THE ART OF DESIGN

A Design Methodology

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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.

—Mao Tse Tung[1]

THE PURPOSE OF THIS ARTICLE is to describe a methodology for design to account for what military designers do and how they do it when they are confronted with a complex situation. This description is a snapshot of an evolving approach that encourages critical thought, innovation, and creativity, and as such should not be taken as prescriptive or limiting. Rather, the intent is to document current best practices to provide sufficient design guidelines for successful planning to occur. This narrative describes how design informs planning and action. It then introduces the prerequisite theory needed to explain the art of design and provides a brief overview of an approach for developing a comprehensive response to a complex situation.

America's International Technology Education Association defines design as an iterative decision-making process that produces plans by which resources are converted into products or systems that meet human needs and wants or solve problems.

According to this definition, design is iterative, meaning it does not follow a linear sequence, and it does not terminate just because a solution has been developed. Because design can be used to produce systems, not just products, and is applicable to the spectrum of human needs and wants, design is both extremely general and ubiquitous in nature. The definition implies that design is focused on solving problems, and as such requires intervention, not just understanding. Whereas scientists describe how the world is, designers suggest how it might be.[2] It follows that design is a central activity for the military profession whenever it allocates resources to solve problems, which is to say design is always a core component of operations.

As a professional intellectual activity, design requires both practical experience and theoretical support. Mastery of a profession can only come through mentoring, coaching, and experiential learning as a member of a community of practice, in addition to the appropriate academic development of a leader throughout the course of a career. The School of Advanced Military Studies (SAMS) has been fostering an experiential learning environment to create a holistic approach for the art of design. Our approach to educating by design is described in a companion article, "Educating by Design," in this issue. In addition to studying military theory, history, and doctrine, SAMS students

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PAINTING: Takeda Shingen (left) versus Uesugi Kenshin (right) at the battle of Kawanakajima, Nagano, Japan, 1561 C.E. Shingen was one of Japan's greatest operational artists. He used Sun Tzu's *The Art of War* to train his commanders in a holistic appreciation of operations, and his great standard displayed calligraphy for "Wind, Forest, Fire, and Mountain," from Sun Tzu. It referred to the Takeda motto taken from *The Art of War:* "Swift as the wind, silent as a forest, terrible as fire, and immovable as a mountain." The words embodied Shingen's policies and philosophy.

learn through large-scale exercises and interactive class activities; evaluate design theory across multiple professions; participate in critical discursive reviews; and contribute to discourse by completing a research monograph that may focus on any aspect of their education. At SAMS, we believe the art of design is a way of thinking more than it is a theory, process, or product.

Even though the design of military operations is informed by design practices of other professions, it is essential to account for the unique situations encountered in the extremes of conflict environments. In no other context does the influence of the adversary feature so centrally in design. Combat operations must account for the role of chance and friction, which Clausewitz noted makes even the simplest things in war difficult.[3] A philosophy of design tailored to military operations, called systemic operational design, has been developed within a largely verbal tradition by retired Israeli Brigadier General Shimon Naveh.[4] A recent article in Military Review by retired U.S. Army Brigadier General Huba Wass de Czege explains the relevance of design to the U.S. Army.[5] Since 2005, SAMS has been closely involved with evaluating these concepts as part of its holistic approach to the art of design. Systemic operational design provides an important foundation for military design, even if some members of our community of practice have struggled to employ many of its intricacies when faced with real-world problem situations.

Through teaching and exercising design, SAMS has linked a number of broad theories with practice, which has provided insight into some of the obstacles to the successful application of design to military operations. One obstacle is that the U. S. Army already has widely accepted and well documented methods for planning complex operations. For design to be useful in the military domain, it must complement and interact with existing planning doctrine. This means the interface between design and planning needs to be clearly specified. The companion article, "Educating by Design," describes the design-plan interface in detail, including a proposed format for a planning directive. Another obstacle is that a methodology for design has not been described in any detail. Wass de Czege rightly declares that there is no formulaic way of presenting design.[6] But a philosophy of design by itself is too broad to function as a guideline for action. What is needed lies between the rigid precision of a technique and the abstract wisdom of a philosophy. Peter Checkland notes that "while a technique tells you 'how' and a philosophy tells you 'what,' a methodology will contain elements of both 'what' and 'how.'"[7]

Employing Design Thinking

Design, planning, and execution are interdependent and continuous activities as illustrated in Figure 1. Design interfaces with planning in one of three basic ways. First, it can precede planning. The commander may choose for his staff to engage in the planning process after a design has been developed. In this approach, design provides guidance to begin planning. Second, design and planning may occur at the same time. Design and planning then interface throughout the doctrinal planning process with design informing planning. Third, the need for design may emerge while executing ongoing operations. In this case, the commander determines a need to use design when the complexity of the situation demands it. In all three cases, design is initiated because there is something inexplicable in the operational environment that requires a new appreciation and a perceived requirement to act. Design is depicted in Figure 1 as a separate layer,

