may be inaccurate or incomplete. Therefore, the set of design skills involved with *moving* requires two things: a temporary

⁶⁰ Nigel Cross, "The Expertise of Exceptional Designers." Research paper presented at Design Thinking Research Symposium 6, Sydney, Australia, November 17-19, 2003. <http://research.it.uts.edu.au/creative/design/acceptedPapers.html>. (Accessed 13 September 2009). Dorst suggests that "frames can be seen as a complete pattern of problem-solution connections that are imposed upon the existing problem and solution." (3-1) See also Barry and Beckman, 44.

⁶¹ IDEO. "Human Centered Design - Process Guide." 2d Edition (2009), IDEO.com. <http://www.ideo.com/work/item/ide-and-gates-foundation-human-centered-design-toolkit> (accessed 10 September 2009), 7. Comparing a military operation to the activities of development-oriented non-profit groups is highly germane, as both types of organization must interact within national and international settings, working with all levels of government, and coordinating efforts among numerous social groups and entities. As the non-profit group Keystone Accountability points out: "Development is usually a long-term, complex process involving many actors and interdependent processes. A single organization working on its own can seldom achieve all the changes required by its theory of change." (Keystone Accountability. "IPAL Guide 1: Impact Planning, Learning and Assessment - an Overview," KeystoneAccountability.org. http://www.keystoneaccountability.org/sites/default/files/1%20IPAL%20overview%20and%20service%20offering_0.pdf (page accessed 12 September 2009), 23).

⁶² IDEO, "Human Centered Design - Process Guide," 7.

⁶³ Lawson, 297.

suspension of subjective judgment and the facilitation of learning (through action) to inform the process.

Suspending judgment requires replacing the traditional emphasis on finding an immediate solution with continuous reviews of previous work and an “argumentative process in the course of which an image of the problem and the solution emerges gradually.”⁶⁴ The set of skills required for *moving* include non-deductive reasoning in the consideration of the current state and the desired state, developing and testing options, and continual questioning of assumptions. In their book, *Change by Design*, Tim Brown and Barry Katz describe this as a “continuous movement” between the process of creating ideas and the process of making decisions.⁶⁵ In a review of the application of design to the development of government policy, Ernest Alexander notes that “to deploy design effectively in the policy process...suspension of judgment to allow systemic evaluation...is necessary.”⁶⁶

Facilitating learning through action is endemic to *moving* because it is the way in which people build experience. Design's iterative approach matches the “learning cycle” of experiencing - reflecting - thinking – acting, as described by education expert David Kolb.⁶⁷ In other words, learning is a process based on iterative action (note the order: experience, then reflect...think, then act). Therefore, a design approach that encapsulates *moving* should emphasize the creation of ‘new’ experience, through action in line with the learning cycle. As

⁶⁴ Rittel and Webber, 162.

⁶⁵ Tim Brown and Barry Katz, *Change by Design* (New York: HarperCollins, 2009), 69.

⁶⁶ Ernest R. Alexander, "Design in the Decision-Making Process." *Policy Sciences*, (1982), 282. Alexander's study focuses specifically on the use of design in the development of U.S. Government policy during the Vietnam Conflict.

⁶⁷ David A. Kolb, *Experiential Learning: Experience as the Source of Learning and Development*. (Upper Saddle River, NJ: Prentice Hall, Inc. 1984), 38-40. Kolb defines learning as “the process whereby knowledge is created through the transformation of experience.”

design theorist A.G. Pleydell-Pearce points out: “Design involves choice. Choice involves acting.”⁶⁸

Suspended judgment and active learning are clearly fundamental aspects of the criteria of *moving*. Approaching problems and solutions without prejudging enables active learning, and forces the design team to initiate deliberate processes to build knowledge through new experience. In order to accomplish this movement, design teams must also be able to represent their ideas clearly, which leads to the next criteria.

Representing

The concept of *representing* examines the degree of emphasis a ‘starting block’ places on the expression of ideas in graphic or narrative form. A design team uses representations of ideas to “interact” with a complex problem “in a conversational way.”⁶⁹ Through this interaction and conversation, the design team builds and refines a conceptualization of both the problem and of the solution. Subsequently, representation is used to convey understanding about the problem to others. As Lawson notes: “representations are thus far from being incidental outputs but are rather central inputs” to a successful design approach.⁷⁰

As an evaluative criterion, *representing* is relatively straightforward; a design team must be able to externalize their thoughts in a manner that is clear and understandable. However, the complexity of human-centric systems present distinct challenges for design-teams that need to convey – or build – shared understanding. Narratives, analogies, diagrams, and any sort of visual representation of the system are all valid representation techniques. The specific form or format

⁶⁸ S.A. Gregory, editor. *The Design Method*. (London: Butterworths, 1966), 121.

⁶⁹ Lawson, 293.

⁷⁰ Lawson, 293.

is not important; building “models that yield insights that can be shared across... [a] team” with clarity is the critical point.⁷¹

Representing is a fundamental enabler to the previous criteria of *formulating* and *moving*. Explicitly framing a problem and learning through action requires that a design team must demonstrate a set of skills for making their ideas tangible. This leads to shared understanding among members, and with others. *Representing* ideas also overtly enables a design team to distinguish between different or competing ideas, highlighting the importance of the next criteria – *evaluating*.

Evaluating

The criterion of *evaluating* assesses how well a ‘starting block’ enhances subjective judgment in the absence of a clear standard means to measure a design’s value. Lawson explains that a design approach requires a set of skills that enables “judgments between alternatives along many dimensions that cannot be reduced to a common metric.”⁷² Additionally, like *moving*, *evaluating* accounts for the under-determined nature of complex problems by promoting sets of skills that enhance a design team’s subjectivity through active learning processes.

The set of skills that enables judgment between alternatives involves “establishing a framework” for “discovering which constraints are important” early in the design process.⁷³ A design team can construct this framework based on a precedent, but, as Business-Design Professor Roger Martin points out: designers ... worry less about whether they can replicate a particular process and more about producing a valid solution to the problem before them. The only proof they tend to accept is future-oriented—i.e., a design solution shown to work with the

⁷¹ Barry and Beckman, 44.

⁷² Lawson, 298.

⁷³ Brown and Katz, 18.

passage of time.⁷⁴ Therefore, a design approach that accounts for *evaluating* must demonstrate a deliberate process for assigning values; explaining what makes a potential solution better or worse than another. ‘Right’ or ‘wrong’ are not as important as a deliberate process for justification, reasoning, and explanation. In the words of educational designer Elliot Eisner: "there is no statistical test...in the end, what counts is a matter of judgment."⁷⁵

In order to better inform this judgment, a design approach that embraces *evaluating* (and *moving*) must build-in a process for learning through action. In terms of *evaluating*, this means a successful design process "integrates design and measurement methods in a continuous learning cycle...one seamless process."⁷⁶ Since the relationship between learning, experience and judgment is intertwined, a successful design approach must incorporate a deliberate process for active-learning.⁷⁷

Evaluating-skills are especially important in a design approach that is used to make recommendations between competing ideas or course of action. A deliberate process for articulating value and incorporating active learning allows a design team to enhance these evaluating skills. Deliberate processes for *evaluating* also enable a design team to better manage the overall design process through *reflection*.

Reflecting

Comparison of the ‘starting blocks’ against the criterion of *reflecting* demonstrates the degree to which emphasis is placed on monitoring the entire design process, including adherence

⁷⁴ Roger L Martin, "Design and Business: Why Can't We Be Friends?" *stepinsidedesign.com*, July 1, 2008. Accessed on website of Rotman School of Business, University of Toronto, <https://www.rotman.utoronto.ca/rogermartin/designandbusiness.pdf> (accessed 13 September 2009).

⁷⁵ Elliot W. Eisner, *The Enlightened Eye: Qualitative Inquiry and the Enhancement of Educational Practice*, (Upper Saddle River: Prentice-Hall Inc., 1998), 39.

⁷⁶ IDEO, "Human Centered Design - Process Guide." 85 and 96.

⁷⁷ Kolb, 28 and 38.

to doctrine and the commanders' intent. *Reflecting* in this sense is a measurement of the "higher level activity in which the process is monitored rather than the state of the design."⁷⁸ As a meta-process over the entire design approach, *reflecting* involves monitoring the *moving* processes and adherence to "guiding principles."⁷⁹ For purposes of a military application of design, these guiding principles are interpreted as doctrine and commander's intent.

In his book *Sketching User Experience*, Bill Buxton emphasizes that a team must be as concerned with the "design of the overall process" as much as the "design of the actual product."⁸⁰ In practical terms, *reflecting* requires a design team to continuously take stock of where they are in the process. This entails "a combination of asking which problems have been examined and which have been neglected, and then of asking if the processes involved in *representing, formulating* and *moving* have all been brought to bear."⁸¹

Another way in which a design team applies *reflecting* to the design process is by continually validating their efforts against some "guiding principles." In his numerous experiments to document the traits of exceptional designers, theorist Nigel Cross observed that expert designers either explicitly or implicitly relied upon "first principles."⁸² For members of a military design, the source of these "guiding" or "first" principles team would logically be the bedrock of a Service's (or Joint) doctrine and/or the intent of the commander.

