B-1B Lancer assigned to 28th Bomb Wing, Ellsworth Air Force Base, South Dakota, undergoes preflight maintenance at Andersen Air Force Base, Guam, September 25, 2020, while participating in exercise Valiant Shield (U.S. Air Force/Nicolas Z. Erwin)

Design Thinking

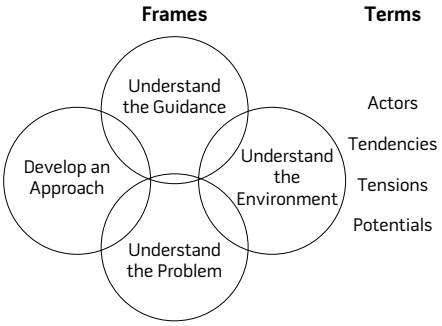
By Daniel E. Rauch and Matthew Tackett

The COVID-19 pandemic is a poignant example of a rapidly changing operational environment (OE). The virus's spread has caused chaos in almost every personal and public sector throughout the world. Facts were sometimes slow to emerge, emotions were high, and conspiracies ran rampant. Political guidance from all sides shifted and was perceived as reactive by some parties. If given the vital responsibility, how would you approach the task of leading the planning effort for the *next* pandemic? How would you assess the change to the OE and identify the key people and organizations involved and affected? Would your organizational readiness be drastically impacted? You probably have an intuitive response based on this latest pandemic. But can you validate those thoughts with facts and logic? Is there structure in your supporting narrative? Having a framework in place to assess problems is a start. Whether the next problem is a pandemic, a counterinsurgency, an invasion, or a major unit reorganization, deliberately approaching those problems is essential to developing options, making sound decisions, and providing recommendations that can be understood by all. Design methodology offers a doctrinal approach to understanding, communicating, and developing approaches to situations, such as a pandemic, where structure can be elusive.

The U.S. military historically acts without developing a comprehensive approach to addressing what might happen once the shooting starts—and ends. Iraq, Afghanistan, and, to an extent, Syria are all recent examples of situations where

Colonel Daniel E. Rauch, USAF, and Colonel Matthew Tackett, USA, are Military Professors in the Joint Military Operations Department at the Naval War College.

Figure 1. Design Methodology



U.S. military involvement "solved" some elements of perceived problems but consequently created other issues. Following the invasion of Iraq in 2006, when the initial assessments seemed wrong and the situation was deteriorating simultaneously in Afghanistan, the Army began investigating alternative approaches to conceptual planning. Design methodology, now validated in joint doctrine, is the result of that inquiry. This methodology is used by planners at U.S. Central Command and U.S. Special Operations Command and, to a degree, at other unified commands, and is part of the curriculum at many U.S. professional military education institutions. Using the methodology will not guarantee a successful outcome and is not a panacea for solving pandemics or complex problems. It does, however, provide a general framework, supported by an underlying logic, for discussing problems and developing approaches.

What Is Design Methodology?

Design methodology is a model to aid in understanding and communicating cause-and-effect relationships in complex environments. Although imperfect, it may still be useful. Design methodology facilitates discourse, enables questioning of guidance and assumptions, and aids in articulating risk and opportunity in order to develop pragmatic options with an ends-ways-means balance. This article addresses the doctrinal application of design methodology at the political-strategic to operational level while also discussing the potential to employ design-thinking techniques at the operational and tactical levels. The intended audience for this article is military and civilian war college students, faculty, and others interested in understanding the basics of design. The article does not set out to discuss design through a theoretical lens, but rather to contextualize its value based on current joint doctrine. Design is not easy to conduct, but the framework and terminology of design methodology are understandable once conversant with aspects of the doctrinal reading.

