Art of Design

Student Text, Version 2.0

School of Advanced Military Studies

SAMS

LEAD.DESIGN.PLAN.

MENS EST CLAVIS VICTORIAE

…considering now the whole house of war in its structural aspect, which was strategy, in its arrangements, which were tactics, and in the sentiment of its inhabitants, which was psychology; for my personal duty was command, and the commander, like the master architect, was responsible for all.

—T. E. Lawrence[1]

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[1] Thomas E. Lawrence, *Seven Pillars of Wisdom: A Triumph* (London: Penguin Books, 1983), 181.

FOREWORD

Our Nation continues to be engaged across a complex, dynamic, and ambiguous world in which situations are poorly understood and ready solutions are neither available nor anticipated. Moreover, what we see as apparent problems are often merely symptoms of deeper issues with their own dynamics and relationships. This is not a new phenomenon. The world has always been and will continue to be complex. The sources of novelty and complexity that we experience everyday are derivatives of technological revolutions and ideological influences that have driven adaptation for millennia. These evolving dynamic factors affect existing cognitive processes and leadership approaches, which at times are proving to be inappropriate for contemporary complex problem solving. These continually emerging realities require adaptive leadership techniques, new strategic and tactical cognitive approaches, and organizational learning methodologies to keep pace with the multiple adversaries who are confronting our country. These lethal assemblages have a strategic perspective and are using asymmetric approaches to leverage the seam between traditional warfare and law enforcement activities of the United States and her allies. When faced with these challenges, commanders and leaders at all levels need to answer four fundamental questions to compete decisively in the future:

- What is the appropriate cognitive approach for 21st century warfare?
- How should one structure and lead adaptive organizational work?
- How should one structure and lead organizational learning?
- How can one communicate effectively in the 21st century?

Answering these questions requires reflection on alternative approaches to leadership; on constructing a cognitive framework for how to reason through complexity; on how to create an organizational learning system to decisively compete in the contemporary operating environment; and how to communicate the resulting understanding with others. Design is a strategic cognitive construct that directly confronts these challenges.

The School of Advanced Military Studies' (SAMS) involvement in this endeavor began with Exercise Unified Quest in 2005. In July 2007 we received the mission to further develop design thinking for the Army, building upon U.S. Army Training and Doctrine Command's (TRADOC) continuing effort to assess the application of design. This required our faculty to establish an open experimental environment to encourage learning, and generate the atmosphere for new thinking to flourish. SAMS developed, taught, and refined an initial curriculum that has matured into a 24-lesson design course grounded in theory, history, philosophy, and doctrine. Our students and faculty have written monographs and professional articles to carry the word to the field and aid further development. Twenty five seminars have studied design as a theory of reflective practice – and indeed, our graduates have taken it straight from the classroom to the battlefields in Iraq and Afghanistan, bringing to the operating force the ability to incorporate a well-thought-out strategic cognitive construct as a complement to what commanders attempt to do intuitively.

Design is elucidated in many recent military doctrinal and concept manuals. Each of these publications has served to advance the professional discourse for the refinement of design concepts and application. A graduate-level institution like SAMS requires a rich supporting text that enables education of the form, function, logic, and practice of design. SAMS' *Art of Design Student Text, Version 1.0* was published in September 2008 as a reference for future instruction at the school. As happens with any new concept, the transition from theory to practice yielded a significant body of experience, which revealed innumerable insights and understanding.

The *Art of Design Student Text, Version 2.0* is the next iteration of this understanding of design as the art of strategic thinking. The utility of this student text will not be limited to the classroom. It will also serve as a comprehensive resource for leaders in the field who are already designing exceptionally complex operations in Afghanistan and Iraq. This student text contains leading edge theory and practical advice for how to educate and lead design. With regard to design, never has there been more truth in our SAMS motto: *MENS EST CLAVIS VICTORIAE* – "the mind is the key to victory."

STEFAN J. BANACH
Colonel, Infantry
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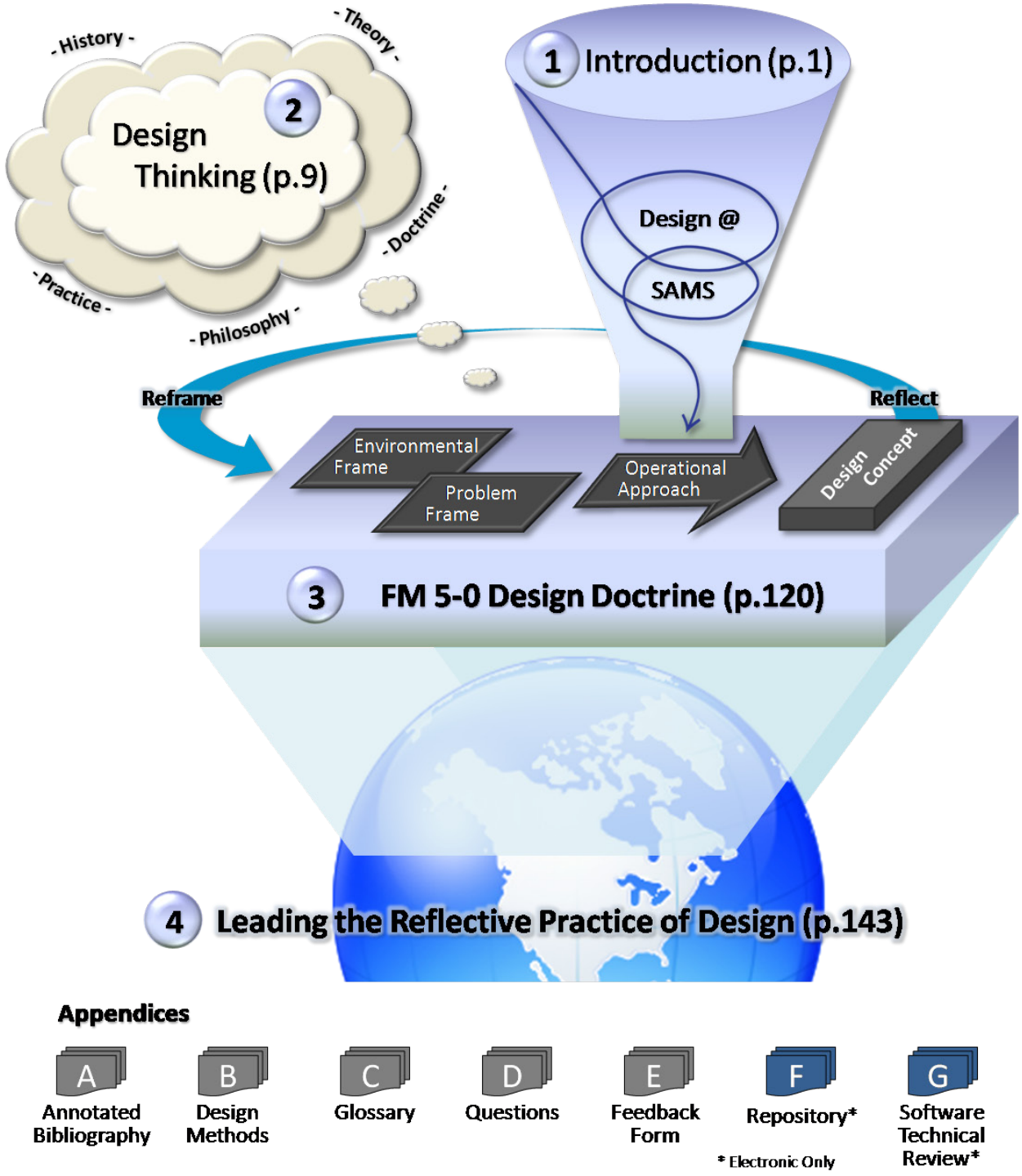
School of Advanced Military Studies

The Art of Design
SAMS Student Text Version 2.0

A Rich Picture Table of Contents



Appendices

1. INTRODUCTION

> *Design does not replace planning, but planning is incomplete without design. The balance between the two varies from operation to operation as well as within each operation. Operational design must help the commander provide enough structure to an ill-structured problem so that planning can lead to effective action toward strategic objectives. Executed correctly, the two processes always are complementary, overlapping, synergistic, and continuous.*
>
> — General James N. Mattis[2]

With the publication of design doctrine within U.S. Army *Field Manual 5-0, Operations*, and the advocacy of the U.S. Joint Forces Command (USJFCOM) Commander General Mattis for migrating operational design into the joint arena, the debate on *whether* and *why* design has now transitioned towards a discussion on *how to* design. If the early problems of learning design were hampered by the lack of any written accounts of design methodology, the current problem facing students of design is the proliferation of books, doctrinal manuals, and journal articles on the subject. While these sources share a common core, there is significant divergence in terminology, and varied emphasis on the philosophical versus practical aspects of design. This is actually a very good sign that design discourse is alive and well, but it can make entry into the subject more daunting. This highlights the requirement for an up-to-date introductory text for students of design.

The School of Advanced Military Studies (SAMS) has been an active participant in design discourse since before its official introduction into the United States Army. An informal academic relationship between SAMS faculty and the enigmatic Israeli commando, division commander, historian, and professor Brigadier General (Retired) Shimon Naveh began in the mid-1990s. It was during this time when the Israel Defense Force (IDF) think tank, the Operational Theory Research Institute (OTRI), first began to develop Systemic Operational Design (SOD). This initial relationship emerged from mutual interests in the history of operational art.

By the time SOD made its debut at SAMS in January 2005, U.S. Army Training and Doctrine Command (TRADOC) Futures had already developed its own curiosity about the approach because it seemed to have potential as a way of thinking that could address some conceptual contradictions that, at the time, were becoming apparent with regard to the war in Iraq. As the war became something else – an insurgency, a civil war – and the reality that somehow 'culture' was a critical component of what was happening, Naveh, along with other senior academics, senior retired IDF officers, and military graduates of OTRI, were invited to SAMS and began what would be the first of a number of workshops and practical exercises with SOD. This first SOD seminar included SAMS faculty, retired Army general

[2] Gen. James N. Mattis, "Memorandum for U.S. Joint Forces Command: Vision for a Joint Approach to Operational Design," 6 October 2009.

officers, and the Fellows who comprised the Advanced Operational Arts Studies Fellowship (AOASF). Eight SAMS students were subsequently chosen to study SOD in greater depth, mentored by BG Naveh and OTRI scholars. As a holistic approach that emerged from, and was developed in relation to, a practical military context in which preponderant power was irrelevant, it was intriguing. **Moreover, it inherently understood the centrality of culture; aimed at adaptability; and was founded on inquiry and learning based on observing difference.** It consciously developed operational art as a place where environmental differences were accounted for and as a relevant source of insight for the refinement of strategy. These features combined with the outcomes of practical exercises – which offered unconventional recommendations – sustained the curiosity and interest.

So it was in 2005 that the first eight students from the Advanced Military Studies Program (AMSP) were selected to study and practice SOD. In May, the group participated in Exercise Unified Quest 2005, to compare the outcomes of SOD with those of two other groups, one using Effects Based Operations (EBO) and the other the Military Decision Making Process (MDMP). Their design caught the attention of several senior officers at Unified Quest because something different was going on. **The logic of the approach was different: it began with a holistic inquiry into the nature of the rival in context and came to its own understanding of 'the problem.'** These aspects combined in the discourses of SOD generated both critical and creative thought. Because the inquiry was holistic, the SOD team produced a very different recommendation within the scenario – an indirect and non-military disruption of the rival system. This first experiment was documented in a collaborative student monograph, "Systemic Operational Design: An Introduction."[3] In one of the first American presentations on SOD, Colonel Mark Inch stated:

> Systemic Operational Design (SOD) is a commander-driven process of structured discourse to understand and modify strategic guidance, in order to frame the problem and solution for the operational planners.[4]

We will see that the new design doctrine, repeated here in Chapter 3, stays true to the themes recognized during Exercise Unified Quest 2005 by Colonel Inch. *FM 5-0* emphasizes the role of the commander; explains the importance of dialog and collaboration; explicitly links design with developing understanding within battle command; and provides a methodology for framing problems and solutions to enable detailed planning.

In the summer of 2005 faculty from SAMS, as well as members of other organizations at Fort Leavenworth and American General Officers, attended and participated in a week-long seminar organized by OTRI in Israel. During this week Americans and Israelis engaged in a robust schedule of presentations and intense discussions centered on cognition and learning. Israeli participants included active duty General Officers, senior academics, and

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[3] Maj. William T. Sorrells et al., "Systemic Operational Design: An Introduction" (Monograph, School of Advanced Military Studies, U.S. Army Command and General Staff College, 2005).

[4] Col. Mark Inch, "Systemic Operational Design: Case A Outbrief," Presentation to Exercise Unified Quest, Carlisle, PA, May 6, 2005.

members of government who had learned and applied SOD. This produced a tremendous expansion of knowledge for a number of the American participants.

The following year, a group of SAMS students self-selected for participation in an elective course in military theory combined with the study of SOD. This group culminated its activities with participation in Unified Quest. Naveh and the team from OTRI once again worked with SAMS directly when it came to instruction in SOD and mentoring during the preparation for the exercise. The Israelis changed some aspects in the application of the approach to overcome practical and cognitive challenges some Americans had demonstrated with the different way of thinking. As the team prepared for Unified Quest they wrote a 20-page article, "Operational Design: Standard Operating Procedure."[5] This reflected not only the nature of the growing interest in SOD, but the thought that was going into adapting SOD to an American organizational structure. Both were able to do this easily without altering the logic of the methodology. Once again, SAMS gained the attention of senior officers at Unified Quest. *What was this?* Majors were discussing philosophy in relation to their thinking during planning, using theory to propose innovative ideas, and developing products that reflected novel conceptions of the problems with which they were presented.

At the same time, interest was growing within SAMS among the Majors who were not participants in Unified Quest. Monographs began to proliferate – about Systemic Operational Design specifically, about linear and non-linear thinking, the form, function, and logic of decision-making processes, cognitive initiative, efficacy in the operational level of war, the nature and role of discourse, and the relationship between design and planning.[6] Other monographs were written that applied SOD to specific issues, and even to other militaries. No one can fully appreciate what Design is as it exists today without an understanding of its intellectual lineage, in the context of SOD, SAMS' early development of the thinking, and the military's ongoing experience in the Middle East and Central Asia. Those were exciting and creative days.

Since that time, SAMS students have participated in every Unified Quest experiment as core members of design teams, where the students have continued to impress exercise participants with their innovative approaches to complex and ill-structured problems. In 2007, based on further positive feedback from the Unified Quest experience, SAMS was charged with introducing design into its core curriculum. In response to this requirement, the *Art of Design Student Text, Version 1.0* was published in 2008, with contributions from both students and faculty.[7] The student text was widely circulated and provided a clear articulation of the value of design:

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[5] Ketti Davison et al., "Operational Design: Standard Operating Procedure" (Monograph, School of Advanced Military Studies, U.S. Army Command and General Staff College, 2006).

[6] For an annotated list of student work up to academic year 2009, see Appendix A.

[7] School of Advanced Military Studies, *Art of Design Student Text, Version 1.0* (Fort Leavenworth, KS, Command and General Staff College, 2008).

> Design's benefit to current doctrine is the creation of a frame of reference that aids comparison in a changing environment and enables learning through iterative actions. Design has the potential to provide a systemic shared understanding that is easily communicated to U.S. forces, coalition, and interagency partners. Design requires an egalitarian collaborative leadership and participative style of command that engages subordinate commanders, coordinating authorities, representatives of various staff disciplines, and the higher commander in continuing dialog and discussion, leading to a shared understanding of the situation and its requirements and a sense of participation by all in decision making. Design enables commanders and leaders to learn by exploiting multiple perspectives, varied sources of knowledge and expertise, while employing critical thinking to formulate a sophisticated understanding of the situation.[8]

In 2009, SAMS faculty participated in the Combined Arms Doctrine Directorate (CADD) integrated planning team assembled to write the first draft of design doctrine. The doctrine evolved from an interim field manual *FMI 5-2 Design*, to a widely staffed *Issue Paper*, and finally to a chapter within *FM 5-0, The Operations Process*. As the U.S. Army has experimented with design, it has adapted it to better fit within the institution's existing processes, structures, and norms.[9]

Broadly speaking, the two biggest changes to design since its introduction in 2005 are simplifications of the design lexicon and alternative approaches to the delivery of design education. Both are intended to lower barriers to entry for practitioners by finding easier paths to the same goal: learning a methodology for shared critical and creative thinking and acting within problematic operational situations. While care must be taken not to diminish design to the point where it is neither critical nor creative, there is great merit in improving the accessibility of design, so that more professionals can make use of this approach to coping with complex operational challenges.

Because of the significant changes to both the language of design and its delivery in the SAMS curriculum, a complete rewrite of the SAMS student text was necessary. A simple design method called "the six serving men" (see Appendix B) illustrates the requirements for the second edition:

Who: The primary audience consists of SAMS AMSP students and AOASF students from all services as well as interagency backgrounds, with ranks equivalent to Major through Colonel. Members of the wider design community of practice are the secondary audience. **In particular, when SAMS graduates are asked to lead a design team in the field, this student text should serve as a single integrative resource for teaching design to new**

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[8] Ibid., 4.

[9] In addition to the development of doctrine, a series of articles in *Military Review* on design documents the American evolution of design. See for example, Brig. Gen. (R) Huba Wass de Czege, "Systemic Operational Design: Learning and Adapting in Complex Missions," *Military Review* (January-February 2009): 2-12; Col. Stefan J. Banach, "Educating by Design: Preparing Leaders for a Complex World," *Military Review* (March-April 2009): 96-104; Col. Stefan J. Banach and Alex J. Ryan, "The Art of Design: A Design Methodology," *Military Review* (March-April 2009): 105-115; Brig. Gen. (P) Edward C. Cardon and Lt Col. Steve Leonard, "Unleashing Design," *Military Review* (March-April 2010): 2-12.

design team members. Other key stakeholders within the design community of practice that have been engaged with SAMS and have a potential use for this text include the United States Army Command and General Staff College (CGSC), United States Special Operations Command (SOCOM), United States Army Central Command (ARCENT), Army Capabilities Integration Center (ARCIC), United States Joint Forces Command (USJFCOM), United States Pacific Command (USPACOM), United States Southern Command (USSOUTHCOM), United States Northern Command (USNORTHCOM), United States African Command (USAFRICOM), Combined Arms Doctrine Directorate (CADD), the United States Army Battle Command Battle Laboratory (BCBL), other governmental agencies, allies including Australia, Canada, and the United Kingdom, and contractors teaching design to the military, including Booz Allen Hamilton.

What: A self-contained student text synchronized with the design chapter of *FM 5-0* that provides the historical, theoretical, and practical context for leading design. The student text is written to academic standards, allowing practitioners to trace the concepts of design back through their multidisciplinary origins. It includes a glossary to clearly and explicitly identify the terminology of design.

When: The student text will be released in May 2010. This date was chosen to follow the publication of *FM 5-0* in March 2010, prior to the graduation of AMSP AY 10-01, and prior to the commencement of design practica for AMSP AY 10-02. This version of the student text should have a shelf life of at least two years.

Where: The student text will be issued both in hard and soft copy to all SAMS students, and be made available to other organizations and individuals on request. It will also be available electronically for download at http://www.dtic.mil.

Why: The official incorporation of design within the operations process requires an up-to-date student text that uses doctrinal terminology and captures how design is educated and practiced at SAMS. This means that as the design community of practice grows, it can build upon the lessons already learned and help communicate both the spirit and discipline of design thinking.

How: The organization of the student text is visually depicted in the Table of Contents on page iii. Unlike a normal Table of Contents, which just lists sections and page numbers, we used a design method called a "rich picture" to show how the parts of the student text are related. [10] This rich picture was initially created as a design sketch on paper, shown in Figure 1. Comparing the Table of Contents with Figure 1 shows there were a number of iterations in the design of this student text. For example, the chapters were originally in a different order, and not all of the important components of the student text had been fleshed out. Rich pictures are often accompanied with a narrative, which walks the reader

[10] Peter B. Checkland and John Poulter, *Learning for Action: A Short Definitive Account of Soft Systems Methodology and its use for Practitioners, Teachers and Students* (Chichester, Sussex: John Wiley & Sons, 2006), 26.

through the picture and explains its meaning. The next three paragraphs provide a narrative for the rich picture Table of Contents.

Chapter 1 introduces the art of design in its historical context, establishes the need for this student text, and uses the "six serving men" to outline the purpose and structure of the text. Chapter 2 provides an introduction to design thinking by summarizing the history, theory, and philosophy taught at SAMS within the design course. The focus is not on the individual readings themselves, but on the key concepts that they contribute to design. Chapter 3 reproduces the third chapter from *FM 5-0*, which is dedicated to design and provides an overview of the design methodology in its entirety. Previous SAMS graduates told us they like to borrow the field manuals of their peers just to read their margin notes, so we made sure Chapter 3 left plenty of space for note taking. Chapter 4 uses real examples of design conversations, narratives, drawings and methods to illustrate how they can be woven together to create holistic understanding and a systemic response to operational challenges. This chapter also builds on the theoretical concepts introduced in Chapter 2 by placing them in an applied context. In Appendix A, the annotated bibliography invites the interested reader to explore the literature that informed the writing of the student text. Appendix B contains a set of design methods, to include more general thinking methods, which have proved useful in the facilitation of design discourse. Appendix C provides a lexicon of design terminology that covers both the official doctrinal terms and some of the language used in the wider design community of practice. Appendix D lists a set of representative questions devised by the faculty to stimulate design discourse. Appendix E contains a feedback form for practitioners to suggest improvements to the text, which helps SAMS complete its own "learning loop" on design. Appendix F contains a repository of previous SAMS design products. The intent of Appendix F is not to provide templates for designing, which is antithetical to design thinking, but rather to provide a gallery of designs for inspiration and to start building the designer's repertoire of historical precedents. Appendix G contains a review of software that is potentially useful within design. Due to the size and interactive nature of the last two appendices, they are provided only in the electronic format of the publication. The electronic format also contains an interactive version of Appendix C's lexicon.

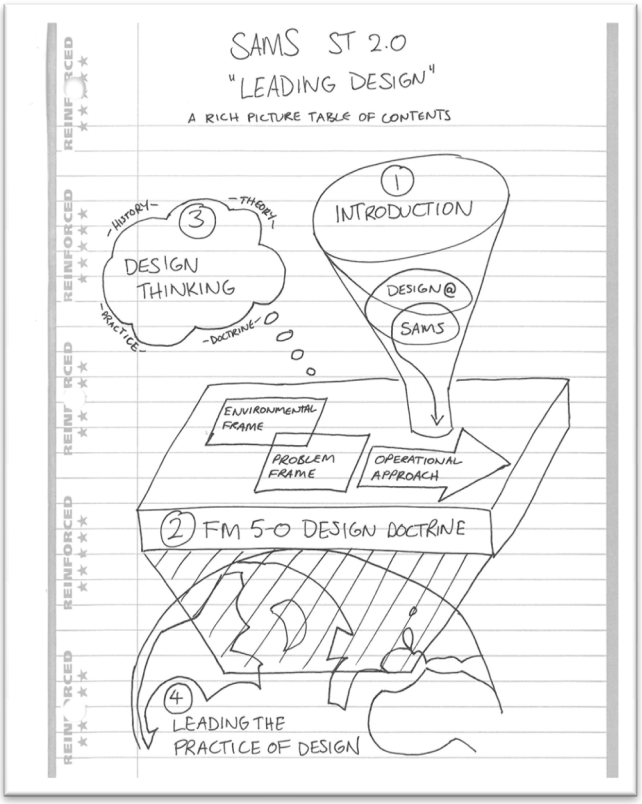

FIGURE 1. ORIGINAL DESIGN SKETCH OF THE RICH PICTURE TABLE OF CONTENTS.

To show how the chapters fit together, it is useful to consider leading systems thinker Peter Checkland's model of the relationship between theory and practice, shown in Figure 2.[11] According to Checkland, there are four main parts to this relationship. The first, F, is a framework of ideas. F represents theory – a set of concepts, as well as the relationships between those concepts. Second, methodology (M) provides a guide for the application of a particular theory. Third, the area of application (A) defines the kind of real world problem situations that are suited to the application of methodology M based on the theoretical framework F. Last, each time F is applied by way of M in context A, the practitioner has an opportunity to learn about and improve F, M, and A. When this learning is captured and implemented, a learning system between theory and practice is formed.

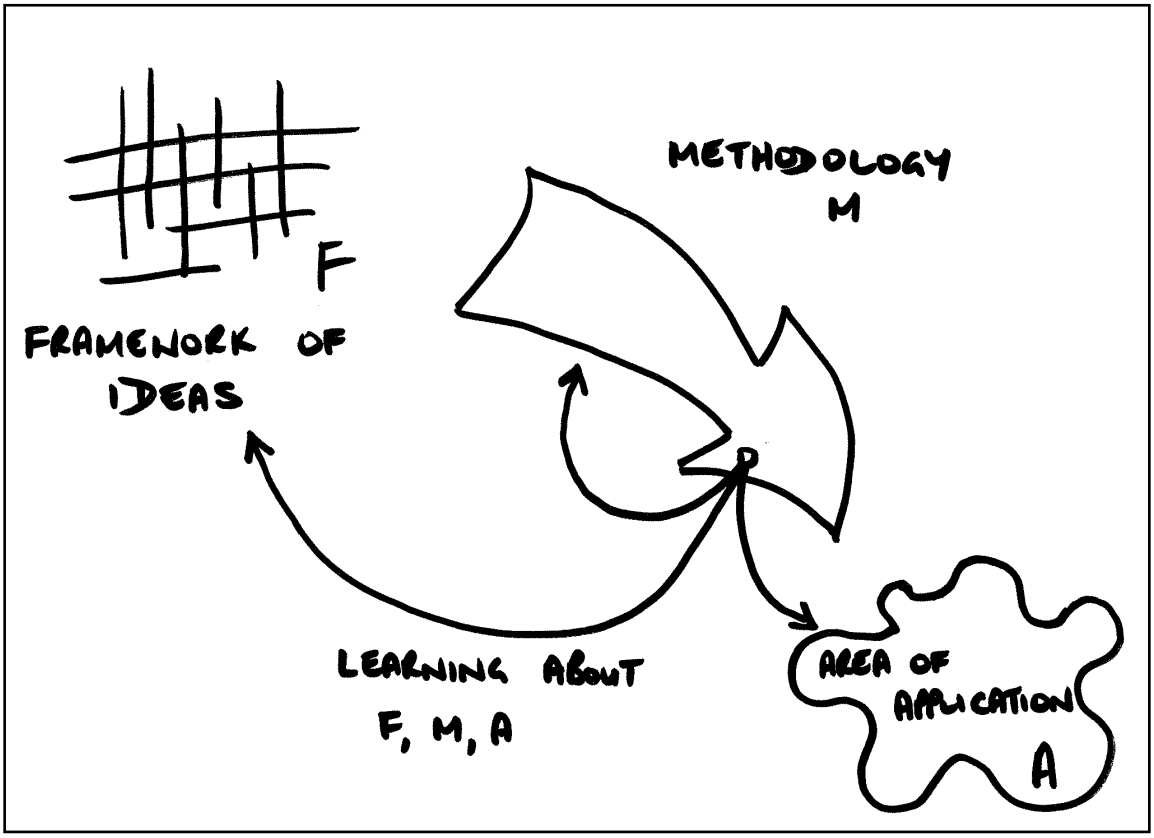

FIGURE 2. THE RELATIONSHIP BETWEEN THEORY, PRACTICE, AND LEARNING

In the context of this student text, Chapter 2 introduces the framework of design concepts. Chapter 3, which reproduces the third chapter of *FM 5-0*, describes the methodology for the military application of design. Chapter 4 maps out the area of application for design, with examples from the field, the classroom and the laboratory. Because SAMS is a military school, and the majority of its students serve in the U. S. Army, there is an emphasis on the application of land power. However, we do not believe that the value of this design framework and methodology is limited to land operations. Within the military, design has

[11] Figure 2 is adapted from Peter B. Checkland, "From Optimizing to Learning: A Development of Systems Thinking for the 1990s," *Journal of Operational Research Society* 36, no. 9 (1985): 758.

great potential not just for the operating force, but also for the generating force. Some of the greatest opportunities for design thinking may be in providing a holistic and innovative approach to interagency projects. There is no reason that other Government agencies and even businesses may not also benefit from this evolution of design thinking within the U.S. Army. Exploring the boundary of the domain of application (A) raises many important topics for further research. Appendix E provides a mechanism for learning about Framework (F), Methodology (M), and Application (A). Readers are encouraged to think critically about the contents of this student text, to experiment with the framework and the methodology, and then tell us what works and what doesn't. Our vision for future versions of this student text, to paraphrase T. E. Lawrence, is to smell less of the lamp and more of the field. Your experience will drive the future of design.[12]

[12] "Not perhaps as successfully as here. I thought out my problems mainly in terms of the Hejaz, illustrated by what I knew of its men and geography. These would have been too long if written down; and the argument has been compressed into an abstract form in which it smells more of the lamp than of the field. All military writing does, worse luck." Lawrence, *Seven Pillars of Wisdom*, 202ff.

2. DESIGN THINKING

Design is thinking made visual.

—Saul Bass

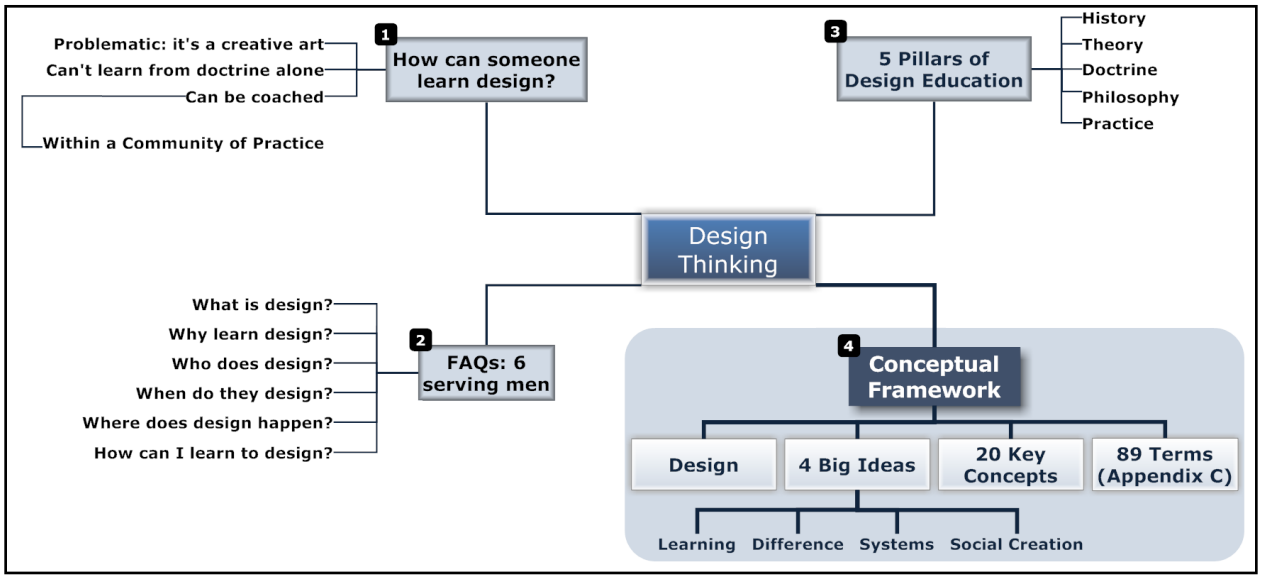

FIGURE 3. MIND MAP FOR CHAPTER 2.

In a 2009 Military Review article, the Director of SAMS, Colonel Stefan Banach, wrote that "design is a way of thinking more than it is a theory, process, or product."[13] This presents a challenge for the student of design. A theory may be understood. A process can be memorized. A product can be copied. But how is a "way of thinking" to be learned? Schön calls this "the predicament of learning to design."

> The paradox of learning a really new competence is this: that a student cannot at first understand what he needs to learn, can learn it only by educating himself, and can educate himself only by beginning to do what he does not yet understand.[14]

This is particularly problematic when learning design, because designing is a form of artistry. It would be paradoxical to expect that a prescriptive doctrine could lead to creative thought. Fortunately, the definition of doctrine in *Joint Publication 1-02* acknowledges that doctrine "is authoritative but requires judgment in application."[15] How, then, is it possible

[13] Banach and Ryan, "The Art of Design," *Military Review*, 106.

[14] Donald A. Schön, *Educating the Reflective Practitioner* (San Francisco: Jossey-Bass, A Wiley Imprint, 1987), 93.

[15] United States, *Joint Publication 1-02 DOD Dictionary of Military and Associated Terms* (Washington, DC: Joint Chiefs of Staff, 2009).

to learn the critical and creative appreciation of doctrine, in order to develop appropriate judgment for the application of design?

2.1. CHARACTERIZING DESIGN

Once again, the "the six serving men" can help to address the frequently asked questions of students of design. The answers given here are accurate to a first order of approximation. However, in the spirit of the iterative and critical nature of design, the reader is encouraged to repeatedly ask these questions as their knowledge of design increases – and to challenge the answers in order to develop a personal philosophy of design.

2.1.1. WHAT IS DESIGN?

According to the doctrine, "design is a methodology for applying critical and creative thinking to understand, visualize, and describe complex, ill-structured problems and develop approaches to solve them."[16] This tells us at least four things about design. First, design is an application of critical and creative thinking. Second, the kind of situation design is intended to address is complex and ill-structured. Third, the use of understand, visualize, and describe associates design with battle command. In the words of Lieutenant General William Caldwell, "[d]esign is the next step on a path to maturing our battle command model for the complexities of operations in an era of persistent conflict."[17] Fourth, design is about problems and solutions. Design theorist Bryan Lawson agrees, observing that the "tension between a problem view and a solution view of the situation is at the very heart of the way designers have to think."[18] In the military context, it is important to note that a solution is not the same thing as a Course of Action (COA). Whereas designing produces a solution that informs the commander's intent, planning compares multiple COAs that provide a possible sequence of activities to accomplish the mission.

While a definition provides a useful start, a clearer picture of what design is can be sketched by comparing design to something more familiar. Nigel Cross compares design with art and science in order to identify the design mindset – what he calls a "designerly way of knowing."

> For instance, the "things to know," the respective fields of knowledge, are the natural world for science, human experience for art, and the artificial world for design; the "ways of knowing," the values of science are rationality and objectivity, those of art are reflection and subjectivity, and those of design are imagination and practicality. Similarly, the "ways of

[16] United States, *Field Manual 5-0, The Operations Process (Final Approved Draft)* (Washington, DC: Headquarters, Department of the Army, 2010), 3-1.

[17] Lt Gen. William B. Caldwell IV, "Foreword," in Jack Kem, *Design: Tools of the Trade* (Leavenworth: U.S. Army Command and General Staff College, 2009), iii.

[18] Bryan Lawson, *How Designers Think: The Design Process Demystified* (Amsterdam: Elsevier, 2006), 271.

> finding out," the intellectual skills, can be differentiated: those of science are experiment and analysis, those of art are criticism and evaluation, and those of design are modeling and synthesis.[19]

While this classification is clearly an oversimplification, it still has utility because it emphasizes the differences between science, art, and design. Attempts to understand design in terms of art and science will ultimately be unsuccessful, because design is a field that is different to both traditions. Design as a discipline has emerged in the last half a century as an evolution of craft.

For the military professional, the dominant framework and tool set, common among all officers and arguably the greatest strength of Western militaries, is planning. Therefore, it is worth comparing design with conventional planning. This comparison does not imply that design and planning are competing approaches, or that one is superior to the other. The differences between design and planning are just as significant as the differences between design, art, and science.

Army *FM 3-07* provides one of the more insightful military articulations of the purpose of planning.

> Simplicity is central to reducing complexity in planning. The most effective plans are clear, concise, and direct… Planning involves projecting thoughts forward in time and space to influence events before they occur. Rather than responding to events as they unfold, proactive planning anticipates these events. Proactive planning contemplates and evaluates potential decisions and actions in advance; it involves visualizing consequences of possible courses of action to determine whether they will contribute to achieving the desired end state. Proactive planning reduces the effects of complexity during execution.[20]

In an earlier chapter, the rationale for planning in detail is provided. "Detailed planning is necessary to integrate and synchronize activities in time and space, identify complementary and reinforcing actions, and prioritize efforts within and across the stability sectors."[21] However, *FM 3-07* also warns of the pitfall of over-planning. "While sound plans must include detail, planning in more detail than needed only consumes limited time and resources."[22]

Colonel Stephen Gerras identifies the assumptions behind rational decision making models, which provides the foundation for detailed planning methods such as the MDMP.

> MDMP and any rational decision making model are typically rooted in several assumptions. First, the model assumes that the problem or goal is clearly definable. Second, the

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[19] Nigel Cross, "Design Research: A Disciplined Conversation," *Design Issues,* 15, no. 2 (1999): 5-10.

[20] United States, *Field Manual 3-07, Stability Operations* (Washington, DC: Headquarters, Department of the Army, 2008), 4-1 – 4-2.

[21] Ibid., 2-6.

[22] Ibid., 4-3.

> information that is required to make a decision is available or can be acquired. Third, there is an expectation that all options generated can be adequately considered, compared, and evaluated to identify an optimal solution. Fourth, the environment is presumed to be relatively stable and predictable, and finally, there is sufficient time for working through the decision making processes.[23]

To these Army doctrinal discussions, we can add Henry Mintzberg's contributions to the theory of planning.

> **Planning is a formalized procedure to produce an articulated result, in the form of an integrated system of decisions.** What to us captures the notion of planning above all—most clearly distinguishes its literature and differentiates its practice from other processes—is its emphasis on formalization, the systemization of the phenomenon to which planning is meant to apply… Formalization here would seem to mean three things, especially (a) to decompose, (b) to articulate, and especially (c) to rationalize the processes… Rationality of this formal kind is, of course, rooted in analysis, not synthesis. Above all, planning is characterized by the decompositional nature of analysis—reducing states and processes to their component parts.[24]

Table 1 summarizes the purpose, assumptions, approach, culture, and logic of military planning. From this, we can see that planning is a formalized approach to influencing events before they occur. This requires certain assumptions to be made about the operational environment. Planning assumes that a clear, stable, and well defined end state is already given in the commander's planning guidance and commander's intent; that it is possible to anticipate future events; that analyzing alternative courses of action will identify the best way to achieve the end; and that this path will be simple, clear, concise, and direct. The planning approach decomposes problems in order to prioritize, synchronize, and integrate a set of interrelated decisions at regular, discrete points in time. Planning is associated with a culture of rational management: hierarchical, decisive, objective, and technocratic behavior is expected to produce optimal decisions. **The underlying logic of planning can be summarized as rational, rigorous, reductive, and repeatable.**

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[23] Col. Stephen Gerras, "Thinking Critically About Critical Thinking: A Fundamental Guide for Strategic Leaders," U.S. Army War College, 2006, 12.

[24] Henry Mintzberg, *The Rise and Fall of Strategic Planning* (London: Financial Times/Prentice Hall, 2000), 12-13.

TABLE 1. THE PURPOSE, ASSUMPTIONS, APPROACH, CULTURE, AND LOGIC OF PLANNING.

Purpose	Formalize the approach to influencing future events.
Assumptions	Clearly defined end state is known.
	Events can be anticipated.
	Alternative courses of action can be objectively evaluated in advance.
	Simple, clear, concise, and direct solutions exist.
Approach	Reduce and rationalize complexity by decomposing and analyzing component parts in detail.
	Synchronize and integrate decisions at regular intervals.
Culture	Hierarchical, decisive, objectivity, optimality, and technocratic.
Logic	Rational, rigorous, reductive, repeatable.

In comparison, according to Army *FM 3-24*, "[t]he purpose of design is to achieve a greater understanding, a proposed solution based on that understanding, and a means to learn and adapt."[25] *TRADOC Pamphlet 525-5-500* identifies an alternative approach suited to complex operational environments.

> Reductionism and analysis are not as useful with interactively complex systems because they lose sight of the dynamics between the components. The study of interactively complex systems must be *systemic* rather than reductionist, and qualitative rather than quantitative, and must use different heuristic approaches rather than analytical problem solving.[26]

Investigating how designers across a number of professions explain how they work, Nigel Cross reaches the following conclusion:

> Designers
>
> - produce novel, unexpected solutions
> - tolerate uncertainty, working with incomplete information
> - apply imagination and constructive forethought to practical problems
> - use drawings and other modeling media as means of problem solving[27]

Tim Brown, CEO and president of design firm IDEO, echoes Cross when he describes design thinking as a "human-centered, creative, iterative, and practical approach to finding the best ideas and ultimate solutions."[28] Donald Schön adds that "[d]esigning in its broader sense involves complexity and synthesis. In contrast to analysts or critics, designers put

[25] United States, *Field Manual 3-24, Counterinsurgency* (Washington, DC: Headquarters, Department of the Army, 2006), 4-1.

[26] United States, *TRADOC Pamphlet 525-5-500, Commander's Appreciation and Campaign Design* (Washington, DC: Headquarters, Department of the Army, 2008), 6.

[27] Nigel Cross, "Discovering Design Ability," in *Discovering Design: Explorations in Design Studies* ed. Richard Buchanan and Victor Margolin (Chicago: University of Chicago Press, 1995), 107.

[28] Tim Brown, "Design Thinking," *Harvard Business Review* 86, no. 6 (2008): 84-92.

things together and bring new things into being, dealing in the process with many variables and constraints, some initially known and some discovered through designing."[29]

Providing a bridge between Army doctrine and design theory, Rick Swain discusses the assumptions of a design approach.

> Design involves a skeptical yet inquiring intellectual approach to learning that cannot be assumed, and a critical stance regarding declared truths and beliefs. Practice of design is progressive if not sequential. Some activities must take place first for others to proceed, although there is an expectation that the "steps" will double back on themselves, continuously, as design is applied…
>
> Operational design adopts a skeptical posture regarding the finality of learning, or achievement of stasis in human situations. It assumes intervention in a situation by one party will elicit a variety of responses from other interested parties—an assumption often omitted by military planners who behave as though they believe they can act on a passive opponent before a local and global audience that will interpret those planners' motives with the same sense of altruism they assigned to themselves.[30]

Table 2 summarizes the characteristics of design. The first and ongoing goal of design is to approach understanding.[31] Because understanding is always incomplete, this requires continual learning, adapting, and reframing of problems and solutions. The design approach is different than planning because it makes different assumptions. Design presumes the end state will be vague, unknown, or a moving target; that unforeseen patterns of events will emerge; that while military judgment is absolutely critical, it may not be sufficient to predict in advance which courses of action will prove most fruitful; and that the shortest path may not always be a straight line, and it may not be simple.

Consequently, the design approach acknowledges complexity rather than attempting to rationalize it, and implies a willingness to act in the face of uncertain relationships between causes and effects. Design approaches a unique situation with dialog and collaboration, drawing and modeling, in order to share interpretations from different perspectives. This highlights relationships within the environment and between worldviews, rather than focusing on components of the environment. Analysis still has a role in design, but synthesis of a systemic response to the problem situation is emphasized. Rather than collecting decisions into discrete bundles to be decided on in advance, design is continuous and dynamic, and adapts decisions in response to interactions with the environment.

Design culture is inherently participative and pluralistic. It encourages continual reflection and discourse to develop inter-subjective (shared) meaning. The design culture is not seeking optimality against a set of measures of effectiveness, but rather improvement

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[29] Schön, *Educating the Reflective Practitioner*, 41-2.

[30] Rick Swain, *Fundamentals of Operational Design* (Leavenworth, Kansas: Booz Allen Hamilton, 2009), iii.

[31] "Understanding is a process of rending the unfamiliar familiar…" Hayden White, *Tropics of Discourse: Essays in Cultural Criticism* (Baltimore, MD: The John Hopkins University Press, 1978), 5.

defined more holistically in terms of cognitive, aesthetic, and ethical values. **The logic of design is thus critical, creative, continuous, and circular.**

TABLE 2. THE PURPOSE, ASSUMPTIONS, APPROACH, CULTURE, AND LOGIC OF DESIGN.

Purpose	Understand, learn and adapt to iteratively (re)frame and (re)solve problems.
Assumptions	Clear end state unknowable in advance.
	Unexpected discontinuous events will emerge.
	Environment is too complex and uncertain to know which course of action is best prior to interacting with the environment.
	Simple, clear, concise, and direct solutions may not exist.
Approach	Acknowledge uniqueness and complexity, develop shared holistic understanding by drawing and modeling, and respond systemically.
	Iterative interaction and dynamic collaborative decision making.
Culture	Participative, pluralistic, reflective, inter-subjective, holistic improvement.
Logic	Critical, creative, continuous, circular.

These differences have important implications for design thinking and design-in-action. The way designers think promotes a different approach to education, understanding, and leading compared to traditional military methods. Together, these differences represent a significant paradigm shift in military discourse. Design education places a greater emphasis on *learning by doing*, supervised by coaches and mentors, rather than the memorization of technical knowledge or the copying of best practices.[32] **Design's holistic understanding of unique situations is reached through critical and creative thinking, mediated by discourse and drawings.**[33] Leading design challenges the dominant model of power leadership, augmenting it with a more facilitative approach tailored to accommodating multiple perspectives in ill-structured problem situations. Ronald Heifetz calls this leading adaptive work, which he defines as "the learning required to address conflicts in the values people hold, or to diminish the gap between the values people stand for and the reality they face."[34]

In addition to differences in design thinking, designers act and interact with their environment in new ways. First, design descriptions are fundamentally different from the conventional approach. Where conventional descriptions list facts and assumptions, design creates a narrative. Because they must have a coherent beginning, middle, and end, a plot, a moral, and a point of view, narratives go beyond just describing facts and are much richer.[35] Second, action in design does not seek to bend reality to fit the idealized form of a design or plan (the real world is far more complex than our representations of it for this to

[32] Schön, *Educating the Reflective Practitioner*, 117.

[33] Lawson, *How Designers Think*.

[34] Ronald A. Heifetz, *Leadership Without Easy Answers*, (Cambridge, MA: Belknap Press of Harvard University Press, 1994), 22.

[35] Elinor Ochs and Lisa Capps, "Narrating the Self," *Annual Review of Anthropology* 25 (1996): 19-43.

ever work). Instead, *inter*action always serves a dual purpose. On one side of the coin, action exploits favorable potentials within the operational environment based on the appreciation of context generated within design.[36] On the other side of the same coin, by stimulating the system, action generates information, which provides a learning opportunity to the designers.[37] **In design, action is taken both to transform the system and to learn.**[38] This creates an interactive feedback loop that enables design to contribute to organizational learning.

It is important to note that the differences we have identified are between the *theory* of design and planning. In practice, commanders adapt the tools they have to the realities of their environment. They analyze and synthesize. They think creatively and acknowledge complexity and uncertainty. It is not surprising that design-like thinking has been practiced in the field well before it was encoded into doctrine; nor is it surprising that planning in real world environments bears only a passing resemblance to the theoretical ideal. Colonel (R) Jim Greer provides a more realistic account of planning:

> Planning does not have a clearly defined end state. The commander describes a desired end state in the upfront guidance, but that's all it is. End states often are refined during planning, and in parallel planning at successive echelons end states often are adjusted based on policy or other considerations. End states are also general in nature, not specific. The planning culture is also not necessarily hierarchical. Military design and military planning both are conducted within the same organizational and cultural framework. Good planning teams have the same level of discourse between Lieutenant Generals and Majors that good Design teams do. That's a function of the leadership climate in the organization. Additionally, most planning today is joint, interagency and multi-national; hardly hierarchical. Finally, planning is not and never has been about optimizing. It has always been about satisficing. Planning is aimed at a future that is unknowable and within a resource constrained environment. With those restrictions, planning solutions are never optimal, at best they satisfy the requirement enough to accomplish the objective within resource constraints.[39]

By including a chapter on design in *FM 5-0*, the hope is that the doctrinal account of the operations process moves closer to the reality of simultaneously designing, planning, preparing, and executing. Understanding the different underlying logics of design and detailed planning helps the commander to make best use of the available tools in a particular context. Because design and detailed planning have very different purposes, assumptions, approaches, cultures, and logics, as General Mattis notes, "the two processes always are complementary, overlapping, synergistic, and continuous."[40]

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[36] Francois Jullien, *A Treatise on Efficacy: Between Western and Chinese Thinking*, trans. Janet Lloyd (Honolulu: University of Hawai'i Press, 2004), vii.

[37] Checkland and Poulter, *Learning for Action*.

[38] Schön, *Educating the Reflective Practitioner*, 73.

[39] Jim Greer, personal communication, April 2010.

[40] Mattis, "Vision for Joint Operational Design," 8.

2.1.2. WHY SHOULD I LEARN TO DESIGN?

FM 5-0 provides many reasons for learning design. According to doctrine, design improves understanding of ill-structured problems, helps anticipate change, creates opportunities, and recognizes and manages transitions.[41] Design encourages solving the right problem (not just solving the problem right), promotes adaptation to dynamic conditions, and strengthens the link between strategy and tactics.[42] A creative design can inform economy of effort, greater coherence across rotations, better interagency and intergovernmental integration, and fewer unintended consequences.[43]

At a more personal level, learning design can improve you and your organization's capacity to cope with complexity over time. Design complements existing intelligence and planning approaches and permits critical inquiry as to whether these more traditional approaches are working. Reading about design and participating in a designer community of practice will equip you with a language to communicate about the critical and creative activities that previously may have only been implicit and private. Embracing the theory will allow you to learn from the innovative ideas of other designers, many from outside the traditional military community, so you do not have to always reinvent the wheel. It will make you a more effective team member when you are required to think critically and create new ideas in a group setting. If you expect to face complex problems requiring critical reasoning and creative thinking, then it can be expected to be of benefit to you to explore the design approach.

Consider the different purposes of thinking. Figure 4 shows three broad purposes for thinking: sensemaking, idea making, and decision making.[44] (This model applies equally to thinking done by individuals, teams, and organizations.) The commander and staff all contribute to each of the three types of thinking. Multiple field manuals provide tools for making sense of information and models for decision making. Yet, prior to the release of the updated *FM 5-0*, there was no detailed discussion of how to generate new ideas and new solutions. Idea making is the gap that design is intended to fill.

[41] United States, *FM 5-0*, 3-2.

[42] Ibid., 3-5 – 3-6.

[43] Ibid., 3-7.

[44] Lt Col. Richard King, "How Stupid Are We?" *Australian Army Journal* VI, no. 3 (Summer 2009): 182-183.

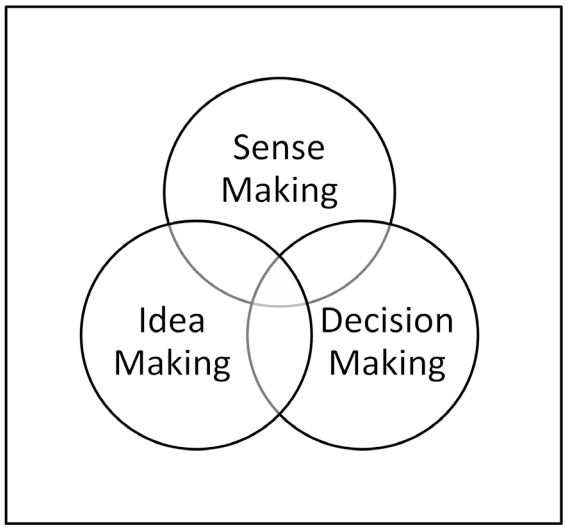

FIGURE 4. THINKING INCLUDES SENSEMAKING, IDEA MAKING AND DECISION MAKING.

Idea making is important to an organization when it is required to deal with complexity over time. Ideally, whenever we become committed to military conflict, we seek rapid, decisive victory. According to Boot, this ideal is even characteristic of a new American way of war, which "relies on speed, maneuver, flexibility, and surprise."[45] Unfortunately, our current enemies understand our preference for rapid victory, and instead seek protracted conflict in complex terrain. They do this to target a perceived weakness of democracies to maintain popular support to fight "small wars" over long periods of time. Whereas decisive victory emphasizes rapid decision cycles to efficiently couple sense making and decision making, long wars are more of a marathon than a sprint. Long wars demand cumulative progress, learning organizations, and innovative thinking. Long wars require an investment of the best available thinking into idea making, as well as decision making and sense making.

This is not to say that design has applicability only to irregular warfare. Rather, the demands of the contemporary operating environment have merely highlighted an imbalance in conventional military thinking. If the circles in Figure 4 were drawn proportional to the amount of attention they are currently given, decision making would dwarf and subsume the other two. Sensemaking would be seen only as the intelligence preparation of the battlespace input to the Joint Operation Planning Process JOPP or MDMP. Idea making would have a small role, with design as an embellished version of mission analysis. While decision making clearly dominates short term military effectiveness, idea making is more strategic, because it is the source of innovations essential for long term success. According to doctrine, conventional planning begins with receipt of mission.[46] (In practice, of course, good units will not wait until they are given a mission to begin planning.) Deliberate decision making focuses on how to accomplish a given mission. **Design and idea making**

[45] Max Boot, "The New American Way of War," *Foreign Affairs* 82, no. 4 (2003): 41-58.

[46] United States, *FM 5-0*, H-1.

permits questioning of the mission, the thinking that got us to where we are now, and even whether any action is actually required. By exposing goals, aims, and objectives to collaborative dialog, design improves the likelihood of effective action towards solving the right problem. Design thinking applies across the spectrum of conflict.

2.1.3. WHO DOES DESIGN?

Any professional responsible for changing existing conditions into preferred conditions already does design – even if they do it implicitly.[47] Architects design buildings and structures to accommodate human needs and desires. Doctors diagnose and prescribe treatments to heal patients. Lawyers design arguments to persuade juries. Teachers design courses to educate students. Military professionals design strategies, operations, and tactics to achieve objectives through the use of force or by other means. As Nigel Cross' comparison above illustrates, design is the common core that unites and distinguishes the professions from the arts and sciences. Whereas art explores the human condition and science explains the natural world, the purpose of profession is to *transform* the world in the context of a greater societal aim. In Schön's view, "designing, broadly conceived, is the process fundamental to the exercise of artistry in all professions."[48] Tim Brown further observes that "[l]ogistics systems, the Internet, organizations, and yes, even strategy—all of these are tangible outcomes of design thinking. In fact, many people in many organizations are engaged in design thinking without being aware of it. The result is that we don't focus very much on making it better."[49]

In spite of this common ground across fields of design, there are also important differences among the professions. As Rick Swain notes, "design lacks practical content when it appears without an antecedent. This is why schools of design organize themselves around specific applications: architecture, industrial design, graphic design, network design, organizational design, and so on."[50] SAMS is a school organized around the design and planning of military operations. The doctrinal design methodology described in Chapter 3 is intended for use by operational commanders and staffs faced with complex, ill-structured problems, requiring joint, interagency, intergovernmental multinational, and commercial (JIIM-C) dialog and collaboration. These operational problems are sufficiently complex that it is safe to assume no single individual has a complete understanding of the environment, the problems, and how to resolve them.

It follows that, in the military context, design as a fully fledged methodology is intended to be performed in teams and groups, rather than by individuals. The power of teamwork is eloquently captured in the U.S. Navy's *Background to Decision Making*, published in 1958.

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[47] Herbert A. Simon, *The Sciences of the Artificial* (Cambridge, MA: MIT Press, 1981).

[48] Schön, *Educating the Reflective Practitioner*, 41.

[49] Tim Brown, "Strategy by Design," *Fast Company*, (June 2005): 53.

[50] Swain, *Fundamentals of Operational Design*, iii.

"An individual is severely limited in his capacity to deal with uncertainty. Situations soon become too complex for individual handling. The organization is the answer, for it permits groups to aim at and to achieve objectives that would be far beyond the reach of any of its members acting alone."[51] However, organizations can also serve as forms of limited human attention and cultural filters. Design often requires the admittance of "outsiders" who can impart differing frames or perspectives on the situation that may be invaluable to the design effort.

Design, then, is ideally done by a design team.[52] The commander is an integral team member, because enhancing his/her understanding is the design team's *raison d'être*. According to *FM 5-0*, "[d]esign underpins the exercise of battle command." Another way of saying this is design provides a collective approach to battle command. Design enables the commander to leverage the collective intellect of his staff and subordinate commanders to develop a deeper understanding of the operational environment, visualize the source of the difference that is causing the current problem, and describe the operational approach to transform towards the desired system. By forming a team, the commander is able to enhance his/her own understanding, which consequently enhances the battle command process.

The commander[53] is responsible for forming the design team and assigning initial roles to structure the work. Key roles in a design team include design team leader, recorder, and observer/controller. The size of the design team depends on purpose and staff availability. However, research in multiple fields suggests that core teams of five to six persons are most effective, teams of up to nine can still be effective, while a team of twenty or more is likely to be completely ineffective.[54] All members of the core design team should aspire towards a holistic appreciation of both the problem situation and the design methodology. It will sometimes be necessary to temporarily augment the core design team with subject matter experts (SMEs). Valid reasons for augmentation include: to engage key stakeholders; to introduce divergent thinking into the design team; and/or to cover specific gaps in knowledge. While SMEs are invaluable for introducing new ideas and perspectives, the core design team always maintains responsibility for organizing the information into a coherent design within the time and resource constraints.

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[51] William Reitzel, *Background to Decision-Making*, (Newport, RI: Naval War College), 1958.

[52] This is supported by complex systems theory. "If a problem is more complex than a single individual, the only way to solve it is to have a group of people – organized appropriately – solve it together." Yaneer Bar-Yam, *Making Things Work: Solving Complex Problems in a Complex World* (Cambridge, MA: NECSI Knowledge Press, 2004), 259.

[53] Or equivalent, if the leader is provided by another JIIM-C organization.

[54] Major Michael L. Hammerstrom, "Size Matters: How Big Should a Military Design Team Be?" (Monograph, School of Advanced Military Studies, U.S. Army Command and General Staff College, 2010).

2.1.4. WHEN DOES DESIGN HAPPEN?

When design occurs is a commander's decision. However, those with design education and experience serve to advise when it may be appropriate. Design should be applied when the situation is complex and requires iteration over time. When we use the word complex in a technical way, it does not mean difficult (in war, friction means even simple problems are difficult). Nor is it the same as complicated. Complicated systems are those systems that are amenable to reductive mechanistic analysis. It is possible to understand, control, and predict complicated systems as if they are machines following fixed rules of operation, even when they have many interacting components. When systems contain feedback – when they learn or evolve or adapt – the rules are no longer fixed, and the behavior of one component changes the way other components behave. **This interdependence is the primary characteristic of complex systems, and the design approach is needed to understand and influence these systems.**

Because time devoted to understanding and framing a problem situation might have been spent on more detailed planning or contingency planning, design always has an opportunity cost. Complicated problems in a stable context may not need a standing design team. Unfortunately, problem situations do not come with signposts warning of oncoming complexity. The solution to a complicated problem may give rise to unforeseeable side effects and the recognition of complexity. For example, the technical problem of how to provide fresh water to a remote community might be solved by building a well. But if the location of the well provides unequal access, some sub-groups may lose power and influence, catalyzing a cascade of complex social processes. The commander is responsible for deciding when to design, informed by an appreciation of the costs and benefits of design, the degree of complexity of the current situation, and the relevance of the current understanding.

Ideally, when the commander anticipates the need to cope with complexity over time, design starts prior to any detailed planning and execution. This enables designers to frame the problem and operational approach up front. This means that detailed planning is fully informed by design's systemic understanding, and execution provides a direct test of the initial frames. In this scenario, designing, planning, preparing, and executing are aligned and complementary, which promotes unity of effort and offers the greatest opportunities for learning.

However, real world constraints will not always allow for iteration of design prior to planning. Unanticipated "black swan" events occur.[55] Enemy action often requires an immediate response, and political factors can force quick decisions. While it is true that the design methodology can be scaled up or down to meet the available time frame, we know that there are diminishing returns to compressing the time available for design. Time pressure forces short cuts. **The deeper meaning generated by design comes from**

[55] Nassim Taleb, *The Black Swan: The Impact of the Highly Improbable* (New York, NY: Random House, 2007).

intentionally inefficient methods. Divergent thinking, iteration, circling back on previous steps, critique, deconstruction, dialog, posing meta-questions, examining alternative perspectives, reflecting, and reframing are slow and all take time. Rather than sacrificing the quality of design under time pressure, in this situation the commander can start designing and planning in parallel. This normally requires separate design and planning teams. The biggest risk of this approach is that shared deeper meanings may be disconnected between designers and planners. Understanding generated by design is wasted if it is not shared with the commander and staff. Planning that ignores concurrent efforts in design may make delivering a product easier, but if the plan frames the problem too narrowly, it may be solving the wrong problem. To mitigate this risk, careful attention must be paid to the command climate, particularly effective communication between the commander, designers, planners, and the JIIM-C community.

There is a third scenario. A unit may already be planning and executing when the commander recognizes a need for design. This case contains the most moving parts, and the design team will be starting behind the curve of current events. Because this is generally the most challenging scenario, the commander needs a design team that has both an intimate knowledge of the current situation, and is a cohesive team with a successful track record of designing together. Unfortunately, in this scenario no such standing design team exists. Forming a design team will be a compromise between including members who have regional experience with the situation, and members with experience of the design methodology. With designing, planning, preparing, and executing all occurring simultaneously, the design team must make a particular effort to maintain an external focus, and ensure their understanding is shared with the commander and JIIM-C participants. They must also be careful to maintain a long-term view; otherwise crises within current operations will quickly limit the design team's focus to near-term tactical concerns. Considering that at present, there are in fact very few standing design teams in the US Army, this may in fact be the most likely scenario a potential design team member finds themselves in. Designers must be comfortable with stepping into the flow of simultaneously designing, planning, preparing, and executing to function effectively in this environment.

2.1.5. WHERE DOES DESIGN HAPPEN?

Design, following the methodology described in *FM 5-0*, requires a headquarters with a staff. According to Brigadier General (R) Huba Wass de Czege, "[n]early all missions this century will be complex, and the kind of thinking we have called 'operational art' is often now required at the battalion level."[56] *FM 5-0* is consistent with this, stating that "…the need for design at lower echelons often increases as brigades and battalions contend with the challenges of shaping environments and conducting operations over extended periods."[57] Based on our own surveys of the field, however, an explicit design methodology

[56] Wass de Czege, *Systemic Operational Design*, 2.

[57] United States, *FM 5-0*, 3-6.

is not yet frequently applied at lower echelons, and even divisions often report that they are challenged to use design within a time-compressed environment. We expect it will take time, further education, and tailored development of the design methodology before it becomes practicable at the battalion level, even if there is already an established need for battalion-level design due to the complexity of current operations.

Looking up the military hierarchy, design appears equally applicable to strategy development as to operational art. Currently, the highest level standing design team resides at USARCENT. However, there is no theoretical reason why design could not be applied above the level of Land Component Command. The logic that mediates strategy and tactics with operational art equally applies to the mediation of policy and operations through strategy development. Operational art provided the initial area of application for design, but future applications are likely to expand into the realm of strategy and policy.

Although there may be an overlap in personnel between design and plans (especially at lower echelons), it is recommended that design occurs in a room dedicated to designing. In order to generate holistic understanding, information needs to be accessible, visual, sharable, and modifiable. Often, the same information will be organized in several different ways to show different insights. A great way to achieve shared understanding in design is to make smart use of shared space within the design room. Designers need whiteboards, flip charts, butcher paper, and/or tri-fold project boards to visually display and manipulate concepts and relationships. Whiteboards are great for drawing rich pictures, and their temporary nature encourages creativity. Flip charts can substitute for whiteboards, and are also good for facilitating and maintaining a record of discourse. When ideas become more stable (but always remaining open to revision), they can be transferred onto butcher paper and pinned to the walls. This helps to maintain the group's attention on the latest drafts, and frees up whiteboards for more dynamic and creative activities. A design team should have no trouble filling the walls with maps, networks, affinity diagrams, problem statements, and other products by using the design methods listed in Appendix B. When the walls are filled, even empty space on the floor can be used to display the results of design inquiry. A good example of the use of walls to visually communicate design is shown in Figure 5.

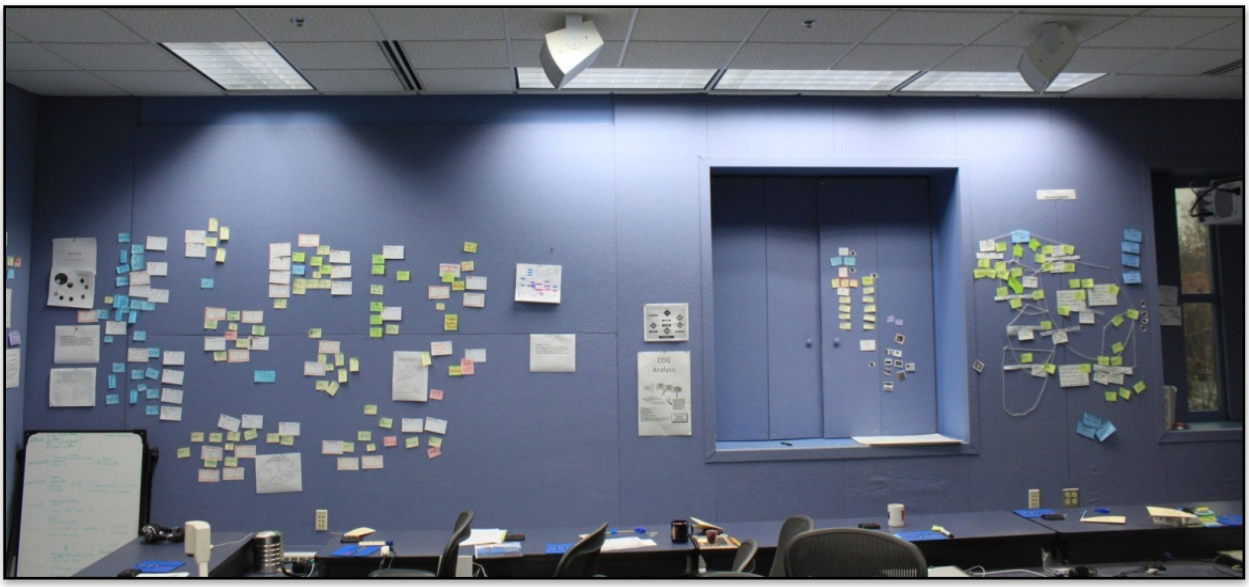

FIGURE 5. EXAMPLE USE OF WALL SPACE IN A DESIGN ROOM.

While this illustrates good use of wall space, Seminar 6 was not entirely satisfied with their first attempt at designing. During their second two-week practicum, they chose to experiment with two smaller, independent design teams, which both moved out of the classroom to better shape their work space. In the after-action review, the observer-controller (OC) documented differences between the teams' work space, shown in Figure 6. The first team, which the OC dubbed 'the collective,' worked as a single unit focused around a white board covered with transparent overlays. The collective used the secondary board on their left for "storyboarding," to keep track of the big picture. The second team, 'the collaborative,' instead had laptops for each team member on the main table. The whiteboard on the right functioned as a projector screen, while the whiteboards on the left were used for brainstorming and storyboarding. Team members would collaborate in twos and threes around what became known as the 'arts and crafts table,' depicted in the bottom right of Figure 6. This table contained three tri-fold project boards, where sticky notes were organized to capture relationships between military, information, diplomatic, law enforcement, infrastructure, finance, and economic aspects within their environmental frame. Although the teams organized their rooms differently, both teams created environments that promoted the visual display of information and inclusive group discourse, which greatly enhanced shared understanding of the problem situation.

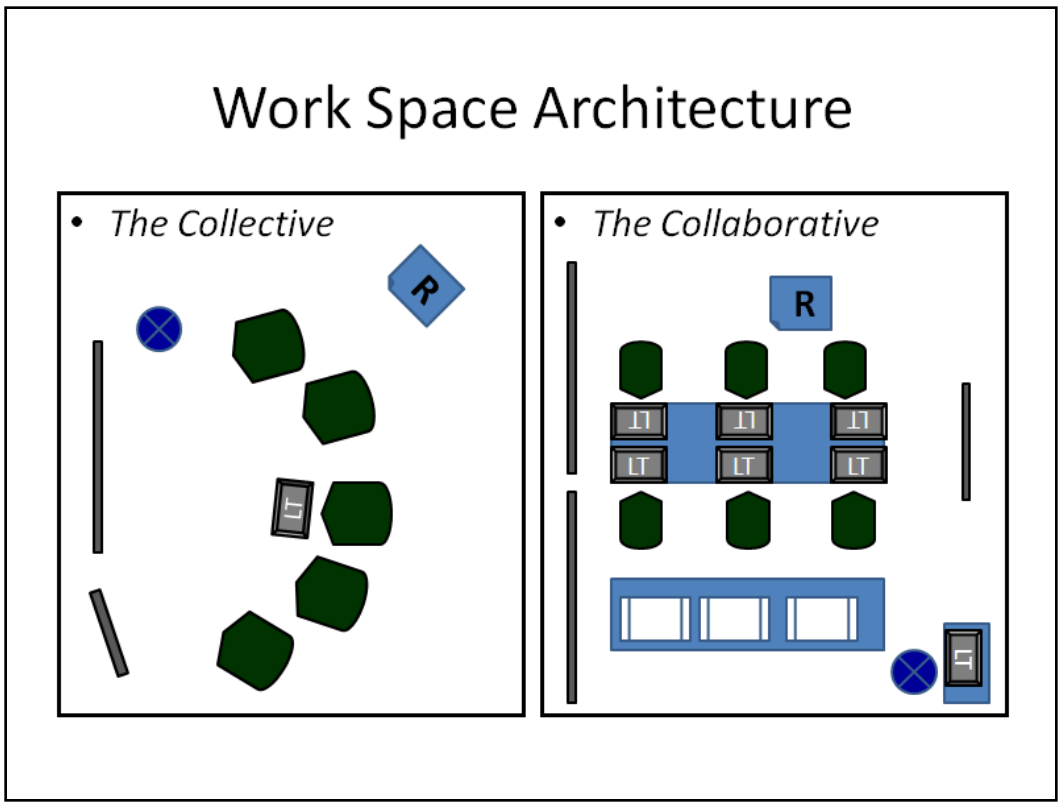

FIGURE 6. SEMINAR 6 SAMS AMSP 2010: DESIGN PRACTICUM 2
WORK SPACE ARCHITECTURE. R DENOTES RECORDER, LT DENOTES LAPTOP.

We also need to explore where design occurs within battle command and the operations process. As the intellectual underpinnings of battle command, design is continuous and central to the plan, prepare, execute, and assess cycle – it informs and is informed by each activity. Of particular importance is the complementary relationship between designing and planning. The most important determinant of the nature of this relationship is the operational environment. In a well-structured environment, with clear goals, a stable strategic context and no more than two dominant actors, design can be largely implicit. Here, detailed planning of branches and sequels in breadth and depth is a key to success. In contrast, an ill-structured problem situation, with no agreement on goals, a dynamic strategic context, and an "ecosystem" of actors demands a much greater role for design to inform balancing and integrating activities. **Because ill-structured problems violate the assumptions required for conventional planning, launching into detailed planning without designing first will generate counterproductive unintended consequences.**

When facing a complex, ill-structured problem situation, designers frame their environment, frame their problem(s), and invent an operational approach capable of transforming the existing problem set. In other words, design sets and frames the problem sufficiently for the commander to articulate clear guidance, which allows detailed planning to occur. However, since design is continuous, this is just the beginning of the relationship

between designing and planning. Continual dialog between designers and planners enhances the level of understanding and the quality of products both produce.

The different logics of designing and planning generate a creative tension between interpretation and analysis, creativity and rationality, holistic and detailed understanding, and situational specificity and generic applicability. Designers can alert planners to subtle interdependencies between operational variables, while planners can inform designers of the scheduling requirements for synchronization. Planners provide important feedback to designers as they work within the current frame, and designers reframe problems and the environment for the planners to maintain the relevance of understanding. Detailed planning operates within the physical constraints of time-distance factors, and through wargaming, explores action-reaction-counteraction dynamics. If designers are not continually interacting with and listening to planners, they risk developing unworkable solutions. **Throughout this interaction, the commander is an integral link between designing and planning.** Design enhances the commander's understanding, while planning realizes the commander's intent.

It is important to emphasize that the current Modification Table of Organization and Equipment (MTOE) for the various U.S. Army headquarters does not allow for a separate design team. Currently, the closest analog to the design team is a Commander's Initiative Group (CIG). In most cases, design teams will be drawn from existing plans staff.[58] In the real world, teams are simultaneously designing, planning, preparing, executing, and assessing. Advice on how to manage this simultaneous action is provided below. For now, it is sufficient to note that because design frames subsequent detailed planning, initially investing in design effort streamlines planning processes. Design should not add to the total workload of a staff. By developing a deeper understanding through designing, the staff may avoid some of the crises and second and third order effects generated by acting without the same level of understanding.

2.1.6. HOW CAN I LEARN TO DESIGN?

At the start of this section, Schön raised an apparent paradox. The artistry of design cannot be taught by memorizing technical knowledge. Instead, the student of design is asked to start designing before the student understands what design is, or how to evaluate the quality of the designs the student produces. Schön states:

> In the terrain of professional practice, applied science and research-based technique occupy a critically important though limited territory, bounded on several sides by artistry. There are an art of problem framing, an art of implementation, and an art of improvisation—all necessary to mediate the use in practice of applied science and technique.[59]

[58] However, the commander should not assume that all designers should be planners. Diversity is strongly encouraged for a design team.

[59] Schön, *Educating the Reflective Practitioner*, 13.

The knowledge of design embodied in this student text is necessary but not sufficient for a professional to learn and embrace design. A book by itself cannot teach students of design the artistry of problem framing, nor the artistry of applying theory to a unique problem situation. It cannot provide rules for how to improvise and create workarounds when the problem has novel characteristics that were not anticipated at the time of writing. How, then, can a student master the artistry of design?

Fortunately, Schön offers a resolution to this paradox. The ladder of reflection, a "chain of reciprocal actions and reflections that makes up the dialog of student and coach," offers a way out of the dilemma.[60]

> Design studios are premised on a particular kind of learning by doing. The student is asked to start designing before she knows what designing means. If she accepts this challenge and the perceived risks it entails, entering, tacitly or explicitly, into a contract with the coach that carries with it a willing suspension of disbelief, she begins to have the sorts of experiences to which the coach's language refers. She puts herself into a mode of operative attention, intensifying her demands on the coach's descriptions and demonstrations and on her own listening and observation.
>
> Her initial efforts at design provide the coach with evidence from which to infer her difficulties and understandings and a basis for the framing of questions, criticisms, and suggestions.[61]

The coordinated actions and dialog between coach and student of demonstrating and imitating, telling and listening provides a way for students to learn to design. Coach and student each move up and down the ladder of reflection as they act and reflect on their actions. Schön explains the vertical dimension of the ladder where:

> …higher levels of activity are "meta" to those below. To move "up," in this sense, is to move from an activity to reflection on that activity; to move "down" is to move from reflection to an action that enacts reflection. The levels of action and reflection on action can be seen as the rungs of a ladder. Climbing up the ladder, one makes what has happened at the rung below into an object of reflection… Climbing down the ladder, one acts on the basis of a previous reflection. Having reflected on an earlier performance, the coach may offer a new demonstration, or the student may try a new drawing.[62]

Design can be learned within a design practicum, where students act and receive feedback from mentors who are experienced designers. The design community of practice, which includes recent SAMS graduates, is an excellent source for mentors to help coach new members of design teams in the language and practice of design. As a SAMS graduate, one must be prepared to lead the practice of design and help mentor new practitioners of

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[60] Ibid., 114.

[61] Ibid., 117.

[62] Schön, *Educating the Reflective Practitioner*, 114.

design through the design methodology articulated in *FM 5-0*. One must also continue to seek out mentors to help reflect upon and improve one's own mastery of design.

2.2. A CONCEPTUAL FRAMEWORK FOR DESIGN

Now that we have answered the journalists' "5Ws and one H" on design, next we organize the key concepts of design within a conceptual framework. The purpose of this framework is not to be definitive, but rather to make explicit the conceptual framework that SAMS has evolved and found useful in design education. **A well rounded design education draws on history, theory, doctrine, philosophy, and practice.** These five pillars are the sources of the concepts in our conceptual framework. In this section, the contributions of the five pillars are summarized. Then, the conceptual framework for design is explained. The conceptual framework is divided into four levels: design, the four big ideas of design, the twenty key concepts, and the full design lexicon. Last, this section expands on the intermediate levels of the conceptual framework – the big ideas and the key concepts.

2.2.1. FIVE PILLARS OF DESIGN EDUCATION

The five pillars of design education at SAMS are history, theory, doctrine, philosophy, and practice. This section explains why each pillar is essential in design education.

2.2.1.1. HISTORY

The value of history in the art of war is not only to elucidate the resemblance of past and present, but also their essential differences.

—Julian Corbett

According to John Gaddis, the study of history shifts and elevates the perspective of the student, resulting in an enlarged experience and expanded horizon.[63] SAMS uses history to assist in educating how to lead design. Throughout the design course, history, theory, doctrine, philosophy, and practice are integrated to generate the appropriate understanding of the different aspects of design. We start the course with an examination of the "Iron Major," then move to a case study/virtual staff ride of a campaign, and then flow history into individual class sessions.

Wedemeyer and the Victory Plan

An example of a historical case study illustrating design-like thinking is the experience of (then) Army Major Albert Wedemeyer as documented by Kirkpatrick.[64] In the summer of

[63] John Lewis Gaddis, *The Landscape of History: How Historians Map the Past* (Oxford: Oxford University Press, 2002), 4.

[64] Charles E. Kirkpatrick, *An Unknown Future and a Doubtful Present: Writing the Victory Plan of 1941* (Washington, DC: Center of Military History, 1992).

1941, Major Wedemeyer received a tasking from the Chief of the War Plans Division of the War Department General Staff. Wedemeyer was to "calculate the nation's total production requirements for the defeat of 'potential enemies' of the United States."[65]

Wedemeyer started with little more than this nebulous guidance. The American political environment did not allow strategic leaders to make positive statements about the nation's desired end state, much less to admit that planning was underway to enter the war. No one could fully articulate who the enemy was, nor could policy makers describe how America and her allies would go about defeating the enemy.

Major Wedemeyer, as the officer responsible, had to organize the work, gather information without arousing suspicion, and frame the problem broadly. His research went well beyond the scope of mobilization facts and figures. Because there was no clear strategy, Wedemeyer first had to propose a strategy. Next, he had to devise concepts of operations across multiple theatres, which exploited emerging mechanized technologies, and which identified the enemy's organizing logic as well as how to defeat it. All this was necessary to appreciate the operational environment and the desired end state the mobilization was intended to satisfy. There were many tensions and competing demands, such as maintaining a sustainable civilian economy, meeting the insatiable materiel demands of allies through the lend lease program, while rapidly building a large expeditionary force. The mobilization problem was not just ill-defined, it was interwoven with many other problems and potential problems that could not be understood without taking what we would call a JIIM-C approach to dialog and collaboration.

Given the "stupendous task" of calculating the nation's total production requirements under serious time pressure, a natural approach would have been to focus inwards on the components required for mobilization. Such an analytic approach would have taken the mission and broken it into simpler pieces to be analyzed separately. Yet Wedemeyer did exactly the opposite. His inquiry was first directed outwards to better understand the context for mobilization. **Wedemeyer appreciated that the answer to the question "Why?" resided in the context, not in breaking apart his mission.** Only when he understood the context in terms of the national objective, the strategy, and the forces required did he attempt to answer the question he had been given. A lifelong commitment to education, combined with broad and varied military experiences, helped prepare Wedemeyer to view the problem of mobilization as a system.

Three months later, Wedemeyer produced a 14-page document that answered the question. His paper became the Army's input to the "Victory Program." According to Kirkpatrick, the "Victory Plan was in effect a comprehensive statement of American strategy that served as a fundamental planning document in preparing the country for war."[66] Had Major Wedemeyer limited his study and his report to the question of

[65] Ibid., 56.

[66] Ibid., 122.

mobilization, he would not have produced such a comprehensive and enduring framework. Even though the Victory Plan did not always accurately forecast the detailed force structures that were implemented, its great strength was that it framed a complex and ambiguous situation sufficiently to allow a coherent and successful mobilization for war.

Vicksburg Virtual Staff Ride

The direction given to a line of operations depends not only on the geographic situation of the country, but also on the positions occupied by the enemy. The general plan of campaign is frequently determined on previous to beginning operations, but the choice of lines and positions must ordinarily result from the ulterior events of the war, and be made by the general as these events occur.

—Henry Wager Halleck, 1862

We expose SAMS students to the Vicksburg staff ride so they have a detailed awareness of the challenges of operational command and control in a complex environment – an understanding they can refer back to on frequent occasions in the rest of the design course. For the first three days of the design course, students assess the nature of operational art and science in 1862, then spend two days role-playing assigned positions as either Union or Confederate senior leaders.

The teams consist of students role playing: Henry W. Halleck (2 students), Ulysses S. Grant (2 students), William T. Sherman/James B. McPherson/John A. McClernand (2 students play all three roles), Admiral David D. Porter (1 student). For the Confederates: Jefferson Davis (2 students), John C. Pemberton (2 students). Joseph E. Johnston (2 students). Another two students change roles from day one to day two. They play the commanders of the cavalry raids – Benjamin Grierson, Earl Van Dorn and Nathan Bedford Forrest.

The intent of the staff ride is to analyze the context of a campaign, identify the strategic requirements for both sides in the campaign, understand the environmental context, the problem appreciation (specifically the challenge of achieving battlefield decisive victory), and generate an interactive discussion of the solutions offered by the commanders in the campaign. The value of the staff ride rests in the deep appreciation, or in Clifford Geertz's phrase, the "thick description" of a complex campaign conducted in a complex environment. Students refer back to the campaign, their roles, and the lessons they learned throughout the design course, and instructors frequently refer them back for specific points of awareness.

Design Spaces and History

When we teach the environmental frame, we use T. E. Lawrence's depiction of his environmental designing from *Seven Pillars of Wisdom*.[67] Chapter XXXIII of this classic of military theory is a superb depiction of an individual conducting design during a period of

[67] Lawrence, *Seven Pillars of Wisdom*, Chapter XXXIII.

enforced reflection. Suffering from dysentery, Lawrence spent ten days in a tent, unable to do anything other than suffer and think. The first part of the chapter is his remembrance of his thinking, of his reflection *before* action, on the situation, the environment facing the Arab revolt, and British interests in the Saudi Arabian peninsula. **He closes the chapter with a single paragraph – perhaps the best single paragraph environmental narrative written in English.** He also adds an interesting footnote, reflecting on the artificial nature of all military writing, which always fails to capture the instrumental details necessary for both conceptual and detailed planning, and make things seems much more ethereal and abstract – in his words, "smelling more of the lamp than of the field." SAMS students are required to present a graphic of Lawrence's environmental frame narrative, and are given 15-20 minutes of class time to create a single PowerPoint slide or whiteboard sketch. During this short practical exercise, students are assigned to small groups to conduct the work, then required to present to their classmates. Sometimes, depending on the learning curve of the seminar, students are required to do either a presentation drawing, a design drawing, or a production drawing, as distinguished by Lawson.

For the problem frame, we refer to Admiral Sandy Woodward's memoir on his command of the British Falkland Islands relief force.[68] In Chapter 4 of these memoirs, Woodward depicts his increasing awareness of the nature of the problem he faced as commander of the joint force. In these 20 pages, he places the reader in his own position of increasing awareness, as he reflects, acts, communicates, and discusses his situation with his superiors, subordinates, and staff officers.

In the advance sheet for this day, students are reminded that getting the right problem identified, and being able to re-sort whether you have the right problem identified, is essential to the art of design. Understanding the challenge of proper problem identification, or framing, is part of the solution. Searching, mapping, and telling the story (or constructing the narrative) are all ways ahead for problem framing. Students are required, as homework, based on Woodward's description of his problem frame, to construct a 225 word single page email problem statement. They are told to be prepared to brief this document to their classmates and to be prepared to discuss their version in a small group to develop consensus and then brief a consensus problem statement or sketch of the problem frame. In class, different groups are required to present either a narrative statement of the problem, or a sketch of the problem. **This practical exercise leads to a discourse on how to present issues of time, space, intent and others graphically.** Instructors frequently use this discourse as a teaching moment to bring in ideas about storyboarding both presentations and actions.

For the solution space, we use a primary source document from the pre-Overlord planning for Normandy from the Chief of Staff to the Supreme Allied Commander (COSSAC) staff. This document, "Digest of Operation Overlord, 7 July 1943. (43) 32 Final," provides the

[68] Admiral Sandy Woodward, *One Hundred Days: The Memoirs of the Falkland Battle Group Commander,* (Annapolis: Naval Institute Press, 1992), Chapter 4.

students an actual operational approach document from conceptual planning in a complex environment.[69] **After looking at this design concept from more than 60 years ago, students step into the worlds of individual and group learning, the deep interconnectivity of blue actions inside the environmental system, the need for discourse as a mode of developing understanding, and the positive, and negative, aspects of design as a team effort.** Students also read about, and discuss in class, the techniques for conducting formulation of an operational approach, and techniques for constructing the bridge from design into planning. The homework assignment for this class is to compose a 225-word, single-page email detailing either the environmental narrative, problem statement/question, or the design concept, as assigned the day before. The in-class practical exercise creates, and then presents, three PowerPoint slides that brief the design of the COSSAC staff in 1943. These slides are usually design drawings, not the production or presentation sketches, discussed by Lawson.

Closing the course, students address the issue of *simultaneity* through reading, discussing, and assessing U. S. Grant's memoir of the Chattanooga Campaign from his *Memoirs*.[70] Grant, in this "cracker-line" campaign, clearly placed his efforts in the larger context of 1863. At the start of this reading, students observe Grant taking stock of various ongoing operations, and accounting for the effects of previous military events. He then is given some specific instructions (design constraints) and begins to design the environmental frame, problem frame, and eventually a design concept for his "space." He then proceeds to execution of specific tasks, but also keeps an awareness of the connections to the larger issues. Students are advised that this class is not the end of this course – it is the start of their personal concept of design. Design is not conducted in a vacuum, nor is it performed as a simple initiation of action. **Indeed, unlike most military exercises, actual military operations are nearly always in a context of previous and sequential operations.** This class explores the contextualization of design – placing it in the midst of ongoing planning and execution, both of the current operation and of precursor and successor events. Some of the class discussion is on identifying differences, and reasons for these differences amongst the language and concepts of *design*, *planning*, *preparation*, *execution, and assessment*. All of this is an effort to initiate ideas on making the seams between these elements useful and relevant for the development of understanding. For homework students are required to prepare for present a sketch of a presentation drawing of one of the following from this campaign: design environmental frame, design problem frame, design operational approach, planning, preparation, execution, or assessment.

[69] COSSAC (Chief of Staff to the Supreme Commander Allied Forces), "Digest of Operation 'Overlord'," available at http://cgsc.cdmhost.com/u?/p4013coll8,1246 (accessed May 17, 2010).

[70] Ulysses S. Grant, *Personal Memoirs of U. S. Grant*, (New York, NY: Charles L. Webster & Company, 1982, originally published 1885), Chapters 40-41.

2.2.1.2. THEORY

So long as no acceptable theory, no intelligent analysis of the conduct of war exists, routine methods will tend to take over even at the highest levels.

—Carl von Clausewitz, *On War*[71]

During the 1974 West Point graduation address, author Ayn Rand argued for the practical importance of philosophy. In her speech, she also explained the essential role of theory.

> Now ask yourself: if you are not interested in abstract ideas, why do you (and all men) feel compelled to use them? The fact is that abstract ideas are conceptual integrations which subsume an incalculable number of concretes — and that without abstract ideas you would not be able to deal with concrete, particular, real-life problems. You would be in the position of a newborn infant, to whom every object is a unique, unprecedented phenomenon. The difference between his mental state and yours lies in the number of conceptual integrations your mind has performed.
>
> You have no choice about the necessity to integrate your observations, your experiences, your knowledge into abstract ideas, i.e., into principles. Your only choice is whether these principles are true or false, whether they represent your conscious, rational conviction — or a grab-bag of notions snatched at random, whose sources, validity, context and consequences you do not know, notions which, more often than not, you would drop like a hot potato if you knew.[72]

Published 132 years earlier, in *On War*, Clausewitz expressed the same insight in nine words: "a working theory is an essential basis for criticism."[73] Design is practical, yet at the same time it is theoretical. When the psychologist Kurt Lewin said "there is nothing more practical than a good theory," he was making a point about the importance of integrating theory and practice.[74] **Because theories provide highly compressed insight into how something works, theories are tools that provide practitioners with a great source of leverage.** Designers must therefore be capable of surfacing and critiquing the theories that underlie the narratives and frames of reference of all the actors within the operational environment – especially our own implicit frames, which can be the hardest to identify and criticize. Designers need to be able to employ theories across multiple knowledge disciplines, replace outdated concepts with more relevant ones, and create new meaning in the light of reframing. Without theory, design cannot be critical, and genuine reframing is

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[71] Carl von Clausewitz, *On War*, ed. and trans. Michael Howard and Peter Paret (New York, NY: Alfred A. Knopf, 1993), 154.

[72] Ayn Rand, *Philosophy, Who Needs It* (Indianapolis: Bobbs-Merrill, 1982).

[73] Clausewitz, *On War*, 157.

[74] Kurt Lewin, *Field Theory in Social Science: Selected Theoretical Papers,* ed. Dorwin Cartwright (New York, NY: Harper & Row, 1951), 169.

implausible. Design is as much about tentatively creating new theory (new sensemaking) as it is about using established theories (old sensemaking).

Military conflicts always have political ends, and they occur within and between societies. This means they are unencapsulated – they do not fit within any single discipline's theoretical framework. Once again, Clausewitz warns us of this when he observes that the first common error of critical analysis "is an awkward and quite impermissible use of certain narrow systems as formal bodies of laws."[75] Brigadier General Jimmy Khoo, while he was Future Systems Architect for the Singapore Armed Forces (SAF), articulated the need for an eclectic and opportunistic approach to theory:

> But we are self-confessed eclectics when it comes to developing the 3G SAF. We want to shop for the best ideas, technology, what have you, from existing theories and research. We are not religious about any particular idea and would be quite quick to adopt another if existing ones no longer work out. We are in fact really promiscuous about this. This is the culture that we feel is needed when we are exploring and experimenting with ideas and concepts.[76]

In a similar vein, Major General Peter Chiarelli advocates a broad education to prepare for full spectrum operations:

> Critical thinking, professionally grounded in the controlled application of violence, yet exposed to a broad array of expertise not normally considered as a part of traditional military functions, will help create the capacity to rapidly shift cognitively to a new environment. We must create an organization built for change, beginning with the education of our officer corps.[77]

Design draws on theory and applications from many disciplines. Those theories and activities serve as sources of heuristics (sources of metaphor, similes, analogical ideas, case studies, frameworks, schema, and so on). "This situation is a lot like…" Interdisciplinary fields are especially useful for understanding unencapsulated conflict situations. Civilian research in design theory, complex systems science, and soft systems are particularly relevant. Political science, anthropology, communication theory, historiography, leadership, linguistics, organization theory, and psychology all have a role in the SAMS design curriculum (see the annotated bibliography in Appendix A). At the same time, grounding in military theory is also essential. **War involves extremes of coercive violence between interacting opponents, an unpredictable dynamic that is unmatched by any other profession.** Care must be taken to avoid the abuse of theory that results from cherry picking fragments of theory from professions operating under very

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[75] Clausewitz, *On War*, 168.

[76] Transcript of Keynote Address by Brig. Gen. Jimmy Khoo, Future Systems Architect, Singapore Armed Forces, at the IMTA 2005 Conference on 8 November 2005 at Pan Pacific Hotel, Singapore.

[77] Maj. Gen. Peter W. Chiarelli and Maj Patrick R. Michaelis, "Winning the Peace: The Requirement for Full-Spectrum Operations," *Military Review,* (July-August 2005): 15.

different rule sets and applying them out of context.[78] However, the requirement for a multidisciplinary approach to design theory means that crossing disciplinary boundaries is unavoidable.

2.2.1.3. DOCTRINE

Generals and admirals stress the central importance of "doctrine." Military doctrine is the "logic" of their professional behavior. As such, it is a synthesis of scientific knowledge and expertise on the one hand, and of traditions and political assumptions on the other.

— Morris Janowitz, *The Professional Soldier*[79]

In an address to the Command and General Staff College, Fort Leavenworth, Kansas, on 16 December 1960, General George Decker stated that "[d]octrine is indispensible to an army…. Doctrine provides a military organization with a common philosophy, a common language, a common purpose, and a unity of effort."[80] Doctrine informs all aspects of design methodology. United States Joint and Army doctrine figures prominently in the SAMS design curriculum, particularly during the design practica, as does the doctrine of the other[81]. Virtually all military-like organizations employ doctrine, whether it is formal or informal. Many state militaries are run through formalized doctrine that is developed through an institutionalized process. Non-state actors may have formal doctrine, but often informal doctrine based on tried methods of operation fills the same function as formal doctrine. Doctrine differs from Tactics, Techniques, and Procedures (TTP) in that doctrine is institutionalized – it has been directed or widely accepted as the fundamental guiding principles for a military force. *Joint Publication 1-02*, the *Department of Defense Dictionary of Military and Associated Terms,* defines doctrine as the "[f]undamental principles by which the military forces or elements thereof guide their actions in support of national objectives. It is authoritative but requires judgment in application."[82] Doctrine informs how militaries conduct operations. Doctrine does not self-limit creativity in military operations, but serves as a common foundation.

J. F. C. Fuller highlights a tension between innovation and integration in the application of doctrine. Doctrine plays an essential role in integrating the force, but at the same time innovation requires "mutating" the doctrine so it is adapted to a unique context.

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[78] This is the second and "far more serious" common error of critical analysis identified in Clausewitz, *On War*, 168.

[79] Morris Janowitz, *The Professional Soldier* (Glencoe, IL: Free Press, 1960), xii.

[80] Robert Debs Heinl, Jr., *Dictionary of Military and Naval Quotations* (Annapolis, MD: United States Naval Institute, 1966), 95.

[81] 'The other' is a key concept in design, described below.

[82] United States, *Joint Publication 1-02*, *Department of Defense Dictionary of Military and Associated Terms* (Washington , DC: Government Printing Office, 2006).

> The central idea of an army is known as its doctrine, which to be sound must be based on the principles of war, and which to be effective must be elastic enough to admit of mutation in accordance with change in circumstances. In its ultimate relationship to the human understanding this central idea or doctrine is nothing else than common sense – that is, adapted to circumstances. [83]

As such, doctrine must be known, understood, and assessed against a particular situation or environment before a military force departs from it in designing, planning, or executing military operations. Eliot Cohen and John Gooch compare U.S. and Soviet conceptions of doctrine, and reach a surprising conclusion.

> Ironically, despite the difference between a liberal democracy and a party dictatorship, the Soviet view is the less rigid, the richer, the more imaginative. One might say, as a kind of shorthand, that the Soviets conceive of doctrine as a picture of future war, incorporating politics and technology as well as tactics. This far more inclusive picture of war makes a great deal of sense: Failures of anticipation may be best understood as doctrinal failures, using the term in the Soviet sense. [...] Such misfortunes result as well from a failure to think as holistically as the Soviet definition of doctrine would suggest.[84]

According to Cohen and Gooch, a holistic, flexible, and imaginative conception of doctrine as a theory for future war is important for a military to reduce the risk of failing to anticipate the next war.

The 2010 version of *FM 5-0*, *The Operations Process*, includes for the first time a chapter on design. The previous edition of *FM 5-0* mentioned design as a precedent to planning, but did not offer any explanation of what design is or how it is accomplished.[85] By its nature as the guide for military activities, doctrine must be widely applicable which in turn means that it is often vague, and Chapter 3 of *FM 5-0* is no different. As a result, the doctrine of design does not provide the level of depth necessary for operational artists to gain understanding of the theory, philosophy, and application behind the concept of design. Therefore, the SAMS design course curriculum deliberately goes beyond the doctrine to foster the deeper understanding of design necessary to enrich operational art. However, a thorough knowledge and understanding of design doctrine as the common baseline of understanding and language of design across the Army (and potentially the joint force) is essential.