As demonstrated by the preceding explanations, *formulating, moving, representing, evaluating* and *reflecting* encapsulate the essential elements of design. When considered as a set of foundational principles, these five essential elements demonstrate one additional theme that is

⁷⁸ Lawson, 299.

⁷⁹ Lawson, 300.

⁸⁰ Bill Buxton, *Sketching User Experiences: Getting the Design Right and the Right Design*. (San Francisco: Elsevier Inc., 2007), 79.

⁸¹ Lawson, 299.

⁸² Cross, "The Expertise of Exceptional Designers," part I. Cross defines first principles as "propositions or assumptions that cannot be deduced from any other proposition or assumption."

central to an understanding of design: the primacy of learning over in-depth analysis, especially at the beginning of a design approach. As management professor Alan Topalian notes: “the learning experience represents one of the most power benefits derived” from the design approach.⁸³ The skills required to frame a problem, suspend initial judgments, make ideas explicit, assign relative values, and monitor the overall process all draw on the ability to make learning a deliberate part of the process. Therefore these five essential elements are ideal criteria for measuring the validity of any design approach techniques, especially techniques that would serve as ‘starting blocks’ for a military application of design. The remainder of this paper attempts such a measurement.

The importance of an emphasis on learning – and the five essential elements – to a design process relates directly to the thesis under review. In short, a design approach that emphasizes learning enables a commander to reduce the tension between the need to act immediately and the need to begin time-intensive analysis of the problem. Therefore, to be considered valid and appropriate design techniques, the ‘starting blocks’ of rapid prototyping, generative analysis, use of experts and reduction of scope must exhibit this learning-emphasis. The following section provides a detailed description of the four ‘starting blocks’ by defining their importance, providing contemporary and historical examples of their application, and showing how they support a learning-focus. Most importantly, an examination of the ‘starting blocks,’ through the ‘lens’ of the five essential elements, demonstrates how a design approach achieves this emphasis on learning over in-depth analysis.

Starting Blocks’ – the Keys to Learning

The purpose of this study is to identify and describe specific techniques that could enhance the design approach, as currently conceptualized by the U.S. Army, in order to relieve

⁸³ Alan Topalian, *The Management of Design Projects*. (London: Associated Business Press, 1980), 114.

the tension between a commander's need to act immediately and the need to conduct in-depth analysis. A broad review of design theory suggests four concepts - rapid prototyping, generative analysis, use of experts, and deliberate limitation of scope – that meet this need. Since a commander's dilemma of action versus analysis is most acute at the outset of an operation, these concepts would necessarily be applied from the beginning of a design approach; hence the label 'starting blocks.' This section analyzes these four concepts by describing their importance, explaining how they could be employed, demonstrating their historical and contemporary relevance, and outlining their congruence with the essential elements of design. The section concludes with two specific recommendations for the further incorporation of design in U.S. Army doctrine. Implications for the ongoing debate and experimentation with design by the United States Army will be outlined in the conclusion of this paper.

Rapid Prototyping

The first 'starting block' is rapid prototyping, the development of models and/or examples expressly created for testing and refinement. Within the context of developing a military campaign, rapid prototyping could take many forms, including war-gaming, narratives, system diagrams, or pilot programs. Prototyping supports learning by enabling dialogue through interaction with the physical manifestation of an idea and relieves the tensions between the need to act and the need to think by speeding up the learning process. Compared against the five foundational principles of *formulating, moving, representing, evaluating, and reflecting*, rapid prototyping is an excellent design technique and contributes to the validation of this study's thesis. This subsection demonstrates that rapid prototyping is a valid 'starting block' for the military application of a design approach.

The application of rapid prototyping to military operations is not new, however there is no doctrinal reference (current or proposed) that establishes this as a technique for design-centric problem management. As the operations staff of the First United States Army observed after

World War II: "However perfect and carefully devised a plan of operations may be, there are always adjustments to be made ...it is far better to discover them and to eliminate them during a practice period than to wait and let them come to light during important action when it will be too late to make corrections."⁸⁴ The experience of the COSSAC staff, as they iteratively refined their concept and in their testing at the war college in Largs, echoed the First Army observation's advocacy of this 'starting block.' The COSSAC staff sought to use initial iterations as learning events to inform future design and planning. For example, the detailed work on Operation COCKADE, the deception efforts of 1943, were established both as a prototype for future deception operations and as a learning tool for the overall design effort.⁸⁵ They also viewed the 1942 raid operation at Dieppe, France as a prototype example. As General Morgan noted, "there were...many invaluable by-products of this raid which stood us at COSSAC in very good stead."⁸⁶ To sum, the COSSAC staff recognized the value of rapid prototyping.

Design teams applying rapid prototyping as a means for testing and refinement view prototypes as "disposable tools used throughout the concept development process, both to validate ideas and to help generate more ideas."⁸⁷ The intention of 'rapid prototypes' is not realism, accuracy, or exact replication. Instead, design teams should think of prototypes as a means for generating options, therefore "quick, timely, inexpensive, disposable, plentiful, minimal detail, [facilitating] suggestion and exploration" are better criteria. As Buxton points out, prototyping "has more to do with exercising the imagination and understanding (mental and

⁸⁴ First United States Army, "Unapproved G-3 After Action Review, Submitted to First U.S. Army Chief of Staff (General William Kean)," from "Summary of Operations, October 1943-July 1944, parts 1 and 2. Accessed from the official records of the Headquarters, First United States Army, 1943-1955, contained within the National Archives at the President Eisenhower Library, section1, page 12.

⁸⁵ Morgan, 83. Morgan noted: "it was evident that we must make what virtue we could of necessity and that while fulfilling the terms of our directive we must be at pains to derive from our rehearsal operations such benefit as we could for our main purpose."

⁸⁶ Morgan, 84.

⁸⁷ IDEO. "Human Centered Design - Process Guide," 75.

experiential) than about the materials used."⁸⁸ The importance of rapid prototyping is making solutions tangible and preventing the design team from getting prematurely attached to a given idea. As the authors of *Change by Design* point out: "prototyping generates results faster. This seems counterintuitive: surely it takes longer to build an idea than to think one. Perhaps, but only for those gifted few who are able to think the right idea the first time."⁸⁹ The obvious benefits of rapid prototyping are savings, in terms of cost and time; "prototyping is a methodology for making solutions tangible in a rapid and low-investment way."⁹⁰

The application of rapid prototyping to the development of a military campaign could take numerous forms, and would likely change throughout the application of a design approach. One obvious prototype example, familiar to military professionals with experience in planning, is the wargame. However, not-so-familiar forms of prototypes include narratives, system diagrams, and mini-pilots. A narrative could be used to "describe and explain the command's understanding of the emergent situation" and "the logic and sequence of how the situation evolves."⁹¹ Another prototyping method applicable to a military campaign is the system diagram, or map of the "activity ecosystem" that identifies and compares the relevant actors in a given situation.⁹² A

⁸⁸ Buxton, 135.

⁸⁹ Brown and Katz, 89.

⁹⁰ IDEO. "Human Centered Design - Process Guide," 56.

⁹¹ Wass de Czege, 9. See also Diego Rodriguez and Ryan Jacoby, "Embracing Risk to Learn, Grow, and Innovate." *Rotman Magazine*, Spring 2007, 57 and Martin, "Design and Business: Why Can't We Be Friends?" 8. Martin suggests "analogy" as a variant of narrative: "crafting a story that takes an existing idea in operation elsewhere and shows how it's similar to the novel idea being proposed ... not necessarily exactly the same, but close enough."

⁹² Keystone accountability, "IPAL Guide 2: Impact Planning, Learning and Assessment – Developing a Theory of Change," 5. KeystoneAccountability.org. http://www.keystoneaccountability.org/sites/default/files/1%20IPAL%20overview%20and%20service%20offering_0.pdf (page accessed 12 September 2009), 33. The IPAL guide also suggests building a "collaboration profile" of relevant actors (from the ecosystem map) in order to determine strategies for "interventions" to better align the activities of different organizations. It is a simple continuum, ranging from "alignment" to "partnership." However, as a Design Team will only be able to make educated guesses (predictions) about how other organizations would react to "interventions," the "collaboration profile" can be seen as a prototype - a model for further experimentation and learning.

final prototyping technique, recommended by non-profit organizations working in developing nations, is the "mini-pilot program" in which "implementation is an iterative process" of experimentation "to perfect the solution and support system."⁹³ Most likely, a design team would apply a mixture of these prototyping examples, and recognize that different prototypes will be useful in different stages of the process.⁹⁴

Although wargaming is a technique familiar to Army planners, developing a rapid prototype of an entire campaign might not be the ideal form for iterative testing. Wargaming portions of a campaign might be feasible, as is the modeling of specific sub-component actions. For example, in their examination of the unique aspects of operations in urban settings, authors Russ Glenn and Gina Kingston identify rules of engagement as something that needs to be tested before starting and that needs to have 'learning' planned for it over time. "The challenge is to get the ROE close to right before operations start and thereafter adapt them quickly and effectively as necessary."⁹⁵

In addition to the benefits of lower cost, faster testing and institutional familiarity, rapid prototyping is an essential 'starting block' because it directly counteracts the tension between an immediate need to act and a long-term need to analyze. This is because rapid prototyping emphasizes the primacy of learning over in-depth analysis. The ways in which rapid prototyping exhibit this central theme of design demonstrate how tension is relieved. For example, rapid prototyping facilitates enhanced dialogue through interaction with a tangible representation of an idea; this speeds up shared understanding and increases 'buy-in' of subordinates by making the learning process deliberate. Design professionals across many disciplines agree that the "design thinking" inherent in rapid prototyping allows a team to "explore more ideas more quickly that

⁹³ IDEO. "Human Centered Design - Process Guide," 85.