Joint Publication (JP) 5-0, *Joint Planning*, the doctrine that includes design thinking, provides a structure or model to visualize, understand, and develop approaches to address complex problems. For the purposes of this article, complex or ill-structured problems may not be a single issue but rather a confluence of several nonlinear and dynamic issues interacting that affect the operating environment.[1] These problems are the most challenging to understand and solve. Unlike well-structured problems, leaders disagree about how to solve ill-structured problems, what the end-state should be, and whether the desired endstate is achievable. At the root of this lack of consensus is difficulty in agreeing on what the problem is.[2] Complicated or well-structured problems are defined as easy to identify because required information is available to solve the issues at hand. In addition, known methods—for example, math formulas—are available to solve these types of problems. While sometimes difficult to solve, well-structured problems display little interactive complexity and have verifiable solutions.[3]

Although complex problems exist at all levels, those problems at or above the operational level (for example, national security campaign planning at the geographical combatant, functional command, or four-star headquarters equivalent) are likely complex and well suited for design application. This methodology enables an informational discourse communicated through the lens of four "frames" and the common use of four terms (as reflected in figure 1). Operational art, which is inherent in all aspects of operational design, "is the cognitive approach by commanders and staffs" (referred to henceforth as designers), "supported by their skill, knowledge, experience, creativity, and judgment to develop strategies, campaigns, and operations to organize and employ military forces by integrating ends, ways, means, and risks."[4] Moreover, "Operational design is the conception and construction of the framework that underpins a campaign or major operation and its subsequent execution."[5] The methodology of operational design is an attempt to provide structure on which to begin discourse in order to help commanders and planners understand the ends-ways-means-risk questions during planning.[6]

While there are other available methods to approach problem-solving, such as the Joint Planning Process or Lean Six Sigma, design is a relatively unpretentious, robust, and doctrinal tool that also supports a "recursive and ongoing dialogue."[7] Design's structure allows operational-level military commanders to communicate with strategic leaders in terms those leaders understand. Design thinking, as addressed in JP 3-0, *Joint Operations*, allows designers to use this methodology when planning major joint operations or campaigns. Fully implementing a design team is resource intensive and suited for large organizations (for example, unified commands); however, the underlying thinking can be beneficial at all levels. Understanding what design is, as defined by current doctrine, is the first step to understanding the theory, and subsequently practicing, the methodology.

Benefits of Design

Design methodology directly supports divergent thinking—the skill of conceiving and considering multiple creative, diverse, and often contradictory approaches, and then treating each with equal intellectual rigor to identify the best approach(es). This skill and the subsequent discourse enable designers to visualize why the current environment differs from their previous experiences. Divergent thinking enables the

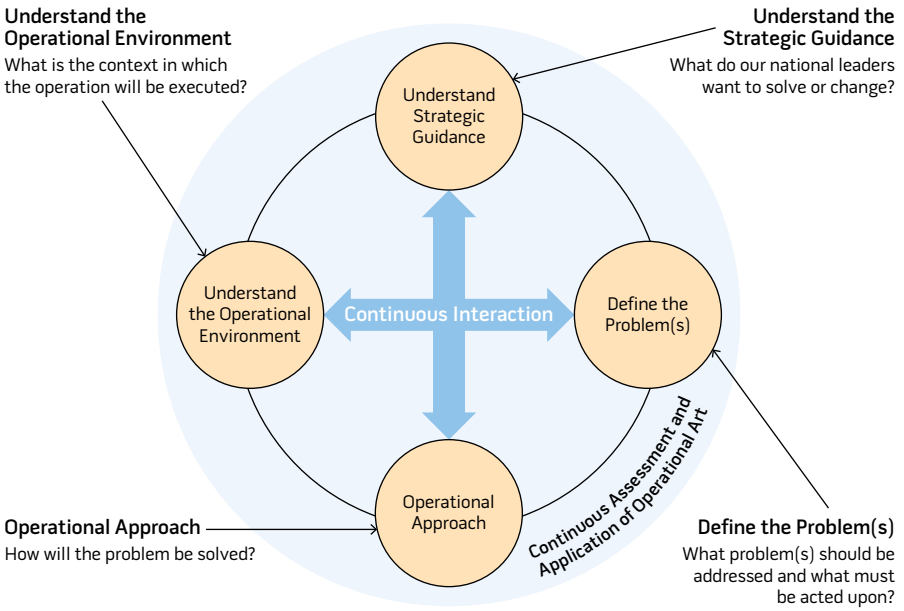
consideration of ideas other than those solutions that worked in past situations. Junior U.S. military officers spend much of their time dealing with well-defined issues, or complicated problems, that are most aptly addressed through structured approaches—but these experiences may create habits of thought and intuitive responses that are not conducive to generating solutions within truly complex environments. Intentionally employing a divergent thinking process to a diverse and uniquely experienced team (for example, epidemiologists and economists when dealing with a pandemic) has the potential of mitigating cognitive biases and developing options appropriate to the uniqueness of the situation.[8] Design should pull the minds of designers out of linear processes and enable them to raise questions that identify additional risks or tensions, as well as opportunities or potentials.