Pre-doctrinal materials and supplanted doctrine related to design, such as *FMI 5-2*, *Design*[86] and *TRADOC Pamphlet 535-5-500, Commander's Appreciation and Campaign Design,*[87]

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[83] Maj. Gen. John F. C. Fuller, *The Foundations of the Science of War* (Washington, DC: Government Printing Office, 1993).

[84] Eliot A. Cohen and John Gooch, *Military Misfortunes: The Anatomy of Failure in War* (New York, NY: Vintage Books, 1991), 239.

[85] This, however, was briefly discussed in *FM 3-24*.

[86] United States, *Field Manual Interim 5-2, Design* (Washington, DC: Headquarters, Department of the Army, 2009).

provide insight to the evolution of military design which led to the current doctrine, and thereby contributes to the depth of understanding in the thought behind Design. One TRADOC publication of particular relevance is the recently released *TRADOC Pamphlet 525-3-0, The Army Capstone Concept Operational Adaptability*, which describes the broad capabilities the Army will require in 2016-2028. The capstone concept identifies adaptability as the way to cope with future uncertainty. **In an operational setting, adaptability is achieved through developing the situation through action and framing problems using design.**

> (1) Developing the situation through action requires understanding the situation in depth, breadth, and context; acting; assessing and adapting tactical and operational actions; consolidating gains; transitioning between tasks and operations; and, ultimately, being prepared to transition responsibility
>
> (a) Understanding the situation in depth, breadth, and context. Because of the complexity of the environment and the continuous interaction with adaptive enemies, understanding in armed conflict will never be complete. While acknowledging the enduring uncertainty of war, however, Army leaders must begin with a clear definition of the operation's purpose and pursue an understanding of the qualitative relationships between factors that interact in the context of armed conflict. Leaders must be adept at applying design as a methodology for framing problems.[88]

In summary, doctrine in general and design doctrine specifically, including its development, are essential to understanding and applying design.

2.2.1.4. PHILOSOPHY

What is the first business of philosophy? To part with self-conceit. For it is impossible for anyone to begin to learn what he thinks that he already knows.

—Epictetus, *Discourses*

The importance of an appreciation of the philosophy of design is best illustrated by analogy. During World War II, Melanesians enjoyed access to previously unseen Western manufactured goods, due to Japanese and American operations in the Pacific theatre. At the end of the war, the bases closed and cargo drops ceased. To restore the flow of goods, cults engaged in ritualistic behavior, including imitating the behavior of the Soldiers they had observed.[89] Life sized replicas of rifles, airplanes, runways, and control towers were built from wood and straw to attract cargo drops. Cult members performed parade drills, lit up

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[87] United States, *TRADOC Pam. 525-5-500*.

[88] United States, *TRADOC Pamphlet 525-3-0, The Army Capstone Concept Operational Adaptability: Operating Under Conditions of Uncertainty and Complexity in an Era of Persistent Conflict* (Washington, DC: Headquarters, Department of the Army, 2009), 17.

[89] Peter Worsley, *The Trumpet Shall Sound: A Study of "Cargo" Cults in Melanesia* (London: MacGibbon & Kee, 1957).

the runways, and manned the control towers wearing carved wooden headphones. The flaw in the causal reasoning of the cargo cults was mistaking a necessary condition for a sufficient condition. The flaw in their *design* was imitating the form of the military bases with no understanding of the underlying function or logic. Adopting design terminology and methods with no deeper understanding of design philosophy and theory risks falling into exactly the same trap. Using new design methods and buzz words within the old paradigm will not lead to improved results.

John Schmitt explains the importance of understanding the unique logic of a problem situation in design. Schmitt proposes Charles Sanders Peirce's class of abductive reasoning (in contrast to inductive and deductive reasoning) as the process design teams can use for theory development.

> Facing a complex operational situation, the commander assembles a design team and holds an iterative, conversational discourse. The purpose of this discourse is to imagine the situation as a system, to hypothesize a causal logic to explain the behavior of that system and to conceive a logical approach, a *counter*logic, for transforming that system through action. The design team uses extensively *abductive* reasoning—the process of inferring best explanations from limited facts. The resulting operational design is a logic system that permeates all operations by establishing a context for all planning and execution. The rationale is to pull out of the problem itself the logic for solving the problem rather than to apply or adapt some predetermined logic. Once the designers have created the design they continue to test and modify it through argumentation, but more importantly through feedback from the results of implementing the design through action.[90]

Making sense of the logic of an emerging situation requires digging beneath the surface impressions of symptoms and issues, which are often based on limited and contradictory information. Philosophy provides a rational foundation for this design inquiry.

The stereotype of the armchair philosopher as removed from all practical concerns is encapsulated in Ambrose Bierce's tongue-in-cheek definition of philosophy as "[a] route of many roads leading from nowhere to nothing."[91] Yet this belies the surprisingly practical tools philosophy offers for design inquiry. Clausewitz's dialectical approach distinctive of *On War*, although believed to be his own invention, has connections to the philosophies of Plato, Kant, Fichte, and Hegel.[92] John Boyd's unpublished paper, "Destruction and Creation," described what he called a 'dialectic engine' of deconstructive analysis and creative synthesis, repeatedly applied to existing conceptual patterns of meaning.[93] The logic of design, moving between the environmental frame, the problem frame, and the operational approach, is also fundamentally dialectical.

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[90] John F. Schmitt, "A Systemic Concept for Operational Design," unpublished article, 2006, 16.

[91] Ambrose Bierce, *The Devil's Dictionary* (New York: Oxford University Press, 1999), 144.

[92] Christopher Bassford, "Clausewitz and His Works," (2008): 17ff.

[93] John R. Boyd, "Destruction and Creation," 1976, http://www.goalsys.com/books/documents/DESTRUCTION_AND_CREATION.pdf, (accessed 12/30/2009).

> Focused primarily on understanding rather than on action, the whole logic of operational design as a dynamic form of knowledge creation is based on a system of heuristics combining three functional components, or three planes of learning: description, problematization, and synthesis…
>
> The conceptual triad thesis–antithesis–synthesis, which is popularly attributed to the German idealist philosopher Friedrich Hegel, basically offers three arguments, which are relevant to our case. First, every learning or advancement of understanding implies a critical attack on an existing conceptual proposition. Second, without the mediating attack upon a proposed understanding, one cannot reach the state of synthesis, which implies the deliberate acquisition of a higher or more relevant state of understanding. And, third, it is through the application of the learning dialectics, which is perpetuated by the mediating problematization, that knowledge progresses.[94]

The dialectical logic of thesis–antithesis–synthesis, the Socratic method of questioning (best documented in the writings of Plato), and Kuhn's paradigm shift are three essential philosophical underpinnings for design discourse. The dialectic generates the theoretical differences needed for creative synthesis. The Socratic Method provides a skeptical approach to challenging confidently held beliefs by questioning their logical foundations from multiple perspectives.

Kuhn's explanation of scientific revolution reveals both the importance of framing for the accumulation of knowledge (this is what Kuhn called 'normal science'), and the mechanism to relax the bounds on research, which allows for reframing (or a 'paradigm shift') in the wake of a crisis.[95] The crisis occurs when the "normal technical puzzle-solving activity" breaks down.[96] A paradigm shift requires a viable alternative framework, and involves a social process of conversion from the old paradigm to the new. Organization theorist James March explains the practical implications of paradigms and frames for decision making.

> *Framing.* Decisions are framed by beliefs that define the problem to be addressed, the information that must be collected, and the dimensions that must be evaluated. Decision makers adopt paradigms to tell themselves what perspective to take on a problem, what questions should be asked, and what technologies should be used to ask the questions. Such frames focus attention and simplify analysis. They direct attention to different options and different preferences. A decision will be made one way if it is framed as a problem of maintaining profits and in a different way if it is framed as a problem of maintaining market share. A situation will lead to different decisions if it is seen as being about "the value of innovation" rather than "the importance of not losing face." Decision makers typically frame problems narrowly rather than broadly. They decide about local options and local preferences, without considering all tradeoffs or all alternatives.[97]

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[94] Shimon Naveh, Jim Schneider and Timothy Challans, *The Structure of Operational Revolutions: A Prolegomena* (Leavenworth, Kansas: Booz Allen Hamilton, 2009), 78-81.

[95] Thomas S. Kuhn, *The Structure of Scientific Revolutions* (Chicago, IL: University of Chicago Press, 1970).

[96] Ibid., 69.

[97] James G. March, *A Primer on Decision Making* (New York, NY: Free Press, 1994), 14.

Chris Paparone recently published an article that casts contemporary design discourse as contributing to a conversation that was first started in philosophy between Heraclitis and Parmenides. In this view, an understanding of philosophy provides context for the current literature on design.

> Framed around how to deal with highly volatile, uncertain, complex and ambiguous (high "VUCA") situations, design is becoming attractive as a complementary or perhaps an alternative for a military staff culture that is deeply rooted in the analytic-planning paradigm. While *design-as-praxis* is a relative newcomer to military professionals, it has conceptual ties to ancient Greek philosophical debates and a decades-long history in the areas of architecture, urban studies, public policy, and more recently, business management.[98]

Above and beyond any immediate practical utility, the study of philosophy teaches its students to keep an open mind. According to Bertrand Russell, "[p]hilosophy is to be studied, not for the sake of any definite answers to its questions, since no definite answers can, as a rule, be known to be true, but rather for the sake of the questions themselves; because these questions enlarge our conception of what is possible, enrich our intellectual imagination and diminish the dogmatic assurance which closes the mind against speculation…."[99] An openness to possibility and intellectual imagination are essential characteristics of designers in any field.

2.2.1.5. PRACTICE

A study of the laws of war is necessary as we require to apply them to war. To learn this is no easy matter and to apply them in practice is even harder; some officers are excellent at paper exercises and theoretical discussions in the war colleges, but when it comes to battle there are those that win and those that lose.

—Mao Tse-tung, *On the Study of War*, 1936

Earlier, Schön provided an answer to the question of how to learn to design, by advocating learning by doing in a reflective practicum. Lawson agrees that practice is essential for learning design.

> Conceptually the studio is a process of learning by doing, in which students are set a series of design problems to solve. They thus learn how to design largely by doing it, rather than by studying it or analysing it. It seems almost impossible to learn design without actually doing it.[100]

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[98] Christopher R. Paparone, "Design and the Prospects of a US Military Renaissance," *Small Wars Journal Blog* (5 May, 2010): 1.

[99] Bertrand Russell, *The Problems of Philosophy* (Plain Label Books, 1938), 159.

[100] Lawson, *How Designers Think*, 7.

The reflective practicum is an essential pillar of the SAMS approach to educating design. Three two-week long design practica provide a studio environment for low risk experimentation and reflection on the practice of design. We believe this is so important to design education that Chapter 4 is devoted to illustrating the practice of design.

While there is no substitute for learning design by doing, the student of design can supplement opportunities for practice with reading theory, history, doctrine and philosophy as foils for reflection. Opportunities to observe other design teams in action are another valuable way to learn more about design. Finally, although the journey of learning in design is always more revealing than the destination, it is possible to learn through sharing design products. This is why we have assembled for the first time a design repository of SAMS AMSP design products in Appendix F.

2.2.2. INTRODUCING THE CONCEPTUAL FRAMEWORK FOR DESIGN

The five pillars of history, theory, doctrine, philosophy, and practice are sources for the rich (and continually developing) design lexicon. Appendix C contains an extensive list of definitions for the technical terms most commonly used within SAMS design practica. Although useful to the student of design, in isolation, a laundry list of definitions falls short of a conceptual framework. It raises questions such as, “Which concepts are the most important?”, and “How are they related?”

In response to the first question, our conceptual framework is organized hierarchically. At the top of the hierarchy is a single concept – design – which has already been discussed at length at the start of this section. The next level down contains four concepts, which we have come to refer to as the ‘four big ideas’ of design. They are learning, difference, systems, and social creation, described below. The third level contains the ‘key concepts’. Our methodology for selecting the key concepts was to extract major themes from the design curriculum. Key concepts are sufficiently important that at least three hours of instruction is focused on exploring them. To ensure the key concepts were truly multidisciplinary, we triangulated by requiring key concepts to be supported by theorists from two or more fields. Finally, the fourth level is the full design glossary. This hierarchy is depicted in Figure 7.

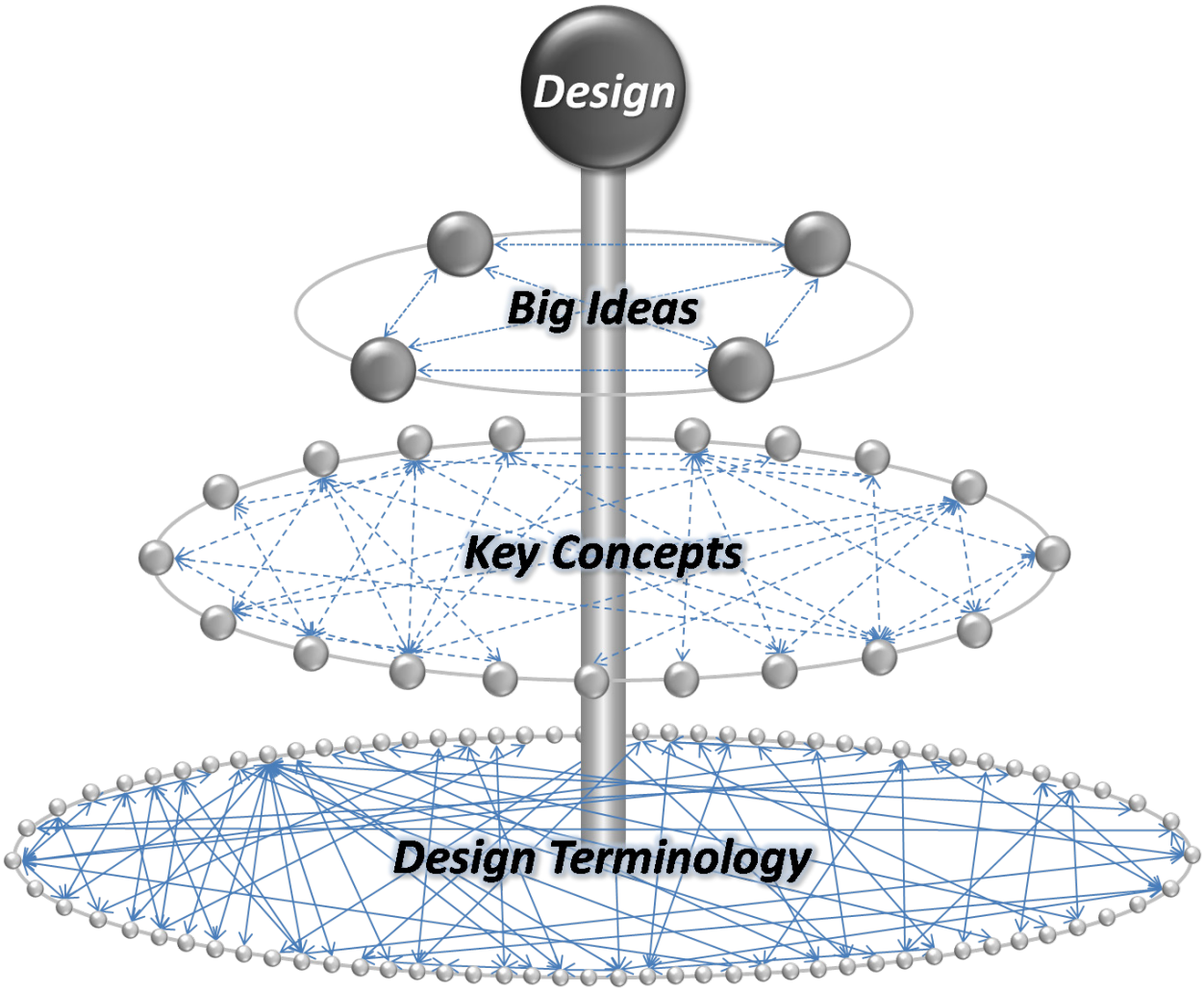

FIGURE 7. THE CONCEPTUAL FRAMEWORK FOR DESIGN.

In response to the second question on relationships, the glossary identifies relationships between the concepts by underlining related concepts in each definition. (In the interactive electronic version of the glossary, these relationships are hyperlinks.) Relationships between the key concepts and between the four big ideas are discussed in increasing detail. An extra advantage of identifying these relationships is it allows the conceptual framework to be represented visually. Figure 8 shows the glossary as a directed graph, where the nodes represent the concepts. A link is drawn between concepts A and B if A refers to B in its definition. The spatial arrangement of the conceptual framework is computed automatically by software that allows the nodes to self-organize to be closer to the concepts they are related to.

At this level of detail, the framework may initially appear too complicated to make much sense of. It does however tell us that the lexicon forms a fully connected web, and that learning the language of design is not trivial! By counting the number of links connected to each node, we can identify 'hubs' of highly connected concepts. System (16 links), design

(noun) (8 links), design (verb) (8 links), problem situation (8 links), adaptation (7 links), problem (7 links), and stakeholder (7 links) are the most connected terms. **In other words, design is a systems approach to problem situations that engages stakeholders to identify problems as well as better ways to adapt.** Similar graphs are drawn for the four big ideas and the key concepts below. Each perspective provides different yet complementary insights into the nature of design thinking.

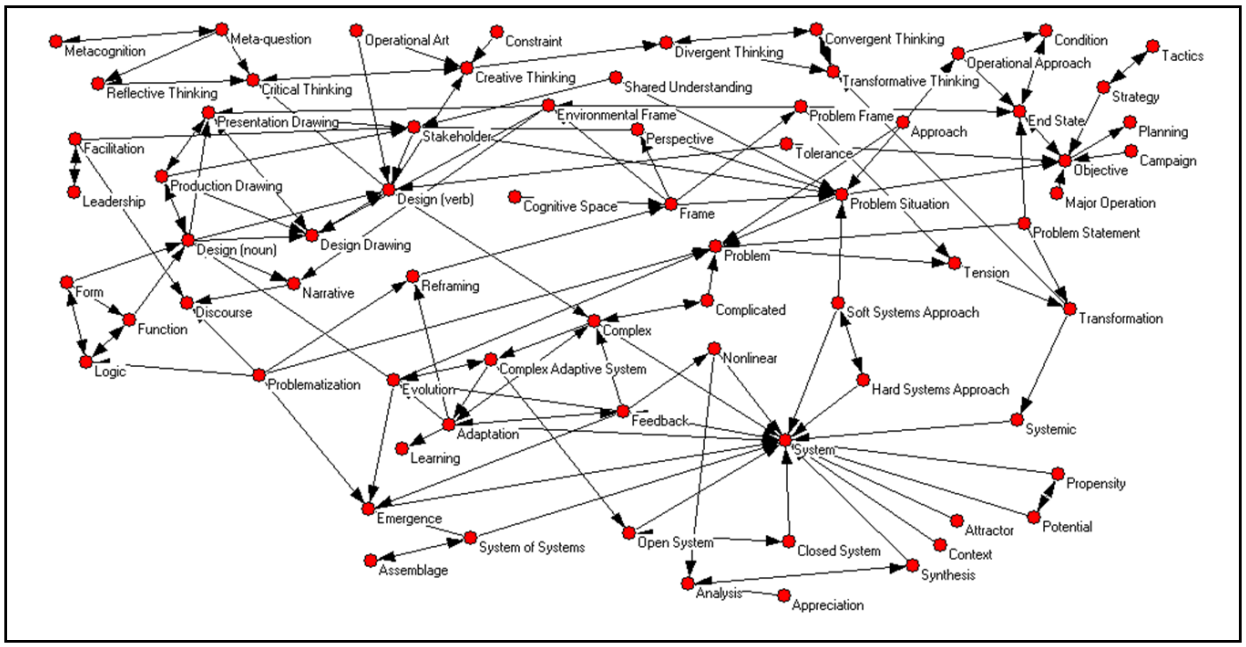

FIGURE 8. DESIGN TERMINOLOGY FROM THE GLOSSARY (APPENDIX C) VISUALIZED AS A DIRECTED GRAPH.

2.2.3. THE FOUR BIG IDEAS OF DESIGN

This section introduces the four big ideas of design: learning, difference, systems, and social creation. They are considered the big ideas because they permeate all of the other key concepts and together embody the 'spirit' of design. The four big ideas are strongly interrelated and self-referential, as depicted in Figure 9. Both the ideas and their relationships are discussed in detail below.

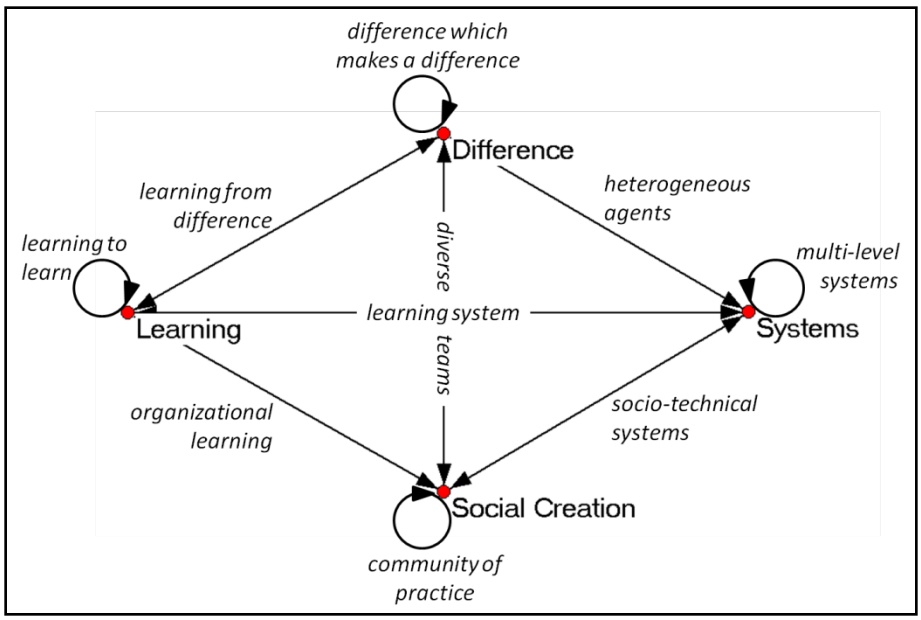

FIGURE 9. THE FOUR BIG IDEAS OF DESIGN.

2.2.3.1. LEARNING

Our capacity to learn, after two years of war, had improved beyond measure. The same blind refusal to learn, which had characterized many of our operations early in the war, had almost disappeared. We were learning, and learning how to learn faster.

—Robert Sherrod, *Tarawa: The Story of a Battle*[101]

Although design as a practical art is ultimately about solving problems, designers do not start by focusing on the solution, or even the problem. The first question for designers required to create an innovative response to a unique problem situation is "How can we learn about this situation?" **Before the design team can design a solution, they must first design their own learning system.** Getting this learning system right is more important than the initial design product. This is why 'learning to learn' in Figure 9 is critical: it allows the designers to improve their products over time, and maintain a relevant understanding in a changing environment.

Learning is a broad theme in design that encompasses reframing, refinement, adaptation and evolution. In the following passage, Peter Senge extols the virtues of learning.

> Through learning we re-create ourselves. Through learning we become able to do something we never were able to do. Through learning we reperceive the world and our relationship to it. Through learning we extend our capacity to create, to be part of the generative process of life.[102]

[101] Robert Lee Sherrod, *Tarawa: The Story of a Battle* (New York, NY: Duell, Sloan and Pearce, 1944), 148.

[102] Peter M. Senge, *The Fifth Discipline: The Art and Practice of the Learning Organization* (New York: Doubleday/Currency, 2006), 14.

Learning in design occurs at multiple levels. At the individual level, design inquiry yields a deeper understanding of the operational environment. Learning is supported by individual research, dialog, drawing and modeling, and above all from interacting with the situation. As the quote from Robert Sherrod above suggests, it is also possible to learn how to learn faster. Psychologist Dietrich Dörner has some advice on learning to cope with complex situations.

> We must learn that events have not only their immediate, visible effects but long-term repercussions as well. We also must learn to think in terms of systems. We must learn that in complex systems we cannot do only one thing. Whether we want it to or not, any step we take will affect many other things. We must learn to cope with side effects. We must understand that the effects of our decisions may turn up in places we never expected to see them surface.[103]

Dörner's main contribution is an understanding of the common cognitive traps decision makers fall snare to that prevent learning. In Dörner's experiments, a poor decision maker would set vague goals, fail to model the system of interest, ignore the temporal dimension, formulate deconditionalized plans, and then engage in 'ballistic behavior' – fire and forget decision making without ever looking for feedback. When a poor decision maker is finally forced to face negative feedback from bad decisions, they are quick to resort to 'external attribution,' which involves finding a scapegoat to take the blame.[104]

At the team level, no theorist has contributed more to an understanding of team learning than Senge. The following captures the importance of distinguishing between dialogue and discussion, and the analog of external attribution at the team level – defensive routines.

> The discipline of team learning involves mastering the practices of dialogue and discussion, the two distinct ways that teams converse. In dialogue, there is the free and creative exploration of complex and subtle issues, a deep "listening" to one another and suspending of one's own views. By contrast, in discussion different views are presented and defended and there is a search for the best view to support decisions that must be made at this time. Dialogue and discussion are potentially complementary, but most teams lack the ability to distinguish between the two and to move consciously between them.
>
> Team learning also involves learning how to deal creatively with the powerful forces opposing productive dialogue and discussion in working teams. Chief among these are what Chris Argyris calls "defensive routines," habitual ways of interacting that protect us and others from threat or embarrassment, but which also prevent us from learning.[105]

At the organizational level, the communication between design teams allows for the transfer of knowledge and learning from the experience of others. Bryan Lawson

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[103] Dietrich Dö rner, *The Logic of Failure: Recognizing and Avoiding Error in Complex Situations* (Cambridge, MA: Perseus Books, 1996) 198.

[104] Dö rner, *The Logic of Failure*, 182.

[105] Senge, *The Fifth Discipline*, 220.

recognizes the importance of situating design teams within the context of organizational learning.

> One other lesson to be drawn from all this is that developing a learning design organisation demands that some effort be put into the sort of reflection we have begun to indulge in here. That is to say a design organisation should try to transfer knowledge gained from the projects it completes in order to develop its processes.[106]

Argyris and Schön describe two types of organizational learning, where learning means the detection and correction of error.

> When the error detected and corrected permits the organization to carry on its present policies or achieve its present objectives, then that error-and-correction process is *single-loop* learning. Single-loop learning is like a thermostat that learns when it is too hot or too cold and turns the heat on or off. The thermostat can perform this task because it can receive information (the temperature of the room) and take corrective action. *Double-loop* learning occurs when error is detected and corrected in ways that involve the modification of an organization's underlying norms, policies and objectives.[107]

Because single loop learning takes the current goals, values, and frameworks of the organization for granted,[108] it is focused on 'solving the problem right.' Doctrine claims that design helps commanders ensure they are 'solving the right problem' because designers are engaged in double loop learning. Double loop learning **"involves questioning the role of the framing and learning systems which underlie actual goals and strategies."**[109] In a sentence, this captures the essence of design as it is applied by the U.S. Army. Double loop learning also connects learning with difference, as well as with the key concepts of the other and asymmetry (described below). According to Argyris:

> …underlying assumptions and governing variables cannot be effectively questioned without another set against which to measure them. In other words, double loop learning always requires an opposition of ideas for comparison.[110]

This is the real role of the rival in Naveh *et al.'s* theory of systemic operational design:

> At the level of learning system, which is reflected in the development of the complete design process, the construction of the opposition system problematizes the initial system frame

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[106] Lawson, *How Designers Think*, 263.

[107] Chris Argyris and Donald A. Schön, *Organizational Learning: A Theory of Action Perspective* (Reading, MA: Addison Wesley, 1978), 2-3.

[108] In fact, the organizational defensive routines associated with single loop learning not only take the status quo for granted, they actively protect it.

[109] Emphasis added. Robin Usher and Ian Bryant, *Adult Education as Theory, Practice and Research* (London: Routledge, 1989), 87.

[110] Chris Argyris, "Double Loop Learning in Organizations," *Harvard Business Review*, 55, no. 5 (September-October 1977): 123.

> and produces a higher level of synthetic synergy. The rival becomes the fundamental element of antithesis.[111]

Zooming out from the organizational level further still, Yaneer Bar-Yam sees the whole learning 'ecosystem' as an evolutionary process involving multiple levels of competition and cooperation. Evolution, conceived as a process of differentiation, selection, and amplification, begins with the generation of variety, then selects and expands on those strategies that actually work in the context of the operational environment.

> Organizations that learn by evolutionary change create an environment of ongoing innovation. Evolution by competition and cooperation and the creation of composites of patterns of behavior is the way to synthesize effective systems to meet the complex challenges of today's world.[112]

In addition to learning at the level of the individual, the team, the organization, and the ecosystem, one of the most distinguishing characteristics of Naveh *et al.'s* theory of systemic operational design is the importance of learning at the meta-level:

> Thinking about their thinking (meta-thinking), the designers examine the compatibility between the existing methodology of the inquiry and the cognitive challenges implied by the circumstantial context, and thus, may reframe the structure of their learning process.[113]

Learning to learn requires the ability to take a meta-perspective at all levels. **The significance of the meta-level is it frees designers from the constraints of any one theory of learning, which allows the design team to reframe when the current paradigm loses relevance in a changing context.**

Table 3 summarizes the importance of learning and its relationships with the big ideas of design.

TABLE 3. LEARNING AS ONE OF THE BIG IDEAS OF DESIGN.

Importance of Learning	Learning at individual, team, organizational, ecosystem and meta levels determines the long-term effectiveness of design.
Learning → Learning	Learning to learn (and to unlearn maladaptive habits) accelerates the rate of learning.
Learning → Difference	Viewed as a special kind of adaptive or evolutionary process, learning involves differentiation, selection and amplification. Learning has an exploration phase, which generates variety, and an exploitation phase, which favors the experiments that worked. The initial differentiation/exploratory phase of learning increases differences within the system.
Learning → Systems	The systems approach creates an interactive cycle of sensing

[111] Naveh, Schneider and Challans, *Structure of Operational Revolutions*, 82.

[112] Bar-Yam, *Making Things Work*, 92.

[113] Naveh, Schneider and Challans, *Structure of Operational Revolutions*, 72.

	and responding to the context. Learning closes the feedback loop of this interactive cycle, which allows a learning system to adapt and improve its fitness over time.
Learning → Social Creation	Learning and social creation are intimately linked at the levels above individual learning. Team learning and organizational learning involve feedback loops that extend across teams and organizational divisions. These feedback loops are socially created and must be continually recreated over time.

2.2.3.2. DIFFERENCE

How different is almost every military problem, except in the bare mechanism of tactics. In almost every case the data on which a solution depends are lacking.

—Dennis Hart Mahan[114]

Difference is foundational to design. Difference is how we learn. What is different? Why? What are the sources of difference? What is the difference between the environment as I understand it and as I want it to be? Why is there a difference between them and what are the origins of that difference? These questions reveal to the designer sources of opposition within that system, and provide an entry point for reflection on self in relation to the environment and the other. Understanding the practical implications of these differences is where relevant, useful, transformative action can be identified. Appreciating difference is how designers assess whether we are "solving the right problem."

The appreciation of difference is the first step of critical thinking. Without this step, decision makers risk falling into the trap of methodism. Methodism, a term coined by Clausewitz and expanded on by Dörner, is "the unthinking application of a sequence of actions we have once learned."[115]

> We can summarize Clausewitz's advice thus: In many complex situations, considering a few "characteristic" features of the situation and developing an appropriate course of action in the light of them is not the essential point. Rather, the most important thing is to consider the specific, "individual" configuration of those features and to develop a completely individual sequence of actions appropriate to that configuration.[116]

Mao Tse-tung echoes Clausewitz by emphasizing the need to understand the differences that make the 'laws' of each war unique.

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[114] Dennis H. Mahan, *An Elementary Treatise on Advanced Guard, Outpost, and Detachment Service of Troops, and the Manner of Posting and Handling Them in Presence of an Enemy; with a Historical Sketch of the Rise and Progress of Tactics, Etc*, 1847.

[115] Dö rner, *The Logic of Failure*, 170.

[116] Dö rner, *The Logic of Failure*, 171.

> It is well known that when you do anything, unless you understand its actual circumstances, its nature and its relations to other things, you will not know the laws governing it, or know how to do it, or be able to do it well.
>
> War is the highest form of struggle for resolving contradictions, when they have developed to a certain stage, between classes, nations, states, or political groups, and it has existed ever since the emergence of private property and of classes. Unless you understand the actual circumstances of war, its nature and its relations to other things, you will not know the laws of war, or know how to direct war, or be able to win victory…. Thus the different laws for directing different wars are determined by the different circumstances of those wars—differences in their time, place and nature.[117]

Recognition of the uniqueness of the current situation is central to design thinking. Major Ed Hayward's monograph on the philosophy of design recognized the central place of difference:

> The process of design is about the recognition of difference; internal difference as *essential* identity, a consequence of flux rather than circumstantial difference, a *predicate* of identity. This recognition occurs following reflective thought.[118]

In addition to underpinning critical thinking, difference is central to framing. In their foundational treatise on operational design, Shimon Naveh, James Schneider, and Timothy Challans articulate an important connection between difference, framing, and systems.

> Framing implies the mental construction of a comprehensive understanding that results from the projection of an exterior perspective on a sphere of phenomena. In other words, the frame presents the logical explanation of an observed variety, which, at first, appears complex. To construct a frame, or to bound an understanding, the designer explores the difference between the object of his/her observation and the paradigm he/she uses as an organizing reference. Or put in Peter Checkland's words, while observing the world outside himself, the beholder frames a system, or a systemic understanding.[119]

Other theorists support the importance of difference to problem solving in general, and design in particular. Jamshid Gharajedaghi offers the memorable dictum: "**Interactive design is both the art of finding differences among things that seem similar and the science of finding similarities among things that seem different.**"[120] The conscious search for the pattern of difference in the superficially similar and similarity in the superficially different is how designers recognize the 'difference which makes a difference'

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[117] Mao Tse-tung, "Problems of Strategy in China's Revolutionary War" in *The Art of War* (El Paso, TX: El Paso Norte Press, 2005), 5.

[118] Maj. Edward P. W. Hayward, "Planning Beyond Tactics: Towards a Military Application of the Philosophy of Design in the Formulation of Strategy" (Monograph, School of Advanced Military Studies, U.S. Army Command and General Staff College, 2005), 7.

[119] Naveh, Schneider and Challans, *Structure of Operational Revolutions*, 69.

[120] Emphasis added. Jamshid Gharajedaghi, *Systems Thinking: Managing Chaos and Complexity: A Platform for Designing Business Architecture* (New York, NY: Elsevier, 2006), 126.

represented in Figure 9. Restated, the difference which makes a difference is the evaluation of *relevance* of information towards understanding a problem situation.

Robert Axelrod and Michael Cohen notice the connection between complex systems science, diversity, and design. "The Complex Adaptive Systems approach, with its premise that agents are diverse, is well suited to design projects… It builds in the default assumption that there is variety within a population that could matter."[121] Difference is essential for the design of complex systems, because "the *variety* within a population is a central requirement for adaptation."[122] Scott Page elegantly articulates the value of difference for team composition.

> What we desire influences how we look at problems, the perspectives we choose. Thus, collections of people with diverse preferences often prove better at problem solving than collections of people who agree. Difference of opinion not only makes a horse race, it also makes for effective, albeit sometimes contentious, teams.[123]

Gregory Bateson, a pioneering member of the cybernetics[124] movement, placed the self-referential use of difference at the center of his theory of mind. Bateson restated the theory of information invented by fellow cybernetician Claude Shannon: "The technical term 'information' may be succinctly defined as *any difference which makes a difference in some later event*. This definition is fundamental for all analysis of cybernetic systems and organization."[125] Bateson argued that the impulses travelling through our brains from the firing of neurons were more correctly thought of as "news of a difference."[126] Hence, he could claim that "the word 'idea' in its most elementary sense, is synonymous with 'difference.' "[127] Bateson applied this concept of difference to human perception as well as thought.

> Human sense organs can receive *only* news of difference, and the differences must be coded into events in *time* (i.e., into *changes)* in order to be perceptible. Ordinary static differences that remain constant for more than a few seconds become perceptible, only by scanning.

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[121] Robert Axelrod and Michael D. Cohen, *Harnessing Complexity: Organizational Implications of a Scientific Frontier* (New York: Basic Books, 2000), 33.

[122] Ibid., 32.

[123] Scott E. Page, *The Difference: How the Power of Diversity Creates Better Groups, Firms, Schools, and Societies* (Princeton, NJ: Princeton University Press, 2007), 12.

[124] Cybernetics and General System Theory were the two original Western schools of systems thinking. Cybernetics aimed to uncover common mechanisms of control and communication between living organisms and machines.

[125] Gregory Bateson, *Steps to an Ecology of Mind* (New York: Ballantine Books, 1972), 381.

[126] Ibid., 460.

[127] Ibid., 459.

> Similarly, very slow changes become perceptible only by a combination of scanning *and* bringing together observations from separated moments in the continuum of time.[128]

Table 4 summarizes the importance of difference and its relationships with the big ideas of design.

TABLE 4. DIFFERENCE AS ONE OF THE BIG IDEAS OF DESIGN.

Importance of Difference	The appreciation of difference is fundamental to our ability to perceive changes in the operational environment, to generate relevant ideas, and to critically examine concepts.
Difference → Learning	Design deliberately seeks differences in perspectives, frames and theories in order to learn. Differences between observation and expectation often produce feelings of surprise, which is an extremely important trigger for learning[129] and reflection.[130]
Difference → Difference	The difference which makes a difference defines the relevant information within design.
Difference → Systems	Diversity of agents provides the raw material for adaptation. Difference is the key to selecting the boundary between a system and its environment, which determines the identity of the system.
Difference → Social Creation	Scott Page's book *The Difference* shows how and under what conditions differences in perspectives, interpretation, heuristics, and models can improve the performance of teams for prediction and problem solving.[131] His work provides the link between difference and social creation.

2.2.3.3. SYSTEMS

When a war is decided upon, it becomes necessary to prepare not an entire plan of operations—which is always impossible—but a system of operations in reference to a prescribed aim…

—Henri Jomini[132]

[128] Gregory Bateson, *Mind and Nature: A Necessary Unity* (Bantam, 1988), Chapter III.

[129] Zvi Lanir, *Fundamental Surprises: The National Intelligence Crisis*. Tel Aviv: Dvir, 1984.

[130] Schön, *Educating the Reflective Practitioner*, 26.

[131] Page, *The Difference*.

[132] Henri Jomini, "Jomini and his Summary of the Art of War: A Condensed Version," in Ardant du Picq, Charles Jean Jacques Joseph, Carl von Clausewitz, and Henri Jomini. *Roots of Strategy, Book 2: 3 Military Classics*. Harrisburg, PA: Stackpole Books, 1987, 453.

When we asked what design was at the beginning of this chapter, Table 2 summarized a key element of the design approach as acknowledging uniqueness and complexity, developing shared holistic understanding by drawing and modeling, and responding systemically. Design thus described is a systems approach. The systems approach emerged in the middle of the 20th century in response to a concern over the specialization and fragmentation of knowledge in science. Systems scientists set themselves the task of organizing knowledge across disciplines of science, to improve the flow of techniques, results and communication between the specialized sciences. The first scientists to apply these new ideas to *designed* systems gave birth to the field of cybernetics. In the subsequent 60 years, systems approaches have proliferated and influenced almost all approaches to design, as well as the specialized branches of science and the humanities.

A designer of military operations today finds themselves in an analogous situation to the early systems thinkers. There is no shortage of SMEs on Afghanistan and Iraq willing to share deep and narrow specialist knowledge of a particular threat, tribe, or resource. In contrast, very few people can integrate all of the pieces of information and tell you what it means within the strategic context. Analysis is in far greater supply than synthesis. **A systems approach equips designers with a framework for synthesizing and organizing complex and often contradictory information.**

So what exactly is a systems approach? Ervin Laszlo, the first philosopher to write about the new systems paradigm, described it this way:

> In sum, nature, in the systems view, is a sphere of complex and delicate organization. Systems communicate with systems and jointly form supersystems. Strands of order traverse the emerging hierarchy and take increasingly definite shape. Common characteristics are manifest in different forms on each of the many levels, with properties ranged in a continuous but irreducible sequence from level to level. The systems view of nature is one of harmony and dynamic balance. Progress is triggered from below without determination from above, and is thus both definite and open-ended. To be "with it" one must adapt, and that means moving along. There is freedom in choosing one's paths of progress, yet this freedom is bounded by the limits of compatibility with the dynamic structure of the whole.[133]

Laszlo's summary highlights the importance of understanding the hierarchical organization of communicating parts into wholes, which is represented in Figure 9 as the concept of multi-level systems. In addition, Laszlo recognizes irreducible emergent properties at each level of the system, the self-organizing dynamic of increasing order from the bottom-up, and the need to adapt, because fitness is always measured relative to a changing context.

There is an important distinction between the everyday meaning of the word system and the more technical meaning of system as 'taking a systems approach.' Peter Checkland and John Poulter write that "everyone is so used to the casual everyday-language usage of the

[133] Ervin Laszlo, *The Systems View of the World: The Natural Philosophy of the New Developments in the Sciences* (New York: George Braziller, 1972), 74-5.

word 'system'. In ordinary talk we constantly refer to complex chunks of the everyday world as systems, even though they do not come close to meeting the requirements of that concept."[134] In contrast, they say " 'systems' are devices used in a learning process to define desirable and feasible 'action to improve'."[135] The implication of systems as devices is that "the notion of systemicity ('systemness') appears in the process of inquiry into the world, rather than in the world itself."[136] **We should always remember that it is our thinking that is systemic, not the world itself.**

In developing a systems approach for the business world, Peter Senge explains that "[s]ystems thinking is a discipline for seeing wholes. It is a framework for seeing interrelationships rather than things, for seeing patterns of change rather than static 'snapshots.'[137]" Senge views systems thinking as the best way to cope with complexity.

> Complexity can easily undermine confidence and responsibility—as in the frequent refrain, "It's all too complex for me," or "There's nothing I can do. It's the system." Systems thinking is the antidote to this sense of helplessness that many feel as we enter the "age of interdependence." Systems thinking is a discipline for seeing the "structures" that underlie complex situations, and for discerning high from low leverage change. That is, by seeing wholes we learn how to foster health. To do so, systems thinking offers a language that begins by restructuring how we think.[138]

The most active and exciting contemporary systems approach, complex systems science, makes the connection between systems and complexity even more explicit. The director of the New England Complex Systems Institute, Yaneer Bar-Yam, expands on Senge's argument.

> What do people do today when they don't understand "the system?". They try to assign responsibility to someone to fix the problem, to oversee "the system", to coordinate and control what is happening. It is time we recognized that "the system" is how we work together… We need to learn how to improve "the system" without putting someone in charge, in order to make things work.[139]

In complex systems science, we see for the first time tools sophisticated enough to provide an alternative to putting someone in charge. **Complex systems science shows how distributed networks of adaptive agents are capable of solving problems no agent could solve alone.** Antoine Bousquet draws the connection between complex systems science and warfare in *The Scientific Way of Warfare*. Prompted by the reflections of General John Abizaid on the networked nature of contemporary operations, Bousquet asks:

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[134] Checkland and Poulter, *Learning for Action*, 18.

[135] Ibid., 19.

[136] Ibid., 22.

[137] Senge, *The Fifth Discipline*, 68.

[138] Ibid., 69.

[139] Bar-Yam, *Making Things Work*, 14.

> How has war, an activity traditionally dominated by institutions extolling the virtues of hierarchical command and submission to orders, come to be understood essentially in terms of decentralised networks of combatants connected together by horizontal information links?[140]

Examining chaos theory and complex systems science, Bousquet characterizes these new scientific approaches as:

> …an outgrowth of cybernetics and information theory, but the focus on change, evolution, and positive feedback breaks with the concern for stability of the cybernetic pioneers… The key notions here are those of non-linearity, self-organisation, and emergence, and the central metaphor is that of the network, the distributed model of information exchange perhaps best embodied by the Internet.[141]

The connection between systems thinking and design is the subject of Jamshid Gharajedaghi's classic book *Systems Thinking*. The following quote describes design in terms of learning and an awareness of systems.

> Designers seek to choose rather than predict the future. They try to understand rational, emotional, and cultural dimensions of choice and to produce a design that satisfies a multitude of functions. The design methodology requires that designers learn how to use what they already know, learn how to realize what they do not know, and learn how to learn what they need to know. Finally, producing a design requires an awareness of how activities of one part of a system affect and are affected by other parts. This awareness requires understanding the nature of interactions among the parts.[142]

Table 5 summarizes the importance of systems and its relationships with the big ideas of design.

TABLE 5. SYSTEMS AS ONE OF THE BIG IDEAS OF DESIGN.

Importance of Systems	Systems thinking – thinking in terms of boundaries, flows, relationships, feedback loops, patterns, and attractors – enables us to take a systemic approach, to construct systems models, and to use those models as a source of questions within design discourse.
Systems → Learning	A learning system implies deliberate thought about and implementation of a system for collecting feedback from action, ensuring that successful actions are amplified and unsuccessful actions are inhibited. Learning without a learning system is haphazard, private, local and transitory.
Systems → Difference	Where traditional approaches average out differences to

[140] Antoine Bousquet, *The Scientific Way of Warfare: Order and Chaos on the Battlefields of Modernity* (New York NY: Columbia University Press, 2009), 2.

[141] Ibid., 34.

[142] Gharajedaghi, *Systems Thinking,* 23.

	simplify analysis, the systems approach explicitly recognizes that agents are heterogeneous, and that this variety has adaptive value to a system in a changing context.
Systems → Systems	The systems concept is naturally recursive. The parts of a system may also be systems, and the parts of those systems may also be systems, and so on. Recognizing that systems are multi-level means not being constrained to a single level of analysis and description.
Systems → Social Creation	The systems approach provides a way to understand and improve social creation.

2.2.3.4. SOCIAL CREATION

Identifying the design problem, building a potential solution, and testing that solution against the activities meant to occur with and around the artifact all require access to cognitive features beyond the scope of the individual designer's mind. Building a shared representation that both designer and client can work from and manipulate is critical to moving a complex design forward.

—Christopher A. Le Dantec[143]

At the start of Chapter 2, we made an assumption that in the military context, design will be performed by teams. **Teams encourage more diverse perspectives and experiences to be represented during designing.** While it is certainly possible for individuals to design – historically architects worked as individuals – it takes a team to engage in dialog. The social nature of design in the military context is a source of great strength, but it also presents significant challenges. If the group dynamics become dysfunctional, there is little chance that the design team will realize their potential in either their depth of understanding or the quality of their design concept. In practice, a significant proportion of leading design involves attending to group dynamics. This challenge is addressed in Chapter 4, which provides practical guidance on leading social creation during design.

In order to understand how social creation underpins design, Major Xander Bullock turned to the engineering design literature, where the importance of designing in teams has long been acknowledged. Bullock recognizes the big idea of social creation has implications for leading design. "Engineering Design, as a theory of social creation, recommends a cultural shift away from single authorship or commander centric leadership."[144] However,

[143] Christopher A. Le Dantec, "Situated Design: Toward an Understanding of Design Through Social Creation and Cultural Cognition," in *Proceedings of the Seventh ACM Conference on Creativity and Cognition* (Berkeley, California, USA, October 27 - 30, 2009): 69-78.

[144] Major Xander L. Bullock, "Engineering Design Theory: Applying the Success of the Modern World to Campaign Creation," (Monograph, School of Advanced Military Studies, U.S. Army Command and General Staff College, 2009), iv.

> …the recommendation to make the cultural shift toward social creation does not imply that the commander has a diminished role. In contrast, commanding in a critical and creative environment requires intellectually agile and competent leadership. Design is part of battle command, and properly harnessing the creative energy of the organization intentionally enhances leadership and decision-making.[145]

Louis Bucciarelli is an engineer who promotes a view of engineering design as a historically situated social process that is full of uncertainty and ambiguity.

> Contemporary design is, in most instances, a complex affair in which participants with different responsibilities and interests—that is, working within different object worlds—must bring their stories into coherence. This is no simple synthesis achieved according to some straightforward instrumental technique, as much as that might be desired by professors of management or engineering design, or even by the participants themselves. Object worlds are not congruent. Interests conflict, trade-offs must be made among different domains, and negotiation is necessary. Design is a social process as much as it is getting things right within object worlds.[146]

Senge identifies four important factors for ensuring social dynamics are healthy and conducive to team learning: dialogue, alignment, a shared language for dealing with complexity, and practice.

> The discipline of team learning starts with "dialogue," the capacity of members of a team to suspend assumptions and enter into a genuine "thinking together."…
>
> Team learning is the process of aligning and developing the capacity of a team to create the results its members truly desire…
>
> Without a shared language for dealing with complexity, team learning is limited. If one member of a team sees a problem more systemically than others, that person's insight will get reliably discounted—if for no other reason than the intrinsic biases toward linear views in our normal everyday language…
>
> Lastly, the discipline of team learning, like any discipline, requires practice.[147]

Social creation requires leaders to manage the level of stress within the design team. Ron Heifetz and Martin Linsky use a metaphor of temperature to explain how to balance tension within a team, an organization, or a community.

> If you try to stimulate deep change within an organization, you have to control the temperature. There are really two tasks here. The first is to raise the heat enough that people sit up, pay attention, and deal with the real threats and challenges facing them. Without some distress, there is no incentive for them to change anything. The second is to lower the temperature when necessary to reduce a counterproductive level of tension. Any

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[145] Ibid., 30.

[146] Louis L. Bucciarelli, *Designing Engineers* (Cambridge, MA: MIT Press, 1994), 83.

[147] Senge, *The Fifth Discipline*, 10, 218, 221, and 251.

> community can take only so much pressure before it becomes either immobilized or spins out of control. The heat must stay within a tolerable range—not so high that people demand it to be turned off completely, and not so low that they are lulled into inaction.[148]

John Kotter notes that in an increasingly complex environment, organizations must also become more complex by embracing diversity and interdependence.

> People who have studied organizations have made very similar observations. Corporations that are leaders in their industries and those that help start new industries tend to be full of diversity, interdependence, and conflict, often by explicit design. The people running these firms sometimes purposely create seemingly messy organizational structures, full of complex interdependent relationships. They encourage and even force diverse elements to interact. In doing so, they realize that more conflicts will then emerge and that this can create more short-term problems and challenges. But they also realize that if those conflicts can be productively managed, the result will be more original thinking, more creative solutions to business problems, and more innovative products and services. And they have learned that such originality can make them more competitive, responsive, and adaptive.[149]

Understanding and addressing the organizational aspects of design is essential to enabling social creation. Mary Jo Hatch provides a meta-perspective on organizations in *Organization Theory: Modern, Symbolic, and Postmodern Perspectives*. Rather than committing to a single prism for understanding organizations, Hatch examines the way organizations have been framed by the three historically dominant paradigms within organization theory. This provides a far richer and very design-like view of the complex reality of modern organizations. The modern, symbolic, and postmodern perspectives are compared within a common conceptual model of organization, depicted in Figure 10. According to this model, organizations consist of the overlapping phenomena of culture, social structure, physical structure, and technology embedded within an environment. These five concepts are shaded grey to represent a sixth concept – power – which infuses the other five.

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[148] Ronald A. Heifetz and Martin Linsky, *Leadership on the Line: Staying Alive Through the Dangers of Leading* (Boston, MA: Harvard Business School Press, 2002), 107-8.

[149] John P. Kotter, *Power and Influence* (New York: Free Press, 1985), 33.

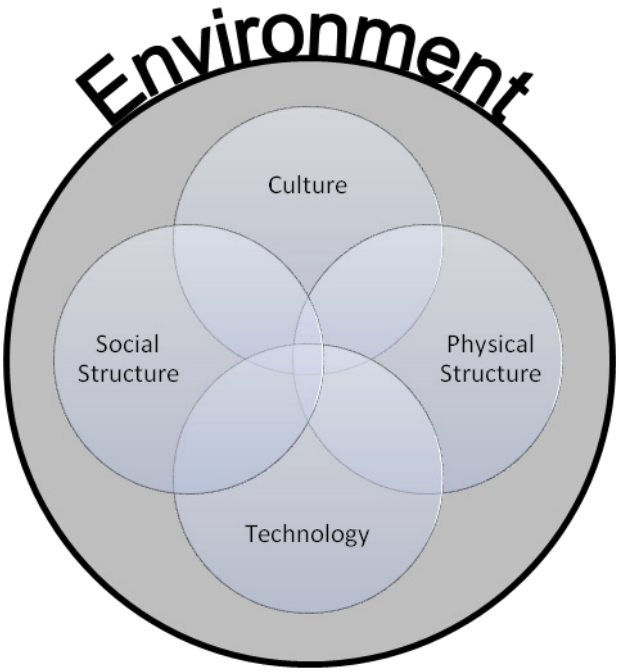

FIGURE 10. A CONCEPTUAL MODEL OF ORGANIZATION, ADAPTED FROM HATCH.[150]

The development of knowledge takes place within a community of practice. The theory of situated learning developed by Jean Lave and Etienne Wenger first introduced this concept.

> A community of practice is a set of relations among persons, activity, and world, over time and in relation with other tangential and overlapping communities of practice. A community of practice is an intrinsic condition for the existence of knowledge, not least because it provides the interpretive support necessary for making sense of its heritage. Thus, participation in the cultural practice in which any knowledge exists is an epistemological principle of learning. The social structure of this practice, its power relations, and its conditions for legitimacy define possibilities for learning (i.e., for legitimate peripheral participation).[151]

Wenger describes the importance of informal communities of practice to official organizational structures.

> People belong to communities of practice at the same time as they belong to other organizational structures. In their business units, they shape the organization. In their teams, they take care of projects. In their networks, they form relationships. And in their communities of practice, they develop the knowledge that lets them do these other tasks.

[150] Mary Jo Hatch and Ann L. Cunliffe, *Organization Theory: Modern, Symbolic, and Postmodern Perspectives* (Oxford: Oxford University Press, 2006), 19.

[151] Jean Lave and Etienne Wenger, *Situated Learning: Legitimate Peripheral Participation* (Cambridge: Cambridge University Press, 1991), 98.

> This informal fabric of communities and shared practices makes the official organization effective and, indeed, possible.[152]

Table 6 summarizes the importance of social creation and its relationships with the big ideas of design.

TABLE 6. SOCIAL CREATION AS ONE OF THE BIG IDEAS OF DESIGN.

Importance of Social Creation	Problem situations are too complex for any single individual to comprehend and resolve. They need diverse perspectives, shared understanding, and social creation to be transformed towards a desirable future.
Social Creation → Learning	Working well in social groups can lead to individual, team and organizational learning.
Social Creation → Difference	Social creation changes the environment. Even if this generates effects other than those intended, social creation generates difference, or information, which provides an opportunity for learning.
Social Creation → Systems	A systems approach is fundamentally interdisciplinary. Social creation, which brings together multiple perspectives, enriches the systems approach.
Social Creation → Social Creation	Applying social creation to the process of social creation may result in the formation of a community of practice. Practitioners design artifacts and institutions to facilitate professional discourse.

2.2.4. THE TWENTY KEY CONCEPTS OF DESIGN

This section summarizes twenty key concepts in the Art of Design, which provides the heart of our conceptual framework. Doctrinal and theoretical references help define and explain the importance of each concept. We demonstrate how the concepts have been used in a military context, and identify relationships between the key concepts. Table 7 shows the twenty key concepts, organized by the functional block of instruction that provides the primary readings for each concept. Of course, the key concepts are interrelated, and neither the blocks nor the key concepts are taught in linear sequence. Figure 11 depicts the relationships between the key concepts. The key concepts expand and elaborate on the four big ideas of design. From this diagram, it is clear that the four big ideas are largely overlapping, with discourse in their intersection at the heart of design.

[152] Etienne Wenger, "Communities of Practice: Learning as a Social System," *Systems Thinker*, June 1998, 4.

TABLE 7. KEY CONCEPTS OF DESIGN, GROUPED BY BLOCK OF INSTRUCTION.

Effective Thinking	**Foundations of Design**	**Communication, Organizations & Leadership**	**Practice of Design**
Critical Thinking	Narrative	Strategic Communication	Assessment
Creative Thinking	Discourse	Authenticity	Iteration
Metaphor	Identity	Organizing to Learn	Simultaneity
Systems Thinking	The Other	Team Learning	Drawings
Complex Systems	Asymmetry	Leading and Facilitating	Reflection

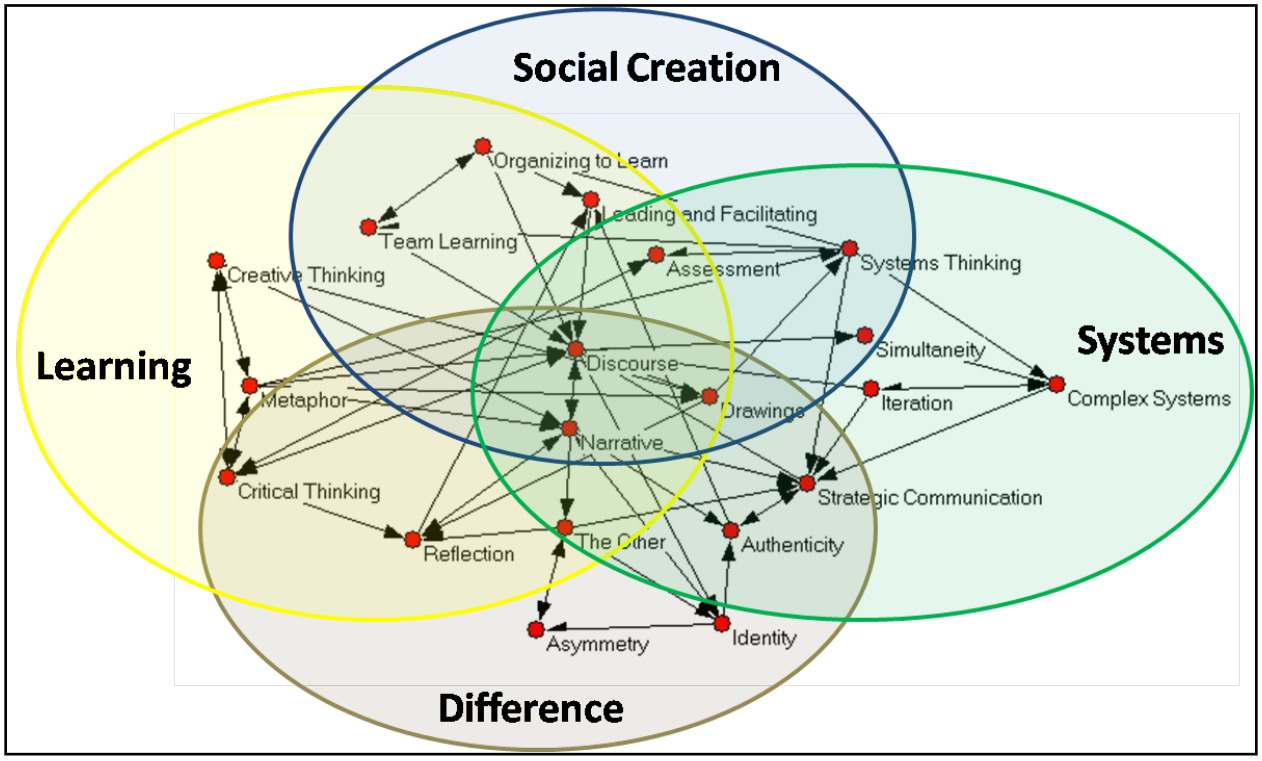

FIGURE 11. KEY CONCEPTS OF DESIGN GROUPED BY THE FOUR BIG IDEAS.

2.2.4.1. CRITICAL THINKING

In design, critical thinking is achieved by focusing on the differences between things, by reflecting on actions, and reflecting on how we think. A reflective approach to history, theory, doctrine, philosophy, and practice enhances critical thinking. Critical thinking is hard work. It requires questioning templated solutions, surfacing and evaluating the grounds that support a claim, and considering the implications (so what, which means, therefore). The most important guideline for critical thinking is to apportion belief in proportion to the evidence. Critical thinking means taking a rational approach to the available evidence.

TABLE 8. KEY CONCEPT 1: CRITICAL THINKING.

Critical Thinking		
Doctrine	*FM 6-22*[153]	Official doctrine offers an overly simplistic definition. "Critical thinking is a thought process that aims to find truth in situations where direct observation is insufficient, impossible, or impractical." This is unhelpful because it sets too high a standard for critical thinking – truth – and it is misleading because it defines critical thinking as a substitute for observation, rather than a way of interpreting observations and evaluating beliefs. A more useful passage in *FM 6-22* provides an operational definition of critical thinking. "Critical thinking implies examining a problem in depth, from multiple points of view, and not settling for the first answer that comes to mind."
Doctrine	*FM 5-0*[154]	"Critical thinking is purposeful, reflective, and self-regulating judgment to determine the meaning and significance of what is observed or expressed."
Theory: Education	Dewey[155]	Dewey preferred the term 'reflective thinking,' but his concept is the same. "*Active, persistent, and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it, and the further conclusions to which it tends*, constitutes reflective thought."
Theory: Critical Thinking	Paul and Elder[156]	"Critical thinking is that mode of thinking – about any subject, content, or problem – in which the thinker improves the quality of his or her thinking by skillfully taking charge of the structures inherent in thinking and imposing intellectual standards upon them… Critical thinking is, in short, self-directed, self-disciplined, self-monitored, and self-corrective thinking."

[153] United States, *Field Manual 6-22, Army Leadership* (Washington, DC: Headquarters, Department of the Army, 2008), 6-1.

[154] United States, *FM 5-0*, vii.

[155] John Dewey, *How We Think* (Boston, MA: D. C. Heath & Co., 1910), 6.

[156] Richard Paul and Linda Elder, *Critical Thinking: Tools for Taking Charge of Your Professional and Personal Life* (Upper Saddle River, NJ: Financial Times/Prentice Hall, 2002), xx.

Theory: Effective Thinking	King[157]	"**Critical Thinking** is the process by which we judge the information and arguments we deal with, and through which we generate questions to help us to understand and deal with issues in complex environments. Critical thinking incorporates analytical and creative thinking skills."
Theory: Military	Clausewitz[158]	Clausewitz's insights into the role of *kritik* (critical analysis) in the study of military history and theory have lost none of their relevance to thinking critically about war today. Note that what he calls 'plain narrative' does not mean the same narrative we refer to in this student text, but rather what historians refer to as a chronology. "We distinguish between the *critical approach* and the plain narrative of a historical event, which merely arranges facts one after another, and at most touches on their immediate causal links. Three different intellectual activities may be contained in the critical approach. First, the discovery and interpretation of equivocal facts. This is historical research proper, and has nothing in common with theory. Second, the tracing of effects back to their causes. This is *critical analysis proper*. It is essential for theory; for whatever in theory is to be defined, supported, or simply described by reference to experience can only be dealt with in this manner. Third, the investigation and evaluation of means employed. This last is criticism proper, involving praise and censure. Here theory serves history, or rather the lessons to be drawn from history."
Usage in Context	Gerras[159] p.1	"Whether we are evaluating the information on a power point slide in a Pentagon briefing, reading a newspaper article, or participating in a discussion with an Iraqi mayor, critical thinking is the <u>deliberate</u>, <u>conscious</u>, and <u>appropriate</u> application of reflective skepticism. Some Army leaders refer to the "critical" in critical thinking as mere fault finding with either a conclusion or the process by which a conclusion was reached. Fault finding is not what critical thinking entails. The word 'critical' really has to do with purposeful, reflective and careful evaluation of information as a way to improve one's judgment."
Relationship	Creative Thinking	Thinking critically about current habits can stimulate creative thinking about new possibilities.

[157] Lt Col. Richard King, "Thinking Skills Resources" (unpublished draft, 2009), 13.

[158] Clausewitz, *On War*, 156.

[159] Colonel Stephen J. Gerras, "Thinking Critically about Critical Thinking: A Fundamental Guide for Strategic Leaders," U.S. Army War College (June 2006): 1.

Relationship	Metaphor	Metaphor (imaginative rationality) is a combination of critical and creative thinking.
Relationship	Discourse	Discourse quality relies on critical thinking.
Relationship	Assessment	Assessment should always involve critical thinking.
Relationship	Reflection	Reflection is an important application of critical thinking.

2.2.4.2. CREATIVE THINKING

Breaking old habits of thought, questioning the status quo, visualizing a better future, and devising integrated responses to ill-structured problems requires highly creative thinking. Creative thinking is encouraged throughout the design methodology, because it enables designers to constantly tailor their work to fit the unique problem situation they are faced with. As design is concerned with 'solving the right problem' in an environment defined by conflicting perceptions of realty, designers must seek ways to generate creative thinking – to get outside their own frames of reference; to grasp the uniqueness of each context; to find ways of operating with relevance in an environment that is composed of competing versions of reality; and to imagine new, more desirable worlds. Creative thinking can be understood as consciously generating new and useful ideas, and re-evaluating or combining old ideas, to develop new and useful perspectives in order to satisfy a need.

TABLE 9. KEY CONCEPT 2: CREATIVE THINKING.

Creative Thinking		
	FM 5-0[160]	"Creative thinking involves creating something new or original. Often leaders face unfamiliar problems or old problems requiring new solutions. Creative thinking leads to new insights, novel approaches, fresh perspectives, and new ways of understanding and conceiving things. Leaders look at different options to solve problems by using adaptive approaches (drawing from previous similar circumstances) or innovative approaches (coming up with completely new ideas). In both instances, leaders use creative thinking to apply imagination and depart from the old way of doing things." Doctrine acknowledges the importance of creative thinking. It does not specify how to think about what constitutes creativity, where it comes from, how we can understand what it is, and most importantly how we generate it? The authors below offer important insights into how to be creative, to understand novelty, and to learn.

[160] United States, *FM 5-0*, 1-6.

Theory: Education	Flesch	This simple definition of creative thinking is attributed to Rudolph Flesch: "Creative thinking may simply mean the realization that there is no particular virtue in doing things the way they have always been done."
Theory: Education	Sternberg and Williams[161]	"Creativity requires a balance among synthetic, analytic, and practical abilities. The person who is only synthetic may come up with innovative ideas, but cannot recognize or sell them. The person who is only analytic may be an excellent critic of other people's ideas, but is not likely to generate creative ideas. The person who is only practical may be an excellent salesperson, but is as likely to sell ideas or products of little or no value as to sell genuinely creative ideas."
Theory: Cognitive Neuroscience	Dietrich[162]	"…creativity is essentially a Darwinian process, that is, it entails a variation-selection process. Ideational combinations are generated all the time but a selection process is required to determine which ideas are truly creative as opposed to merely new."
Theory: Psychology	Csikszentmihalyi[163]	"[C]reativity can be seen as a special case of evolution; specifically, it is to cultural evolution as the mutation, selection, and transmission of genetic variation is to biological evolution."

[161] Robert J. Sternberg and Wendy M. Williams, *How to Develop Student Creativity* (Alexandria, VA: Association for Supervision and Curriculum Development, 1996), 3.

[162] Arne Dietrich, "Who's afraid of a cognitive neuroscience of creativity?" *Methods*, 42 (2007): 25.

[163] Mihaly Csikszentmihalyi, "Implications of a Systems Perspective for the Study of Creativity," in *Handbook of Creativity*, ed. Robert J. Sternberg (New York, NY: Cambridge University Press, 2007), 316.

Theory: Emergence	Goldstein[164]	"…emergence and creative process share a common logic of novelty. …an anacoluthian logic points to how both emergence and creative processes are *creative*, that is, how they enable the coming into being of the radically novel. (Anacoluthian refers to a grammatical expression that changes midstream.) [These processes] are the origin of originality for they mix things up so much so that unpredictable, non-deducible and irreducible novelty results through paradoxical sounding-simultaneous continuing and undermining of extant rules, routines, and procedures. An important aspect of the logic of following and negating is that every creation must have familiar or it would not be recognized as departing from the familiar. Thus, while it is necessary that radical newness implies some kind of discontinuity with the past, the novelty that is generated in the creative process must be *at the same time* inextricably tied-up with the past." For example: "In this world we walk on the roof of hell gazing at flowers."
Usage in Context	*FM 3-0*[165]	"*Operational art* is the application of creative imagination by commanders and staffs—supported by their skill, knowledge, and experience—to design strategies, campaigns, and major operations and organize and employ military forces."
Usage in Context	*FM 3-90*[166]	"Every commander needs a high degree of creativity and clarity of thought to outwit a willing and able opponent."
Relationship	Critical Thinking	Thinking critically also involves creative thinking about new possibilities.
Relationship	Metaphor	Metaphor (imaginative rationality) is a combination of critical and creative thinking.
Relationship	Narrative	Creative thinking is an integral part of narrativizing.
Relationship	Drawings	Creative thinking enhances design drawings.

[164] Jeffrey Goldstein, "Emergence, Creativity, and the Logic of Following and Negating," *The Innovation Journal* 10 no. 3 (2005): 3; 6-7.

[165] United States, *Field Manual 3-0, Operations* (Washington, DC: Headquarters, Department of the Army, 2008), 6-1.

[166] United States, *Field Manual 3-90, Tactics* (Washington, DC: Headquarters, Department of the Army, 2001), 1-5.

2.2.4.3. METAPHOR

The use of metaphor is unavoidable when comprehending novel and complex situations. Metaphor enables us to capture the systemic features of one context in terms of another, better understood context. However, the commonly accepted metaphors within our culture operate largely subconsciously and must be surfaced before they can be critically examined. That makes understanding the role of metaphors essential to designers who themselves are trying to understand complex systems (and situations) and convey that understanding to others.

Metaphors also come with dangers. Metaphors bring attention to some features and connections within a problem situation, but they necessarily hide others. **In other words, metaphors help to frame an understanding of the operational environment.** A metaphor used to describe a previous situation may have to be replaced to convey the new. For example, the term "hard power" was a dominant metaphor within international relations to describe the use of military and economic means to coerce other, usually lesser, powers. The metaphor of "soft power", which refers to influence through diplomacy, culture, and history, was coined by Joseph Nye to challenge the concept of hard power. However, by negating the dominant metaphor, soft power operates within the existing frame and only adds legitimacy to the case for hard power. A strategy recently adopted by the U.S. State Department has reframed the debate by adopting the metaphor "smart power" to promote consideration of the full range of tools at their disposal, thus dissolving the hard/soft dichotomy. Trying to negate this frame would be equally unsuccessful - who would ever argue for "dumb power?" To displace the concept of smart power, it would be necessary to create a new metaphorical basis to reframe the debate.

TABLE 10. KEY CONCEPT 3: METAPHOR.

Metaphor		
Doctrine	*FM 3-24*[167]	Although doctrine does not discuss the use of metaphor, it does make use of metaphors for explaining abstract concepts. "The relationship of LLOs [Logical Lines of Operation] to the overall operation is similar to the stands of a rope... Each LLO is a separate string. Operations along it cannot accomplish all objectives required for success in a COIN operation. However, a strong rope is created when strands are woven together. The overall COIN effort is further strengthened through IO, which support and enhance operations along all LLOs by highlighting the successes along each one."
Theory: Linguistics	Lakoff and Johnson[168]	*"The essence of metaphor is understanding and experiencing one kind of thing in terms of another."*

[167] United States, *FM 3-24*, 5-6.

Theory: Linguistics	Lakoff and Johnson[169]	"The reason we have focused so much on metaphor is that it unites reason and imagination. Reason, at the very least, involves categorization, entailment, and inference. Imagination, in one of its many aspects, involves seeing one kind of thing in terms of another kind of thing—what we have called metaphorical thought. Metaphor is thus imaginative rationality."
Theory: Military	Bousquet[170]	"The word 'metaphor' itself is from the Greek for 'transfer' with metaphors effectively transfering meaning from one domain to another… If conceptual thought is therefore largely structured according to specific metaphors, it follows that many (if not all) social activities and human representations of the world around us are organised by metaphorical understandings… While new metaphors can modify our conceptual system, they also help us apprehend novelty."
Philosophy: Aesthetics	Aristotle[171]	"The greatest thing by far is to be a master of metaphor. It is the one thing that cannot be learned from others; it is also a sign of genius, since a good metaphor implies an eye for resemblance."
Usage in Context	Paparone[172]	"Given a framework for evaluating metaphors, the reflective military practitioner can adjust to the ambiguity prevalent in complex operational environments."
Usage in Context	Lakoff[173]	"Metaphors can kill. The discourse over whether to go to war in the gulf was a panorama of metaphor. Secretary of State Baker saw Saddam Hussein as 'sitting on our economic lifeline.' President Bush portrayed him as having a 'stranglehold' on our economy. General Schwarzkopf characterized the occupation of Kuwait as a 'rape' that was ongoing. The President said that the US was in the gulf to 'protect freedom, protect our future, and protect the innocent', and that we had to 'push Saddam Hussein back.' Saddam Hussein was painted as a Hitler. It is vital, literally vital, to understand just what role metaphorical thought played in bringing us in this war."

[168] George Lakoff and Mark Johnson, *Metaphors We Live By* (Chicago, IL: The University of Chicago Press, 2003), 5.

[169] Ibid., 193.

[170] Bousquet, *Scientific Way of Warfare*, 25-26.

[171] Aristotle, *The Poetics,* transl. Ingram Bywater (Whitefish, MT: Kessinger Publishing, 2004), 35.

[172] Chris Paparone, "On Metaphors we are Led by," *Military Review* (November-December 2008): 64.

[173] George Lakoff, "Metaphor and War: The Metaphor System Used to Justify War in the Gulf," *Viet Nam Generation Newsletter and Journal* 3, no. 3 (1991).

Relationship	Critical Thinking	Surfacing implicit metaphors promotes critical thinking about what the metaphor hides.
Relationship	Creative Thinking	Extending metaphors provides a creative way of reasoning through novel situations.
Relationship	Systems Thinking	Metaphors can capture systemic features of a novel situation in terms of a better understood situation.
Relationship	Narrative	Metaphor provides an organizing logic for narrative.
Relationship	Discourse	Metaphor conveys systemic understanding within discourse.
Relationship	Drawings	Metaphor provides an organizing logic for rich pictures.

2.2.4.4. SYSTEMS THINKING

Checkland's distinction between systems as a chunk of the world compared to a systemic approach to inquiry is very useful in design. In design we are not interested in identifying and labeling all of the systems within the operational environment. **Rather, we want to take a systemic approach, to construct systems models, and to use those models as a source of questions within design discourse.** Often, this systemic approach is characterized as 'systems thinking.' Systems thinking means thinking in terms of boundaries, flows, relationships, feedback loops, patterns, and attractors, both between a system and its environment, and between parts of the system. In contrast to analysis, which breaks apart wholes to understand the parts, systems thinking provides a way for designers to synthesize new emergent wholes.

TABLE 11. KEY CONCEPT 4: SYSTEMS THINKING.

Systems Thinking		
Doctrine	*FM 3-24*[174]	"*Systems thinking* involves developing an understanding of the relationships within the insurgency and the environment. It also concerns the relationships of actions within the various logical lines of operations (LLOs). This element is based on the perspective of the systems sciences that seeks to understand the interconnectedness, complexity, and wholeness of the elements of systems in relation to one another."

[174] United States, *FM 3-24*, 4-3.

Theory: Management	Gharajedaghi[175]	Gharajedaghi, a consultant who also teaches systems thinking to MBA students, provides a framework for systems thinking. "…effective systems methodology lies at the interaction of the following four foundations of systems thinking: • Holistic Thinking (iteration of stucture, function and process) • Operational Thinking (dynamics of multi-loop feedback systems; chaos and complexity) • Self-organization, movement toward a predefined order (socio-cultural model) • Interactive Design (redesigning the future and inventing ways to bring it about)"
Theory: Complex Systems	Checkland[176]	"Systems thinking is founded upon two pairs of ideas, those of emergence and hierarchy, and communication and control. Emergence and hierarchy comes from the field of biology. Biologists have been among the pioneers in establishing ways of thinking in terms of wholes, and it was a biologist who suggested generalizing this thinking to refer to any kind of whole, not simply biological systems. Communication and control comes from a very different source, from electrical, communication, and control engineers."
Usage in Context	Kirkpatrick[177]	"In three tours of duty as an aide-de-camp, Wedemeyer had the unusual opportunity, as a very junior officer, to see how the Army functioned at much higher levels. He came to understand the Army as a system, to appreciate the high-level perspective on day-to-day operations, and to observe top flight, experienced leaders."
Relationship	Complex Systems	Complex systems is a form of systems thinking.
Relationship	Strategic Communication	Systems thinking is essential for effective strategic communication.
Relationship	Organizing to Learn	Systems thinking underpins learning organizations.
Relationship	Team Learning	Systems thinking enhances team learning.
Relationship	Assessment	Assessment is inherently systemic and requires systems thinking to connect assessment of parts with performance of the whole.

[175] Gharajedaghi, *Systems Thinking*, 107.

[176] Peter B. Checkland, *Systems Thinking, Systems Practice* (Chichester, Sussex: John Wiley & Sons, 1981), 75.

[177] Kirkpatrick, *Unkown Future Doubtful Present*, 11.

2.2.4.5. COMPLEX SYSTEMS

Complex systems is a particular approach to multi-disciplinary systems thinking dedicated to understanding how self-organizing networks of adaptive agents give rise to complex patterns of behavior. These networks are often called complex adaptive systems. Complex systems provides an understanding of the sources of complexity, as well as new approaches to coping with complexity by becoming more adaptive. Designers can leverage the complex systems approach to deal with complexity over time.

TABLE 12. KEY CONCEPT 5: COMPLEX SYSTEMS.

Complex Systems		
Doctrine	*TRADOC Pam 525-5-500*[178]	"It is the number of parts and the ways in which they interact that define the complexity of a given system. (1) *Structural complexity* is based upon the number of parts in a system. The larger the number of independent parts in a system, the greater its structural complexity. (2) *Interactive complexity* is based upon the behavior of the parts and the resulting interactions between them. The greater the freedom of action of each individual part and the more linkages among the components, the greater is the system's interactive complexity."
Doctrine	*FMI 5-2*[179]	"The nonlinearities of complex systems due to feedback, self-organization, emergence, memory, and side-effects act as surprise-generating mechanisms. Actions taken on the basis of experience in similar situations can lead to serious mistakes."
Theory: Complex Systems	Ryan[180]	"There is no concise definition of complexity that all complex systems scientists are agreed upon. However, the essence of complexity is related to the amount of variety within the system, as well as how interdependent the different components are. Interdependence means that changes in the system generate many circular ripple effects, while variety means there are many possible alternative states of the system and its parts. Because interdependencies are the result of many interactions over time, complexity is fundamentally a dynamical characteristic of a system."

[178] United States, *TRADOC Pam. 525-5-500*, 5.

[179] United States, *FMI 5-2*, 14-15.

[180] Alex J. Ryan, "The Foundation for an Adaptive Approach: Insights from the Science of Complex Systems," *Australian Army Journal*, VI, no. 3 (2010): 71.

Theory: Complex Systems	Bar-Yam[181]	" 'Complex Systems' is a new approach to science, which studies how relationships between parts give rise to the collective behaviors of a system and how the system interacts and forms relationships with its environment."
Theory: Complex Systems	Bousquet[182]	"…complexity suggests the 'intricate intertwining of elements within a system, and between a system and its environment.'[183] The notion of network is therefore critical to describing the patterns of interaction which are constituted by the interplay of multiples [sic] entities in a complex system."
Theory: Complex Systems	Bousquet[184]	"The worldview constituted by [chaos and complexity theory] marks a seismic shift away from the dominant conceptions of the natural world. No longer is order to be seen as the product of a natural tendency towards equilibrium. On the contrary, it is with non-equilibrium that order emerges from chaos, at the point where instability and creative mutation allow for the genesis of new forms and actions... Not only are ambiguity and unpredictability the conditions of true creativity but they are also assets to be exploited against one's opponents."
Usage in Context	McChrystal[185]	"Our strategy cannot be focused on seizing terrain or destroying insurgent forces; our objective must be the population. In the struggle to gain the support of the people, every action we take must enable this effort. The population also represents a powerful actor that can and must be leveraged in this complex system… My conclusions were informed through a rigorous multi-disciplinary assessment by a team of accomplished military personnel and civilians and my personal experience and core beliefs. Central to my analysis is a belief that we must respect the complexities of the operational environment and design our strategic approach accordingly."

[181] Bar-Yam, *Making Things Work*, 24.

[182] Bousquet, *Scientific Way of Warfare*, 174.

[183] James Moffat, *Complexity and Network-Centric Warfare* (Washington DC: CCRP Publications, 2003), 68.

[184] Bousquet, *Scientific Way of Warfare*, 181; 194.

[185] General Stanley A. McChrystal, *COMISAF's Initial Assessment*, 2009.

Usage in Context	Kilcullen[186]	"Complex adaptive systems modelling shows that the global nature of the present Islamist *jihad*, and hence its dangerous character, derives from the links in the system – energy pathways that allow disparate groups to function in an aggregated fashion across intercontinental distances – rather than the elements themselves."
Relationship	Systems Thinking	Complex systems is a form of systems thinking.
Relationship	Strategic Communication	The complexity of strategic communication requires a complex systems approach.
Relationship	Iteration	Complex systems cannot be fully understood in advance – they require iteration and interaction to comprehend.
Relationship	Simultaneity	Complex systems provides tools for simultaneous rather than sequential action.

2.2.4.6. NARRATIVE

In a broad sense, narrative is a story that is *constructed*, either intentionally or unintentionally.[187] In both cases its purpose is to give meaning to artifacts.[188] So to *narrate or narrativize* is to engage in the process of and production of a story – an explanation of an event or phenomenon by *proposing a question* in relation to the artifacts themselves. What is the meaning of what I see? Where does this story begin and end? How do different possible boundaries of this story in time and space change my understanding of what I am considering? Why has this happened? To *narrate,* then, is to develop a technique or art of consciously and self-consciously giving a plot to artifacts and events that determine the course of a story. So, narrative is meaning ascribed to data. It asks 'why' and answers 'because' as it reconfigures time, space, events and artifacts. The meaning that is produced is inherent in the nature of the questions asked. And the plot, or logic, of the final story emerges in relation to where the story begins and ends. **Narrative construction – conscious bounding of events and artifacts in time and space – produces an understanding of the logic of what is observed.** Meta inquiry leads us to the sources of that meaning.[189]

Individuals, groups, organizations, countries – all have narratives with many components that reflect and reveal how they define themselves. Political parties, social organizations,

[186] David J. Kilcullen, "Countering Global Insurgency," *Journal of Strategic Studies* 28, no. 4 (2005): 597-618.

[187] An intentional narrative is a conscious effort to produce explanation in context, whereas an unintentional narrative is an unconscious reflection of the predispositions of the story teller

[188] Artifacts are tangible objects that have been created by people and can include such things as archeological evidence, historical documents, to organizations that function as representations of those who define, organize, and run them.

[189] Meta can be understood as something beyond, more comprehensive – transcending.

government institutions, for example, all have stories that are bounded chronologically and spatially. They incorporate symbols that impart and elucidate core meaning, historical events and artifacts that together with a plot explain their *raison d'être*.

For design, narrative represents a multi-purpose tool. Design distinguishes itself from conventional planning in its goal of understanding – systemic explanation – rather than complete knowledge of the facts. Narrative is a mechanism for producing systemic understanding. **Once one grasps that narrative is the connection of data and meaning through plot, it becomes clear that information – complete as it may be even temporarily – is incomplete itself because there is no inherent meaning in a collection of facts.** As a place in which meaning is consciously created, narrative is an important resource for the designer as a tool for developing self-awareness. Practically, the narrative is a product in the process of design that communicates the design team's explanation of the environment, the problem, and the solution – with the logic of that explanation uniting understanding, context, and action.

TABLE 13. KEY CONCEPT 6: NARRATIVE.

Narrative		
Doctrine	*FM 5-0*[190]	"As commanders visualize an operation, they describe it to their staffs and subordinates to facilitate shared understanding of the situation, the mission, and commander's intent. Commanders ensure subordinates understand the visualization well enough to begin course of action development and preparation activities. Commanders describe their visualization in their commander's intent and planning guidance. During execution, commanders describe their updated visualization as planning guidance that results in fragmentary orders." Useful for comparison to the concept of narrative.
Doctrine	*FM 5-0*[191]	"The environmental frame's narrative captures a more detailed understanding of the relevant actors and their interactions and relationships."
Theory: Historiography	White[192]	"To raise the question of the nature of narrative is to invite reflection on the very nature of culture and…even on the nature of humanity itself. …does the world really present itself to perception in the form of

[190] United States, *FM 5-0*, 1-11.

[191] Ibid., 3-10.

[192] Hayden White, *The Content of the Form: Narrative Discourse and Historical Representation* (Baltimore, MD: The John Hopkins University Press, 1987), 1; 23-24.

		well-made stories, with central subjects, proper beginnings, middles, and ends, and a coherence that permits us to see 'the end' in every beginning? And does the world, …ever really come to us …already speaking for itself from beyond the horizon of our capacity to make scientific sense of it? …we cannot say, surely, that any sequence of real events actually comes to an end, that reality itself disappears, that events of the order of the real have ceased to happen. Such events could only seem to have ceased to happen when meaning is shifted by narrative means from one physical or social space to another."
Theory: Linguistics	Ochs and Capps[193]	"Personal narrative is simultaneously born out of experience and gives shape to experience… narratives are versions of reality. They are embodiments of one or more points of view rather than objective, omniscient accounts… Narratives situate narrators, protagonists, and listener/readers at the nexus of morally organized past, present and possible experiences… Aristotle discerned that narratives have a thematically coherent beginning, middle and end. As Goffman noted every tale is told from a particular vantage point. Ricoeur referred to the configurational dimension of narrative which 'construes significant wholes out of scattered events'."
Theory: Literary	Iser[194]	"Ultimately, the text brings about one more boundary-crossing that occurs within the readers' experience: it stimulates attitudes toward an unreal world, the unfolding of which leads of which leads to the temporary displacement of the reader's own reality. The acts of fictionalizing can be clearing distinguished by the different gestalt each of them brings about: Selection results in revealing the intentionality of the author; combination results in bracketing the world represented, thereby converting it into a sign for someone else, and simultaneously suspending the reader's natural attitude. All these cases are "facts from fiction. On the one hand the writer's reality fades into a range of its own possibilities, and on the other these possibilities overstep what is …the real and the possible coexist, for it is only the author's selection from and textual representation of the real world that

[193] Ochs and Capps, "Narrating the Self," 20-22; 25-26.

[194] Wolfgang Iser, "The Significance of Fictionalizing," *Anthropoetics* III no. 2 (Winter 1997-1998): 4, 5.

		can create a matrix for the possible to emerge, whose ephemeral character would remain shapeless if it were not for the transformation of something already existing."
Theory: Historiography	White[195]	"…there are at least two levels of interpretation in every historical work: one in which the historian constitutes a story out of the chronicle of events and another in which, by a more fundamental narrative technique, he progressively identifies the *kind of story* he is telling…. Moreover, [if] we can say with some certitude 'what happened', we cannot always say, on the basis of appeal to the record, 'why' it happened as it did. The record [has] to be interpreted, and this meant 'seeing realities in past events, realities with that certain plenitude of conditions which they must have had in order that they might become realities'. This seeing [is] a cognitive act…. Every proper history presupposes a metahistory which is nothing but the web of commitments which the historian makes in the course of his interpretation on the aesthetic, cognitive, and ethical levels…"
Theory: Historiography	White[196]	"…narrative is a meta-code, a human universal on the basis of which transcultural messages about the nature of a shared reality can be transmitted. …between our experiences of the world and our efforts to describe that experience in language, narrative ceaselessly substitutes meaning for the straightforward copy of the events recounted. …the absence of narrative or a refusal of narrative indicates an absence or refusal of meaning itself."
Usage in Context	Lawrence[197]	"In the Arab case the algebraic factor would take first account of the area we wished to conquer, and I began idly to calculate how many square miles…and how would the Turks defend all that…if we were an army attacking with banners displaying…but suppose that we were an influence (as we might be), an idea, a thing invulnerable, intangible, without front or back, drifting about like a gas? Armies were like plants, immobile as a whole, firm-rooted, nourished through long stems to the head. We might be a vapour, blowing where we

[195] White, *Tropics of Discourse*, 53; 70.

[196] White, *Content of the Form*, 1-2; 23-24.

[197] Thomas E. Lawrence, "The Evolution of a Revolt," CSI Reprint from the *Army Quarterly and Defence Journal*, (1920): 7, 8.

		listed. Our kingdoms lay in each man's mind, and as we wanted nothing material to live on, so perhaps we offered nothing material to kill. It seemed a regular soldier might be helpless without a target."
Usage in Context		Operation Badr in October 1973 arguably began for the Egypt with the deep humiliation the nation felt at the overwhelming defeat of its military by Israel in 1967. The logic of the operation was evident in its name, after the battle that resulted in the restoration of the Prophet Mohammed's honor when he returned to Mecca from Medina to defeat the forces that had cast him and his followers out after a humiliating defeat. From a strictly military perspective the story might have ended when the Egyptian Army was able to achieve its objectives. The Egyptian military still tell a story of unquestionable victory. The end of this story may also have be the realization of the Camp David Accords nearly 5 years later – Operation Badr lead to an honorable agreement between Egypt and Israel and the restoration of Egypt's position as leader of the Arab world. A conscious awareness of the functioning of narrative cannot be separated then from an understanding of meta-meaning and meta-cognition. It is possible to understand that the plot of Operation Badr gives the event and the motivations of the participants' coherence and meaning. The plot centers on a restoration of honor. Questions about the meta-meaning of Operation Badr focus at the deeper level of inquiry: What are the sources of Egyptian understanding of honor? What does this imply about their conception of victory and success and where do those come from?
Relationship	Creative Thinking	Narrative can transcend traditional ideas, rules, patterns, and relationships to enhance creative thinking.
Relationship	Discourse	The value of narrative is fully realized as it is practiced in conjunction with discourse.
Relationship	Identity	Narrative helps to create identity.
Relationship	The Other	Narrative serves as a reference and source of insight into the other.
Relationship	Strategic Communication	Strategic communication includes the battle of competing narratives.
Relationship	Authenticity	Authentic communication rests on listening closely to the narratives of each party in the meaning-making

		process.
Relationship	Reflection	Narrative is a tool for reflection.

2.2.4.7. DISCOURSE

It is important to understand the utility of narrative for generating new understanding, and how narrative constitutes a representation of systemic logic, which comes from the structure and meaning of plot. Narrative also clarifies the distinctions between self and other when looking at the environment and understanding the adversary/adversaries. But narrative can only function in relation to discourse. Discourse is essential to narrative creation and refinement, and to producing a common understanding both within the design team and with the strategic sponsor.

What discourse does, how it functions, and the components that identify it are found in its definition. Discourse comes from the Latin *'discurrere'* and means 'running to and fro' and it suggests a movement 'back and forth.' It is a reasoning process that incorporates the complete range of objects, events, attributes, relations, that are expressed, assumed or implied, in discussion. It is holistic in character and dialectic as a process. Discourse is not simply an exchange of information. It is a technique that intends to establish fact in an event or situation under consideration, and what way of expressing the meaning of those facts is appropriate to an understanding of those facts.

Design is about learning, achieving understanding of what is unknown and emerging, and of standing outside of self to both reflect on the nature of self and other in context in order to do so. Discourse is central to design as a mode of learning and because in its nature it is central to generating understanding. **If creativity is a result of combining the known with the unknown through reconfiguration – unbounding and rebounding – then discourse provides the mechanism that accomplishes this.** The discursive process mediates between what is known and unknown and is as much about interpretation as it is about the subject at hand. It endeavors to make sense of the world as it deconstructs preconceptions or ideas that have become fixed and are impediments to new thoughts or ideas, and it makes evident areas that require more analysis.

Discourse is a continuous process as conflicting narratives confront each other and are modified. Discourse is evidence of societies' conscious efforts to reconcile, or rationalize, areas of experience that fall outside the comfort of a reality or narrative explanation its *milieu*. Warfare, as an expression of narratives in competition, is another form of discourse. **Design consciously identifies tensions through its awareness of narratives in discourse in an effort to both enhance understanding and opportunities for learning, and to identify asymmetries that can be exploited.** Designers themselves practice discourse to consciously expose their own preconceptions as they engage over fact and meaning in context through constructing and reconstructing narrative explanation. The emergent explanation of the environment then becomes the underlying logic of the

approach taken, and a frame of reference for further learning as the systems exhibits difference when action generates change.

Ultimately design reaches to and refines strategy with discourse as the vehicle, or medium, for learning and understanding. The practice of discourse requires discipline, suspension of disbelief, and the ability to listen. Conscious and self-conscious discursive practice has the potential to refine strategy, create adaptability, and to produce relevant action in relation to the environment over time.

TABLE 14. KEY CONCEPT 7: DISCOURSE.

Discourse		
Doctrine	*FM 5-0*[198]	"Throughout operations, commanders, subordinate commanders, staffs, and other partners collaborate and dialog actively, sharing and questioning information, perceptions, and ideas to better understand situations and make decisions. Collaboration is two or more people or organizations working together toward common goals by sharing knowledge and building consensus. Dialog is a way to collaborate that involves the candid exchange of ideas or opinions among participants that encourages frank discussions in areas of disagreement." It is instructive to compare this understanding of dialog with discourse, what it implies in its etymology and how it can generate creativity. Consensus represents the lowest common denominator through compromise, not necessarily the most creative and relevant ideas. A group can come to a common understanding after discourse during which ideas were not reduce but refined.
Doctrine	*FM 5-0*[199]	"During design, the commander and staff consider the conditions, circumstances, and factors that affect the use of capabilities and resources as well as bear on decisionmaking. As an organizational learning methodology, design fosters collaboration and dialog as commanders and staffs formulate conditions that define a desired end state and develop approaches that aim to achieve those conditions. When initial efforts do not achieve a thorough enough understanding of behaviors or events, commanders reframe their understanding of the operational environment and problem. This cycle of inquiry, contextual understanding, and synthesis relies on continuous collaboration and dialog." Should design foster

[198] United States *FM 5-0*, 1-6.

[199] Ibid., 3-7 – 3-8.

		dialog or rely on discourse – and what is the difference given what the authors propose discourse means and does?
Theory: Historiography	White[200]	"…*discourse*…suggests a movement 'back and forth' or a 'running to and fro'. This movement, discursive practice shows us, may be as much prelogical or antilogical as it is dialectical. As antilogical, its aim would be to deconstruct a conceptualization of a given area of experience which has become hardened into a hypostasis that blocks fresh perception or denies, in the interest of formalization, what our will or emotions tell us ought not be the case in a given department of life. As prelogical, its aim is to mark out an area of experience for subsequent analysis by a thought guided by logic. …It moves 'to and fro' between received encodations of experience and the clutter of phenomena which refuses incorporation into conventional notions of 'reality'…Discourse, in a word, is … a meditative enterprise. As such it is both interpretive and preinterpretive: it is always as much *about* the interpretation itself as it is *about* the subject matter which is the manifest occasion of its own elaboration."
Theory: Historiography	White[201]	"Discourse must be analyzed on three levels: that of description of the 'data' found in the field of inquiry being investigated or marked out for analysis; that of the argument or narrative running alongside of or interspersed with the descriptive materials; and that on which the combination of these previous two levels is effected…a discourse is itself a kind of model of the of the process of consciousness by which a given area of experience… is assimilated by analogy to those areas of experience felt to be *already* understood as to *their* essential natures."
Theory: Semiotics	Lefkowitz[202]	"There is nothing simple about the play of symbols… They are enmeshed in webs of significations that lead outward in many directions… Symbols are meaningful by virtue of their deployment in situated contexts of communication, and their meaning emerges from such use, rather than inhering in the symbols themselves. But the meaning of any particular deployment of a symbol depends upon emergent characteristics of the discourse context… The

[200] White, *Tropics of Discourse*, 3-4.