⁹⁴ Brown and Katz, 106-107.

⁹⁵ Russell W Glenn, and Gina Kingston, *Urban Battle Command in the 21st Century*, (Santa Monica: RAND Corporation. 2005), 51.

you could otherwise."⁹⁶ However, as prototyping expert Michael Schrage notes, the real value in constructing a deliberate learning process around prototypes "resides less in the models themselves than in the interactions - the conversations, arguments, consultations, collaborations - they invite."⁹⁷ This collaboration, resulting from the rapid exploration of numerous ideas through prototypes, leads to faster shared understanding. Brown and Katz suggest that "a successful prototype is not one that works flawlessly; it is one that teaches us something."⁹⁸

Additionally, rapid prototyping acknowledges the need for deep analysis, but accounts for the fact that it cannot all be done up-front by setting in motion a process to increase the depth and quality of analysis over time. Prototyping is suited towards setting the conditions for learning over time through "iterative hypothesis and experiment," defining problems more precisely, and discarding solutions that "aren't fruitful."⁹⁹ Additionally, the experimentation inherent in prototyping can be extremely useful in the generation of questions to be examined as part of the Commander's Critical Information Requirements. The goal of building and using prototypes should be to "learn about the strengths and weaknesses of the idea and to identify new directions that further prototypes might take."¹⁰⁰ Buxton notes that design teams should approach prototyping as a means to "fail early and fail often...and learn."¹⁰¹

⁹⁶ Tim Brown, "Design Thinking." *Harvard Business Review* (June 2008), 8; Roger L. Martin, "Why Decisions need Design." *Businessweek.com*, August 30, 2005, http://www.businessweek.com/innovate/content/aug2005/id20050830_416439.html (accessed 13 September 2009). Buxton, also actively support the idea that prototyping increases the speed of a design approach (Buxton, 143).

⁹⁷ Michael Schrage, *Serious Play: How the World's Best Companies Simulate to Innovate*, (Boston: Harvard Business School Press. 2000), 20. This idea is also supported by Roger Martin (Martin, "Why Decisions need Design, part 1).

⁹⁸ Brown and Katz, 105.

⁹⁹ Jane Fulton Suri, "Informing our Intuition: Design research for radical innovation." *Rotman Magazine*, Winter 2008, 54. See also Rodriguez and Jacoby, 57.

¹⁰⁰ Brown, "Design Thinking," 3.

¹⁰¹ Buxton, 141.

Evaluated against the foundational principles of design (*formulating, moving, representing, evaluating, and reflecting*), rapid prototyping is an ideal skill-set for teams applying design to the development of campaigns. Rapid prototyping supports the concept of *formulating* by facilitating the framing process and by setting the conditions for deeper analysis. The process of framing a problem demands that a design team continually question what they think they know; prototyping enables the iterative examination of questions. As Schrage explains, “prototypes...do more than answer questions, they can also raise questions that have never been asked before;” a process that is invaluable to the generation of CCIR.¹⁰² The process of framing, in turn, enables deeper analysis by setting the conditions for deeper analysis through learning. As noted above, this condition-setting is also the purpose of prototyping: “the goal of prototyping is not to create a working model. It is to give form to an idea to learn about its strengths and weaknesses and to identify new directions for the next generation of more detailed, more refined prototypes.”¹⁰³

Rapid prototyping also supports the *moving* criteria, as the concepts of judgment-suspension and learning-through-action are built into the process of iterative testing. Judgment must necessarily be temporarily suspended while prototyping because “the more you try, the more you learn; and the more you learn, the greater the likelihood that you can design a new and better experience for a user.”¹⁰⁴ By continually interacting with each other through prototypes, design teams construct a deliberate process for learning through action and iteration. As the “Human-Centered Design” handbook points out: “prototyping is about building to think,

¹⁰² Schrage, 77.

¹⁰³ Brown and Katz, 91.

¹⁰⁴ Rodriguez and Jacoby, 56.

acknowledging that the process of making ideas real and tangible helps us to refine and iterate the ideas quickly."¹⁰⁵

Likewise, this ‘starting block’ supports the concept of *representing*, as the inherent value of rapid prototyping is to make ideas explicit. Schrage captures this notion when he explains that prototypes are not ideas...they are "representations of ideas" built and used for the purpose of engaging “the organization's thinking in the explicit” in order to “externalize thought and spark conversation.”¹⁰⁶ Rapid prototyping also aligns with principle of *representing* in that accuracy is not the goal; facilitation of "an internal dialogue about how the concept works and external communication about the concept" are the important factors.¹⁰⁷

Rapid prototyping also supports the concept of *evaluating*, in that the explicit purpose of rapid prototyping is to assist design teams with building and recommending better choices. As the critical aspect of *evaluation* is the ability of a design team to assess potential solutions in the absence of objective measurements, the constant testing of a prototype rapidly provides insights into applicable metrics. Brown characterizes prototyping as “an evaluative process” in which the ability of design teams to improve subjective valuation is naturally enhanced through the feedback of subsequent iterations.¹⁰⁸ More importantly, the implicit purpose of rapid prototyping is informing these choices by enhancing experience through learning. As the explanation of formulating and moving noted above, prototyping is a tool that enhances learning and has little value for a design team unless “it can teach them something.”¹⁰⁹

¹⁰⁵ IDEO. "Human Centered Design - Process Guide," 56.

¹⁰⁶ Schrage, xvi and 14.

¹⁰⁷ IDEO. "Human Centered Design - Process Guide," 56. Brown notes that “the goal [of a prototype] isn't to create a close approximation of the finished product or process; the goal is to elicit feedback that helps us work through the problem we're trying to solve (Tim Brown, "Strategy by Design," *Fast Company*, June 2005, 4).

¹⁰⁸ Brown, "Strategy by Design," 4.

¹⁰⁹ Rodriguez and Jacoby, 57.

When examined in terms of *representing*, the last foundational principle, rapid prototyping is again congruent. As a tool intended for use during all phases or steps of a design approach, rapid prototyping facilitates a design team's ability to keep track of their progress – a key aspect of *representing*. The *Change by Design* authors make this point in their assertion that prototyping is something to be used throughout all the phases or 'frames' of the Design process; it is not a distinct step or a portion of a step.¹¹⁰ Representing also requires a design team to continually consider 'guiding principles.' Prototyping accomplishes this by iterative testing and validation of principles in a specific context.

This comparison of the rapid prototyping against the foundational principles embodied in formulating, moving, representing, evaluating, and reflecting makes clear that this is a valid 'starting block' for a design approach. As a "methodology for making solutions tangible in a rapid and low-investment way," rapid prototyping provides design teams a skill-set that integrates learning through active testing and collaboration on explicitly stated ideas.¹¹¹ This 'starting block' would positively improve the development of military campaigns and assist in the generation of CCIR. Stated succinctly, prototyping supports the concept that learning is more important than deep analysis, especially at the outset of a problem-management process. Schrage summarizes this precisely by pointing out that thinking novel solutions to complex problems "can be studied or analyzed into existence flies in the face of history and fact."¹¹²

Generative Analysis

The second 'starting block' is generative analysis, analysis that sets the baseline for future learning. As a tool used in developing a military campaign, generative analysis is the process of

¹¹⁰ Brown and Katz, 106-107.

¹¹¹ IDEO, "Human Centered Design - Process Guide," 56.

¹¹² Schrage, 2.

creating and executing a deliberate plan for learning over time by explicitly identifying what information is known, what information can be learned through deeper analysis, and what information can only be learned by interacting with the problem-situation (system) under consideration. Generative analysis supports learning by leveraging informed intuition and experience to determine what needs to be known rather than attempting to conduct premature in-depth analysis and relieves tension by avoiding 'work-overlap' with planners. Compared against the five foundational principles of formulating, moving, representing, evaluating, and reflecting, generative analysis is a solid design technique and contributes to the validation of this study's thesis. This subsection demonstrates that generative analysis is a valid 'starting block' for the military application of a design approach.