Design, as codified in joint doctrine, helps commanders, staffs, and designers articulate complex relationships in a manner relatable to both senior military and civilian leaders. Design provides a plain but malleable framework to structure dialogue in a way that addresses problems. The terminology is simple and relatable among diverse groups. It is not military lexicon filled with acronyms and nontransferable concepts, nor is it arduous academic or scientific jargon that requires unique education to be comprehensible. When fully adopted and understood, design can assist the joint force in defining and addressing complex problems.

Design in Doctrine

Design is built on the iterative and supporting frames of understanding strategic guidance, the operational environment, the challenges of that environment, and the development of an approach that addresses a given problem (see figure 2). This framing is conducted with continuous interaction from and into previous and later frames. These frames can be envisioned as four rooms, and as one moves from room to room, the doors remain open to all rooms. One must go back and forth between rooms to understand and describe all of them. The model artificially separates the discussion of each frame, but the interaction of the frames cannot be overlooked. Designers may begin hypothesizing approaches at the beginning as a way to better determine the interaction between and within the frames. However, the OE and problem frames should be thoroughly understood in order to develop an actionable approach.

Figure 2. Operational Design Framework



Throughout these framing discussions, four terms (from JP 5-0, chapter 4) are used continuously by strategic leaders to describe and facilitate clarity within frames: *actors*, *tendencies*, *tensions*, and *potentials*. Understanding the frames and terms goes beyond just knowledge of the capabilities and capacities of the relevant actors (individuals and organizations) or the nature of the OE. This understanding also provides context for decisionmaking and what facets of the problem are likely to interact, allowing commanders and planners to identify consequences and opportunities and to recognize risk.[9]

Understanding strategic guidance is a cornerstone of design and provides strategic or political objectives, desired endstates, force availability, and operational limitations. This guidance is the higher level culmination and the "why" that balances ends, ways, means, and risk, and it must be continuously evaluated (and questioned) in order to confirm there are no changes. The information garnered by this strategy provides the lens through which designers are able to understand the OE. Often, they attempt to foresee the desired future state of the OE—the conditions that should exist when operations end—while fully recognizing that these frames are not sequential. Designers examine guidance, or questions asked within that guidance, and ensure that the right questions are answered. At times, guidance may be missing, incomplete, or rapidly changing. In this case, design methodology may assist in clarifying and completing guidance through an examination of the environment (including policy and political considerations).

Using graphics to capture the operational environment provides a doctrinally based technique that helps designers visualize systems as part of that environment.[10] One way to visualize, understand, and depict the OE is as a complex adaptive system.[11] Designers identify the actors at play in the environment and then examine their tendencies in order to provide a "continuous and recursive refinement of situational understanding."[12]

Actors are the individuals or groups within a specific system who operate to advance personal or other interests. Relevant actors might include states, governments, multinational actors, coalitions, regional groupings, alliances, terrorist networks, criminal organizations, cartels, families, tribes, multinational and international corporations, nongovernmental organizations, and others able to influence the situation either through, or in spite of, the established civil, religious, or military authorities.[13] *Tendencies*, also part of understanding actors within the OE, reflect the inclination to think or behave in a certain manner. Tendencies are not considered deterministic; instead, they are models that describe the thoughts or behaviors of relevant actors. Tendencies help identify the range of possibilities that relevant actors may develop with or without external influence.[14]