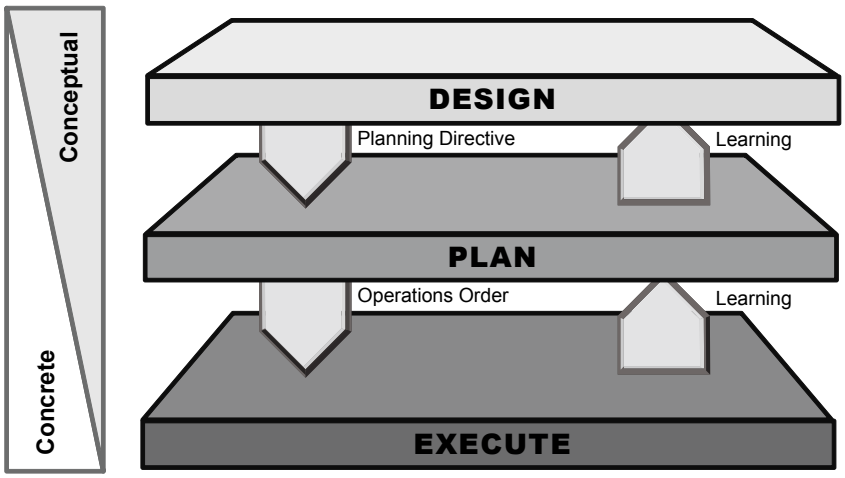

Figure 1. A layered architecture for design.

because a layered architecture is a useful way to separate activities that occur at different levels of abstraction. Layers provide loose coupling, meaning that planners do not need to know the details of what the designers are doing, so long as they agree on the design-plan interface. This interface is the planning directive that communicates the design to planners, as well as all the feedback from planners to the design team. Design does not conclude when the planning directive is issued, because ongoing feedback is essential to iterative learning, and enables future reframing of operations.

Key Design Concepts

The language of design continues to evolve. In order to transition from theory to practice, an effort is underway to simplify the language of design as much as possible, so that it is accessible to the field. A major criticism and stumbling block in moving design forward has been an inability to define terms and use ordinary language. This article draws on both the current SAMS design language, and choices made towards a simplified lexicon during a recent design development meeting hosted by the Combined Arms Doctrine Directorate (CADD) at Fort Leavenworth, Kansas.[8] To avoid confusion, we define and reference those terms that have a specific meaning for the art of design. These include *problem situation, frame*, *reframing*, and *reflective thinking*.

Problem situation. The reader may be familiar with a number of different terms used to describe problems that are difficult to understand, such as complex problems, ill-structured problems, wicked problems, and messes. Although these terms can be a useful reminder of the dangers of simplistic solutions, they all share a common assumption. By categorizing problems into different types—for example, well-structured, medium-structured, and ill-structured—they imply that problems exist in the world and can be discovered, recognized, and classified by problem solvers.

Our approach to design makes a different assumption. We assume that design occurs in the context of situations, not problems. Designers determine their own purpose; therefore they set their own problems. When they solve the problems they have set, they will have a new situation and can set new problems. Progress may be more reliably assessed by comparing the new problems that are set to the old ones than by directly evaluating solutions. To reflect this difference, we prefer the phrase *problem situation*, which was coined by Checkland. Problem situation refers to problems that cannot be explicitly stated without appearing to oversimplify the situation, ones in which the designation of objectives is itself problematic.[9] For simplicity we may refer to a singular problem, but it should be understood that, in general, military operations will be conceived as a series of interlocking subproblems requiring trade-offs and compromises for their collective resolution.

Framing. According to Martin Rein and Donald Schön, a frame is a perspective from which an amorphous, ill-defined problematic situation can be made sense of and acted upon."[10] Every human perspective has limitations, and at the same time, each varying perspective is important in seeing all facets of a problem. Just like framing a photographic shot, the choice of a conceptual frame will bring certain issues into focus while deliberately blurring distracting peripheral issues, and leaving most issues out of the frame entirely. The language we use to categorize and structure the world shapes our perspective—naming is framing.[11] Whether a conflict is labeled as terrorism, insurgency, civil war, ethnic cleansing, sectarian violence, or revolution will shape attitudes and expectations, the problems people see, and the solutions that are considered.

Reframing. Reframing is an intellectual activity to identify new opportunities and overcome obstacles to progress when interactions with the real world situation or new sources of information reveal issues with a current problem. Reframing shifts attention from trying to solve the current problem right to asking whether the right problem is being solved. It is a way for designers to pull back and reassess the operational environment, allowing them to challenge their situational understanding and review expectations of actor behavior against the evidence.[12] When operators consciously and critically select theories and hypotheses that help to structure their view of reality, they gain the freedom to operate beyond the limitations of any single perspective.