The actions of the COSSAC staff exemplify how emphasis on generative analysis translates known information and experience into an active plan for future learning/analysis and highlights how it reduces a commander's tension. By dedicating a large part of their initial effort to analysis of previous planning, the COSSAC staff sought out specific ways in which to learn. When outlining potential campaigns for the "unexpected surrender" of Germany (Operation RANKIN), General Morgan expressed a need for a form of generative analysis in order to ensure flexibility. Since the COSSAC staff could not predict, with any certainty, what would happen, they outlined three separate cases, each one based on a different set of circumstances, using generative analysis to identify the requirements for future re-framing. This learning-centric approach relieved act-versus-understanding tension, enabling Morgan and his staff to focus on the overall campaign, leaving the task of detailed mission analysis to the planners of the operational groups eventually assigned the actual tasks.¹¹³

The concept of generative analysis is a categorization of research that is conducted by teams at the beginning of a design process to use existing knowledge and experience to find

¹¹³ Morgan, 63-102, 104, and 107.

"emergent patterns, challenges, and opportunities."¹¹⁴ The result of generative research is an initial assessment of the problem and a road-map for future learning. The importance of generative research is that it accounts for the uncertainty inherent in complex systems by eschewing in-depth analysis prior to problem refinement. Policy expert Ernest Alexander highlights the importance of this technique when he suggests that "solutions cannot always be found or constructed on the basis of bits of pre-existing information."¹¹⁵ Generative research accounts for what instructional-design expert Peter Pipe characterizes as "the fact that you will not necessarily be right about everything the first time around."¹¹⁶ This is a tacit recognition that learning is a necessary precursor to deep understanding.

Based on this definition, the application of generative analysis to the development of a military campaign involves a change of emphasis rather than a change of process. The methodology outlined in *FM 5-0 (FINAL APPROVED DRAFT)* is fundamentally sound; in general, it involves a stock-taking of known data, the development of options, and the generation of a detailed plan for learning.¹¹⁷ However, instead of orienting this process on the in-depth analysis required to "understand a problem and appreciate its complexities before seeking to solve it" required for immediate decision-making, the design team should focus efforts on determining where information is lacking and overall understanding of the situation is weak.¹¹⁸ This would enable the development of a detailed plan for learning - an exhaustive list of

¹¹⁴ IDEO, "Human Centered Design - Process Guide," 25 and Suri, 56. Design theorists assign this label to distinguish "generative research" from later, in-depth ("evaluative") research. See also the description of "action research" outlined by Bell and French (Cecil H. Bell and Wendell L. French, *Organization Development - Behavioral Science Interventions for Organization Improvement*, (Englewood Cliffs: Prentice-Hall, Inc. 1978), 89-93).

¹¹⁵ Alexander, 285.

¹¹⁶ Peter Pipe, *Objectives - Tool for Change*, (Belmont, California: Fearon Publishers, 1975), 10.

¹¹⁷ *FM 5-0 (FINAL APPROVED DRAFT)*, 3-7 to 3-12. The basic methodology for the design approach, as outlined in *FM 5-0 (FINAL APPROVED DRAFT)* is the development of an environmental frame, problem frame, and an operational approach, or solution, in the form of a "design concept."

¹¹⁸ IDEO. "Human Centered Design - Process Guide," 25 and *FM 5-0 (FINAL APPROVED DRAFT)*.

information gaps (questions addressed by CCIR) and identification of historical precedents.¹¹⁹

Considered in the context of a larger problem-management process, the design team should focus on building a plan to learn rather than a plan to achieve immediate understanding; this avoids work-overlap with the planning team that will conduct the mission analysis.¹²⁰

When assessed against the essential elements of design (*formulating, moving, representing, evaluating, and reflecting*), generative analysis is the proper focus for teams applying design to the development of campaigns. In terms of *formulating*, the emphasis-shift to learning required in generative analysis is critical to a design team's ability to both conduct framing and set the conditions for later, deeper analysis. Generative analysis apprehends that problem management requires an iterative and evolutionary approach, but that a "framework for dialogue and learning" is necessary to begin the design process.¹²¹ Management experts emphasize that at the outset of a design approach, the "process must have as much to do with finding the right questions to ask (in the choice and structuring of problems) as it has with providing appropriate answers (in the formulation of solutions);" generative analysis enables these questions and structure.¹²²

Generative analysis also aligns with the principle of *moving*, as it forces design teams to temporarily suspend judgment until learning is deliberately planned. The cyclical consideration

¹¹⁹ Alexander, 288. Alexander's analysis of the application of design to the development of Vietnam Policy "suggests that systemic search [of known factors] can effect an even greater improvement in the quality and range of available options."

¹²⁰ The concepts of "conceptual planning" and "detailed planning," as outlined in *FM 5-0 (FINAL APPROVED DRAFT)* provide another framework for understanding generative analysis. Conceptual planning means "developing tactical, operational, or strategic concepts...understanding the operational environment and the problem, determining the operation's end state, establishing objectives, and sequencing the operation in broad terms" in order to "answer questions of what to do and why." This contrasts with detailed planning which "translates the broad operational approach into a complete and practical plan." Generative analysis is a methodology for approaching conceptual planning." (*FM 5-0 (FINAL APPROVED DRAFT)*, 2-6, 2-7.)

¹²¹ Keystone accountability, "IPAL Guide 2," 7. See also Dorst, 3.1.

¹²² Topalian, 8.

of the environment, the problem, and potential solutions in accordance with the design approach is a prime illustration of the concept of *moving*.¹²³ However, by shifting their focus onto learning (vice understanding), the team applying generative analysis is able to further enhance the design approach with an explicit plan for determining where deep analysis is most needed and best applied. The importance of this concept is reinforced by several studies of recent operations that suggest “the further ahead we consider, the less precision we should attempt to impose” because a design team will “lack sufficient resources [and experience] to address the entirety all at once.”¹²⁴

In terms of *representing*, the process of making ideas explicit, generative analysis is like any other form of research in that it works, as Eisner puts it, to “deepen and broaden our experience and help us understand what we are looking at.”¹²⁵ A design team's ability to convey thoughts and concepts is particularly enhanced by the generative analysis technique of searching for historical precedence as a means of description and explanation.¹²⁶ The process of determining and articulating specific informational gaps to drive a process of future learning also supports the principle of *representing*; by determining what is 'not known' in a given situation, the design team is better able to clarify both facets of the problem and what is needed to resolve these problems.

Generative research also contributes positively to the enhancement of subjective judgment inherent in the concept of *evaluating*. As Eisner points out, design teams “often tend...to avoid studying what [they] cannot measure.”¹²⁷ By utilizing generative research to

¹²³ *FM 5-0 (FINAL APPROVED DRAFT)*, 3-8. “Design is essentially nonlinear. It flows back and forth between environmental framing and problem framing while considering several operational approaches.”

¹²⁴ Glenn E. James, *Chaos Theory: The Essentials for Military Applications*, Newport Paper #10. (Newport: Newport War College Press. 1996), 60 and Glenn and Kingston, “Urban Battle Command,” 51.

¹²⁵ Eisner, 59.

¹²⁶ Martin, “Design and Business,” 8.

¹²⁷ Eisner, 45.

outline the specific aspects of a problem in which understanding is poor, and building an active process of learning to increase understanding, the design team avoids this pitfall and improves the capacity for subjective judgment. This active process of learning can also assist the design team in refining their assessment of relative values.

Finally, generative research corresponds with the foundational principle of *reflecting*, the meta-cognitive skill of monitoring the overall design process. A design team applying generative research implicitly agrees with Brown and Katz's suggestion that "a design project...has a beginning, middle, and end, and...restrictions that anchor it to the real world."¹²⁸ Through the establishment of a deliberate process of active learning, the design team is able to "articulate a clear goal at the outset" and "impose discipline...review progress, make midcourse corrections and redirect future activity."¹²⁹ Generative analysis' emphasis on reviewing known information, experience, and precedence, also reinforces reflecting by driving the design team to remain mindful of guiding principles, including doctrine and intent.

Evaluation of generative research in terms of these five foundational principles demonstrates that this is also a strong 'starting block' for a design approach. As a process for temporarily setting aside the demands of in-depth research in order to outline a deliberate process for learning, generative research is a perfect fit for the development of military campaigns. The simple, but critical, shift in emphasis from understanding to learning at the outset of a problem management situation fits well within the U.S. Army's current conceptualization of design and better sets conditions for the operational commanders and their staffs that translate design concepts into plans. The deliberate approach to learning also portends obvious benefits for the development of CCIR. Additionally, generative analysis fits well with leadership expert Leonard Wong's concept of "adaptive leadership," as design teams focused on learning can "spend less

¹²⁸ Brown and Katz, 21

¹²⁹ Brown and Katz, 21.

time fretting about the inability to establish a routine or control the future and focus more on exploiting opportunities."¹³⁰

Use of Experts

The third 'starting block' is the inclusion of experts on the design team. Although the commanders and military professionals assigned as an organization's design team inherently represent experts, the idea behind this 'starting block' involves the active recruitment and utilization of outside expertise. Experts support learning by enabling better questioning and providing more informed intuition of what is important for the design team. This is also important in relieving the tensions between the need to act and the need to think because of the increased potential for making sense of a large amount of information (more analysis) in a shorter amount of time (quicker action.) Compared against the five foundational principles of *formulating, moving, representing, evaluating, and reflecting*, the use of experts is another positive design technique and contributes to the validation of this study's thesis.