[201] Ibid., 4-5.

[202] Daniel Lefkowitz, *Words and Stones: The Politics of Language and Identity in Israel* (New York, NY: Oxford University Press, 2004), 77-78.

		gap between a symbol's (historical) meaning potential and its emergent meaning in discourse is a source of play. Discourse is thus simultaneously structured by the historical meanings of symbols, and structuring, as it re-sets trajectories for subsequent meanings. Formal linguists tend to use discourse to refer to levels of linguistic structure larger than a sentence. Linguistic anthropologists use discourse to refer to levels of linguistic structure larger than a sentence. And cultural anthropologists use discourse in the… sense of forms of power that work by limiting and constraining what can be said."
Philosophy: Postmodern	Deleuze and Guattari[203]	"Hjelmslev remarked that a language necessarily includes unexploited possibilities or potentialities and that the abstract machine must include these possibilities or potentialities. 'Potential' and 'virtual' are not at all in opposition to 'real'; on the contrary, the reality of the creative, or placing-in-continuous variation of variables, is in opposition only to the actual determination of their constant relations. Indirect discourse is the presence of a reported statement within a reporting statement, the presence of an order-word within the word. Language in its entirety is indirect discourse. Indirect discourse in no way supposes direct discourse; rather the latter is extracted from the former. …Direct discourse is a detached fragment of a mass and is born of the dismemberment of the collective assemblage."
Usage in Context	Cerami *et al.*[204]	"The stated intent of the Goldwater-Nichols legislation is broadly accepted as valid for effective political discourse on issues affecting the nation's security; the Congress and the Executive need a common understanding of the strategic environment and the administration's intent for future dialogue. That said, however, it is understood that in the adversarial environment that prevails, this report can only provide a beginning point for the dialogue necessary to reach such a 'common' understanding."
Relationship	Critical Thinking	Discourse provides the social context for critical thinking.
Relationship	Narrative	Narrative is part of discourse.
Relationship	Identity	Discourse reveals and also shapes identity.

[203] Gilles Deleuze and Felix Guattari, *A Thousand Plateaus: Capitalism and Schizophrenia* (Minneapolis, MN: University of Minnesota Press, 1987), 84; 99.

[204] Joseph R. Cerami *et al.*, *U.S. Army War College Guide to Strategy* (Carlisle, PA: Strategic Studies Institute, U.S. Army War College, 2001), 130.

Relationship	Team Learning	Discourse develops shared understanding and contributes to team learning.
Relationship	Simultaneity	Discourse provides a way to achieve near-simultaneity in design inquiry.

2.2.4.8. IDENTITY

Alfred Korzybski's quotation of E. T. Bell, "the map is not the thing being mapped," which he famously paraphrased as "the map is not the territory," makes the point that boundaries are nothing but abstractions.[205] This observation is nothing if not a basic truism in the contemporary context. As a holistic approach that understands the role of the cognitive in conflict and conflict resolution, design requires practitioners to engage in meta-inquiry. This is at the level of identity, and the sources of identity; to distinguish between self and other in analysis, and establish sources of difference; to create space to learn and to develop understanding. In its interest in identity, design challenges the conventional understanding of physical and cognitive boundaries and boundary construction, and the practical implications of how we conceptualize both. The experience of Iraq continues to illustrate the limited utility of defining 'problem' within the limited context and geographical boundaries of a single nation-state. The Global War on Terrorism (GWOT) concept, vague as it was, did seem to articulate recognition that there was a conflict in process that defied national boundaries and was tied to fundamental tensions that existed at the level of how people saw and identified themselves.

Individuals and groups possess identities – self-conceptions, ideas, and perceptions of reality that shape physical and cognitive boundaries. Meanings can be both generated and reflected in discursive tools such as narratives, symbols, and labels as they are applied to other narrated actors or groups in specific contexts. Because identity is composed of multiple components, the uniqueness of each context is essential to the inherently understood, or the constructed, meaning in time and space. **Boundaries can create identities, and identities can create and re-create boundaries themselves.** Anssi Paasi has said that "identities and boundaries are different sides of the same coin." As a place for learning in design, it is significant that "…borders and boundaries, identities and difference construct and determine to a large extent the space of agency and [individuals] mode of participation…"[206]

Identity can be a fundamental source of conflict. It is important to remember that identities can reconfigure in relation to a changed context or central issue. They can be implicit as well as consciously constructed. In either case, as the genesis of conflict, perceptions of

[205] Alfred Korzybski, *Science and Sanity: An Introduction to Non-Aristotelian Systems and General Semantics* (Lancaster, PA: The International Non-Aristotelian Library Pub. Co., 1933), Book I, 247.

[206] Nikki Slocum-Bradley, ed., *Promoting Conflict or Peace Through Identity* (Aldershot, England: Ashgate, 2008), 6-7.

reality that exist in tandem with identity constructions are critical to locating the problem at its source and to selecting indirect approaches to problem resolution.

For the purposes of design, it is not only important to understand the implications of identity and the boundaries that it creates. Recognition of the importance of boundaries to the creation of a logic is useful for a designer as a basis for conceptual inquiry and creativity. Consciously 're-bounding' space can produce fresh insight into the realities of any context under investigation. For example, rather than relying on national boundaries as the explanation for the configuration of space, ask, "Where the boundaries would be if the question were about the distribution of power, ethnic, or religious communities?" This practice of deterritorialisation and reterritorialisation can serve as a technique for learning and, when followed by inquiry into the sources of these various self-understandings, can produce systemic understanding. In other words, deconstruction and reconstruction create something new, and that is the basis of creativity and learning.

TABLE 15. KEY CONCEPT 8: IDENTITY.

Identity		
Doctrine:	*FM 5-0*[207]	"...Red teams assist the commander and staff with critical and creative thinking and help them avoid groupthink, mirror imaging, cultural missteps, and tunnel vision throughout the conduct of operations. Red teams are part of the commander's staff at division through theater army. … Commanders use red teams to provide alternatives during planning, execution, and assessment to— • Broaden the understanding of the operational environment. • Assist the commander and staff in framing problems and defining end state conditions. • Challenge assumptions. • Ensure the perspectives of the adversary and others are appropriately considered. • Aid in identifying friendly and enemy vulnerabilities and opportunities. • Assist in identifying areas for assessment. • Anticipate cultural perceptions of partners, adversaries, and others. • Conduct independent critical reviews and analyses of plans and concepts to identify potential weaknesses and vulnerabilities."
	FM 5-0[208]	"Persistent conflict presents a broad array of complex, ill-

[207] United States, *FM 5-0*, 1-7.

[208] Ibid., 3-2.

		structured problems best solved by applying design. Design offers a model for innovative and adaptive problem framing that provides leaders with the cognitive tools to understand a problem and appreciate its complexities before seeking to solve it. This understanding is fundamental to design. Without thoroughly understanding the nature of the problem, commanders cannot establish the situation's context or devise approaches to effect change in the operational environment. Analyzing the situation and the operational variables provides the critical information necessary to understand and frame these problems." How and why does design do what it purports to do? What is a source of energy that creates the "ill-structure" of problems? What role is played by concepts such as identity, sense of other, and the re-bounding of conceptual space that is so central to the discussion of globalization?
Theory: Anthropology	Lefkowitz[209]	"Identity is a complex field of ideas… 'Identity' implies complete equivalence, as in the related word 'identical', but social scientists conceptualize a person's 'social identity' as meaning the opposite, namely the ways in which a person differs from other individuals. Moreover 'identity' in its mathematical meaning of 'equation' implies an eternal equivalence, whereas recent studies of identity focus on the ways that individuals may be constituted differently depending upon the context. Identity… conceptualized as a discourse phenomenon… never loses sight of the real power that is won and lost as identities are fixed – and refixed – by culture, by ideologies, and by individuals in their everyday speaking practices."
Theory: Geopolitics	Newman[210]	"Many changes have taken place in the world political map during the past decade, not only in pattern (the collapse of the Soviet Union, the formation of new states) but also in process (the impact of globalisation on information and economic flows, the emergence of non-territorial communities). The social construction of national identities is still inherently tied up with notions of territory, space, and place. …it is important to understand the spatial reconfiguration of the world political map and the extent to which the previous dominance of the state as the supreme play in this map is now being shared with the supra-state and intra-state levels of territorial ordering. It is a more complex world with power being diffused both upwards and downwards from the state, and with boundaries taking on multi-dimensions of bordering, excluding and including, not

[209] Lefkowitz, *Words and Stones*, 76.

[210] David Newman, *Boundaries Territory and Postmodernity* (London: Frank Cass, 2002), 13.

		only territories but also social groups and virtual communities."
Theory: Geopolitics	Albert[211]	" 'Postmodernist' thought is not about a breakdown of boundaries and a deterritorialisation of statehood in the sense that space would be entirely displaced by time. …reterritorialisation is always conceived to form a necessary part of deterritorialisation. What is changing in the process are the exact mode and the relative importance of certain kinds of borderings. What… ['debordering'] suggests is that we currently witness a continuing functional differentiation on a worldwide scale, with an ensuing incongruence of functional boundaries that cease to overlap on one line (the territorial state's boundary). …it appears that new modes of inclusion and exclusion as well as the breakdown of such modes in cultural practices can be equally telling about the new structural features of a 'postmodern' world as can be solely political-spatial demarcations. It is by now very well understood that the appearance, function, and even the location of territorial boundaries can usually not be pinned down in a simple manner: 'The boundary does not limit itself merely to the border area or landscape itself, but more generally manifests itself in social and cultural practices…which are expressions of narratives connected with boundaries and border conflicts as well as definitions of the Other….anthropologists and ethnographers have come to perceive culture not as an object to be studied but as a boundary-construction exercise which can only be understood by studying the way that cultural reality is expressed through symbolic markers."
Theory: Anthropology	Cohen[212]	"The following interrelated arguments recur, the first two summing up positions well established in literature, the others developing them significantly: • that the definition or ascription of a group's identity may be the subject and outcome of a cross-boundary struggle for control; • that the social identity of a group may also be contested *within* the group itself, on grounds related to the cross-boundary interaction; • that discourse about identity within the boundary tends to focus on its *absolute* character. …It is in cross-boundary transaction and discourse that the identity and its predicates may become explicitly contingent, 'other-

[211] Mathias Albert, "On Boundaries, Territory and Postmodernity: An International Relations Perspective," in David Newman, ed., *Boundaries, Territory, and Postmodernity* (London: Frank Cass, 2002), 62-63.

[212] Anthony Cohen, *Signifying Identities: Anthropological Perspectives on Boundaries and Contested Identities* (London: Routledge, 1999), 1-2.

		referential' and relativistic. …what seems peripheral to those at the putative political and economic center is central to those on the putative periphery, and so on; • that therefore the cultural differences which discriminate people on either side of a boundary are not just matters of degree or relativity (powerful/powerless… authentic/inauthentic, god-fearing/pagan) but of kind: each party sees different issues as being at stake, or the terms in which they perceive them may be incongruent and incommensurate. The point of discrimination…is not just to draw a gratuitous contrast between internal and external interactions, but to address the qualitative character of social and cultural boundaries, and to show how they are implicated in formulation, articulation, management and valorisation of collective identities."
Usage in Context	Khadduri[213]	"Muslim publicists have classified the territory of Islam into a variety of divisions and subdivisions, depending on the approach and purpose of each one of them. Some writers have stressed tribal distribution, others the dynastic division (according to the dynasty ruling in a certain region, such as the… Fatimids in Egypt, the Buwayhids in Persia, etc.); and still others, especially the geographers, have based their division on regional grounds. For instance, al-Muqaddasi divides the dar al-Islam in Arab and …(Persian) zones; the latter was subdivided into eight regions and the former into six. The author of *Hudud al –Alam*, who describes not only Muslim but also non-Muslim territory, divides the world into three parts – Asia, Europe, and Libya – subdivided into fifty-one regions…In Muslim law, however, these divisions have no validity whatsoever, since the law recognizes neither division in Muslim authority nor differentiation among Muslims on racial or cultural background. The law recognizes one umma…to whom belongs every one who professes the religion of Islam regardless of the ruler or dynasty that enforces the law and the region in which he resides."
	Ochs and Capps[214]	"Personal narrative simultaneously is born out of experience and gives shape to experience. In this sense, narrative and self are inseparable. Self is here broadly understood to be an unfolding reflective awareness of being-in-the-world, including a sense of one's past and future. We come to know ourselves as

[213] Majid Khadduri, *War and Peace in the Law of Islam* (Baltimore, MD: Johns Hopkins Press, 1955), 157-158.

[214] Ochs and Capps, "Narrating the Self," 20-21.

		we use narrative to apprehend experiences and navigate relationships with others."
Relationship	Narrative	Identity provides the point of view for narrative – any narrative is told by someone.
Relationship	The Other	Identity separates self from the other.
Relationship	Asymmetry	Identity as demarcation between self and other creates asymmetry.

2.2.4.9. THE OTHER

Other is whatever is not self. Other can only be constructed and understood – explicitly or implicitly – in relation to self. For the individual and the group, 'other' is where differences create a distinction that distinguishes self in a holistic sense. Reflection on the difference and sources of difference, between self and other, is potentially the most revealing cognitive space toward understanding self. One's individual or affiliation(s) systemic logic is different than the other. Sources of otherness emerge at the meta-cognitive level in cultural and historical *milieus* and are intimately bound up with the concept, or understanding, of identity. They are those ideas and perceptions of reality that are central to what makes self, self.

Why is this important? Because when we mirror-image, we often 'solve the wrong problem' – we assume that a problem is existential, what is a problem for us is a problem for everyone, and that our 'solution' is relevant in any context. For example, when European missionaries were working to convert the indigenous tribes in North America during the colonial period, there was a frustration at the very limited results which accrued from their efforts. In the sparse written record from the perspective of the proselytized it became apparent that the message of the Europeans offered no promises that were meaningful to their world view. They had no aspiration for gold streets and pearl gates – what had value to them were natural resources associated with nomadic life. Likewise, tribespeople who had acquiesced to the ritual of Last Rights became apprehensive about their futures since nearly everyone who received the Right died after. For them causality was "this ritual causes death," not "this ritual assures an afterlife in heaven." So understanding the differences between other and self has basic implications for holistic apprehension of the context.

For designers, differences, and difference, are ultimately what generate the boundaries for relevant action. Moreover, they expose a scope for action to include exploiting the intangible. **It is in difference that we can begin to understand the systemic logic of the adversary – of systems of opposition.** By seeing actors as rational according to their own logic, we can identify when we are saying the same things, but understand the frames of reference for saying them come from different constructs. In the reasons for and sources of difference between self and other, the 'problem' emerges along with an understanding of the potential of the system for change.

TABLE 16. KEY CONCEPT 9: THE OTHER.

The Other		
Doctrine	*FM 5-0*[215]	"As part of building their situational understanding, commanders consider how culture (both their own and others' within an operational area) affects operations. Culture is the shared beliefs, values, customs, behaviors, and artifacts members of a society use to cope with the world and each other. Culture influences how people make judgments about what is right and wrong and assess what is important and unimportant. Culture provides the framework for rational thought and decisions. What one culture considers rational another culture may consider irrational. Understanding the culture of a particular society or group within a society can significantly improve the force's ability to accomplish the mission. Leaders are mindful of cultural factors in three contexts: • Awareness of the cultures within a region that the organization operates. • Sensitivity to the different backgrounds, traditions, and operational methods of the various military (joint and multinational), civilian (intergovernmental, nongovernmental, and private), and host-nation organizations. • Awareness of how one's own culture affects how one perceives a situation. Understanding other cultures applies to all operations, not just those dominated by stability. For example, some enemies consider surrender a dishonor worse than death whereas others consider surrender an honorable option. Commanders use different tactics with the enemy depending on the culture." From these passages, we can know that culture is important, but how do we understand why it matters, what it means, and how it works?
Doctrine	*FM 3-24*[216]	"The contest of internal war is not "fair"; many of the "rules" favor insurgents. That is why insurgency has been a common approach used by the weak against the strong.

[215] United States, *FM 5-0*, 1-4.

[216] United States, *FM 3-24*, 1-2.

		At the beginning of a conflict, insurgents typically hold the strategic initiative. Though they may resort to violence because of regime changes or government actions, insurgents generally initiate the conflict. Clever insurgents strive to disguise their intentions. When these insurgents are successful at such deception, potential counterinsurgents are at a disadvantage. A coordinated reaction requires political and military leaders to recognize that an insurgency exists and to determine its makeup and characteristics." As we can see in the range of literature below, there can be cultural bases for the form conflict combatants take. The sense of 'fairness', or lack of it, simply reflects what is at the heart of the idea of ontological asymmetry – every system operates according to its own logic. Design proposes that the non-quantifiable aspects of the combatant are potentially more significant than "attributes" and "makeup," both of which are defined as something that can be measured and understood by virtue of its structure.
Theory: Anthropology	Geertz[217]	"In finished anthropological writings… this fact—that what we call 'our data' are really our own constructions of other people's constructions of what they and their compatriots are up to—is obscured because most of what we need to comprehend a particular event, ritual, custom, idea, or whatever is insinuated as background information before the thing itself is directly examined… What the ethnographer is in fact faced with… is a multiplicity of complex conceptual structures, many of them superimposed upon or knotted into one another, which are at once strange, irregular and inexplicit… Doing ethnography is like trying to read (in the sense of 'construct a reading of') a manuscript—foreign, faded, full of ellipses, incoherencies, suspicious emendations, and tendentious commentaries, but written not in conventionalized graphs of sound but in transient examples of shaped behavior."
Theory: Linguistics	Ochs and Capps[218]	"The notion of a narrative of personal experience implies that person has his or her own experiences, that selves are ultimately discrete entities. At the same time, the unfolding narrative defines self in terms of others in past, present and imagined universes. Scholars and artists

[217] Clifford Geertz, *The Interpretation of Cultures*: *Selected Essays* (New York, NY: Basic Books, 1973), 9-10.

[218] Ochs and Capps, "Narrating the Self," 28-29.

		emphasize that selves are not necessarily the same across time and place nor do they necessarily cohere. Although many societies celebrate the notion of an individual thinking ego, the development of self awareness in all human beings is inextricably tied to an awareness of other people and things. One of the most important functions of narrative is to situate particular events against a larger horizon of what we consider to be human passions, virtues, philosophies, actions and relationships. As narrators, we evaluate specific events in terms of communal norms, expectations, and potentialities; communal ideas of what is rational and moral; communal senses of the appropriate and the esthetic. In this way we come to understand, reaffirm, and revise a philosophy of life."
Theory: Political Science	Auerbach[219]	"International conflicts vary in intensity, duration, the number of players, and a host of other parameters. One crucial dimension for distinguishing between conflicts is the kind of issue around which they have evolved. Looking at conflicts from this angle one can differentiate between *material conflicts* and *identity conflicts*. While identity conflicts may…have a material dimension, the core bone of contention is *identity* and the feeling…that the other has usurped their legitimate rights. This search for a unique and exalted identity at time of conflict, which Gompin calls 'negative identity', 'tends to focus on what makes me the most different precisely when I feel the most mortally and existentially threatened by an enemy'. The identity conflict which 'is usually nourished by a powerful sense of injustice on the part of the victimized…group' tends to be passionate and intense. 'The historic wounds are felt as assaults on the self-concept…safety and security of the victim group'. Religion is then offered both as a rationalization for the suffering and as a source for consolation and hope for days of glory."
Theory: Social Psychology	Slocum-Bradley[220]	"While many factors contribute to the fomenting of violent conflict, violence between social groups – whether defined as ethnic, religious, linguistic, gender, racial or other terms – necessarily entails the construction of a certain perception of one's own group and that of the

[219] Yehudith Auerbach, "Forgiveness and Reconciliation: The Religious Dimension," *Terrorism and Political Violence* 17, no. 3 (2005): 472, 473.

[220] Slocum-Bradley, *Promoting Peace or Conflict*, 1-2; 5; 7; 11.

		'other', as well as all persons esteemed to be members thereof. …we are concerned with the identities of actors, as opposed to objects. Actors can obviously be individual persons, but they can also be anything else which is narrated – or positioned – as an actor, such as a groups of persons ('Muslims'), a country ('South Africa'), a region (…'Flanders'), an institution (the 'United Nations') or any other type of purported community ('migrants', 'the international community', 'people of color')… 'Identities' are meanings - labels, categories, symbols, and so forth – applied to persons or other narrated actors in specific contexts. Understanding the formation of regional identities as an expansion of the 'we' from nation-state identities aligns with Paasi's definition of regional identities as 'collective narratives on who and what 'we' and 'our region' are and how these differ from others'. Paasi emphasizes that such narratives always include a normative element of power, alluding to the fact that the psychological and ideological nature of regional borders is no less than that of state borders. Linking identity with agency… 'a region and regional identity are social facts that can generate action as long as people believe in them.'… Kaufman concludes that the 'fundamental explanation of ethnic war lies in the meanings the participants see'."
Theory: Geopolitics	Newman[221]	"The geopolitical imagination follows on from such notions as 'imagined communities' and 'banal nationalism' which relate to the national imaginations held by citizens of the state, at both the individual and collective level, and which reflect…the preferred geopolitical location of these groups within the global system. The fact that the position accorded to the state does not necessarily coincide with the preferred location of the state, as reflected in its geopolitical imagination(s) may often be the cause for conflict and tensions within the global system. As globalization and boundary permeability affect the state at one end of the spectrum so too do the emergence of new states and the associated creation of new boundaries affect the lower end of the system. Globalization itself is partly responsible for a parallel increase in ethnic identities at local and regional levels with the demand for autonomy, self-government,

[221] David Newman, "Geopolitics Renaissant: Territory, Sovereignty and the World Political Map," in David Newman, ed., *Boundaries, Territory and Postmodernity* (London: Frank Cass, 2002), 4-5.

		secession and independence becoming stronger, rather than weaker. Territorial ideologies remain strong at both the concrete and symbolic levels."
Theory: Identity	Paasi[222]	"The construction of identity narratives is a contested political process and part of the distribution of social power in society. The narrative constitution of identity points to the fact that language is a fundamental element in the nature of identity, where language is understood broadly as including other language-like systems which mean, represent or symbolize something 'beyond themselves'. …instead of analyzing how boundaries distinguish social entities, we should concentrate on how social action and discourse produce diverging, continually changing meanings for boundaries and how these are then used as instruments or mediums of social distinction… instead of comprehending boundaries merely as stable, fixed lines and products of a modernist project… conceptualise them as *processes* that exist in socio-cultural action and discourses… A boundary… manifests itself in many institutions such as education, the media, novels, memorials, ceremonies and spectacles, etc. These are effective expressions of narratives linked with boundaries and border conflicts and serve as references to the Other."
Usage in Context:	Vlahos[223]	"The key features of non-state ascendency in war are— • Ineffectiveness of the nation-state order in deploying and using military force. • Greater energy and battle focus among non-state actors than nation states. • Selective technology equalizations that, combined with tactical creativity, make non-state fighters equal to our Soldiers on the battlefield. …We lack a holistic approach to human conflict. We have no access to the religious dimension of war, and so no way to assess the inner dynamics of wars of identity. Because we are chained to the mental construct of war-as-phenomenology, we can only adapt to today's transformation of war by superficially adapting to its changing phenomena."

[222] Anssi Paasi, "Boundaries as Social Processes: Territoriality in the World of Flows," in David Newman, ed., *Boundaries, Territory, and Postmodernity* (London: Frank Cass, 2002), 69-70; 72; 76.

[223] Michael Vlahos, "Fighting Identity: Why We Are Losing Our Wars," *Military Review* (November-December 2007), 4; 7.

Relationship	Identity	Reflecting on the other can provide perspective on identity.
Relationship	Asymmetry	Asymmetry exists between self and other.
Relationship	Strategic Communication	Understanding the other enables effective strategic communication.
Relationship	Reflection	The other provides a foil for reflection.

2.2.4.10. ASYMMETRY

Something is asymmetric if it cannot be divided into two balancing parts. Dictionaries exhibit a profound preference for explanation it in terms of what it is not – a lack of symmetry. Interestingly, one suggestion is that it can be an absence of symmetry in logical relations – or causal relationships. Traditionally from the perspective of the military, asymmetry has been understood in terms of practical capabilities. In confrontations, even competitions, between conventional militaries that identified victory and defeat in the same terms – advantage was not necessarily thought of in terms of asymmetry. In conflicts between adversaries with vastly different capabilities such as insurgents and professional militaries public discourse focuses on proportionality while professionals retreat to semantic debates that produce explanations based on their own rationality. Terms such as 'radical,' 'extreme,' 'irrational,' and 'criminal' are often an unreflective expression of a world view that is endeavoring to make events comprehensible and its understanding of capability and will relevant.

Design, however, acknowledges that asymmetry is, in fact, holistic. In the current context, 'asymmetric conflicts' are between systems that are based on and operate according to different systemic logics, emergent from different perceptions of reality. Through meta-questions, the source of an implied ontology is revealed. Viewed from this perspective, practical differences between adversaries are only evidence of an asymmetry of thought. The competition, and the field of competition, is no longer simply confined to the spatial. Moreover, once the visible manifestation of the adversary becomes united with the organizing logic that produced it, it becomes possible to challenge the adversary in ways that are productive and meaningful according to their logic. These may be direct, indirect, cognitive, and practical. Tensions within a worldview (at the place where an enemy system finds its meaning) have the most transformative potential because asymmetric conflict understood holistically is fundamentally about perceptions of reality, or realities, in conflict. Within the context of holistic asymmetry, it is essential to locate sources of identity. **Because identity sustains conflict, understanding sources of identity supports relevant action.**

TABLE 17. KEY CONCEPT 10: ASYMMETRY.

Asymmetry		
Doctrine	*FM 5-0*[224]	"...clearly discerning the motivations and reactions of various population groups with respect to the friendly force or the enemy often proves difficult. American ideas of what is normal or rational are not universal. Members of other societies often have different notions of rationality, appropriate behavior, levels of religious devotion, and cultural norms. These differences in perspectives and culture add to the uncertain nature of operations." Design proposes that the cultural difference (cultural and ontological asymmetry) is a focal point for learning and self-reflection. This is particularly the case because it is precisely those perceptions of reality that organize the system and establish the parameters for 'relevant' action.
Doctrine	*FM 5-0*[225]	"...Understanding is more than awareness of information or the immediate surroundings. In the context of the cognitive hierarchy, *understanding* is knowledge that has been synthesized and *had judgment applied to it [emphasis added]* in a specific situation to comprehend the situation's inner relationships (*FM 6-0*). *Situational understanding* is the product of applying analysis and judgment to relevant information to determine the relationships among the mission variables to facilitate decisionmaking (*FM 3-0*). As commanders develop their situational understanding, they see patterns emerge, dissipate, and reappear in their operational environment. These patterns help them direct their own forces' actions with respect to other friendly forces, civilian organizations, the enemy, the terrain, and the population. While complete understanding is the ideal for planning and decisionmaking, commanders accept they will often have to act despite significant gaps in their understanding. The complex nature of an operational environment requires both analysis and synthesis to build and maintain situational understanding throughout the conduct of operations. Analysis is the process of studying

[224] United States, *FM 5-0*, 1-2.

[225] Ibid., 1-3 – 1-4.

		a situation by successively dividing it into parts and addressing each part in turn..."
Theory: Political Science	Henrotin and Swielande[226]	"Symmetry tends more and more to give way to asymmetry. In a way, people and States are fighting each other, but without understanding each other's reciprocal strategies, because they are acting according to different cultural, ontological patterns, making it impossible to adopt common rules. In the evolution of strategy, defined as *a conceptual object where force – in its physical and psychological forms – is the medium between opposing adversaries*, this could mark a dramatic shift, where one's force will try not to enter in the game of the other to fight him – as this was the case in the traditional way to conduct military operations – but rather to fight in a completely different way, negating the norms of combat of the adversary... [a]symmetric warfare is a confrontation between political, cultural, social and organizational systems, obedient to different logics, and far away from the single question of its weapons."
Theory: Military	Naveh[227]	"...the advent of a disordered strategic setting, the emergence of novel operational forms, and of certain practical trends, in the course of the last decade imply a quantum change in the elusive nature of "small wars", on the one hand, and invite a revision of traditional paradigms on the other. ...Unlike cases of cultural symmetry, where the conceptual boundaries of the problem at stake, including random occurrences, are determined by the commitment of the belligerents to state conventions... in a competition against a social entity whose *raison d'être* derives from a different cultural source, two meta questions are raised. First, the rationalisation of the "unique other" as a reference for the construction of a relevant logic of one's "self" invites organizational ...learning practices that differ from those exercised in conditions of cultural homogeneity. Secondly, the conceptualization of the cultural difference estranging the competing agents in asymmetric conflict requires the employment of different conceptual materials from those used in contexts of conceptual

[226] Joseph Henrotin and Tanguy Struye de Swielande, "Ontological-Cultural Asymmetry and the Relevance of Grand Strategies," *Journal of Military and Strategic Studies* 7 no. 2 (2004).

[227] Shimon Naveh, "Asymmetric Conflict: An Operational Reflection on Hegemonic Conflict," *Operational Theory Research Institute*, unpublished paper (2002): 3, 21.

		uniformity."
Theory: Military	Hirsch[228]	"...modern armies must be ready to abandon linear patterns of action in order to remain a capable fighting force. At present armies provide their enemies with an easily identifiable form, thus a clear target, in contrast the enemy is able to conceal his form...this is the essence of asymmetry. In asymmetric conflict, the issue of decision is a political matter, while the strike is the military interpretation. Once the strike has achieved its objectives and effected a change in the circumstances, the learning begins; the conditions are set for a different design."
Theory: Intelligence	Lanir[229]	There are two types of surprise that are the product of two approaches to utilizing information and generating understanding: "Situational Surprise – a surprising event caused by failures in the collection, analysis, judgment or distribution of information about known phenomena, and Fundamental Surprise – a surprising event which reveals a personal, group or national mindset as irrelevant and misleading in interpreting the occurrence."
Philosophy: Eastern	Jullien[230]	"…the definition that follows: That potential consists in 'determining the circumstances with a view to profiting from them.' Understood in this fashion, circumstances are no longer something unpredictable that will turn out in a particular way, always threatening to ruin any plan imposed upon them. Instead, thanks precisely to their variability, circumstances can progressively be turned to advantage by the propensity emanating from the situation…one accedes to a logic of *unfolding…* The potential of a situation [is] variable; it cannot be determined in advance, since it proceeds from continuous adaptation; the assessments from which the potential is deduced [combine] spiritual and physical features….[and] the dimension of reciprocity lies at the very heart of what constitutes the potential of a situation…"
	Lai[231]	"*shi*" is such an important concept that Sun Tzu…used it for the title of a chapter in his *Art of War*….In this chapter Sun Tzu has discussed four key aspects of *shi*. First, it is the idea of *qi* and *zheng*. *Zheng* is the regular way of doing

[228] Gal Hirsch, "On Dinosaurs and Hornets: A Critical View on Operational Moulds in Asymmetric Conflict," *Royal United Services Institute Journal* (August 2003): 65-66.

[229] Zvi Lanir, "Fundamental Surprises."

[230] Jullien, *Treatise on Efficacy*, 21-23.

[231] David Lai, *Learning from the Stones: A* Go *Approach to Mastering China's Strategic Concept* Shi (Carlisle, PA: Strategic Studies Institute, U.S. Army War College, 2004), 1-2.

		things, or in military term, the regular order of battle. A commander deploys his troops in regular ways. However, the commander must mobilize his troops to engage the enemy in extraordinary (*qi)* ways. *Zheng* is, in essence, a given. It is open knowledge to friends and foes. Yet *qi* is a variable and its variation inexhaustible. The second aspect…is about creating an overwhelming force with irresistible unleashing power. The third aspect…is about developing a favorable situation with great potential to achieve the political objective. Finally, *shi* is about taking and maintaining the initiative. As Sun Tzu puts it, 'those skilled at making the enemy move do so by creating a situation to which he must conform'."
Usage in Context	Secretary of Defense[232]	"There is no Western equivalent to the concept of *"shi"*.. Chinese linguists explain it as "the alignment of forces," the "propensity of things," or the "potential born of disposition," that only a skilled strategist can exploit to ensure victory over superior force. Similarly, only a sophisticated assessment by an adversary can recognize the potential exploitation of "*shi.*"
Relationship	The Other	Penetrating the rationality of the other requires acknowledging ontological asymmetry.

2.2.4.11. STRATEGIC COMMUNICATION

Strategic Communication stresses the importance of understanding the role effective communication plays among different actors in conflict environments. Strategic communication attempts to understand the ways different audiences understand or frame the meaning of military, diplomatic, and other influencing actions. Previously, strategic communication occurred at the theater-strategic and national-strategic levels. However, with the proliferation of new media tools like smart-phones, digital cameras, and the internet, the structure of mass communication has changed. **Strategic communication is now an essential and integral part of operational planning.** Where before, mass communication meant a limited number of media sources (broadcast t.v., radio, newspapers) controlled the content and spread of information to a few aggregated and passive audiences, the contemporary world has seen an explosion where there are many sources of information (cable t.v., internet video, blogs, etc.) able to communicate to ever more segregated audiences. As a result, the interpretation of a military or other national-strategic action is highly varied depending on the audience. Strategic communication is integral to design theory for two reasons: (1) communication occurs in a complex systems environment in its own right; strategic communication is a complex activity; and (2) as an

[232] Secretary of Defense, *Annual Report on the Military Power of the People's Republic of China* (Washington, DC: Pentagon, July 2002), 6, 1ff.

element of a conflict environment communication pathways among actors are often key connectors among "nodes" in a larger system.

TABLE 18. KEY CONCEPT 11: STRATEGIC COMMUNICATION.

Strategic Communication		
Doctrine	*JP 1*[233]	"**The USG uses strategic communication (STRATEGIC COMMUNICATION) to provide top-down guidance relative to using the informational instrument of national power in specific situations.** (1) Strategic communication is focused USG processes and efforts to understand and engage key audiences to create, strengthen, or preserve conditions favorable to advancing national interests and objectives through the use of coordinated information, themes, messages, and products synchronized with the actions of all instruments of national power. Strategic communication's primary communication capabilities are coupled with **defense support to public diplomacy** (DSPD) and military diplomacy activities to implement a holistic strategic communication effort. (2) The predominant military activities that support strategic communication themes and messages are information operations (IO), public affairs (PA), and DSPD." Strategic communication is most similar to PA and DSPD, but should not be confused with them. The key doctrinal point is that strategic communication planning must be integrated into military planning and operations, documented in operation plans (OPLANs), and coordinated and synchronized with OGAs and multinational partners. Strategic communication should not been seen as something separate from operational planning, but inherent to it.

[233] United States, *Joint Publication 1, Doctrine for the Armed Forces of the United States* (Washington, DC: Joint Chiefs of Staff, 2007 (2009 update)), I-9.

Doctrine	*FM 3-0*[234]	"The Army implements strategic communication and defense support to public diplomacy while applying focused efforts to understand and engage key audiences. Such actions promote awareness, understanding, commitment, and action in support of the Army and its operations." Though strategic communication has generally been considered a national strategic concept, it is currently addressed at the theater strategic level as well.
Doctrine	IO Primer[235]	"Strategic communication comprises an important part of the U.S. government's information arsenal. The government communicates themes and messages based on fundamental positions enumerated in the U.S. Constitution and further developed in U.S. policy. While U.S. leaders communicate some of this information directly through policy and directives, they also shape the environment by providing access and information to the media."
Theory: Strategic Communication	Corman *et al.*[236]	Strategic communication adopts a modern definition of communication as a process of dialog. This is opposed to the standard idea that confuses "marketing" with "communication." Strategic communication emphasizes that actions are communications and that interpersonal dialog, rather than mass media techniques, should guide the practice of strategic communication.
Usage in Context	IO Primer[237]	"While 'strategic communication' is a fairly new term in the U.S. government lexicon, the concept, theory, and practice behind it is not. For example, General Winfield Scott recognized the importance of strategic communication at the theater level in Veracruz in 1847. Realizing the influence of the Catholic Church on Mexican society, Scott attended Mass with his staff at the Veracruz Cathedral to display the respect of U.S. forces. He further ordered U.S. Soldiers to salute Mexican priests in the streets. Each of these measures was 'part of a calculated campaign to win the friendship of the Mexicans'."

[234] United States, *FM 3-0*, 7-5.

[235] United States Army War College, *Information Operations Primer* (Carlisle, PA: United States Army War College and Carlisle Barracks, 2007), 116.

[236] Steven R. Corman, Angela Trethewey and H. Lloyd Goodall, *Weapons of Mass Persuasian: Strategic Communication in the War of Ideas* (New York, NY: Peter Lang, 2008).

[237] United States Army War College, *Information Operations Primer*, 10.

Usage in Context	Waugh[238]	General Grant understood the "larger truth" of the American Civil War, publicly supporting the Emancipation Proclamation as a significant blow to the underlying social system of the South that would have an effect greater than many direct military defeats. Further, Grant also acted with the post-war reunification of the States in mind by giving paroles (over the objection of many in the North) to captured Confederate Soldiers. In this way he used actions as a means to communicate the strategic aim of the war – the end of slavery as an economic system, but a reunification of the States.
Relationship	Discourse	Strategic communication contributes to and influences multiple discourses.
Relationship	Authenticity	Strategic communication promotes a dialog, not a model of "ballistic" communication where a message is "fired" at a target audience like a one-way marketing campaign.

2.2.4.12. AUTHENTICITY

In strategic communication the focus is less on crafting the exact message the sender intends, but more on understanding how an audience interprets a message as valid. **Authenticity requires the sender to explore the actors, philosophies, and cultural symbols that signal to a given audience that the sender of a message is trustworthy and an authentic representative for a given community.** In this way, the content of the message is less important to transmit to the audience than the building of a relationship of sincere dialog among groups where an *ongoing* process of communication may occur. Within design theory authenticity is central to the effectiveness of design methods in facilitating group work. In addition, the purpose of many narratives is to demonstrate the authenticity of a worldview, especially in relation to understanding foreign norms.

[238] Joan Waugh, *Personal Memoirs of U. S. Grant: A History of the Union Cause*, Frank L. Klement lectures, no. 12 (Milwaukee, WI: Marquette University Press, 2003), 12-16.

TABLE 19. KEY CONCEPT 12: AUTHENTICITY.

Authenticity		
Theory: Communication	Luhman[239]	Communication is not about designing the right message to market, and then delivering it via mass media. Rather, it is a "meaning-making" process across audiences. Further, "meaning cannot simply be transferred" as in the standard marketing or "ballistic" model of communication theory. Meaning-making only occurs through the development of a shared sense of authenticity among member audiences to the dialog. By creating a sense of trust that each side in a dialog is an authentic representative for a given audience, mis-communication happens less often. Also, a forum is established where different interests can be communicated with a sense that each party is sincerely trying to come to a common understanding of the meaning of the conflict and the positions of each side.
Theory: Anthropology	Paine[240]	Quoting Sociologist Zygmunt Bauman: "Modernity makes all being contingent, and thus a 'problem', a 'project', a 'task'. Lifting identity to the level of awareness, making it into a task." "There is…the personal or private domain where authenticity is self-originated, but there is also the public and group domain where authenticity is proclaimed by authority – an authority that either emanates from within the group or is imposed upon it. [Postmodernism] considers authenticity to be as much about what we will be, or should be as about what we are. We must not conceptualise authenticity as either given or as unchanging, but as a process with relational and contingent qualities. We can expect 'the authentic' itself to become dated… 'the authentic is not immune to culture-in-the-making even though common sense tells us that because authentic is 'genuine' it is not 'fictional'."

[239] Niklas Luhman, *Social Systems* (Stanford, CA: Stanford University Press, 1995).

[240] Robert Paine, "Aboriginality, Authenticity, and the Settler World," in Anthony Cohen, *Signifying Identities: Anthropological Perspectives on Boundaries and Contested Identities* (London: Routledge, 1999), 80-82.

Usage in Context (What not to do)		An example of how the standard "ballistic" model of communication fails comes from former White House Communications Director Karen Hughes. In an effort to explain U.S. policy Hughes used her right to drive as an example of freedom. "I feel, as an American woman, that my ability to drive is an important part of my freedom. It has allowed me to work during my career. It has allowed me to go to the grocery store and shop for my family." However, her intended audience throughout the Arab world reacted opposite to the administration's expectation. Seeing her example as outside Arab norms, her view of freedom was seen as inauthentic and her speech as a one-sided PR campaign that denigrated Arab and Muslim values. As the major Egyptian newspaper put it, "We in Egypt, and everywhere else, don't need America's public relations campaign."
Usage in Context (What to do)		Rather than continually promote an American view of democracy, an expression of the faults of the American political system might open the way for a dialog about the faults in adversary systems. However, the subtle effect is also to signal that the American system, though flawed, is strong enough to endure criticism while other systems are not. Thus a dialog of mutual meaning-making might be created that lessens negative views of America as arrogant while suggesting to other audiences that they adopt a U.S. model of self-criticism within their own societies.
Relationship	Strategic Communication	Authenticity is essential for effective strategic communication.
Relationship	Leading and Facilitating	Authenticity underpins successful leadership and facilitation.
Relationship	Narrative	Authentic communication rests on listening closely to the narratives of each party in the meaning-making process.

2.2.4.13. ORGANIZING TO LEARN

Military design is a social creation generated through dialog and collaboration, according to doctrine. A key role of the design leader is to organize the group's learning. Brian Lawson refers to this need as the question of "how to construct the social organization of the practice?"[241] What complicates the process of organizing the learning in a design setting is

[241] Lawson, *How Designers Think*, 248.

the breadth and depth of the inquiry. As Lawson observes, "**One of the essential difficulties and fascinations of designing is the need to embrace so many different kinds of thought and knowledge.**"[242] Like an architect, who must balance client, legislators, and the architectural firm's members, design team leaders must be mindful of both the internal and external relationships of the team. A consideration related to this function is how to keep the team on track while designing, which implies informal leadership skills and the ability to manage an *ad hoc* organization with responsibilities that cut across broad functional and hierarchical groups.

TABLE 20. KEY CONCEPT 13: ORGANIZING TO LEARN.

Organizing to Learn		
Doctrine	*FM 5-0*[243]	"In leading design, commanders typically draw from a select group within the planning staff, red team members, and subject matter experts internal and external to the headquarters. The commander selects these individuals based on their expertise relative to the problem. The commander expects these individuals to gain insights and inputs from areas beyond their particular expertise—either in person or through reachback—to frame the problem more fully. Design serves to establish the context for guidance and orders. By using members of the planning staff to participate in the design effort, commanders ensure continuity between design and detailed planning as well as throughout the operations process. These are purpose-built, problem-centric teams, and the commander may choose to dissolve them once they complete the design effort."
Doctrine	*FM 3-0*[244]	Doctrine leaves open the question of how commanders "develop a personal and in-depth understanding of the enemy and operational environment" before visualizing their concept.
Theory: Design	Lawson[245]	Lawson wrote primarily about architectural design, but his observation that "Design practices are intensely social compared with, for example, legal or medical practices where the partners and junior members work more in isolation" holds true for military applications.

[242] Emphasis added. Ibid., 13.

[243] United States, *FM 5-0*, 3-6.

[244] United States, *FM 3-0*, 5-3.

[245] Lawson, *How Designers Think*, 250.

Theory: Management	Gabarro and Kotter[246]	While most management texts focus on the top-down aspect of management, Gabarro and Kotter contend, at a minimum, that one must appreciate the boss's goals and pressures. Gabarro and Kotter offer suggestions on how to interact with one's superior so that organizational goals get accomplished.
Theory: Sensemaking	Weick and Sutcliffe[247]	The authors offer a theory that individuals and organizations engage in sensemaking when faced with situations that do not meet expectations or cannot be explained with existing models. In such circumstances, the organization probes the environment (i.e. acts) to construct a retrospective explanation of the situation. "Sensemaking involves the ongoing retrospective development of plausible images that rationalizes what people are doing."
Theory: Business	Page[248]	"A good starting point for thinking about how to leverage diversity is to recognize (and then often restructure) the nature of the task. The organizational theorist I. D. Steiner distinguished between *disjunctive tasks*, those in which only one person needs to succeed for the group to be successful, and *conjunctive tasks*, those in which everyone's contribution is critical. Solving a vexing math problem is disjunctive: the more diverse heads, the better. In football, the offensive line's task of protecting the quarterback is conjunctive. If any one lineman fails to do his job, the quarterback gets sacked. Diversity works best on disjunctive tasks because multiple approaches can be tried simultaneously, and one good idea means success for everyone."
Theory: Organization	Ancona and Bresman[249]	"…the critical knowledge needed to beat the competition has become ever-more complex, fast advancing, and spread out. The knowledge teams need to accomplish their task increasingly cannot be found within the team or even in the company itself. Instead, these teams have found it critical to span their boundaries in pursuit of the knowledge they need."
Usage in Context	Kirkpatrick[250]	"The problem was in determining where to begin."

[246] John J. Gabarro and John P. Kotter, "Managing Your Boss," *Harvard Business Review* (January 2005): 92-99.

[247] Karl E. Weick and Kathleen M. Sutcliffe, "Organizing and the Process of Sensemaking," *Organization Science* 16, no. 4 (July-August 2005): 409-421.

[248] Page, *The Difference*, xv.

[249] Deborah Ancona and Henrik Bresman, *X-Teams: How to Build Teams That Lead, Innovate, and Succeed* (Boston, MA: Harvard Business School Press, 2007), 55.

[250] Kirkpatrick, *Unkown Future Doubtful Present*, 56.

Usage in Context	Augustine[251]	Augustine writes from a practical perspective. By observing that "recognizing that, in fact, there is a crisis" is perhaps the most difficult stage in crisis management, he illuminates the difficulty inherent in seeing the situation's magnitude.
Usage in Context	Kirkpatrick[252]	Kirkpatrick's monograph highlighted the use of "murder committees," in which participants gathered to provide frank critiques of concepts. "Friendship notwithstanding, these men were experienced staff officers who did not spare Wedemeyer's feelings as they dissected and examined every facet of his drafts in minute and critical detail."
Relationship	Discourse	Organizing to learn includes structuring time for discourse.
Relationship	Team Learning	Organizing to learn improves team learning.
Relationship	Leading and Facilitating	Organizing to learn is part of informal leadership and creates processes to facilitate design.

2.2.4.14. TEAM LEARNING

Design in a military context takes place in a social setting. According to Peter Senge, team learning is "the process of aligning and developing the capacity of a team to create the results its members truly desire." Senge offers three features of team learning: a "need to think insightfully about complex issues," "the need for innovative, coordinated action," and "the role of team members on other teams."[253] Although Schön and Lawson devote most of their work to developing the theme of design as "an entirely personal and individual process," Lawson supplements his work with a lengthy discussion of designing in teams.[254] Thus, team learning requires skill in creating an environment wherein the team can think together about difficult, frequently ambiguous, perhaps incomprehensible, issues.

TABLE 21. KEY CONCEPT 14: TEAM LEARNING.

[251] Norman R. Augustine, "Managing the Crisis You Tried to Prevent," *Harvard Business Review* (November-December 1995): 147-158.

[252] Kirkpatrick, *Unkown Future Doubtful Present*, 58.

[253] Senge, *The Fifth Discipline*, 218-19.

[254] Lawson, *How Designers Think*, 234.

Team Learning		
Doctrine	*FM 6-22*[255]	In the discussion about team structures, *FM 6-22* observes that "teams are formed to share information and lessons gained from experience." Doctrine indirectly acknowledges the role of team learning in solving problems.
Doctrine	*FM 5-0*[256]	"The commander works with the design team to evaluate ideas and information from multiple perspectives. They then synthesize their understanding as they work within the design activities, leaving open for further exploration those matters that cannot be understood on the basis of current information."
Doctrine	*FM 5-0*[257]	"Design is also an organizational learning methodology. The design team organizes critical inquiry by questioning and discussing their knowledge of the operational environment. They develop models or hypotheses to compare against the operational environment. Given higher directives, they formulate conditions that define a desired end state and develop approaches that aim to achieve those conditions. When initial models fail to coherently explain behavior or events, the design team reframes its understanding of the situation. This cycle of inquiry, contextual understanding, and synthesis includes rigorous debate about meaning. Collaboration affords commanders opportunities to revise their understanding or approaches so they can execute feasible, acceptable, and suitable operational approaches to achieve the desired end state."
Theory: Organizational Learning	Senge[258]	"Systems thinking requires mature teams capable of inquiring into complex, conflictual issues." Senge claims that discourse has two components: dialogue and discussion. Relying on the work of Heisenberg, Senge offers that the IQ of the team is (potentially) greater than the individual.
Theory: Design	Lawson[259]	"Design cannot be practiced in a social vacuum. Indeed it is the very existence of the other players such as clients, users and legislators which makes design so challenging." With respect to team learning, Lawson shows that "a group, which acts not just as a collection of individuals, but also in a manner somehow beyond the abilities of the collective individual talents."

[255] United States, *FM 6-22*, 3-9.

[256] United Sates, *FM 5-0*, 3-5.

[257] Ibid., 3-6.

[258] Senge, *The Fifth Discipline*, 220-223.

[259] Lawson, *How Designers Think*, 237; 242.

Usage in Context	Schmitt[260]	"The design team should consist of a relatively small group of key stakeholders with a compelling interest in the outcome of the situation. The commander is necessarily a central member because the ultimate responsibility for any decisions rests with him. In effect, the process exists to produce in the commander the insight that activates intuition. This does not mean that the commander is necessarily the chief designer driving the process and responsible for originating all the ideas. But he should be a direct participant, contributing but also learning from the other designers. The design team should not consist of a designated, segregated group of "expert designers" who create a design and hand it down to others for planning and execution. Rather, it should include those who will have to live with the result, particularly the subordinate commanders who will ultimately have to execute the plan. The team may also include other key military and non-military partners, as well as functional or other experts. The design process will almost certainly include a recurring discourse with the higher authorities to ensure that the emerging design is consistent with expectations. Diversity of perspective is a valuable trait in the composition of the design team. It promotes the competing ideas and opinions that are critical to a dialectic discourse and militates against the development of group think. Giving stakeholder groups representation in the design team will tend to provide this diversity naturally. Including "heretics" in the design team can likewise inject creative tension into the design process."

[260] Schmitt, *Systemic Concept for Operational Design*, 22-23.

Usage in Context	Weick[261]	The need for team learning can be derived from Weick's description of a developing crisis. "Things seem inexplicable. And to make it worse, many of our ways of making sense of the inexplicable seem to have collapsed. Our weaknesses come rushing to the forefront. The first impulse is to grasp for some explanation, any old explanation. And what we get hold of are the automatic explanations we have lived with longest and invoked most often. We often find the initial meaning of events by drawing inferences from how we feel. Since many of us feel frightened and out of control, then this must "mean" that whatever we face is something we need to flee from or fight. Neither explanation is profound. But either explanation is better than nothing. Either explanation, oddly enough, is soothing, since the prospects of having no explanations at all and no ways to cope, are even more frightening."
Relationship	Discourse	Effective team learning enhances discourse.
Relationship	Organizing to Learn	Team learning includes learning how to better organize for learning in design (learning to learn).

2.2.4.15. LEADING AND FACILITATING

Design doctrine claims that design teams are best kept small—six to eight individuals at the core.[262] This implies that the leader simply be proficient in managing the activities of a relatively small group. Adopting this view understates the task, as it does not represent the scale of a design effort. Leading a design effort requires that the leader manage the internal and external relationships necessary to create understanding about a problem situation.

Military organizations do not have formally established and resourced "design teams." As a consequence, the design team leader holds an informal position and must rely on informal leadership. "How do I lead peers, subordinates, and seniors in a team?" becomes a key question. Leading design requires equal talent in facilitation and interpersonal relationships, to build networks supporting the team's work across organizations, as well as within the organization itself. Ron Heifetz labels leadership in these circumstances as "mobilizing adaptive work."[263]

[261] Karl E. Weick, "Leadership When Events Don't Play By the Rules," Trying Times series, University of Michigan, (2002): 1.

[262] United States, *FMI 5-2*, 19.

[263] Heifetz, *Leadership Without Easy Answers*, 69.

TABLE 22. KEY CONCEPT 15: LEADING AND FACILITATING.

Leading and Facilitating		
Doctrine	*FM 5-0*[264]	"Commanders are the central figure in design. Generally, the more complex a situation is, the more important the commander's role is in design. Commanders draw on design to overcome the challenges of complexity. They foster iterative collaboration and dialog while leveraging their collective knowledge, experience, judgment, and intuition to generate a clearer understanding of the conditions needed to achieve success. Design supports and reinforces the application of battle command, supporting the commander's ability to understand and visualize the operational environment."
Doctrine	*FM 6-22*[265]	Informal leadership is commonly characterized as *influential* power obtained through knowledge or initiative.
Doctrine	*FM 6-22*[266]	Leading design requires the ability to "build trust outside lines of authority."
Theory: Informal authority	Heifetz[267]	"*Formal* authority is granted because the officeholder promises to meet a set of explicit expectations (job descriptions, legislated mandates), whereas *informal* authority comes from promising to meet expectations that are often left implicit (expectations of trustworthiness, ability, civility)."
Theory: Typology of problem situations	Heifetz[268]	Heifetz offers three levels of problems: Type I, II, and III. In his scale, problem situations range from technical to adaptive. He defines Type III (adaptive) problems as those in which the "problem definition is not clear-cut, and technical fixes are not available." He goes on to say, "Learning is required both to define problems and implement solutions."
Theory: Mobilizing adaptive work	Heifetz[269]	In tackling social dilemmas, Heifetz offers that the leader must distinguish between technical and adaptive problems, recognize that an authority relationship can be a constraint on the leader's actions, and direct attention towards issues, thus disaggregating the intractable adaptive problem into a series of technical problems.

[264] United States, *FM 5-0*, 3-1.

[265] United States, *FM 6-22*, 3-8 – 3-9.

[266] Ibid., 7-21.

[267] Heifetz, *Leadership Without Easy Answers*, 101.

[268] Ibid., 75.

[269] Ibid., 87-88.

Theory: Facilitation	Schwarz[270]	Schwarz offers extensive practical advice on how to facilitate the work of groups. He defines a group facilitator as one "whose selection is acceptable to all the members of the group, who is substantially neutral, and who has no substantive decision-making authority diagnoses and intervenes to help a group improve how it identifies and solves problems and makes decisions, to increase the group's effectiveness." According to Schwarz, the facilitator, who manages the process rather than content of the design discourse, should be someone other than the commander.
Usage in Context	Kirkpatrick[271]	"Wedemeyer parceled out aspects of the problem to other officers in WPD [War Plans Division] and elsewhere in the War Department staff. While many men worked on the Victory Plan, however, they worked under Wedemeyer's guidance, and it was always Wedemeyer who designed the work and at whose desk the final product took shape."
Relationship	Discourse	Leadership and facilitation is required for discourse to occur.
Relationship	Organizing to Learn	Leading and facilitating must include organizing the design team to learn.

2.2.4.16. ASSESSMENT

To begin to understand how to deal with complexity, assessment and interpretation skills are essential. Complexity cannot be fully understood; however, the designer must work within a contingent, changing, and ephemeral environment in order to achieve some desire. Assessment and interpretation are essential initial steps for appreciating the environment, and judging whether the current design is still relevant.

TABLE 23. KEY CONCEPT 16: ASSESSMENT.

Assessment		
Doctrine	*FM 3-24*[272]	The purpose of design is to gain greater understanding, identify proposed solutions, and develop the means to learn.

[270] Schwarz, *The Skilled Facilitator*, 5.

[271] Kirkpatrick, *Unknown Future Doubtful Present*, 57.

[272] United States, *FM 3-24*, 4-1.

Doctrine	*FM 5-0*[273]	"Assessment involves deliberately comparing forecasted outcomes to actual events to determine the overall effectiveness of force employment. More specifically, assessment helps the commander determine progress toward attaining the desired end state, achieving objectives, or performing tasks. It also involves the continuous monitoring and evaluation of the operational environment to determine changes that might affect the conduct of operations. Assessment also helps commanders determining if they need to reframe their original commander's visualization."
Theory: Design Education	Schön[274]	Schön opens the door to understanding the role of personal, professional mastery of craft as an element of dealing with the complexity of creativity. Key concept supporting assessment and interpretation is his discussion of the "indeterminate, swampy zone of practice."
Theory: Military	Clausewitz[275]	Clausewitz offers a "method" for assessing human action in a complex environment in his chapter "Critical Analysis."
History: Military	Clausewitz[276]	Clausewitz expands on assessment using events from history in his chapter "On Historical Example."
Theory: Anthropology	Geertz[277]	Geertz discusses the need for thick description, and discusses ways to achieve this, while understanding that interpretation is all contingent, contextual, and ephemeral. (pp. 28-29)
Usage in Context	Slim[278]	Slim reflects on his continual reassessment of military actions in the complex theater of China-Burma-India.
Relationship	Critical Thinking	Assessment stimulates critical thinking.

2.2.4.17. ITERATION

Multiple attempts to gain understanding of complex systems, combined with the foresight that one can only gain understanding through multiple interactions with the system, generates a different knowledge of what actions do to generate understanding. This iteration can be in virtual worlds of experiment without actual interaction, specific acts of

[273] United States, *FM 5-0*, 6-1.

[274] Schön, *Educating the Reflective Practitioner*, 3.

[275] Clausewitz, *On War*, book 2, chapter 5.

[276] Clausewitz, *On War*, book 2, chapter 6.

[277] Clifford Geertz, "Thick Description" in *The Interpretation of Cultures*: *Selected Essays* (New York, NY: Basic Books, 1973), 28-29.

[278] Field Marshall The Viscount Slim, *Defeat into Victory* (New York, NY: Macmillan, 1986), 111-121.

intervention designed only to increase learning, or a series of actions designed to generate change, in order to learn.

TABLE 24. KEY CONCEPT 17: ITERATION.

Iteration		
Doctrine	*FM 5-0*[279]	"Unlike steps in a sequential process, the design method is iterative, flowing back and forth between understanding the environment, problem framing, and developing an operational approach in the operations frame. Hence, when commanders have an idea arise, they can place it in the appropriate activity to address the idea, even if the idea is outside the design team's current frame."
Theory: Design Education	Schön[280]	For Schön, there is an inevitable and powerful relationship between the experience base of the designers and their skill in practice. He believes, however, that practice can itself only be gained through the experience of doing design, while being coached by a more experienced practitioner. This experience is gained through iteration.
Theory: Design	Lawson[281]	Lawson offers several techniques to enhance iterative creativity. He discusses various generators, develops and presents a Rubik's Cube of design constraints, which themselves enhance creative iteration. He also discusses the generation of alternatives as a form of creative iteration.
Theory: Systems	Gharajedaghi[282]	"Iteration is the key for understanding complexity." "Successive iterations would yield a greater understanding and more closely approximate the nature of the whole."
Theory: Systems	Gharajedaghi[283]	Gharajedaghi addresses iterative design through his process steps – searching, mapping, and telling.
Theory: Design Education	Schön[284]	Schön believes that iteration includes reflection while acting. To make use of this gained reflective ideation, Schön recommends what he calls reciprocal reflection, which also requires numerous iterations for effect. He adds a third component to the iterative process – trust.

[279] United States, *FM 5-0*, 3-11.

[280] Schön, *Educating the Reflective Practitioner*, 70-72.

[281] Lawson, *How Designers Think*, 89; 106; 209.

[282] Gharajedaghi, *Systems Thinking*, 112-113.

[283] Ibid., 132-140.

[284] Schön, *Educating the Reflective Practitioner*, 87-8; 101; 163-7.

Usage in Context	Grant[285]	As Grant approaches the Chattanooga area, he reflects, acts, reflects some more, gains new information and intelligence, acts some more. His approach is that of iteration.
Relationship	Complex Systems	Iteration is the source of many complex pattern formation processes.
Relationship	Discourse	Discourse is iterative, an unending process of back and forth.
Relationship	Strategic Communication	Strategic communication requires continual iteration for success

2.2.4.18. SIMULTANEITY

Design is conducted not in a strict sequence but in a realm of both internal and external simultaneity. Internal simultaneity involves disciplined and coherent movement amongst the cognitive spaces of design in order to generate understanding and concepts. External simultaneity captures the reality of actual operations, where design, planning, preparation, execution, assessment are all being conducted at the same time. Both forms of simultaneity need to be harnessed by the design team.

TABLE 25. KEY CONCEPT 18: SIMULTANEITY.

Simultaneity		
Doctrine	CACD[286]	"Understanding the problem and conceiving a solution are identical and simultaneous cognitive processes. For example, if we formulate an insurgency as the result of a failed regional economy, our solution will be different than if we formulated the insurgency as the result of poor governance. The formulation of the problem points in the direction of a particular solution."
Doctrine	*FM 6-0*[287]	Operations include assessment, planning, preparation, and execution. We need to add design to this set of activities. Simultaneity is implied in doctrine, real in actual operations, and infrequently employed in training exercises. Design needs to be conducted using aspects of all the activities of operations in order to generate adequate knowledge and develop appropriate actions.

[285] Ulysses S. Grant, *Memoirs* (New York, NY: Literary Classics, 1990), 403-421.

[286] United States, *TRADOC Pam. 525-5-500*, 10.

[287] United States, *Field Manual 6-0, Mission Command: Command and Control of Army Forces* (Washington, DC: Headquarters, Department of the Army, 2003). 6-1 – 6-32.

Theory: Design Education	Schön[288]	In his discussion of the coherence of the simultaneous whole, Schön develops the idea that design functions best when the design team is engaged with all of the instrumental problems of the challenge simultaneously. If a strictly sequential approach is taken the design is hampered by artificial construction of constraints. Keeping all aspects in mind as the design approach is taken stimulates more effective understanding of the challenge, and generates better suited solutions and actions.
Theory: Design	Lawson[289]	Lawson describes techniques for moving the design process forward. These are really elements of near-simultaneity, since narration, conversation, and negotiation occur at the same time in the design space and in the execution space. This is particularly true when added to the concept of creating social organizations as extended design/execution teams.
Theory: Design	Lawson[290]	In Chapter 16, Lawson gives details on his models for moving design forward. These are, in essence, all efforts to generate a certain sense of simultaneous presence in the design, planning, preparation, execution, and assessment areas.
Theory: Social Planning	Rittel and Webber[291]	"For wicked problems, however, this type of scheme cannot work. One cannot understand the problem without knowing about its context; one cannot meaningfully search for information without the orientation of a solution concept; one cannot first understand, then solve… Approaches… should be based on a model of planning as an argumentative process in the course of which an image of the problem and of the solution emerges gradually among the participants, as a product of incessant judgment, subjected to critical argument."

[288] Schön, *Educating the Reflective Practitioner*, 159.

[289] Lawson, *How Designers Think*, Chapter 15.

[290] Ibid., chapter 16.

[291] Horst W. J. Rittel and Melvin M. Webber, "Dilemmas in a General Theory of Planning," *Policy Science* 4 (1973): 162.

Usage in Context	COSSAC[292]	The staff of the COSSAC had to deal with simultaneity, but were severely hampered due to a lack of command and control of the forces needed to act simultaneously with the designing. This comes out most clearly in the discussion of the need to prepare shipping and landing craft production quotas well in advance of execution and the lengthy discussion of the need to properly develop (execute) airpower operations for both air command and for interdiction before the actual invasion (paragraphs 8, 11, 13, 16, and others). Of even greater interest in understanding simultaneity is their assessment of the strength of the German ground forces a year in advance – the design was based on an assessment of propensity (paragraphs 14, 15, and 35).

2.2.4.19. DRAWINGS

Drawing is characteristic of both the process and the products of design. **Drawings are so essential to design because they show relationships and organize information.** Two levels of understanding are essential here: first is the concept of doing, of making specific, deliberate, and intentionally developed drawings. These drawings help the designers establish a reflective conversation with the situation, but they also have real world impacts – actions, social groupings, and other products are commissioned as a result of design drawings. The second level of understanding involves the need to characterize the form of various products based on their outcome desired. SAMS follows Lawson's categorization of design drawings, presentation drawings, and production drawings. Both concepts help the leader of design teams focus both the process and the products of the design team.

[292] COSSAC, "Digest of Operation 'Overlord'."

TABLE 26. KEY CONCEPT 19: DRAWINGS.

Drawings		
Doctrine	*FM 5-0*[293]	All three cognitive spaces of design, as well as the final product of design (the design concept) make use of drawing to depict systemic relationships. "The environmental frame is a graphic and narrative description that captures the history, current state, and future goals of relevant actors in the operational environment… The problem frame is a refinement of the environmental frame that defines, in text and graphics, the areas for action that will move existing conditions toward the desired end state… One method to depict the operational approach is to use lines of effort, but it is not the only way. Design teams require latitude to portray the operational approach in a manner that best communicates its vision and structure. However, it is important that narratives accompany lines of effort to ensure they are understood… The design concept is the formal output of the design method conveyed in text and graphics that informs detailed planning."
Theory: Design Education	Schön[294]	Discussing various ways to generate creativity, Schön recommends the creation of specific products, for example, a scale drawing, to generate the intellectual, mental, and emotional tensions that themselves stimulate creative ideas. He also recommends creating examples to serve the same end. Of course, for Schön, the very creation of an educational practicum itself is the creation of a product which enhances the process of learning.
Theory: Design	Lawson[295]	Lawson describes three very useful forms of drawings: design which are generated during the design process as a generator of ideas; presentation which are created to show the outcome of the process to the client or others; production which are generated as the process ends a design cycle in order to stimulate and inform down-stream planning and execution efforts. These "drawings" can also be word documents, PowerPoint presentations, white board sketches, 3-d models or any form of communication relevant to the design.

[293] United States, *FM 5-0*, 3-10; 3-12; 3-14; 3-15.

[294] Schön, *Educating the Reflective Practitioner*, 158; 161; 170ff.

[295] Lawson, *How Designers Think*, 26.

Theory: Systems	Checkland and Poulter[296]	"The complexity of human situations is always one of multiple interacting relationships. A picture is a good way to show relationships; in fact it is a much better medium for that purpose than linear prose. Hence as knowledge of a situation was assembled – by talking to people, by conducting more formal interviews, by attending meetings, by reading documents, etc. – it became normal to begin to draw simple pictures of the situation. These became richer as inquiry proceeded, and so such pictures are never finished in any ultimate sense. But they were found invaluable for expressing crucial relationships in the situation and, most importantly, for providing something which could be tabled as a basis for discussion. Users would say: 'This is how we are seeing your situation. Could we talk you through it so that you can comment on it and draw attention to anything you see as errors or omissions?'In making a Rich Picture the aim is to capture, informally, the main entities, structures and viewpoints in the situation, the processes going on, the current recognized issues and any potential ones."
Usage in Context	COSSAC planning document[297]	COSSAC should be considered a narrative of a production drawing. It is a useful process to look at this document and imagine what the design drawing would look like, and equally useful to generate an actual presentation drawing from the document.
Relationship	Creative Thinking	Drawings are a tool for creative thinking.
Relationship	Systems Thinking	Because drawings show relationships they are useful for systems thinking.
Relationship	Discourse	Drawings focus design team discourse.
Relationship	Reflection	Drawings enable a reflective conversation with the situation.

2.2.4.20. REFLECTION

Drawn from Schön and with Slim as an example of doing reflection, this concept focuses the student on the need to think about what mastery of practice is, how it is done, and the merits of thinking about doing, both while and after. Reflection, critical thinking, and meta-thinking are all closely related concepts. Together they enable the reflective practitioner to master their craft through iterative reflection on action.

[296] Checkland and Poulter, *Learning for Action*, 25.

[297] COSSAC. "Digest of Operation Overlord."

TABLE 27. KEY CONCEPT 20: REFLECTION.

Reflection		
Theory: Design Education	Schön[298]	Schön's discussion of the ladder of reflection is the place to start. For Schön, action without thought is not purposeful or useful. The skilled designer must reflect frequently on both his own actions and the actions of others in the design world. For Schön, the designer has a double burden of both execution of task and reflection on task.
Theory: Design Education	Schön[299]	A careful, and somewhat obvious, distinction is made between reflection in action and reflection on action.
Theory: Systems	Checkland and Poulter[300]	Soft Systems Methodology (SSM) is an example of a reflective approach to problem structuring. "This implies what is probably the key step in really understanding SSM and its use: grasping that the user…is *consciously thinking about his or her own thinking*. This 'meta-level' thinking is not all that common… This lifts the thinking to a level above that of simply perceiving the complexity. It lifts it to a meta-level, and makes the user able to inspect their own thinking and then think about it. It is this shift from stance (a) to stance (b) which increases the richness of thinking and enables insights to emerge and formula-driven thinking to be avoided. It is the (a) to (b) shift which turns a practitioner into a reflective practitioner and defines SSM as an articulation of reflective practice."

[298] Schön, *Educating the Reflective Practitioner*, 114; 88-9.

[299] Schön, *Educating the Reflective Practitioner*, 26.

[300] Checkland and Poulter, *Learning for Action,* 157-158.

Usage in Context	Lawrence[301]	The entire chapter by T. E. Lawrence is an example of individual reflection on anticipated actions. This example does not include group reflection nor does it address the need to generate the reflection during action required by Schön. "About ten days I lay in that tent, suffering a bodily weakness which made my animal self crawl away and hide till the shame was passed. As usual in such circumstances my mind cleared, my senses became more acute, and I began at last to think consecutively of the Arab Revolt, as an accustomed duty to rest upon against the pain. It should have been thought out long before, but at my first landing in Hejaz there had been a crying need for action, and we had done what seemed to instinct best, not probing into the why, nor formulating what we really wanted at the end of all. Instinct thus abused without a basis of past knowledge and reflection had grown intuitive, feminine, and was now bleaching my confidence; so in this forced inaction I looked for the equation between my book-reading and my movements, and spent the intervals of uneasy sleeps and dreams in plucking at the tangle of our present."
Relationship	Critical Thinking	Critical thinking requires reflection.
Relationship	Narrative	Reflection is captured in narratives.
Relationship	Leading and facilitating	Leading and facilitating is more effective when the leader / facilitator creates space for individual and group reflection.

2.3. SUMMARY OF DESIGN THINKING

This chapter presented a conceptual framework for design thinking. This multi-level conceptual framework provided three levels of successively more detailed answers to the question "what is design?" We compared design with art and science, as well as comparing the purpose, assumptions, approach, culture, and logic of design with conventional planning. We confronted the predicament of learning to design, which was resolved by the five pillars of design education: history, theory, doctrine, philosophy, and practice. **This provided a vision for designing operations within a community of practitioners, learning to design by doing; reflecting on their doing with coach/mentors; and reflecting on the relationship between theory and practice.** The promise of this approach is continual improvement of individual professional mastery and the ability to design in teams, leading to organizational learning and rapid adaptation to future contexts.

The conceptual framework then elaborated four highly interwoven 'big ideas' of design: learning, difference, systems, and social creation. These four ideas highlight the cultural

[301] Lawrence, *Seven Pillars of Wisdom*, 193-202.

shift needed for design thinking to take hold. Design promotes a shift from ballistic "fire and forget" action and quick fixes to acting to learn; from valuing conformity to appreciating difference; from reductionism to systemism; and from power leader to discourse facilitator. As with any cultural change, each of these big ideas presents significant implementation challenges, but equally significant payoffs for an Army engaged in extremely complex enduring conflicts.

Last, twenty key design concepts expanded on the themes implicit within the four big ideas. Each key concept established a connection with the Art of Design and provided pointers to doctrinal, theoretical, and historical/practical references for the concept. An objective of the theoretical component of SAMS design instruction is to familiarize students with these key concepts. For the past five years, the language of design has been in a state of flux, as new theorists with different lexicons have entered the melting pot of multidisciplinary design theory. What one author calls a wicked problem, another refers to as an ill-structured problem, a problem situation, a complex adaptive problem, a complex adaptive system, or even a mess. While there are important subtle differences between these phrases, there is also a shared concept that is important to design thinking: a design problem is different *in kind* to a crossword puzzle, and cannot be solved using the same logic. While the language of design will continue to evolve, the concepts will be far more stable. Identifying the key concepts of design allows us to continue to search for better ways to educate design theory without compromising coverage of the key concepts.

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3. *FM 5-0*: DESIGN

This chapter establishes the fundamentals that guide the application of design. It defines and explains the goals of design. It discusses design in context and describes how leaders drive design. Next, it describes the design methodology that includes framing the operational environment, framing the problem, and developing a design concept. The chapter concludes with a discussion of reframing.

DESIGN DEFINED

3-1. *Design* is a methodology for applying critical and creative thinking to understand, visualize, and describe complex, ill-structured problems and develop approaches to solve them. Critical thinking captures the reflective and continuous learning essential to design. Creative thinking involves thinking in new, innovative ways while capitalizing on imagination, insight, and novel ideas. Design is a way of organizing the activities of battle command within an organization. Design occurs throughout the operations process before and during detailed planning, through preparation, and during execution and assessment.

3-2. Planning consists of two separate, but closely related components: a conceptual component and a detailed component. The conceptual component is represented by the cognitive application of design. The detailed component translates broad concepts into a complete and practical plan. During planning, these components overlap with no clear delineation between them. As commanders conceptualize the operation, their vision guides the staff through design and into detailed planning. Design is continuous throughout planning and evolves with increased understanding throughout the operations process. Design underpins the exercise of battle command, guiding the iterative and often cyclic application of understanding, visualizing, and describing. As these iterations occur, the design concept—the tangible link to detailed planning—is forged.

3-3. Design enables commanders to view a situation from multiple perspectives, draw on varied sources of situational knowledge, and leverage subject matter experts while formulating their own understanding. Design supports battle command, enabling commanders to develop a thorough understanding of the

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operational environment and formulate effective solutions to complex, ill-structured problems. The commander's visualization and description of the actions required to achieve the desired conditions must flow logically from what commanders understand and how they have framed the problem. Design provides an approach for how to generate change from an existing situation to a desired objective or condition.

3-4. Moreover, design requires effective and decisive leadership that engages subordinate commanders, coordinating authorities, representatives of various staff disciplines, and the higher commander in continuing collaboration and dialog that leads to enhanced decisionmaking. (Paragraphs 1-31 through 1-36 discuss collaboration and dialog.) This facilitates collaborative and parallel planning while supporting shared understanding and visualization across the echelons and among diverse organizations. It is the key to leveraging the cognitive potential of a learning organization, converting the raw intellectual power of the commander and staff into effective combat power.

3-5. Innovation, adaptation, and continuous learning are central tenets of design. Innovation involves taking a new approach to a familiar or known situation, whereas adaptation involves taking a known solution and modifying it to a particular situation or responding effectively to changes in the operational environment. Design helps the commander lead innovative, adaptive work and guides planning, preparing, executing, and assessing operations. Design requires agile, versatile leaders who foster continuous organizational learning while actively engaging in iterative collaboration and dialog to enhance decisionmaking across the echelons.

3-6. A continuous, iterative, and cognitive methodology, design is used to develop understanding of the operational environment; make sense of complex, ill-structured problems; and develop approaches to solving them. In contrast to detailed planning, design is not process-oriented. The practice of design challenges conventional wisdom and offers new insights for solving complex, ill-structured problems. While plans and orders flow down the echelons of command, new understanding may flow up from subordinate echelons where change often appears first. By enhancing and improving commanders' understanding, design improves a higher authority's understanding of the operational environment and the problems commanders are tasked to solve.

DESIGN GOALS

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3-7. Successfully applying design seeks four concrete goals that, once achieved, provide the reasoning and logic that guide detailed planning processes. Each goal is an essential component to reshaping the conditions of the operational environment that constitute the desired end state. Collectively, they are fundamental to overcoming the complexities that characterize persistent conflict. The goals of design are—

- Understanding ill-structured problems.
- Anticipating change.
- Creating opportunities.
- Recognizing and managing transitions.

UNDERSTANDING ILL-STRUCTURED PROBLEMS

3-8. Persistent conflict presents a broad array of complex, ill-structured problems best solved by applying design. Design offers a model for innovative and adaptive problem framing that provides leaders with the cognitive tools to understand a problem and appreciate its complexities before seeking to solve it. This understanding is fundamental to design. Without thoroughly understanding the nature of the problem, commanders cannot establish the situation's context or devise approaches to effect change in the operational environment. Analyzing the situation and the operational variables provide the critical information necessary to understand and frame these problems. (Paragraph 1-21 discusses the operational variables. See chapter 2 [in *FM 5-0*] for a discussion on the structure of problems.)

3-9. A commander's experience, knowledge, judgment, and intuition assume a crucial role in understanding complex, ill-structured problems. Together, they enhance the cognitive components of design, enhancing commanders' intuition while further enabling commanders to identify threats or opportunities long before others might. This deepens and focuses commanders' understanding. It allows them to anticipate change, identify information gaps, and recognize capability shortfalls. This understanding also forms the basis of the commander's visualization. Commanders project their understanding beyond the realm of physical combat. They must anticipate the operational environment's evolving military and nonmilitary conditions. Therefore, design encompasses visualizing the synchronized

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arrangement and use of military and nonmilitary forces and capabilities to achieve the desired end state. This requires the ability to discern the conditions required for success before committing forces to action.

3-10. Ultimately, understanding complex, ill-structured problems is essential to reducing the effects of complexity on full spectrum operations. This understanding allows commanders to better appreciate how numerous factors influence and interact with planned and ongoing operations. Assessing the complex interaction among these factors and their influences on operations is fundamental to understanding and effectively allows the commander to make qualitatively better decisions under the most dynamic and stressful circumstances.

ANTICIPATING CHANGE

3-11. Applying design involves anticipating changes in the operational environment, projecting decisionmaking forward in time and space to influence events before they occur. Rather than responding to events as they unfold, design helps the commander to anticipate these events and recognize and manage transitions. Through the iterative and continuous application of design, commanders contemplate and evaluate potential decisions and actions in advance, visualizing consequences of possible operational approaches to determine whether they will contribute to achieving the desired end state. A thorough design effort reduces the effects of complexity during execution and is essential to anticipating the most likely reactions to friendly action. During detailed planning, these actions and sequences are often linked along lines of effort, which focus the outcomes toward objectives that help to shape conditions of the operational environment.

3-12. Design alone does not guarantee success in anticipating change—it also does not ensure that friendly actions will quantifiably improve the situation. However, applied effectively and focused toward a common goal, design provides an invaluable cognitive tool to help commanders anticipate change and innovate and adapt approaches appropriately. Performed haphazardly and without proper focus and effort, it may become time-consuming, ineffective, process-focused, and irrelevant. Iterative, collaborative, and focused design offers the means to anticipate change effectively in the current situation and operational environment, as well as achieve lasting success and positive change.

CREATING OPPORTUNITIES

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3-13. The ability to seize, retain, and exploit the initiative is rooted in effective design. Applying design helps commanders anticipate events and set in motion the actions that allow forces to act purposefully and effectively. Exercising initiative in this manner shapes the situation as events unfold. Design is inherently proactive, intended to create opportunities for success while instilling the spirit of the offense in all elements of full spectrum operations. Effective design facilitates mission command, ensuring that forces are postured to retain the initiative and, through detailed planning, consistently able to seek opportunities to exploit that initiative.

3-14. The goals of design account for the interdependent relationships among initiative, opportunity, and risk. Effective design postures the commander to combine the three goals to reduce or counter the effects of complexity using the initial commander's intent to foster individual initiative and freedom of action. Design is essential to recognizing and managing the inherent delay between decision and action, especially between the levels of war and echelons. The iterative nature of design helps the commander to overcome this effect, fostering initiative within the initial commander's intent to act appropriately and decisively when orders no longer sufficiently address the changing situation. This ensures commanders act promptly as they encounter opportunities or accept prudent risk to create opportunities when they lack clear direction. In such situations, prompt action requires detailed foresight and preparation.

RECOGNIZING AND MANAGING TRANSITIONS

3-15. A campaign quality Army requires versatile leaders—critical and creative thinkers who recognize and manage not just friendly transitions but those of adversaries, as well as the operational environment. Commanders must possess the versatility to operate along the spectrum of conflict and the vision to anticipate and adapt to transitions that will occur over the course of a campaign. Design provides the cognitive tools to recognize and manage transitions by educating and training the commander. Educated and trained commanders can identify and employ adaptive, innovative solutions, create and exploit opportunities, and leverage risk to their advantage during these transitions.

DESIGN IN CONTEXT

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3-16. The introduction of design into Army doctrine seeks to secure the lessons of 8 years of war and provide a cognitive tool to commanders who will encounter complex, ill-structured problems in future operational environments like in March 2003. Division commanders of the 101st Airborne (Air Assault), 4th Infantry Division, and 1st Armored Division were ordered to maneuver their units from Kuwait and into Iraq to defeat the Iraqi Army and to seize key cities and infrastructure. This was a task familiar to each of them—a structured problem—and they communicated their intent and began to build orders through the military decisionmaking process. Soon after accomplishing their mission, they were issued further instructions to "establish a safe and secure environment" in Ninewa Province, Diyala Province, and Baghdad. This was a task unfamiliar to them—an ill-structured problem—and each of them realized that they had to first understand the problem and frame the task before seeking to solve it. These commanders used design intuitively and adapted their existing processes to gain this understanding.

3-17. As learned in recent conflicts, challenges facing the commander in operations often can be understood only in the context of other factors influencing the population. These other factors often include, but are not limited to, economic development, governance, information, tribal influence, religion, history, and culture. Full spectrum operations conducted among the population are effective only when commanders understand the issues in the context of the complex issues facing the population. Understanding context and then deciding how, if, and when to act is both a product of design and integral to the art of command.

PERSISTENT CONFLICT

3-18. In the 21st century, several global trends shape the emerging strategic environment and exacerbate the ideological nature of current struggles. These trends present dilemmas as well as opportunities. Such trends include—

- Globalization.
- Technological diffusion.
- Demographic shifts.
- Resource scarcity.
- Climate changes and natural disasters.

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- Proliferation of weapons of mass destruction.
- Failed or failing states.

3-19. The collective impact of these trends makes it likely that persistent conflict will characterize the next century. *Persistent conflict* is the protracted confrontation among state, nonstate, and individual actors that are increasingly willing to use violence to achieve their political and ideological ends. Conflicts will erupt unpredictably, vary in intensity and scope, and endure for extended periods. In a dynamic and multidimensional operational environment, design offers tools vital to solving the complex, ill-structured problems presented by persistent conflict.

EVOLVING CHARACTER OF CONFLICT

3-20. Although the essential nature of conflict is timeless, its character reflects the unique conditions of each era. Conflict is invariably complex because it is fundamentally human in character. As such, conflict is characterized by uncertainty, chance, and friction. Design provides additional tools necessary to understand this environment and to mitigate the adverse effects of complexity on full spectrum operations. As modern conflict evolves, it is characterized by several key factors:

- Conducted between and among *diverse actors*, both state and nonstate, with the former frequently acting covertly, and the latter sometimes acting through state sponsorship or as a proxy for a state.
- Unavoidably waged *among the people*.
- Increasingly *unpredictable* and sudden, with the potential to expand rapidly into unanticipated locations and continue for unexpected durations.
- Increasing *potential for spillover,* creating regionally and globally destabilizing effects.
- Waged in *transparency*.
- Increasingly likely to include *hybrid threats,* dynamic combinations of conventional, irregular, terrorist, and criminal capabilities adapting to counter traditional advantages.

FUNDAMENTALS OF DESIGN

3-21. Today's operational environment presents situations so

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complex that understanding them—let alone attempting to change them—is beyond the ability of a single individual. Moreover, significant risk occurs when assuming that commanders in the same campaign understand an implicit design concept or that their design concepts mutually support each other. The risks multiply, especially when a problem involves multiple units, Services, multinational forces, or other instruments of national power. Commanders mitigate these risks with collaboration and by applying the design fundamentals:

- Apply critical thinking.
- Understand the operational environment.
- Solve the right problem.
- Adapt to dynamic conditions.
- Achieve the designated goals.

Apply Critical Thinking

3-22. Commanders ensure that superiors and subordinates share a common understanding of the purpose behind intended actions. Initial guidance provided by a higher political or military authority may prove insufficient to create clearly stated, decisive, and attainable objectives in complex situations that involve political, social, economic, and other factors. After commanders conduct a detailed study of the situation, they may conclude that some desired goals are unrealistic or not feasible within the limitations. These limitations stem from the inherent tension that often exists among different goals, historical tensions in the local population, interactions of different actors seeking to improve their own survivability and position, and limited resources and time available to achieve the mission. One can never fully understand the dynamics of a conflict in advance. Well-intentioned guidance without detailed study may lead to an untenable or counterproductive solution.

3-23. Design helps mitigate the risk associated with guidance that does not fully account for the complexities of the operational environment by using a critical and creative approach for learning, innovation, and adaptation. Design helps to clarify objectives in the context of the operational environment and within the limits imposed by policy, strategy, orders, or directives. This does not imply that commanders can arbitrarily disregard instructions. If, however, they receive unclear guidance or consider the desired conditions unachievable, commanders engage in active dialog.

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Dialog clarifies guidance and enables commanders to offer recommendations to achieve a mutual understanding of the current situation and the desired end state. Design can assist commanders in leading the top-down/bottom-up approach at all echelons.

Understand the Operational Environment

3-24. Design challenges leaders to understand the impact of their decisions and actions on the operational environment. (See chapter 1 [in *FM 5-0*].) Gaining a deeper and more thorough understanding of the operational environment enables more effective decisionmaking and helps to integrate military operations with the other instruments of national power. In an environment characterized by the presence of joint, interagency, intergovernmental, and multinational partners, such understanding is essential to success. In this context, human variables, interactions, and relationships are frequently decisive. Military force may be necessary to achieve national policy aims, but, by itself, force proves insufficient to achieve victory in these situations. More importantly, leaders and Soldiers must recognize the relationship between the character of conflict and the approach one takes to effect changes in the operational environment.

3-25. Developing a thorough understanding of the operational environment is a continuous process. Even though this understanding will never be perfect, attempting to comprehend its complex nature helps identify unintended consequences that may undermine well-intentioned efforts. Deep understanding reveals the dynamic nature of the human interactions and the importance of identifying contributing factors. Leaders can gain this understanding by capitalizing on multiple perspectives and varied sources of knowledge. Intelligence knowledge generated as part of the intelligence process contributes to contextual understanding of the operational environment. (See *FM 2-0*.) Design encourages the commander and staff to seek and address complexity before attempting to impose simplicity.

Solve the Right Problem

3-26. Commanders use design to ensure they are solving the right problem. When commanders use design, they closely examine the symptoms, the underlying tensions, and the root causes of conflict in the operational environment. From this perspective, they can identify the fundamental problem with greater clarity and consider more accurately how to solve it. Design is essential to ensuring

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commanders identify the right problem to solve. Effective application of design is the difference between solving a problem right and solving the right problem.

Adapt to Dynamic Conditions

3-27. Innovation and adaptation lead to capitalizing on opportunities by quickly recognizing and exploiting actions that work well while dismissing those that do not. Adaptation does not rely on being able to anticipate every challenge. Instead, it uses continuous assessment to determine what works and what does not. Adaptation occurs through the crucial process of assessment and subsequent changes in how one approaches problems. In the military domain, adaptation demands clearly articulated measures of effectiveness. These measures define success and failure along with after action reviews that capture and implement lessons at all echelons.

3-28. Effective use of design improves the ability to adapt. Adaptation in this sense involves reframing the situation to align with new information and experiences that challenge existing understanding. Through framing and reframing achieved through iterative collaboration and dialog, design provides a foundation for organizational learning and contributes to the necessary clarity of vision required by successful commanders.

Achieve the Designated Goals

3-29. If the link between strategy and tactics is clear, the likelihood that tactical actions will translate into strategic success increases significantly. For complex, ill-structured problems, integrating and synchronizing operations to link sequences of tactical actions to achieve a strategic aim may prove elusive. Through design, commanders employ operational art to cement the link between strategic objectives and tactical action ensuring that all tactical actions will produce conditions that ultimately define the desired end state. As understanding of the operational environment and problem improves, design adapts to strengthen the link between strategy and tactics, promoting operational coherence, unity of effort, and strategic success.

LEADING DESIGN

3-30. Commanders are the central figure in design. Generally, the more complex a situation is, the more important the commander's

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role is in design. Commanders draw on design to overcome the challenges of complexity. They foster iterative collaboration and dialog while leveraging their collective knowledge, experience, judgment, and intuition to generate a clearer understanding of the conditions needed to achieve success. Design supports and reinforces the application of battle command, supporting the commander's ability to understand and visualize the operational environment.

3-31. The practice of design is not exclusive to a particular level of command. Design can apply to all levels, depending on the context and circumstances. However, given the complexity of the operational environment, the need for design at lower echelons often increases as brigades and battalions contend with the challenges of shaping environments and conducting operations over extended periods.

3-32. In leading design, commanders typically draw from a select group within the planning staff, red team members, and subject matter experts internal and external to the headquarters. The commander selects these individuals based on their expertise relative to the problem. The commander expects these individuals to gain insights and inputs from areas beyond their particular expertise—either in person or through reachback—to frame the problem more fully. Design serves to establish the context for guidance and orders. By using members of the planning staff to participate in the design effort, commanders ensure continuity between design and detailed planning as well as throughout the operations process. These are purpose-built, problem-centric teams, and the commander may choose to dissolve them once they complete the design effort.

3-33. Commanders compare similarities of their current situations with their own experiences or history and the design team's experiences or history to distinguish unique features that require novel, innovative, or adaptive solutions. They understand that each situation requires a solution tailored to the context of the problem. Design provides an approach for leading innovative, adaptive efforts from which to effectively act on and efficiently solve a complex, ill-structured problem. It fosters thinking and interacting as commanders develop approaches to resolve the differences between the current conditions and desired conditions of the environment through the conduct of full spectrum operations.

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3-34. Commanders leverage design to create and exploit opportunity, not just to ward off the risk of failure. Design provides the means to convert intellectual power into combat power. A creative design tailored to a unique operational environment promises—

- Economy of effort.
- Greater coherence across rotations among units and between successive operations.
- Better integration and coordination among the instruments of national power.
- Fewer unintended consequences.
- Effective adaptation once the situation changes.

3-35. Design requires the commander to lead adaptive, innovative efforts to leverage collaboration and dialog to identify and solve complex, ill-structured problems. To that end, the commander must lead organizational learning and develop methods to determine if reframing is necessary during the course of an operation. This requires continuous assessment, evaluation, and reflection that challenge understanding of the existing problem and the relevance of actions addressing that problem.

DESIGN METHODOLOGY

3-36. Three distinct elements collectively produce a design concept as depicted in figure 3-1. Together, they constitute an organizational learning methodology that corresponds to three basic questions that must be answered to produce an actionable design concept to guide detailed planning:

- Framing the operational environment—what is the context in which design will be applied?
- Framing the problem—what problem is the design intended to solve?
- Considering operational approaches—what broad, general approach will solve the problem?

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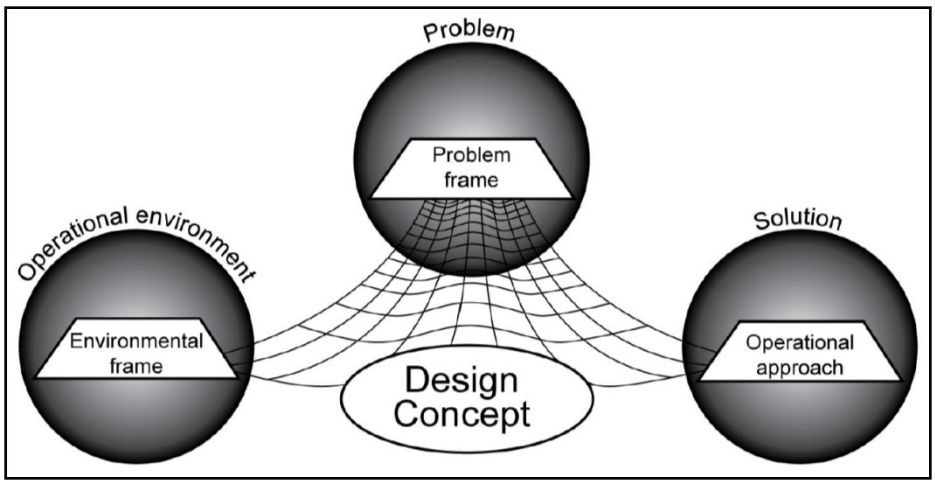

FIGURE 3-1. THE DESIGN METHODOLOGY

3-37. During design, the commander and staff consider the conditions, circumstances, and factors that affect the use of capabilities and resources as well as bear on decisionmaking. As an organizational learning methodology, design fosters collaboration and dialog as commanders and staffs formulate conditions that define a desired end state and develop approaches that aim to achieve those conditions. When initial efforts do not achieve a thorough enough understanding of behaviors or events, commanders reframe their understanding of the operational environment and problem. This cycle of inquiry, contextual understanding, and synthesis relies on continuous collaboration and dialog. Collaboration—especially with joint, interagency, intergovernmental, and multinational partners—is fundamental to success. Collaboration affords commanders opportunities to revise their understanding or approaches so they can execute feasible, acceptable, and suitable approaches to achieve desired conditions or objectives.

3-38. Design is essentially nonlinear. It flows back and forth between environmental framing and problem framing while considering several operational approaches. No hard lines separate the efforts of each design element. When an idea or issue is raised, the commander can address it in the appropriate element, even if the idea or issue is outside the current focus. The change in emphasis shifts from focusing on understanding the tendencies and potentials of actors in the operational environment, to understanding how they relate to and affect the problem, to understanding their likely contributions toward transforming

existing conditions to a desired end state. As commanders and staffs gain new knowledge or begin a new line of questioning, they often shift their focus among elements of design while building understanding and refining potential operational approaches to solve the problem.

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FRAMING THE OPERATIONAL ENVIRONMENT

3-39. Framing involves selecting, organizing, interpreting, and making sense of a complex reality to provide guideposts for analyzing, understanding, and acting. Framing facilitates hypothesizing, or modeling, that scopes the part of the operational environment or problem under consideration. Framing provides a perspective from which commanders can understand and act on a complex, ill-structured problem.

3-40. In understanding the operational environment, the commander and staff focus on defining, analyzing, and synthesizing the characteristics of the operational variables. They do so in the context of the dynamic interactions and relationships among and between relevant operational variables and actors in the operational environment. Often, learning about the nature of the situation helps them to understand the groupings, relationships, or interactions among relevant actors and operational variables. This learning typically involves analysis of the operational variables while examining the dynamic interaction and relationships among the myriad other factors in the operational environment.

3-41. Understanding the operational environment begins with analyzing the context of the situation in accordance with guidance and direction from a higher authority. This fosters learning while generating an increased understanding of the operational environment. Commanders and their staffs review relevant directives, documents, data, previous guidance, and missions. Commanders inform their higher authority of new information or differences in initial understanding of the operational environment. Commanders also confirm the desired end state, if provided by the higher authority, or propose their own. For the commander, this knowledge clarifies the higher authority's perspective of the operational environment.

3-42. To achieve a shared understanding of higher directives and policy, the commander and staff—

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- Clarify the reasons and expectations to change existing conditions.
- Compare current or new instructions with other standing guidance or policies.
- Identify and resolve conflicting guidance with known facts.
- Assess feasibility, acceptability, and suitability of any directed action for achieving the desired end state.

3-43. Commanders apply critical thinking to every aspect of this analysis. Critical thinking leads to a deeper appreciation of the higher commander's intent and helps to refine the higher commander's understanding of the operational environment. This is an essential step to gain a shared understanding of the situation. The environmental frame depicts the current state of the operational environment. Based on higher guidance, it also defines the desired conditions that constitute a desired end state by examining the tendencies and potentials of relevant actors and operational variables.