Units already implement many adaptations during operations, learning new tactics and approaches to overcome unexpected obstacles. Reframing is a more challenging and deeper extension of this natural capacity to adapt. It requires letting go of ideas

that worked in the past, which Liddell Hart observed is even harder than adopting new ideas.[13] Reframing requires space to think and reflect, and is unlikely to occur under time pressure. It is underpinned by critical thinking, since it requires appreciating the values, perceptions, and biases of ourselves, allies, and adversaries. Critical thinking is also necessary to choose between competing explanations of events, to ensure that hypotheses within a frame are weighted in proportion to the evidence, and to assess second- and third-order effects.

Doctrine discusses the use of measures of effectiveness during planning to assess progress, and these measures may identify the need to reframe in the light of experience. However, standard measures of effectiveness may no longer be sufficient since they are constructed within a frame. A successful design necessarily transforms the environment and changes its nature. Institutions have strong motivation to reflect and reframe following failure, but they tend to naturally resist change when recent actions have been successful. To guard against complacency, it is important to maintain the design layer during planning and execution, to question the current understanding and reframe in response to environmental changes and new knowledge. Reframing is the most difficult—but most important—element of design.

Reflective thinking. Reflective thinking draws on research in developmental psychology on the topic of metacognition. Metacognition is defined as "knowledge that takes as its object or regulates any aspect of any cognitive endeavor."[14] This involves two separate kinds of knowledge. The first is knowledge about cognition—what do I know, what cognitive abilities do I have, and how does this help me to learn about the situation at hand? The second is knowledge about how to regulate and control cognitive activity—how do I avoid falling into common cognitive traps, and how should I balance my cognitive resources among understanding the environment, the problem, and the solution? Designers need both types of metacognitive knowledge to become reflective thinkers. Through reflection, designers can continue to improve both their knowledge of their own ability and their capacity to regulate the cognitive focus of themselves and their team.

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SAMS uses meta-questions as an integral part of the design activity to improve reflective thinking. Meta-questions function as probes to determine the depths of the current understanding of the system; to consider second- and third-order effects of action; to introduce alternative perspectives that may challenge the established relationships and mental models of the situation; and to help create the narrative that explains the systemic logic of the operational environment. For example, when directed to prepare a brigade-sized counterattack, many staff officers will immediately inquire about the timing, location, and logistics of the mission. Instead of these typical planning questions, meta-questions within design might ask:

- What infrastructure damage could the counterattack incur?
- How would that impact on the different actors and tribal groups in the region?
- Are we creating a disaffected minority by upsetting the power balance, risking a refugee crisis that would overwhelm the regional humanitarian capacity, or create other unintended consequences?

More generic meta-questions include:

- What is the logic of the guidance?
- What are the sources of legitimacy of the different power bases within the enemy's social system?[15]

A Design Methodology

This section provides a simple, logical account of the current design methodology at SAMS. Design as practiced is a creative activity, which draws freely on terminology and a variety of theories unique to an individual problem situation. Whereas our description of design methodology needs to be logical and orderly to be comprehensible, design practice can be much more flexible in implementation. Design is a non-linear, interactive, and continuous cognitive activity. The reader should bear in mind the limitations associated with a linear presentation of a creative and iterative activity. We begin by describing

the starting criteria, the output of design, and the three cognitive spaces of design. The detailed elements of design are then explained.

As described above, design begins when the commander is faced with a problem situation and a perceived requirement to act. Once a design team has been formed by the commander to help him understand the situation, it needs to ask:

- Why has this situation developed?
- What does it mean?
- What's the real story here?

These questions provide a starting point for learning about the operational environment. The design team must review all relevant directives, documents, data, and previous guidance, considering implicit as well as explicit sources. As early as possible, the design team needs to start a conversation with its higher authority or the issuing authority to ensure that guidance is clearly understood at both levels. The team should acknowledge guidance that is clearly understood, seek clarification of guidance that is unclear, seek understanding of contradictions and conflicts between guidance and other sources of information, inform the higher authority of new information or of any difference in understanding of the environment, and confirm the desired state or end conditions for the situation.

The output of design is a planning directive. This draws on the three primary artifacts produced during design, described in greater detail below: an environmental frame, a problem frame, and a design concept. These artifacts capture the shared understanding of the environment, the problem, and its broad solution. The planning directive communicates these products in a form that is tailored to the needs of planners. SAMS is actively experimenting with new methods for effectively communicating the products of design in both narrative and graphical forms. Experience and practice are required to master effective design-communication techniques. There is no standard template or checklist flexible enough to encompass the variety of products needed to communicate the results of design, so SAMS encourages the creative use of both written narratives and graphic portrayals of design thinking to transmit ideas.

Design can be thought of as taking place within three cognitive spaces: the operational environment, the problem, and the solution (see Figure 2).[16] They correspond to three basic questions designers must answer to produce a successful design—

- What is the context in which the design will be implemented?
- What problem is the design intended to address?
- How will the design resolve or manage the problem?