As with the previous 'starting blocks,' the experience of the COSSAC staff provides a detailed example of this concept in action. The integration of subject matter experts to supplement the military staff was extensive. As General Morgan pointed out: "ambassadors, microfilm operators, bankers, agriculturists, newspapermen, lawyers, foresters, and a host of others, each the master of some technique [were] needed to help get us where we wanted to go." In addition to SME-integration, the COSSAC staff was "in daily contact with the headquarters of the European Theater of Operations, United States Army...specially so with its Services of Supply organization." As the size and scope of the COSSAC staff's efforts grew, the inclusion of experts in all of the various directorates and subordinate sections was logical and inevitable.

¹³⁰ Leonard Wong, *Developing Adaptive Leaders: The Crucible Experience of Operation Iraqi Freedom*. (Carlisle, PA: Strategic Studies Institute. July 2004), 11.

However, the experts most critical to the success of the effort were the high-level diplomats with the broadest understanding of the overall situation who only interacted with the core members of the design effort, but "added immeasurably to the general effectiveness of the whole organization."¹³¹

The use of experts is important to the overall design approach because it increases the capability of teams to start the process of framing and problem definition in the right direction. Using experts to supplement design teams is a technique that dates back to "first generation" design theories of the 1960s where "approaches led designers to think explicitly about how to decompose a complex problem into a set of smaller well-defined problems and to seek experts in the sub-disciplines to solve those problems." Barry and Beckman found that although subsequent generations of design theory de-emphasized the reductive approach of looking at complex problems as sub-components, and "relied less on experts to provide solutions," the value of engaging expertise through a "broader range of players" remained intact.¹³² As a technique for teams applying design to the development of military campaigns, this value is especially cogent. Military design teams possess a high degree of expertise in the application of Joint power to defeat an enemy, but - as numerous studies of on-going operations demonstrate - these teams generally have very little knowledge of the social, political, and economic systems of the environments in which they operate.¹³³ The danger in this, as Barry and Beckman note, is that analysis without experience tends to focus too much on "operating only in the abstract realm" which leads to failures when applied to real life situations.¹³⁴

¹³¹ Morgan, 44, 64, and 217.

¹³² Barry and Beckman, 26.

¹³³ Colin Gray, "Irregular Enemies and the Essence of Strategy: Can the American Way of War Adapt?" StrategicStudiesInstitute.army.mil (March 2006), <http://www.strategicstudiesinstitute.army.mil/pubs/display.cfm?pubID=650> (page accessed 6 July 2009), 10. See also: Was de Czege, 1 and *FM 5-0 (FINAL APPROVED DRAFT)*, 3-3.

¹³⁴ Barry and Beckman, 49.

Within the context of developing a military campaign, the use of experts could be applied in two primary ways - the inclusion of subject-matter experts (SMEs) on the design team or interaction with operators (or other design teams) from subordinate or peer organizations. Experts integrated into a core design team need to have both a breadth and depth of knowledge about the problem-situation, and should be capable of contributing to the entire process. For example, an expert on general financial systems with no knowledge of the specific culture or political processes of a given environment would be of little use to the design team's efforts. In other words, the make-up of design teams needs to be interdisciplinary and capable of leveraging transformative, emergent ideas.¹³⁵ The integration of Human Terrain Teams into Division and Brigade Combat Team staffs in Iraq serves as a loose example of SME-inclusion.¹³⁶ Interaction with members of peer or subordinate organizations is a more self-evident application of this technique; however the expertise of these 'outside' organizations is often times overlooked. Generally, the only person that regularly practices this technique is the commander (in the form of battlefield circulation), which often means that this sort of expertise never reaches the design team.¹³⁷ As a form of 'starting block,' this use of experts would need to be formalized.

The inclusion of experts on a team supports the emphasis on learning which is inherent in design; important because a learning-emphasis leads to a decrease in the tension between the need to act and the need to analyze. Experts enable the learning focus of design by facilitating the development of better questions and through more precise framing activities. As Topalian noted

¹³⁵ Brown and Katz, 27-28. The authors distinguish between multidisciplinary and interdisciplinary teams. Of interest, the authors note that multidisciplinary teams lead to debates and compromises, not the emergence of new and better ideas.

¹³⁶ Jacob Kipp, Lester Grau, Karl Prinslow, Don Smith, "The Human Terrain System: A CORDS for the 21st Century." *Military Review* (September-October 2006): 8-15. Kipp, et al provide an overview of the Human Terrain System and the employment of Human Terrain Teams.

¹³⁷ This observation is based on fourteen months of experience as a battalion commander in Iraq in which this phenomenon was both observed (at several levels of command) and unwittingly committed by the author.

in his study of design management, "outside designers [experts] are introduced into project teams in order to raise standards."¹³⁸ Better questions and precision in framing results in more relevant CCIR and faster determination and articulation of a problem. Experts can also relieve tension by making sense of large amounts of information in a short amount of time. Studies of experts included in design suggest that this is because experts possess an intuitive grasp of the functionality of larger systems and understand how systems, or key portions of systems, are supposed to act and therefore able to more rapidly diagnose problems.¹³⁹ Brown and Katz support this idea with the observation that one of the values of employing experts is an increase in empathy, or the ability to see problems from the perspective of those more intimately involved. "A designer...who simply generalizes from his own standards and expectations will limit the field of opportunity."¹⁴⁰

When assessed against the foundational principles of design (*formulating, moving, representing, evaluating, and reflecting*), the use of experts in the development of campaigns is a valid technique. Regarding *formulating*, Cross notes that experts are specifically adept at "developing a particular perspective or problem frame for guiding the solution concept." This is because the experience-base of experts is greater, providing both additional breadth and depth of knowledge about a given subject. This means that experts can query a larger "systems view" of a particular situation, and rapidly cull out the factors of importance.¹⁴¹ As a tool-set for applying design to human-centric situations, the inclusion of experts on interdisciplinary teams is one of the three "generic best practices" identified in the IDEO Company's HCD Process Guide.¹⁴²

¹³⁸ Topalian, 77.

¹³⁹ Cross, "The Expertise of Exceptional Designers," 1.1.

¹⁴⁰ Brown and Katz, 49-50.

¹⁴¹ Cross, "Expertise of Exceptional Designers," 1.1.

¹⁴² IDEO, HCD Process Guide, 11. The other two "best practices" are less useful to the military application of design: assigning "dedicated work spaces" and establishing "finite timelines" (deadlines) for the design team.

In terms of *moving* and *representing*, the use of experts would be a catalyst to improving a design team's ability to suspending judgment, facilitating the development of a plan for learning, and making ideas explicit. Experts would enhance these skill-sets because of the additional knowledge, experience, and ability that justify the designation of their expertise. Martin suggests that design teams that include experts can speed-up the buy-in process, better visualize how "decisions at one level effect the next level down," and "leverage the unique and generative experience" of SMEs to improve the design through subsequent iterations.¹⁴³ This leads to better questions (CCIR) and faster identification of problems.

The enhancement of subjective judgment, or the principle of *evaluating*, is also improved by the use of experts. One of the values of employing experts is an increase in empathy, or the ability to see problems from the perspective of those more intimately involved. Brown and Katz observe that "a designer...who simply generalizes from his own standards and expectations will limit the field of opportunity."¹⁴⁴ Experts enable design teams to articulate a more precise expression of relative value in what retired Brigadier General (and first director of SAMS) Huba Wass de Czege, describes as "a collective design approach [that] attains a broader, holistic, and shared understanding."¹⁴⁵

Finally, the use of experts enables a design team to recognize and apply guiding principles, a key aspect of reflecting. Again, this is largely a byproduct of the expert's (greater) experience. In his focused study of expertise, Neil Cross observed that an expert's greater familiarity with "first principles" ensured better adherence to precedence and standards. This led

¹⁴³ Martin, "Why Decisions Need Design, pt 1".

¹⁴⁴ Brown and Katz, "Change by Design, 49-50.

¹⁴⁵ Wass de Czege, 7.

to fewer mistakes, ease of identifying and explaining value-judgments, and a general increase in the speed of entire projects.¹⁴⁶

Examining the inclusion of experts in terms of these five criteria demonstrates that this is also a worthy 'starting block.' As the Human-Centric Design Process Guide suggests, design teams can achieve a "higher likelihood of success...by intentionally assembling the right team of people."¹⁴⁷ Experts would increase the quality of military campaigns and provide commanders with more incisive questions for CCIR. In short, experts increase the one thing that a design team cannot replicate - experience. Given the relationship of experience to learning and knowledge in the context of a design approach, the inclusion of experts adds a great amount of value, especially at the outset of a problem-management situation.