Environmental Frame

3-44. The commander and staff develop a contextual understanding of the situation by framing the operational environment. The environmental frame is a narrative and graphic description that captures the history, culture, current state, and future goals of relevant actors in the operational environment. The environmental frame describes the context of the operational environment—how the context developed (historical and cultural perspective), how the context currently exists (current conditions), and how the context could trend in the future (future conditions or desired end state). The environmental frame enables commanders to forecast future events and the effects of potential actions in the operational environment. The environmental frame explains the actors and relationships within a system and surfaces assumptions to allow for more rapid adaptation. The environmental frame evolves through continuous learning but scopes aspects of the operational environment relevant to higher guidance and situations.

3-45. Within the environmental frame, commanders review existing guidance, articulate existing conditions, determine the desired end state and supporting conditions, and identify relationships and interactions among relevant operational variables and actors. They analyze groupings of actors that exert significant influence in the operational environment knowing that individual actors rarely share common goals. By identifying and

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evaluating tendencies and potentials of relevant actor interactions and relationships, commanders and their staffs formulate a desired end state that accounts for the context of the operational environment and higher directives.

End State and Conditions

3-46. The desired end state consists of those desired conditions that, if achieved, meet the objectives of policy, orders, guidance, and directives issued to the commander. A condition is a reflection of the existing state of the operational environment. Thus, a desired condition is a sought-after future state of the operational environment. Commanders explicitly describe the desired conditions and end state for every operation. This description provides the necessary integration between tactical tasks and the conditions that define the end state.

3-47. Time is a significant consideration when developing the desired end state. How time relates to the desired end state heavily influences not only the expectations of higher authorities but also how commanders use forces and capabilities to achieve desired conditions. Staffs exercise diligence throughout design to account for the expected time required to achieve the desired conditions. They also qualify whether the desired conditions are intended to be lasting or transient in nature. This temporal dimension is essential to developing effective operational approaches. It impacts the feasibility, acceptability, suitability, and completeness of any resulting plan.

3-48. The characteristics and factors of conditions vary. Conditions may be tangible or intangible. They may be military or nonmilitary. They may focus on physical or psychological factors. They may describe or relate to perceptions, levels of comprehension, cohesion among groups, or relationships between organizations or individuals. When describing conditions that constitute a desired end state, the commander considers their relevance to higher policy, orders, guidance, or directives. Since every operation focuses on a clearly defined, decisive, and attainable end state, success hinges on accurately describing those conditions. These conditions form the basis for decisions that ensure operations progress consistently toward the desired end state.

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Relevant Actors

3-49. Commanders use the environmental frame to understand and explain behaviors of relevant actors in the operational environment. An actor is an individual or group within a social network who acts to advance personal interests. Relevant actors may include states and governments; multinational actors such as coalitions; and regional groupings, alliances, terrorist networks, criminal organizations, and cartels. They may also include multinational and international corporations, nongovernmental organizations, and other actors able to influence the situation either through, or in spite of, the appropriate civil, religious, or military authority.

3-50. A diagram illustrating relevant actor relationships is a valuable tool for understanding and visualizing the operational environment. However, such diagrams may become so complicated for more complex situations that they impart only limited insight and inhibit critical and creative thought when viewed in isolation. The environmental frame's narrative captures a more detailed understanding of the relevant actors and their interactions and relationships. Often relationships among actors are multifaceted and differ depending on the scale of interaction and their temporal aspects (history, duration, type, and frequency). Clarifying the relationships among actors requires intense effort since relationships must be examined from multiple perspectives. Commanders can also depict relationships by identifying and categorizing their unique characteristics.

Tendencies and Potentials

3-51. In developing understanding of the interactions and relationships of relevant actors in the operational environment, commanders and staffs consider natural tendencies and potentials in their analyses. Tendencies reflect the inclination to think or behave in a certain manner. Tendencies are not considered deterministic but as models describing the thoughts or behaviors of relevant actors. Tendencies identify the likely pattern of relationships between the actors without external influence. Once identified, commanders and staffs evaluate the potential of these tendencies to manifest within the operational environment. Potential is the inherent ability or capacity for the growth or development of a specific interaction or relationship. Not all interactions and relationships support achieving the desired end state. The desired end state accounts for tendencies and potentials

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that exist among the relevant actors or other aspects of the operational variables in the environmental frame.

FRAMING THE PROBLEM

3-52. Problem framing involves understanding and isolating the root causes of conflict—defining the essence of a complex, ill-structured problem. Problem framing begins with refining the evaluation of tendencies and potentials and identifying tensions among the existing conditions and the desired end state. It articulates how the operational variables can be expected to resist or facilitate transformation and how environmental inertia can be leveraged to ensure the desired conditions are achieved. The staff relies on text and graphics to articulate the problem frame.

The Problem Frame

3-53. The problem frame is a refinement of the environmental frame that defines, in text and graphics, the areas for action that will transform existing conditions toward the desired end state. The problem frame extends beyond analyzing interactions and relationships in the operational environment. It identifies areas of tension and competition—as well as opportunities and challenges—that commanders must address so to transform current conditions to achieve the desired end state. Tension is the resistance or friction among and between actors. The commander and staff identify the tension by analyzing the relevant actors' tendencies and potentials within the context of the operational environment.

3-54. The commander and staff challenge their hypotheses and models to identify motivations and agendas among the relevant actors. They identify factors that influence these motivations and agendas. The commander and staff evaluate tendencies, potentials, trends, and tensions that influence the interactions among social, cultural, and ideological forces. These may include political, social, or cultural dispositions in one group that may hinder collaboration with another group.

3-55. In the problem frame, analysis identifies the positive, neutral, and negative implications of tensions in the operational environment given the differences between existing and desired conditions. When the commander and staff take action within the operational environment, they may exacerbate latent tensions. Tensions can be exploited to drive change, so they are vital to

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transforming existing conditions. If left unchecked, other tensions may undermine transformation and must be addressed appropriately. Because tensions arise from differences in perceptions, goals, and capabilities among relevant actors, they are inherently problematic and can both foster and impede transformation. By deciding how to address these tensions, the commander identifies the problem that the design will ultimately solve.

Identifying the Problem

3-56. A concise problem statement clearly defines the problem or problem set to solve. It considers how tension and competition affect the operational environment by identifying how to transform the current conditions to the desired end state—before adversaries begin to transform current conditions to their desired end state. The statement broadly describes the requirements for transformation, anticipating changes in the operational environment while identifying critical transitions. The problem statement accounts for the time and space relationships inherent in the problem frame.

CONSIDERING OPERATIONAL APPROACHES

3-57. Considering operational approaches to the problem provides focus and sets boundaries for the selection of possible actions that together lead to achieving the desired end state. The staff synthesizes and reduces much of the information and products created during the design to create the design concept and a shared understanding of a rationale behind it. The staff converges on the types and patterns of actions determining how they will achieve the desired conditions by creating a conceptual framework linking desired conditions to potential actions. The entire staff considers how to orchestrate actions to solve the problem in accordance with an operational approach.

The Operational Approach

3-58. The *operational approach* is a broad conceptualization of the general actions that will produce the conditions that define the desired end state. In developing the operational approach, commanders consider the direct or indirect nature of interaction with relevant actors and operational variables in the operational environment. As commanders consider various approaches, they evaluate the types of defeat or stability mechanisms that may lead

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to conditions that define the desired end state. Thus, the operational approach enables commanders to begin visualizing and describing possible combinations of actions to reach the desired end state given the tensions identified in the environmental and problem frames. As courses of action are developed during detailed planning, the operational approach provides the logic that underpins the unique combinations of tasks required to achieve the desired end state.

3-59. One method to depict the operational approach is by using lines of effort that provide a graphic to articulate the link among tasks, objectives, conditions, and the desired end state. (See appendix B [in *FM 5-0*] for more detailed guidance on developing lines of effort.) Design offers the latitude to portray the operational approach in a manner that best communicates its vision and structure. Ultimately, the commander determines the optimal method to articulate the operational approach. However, it is important that narratives accompany lines of effort to ensure Soldiers understand the operational approach.

Operational Initiative

3-60. In developing an operational approach, the commander and staff consider how potential actions will enable the force to maintain the operational initiative. The *operational initiative* is the setting or dictating the terms of action throughout an operation (*FM 3-0*). The staff evaluates what combination of actions might derail opposing actors from achieving their goals while reinforcing their own desired end state. This entails evaluating an action's potential risks and the relevant actors' freedom of action. By identifying the possible emergence of unintended consequences or threats, commanders consider exploitable opportunities to create effects that reinforce the desired end state. The staff explores the risks and opportunities of action by considering exploitable tensions. This includes identifying capabilities and vulnerabilities of the actors who oppose the desired end state. The commander and staff can then formulate methods to neutralize those capabilities and exploit such vulnerabilities.

Resources and Risks

3-61. When creating the broad recommendations for action, the commander and staff consider resources and risks. The staff provides an initial estimate of the resources required for each recommended action in the design concept. Rarely does one

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organization directly control all the necessary resources. However, to create lasting changes in conditions, the effort may require substantial resources. Creative and efficient approaches can greatly amplify the limited resources directly controlled by the commander. Detailed planning determines the exact resources required.

3-62. The initial planning guidance addresses risk. It explains the acceptable level of risk to seize, retain, or exploit the initiative and broadly outlines risk mitigation measures. Planners identify and consider risks throughout the iterative application of design. Collaboration, coordination, and cooperation among multinational military and civilian partners are essential to mitigating risk, conserving resources, and achieving unity of effort. These are easier to achieve if military and civilian partners participate in design from the outset to build trust and confidence in the effort and one another.

FORGING THE DESIGN CONCEPT

3-63. The design concept is the link between design and detailed planning. It 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. The design concept is the proper output of design, conveyed in text and graphics, which informs detailed planning. It is articulated to the planning staff through the—

- Problem statement.
- Initial commander's intent.
- Commander's initial planning guidance.
- Mission narrative.
- Other products created during design.

3-64. Products created during design include the text and graphics of the operational environment and problem. Diagrams representing relationships between relevant actors convey understanding to the planning staff. The problem statement generated during problem framing communicates the commander's understanding of the problem or problem set upon which the organization will act.

3-65. The initial commander's intent and planning guidance visualize and describe the desired end state along with implications

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for further planning. The design concept organizes desired conditions and the combinations of potential actions in time, space, and purpose that link the desired end state to the conduct of full spectrum operations. The planning guidance orients the focus of operations, linking desired conditions to potential combinations of actions the force may employ to achieve them. Other information provided in the initial planning guidance includes—

- Information integration.
- Resources.
- Risk.

3-66. The *mission narrative* is the expression of the operational approach for a specified mission. It describes the intended effects for the mission, including the conditions that define the desired end state. The mission narrative represents the articulation, or description, of the commander's visualization for a specified mission and forms the basis for the concept of operations developed during detailed planning. An explicit reflection of the commander's logic, it is used to inform and educate the various relevant partners whose perceptions, attitudes, beliefs, and behaviors are pertinent to the operation. It also informs development of supporting information themes and messages for the mission and serves as a vital tool for integrating information engagement tasks with other activities during execution.

3-67. In applying design, the commander and staff may draw on the elements of operational design relevant to the situation. (See *FM 3-0*) The design concept promotes mutual understanding and unity of effort throughout the echelons and partner organizations. Thus, the design concept is the rationale linking design to detailed planning. From the design concept, planners determine how to apply forces and capabilities to achieve the desired end state.

REFRAMING

3-68. Reframing is a shift in understanding that leads to a new perspective on the problems or their resolution. Reframing involves significantly refining or discarding the hypotheses or models that form the basis of the design concept. At any time during the operations process, the decision to reframe can stem from significant changes to understanding, the conditions of the operational environment, or the end state. Reframing allows the commander and staff to make adjustments throughout the

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operations process, ensuring that tactical actions remain fundamentally linked to achieving the desired conditions. Commanders must retain this versatility and agility while exercising battle command.

3-69. Because the current operational environment is always changing and evolving, the problem frame must also evolve. Recognizing when an operation—or planning—is not progressing as envisioned or must be reconsidered provides the impetus for reframing in design. Reframing criteria should support the commander's ability to understand, learn, and adapt—and cue commanders to rethink their understanding of the operational environment, and hence rethink how to solve the problem. Generally, reframing is triggered in three ways: a major event causes a —catastrophic change in the operational environment, a scheduled periodic review shows a problem, or an assessment and reflection challenges understanding of the existing problem and the relevance of the operational approach.

3-70. During operations, commanders decide to reframe after realizing the desired conditions have changed, are not achievable, or cannot be attained through the current operational approach. Reframing provides the freedom to operate beyond the limits of any single perspective. Conditions will change during execution, and such change is expected because forces interact within the operational environment. Recognizing and anticipating these changes is fundamental to design and essential to an organization's ability to learn.

3-71. Reframing is equally important in the wake of success. By its very nature, success transforms the operational environment, creating unforeseen opportunities to exploit the initiative. Organizations are strongly motivated to reflect and reframe following failure, but they tend to neglect reflection and reframing following successful actions.

4. LEADING THE REFLECTIVE PRACTICE OF DESIGN

Officers who find themselves in charge of a design group frequently experience a series of challenges, often in a similar sequence. This chapter offers advice for a functional approach to working your way through these challenges, with specific guidance on how to lead your way to success. Although specifically focused on the leadership challenges expected of AMSP graduates, this chapter can also be used as both an *aide memoire* for the design team leaders and as a forum for professional development of the junior members of the team.[302] **The most significant challenges are in two different areas – intellectual (cognitive) challenges and organizational (social creation) challenges.** The intellectual challenges include leading learning, then leading innovation – the creation of novel ideas. Perhaps the most difficult of the intellectual challenges is to lead the design of the social creation throughout an organization, and its coalition of actors, necessary for effective design and its implementation. The organizational problems include coaching iterative work amongst all three design spaces, sorting out how best to integrate the design understanding, including the use of assessment, with the other elements of the staff, subordinate and senior organizations – the operationalization of design. Above all, the design team leader must maintain intellectual and social adaptability and be able to lead reframing. [303]

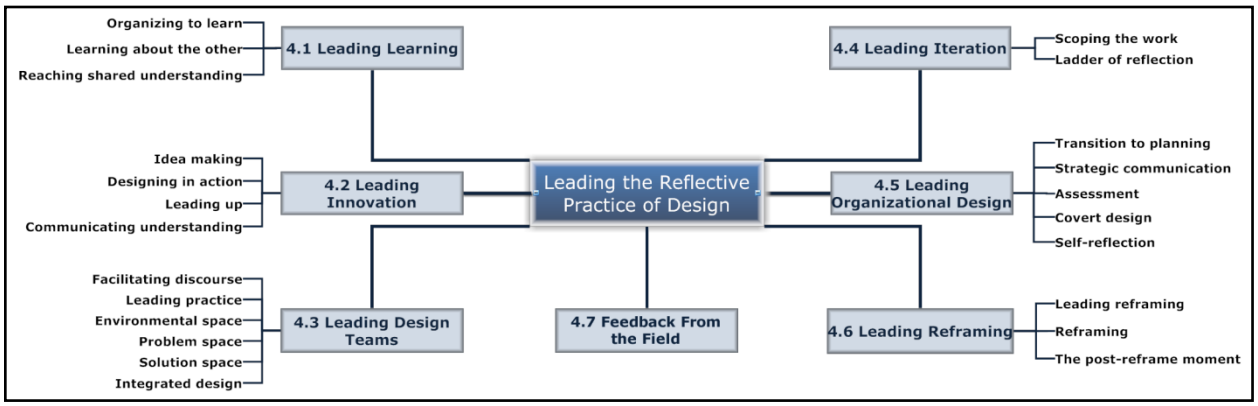

FIGURE 12. MIND MAP FOR CHAPTER 4.

4.1. LEADING LEARNING

[302] The techniques in this chapter are drawn from doctrine and from three of the basic texts used in the design course at SAMS. The doctrine includes United States, *FM 5-0, The Operations Process*. The reader is also referred to the out of date United States, *FMI 5-2, Design (Draft)* dated 20 February, 2009 for further ideas, especially terms useful in environmental and problem framing. The design texts are Lawson, *How Designers Think*; Schön, *Educating the Reflective Practitioner*; and Gharajedaghi, *Systems Thinking*.

[303] Reference will be made to two student monographs from SAMS. The first, useful primarily as a source of helpful terminology is Hayward, "Planning Beyond Tactics." The second, useful for ideas of how to execute design as a cognitive tool is Colonel John Marr's "Learning Over Time: Using Rapid Prototyping, Generative Analysis, Experts and Reduction of Scope to Operationalize Design," (Monograph, School of Advanced Military Studies, U.S. Army Command and General Staff College, 2010).

...the Army's approach to design needs to consider that the concepts behind [it] are more important than the specific design methodology itself. The Army design approach should focus on teaching concepts such as Gharajedaghi's systems and iterative thinking, Jullien's propensity and potential, Bar Yam's competition and cooperation, and White's discourse and narrative.

—Major Rick Finfera

The first challenge is how to open the minds of the team members to the intellectual, emotional and moral challenges of thinking critically about complex issues. The design team leader assists environmental understanding, innovation, adaptation, and solution creation through an approach using the three cognitive spaces of design. Following Peter Peverelli, we define a cognitive space as "an association of any number of actors bound by a certain shared cognitive element."[304] A cognitive space has a social element and a cognitive element. Cognitive spaces trigger organizing processes. In design, the environmental space, problem space, and solution space are three cognitive spaces that help to organize information about the environment, the problem, and the solution. The cognitive spaces will be used continually throughout this chapter to structure the design inquiry. However, they are also discussed in detail in Sections 4.3.3 – 4.3.5.

The first space, and the place most design teams start, is the understanding of the context, the environment. The second space is to sort through the statement of the problem, and the final space is to propose iterative solution steps. However, these spaces are not independent. **True, deep understanding of a complex situation requires near-simultaneous movement in all three spaces.**[305] The challenge of organizing this work is for the leader to stimulate ideas while protecting the team from both outside interference and internal dissension.

One of the greatest challenges for the team leader is to manage the tension between the design team's need for time and the commander's desire to initiate action quickly. Action without a preliminary understanding of the environment can waste resources or stimulate unforeseen and unwanted reactions. **One technique to alleviate this conflict between the commander's desire to act and design team's need to reflect is to generate sensing or learning actions – blue acts designed to learn about the environment, rather than to immediately achieve the desired conditions.** This type of action must be carefully considered by the team leader before they are recommended to the commander, but their judicious use is important to both creating understanding and providing a form of action for the commander and the larger organization[306] (see also Sections 4.2.2 and 4.5). This section has three parts – organizing the team for effective learning, approaches to

[304] Peter J. Peverelli, *Creating Corporate Space: In Search of Chinese Corporate Identity*, Serie research memoranda, 2004-20 (Amsterdam: Vrije Universiteit, 2004).

[305] Schön, *Educating the Reflective Practitioner*, 163ff.

[306] Marr, "Learning Over Time," 30.

learning about the other in the environment, and techniques for creating common shared understanding.

There are several general techniques for stimulating learning. Team leaders should encourage holistic thinking among the designers. It may be useful to organize some of the work into three areas of exploration – asking what is the structure of the environment, what are the functions of nodes and agents, and what are the purpose of actors, agents, and organizations.[307] Organizing the asking of questions around these three larger questions will stimulate ideas and inquiry.

Helpful to the encouragement of learning within the team is the expressing the challenge facing the team as an instrumental problem. By this, we mean that the problem should simultaneously be seen as fundamental and concrete – the problem can be manipulated through praxis. When the team leader discusses the path forward inside the design approach, it is couched in terms of a practical, executable set of actions with foreseeable (if not predictable) results.[308] The very specific nature of actionable outcome from design, the practical nature of the challenge, is a great stimulant to learning. The team leader must carefully, and frequently, point out to the design team that specific outcomes are required – generic, formless discussion without substantive outcome can be a waste of effort.

Another method for organizing the learning is to think operationally – asking what are the dynamic behaviors, and then asking how they can be mapped during the inquiry.[309] The actual nature of a problem, the concept that there is something in the environment contrary to the desires of the national policy or regional strategy, is helpful for the design team leader, who can use this discomfort, or tension between the current and the desired set of conditions to harness the creativity of the design team, as explained next.

Schön outlined three issues for designers as they approach learning how to learn. For him, the single key to effective learning is to embrace the complex challenge confronting the team as a stimulating issue. In other words, the very complexity of the environment, the very nature of its intellectual challenge, if accepted by the team and not denied, will be the greatest single stimulator of learning. Another helpful challenge is the substantive nature of the problem. Understanding that the problem has concrete knowable factors, a difficult transition from the current state to a future state, and the need to have an operationalizable way forward as an outcome of the design approach is also an effective stimulator of learning. Finally for Schön, the very need to operationalize the design outcome as specific forms of action, as concrete things, is an exceedingly effective tool for learning.[310] Key to using these three characteristics to stimulate thinking is to avoid denial

[307] Gharajedaghi, *Systems Thinking,* 108ff.

[308] Schön, *Educating the Reflective Practitioner*, 33.

[309] Gharajedaghi, *Systems Thinking,* 114ff.

[310] Schön, *Educating the Reflective Practitioner*, 163ff.

of them, to encourage the team to embrace the difficult intellectual challenge of the design tasks, and to involve those who enjoy intellectual challenges.

4.1.1. ORGANIZING TO LEARN

In theaters like Afghanistan where other agency elements are crucial to mission success, personnel outside of the JFC staff must be integrated into the design process. Failure to include other government and even NGO actors in the design process results in an incomplete or even inaccurate final design deliverable.

—Tim Cunningham, AMSP Officer

The design team leader allows his team to move in and out of the three cognitive spaces of design, with clear intent, careful appraisal of outcomes achieved, and a disciplined yet flexible approach.[311] While moving amongst the spaces, the team leader carefully creates a free learning environment, encouraging all team members to engage in discussion, maintaining a low-risk atmosphere[312] (see Sections 4.2.2.1 and 4.4.2). Divergence in opinion is encouraged and is essential for the creation of new ideas. **Regulating movement between the three spaces requires meta-cognitive awareness – thinking about the way the team is thinking.** The six thinking hats method in Appendix B offers one framework for doing this. So-called "blue hat thinking" requires the design team to jointly engage in meta-thinking and meta-questioning – questioning the current line of questioning.

The team leader must, at all costs, establish and maintain an atmosphere of trust within the design team.[313] To facilitate trust, the leader should encourage comments from all, restricting the discussion in terms of outcome needed, but not in terms of individual restrictions. One form of control of the discussion in the team is to establish shared rules and conventions inside the team (see 4.2.2).

To be effective, design must be a team effort. The team leader must encourage wide engagement amongst all members of the team, and should avoid over-reliance on individuals, especially his or her own ideas. The team leader is both an active facilitator of the team and of the process – he watches and engages individuals on the team to produce creative thought while skillfully monitoring and orchestrating where the inquiry is going.[314] The design team leader is responsible for recognizing when the team has achieved synthesis, and guide the evaluation of new creations. The team leader must be strong and secure enough to be practically invisible to the design inquiry while maintaining control

[311] For a discussion of the three cognitive spaces, see *FMI 5-2*, 13. For a very brief discussion, see United States, *FM 5-0,* paragraphs 3-36 through 3-38.

[312] Schön, *Educating the Reflective Practitioner*, 17.

[313] Schön, *Educating the Reflective Practitioner*, 163ff.

[314] Lawson, *How Designers Think*, 235, 237.

over the design timeline and the resulting products. The following quote, attributed to Lao-tzu, who is regarded as the founder of Taoism, shows the enduring significance of this ideal.

> To lead people, walk beside them … As for the best leaders, the people do not notice their existence. The next best, the people honor and praise. The next, the people fear; and the next, the people hate… When the best leader's work is done the people say, 'We did it ourselves!'

Rick Swain, who has frequently mentored SAMS students during design practica, provides keen insight and practical advice into how to organize design team learning.

> To lead collaborative learning in design teams, a commander must do three things. First, he or she must make it clear that disagreement is invited, indeed considered a duty, for each member of the design group. Second, the commander must demonstrate that this is so by the way he or she responds when his or her understanding is challenged. Finally, it is helpful if the commander, or group leader, remains in the middle distance from the process itself, what Harvard Kennedy School of Business professors Ronald A Heifetz and Marty Linsky call "taking the balcony perspective," giving broad guidance, organizing the learning group, and then standing outside the process of learning and observing how the group works, intervening only by exception as the learning process unfolds…
>
> There are two major parts of the design learning process. One is a research effort—seeking information from whatever sources are available. The second part involves evaluating the role that specific information plays in creating a provisional but comprehensive understanding of the situation at hand, teasing meaning from factual data, and accepting that the total available data are always incomplete and subject to revision. While some design proponents believe only the interpretive function matters, it is more logical to believe that more facts, well understood, are more likely to provide the desired, nuanced understanding of the situation than a much smaller number of facts exquisitely tortured for understanding. One of the most important qualities of a design effort is the extent to which it draws on multiple perspectives and sources of expert counsel. On the other hand, the design team must balance the desire for the greatest possible store of data with the need to conduct an adequate cross-examination of the data it already possesses.
>
> The learning process itself must be self-conscious and reflective. The design team must organize its campaign of learning deliberately, in light of what it knows to begin with about the nature of the situation and the commander's requirements. Participants must frequently pull back and take an introspective view of how their approach is working and how well the members are collaborating. Then they must adjust their behavior as required. As new information is developed, new lines of relevant inquiry will suggest themselves, and the team should be reorganized to pursue them by either breaking off an inquiry team or bringing in new experts. Sometimes just reorganizing subgroups will generate new perspectives on stalemated problems. Periodically, the whole team must get together to share its learning and test the findings of one group against the perspectives of others. At the end of the day, time should be reserved to evaluate how the learning process itself is going, identify required information, and develop a plan for continuation the next day. The group should be self-critical, insisting on participation and contribution by all members and on demeanor that respects the person while disagreeing, sometimes intensely, with the

> understanding. Groups progress best that keep a running narrative, employed self-critically to sharpen the logic of group conclusions.[315]

SAMS Seminar 6, academic year 2008-09, emphasized the running textual narrative and organized their design team effectively. Their after-action review recognized the benefits of 'strategy control' to enable cooperative creation, and identified several key design team roles. Seminar 6 borrowed the phrase 'strategy control' from Chris Jones' classic book *Design Methods*, to mean a style of leadership where "the team leader loosely controls the creative methodology through requirements for production."[316] The role of strategy control focused on process rather than content, similar to the role of a facilitator in effective meetings. In Seminar 6, the strategy controller monitored group tensions, looked for dysfunctional behaviors, and reorganized the sub-teams seven times in six weeks to maintain team effectiveness. Other team roles Seminar 6 created to structure their learning included: narrative recorder, systemic designer, contextual work group member, and observer/controller (OC). The narrative recorder writes a running narrative that "captures knowledge; is a tool to achieve shared understanding; is an anchor for further exploration; and either demonstrates completeness of logic, or reveals inconsistencies."[317] The systemic designer role is to sit outside the detailed working groups to focus on the overall system – "to keep the forest in view while studying the trees."[318] A systemic designer asks meta-questions, encourages synthesis, and develops overarching hypotheses that are shared with the research teams. The contextual work group member conducts focused research to fill identified gaps in knowledge. The OC stays in the background, observes and takes notes on the design process, and leads the after-action review.

In his monograph on design team organization, Brad Gill identified seven roles within a design team.[319] They are: designer, designer (liaison officer), Subject Matter Expert (SME), discourse leader, team leader, scribe, and senior leader. The designer conducts research, engages in discourse, develops strategies for action, and reflects on the design activity. The liaison officer, in addition to being a designer, interfaces between the design team and planners or other important external agencies and partners. An SME provides deep knowledge on a relevant topic, but is not a permanent member of the design team. The discourse leader "facilitates group learning and critical thinking as they relate to understanding the system." The team leader has the same responsibilities as the discourse leader, but also manages external interactions. The scribe records and manages all guidance, sources, narratives, graphics, questions, issues and artifacts generated during design. The senior leader initiates the activity and provides guidance. Each role may be played by one or more persons; and one person may perform more than one role. A larger

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[315] Swain, *Fundamentals of Operational Design*, 17.

[316] Bullock, "Engineering Design Theory," 2009.

[317] Seminar 6 AAR Presentation.

[318] Ibid.

[319] Brad Gill, *Enabling Design*, AMSP Monograph, 2009.

design team might be expected to identify more specialized roles than a small design team. However, this is not a necessary condition. Team roles should be structured by the nature of the problem situation, rather than by the size of the team or any other *a priori* factor.

Other seminars structure their learning with similar roles to those considered above, often using simpler terminology. A typical SAMS design team includes at least the following five roles:

- Commander
- Design team leader
- Deputy design team leader
- Recorder
- Observer / Controller.

In addition, almost all SAMS design teams use focused SME injects to augment the knowledge and experience resident within the core design team.

In the social psychology literature, one useful and popular classification of informal small group roles divides members into three groups: those facilitating the accomplishment of a particular task, those of building and maintaining the group, and those which satisfy entirely individual needs.[320]

The first category, task roles, is the set of roles that help to get the job done. The roles have self-explanatory titles, such as initiator/contributor, information seeker, opinion seeker, elaborator, coordinator, energizer, and evaluator/critic. Often, these roles require tough, single-minded individuals to maintain focus on their role. These roles provide the rationale for the group's existence.

The second category, maintenance roles, is the set of roles that maintain the social cohesion of the group. Example roles include supporter/encourager, harmonizer, tension reliever, feeling expresser, and follower. These roles tend to the emotional life of the group, improve the way it works, and consider the needs of individuals. **Not only do maintenance roles improve cohesion, they also open up the channels of communication within the group, which is essential to generating new ideas and shared understanding within design.**

The roles within the last category that satisfy purely individual needs are considered to be dysfunctional, since they disrupt the group and weaken cohesion. Examples of dysfunctional roles include the blocker, who takes a negative stand on all issues, the deserter, withdraws into irrelevant side conversations, and the dominator, who monopolizes the conversation. Awareness of dysfunctional group roles can enable design team members to police their own behavior and avoid destructive patterns of interaction.

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[320] Kenneth D. Benne and Paul Sheats, "Functional Roles of Group Members," *Journal of Social Issues* 4, no. 2 (1948): 41-49.

To create a learning system within design, all team members must pay attention to both the formal and informal roles within the design team. Checkland's soft systems methodology provides a useful framework for identifying and improving the group dynamics within a design team.[321] Using soft systems methodology, it is possible to document formal and informal roles, the associated norms and values, and the politics of how power is distributed. The use of rich pictures and purposeful activity models can identify tensions and surface different worldviews. This gives the design team a better understanding of the current distribution of roles, as well as guiding practical action to improve the group dynamics.

4.1.2. LEARNING ABOUT THE OTHER

It is important to establish the design team's identity early in design inquiry. It is easy to assume that the team implicitly knows the answer to the question "Who are we?" Experience shows that this is often one of the hardest questions to answer beyond the obvious and the superficial. Individual egocentrism and cultural ethnocentrism inhibit gaining the perspective needed to address this question. **Often, the best insights into who we are can be gained by reflecting on who we are not.** What beliefs and behaviors would we most strongly reject? Why? At multiple levels, where do we draw the boundary between us and the other? Why? What does this tell us about our identity, values, and morals? What can we control? What can we influence? What lies outside the boundary of our influence and control? Questions of identity are inextricably linked with questions about the other.

If the challenges of understanding self stem from a lack of perspective, the challenges of learning about the other derive from the difficulty of understanding a different logic. Or as Henrotin and Struye de Swielande phrase it, "we fail to penetrate the rationality of the adversary, never fully understand his *Weltangschauung* [worldview]."[322] If we are to learn about the other in design, then we need to find ways to penetrate rationalities and surface worldviews.

The level at which we choose to distinguish between self and other will have the biggest influence on the understanding that is generated. What levels are appropriate depends mostly on the specific context of the design team and the problem situation. However, it is almost always necessary to ask this question at more than one level based around more than one identity. For example, it may be fruitful to ask about the boundary between self and other at the following levels and their implied perspectives:

- The design team and the rest of the headquarters staff;
- The unit and the U.S. military command;
- The deployed U.S. forces and the supporting / generating force;

[321] Checkland and Poulter, *Learning for Action*.

[322] Henrotin and Struye de Swielande, "Ontological-Cultural Asymmetry," 10.

- The U.S. forces and the U.S. population;
- The U.S. forces and the coalition;
- The coalition and the adversary; and
- The coalition and the population.

There are levels below, above, and between those suggested here that offer other valid perspectives. The point of this list is that because there are always multiple levels and multiple identities, there are multiple ways to define the other. The other is a concept that is much broader than traditional concepts of enemy, although of course the enemy remains an essential consideration in war.

Once the level of inquiry has been selected, the first step is to acknowledge that there is indeed a logic underlying the narratives and actions of the other. Because conflict in general, and war in particular, is bound up in hatred, discourses that demonize the other abound that act as a barrier to learning about the other. The political rhetoric between the U.S. and Iran illustrates demonizing discourse on both sides. Since 1979, the countries have constructed two 'grand images' of evil and irrational actors: Great Satan and the Mad Mullahs.[323] In his analysis of this discourse, William Beeman writes:

> When confronted with individuals whose actions are incomprehensible, the natural human tendency is to assign them to a "residual" category within the culture. "Crazy," "irrational," "evil," "incompetent," "moronic," and "incomprehensible" are just a few of these categorizations.
>
> Of course, the incomprehensible actions of any person or group can be made comprehensible with the right information and conceptual tools for understanding. What seems crazy becomes rational in light of historical circumstance, medical history, cultural practice, or individual motive. One must only search for the correct logical framework among many to give clarity to a murky situation.[324]

The conceptual tools needed to penetrate the rationality of the other are most mature within the discipline of anthropology. In his classic text on anthropology, Clifford Geertz provides an enduring metaphor for the task of understanding the other:

> The concept of culture I espouse… is essentially a semiotic one. Believing, with Max Weber, that man is an animal suspended in webs of significance he himself has spun, I take culture to be those webs, and the analysis of it to be therefore not an experimental science in search of law but an interpretive one in search of meaning.[325]

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[323] William O. Beeman, *The "Great Satan" Vs. the "Mad Mullahs": How the United States and Iran Demonize Each Other* (Chicago, IL: University of Chicago Press, 2008).

[324] Ibid., 69.

[325] Geertz, *The Interpretation of Cultures*, 5.

As a semiotic endeavor, understanding the other requires interpreting the meaning of symbols. Geertz describes this as creating "thick descriptions" of the significance of actions, conversations, and artifacts that comprise the culture of a society or human group.

To rationalize the logic of the other, it is not sufficient to merely highlight superficial differences between cultures. Rather, it is important to explain the underlying dynamics that perpetuate a different rationality. Seminar 5 from SAMS AMSP 2010 captured their understanding of the system of opposition in Afghanistan in the presentation drawing depicted in Figure 13. This depiction applies theoretical concepts from design education to explain the observed patterns of behavior that oppose achievement of the friendly desired system. Theoretical influences for this explanation include Thucydides' trinity of fear, honor and interest; Bar-Yam's multi-level competition and cooperation; Clausewitz's trinity, represented in the center of the Afghan system of control; and Senge's reinforcing feedback loop that perpetuates a cycle of violence.

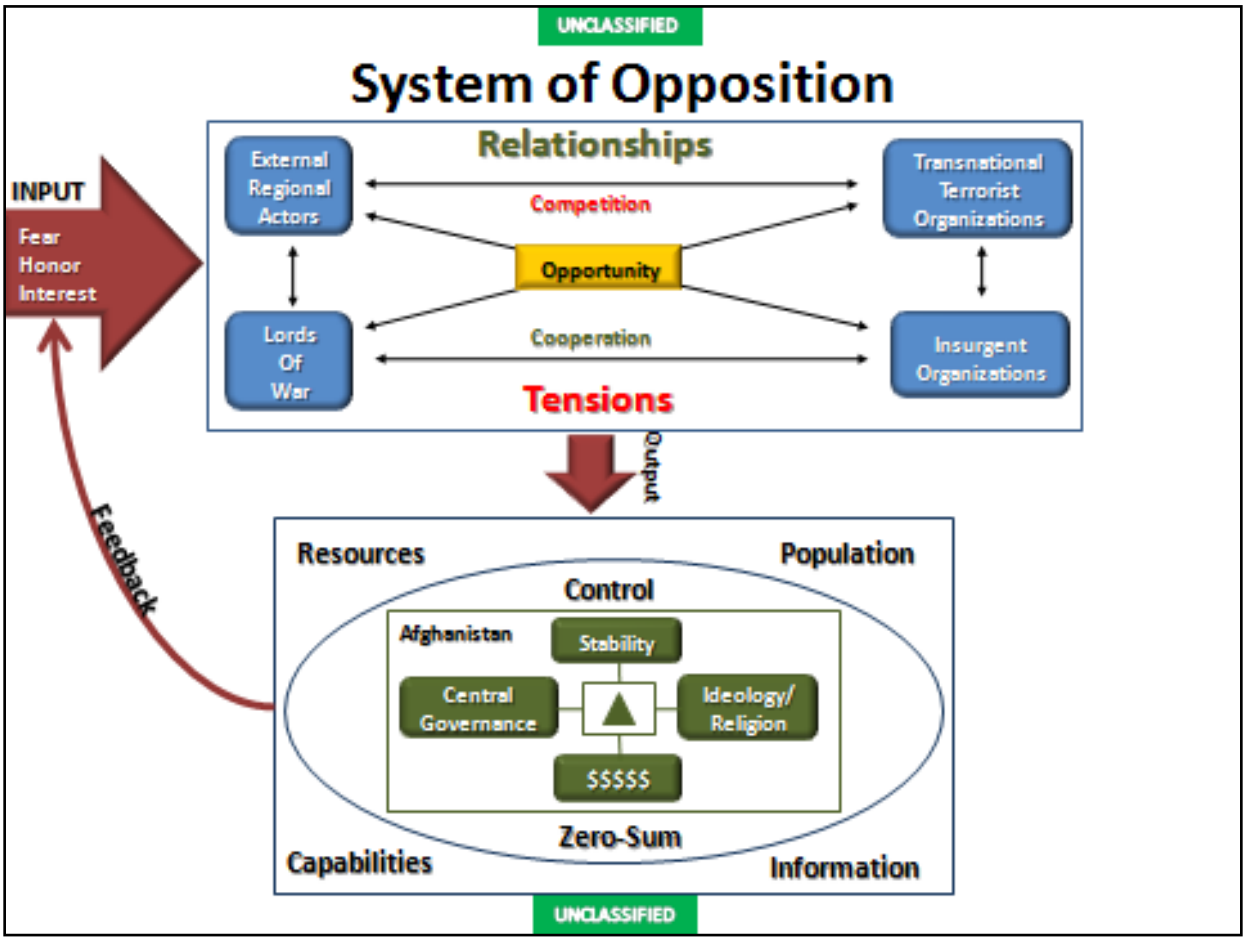

FIGURE 13. SEMINAR 5, SAMS AMSP 2010: MAPPING THE LOGIC OF THE OTHER.

4.1.3. REACHING SHARED UNDERSTANDING

Many see this as a G2 problem... the comment "isn't this already captured in the Annex B?... Don't we already have this information? Somebody in the command knows this!" were frequent. The "monograph/thesis/dissertation example" proved helpful here... I pointed out that most people assembled known knowledge in the "library phase" (analysis). Our next step is to "write the thesis" in the synthesis phase. We're taking known knowns and assembling them to develop new understanding. Surprisingly, most of the group "got that."

—Major Dave McHenry

Teams are not organized as one unitary body, but are organized into factions, re-organized on the fly, and engaged in different pursuits at different times, all at the initiative of the design leader. **Although the goal is a common shared understanding within the team and the larger organization, the team is not monolithic and static.**

Team leaders must be aware of natural factions arising within the team, and then use them skillfully for the benefit of learning and creation.[326] Factions are particularly useful since they generate cognitive competition between groups. These factions should be allowed to prosper, as long as they positively contribute. A faction that begins to be non- or counter-productive must be re-organized to benefit the larger team. Factions, the natural groupings of like-minded individuals, or people with similar agendas, help stimulate wide-ranging discussions. Factions can themselves be stimulated by bringing individuals into the team, who represent specific influential agendas, sub-organizations or stakeholders.

Often, the team leader will choose to divide the team into small groups, and then progressively combing groups until the whole design team is together. In 2010, Seminar 5 used this to great effect during their environmental frame. The OC presented the slide in Figure 14 during their AAR. Initially, small teams and individuals were given specialized topics to "deep dive" on. Team members were differently enabled by the different knowledge they gained from individual research. The teams were then reorganized into groups of three or four individuals to look at the same situation through three different filters: enemy, friendly, and population perspectives. Next, the Seminar split into two teams who were given exactly the same task in parallel, to map the current and desired systems. Finally, the group synthesized the ideas generated by the parallel efforts to produce their environmental frame. The Seminar found that this was effective in transforming deep individual understanding into shared team understanding. They also noticed that as they formed into larger groups, their products became simpler, which helped the transition from design sketches to presentation sketches (see below).

[326] Lawson, *How Designers Think*, 238.

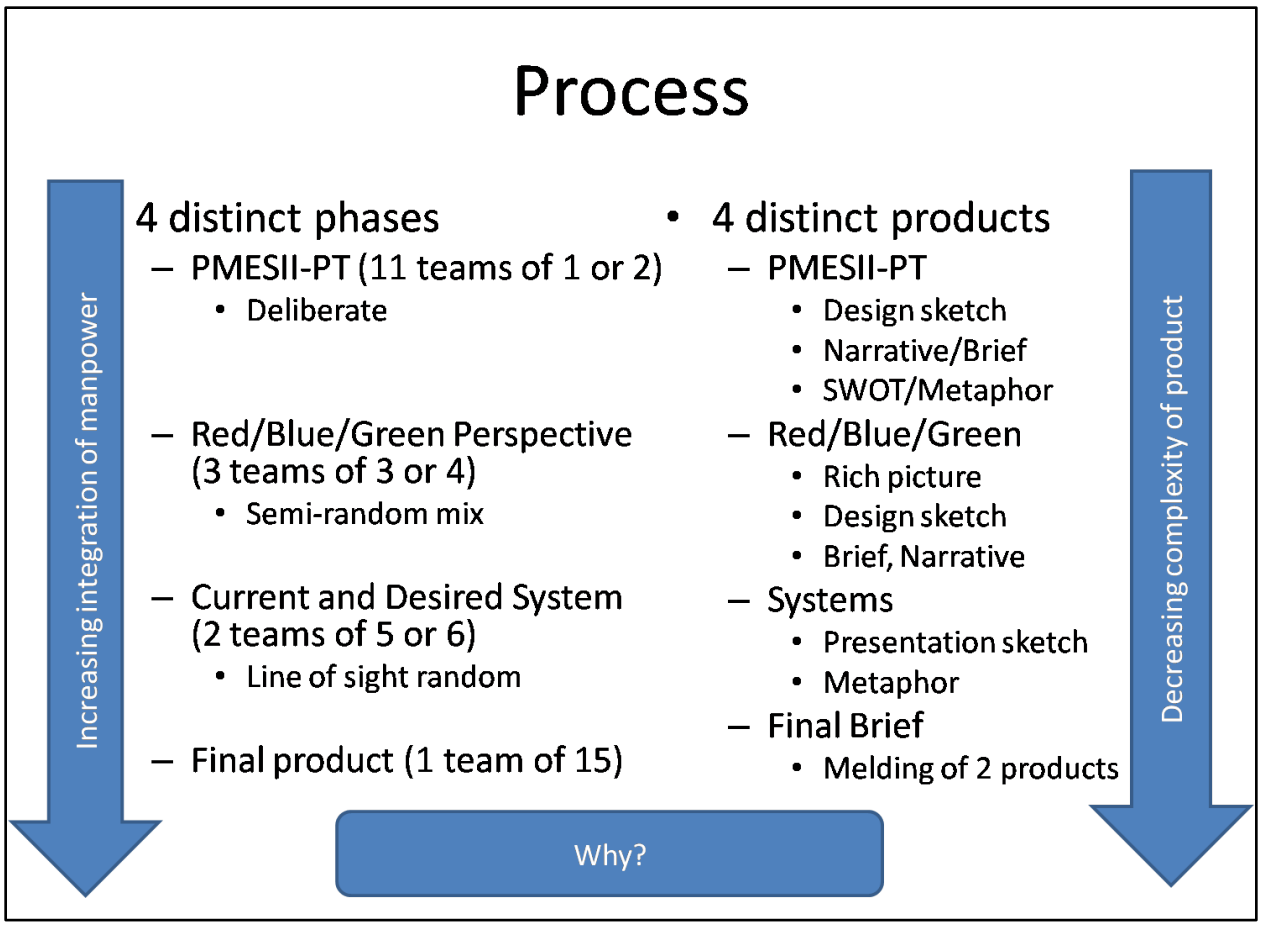

FIGURE 14. SEMINAR 5 SAMS AMSP 2010:
AAR COMMENTS ON MOVING FROM SMALL TEAMS TO LARGE TEAMS.

Leading a particular organized approach to thinking can also be helpful. Taking an idea from Gharajedaghi, the team can approach developing understanding through holistic thinking.[327] **Holistic thinking, according to Gharajedaghi, consists of four aspects: structure, function, process, and context/purpose.** These four aspects of a system are considered iteratively, with a pause for reflection and learning after every cycle. Since structures exist to perform different functions, there is a link between function and structure. There is also a link between structure, function, and process in any system. Assessing the context, or purpose of activity will generally provide a synthesis of the other three elements. However, the critical point is to evaluate these four entities, then reflect on what you have learned about the entire system through the assessment. This process then continues for as much time as you have available, in a cyclic and iterative fashion.

Lawson points out, quite correctly, that the design team leader must not lose the rapport with and within the team.[328] Effective design cannot be accomplished if the team fails to

[327] Gharajedaghi, *Systems Thinking*, 108ff.

[328] Lawson, *How Designers Think*, 240.

work together as a professional group. The team leader must make every effort to lead the team with a positive and professional attitude despite the inevitable stress of the environment.

Arguably one of the best techniques for stimulating shared understanding is the construction of organized and purposeful discourse. Frequently organized around a conceptual drawing or rich picture, the team leader uses these directed conversations as a way to both stimulate new ideas and to share the current level of understanding amongst the team as a whole. These conversations about a concept result in common language, commonly understood concepts, and a common vocabulary – all critical steps toward a common shared understanding.[329] The conversation becomes one element of the team's shared experience.

An example of conversation organized around the rich picture is given in Figure 15 was exhibited by Seminar 4 in 2010. Through discourse, it was recognized that the Joint Inter-Agency Task Force–South was uniquely positioned to be the focusing lens for the Inter-Agency. This recognition provided the persistent theme (which Bryan Lawson would call the primary generator) for the entire campaign design.

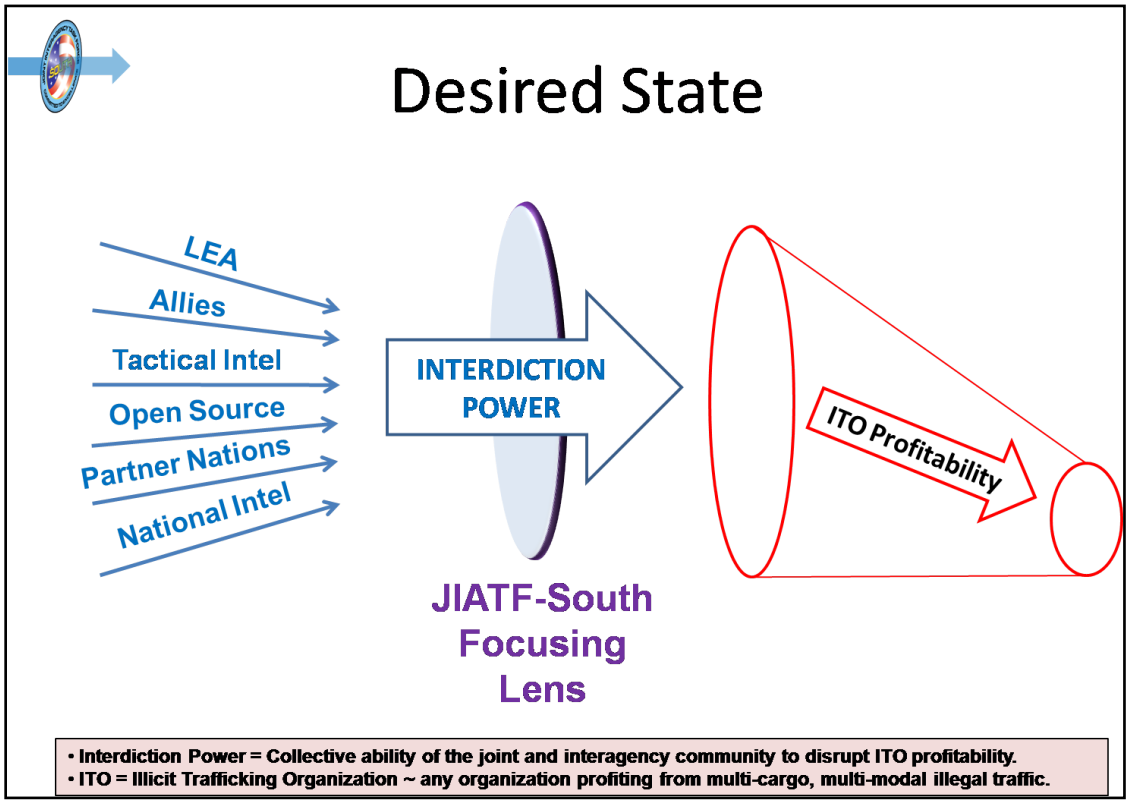

FIGURE 15. SEMINAR 4 SAMS AMSP 2010: PRESENTATION DRAWING OF THE DESIRED STATE.

[329] Lawson, *How Designers Think*, 277.

The Seminar documented the process of coming to this understanding, which is given by the narrative in Table 28. The evolution of terms and labels – naming and framing – demonstrates the development of common understanding within the design team.

TABLE 28. SEMINAR 4 SAMS AMSP 2010: NARRATIVE OF LEARNING THAT LED TO FIGURE 15.

During the past year Seminar 4 was fortunate to have Joint Interagency Task Force-South located in Tampa, Florida as our strategic sponsor for almost all of the design practicums and exercises.

At the beginning of the year we saw JIATF-S and their mission as a complicated drug problem. As Axelrod and Cohen would describe, we saw a system that had a lot of moving parts but was not complex.

Even after spending the first ten to fifteen minutes every class period on studying the topic of illicit drugs we remained fixed on the complicated nature of production, distribution, and financial returns of primarily cocaine in South America.

Returning to the products from design practicum I and II we concluded a need for JIATF-S to shift its operational mindset to the offense.

- We recommended the command develop operational plans that accomplish strategic ends by identifying the appropriate operational means.
- We created Lines of Effort to operationally focused intelligence to identify drug trafficking organizations threats and trends.
- And by the end of DP II we assessed that JIATF-S should retain the operational offense allowing JIATF-South, in accordance with its partners, to increase regional security and reduce DTO operations.

Then we were invited by Rear Admiral Lloyd to visit his organization to further refine our design and build the foundations for their unit's campaign plan.

Seminar 4 packed up our bags and, tongue in cheek, reluctantly headed to Tampa, Florida amidst a blizzard in Kansas to solve JIATF-S problems…

Upon our arrival we realized several real world impediments to our lofty advice given in Practicum I and II. First we were not facing a complicated system but a complex system composed of interacting agents, strategies, and elements in dynamic relationships. Each actor with its own artifacts and environmental factors driving them to respond to goals and strategies in different manners.

Along with Axelrod and Cohen, we attempted to harness the complexity of JIATF-S but first we needed the life preserver of Mary Joe Hatch to understand the organizational structure of what JIATF-S really was.

In previous DPs we defined the problem primarily as a drug issue but after exploring all facets of the environment and dealing with multiple interagency partners Seminar 4 redefined the problem as Illicit trafficking organizations or **ITOs defined as any organization profiting from multi-cargo, multi-modal illegal traffic.**

Bottom line: "It's all about the money."

As depicted on the slide displayed, the desired end result is a drastic decrease of the profitability of

these ITOs operating from South America to the rest of the world. This slide generated a visceral reaction from the JIATF-S staff.

Another change in the design came from understanding how JIATF-S is uniquely positioned in the interagency world. All partners are invited to participate as knights at the round table but are not forced to sit there.

- Agents from multiple U.S. and multinational agencies come to JIATF-S because they are the focusing lens for the IA.
- JIATF-S is the organization that holds the collective ability of the joint and interagency community to disrupt ITO profitability through what we coined as interdiction power.
- Again this is the persistent theme through which the campaign plan framework was designed.

Therefore, upon the completing DP III we realized, as Bar-Yam says, the organization had to be as complex as the situation.

- It was no longer sufficient for JIATF-S to focus only on measuring metric tons of cocaine and drug money seized in the air and maritime environments.
- The approach had to center on a holistic understanding of the illicit trafficking system.
- By changing the effectiveness, efficiency and scope of the organization's support to interdiction operations and become a learning organization with a long-term strategic focus, capable of synchronizing a whole of government and international effort JIATF-S could better disrupt ITO's profitability across the continuum of illicit trafficking.
- The goal of this synchronization was to focus resources and capabilities to generate Interdiction Power across the "cradle to grave" spectrum of case initiation, detection and monitoring, law enforcement endgame, and legal prosecution.

By the end of DP III the Operational approach:

1. Expanded the ***focus*** of detection and monitoring to include entire Illicit trafficking continuum

2. Developed a long term ***planning*** strategy that synchronizes Interagency and Partner Nations operations

3. Developed new ***Measures of Effectiveness and Performance*** relevant to the stated mission

4. Implemented ***partnership*** initiatives focused on endgame, stability, and academic learning

By the end of the year Seminar 4 faced an adaptive challenge to refocus and reframe the narrative and overall campaign plan of one of the largest interagency organizations in the United States.

4.2. LEADING INNOVATION

...the Army must realize that design is an attitude. It is a mindset. It is the creative, inquisitive nature of an individual and a team. The practitioner must be comfortable with knowing he does not have all the answers at any given time. Through experimentation, a flexible, iterative approach, and a never-ceasing contemplation of the higher-order effects of his injection into the complex adaptive system, the practitioner's cognitive agility and organizational flexibility will allow him to get inside the enemy's OODA loop, seek resolution to the right problems, and set the conditions for lasting and favorable system stability.

—Major Sean "Stick" Slaughter, USAF

The second intellectual challenge is to generate new ideas, in all three areas of design – understanding the environment, problem identification and solution creation. Although seemingly difficult, if not impossible, to be creative "on demand," the creation of new ideas can actually be stimulated with several relatively simple techniques. This section discusses techniques for generating ideas. Subsection 4.2.2 centers on putting design into action, from the cognitive perspective, including reflection, leading critical thinking, and critical listening techniques. Two following subsections address "leading up" – the critical need for effective discourse with your commander and his bosses – and the difficult task of communicating understanding once achieved.

4.2.1. IDEA MAKING

Just starting is the hardest part. The Dan Roam book says to "just draw a circle," that advice proved helpful. The discussion of "how" is nearly endless though.[330]

—Major Dave McHenry

There are many valid techniques for generating ideas. Being explicit about known information; generating ideas by changing the various forms of illustrating; capturing initial large ideas and then manipulating them; using the input from outsiders as constraints or liberators; and using pre-established intellectual frameworks for idea stimulation are all effective methods discussed here. Brainstorming, affinity diagrams, reversal, fractionation, analogies, sentence completion, options generation matrix, and SCAMPER (which stands for Substitute, Combine, Adapt, Modify, Put to other purposes, Eliminate, Rearrange) are further techniques summarized in Appendix B.

Making explicit what you already know, and then using the explicit identification and characterization as a stepping stone forward, is very effective. Frequently, a design team will assume knowledge, or even assume other team member's knowledge without really understanding what is known. By rendering absolutely explicit, for the whole team, in small

[330] Dan Roam, *The Back of the Napkin: Solving Problems and Selling Ideas with Pictures* (New York, NY: Portfolio, 2008).

groups, or as individuals, particular aspects of known ideas, further exploration results in the generation of new ideas, and new levels of knowledge[331] (see also Section 4.3.2.1).

Altering the medium of your expression of knowledge also can generate new perspectives and creative thoughts. Simply moving from a drawing to a narrative, or from a Word document to a PowerPoint presentation, or from a rich picture to a discussion, can generate new ideas. Frequently, illustrating a point of view requires the illustrator to gain new insights – drawing a perspective captures more nuances than simply describing it verbally, for example.[332] Producing new perspectives and the creation of novel approaches are the goal of creativity - using these new perspectives, even if seemingly forced or awkward, will generate new ideas, and eventually assist in building novel approaches to the environment at hand.

A good example of changing media is one of the in-class practical exercises from the design instruction. The exercise involves constructing the influence diagram implied by two paragraphs of an article by Captain Brad Fultz. The corresponding influence diagram is shown in Figure 16.

> **What does security mean in a small war?**
>
> There is a popular axiom in the combat arms community: Fire without movement is wasted ammunition, and movement without fire is suicide. This adage drives home the lessons of fire and maneuver to the small unit leader. Similar to this is another proposed moral of small wars: effective governance without established security is impossible, and establishing security without effective governance is a waste of time and unnecessary risk to combat troops lives. Security in small wars is directly connected to governmental progress. The two are inseparable. Security establishment, at all levels of operations, from the squad to the brigade must directly support the goal of establishing effective governance. Security in a small war means that institutions are able to conduct business in a manner that contributes to effective governance in accordance with local norms. To accomplish this, institutions must be developed at the local level with local support. Providing the ability for local governance to take place is the true measure of security in small wars. By using the limited resources at hand of the US military it is essential that security is established at the grassroots level, just like governance must be established at the grassroots level. The top-down method of governance and security establishment is antithetical to the realities of the traditional societies in which the US is currently conducting operations, and is a massive waste of resources. Only when security and governance are established at the local level, can these successes be transferred to centralized control, and not the other way around.
>
> **Recommendations**
>
> 1) Counterinsurgency elements, be they military or administrative, must find local answers to local security and administrative problems. By propping up government forces that lack legitimacy, we are essentially weakening the institutions we are indeed attempting to

[331] Schön, *Educating the Reflective Practitioner*, 87.

[332] Schön, *Educating the Reflective Practitioner*, 161.

> create. We are preaching responsible governance, civic participation and security. Simultaneously US forces have to explain rigged elections, corrupt officials and bribe demanding police. This places both military and State Department officials in an incredibly precarious position. We are simply seen as the strong arm of a broken, corrupt system. It is essential we find traditional local methods to establish a system that is unfriendly to insurgents and supportive of local stability. Additionally it is necessary these institutions of governance and security have local legitimacy so as those participating will display loyalty to its institutions.

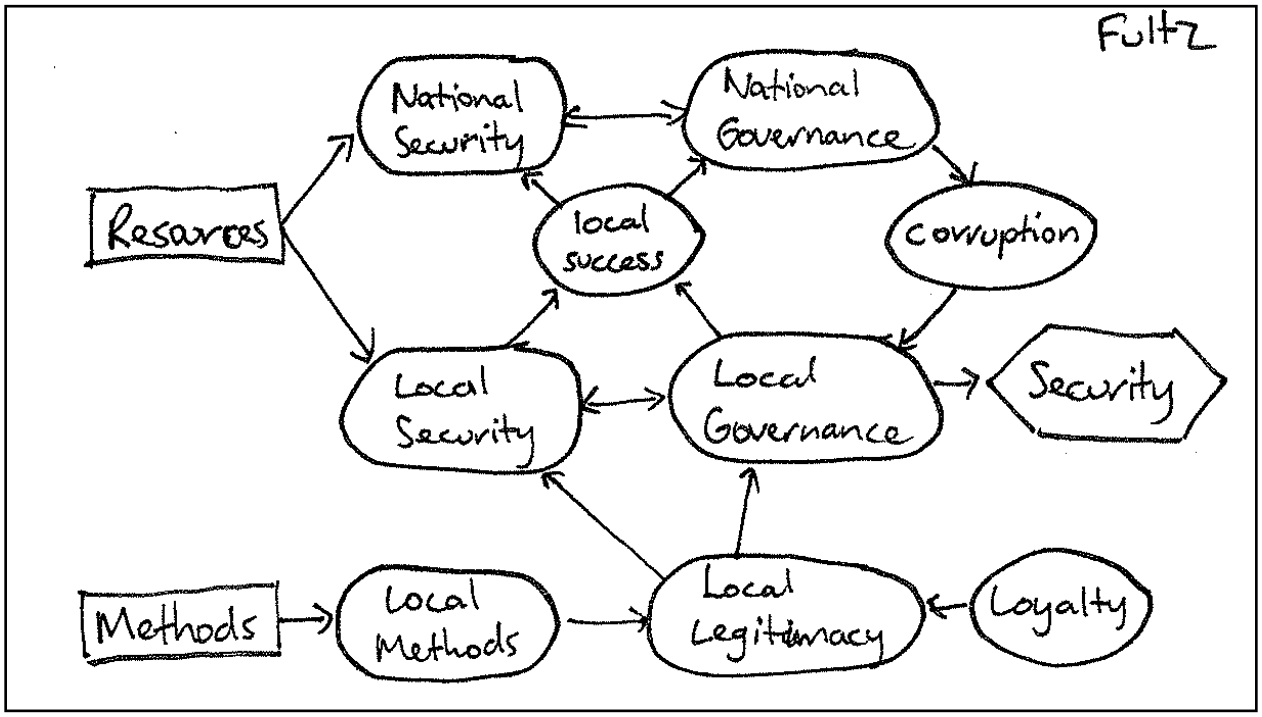

FIGURE 16. INFLUENCE DIAGRAM IMPLIED BY FULTZ' *SMALL WARS* ARTICLE.

The influence diagram in Figure 16 is drawn according to the symbolic conventions given in Appendix B. Rectangular boxes indicate decision variables, Rounded rectangles are derived variables, circles are chance variables, and hexagons are measurable objective variables. The first point this exercise draws out is that even two paragraphs of text can make a large number of claims about the causal and influence network between variables in the operational environment. Second, every team will generate a different influence network, given exactly the same instructions, tools, and text. This shows that translating between mediums is not an automatic task, but requires critical thinking and making choices that frame what is shown in the influence diagram. Third, this demonstrates that written text is often ambiguous in precisely what claims it makes about relations between cause and effect. Laying out an argument in graphical form can clarify these relationships, which can improve the quality of discourse. Last, seeing the argument in a different medium will lead to different questions and different insights. For example, the methods used by the counterinsurgent is a decision variable, yet the article only explores local methods. Seeing the article in graphical form naturally leads to the question of what other

methods are available to the counterinsurgent. Graphical depiction of narrative can help identify what relationships and variables are missing from the text. Conversely, writing a narrative to accompany a design drawing forces the design team to tell the story that animates the relations between parts of the system, and to develop the moral – the insight or the 'so what' – that makes the drawing meaningful.

In every design challenge, an initial large idea, even if flawed, serves to generate additional, more sophisticated ideas downstream. These initial ideas are referred to as primary generators.[333] By deliberately using these initial ideas, the design team leader identifies focal points for further discussion, creates discourse on the new ideas that refines knowledge and understanding, and generates new concepts and creative ideas throughout the design approach. Although these initial ideas frequently do not survive either energetic discourse, or first contact with the actual environment, they are still powerful tools to force the generation of new ideas better suited to increased understanding.

One likely source of primary generators are the ideas of outside agents – in the military world frequently subordinate commanders or staffs, adjacent units, or senior officers.[334] The precise nature of primary generators from higher headquarters will often not emerge until initial discourse with the higher commander (see section 4.23 above). Discourse with the commander of the organization doing design is frequently an excellent source of ideas that serve as generators. Joint and service doctrine can also be sources of initial generators. Although doctrine and commander's initial concepts may also be constraints, even constraints serve as initial generators of ideas as the team attempts to work around the impact of the constraints.[335]

Another useful generator is the conflict of time with desired state. Frequently, the design team leader can formulate an awareness of the passage of time, linked to some internal or external time line, or discrete events, which then generate effective creative thinking about boundaries, constraints, and enablers. An example is Admiral Sandy Woodward during the Falkland Islands campaign.[336] Confronted with oncoming winter, limited time between significant maintenance failures on his ships, and the need to conduct several lengthy preparatory operations, he generated a series of strips of paper each depicting the challenges of passing time. With these strips of paper, he then sequenced activities, and relayed his concept to political authorities for approval, all based on the influence of time on his operational ideas.

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[333] Lawson, *How Designers Think*, 46-47.

[334] Lawson, *How Designers Think*, 89 for a civilian example.

[335] Marr, "Learning Over Time," 28.

[336] Admiral Sandy Woodward, *One Hundred Days: The Memoirs of the Falklands Battle Group Commander* (Annapolis: Naval Institute Press, 1992), Chapter 4.

Other primary generators useful to the military design team are doctrinal concepts such as METT-TC and PMESII-PT, or other pre-existing frameworks.[337] By using these intellectual frameworks, the design team leader can "force" the formation of conceptual new ideas, which although they will require alteration through the process, serve to generate further concepts and ideas, usually as part of internal or external discourse. An example of how the MIDLIFE framework was used to create an environmental frame is shown in Figure 17. This sketch was created by Seminar 6 in 2010 and has been modified for this text to improve readability in print format. MIDLIFE categorizes the environment by Military, Intelligence, Diplomatic, Law Enforcement, Infrastructure, Finance, and Economic variables. It is important to note that in Figure 17, the relationships between these concepts are just as important as the categories themselves. Injects and flows from outside the system are not considered separately, but how they impact the whole system.

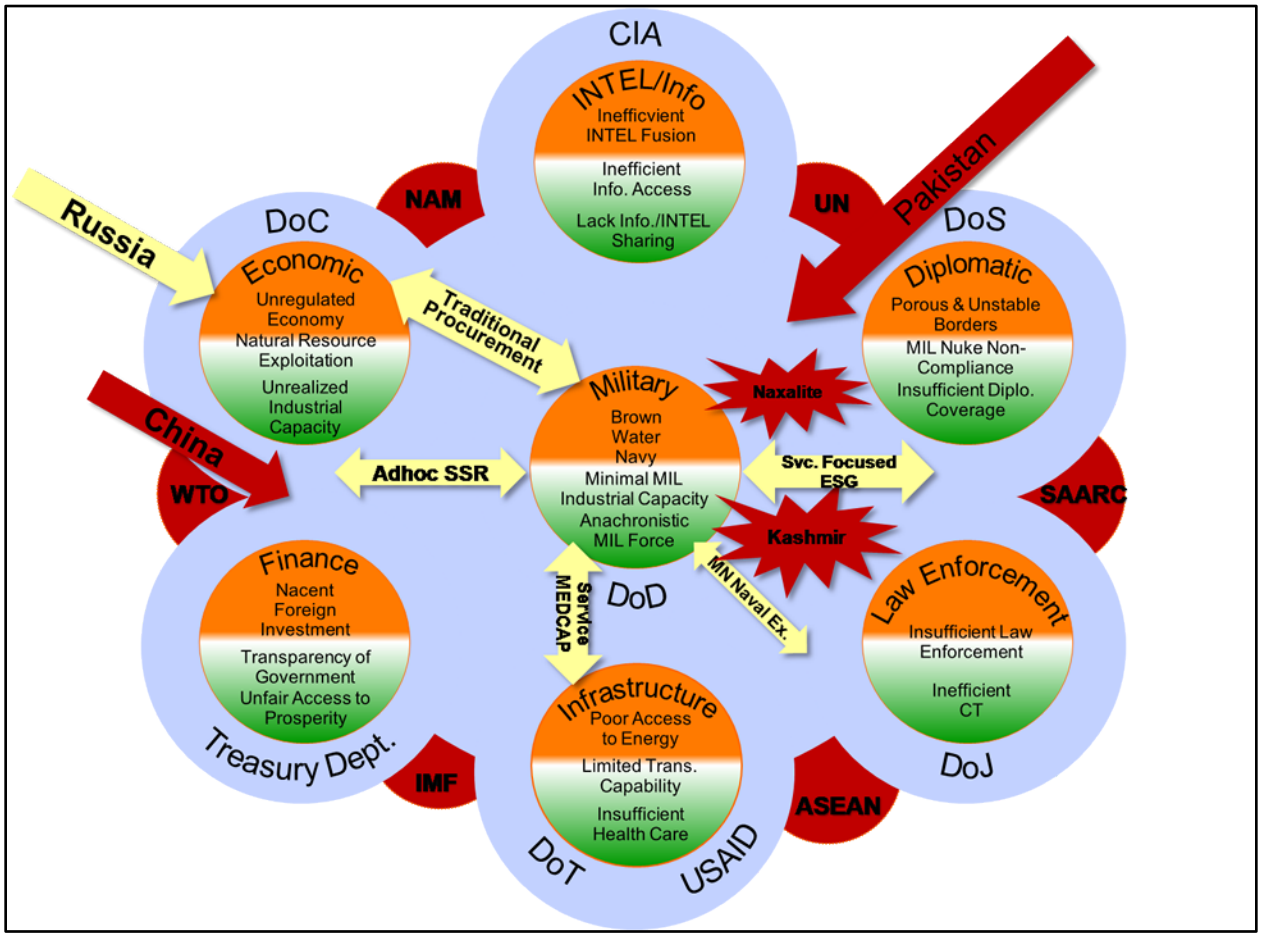

FIGURE 17. SEMINAR 6 SAMS AMSP 2010:
MAP OF THE CURRENT SYSTEM ORGANIZED BY THE CATEGORIES MIDLIFE.

The design team leader, however, is warned that the use of pre-existing templates and analytic or synthetic constructs may present the challenge of trying to fit a system into a

[337] United States, *FM 5-0*, paragraph 1-21.

framework initially designed within a completely different system. Due care must be exercised that the unique nature of the system is accounted for – any effort to cram the existent system into a pre-existing analytic tool must be avoided.

An alternative to viewing a unique operational environment through an *a priori* set of categories is to use two of the design methods in Appendix B, brainstorming and affinity diagrams. First, the design team can brainstorm all of the issues observed in the problem situation, placing each issue on a sticky note. Next, they use the affinity diagram process to sort place similar sticky notes together, replicating sticky notes that belong in more than one place. When the team has finished moving the sticky notes, they label each cluster of sticky notes, even if a cluster only contains one loner sticky note. This provides the design team with emergent categories that are not imposed, but are generated by the team's understanding of the relationships between issues in the environment.

4.2.2. DESIGNING IN ACTION

Doing design requires near-simultaneous willful movement of the team through the three cognitive spaces of design (see Sections 4.1.1, 4.2.2.1, 4.3.3 – 4.3.6, and 4.4.2). Before investigating techniques for work inside each space, general ideas for the handling of design are in order. Although design is done to allow free thinking to create better understanding, the design team leader needs to understand several practical frameworks for his/her active leadership of the team.

Some of these frameworks, or in Schön's terminology, rituals of practice, include the understanding and promulgation of rules for the team, establishment of team conventions and constraints, the agreement upon certain language components of the team, and general understanding of the roles of individual's repertoires in the team. These rules, conventions, and agreed upon practices can be used in virtual worlds, by using Gharajedaghi's three forms of activity, and through Lawson's five distinct techniques for creating understanding.[338] **Gharajedaghi discusses three forms of activity in what he calls "formulating the mess." They are searching – the effort to gather knowledge and understanding; mapping – the placement of actors, entities, and things in relation to each other; and telling the story – the addition of narrative meaning into the understanding of the system.** Lawson's five techniques are moving, representing, formulating, evaluating and reflecting. These are all guides for thinking and teaming; however, all team members must also reflect in action and reflect on action (see Section 4.2.2.1 below).

The leader establishes rules in discourse with the team. Rules are followed early in the design approach when there is little firm knowledge in any of the three cognitive spaces. These rules give the team a place to start, and a set of conventions to change or modify as knowledge increases. Rules provide constraints on design inquiry and structure the

[338] Schön, 34-42, 75; Gharajedaghi, *Systems Thinking,* 132-140; Lawson, *How Designers Think*, 291-301.

learning. Functional rules can include rules for data gathering, for creating inference and meaning, for hypothesis testing, and for resolving disagreements. According to Schön, rules govern inquiry for professionals, especially when dealing with routine issues. However, rules are also useful when dealing with non-routine, or complex issues. Rules, combined with reflection, provide new understanding of the complex issues which face designers. Without rules, reflection would be very difficult to achieve, and nearly impossible to communicate effectively.[339]

Rules include guides to the practice of design, accepted and understood conventions, constraints, the specific language of the design team, the tools in individual repertoires, and patterns of behavior and inquiry.[340] Since the design team inevitably works in an artificial world, rules help in bounding the inquiry, empower individuals in the team, and assist in moving amongst the three spaces of design with effect and purpose. Design cannot be unbounded, or there will be no progress. **One of the critical tasks of the team leader is to assess the bounds – the rules – of the team and change them as the situation requires.** Rules must also always be part of the common shared understanding of the team. One of the more effective gatherings of the design team is to periodically reassess the rules in effect at any particular juncture of design. The discussion which emerges from disagreement over rules frequently generates new perspectives on the design itself. An example of the rules of discourse adopted by Seminar 9 in 2009 is given in Table 29. These rules were posted by the door as a constant reminder to the design team. Note that Seminar 9 referred to their team leader as the Chief of Plans.

TABLE 29. SEMINAR 9 SAMS AMSP 2009: RULES OF DISCOURSE.

Rules of Discourse
• Chief of Plans will moderate! • Speaker presents argument and reasoning. • Assume that everyone, like you, is seeking truth. Listen in a spirit of humility so you can learn from others, painful though that process may be. One technique to try is to honestly ask yourself "what if what I believe about this really is wrong, and his/her perspective really is right?" Keep this question in mind to help you non-defensively consider others' ideas. • Every person is treated with respect. No personal attacks or comments. Say "I don't understand how those ideas relate" rather than "You can't really believe that." Ask clarifying questions rather than making judgments about people. • Listen carefully to each other – if you are thinking about how you're going to respond, you are probably not listening. • No interruptions. To respond to someone speaking, raise your hand and the discussion leader will note that you will speak next. When many hands are raised, the leader will choose those who have not yet spoken to continue the discussion. • Big Boy Rules are in effect. Keep this in perspective. Discourse, Murder Boards,

[339] Schön, *Educating the Reflective Practitioner*, 34.

[340] Schön, *Educating the Reflective Practitioner*, 34-36.

Black Hats–it is what it is and it serves an important purpose.

The "power leader" who tries to dominate the discourse can harm group dynamics in a design team. Agreeing to and abiding by rules of discourse limits the ability of any one individual to dominate discussions. This ensures multiple viewpoints can be expressed and harnesses the collective intellect of the design team.

Conventions include the manner in which the team will agree to bound their inquiry, including standard procedural matters and limits to authority or responsibility for certain actions, events, or outcomes. In particular, issues that others may be relied upon to solve, or concerns that are of interest, but are not deemed critical to forward progress, may be acknowledged and then noted as outside the scope of the current design inquiry. Again, the very discussion of these terms and concerns can generate significant insight.

Constraints are very useful for establishing rules. No design team can function without effective limits on their effort. Constraints assist the team in providing left and right limits, or boundaries, to their inquiry. The team leader, in concert with the commander, continually assesses the value, and the limiting effect, of constraints on the team. His/her efforts to rationalize the effective constraints are critical for team success, since improperly imposed constraints will inhibit effective understanding, and unlimited work will not effectively provide understanding. The team leader should initially develop, with the team, a framework for identification of constraints – some form of shared understanding of what are considered constraints, and why they are constraints.[341] Asking and answering the why of constraints can itself be very liberating for the team. Design teams are always in search of things they do not need to worry about. In this case constraints can take things off the plate of the design team.

The rules of language assist the team in agreeing on how they will name developing concepts or emergent ideas about the system. **In the naming frequently are perspective shifts, changes of insight, and generation of new conceptualizations.** Naming, and the use of specific terms, must be disciplined by the team leader – sloppy use of language and terming may generate ideas, but they will frequently not be supportive of the team's goal of increased shared understanding. The challenging boundaries technique in Appendix B is often useful for testing the boundaries implied by the use of language. It helps to clarify the meaning of terms and consider whether the current language bounds the problem too narrowly or too broadly.

Individuals bring specific, identified, and commonly understood tools to the design team. Agreeing upon the identity of the team members, in other words, having the team agree that some individuals are strong in certain skills, that they represent certain agendas and external organizations, that the team can rely on them for certain tasks, empowers all members of the team. One of the earliest tasks for the team leader is gain consensus on the

[341] Marr, "Learning Over Time," 26.

identities and representation of the members of the team. This is sometimes obvious, for example the liaison officer from 2d brigade represents the agenda of the 2d brigade, but at times roles may be challenging to identify and agree upon. The team leader also modifies these repertoires as the team matures and develops, but must keep current a common shared understanding of the formal and informal roles of each member.

Rituals of practice for a design team include routine meeting times, relatively stable core membership in the team, a sequence of events inside each meeting of the team, agreed upon outcomes for design sessions, usually decided at the beginning of the team meeting, and established systems for external and internal communication.[342] If all things for the design team are in flux, if nothing has any degree of certitude, there is little chance of effective designing. All rituals of practice are open to criticism, reevaluation, and generating a new approach, but these must be agreed upon in group session. The team leader has particular responsibility for moderating changes in the rituals of practice. He/she must be self-critical and self-aware of the positive and negative impacts on the design team of changing things as simple as times of meetings. Ritual of practice is particularly important in developing the proper respect and trust internal to the design team. Willful but thoughtless changing of rituals of practice is very disruptive of team cohesion. On occasion, the team leader may want to generate disruption if the team has stagnated, but this must be a careful and deliberate decision.

The design team should use virtual worlds as a method for generating ideas. Better known as simulations or wargaming, virtual worlds enable the team to experiment with both the substance of their environment, and with their own rituals of practice.[343] This two-fold utilization is critical to team success. **Adopting virtual worlds, which can vary from elaborate computer simulations to something as simple as a chalk-talk on a whiteboard, is a key technique for design.** By creating what Colonel Jack Marr calls "rapid prototyping," the design team simultaneously generates options to consider and new ideas stimulated by the need to create the prototypes.[344] Prototyping or using virtual worlds in design should be characterized by rapid, frequent, disposable prototypes – the goal is to generate discourse as the prototypes are designed, then to test their action in the environment, either virtually or real. Prototypes should be tangible solutions to portions of the environmental challenge. In the scoping or scaling the work, and in the discussion about the boundaries of a particular prototype, rests greater understanding by the team.

The team leader calls for the creation of prototypes in a methodical, deliberate, and willful manner, in an effort to move the design process forward. As tangible solution options are generated, the team develops deeper understanding of the specific area of the environment the prototype is designed against, and they learn to ask new questions of the remainder of the environment. Prototypes can also result in real action by the organization. Real actions

[342] Schön, *Educating the Reflective Practitioner*, 42.

[343] Schön, *Educating the Reflective Practitioner*, 75. Also see Marr, 31-36 on rapid prototyping.

[344] Marr, "Learning Over Time," 31.

in the environment can be an extension of the virtual work done by the design team. Obviously more labor-intensive than virtual activities, real actions result in direct live learning from the environment. The use of rapidly developed virtual worlds, combined with real actions, leads to effective design (see Section 4.3.6). The virtual walkthrough design method in Appendix B provides one method for doing this. Table 30 shows an example of part of a wargame that Seminar 5 in 2010 used to test the efficacy of their design concept.

TABLE 30. SEMINAR 5, SAMS AMSP 2010: EXAMPLE OF WARGAMING THE PROPOSED ACTIONS WITHIN THE BASIC SERVICES LINE OF OPERATION.

LOOs	Effect	Consequences (Intended /Unintended)	
		Positive	Negative
Basic Services	• Sustainable projects • District / Qawm focus enhances the legitimacy of the eyes of the people (governance)	• Needs of populace are meet through taking a decentralized approach. They determine where the projects need to be focused. • The environment fosters the necessary security to enable project development. • District and local level elections hold the government accountable to the people and facilitates project development. • As security and basic services increase Donor nations might be willing to reinforce success.	• Decentralized approach leads to slow development which negatively affects the view of the government. • Led to feuds over who is getting the focus on the resources causing security problems • Inter-Qawm rivalry over where resources are placed. Could lead to conflict and decrease in security and legitimacy of Afghan Government. • Basic services provide a target for insurgents and if government does not provide security it could serve to further delegitimize the Government. • Potential to hyper-inflate the economy with without it being sustainable once the donor nations stop support the efforts. • Projects could empower the wrong individuals and delegitimize the Government. • Could make the Afghan economy completely dependent upon the IC.

An extension of the techniques of virtual worlds can be found in the ideas of Gharajedaghi on the techniques for dealing with a complex system. He posits three general techniques – searching, mapping, and telling a story.[345] Searching is the initial efforts toward

[345] Gharajedaghi, *Systems Thinking,* 132-140.

understanding. In searching, the design team evaluates how the system is currently working, what obstructions exist in the system that interfere with achieving the desired state, and develop an initial understanding of the interrelationship of the manifold actors in the system. This is an iterative effort, with understanding increasing with each cycle of searching. Of course, searching can be combined with the use of virtual worlds to increase understanding. As in all things associated with design, the amount of time available for the design team determines the depth, complexity, and specificity of understanding. A major outcome of searching is the development, in discourse, of the key hypotheses and assumptions of the design team. These must be explicit and periodically reviewed by the team led by the team leader[346] (see Sections 4.3.3 and 4.4).

In mapping, the design team begins to classify individual phenomena into groups that share motivations, essential characteristics, or common behaviors. Attempts are then made to identify themes which bind groups – looking especially to determine the existence of essential characteristics of the system and the emergent properties of the system. Key to understanding any system is the awareness of grouped actors, or assemblages of shared interests or motivations[347] (see Section 4.3.3). **According to Gharajedaghi, mapping identifies the "second order machine," the emergent properties of the current system that create inertia and frustrates efforts to improve the system.** The second order machine must be recognized and dismantled before the system can be transformed.

In telling the story, the design team moves from developing its common shared understanding to communicating this, in a compelling and credible story, to a wide group of stakeholders both inside and outside the organization[348] (see Sections 4.2.4 and 4.5.2).

An example of using Gharajedaghi's searching, mapping, and telling approach in design is given by Seminar 6 in 2010. The following narrative tells the story of how power is perceived in India. Seminar 6 search, map, and tell this story in order to improve the efficacy of U.S.–India relations from the perspective of USPACOM. The accompanying graphic in Figure 18 shows the photo referred to in the narrative, taken from the front cover of Pavan Varma's *Being Indian*.[349]

> "Power is an end to itself." This one statement singularly best captures the narrative of the Indian's second order machine.
>
> While the above seems contradictory to the Western view of logic, for Western minds, power is a means to an end—it does succinctly capture the idea that the Indian's personal and national quest for power is what defines the way in which he/it both sees and acts.

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[346] Gharajedaghi, *Systems Thinking,* 132-135.

[347] Gharajedaghi, *Systems Thinking,* 135-140. Assemblage theory is discussed in Hayward, 40-45.

[348] Gharajedaghi, *Systems Thinking,* 140.

[349] Pavan K. Varma, *Being Indian: Inside the Real India* (London: William Heinemann, 2005).

The first element of the photo you focus on is the tattoo. The tattoo is clearly of India. But look closer… not only do you see India, you also can see in the Northwestern corner of the tattoo the inclusion of Kashmir (Pakistani and Indian sides). The significance of that cannot be overstated. Widen your gaze to include the rest of the arm. That arm is the landscape of the Indian—notice the smallpox scar… moving down from there you see young, but muscular arm that rests upon the hands… clearly the man's arms are crossed in a provocative, self-assured manner. On the fingers you can see multiple rings…gold, silver, diamonds—clearly the trappings of wealth. Widen your gaze a bit further to see the man's shirt—a bit wrinkled, cut-off sleeves, saffron in color. The man is clean-shaven, and wears a gold necklace—perhaps a mid-twenties male who so far might look comfortable in an upscale bar discussing the frailties of Westerners' understanding of international relations theory as applied to South Asia—or the alley out behind it? Please, pay no attention to the unfocused scene you can see in the background. Streets that have not been swept. A shoeless boy peers out from around a doorframe. He's on a smoke break, coming out for "fresh air." Behind that door is a sweatshop where he makes pirated DVD's of Bollywood movies. His sister works two doors down, a seamstress making fashionable undergarments for an upscale American lingerie retailer. Slumville. The boy and his unseen sister are both Dalits—the lowest caste. Of course the caste system was outlawed years ago. Again, pay no attention to the fuzzy background—pay strict attention to the power and bravado the man in the foreground is trying to project. The boy is not even worth talking about—considering the man in the foreground clearly is more powerful than the boy. Outside of the camera's field of view is the fact that the man seen here is looking toward his patron, wondering if he still retains enough power to be deserving of transitory loyalty.

Referring back to the quote: The pursuit of power is acceptable. Those who have it deserve loyalty, but not out of moral compunction. As soon as you transmit your relative lack or waning power base, it is time to switch allegiance so as to climb up another rung on the ladder.

The question in every Indian's mind—and in India's "mind" as a whole—who can and should it pick to align itself? (For now).

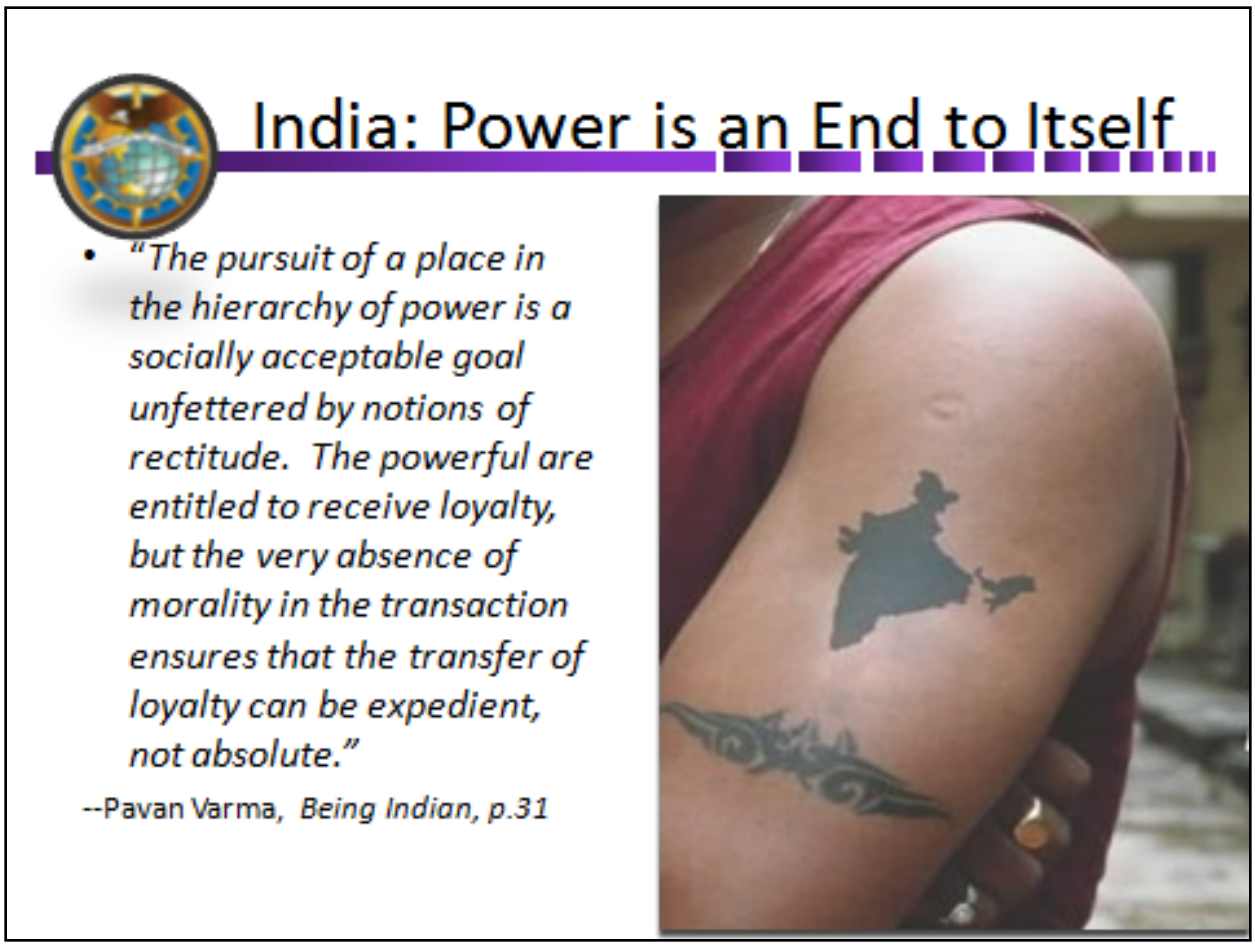

FIGURE 18. SEMINAR 6, SAMS AMSP 2010:
SEARCHING, MAPPING, AND TELLING A STORY ABOUT INDIA'S SECOND ORDER MACHINE.

The very essence of complex problems faced by any design team generates another set of perspectives useful for design. According to Lawson, four fundamental considerations guide design – and the team leader should refer to these fundamentals frequently.[350] These fundamentals are particularly useful when stuck, when the team reaches a point of cognitive exhaustion and is out of steam. The first fundamental is to define your design problem – not the problem of the environment, but the challenge the design team faces. This presents a continual challenge for the team leader, since there exists a tendency to want to understand every facet of the environment, and then try to develop solutions for every problem. The design team must focus, instead, on those aspects of the environment which are only contradictory to the desired conditions of 'blue.' However, blue may change its desired conditions as the environment changes, so even blue's desires can never be comprehensively fixed.

[350] Lawson, *How Designers Think*, 120-121.

The second fundamental is that nothing the design team does, from environmental framing through assessment can ever be comprehensively stated. All communications are approximations of the reality, so the team leader must modulate the desire to achieve comprehensive understanding with the reality of its impossibility. This is a critical issue for the design team leader – he/she must always keep in mind the approximate nature of the team work, and should not attempt to further refine something that is already at a usable level of awareness. Also critical to understanding the design approach is the awareness that much understanding of the environment will not be attained until solutions are identified and attempted. In iteration is the progress to the desired conditions, not in some form of miraculous initial understanding, which is impossible.

The next fundamental is that all of the work of the design team is in essence a subjective interpretation of reality. Additionally, linked to the concept that understanding emerges from stimulating the environment through action, or identifying and attempting to implement solutions, is that even then, awareness and satisfaction with action is a subjective evaluation. **There are no objective realities in design, or in complex systems.** Perspective yields different understanding, and this changes with changing events and the passage of time.

The final fundamental is design problems tend to be organized hierarchically, and the team leader should take full advantage of this characteristic. The advantage of hierarchical organization, in other words, echelons of both different understanding and different statements of desired conditions, is that the team leader can adjust the focus of the design team, moving up and down the echelons of command or responsibility, to better understand the complex environment. Taking advantage of essential characteristics of complexity is frequently the way out of stagnation. (This fundamental is linked to the ladder of refection discussed in Section 4.4.2; also see Section 4.3.5 for a discussion of Lawson's solutions.)

4.2.2.1. LEADING REFLECTION

Perhaps the most fundamental technique of design is reflection. Schön describes two types of reflection helpful in design – reflection in action and reflection on action.[351] Reflection in action is the more useful of the two concepts, although the team leader needs to use the technique of reflection on action – expressed as post-design AARs with the design team, and enhanced by assigning the role of OC to a design team member. Reflection in action requires all members of the design team to think about their interpretations, and their actions, as they go through the design approach. "In action" means this is done during the active work of design. Members of the design team should reflect on their interpretations, and then make those reflections public knowledge in larger group discourse. This can be done as an integral part of every design team meeting, or may be done with periodic AARs conducted during the execution of design. According to Schön, reflection in action is often triggered by surprise. **Whenever unexpected events occur**

[351] Schön, *Educating the Reflective Practitioner*, 25-26.

while designing, these should not be dismissed but closely examined as opportunities for reflection and learning. The team leader needs to modulate his/her desire to have team members discuss their reflection with a desire to move the approach towards its outcomes. However, if no time is allocated for individual reflection, nor public discourse on reflection planned, it is likely the team will not be doing reflection in action. Without reflection in action, the learning of both the team as a group and as individuals is severely restricted.

Reflection on action happens when the design is completed, or when a significant aspect of the approach is thought to be complete. This is not as critical to the generation of a single design approach, but it is arguably just as critical for the growth of the design team. Since the core members of the team should be utilized for the next design effort, doing post-design AARs as reflection on action will markedly improve the capability of the team, and also the self-awareness of the team leader. Recording the designers' expedition of learning in writing can contribute to wider organizational learning within the design community of practice.

A good example of reflection on action is provided by SAMS graduate Major Robert Schexnayder, who led a design team that initiated the Army Advisory and Assistance Brigade concept, tailored for training and mentoring Iraqi security forces.

TABLE 31. REFLECTION ON ACTION:
MND-C DESIGN CONCEPT FOR ARMY ADVISORY AND ASSISTANCE BRIGADES.

In August 2008, Iraq's Multinational Division-Center (MND-C, now called United States Division-South) formed a design team to address a specific strategic question. The question posed by Major General Michael Oates, then the Division Commander of 10th Mountain Division and MND-C, was "What should strategic partnership and transition teams in Iraq in the summer of 2009 look like?" This short and concise question started a chain of events that eventually led to the creation of the current Army Advisory and Assistance Brigade (AAB). However, at the very beginning of this process was a seven officer design team that used the theory of Systemic Operational Design (SOD) to help frame the problem and recommend a plan of action. What follows is a brief summary explaining how this design team was created, the methodology we used, and the course of events that followed…

One of the processes going on at the time was a meeting called "Choir Practice." This was a meeting sponsored by the CG, MG Oates, which involved a number of staff majors, the G3, Effects Coordinator, Chief of Staff, Assistant Division Commanders (ADCs), and the Commanding General. The meetings were held once every two weeks, in a very informal setting, and discussed different topics in an open forum. Usually the topics were related to information operations, but not always. I attended one of these sessions and immediately made the observation that this was design in action! I thus recommended to the G3, Colonel Jay Gordie Flowers, that we create a design team and use SOD as its methodology. Shortly thereafter, because of the upcoming Status of Forces Agreement (Security Agreement), upcoming US Presidential Elections, renewed US focus on Afghanistan, and the current environment in Iraq, the Commanding General asked to look at the strategic problem of "What should strategic partnership and transition teams in Iraq in the summer of 2009

look like?" The G3 assigned me to lead this project and recommended that I use SOD in the process. He also gave me the latitude to pick my own team from across different sections.
The first thing I did was seek out professional help. I was not a member of the 2nd Semester Design Seminar at SAMS, but Major Luis Fregoso (SAMS 2008), a USMA and SAMS classmate of mine, was and he was working right down the street at Multinational Division-Baghdad (MND-B, 4th ID) Headquarters. I met with him to discuss the project I was working on and asked for advice. He gave me much useful information, especially advice on the use of assemblages and reframing. I also re-read as much SAMS literature as I could. I decided to use the SOD Seven Discourses as our template and then went about picking the team.

I had already sent out information about Design and SOD through friendly e-mails to members of both G3 FUOPS and G5 Plans. As expected, some officers were interested and some vehemently disagreed with the theories and principles behind it. I ensured I picked officers with opposing viewpoints to be members of the team. Even though some disagreed with Design and SOD, they were all willing to participate on the team. I gave the team a quick initial brief on SOD and then we went to work.

We were on a very short timeline—two weeks—and most of the team did not have any formal education in SOD. Additionally, there were two large unknowns—the US Presidential elections of 2008 and the signing of the Iraqi Security Agreement, both had not happened yet. We knew we had to take these into account in our design. We met 8 times for 2 hour sessions each, usually late at night, since we still kept our normal day jobs. In between sessions, members of the team were given homework assignments to research information for the upcoming session and were given essays about SOD to read in preparation for the session. As a result, these officers were getting educated on SOD as we developed our design. We met twice during this two week period to discuss our progress with Colonel Flowers. While much of the team's work still remains classified, Enclosure B shows the declassified model of the Seven Discourses the team used.