While these spaces can be conceptually separated, they cannot be separated in practice, because designers need to have the freedom to cycle repeatedly between exploring the operational environment, the problem, and the solution. Developing the three spaces iteratively and concurrently allows a coherent understanding to emerge that relates the solution to the problem within the context of the environment. Inexperienced design teams may uncritically accept the initial presentation of the problem and move on with solving the problem, only to discover after detailed effort that their solution is irrelevant because they did not actually identify the true problem. Meta-questions can help to avoid this natural tendency. At the other extreme, some seminars have struggled trying to fully understand the environment.[17] These teams eventually learn that moving among the operational environment, problem, and solution spaces takes their learning to a higher

Figure 2. The three design spaces.

level by revealing the interactions and relationships between the spaces. Leaders must carefully monitor and balance the amount of time spent in each space as teams proceed through design.

The Elements of Design

The elements of design include understanding the operational environment, setting the problem, creating a theory of action, working the problem, developing a design concept, and assessment and reframing.

Understanding the operational environment. Comprehending the operational environment in design requires conceptualizing the environment as a system. This representation is called an environmental frame. The environmental frame is a graphic and a narrative that captures shared understanding of the history, current state, and future goals of relevant actors within the operational environment. It emphasizes flows and relationships between the actors and identifies the propensity of the environment to exhibit patterns of behavior within certain limits (Figure 3). The environmental frame bounds the inquiry and needs to be larger than the design team's direct area of responsibility so that it includes the operational context. Boundary setting must also include areas that go beyond the tangible domain. During environmental framing, boundaries will expand and contract as learning occurs.

The design team needs to understand the current state, history, and future goals of each actor within the operational environment. The team can use all forms of reference, including available doctrinal resources, which help explain the operational environment. Mapping and exploration of this space can include the cultural and historical narrative; U.S. policies; system propensity;[18] system potential;[19] system tensions;[20] strategic, regional and local trending; contingent relationships; and consideration of the dimensions of time, space, and cyberspace. The object of environmental framing is to set a boundary for the inquiry and ask what is new or different in the emerging context that implies the current level of understanding is no longer sufficient to comprehend and explain the problem. Leaders will bound the scope and resolution of the inquiry as learning evolves and, as a result, will determine which actors will be considered and which organizations, communities and factions sharing similar goals, values, and behavior will be examined more closely. These include, but are not limited to, states, multinational corporations, regional alliances, international terrorist organizations, and individuals. Understanding the environment as a system means thinking about the relationships between actors. The patterns of conflict, alliances, competition, and cooperation between the actors are more critical to environmental framing than the particular details of the individual actors.

Setting the problem. Even though design is highly iterative, for complex situations the design team will be unable to clearly state the problem until they have a mature environmental frame. Understanding the dynamics of the operational environment helps to explore beneath the initial symptoms towards the root causes of conflict. When the design team has a satisfactory explanation of why the situation developed the way it did, it can craft an initial problem statement. FM 3-07 articulates the principle that the purpose of friendly interventions in the present is to shape a better future.[21] We use the term *"desired system"* to refer to the friendly vision for a better future. The problem statement is defined as a summary of the difference between the propensity of the environment and the desired system. The problem statement is a bridge between the environmental space and the problem space.

Potential Considerations

Historical Context
Cultural Narrative
Boundaries
PMESII-PT
DIME
Contingent Relationships
Alliances and Coalitions
Trends
Conflicts
Points of Disequilibrium
Current System
Desired System
System Potential
System Propensity
System Tensions
Domain Exploration (Physical, Moral, Cognitive, Cyber)
Dimension Analysis & Synthesis (Use of Time & Patterns of Space)

Figure 3. Within the operational environment space an environmental frame is constructed.

It is a restatement of the higher authority's current guidance in light of the deeper understanding obtained during the evolutionary learning and development of the environmental frame. The vision of the desired system needs to be feasible and within an acceptable level of risk, given the available resources and the current understanding of the operational environment.

Creating a theory of action. The theory of action is the complement of the problem statement. A theory of action is a hypothesis. The problem statement sets the problem—the theory of action is a simple and suggestive insight about how to solve the problem. It is a creative spark that inspires the design team, provides focus to maintain coherence of the design effort, and acts as the foundation for strategic communications. The theory of action combines identification of positive or reinforcing actions (to support or exploit recognized opportunities) with action to overcome anticipated resistance (to mitigate recognized vulnerabilities) in order to realize the shared vision. The theory of action does not specify the detailed solution—this is developed within the solution space—but it must be consistent with it. Figure 4 summarizes the problem statement and theory of action design elements.

Working the problem. The problem frame, illustrated in Figure 5, is a refinement of the environmental frame that defines, in written and graphical form, the areas for intervention. Intervention may focus on aspects of the actors within the environment, but usually it also requires changing the way actors relate to one another.