As thought and discussion related to the current and desired systems continue, the commander and staff will begin to identify the problem frame—the factors that must be addressed in order to achieve the desired system conditions. Understanding the problem is essential to finding its solution. Essential activities continue to be thinking critically and conducting open and frank discussions with stakeholders, while considering their diverse perspectives, thereby discovering and understanding the underlying nature and essence of the problem and thus furthering understanding of the current OE.[15] The precise problem is the one that defines the gap between the desired better state (defined by understanding the guidance) and the current state (defined by the actors, tendencies, potentials, and tensions of the OE).

The factors at play between actors and their tendencies impact *tensions* (for example, frictions, conflicts, and competitions) and include geographic, demographic, economic, religious, and resource consumption trends.[16] Designers identify tensions by analyzing the context of the relevant actors' tendencies and potentials within the operational environment. Given the differences between existing and desired conditions in the environment, analysis identifies the positive, neutral, and negative implications of tensions to determine the problem while understanding that the force's actions within the OE may exacerbate latent tensions.[17] As designers identify these problems, they also hypothesize solutions along the way. During exploration of these frames, interactions are discovered, and a better understanding of the OE and problem is developed, which leads to different, and potentially better, approaches to this complex problem.

To reiterate, the problem that the operational approach must address is the gap between the current and the desired systems or conditions.[18] The *operational approach*, as defined by JP 5-0, is a primary product of operational design, which allows the commander to continue the Joint Planning Process, translating broad strategic and operational concepts into specific missions and tasks in order to produce an executable plan.[19] Failure occurs when designers apply the wrong (or any) solution to the wrong problem. Strong commanders and designers must consider the possible problem and its possible solutions without being tied to "their" solution. The problem statement identifies the areas for action that will transform existing conditions toward a better state, if not a desired endstate. Defining the problem extends beyond analyzing interactions and relationships in the OE. It also identifies areas of tension and competition—as well as opportunities and challenges—that commanders must address to transform current conditions in order to attain the desired endstate.[20]

As better understanding emerges, the commander and staff determine broad actions (the operational approach to improve the environment) that can address the factors of actors, tendencies, and tensions. JP 5-0 names three purposes for developing an operational approach:

- It provides the foundation for the commander's planning guidance to the staff and other partners.
- It provides the model for execution of the campaign or operation and development of assessments for that campaign or major operation.
- It enables a better understanding of the operational environment and the problem.[21]

Designers develop approaches to achieve an endstate—or a better state—and improve the environment based on the guidance received. Understanding the environment and its actors and tendencies, and the problem and tensions associated with it, allows designers to identify *potentials*—inherent abilities or capacities for the growth or development of a specific interaction or relationship. Commanders need to identify opportunities they can exploit in order to influence the situation in a positive direction. When limited windows of opportunity open, the commander must be ready to exploit these to set the conditions that will lead to successful conflict transformation, and thus to transition.[22] Not all interactions and relationships support achieving the desired endstate—design helps identify those that do and those that do not.

Understanding these terms, and how they influence the previously discussed frames, provides clarity in design discourse. Design is one of several tools available to help the joint force command and staff understand the broad solutions for mission accomplishment and the uncertainty in a complex OE. Additionally, design supports a recursive and ongoing dialogue concerning the nature of the problem and an operational approach to achieving the desired political or military objectives.[23] It is also important to understand the flexibility with initiating this concept. The process is not linear. The team can start by proposing solutions as easily as by listing actors—the goal is, through research and discourse, to gain the best possible understanding of all four frames before taking action.