At the end of the two weeks, the team attended choir practice and discussed our results with the Commanding General, ADCs, Chief of Staff, G3, and Effects Coordinator. It was a very good, open discussion about the Design Narrative we created. In the end, the Commanding General decided agreed with most of our findings and decided to move the project forward. He tasked the G5 Section with developing a plan for this new brigade and work out the details. In the end, the Army agreed upon the current AAB structure that is currently deploying to Iraq.

In conclusion, this Design effort was extremely useful in helping to develop a much needed capability for the Army that is currently now deploying to Iraq. All members of the team learned about SOD and design and all agreed that it gave them a better understanding of the problem. Unfortunately, due to a myriad of reasons, neither design nor SOD was used again in MND-C while the 10th Mountain Division was in charge.

Effective individual and group reflection also enhances the repertoire of the individual and the group.[352] As team members learn from their individual reflection and participate in

[352] Schön, *Educating the Reflective Practitioner*, 68.

group discourse and AARs, each individual increases the skills in their repertoire. The repertoire of the team increases as well.

4.2.2.2. LEADING CRITICAL THINKING

In one instance, a class suffered 11 failures in the STAR land navigation exercise conducted during the tactics phase of training. Instead of asking "why do Soldiers fail STAR land nav?" or "Does success or failure at land nav have any correlation to success in later phase of the SFQC?" the assumption was made that land nav increases attrition and is therefore bad. The "solution" was made to conduct more pre-training and eliminate the STAR as a performance standard. Attrition due to failing land navigation has dropped, but now we have students struggling later during the tactics phase because they get their squads lost during a patrol, or quitting later in the course because they lack the commitment and drive to persevere in the face of a challenge. This trend towards doing more (measures of performance) and eliminating the methods to evaluate the effectiveness of the efforts (measures of effectiveness) is all too common.

—Major David Wise

The outcome of the design team is only as effective as the quality of critical thinking exhibited by the group. For Lawson, there are three useful concepts for critical thinking, and three necessary skills.[353] Concepts helpful to critical thinking include the willful manipulation of information to suit the purpose of the design team. Designers take existing conditions, understand the interrelationship of the parts of a complex system, define a set of desired conditions, and then manipulate parts of the system in an effort to achieve those desired conditions. This manipulation of the system in turn aids understanding of the system as it reacts to the manipulation, which iteratively helps refine subsequent actions.

Another useful concept is to conceive of the design effort as creating a coherent set of ideas or beliefs. These beliefs emerge from the iterative cyclic of assessment, beginning with analysis of the system, moving on to manipulation of the system, and adds synthetic understanding of the relationships in the system with each iteration of action, reflection, and understanding. Each cycle adds to the designer's belief structure – using Gharajedaghi's fourfold holistic thinking (see Section 4.1.3 above) or some other system of design synthesis. The value of the manipulated information and the coherency of the belief set are tested through willful construction of a new reality. Often tested in virtual worlds, the iterative cycle of manipulation and restructuring of the belief set eventually increases the level of understanding of the system (see Sections 4.3.3 and 4.4).

The necessary skills, which the team leader must carefully cultivate, are technical knowledge, imagination, and an aesthetic sensibility. Technical knowledge is self-explanatory, but it should be clearly expressed in open discourse in the team. Each individual should be acknowledged as an expert in some aspects of the design approach

[353] Lawson, *How Designers Think*, 4, 13, 14.

and the system of interest. Each individual's agenda should also be discussed openly, so the team best understands each member's authority and responsibility within the team. Imagination is the goal of the team leader – he/she must approach the team in a manner selected to maximize imagination and creativity. Aesthetic sensibility seems like a foreign concept to most groups of military officers, at least when it comes to professional skills, knowledge and attributes. However, for the design team, aesthetic sensibility is essential for forward progress. For a military design team, this aesthetic sensibility is frequently an expression of "it feels right." Using intuitive feelings of rightness is a step, although it must be carefully evaluated against the known understanding of the system and the desired conditions for validity. Without an aesthetic sense of rightness, there are few guides to correcting the team's understanding of the system. The importance of aesthetics in design is that it can produce resonance that leads to a cascade of positive side effects. Iconic designs like the Golden Gate Bridge or the Sydney Opera House generate many positive externalities. By adding to the cultural wealth of a city, these designs attract talented and creative residents, stimulate investment, and are a magnet for tourism and trade. An aesthetically elegant military design generates good press, is studied and emulated by others, and can have far reaching influence beyond its immediate effects. T. E. Lawrence created an operational design with such aesthetic appeal that it united rival tribes with a shared vision for Arab freedom and made victory appear inevitable.

4.2.2.3. LEADING CRITICAL LISTENING

The team leader must actively encourage discussion and discourse in the team. His own active listening, the skill to actually listen to what is being said, and try to understand the motivations and the why behind the said language, is a critical skill. Since design can only be learned through doing design, every time the design team meets is an opportunity for the team leader to improve the skills of every member of the team.[354] Valid techniques for critical listening include the obvious positive leadership acts of not interrupting, not demeaning individuals, always accepting input in public, repeating back to the speaker the essence of a comment, and then asking for clarification and/or extension of a thought. Simple leadership skills like these are essential to the progression and development of any design team. Negative leadership traits – the opposite of these positive traits – will quickly destroy the coherence, trust, and teamwork of a design team.

A design team leader should be comfortable switching between multiple leadership styles to suit the circumstances. Active listening can be promoted by adopting a leadership style that is more akin to facilitation. Alternatively, the leader can choose to appoint a member of the design team to facilitate discourse, freeing the design team leader up for other roles. Through their listening, questioning, and methods of facilitation, a facilitator can improve the quality of discourse, even if they are not an expert in the topic of the discourse. Roger Swartz identifies the main task of the facilitator. "The facilitator's main task is to help the group increase effectiveness by improving its process and structure…

[354] Lawson, *How Designers Think*, 7. See also Schön, *Educating the Reflective Practitioner*, 16.

Underlying the facilitator's main task is the fundamental assumption that in-effective group process and structure reduces a group's ability to solve problems and make decisions."[355]

The model for facilitation advocated by Swartz is a diagnosis-intervention cycle containing six steps.[356] The first three steps of diagnosis are conducted privately by the facilitator. First, the facilitator observes behavior during discourse. Second, the facilitator infers meaning from the observed behavior. Third, the facilitator decides whether, and how, to intervene. The next three steps describe the intervention between the facilitator and the group. Step four of the diagnosis-intervention cycle describes the observed behavior to the group, and importantly, tests for different views. Step five shares the facilitator's inference with the group, once again testing for different views. Finally, in step six, the facilitator helps the group to decide whether and how to change its behavior. The facilitator tests for different views one last time to ensure the group remains open to inquiry and alternative perspectives. Assuming the group decides to change its behavior, the cycle then repeats.

The reader should reflect on the difference between a facilitative approach and a "power leadership" model that assumes that the leader has the best intuition, the most experience, and the deepest knowledge of the problem situation. There certainly are many situations where these assumptions do hold. However, familiarity and practice with the techniques of facilitation enables a leader to effectively harness corporate intellect in situations where these assumptions no longer hold. Because design is intended for novel, complex, and ill-structured problem situations, a design team leader should be able to facilitate effectively in situations where they do not personally have the answers. First and foremost, this requires the ability to lead critical listening.

4.2.3. LEADING UP

Here is my take on how this works. 1. The commander and staff both develop their understanding of the problem. When the staff briefs their mission analysis to the commander, they are briefing their "thesis" or narrative of the problem. The commander already has his "thesis" or narrative of the problem in his head when he comes to the briefing. 2. If the two "thesis'" or narratives are the same, then they have perfect mutual understanding…if not, then their "thesis'" become the antithesis to the other which forces the discourse to take place. Within this discussion the commander and staff help to fill in the missing elements of each other's "frames" or to confirm elements of the frames. Through this process, the real frame emerges….i.e. the thesis-antithesis-synthesis process. This happened the other day with our CG. We had been working on a project for two weeks. As we briefed him it became apparent that he didn't agree. So we began to deep dive on different aspects of our problem framing…we found out info that our commander had gathered during a command visit that we didn't have any knowledge of. At the same time, we had intel that our commander had not seen and thus we provided key info to help complete his frame. Out of this we all reached common

[355] Swartz, *The Skilled Facilitator*, 5-6.

[356] Ibid., 137.

understanding…and all in less than an hour with the commander. I don't think this process is new. I think it is the staffing process that has always been used…but now we need to formalize it as a key element of developing understanding.

—Major Derek Jones

In hierarchical organizations, "leading up" can be an uncomfortable subject.[357] The idea of a subordinate telling military and civilian superiors how to think about a problem situation requires suspending assumptions about how large organizations function and how senior leaders gain shared understanding. Discourse between the commander and staff, with commanders up the chain of command – and outside the military chain of command – must occur to identify disagreements, to create a shared understanding, and to communicate the learning from each of the three spaces that is essential to design.

Army doctrine identifies formal and informal leadership as two forms of team leadership.[358] Leadership doctrine acknowledges the concept of shared leadership, which occurs more frequently at the organizational and strategic level.[359] Informal leaders can create and lead "chains of learning" that support the commander's formulation of an operational approach. Exercising informal leadership takes professional tact and interpersonal skills. As discussed in the previous section, orchestrating a design effort requires good facilitation skills to transfer knowledge gained through exploration and to manage discourse among non-peers.

Commanders have an essential role in creating an open atmosphere for discourse – what Heifetz termed a "holding environment" – so that "addressing difficult issues" or accommodating "wide value differences" does not lead to divisive exchanges, ultimately defeating the purpose of discourse.[360] Early discussion of design in a military context recognized this need:

> Commanders must teach and encourage subordinates to "Lead Up."[361] That is to say, commanders should be transparent with subordinates and convince them that their views, ideas, and perspectives are invaluable to the success of the organization. The main inhibitors of Design are stove-piping, micromanagement and a herd-mentality within the command. The commander must take care to avoid organizational obstacles and be willing to share the work of command, including allowing subordinates and staff officers to exercise healthy initiative and experimentation…. None of this is new, of course. Good

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[357] For a case study approach to the concept of leading up, see Michael Useem, *Leading Up: How to Lead Your Boss So You Both Win* (New York: Three Rivers Press, 2001). Useem drew three examples from senior military commanders' experiences.

[358] *FM 6-22*, 3-8.

[359] *FM 6-22*, 3-9

[360] Ronald A. Heifetz and Marty Linksy, *Leadership on the Line: Staying Alive through the Dangers of Leading* (Boston: Harvard Business School Press, 2002), 102

[361] LTG (P) Martin Dempsey, SAMS Graduation, 22 May 2008.

> commanders have done it for years. The point here is that these conditions are essential for the practice of Design. Where they are absent, Design simply won't work.[362]

The commander allows and encourages the free and open exchange of ideas to create the understanding necessary for design. As recognized by this passage, design can involve uncomfortable and oftentimes contentious issues and beliefs. Identifying disagreements amongst stakeholders is a necessary and essential part of design. This identification aids creative approaches. The tension amongst stakeholders, especially most senior officials, is a great aid to moving forward – in both the identification and the resolution of these tensions lies greater understanding. Understanding sources of tension can aid in managing the interaction among the design team. Tensions do not solely arise from individual participants. One perspective on stakeholders comes from Brian Lawson. Lawson named four "generators of design constraints": the designer, the client, users, and legislators.[363] Lawson further differentiated constraints into internal and external forms, and he classified them as radical, practical, formal, and symbolic constraints.[364] Lawson then combined the generators, domains, and functions of constraints into a three-dimensional model.[365] Knowledge of this model can assist the team lead.

Practical guides to managing the relationship between the design team and the system of stakeholders exist. John Kotter identified the social nature of modern organizations in *Power and Influence*. Kotter outlined the management of relationships in three dimensions: laterally (outside the chain of command), downward (with subordinates), and upward (with superiors). Of note is the active role the subordinate must take "to get the support, information, resources, and help needed from the boss to perform a difficult leadership job in an effective and responsible manner…."[366] In a more recent collaborative piece, authors Gabarro and Kotter used "Managing Your Boss" to mean "the process of consciously working with your superior to obtain the best possible results for you, your boss, and the company." **The boss-subordinate relationship is a two-way system involving mutual interdependence between two fallible human beings.** The authors say that management theorists pay little attention to this necessary aspect of being a member of an organization. While most management texts focus on the top-down aspect of management, the authors contend, at a minimum, that one must appreciate the boss's goals and pressures.[367]

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[362] SAMS Student Text, Version 1.0, 24 September 2008, 41-42.

[363] Lawson, *How Designers Think*, 90-92.

[364] Ibid., 93-107.

[365] Ibid., 106.

[366] John P. Kotter, *Power and Influence: Beyond Informal Authority* (New York: The Free Press, 1985), 100-101.

[367] John J. Gabarro and John P. Kotter, "Managing Your Boss," *Harvard Business Review* (January 2005): 92-99.

4.2.4. COMMUNICATING UNDERSTANDING

Communicating understanding derived from the design team's work demands that the team view the design from the perspective of one unfamiliar with the team's detailed work. The transition from design drawings to a presentation requires planning and rehearsal. **The single most effective technique for creating useful presentations is to storyboard the effort.** Drawn from the storyboarding introduced by William Cameron Menzies for the 1939 film *Gone With the Wind*, storyboarding requires the leader to make early decisions about the intent and structure of presentations.[368] Given a limited amount of time for the engagement with the commander, or any audience, the design team should discuss the number of slides appropriate to the engagement, the desired communication outcome, and then produce a sketch of how the sequence and material of slides will generate that outcome. This discussion can be done by the team leader as individual work, or as small group, but should then be discussed in large group forum, taking input from all members of the team. It is important to listen to all team stakeholders when discussing the content and method of presentations. It is also important that a narrative is developed to accompany the presentation. This provides the benefits of altering the medium of expression described in Section 4.2.1; ensures the presentation has a coherent beginning, middle and end; and is a forcing function for ensuring the presentation has a moral or meaning. In 2010, SAMS AMSP Seminar 3 used the storyboarding technique to create an overview of the design methodology as they practiced it at SAMS, which is shown in Figure 19.

[368] See *Wikipedia* for references to Menzies. http://en.wikipedia.org/wiki/William_Cameron_Menzies (accessed May 17, 2010).

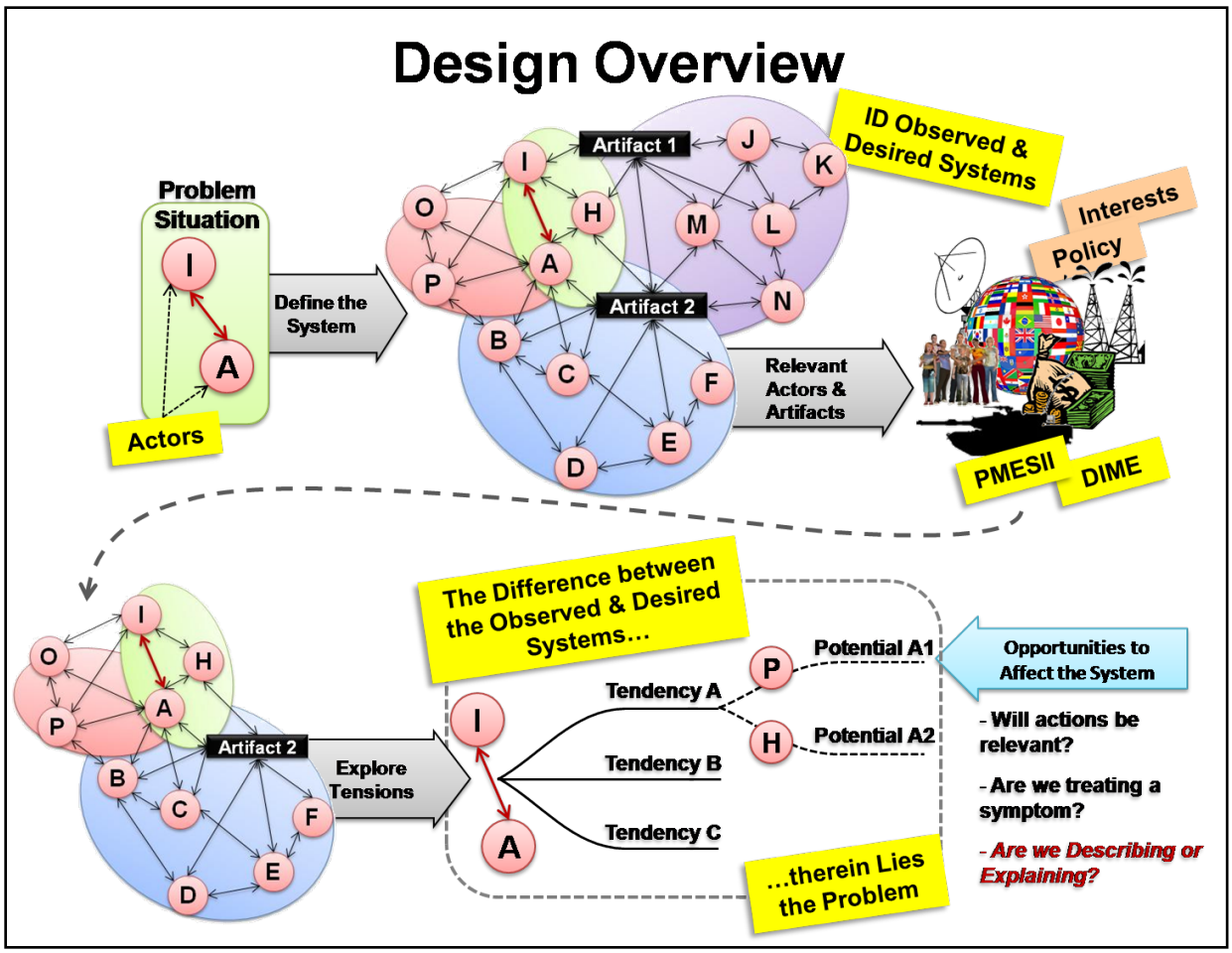

FIGURE 19. SEMINAR 3 SAMS AMSP 2010:
STORYBOARD OUTLINE OF THE DESIGN METHODOLOGY.

Although Seminar 3 did not create a full narrative, they did provide notes to explain the progression through seven builds of the storyboard from left to right, with three builds in the first row and four builds in the second row. The notes are provided in Table 32.

TABLE 32. SEMINAR 3 SAMS AMSP 2010: NOTES ACCOMPANYING DESIGN STORYBOARD.

This slide is a simplified representation of the design process. **Build 1:** The designer is confronted with a problem situation that requires design. The problem in this example involves two actors whose relationship or interaction has become undesirable. The problem is complex and cannot be solved easily. **Build 2:** The designer must define the observed system and determine the desired system. An initial analysis of the actors and artifacts associated with the central actors may result in a very complex system of actors, artifacts, and interacting systems. **Build 3:** The designed must then attempt to define the relevant actors within the system, to narrow the scope of the study. An understanding of the observed system is shaped by examining relationships using DIME, PMESII, and other tools. The desired system is shaped by policy and national interests.

Build 4: This helps to bound the system.
Build 5: Once the system has been bounded, the relationships and tensions between actors can be further explored to determine the nature of the relationships: What are the tendencies of actors in relation to the desired system without outside interference? What are the potentials to shape an actor's tendencies if an outside actor attempts to act or interfere within the system? Exploring these tensions, tendencies and potentials helps the designer to gain an understanding of the observed system. This also helps the designer to gain an understanding of the system's capacity to move toward the desired system. The difference between the observed and the desired system helps to identify the problem.
Build 6: The identified potentials provide the designer areas to affect the system and actions that will shape the design concept. It provides a vision of how to manage the problem within acceptable levels of tolerance as we attempt to move toward the desired system.
Build 7: But are the identified potentials really opportunities to effectively manage the problem? Will the identified actions be relevant within the system? Are we treating the symptom or the problem? Are our conclusions based upon descriptions of the system or an explanation of the system that provides understanding?

4.3. LEADING DESIGN TEAMS

This is not a "Command Centric" Process. We built a team of minds that often met at the end of the day in our Plans Shop while deployed. They were not all planners – they were people that were intelligent, motivated, in tune with world events, and could look at problems differently.

—Major Jeffrey Powell

…the commander HAS to be involved and accepting of the concepts or only a few insights will make their way up the Chain of Command – and many political and other pressures will derail most "Design" insights.

—Major Grant Martin

The social creation challenges are more difficult than the intellectual challenges associated with your small design team and their relationship with the organization's commander. In the realm of social design, the team leader is required to construct functional relationships with people and organizations that do not work directly or even indirectly for your commander, develop relationships with organizations foreign to your concerns, and work well with others when you have very little in common. The specific challenges facing the design team leader are leading the team itself, leading repetitive and iterative work in all three design spaces, integrating the work of his/her own team and the work of others, and sorting out how to do the essential continuous assessment (see Section 4.4 for iteration and Section 4.5 for adaptation and assessment).

When the team leader begins the process of social construction, both of the immediate design team, of SMEs who will inform the team, and of both personnel organic to the organization, as well as the larger circle of coalition organizations, agencies, and entities, he/she must be deliberate and willful in the construction. Membership and communication of beliefs must be deliberate and not left to pre-existent groups or alignments. **Each design effort requires new and novel approaches to social organization – frequently the most critical step of design is to organize, structure, and empower the various teams for design.**[369]

As the team leader builds the concentric circles of design teams and their affiliates, he/she must pay particular attention to the initial structuring of group dynamics, and then continue to re-assess group dynamics as the design work progresses. This is not a matter left to chance, but is deliberately assessed, analyzed, and corrected throughout the design process.[370] An essential part of this group dynamics assessment is for the team leader to assess his/her own leadership skills and correct his/her leadership deficiencies as the team progresses.

The team leader must also continually appraise the team's perception of goals, assess the functional and dysfunctional characteristics of the design group, work on developing team norms (rituals of practice), and then lead the team through understanding and use of these norms.[371] Seminar 7 from SAMS AMSP 2010 captured their top four best practices from three design practica, shown in Table 33. It is interesting that three of four best practices relate to issues of social creation. (Only their third lesson – keep asking why – did not directly relate to group dynamics.) First, proximate designers, or SMEs outside the core design team, were found to contribute best when they were included from the beginning of design. Second, the relationship between the design team and the commander is probably the most important relationship for the success of design. Last, functional teaming, involving the forming and reforming of small and large groups within the design team, is essential to maintaining team productivity and effectiveness.

TABLE 33. SEMINAR 7 SAMS AMSP 2010: BEST PRACTICES.

SAMS Seminar VII Best Practices
1. Proximate Designers. Design teams must include proximate designers early in the process. Proximate designers provide the necessary expertise to create the environmental frame. Failure to introduce the proximate designers early in the process could result in an incomplete environmental frame leading to an early reframe. 2. Commander. Design teams must have access and interact (discourse) with the commander. The discourse between the design team and commander facilitates a common understanding of the environment and further formulation of the design

[369] Lawson, *How Designers Think*, 248.

[370] Lawson, *How Designers Think*, 242ff.

[371] Lawson, *How Designers Think*, 246ff.

concept. Commander participation is critical for design to be successful, but more critical may be the design team's ability to engage with the commander on a frequent basis.

3. The constant questioning of "Why." A key purpose of design is to identify the right problem. By asking the meta-question of why, the team was able to develop a more in depth understanding of the environment a truer identification of the problem and how best to transform it. The constant quest for causality was critical.
4. Functional Teaming. The design team benefited from organizing into functional teams. Functional teams conducted separate breakout planning sessions to gain a basic understanding of new problem sets. Following small group learning, the large group rejoined to gain a holistic understanding of the environment.

4.3.1. FACILITATING DISCOURSE

Arguably the most essential characteristic of a functional design team is the ability of the team to conduct useful holistic discourse. Discourse is much more than mere dialog or discussion. Discourse is the open and living movement of ideas in free conversation amongst the members of the team. The team leader must also make every effort that open discourse also occur with the team's commander, higher commanders and leaders, subordinate design entities, and design teams in parallel organizations. Without discourse, there will be little chance of developing iterative understanding, since iterative understanding relies on the free exchange of ideas, where individuals are entrusted and empowered to use their skills in support of the team understanding.

Discourse is not just what is said, but also includes the actions and products of the design team. Klaus Krippendorff identifies five features of discourse as a design problem:[372]

1. A discourse surfaces in a body of textual matter, in the artifacts it constructs and leaves behind;
2. A discourse is kept alive within a community of its practitioners;
3. A discourse institutes its recurrent practices;
4. A discourse draws its own boundary; and
5. A discourse justifies its identity to outsiders.

From this definition, we can see that discourse extends beyond dialog into all of the texts and artifacts produced by design. Discourse requires a community of practice who are actively reading, writing, and communicating with each other to improve the way they design. Discourse habitually repeats its recurrent practices, which are simply the rules and norms discussed in Section 4.2.2 above. A discourse draws its own boundary, meaning that it defines what problems it solves, who belongs to the design community, and what are the

[372] Klaus Krippendorff, *The Semantic Turn: A New Foundation for Design* (Boca Raton, FL: CRC/Taylor & Francis, 2006), 23-24.

paradigmatic examples of good design. Lastly, a discourse must have a story justifying its identity. The knowledge, values, and expertise of its practitioners provide justification to outsiders of the success of a particular discourse. From a practical perspective, this broad definition of discourse implies that the design team leader must pay attention to all five features of discourse. They must be aware that the references the design team uses, the communities of practice with which they interact, and even the room in which the discussion takes place will all affect what is said and what it is interpreted to mean. Discourse involves not just the dialog within the team but also the elevator speech that team members can give to outsiders to explain what the designers are doing and why this is of value.

Discourse is encouraged by active listening, good basic team leader leadership skills, the positive group dynamics of the team, encouragement of different skills in each member of the team, and empowering team members to engage in the discourse. The team leader can use several techniques for empowering discourse. These techniques include asking team members to demonstrate their current knowledge of the system through some manipulation of the system in a simulation, and then ask the team to comment constructively on the demonstration. The leader can also personally provide a movement or an action that could be tested against the assumptions of the team, although the team leader must exercise caution in providing his own belief structure as the final structure – his/her thoughts are no more valuable or accurate than those of any member of the team. The team leader could also encourage the use of telling part of the understanding of the system, then encourage open questioning of the belief, adding other ideas from members of the team as they develop and emerge. **Perhaps the most effective discourse, either in the team or with external entities, is a combination of telling, listening, demonstrating, and moving elements of the system to encourage new ideas on how the system operates and how the organization can influence the system toward the desired goals.**[373] Lawson agrees, discussing design in terms of selection of awareness focus, combining ideas about the system, creating new interpretations, and pursuing innovative solutions, all in the context of group discourse to stimulate deep, innovative understanding.[374]

The following example of design discourse took place during the main two week phase of Exercise Omni Fusion 2009. A nine person[375] stand-alone design team within the division headquarters is attempting to design the division's response to a fictitious conflict scenario involving the imaginary countries of Elis and Attica. Coalition forces have successfully repelled Attican forces involved in a hostile incursion into sovereign Elisian territory.

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[373] Schön, *Educating the Reflective Practitioner*, 102ff, 107ff, and 111.

[374] Lawson, *How Designers Think*, 5. Also see his design process map on 37-38 for more information.

[375] The design team had six core United States team members (one with expertise in each of the PMESII variables) and three multinational Army designers representing Australia, Canada, and the United Kingdom. Although a majority of design discourse occurred between these nine designers, other participants included the CG, Deputy CG, G3, G5, G2, and the six members of the joint interagency coordination group.

However, remnants of the aggressor's conventional force remain in theatre; Attica has a nuclear program that threatens regional stability; the Elisian government is weakened and has issues with perceptions of its legitimacy; tribal tensions have flared in the wake of the invasion; and several tribes are known to have conducted terrorist activities, cross-border smuggling, human trafficking, and are promoting separatist ideologies. The Commanding General (CG) engages actively with the design team several times per day. He looks to his design team for deeper understanding of the operational environment and engages in discourse to help shape his strategy and to articulate his planning guidance. In this discourse at the beginning of day three of the exercise, there are four active participants, who we will call John, Paul, George, and Ringo.

John: We need to have a discourse on the operational approach. Paul, can you show us your problem frame graphic on the whiteboard?

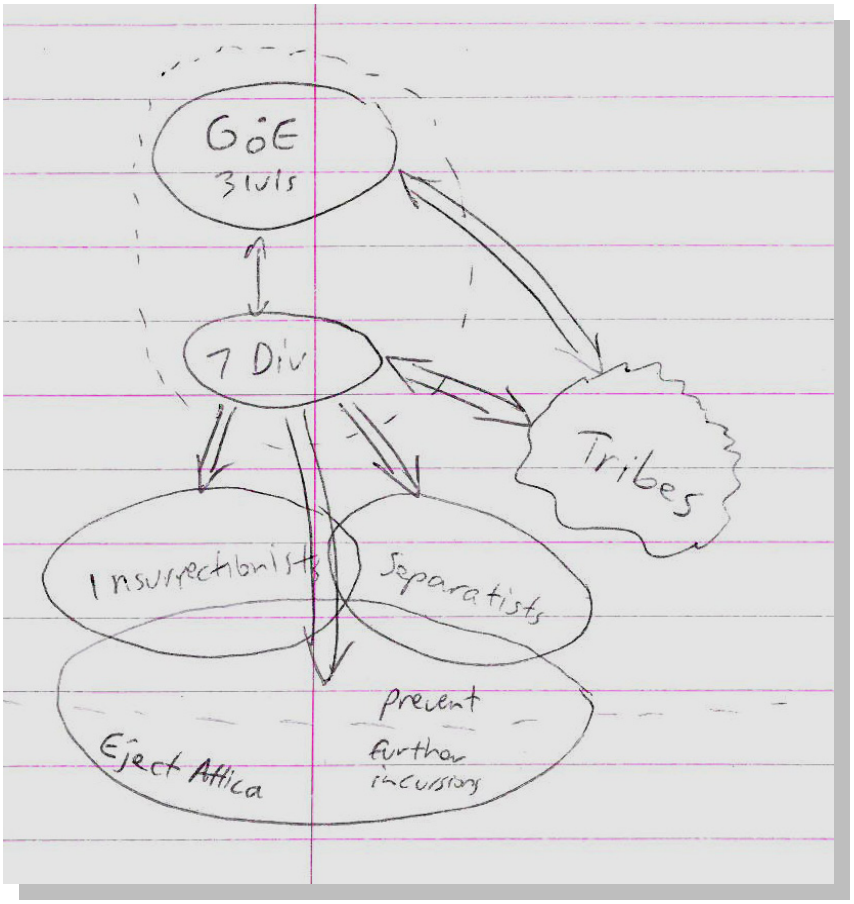


FIGURE 20. COPY OF THE OMNI FUSION 2009 PROBLEM FRAME GRAPHIC.

Note that GoE = Government of Ellis

Ringo: The population is missing from both the graphic of the problem frame and the narrative.

Paul adds the population to the graphic as a bubble surrounding the Elisian actors

John: So what is the real problem here?

George: This was the CG's guidance: I need you to clean up and prepare for entry of Attica.

Paul: Is 7 Division expected to be required to stabilize before Attica attack?

George: Yes, phase 2D has stability functions. Phase 2 to phase 3 depends on UN Security Council Resolutions.

Paul: Phase 3 will kick our arse [sic]. None of phase 2 will unless we're here for 5 years. This is a bifurcated problem: prepare for future operations South of the border; or focus on caretaker actions to improve our AO. Whatever problem we choose to address, the CG needs to accept this risk.

George: None of these tensions have come out previously in the design. It is the difference between 90 days of stability or 5 years.

Paul: Does the PMESII framework bias us towards stability rather than major combat operations?

John: Yes. It did a great job of informing our comprehensive analysis, but we deliberately left off the variable of time. We were told not to go South of the border, so we constrained our analysis to our AO. Also, we truncated the environmental frame and the problem frame.

George: I'm responsible for the Military variable, this was my oversight. I failed to look beyond phase 2D. I did not consider the temporal dimension.

Paul: So what are the required deliverables? We need to write up the risk assessment for the CG to decide on the Corps bifurcation point. We need to revise the quad chart overview. And we need to convert the whiteboard graphic into a PowerPoint slide.

There are a number of insights on the nature of design discourse contained in this dialog.

1. *Design drawings provide a focus for discourse*. This particular design team had resisted drawing early in their design work. Omni Fusion 2009 was interested in the value of design in a time constrained environment, and it was felt that drawing – starting from a blank slate – would waste valuable time. In spite of this initial resistance, when Paul began sketching out the relationships to aid his own understanding, the design team leader, John, asked him to share it with the group. The problem frame was no work of art, but it provided focus for the discourse. It prompted Ringo to notice what was *not* represented in the diagram. It also led to the asking of new questions that had not been asked in the first two days of design discourse.
2. *The real problem can emerge unexpectedly at any time*. In this passage, Paul introduces new language to describe his new appreciation of the problem: "This is a bifurcated problem." Prior to this point, the design team had been more focused on the immediate symptoms of the conflict, such as border issues, insurgent activity, and tribal tensions. Prompted by the design drawing, the design team realizes that the real problem they need to address is to decide whether the main effort is to

prepare for conventional operations or to provide stability within the current AO. Until the nature of the campaign they are fighting is established, the operational approach cannot be determined, and the priority for addressing current and potential crises cannot be set. Other members of the design team express surprise at this new appreciation. As we have noted above, **surprise is a key emotion in design, because it triggers reflection in action.** John blames the initial framing of the environment and the problem, which in hindsight appears to have been overly constrained by the PMESII operational variables, geographical limits on the environmental frame based on the uncritical acceptance of guidance, and short cuts taken in the time-compressed design approach. George assigns blame to the analysis within the military variable of PMESII, for not adequately considering the temporal aspect of the military problem. Of course, it is unnecessary to assign blame when one realizes design is not a linear process. It is more important to continue to provide opportunities for discourse than to expect to identify the 'real problem' up front.

3. *Reframing can be caused by changes to understanding as well as real world events*. Omni Fusion programmed in two intentional reframing events to analyze how the design team would respond. Ironically, the design team understood the scenario so well that neither reframing event was a surprise. The understanding of the problem expressed above caused a more significant ripple in the design team's products and approach than any real world event.
4. *Discourse is freewheeling*. The stated purpose at the beginning of discourse was to determine the operational approach. Yet the outcome of this session was an articulation of the risk of the birfurcated problem, requiring the CG to take a decision; changes to the quad chart summary of the design to reflect the new appreciation of the problem; and the creation of a presentation drawing to communicate the insights of the design drawing to the CG. While it is essential to impose structure on discourse to ensure progress, it is equally important to allow unanticipated avenues to be explored and encourage meta-questioning that may revisit earlier stages of the design methodology.

According to Schön, discourse includes the freedom in the group to conduct, without fear of reprisal or silencing, hypothesis testing by all members of the team.[376] Since the team developed the initial hypothesis as a team, the team discourse is the opportunity for all reappraisals of the baseline hypothesis (see Section 4.3.3 for the use of hypotheses in environmental framing).

NATO Training Mission – Afghanistan (NTM-A) / Combined Security Transition Command – Afghanistan (CSTC-A) currently have several staff with a deep understanding of the design methodology. This includes, Dr. Jack Kem, who serves as Deputy to the Commander, and who is the primary author for *FM 5-0* Chapter 3 on design. In a recent meeting, Kem stated that design was "tailor made" for the collaborative environment required for

[376] Schön, *Educating the Reflective Practitioner*, 70.

running an Operational Planning Team with representatives from 46 countries, multiple non-Governmental organizations, and the United Nations.[377] There is also an informal Inter-staff Initiatives Group (IIG) that provides design-like products to provide the CG with an alternative perspective on some longer term challenges (for further discussions from a SAMS graduate within this group, see Section 4.5.4 below). An example product generated by the IIG is shown in Figure 21. Here, it can be seen that the group is using discourse to surface commonly held assumptions for the purpose of hypothesis testing. The implications of their discourse are that when it comes to recruiting for the Afghan National Police, quality is more important than quantity. Moreover, even quality recruits may end up working against the desired state if there are structural and cultural issues that incentivize harmful patterns of behavior.

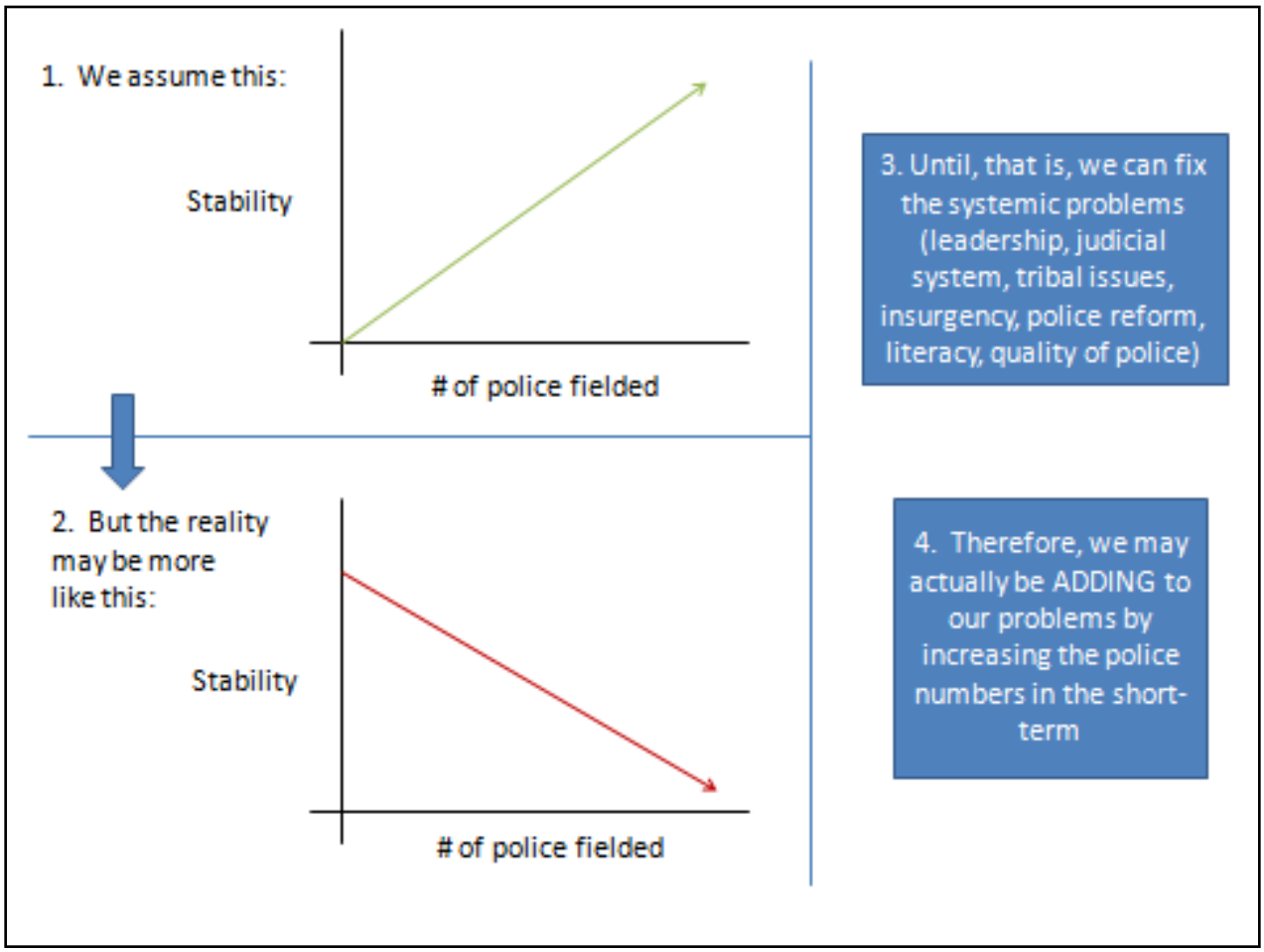


FIGURE 21. NTM-A/CSTC-A INTER-STAFF INITIATIVES GROUP TESTS THE HYPOTHESIS THAT NEW POLICE RECRUITS CONTRIBUTE TO STABILITY IN THE CURRENT CONTEXT.

[377] Jack Kem, Friends of Design Meeting, Fort Leavenworth, March 2010.

Discourse may be freewheeling, but it is also purposeful. Often, it is useful to provide some shape to the design discourse. In a *Military Review* article, Major Xander Bullock and Major Bruce Vitor describe how to structure discourse within a broad framework of divergence, transformation and convergence.

> Divergence occurs when a team receives guidance and begins by tearing apart a problem or situation to develop a more complete understanding. Divergence includes asking questions and creating an understanding of the operational environment by looking at known facts and assumptions with skepticism. In this divergent phase, it is important not to limit the expertise to the field that seems most applicable. Divergence seeks transformation. Transformation is the spark of insight, which illuminates the way forward for the designing organization. It is common for teams to become stuck in the divergent phase because they lack or have not developed the creative spark that will form the solution.
>
> The transformative phase starts with a mass of divergent information and contrasts it with the current problem understanding to determine possible outcomes. The design team is ready to move forward from the transformative phase to the convergent phase in the form of a "design concept" once a series of unifying ideas and concepts have been developed and agreed upon.
>
> The convergent phase is the one most familiar to the Army culture. In convergence, the design team must be intentionally reductionist and cast aside much of the information and products created during design creation to converge on a product and a singular understanding of a situation. Lacking any one of these cognitive phases, a design will not be complete.[378]

The distinction between divergence, transformation and convergence was first introduced by J. Christopher Jones in his classic book *Design Methods*.[379] This general schema maps onto almost any design methodology, including the one used by SAMS. The terminology of divergence, transformation and convergence was also used in the outdated *FMI 5-2*. Students may find this to be a useful tool for guiding discourse throughout the three cognitive spaces of design.

4.3.2. LEADING PRACTICE

Much of design theory centers on the requirement to learn by doing design. This is not possible through the introduction of another document into the Army publishing website. The practice sessions under knowledgeable coaches required to internalize the concepts and techniques are not transferrable through the pages of doctrine alone.

—Major William "Yogi" Maher, USAF

[378] Major Xander Bullock and Lieutenant Colonel Bruce Vitor, "Design: How, not Why," *Military Review* (March-April 2010): 104-105.

[379] J. Christopher Jones, *Design Methods* (New York, NY: Van Nostrand Reinhold, 1992).

The actual practice of design is learned by the team as they do design. The team leader, even if a very experienced designer and leader, cannot simply lead the team into understanding – he/she must have the team engage in design activities in order to increase their understanding of both the subject of study and the actual practice of design. Design is learned by doing design as a team – there is no substitute for this experience, complemented with reflection on the other four pillars of design.[380]

4.3.2.1. MODULATING THE WORK

USARAF is a relatively "flat" organization (roughly 10 COL/O6 level directorates in a 300PAX staff). Therefore, each "rice bowl" owner wants a seat at the Design Table. Plus, there's a requirement to balance with the Navy, Air Force, Marines, and various OGAs (not just super secret squirrel groups... DoS, USAID, etc.). Thus, the "core" Design group is numbering around 40PAX. Organizational dynamics, informal leadership, and knowledge management issues abound.

—Major Dave McHenry

One of the most useful ideas for a team leader is to modulate the work of the team.[381] Some work needs to be done by all members of the team engaged in discussion, other elements of work can best be accomplished by a small sub-group of the team, and some work can best be accomplished by individuals. The team leader must deliberately decide when to use which technique, and he must be flexible to alter his decisions as the situation changes. Large group work is optimal for shared understanding, and although slow at times, it is essential that the large group be called together periodically to share their understanding and exchange ideas about future progress.

Small group work, also deliberately modulated by the team leader, is used when the large group has too many issues to sort through, or the expertise of all members of the group are not needed for a particular inquiry or activity. The team leader must bear in mind that the work of small groups is always subject to criticism by non-present SMEs. All the work of small groups should be vetted in large forum, with all SMEs present. This not only provides a chance for all to comment, but also shares understanding and provides an opportunity for the team leader to construct "buy-in" by all members of the team.

Individual work is useful when a road block has been encountered, and the large group or small groups are challenged to move beyond the blockage. Individual work is frequently done by either the team leader or by trusted agents – those he can trust to carry a significant work responsibility without unduly biasing their work. The best use of individual work is to conduct reviews of work progress and develop schemes for forward movement. These schemes should be presented to the large group as options, not as a *fait accompli*. Individual work can also provide useful guidance for presentations, engagements,

[380] Lawson, *How Designers Think*, 237.

[381] Lawson, *How Designers Think*, 256.

and planned meetings of the team. Like small group work, individual work must be vetted with all members of the team.

4.3.2.2. SKETCHING TOWARDS UNDERSTANDING

Another excellent and useful technique for developing forward progress in the team is to focus, on occasion, deliberately on a specific form of drawing or sketch. There are generally three forms that can be used – the design drawing, the presentation drawing and the production drawing.[382] The design drawing is frequently the emergent sketch from the actual work of designing – frequently multiple sketches presented by factions or sub-groups to a common shared understanding discussion by the larger group. Individuals may also provide specific design sketches of work they were assigned. An example of an individual design sketch is shown in Figure 22.

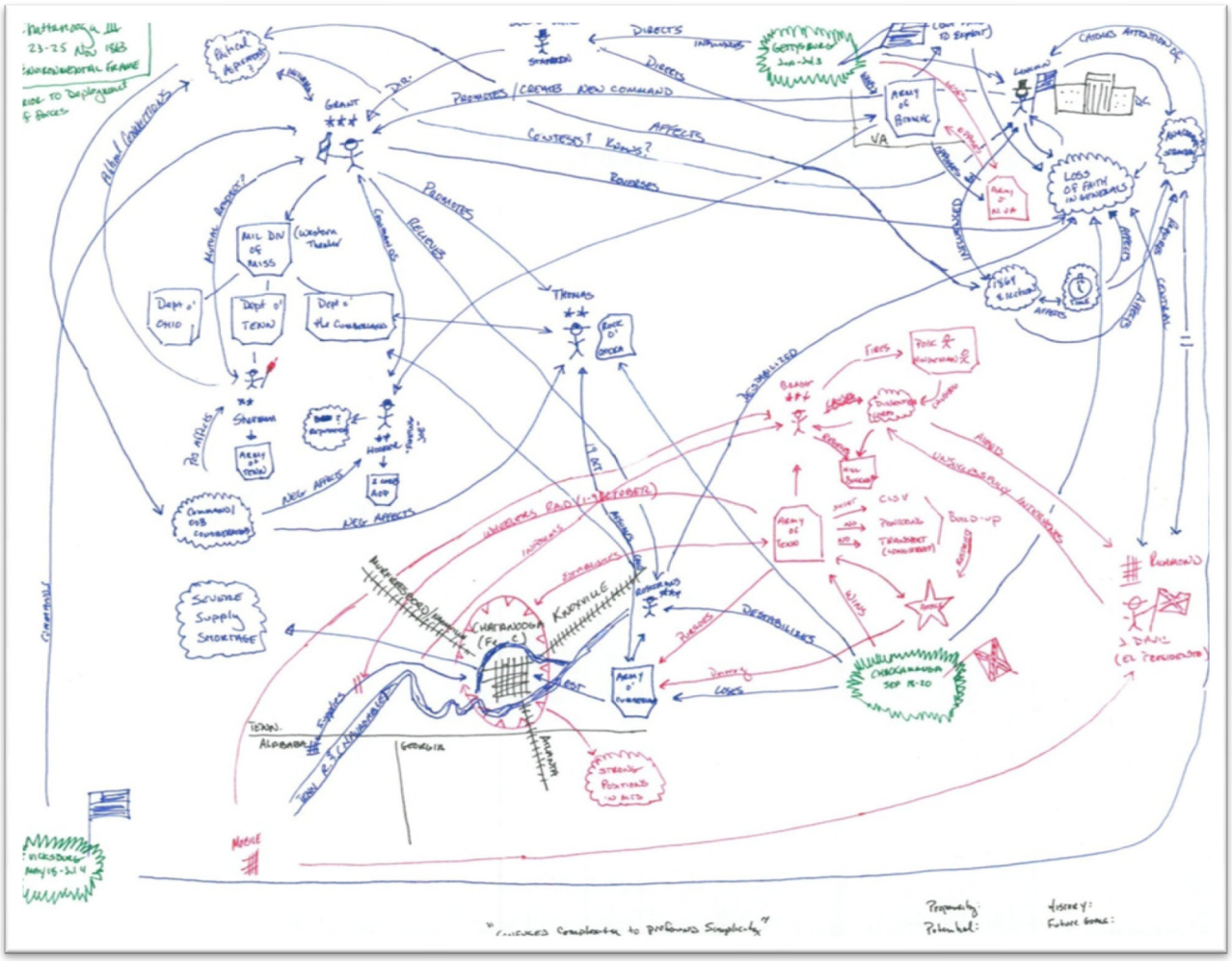


FIGURE 22. MAJOR DAVE RAPONE, SEMINAR 5 SAMS AMSP 2010: DESIGN SKETCH OF CHATTANOOGA.

[382] Lawson, *How Designers Think*, 26-27.

Major Rapone's design sketch emphasizes relationships between actors in the Battle of Chattanooga. In developing his "Cracker-line" Campaign, General U. S. Grant first examined activities in 1863 in the larger context of the war. He described in his *Memoirs* how he reflected on previous military events and ongoing operations. He then took those considerations, along with specific guidance he received (designing constraints), and designed his campaign. A historical review illustrates how he proceeded through what today we call an environmental frame, a problem frame, and a design concept. He then moved on to specific tasks and execution, but he remained cognizant of the larger issues evolved from his design understanding. The design sketch in Figure 22 is an attempt to capture the richness of this situation.

Major Rapone's rich picture shows connections between individuals, such as Grant and Thomas; organizations, such as the Military Division of the Mississippi and Army of Tennessee; physical entities, such as the river and the railroad; as well as conceptual factors, such as 'loss of faith in Generals' and the psychological impact of Chickamauga. The use of a drawing discipline means that these factors are represented with different symbols, and all relationships are labeled with descriptive text. The use of colors and icons (flags, military graphics, and caricatures of the individuals) adds further richness to the information depicted in the sketch. The quote on the bottom of the page says "confused complexity to profound simplicity." This drawing is not intended for an external audience. Rather, it is the first step in mapping the complexity in order to have a reflective conversation with the situation. The process of acknowledging and mapping the complexity helps generate the insights of profound simplicity.

The presentation sketch is generally used to present understanding of the design team to an outside-the-team individual, frequently the organization's commander or more senior commanders. These are difficult sketches, but in the challenge of creating understanding in a person not in the design team, the team itself frequently hones its own understanding of the issues at hand. **The key principles to effective presentation sketches include using commonly understood, doctrinal terms to describe the understanding.** Using words only understood by the design team will not aid the understanding of those not intimately involved in the design itself. Another principle is to red-team the presentation with personnel who have not been engaged in the design to gauge their increase in understanding. Figure 23 is a good example of a presentation drawing, because it focuses on the "so what?" of the understanding developed in the environmental framing.

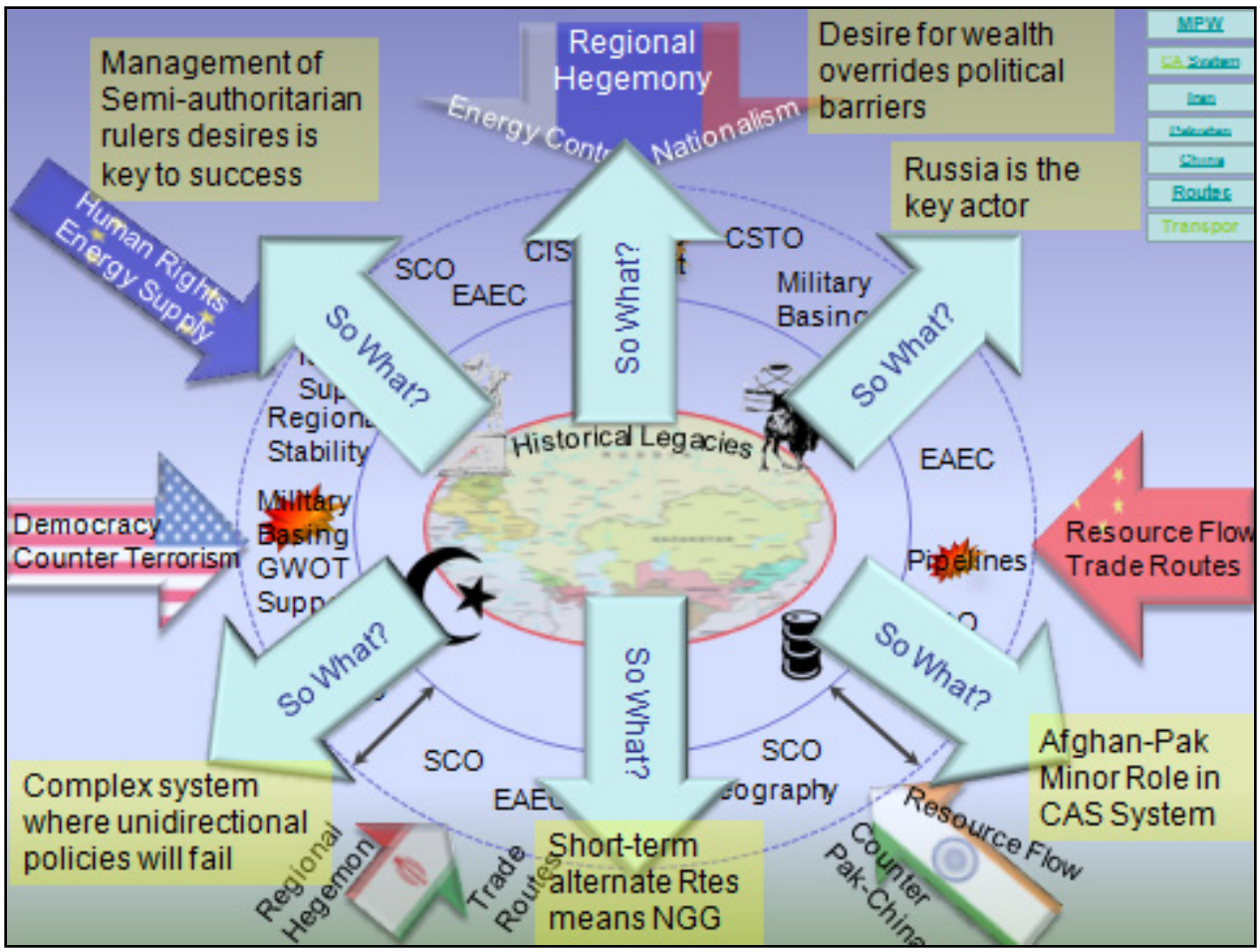


FIGURE 23. SEMINAR 8 SAMS AMSP 2009: PRESENTATION DRAWING OF THE ENVIRONMENTAL FRAME IDENTIFIES THE ACTORS, FLOWS, AND IMPLICATIONS OF THE CURRENT SYSTEM.

The production sketch, likened to a blueprint or a contractor's drawing, is the tool used to transfer action to members of the organization outside the design team. In a manner similar to the presentation sketch, the creation of a production drawing will frequently hone the design team's understanding of the issues. It is sometimes difficult to generate an effective production sketch since the members of the design team may know the situation so well that they are challenged to articulate it in enough detail for those outside the design. In this case, it is frequently helpful to bring in an individual or a small group from outside the design team to act as a "sanity check" on the creation of the production drawing. Figure 24 illustrates the difference between a production drawing and a presentation drawing created by Seminar 1 in 2009.

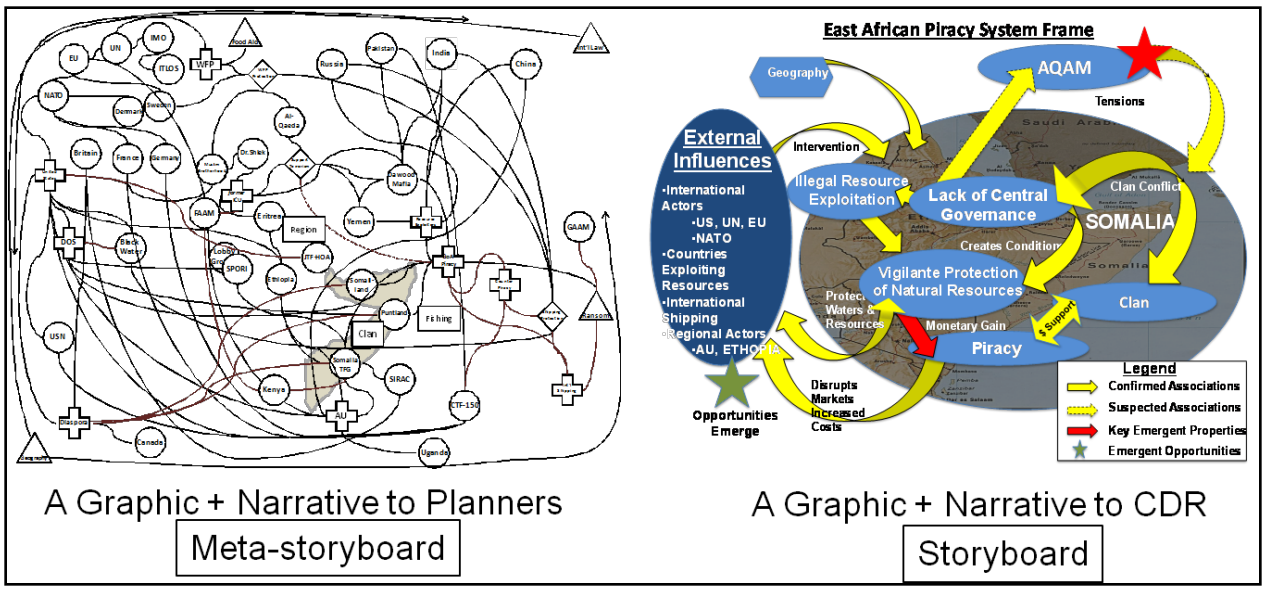


FIGURE 24. SEMINAR 1 SAMS AMSP 2009:
PRODUCTION DRAWING COMPARED WITH PRESENTATION DRAWING

Another useful technique, helpful in these three drawings, and helpful elsewhere as well, is to alter the media of the drawing effort.[383] If the team has been using a free hand drawing on a whiteboard, simply altering the sketch to a map, or a PowerPoint slide format, can generate new understandings and help identify additional issues of interest. Similarly, reproducing a sketch or drawing as a narrative word document can generate new perspectives. Design leaders are encouraged to alter the media of team products whenever the team is blocked – a useful technique for generating new perceptions. The rich picture table of contents above provides an example of how moving from a sketch to a PowerPoint graphic prompted new perspectives, such as the importance of depicting reframing as an integral part of the design doctrine.

4.3.2.3. USING FUNDAMENTAL PRINCIPLES FOR DESIGN

There are as many different lists of design fundamentals as there are design practitioners and theorists. However, Lawson offers five clear and useful fundamentals for a model approach to design. **For Lawson, formulating, moving, representing, evaluating, and reflecting are the key components of effective design.**[384] They are useful for a military design team leader as well.

Formulating includes efforts to understand the nature of the system, assisted by naming or identifying components of the system, and by framing the system within certain, created boundaries for focused understanding.[385] (Gharajedaghi's fourfold iterative understanding

[383] Lawson, *How Designers Think*, 217.

[384] Lawson, *How Designers Think*, summary on 290-301.

[385] Lawson, *How Designers Think*, 292-293.

concept is useful here – see Section 4.1.3; also see discussion of environmental framing in Section 4.3.3.)

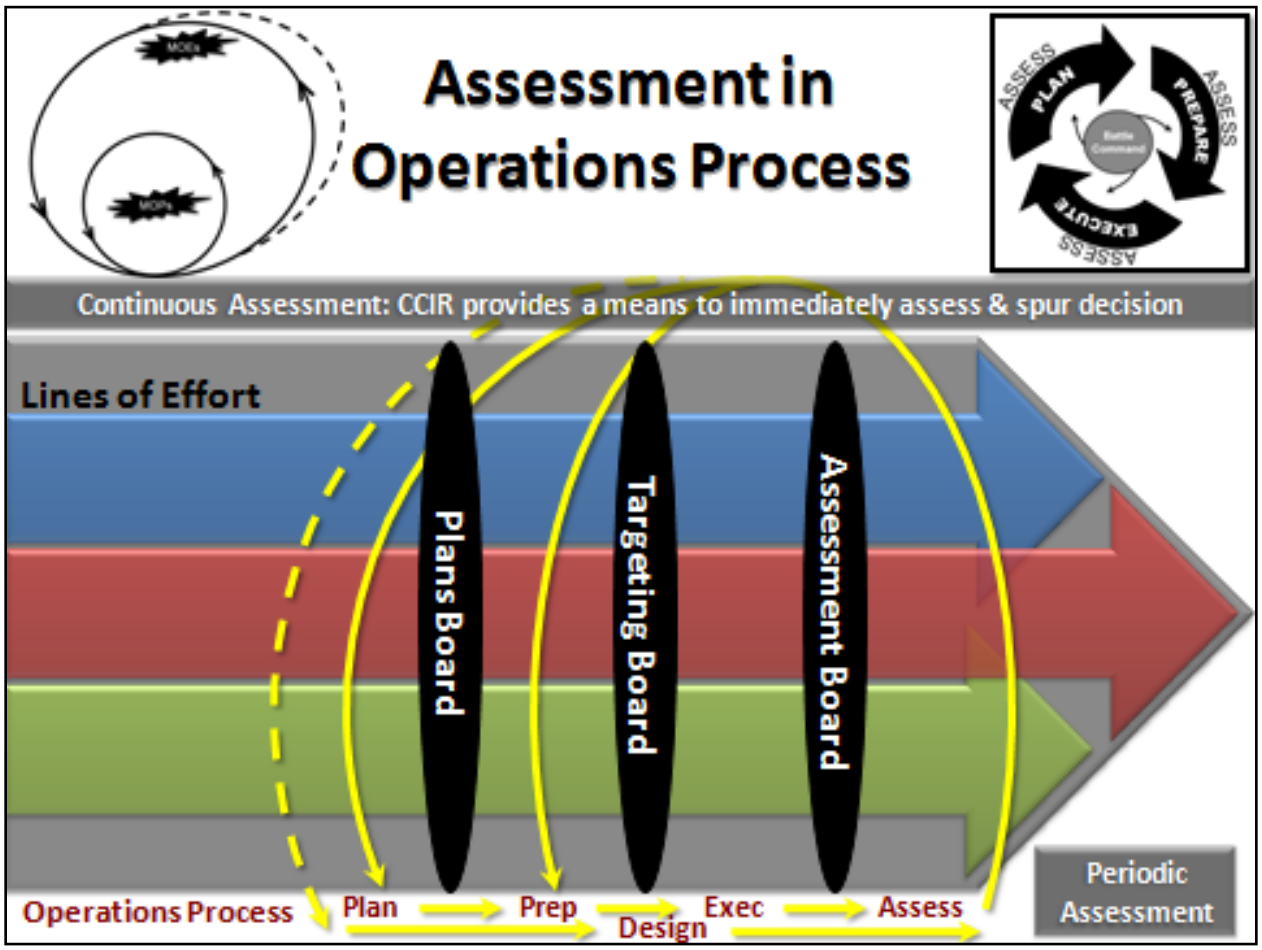
Moving, the making of alternatives, is the second powerful fundamental of design. To move is to create a new understanding – which is then tested against the initial hypothesis of understanding. In moving, the design team looks to its initial big idea, tests that against the current understanding, and then interprets the actions of the system against this new form of understanding. The team leader can also use developmental moves. These are experimental novel approaches, identified and named, discussed in team meetings, and then tested against the existent understanding to judge value and effectiveness. Developmental moves can also be derivative from earlier moves, or from an emergent understanding. The key to successful use of moves is to do many of them – if there are too few, team members may become fascinated with one they generated, and involve their ego in the maintenance of a particular move. **All moves must be considered disposable – their only function is to generate discourse and improve understanding.** A design method from Appendix B that is particularly useful for testing moves is a decision tree. This method has been used in the field by Major Jason Pape to think through possible sequences of actions and reactions in Korea.

After formulating and moving, representing – the making of design propositions – aids the discourse by converting the discussion into a conversation about meaning. Bringing together the ideas generated through multiple moves and through multiple iterations of formulating, representing helps focus the discourse of the design team on the nature of the system itself, and on the transformation(s) required to achieve the desired state(s). The team leader plays a key role here, usually assisted by a small group of trusted agents, in selecting several emergent understandings to represent for the team. However, the team leader must also allow room for emergent representations to come from any team member at any time, as well.

After formulating, moving and representing, the team develops a new holistic understanding, relevant to this iterative cycle of understanding. This phase is evaluating. In evaluation, previous awareness is compared to team criteria and team judgment for validity of both the novel ideas and of the previous understanding of the system. Not all new ideas are judged acceptable or useful – frequently this cycle results in the abandonment of a particular train of thought. Yet even conceptual dead ends can result in increased understanding of the system amongst the team. The judgment of the team is both subjective and objective, with team members engaged I active discourse of both types of awareness.

Reflection is the critical component of this phase of design development. The team leader must oversee reflection, but his/her main role is to encourage and require all team members to engage in reflection. This is not the team lead's reflection – it is the reflection of the entire team, generated by individuals who then narrate their reflection for the team. Figure 25 shows two slides from 1ID that attempt to build double loop learning into the

assessment activity in the operations process. This slide demonstrates both evaluation and reflection on the 1ID campaign design by Major Jason Pape.



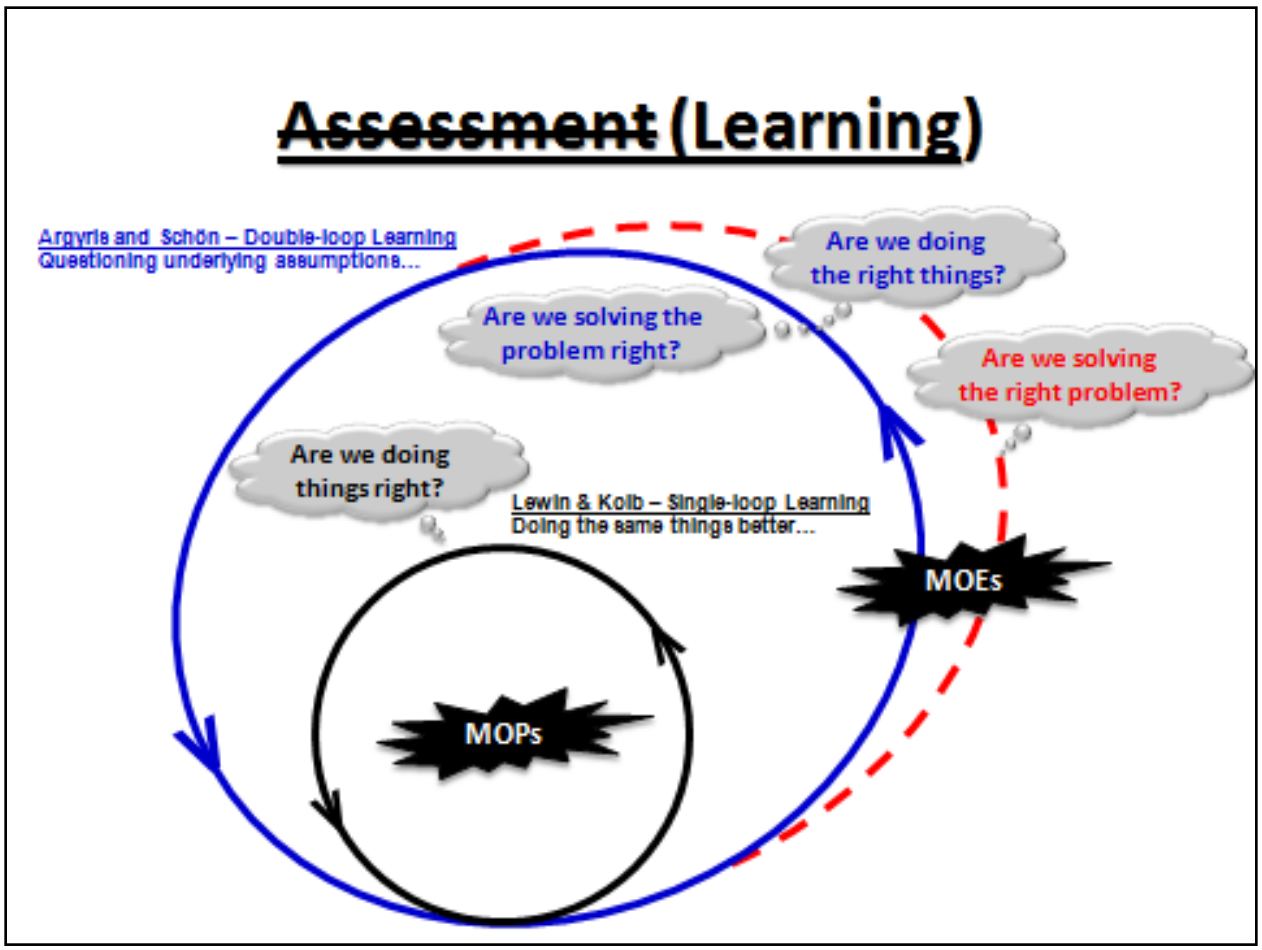


FIGURE 25. 1ST INFANTRY DIVISION: REFLECTING ON CAMPAIGN DESIGN BY BUILDING DOUBLE LOOP LEARNING INTO THE ASSESSMENT ACTIVITY IN THE OPERATIONS PROCESS.

4.3.2.4. PROTECTING FROM ERROR

The ACTO level discussion and discourse is great, and when we do get an O-6 or two to attend planning meetings, they get on board pretty quick. Otherwise, I have to visit the O-6's individually and separately to get buy in because they go straight to the GO's with their own interpretation of problems and solutions. A very difficult and ineffective process as the O-6's only expect briefings and don't really like to sit around during long discussions unless a GO is present. The committees each consist of about 15-30 individuals, mostly O-6's and above. It is NOT conducive to good discourse and every trap you'd expect a group like that to fall into, they do and don't even realize it. Facilitating such discussions is a bit of a challenge.

—Anonymous

The design team is subject to many errors in the progress of design. The team leader must be sensitive to these likely errors or faults, and be prepared to correct them, encourage the team to learn from them, and move forward.[386] Errors include procrastination, non-

[386] Lawson, *How Designers Think*, 114-116.

commitment, and the creation of throw-away ideas. Procrastination is usually evident when team members refuse to engage in conversation, or refuse to meet suspense. This is either through intimidation, which must be moderated by the team leader, or due to mental fatigue from too rigorous a work schedule. Non-committal is evidence of past public humiliation, or a lack of trust by the team members. Throw-away ideas are a waste of everyone's time, and must be discouraged, without bringing on procrastination or non-commitment.

Various traps also await the design team.[387] Teams are frequently seduced by the use of too-cute categories where they are trapped into thinking they have defined exactly right categories for each of the actors or events in a system, and they are complete with their understanding long before they actually have an effective understanding. Some teams will endeavor to turn the systems understanding into a puzzle solution – where there is a right answer, and they will refuse to come back from the pursuit of the right answer to return to developing better understanding. Other teams will decide that their answer lies in quantitative assessment to the exclusion of qualitative awareness – a trap sometimes encouraged by the use of computer simulations and/or an over reliance on Operations Research / Systems Analysis (ORSA) data collecting. Other design teams fall in love with a particular set of solutions, because of their elegance, because they believe the commander will like the solution, or because they are simply exhausted. For whatever reason, this collective agreement on an iconic solution stops the development of real understanding. Teams sometimes also confuse enthusiasm for an idea with the capability of the organization to actually do something about the idea. All design teams need to be cautioned to bound themselves within a reasonable, and clearly articulated, set of capability limitations throughout the design approach.

4.3.3. ENVIRONMENTAL SPACE[388]

I served in the G3 for 1st Cav. Division who was serving as Multi-National Division Baghdad. I did use my design experience to help "re-design" our division targeting process… one key component was our "network map" that we used to graphically depict how AQI was influencing Baghdad at the time. Essentially it was an "environmental frame" drawn as a cartoon or concept sketch.

—Major Mark Huhtanen

Working in the environmental space is fundamentally initial exploration of the environment, its various actors, their interrelationships, and establishing a starting hypothesis for further testing and refinement.[389] Current doctrine is not explicit on the

[387] See Lawson, *How Designers Think*, 220-229.

[388] United States, *FM 5-0*, paragraphs 3-39 through 3-51 discuss the environmental frame. *FMI 5-1,* footnote on page 21 has a useful discussion of terminology for the environmental frame.

[389] United States, *FM 5-0*, paragraph 3-39.

methods for working in this space, so reference will be to the *FMI 5-2* and various theorists of design.

The goal of environmental framing is the creation of an environmental drawing and an environmental narrative. The design team leader needs to organize the work carefully in this stage, since this is usually the starting frame for design. From the start, it is recommended a small group of the design team be assigned to work within the problem space, and another to work in the solution space, both sub-groups working in careful synthesis with the bulk of the team working in the environmental space. **The purpose of working in all three spaces simultaneously is to develop integrated understanding of the relationships of environment, problem, and solutions.**

In the environmental space, work begins on the sketch and the narrative simultaneously. It is an error to hold off work on one of the two until later – the crafting of both the sketch and the narrative help generate useful questions, and answers, from the team. The choice of where to begin is important for the team leader, but it is not as critical as ensuring there is reflection in the activity of the environmental space, and that understanding is built iteratively around a series of large-scale questions. The team leader should be methodical in his positing of these large-scale questions, with deliberate efforts to share emerging answers with the team, post developments in some common space, and convene periodic discussions of progress made in understanding.

It is usually helpful to engage the commander as early as possible in this space, to receive his constraints and initial guidance. However, the team leader needs to acknowledge that as understanding develops, the initial guidance from the commander may be supplanted or replaced with new and better understanding. The team leader should also engage with other members of the organization's staff, higher and lower headquarters, and other members of the wider design community of practice. This wider engagement is to identify subject matter experts who should be brought into the design team, as well as identify any useful pockets of understanding or intelligence amongst the coalition.

Inside the design team, the team leader should discuss the constraints and boundaries of the initial limits for the required environmental understanding, the organization for work, timelines and limits on cooperation, if known. The team should begin its ritual of practice, as discussed earlier. All members of the team should be kept informed of all changes of both external guidance or input and internal developments from the design team.

Initiation of work can begin with the team developing its understanding, by using the products of the sketch and the narrative to identify relevant actors in the environment, their motivations, and the apparent connections amongst the actors. Part of this assessment is the existence and potency of interior relationships amongst actors in the system, and any effective relationships which appear to extend exterior to the bounds of the system. Iterative movement helps develop more coherent understanding if this is not done sequentially but simultaneously. It is critical that the team leader carefully modulate the work effort, ensuring sharing of understanding, but also pacing team members in

competition with each other to stimulate understanding. As information becomes known, the team leader also must moderate the updating of the narrative and the sketch – working carefully to ensure updates do not distract from adding new information, but also ensuring that updated information then generates new requests for information. This is all iterative and cyclic.

As actors and their relationships are identified, attention must be paid to the boundary conditions of the frame. Some important actors will have connections external to the initial limits of interest, and the team leader must negotiate with the commander for expansions or contractions of the boundary. The team leader must also discuss with the commander, either individually or with the team present, the commander's understanding of the desired state from the perspective of U.S. or coalition policy, strategy, or objectives. **All discussions in the environmental space are prone to develop assumptions about meaning, boundaries, and conditions, both extant and desired.** These assumptions must be carefully articulated, discussed in large team meetings, and verified both with the commander, and his higher, and with virtual worlds simulating the environment. This must be methodical and rigorous. The team leader is advised to make this absolutely explicit, and an integral part of the ritual of practice.

A useful product from this frame starts with a narrative discussion of the meaning of the relationships inside the environment. This is usually included in a larger discussion of the historical, cultural, geographic, and other aspects of the current system, as well as a forecast of the likely evolution of the system for a certain time into the future. This statement must include an extensive discussion of the why of the system – why is it doing what it is doing, and why will it go to some future state. Part of this narrative is the tendency of the system – its likely future state and the potential(s) of the system – where it could go given likely inputs from inside and outside actors.[390] The narrative and sketch also includes discussion of alignment of actors into communities of interest or practice.[391] Additionally, there should be a discussion of the tensions in the system, both tensions in support of the tendency, and tensions amongst elements of the system that could be used to gain traction towards the desired state.

Tensions are fundamental to the characteristic of successful leaders Roger Martin calls integrative thinking. An integrative thinker has "…the predisposition and the capacity to hold two diametrically opposing ideas in their heads. And then, without panicking or simply settling on one alternative or the other, they're able to produce a synthesis that is superior to either opposing idea".[392] Just like opposable thumbs, Martin's metaphor of the opposable mind is proposed as an explanation for how constructive tension between conflicting ideas can be a generator of synthesis. Tensions should not be seen as

[390] United States, *FM 5-0*, paragraph 3-51.

[391] Sometimes referred to as assemblages. For a discussion of this, see Hayward, 40-45.

[392] Roger Martin, *The Opposable Mind: Winning Through Integrative Thinking* (Boston, MA: Harvard Business School Publishing, 2009), 6.

undesirable in design, but rather as a source of creativity. Martin offers insight into six features characteristic of integrative thinkers, capable of leveraging constructive tension:

Stance about the world
1. Existing models do not represent reality; they are our constructions.
2. Opposing models are to be leveraged, not feared.
3. Existing models are not perfect; better models exist that are not yet seen.

Stance about self
4. I am capable of finding a better model.
5. I can wade into and get through the necessary complexity.
6. I give myself the time to create a better model.[393]

The most challenging aspect of the environmental frame for the team leader is to acknowledge that the work will never get beyond a certain point of understanding, usually a point well short of commander and design team members' expectations. Additionally, there is usually an expectation of a finite, finished product from the environmental frame, but complex systems cannot be understood, even incompletely, until they are acted upon. This is a critical point of reference – until the problem and solution spaces are cognitively populated by design team members, and until the organization begins, at least virtually, if not actually, to act on the environment, the narrative and sketch of the environment are, at best, incomplete, and more likely just wrong. It is essential that the narrative and the sketch both clearly identify the meaning relevant to the system, and the structures of meaning relevant to the actors in the system.[394]

A critical, but exceedingly difficult task for the team is to identify, and use, criteria for relevancy. This is essential since any system generates a practically infinite number of actors and interrelationships. **Some form of relevancy test must be continually administered to bound the work of the design team.** It is most useful if relevancy is determined in broad discourse of all the design team, to include the sub-groups working in the problem and solution spaces. Meetings to discuss the criteria of relevance are arguably the most important meetings for the environmental space. It is recommended that negotiations on relevancy criteria include the commander and senior members of the staff, especially early on in the process.[395] This is the most effective way to bound work, but it is also very dangerous – if done incorrectly, the design will exclude some critical, perhaps essential, actors from consideration.

4.3.3.1. LEADING THINKING ABOUT THE SYSTEM

I have this project and we've studied the environment and are now proposing a draft solution to the immediate problem we are focused on solving. The proposed COA's make perfect sense from a planning team perspective. BUT, the committees have target fixation where they think

[393] Ibid., 115-116.

[394] See Lawson, *How Designers Think*, for a discussion of narrative, meaning, and naming of actors and relationships, 267-269.

[395] Lawson, *How Designers Think*, helpful in describing negotiations over meaning, 272

the solution only needs to solve the immediate problem (even though they somewhat recognize there are sequels to this problem). Some of the solutions our planning team is proposing is because we understand the context for which the problem exists, and we also understand that there is tremendous opportunity that our solution (or solutions) to the immediate problem could help set the conditions to solve the sequels and network into other command initiatives, but it would require a more comprehensive plan to leverage opportunities and find ways to mitigate other potential challenges. But the committees don't seem to be interested in anything that goes beyond solving the immediate problem or taking a more comprehensive/holistic approach to connect the problems and solutions together, nor is any one planning team able to capture and present such proposal. They are falling into a trap of establishing planning committees (several so far) that compartmentalize problems and solutions that do not understand networked connections and that fail to connect problems and solutions that exist at different times.

—Anonymous

By choosing to view the operational environment as a system, the design team emphasizes the interconnected and interdependent nature of actors, goals, problems, and events. **The systems view encourages integrative solutions that account for complex interactions between parts of the system.** It would be much simpler if instead of taking a systems approach, we could consider different problems and sub-problems as independent. Then we could break them down, solve them in isolation, and expect cumulative progress towards the desired end state. Unfortunately, for complex ill-structured problems, this approach does not work. Initial progress towards the desired end state is soon overwhelmed by the unintended side effects and long term effects of ignoring interdependencies.

The first concept required for a systems approach is feedback.

> Feedback is a fundamental concept because it marks the difference between linear and non-linear systems. Whereas outputs are always proportional to inputs in linear systems, non-linear systems magnify some inputs (positive feedback) and counteract others (negative feedback). Because feedback creates interdependence, it is a source of complexity. Feedback is also the underlying cause of emergence, self-organisation and attractors. For many centuries, most scientists approximated non-linear systems using linear methods, a very useful simplification, but one that only works up to a point.[396]

Recognizing positive feedback loops within a system allows designers to identify areas of leverage, where comparatively small injections of energy can lead to large changes in patterns of behavior. In contrast, negative feedback loops provide stability and diminishing returns on injections of energy in other regions of the system. Negative feedback loops are essential for regulation and stability, because they require so much more energy to overcome. Most situations contain a mixture of positive and negative feedback: of change

[396] Alex J. Ryan, "The Foundation for an Adaptive Approach: Insights from the Science of Complex Systems," *Australian Army Journal* VI, no. 3 (2009): 71-72.

and stability. Thinking about the mix of positive and negative feedback loops within a system encourages designers to consider the underlying sources of the observed patterns of behavior in the operational environment.

Senge calls recurring structures of positive and negative feedback "systems archetypes."[397]

> The systems archetypes reveal an incredibly elegant simplicity underlying the complexity of management issues. As we learn how to recognize more and more of these kinds of archetypes, it becomes possible for us to see more and more places where there is leverage in facing difficult challenges, and to explain these opportunities to others.[398]

One of these archetypes is 'shifting the burden.' The shifting the burden archetype arises when an underlying problem generates symptoms that demand attention, yet the root cause is difficult to address.[399] Decision makers look for quick fixes, which mask the symptoms but leave the underlying problem untreated. As a consequence, the problem actually gets worse, and will inevitably resurface. Shifting the burden is a pattern of behavior caused by two negative (stabilizing) feedback loops. Changes in the severity of the problem symptom can be balanced out by the two stabilizing loops – the quick fix and the fundamental solution. The difference: the quick fix operates immediately but only temporarily, while the fundamental solution solves the problem, but there is a time delay before the symptoms are affected. An over-reliance on the quick fix can make it appear as if the problem has gone away, reducing the pressure to implement the fundamental solution. The shifting the burden pattern is worse if the quick fix has side-effects. The side effects create a third feedback loop between the symptoms, the symptomatic solution, and the fundamental solution. However, this is a positive (reinforcing) feedback loop. In this situation, relying on the quick fix solution triggers a viscous cycle that actually erodes the effectiveness of fundamental solutions at an accelerating rate.

Jim Baker applied Senge's concept of systems archetypes to counterinsurgency.[400] He developed increasingly elaborate models of counterinsurgency based on several key feedback loops between popular support for insurgents, security, and the rule of law. One model demonstrates the dangers of shifting the burden.[401] For the case that the insurgent cause is driven by perceived injustices, the fundamental solution requires addressing grievances and demonstrating just and legitimate rule of law. However, there is usually a considerable time delay before population perceptions of Government legitimacy shift. A more immediate solution is to crack down on the insurgents with military action (although there is still some delay). The problem with the quick fix of increasing security measures is

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[397] Senge, *The Fifth Discipline*, 93.

[398] Ibid.

[399] Ibid., 103.

[400] Jim Baker, "Systems Thinking and Counterinsurgencies," *Parameters* (Winter 2006-07): 26-43.

[401] Ibid., 35. The description and graphic here are adapted from Baker's Figure 6. We have simplified this discussion by ignoring an additional loop involving 'poor intelligence,' which has the same effect as the 'provide security' – 'indiscriminate measures' – 'feelings of resentment' loop.

the side effects generated by the indiscriminate use of force. This fuels resentment within the population, which undermines the perception of Government legitimacy. Baker's model, depicted in Figure 26, is a simple example of how systems thinking can identify feedback loops that explain one of the dilemmas of fighting a counterinsurgency. Security is an essential precursor to the just rule of law, yet applied indiscriminately, it risks undermining the legitimacy of the very Government it is intended to support.

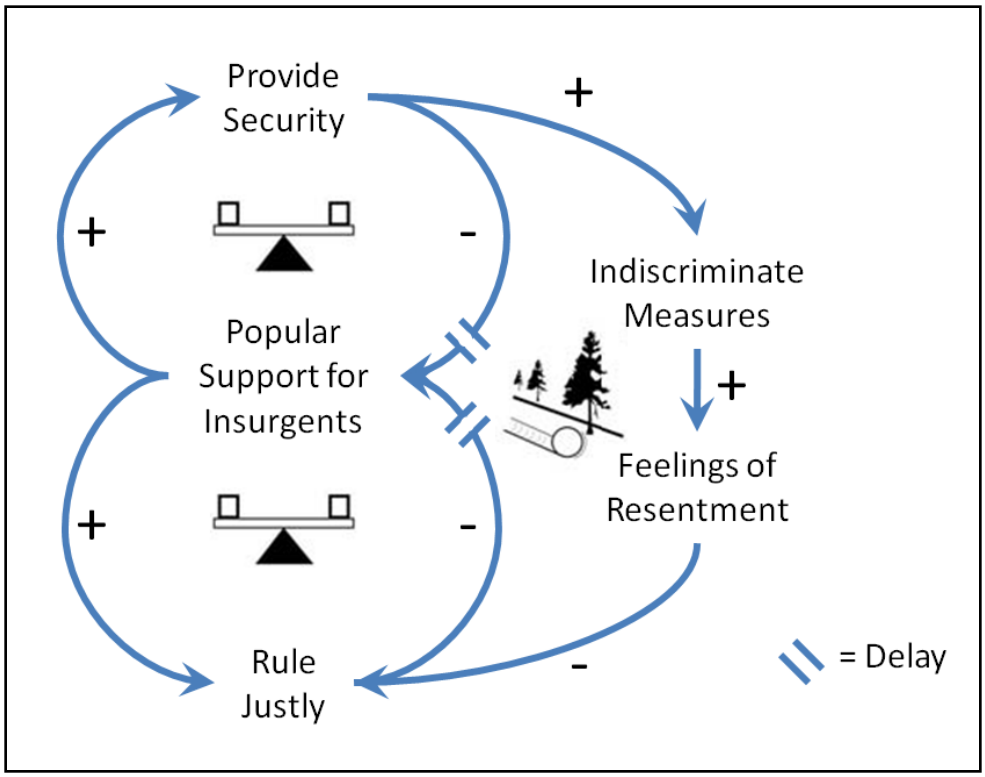


FIGURE 26. THE "SHIFTING THE BURDEN" SYSTEM ARCHETYPE FOR COUNTERINSURGENCY, ADAPTED FROM BAKER.

Systems archetypes provide useful building blocks for thinking about systems, because they are inherently nonlinear (the building blocks are loops). However, most operational environments are extremely high dimensional. They have hundreds of variables that interacting through weak causal chains that are constantly evolving. In contrast, our description of Baker's model contained just five variables: 'popular support for insurgents,' 'provide security,' 'indiscriminate measures,' 'feelings of resentment,' and 'rule justly.' If we want to understand more realistic models of reality as networks of positive and negative feedback loops, we need to be able to build dynamic graphic representations of the operational environment as a system. Appendix G includes reviews of software tools for modeling complex systems.

Several SAMS AMSP seminars have developed more extensive influence diagrams or system dynamics models in order to better understand the operational environment as a system. In Figure 27, Seminar 3 from 2009 used an influence diagram to highlight sources

of instability. In the same year, Seminar 6 considered both positive and negative feedback to identify balancing and reinforcing loops in the SOUTHCOM area of interest, which is depicted in Figure 28. In October 2009, U.S. Navy Pilot Captain Brett Pierson from the Warfighting Analysis Division of J8 in the Joint Staff presented a system dynamics model of Afghanistan at SAMS. The full model is shown in Figure 29. This model has been briefed on hundreds of occasions, including to the Commander, International Security Assistance Force (ISAF) General Stanley McChrystal. It has been widely discussed in the blogosphere and even parodied on Jon Stewart's The Daily Show and The Colbert Report. To the lay person, the only meaning conveyed by this "spaghetti diagram" is that Afghanistan is complex.

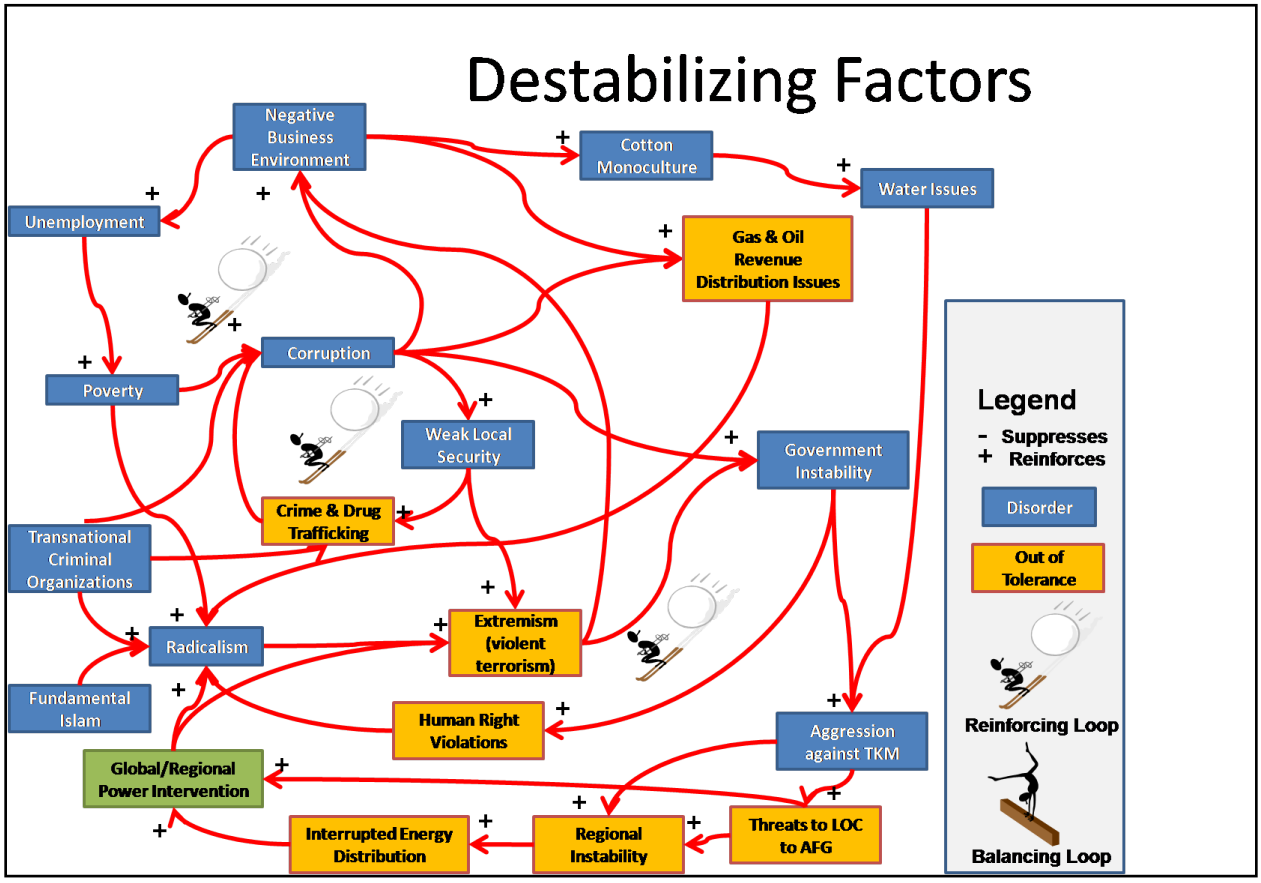


FIGURE 27. SEMINAR 3 SAMS AMSP 2009:
SYSTEM DYNAMICS MODEL OF DESTABILIZING FACTORS.

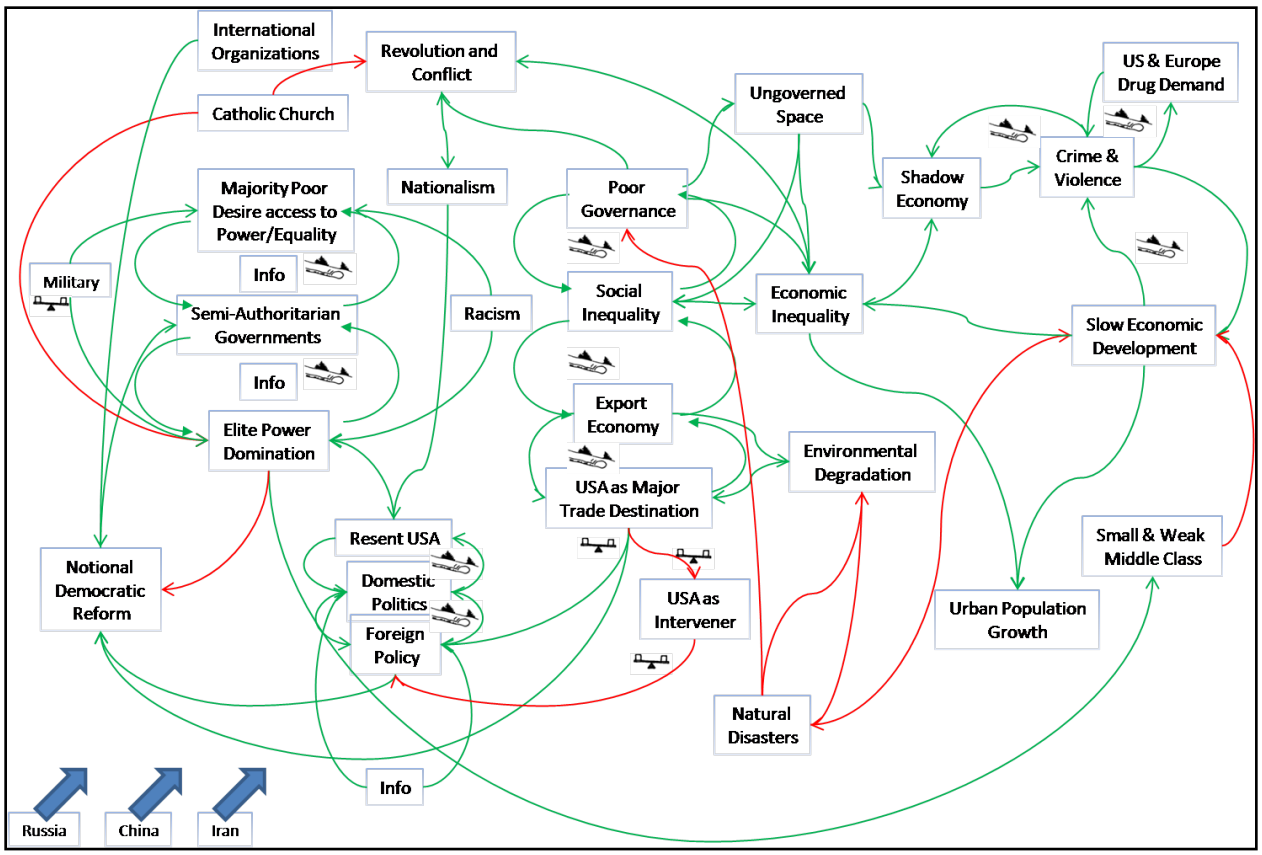


FIGURE 28. SEMINAR 6 SAMS AMSP 2009:
SYSTEM DYNAMICS MODEL OF THE SOUTHCOM SYSTEM.