Deliberate limitation of Scope

The final 'starting block' is deliberately reducing the scope of the problem-set by limiting the time-horizon or temporarily ignoring portions of the problem-set. As a tool used in developing a military campaign, reduction of scope is the meta-process of prioritizing and managing work efforts. Reducing the scope of a design effort supports learning by enacting a deliberate process of separating knowns and unknowns so that confidence in the fidelity and accuracy of the analytic effort is built over time. This relieves the tension between planning and doing because it avoids the misapplication of effort. Compared against the five foundational principles of formulating, moving, representing, evaluating, and reflecting, reduction of scope is a proven design technique and contributes to the validation of this study's thesis.

¹⁴⁶ Cross, "Expertise of Exceptional Designers," 2.0.

¹⁴⁷ IDEO, "HCD Process Guide," 11.

Given the unique problem of having no commander, the COSSAC staff wisely limited its scope to things they could control.¹⁴⁸ Two specific examples demonstrate how COSSAC applied this technique – the initially singular focus on the channel crossing and the deliberate delay in analyzing alternate invasion directives. The original CCS planning directive, issued in March of 1943, tasked the COSSAC staff to prepare three separate plans – RANKIN (deception operations), RANKIN (unforeseen German surrender) and OVERLORD (channel crossing). However, after preparing the first overview of all three plans (by May of 1943), General Morgan convinced the CCS to reduce the scope of the staff’s efforts to the advanced guard mission of crossing the channel – Operation OVERLORD. As Morgan noted, “this supplementary directive gave us a more tangible object,” leading to a better refined, more focused effort.¹⁴⁹ Later (following the QUADRANT conference in August of 1943), the COSSAC staff was given a new, additional, planning requirement: examination of an invasion of Europe through Norway (Operation JUPITER). Fortunately, this task was ignored by the COSSAC team and rapidly became overcome by events. This deliberate scaling of effort was again made possible by Morgan confronting the CCS, arguing that “if justice were to be done to a plan for Operation JUPITER, less than justice would be available to Operation OVERLORD.”¹⁵⁰ In both cases, the COSSAC staff was able to purposefully limit the scope of their problem, achieving a more refined and better-developed effort on parts of the problem that were most important.

As a skill-set available to teams applying a design approach to the development of a military campaign, reduction of scope is a process of prioritization and time management. Alan

¹⁴⁸ Morgan, 131. Morgan and the COSSAC team recognized that defeat of the enemy’s reserves was the key to the overall campaign; however, getting there was the initial focus: “The climax of the campaign will be the defeat in battle of the main body of the enemy's reserves. This will definitely not take place on or near the beaches. . . .we must never lose sight of the fact that the assault on the beaches is merely a first step to what must follow.”

¹⁴⁹ SHAEF, 3 and 5 and Morgan, 66.

¹⁵⁰ Morgan, 241.

Topalian succinctly states the intention underlying the purpose of applying reduction of scope to a design problem: "clearly it is not always possible to define problems accurately (or even to ask the right questions) at the start of projects; there is just so much that can be known about certain kinds of problems before work starts on solving them."¹⁵¹ Additionally, Topalian points out that:

many design projects stretch out over several months, if not years, and deal with complex problems within rapidly changing environments. What was considered a minor shortcoming yesterday can become a pressing need tomorrow; an aspect of a problem which is given relatively low priority at one stage may turn critical if left unresolved; what is perceived as a problem today may, for all sorts of reasons, cease to be one in the future, and so on.¹⁵²

Considered thusly, reducing scope is a way to maximize the use of available time by focusing on immediate problems. This enables the majority of effort to be oriented on the development of action-plans for future learning.

Specifically, a team applying reduction of scope to a design approach limits the sizes of the environmental and problem frames, consciously designates a prioritization of effort, and explicitly identifies time references to bound the limits of the problem-set under consideration. Strongly related to this concept is the idea of backwards planning from a known point. Given the potentially open-ended time horizon of long-duration military campaigns, statements of end state cannot be fixed, and therefore have no known point. The authors of the Impact Planning, Learning, and Assessment Guide attribute this is to the under-determined nature of complex systems: "it may not be possible to map all the preconditions of success."¹⁵³ Backwards planning from an idea or condition is so open-ended as to lose its usefulness. This makes it difficult to timeline out intermediate objectives; it also provides little or no guidance for how long a commander can allow subordinates to employ mission-tactic approaches to solving problems at their level. Reducing scope through the conscious limitation of environmental and problem

¹⁵¹ Topalian, 10.

¹⁵² Topalian, 33.

¹⁵³ Keystone accountability, "IPAL - Guide 2," 19-20.

frames - the specific portions of a problem-set that the design team chooses to concentrate effort on - is one way that complex situations are made manageable. Prioritization of effort is another way. Topalian suggests that a third technique is to designate a "time reference during which information gathered on the nature of the problem and its context is expected to remain relevant," which enables a design team to fix a point in time that enables concrete backwards planning by subordinate elements.¹⁵⁴

By applying reduction of scope techniques, the design team supports the overall learning process through iteratively-constructed confidence and reduces the inherent tensions between acting and analysis by preventing wasted effort. Reducing the scope of a design problem builds confidence over time by enabling the iterative learning process: a small portion of the environment and problem are framed, learning is actively planned, and the results of this short-range analysis are quickly examined for accuracy of predicted outcomes. Roger Martin provides an illustration of this effect in his description of a typical interaction between designers and executives in business:

There is both good news and bad news about the future. The bad news is a year from now is now in the future. From a proof standpoint, what happens in the future is not relevant. The good news is that a year from now, this year will be in the past. This nuance is critical to reliability-oriented executives. Designers can convince executives to bite off a piece of what they would like to do, saying, "Here is my prediction of what will happen. Let's watch next year to see what did happen." If the executives agree to bite off that chunk, and the designer's predicted results happen, it builds confidence.¹⁵⁵

A deliberate limitation of scope also reduces planning-versus-doing tensions by allowing the design team to rapidly develop a planning directive that operators and planners can work with fidelity. By limiting the time horizon concerned, predictions and expectations increase in fidelity. This avoids basing efforts on what Buxton describes as the "false assumption that we can adopt a

¹⁵⁴ Topalian, 33.

¹⁵⁵ Martin, "Design and Business, Why Can't We Be Friends?"

process that will take us along a straight path from intention to implementation" because "the fastest and most efficient path is never a straight line."¹⁵⁶

When assessed against the foundational principles of design (*formulating, moving, representing, evaluating, and reflecting*), the reduction of scope in the development of military campaigns is a valid technique. The correspondence of this technique to the principle of *formulating* is obvious; reduction of scope is directly related to the process of framing and is a primary technique for setting the conditions for deeper analysis. Reducing the scope of a design problem involves establishment of what the IPAL Guide authors classify as a "clear and accessible set of short term outcomes that the organization can realistically hope to influence and help bring about," and the explicit designation of a time horizon with which to bound a process of learning.¹⁵⁷ This reduction of scope in the process of framing also exhibits support of the principles of *moving, representing* and *evaluating*. By establishing "constraints – such as schedule, headcount, and scope," Rodriquez and Jacoby note that a design team is better able to "learn more about what it will take to execute [a]...proposition without spending big-picture amounts of energy, money and time"¹⁵⁸ This requires the temporary suspension of judgment and puts into motion an iterative process for learning through action - key aspects of *moving*. Additionally, reducing the scope of a design project reflects the concept of *representing* in a tangential, sideways fashion. By limiting the size of the environmental and problem spaces, the descriptive tasks - making ideas explicit - become more manageable for the design team. This aids both in focusing the overall effort, and leads to the development more refined and precise CCIR. Furthermore, this same application of a reduced scope to framing exemplifies the principle of *evaluating* in a tangential way. A design team applying this technique uses subjective

¹⁵⁶ Buxton, 77.

¹⁵⁷ Keystone accountability, "IPAL - Guide 2," 20.

¹⁵⁸ Rodriquez and Jacoby, 58.

judgment and leverages experience and intuition to drive the selection/determination of short and mid-term goals as the limits or size of the framing effort. As Glenn and Kingston suggest, reducing scope does not mean ignoring or failing to think about the long term or end state. It means that a design team should focus on information and intuition that is at hand to estimate the short term goals that they think lead to an end state, and then iteratively test them for validity.¹⁵⁹ Finally, the reduction of scope technique also adheres to the principle of *reflecting*, primarily by enabling the design team to better monitor their progress in the overall process. As a design team reduces the scope of a problem-set, and establishes prioritized time horizons, Topalian observes that the "work load will be broken down in to smaller, more manageable elements or stages."¹⁶⁰ This allows the team to keep track of where they are in the process, and better focus on the big picture.