To develop a deeper understanding of the practical implications of changing patterns of behavior, problem framing constructs a detailed map of the parts of the environment where intervention is needed to resolve the problem statement. Detailed analysis includes identifying all of the actors that are influencing or have the potential to influence the problem. One must determine each actor's behavior in terms of composition, role, motivation, intentions, and mode of operation to include the actor's support structures. Actors belong to different groupings within the environment and will behave differently depending on the context of an event. It is of fundamental importance to examine and understand organic relationships of the actors and contingent relationships outside of their community.

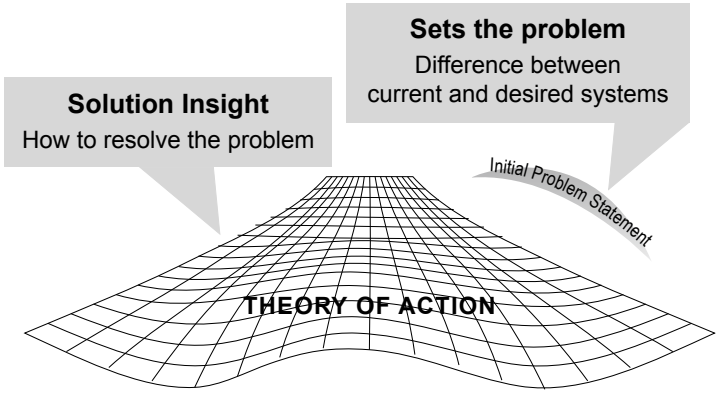

Figure 4. Problem statement and theory of action.

Within the problem, environmental propensity, potential, and tensions are examined once again. SAMS practical exercises have demonstrated the utility of examining these three concepts for focusing on areas within the environment that require intervention. Propensity helps set a baseline for understanding how the environment is expected to behave. Determining realistic potential helps confirm what range of desired future behavior is in the realm of the possible and what tensions must be mitigated or enhanced to achieve the desired system.

The environment is characterized and animated by tension. Identification of tensions is important

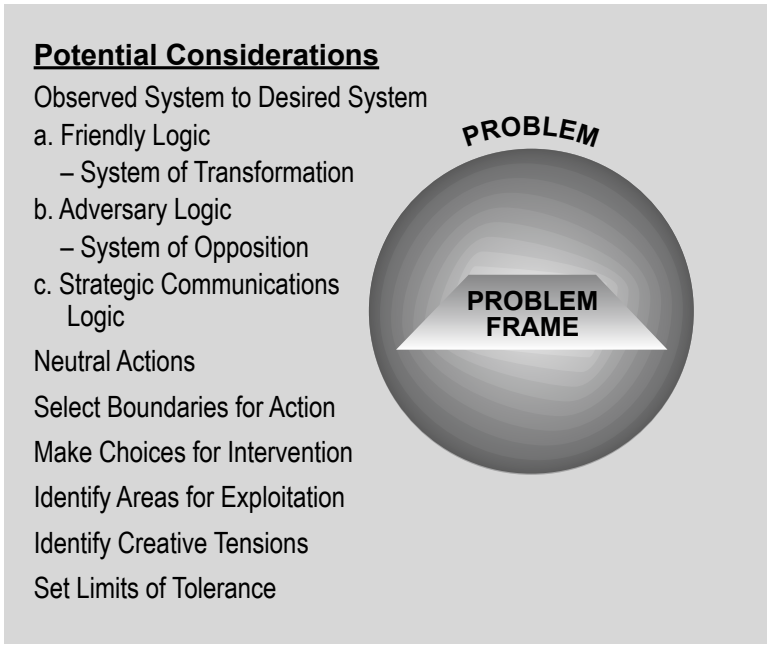

Figure 5. Within the problem space a problem frame is constructed.

for several reasons. Tensions offer opportunities for exploitation and provide insight into how actors learn and how the environment evolves. Interactively complex systems contain regions of stability that mask intricate underlying feedback networks. These systems cannot be understood by passive observation. Tensions provide a way to obtain a deeper understanding of interactively complex systems. Tensions exist in the physical realm and also at the meta-level—that is, within the meaning of things. Tensions within the environment can act positively to move the system closer to the friendly, desired system, or they can act negatively to transform it towards a competitor's desired system. The combination of friendly, enemy, and neutral actions moving the environment towards the friendly desired system forms the basis for a system of transformation. Likewise, the combination of enemy, friendly, and neutral actors' actions pulling the environment towards the enemy's desired system forms the basis for a system of opposition. It is important to note that there will always be asymmetries between the system of opposition and the system of transformation. Awareness and analysis of the difference provides insights into behavior and relationships, furthering an understanding of friendly and adversary logic and why components within the environment behave in ways that the design team members may have a hard time recognizing in relation to their own cultural references or logic. There will also be tensions identified where there is not enough information to determine positive and negative implications. These tensions provide areas for further exploration and identify areas where intervention may be considered to stimulate the environment and observe how it responds.