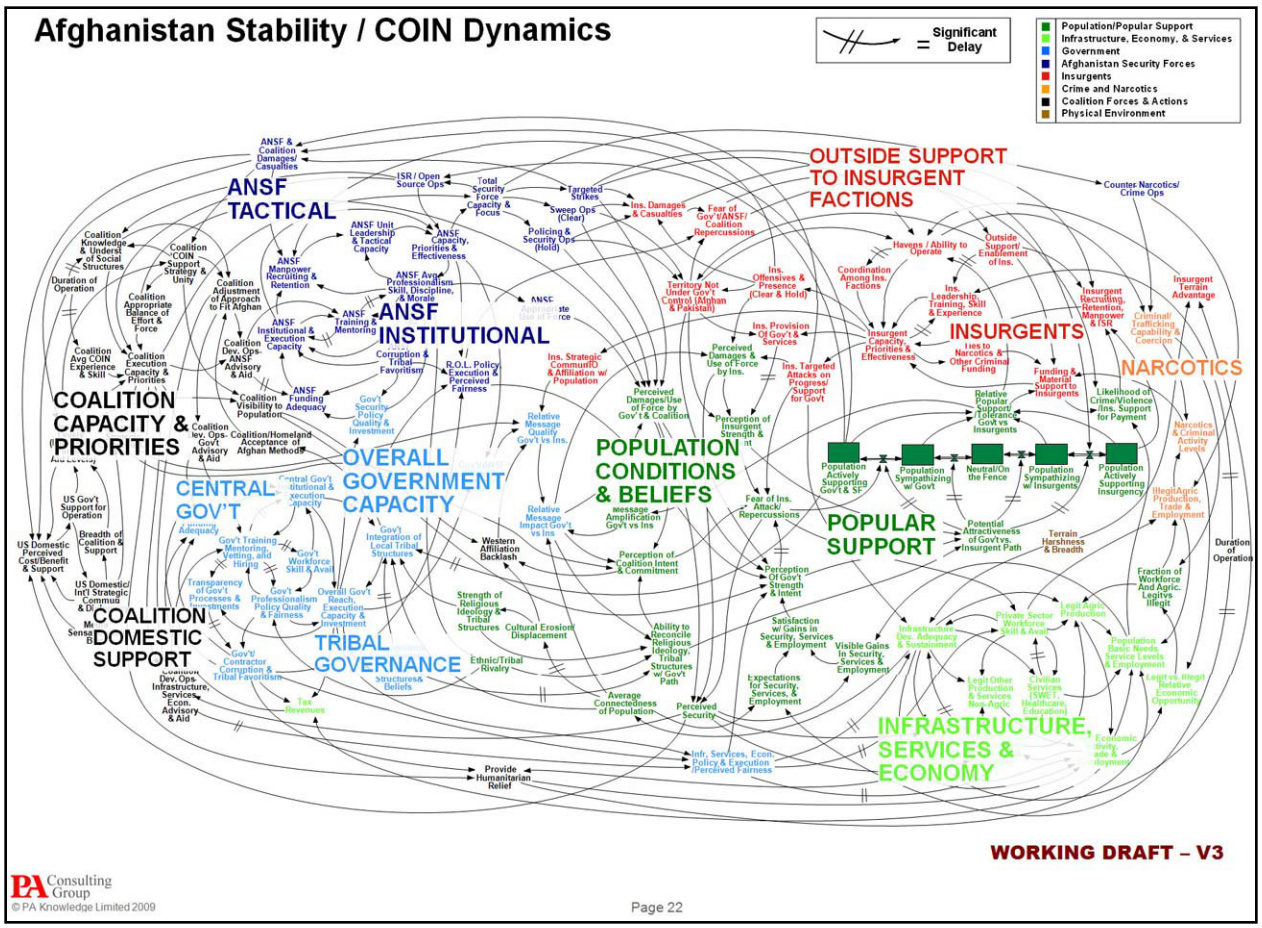


FIGURE 29. JOINT STAFF SYSTEM DYNAMICS MODEL OF AFGHANISTAN.

The model pushes the application of system dynamics to its limits by attempting to display the full complexity of Afghanistan as an interdependent whole. In spite of its complexity, it still falls well short of the true complexity of Afghanistan. The variables are aggregated to the national level, so no distinction is made between villages, districts, or provinces. Cross level effects (bottom-up influences from the districts or top-down pressure from the international community) cannot be easily accounted for in this model. The interactions with neighboring countries are not represented, and the international community is aggregated to several variables focused mostly on the U.S. Mental, moral, and physical factors are all idealized as either stocks or flows. The flows represent causal links between variables, so they cannot account for other kinds of relationships (such as semiotic links). The choice of variables frames the system from a very Western perspective. The flows between variables represent hypotheses that are difficult to validate individually, and impossible to validate collectively. Because of the high dimensionality of this model, the underlying equations are inherently unstable, meaning that even if the model was perfectly accurate, it would tell us very little about the time evolution of the system. Although the model represents dynamics, there is no novelty and no adaptation in this system – the feedback loops themselves never change.

What, then, is the value of such an elaborate model? One advantage over traditional approaches is that many people who are working pieces of the problem may not be aware of their impact on other parts of the system. Such an overarching model provides a way to trace potential pathways of unintended consequences. Captain Pierson coined the term "loops of operation" to show how seeing lines of effort in the context of the whole system. Another advantage is that having a systems model allows a more sophisticated approach to assessment, capable of accounting for nonlinearities and time lags. As with Senge's more simplified systems archetypes, Pierson's model suggests high leverage points of intervention. There may even be some utility in showing people such an intricate model of Afghanistan, as an antidote to simplistic linear solutions accompanied by the illusion that a single individual is capable of understanding how Afghanistan really works.

While designers would find the model in Figure 29 of interest for potential insights it may shed on the operational environment, they would never construct this kind of systems model themselves. That is because the purpose of building systems models in design is not to mirror reality as accurately as possible, but rather to have a reflective conversation with the situation. Systems models also serve as an excellent source of questions to focus discourse. **For these purposes, simple models that can be easily discarded are more conducive to creative designing.** A design team would build a much simpler model of Afghanistan at the national level, but they would also build multiple models at different levels and from different perspectives, to allow zooming in and out. These models would be classified as design drawings, for the internal understanding of the design team, rather than for external consumption.

A nice example of a systems model created by designers is provided in Figure 30. The model is considerably simpler to understand compared with Figure 29, yet in some ways it is more comprehensive. It uses the vertical dimension of the drawing to represent four levels within the system. Key actors at each level are shown, as well as relationships, coordinating mechanisms, and tensions within the system. By distilling the system down to the essential actors for expanding the Qawm, this graphic works as a presentation drawing, capable of communicating insights to external audiences. Although this individual frame is not dynamic, it is one of several slides that explores the dynamics of expanding the Qawm, including the new tensions the desired expansion could create.

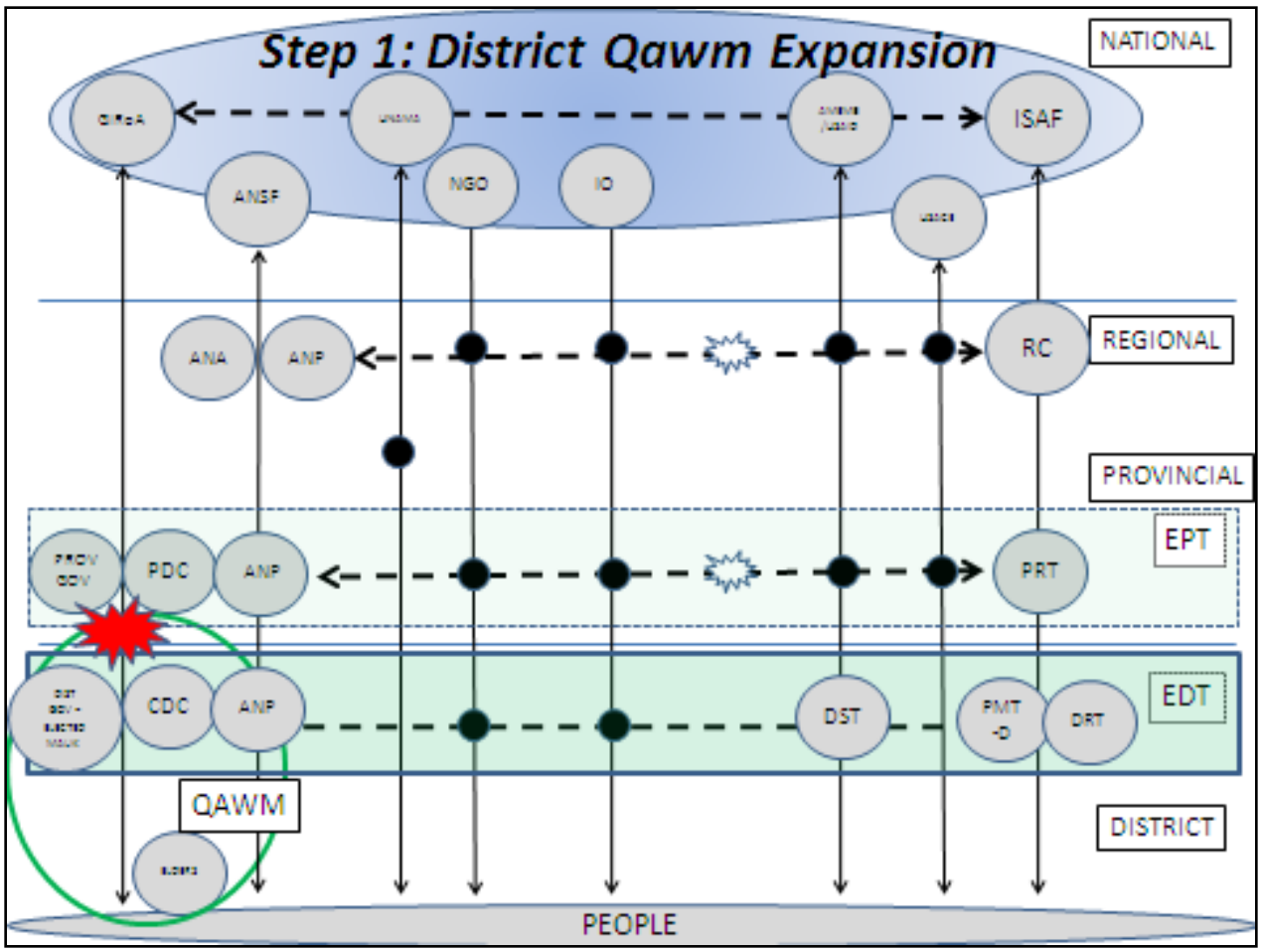


FIGURE 30. SEMINAR 5 SAMS AMSP 2010:
MAP OF THE ACTORS IN THE SYSTEM AT MULTIPLE LEVELS.

Several other key systems concepts are useful for understanding the operational environment as a system. Insights from complex systems science emphasize bottom-up sources of order. For designers, this translates to considering informal as well as formal mechanisms of control and influence. The source of patterns observed within the system may be self-organizing from the bottom-up, not just planned and executed from the top-down.

In contrast to systems dynamics models that seek to represent reality as composed of systems, Soft Systems Methodology (SSM) makes no assumptions about the composition of the operational environment. Instead, SSM provides a systemic approach to learning about problematical situations.[402] SSM surfaces conflicting worldviews that exist within purposeful activity systems. This promotes seeing the operational environment from multiple perspectives, with a view towards taking action to improve the system that is desirable and culturally feasible from different worldviews. SSM is possibly the closest

[402] Checkland and Poulter, *Learning for Action*.

analog of military design in the civilian sector, and has a wide and accessible literature on how to use a systems approach to structure problems.

4.3.3.2. LEADING THINKING ABOUT YOUR OWN SYSTEM

Failure to frame ourselves in the environment, problem, and solution space… *What I have now observed is that strategic and operational concept plan (CONPLAN) development rarely has assigned/allocated forces known from the start. Because of this, they are not framed in the environment or problem frame, but are included in the solution space as the "means" that support the "ways" or the theory of action. What I have now come to realize is that framing "a wish list" into the solution space is unrealistic, especially for the US with multiple contingencies and few actual assigned forces. So inherently, the initial resourcing, i.e. the wish list, used in the solution frame and theory of action will likely not be supportable by the forces that are actually "apportioned." This tension automatically leads to the requirement for a complete reframing to find a viable theory of action. So in this sense, you can frame the problem, but you cannot frame the solution until you know what forces you will have.*

—Major Derek Jones

Systems thinking applies equally to self as to the operational environment. Moreover, because we have so much more control over self compared with the environment, insights about our own system should in theory be easier to implement.

The biggest lesson from systems theory is that the way to cope with complexity is through adaptation. Adaptation allows a system to improve its fit with its environment, so it is most applicable to your own system. However, a corollary of the need to improve our own ability to adapt is the desirability of disrupting the adversary's adaptive cycles.

Adaptation is a process variation and selective retention.[403] Biological evolution, human learning, machine learning, and cultural evolution are all examples of adaptation. Without an internal or external source of variation, there is no possibility of change, so variation is an essential prerequisite for adaptation. Selective retention inhibits some variants (negative feedback) and reinforces others (positive feedback) with a bias towards retaining fitter variants. In simple terms, adaptation is nothing more than a principled and sustained application of trial and the elimination of error.

However, there are many ways this simple algorithm can be implemented within the design of operations. Tradeoffs exist because there is no one right way to organize your own system. The best way to organize depends on the context, which is in constant flux. There are a number of tradeoffs that have been identified within complex systems science,

[403] Donald T. Campbell, "Blind variation and selective retention in creative thought as in other knowledge processes," *Psychological Review,* 67, 1960, 380-400.

listed in Table 34. Adaptation can be used to manage these interrelated systems tradeoffs at multiple levels within your own system.

TABLE 34. DESIGN TRADEOFFS TO CONSIDER FOR THE DESIGN OF YOUR OWN SYSTEM[404]

Tradeoff		Description
Adapted	Adaptability	Adapted to current context or adaptable to future contexts
Exploration	Exploitation	Exploit the current best strategy or explore alternatives
Competition	Cooperation	Agents compete to achieve individual goals or cooperate to achieve a shared goal
Independence	Interdependence	Agents separated to maintain independence or connected to create interdependence
Innovation	Integration	Organizational orientation towards innovation and creativity or integration and control
Bottom up	Top down	Decision making and change initiated from the top of the hierarchy down or from the bottom up
Decentralized	Centralized	Control is centrally coordinated or independently implemented in parallel
Specialization	Multitasking	Agents are heterogeneous and highly specialized or homogeneous and able to perform multiple functions
Induction	Deduction	Agents act on rules generalized from past experience or by deducing logical consequences of assumptions
Deterministic	Random	The system's behavior is completely determined by the input or uniformly random regardless of the input
Chaos	Order	System is unstable and changes quickly or system is stable, ordered and robust to perturbation

Bar-Yam uses case studies from across military conflict, ethnic violence, international development, engineering, health care, and education to explore the application of complex systems insights to real world problems. His book *Making Things Work* provides many tips for how to organize your own system in response to a complex environment.[405] Bar-Yam focuses on evolutionary forms of adaptation to cope with environmental complexity. Some of the most relevant advice to military organizations includes:

- Before complex problems can be addressed, we have to give up the idea of centralizing, controlling, coordinating and planning in a conventional way (p. 260).

[404] This table also appears in Ryan, "Foundation for an Adaptive Approach," 83.

[405] Bar-Yam, *Making Things Work*.

- The first step to reducing the likelihood of failure in a complex task is to simplify the objectives as much as possible (p. 228).
- Five ways to reduce the likelihood of errors: feedback correction, eliminating steps, redundancy, automation, and reducing the local complexity of the task (p. 137).
- Specialization is an important and effective technique for reducing complexity (p. 152).
- Teams can handle much more complexity than individuals can (p. 155).
- Systems should be networked only when the demands on different parts of the system are linked, and not otherwise. There are benefits to connections but also to subdivisions between parts, depending on the environment (p. 49).
- Systems designed for large scale, repetitive tasks have a very different structure than systems designed for high complexity, fine scale tasks (p. 106).
- Partitioning the system into large scale, repetitive tasks that can be solved efficiently, and fine scale complex tasks that require tailored treatment, improves overall system effectiveness (pp. 124-125).
- Large scale, uniform approaches to complex problems can produce some initial success, but fail over time in the details, piece by piece (p. 185).
- Evolution, involving competition and cooperation over multiple levels, is the basic mechanism for improving the fit between a system and its environment (pp. 71-85).
- An evolutionary process can be designed by creating an environment that fosters continuous innovation in the system itself, which explores possibilities as rapidly as possible (p. 230).
- In complex systems, the main role for management is to create the environment in which the systems create themselves (p. 159).
- The more complex the system, the more valuable individual differences and variation become (pp. 166, 181).
- In highly complex systems, effective change should arise from local experiments (p. 158).
- Evolutionary processes always try multiple paths to success, rather than relying on a single global plan (p. 215).
- Use multiple criteria for success, to ensure that evaluating success and failure encourages many different ways to be successful. Allow for different rates of learning, broaden what counts for assessment, and allow selection pressures to operate as a force for change. (pp. 189-194).
- Sustainable development has to be "natural," it must fit within the history and context of the system (p. 209).
- Redundancy plays an important role of achieving reliability and security in a complex and dynamic environment (p. 234).
- Systems with smaller, independent parts innovate faster, but cannot perform all the functions that larger scale integrated systems can perform – there is a tradeoff between innovation and integration (p. 237).
- Evolutionary processes can be accelerated by simulation or through virtual worlds (p. 237).

- Negotiating new boundaries can reduce patterns of conflict and violence within a system (p. 257).
- The complexity of the organization must match the complexity of the tasks it is required to perform (p. 259).

Bar-Yam summarizes with the following advice for organizing your own system:

> When large scale tasks are identified, then one can adopt the traditional approach of centralizing authority, instituting standards, imposing uniformity, planning upgrades and improving efficiency. When complex tasks are identified, then one should adopt the complex systems evolutionary approach of distributing decision, action and authority, setting functional goals and directions for improvement, supporting individual initiative, measuring effectiveness in the field, instituting redundancy, forming cooperative teams, and creating rules that promote competition with performance feedback at the functional team level.[406]

4.3.4. PROBLEM SPACE[407]

We have been working on a proposal that required GCC approval. The combatant commander's staff is divided on whether they support the proposal or not. So they have developed three other COAs in addition to ours to brief the GCC commander. We were reviewing their slides with our CG Friday morning and he was getting frustrated because there seemed to be something missing…in this case, a problem frame. There were four solutions, but it seemed like no one agreed upon the problem. So I quickly framed the problem with a strategic and theater problem, facts, assumptions, and forces available. Once I got this done, it quickly became apparent that only two of the COAs were feasible, acceptable, and suitable for the problem. The other two answered the wrong problem.

—Major Derek Jones

When the team leader and/or the commander decide to shift priority effort to the problem space, and the bulk of the design team moves into the problem space, they should be introduced to the space by those members of the team who have been working there from the start. The team leader must ensure the sub-group active in the problem space is linked with the discourse in the environmental space, and kept aware of all changes in the environmental narrative and sketch. As the team settles into discussing the nature of the problem, a small element should be left in the environmental space to continue to update those products.

In the problem space, the focus is on making specific the areas where transformation of the existing, or forecasted future conditions, into desired conditions can occur. **Much of the work in the problem space is concerned with the tensions in the system, both**

[406] Ibid., 262-263.

[407] United States, *FM 5-0,* paragraphs 3-52 through 3-56.

positive and negative. Figure 31 shows the tensions between the observed and desired system for Seminar 8 in 2009. The graphic clearly lays out the relationship between the observed system, the desired system, and the tensions, which leads to a problem statement.

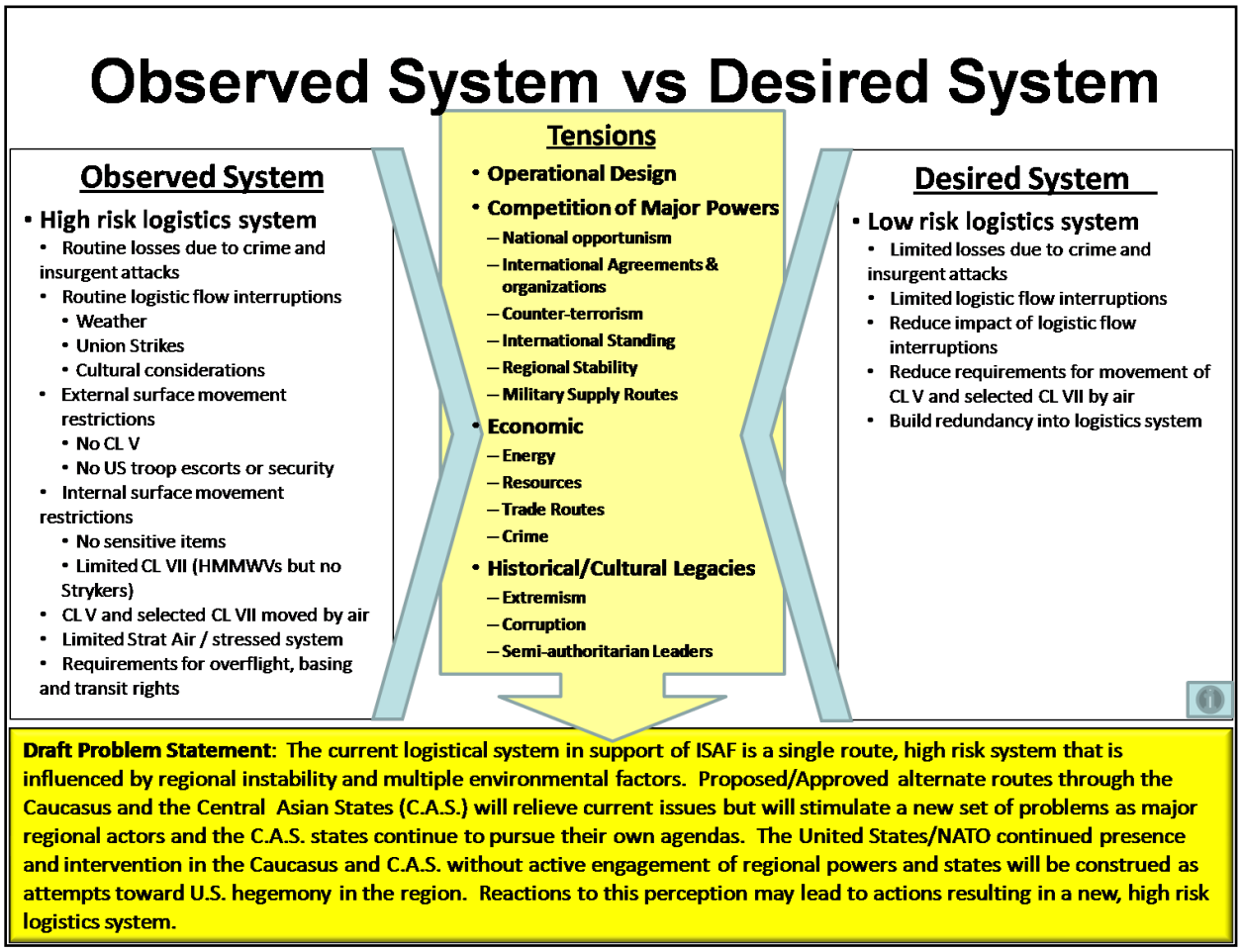


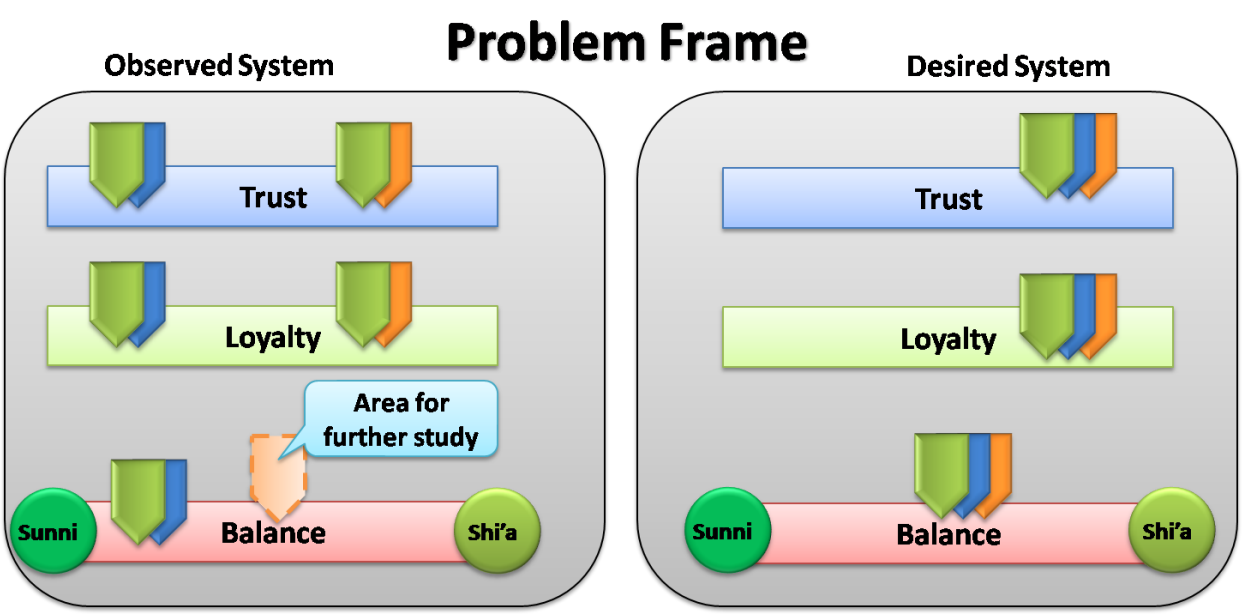
FIGURE 31. SEMINAR 8 SAMS AMSP 2009: DIFFERENCES BETWEEN THE OBSERVED SYSTEM AND THE DESIRED SYSTEM GENERATES TENSIONS, WHICH INFORM THE PROBLEM STATEMENT.

A useful concept from obsolete doctrine is limits or zones of tolerance. Although not discussed in *FM 5-0, FMI 5-2* added the very useful concept of zones of tolerance to the language of design.[408] Zones of tolerance are depictions, in sketches or text, of the acceptable limits of a system's future state from the perspective of various potent actors, to include the friendly organization. By scoping the nature of the problem in terms of a range of outcomes all of which are acceptable, the design team is enabled to generate actions in the solution space with less concern for precise future outcomes. Another advantage of the use of zones of tolerance is the often very informative discourse with higher commanders about the nature of the zones of acceptability. In these engagements, the commanders and

[408] United States, *FMI 5-2,* 24.

designers tend to learn significant insights into the range of acceptable outcomes, insights that would not be gained through a simpler discussion of end states or desired objectives.

In 2010, SAMS Seminar 3 developed a useful articulation of how they framed their problem. The first part of Figure 32 shows a graphical depiction of the problem and a concise problem statement, which identifies perceptions of trust as the important issue.



Problem Statement

Within this system the identified problem is a lack of global and regional perceptions of trust in terms of Iranian nuclear intentions, a lack of regional loyalty and perceptions in the sources of power (alliances, military strength, nuclear weapons, oil, etc.) that affect the balance in Islamic leadership between the Shi'a and Sunni assemblages of the Islamic faith.

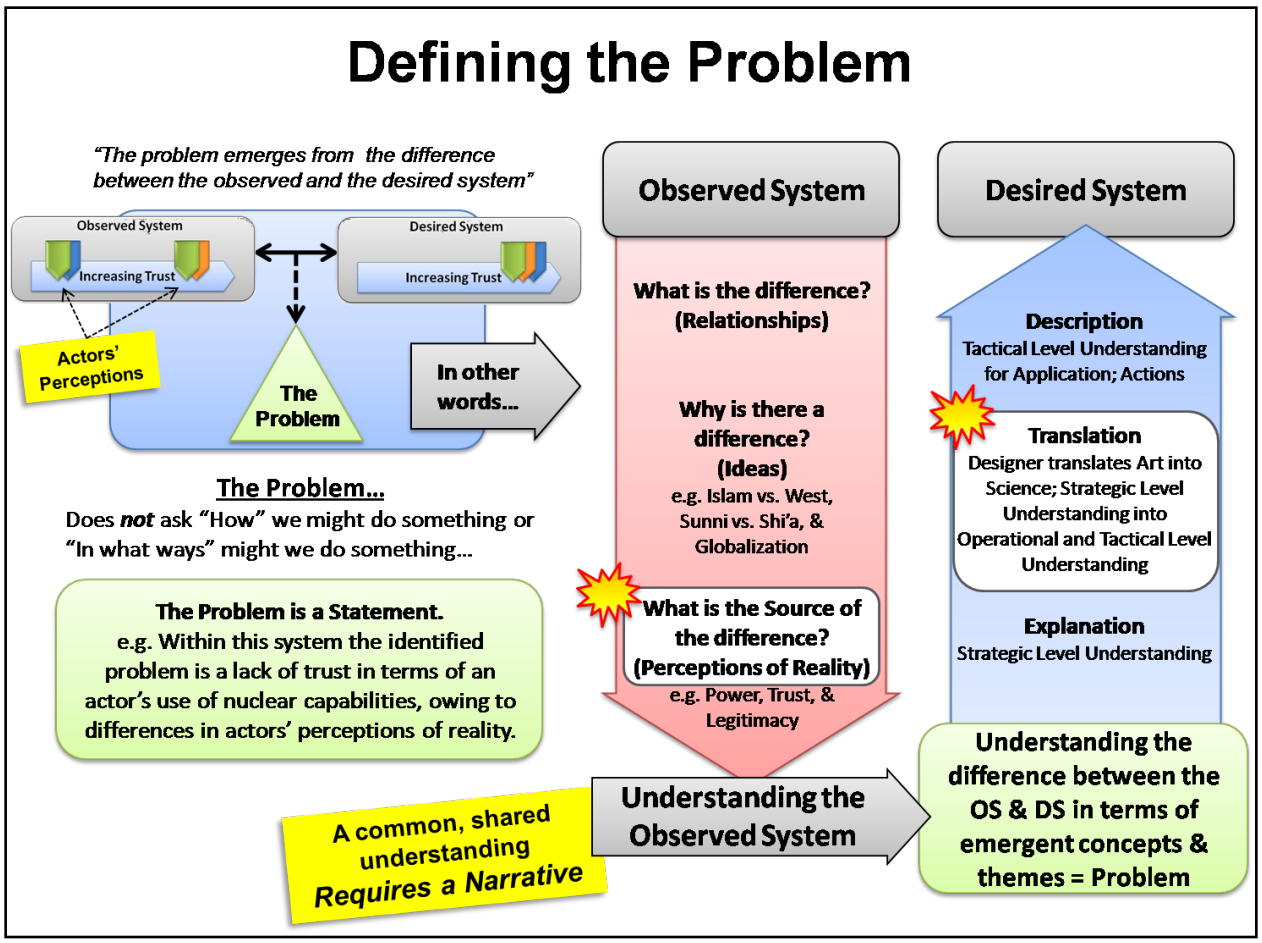


FIGURE 32. SEMINAR 3 SAMS AMSP 2010: FRAMING THE PROBLEM BY UNDERSTANDING THE SOURCE OF DIFFERENCE BETWEEN THE OBSERVED AND THE DESIRED SYSTEM.

The second part of Figure 32 shows the process Seminar 3 used to identify the problem. This involved beginning by looking for differences in relationships between actors in the observed system. These "What?" questions identified surface differences, which were explored by "Why?" questions. This directed the inquiry from information towards ideas and conceptual differences between the actors. Continually asking "Why?" dug deeper towards sources of difference – in this case, perception of trust. Having reached an explanation, the team translated this explanation back into a tangible description of the desired system. Now, the problem statement could capture the difference between the observed and desired systems, along with the logical explanation for the difference.

4.3.5. SOLUTION SPACE – DEVELOPING THE OPERATIONAL APPROACH[409]

SAMS should stress that Design is about creating rather than an endless cycle of learning.

—Major Don Fuqua

In a discussion of the solution space, care must be given to the manner in which the design team works its way through solving the problem confronting it. Lawson offers some solutions to the challenges of working in the solution space.[410] He recommends a series of options for beginning work the design team leader may find useful. The first option is to choose solution options from pre-existing solutions out of past experience of the organization, from doctrine, or from some form of pattern book. This method has a low risk of spectacular failure, since the organization has some initial familiarity with the solution approach, but it also has a limited chance of deep success, since pre-existing ideas are brought to bear on a unique design challenge. Another technique is to simply copy an existing solution from another problem set. This has similar failures, and minor successes, as the pattern book approach. Another, more useful technique, is to use established rules or doctrines for micro-behavior to move a discussion of comprehensive solution forward. By limiting the behavior of the subordinate units of an organization to tasks they are familiar with, the design team is then bounded to consider a limited range of options. If this enables forward progress, it is useful as a technique, although the unique nature of complex systems informs the team that these solutions will not be exact, or possibly even effective, matches to the unique system being addressed. Another useful technique is to discuss solutions in terms of analogies, not to copy a solution over, but to stimulate thought about unique solutions by thinking in terms of analogous situations and solutions.

It is especially important to consider solutions in the context of the environmental frame and the problem frame. The environmental frame provides insight into the propensity and potential of the current system, as well as the desired system. Framing the problem identifies the areas for intervention and will already direct inquiry towards certain kinds of solutions. **An integrative solution should resolve multiple issues surfaced within the problem space.** Above all, the design team must avoid stovepiped solutions that treat interdependent sub-problems separately.

Any or all of these techniques can be combined in the solution space. Whichever are selected by the team leader, he/she should encourage the team to develop multiple possible solution sets, again as a means to stimulate creative thinking by the team. The team can then select from this set of possible solutions divergent ideas to again stimulate creative discourse. A significant question for the team leader involves the number of solutions to capture, assess, and brief to the commander. More than one is always better –

[409] United States, *FM 5-0,* paragraphs 3-57 – 3-67.

[410] Lawson, *How Designers Think*, 203-209.

in the contest between solutions, the team and the commander will generate new ideas. Too many, however, is counter-productive to effective discourses.

Three different representations of the operational approach developed in the solution space are shown below. Figure 33 looks like a typical Lines of Effort (LOE) or Logical Lines of Operation (LLO) chart. However, it also represents uncertainty and the possible need to reframe following injections of energy into the system. Figure 34 shows how in 2009 Seminar 2 extended the concept of Lines of Operation (LOO) to develop Zones of Operation. This allowed them to depict overlaps and growth in the zones over time. Importantly, this also depicted problems and obstacles that would hinder progress towards the objective, whereas most LOO charts show a one-sided picture of only those actions that contribute to the objective.

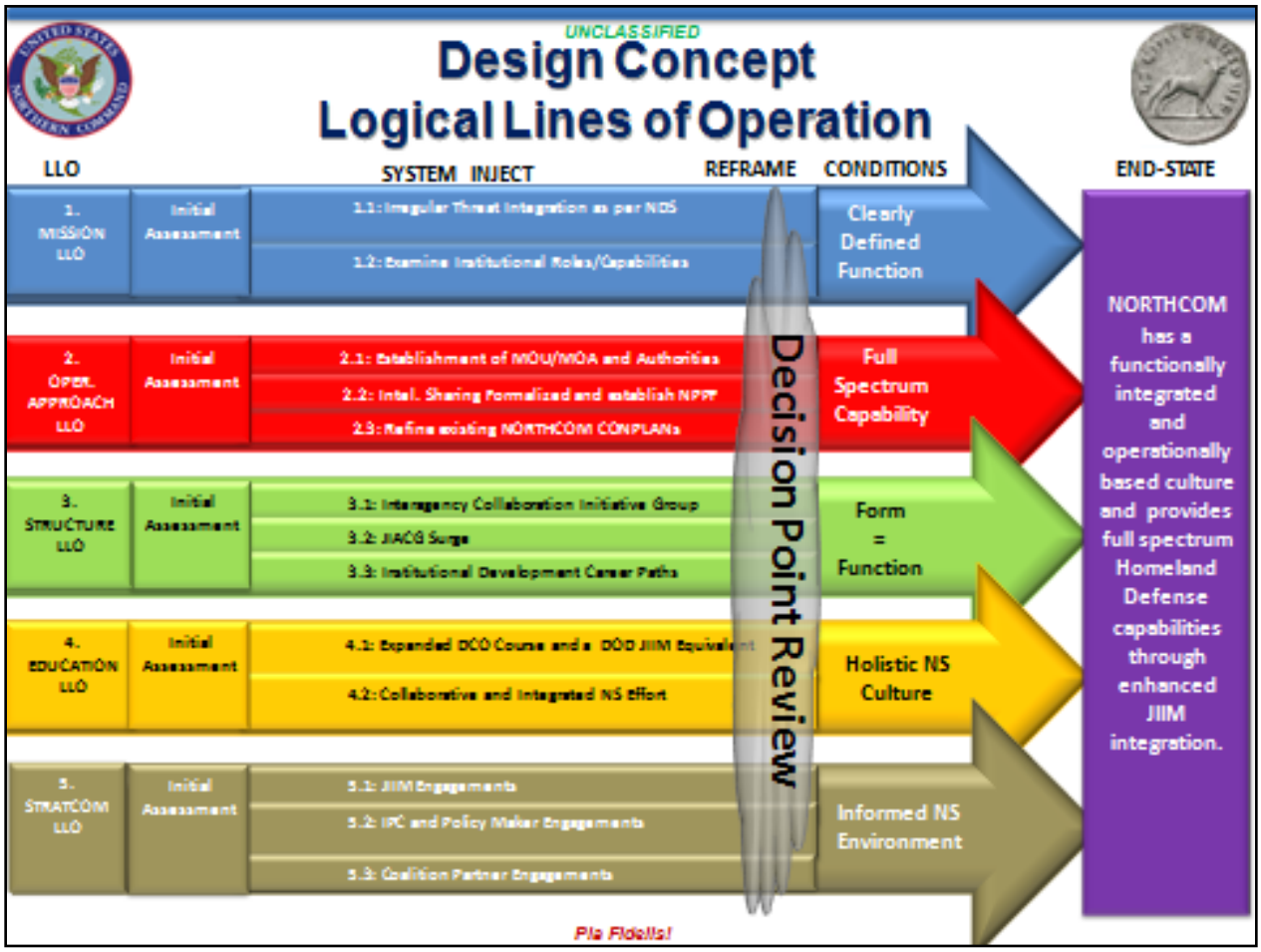


FIGURE 33. SEMINAR 7 SAMS AMSP 2010: LOGICAL LINES OF EFFORT IDENTIFY THE END STATE, DESIRED CONDITIONS, SYSTEM INJECTS, AND POTENTIAL REFRAMING POINT FOR THE DESIGN.

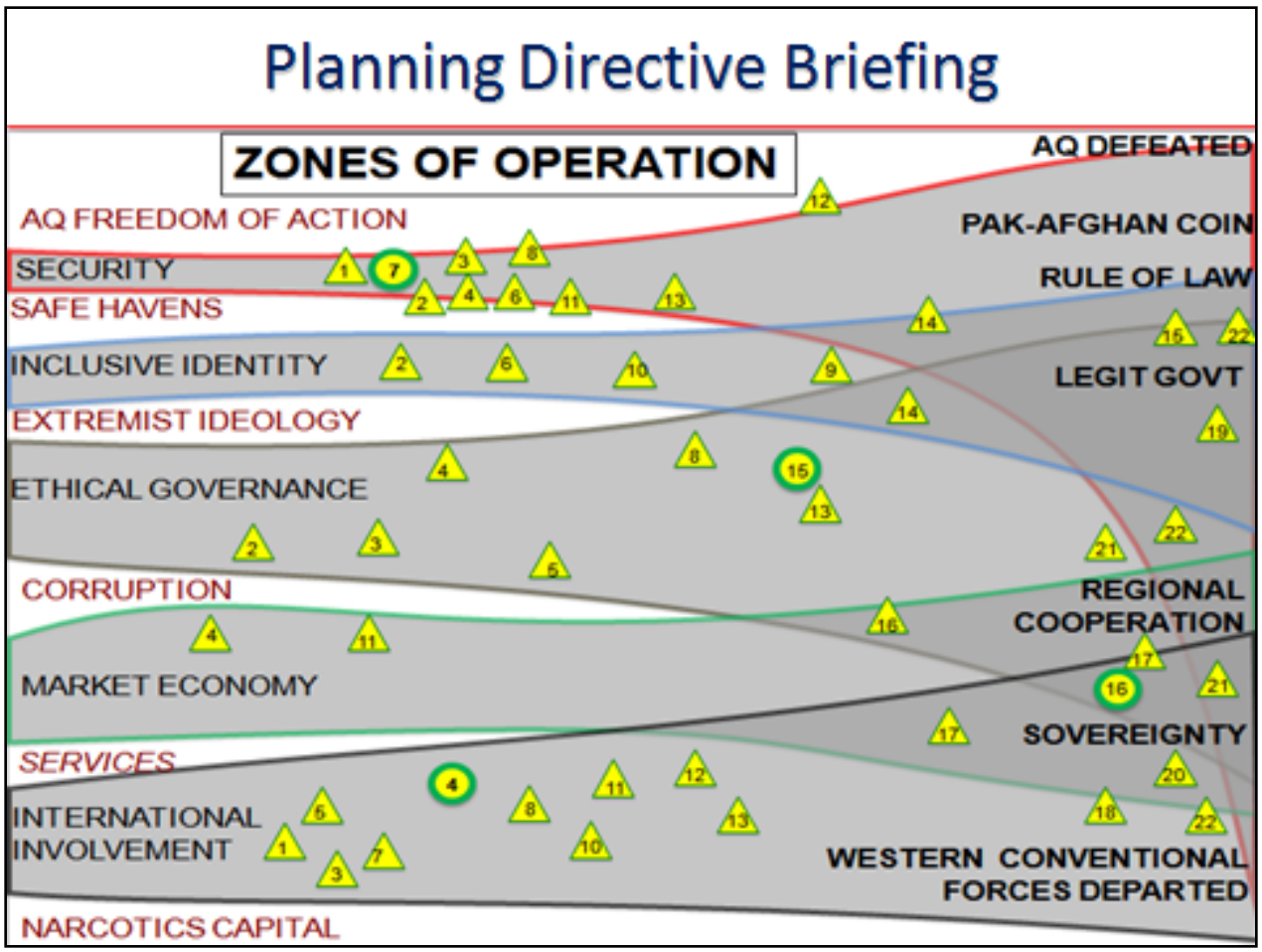


FIGURE 34. SEMINAR 2 SAMS AMSP 2009: ZONES OF OPERATION PROVIDE A BROADER CONSTRUCT THAN TRADITIONAL LINES OF OPERATION, SHOWING OVERLAPS AND PROBLEMS IN ADDITION TO FRIENDLY ACTIONS AND OBJECTIVES.

The third example of an operational approach presented here in Figure 35 departs from the tradition of representing time as flowing horizontally from left to right. Instead, Seminar 1 in 2010 used a quad chart to map out current, undesired, acceptable, and desired states of the system (a technique that was also used by Seminar 8 in 2009). This provides graphical depiction of the short-, mid-, and long-term solutions to the situation, as well as highlighting events that would cause a reframing of the problem and solution. Each of these sketches has different strengths and weaknesses in terms of what they show and what they hide about the proposed operational approach. Hence it is always useful to develop multiple visualizations, as well as capturing detailed understanding of the operational approach within the accompanying narrative.

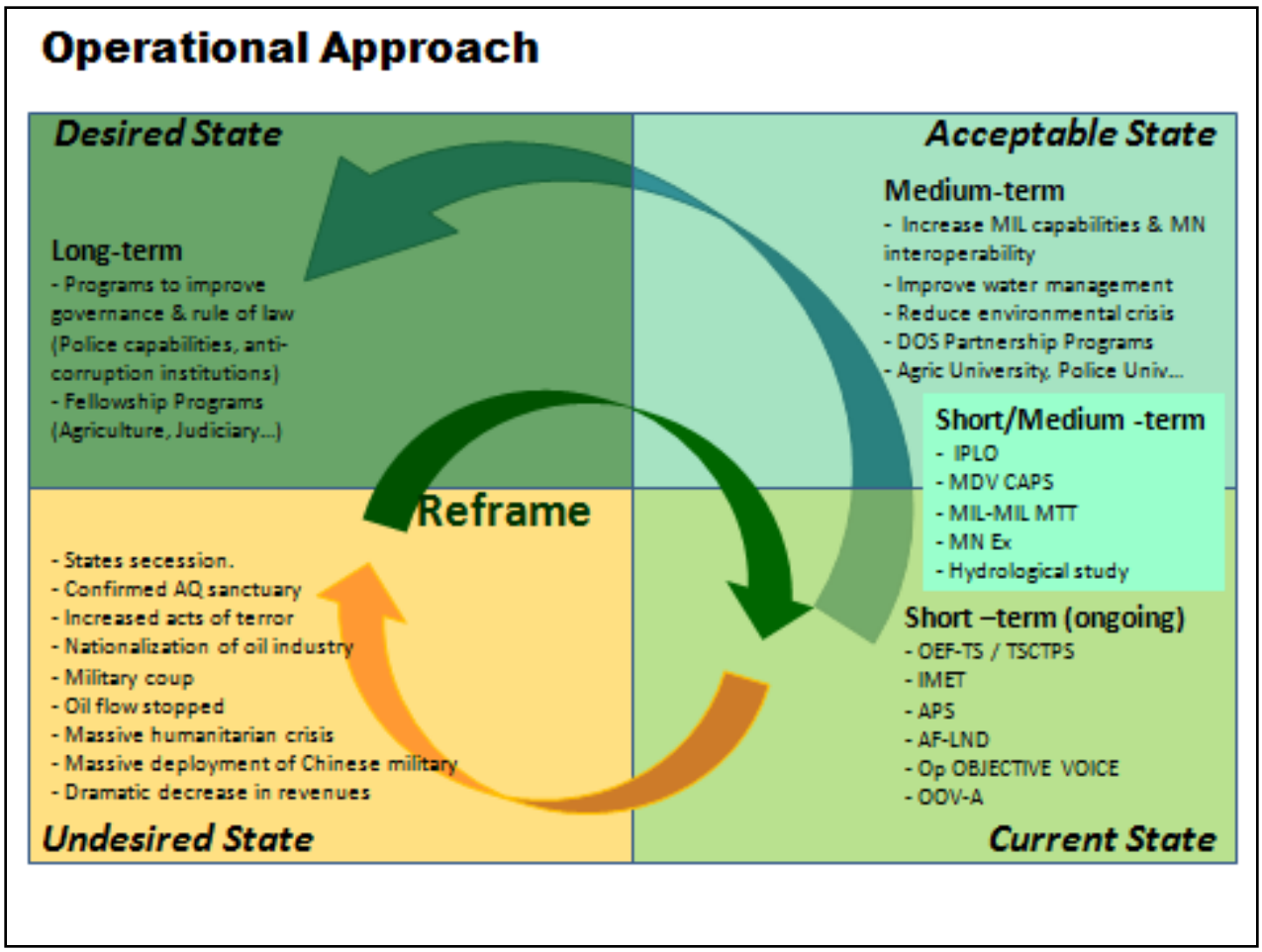


FIGURE 35. SEMINAR 1 SAMS AMSP 2010: OPERATIONAL APPROACH INVOLVES MOVING FROM THE CURRENT STATE TO THE DESIRED STATE VIA THE ACCEPTABLE STATE, WHILE AVOIDING THE UNDESIRED STATE.

4.3.6. INTEGRATED DESIGN

I've come to the realization that time spent Designing, developing an understanding of the system, enables the Chief of Staff and staff primaries to synchronize their efforts through the development of sub-systems. So Design is more than a way of understanding the operational environment, it can also be a tool to help synchronize, organize and integrate the staff.

—Anonymous

Doctrine clearly depicts design as occurring in three spaces, but just as clearly states that the design team must work simultaneously in all three spaces to achieve understanding.[411] Effective design requires the team work in multiple spaces simultaneously, as organized by the team leader.[412] However, the design team, usually through the team leader or his

[411] United States, *FM 5-0,* paragraph 3-38.

[412] Lawson, *How Designers Think*, 296ff.

designated trusted agent, must maintain contact with the relevant boards, cells, and working groups in the organization. The team must also maintain effective contact with subordinate and superior echelons, especially making and maintaining contact with civilian representatives of critical non-military agencies. Critically important to the success of the organization, the design team leader must represent the understanding of the commander and the design team in every engagement he, and members of the team, have with the detailed planning staff and current operations personnel. Especially important is the seamless integration of design with the assessment personnel of the organization (see below for more ideas and techniques on all of these integration efforts).

One of the strengths of the design approach is its inherent appeal to members of government agencies beyond the military. Both the terminology and the concepts of design are less foreign to civilian personnel than the military-specific language of the Joint Operations Planning Process of the Military Decision Making Process. The design approach also encourages a freer ranging discussion, especially evident to civilians, than the processes of JOPP or MDMP. **Since design encourages reflections, iteration, re-construction of understanding and cognitive discourse about the nature of systems, problems and solutions, civilian members of the team are more likely to engage in the design spaces than in either detailed planning or current operations.**[413]

Figure 36 and Figure 37 show two examples of integrated design concepts developed by Seminar 9 in 2009 and Seminar 4 in 2010 respectively. Seminar 9 shows the logic of how their whole design concept fits together, from the problem statement to the theory of action, and how their lines of effort contribute to transforming from the observed to the desired system. Seminar 4 develops lines of effort to guide short term tactical action, while acknowledging that strategic communication and changing the narrative are critical to operational and strategic success.

[413] Lawson, *How Designers Think*, 296ff for bringing problems and solutions together in open discussion.

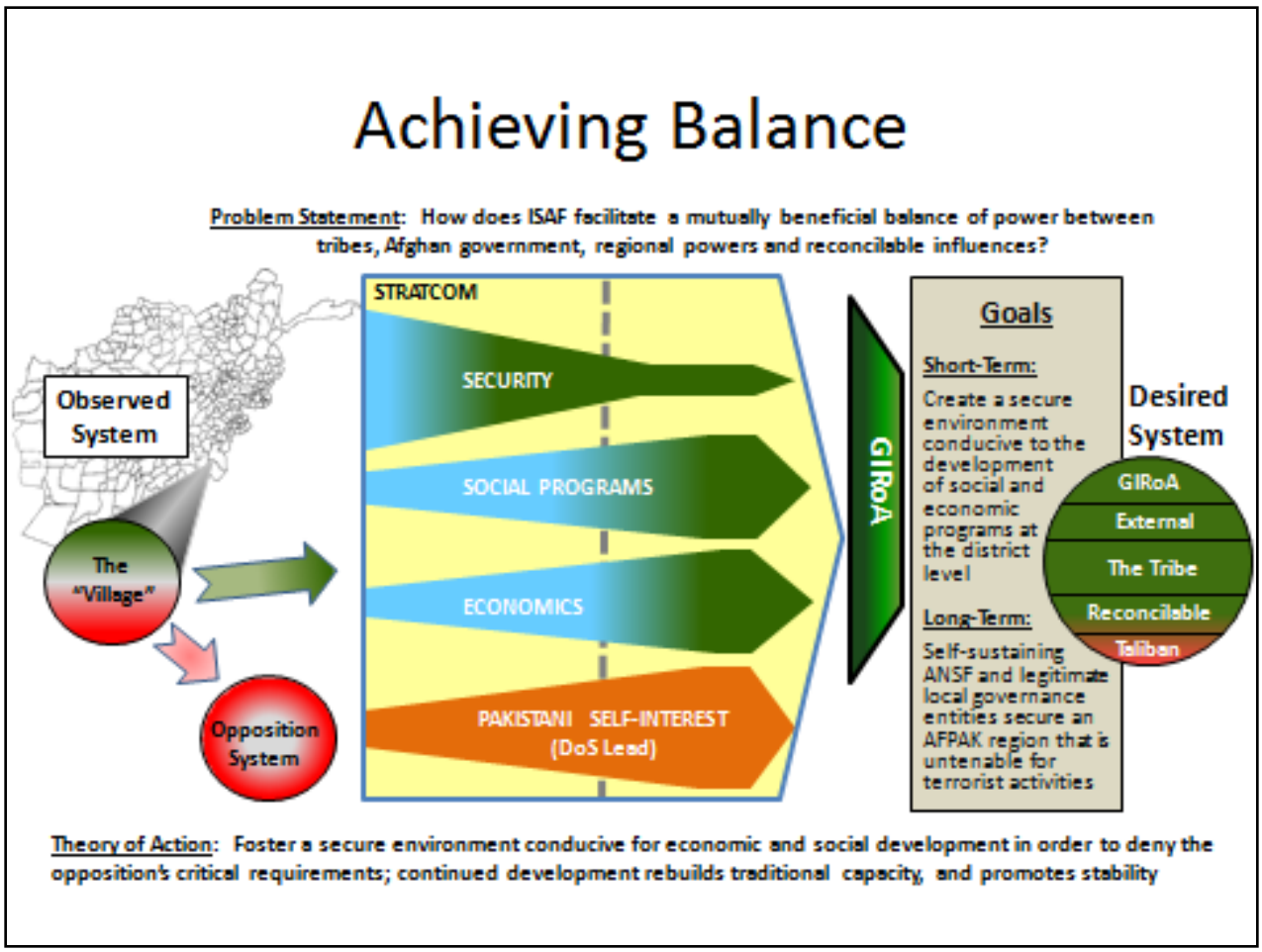


FIGURE 36. SEMINAR 9 SAMS AMSP 2009:
INTEGRATED RESPONSE TO THE AFGHANISTAN PAKISTAN PROBLEM SITUATION.

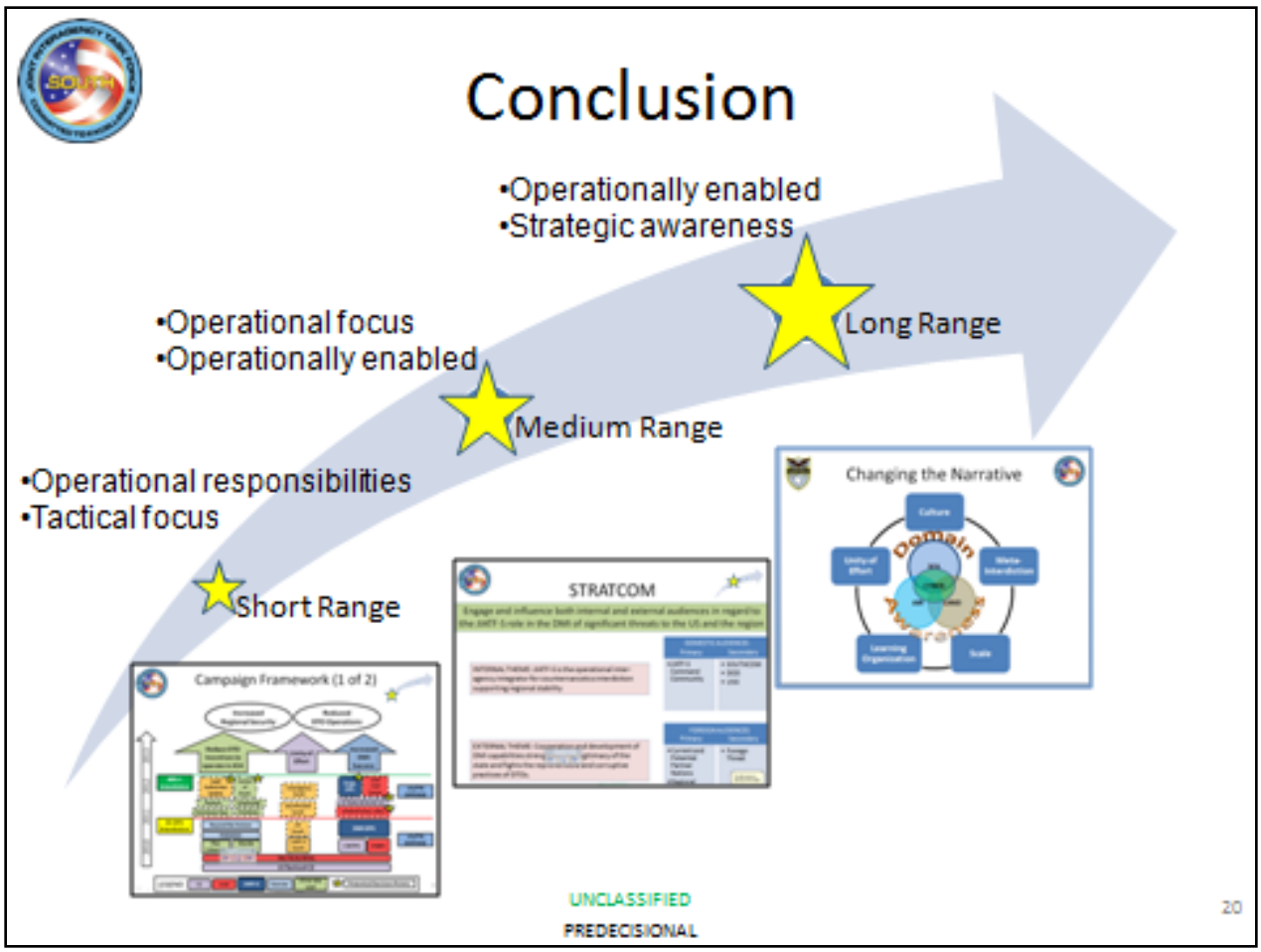


FIGURE 37. SEMINAR 4 SAMS AMSP 2010: DESIGN CONCEPT ARTICULATES SIMULTANEOUS ACTION TO TRANSFORM THE SYSTEM OVER THREE DIFFERENT TIME SCALES.

4.4 LEADING ITERATION

Using design now as we prep for mission in Haiti. Will use it once we get there as part of the iterative development of understanding. Will try to capture lessons learned and talk about methods.

—Lieutenant Colonel Dave Doyle

Understanding of a complex situation is impossible without acting on the environment. Initial awareness is an essential first step, but decisive or culminating actions should not be identified until the environment has been engaged in a set of actions designed to learn about the issues and actors of the situation. In other words, comprehensive action steps conceived and stipulated before the environment has been stimulated with "testing" actions, are most likely going to fail due to a lack of understanding. To learn, iterative action, reflection, and creation are necessary. The very nature of reflecting on actions, of learning from the stimulation of the environment, is the essence of the design approach. To

believe sufficient understanding can be gained before ever interacting with a complex situation is to ignore the precepts of complexity. In a context where cause and effect are ambiguous or even counter-intuitive, initial understanding will never be holistic or accurate. **To gain holistic and relevant awareness, multiple engagements over time, with adequate space for reflection and learning, are essential.**

The design team leader must deliberately control the iterative actions that emerge from the design team's efforts. This iterative work is in coordination with the larger organization, and organizations beyond your own. Iteration can take place in many ways, some internal to the design team, others in more open engagements with the rest of the organization or with the larger system itself. Team leaders should take full advantage of iteration as opportunities for themselves and their team members to reflect on previous understanding and actions, and attempt to re-configure knowledge and understanding. Several techniques are helpful. The first is to conceptualize iteration in one form as confronting understanding as represented in a sketch, a drawing, or in the words of a text document.[414] The team leader should encourage members of the design team to engage older works in an effort to re-construct, through iteration, old ideas and then configure new conceptions. By using artifacts of work, the capturing itself is an opportunity for reflection, and so is the effort undertaken to explain the artifact to other members of the team. Both events can, and should, generate discourse through iterative reflection.

Iteration also occurs with every engagement outside the design team. Particularly useful iterative engagements should occur with the personnel engaged in detailed planning and current operations. The design team leader must encourage effective iterative reflection and re-construction in these engagements, always striving to make them into opportunities for adjusting and improving the understanding of all participants. Particularly useful iteration should occur with the personnel responsible for all forms of assessment in the organization (see Section 4.5.3 below).

The key concept of iteration describes how design interacts with other activities in the operations process. In his monograph applying design to military transformation, where there is no exact equivalent of the operations process, Major Luis Cepeda identified a fourth cognitive space for the iteration "…required to plan, implement and assess the myriad of interactions that result within the system."[415] According to Cepeda, "[t]his new dimension is where the transformational design process physically and/or cognitively interacts with the environment: political authorities, geography, enemy, public opinion, populace attitude, allies, and media, amongst many others."[416] Cepeda calls this new dimension the engagement space.

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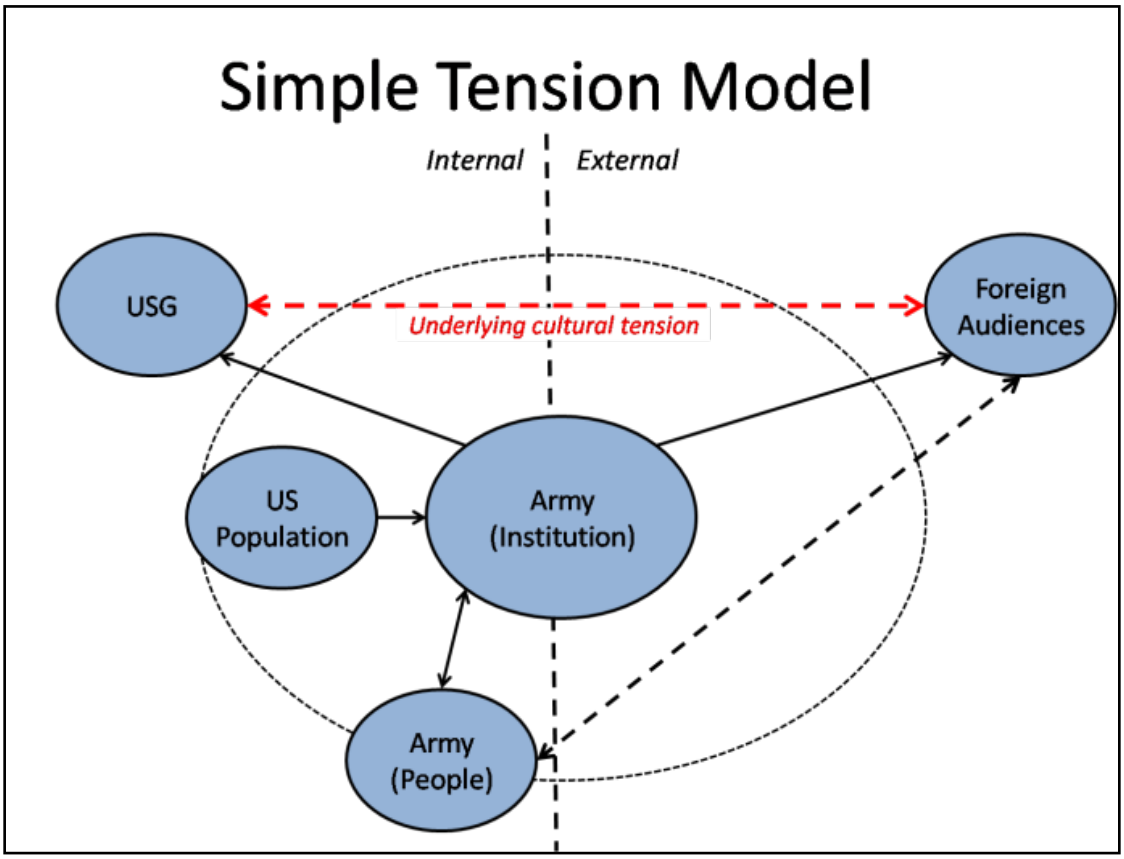
[414] Lawson, *How Designers Think*, 273, 277-278.

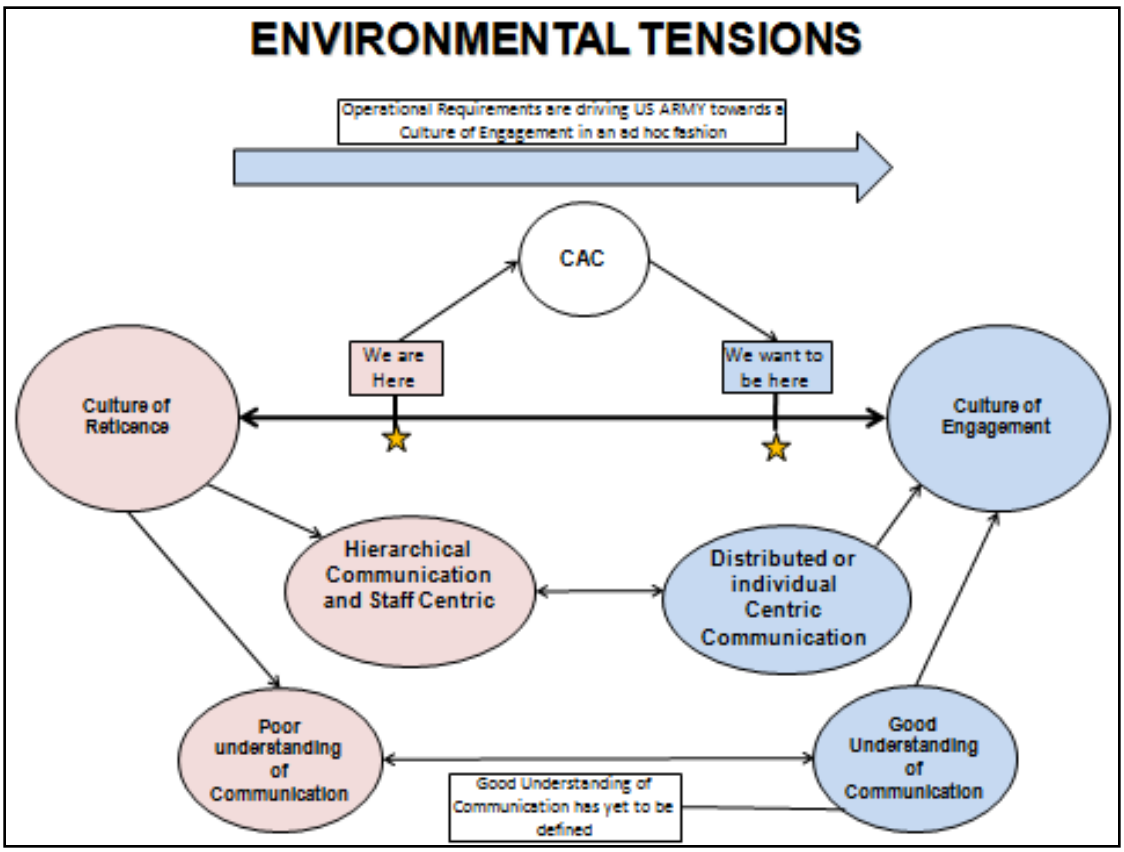
[415] Major Luis F. Cepeda, "Towards a Theory on the Design of Military Transformation: A Systemic Approach" (Monograph, School of Advanced Military Studies, U.S. Army Command and General Staff College, 2010), 54.

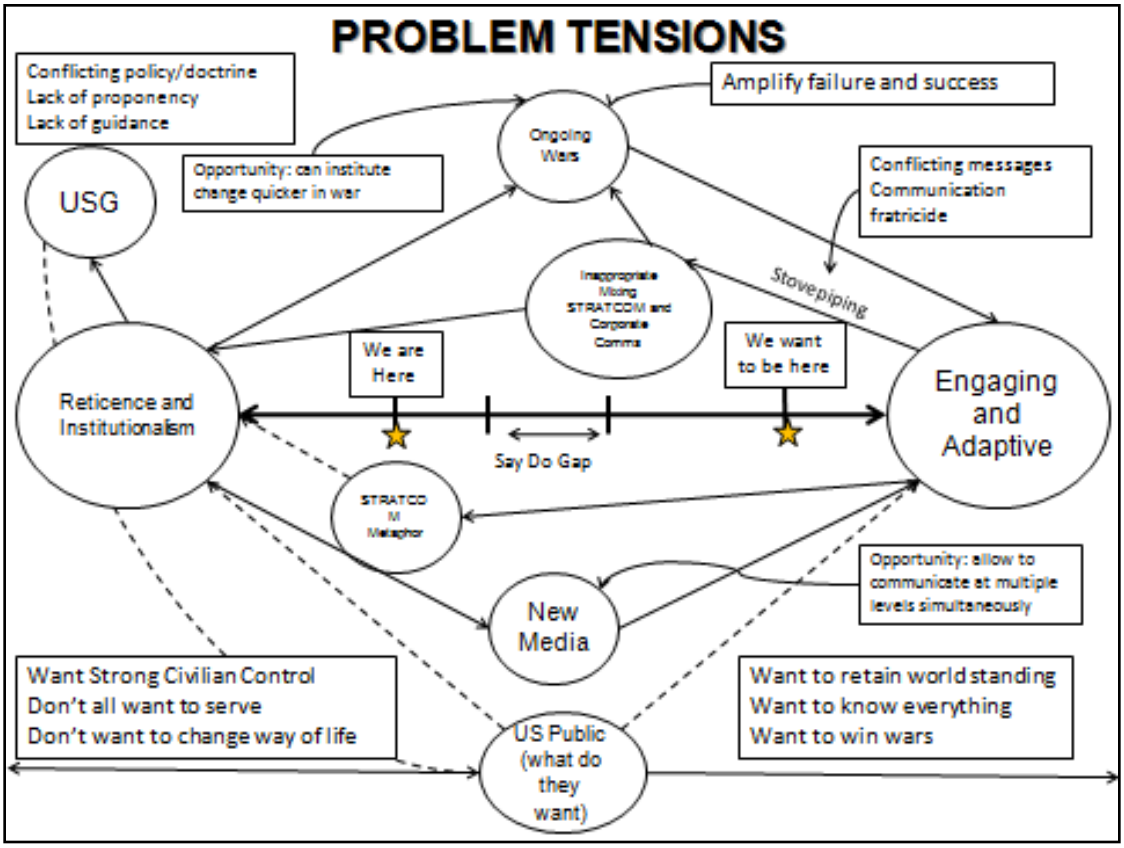
[416] Ibid., 51.

Iteration also, of course, occurs in the actions inside the system, in the actions the organization takes in accordance with the design and detailed planning efforts. Here, the design team leader has a clear responsibility to inject stimulating questions while engaging personnel responsible for monitoring the results of the planned and executed actions. The team leader also has a responsibility to ensure similar questions are asked of unplanned actions by the organization. Close engagement with intelligence personnel is necessary to gain the same iterative reflection on threat or adversary actions as well. It is critical for the design team, through the organizing efforts of the team leader, to maintain contact with all active elements of the organization in order to increase learning through iterative analysis, synthesis, and reflection.

Figure demonstrates iteration in the way tensions were represented by Seminar 2 in 2010. The first model of tensions emerged in the first couple of days of a six week design effort. The influence of this early sketch is still apparent in the final tensions presentation sketch shown in Figure 38. However, the two intermediate sketches between the initial and the final sketch demonstrate a total of four iterations in the way tensions were seen within the Strategic Communication system. By the third iteration, most of the components of the sketch had stabilized. However, the color coding from the second iteration was reintroduced and extended for the final iteration to visually depict more information in the final sketch.




ENVIRONMENTAL TENSIONS
Operational Requirements are driving US ARMY towards a Culture of Engagement in an ad hoc fashion
CAC
We are Here
We want to be here
Culture of Reticence
Culture of Engagement
Hierarchical Communication and Staff Centric
Distributed or individual Centric Communication
Poor understanding of Communication
Good Understanding of Communication
Good Understanding of Communication has yet to be defined


PROBLEM TENSIONS
Conflicting policy/doctrine
Lack of proponency
Lack of guidance
Amplify failure and success
Ongoing Wars
USG
Opportunity: can institute change quicker in war
Conflicting messages
Communication fratricide
Stovepiping
Inappropriate Mixing STRATCOM and Corporate Comms
We are Here
We want to be here
Reticence and Institutionalism
Engaging and Adaptive
Say Do Gap
STRATCOM Metaphor
New Media
Opportunity: allow to communicate at multiple levels simultaneously
Want Strong Civilian Control
Don't all want to serve
Don't want to change way of life
Want to retain world standing
Want to know everything
Want to win wars
US Public (what do they want)

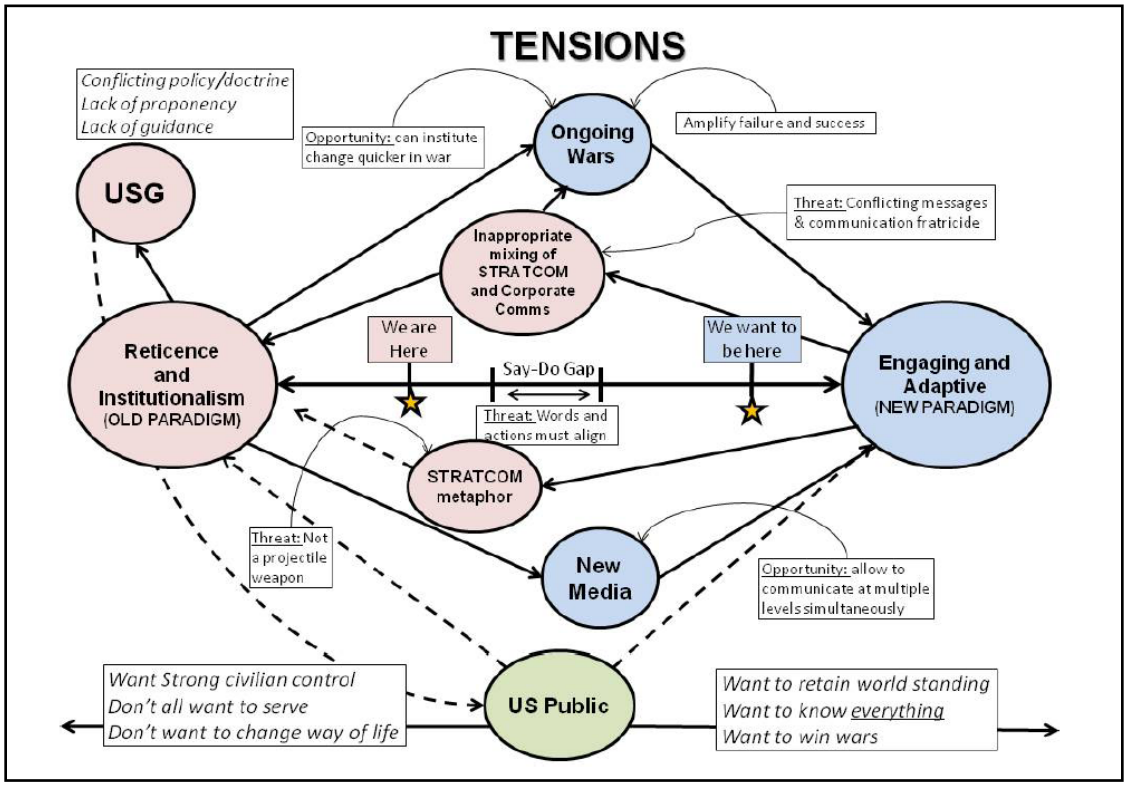


FIGURE 38. SEMINAR 2 SAMS AMSP 2010: ITERATION LEADS TO IMPROVEMENTS IN THE HOW THE SITUATION IS UNDERSTOOD, REPRESENTED, AND COMMUNICATED.

A critical central concept to design is a near-constant and deliberate effort to negotiate forward toward common shared understanding. Negotiation occurs in many ways during design. You will conduct negotiations internal to the design team, many negotiations with your own commander and the commanders of superior and lower echelons, and conduct frequent negotiations with both the deliberate planners and the personnel in current operations. **Each opportunity for negotiation, each engagement with some person or entity involved in the system, is itself an opportunity to learn, and to increase your own understanding.** The team leader should feel empowered to enter into many forms of negotiation, since no one individual has the key concept or the complete understanding of any system. Learn though effective negotiation – through effective discourse, where the value of ideas is based solely on their ability to better explicate the system, the problem set, and possible solutions. The design team leader must create the need for negotiation, frequently through forcing a discussion about a concept, action, or event that others would prefer to avoid. Sometimes these are the most meaningful of all negotiations.

Use of virtual worlds, wargaming, simulations and effective discourse are all tools for developing greater understanding of the environment before action. They are also useful for testing actions before operationalizing them in the actual system itself. Arguably the most useful application of virtual worlds is in testing the outcome of actual actions in the

real system, after they have occurred. This assessment-linked use of virtual worlds while actions are occurring aids in both increasing understanding of the complex system and in honing the next set of blue actions.

4.4.1 SCOPING THE WORK

A technique useful to generate new perceptions is to scope and scale the work.[417] Scope refers to how broad or narrowly the issue is bounded. Scaling the work involves zooming in or out. Scaling the work allows the team to re-look their general and specific concepts by looking at details of the situation, or alternately, pulling back and looking at the bigger picture. In this scaling, in the going into detail or looking at the larger picture, new perceptions can be generated, new understandings of linkages and meaning can be re-constructed, and the team itself can be cognitively refreshed. One effective technique for doing this is to have the personnel engaged in a design space split into two smaller teams, with one team going into a detailed assessment of a particular component, and the other team going to a longer, wider view. The teams are then brought together to discuss what changed perceptions they garnered through this activity. The team leader should assist in these discourse moments, focusing the ideas of the teams on new conceptualizations, new understandings, and new perceptions. The team leader then should re-orient the team personnel by publicly identifying the new perceptions and leading a discourse on how the new perceptions affect the former understanding of the design space.

4.4.2 LADDER OF REFLECTION

A very useful technique when the design team is stuck is to use Schön's ladder of reflection.[418] Becoming stuck, or hitting a block, is often due to simultaneous mental exhaustion on a particular issue. By using the technique of the ladder of reflection, the team is redirected to look at the issue from a different perspective, or even look at a different issue altogether. To use this technique, the team leader simply asks the team to reflect on the issue under discussion from a different perspective – Schön recommends going up to a higher level of cognition or down to a baser form of thinking. For example, if the team is stuck on an issue of the relationships amongst several actors in the context, the team leader simply asks the team to focus on one actor for a while, or asks them to look at the relationship of the group of actors with some other entity in the environment. This change of perspective is usually enough to generate a new idea chain which helps the team negotiate past the blockage.

Another form of moving up and down the ladder of reflection is to modulate which space the team works in at any time. Although some members of the design team should be

[417] Schön, *Educating the Reflective Practitioner*, 158.

[418] Schön, *Educating the Reflective Practitioner*, 114ff. Also see Lawson's parallel lines of thought – a similar device, *How Designers Think,* 143, 154-155.

assigned to all three spaces at most times, when stuck, the team leader may move all members to one space to stimulate new perspectives and ideas. Alternatively, the team leader may move responsible individuals around the spaces to gain fresh perspectives. All of this is determined by the team leader's assessment of the progress of the design team.

This technique is also useful for generating new ideas along a commonly held preconception. Asking the team to reflect from a new perspective will generate differing factions, and will frequently result in an increased understanding of the issue.

4.5 LEADING ORGANIZATIONAL DESIGN

As leader of a design team, your responsibilities go far beyond the confines of design. Your responsibility includes orchestrating the movement of priority work from design into detailed planning, and then assisting the detailed planners in moving the priority of effort into current operations. You are also responsible, in part through the mission narrative, for assisting the synchronization of strategic communication throughout the system. You also play a key role in creating a system of assessment tools for the organization – since action without effective assessment is useless. Additionally, you may need to conduct some of the techniques and cognitive skills of design in an environment where formal, deliberate design is not acceptable. Finally, you must retain your own sense of balance, and be able to conduct useful self-reflection.

4.5.1 TRANSITION TO PLANNING

I hate that we practiced "Design" in SAMS by doing it in formal practica prior to launching into JOPP and MDMP. I would rather have had it infused within all the things we did. Part of the "problem" of Design is that it requires interaction with the environment one will operate in.

—Major Grant Martin

The transition to planning is frequently considered one of the more challenging aspects of design. However, it is actually straight forward, if one keeps in mind several of the key tenets of design. First, the movement from design to planning is not based on a single product, but an iterative common shared understanding of the context, the problem, and initial ideas for problem management or solution. Although the bridge from design to planning is sometimes expressed in a particular document, the creation and sending of the document does not absolve the design team from continual engagement with the rest of the organization. This should not be a "hand off and forget it" effort. Second, the communication to the rest of the organization will never be fully completed – additional engagements with the rest of the staff and all echelons of commanders are essential for success. Third, as expressed by General Dempsey in the forward to *FM 5-0*, design allows commanders to understand the environment "before entering the visualize, describe,

direct, lead and assess cycle."[419] Focusing on the understand aspects of battle command during design is the "get out of jail free" card for all challenges of the transition to planning – the team leader must keep in mind that if a subject or an issue it is not concerned with understanding, it is a planning function, not a design product.

Additionally, it may be helpful to use design, and its products, to establish the fundamentals of assessment for the operation or campaign. Although this is not clear from *FM 5-0*, most experienced planners understand that the difficulties of assessment are moderated if it is begun as early as possible.[420] Beginning assessment "understanding" belongs correctly to the world of design. Given design is now helpful in the initial stage – understand – and in the final stage – assess, the design team has clarity on what needs to be done and what can be assigned to the detailed planning (see Section 4.5.3).

The doctrinal products of design are collectively referred to as the design concept. The design concept, which can include the by-products of the design itself, a problem statement, initial commander's intent, initial planning guidance, and the mission narrative, is incompletely defined in *FM 5-0*.[421] If the design team keeps in mind the iterative nature of complex problem solving, some of the ambiguity in doctrine falls away. Rather than being overly concerned with future friendly actions, the design team should focus clearly on understanding, include environmental, problem, and operational approach understanding, and with assessment. Commander's intent and guidance can be expressed as the outcome of understanding and with a look forward to the critical assessment concepts. This will be sufficient for the detailed planners to pick up the primary execution planning responsibilities.

The mission narrative, however, requires both broader and more specific work from the design team. This document should be focused in two directions: toward clear information/strategic communication understanding of the situation and toward clear understanding of the need to communicate with interagency, coalition, and host-nation partners. Keeping the mission narrative focused on these two issues, again with one eye on understanding and one eye on assessment, the design team will not over burden itself with issues more appropriate to detailed planning Focus on these two will also clearly provide a useful document for the commander, for the more senior officials, and for the staff.

To streamline the transition to detailed planning, the design team should simply capture its earlier presentation and design drawings and narratives, avoiding extensive rewrite of previous products.[422] If the design team has used clear and unambiguous language while designing, there should be no need to rewrite products.

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[419] United States, *FM 5-0,* Foreword.

[420] United States, *FM 5-0,* paragraph 3-1 calls for design to aid in the understand, visualize and describe portions of battle command.

[421] United States, *FM 5-0,* see paragraphs 3-63 through 3-66.

[422] Lawson, *How Designers Think*, 26-27.

One of the best examples to date of capturing the learning from design to guide detailed planning is the report "A Design Concept for Moving Beyond Strategic Communication" written by SAMS Seminar 2 in 2010. The report explains both the findings of the seminar's inquiry and the design methodology used to explore the issue of strategic communication, including both narratives and presentation drawings developed during design. The introduction of the report is shown in Table 35. For the full report, see Appendix G.

TABLE 35. SEMINAR 2, SAMS AMSP 2010:
INTRODUCTION TO "A DESIGN CONCEPT FOR MOVING BEYOND STRATEGIC COMMUNICATION."

The DoD Dictionary of Military and Associated Terms (Joint Publication 1-02) defines the phrase strategic communication for the Department as "Focused United States Government efforts to understand and engage key audiences to create, strengthen, or preserve conditions favorable for the advancement of United States Government interests, policies, and objectives through the use of coordinated programs, plans, themes, messages, and products synchronized with the actions of all instruments of national power." However, this recitation of a dictionary definition does not explain how this term is interpreted and implemented.

The 20th century presented the Army with the challenge of revolutionizing its training and doctrine in order to maintain dominance. The 21st century presents an equal challenge for the Army to revolutionize the way it communicates to achieve commensurate information dominance. The information domain and cyberspace are the decisive terrain in 21st Century warfare. Currently, the United States Army is not optimized for success in this area and must quickly grasp the gravity of its current stance. The modern operational environment is increasingly devoid of traditional states, borders, and militaries. Instead, the new battlefield deals increasingly with both the physical environment and the communication environment where weapon systems and lethality combine with perception management as the keys for ultimate success. This evolution necessitates a significant change in the way the Army understands strategic communication and has fundamentally changed the necessary communication skills required for the US Army to meet national objectives at home and abroad.

Strategic communication is about generating shared meaning in support of national objectives. This involves listening as much as transmitting, and applies not only to information, but also to physical communication – action that conveys meaning. The concept deals with the challenge of influence – convincing others to think and act in ways compatible with our objectives, whether this means causing others to adopt a specific course of action or simply understand us better and accept us more. Influence is a pervasive and fundamental form of any social interaction, as essential to cooperation as it is to competition or conflict. One mechanism for exerting influence is communication.

Strategic communication is an adaptive, decentralized process of trying to understand selected audiences thoroughly, hypothesizing physical or informational signals that will have the desired cognitive effect on those audiences, testing those hypotheses through action, monitoring the actual result through feedback, and disseminating the best solutions

quickly. The strategic communication process is always a work in progress, one that is inherently aspirational in its goals. Nonetheless, it is a critical process, one that the Army must be committed to improving.

Emergent thinking is coalescing around the notion that strategic communication should be viewed as a process, rather than as a set of capabilities, organizations, or discrete activities. In its broadest sense, "strategic communication" is the process of integrating issues of audience and stakeholder perception into policy-making, planning, and operations at every level. Echeloned empowerment, laws, and regulations must be operationalized to create the communication environment needed in the United States Army.

Although imprecise, the term strategic communication connotes the qualities of effective communication that most directly impact operational effectiveness. It provides a shared starting point for discussing communication as well as what must be done to leverage the latent communicative potential inherent in the Army.

The School of Advanced Military Studies (SAMS) undertook a design effort, drawing from communication theory, Army doctrine, and insights from communication practitioners. The theoretical research considered a broad range of topics from interpersonal communications to communicating via new media. The design considered communication practices from across the force and compared these against communication theory to identify and examine areas for improvement. Additionally, subject matter experts in strategic communication from the fields of government, politics, business, and academia informed the design by providing recommendations based on their respective areas of expertise. By applying the design methodology, the SAMS design team applied critical thinking skills toward understanding the Army's strategic communication efforts.

There are many techniques for carrying design into the detailed planning. Doctrine specifies that the design team is drawn from the planning staff to encourage effective sharing between the conceptual and detailed planning efforts.[423] Other techniques include assignment of members of the design team to specific detailed planning actions. It is recommended that the use of assessment tools be the primary method of integrating the efforts of the design team and the detailed planners. If assessment is used carefully, it captures the essential outcomes of blue action to achieve the desired conditions. This focus is sufficient for coordinating the work of designers and detailed planners (see Section 4.5.3).

4.5.2 STRATEGIC COMMUNICATION

At its most basic, Strategic Communication uses a variety of media to communicate messages intended to shape the understanding of specific audiences. When leading

[423] United States, *FM 5-0,* see paragraph 3-32 for design team make up, see paragraphs 2-37 through 2-40 for discussion of conceptual and detailed planning.

strategic communications the initial struggle is to recognize that the communication process is itself a complex adaptive system. The fundamental attributes of complex systems and design theory apply to the communication process in the same way they do to the overall design of operations. The second element to keep in mind is that strategic communication is not a separate element of design, but an integral part of the design concept as a whole.

In leading the communication process it is imperative that the team not confuse traditional ideas about product "marketing" with strategic communication. Leading strategic communication means establishing an environment within the design team that reflects this understanding. Communication within the team and among the team and external audiences, including commanders, interagency partners, in-theater communities, etc., should be viewed through this lens.

The hardest part in leading Strategic Communication is to guard against the tendency to confuse Strategic Communication with Information Operations. The institutional history of the military focuses on hands-on, "can-do" techniques. **Strategic Communication is frustrating, slow, and often ineffective because of the complexities of how different audiences transmit and receive meaning.** Leading effective strategic communication means setting the right expectations for the role of strategic communication without creating an atmosphere that dismisses its importance. One of the best ways to do this is to remind team members that the communication process is not a one-time act, but a long-term series of acts in a larger campaign. And just like with any kinetic campaign, strategic communication must be *strategic*. In other words, a communication campaign must *focus* its message to maintain clarity and must *limit* the audiences it addresses. At the same time strategic communication does not limit the means of communication. A good leader will maintain an adaptive strategic communication plan that shifts to accommodate changes in how its key audiences receive and understand messages. Groups frustrated with the pace and hit-and-miss nature of communication will quickly lose this adaptability.[424]

In their practicum design concept, SAMS Seminar 6, academic year 2009, incorporated Strategic Communication as a central element of their approach. In looking at their environmental frame Seminar 6 asked, "What kind of reality has this particular system that we are trying to influence constructed for itself?"[425] In asking the question this way the Seminar recognized two concepts emphasized in Design: the need to understand the way foreign communities create a sense of identity (the problem of the other), and the centrality local concepts of authenticity play in facilitating cross-cultural communication.

For SAMS Seminar 5, academic year 2010, the first element of their Strategic Communication design was to focus their efforts on supporting the Qawm – the local Afghan institution that spoke with the most authentic voice to the community. "The 'Support the Qawm' theme's intent is to provide a reinforcement of the traditional social structures in Afghanistan and to bolster the capability of local leadership mechanisms,"

[424] Workshop in Strategic Communication, University of Missouri School of Journalism, February 17-19, 2010.

[425] SAMS Seminar 6, Academic Year 2009-10 Strategic Communication Narrative.

noted the Strategic Communication narrative. By supporting this traditional structure of leadership, the Seminar intended to create a more effective channel through which they could engage their target audiences in specific dialogues about the other themes identified. Through the Qawm they could establish themselves as having the support of a legitimate authority and begin discussions about the future of Afghanistan, the structure of its government, and the role of international forces.

The slide below in Figure shows the themes emphasized by the seminar and the trend of effort over time. Also note the definition of Strategic Communication at the top of the slide.

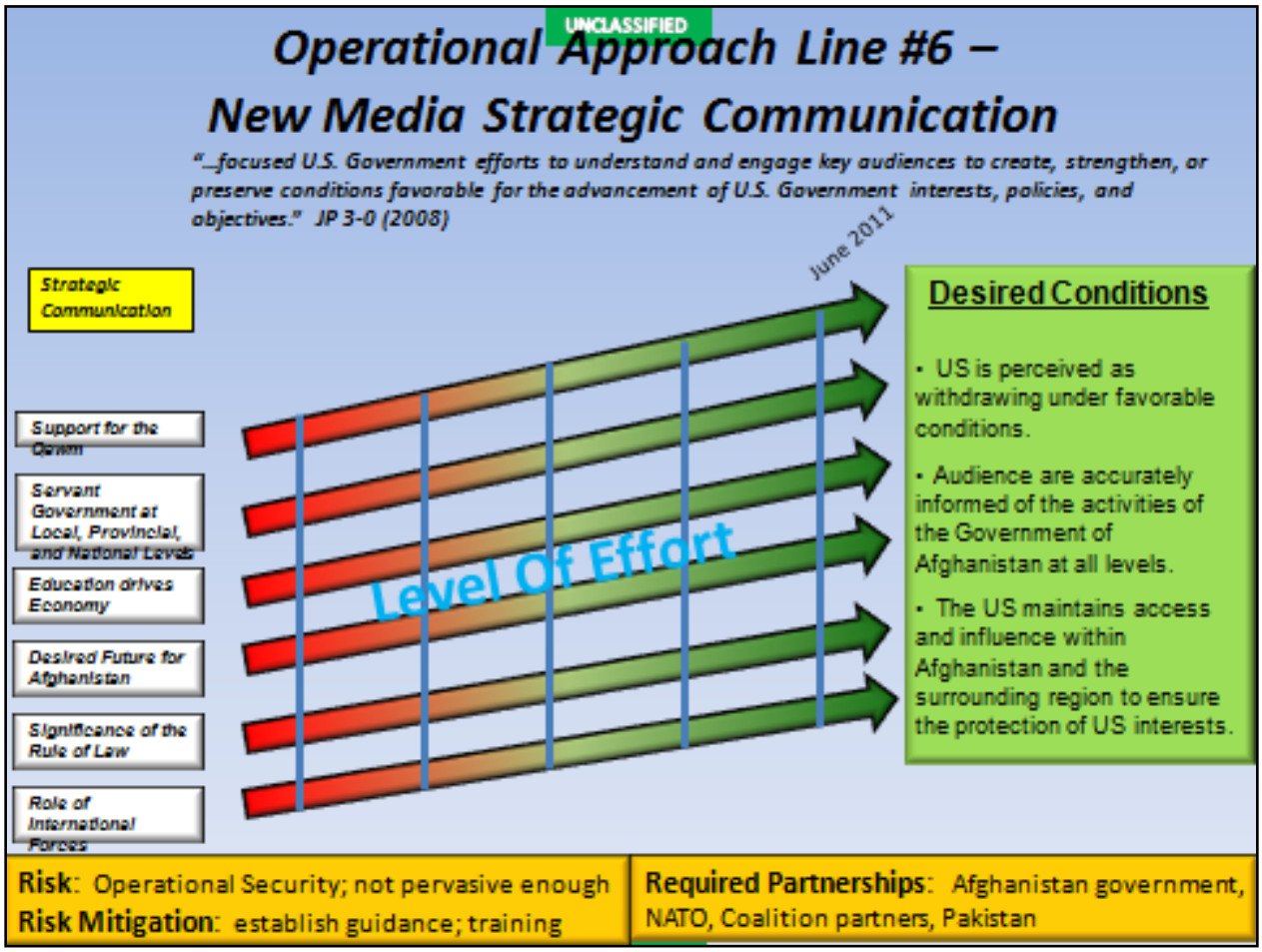

FIGURE 39. SEMINAR 5 SAMS AMSP 2010:
NEW MEDIA STRATEGIC COMMUNICATION LINES OF EFFORT.

4.5.3 ASSESSMENT

If understanding and assessment are the two key cognitive spaces for the linkage of design to detailed planning, they are also the linkage to preparation, execution, and assisting the

commander in leading the force.[426] In doctrine, assessment is only loosely linked to design, usually solely through a need to reframe if the mission is not functioning, and if the plan needs to be completely redone.[427] This is inadequate, since the design team leader is the staff officer most familiar with the environment, the problem framing and the concepts of the operational approach. The design team leader must pursue active involvement in all organizational assessments, including being named the staff officer responsible for the assessment working group. Assigning that critical task to an operations officer or to an ORSA officer, as recommended by doctrine, hinders the effectiveness of design.[428]

One effective technique for assessment provided in Appendix B is a Strengths, Weaknesses, Opportunities, Threats (SWOT) analysis. An example of SWOT analysis applied to design is given in Figure 40. Seminar 2 in 2010 conducted a SWOT analysis on the issue of the Combined Arms Center's strategic communication. In SWOT analysis, it is important not just to list out each category, but to consider their combinations: how weaknesses can be turned into strengths, how strengths can mitigate against threats, and so on. SWOT analysis provides a framework for assessment of both the internal and external context.

[426] See Lawson, *How Designers Think*, Chapter 5 for a detailed discussion of assessment.

[427] See United States, *FM 5-0,* Chapter 6 for a discussion of assessment.

[428] United States, *FM 5-0*, paragraph 6-61 calls for "operations officer, plans officer, or senior ORSA staff section serves as the staff lead for the assessment working group."