Evaluation of reduced scope in terms of these five foundational principles demonstrates that this is also a strong 'starting block' for a design approach. Reducing the scope of a problem-set is a powerful tool for setting the conditions for learning; problem-sets become more manageable and a design team is able to maximize efforts on building confidence iteratively. This technique is not a repudiation of the concept of backwards planning or the importance of end state; as Rittel and Webber warn: "If...the problem is attacked on too low a level (an increment), then success of resolution may result in making things worse, because it may become more difficult to deal with the higher problems."¹⁶¹ However, time spent on consideration of problems too far into the future, with too many unforeseen variables, can be wasted time. This stands to

¹⁵⁹ Glenn and Kingston, "Urban Battle Command," 39. Glenn and Kingston examined extended operations conducted in urban terrain. They conclude that accurately predicting the sub-objectives needed to achieve long-term goals through wargaming is difficult. However, they go on to suggest the need for prototyping (wargaming) rules of engagement. This is an example of a design team focusing on something that it can control, rather than dedicated excessive time to trying to model an 'underdetermined' system.

¹⁶⁰ Topalian, 65.

¹⁶¹ Rittel and Webber, 162.

make campaign design better, and assist with the prioritization of CCIR. Reduction of scope prompts serious thought to framing and prioritization.

Recommendations

The congruence of all four starting blocks to the essential elements of design, as outlined in the section above, is clear. Furthermore, the historical and contemporary examples of their applicability to the development of military campaigns argue positively for their inclusion in any military design approach. Based on this reasoning, the U.S. Army should strongly consider two specific recommendations concerning the integration of these 'starting blocks' into the emerging doctrine and practice of design. One recommendation is simple: expand the currently proposed doctrine to include the 'starting blocks' in the design of military campaigns. The other, less obvious, recommendation is that this expansion of doctrine should also demonstrate a shift of the stated outcome of design from the development of a planning directive to the refinement of CCIR. The remainder of this section outlines the what, how, and why of these recommendations.

The first recommendation suggested by this research is that the U.S. Army should explicitly codify design as the doctrinal model for the development of military campaigns. Specifically, the Army should expand the doctrinal description of design included in the forthcoming *FM 5-0* to encompass the four 'starting blocks' described above and consolidate all design-related doctrine into a separate, stand-alone manual that outlines a campaign-development methodology (*Field Manual 5-1, Design of Long-Duration Operations?*).¹⁶² A comprehensive listing of all design-related doctrine is beyond the scope of this study; however, one critical

¹⁶² Although not a specific doctrinal term, "Long Duration Operations" is meant to convey military actions of scope and effort commiserate with the development of campaigns. Since "campaign" is a specific term connoting military actions undertaken by joint formations, use of this term in an Army-doctrine manual would necessarily be avoided. However, the joint definition of campaign as "a series of related major operations...within a given time and space" is directly comparable with the intention of the term "Long Duration Operations." See United States Department of Defense, *Joint Publication 1-02, Department of Defense Dictionary of Military and Associated Terms*, (Washington D.C.: Government Printing Office, 31 October 2009), 74.

example would be the relationship of design to the development of lines of operation. As a companion/subordinate doctrinal reference, this new manual would expand upon the goals, principles, and overview of design and provide U.S. Army-led campaign design teams with the same level of detail and examples that *FM 5-0 (FINAL APPROVED DRAFT)* provides on the MDMP.

Acceptance of this recommendation would enhance the effectiveness of Army-led operational organizations in three distinct ways. Firstly, it would enable the U.S. Army to take the lead in revising operational planning by clearly outlining a methodology for campaign development to fill the doctrinal gap at the operational-level of war. Although the JOPP is the currently-accepted means for detailed operational-level planning, it is a process modeled largely on the MDMP and, therefore, it is not well-suited to dealing with ill-structured problems. Conceived as a response to the inadequacies of current methodologies, a design approach explicitly aimed at campaign-development would largely fill this ‘doctrinal gap.’¹⁶³ Providing a specific and distinct doctrine would allow the other services to better synchronize their efforts and educational practices. Furthermore, it would provide the entire Joint community with a starting point for discussion and refinement of future Joint campaign doctrines.

Secondly, a stand-alone manual would increase overall effectiveness of campaign-planning efforts by deliberately working to prevent overlapping efforts between design teams and planning teams - preserving the ‘goodness’ of the two distinct efforts. The final approved draft of *FM 5-0* goes to great length to explain the need for both the “conceptual” and “detailed” efforts represented by design-teams and planning teams.¹⁶⁴ However, examples from the business world, where design and planning have co-existed for much longer, suggest that failure to recognize these processes as distinct leads to a tendency to use design to think better about planning, instead

¹⁶³ Cardon and Leonard, 3.

¹⁶⁴ *FM 5-0 (FINAL APPROVED DRAFT)*, 3-1.

of using it as a meta-process to guide planning over time. Buxton cites as an example the fact that the approval for most new products in several software companies are generally given before any design takes place; his recommendation is for a distinct, separate design step - one that happens prior to planning: "if we factor out luck and a few rare exceptions, it is always faster cheaper, and leads to a better [solution] if we take the extra step of incorporating an explicit, up-front design phase."¹⁶⁵

In addition to these two reasons, the extensive examination above demonstrates that the four 'starting blocks' of rapid prototyping, generative analysis, use of experts, and reduction of scope are excellent design tools deserving of codification in the doctrine for campaign development. To review the earlier comparison of design and planning: the fundamental difference between planning and design is focus. Planning is focused on decision-making and design is focused on learning over time; as the *FM 5-0 (FINAL APPROVED DRAFT)* notes, "innovation, adaptation, and continuous learning" are design's central tenets.¹⁶⁶ Although the two are related, the difference is critical. Given this criticality, the fact that the 'starting blocks' are most applicable as tools for building deeper understanding - through learning over time - marks them as a good fit for design.

The second recommendation suggested by this research is that the U.S. Army should deliberately link the outcomes of the design approach to developing Commander's Critical Information Requirements (CCIR) in the practical application of the design approach to operational problem management. In line with the first recommendation to expand the current doctrine, the recommended companion manual should update the description of outcomes to

¹⁶⁵ Buxton, 77 and 80. See also: Martin, "Why Can't We Be Friends? Roger Martin's comparisons of businesses that employed design approaches without the full buy-in of management echo this overlap of effort.

¹⁶⁶ *FM 5-0 (FINAL APPROVED DRAFT)*, 3-2.

provide a specific and deliberate linkage between design and CCIR.¹⁶⁷ The connection between design and CCIR should encompass two distinct processes – applying design to the development of planning CCIR, and the subsequent relationship of design to the assessment-model of the Operational Process. This emphasis on the relation of design to CCIR should not supplant or replace the discussion of planning directives.

The justification for modifying design doctrine in this manner is directly related to the nature of planning and the purpose of CCIR; planning is concerned with analysis of the knowns and CCIR development - by definition - is an attempt to reduce the number of unknowns. Reducing – or at least addressing – unknowns is the obvious purpose of the learning-emphasis inherent in design. Additionally, the development of CCIR is already a precursor to the mission analysis process; as the *FM 5-0 (FINAL APPROVED DRAFT)* states: “the commander and selected staff meet prior to the mission analysis brief to approve the initial CCIRs.”¹⁶⁸ Since design is billed as a potential lead-in to planning (hence the focus on “planning directives” as an outcome), design – logically – must inform initial CCIR development.

The inclusion of the four ‘starting blocks’ in future design doctrine provides another compelling reason for a design-CCIR linkage: connecting the process of design to the development of CCIR demonstrates an usefulness obvious even to those skeptical of design’s utility. Rapid prototyping, generative analysis, inclusion of experts and reduction of scope are all centrally concerned with question-generation, and therefore more germane to CCIR than a planning directive; the inputs of a learning process are questions. Rapid prototyping, in providing models for testing, will likely generate questions that experimentation cannot answer. As the process of determining what questions to ask by quickly filtering knowns from unknowns,

¹⁶⁷ The omission of a link between design and CCIR should also be addressed in future revisions of *FM 5-0*.

¹⁶⁸ *FM 5-0 (FINAL APPROVED DRAFT)*, B-9.

generative analysis is exactly synonymous with CCIR-development.¹⁶⁹ The stated intention of using experts is to increase the design-team's ability to understand what questions to ask. Finally, efforts to reduce scope can assist commanders in refining the prioritization - and numbers - of CCIR requirements.¹⁷⁰ To sum, the question-generation process inherent in applying the four starting blocks to design has a direct and useful application to the development of CCIR, providing yet another direct example of design's practical utility.