Often systems of collaboration and systems of opposition create tensions by competing for support or attempting to influence the same population or circumstances within the operational environment. Identification of these convergent points and relationships help illuminate the true problem. As understanding of what to act on develops, the parameters for relevant intervention become clear. Practical experience with problem framing indicates that the initial understanding of the problem gained while developing the environmental frame is usually revealed as incomplete, and may be partially invalid. The design team should repetitively review and refine the environmental frame and the initial problem statement to maintain coherence with the problem frame.

Developing a design concept. The problem frame articulates what the problem is by identifying the areas of the environment that need to change. However, it does not guide planners on how to resolve it. The theory of action provides a focal direction, but does not say how the areas for intervention interact. A design concept that resolves or manages the problem within limits of tolerance over time needs to organize interventions as patterns in space and time. The design concept is usually expressed as a strategy[22] with a set of interdependent and mutually reinforcing lines of effort.

While developing the problem, analysis identifies the positive and negative implications of tensions within the system. When developing the solution, synthesis is required to create a coherent strategy of intervention. The goal is to exploit the transformative potential of the system's tensions while mitigating negative consequences of instability and change. Shifting emphasis from analysis to synthesis has implications for team dynamics. SAMS design teams will almost always organize into parallel smaller working groups to analyze the details of the environmental frame and problem frame. Such an approach cannot be applied to synthesis. Instead, the whole design team considers how to orchestrate the intervention to resolve the problem in accordance with the theory of action.

Once the broad strategy of intervention is agreed to, individual lines of effort can be developed. One way to exploit tensions, as explained in joint doctrine, is to identify the capabilities and vulnerabilities resident in the system of opposition. The team begins to discover ways to neutralize capabilities and to exploit vulnerabilities. The same approach applies to tensions with positive implications. Some positive tensions can be left alone as they are already effectively supporting the move toward a friendly desired system. Other positive tensions may need reinforcement or modification to best change behavior towards the desired system.

Intervention can take many forms and is specifically not limited to actions taken against a recognized enemy. It is the combination of all actions taken to deny the system of opposition and support the system of transformation in reaching their objectives. For example, intervention could include engaging an

ally to change a national caveat, changing a policy, or using an adversary's logic against himself.

Before determining the broad recommendations for intervention, the design team must consider both risk and resources. There are always risks to any intervention and these must be clearly determined and possible mitigation identified. Planning will determine the exact resources required but in the solution there will be resources identified as critical for enabling intervention to address the correct problem. Not all of the necessary resources will be directly controlled by the organization. The art of design requires exercising indirect influence in addition to control to persuade other actors of the mutual benefits of implementing the design concept. This is easier to achieve if all stakeholders are part of the design team from the outset. This way they can build trust and leverage their different perspectives.

In the face of uncertainty, the capacity to adapt postures the force to exploit new opportunities as well as manage the risks of a changing environment. A design concept that allocates resources to learning and adaptation can better respond to unforeseen challenges and maintain relevance. The key to adaptive action is collecting and interpreting feedback from designed interventions, so that success is recognized and built upon. The design team should endeavor to make every action an organizational learning opportunity—for each intervention, assess its effect, decide whether changes are needed, and ensure that the changes get implemented. Maintaining the design layer during planning and execution provides additional learning capacity.

Once again, the design concept is communicated in narrative text and graphical form (see Figure 6). The design concept is still broad relative to the detailed courses of action that planners will develop and analyze, but provides a construct for planning to begin. There is a transparent logic linking the design concept with the problem frame and the environmental frame. This means that when the operational environment changes, it is easier to assess the implications of the changes.

Assessment and reframing. The duration of extended operations in complex situations makes it likely that aims will change during execution. Such change is expected from a complex system, which will change not just while we are interacting with it, but *because* we are interacting with it. A key to our ability to adapt to changes in the environment is recognizing changes as they occur. FM 6-0 discusses the concept of variances, which are differences between the situation we encounter during operations and the one that we expected when developing the plan. Both commanders and staffs use recognition of these variances to identify times and places where they might make adjustments to operations in order to better achieve goals or to defend against developing risks. Identifying these differences when conducting operations leads naturally to assessing whether our plan is valid or requires adjustment. In planning, the staff develops what latest draft of FM 5-0 calls measures of effectiveness to help identify these variances, and then articulates these in orders to ensure that systems are established to identify and report those variances.

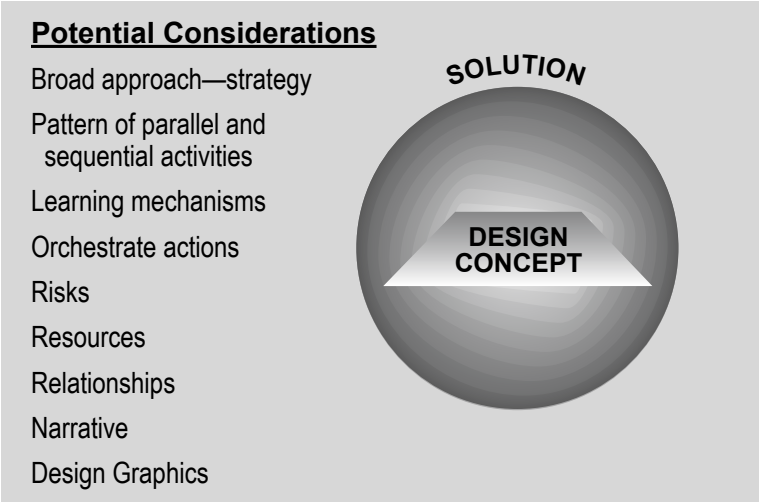

Figure 6. Within the solution space a design concept is developed.