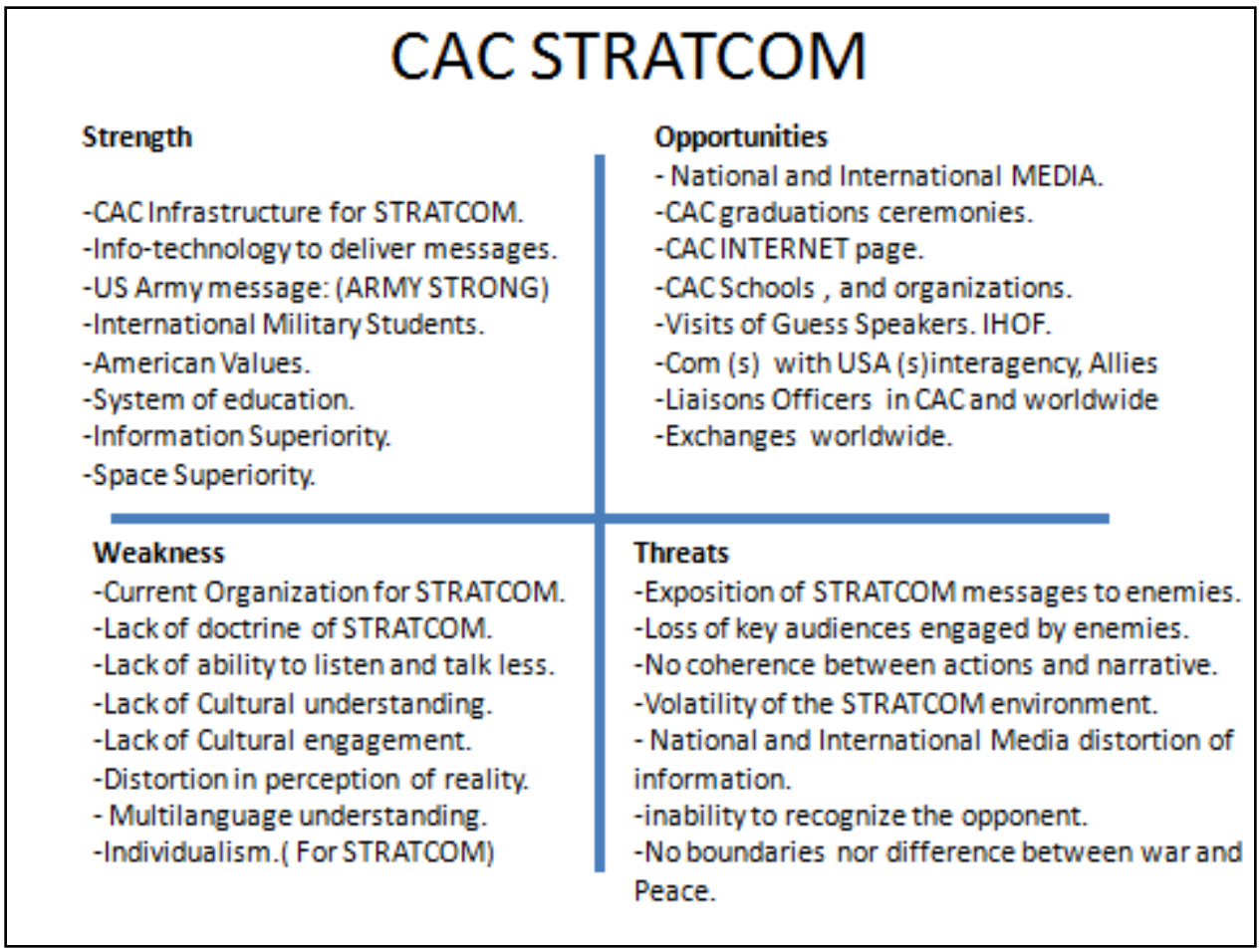

FIGURE 40. SEMINAR 2 SAMS AMSP 2010:
SWOT ANALYSIS IS A USEFUL TOOL FOR ORGANIZING ASSESSMENT.

Without effective assessment, any action is simply a shot in the dark. With effective assessment, the organization learns the value of its environmental, problem and solution space understandings, the currency of its detailed planning, and the relationship of current operations on the organizations' overall understanding. Assessment must be linked to all of these forms of cognitive awareness. Lawson refers to assessment as empowering an integrated response to a whole range of issues which emerge when engaging the system.[429] Designers, especially leaders of design teams, must embrace the idea that they have a critical responsibility in the creation of effective assessment for the organization. Creating assessment "tools" must begin as soon as design starts – if left to a later stage of design, it will not be integrated into initial understanding, and initial actions by the organization will tend to be conducted without direct and powerful linkage to the assessment system. In the environmental space, designers will identify particular nodes, relationships, and entities in the system that can be specifically assessed for changes of state, changes of relationship, or alterations in narrative meaning. These ideas must be captured and provided to a

[429] Lawson, *How Designers Think*, *How Designers Think,* 62.

designated member of the design team responsible for incorporating ideas on assessment. In the problem space, the design team should identify similar items linked to the statement of the problem, with particular emphasis on issues that confirm or deny the validity of the problem conceptualization, through reactions of the system to action.

In the solution space, as the operational concept is developed, there are two primary threads for assessment. The first is to be able to assess whether the actions required by design actually appear to impact the nature of the problem, or the nature of the understanding of the system. The second form of solution space assessment is whether the actions to be conducted are actually linked in space, time, and function with each other. The system will react to actions, usually in ways not precisely foretold, and the organization itself may not be able to effectively coordinate its own actions, as desired in the design or in detailed planning. Both areas require effective assessment, usually in rather different forms.

As the organization moves into detailed planning, preparation, and actual execution of operations, the design team leader must re-assess the effectiveness of the assessment tools generated in design, assist the detailed planners with validating their assessment tools, and monitor assessment developments in current operations. Participation by design team members in organizational after action reviews (AARs), as well as assisting in the conduct of detailed planning AARs and leading AARs in the design team are all essential steps in maintaining effective assessment.

4.5.4 INFORMAL DESIGN

There are HUGE rice-bowls that will be upset if we truly attempt to incorporate Design into how we do things. It almost has to be a "stealth" Design, I think. Incorporate it where you can on the margins to make some change and be cognizant that we won't change the world tomorrow.

—Major Grant Martin

The feedback we received from the field indicates that not all command climates are permissive for the explicit use of the design methodology. This is understandable, given that design is relatively new, and SAMS graduates are usually the only members of the staff to have had formal education in design and participated in multiple reflective design practica. If current processes are already working, there may be a reluctance to deviate from the status quo.

Graduates who have found themselves in this situation have requested methods for informal design. Fortunately, other graduates have provided us with examples of their own experience, which often includes adopting a design mindset, even when they do not use design terminology within their operational planning teams or in their products. The ability to internalize design yet still explain activities in commonly understood language is an extremely useful skill, regardless of the command climate. A feature of great design is

that the design itself does not detract attention away from the *purpose* of the design. In Table 36, we summarize the advice from our students in the field on how to design without explicitly taking a design team through the methodology provided in *FM 5-0*.

TABLE 36. AMSP GRADUATE FEEDBACK ON INFORMAL DESIGN.

Advice for Informal Approaches to Design
Recommendation for the student text: "Perhaps some discussion for methods of "covert design"… some sort of design approach that does not scare other staff officers and/or leaders." Anon.
"When design is applied behind the "scenes" with a core group and used to feed MDMP (either Mission Analysis, or COA Development) it is actually well accepted. Many times during my deployment I was asked be superiors to "show the math", this was the door that allowed me to utilize design and show what I had done. Using design also allowed in many cases for me to lead an operational planning team quickly through MDMP as long as I was prepared ahead of time. Finally, on a Division staff, one must be prepared to form their own design team." Major Mark Huhtanen
"We had started as just an "after dinner" group, made up of 13 people from various staff sections- most who had worked on the Planning Group for the Command's OPORD. Eventually we obtained the support of the SAG Chief and CJ5 and then later the CG's Military Assistant. We met 2-3 times a week for an hour and a half. We brought in guest speakers- Ministry of Interior folks, different Command section members, and NGO people. We did outside research and briefed each other on different aspects of the police and Ministry of Interior. We loosely followed an environmental understanding, a "problems" understanding, and a solutions discussion- spending about 2 weeks on each (4-6 meetings on each "phase")… Lessons learned so far: • We had to get sponsorship from key staff section chiefs or we wouldn't get traction with anyone on the CG's staff. • Have to get buy-in from someone in the commander's inner circle- and it has to be the right person. • Have to manage expectations of the CG and sponsors – but also be willing to negotiate on what is expected of the group- give and take is paramount. Know when to take a stand and when to flex. • We initially thought we should keep our conclusions to ourselves and only share with the CG and his MA – the idea being that we would stir up less staff discontent if our ideas seemed to come from the CG and not us. Ended up sharing a lot of what we came up with in the group- since our learning started to influence our "day jobs" and we incorporated ideas into advice and plans, etc. – which bubbled up to the CG through different venues. We now plan to share our info more openly – although we still are having to be cognizant that not all staff section chiefs or other G.O.s are as enthusiastic about us as others are. Currently we share our conclusions more openly; officially we share them with the CofS, the CJ5, the SAG, the MA, and a few others- deputies mostly. Individual comments are all non-attributive, and that goes for guest speakers especially. • We were told to stay away from "Design-speak" and doctrinal terms dealing with

Design. As such, our first name – the Design team – changed into the Planning Initiatives Group (PIG) – the idea of the CJ5 who likes to call us "the PIG." We changed it to the Inter-staff Initiatives Group to note our multiple staff section makeup. Bottom line is that I think we are doing "underground Design" – using some of the things we have learned, but couching it in different language to make it palatable. What we conclude and the "so what" are more important in the end to our "clients." And, just as in sales – you HAVE to know what your client wants.

- Design – at least in some of the doctrinal concepts and foundational literature – seems to assume that one can get at fundamental problems and issues and that you can target these base issues directly. Unfortunately – politics forces the environment into a different shape than the one that exists on the "fundamental" level. In other words, the State Department, the Justice Department, the U.S. Government, the GIRoA, and even different commands and branches within the military (and our own command!) are as much a part of the environment and obstacles in the way of solutions as the insurgents are. You have to get away from spending a lot of time thinking all "blue" forces are monolithic and driving towards the same goals. You have to understand the inner politics and networks of "us" as much as you do – or maybe even more at this level – than you do "them" – and you have to take into account the most likely and most dangerous COAs of these entities. The so what is that even with Design you can't develop this "magical solution" that will get at the heart of the problem – because we, from our own structures, make the complex even more wickedly complex. You acknowledge the heart of the problem, but then very quickly get into what you will pragmatically be able to accomplish – and how. I think Design literature sometimes seems to promise we can get at fundamental problems instead of symptoms – but I would caution against thinking that simply identifying fundamental problems means you can actually start to get at these fundamental problems. Instead it just might frustrate you more!" Major Grant Martin

"Dissipative Groups. I have used two different methods. One is using a normal JPG the other is using the other guys in my section. Depending on who the members are, I generally don't tell them what I am doing because different stuff scares people…they don't like new ideas, so instead I just tell them we are doing a modified mission analysis…they are comfortable with mission analysis. So what I have done with ill structured problems or no structured problems is do a quick frame in my mind to identify the what I think the main elements of the problem based on my "thesis" of the problem. I take these and tell the JPG or other staff members to go do research on the area paying particular attention to certain aspects. So we generally have three day between projects, so I give them a day. When we come back together, then we go through their findings and discard what looks like it doesn't matter to the problem, and we dig deeper on the next round on either aspects found during the initial research or we move to other aspects to do research on. So we can quickly develop a frame and identify the key elements around which to spend most of our time.

The other method which is a modified version of this has emerged in the last couple of months within my section where we have all learned each other strengths and weaknesses. We use internal process for very quick turnaround problems. So the lead will quickly frame what he thinks the problem is…again, I used to use MA, now I largely use problem framing

openly because they understand it well enough…then we send that out to the other seven members of our division for review. In reviewing it, each individual will add or take away from the frame based on their expertise and critical eye. It has been interesting how quickly we can frame complex problems. What has also happened is that we have learned from each other and try to frame with the idea of what the other guys will focus on, and in doing so, each lead tries to head the reviewers off at the pass. So we have actually made ourselves more critical from multiple points of view which has been interesting to see. Then as a third level of dissipation, each person sends his response back to the other members of the division, which causes another set of discussions about the problem helping everyone to synthesize the real problem and solutions.

This also works at senior level. In fact on Friday we went through this same technique, but this time from the 0-4 to the 0-8 level in about two hours, which we hadn't done before. We have been working on a proposal that required GCC approval. The combatant commander's staff is divided on whether they support the proposal or not. So they have developed three other COAs in addition to ours to brief the GCC commander. We were reviewing their slides with our CG Friday morning and he was getting frustrated because there seemed to be something missing…in this case, a problem frame. There were four solutions, but it seemed like no one agreed upon the problem. So I quickly framed the problem with a strategic and theater problem, facts, assumptions, and forces available. Once I got this done, it quickly became apparent that only two of the COAs were feasible, acceptable, and suitable for the problem. The other two answered the wrong problem. So that was very interesting and timely for this discussion!" Major Derek Jones

"**Fifth Column of Wisdom: A Survivor's Guide to Informal Design**

Words matter. The cascading of words from audience to audience is a perilous game of logic. When one hears that "To be great is to be misunderstood," the comforting if mistaken corollary that "to be misunderstood indicates greatness" must be banished. So it is with design. As an approach to hiding design in the open, the following discussion offers opportunities for practitioners to apply critical thinking and creative communication in an environment where the *lingua franca* is PowerPoint, Excel, and MDMP. Next slide.

The requirements to orchestrate informal design can be viewed along a continuum between buying time and getting buy-in. The command climate within a unit will indicate the level of permissiveness for a group of planners to sit around the dry erase board for hours and not come away with tangible product. The staff climate within a unit will dampen or encourage the use of "other people's product" or, in other words, the extent to which a staff officer is measured against the wear and tear on the keyboards' shortcuts to "cut" and "paste." Upon careful consideration of how many hours in a given month can be set aside for gaining understanding and how many minutes must be devoted to clear demonstrations of the outputs of the planning work, then and only then can the planning team assemble under cover of "meeting" or "OPT."

The extreme case bears some examination. Those places where the mention of "design" brings an almost pathological revulsion and memories of an inarticulate, incomprehensible, and annoying Design Proselytizer pushing a multi-colored diagram with circles and arrows may someday fade away into history along with the Advanced Guard Main Body. In the meantime, planners faced with a design-hostile workplace must use the language well

within the comfort zone. Mission Analysis is a perennial favorite. Gathering the planning team under the auspices of mission-analysis-without-a-mission is not as difficult as one might initially think. This is where standards come in.

A training-based approach to conducting mission analysis is a formidable way to begin disarming the resistance to more formal design. Teach a class on mission analysis using a practical example relevant to the design problem. By providing clear structure with agenda items and expected training outcomes, a "class" on mission analysis takes a staff through the relationships of facts and assumptions as they bear on a sample problem. The language of problems remains firmly planted in the doctrine that many grew up with, as does the construct of task and purpose; task conditions and standards; and purpose, method, and endstate. Building a framework in which the movement toward "what is going on" rests on geography, forces, and conditions can ease the sleight of hand where specified and implied tasks spring from the questioning behind "why is it going on?"

Importantly, when leadership wanders in and sees the inevitable whiteboard graffiti spilled all over the room, words like "essential tasks" and "assumptions" provide context. Again, every hour spent not in meetings and not making products for meetings must have a justification with a price tag: we accomplished this, captured it this way, and this is where and how our work directly relates to the job at hand.

The transition from training to learning is where informal design pays off. Staff officers fixated on completing their appropriate Annex can be brought in during course of action analysis exercises to see where their expertise and input shape wargaming for everyone. Key leaders can see how the groundwork taking place during "training" sessions directly supports the future requirements for detailed planning. By directing the learning toward identifying the strengths and weaknesses of the staff, planning team leaders determine where and how to couple staff sections together to leverage consistent movement towards overall level of understanding. Gaining a feel for the dynamics of the staff during "training" lays out a way forward when the breakout occurs.

Eventually, the light goes on within the staff. Whether from the very beginning or through the slow churn of informal design, there comes a time when the momentum of looking at the relationships relevant to the problem can be exploited. The critical factor is whether the staff at this time is ahead of, in line with, or behind the commander. The cases in which the staff is in line with or behind the commander simply require the staff to do what they do best: work harder. In the special case where the staff is ahead of the commander (purely hypothetical for the sake of argument), or where there is an unavoidable gap between the commander and the staff from within the staff itself, informal design comes in to play again.

The language of design in this special case is either problematic or counter-productive. It is imperative that the forums for discussion, the decision briefings, and the written and graphic products consistently portray a mature level of understanding well within the boundaries of planning products. No commander wants a mission analysis brief that displays the level of work put in by the staff. The purpose is the communication of the *analysis*, namely seventeen slides of "so what." Or less. The challenges associated with presenting analysis sequentially (MA brief, COA development, COA analysis, etc) are where and under what pretext to inject new understanding. The curse of the combat operations

daily FRAGO and the just-in-time directed course of action cannot be left unaddressed. Conveniently, the tried and mostly true running estimate serves a purpose here.

Just inside the threshold of gaining buy-in from within the staff and from the commander, informal design can leverage another technique consistent with MDMP. While commander's guidance and intent span a wide range of qualities in terms of timeliness, completeness, and usefulness, the judicious shaping of commander's critical information requirements (CCIR) throughout the planning and execution phase assists in the commander-staff dialogue. The chain of reasoning that links observations to decisions to actions, as depicted for example in a decision support matrix, can be leveraged early on to support design requirements. Consider what an intelligence, surveillance, and reconnaissance (ISR) plan for *assumptions* really looks like.

Both internally and externally, the questions of what to look *into*, what to look *at*, what to look *for* provide a powerful and insightful engagement tool for the commander, the staff, higher headquarters, collaborators, and subordinate units to at the very least see each other. By balancing a discussion of "information requirements" with the methods and means for getting after them, planning leads can harness the looping nature of design well within the mechanics of an organization versed in servicing targets and moving on." Anon.

4.5.5 SELF-REFLECTION

Finally, the design team leader must understand, accept, and cope with the gravest challenge of all – maintaining personal intellectual flexibility. Two things assist the design team leader in this task – the first is the presence of a top cover individual. Some officer, preferably senior to the design team leader, should prevent interference from competing demands, questions, and tasks from senior officers on the design team.

The other thing which can greatly assist the team leader is a set of trusted agents in the team itself. These trusted agents can act as foils for reflection to bounce new ideas off and ensure the rituals of practice remain relevant, rather than stifling intellectual flexibility. An example of reflection on the design methodology is provided in Figure 41.

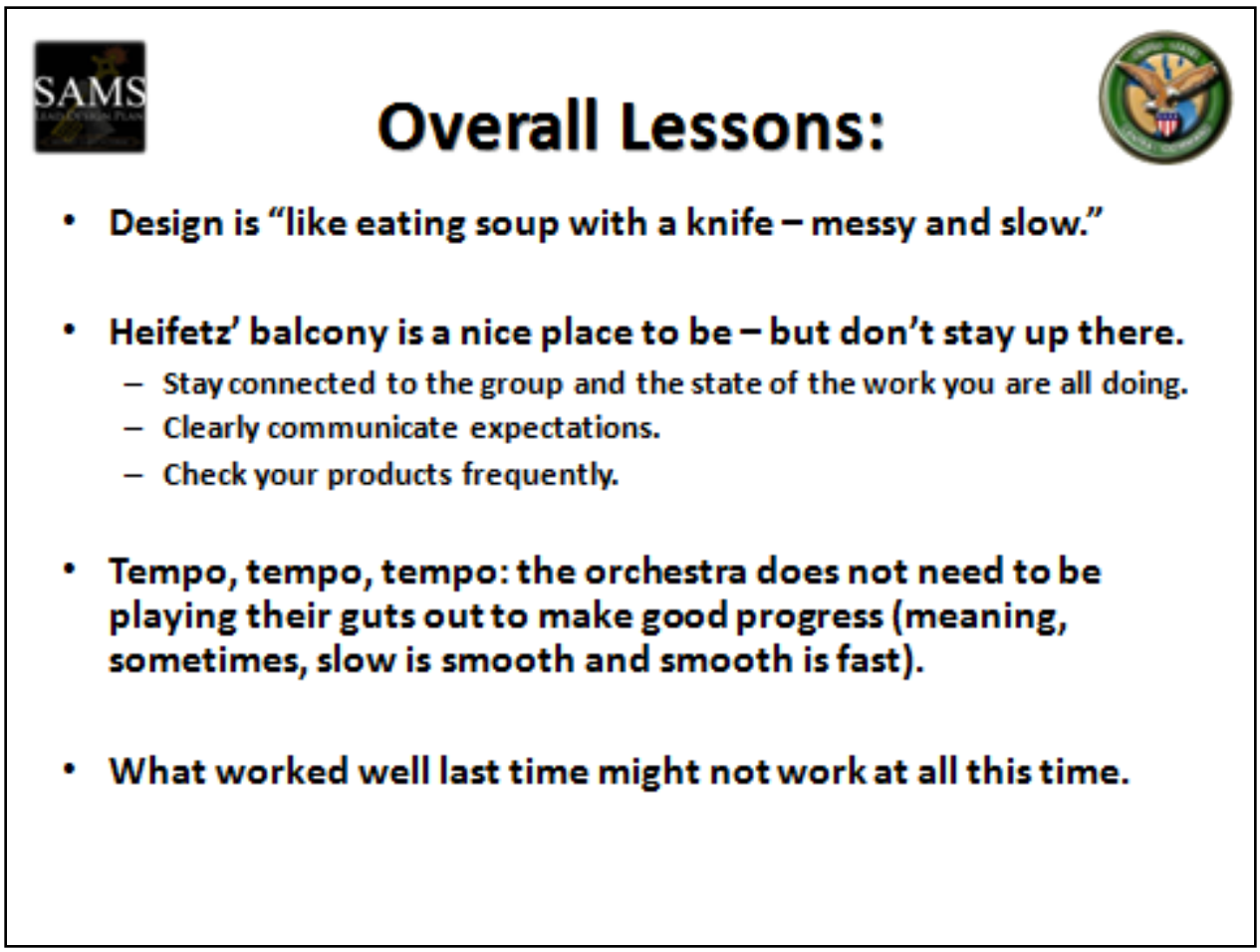

FIGURE 41. SEMINAR 3 SAMS AMSP 2010:
REFLECTIONS ON THE DESIGN METHODOLOGY.

4.6 LEADING REFRAMING

It's all a question of story. We are in trouble just now because we do not have a good story. We are in between stories. The Old Story - the account of how the world came to be and how we fit into it - is not functioning properly, and we have not learned the New Story. The Old Story sustained us for a long period of time. It shaped our emotional attitudes, provided us with life purpose, energized action. It consecrated suffering, integrated knowledge, guided education. We awoke in the morning and knew where we were. We could answer the questions of our children. We could identify crime, punish criminals. Everything was taken care of because the story was there. It did not make men good, it did not take away the pains and stupidities of life, or make for unfailing warmth in human association. But it did provide a context in which life could function in a meaningful manner.

—Thomas Berry

A critical component of design, especially for long duration campaigns and for extremely ambiguous environments is the idea of reframing. **Reframing is the altered understanding of any of the three design spaces which causes the organization to rethink the nature of that design space.** Described in doctrine as when a plan must be entirely re-conceived, reframing actually applies in many circumstances, in many different ways.[430] Reframing of the environmental frame may occur at any time during design, during detailed planning, or during actual operations. The reframe based on the environmental frame is due to a fundamental misunderstanding of the nature of the system. Reframing of the problem statement may occur during design, but is more likely to occur during detailed planning when physical requirements are identified that were overlooked in design., It may also occur during actual operations, but is unlikely to occur during preliminary design itself, since new inputs into the problem space will frequently not be powerful enough to generate a reframe. Reframing of the operational approach most frequently occurs during actual operations, although it may occur during detailed planning. This form of reframe usually results from a successful encounter in the system which did not produce the anticipated results. Reframing inside detailed planning is also possible, although this will usually affect only the problem or solution spaces of design. Reframe, despite the doctrinal statement about complete re-design and re-planning, may not require wholesale change of actions, plans, or even design. It will, however, always be significant, or it is simply an adjustment and not a reframe.

4.6.1 REFRAMING

Reframing is a big hairy deal!

—Major Dave McHenry

The first concern of the design leader is to validate the need to reframe. Secondly, the leader must arrange for an engagement with the commander to discuss the need for the reframe and the downstream effects of reframing. The leader must constantly be aware of the tension and anxiety caused in the design team upon reframing. However, reframing is not to be feared or avoided, since reframing is one of the most effective generators of creative new ideas and paths to solutions.[431] When is becomes apparent that reframing is necessary, usually from what Schön refers to as "backtalk" from the system, the design team, with the advice and consultation of the commander, re-assesses which portions of the design conceptualization require reframing.[432] If the backtalk was extensive, and revealed significant gaps in the baseline understanding of the system, reframing may go all the way back to foundational understanding in the environmental space. If the backtalk was less fundamental, and related more to either the awareness of the problem set or a

[430] See *FM 5-0*, paragraphs 3-68 through 3-71 for a useful, nuanced discussion of reframing. Paragraphs 6-2 and 6-33 limit the discussion of reframing only to the development of an entirely new plan.

[431] Lawson, *How Designers Think*, 275.

[432] Schön, *Educating the Reflective Practitioner*, 157.

difference in the possible solutions, then work would be prioritized in the appropriate space of design. Like other work in design, however, there should be presence in all three spaces of design simultaneously, coordinated and integrated under the leadership of the design team lead. It is critical that this occur during reframing, since the initial assessment of the backtalk may be in error, and the team may well determine that the error that led to the backtalk was based on another, or perhaps all three, design spaces.

Reframing should also be coordinated with the detailed planning team(s) and with current operations. Since the backtalk frequently occurs in the realm of current operations, careful observation of the current system is the responsibility of the design team. Some mechanism, some element of a learning organization, should be employed to gain and maintain situational awareness and understanding through current operations to the design team, or at least an element of the design team.

While coordinating reframing activities with both the detailed planning personnel and with current operations, care should be taken that higher and lower echelons are also informed of the reframe, the reason for the adjustment, and likely actions to result.

4.6.2 THE POST-REFRAME MOMENT

After reframing is ordered by the commander, or the design team engages in assessment of a reframe, but has not yet received guidance from the commander, the design team leader is responsible for maintaining awareness of both the internal atmosphere of the design team, and the overall impression of the reframe moment on the larger organization. As stated above, this is an opportunity to better accomplish the mission, not the time to launch into endless second guessing or blame finding. **Reframing is an integral part of dealing with complex systems, and should always be embraced as a positive sign of increased understanding of the system.**

4.7 FEEDBACK FROM THE FIELD

This section collates feedback from the field on how design is actually being used by SAMS graduates. It is hoped that reading this spectrum of experience can help to prepare current SAMS students for their future duty assignments. Further, we hope that publishing the feedback we receive from the field will encourage others to complete the feedback form in Appendix E to share their experience with future students.

TABLE 37. FEEDBACK FROM THE FIELD: THE SPECTRUM OF DESIGN EXPERIENCE.

"Since I have been at the TSOC, I have been involved in developing a strategic appreciation, TSOC vision, SOF Theater Strategy, SOF Theater Campaign Planning, DoD Counterterrorism Strategy and Campaign Planning, and a global planning effort which included all GCCs. What my Design education did for me was allow me to think bigger and help frame problems quickly in my head so that I could concisely describe what we needed to do or at least provide an initial solution to problem framing that then generated discussion. On more than one occasion I have taken over planning efforts that were being led by 0-5s and 0-6s because they were unable to frame the problem to begin the planning effort." Major Derek Jones
"As the Chief of Plans for the 25th ID, MND-N, we used the design process for all of our complex problems; Border Security, Kurd-Arab Relations." Major Jeff Powell
"I just recently redeployed from Iraq and was in the plans shop. We however did not use Design because we fell in on a Division HQs that was pretty wedded to their current campaign design and did not want any changes to it." Major Tom Wilson
"At the division level I have not used design. There are clearly applications for its use, Parliamentary Election support, Transition to Phase IV: Stability Operations, Reduction of Forces, however, the 1AD command climate is averse to its use. Command climate and unit culture are critical to the application of design. At the divisional level, if the command group is unfamiliar with Design, it won't happen. The culture within 1AD is very linearly focused, checklist oriented. There is little to no systemic thinking, the command general is a SAMS graduate but either is unaware of Design, or is averse to its use; despite a climate that almost requires a systemic approach and the application of Design thinking. When I arrived to the division the first question posed to me by the Chief of Staff and the commanding general was, 'Why the F@#$ did you go to SAMS?' " Anon.
"I would like to share...there is room for Design in our Army - particularly when working for former SAMS planners like our CG, MG Brooks. I actually face a problem that is opposite most of my peers...instead of facing push-back from my sponsor, it's the staff who's resistant. Our CG is asking for Design, begging for it almost. But very few on the staff are comfortable giving him what he wants and we're only recently finding direct access to him in a small-group setting." Major Jason Pape
"After attempting to use a piece of design to create an Environmental Frame, it became obvious to me that the free-form design methodology was anathema to the Corps Staff and the situation at hand. I was to brief the MNC-I commander an initial Mission Analysis Brief on Friday, only 5 days after my arrival in theater. With this deadline and the lack luster response from the Corps Staff when confronted with a blank slate and a confusing way ahead, I immediately reverted to the JOPP… The withdrawal of forces from Iraq while

continuing to conduct FSO while transitioning to Stability Operations with a force cap of 50K troops while coordinating with the inter-agency to build a long lasting strategic partnership with Iraq is daunting. If any problem warranted Design, it is this one. The process however, is not conducive to the personnel and processes in USF-I." Anon.
"Let me get this straight…We are still teaching that Design mess there at SAMS? I expected that to die when Commanders in the field were complaining that we are graduating with pie-in-the-sky design concepts, but cannot spell MDMP. I have used Design in the sense of JP 5-0; often, but I have not opened the "Art of Design" manual SAMS is so excited about." Anon.
"The first project upon arrival at my unit following graduation was Unified Endeavor (Division MRX). This was clearly not a planning intensive exercise. I used this time to develop a campaign concept for our deployment and used several of the 'Design Tools.' One particularly was developing CCIR clusters to develop the DST. Linking multiple CCIR categories across our LOEs to identify how all supported decision making. The Affinity Diagram really helped and several staff sections now use that and Mind Mapping when examining problems and solutions. Use of these tools also, identified CCIR that were not linked to decisions and needed to be rewritten or thrown out. I have used many design tools and language in developing our Operational Design for the RC. Just briefed COMIJC this morning on it via VTC. We described Operational Environment, complexity, actors, agents, tensions (Environmental / Problem Frame). In our Operational Design, I merged traditional 5.0 language and some design language. I wrote a script for the brief as a narrative to explain our understanding. I have been a big fan of using narrative in notes pages of our briefs, especially to explain complex slides, definitions and ideas. (Reference NYT article on PowerPoint[433]). So far the briefing has been well received by all, and created a better understanding for those not at the brief, especially when we send read-aheads. I have a core group of folks using design and design tools when examining problems. The 2, 3, 35, myself, and my planners form the core of this group. The challenge is the majority of staff officers and plans reps are not familiar with design, complexity theories or its terms of reference. The most important part is to create avenue for the CG, and DCG's to participate in the process. To implement design you must get the "power brokers" in the Division on board and then it starts to promulgate. Key players are the 2, 3, 5; secondary players are the CHOPS, 35, 4, 9. They need to know the influence of each position within the staff. The 35 and the CHOPS can be more important than a primary. Good relations with the 2, 3 and CHOPS, and 35 breed good planning, and a unified front to the command group. I was assigned a CPT that just graduated from the Career Course. His first task was the collaborative planning related to the major force introduction to Afghanistan. He reviewed Draft FM 5.2, several design tool products and discussed these with our planners. He developed and briefed multiple courses of action, one later approved by the Commanding

[433] Elisabeth Bumiller, "We Have Met the Enemy and He Is PowerPoint," *New York Times*, April 26, 2010. http://www.nytimes.com/2010/04/27/world/27powerpoint.html (accessed May 17, 2010).

General, for the employment of surge forces in Afghanistan accounting for the multiple variables in the environment to achieve the Division's objectives, decisive operation and decisive point. He fully integrated the application of design to understanding the environment, problem and development of viable solutions at the General Officer level." Lieutenant Colonel John Hale
"General staffs and joint staffs have a lot of institutional hesitation to accept Design as a way to frame a given problem. Operational planning teams often jump directly into mission analysis, COG analysis, etc, without performing the due diligence on scoping the problem." Major Joe Jackson
"I haven't formally used Design in the year since graduation, however I find myself using concepts and critical thinking skills on a daily basis. It has enhanced my ability to examine problems and get to the root of issues, particularly when asked to provide comment on Strategic/Policy issues which affect my ASCC-level command." Major Royal 'Sim' Ripley
"Unfortunately, I have no design experiences to offer you, although my SAMS design education has surely influenced the way I think and the lens with which I now look through." Lieutenant Colonel Daniel "SHIP" Lasica, USAF
"I have not used a deliberate design approach in my post-SAMS assignment. I have used MDMP with a mind more open to the concepts of design. I credit SAMS as having imparted "how to think", and SAMS is the only school I can honestly say that about." Major J. P. Maddaloni
"I still think that Design is the best way to attack the complex problems we encounter in the field. In my job as the J4 Plans for SOCAFRICA, I try to introduce Design (without the Design lexicon) with varying degrees of success." Major Don Fuqua
"No, we did not use design in the field. I joined my unit mid-deployment to Iraq, and what they called design was set in stone and we were not allowed to change because the CoS felt that it was still valid despite dramatic changes in the situation or conditions in which we operate. Consistency was valued higher than constant never ending improvement. The Division Staff that I worked on was under-utilized and very open in admitting to its Dysfunctional nature. We never conducted an MDMP, so don't feel bad that we didn't update/change/improve the design at any point in the deployment." Anon.
"- During the JPG for the command's OPORD to support COMISAF's campaign plan we discovered not many people knew much about the command outside of their lanes. After a month, the JPG were THE holistic command thinkers. - Three members of the SAG, 5 of the J5, 1 of the J3, 1 of the J7, 1 of the J2, and one from the air guys (CAPTF) got together and formed a "Design" group with the blessing of the SAG and J5 chiefs. (we have 1 Aussie, 3 Brits, 2 US AF, 1 Dutch officer, and 5 US Army guys). We meet right now for an hour a night- with a plan to go to 2-hour meetings once a week after the first week. - We are working on what to do with ourselves right now- with these ideas: 1) work to inform commander on alternative concepts than what he is getting through normal chain of command; 2) prepare for 6 month assessment on the command OPORD (and possible new JPG convening); 3) offer the command a "think-tank"-like group that can offer a more holistic view of the command and possibly a more objective view with insights into second

and third order effects; 4) disseminate information throughout the command on issues we uncover that are hard to "see" from the matrixed staff perspective; 5) review all of the JPG assumptions, outputs, and the OPORD itself; 6) inform doctrine writers on our insights into the practicality of Design.

- We are discussing now who to get to "sponsor" us- to give us strategic guidance and who we would report to. Candidates are the CG, the CG's deputy, or one of the other G.O.s. Also discussing what kind of Afghan representation – if any – to attempt to get.

- We are also discussing what our boundaries should be (NTM-A/CSTC-A or something broader or something more specific within the command)." Major Grant Martin

"Upon arriving here I assumed the duty as Chief of the USARPAC Operational Design branch and Chief of Strategy and Policy. As of next week I also assume duties as the Plans Chief responsible for all the CONPLANs/OPLANs. Fortunately, our CG had decided to give design a try and allowed our G5, COL Sorrells to contract out Booz Allen Hamilton to come out and conduct a seminar to train up representatives from each of the staff sections and gave us our first assignment of looking at India due to the administration's heightened support of India as a Global Core Partner. The team was organized out of hide pulling one of our civilians out of the G3 Knowledge Management, a MAJ out of G4, and a WO out of the G2.

For obvious reasons this matchup works very well for us since it provides an individual to collect, organize, and store our data. Additionally, he is a systems guy/ ORSA as well as a meta-question type who serves to question what we are doing and why we are doing things that way. The G4 MAJ acts as my deputy and works the contracts while representing the G4 side of the house. The warrant officer is our link into the ACE and although he is a core member he still works in the G2 section which helps to maintain a strong link there. As for outside help, we have reached out to ADSO, PACOM, the FAOs, country teams, SAMS Seminar, BAH, SMEES, and relevant staffers depending on where our focus was. Upon reporting in, the team was to brief the CG the very next morning. They were trying to get their slides together and were not sure exactly what they should be presenting to the CG. I jumped in had them fix their slides at least to meet the CG's requirements and to facilitate getting a read-ahead upstairs. After I ran the slides by the G5, he had me go ahead and brief the CG the next morning. After that brief and acquiring an understanding as to what the CG wanted I reorganized our way ahead and had the team go back and redo the environmental frame from a more strategic perspective, then from an Army to Army perspective. The next time we briefed the CG a month later I was able to show him both and environmental frame and problem frame with a logic for transformation. This allowed him to think out loud and gave our FAOs enough information to improve their products for the upcoming Executive Steering Committee and HQDA Staff Talks in India.

Upon returning from India we pulled in key staff elements into an OPT and worked two weeks developing an Operational Approach. Upon briefing this to the CG, LTG Mixon gave us guidance to socialize this with PACOM, HQDA, and the Embassy. We also added to our list SOCPAC and MARFOR. Since then, we have been holding a number of meetings with these elements to collaborate and get feedback. We are due to travel to HQDA the third

week of May and back to India the end of May. I intend to back-brief the CG on the feedback we received and hand this off to Plans for development of an India Country (Campaign) Plan to be completed by August. In addition to India we moved on to Indonesia/ SE Asia and began doing an Environmental Frame for this region as well. Some lessons we learned was to give some outside agencies (i.e. ADSO, BAH, Indonesia Country Team) and internal (ACE) a heads up on information briefs we needs so these briefs were ready upon starting our environmental frame. Being in a HQ we had to be reasonable and keep our OPTs to half days and be flexible to who could show or not. One aspect we applied in both cases was examining the country in question from a strategic perspective of how the country in question saw itself, those relevant actors within the region and how the country viewed them and vice versa. We then asked what the so what of all this meant.

Understanding that politics drives what an Army does, we first examined the current state and propensity at the strategic level (we used DIME) and the desired state based upon USG and PACOM objectives. From this we identified positive and negative tensions for convergence and divergence to our desired state and then tried to identify the specified countries military strategy and did the same thing at that level. Once again we asked ourselves what all of this meant. Of note, when identifying tension we combined those tensions that would impact our achieving the desired state along with tension/friction created by systems of opposition and support. A number of times while doing India we have gone back into the environmental space, especially when a country came up or an event happened that might impact our operational approach. Additionally, as we hand this off to the planners we see ourselves going from the supported to the supporting.

The design team has a special relationship with the CG in that we are in some ways his think tank that can develop on his ideas or questions. With this we for the most part can get on his calendar whenever we need to brief him without having to go through the chain of command for approval. The same goes for the read ahead slides. We do not have to run these through the CoS of G3 for their input prior to the CG seeing it. We do however, as a courtesy to them provide them a read-ahead as well. Of note, this has not been an issue and has been accepted by the COS and G3 due to the quality of our products. I am sure if we went in there one time with junk, they would want to get involved.

Additionally, although the CG was willing to give design a try, since our MTOE does not support a Design Team, our existence is only matched by our relevance to what we bring to the table. I was under this understanding coming out of my first brief so I constantly questioned as we developed our products; are we giving the CG not just what he wants but what he needs? It appears that we are meeting these requirements and have therefore got the support of the COS, G3 and G2 in our efforts and also got a budget approved for our travel to these countries. Because we were able to link strategic objectives to the tactical execution we also earned support. Our successes so far has earned me the opportunity to brief the USARPAC staff on design at a staff off-site last month, a place at the table for the India ESG, and the opportunity to do another training/ China design this summer. I would, however, be remiss to say that without have the CG and the G4 as supporters it would have been difficult to get to where we are at. We have also started sharing products with

ARCENT's design team and USAREU's plans teams.

I would have to say that SAMS very well prepared me for my assignment here. More than anything it is in the way to think and address problems through critical thinking skills and be able to back this with history and doctrine. Bottom line, with the SAMS moniker come great expectations to live up to but the education in my view provides a firm foundation for meeting these expectations. Ultimately, though, it is up to the individual to perform versus just riding the SAMS reputation." Lieutenant Colonel James "Buddy" Frick

APPENDIX A: ANNOTATED BIBLIOGRAPHY

SAMS MONOGRAPHS

2005 MONOGRAPHS

Blakesley, Major Paul J. "Operational Shock and Complexity Theory." Monograph, School of Advanced Military Studies, U.S. Army Command and General Staff College, 2005.

Enabler: Major Blakesley, British Army, applies complexity theory to the concept of operational shock. The early literature on systemic operational design by Shimon Naveh is reviewed as an example of a systems approach to operational art.

2006 MONOGRAPHS

Bell, Major Christopher J. "Is Systemic Operational Design Capable of Reducing Significantly Bias in Operational Level Planning Caused by Military Organizational Culture?" Monograph, School of Advanced Military Studies, U.S. Army Command and General Staff College, 2006.

Enabler: Major Bell explores the application of systemic operational design to biases in planning caused by ethnocentrism and reductionist epistemology. Bell concludes that the future of operational design and planning lies in improving individual and collective abilities to learn more effectively than rivals.

Dalton, Lieutenant Colonel L. Craig. "Systemic Operational Design: Operational Bumpf or the Way Ahead for Operational Design?" Monograph, School of Advanced Military Studies, U.S. Army Command and General Staff College, 2006.

Enabler: Lieutenant Colonel Dalton, Canadian Army, compares the Canadian Forces' classical elements of operational design with systemic operational design. Dalton concludes that the theoretical underpinnings of systemic operational design are better matched with the contemporary operating environment, and recommends further exploration by the Canadian Forces to adapt their approach to operational design.

Davison, Major Ketti C. "Systemic Operational Design (SOD): Gaining and Maintaining the Cognitive Initiative." Monograph, School of Advanced Military Studies, U.S. Army Command and General Staff College, 2006.

Enabler: Major Ketti Davison's influential monograph differentiates between systemic operational design, the military decision making process, and effects-based operations. Davison characterizes systemic operational design as creating a living cognitive map updated by learning through action. Davison recommends fusing systemic operational design with the military decision making process as a way forward for operational design.

Dixon, Major Robert G. "Systems Thinking for Integrated Operations: Introducing a Systemic Approach to Operational Art for Disaster Relief." Monograph, School of Advanced Military Studies, U.S. Army Command and General Staff College, 2006.

Enabler: Major Dixon claims that the less than impressive response to Hurricane Katrina was exacerbated by an absence of operational art and systemic thinking in the interagency arena. Dixon explores the potential for systemic operational design to improve interagency cooperation, both domestically and overseas.

Groen, Major Jelte R. "Systemic Operational Design: Improving Operational Planning for the Netherlands Armed Forces." Monograph, School of Advanced Military Studies, U.S. Army Command and General Staff College, 2006.

Enabler: Major Groen, Armed Forces of the Netherlands, applies systemic operational design to the problem of planning defense reorganization. Changes to the existing operational planning process are recommended to incorporate insights from systemic operational design.

Lopez, Major Rafael. "On Learning: Metrics Based Systems for Countering Asymmetric Threats." Monograph, School of Advanced Military Studies, U.S. Army Command and General Staff College, 2006.

Enabler: Major Lopez investigates why a learning organization is critical to defeating asymmetric threats. Systemic operational design is explored as a holistic approach to learning in the face of uncertainty.

Umstead, Major Robert K. "Keep Your Friends Close and Your Enemies Closer: Operational Design for a Nuclear-Armed Iran." Monograph, School of Advanced Military Studies, U.S. Army Command and General Staff College, 2006.

Enabler: Major Umstead, United States Air Force, applies systemic operational design to the issue of a nuclear-armed Iran. Systemic operational design is used to suggest an approach that simultaneously pursues economic growth and regional stability while disrupting foreign networks that support nuclear proliferation.

2007 MONOGRAPHS

Bernard, Major Barrett M. "Systemic Operational Design: Bringing Efficacy to the Operational Level of War." Monograph, School of Advanced Military Studies, U.S. Army Command and General Staff College, 2007.

Enabler: Major Barrett contends that the elements of operational design are incapable of linking the tactical employment of forces to strategic objectives. A case study on the Global War on Terrorism is used to compare the elements of operational design with systemic operational design. Barrett asks and answers three questions on the continuing relevance of the elements of operational design, the relevance of the principle of mass for the 21st

Century battlefield, and whether terrorism should be classified as an act of war or as a crime.

Delacruz, Major Victor J. "Systemic Operational Design: Enhancing the Joint Operational Planning Process." Monograph, School of Advanced Military Studies, U.S. Army Command and General Staff College, 2007.

Enabler: Major Delacruz critiques current joint doctrine on operational design, arguing it lacks coherence and completeness. Delacruz investigates the potential of systemic operational design's discourse to operate in parallel to the doctrinal elements of operational design to develop a designing-based approach to the joint operation planning process.

DiPasquale, Major Joseph A. "Discourse in Systemic Operational Design." Monograph, School of Advanced Military Studies, U.S. Army Command and General Staff College, 2007.

Enabler: Major DiPasquale's inquiry centers on the concept of discourse within systemic operational design. By taking a linguistic anthropological perspective on agency, narrative and artifact structure, and socio-cultural relationships, DiPasquale identifies how choices in narrative content influence the efficacy of design discourse.

2008 MONOGRAPHS

Hayward, Major Edward P. W. "Planning Beyond Tactics: Towards a Military Application of the Philosophy of Design in the Formulation of Strategy." Monograph, School of Advanced Military Studies, U.S. Army Command and General Staff College, 2008.

Enabler: Major Hayward, British Army, was awarded best monograph for his exposition of design philosophy. Drawing on Deluze's philosophy of difference, Hayward distinguishes between form, function and logic to explain the philosophy of design. The practical significance of this is realized by connecting the design approach with strategy formulation.

Herman, Major Bradley J. Jr. "The Army's Military Decision Making: Adequate or Update and Expand?" Monograph, School of Advanced Military Studies, U.S. Army Command and General Staff College, 2008.

Enabler: Major Herman argues that the US Army missed the signs of threats that emerged following the end of the Cold War, due to inadequacies in the existing military decision making process. He argues that the US Army must adopt measures at all levels in order to better understand the complexities of the operating environment, including systemic operational design and the effects based approach to operations.

Hibner, Major Daniel H. "A Cognitive Assessment of Military Approaches to Understanding." Monograph, School of Advanced Military Studies, U.S. Army Command and General Staff College, 2008.

Enabler: Major Hibner seeks to identify the most effective military approach to achieving understanding of the complex problems posed by the Global War on Terror. In his paper, he compares the effectiveness of four approaches – FM 3-0's operational variables (PMESSI-PT), joint doctrine's concept of system of systems analysis, systemic operational design, and the emerging doctrine contained in *TRADOC Pamphlet 525-5-500, Commanders' Appreciation and Campaign Design*.

Schaefer, Lieutenant Colonel Christof. "Army Transformation in the Age of Globalization – Implementing Directed Change with Strategic Management Design (SMD) An Analysis based on the Army Staff in the German Ministry of Defense." Monograph, School of Advanced Military Studies, U.S. Army Command and General Staff College, 2008.

Enabler: Lieutenant Colonel Schaefer, German Army, examines the implications of strategic transformation for the German Army. He argues that an improved decision process, based on modern and post-modern change theory, concepts of a learning organization, and elements of integrated emerging strategic design, can produce an effective and efficient readiness model for German Army transformation.

Wise, Major David. "The Role of Sanctuary in an Insurgency." Monograph, School of Advanced Military Studies, U.S. Army Command and General Staff College, 2008.

Enabler: Major Wise examines the changing nature of sanctuaries, and their value to insurgent groups. He argues that planners must use systemic operational design in order to develop a holistic, qualitative, and systemic operational approach to meet the challenges posed in the operating environment.

2009 MONOGRAPHS

Bullock, Major Xander L. "Engineering Design Theory: Applying the Success of the Modern World to Campaign Creation." Monograph, School of Advanced Military Studies, U.S. Army Command and General Staff College, 2009.

Enabler: Major Bullock examines design from the perspective of engineering design theory, and develops an argument for the incorporation of design thinking at the strategic and operational levels. Bullock concludes that design is the next evolution of the military craft, and that its adoption will enable intelligent campaign creation.

Gill, Jonathan B. "Enabling Design." Monograph, School of Advanced Military Studies, U.S. Army Command and General Staff College, 2009.

Enabler: Mr Gill, Battle Command Battle Laboratory, argues that the introduction of design into the Army has focused largely on the development of theory. His paper examines the practical issues arising from the practice of design, and he identifies the gaps in areas of organization, management, and the support environment that should be addressed if the Army is to maximize the advantages of the design approach.

McHenry, Major David P. "Battle Command: An Approach to Wickedness." Monograph, School of Advanced Military Studies, U.S. Army Command and General Staff College, 2009.

Enabler: Major McHenry examines the emergence of design. He addresses the ability of the Army to understand ill-structured, or wicked problems, and compares the application of design with the application of existing Army doctrine to address those problems. He concludes that the doctrinal precept of battle command provides a complete expression for addressing ill-structured problems.

Papanastasiou, Major Bill A. "More Than Just Plan, Prepare, Execute, and Assess: Enhancing the Operations Process by Integrating the Design and Effects-Based Approaches." Monograph, School of Advanced Military Studies, U.S. Army Command and General Staff College, 2009.

Enabler: Major Papanastasiou evaluates the effects based approach to operations and design and attempts to integrate the practical elements of both constructs into the cyclic operations process of plan, prepare, execute, and assess. He concludes that design provides a superior approach while operating in complex environments.

LEARNING

Augustine, Norman R. "Managing the Crisis You Tried to Prevent." *Harvard Business Review (*November-December 1995).

Enabler: Augustine's experience with crisis provides insight to the recognition and management of crises within large organizations. He provides a practical explanation of what happens when routine organizational flows and relationships are interrupted.

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

Enabler: COL Banach lays out where the school is in the pursuit of something to assist us in the contemporary operating environment.

Lakoff, George and Mark Johnson, *Metaphors We Live By*. Chicago: The University of Chicago Press, 2003.

Enabler: Lakoff and Johnson go beyond the classical understanding of metaphor – figures of speech, typically viewed as characteristics of language alone; to claim that metaphor use is pervasive in everyday life, not just in language, but in thought and action. Use this reading to challenge your own meta-cognitive awareness – how much is your own thought process shaped by metaphor, particularly for understanding abstract concepts?

Lanir, Tzvi. *Fundamental Surprises: The National Intelligence Crisis*. Tel Aviv: Dvir, 1984.
http://google1.it.ohio-state.edu/search?q=cache:oL7gmwxXw0EJ:csel.eng.ohio-s

Enabler: "Fundamental Surprises" explores existing theory and practice relative to surprise, surprise prevention, and its utility in the increasingly complex environment, and finds it wanting. Lanir proposes an alternative understanding of the nature, function, and effect of surprises, develops the concept of "fundamental surprise", and suggests that surprise indicates/reveals more about self than the other. Self-reflection is part of learning and frame of reference for understanding difference, and change is so fundamental to the underlying purpose of design. Lanir uses the 1973 War to dissect these ideas.

Lanir, Tzvi and Gadi Sneh. "The New Agenda of Praxis." 2000.
www.praxis.co.il/download/the%20new%20agenda%20of%20praxis.doc

Enabler: Lanir and Sneh tie together many of the concepts together that comprise design thinking. Of particular importance is resolution of deconstruction through praxis.

Ochs, Elinor and Lisa Capps. "Narrating the Self." *Annual Review of Anthropology*. 1996.
http://www.jstor.org/stable/2155816?&Search=yes&term=Self&term=Narrating&list=hide&searchUri=%2Faction%2FdoBasicSearch%3FQuery%3DNarrating%2BSelf%26wc%3Don%26x%3D9%26y%3D7&item=1&ttl=2307&returnArticleService=showArticle

Enabler: Ochs and Capps look at the relationship between narrative, self, and how we make sense of our experience in context. They provide insights self-awareness and for deconstructing how/where narrative, discourse and society intersect. Their work is a useful reference for analyzing how we can initiate meta enquiry about the other as well.

Schön, Donald A. *Educating the Reflective Practitioner.* San Francisco, CA: Jossey-Bass, 1987.

Enabler: Schön discusses the need for reflective practice in the modern world. His discussion of the difference in educating applied practitioners and educating theoretical scientists is appropriate for our discussion today. Reflection in action, practice, and the design process as reflection in practice, are the hallmark ideas of Schön. The identification of essential things, which is part of the problem framing, is Schön's major point in Chapter 4. Schön also makes a major point of identifying changing states, or changing the system, as a major component of problem framing, or in his terminology, problem solution. In Chapter 5, Schön describes the valued outcome of discourse between a coach and a student. Schön lays out some very useful concepts for sorting through the need to design, the need to formulate a design concept, the issue of group effort, all tied into individual and group learning.

Weick, Karl E. *Sensemaking in Organizations.* Thousand Oaks, CA: Sage Publications, 1995.

Enabler: In the midst of crisis, ambiguous, conflicting information frequently leads to incorrect or incomplete diagnosis of what must be done to remedy the situation. The novelty of a situation may dislocate existing frames of reference. The absence of guidance from the next higher echelon, coupled with directives to "do something," can lead to the efficient solution to precisely the wrong problem.

Enabler: Weick is a foundational reading for understanding an entire body of scholarship regarding organizational behavior. Sensemaking occurs when individuals and organizations realize that the system and situation no longer match preconceived notions of problem resolution. Cues accumulate outside of existing processes for obtaining information about the environment. Weick's position is that in a changing world, it is not just the old answers that are suspect, it is the old questions. Since people are unsure what questions to ask, more information will not help. Cues that do not fit established patterns introduce uncertainty into existing organization processes, or sufficient ambiguity exists to lead to a need for sensemaking.

DIFFERENCE

Adler, M. "Critical Thinking Programs: Why They Won't Work." *Education Digest* (1986).

Enabler: Adler rejects the idea of standalone "how to" programs of instruction designed to improve pupils' critical thinking skills.

Auerbach, Yehudith "Forgiveness and Reconciliation: The Religious Dimension." *Terrorism and Political Violence* 17, no. 3 (2005).
http://www.informaworld.com/smpp/content~db=all?content=10.1080/09546550590929174

Enabler: Religion, as an often significant component of self, individual, and group self-understanding and identity, creates a different dynamic in conflict which makes irrelevant traditional approaches of conflict resolutions and conceptions of "peace."

Augier, Mie and Kristian Kreiner. "Rationality, imagination and intelligence: Some boundaries in human decision-making." *Industrial and Corporate Change* 9, no. 4 (December, 2000). Available through ProQuest:
http://proquest.umi.com/pqdweb?index=0&did=390367301&SrchMode=1&sid=1&Fmt=3&VInst=PROD&VType=PQD&RQT=309&VName=PQD&TS=1268687912&clientId=5094

Enabler: Augier and Kreiner compare Herbert Simon, George Shackel and James Marsh on notions of bounded rationality. It is useful to our efforts at thinking about thinking to consider decision-making models that aim at intelligence and creativity.

Bateson, Gregory. *Mind and Nature: A Necessary Unity.* Bantam (1988).
http://www.oikos.org/m&nmultiple.htm

Enabler: This is a very accessible piece that explores how we learn and, from that, how we can consciously create new understanding. He identified 'difference' as essential to learning. This principle is foundational to Design as an approach to learning and adaptability.

Beyerchen, Alan. "Clausewitz, Nonlinearity, and the Unpredictability of War." *International Security* 17, no. 3 (1992).

Enabler: Beyerchen suggests that the enigma of Clausewitz's work owes to his realization that war is fundamentally non-linear, and as such is unique in ways that cannot be predicted. He offers important and clear distinctions between linear and non-linear that clarify the current context and are useful to thinking about difference. His work ties together all of the issues and themes we have discussed thus far.

Bjorge, Gary J. *Moving the Enemy: Operational Art in the Chinese PLA's Huai Hai Campaign.* Leavenworth papers, no. 22. Fort Leavenworth, KS: Combat Studies Institute Press, 2004.

Enabler: Bjorge discusses the application of Sun Tzu – and the idea of propensity and potential – in a few short pages of his extended work on the Huai Hai Campaign.

Booth, Ken. "Security and Self: Reflections of a Fallen Realist." York Centre for International and Security Studies, Occasional Paper Number 26. North York, Ontario: Centre for International and Strategic Studies, 1994.
http://www.yorku.ca/yciss/publications/OP26-Booth.pdf

Enabler: Booth grapples with the cognitive shifts made necessary by the end of the Cold War as he proposes that we think about thinking, how we think, and the sources of the thoughts that animate us. Though in a different context and as a security specialist, he echoes some of Zvi Lanir's thoughts on the need for self-reflection: if we indeed see things as *we* are. He looks at theories about sources of identity, and identity construction in relation to Realism and argues that "[i]nstead of positivism's 'seeing is believing', the social world is…constructed by the phenomenon of believing is seeing." Realism was in effect then deterministic. Booth proposes a 'critical security studies' in the move away from realism and toward acceptance of a complex world. He is the author of *Strategy and Ethnocentrism*, which was seminal for its exploration of the relationship between cultural predispositions and the theory and practice of strategy.

de Atkine, Norville. "Why Arabs Lose Wars." *Middle East Review of International Affairs* 4, no. 1 (March, 2000).
http://meria.idc.ac.il/journal/2000/issue1/jv4n1a2.html

Enabler: de Atkine explores the implications of culture for behavior; in this case of Arab culture adopting methods of conventional warfare.

Deleuze, Gilles and Fé lix Guattari . *A Thousand Plateaus: Capitalism and Schizophrenia*. Minneapolis: University of Minnesota Press, 1987.

Enabler: Deleuze and Guattari explore the relationship between the state and its war machine. They propose that warriors (the army) are not part of the state – rather they are nomads who exist from the outside and threaten the authority of the state. Likewise the nomadic science of the military keeps infiltrating royal science, undermining its axioms and

principles. It is a theory of a dynamic relationship between sedentary power and "schizophrenic lines of flight." The two venture into the ethics of asymmetric warfare in their proposition of a creative military form that becomes imperceptible – strategizing a continuous invention of weapons as necessary. It is an unorthodox interdisciplinary tome that extracts from anthropology, history, military strategy, and aesthetics. Most importantly for thinking about thinking as it relates to Design, Deleuze and Guattari present nine dichotomous concepts that get at the notions of non-linearity – perhaps more thoroughly than does Jullien and Sun Tzu.

Dietrich, Arne. "Who's afraid of a cognitive neuroscience of creativity?" *Methods* 42 (2007).

Enabler: Dietrich critiques four common myths regarding creativity: creativity is divergent thinking; creativity is in the right brain; creativity occurs in a state of defocused attention; and altered states of consciousness facilitate creativity.

Geertz, Clifford. *The Interpretation of Cultures*. New York, NY: Basic Books, 1977. Also available at:
http://www.cla.wayne.edu/polisci/kdk/seminar/sources/geertz.pdf

Enabler: Geertz addresses what he believes to be the incompleteness of cultural studies. Apprehension of his discussion is critical to grasping the essence of what Design proposes to accomplish. To overcome this incompleteness, Geertz proposes a 'semiotic concept of culture' – an attention to symbols and signs in order to attribute meaning to culture. His 'thick description' is what we can also understand as explanation. Like narrative, his approach understands constructed meanings as interpretation.

Goldstein, Jeffrey. "Emergence, Creativity, and the Logic of Following and Negating." *The Innovation Journal* 10, no. 3 (2005).
http://www.innovation.cc/volumes-issues/goldstein_2_ecl_jagrevised_2.pdf

Enabler: Explores the utility of narrative and narrative creation to generating learning and emergent understanding in relation to emergence.

Henrotin, Joseph and Tanguy Struye. "Ontological-Cultural Asymmetry and the Relevance of Grand Strategies." *Journal of Military and Strategic Studies* 7, no. 2 (2004).
http://www.jmss.org/2004/winter/articles/henrotin_struye.pdf

Enabler: The Authors challenge the notion that asymmetry is only practical and technical and propose that we are likely to continue facing opponents that are not like us, but have a command of our logic. They continue by discussing how we will likely remain vulnerable owing to what Ken Booth would call the 'fog of culture' and our own ethnocentrism.

Hirsch, Gal. "On Dinosaurs and Hornets: A Critical View on Operational Moulds in Asymmetric Conflict." *Royal United Services Institute Journal* (August 2003).
http://www.rusi.org/publication/journal/ref:J40c1f7e594d5e/

Enabler: Gal Hirsch gives us a practical example of the utility of deconstruction for thinking about space and application of power differently. SOD was employed to shape IDF analysis and operations from the late 1990s through mid 2006.

Iser, Wolfgang. "The Significance of Fictionalization." *Anthropoetics* III, no. 12 (1997-98). http://www.anthropoetics.ucla.edu/ap0302/iser_fiction.htm

Enabler: Makes the argument that the world as it is represented is only a conception – "as if it were a world in order". You should read this with the question in mind: "What is the anthropological significance of fictionalizing?" It rebounds what you see and understand with the opportunity for different perspective and understanding. "Literature permits limitless patterning of human nature…we can see that it lends itself to a culture-bound re-patterning." This recognition should help to facilitate understanding of other(s) in context.

Jullien, Francois. *A Treatise on Efficacy: Between Western and Chinese Thinking*. Trans. Janet Lloyd. Honolulu: University of Hawai'i Press, 2004.

Enabler: Jullien is a staple for thinking about systemic logic and responses that reflect that logic. The understanding of systemic propensity and potential you gain will be important to you as you do design and plan, as will the concept of efficiency. He makes clear distinctions between linear thinking and direct action and systemic thinking and non-linear approaches toward systemic change. By contrasting Western and Eastern thinking, Jullien emphasizes difference as a generator of critical thought.

Kent, Glenn A. *Thinking About America's Defense.* Santa Monica, CA: RAND Corporation 2008.

Enabler: Kent has a contrarian view of analysis, and believes that analysts should not be in the business of making recommendations to decision makers.

Khadduri, Majid. *War and Peace in the Law of Islam.* Baltimore, MD: Johns Hopkins Press, 1955, 157-158.

Enabler: Khadduri's work is significant, not only because of his authority, but also because he wrote on Islamic law in 1955 when the context was not characterized by the polemics of today. In fact things across the ME and Islamic world were quite happy relatively speaking. The mandates had been relinquished and the modern nation states were getting underway as secular entities. Khadduri was writing as a scholar and his work reveals the logic of Islamic law that we are loathe to consider today for its incorrectness. The systemic logic that he outlines is important as an example of holistic asymmetry and for what it can teach us about the current context.

Lai, David. *Learning from the Stones: A* Go *Approach to Mastering China's Strategic Concept* Shi. Carlisle, PA: Strategic Studies Institute, U.S. Army War College, 2004. http://www.strategicstudiesinstitute.army.mil/Pubs/display.cfm?pubid=378

Enabler: This article offers interesting insight into the Chinese conception of propensity – in relation to current Chinese policy. The intention is not that you look at Chinese policy, but at the concept of *shi* and what it means in relation to Design thinking. What does the "propensity of things" or "potential born of disposition" imply for the military planner? Why is it important in asymmetric conflict? Play *Go* online at:
http://361points.com/computergo/#gnugo

Mattis, General James N. "MEMORANDUM FOR US JOINT FORCES COMMAND, Subject: Assessment of Effects Based Operations." 14 August, 2008.

Enabler: General Mattis' prescription against EBO is a starting point for our discussion of the differences between EBO and design.

Naveh, Dr. Brigadier General (Res.) Shimon. "Asymmetric Conflict: An Operational Reflection on Hegemonic Strategies." Unpublished paper, 2002.

Enabler: Naveh's paper is a reflection on the theoretical and practical dilemmas that faced the IDF in the context of an ongoing "small war" in which preponderant power was irrelevant and conventional thinking about time, space, and success - traditional boundaries - were not useful or even applicable. He finds existing theory/understanding of asymmetric conflict deficient and any system for learning absent. In its place he proposes, among other things, a notion of holistic asymmetry, and reflective learning in action through the central role of the operational level.

Newman, David, ed. *Boundaries, Territory and Postmodernity.* London: Frank Cass, 2002.

Enabler: Newman's edited volume looks at the consequences of globalization - technological development, economic interdependence, and a loss of national sovereignty - for traditional state boundaries, their meaning, and what are the practical consequences.

Paul, Richard and Linda Elder. *Critical Thinking: Tools for Taking Charge of Your Learning and Your Life*. New Jersey: Prentice Hall, 2001.

Enabler: Paul and Elder clearly articulate a useful set of standards and categories for critical thinking.

Plato, and John Henry McDowell. *Theaetetus*. Oxford: Clarendon Press, 1973. Available at:
http://classics.mit.edu/Plato/theatu.html

Enabler: Note the method of questioning Socrates uses to uncover the implications and logical contradictions of different positions.

Purvis, Trevor and Alan Hunt. "Discourse, Ideology, Discourse, Ideology…" *British Journal of Sociology* 44, no. 3 (1993).

Enabler: This analysis of primary sources provides a current specific example of the Islamic law laid out by Khadduri.

Roemer, Michael. *Telling Stories: Postmodernism and the Invalidation of Traditional Narrative*, Lanham, MD: Rowman & Littlefield, 1995.

Enabler: Roemer is a good follow-on to Ochs and Capps "Narrating the Self." It explores the relationship between self and story. Our purpose for reading this selection is to explore the ways in which Positivism influences – or not – how we see the world, and act in it. It should generate reflection on how we define ourselves and how that self-understanding pre-determines what we see and understand about the world. If you were to read the entire book, you would see that Roemer is a pessimist, arguing that the traditional story has lost its meaning because the source of power and control implicit the Positivist plot has become irrelevant in the current context.

Slocum-Bradley, Nicki, ed. *Promoting Conflict or Peace through Identity*, Ashgate, 2008.

Enabler: Looks at sources of "nation" and posits the role of identity constructions in creating conflict and the utility of this understanding for conflict management.

Vlahos, Michael. "Fighting Identity: Why We Are Losing Our Wars." *Military Review* (November-December, 2007).
http://usacac.army.mil/CAC/milreview/English/NovDec07/indexengnovdec07.asp

Enabler: Vlahos identifies the intangible sources of conflict and the irrelevance of conventional force and traditional diplomacy in identity conflicts.

Weizman, Eyal. "Walking Through Walls: Soldiers as Architects in the Israeli-Palestinian Conflict." *Radical Philosophy* (March-April, 2006).

Enabler: Architectural theory was the conceptual source for SOD. Weizman provides an account of Aviv Cohavi's use of SOD to design operations. What you should get out of these articles which outline the practical application of design thinking – is how theory provides a basis for new thinking and action that reflects it for its different form.

White, Hayden. *The Content of the Form: Narrative Discourse and Historical Representation.* Baltimore, MD: The John Hopkins University Press, 1987.

White, Hayden. *Tropics of Discourse: Essays in Cultural Criticism.* Baltimore, MD: The John Hopkins University Press, 1978.

Enabler: White provides insights into the nature and purpose of narrative and a definition of discourse that is useful to design. He also suggests constraints on our cognitive processes and the implications of that for our understanding of what is real or actual.

SYSTEMS

Arendt, Hannah. *On Revolution*, New York, NY: The Viking Press, 1963.

Enabler: Arendt discusses here the differences between war and revolution. In particular, she notes the rise of revolution and the idea of freedom connected to it as a modern phenomenon (in contrast to the long history of warfare and its disconnect from the freedom rationale).

Bar-Tal, Daniel. "Why Does Fear Override Hope in Societies Engulfed by Intractable Conflict, As It Does in the Israeli Society?" *Political Psychology* 22 (2001).

Enabler: Bar-Tal discusses the differences between the human fear response and hope response. How does the nature of these differences affect the problem of modifying group behavior through the communication of threat and violence?

Bar-Yam, Yaneer. *Making Things Work: Solving Complex Problems in a Complex World*. Boston, MA: NECSI Knowledge Press, 2004.

Enabler: The multi-scale complexity profile, the importance of evolution in complex systems, and the intricate relationship between competition and cooperation are highlights of the theoretical discussion of complexity. The fundamental assumption of complex systems science is that the way the system is organized is more important than the actual composition of its parts or the domain of applicability.

Bousquet, Antoine. *The Scientific Way of Warfare: Order and Chaos on the Battlefields of Modernity*. New York, NY: Columbia University Press, 2009.

Enabler: Bousquet's book examines how developments in science have changed the way war is understood and fought. He argues that metaphor explains how different discourses interact, and uses this to construct a framework that weaves together history, philosophy, science and military theory to address the question: "How has war, an activity traditionally dominated by institutions extolling the virtues of hierarchical command and submission to orders, come to be understood essentially in terms of decentralized networks of combatants connected together by horizontal information links?"

Brin, David. "Disputation Arenas: Harnessing Conflict and Competitiveness for Society's Benefit, Journal of Dispute Resolution." 15, no. 3 (2000). Available at: http://www.davidbrin.com/disputation.htm.

Enabler: A thought-provoking non-technical synthesis of many of the ideas involved in critical thinking, complexity, and systems thinking.

Checkland, Peter B. and John Poulter. *Learning for Action: A Short Definitive Account of Soft Systems Methodology and its use for Practitioners, Teachers and Students.* Chichester, Sussex: John Wiley & Sons, 2006.

Enabler: Checkland and Poulter provide an updated explanation of perhaps the most successful systems methodology for intervening in social systems. The concepts of

problematical situations, rich pictures, transformation, root definitions, and control actions are just some of the tools explained here that apply directly to military design.

Cialdini, Robert. *Influence Science and Practice*. Boston, MA: Pearson A&B, 2009.

Enabler: This gives the ground work for the author's learning and some examples to reinforce his ideas.

Cialdini, Robert B. and Noah J. Goldstein. "The Science and Practice of Persuasion." *Cornell Hotel and Restaurant Administration Quarterly*. 43, no. 2, 2002.

Enabler: Robert Cialdini lays out six principles of influence. His thesis is that these six principles govern how one might influence another or ways to establish one's self (or one's organization) as a legitimate authority on a particular subject. The principles are; liking, reciprocity, consistency, scarcity, social validation, authority.

Collender, Michael and Lieutenant Colonel Matthew Deller. "Scoping Complex Systems for the Joint Task Force Commander." *Campaigning* (Fall, 2008).

Enabler: Meaning, narrative, understanding, encompassing the physical world into mental conceptualizations, all these and more are the heart and soul of sorting out an environmental frame. Despite the opaqueness of their language, our two authors make several useful points. One is the need to understand the deep interconnectivity of blue actions inside of the environmental system, the need for discourse as a mode of developing understanding, and the idea of focusing assessment and evaluation on teleology, or goals and motivations.

Cohen, Eliot A. and John Gooch. *Military Misfortunes: The Anatomy of Failure in War.* New York, NY: Vintage Books, 1991.

Enabler: Cohen and Gooch develop and illustrate a framework for a systems approach to analyzing historical failure in war. One of their conclusions is that the ability to adapt is the most important attribute

Corman, Stephen R., Angela Trethewey, and Bud Goodall. "A 21st Century Model for Communication in the Global War of Ideas From Simplistic Influence to Pragmatic Complexity." Consortium for Strategic Communication, Arizona State, 2007.

Enabler: This article explains the basic message influence model by Shannon and Weaver that is still in use today. The Pragmatic Complexity Model (PCOM) is introduced and the idea that information operations (IO) and strategic communication (without the 's') are different.

Corman, Stephen R. and Jill S. Schiefelbein. *Communication and Media Strategy in the Jihadi War of Ideas*, Report #0601, Consortium for Strategic Communication, Arizona State University, 2006.

Enabler: Discusses the importance of the Jihadi strategic communication concept and provides six recommendations for improving U.S. strategic communication in response.

Corman, Stephen R. and Kevin J. Dooley. "Strategic Communication on a Rugged Landscape Principles for Finding the Right Message." Consortium for Strategic Communication, Arizona State, 2008.

Enabler: Instead of message discipline, control, singular message, and repetition this theory states that message influence requires abandoning a simple model of linear control over meaning. Optimal messages consist of many things, correct words, sentiments, themes, delivery, medium, and timing – and all of these may yet again be different with each sub-group.

Dörner, Dietrich. *The Logic of Failure: Recognizing and Avoiding Error in Complex Situations.* New York, NY: Basic Books, 1996.

Enabler: This book is easy to read yet has significant implications for design and planning in complex situations. Chapter 4 on information and models is particularly useful.

Ferguson, Sherry D. "Communication Planning: an Integrated Approach." *Communication Abstracts.* 24, no. 4 (2001).

Enabler: In this approach, The Integrated Approach, Ferguson provides guiding principles for writing a multiyear strategic communication plan. This approach is very similar to design. The main ideas are to think broadly, think globally, write from the perspective of a larger organization, and don't adopt bias. An organization's strategic plan must be the basis for the communications plan. The communications plan must be nested in and support the overall plan.

Gerras, Colonel Stephen J. "Thinking Critically about Critical Thinking: A Fundamental Guide for Strategic Leaders." U.S. Army War College, June 2006. Available at: http://www.au.af.mil/au/awc/awcgate/army-usawc/crit_thkg_gerras.pdf.

Enabler: This paper examines the application of a critical thinking framework for the Army, based on Paul and Elder's critical thinking model.

Gharajedaghi, Jamshid. *Systems Thinking: Managing Chaos and Complexity: A Platform for Designing Business Architecture.* New York, NY: Elsevier, 2006.

Enabler: Gharajedaghi's use of four aspects, **function, structure, process and context**, are very useful in sorting out relevance in a complex system. The book also addresses techniques such as searching, mapping and constructing the narratives as aids to problem framing.

Goodall, Bud, Angela Trethewey and Kelly McDonald. "Strategic Ambiguity, Communication, and Public Diplomacy in an Uncertain World: Principles and Practices." Consortium for Strategic Communication, Arizona State, 2006.

Enabler: This theory is in response to what is seen as two main failures of communication in public diplomacy. They are; a reliance on an outdated one-way model of influence and an inability to prepare for and respond to Jihadi media and message strategies. The key concept of this communications theory is that one must allow for and empower local interpretations of meaning to build relationships because you cannot always fully understand or trust audiences.

Johnson, Neil F. "Complexity in Human Conflict." In *Understanding Complex Systems*, Berlin: Springer, 2008.

Enabler: This paper will help to understand power laws, which are characteristic of complex systems, and explores how this can give rise to clumpy casualty statistics and common patterns across diverse theatres, such as the Iraq war and the Colombian war.

Johnson, Steve. *Emergence: The Connected Lives of Ants, Brains, Cities and Software*, London: Penguin, 2001.

Enabler: Like any good popular science book, Johnson's *Emergence* captures the enthusiasm and excitement of recent breakthroughs in complex systems science, without being overly careful to define terms or state assumptions and limitations. As you read *Emergence*, apply what you have learned about critical thinking to identify caveats that are missing from this narrative, and boundary judgments that are not made explicit. Also, try to understand the transition from theory to practice. How has understanding of the mechanisms of self-organization, adaptation and emergence helped businesses to produce robust and scalable solutions?

Lehrer, Jonah. "The neuroscience of screwing up." *Wired Magazine* (February, 2010). Available at:
http://www.wired.co.uk/wired-magazine/archive/2010/02/features/the-neuroscience-of-screwing-up.aspx?page=all

Enabler: This article links current understanding of neuroscience with critical thinking, the logic of failure, and paradigm shifts in science. Within design, this has implications for creating diverse teams to overcome individual limitations.

MacDonald, Charles Brown. *The Decision to Launch Operation MARKET-GARDEN*. CMH pub, 70-7-19. Washington, DC: Center of Military History, U.S. Army, 1990.

Enabler: Read Chapter 19. Examine the rationalization of assumptions and the role of critical thinking in Operation Market Garden.

Norman, Douglas and Michael Kuras. "Engineering Complex Systems." *MITRE Technical Report.* 2004. Available at:

http://www.mitre.org/work/tech_papers/tech_papers_04/norman_engineering/norman_engineering.pdf

Enabler: Engineering of complex systems presents a similar challenge to operational design. Consider Norman and Kuras' discussion of the boundary conditions for traditional systems engineering and the need for complex systems engineering in relation to planning and design.

Ryan, Alex J. "What is a systems approach?" *Arxiv*. 2008. Available at http://arxiv.org/PS_cache/arxiv/pdf/0809/0809.1698v1.pdf

Enabler: This survey provides an overview of the systems approaches that are most relevant to defense.

Ryan, Alex J. "The Foundation for an Adaptive Approach: Insights from the Science of Complex Systems," *Australian Army Journal*, VI, no. 3 (2010). Available at: http://www.defence.gov.au/army/lwsc/docs/aaj_summer_2009.pdf

Enabler: This article is a summary of concepts from complex systems science that are relevant to the design course. It identifies seven insights that are useful for the design of complex systems.

Ulrich, W. *A Brief Introduction to Critical Systems Heuristics*. Available at: http://projects.kmi.open.ac.uk/ecosensus/publications/ulrich_csh_intro.pdf

Enabler: Ulrich combines systems thinking with critical thinking to address the critical yet often implicit topic of boundary judgments. Critical Systems Heuristics provides a tool that is useful for bounding the environmental and problem frames during design.

U.S. Army War College. *Information Operations Primer*. Ft. Belvoir: Defense Technical Information Center, 2007.

Enabler: This reading actually gives the definition for Strategic Communications, goals, and objectives from the QDR.

Vego, M. N., Systems versus Classical Approach to Warfare, *Joint Forces Quarterly*, issue 52, 1st quarter 2009. Available at: http://www.ndu.edu/inss/Press/jfq_pages/editions/i52/10.pdf

Enabler: Not everyone agrees that a systems approach to warfare is needed. Vego is one of the more vocal and articulate critics of applications of systems thinking (including design) to warfare.

SOCIAL CREATION

Alberts, David S. and Richard E. Hayes. *Power to the Edge.* Information Age Transformation Series. Washington, DC: DOD Command and Control Research Program, 2005.

Enabler: Edge theory is an emerging theoretical construct which should be understood in its relation to more developed organization theories covered in Hatch. One must also acknowledge edge theory's roots in network-centric warfare and the belief that military operations are moving from industrial age warfare to information age warfare. Read this selection to understand the basic concept and to assess its usefulness to military organizations.

Fuller, Sally Riggs and Ramon J. Aldag. "Challenging the Mindguards: Moving Small Group Analysis beyond Groupthink." *Beyond Groupthink*. Paul't Hart, Eric K. Stern, and Bengt Sundelius, eds. Ann Arbor: University of Michigan, 1997.

Enabler: This essay provides a useful counterpoint to *Decision Making* and the groupthink model represented by Janis. Fuller and Aldag question the heuristic value of the groupthink model, offering instead the General Group Problem Solving model as an alternative.

Gabarro, John J. and John P. Kotter. "Managing Your Boss." *Harvard Business Review* (January, 2005):

Enabler: While most management texts focus on the top-down aspect of management, the authors contend, at a minimum, that one must appreciate the boss's goals and pressures. Gabarro and Kotter offer a menu of typical behaviors leading to ineffective boss-subordinate relationships. Reflect on how their suggestions might work in a strongly hierarchical organization.

Hatch, Mary Jo. *Organization Theory*. Oxford, UK: Oxford University Press, 1997.

Enabler: Hatch is not a theorist of organizations; she is more properly a theoretician. She claims that one must use multiple perspectives to approach organization theory. The multi-perspective approach attempts to view the components of organizational activity from each of the four camps—classical, modern, symbolic-interpretive, and postmodern. She does not attempt a synthesis, choosing instead to take a trip around the fence line, looking at each of six core concepts separately (Part II, Chapters 3-8). This makes it a bit difficult to piece together the strands, since the emphasis in any one chapter shifts from modern to postmodern, depending on the concept under consideration. Part III (Chapters 9-12) highlights four current areas of concern for organization theorists.

Heifetz, Ronald A. *Leadership Without Easy Answers.* Cambridge, MA: The Belknap Press of Harvard University Press, 1994.

Enabler: You will see terms borrowed from Heifetz's explanation of leadership scattered throughout the design literature. Heifetz outlines leadership in terms of adaptive work. These illustrations are of lesser importance than getting to the conclusions Heifetz makes

about the nature of adaptive leadership. Of interest to future staff officers, Heifetz has two chapters in Part III on how one leads when he/she does not occupy a formal position of authority.

Janis, Irving L. and Leon Mann. *Decision Making*. New York: The Free Press, A Division of Macmillan Publishing Company, 1977.

Enabler: Janis is the originator of the groupthink concept. Groupthink is a term pioneered by Irving Janis to describe group behavior leading to faulty collective decision making. This book incorporates some of his later research into the phenomenon of making decisions under stress. The conflict model of their study provides some useful background understanding as you structure learning during design in small groups. The authors are principally concerned with making decisions under stress. They establish the stage for their research questions by observing "human beings, programmed as they are with emotions and unconscious motives as well as with cognitive abilities, seldom can approximate a state of detached affectedness when making decisions that implicate their own vital interests or those of their organization or nation."

Kotter, John. *Power and Influence beyond Formal Authority.* New York, NY: Free Press, 1985.

Enabler: Kotter's book starts with a simple premise that management texts do not cover the conflict, struggle, manipulation, antagonism, fighting, and disagreements that occur throughout organizations. His work considers the many dimensions of interaction.

Lawson, Bryan. *How Designers Think: The Design Process Demystified*. Amsterdam: Elsevier, 2006.

Enabler: Lawson addresses some of the basic concepts, and the place of design in the world of architecture. Lawson adds to our discussion the ideas of multiple actors as "generators of design problems." He also adds a very useful concept – the idea of design constraints. In Chapter 7, he talks of the critical role of future in design. The concepts of the generation of multiple alternatives, and of parallel lines of thought, are the highlights of Chapter 12. In Chapter 13, he offers several pitfalls for the designer – things we must be wary of as we approach a design concept. In Chapter 14, he describes the positive, and negative, aspects of design as a team effort.

Senge, Peter M. *The Fifth Discipline: The Art and Practice of the Learning Organization*. New York: Doubleday/Currency, 2006.

Enabler: We will consider one specific aspect of Senge's theory, that of team learning. Team learning requires dialogue. Dialogue and discussion are potentially complementary, but most teams lack ability to distinguish between the two and to move consciously between them.

DOCTRINE

Commander, US Joint Forces Command. "Memorandum for U.S. Joint Forces Command, Subject: Vision for a Joint Approach to Operational Design." October 6, 2009.

Enabler: Emerging senior officer concept for the Joint use of design. Over the next several months, keep General Mattis' thoughts in mind as you develop your own philosophy of design.

United States Army. *Field Manual 3-24, Counterinsurgency.* Washington, DC: Headquarters, Department of the Army, 2006.

Enabler: Recent doctrine that is part of the dialogue about the role of design in security operations

United States Army. *Field Manual 5-0, Operations Process*. Washington, DC: Headquarters, Department of the Army, 26 March 2010.

Enabler: The newly released FM 5-0 is assigned here to begin bringing operations process doctrine into our discussion. There should not be a dividing wall between the art of design and the operations process, so we use this doctrine to explore the relationship of problem framing with the doctrine of battle command.

United States Army. *Field Manual 3-0, Operations.* Washington, DC: Headquarters, Department of the Army, February 2008.

Enabler: Chapter 5 is assigned to inform us of the language of planning and operations. Some of this language, and some of these concepts, match the ideas behind design, but some of them are a bit contrary to the precepts of design.

United States Army. *Field Manual 3-0, Operations*. Washington, DC: Headquarters, Department of the Army, 2008. Chapter 7.

Enabler: Information systems are everywhere meaning that individual actions may have strategic implications at anytime. Effective employment of information aids in achieving success. It is a combat multiplier. Information superiority is the operational advantage derived from the ability to collect, process, and disseminate an uninterrupted flow of information while exploiting or denying an adversary's ability to do the same. There are five information tasks that the Army conducts: information engagement, command and control warfare, information protection, operations security, and military deception. Knowledge management is the art of gaining and applying information throughout the Army and Joint Force.

United States Army. *Field Manual 3-0, Operations*. Washington, DC: Headquarters, Department of the Army, 2008. Chapter 6.

Enabler: Review the Elements of Operational Design. Consider how these, combined with MDMP and JOPP, shape the ability of a military organization to manage a crisis as described by Augustine. How do they contribute to sensemaking?

United States Army. *Field Manual 3-07, Stability Operations.* Washington, DC: Headquarters, Department of the Army, October 2008.

Enabler: The Army's doctrine on stability operations posits a fundamental tension between the nature of stability operations and planning. Read this to grasp how Army doctrine explains the role of understanding and its relationship to planning for stability operations.

United States Army. *Field Manual 3-13, Information Operations (Draft)*. Washington, DC: Headquarters, Department of the Army, 2009.

Enabler: Information and Full Spectrum Operations: Recognizes that information superiority is illusive. This new manual approaches the use of information to affect the operational environment. By addressing three operational challenges inherent in conducting military operations in a globally inter-connected, information saturated world. They are: winning the psychological contest with real and potential adversaries; keep friends and gain allies; and winning the operational and strategic cognitive and technical contest with adversaries to gain and retain the advantage.

United States Army. *Field Manual 6-0, Command and Control*. Washington, DC: Headquarters, Department of the Army, 2003. Appendix B.

Enabler: This is a good discussion of the uses of information and brings in the tactical piece.

United States Army. *Field Manual 6-0, Command and Control*. Washington, DC: Headquarters, Department of the Army, 2003. Chapters 2 and 3.

Enabler: Refresh your understanding of the nature of command. Consider the distinctions between command and leadership as you read this chapter. Control is the systemic element of C2. Review Chapter 3 to refresh your understanding of the three elements of control and the principles.

United States Army, *Field Manual 6-22, Army Leadership.* Washington, DC: Headquarters, Department of the Army, 2008.

Enabler: Army leadership doctrine already recognizes the challenge of leadership without authority and the need to influence others beyond the chain of command. Use this opportunity to reflect on the challenge of getting others to participate in design and planning, given that some may not understand or embrace the methodology.

Joint Staff, U.S. Department of Defense. *Joint Publication 5-0, Joint Operations Planning*. Washington, DC: Joint Chiefs of Staff, December 2006. Chapter 4.

Enabler: Our formulations of design concepts should not be done in a vacuum. Eventually, design concepts need to be transferred into either the JOPP or MDMP operations systems, or into some other form of tool to turn into action steps. JP 5-0, Chapter 4, offers the bridge supports on the planning side of the chasm between design and planning. Investigating what is expected in the initial stages of JOPP offers a manner for the construction of the bridge itself from the near side ideas of design to the far side ideas of planning and execution.

TRADOC, ARCIC, Department of the Army. "Campaign Directive Format, Operational Command Workshop, Unified Quest 2009."

Enabler: This is not doctrine, but it is an initial attempt to prescribe the format of the document(s), which serve a bridging function from design into planning.

United States Army. *TRADOC Pamphlet 525-5-500, Commander's Appreciation and Campaign Design.* Washington, DC: Headquarters, Department of the Army, 2008. Chapter 2.

Enabler: This precursor to *FMI 5-2, Design* provides an understanding of the doctrinal heritage of design. Of practical value are the questions you might ask during framing as described in the manual.

United States Army. *Field Manual Interim 5-2, Design*. Washington, DC: Headquarters, Department of the Army, 2009.

Enabler: FMI 5-2 was the basis for chapter 3 of *FM 5-0* on design and offers an expanded discussion of design methodology.

HISTORY

Clausewitz, Carl von. *On War*. Ed. and trans. Michael Howard and Peter Paret. New York, NY: Alfred A. Knopf, 1993.

Enabler: Book One, Chapter Three, "Military Genius." This section is the closest Clausewitz comes to a discussion of leadership. As you read this passage, consider how Clausewitz's view of military genius contrasts (favorably or not) with the views of Heifetz, Fuller, and Army doctrine.

Fuller, J. F. C. *Generalship.* Harrisburg, PA: Military Service Publishing Co., 1936.

Enabler: Fuller's thoughts on generalship offered three common characteristics of good generals, namely courage, creative intelligence, and physical fitness. To better understand why Fuller wrote his invective against British generals, look at the graph on pages 105-06.

Gole, Henry G. *The Road to Rainbow.* Annapolis, MD: Naval Institute Press, 2003.

Enabler: Major Wedemeyer's project did not occur in a vacuum. You should understand the difficulty of interwar planning and the scope of military efforts directed at understanding the future. In particular make note of the difficulties that the planners operated under given the strategic circumstances and lack of clear political direction.

Grant, U. S. *Memoirs*. New York, NY: Literary Classics, 1990.

Enabler: Grant, in the "cracker-line" campaign, clearly places his efforts in the larger context of 1863. At the start of this reading, we see Grant taking stock of various ongoing operations, and accounting for the effects of previous military events. He is given some specific instructions (designing constraints) and begins to design the environmental frame, problem frame, and eventually a design concept for his "space." He proceeds to execution, of specific tasks, but also keeps an awareness of the connections to the larger issues.

Kirkpatrick, Charles E. *An Unknown Future and a Doubtful Present, Writing the Victory Plan of 1941.* Washington, DC: Center of Military History, 1992.

Enabler: Chapters 3 and 4 form the heart of the discussion about Wedemeyer's experience with a "stupendous" problem.

Lawrence, Thomas E. *Seven Pillars of Wisdom*. London: Penguin, 1926, 1962.

Enabler: A careful examination of the chapter, *including the rather strange note on page 202*, is illuminating of the reality of thinking about managing problems. Note – the internet version left out the interesting footnote to the first sentence of the second to last paragraph: "Not perhaps as successfully as here. I thought out my problems mainly in terms of the Hejaz, illustrated by what I knew of its men and geography. These would have been too long if written down; and the argument has been compressed into an abstract form in which it smells more of the lamp than of the field. All military writing does, worse luck."

Mao, Tse-tung. "Problems of Strategy in China's Revolutionary War" in *The Art of War*. El Paso, TX: El Paso Norte Press, 2005.

Enabler: This brief excerpt allows you to explore (or more likely review) Mao's thoughts on war and generalship.

Slim, Field Marshal William J., 1st Viscount Slim. *Defeat into Victory*. New York, NY: Macmillan, 1986.

Enabler: Slim clearly believed that complexity was the normal situation for a corps commander in World War II. Despite claims of others, complexity is not a figment of the contemporary operating environment.

COSSAC, Staff of. "Digest of Operation Overlord, 7 July 1943. (43) 32 Final."

Enabler: This original document is an of an initial problem statement. One question this document raises, did they frame the right problem? This questioning is an essential aspect of the art of design.

Stewart, Richard W. *Staff Operations: X Corps in Korea, 1950.* Fort Leavenworth, KS: Combat Studies Institute, 1991.

Enabler: X Corps found itself in an untenable position in December 1950. As a result, the entire corps was ordered to conduct a withdrawal by sea. Read this monograph to understand the organization the corps staff used to manage the operation.

Sun Tzu. *Art of War.* Trans. Ralph D. Sawyer. Westview, 1994.

Enabler: Also see Giles translation, Chapter Five, "Energy" at

http://www.chinapage.com/sunzi-e.html and Giles translation with commentary at http://suntzusaid.com/book/5

Woodward, Sandy. *100 Days*. Annapolis: Naval Institute Press, 1992.

Enabler: Sandy Woodward, as a senior Royal Navy officer, commanded the British assault on the Falkland Islands. His description of his design concept, his evaluation of the environment, the problem, and his initial design concept, is classic – if typically Navy in that it is fully command-centered, with little input from a staff. The image of him in his office afloat with his little strips of paper will stay with you for some time.

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APPENDIX B: DESIGN METHODS

The structure and organization for this appendix are based on an unpublished manuscript by Lt Col Richard King of the Australian Defense Forces titled *Thinking Skills Resources*. His paper is used in the curriculum of the School of Advanced Military Studies. He can be contacted at: richard.king@defence.gov.au

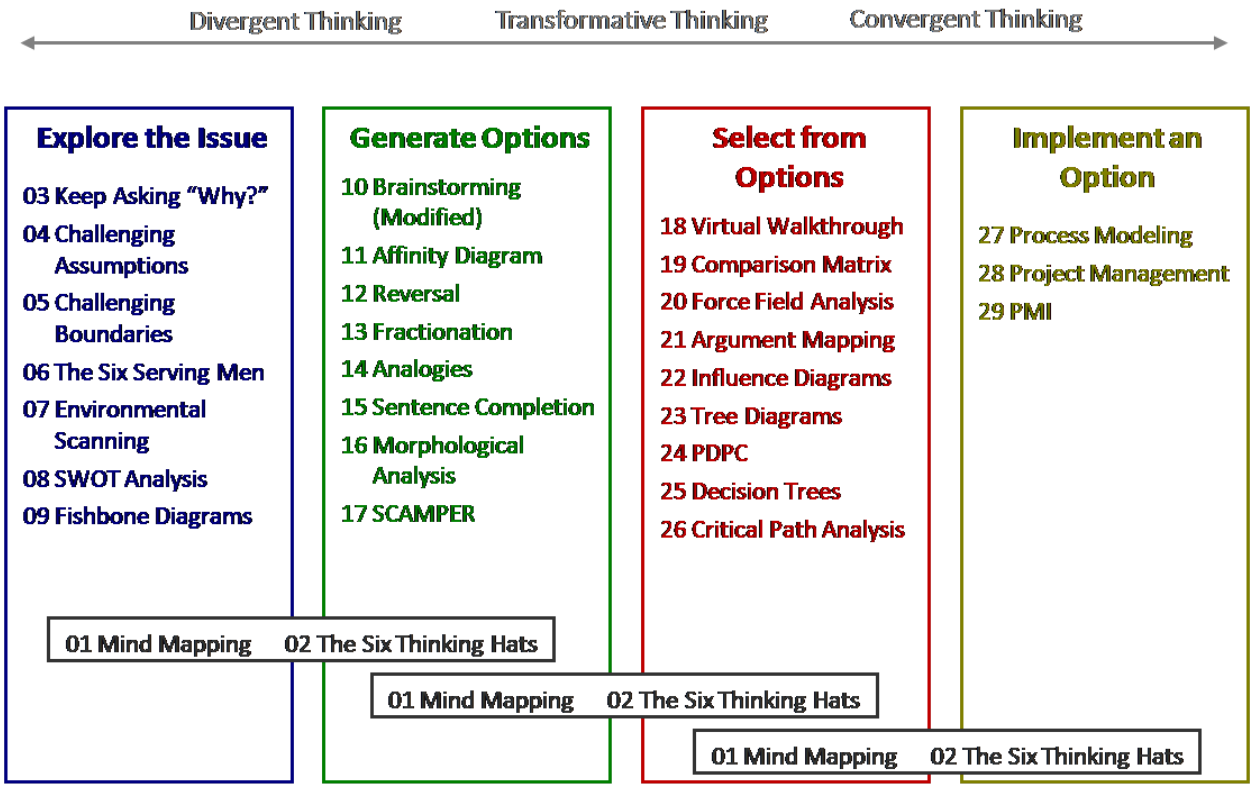
Within his paper, Lt Col King catalogued and described 29 primary techniques for critical thinking. The order and explanation of those techniques within this document derive from King's work. Where applicable, King's specific descriptions or examples are noted. In other cases, new examples were generated or were taken from additional research and sources. Many of the techniques are common applications in critical thinking, while others (as described) have been enhanced by commercial instructional enterprises. Credit is given as appropriate.

Lt Col King's effective thinking framework is shown on the next page. In his model he separates the framework into divergent and convergent thinking, and he further establishes a taxonomy with four steps:

1. Explore the issue
2. Generate options
3. Select from options
4. Implement an option

In King's methodology, two of the 29 techniques (Mind Mapping and The Six Thinking Hats) apply across all four steps, while the others are most appropriate to a specific step of the methodology, as shown. Practitioners of design should consider this when performing as design team leaders or members. This document and King's taxonomy will be useful tools when one must assess where the team is at in the endeavor, particularly if techniques are needed to move forward.