These two recommendations, considered together, represent a significant expansion of the U.S. Army's current conceptualization of design. However, the potential benefits of making a clearer distinction between design and planning are great. As the authors of the final revised draft of *FM 5-0* point out: "understanding context and then deciding how, if, and when to act is a product of design and integral to the art of command."¹⁷¹ Although similar, this is a distinct process from the deliberate planning necessary for the command and control of forces in long-term campaigns. Likewise, the four 'starting blocks' of rapid prototyping, generative analysis, inclusion of experts and reduction of scope are similarly integral. These tools reflect the positive benefits of design's essential elements, and are proven techniques for resolving a commander's dilemma between the need to act and the need to gain in-depth understanding. Inclusion of these four skill-sets in a distinct, campaign-level doctrine would improve the overall effectiveness of U.S. Army-led operational and tactical formations.

¹⁶⁹ IDEO, HCD Process Guide, 98. IDEO's Human-Centered Design process includes a CCIR-like process known as "LEAD-A" as the primary purpose of generative analysis. LEAD-A (Leaders, Engagement, Analogies, Dynamic Changes and Awareness) is a short-hand list of critical factors used to determine the "right questions" for learning.

¹⁷⁰ *FM 5-0* highlights the importance of keeping the number of CCIR low.

¹⁷¹ Clinton J. Ancker III and Michael Flynn, "Field Manual 5-0, Exercising Command and Control in an Era of Persistent Conflict," *Military Review* (March-April 2010), 15.

Conclusion – Application to today’s ‘Design Debate’

The methodology for a design approach as currently envisioned by the U.S. Army is a positive step towards filling the doctrinal gap with regards to the development of campaigns. As bridge-builders between strategic aims and operational approaches, commanders and staffs at the operational level need to provide quick initial recommendations for immediate actions (doing something now) that does not preclude or eliminate doing something in the future that may better manage problem situations. However, failure to explicitly align the design process with the operational level (campaigns) and the over-emphasis on deep analysis adds to, rather than relieves, the time-intolerance of commanders.

As the thesis established and analyzed in this paper demonstrated, a design approach that includes the ‘starting blocks’ of rapid prototyping, generative analysis, the inclusion of experts, and the deliberate limitation of problem-solution scope sets the conditions for learning over time, which works directly to relieve the pressures of this time-intolerance. Although operating without the benefit of an overtly designated methodology, the example of the COSSAC staff provides direct evidence that the application of ‘starting block’ techniques to a design approach works in practice as well as theory. This success of these techniques is directly attributable to the fact that the four ‘starting blocks’ examined are synchronous with the foundational principles of design; the essential elements of *formulating, moving, representing, evaluating, and reflecting*.

The justification of rapid prototyping, generative analysis, the inclusion of experts, and the reduction of scope as historically and theoretically valid techniques makes manifest their usefulness and importance to the military application of design. A comprehension of their utility in establishing a learning-centric approach to problem management and the importance of a learning-centric approach to the complexity of campaign design logically commends their inclusion in U.S. Army design doctrine. As the previous section demonstrated, the U.S. Army should seriously consider expanding the goals and fundamentals of design outlined in the upcoming *FM 5-0* into a separate and distinct campaign-level doctrine that incorporates these

four 'starting blocks.' Furthermore, making a more explicit connection between a design approach and the development of CCIR, through the application of rapid prototyping, generative analysis, the inclusion of experts, and scope reduction, demonstrates another example of design's usefulness, facilitating acceptance of the methodology by design-skeptics. Even if the U.S. Army decided not to adopt design as a part of the doctrine of the *Operations Process*, the obvious benefits of these four 'starting blocks' to planning and CCIR-development in general warrants serious consideration for their inclusion in doctrine.

The recommendation to create and publish a distinct campaign-design doctrine implies two additional conclusions. The first idea is that it might be helpful to the U.S. Army and overall Joint force if the design approach was directly associated with future planning. In other words, make the dichotomy between design teams and plan teams explicit by tying the design approach to the actions of G-5s/J-5s as distinct from the MDMP-focus of G-3s/J-3s.¹⁷² The second implication is that this 'split' should be reflected directly in the U.S. Army's approach to professional military education (PME). Specifically, the practice of design and the MDMP should be taught as separate (although related) subjects at the intermediate level of education. These two conclusions demand further explanation.

Emphasizing the difference between design and planning by explicitly linking design to the actions of G-5/J-5 planners would help clarify the relationship between the two methodologies, reinforce the applicability of design to campaign-development, and assist the military planning community with acceptance of this new concept. As the new doctrinal

¹⁷²For a joint doctrinal description of the roles and responsibilities staff functions, see: United States Department of Defense, *Joint Publication 1, Doctrine for the Armed Forces of the United States*, (Washington D.C.: Government Printing Office, 14 May 2007), V-16. Specifically, "the J-3 assists the CDR in...the direction and control of operations, beginning with planning and follow-through until specific operations are completed. When the joint staff includes a plans directorate of a joint staff (J-5), the J-5 performs the long-range or future planning responsibilities." Current U.S. Army doctrine regarding the composition of staffs has not been updated since 2003, but operational units employed world-wide have aligned with the joint doctrine system.

cornerstone for Army planning explains, separation of effort along different points of the planning horizon is a useful way for commanders and staffs to organize work.¹⁷³ In the terms of *FM 5-0*, the conceptual nature of the design process aligns best with the long-range efforts of the plans cell; whereas the concrete and detailed needs to translate and implement of the future operations and current operations cells demand the specificity of the MDMP (see figure 2.) By making the relationship of design to the campaign-centric focus of long-range planning explicit,

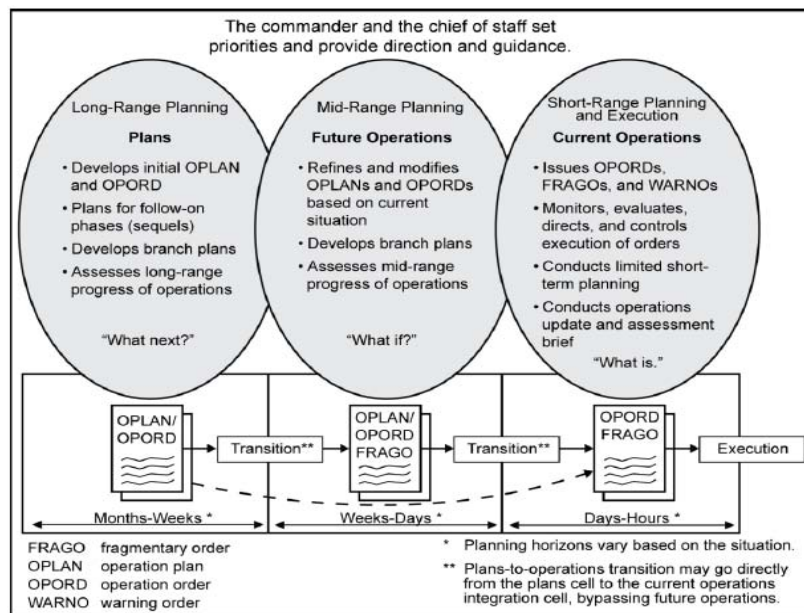


Figure 2 – Integration of plans, future operations, and current operations¹⁷⁴

some of the confusion over when to use design disappears. As the figure above demonstrates, the central question examined by long-range planners is "what's next?", which is synonymous with design's focus on solving the right problem.¹⁷⁵ Furthermore, the requirements of long-range planners to consider actions operations beyond the scope of the current order and assess long-range progress are directly related to the development of campaigns.¹⁷⁶ Although, as design

¹⁷³ *FM 5-0 (FINAL APPROVED DRAFT)*, A-5.

¹⁷⁴ *FM 5-0 (FINAL APPROVED DRAFT)*, A-5.

¹⁷⁵ Cardon and Leonard, 6.

¹⁷⁶ *FM 5-0 (FINAL APPROVED DRAFT)*, A-6.

theorists point out, there is no easy distinction between design and planning, this ambiguity is unsettling to military professionals.¹⁷⁷ Making the applicability of the two processes - design and planning - distinct and overt reduces this ambiguity.

Taking this conclusion to the next logical step, the U.S. Army should use this 'split' in responsibilities to shape its approach to the instruction of the Operations Process. In short, programs such as the School for Advanced Military Studies (SAMS) and Intermediate Level Education (ILE) should teach design and MDMP as separate and distinct methodologies. Currently, the program of instruction in the Advanced Military Studies Program (AMSP) at SAMS incorporates three different design practicum and only two MDMP exercises.¹⁷⁸ Although there is a great deal of conceptual and theoretical overlap, the design and planning processes are different and SAMS-graduate planners are expected to be experts in both. As the current director of SAMS points out, "design, planning, and execution are inextricably linked...nevertheless the functions of each activity are different."¹⁷⁹ In terms of the planning horizon illustrated in figure 2, two thirds of the Operational Process centers on the MDMP; the AMSP should reflect this reality. The demands of the MDMP require practice and repetition to ensure this expertise. A revision of the instructional methodology that incorporates this pragmatic dichotomy is in order.

¹⁷⁷ Topalian, 111.

¹⁷⁸ Banach, "Educating by Design," 99.

¹⁷⁹ Banach, "Educating by Design," 101.

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