Not only does the situation change, but the limitations of any one perspective for understanding a complex system means that learning about the system from within the frame is also limited. This insight is best captured by a quote attributed to Albert Einstein: "The significant problems we have cannot be solved at the same level of thinking with which we created them." Because of this, the ability to reframe as a result of interacting with the environment is even more important than the quality of the initial design.

Summary and Conclusion

Design provides commanders with an additional layer of understanding for incomprehensible problem situations that promote conscious problem-setting and critical reflection. Designers develop an environmental frame, problem frame, and design

concept to describe graphically and textually the operational environment, the problem, and the solution. The commander is an active participant in every phase of design. In practice, design progress is neither smooth nor orderly, it is iterative and recursive as problems and solutions emerge, new experiments are conducted, consequences are evaluated, obstacles are overcome, and old problems are reframed.

The SAMS design methodology is summarized in Figure 7.[23] The design team develops theories and organizes information within three spaces. The environmental frame is the product that depicts the current state and trajectory of the actors and the propensity of the conflict situation. The problem statement provides a bridge to help transition between understanding the environment and the problem. The problem frame identifies what needs to be changed to realize the desired system as articulated within the problem statement. The design concept specifies the pattern of parallel and sequential activities that are required to move towards the desired system. The theory of action is a simple, unifying, higher level statement that binds together the three cognitive spaces and maintains coherence throughout the design effort. All of the design effort to explicitly frame the environment, problem, and solution is performed to enable the ability to reframe—to shift perspectives and reset the problem as circumstances change and new knowledge is created.

It is hoped that our account of the SAMS methodology for the Art of Design will have utility not only for SAMS students, but more broadly to the operational force as it confronts complex situations that cannot be fully addressed with existing doctrinal techniques. We will continue to evolve our design methodology through exercises and experiments, incorporating innovations and feedback from the field. SAMS will work closely with the Combined Arms Center's Combined Arms Doctrine Directorate (CADD) on the upcoming interim field manual on design, and continue to foster links with other U.S. Army design stakeholders. Internationally, ongoing relationships are being established with allies, such as the collaboration with the Australian Army and the Australian Defence Science and Technology Organisation to exploit complementary advances between adaptive campaigning and the art of design. Upcoming design work will test current thinking on the design-plan interface, assess key components of our design methodology, and capture student learning and innovations. To enable continued improvement in the practice of design, we will develop and maintain a suite of tools useful to design and a library of example products. The last two years have seen rapid advances in the theory and practice of design. The near future promises even greater change, as the design community of practice expands and design is codified into U. S. Army doctrine. ***MR***