EFFECTIVE THINKING FRAMEWORK



REFERENCE: LT COL RICHARD KING, AUSTRALIAN DEFENSE FORCES

DESIGN TOOLS FOR SAMS D300 – Organizational Description

NAME OF TECHNIQUE:

Utility: Describes where this particular tool or technique may be useful or relevant. Also shows where caution should be taken.

Explanation: Describes how the particular technique can be applied.

Examples: If displayed, amplifies the explanation, furnishes new issues, or provides examples of the technique discussed. If taken from a source, then that source is identified.

Source: (King 1) Provides the reference (or in some cases, one or two of numerous possible references) to the technique.

MIND MAPPING

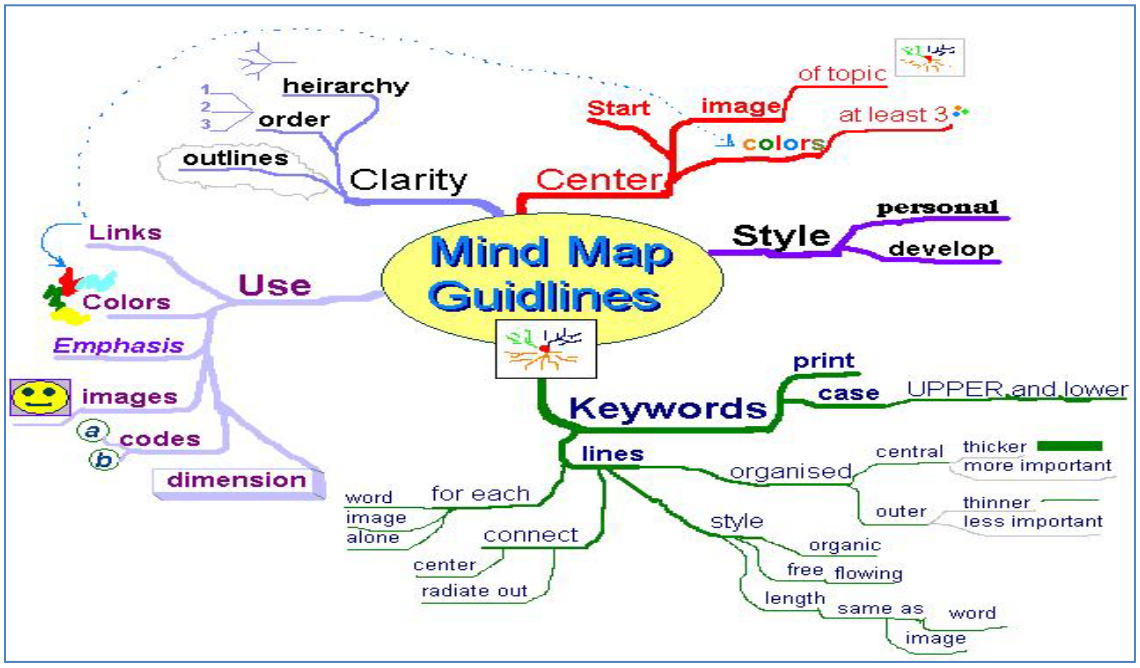
Utility: At the beginning of a problem to represent and manage ideas and information graphically. Serves as a graphical outline. Stimulates creativity and identifies relationships between ideas. Can be used by individuals and in groups. Other applications include:

- Making notes during meetings and 'thinking' sessions.
- Planning meetings and 'thinking' sessions.
- Summarizing notes during study.

Explanation:

- Begin in the center with an image of the primary topic.
- Use images, symbols, codes, and dimensions throughout the Mind Map.
- Select key words the show secondary areas; use upper or lower case to establish emphasis.
- Each word/image must be alone and sitting on its own line.
- Connected lines, starting from the central image. The central lines may be thicker, becoming thinner as they radiate out from the center.
- Make the lines the same length as the word/image.
- Use colors – your own code – throughout the Mind Map.
- Develop your own personal style of Mind Mapping.
- Use emphasis and show associations in the Mind Map.
- Keep the Mind Map clear by using radial hierarchy, numerical order or outlines to embrace your branches.

Example:



Source: (King 1) Popularized by Buzan, Tony and Buzan, Barry, *The Mindmap Book,* BBC Books, London, 1997.
CGSC Copyright Registration #10-429 C.

SIX THINKING HATS

Utility: At any time during methodology. Very useful when group is stuck in unproductive arguments or stalls and is not moving forward. Helpful for controlling group dynamics. Caution: Can get stuck in emotional arguments.

Explanation: Group members analyze the problem from different mental states by "wearing" different colored hats. The group leader specifies what hats to "wear," and discussions follow just from that hat's perspective. All can wear the same hat or mix it up to move past emotional arguments, though better collaboration occurs if everyone "wears" the same hat at the same time and hats are "changed" in sequence.

If the group is being too subjective or even too critical, the leader may ask the members to put on their white hats and proceed. If the group is being too optimistic about outcomes and no downsides are identified, the leader may direct a discussion with black hats.

Example:

White hat - FACTS AND FIGURES
White is neutral and objective (a blank sheet of paper). The white hat is concerned with objective facts and figures. Uses: Just facts and information, no interpretations.

Red hat - EMOTIONS AND FEELINGS
Red (heat) suggests anger (seeing red), rage and emotions. The red hat gives the emotional view. Uses: Feelings, hunches, intuitions, impressions. No need to justify.

Black hat - NEGATIVE THINKING
Black is gloomy and negative. The black hat covers the negative aspects – why it cannot be done. Uses: What is wrong, incorrect or in error. A REALITY CHECK.

Yellow hat - POSITIVE THINKING
Yellow is sunny and positive. The yellow hat is optimistic and covers hope and positive thinking. Uses: Positive aspects, constructive thinking and making things happen.

Green hat - CREATIVE AND LATERAL THINKING
Green is grass, vegetation and abundant, fertile growth. The green hat indicates creativity and new ideas. Uses: Creation of new ideas, concepts and approaches

Blue hat - CONTROL OF THINKING
Blue is the colour of the sky, above everything else. The blue hat is concerned with control and organization of the thinking process (including the use of the other hats). Uses: Directing the use of the hats. Summaries, overviews and conclusions.

Source: (King 2) By Edward De Bono "Six Thinking Hats" (1985) Also see Mind Tools at http://www.mindtools.com/pages/article/newTED_07.htm

KEEP ASKING WHY

Utility: To bore deeper into an issue or discover its real causes (vice symptoms). Helps to ensure the root causes are genuine and not just what the group thought were germane. Also helps to smoke out specious or shallow arguments. Like meta-questioning.

Caveat: Some people will be offended by the questioning, seeing it as badgering or disrespectful. The questioner could request: "Help me understand this; why …?"

Explanation: This is a five-step process:

Step 1: Identify an element of the issue.
Step 2: Ask 'why?'
Step 3: Consider the response.
Step 4: Ask 'why?' again.
Step 5: Repeat steps 3 and 4 until you run out of responses.

Example:

Person 1. We <u>need to conduct drown proofing training.</u>
Person 2. Why do we need to conduct drown proofing training?
P 1. The Army safety regulation requires it.
P 2. Why does the Army require it?
P 1. To identify soldiers who can't swim?
P 2. Why? And what will you do about the soldiers who are weak swimmers?
P 1. We'll train them to be proficient swimmers.
P 2. What will you train them to be able to do?
P 1. Soldiers will train to perform their mission activities?
P 2. What is your mission profile??
P 1. We are an armored unit operating in the desert.
P 2. Why would you train soldiers to swim when it's not in the mission profile?
P 1. Perhaps <u>we just need to know who they are</u> in case the mission changes.

Note that the initial guidance (conduct drown proofing training) opened the door for a potential extensive training program the unit may not have been able to conduct. By questioning, a better course of action was revealed (since the mission will not expose these soldiers to water, we'll just assess proficiency in order for the chain of command to know who the weak or non swimmers are).

Source: (King 3)

CHALLENGING ASSUMPTIONS

Utility: To validate existing assumptions, especially in complex situations. Aids group understanding and also serves to potentially eliminate assumptions which may be constraining. Ensures assumptions are not taken for granted.
Caveat: can be time consuming.

Explanation: This is a three-step process:

Step 1: Write the issue down.
Step 2: Identify underlying assumptions.
Step 3: Challenge and discuss each assumption.

Example:

Step 1: How can we reduce the SAMS reading load?
Step 2: Assumptions:

- Students can't read all the material.
- Students don't want to read all the material.
- Faculty wants to add more readings.

Step 3:

- Can't read it all? Time isn't always the problem; availability also is an issue. Some readings are only available in the library, but if they could be offered online, students could read them at home.
- Don't want to read it? Not wanting to read the material isn't always the case. However, when monograph progress is due, course readings become secondary. Scheduling both so they don't conflict will help with overall workload.
- Faculty wants more? Faculty understands the reading load issue, but individual course authors feel their information is important. Setting a maximum number of required pages for reading can be modified by some readings being assigned for scanning – understanding that the instructor will have to present more.

Source: (King 4) Derivative of MDMP from Page's cumulative strategy – 1961

CHALLENGING BOUNDARIES

Utility: (King 5) Aids in framing a problem. Most utility in complex problems or when the problem appears to be too restrictive.
Putting boundaries on an issue helps to define it. Writing an issue down leads people to see the boundaries as fixed when perhaps they are bad boundaries in the first place. By challenging the preconceived boundaries, new perspectives may evolve; one may also discover that the original boundaries are either too restrictive or too broad.
Resembles Schön's use of boundaries to generate creativity.

Explanation: This is a three-step process comprising:

Step 1: Write the issue down.
Step 2: Underline key aspects.
Step 3: Challenge key aspects.

Challenge the key aspects of the issue. This will raise additional questions or insights into the issue. The additional questions or insights can be dealt with by asking the question: "So what?"

Example:

Step 1: How can we reduce the SAMS reading list to make the lessons easier for students?
Step 2: How can we <u>reduce</u> the <u>SAMS reading list</u> to make the <u>lessons</u> <u>easier for students</u>?
Step 3:

- <u>reduce</u>: Do we mean authors or pages? How do we measure difficult readings against less obtuse writing? So what?
- <u>SAMS reading list</u>: How do we compare "read for understanding" against "scan" in the lesson plan? Should all students be required to read every source (even those which are just recommended)? How does online material count? So what?
- <u>lessons</u>: How must the readings tie into the classroom discourse and the instructors' presentations? So what? What is sacrificed if students are lectured to without their reading assigned material?
- <u>easier for students</u>: Does reading load or page count equate to easier work? So what? Should SAMS make the work easier, and if so, what is the threshold? Are there times when other SAMS requirements make preparatory reading problematic? There used to be a requirement for two monographs, so why is there a problem?

Source: (King 5)

THE SIX SERVING MEN

Utility: To develop the right questions in order to improve understanding of the nature and scope of an issue. Useful for dealing with issues that the group has little information or knowledge about. Provides a structured view of a situation from a variety of different perspectives. Can prevent rushing in to identify a quick (and often short-term) solution.

The "six serving men" come from a Rudyard Kipling poem. They are who, what, where, when, why, and how in relation to the situation and problem. Like meta-questioning.

Explanation: This is a three-step process:

Step 1: Define the issue in brief, precise terms.
Step 2: Questions (who, what, where, when, why, and how). Frame a series of questions, about aspects of the issue, using the six serving men from positive and negative perspectives.
Step 3: Analysis (who, what, where, when, why, and how) Then analyse the questions to see if you can gain new insights into the issue, or identify areas that need more data and analysis. When you identify an insight, ask yourself "So what?"

Example:

Step 1: How might SAMS change the students' reading requirements to be more palatable?
Step 2: (Shown below in bold)
Step 3: (Shown below after the questions in bold)

- Who says there's too much reading? Who says there isn't enough? Is it faculty, students, spouses? How many hours per day are spent reading?
- What is on the reading list? What isn't included on it? Do we only mean the required readings, or are recommended readings included?
- Where are reading materials made available? Where they are not made available? Must the readings be done in the library? Are there enough books for each student? Can they be made available online?
- When does the student actually read? When are readings not done by students? Can resources be shared, or must they be made available to all students simultaneously? What is the daily study regimen for students?
- Why do people think there is too much reading required? Why do some people think it is adequate or even insufficient? In what manner is the load determined? Do they think there is goodness in the reading regimen?
- How are reading lists developed, and how are they currently being read? How do students skip readings, and how do they get away with it? How frequently are lists changed, and who approves? How are lists deconflicted among modules?

Source: (King 6) Myriad sources with this common approach. Also see http://www.mycoted.com/Five_Ws_and_H

ENVIRONMENTAL SCANNING

Utility: To explore for Information; in strategic planning, provides for accumulating, analyzing, and distributing information in order to identify trends, potential, opportunity, and threats. Has similar objective as SAMS Environmental Frame: develop understanding after which priority issues can be further developed. When taken fully, it is similar to the entire design methodology. Good for a learning organization. Also like MDMP Mission Analysis.

Explanation: Resembles "triangulation" looking at a situation from various angles and perspectives. First determine who is responsible for the process. Then steps are:

Step 1: Review and update general socioeconomic and country/area situation information.
Step 2: Take stock of existing "in-house" information.
Step 3: Actively collect and assess scanning information from other organizations.
Step 4: Access existing networks.
Step 5: Select additional techniques to complement and supplement information available
More info at: http://en.wikipedia.org/wiki/Environmental_scanning

Example:
Principles of environmental scanning (from CUCE *):

- Explore "both sides of the ledger" to gain a complete picture: needs and opportunities; assets and limitations; barriers and aids
- Think micro and macro
- Use multiple "lenses" to look at the same information or situation: economic, social, cultural, environmental, health, technological, and political lenses; immediate, near-term, longer-term considerations; past, present, future perspectives
- Look for ways to "triangulate" information: ways to confirm, expand upon, or potentially contradict an observation; additional sources that could be helpful; important information gaps
- Think beyond felt needs and opportunities consider also: expressed needs and opportunity – evidenced by what people do; comparative needs and opportunity – identified by comparisons to other situations;
- Look for evidence on how CCE is perceived: credibility, roles, value, etc.
- Identify what you don't know as well as what you do; think about other possible sources.

Three methods for scanning:

- Ad-hoc (when needed)
- Regular (regular schedule)
- Continuous (always ongoing)

Source: (King 7) Michael Duttweiler: mwd1@cornell.edu & *Cornell University Cooperative Extension at http://staff.cce.cornell.edu/administration/program/documents/scanintr.htm

SWOT ANALYSIS

Utility: A strategic planning model to look at a problem initially. Must have a desired end state already established. It is an aid in assessing an organization's resources and capabilities as well as external environmental influences, good and bad. Applicable in crisis scenarios.
Caveat: Overly subjective based on perceptions. Not prescriptive.

Explanation: SWOT is a method for examining internal and external conditions so that strategies can be developed. Strengths and weaknesses are internal in origin, while external conditions are described as opportunities and threats.
Internal factors can include processes and procedures, human resources status, organizational culture, proficiency, owned resources, training, and structure. Analysis should address what should be maintained and what should or could be improved.
External factors can be alliances, social and cultural patterns, economics and politics, etc. - PMESII-PT and DIME.
In analysis, users must attempt to minimize or eliminate weaknesses or threats or turn them into opportunities. It resembles the approach of identifying propensities which can be addressed by systems of transformation or opposition. The SWOT diagram (below left) is a good tool for analysing the (internal) strengths and weaknesses of an organization and the (external) opportunities and threats emanating from the environment. The results of analysis must be assessed in terms of fitting into the environment. A "next step" cousin methodology is TOWS (on the right).

Example: TOWS Strategic Alternatives Matrix

	External Opportunities (O) 1. 2. 3.	**External Threats (T)** 1. 2. 3.
Internal Strengths (S) 1. 2. 3.	**SO** *"Maxi-Maxi" Strategy* Strategies that use strengths to maximize opportunities.	**ST** *"Maxi-Mini" Strategy* Strategies that use strengths to minimize threats.
Internal Weaknesses (W) 1. 2. 3.	**WO** *"Mini-Maxi" Strategy* Strategies that minimize weaknesses by taking advantage of opportunities.	**WT** *"Mini-Mini" Strategy* Strategies that minimize weaknesses and avoid threats.

Source: (King 8) Credited to Albert Humphrey at Stanford.
More at: http://en.wikipedia.org/wiki/SWOT_Analysis.
Matrix sourced from: http://www.mindtools.com/pages/article/newSTR_89.htm
CGSC Copyright Registration #10-427 C.

FISHBONE DIAGRAMS

Utility: To determine the root cause(s) of a problem, to identify areas for data collection, or to study why a process is behaving the way it does. Fishbone diagrams, also called Ishikawa Diagrams, Cause and Effect Diagrams, and Root Cause Analysis Diagrams, are used to explore potential or real causes (or inputs) that result in a single effect (or output). A good technique for group work.

Explanation:

- Put the main problem on the right at the "head" of the fishbone.
- Use brainstorming to identify 3-6 possible causal groups or "bones" (the 4 M's of "Materials", "Machines", "Manpower", and "Methods," as shown, are common in industry).
- Draw the diagram by sub-dividing the groups into process variables, generally to 4-5 levels.
- When completed, there will be ample areas to examine and correct, if applicable. Analysis follows.
- Then the team should rank order the most likely causes of the situation being examined.

Image to be included
http://mot.vuse.vanderbilt.edu/mt322/Ishikawa.htm

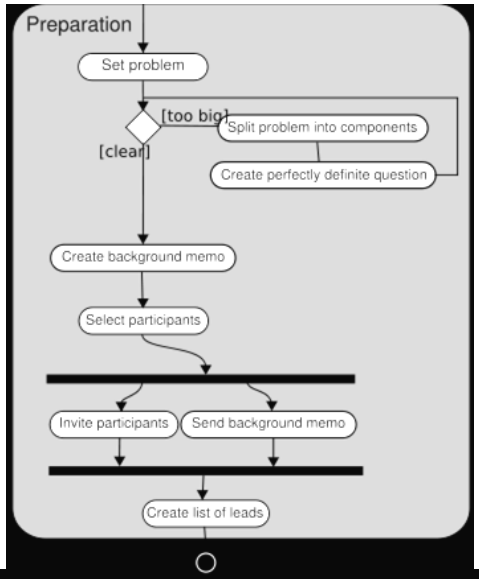
Source: (King 9) Developed by Kaoru Ishikawa (1969). More info at:
http://www.isixsigma.com/offsite.asp?A=Fr&Url=http://www.skymark.com/resources/tools/cause.htm

BRAINSTORMING

Utility: To aid when group dynamics are problematic or when many ideas need to be surfaced. Brainstorming can stand alone, or it can be used in conjunction with other techniques.

Explanation:

- Set or define the problem
- Develop a background memo
- Select participants
- Create lead questions
- Conduct brainstorming session
- Evaluate ideas



Example:

Guidelines:

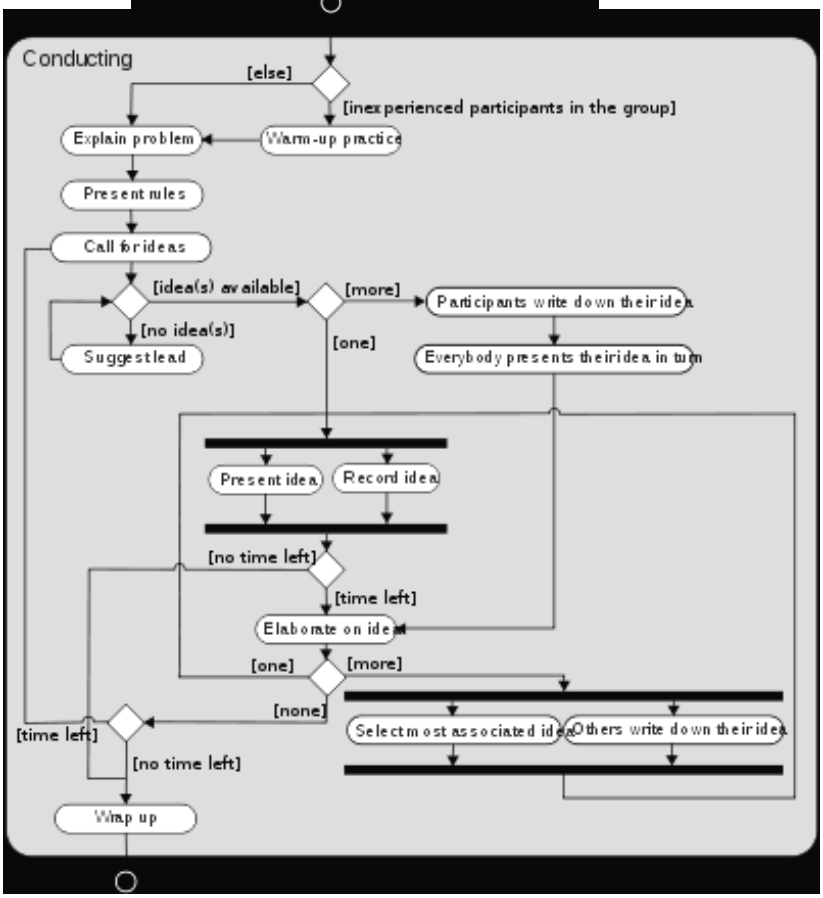
- Size of group- 6-15
- Leader- controls group
- Facilitator- Assists leader
- Note taker
- Time required- 20+ minutes
- Warm-up- practice or comedy
- Follow-up- allow process for post session ideas
- Evaluation- Session to consider the results
- Feedback- Final results

Four Rules:

1. Criticism is ruled out
2. Freewheeling is welcomed
3. Quantity is wanted (breeds quality)
4. Combination and improvement are sought

Two Principles:

1. Defer judgment
2. Quantity breeds quality



Source: (King 10) Developed by Alex Osborn in the 1930s

BRAINSTORMING MODIFIED

Utility: These techniques ensure there is more active participation from group members than in standard brainstorming. Helps those reluctant to speak up.

Nominal Group Technique
1. Members write their individual ideas down without speaking.
2. Each member, in turn, reads out one of their ideas. All ideas recorded; no evaluation allowed at this stage. Repeat until there are no unrecorded ideas. New ideas may be added.
3. Leader requests clarification if required, eliminates exact duplicates.
4. Each member is given cards and asked to rank the ideas in order of preference: members write the idea in the center of one card and the list number of the idea in the top left corner. Repeat with a card for each idea. Next members rank the idea cards from best to worst (alternating between best, worst, second best, second worst and so on). When done, members write the rank number (1 for best, etc.) in the bottom right corner of the card.
5. Leader collects cards and tallies rankings. Group analyses results. If there are inconsistencies, clarification may be sought and the voting repeated.

The Delphi Method
A variation on the Nominal Group Technique, except the group never physically meets. Experts share ideas by correspondence. (See Bullock)

Gallery Method
Simulates the environment of an art gallery. Participants develop ideas individually or in groups and then vote for the ideas in a 'gallery'.
1. Participants work individually or in groups to generate ideas.
2. Ideas recorded on butcher paper; sheets displayed around the walls of room.
3. Once all sheets are displayed, the participants circulate and browse.
4. Participants vote for the ideas they believe are most useful or important.
5. The votes are tallied and the key ideas are recorded separately.

Slip/Card Writing (Neville I. Smith & Murray Ainsworth).
1. Members get blank slips of paper; group considers problem statement.
2. Each member writes down as many ideas as possible on how to solve the problem, one idea written on each slip; continues until people run out of ideas.
3. The slips/cards are collected and the ideas are analysed and evaluated.

Brain Writing Pool (Arthur B. VanGundy) Group of 5-8 people, sitting around a table:
1. Each person writes four ideas on a sheet of paper.
2. Each person places their sheet of paper of four ideas in the center of the table and exchanges it for another sheet with somebody else's ideas.
3. Person reads the ideas on the sheet of paper selected; uses them to stimulate new ideas; adds their ideas to the sheet and then exchanges it for another one from the 'pool'.
4.Continue the process for about 15 minutes.

Source: (King 10)

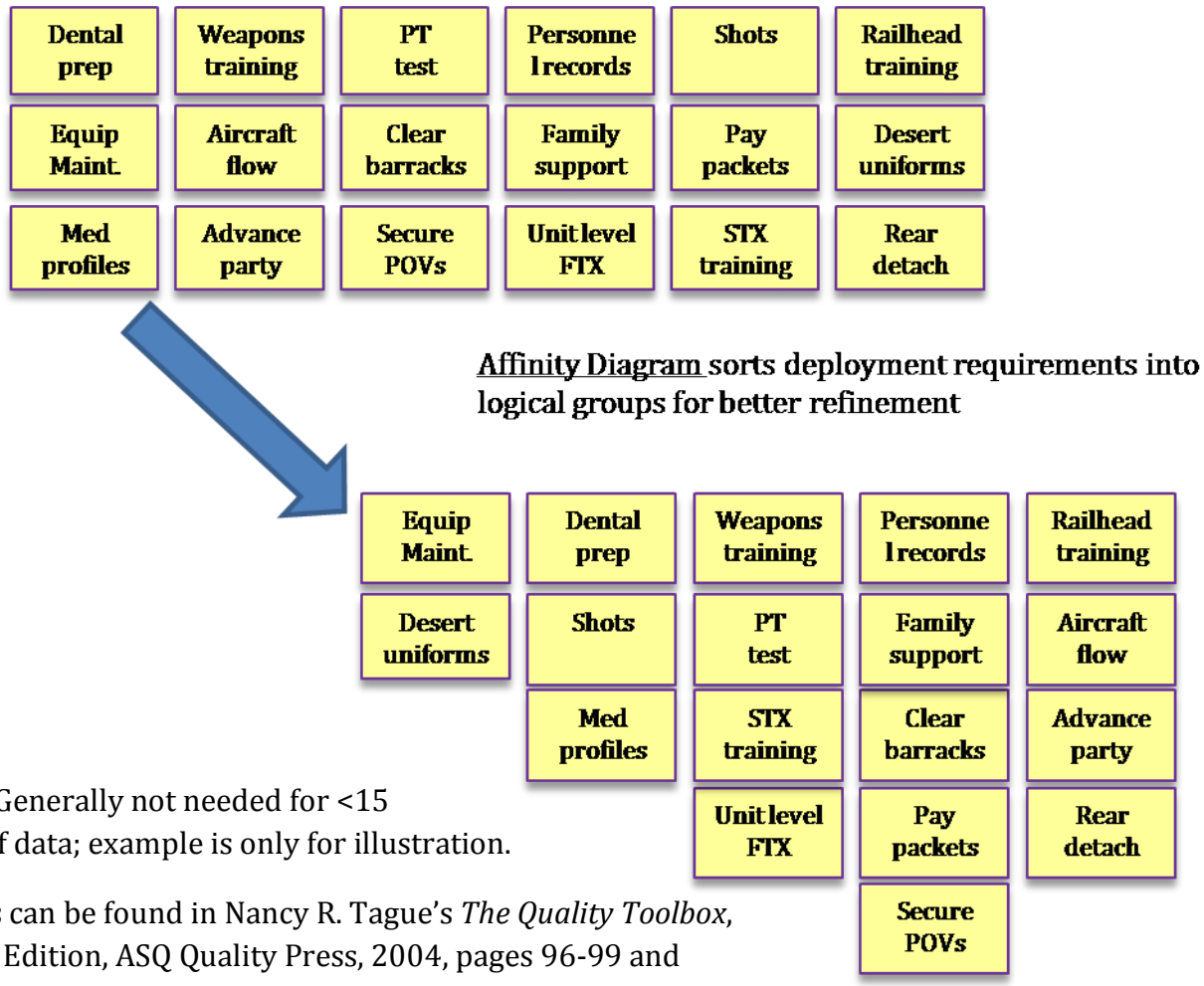
AFFINITY DIAGRAM

Utility: Can follow brainstorming. Organizes large amounts of data or ideas into natural relationships. Useful for complex issues, in chaos, or when there is no group consensus. Taps into the group's intuition and creativity. Best with max of 5-6 participants.

Explanation:

- Conduct a brainstorming meeting
- Record ideas and issues on post-it notes or cards.
- Gather post-it notes/cards into a single place (e.g. a desk or wall)
- Sort the ideas into groups based on the team's thoughts. Don't talk.
- Name each group with a description of what the group refers to and place the name at the top of each "group."
- Capture and discuss the themes or groups and how they may relate.

Example: Brainstorming - results of things to be done before deployment



NOTE: Generally not needed for <15 items of data; example is only for illustration.

Process can be found in Nancy R. Tague's *The Quality Toolbox*, Second Edition, ASQ Quality Press, 2004, pages 96-99 and http://www.asq.org/learn-about- quality/ idea-creation-tools/overview/affinity.html

Source: (King 11) Created in the 1960s by Japanese anthropologist Jiro Kawakita.

REVERSAL

Utility: Reversal is a useful technique that leverages the fact that we initially find it easier to identify negative thoughts and ideas than positive ones. Similar to Negation in Engineering Design Tactics.

Explanation: Creates a hypothetical solution, reduces that solution to its *necessary* components, and then critiques and nullifies each component in order to generate ideas.

Step 1: Write the issue down.
Step 2: Reverse the issue statement in any way (subject, verb, or object).
Step 3: Write down ideas relating to the reversed statement. Then reverse each 'negative' idea to generate a positive idea.

Example: Sample Question 1 – Heat Injuries (from King)

In what ways might we decrease heat injuries among soldiers during training in tropical areas?
Step 1: Write the issue down: In what ways might we decrease heat injuries among soldiers during training in tropical areas?
Step 2: Reverse the issue statement in any way (subject, verb, or object): In this case we might reverse the problem statement to be: *In what ways might we <u>increase</u> heat injuries among soldiers during training in tropical areas?*
Step 3: Write down ideas relating to the reversed statement. Then reverse each 'negative' idea to generate a positive idea.

- Hold the training during the hottest season. This leads to an option of holding the training during the coolest season.
- Hold the training during the hottest part of the day. This leads to an option of holding the training (or at least the strenuous activities) during the coolest parts of the day (early morning or evening).
- Hold the training in a hotter climate. This leads to an option of holding the training in a cooler climate (or even another country).
- Don't give the soldiers enough water to drink. This leads to an option of giving the soldiers more water to drink (and perhaps drinks with additives to reduce the incidence of heat injuries).
- Don't provide any shade. This leads to an option of providing more shade.
- Don't provide any respite from the heat. This leads to an option of providing respite from the heat (through scheduling strenuous activities with rest breaks).
- Don't educate staff to identify the symptoms of heat injuries. This leads to an option of educating staff to identify the symptoms of heat injuries.

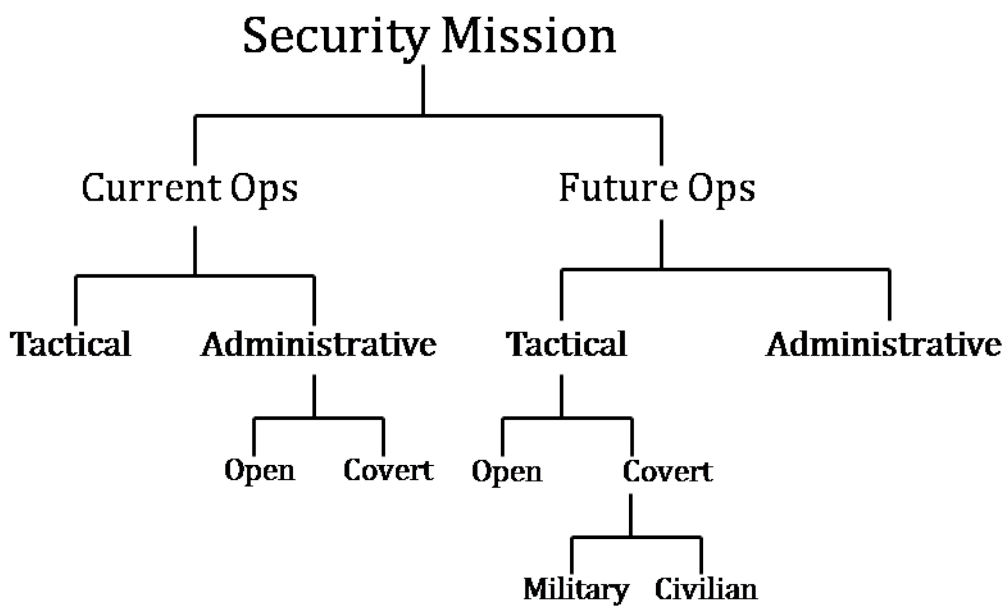
Source: (King 12)

FRACTIONATION

Utility: Fractionation is another method of using divergent thinking to contend with numerous factors or items of data. It aids in generating options by breaking an issue into parts and then examining the resulting parts to seek solutions that address the problem at hand. In effect, it simplifies large, difficult problems by creating smaller components for greater examination and solutions. Fractionation helps to overcome the difficulty that occurs when, over time, issues, habits and ideas tend to be grouped together into patterns. Eventually, people see the forest for what they believe it to be, but they may have lost sight of what is happening to the trees. While useful in contending with complex problems, fractionation is ideal in resolving complicated problems.
Factorization is included in traditional engineering tactics.

Explanation: Any method of fractionating is useful. To alleviate the problem of the forest and trees, sometimes unconventional or less-obvious fractions offer greater creativity. Otherwise, "traditional" breakdowns are good.
Fractionation is not analysis, but it aids analysis by creating manageable elements. When it deals with artifacts, it must be understood that relationships are not reflected.

Example:



Source: (King 13)

ANALOGIES

Utility: Allows one to resolve an issue in the context of a different issue seeking novel approaches or perspectives. While it works best with simple problems, multi-step problems can also be addressed with analogies. When the new situation is befuddling and the group doesn't know where to start, referring to a more-familiar situation can be helpful.
Included in traditional Architectural tactics and is part of Broadbent (individual) and Synectics (Group) analogical searches.
Explanation:

Step 1: Choose a major principle of the issue being considered.
Step 2: Generate a list of analogies for the issue being considered.
Step 3: Choose one of the analogies and describe it in detail.
Step 4: Use the description generated in Step 3 above to suggest ideas in relation to the original problem.

Example:
In what ways can we ensure the security and safety of the installation?

Step 1: Security
Step 2: Securing an installation is like:
- Guarding a prison
- Protecting a city
- Guarding your home

Step 3: Protecting a city involves:
- Being vigilant
- Preventing trespassing or intrusions in public and private places
- Alerting citizens
- Reacting to disasters and crimes

Step 4:
- Determine how and where to patrol and set up electronic surveillance
- Assess perimeter fencing and key buildings
- Examine access control checkpoints
- Study how mayors and city managers inform the public
- Review training programs and operational policies for police and firemen

Source: (King 14) Arthur B. VanGundy, *Idea Power*, pp. 134-136

SENTENCE COMPLETION

Utility: Encourages people and groups to examine a situation from different perspectives. Similar in some respects to Analogies, but is more randomised.

Explanation:

Step 1: State the issue (or an aspect of the issue) in the form of an incomplete sentence.
Step 2: Complete the sentence.
Step 3: Free associate with the completed sentence.
Step 4: Develop the ideas.

Example:

Step 1: An Army installation is like...
Step 2:
... a ship
… a city
… an airport
Step 3:
Ships are like tight groups of teams working together.
Cities are like eclectic groups of people going in different directions.
Airports are like places for rapid throughputs.
Step 4:
Ships: We require well integrated and synchronized functions.
Cities: We must address people systems (security, aid, traffic, health).
Airports: We must develop systems for ease of movement and flow.

Source: (King 15)

MORPHOLOGICAL ANALYSIS

Utility: Morphology is the scientific study of form and structure. This method aids analysis and problem solving by exploring novel solutions. Problems with multiple components or multiple processes can be addressed with morphological analysis. Same as engineering function analysis or Alexander's function model.

Explanation: Six step process:

Step 1: State the issue
Step 2: Identify a single element (item or process)
Step 3: Identify components of the element
Step 4: Identify and list the full range of possible options for these components
Step 5: Trace pathways through the matrix
Step 6: Identify feasible options and generate a list of ideas

Component 1	Component 2	Component 3	Component 4
Option 1	Option 1	Option 1	Option 1
Option 2	Option 2	Option 2	Option 2
Option 3	Option 3	Option 3	Option 3
Option n	Option n	Option n	Option n

Example:

Step 1: How can we better structure our airfield for safety and efficiency?
Step 2: Airfield
Step 3:

Hangars	Ramps/AC Parking	ATC	Crew Space

Step 4:

Hangars	Ramps/AC Parking	ATC	Crew Space
one large	long taxiway	only in tower	one large area
tents	surrounding hangar	in ops rooms	with units
more but small	keyholes	units and tower	none

Step 5: There are 3x3x3x3 = 81 possible options
Step 6: Feasible options:

1. One large hangar, A/C parking surrounding it, ATC in a tower, one large area for crews. This is a "central" arrangement where access is convenient, but there is little room for expansion if more units, crews, or aircraft are added.

2. Numerous small hangars, A/C parked on a long taxiway, ATC in both towers and unit operations, crews remain with units. This arrangement calls for "distributed" airfield operations which are unit-focused. Centralization is impossible, but it accommodates growth.

Source: (King 16) Originated by Fritz Zwicky

SCAMPER

Utility: SCAMPER is an acronym for possible actions a group might use to seek new and novel solutions or problem definition.

Explanation:

- **S**ubstitute- part of your product/process for something else
- **C**ombine- two or more parts of your product/process parts
- **A**dapt- change the nature of your product/process
- **M**odify- change part or all of the current situation
- **P**ut to other Purposes- try for other purposes
- **E**liminate- various parts of the product/process
- **R**earrange/Reverse- order or work in reverse

Example: If examining the structure of a peacekeeping force, one might ask:

Substitute – replace a trans unit for a maintenance unit?
Combine – consolidate the lift and C2 aviation units?
Adapt – train the force protection elements to perform reconnaissance?
Modify – reduce the number of areas to be secured?
Put to other purposes – force structure might be applicable for warfighting?
Eliminate – cut out the psyops component?
Rearrange/Reverse – prepare to hand the mission over to local nationals?

Source: (King 17) http://www.brainstorming.co.uk/tutorials/scampertutorial.html
http://www.mindtools.com/pages/article/newCT_02.html **Infinite Innovations Ltd.**

VIRTUAL WALKTHROUGH

Utility: To analyze options and consequences, surface unforeseen reactions, and offer insights into the likely success, failure or consequences of a plan of action. Like a map drill or "rock drill," helpful when it is impossible to "get on the ground." Akin to a virtual rehearsal or wargaming. Helps identify and thus avert problems. Groups or individuals can perform this. Useful in temporal assessment.

Explanation: A three-step process comprising:

Step 1: Define the issue you need to deal with as a series of actions.
Step 2: Imagine you are taking each of the actions; for each one ask the following questions:

- What exactly is required (in full detail)?
- Do I believe that the required action is possible?
- Is this action related to another action?
- If it is related to another action, then will it help or hinder the overall process?

Step 3: Adjust the series of actions as required by the answers given to the questions in Step 2.

Example: (abbreviated via description; real virtual walkthrough is considerably longer)

Step 1: The Military Academy accepts and prepares 1500 new cadets in one day, culminating in a swearing in ceremony in the afternoon.
Step 2: New cadets must be received, examined, measured for and receive uniforms, and trained to march; also must get haircuts, eat lunch, meet their chain of command, find their rooms, and accept issue of equipment – all in 8 hours or less. Each station has specific requirements, and each cadet must be "tracked" for progress in order to be ready for the afternoon formation. It is the responsibility of the cadet and academy cadre to make this happen.
Step 3: A virtual walkthrough by the cadre is paramount to ensuring that every detail of each station is set up, timed, and tracked. (This will be followed by an actual walkthrough.) Resources are shifted and explanations are provided where necessary. Events and activities are timed. On the actual day of arrival, new cadets will appear at different times and with different levels of preparation, so the cadre must be prepared and agile in order to steer cadets to the most important stations. At 1600 in the afternoon, all 1500 new cadets must be in formation, in the correct place, in military uniform, and trained to march. They then receive a briefing on the oath of office and are sworn in. Rehearsals are essential.

Source: (King 18) See FM 6-0, Appendix F for a full description of rehearsals

COMPARISON MATRIX

Utility: To analyze options objectively. A comparison matrix is a tabular method of ranking and evaluating competing options. Also called a decision support matrix (DECMAT) or template (DST). This technique is familiar to most Army officers.

Explanation: Start by defining the problem ("To determine ….") Then list facts and assumptions germane to the problem. Now:

Step 1: Select the set of options or courses of action (COA).
Step 2: Establish a set of criteria against which to rank the options. Should be named, defined, and weighted; given an order ("more" or "less" is better); provide a threshold on what constitutes an advantage.
Step 3: Create a matrix showing the options and criteria.
Step 4: Select a criterion and rate each option against that criterion.
Step 5: Total the scores for each option; list the options in order of ranking.

Example: To determine the best car to buy. (Facts/assumptions omitted here.)

Step 1: BMW, Prius, Escort
Step 2:
a) Appeal, wt 2.0
b) Mileage, wt 1.0
c) Cost, wt. 2.0
Steps 3 & 4: See matrix
Step 5: Weighted score shows that the Prius is the best option given the criteria and weights established. A more thorough decision could include advantages/disadvantages of each COA and an analysis of COAs.

A simple matrix could just show + or – for each criterion.

Decision making sequence from Ch 2, FM 5-0

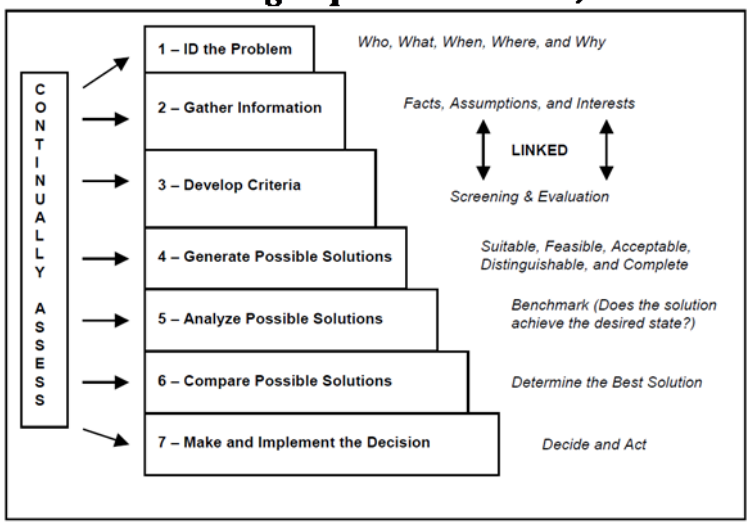


Figure 2-1. Seven Step Problem-Solving Model

	BMW	Prius	Escort
Appeal (wt 2.0)	3x2.0=6	2x2.0=4	1x2.0=2
Mileage (wt 1.0)	1x1.0=1	3x1.0=3	2x1.0=2
Cost (wt 2.0)	1x2.0=2	2x2.0=4	3x2.0=6
Score (> is better)	9	11	10

Source: (King 19) See also FM 5-0, Army Planning and Orders Production

FIELD FORCE ANALYSIS

Utility: Useful in a situation where positive forces are driving change forward and negative change drivers are holding change back. Can help identify:

- balance of power on an issue
- most important stakeholders
- who to target on the issue
- opponents and allies
- how to influence each group

May be called the Franklin method. As a change management tool, FFA resembles design methodology in which system propensities are assessed against systems of opposition and transformation and relevant tensions are gauged. A "field" is a social system in this context.

Explanation: Begins with description of current and desired states and what is likely to occur if there are no change agents (SAMS "propensities"). Then agents, pro (driving forces) and con (restraining forces), are identified as follows:

Step 1: Draw a large letter "T" on a whiteboard or flipchart.
Step 2: Write the change issue across the top of the "T".
Step 3: List positive change drivers down the left side of the "T"
Step 4: List negative change drivers (change inhibitors) down the right side of the "T"
Step 5: Score the change drivers and develop plans to reinforce positive drivers or remove negative drivers.

Examples:

Plan: Incorporate Design into the Army			
Forces for Change		**Forces Against Change**	
8	Officers suspect there is room for improvement	3	Officers don't want to learn new things
4	Rest of world accepts complexity theory/etc	8	Officers think old ways get it done just as well
9	Doctrine is being developed/ chance of being left behind	5	Concept is too complicated
Total score (+) = 21		**Total score (-) = 16**	

Note: The FFA on the left shows numerical "scores" (1-10 basis). The generic FFA on the right (see source) translates power scores into visual arrow lengths.

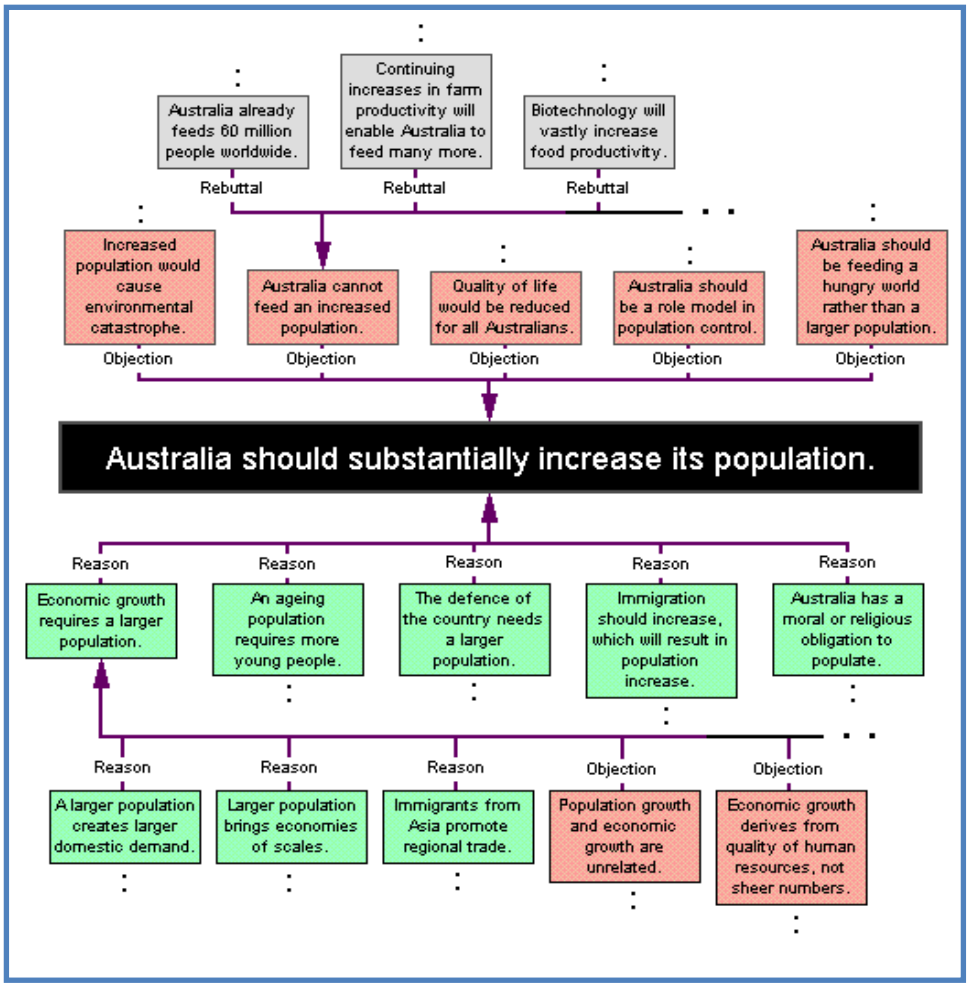
Source: (King 20) Developed by psychologist Kurt Lewin (1890-1947).
See also: http://www.valuebasedmanagement.net/methods_lewin_force_field_analysis.html
http://www.wilderdom.com/theory/FieldTheory.html

ARGUMENT MAPPING

Utility: Useful when a visual representation of logic and reasoning is helpful to understanding a complex situation. Also helps groups see where they are in an evaluation process by identifying key reasons or objections for discussion.

Explanation: Identify the problem or problem statement in the center of the "map." Then prepare boxes for each "reason" to support the proposition, as well as the key objections, and connect with arrows. Develop additional sub-arguments for each of those reasons and rebuttals for the objections; also connect with arrows. Use colors to visibly reflect pro or con. In the example below, green supports the argument, red opposes it, and grey identifies the rebuttals.
The example below is very simple. Actual argument maps can be quite lengthy.

Example:



See Dr. Tim Van Gelder, director of AUSTHINK Consulting, for information on hypothesis mapping as a cognitive tool (www.austhink.com). He also describes hypothesis mapping at: http://timvangelder.com/2009/01/20/what-is-hypothesis-mapping/ somewhat similar in form, it begins with a hypothesis and builds the evidence and counter-evidence downward.

Source: (King 21) from http://www.austhink.org/argumentmapping/ArgMappingBrief.doc
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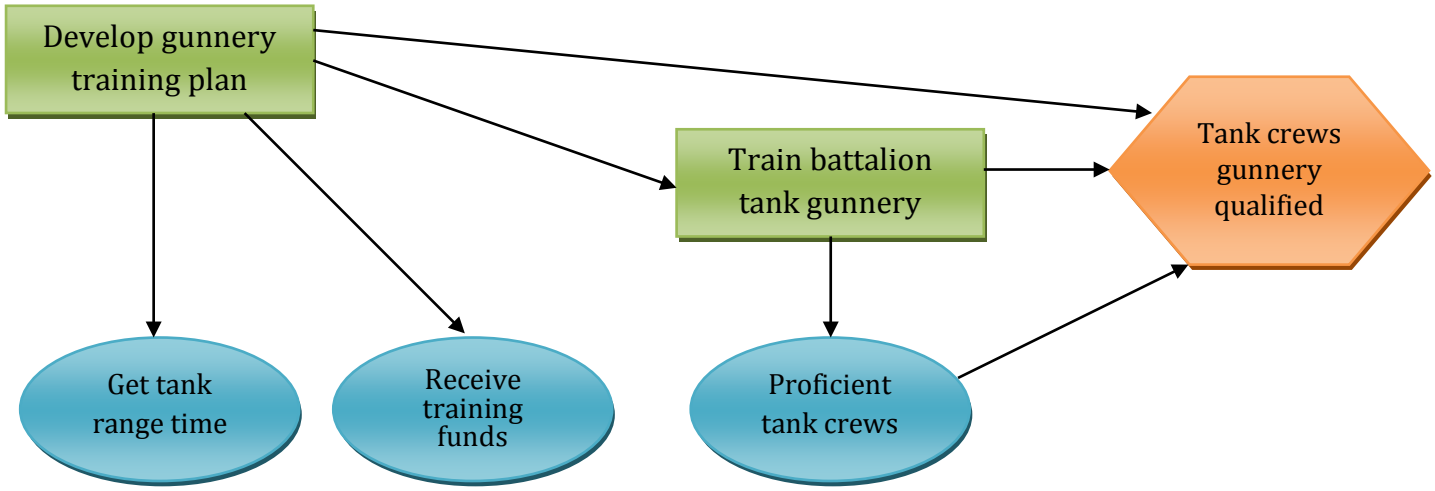
INFLUENCE DIAGRAMS

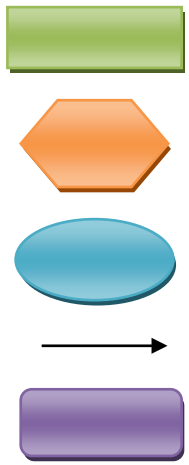
Utility: Also called a decision network or relations diagram. Useful for visually displaying the components of a decision: certainties and uncertainties, outcomes, the decisions themselves, (called variables or nodes) and the relational influences brought on by them. Can begin as a subjective analysis and be developed into an objective/quantitative one.

Explanation: A simple relations diagram shows actors, places the bases of influence arrows with those actors, and points the arrow to that entity being influenced. A more developed diagram represents a decision situation.

Example:



Legend:



A decision that you can control; a decision node

An objective variable with a measureable outcome; a known value

A chance variable as an uncertain outcome which you can control; a chance node

An influence to show relevance

A general variable derived from other variables; a chance node

Source: (King 22) Refined by Professor Ronald Howard from Stanford University. Also see http://www.Juliasilvers.com/embok/Risk_Management/RiskAssessmentMgmt/influence_diagram.htm
Graphic adapted from:
http://www.lumina.com/software/influencediagrams.html
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TREE DIAGRAMS

Utility: Used to take a goal and apply more detailed sub goals and actions. Allows team members to think and participate in goal development and then help to create activities to meet those goals.

Explanation:

Step 1: Choose the goal statement.
Step 2: Assemble the team. Generate the major sub-goals to pursue.
Step 3: Generate the major sub-goals to pursue. (via brainstorming, affinity diagrams, etc.)
Step 4: Break major sub-goals down into greater detail.
Step 5: Review the completed Tree Diagram for logic and completeness.

Example: (Note only one set of sub-goals are shown at each junction)
SAMS mission: Educate future leaders of our armed forces, our allies, and the interagency at the graduate level to be agile and adaptive leaders who think critically at the strategic and operational levels to solve complex ambiguous problems.

- Develop innovative leaders who are willing to accept risk and experiment
- Develop adaptive leaders who excel at the art of command
- Develop officers who anticipate future operational environments
- Enable officers to apply critical and creative thinking skills in order to solve complex problems
- Train officers to demonstrate mastery of operational art and doctrine

- Develop officers who can synthesize the elements of national power in JIIM operations
- Develop officers who can demonstrate effective communications
- Ensure officers can perform thorough academic and practical research
- Ensure officers can perform briefings for senior officers and government leaders
- Ensure officers can use a wide variety of graphics and technology
- Ensure officers can synthesize and write at the graduate level

- Students prepare and submit two written analytical papers per block to be evaluated by faculty.
- Students are assessed weekly by seminar leader for classroom written work.
- Students research for and write one 40-page monograph to be evaluated by a faculty team.
- Students prepare and submit other written products as required.
- Students receive remedial training if below standards.

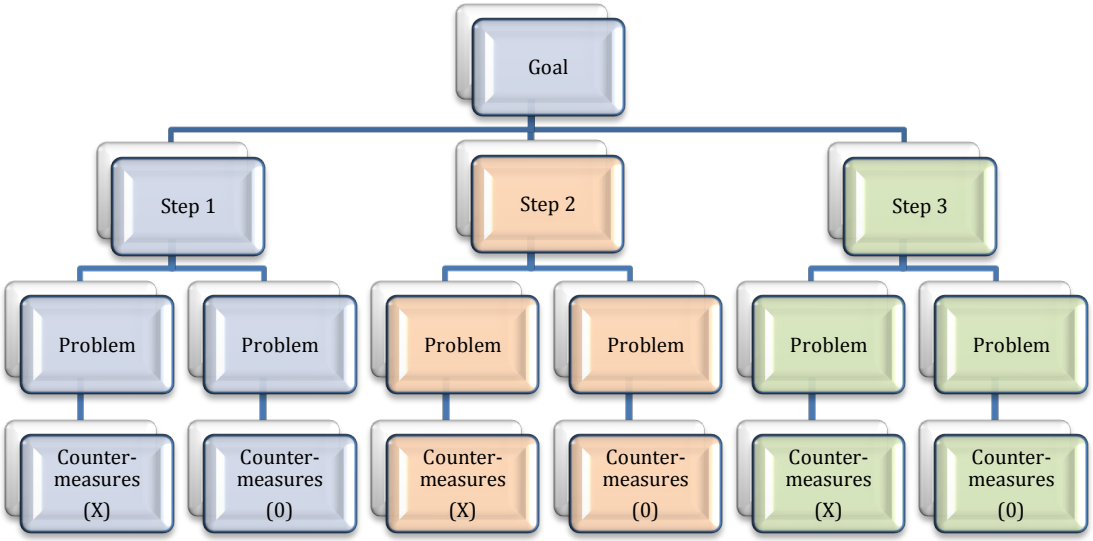
Source: (King 23) See Michael Brassard, “The Memory Jogger” pp 156-164

PDPC

Utility: Process Decision Program Chart. A tool to examine what can go wrong in a plan and develop measures or contingency plans to repair or ameliorate the effects. Could be used to develop branches and sequels to a plan. Team input is useful.

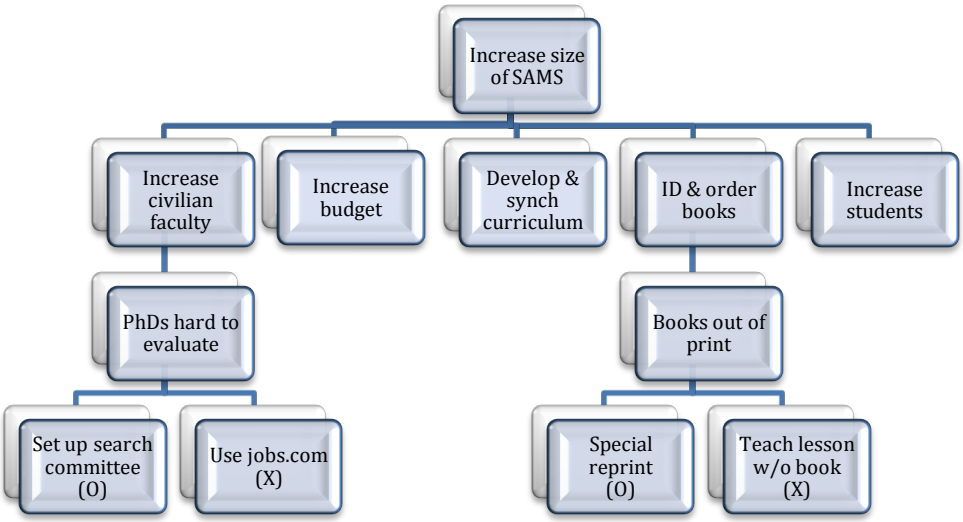
Explanation: First identify the goal; then:

Step 1: Determine the steps or phases to achieve the goal (more substeps can be added)
Step 2: Identify and branch any likely problems off each step
Step 3: Identify possible and reasonable responses off each likely problem; branch them
Step 4: Choose most effective countermeasures and build them into a revised plan



X = Difficult / impossible O = Selected

Example:



Source: (King 24) See http://en.wikipedia.org/wiki/Process_decision_program_chart; more info may be in Goal QPC, David (1994). *The Memory Jogger II or* Tague, Nancy (2004).
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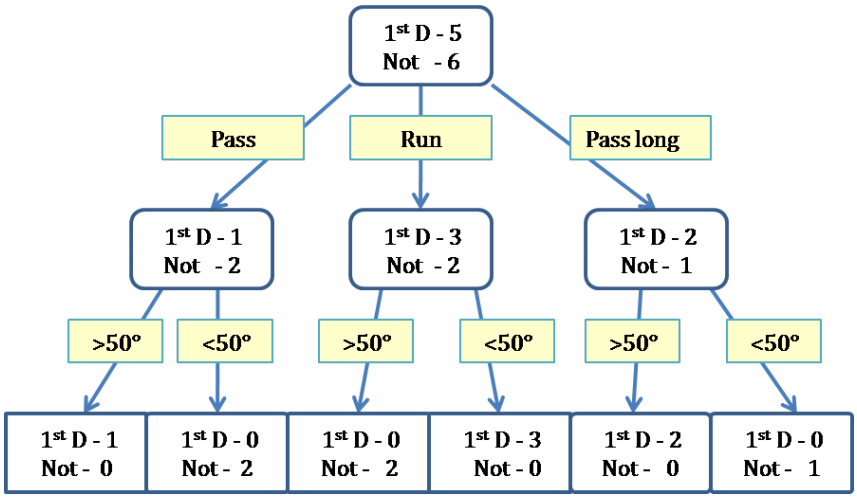
DECISION TREES

Utility: Enables you to quantify decision making; useful when the outcomes of decisions are uncertain; places a numerical value on likely potential outcomes; allows comparisons to be made between different possible decisions and shows relations to follow-on decisions.
Caveat: Probabilities aren't givens. Also doesn't clearly show dependencies among variables.

Explanation: There are various versions of decision trees, some reflecting probabilities and others the raw numbered results. Begin with known variables, and place them with their data into a matrix. Indicate the outcomes (the independent variables) for each circumstance. Start the tree with a root node showing the total outcomes, and then branch down according to the variables.

Example: The coach wants to know the likelihood of a 1st down on 3rd-and-long situations. He can pass short, pass long, or run, and he gauges the choices against temperatures > or < 50°. The record is shown on the matrix on the left. The decision tree (below) shows he has a good chance of a 1st down by running if the temp is < 50°, while he should pass if the temp is > 50°.

Play	Temp	Outcome
Pass long	20	4th down
Run	45	1st down
Pass long	95	1st down
Pass	70	1st down
Run	12	1st down
Pass	35	4th down
Run	98	Fumble
Run	30	1st down
Pass long	80	1st down
Pass	40	Intercept
Run	85	4th down



Source: (King 25) http://www.bized.co.uk/educators/16-19/business/strategy/lesson/ decision1.htm

CRITICAL PATH ANALYSIS

Utility: A standard management tool in construction or manufacturing. Shows the activities essential to a project and the order in which they must occur. Also shows which activities can happen simultaneously (in parallel) vs. which must occur in sequence. Since the CPA is tied to time for each activity, the critical path shows the shortest time for project completion. Also shows "slack" time within a project. Generally the same as a PERT diagram. More visual than a Gantt chart.

Explanation: Prepare a matrix that shows each activity in the process, the time it takes, and any relationships to other activities (e.g., must follow activity X). Then convert the data on the matrix to a diagram. Determine the critical path.

Example: Simple diagram to show time to set up a range

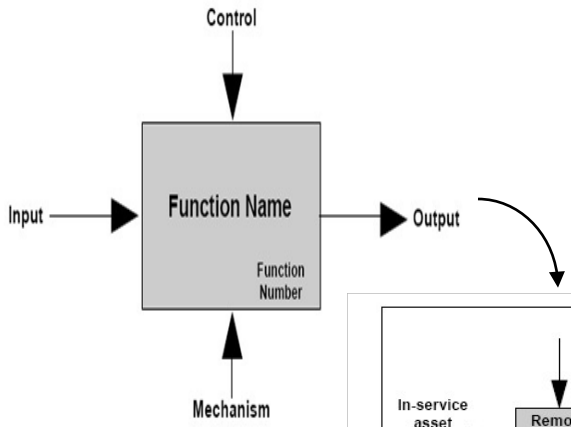
Task #	Task Description	Sequence Order	Time
A	Draw ammo at ASP		2+00
B	Take ammo to range	Start after Task A	0+30
C	Move troops to range		1+00
D	Set up tower/lanes	Start after Task C	1+00
E	Issue ammo at range	Start after Tasks B & C	0+30
F	Conduct safety brief	Start after Tasks C,D & E	0+15

Source: (King 26) See http://www.netmba.com/operations/project/pert/; http://www.bizhelp24.com/small-business-portal/critical-path-analysis-3.html; or http://www.tutor2u.net/business/production/critical-path-analysis.htm

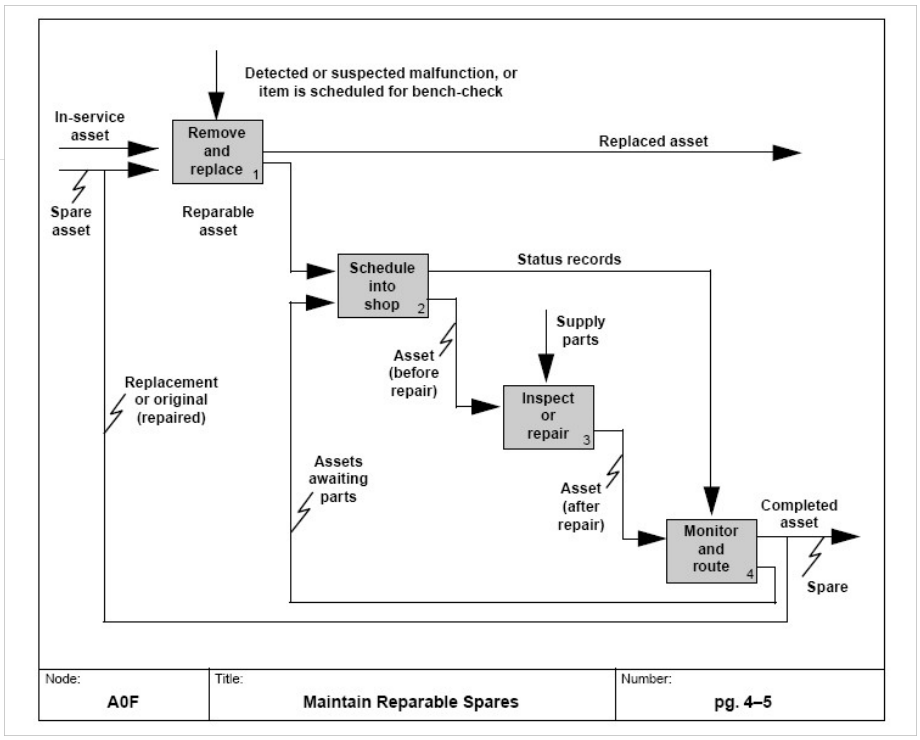
PROCESS MODELING

Utility: Builds on flowchart format to graphically reflect complex interrelationships. Helps to understand a process in order to analyze it and make improvements. Also useful for representing newly designed processes. Describes, prescribes, and explains the process. Various commercial software programs available for generating models. Models can be current (as-is) or desired (to-be). There are many types of process models.

Explanation: For IDEF0 model: show function box (at right) and the activity in the box. ID controls (things that control how we do the activity (e.g. laws, SOPs, or budgets); inputs (resources consumed or altered by the activity); mechanisms (resources required for the activity but not transformed or consumed (e.g. staff or buildings); and outputs (what is produced by the activity). Then add other activities in similar fashion to describe the entire process.
A process model generally has an activity map (below), an explanatory text, and a glossary for definitions.
Basic model. See http://en.wikipedia.org/ wiki/File:IDEF_Box_Format.jpg



Example:



Source: http://en.wikipedia.org/wiki/File:IDEF_Diagram_Example.jpg

Source: (King 27) Integrated Computer Aided Manufacturing (ICAM) IDEF0 developed by USAF in the 1970s as a function model. See http://en.wikipedia.org/wiki/IDEF0

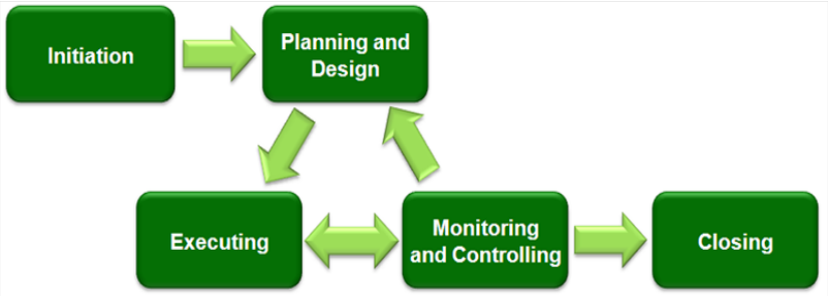
PROGRAM MANAGEMENT

Utility: To plan, organize, and manage resources to achieve goals and objectives on a project or operation. Project management differs from a process in that the former has an end state while the latter does not.

Explanation: There are a variety of approaches that fall under the general title of Project Management. A general overview can be seen at http://en.wikipedia.org/wiki/Project_management. A few examples are shown below.

Examples:

Traditional approach:

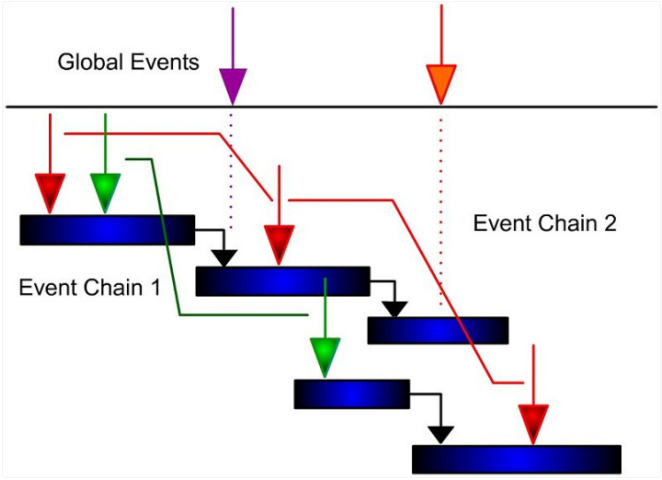


Source: http://en.wikipedia.org/wiki/File:Project_Management_(phases).png

Critical Chain Project Management (CCPM): Similar to Critical Path Method, but it assesses both most likely and safest duration estimates , determines buffers from those, and then collects the buffers at the end of the project. Duration times are "locked" and the critical chain events are closely monitored when they are active.

Extreme Project Management (XPM) is used to manage very complex, uncertain projects. Emphasizes managing stakeholders more than schedules. Embraces change and rapid feedback. See: http://en.wikipedia.org/wiki/Extreme_programming

Event Chain Methodology: See http://en.wikipedia.org/wiki/Event_chain_methodology. Based on tracking events occurring within an activity, determining which events are critical, and how critical event chains emerge. Appears with arrows (events) aligned with Gantt charts. Goes beyond CPM for event scheduling by reducing risks and scheduling biases.

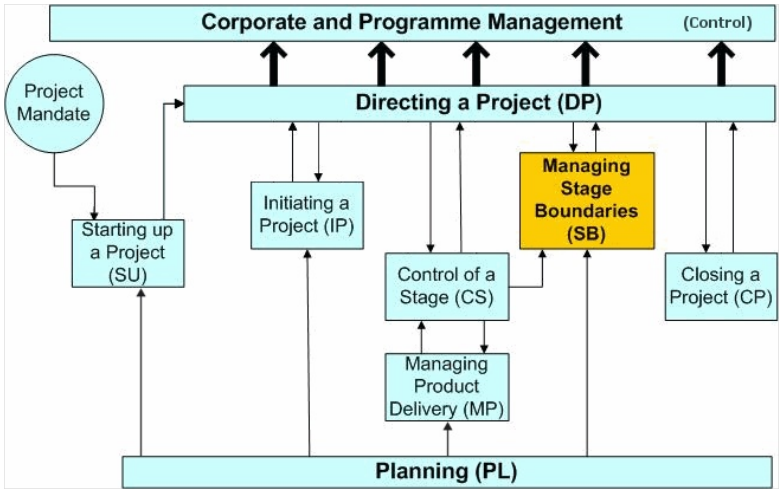


Source: (King 28) See http://en.wikipedia.org/wiki/Project_management.

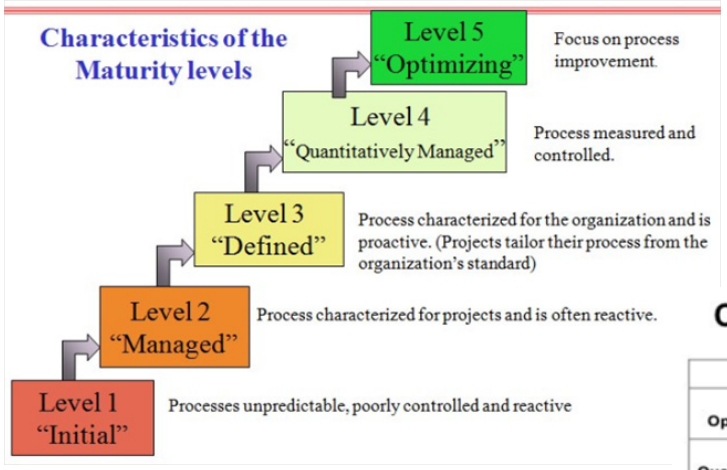
PROGRAM MANAGEMENT (CONTINUED)

Examples (continued):

PRINCE2: (Projects IN Controlled Environments; at right). A model for organizing, managing, and controlling projects. A standard for project management in the UK. Each component in the model has requirements. See http://en.wikipedia.org/wiki/PRINCE2.



Process-based Management: More for achieving a vision than directly managing projects or activities. That translates into a strategy, structure, and personnel needs from which tasks and activities evolve. CMMI (below) is one approach. See http://en.wikipedia.org/wiki/CMMI



Capability Maturity Model – Integrated

Level	Focus	Process Areas	Result
5 Optimizing	*Continuous process improvement*	Organizational Innovation & Deployment Causal Analysis and Resolution	Productivity & Quality
4 Quantitatively Managed	*Quantitative management*	Organizational Process Performance Quantitative Project Management	
3 Defined	*Process standardization*	Requirements Development Technical Solution Product Integration Verification Validation Organizational Process Focus Organizational Process Definition Organizational Training Integrated Project Management Risk Management Decision Analysis and Resolution	
2 Managed	*Basic project management*	Requirements Management Project Planning Project Monitoring & Control Supplier Agreement Management Measurement and Analysis Process & Product Quality Assurance Configuration Management	
1 Initial	*Competent people and heroics*		

Source: (King 28) http://en.wikipedia.org/wiki/Project_management

PMI

Utility: "Plus-Minus-Interesting" technique. A simple way to examine a plan in effect to determine what went well, what didn't, and what could be analyzed later, like an AAR (post facto). Also useful for assessing a course of action before execution by weighing pros and cons (a priori). Avoids pre-judging a course of action.

Explanation:

Step 1: Identify the plan or course of action
Step 2: List and score the pluses (advantages)
Step 3: List and score the minuses (disadvantages)
Step 4: List and score the interesting aspects (neither positive nor negative)
Step 5: Tally the scores; analyse the course of action; follow up on the "interesting" aspects

Example: Major Jones is trying to decide if he should apply for SAMS

Plus	Minus	Interesting
More professional education (MMAS) (+5)	Away from troop units (-7)	Might meet interesting people?
Develop network of peers (+4)	Hard academic rigor (-5)	More time in beautiful Kansas
Gain more knowledge about profession (+8)	Eyes could go bad from reading (-1)	Selective/directed assignments
Another "best year of my life" (+3)		Effect on promotion potential unknown
+20	-13	(Could score these)

There is a net (positive) score of +7 for applying for SAMS. Major Jones is therefore positively inclined to attend without any seriously negative issues being identified. Items in the "interesting" category could also be scored, though some PMI advocates say these are neither positive nor negative. In any case, "interesting" aspects are opportunities for further exploration (e.g., Who are the interesting people? What are the post-SAMS assignments?)

Source: (King 29) Developed by Edward de Bono in Serious Creativity: Using the Power of Lateral Thinking to Create New Ideas

APPENDIX C: DESIGN GLOSSARY

Adaptation "[D]escribes the ability of living systems to change in ways that help them meet the challenges of their complex world. It takes many forms (natural examples include evolution and learning), operates simultaneously over many timescales, and may be implemented via many different mechanisms… The essence of adaptation is deceptively simple– a continuously repeated cycle of *variation → interaction → feedback → selection*, or in other words: '*generate options, try them, see which ones work best and retain them*'."[1]

Analysis "Breaking down of complex wholes into their constituent parts in order to improve our understanding of them. It involves taking things apart *to see how they **do** work*".[2] See also synthesis.

Appreciation The act of estimating the qualities of things and giving them their proper value; understanding the nature, meaning, quality or magnitude of a situation.[3] Whereas facts may be analyzed (see analysis), situations requiring operational art must be appreciated.

Approach Ideas or actions intended to deal with a problem or problem situation. See also operational approach.

Assemblage A synthetic whole comprised of contingent relationships between autonomous parts. The theory of assemblages, created by philosopher Gilles Deleuze and elaborated by Manuel De Landa, is similar to the engineers' concept of a system of systems.

Attractor "A point or set of points that attracts all nearby states of a dynamical system".[4]

Campaign "A series of related military operations aimed at accomplishing strategic and operational objectives within a given time and space".[5]

Cognitive space "[A]n association of any number of actors bound by a certain shared cognitive element".[6] A cognitive space has a social element and a cognitive element. Cognitive spaces trigger organizing processes. In design, the environmental space, problem space, and solution space are three cognitive spaces that help to organize information about the environment, the problem, and the solution. A cognitive space is broader than a frame.

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[1] Mark Unewisse and Anne-Marie Grisogono, "Engendering Flexibility in Defence Forces," 14th ICCRTS, Washington, DC, 2009.
[2] Lt Col. Richard King, *Thinking Skills Resources (Draft)*, 2009, 11.
[3] United States, *TRADOC Pam. 525-5-500*.
[4] Ryan, "Foundation for an Adaptive Approach."
[5] United States, *JP 1-02*.
[6] Peverelli, *Creating Corporate Space*.

Complex "[T]he essence of complexity is related to the amount of variety within the system, as well as how interdependent the different components are." Contrast complex with complicated. See also complex adaptive system.

Complicated Containing a large number of convoluted parts. The fundamental difference between complicated and complex is where a complicated problem can be decomposed into simpler problems and solved separately; complex problems contain too many interdependencies to allow the problem to be broken into separate sub-problems.

Condition A broad description of actual or potential circumstances. See also end state.

Context The set of circumstances that surround a particular event, action or system.

Constraint "Constraints in design result largely from required or desired relationships between various elements".[7] Counter-intuitively, design constraints are an important source of creative thinking.

Design (noun) The artifacts (drawings and narratives) produced through the act of designing. See also design (verb).

Design (verb) A "method of critical and creative thinking for understanding, visualizing, and describing complex problems and the approaches to resolve them".[8] See also design (noun).

Dialog "In dialogue, there is the free and creative exploration of complex and subtle issues, a deep 'listening' to one another and suspending of one's own views."[9]

Difference Unlike or dissimilar. Contrast with identity. Difference is esssential to design because adaptation, critical thinking, discourse, divergent thinking, problematization and tension all depend on the presence of difference.

Discourse An organized way of talking, writing, and acting accordingly.[10] See also narrative, problematization.

Drawing, design Drawing produced by designers "not to communicate with others but rather as part of the very thinking process itself which we call design".[11] See also presentation drawing and production drawing.

Drawing, presentation Drawing produced by designers to communicate insights and results from designing to external stakeholders, such as the higher authority or lateral designers. See also design drawing and production drawing.

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[7] Lawson, *How Designers Think*, 92.
[8] United States, *FM 5-0*, 3-1.
[9] Senge, *The Fifth Discipline*, 220.
[10] Krippendorff, Klaus. *The Semantic Turn: A New Foundation for Design*. Boca Raton: CRC/Taylor & Francis, 2006, 11.
[11] Lawson, *How Designers Think*, 26.

Drawing, production Drawing produced by designers to communicate with stakeholders responsible for operationalizing the design, such as planners or subordinate commanders. See also design drawing and presentation drawing.

End state "The set of required conditions that defines achievement of the commander's objectives".[12]

Emergence Relationships between parts of a system give rise to novel properties that are not properties of the parts in other combinations. Emergence is both spatial (emergent properties span multiple parts) and temporal (emergence is dynamic, and as a system's relationships change, new properties will emerge).

Evolution A process of differentiation, selection, and amplification that underpins the emergence of novelty in complex adaptive systems. Evolution "is an all-purpose formula for innovation, a formula that, through its special brand of trial and error, creates new designs and solves difficult problems".[13]

Facilitation "Group facilitation is a process in which a person whose selection is acceptable to all members of the group, who is substantively neutral, and who has no substantive decision-making authority diagnoses and intervenes to help a group improve how it identifies and solves problems and makes decisions, to increase the group's effectiveness. The facilitator's main task is to help the group increase effectiveness by improving its process and structure."[14] Contrast with leadership. Facilitation can improve stakeholder engagement and the quality of design discourse.

Feedback Where the output of a system loops back and modifies subsequent inputs to the system. A negative feedback loop stabilizes the system by damping perturbations away from equilibrium. A positive feedback loop destabilizes the system by amplifying perturbations. Feedback is the underlying source of complexity, emergence, and nonlinearity. Adaptation and evolution require both positive and negative feedback loops to generate and retain novelty.

Form The visualized physical arrangement of organizations, materiel and actions. Form is the tangible expression of the design's function and logic.

Frame "A perspective from which an amorphous, ill-defined problematic situation can be made sense of and acted upon".[15] See also environmental frame, problem frame, problem situation.

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[12] United States, *JP 1-02*.
[13] Eric D. Beinhocker, *The Origin of Wealth: Evolution, Complexity, and the Radical Remaking of Economics*, (Boston, MA: Harvard Business School Press, 2006), 12.
[14] Schwarz, *The Skilled Facilitator*, 5.
[15] Martin Rein and Donald A. Schön, "Frame-reflective policy discourse," in *Social sciences, modern states, national experiences and theoretical crossroads*, ed. Peter Wagner, Carol H. Weiss, Bjorn Wittrock, and Hellmut Wollman (Cambridge: Cambridge University Press, 1991), 263.

Frame, environmental A "graphic and narrative description that captures the history, current state, and future goals of relevant actors in the operational environment".[16] The graphics may include both design drawings and presentation drawings.

Frame, problem A "refinement of the environmental frame that defines, in text and graphics, the areas for action that will move existing conditions toward the desired end state. Whereas the environmental frame focuses on actors and relationships, the problem frame focuses on tensions".[17]

Function An intended purpose for a design. The functions identified in design are always underpinned by a logic, and form follows from function.

Leadership "The process of influencing people by providing purpose, direction, and motivation, while operating to accomplish the mission and improve the organization."[18] Contrast with facilitation.

Logic The principles that guide the reasoning of an actor in a particular situation. See also form and function.

Major operation "A series of tactical actions (battles, engagements, strikes) conducted by various combat forces of a single or several services, coordinated in time and place, to accomplish operational, and sometimes strategic objectives in an operational area. These actions are conducted simultaneously or sequentially under a common plan and are controlled by a single commander."[19]

Metacognition "Knowledge that takes as its object or regulates any aspect of any cognitive endeavor".[20] See also meta-question.

Meta-question Questioning the current line of questioning. Meta-questions are used during design discourse to enhance critical thinking. See also reflective thinking, Appendix B.

Narrative "[T]ales that tellers and listeners map onto tellings of personal experience… Narratives situate narrators, protagonists, and listener/readers at the nexus of morally organized, past, present, and possible experiences… A narrative of personal experience is far more than a chronological sequence of events. In his Poetics, Aristotle discerned that narratives have a thematically coherent beginning, middle, and end… Interweaving human conditions, conduct, beliefs, intentions, and emotions, it is the plot that turns a sequence of events into a story or a history… In contrast with paradigmatic thinking, which emphasizes

[16] United States, *FM 5-0*, 3-10.
[17] United States, *FM 5-0*, 3-12.
[18] United States. *FM 6-22*, Glossary-3.
[19] United States, *FM 3-0.*
[20] John H. Flavell, "Metacognitive development," in *Structural/process models of complex human behavior*, ed. J. M. Scandura and C. J. Brainerd (Alphen a.d. Rejn, The Netherlands: Sijthoff and Noordhoff, 1978).

formal categorization, narrative thinking emphasizes the structuring of events in terms of a human calculus of actions, thoughts, and feelings".[21] See also discourse.

Nonlinear The output of a system varies disproportionately with the input. In technical terms, a system is linear if and only if $f(a+b)=f(a)+f(b)$ for all possible inputs a and b; otherwise it is nonlinear. Assuming a system is linear greatly simplifies analysis, however almost all real world systems are nonlinear.

Objective The clearly defined, decisive, and attainable goals towards which every military operation should be directed. The specific target of the action taken (for example, a definite terrain feature, the seizure or holding of which is essential to the commander's plan, or, an enemy force or capability without regard to terrain features).[22] See also planning, end state.

Operational approach A "visualization of the broad general actions that will produce the conditions that define the desired end state".[23]

Operational art "The application of creative imagination by commanders and staffs – supported by their skill, knowledge, and experience - to design strategies, campaigns, and major operations and organize and employ military forces. Operational art integrates ends, ways, and means across the levels of war".[24]

Perspective The position or point of view from which events and experiences are categorized, made sense of and explained. Stakeholders interpret the same problem situation differently because they have different perspectives.

Planning "Planning helps commanders anticipate events and set in motion the actions that allow forces to act purposefully and effectively… Planning involves projecting thoughts forward in time and space to influence events before they occur."[25]

Potential The inherent ability or capacity for growth, development, or coming into being. The potential reveals how much the propensity of the system can be changed through intervention.[26]

Problem An expression of tension between the environment and a sponsor's guidance (needs and desires). An *operational problem* is a discrepancy between the state of affairs *as it is* and the state of affairs *as it ought to be* that compels action to resolve it.[27]

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[21] Ochs and Capps, "Narrating the Self," 21-6.
[22] United States, *JP 1-02*.
[23] United States, *FM 5-0*, 3-14.
[24] United States, *JP 1-02*.
[25] United States. *FM 3-07*.
[26] United States, *FMI 5-2*.
[27] United States, *Art of Design: Student Text, version 1.0* (Fort Leavenworth, KS: U.S. Army School of Advanced Military Studies, 2008).

Problem situation Problems that cannot be explicitly stated without appearing to oversimplify the situation, ones in which the designation of objectives is itself problematic.[28]

Problem statement "[C]learly defines the problem or problem set that commanders must manage or solve. Commanders can determine the problem statement by comparing the existing conditions in the operational environment to the desired end state. It broadly describes the requirements for transformation, acknowledging the anticipated opponents and obstacles".[29]

Problematization "[T]he analysis of the way an unproblematic field of experience, or a set of practices which were accepted without question, which were familiar and out of discussion, becomes a problem, raises discussion and debate, incites new reactions, and induces a crisis in the previously silent behavior, habits, practices, and institutions".[30] "Problematization is the search for inconsistencies or incoherence in the logic of the methods or the deeper structures being applied".[31] Problematization is essential in design discourse both for drawing attention to the emergence of a crisis in the current understanding, and for recognizing the discrepancy between the current system and the desired system. See also discourse, reframing.

Propensity The organic tendency of the system, which does not account for the influence of external actions. The propensity of a system is not deterministic. It identifies a range of possible futures if the system is allowed to evolve without intervention.[32] See also potential.

Reframing "[A]lternative framing (or reframing) is seeing the situation in ways that extend beyond our normal expectations in different ways to our default settings".[33] See also frame.

Shared Understanding A common appreciation of a problem situation among a group of stakeholders, such as a design team and senior and subordinate commands. Shared understanding does not imply consensus, since the same situation may be interpreted differently from different perspectives, but it does at a minimum require all actors to be aware of the alternative perspectives.

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[28] Checkland, Peter. *Systems Thinking, Systems Practice*. Chichester, West Sussex: John Wiley & Sons, 1981, 154-5.
[29] United States, *Field Manual 5-0,Operations Process (Draft)*. Washington, DC: Headquarters, Department of the Army, 2009, 3-13.
[30] Foucault, Michel, and Joseph Pearson. *Discourse and Truth: The Problematization of Parrhē sia* 1985. Available from http://foucault.info/documents/parrhesia/. Accessed 8 December, 2009.
[31] Naveh, Shimon, Jim Schneider, and Timothy Challans. *The Structure of Operational Revolution: A Prolegomena*. Leavenworth, KS: Booz Allen Hamilton, 2009, 118.
[32] United States, *FMI 5-2*.
[33] Loughran, J. John. *Developing a Pedagogy of Teacher Education: Understanding Teaching and Learning About Teaching*. London: Routledge, 2006, 96.

Stakeholder "A person, organisation or group with an interest in or concern about something".[34] In design, key stakeholders have both high interest and high impact on the problem situation.

Strategy A prudent idea or set of ideas for employing the instruments of national power in a synchronized and integrated fashion to achieve theater, national, and/or multinational objectives.[35] Contrast with tactics.

Synthesis "Combining of separate elements into complex wholes in order to create something different. It involves putting things together *to see how they **might** work*".[36] See also system. Contrast with analysis.

System A representation of an entity as a complex whole open to feedback from its environment.[37]

System, closed A system that does not exchange matter, energy, or information with its environment. A closed system is self-contained and is not significantly affected by external influences. Contrast with open system.

System, complex adaptive An open system that changes its structure and behavior in response to external stimuli in order to increase its fitness. See also adaptation, evolution.

System, open A system that exchanges matter, energy, or information with its environment. An open system changes its structure and behavior over time, so it may respond differently to the same stimuli. Contrast with closed system.

System of systems Distinguished from large but monolithic systems by the independence of their components, their evolutionary nature, emergent behaviors, and a spatial or geographic extent that means information exchange is more important than flows of matter or energy.[38] See also assemblage.

Systemic Relating to the entire system; holistic; not localized in any one area.

Systems approach, hard: Use of precise and, when possible, quantitative techniques intended to produce one or more views and a dynamic model of the system of interest.[39] Contrast with soft systems approach.

Systems approach, soft: Use of loosely structured methods to investigate a problem situation in human activity systems from multiple perspectives in order to identify

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[34] King, *Thinking Skills Resources*, 48.
[35] United States, *JP 1-02*.
[36] King, *Thinking Skills Resources*, 11.
[37] Ryan, What is a systems approach?
[38] Maier, Mark W. 1998. "Architecting Principles for Systems-of-Systems". *Systems Engineering.* 1 (4): 267-284.
[39] United States, *Art of Design v.1.0*.

interventions that are feasible and desirable from all perspectives.[40] Contrast with hard systems approach.

Tactics: The employment and ordered arrangement of forces in relation to each other.[41] Contrast with strategy.

Tension "The resistance or friction among and between actors".[42] Tension arises from differences and can be exploited as a source of transformation.

Thinking, creative Challenges existing habits, patterns and paradigms to generate relevant responses to unique situations. See also critical thinking, divergent thinking.

Thinking, critical Deliberate, conscious and reflective evaluation of facts, assumptions and inferences from multiple perspectives in order to appreciate the consequences of actions and beliefs. See also creative thinking, reflective thinking.

Thinking, convergent "[T]he stage after the problem has been defined, the variables have been identified and the objectives have been agreed. The designer's aim becomes that of reducing the secondary uncertainties progressively until only one of many possible alternative designs is left as the final solution to be launched into the world".[43] See also divergent thinking and convergent thinking.

Thinking, divergent "The act of extending the boundary of a design situation so as to have a large enough, and fruitful enough, search space in which to seek a solution".[44] See also creative thinking, convergent thinking and transformative thinking.

Thinking, reflective "[I]n distinction from other operations to which we apply the name of thought, involves (1) a state of doubt, hesitation, perplexity, mental difficulty, in which thinking originates, and (2) an act of searching, hunting, inquiring, to find material that will resolve the doubt, settle and dispose of the perplexity".[45] See also critical thinking.

Thinking, transformative "[T]he stage of pattern-making, fun, high-level creativity, flashes of insight, changes of set, inspired guesswork; everything that makes designing a delight. It is also the critical stage when big blunders can be made, when wishful thinking or narrow mindedness can prevail and when valid experience and sound judgement are necessary if the world is not to be saddled with the expensive, useless, or harmful, results of large but misguided investments of human effort".[46] Transformative thinking bridges the gap between divergent thinking and convergent thinking.

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[40] United States, *Art of Design*.
[41] United States, *JP 1-02*.
[42] United States, *FM 5-0*, 3-12.
[43] Jones, *Design Methods*, 68.
[44] Jones, *Design Methods*, 64.
[45] Dewey, *How We Think*, 12.
[46] Jones, *Design Methods*, 66.

Tolerance The permissible range of variation for a concept, action, or outcome. The concept of tolerance enables designers to evaluate their strategic sponsor's guidance and directives in light of what is acceptable and why, and to consider design actions through a lens that encompasses a wider space for action over time.[47] Contrast with objective.

Transformation Qualitative and systemic change to a situation. See also transformative thinking.

[47] United States, *Art of Design*.

APPENDIX D: DESIGN QUESTIONS

- What observed facts and patterns are the underlying problems obstructing the way to the desired system?
- What are the possible explanations for what we see and what time/space boundaries do those explanations suggest?
- What are the sources of variety and interdependence that make this situation complex?
- What other worldviews might be relevant?
- What metaphors shape our understanding of the problem situation?
- What are the informal sources of power?
- What are the bottom-up sources of organization?
- What stabilizing dynamics maintain the current patterns of behavior?
- Where are the positive feedback loops that are capable of destabilizing current patterns of behavior?
- Where are the boundaries of my system? What can I control? What can I influence? When can I influence the system?
- What parts of the context are relevant to the things I can control and influence?
- What are the flows of energy, matter, and information that maintain the adversaries' organization?
- What are the flows of energy, matter, and information that maintain our own organization?
- What are the cross-level interactions within the system?
- What are the cross-scale interactions within the system?
- How might cross-scale interdependencies generate cascading success or failure for us or for the adversary?
- What are the relationships between what I can control and influence and the goals I want to achieve?
- What do success and failure look like?
- What are the tradeoffs and tensions between short term and long term goals?
- Are our goals clear or unclear, aligned or conflicted, abstract or concrete, too many or too few?
- What are the interdependencies between my goals?
- What tradeoffs and tensions exist between my goals?
- How do my goals nest with higher and lower command's goals?
- What are the tradeoffs and tensions between local and global goals?
- How is this system changing over time?
- What assumptions am I making about how the system will evolve?
- How can we build adaptability into our design to cope with unforeseen obstacles?
- What cultural references form the basis of the adversaries' learning?
- What is it most important to learn about during the operation?
- How can I improve learning during the operation?
- How can I learn how to learn faster?

- How do I create an environment where the organization learns from both success and failure?
- How do I recognize and learn from “near misses” in order to prevent failure?
- How do I decriminalize mistakes to promote reporting and learning from error?
- What theory of learning is most appropriate to the current context?
- What is the primary reference for our learning?
- How can I seek evidence that would disconfirm my hypotheses and assumptions?
- How can I position the force to exploit unforeseen opportunities?
- What possible unintended consequences could the operational approach generate? How would I know? How can I mitigate against unintended consequences?
- How can I build reflection into designing, planning, preparing, and executing the operation?
- What probing actions could provoke the adversary to respond and reveal information about their organization and intent?
- How can I degrade the system of opposition's ability to adapt?
- How can I capture my learning for the benefit of future operations? Who needs to know what I have learned?
- How can I build and/or mobilize the system of transformation that is working towards the desired end state?
- How can I disrupt, disaggregate, and/or isolate the system of opposition that is working against the desired end state?
- How can I exploit sources of complexity and uncertainty to disrupt and disorient the adversary?
- How can I balance exploitation of the current strategy with exploration of alternative strategies?
- How can I balance sources of competition and cooperation within the system to move towards the desired state?
- Within the system of command, what parts should be interdependent and what parts need to be independent?
- How does my organization resolve the tradeoff between integration and innovation?
- Does the current operational environment require synchronized large scale effects or decentralized effects tailored to the local context? Or both?
- How do I resolve top-down and bottom-up flows of information and control?
- What decisions need to be centralized and what should be decentralized?
- How do I manage the rate of change of my organization to maintain a productive level of distress?
- What indirect changes to the environment will help to achieve my goals?
- What observed facts and patterns of the current system are symptoms of a problem?
- What are the competing versions of ‘reality’ that we can observe in the system and where do they originate?
- What are the sources of difference between the observed system and the desired system?
- What are the sources of meaning, and ‘reality’ in this environment and what manifestations portray this logic?

- What indicators would reveal that the logic of our design has been violated?
- What emergent trends indicate that our design has transformed the environment?
- What conditions would require a reframing of the environment, problems, and operational approach?
- What emergent trends indicate the irrelevance of the existing theory and the necessity for reframing?

APPENDIX E: FEEDBACK FORM

Feedback is an essential component of any learning system. If you have experience applying design to solve real world problems, let us know how it went. Your feedback will be incorporated into the next edition of the SAMS Student Text on the Art of Design. Fax feedback to (+1) 913-758-3309 Attention: Design Course Author.

Name	Rank
Branch	Unit

Design experience

How long (years, months) have you been consciously using design?	How many times have you designed in a real world situation?
1. Most Influential Design Reference	3. Most Influential Design Reference
2. Most Influential Design Reference	Most Influential Design Mentor

What are the positives of your design experience?

What are the negatives of your design experience?

What other interesting observations have you made on design?

What recommendations do you have for the next version of the student text?

Please attach all supporting evidence (design drawings, presentations, narratives, photographs, etc.).

I want my contribution to be: ☐ Acknowledged ☐ Anonymous

I authorize the use of this information and all attached documents by the School of Advanced Military Studies for educational purposes.

Sign or Type Name	Date