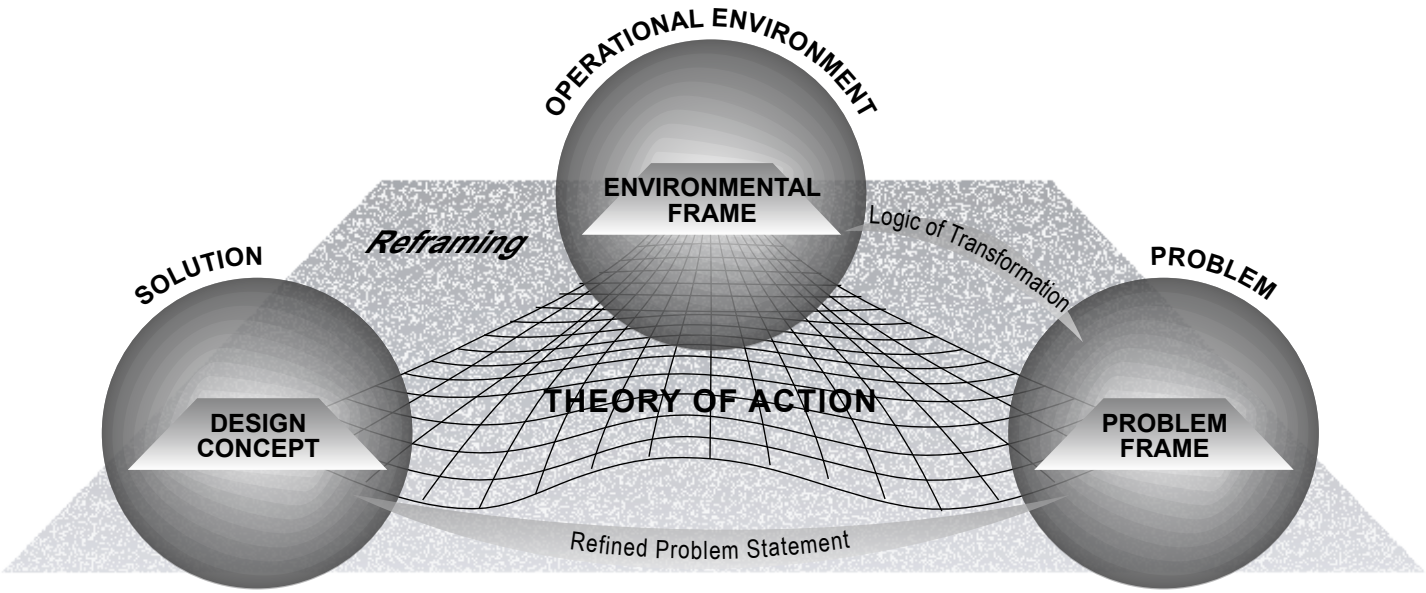

Figure 7. Elements of design.

NOTES

1. Mao Tse-Tung, "Problems of Strategy in China's Revolutionary War," December 1936, in *Selected Military Writings of Mao Tse-Tung* (Peking [sic]: Foreign Language Press, 1968) 77.

2. Bryan Lawson, *How Designers Think: The Design Process Demystified* (Amsterdam: Elsevier, 2007), 112.

3. Carl von Clausewitz, *On War,* trans. and ed. by Sir Michael Howard and Dr. Peter Paret (Princeton, NJ: Princeton University Press, 1984), 119.

4. See for example, Shimon Naveh, "Operational Art and the IDF: A Critical Study of a Command Culture," Center for Strategic & Budgetary Assessment (CSBA) (September 30, 2007), written for the Director of Net Assessment, Office of the Secretary of Defense, Contract: DASW01-02-D-0014-0084.

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

6. Wass de Czege, 6.

7. Checkland, *Systems Thinking, Systems Practice* (John Wiley & Sons: Chichester, 1981), 162.

8. The Commander's Appreciation and Campaign Design Integrated Concept Team; Field Manual Interim Development Meeting, 5-6 February 2009, brought together representatives from CADD, ARCIC, SAMS, AWC, ARCENT, and Booz Allen Hamilton to form an Integrated Concept Team for developing a field manual on design.

9. Peter Checkland, *Systems Thinking, Systems Practice* (John Wiley & Sons: Chichester, 1981), 154-55.

10. 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.

11. Tim Challans, personal communication. See also Rein and Schön, 270. This insight has implications for the insufficiency of doctrine, insofar as doctrine promotes a standardized lexicon, which necessarily inhibits the ability of officers to reframe.

13. "…the real challenge is not to put a new idea into the military mind but to put the old one out…" Sir Basil Liddell Hart, *Thoughts on War* (Faber & Faber: London, 1944).

14. 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).

15. The last two meta-questions are courtesy of retired Brigadier General Shimon Naveh, OTRI Lecture Notes.

16. The operational environment space, problem space and solution space are called spaces because they are all highly multidimensional. Conceptually, it is useful to maintain three separate spaces, so that the information on why the environment behaves the way it does, what needs to be done, and how to do it can be organized differently. Whereas steps in a process form a linear sequence, spaces do not imply a time ordering.

17. Feedback from Rick Swain is representative of a number of observations consistent with a tendency to get trapped in system framing: "You can't just let the discourse go on and on—it has to be managed by the commander or chief of plans." Faculty after action review, midway through Design Practicum 2, 12 December 2008.

18. Propensity is the natural inclination or tendency of a system. Francois Jullien, *A Treatise on Efficacy: Between Western and Chinese Thinking*, trans. Janet Lloyd (Honolulu: University of Hawai'i Press, 2004.16.

19. Potential is the inherent ability or capacity for growth, development, or coming into being. Jullien, 16.

20. Tension is a strained relationship between individuals, groups, nations, or elements of the system. Booz Allen Hamilton, 62.

21. U.S. Army Field Manual 3-07, *Stability Operations* (Washington, DC: U.S. Government Printing Office, 2008), para. 4-13.

22. Here, we mean "small 's'" strategy, that strategy which exists for all commanders independent of their level of war.

23. Note that this is not a process diagram—it does not represent a sequence of step-wise activities. Rather, the figure shows how the elements are interrelated and fit together to produce a coherent design.

THE RETURN

Doves knock dates on my head
As I walk under the palms
A flutter of wings as they
Fly off into the desert sky.
The west walls crumble
In front of the setting sun,
Stained pink with light
As they contain me within the prison of our own making.
My hands grow cold in the December air.
I breathe into them to warm them from the chill.
It's quiet.
Again.
No gunfire tonight
No explosives today.
For now, the helicopters shuttle only boredom; the cries of the wounded no longer on board.
Iraq is different now.
Not like before…

—MAJ Theodore E. Lockwood II