The Artifact

The artifact, or output of a design team, will vary depending on the objective, the gravity of the situation, and the team's audience. The initial output may be to simply aid discourse at the national security level. The goal is to eventually create an initial operational approach that will be further defined

Soldier assigned to 209th Aviation Support Battalion, 25th Combat Aviation Brigade, 25th Infantry Division, uses hand signals during 25th Infantry Division Noncommissioned Officer and Soldier of the Year competition at Schofield Barracks, Hawaii, June 2, 2020 (U.S. Army/Sarah D. Sangster)

and debated during detailed planning. In doctrinal terms, the output is best described as level 1 planning detail, which can take many forms. Level 1 planning, per JP 5-0, involves the least amount of detail and focuses on producing multiple courses of actions to address a contingency. The product for this level can be a briefing, command directive, commander's estimate, or memorandum with a required force list. To inform higher level discourse, the output may be extremely descriptive of the environment and perceived problem. In order to move into detailed planning, the output must provide further planning guidance, the commander's intent, and sufficient description of the environment, problem, and approach. Whatever the desired use, bullet slides are generally an *inappropriate* format, as they often fail to capture the rich discourse and understanding of the design team. The optimum output is a balance between prose narrative and pictures that capture the tendencies and tensions of relevant actors, along with the potentials and risks associated with the initial guidance.

General Martin Dempsey's July 2013 memorandum outlining options for intervention in Syria is a good example of level 1 planning detail that effectively enabled strategic discourse with policymakers.[24] His task was to provide military options. He provided those options in terms of ends-ways-means-risk and cost. His conclusion was rich with the portrayal of the complexity of the environment, the natural tensions between select actors, coupled with the potentials if acted on without a whole-of-government approach. This memorandum was written prior to the rise of the so-called Islamic State in 2014. At that time, the tension between acting or not acting weighed against the tendency of a weakened Syrian regime that presented the potential for empowering extremists—a correct foreshadow that demonstrates understanding the environment. It is apropos to point out that Russia is not mentioned in this memo. Russia's entry into the environment was a significant change that altered the potential collapse of the Syrian regime—a demonstration of not fully understanding the actor(s) in, and potential(s) of, the environment.

Argument for Design

The evolution of design into what is now codified in doctrine has resulted in both positive and negative perceptions. After the invasion of Iraq, the Army began exploring design concepts to help tackle the complexity of the situation. The School of Advanced Military Studies at Fort Leavenworth studied and evaluated the Israeli version of

Table. Elements of Operational Design

Termination	Direct and indirect approach
Military endstate	Anticipation
Objectives	Operational reach
Effects	Culmination
Center of gravity	Arranging operations
Decisive points	Forces and functions
Lines of operation and lines of effort	

design developed by the Operational Theory Research Institute led by Brigadier General Shimon Naveh.[25] Naveh's theory derives from the interdisciplinary general systems theory introduced by a biologist in the 1930s—the concepts and associated terminology of which can be elusive without extensive study.[26] Naveh, a London-educated Ph.D. in military sciences, adapted general systems theory into a methodology to develop approaches for complex military problems, and termed the approach systemic operational design.[27] His adaptation created additional complex language drawn from his diverse education—even he would admit his concepts were "not for mere mortals."[28] Critics of Naveh's work have even called the systemic operational design's terminology unintelligible.[29] What is currently codified in U.S. doctrine, however, is a pragmatic methodology for conceptual planning that can be understood with minimal study.

Joint doctrine does create some confusion by using *operational design* as the methodology (properly so) and then later as the *elements of operational design* (see figure 3). This makes the term sound both like a cognitive process and an artifact.[30] Interpreting section B, chapter 4, of JP 5-0 as *operational design methodology* may minimize the confusion associated with the *methodology* and the *elements* that compose the approach. Recognizing that joint doctrine is a compromise among the Services and that design evolved within U.S. ground forces (specifically the Army at Fort Leavenworth), it is advised to consult Army and Marine Corps publications for clarity. Neither Army Techniques Publication 5-0.1, *Army Design Methodology*, nor Marine Air-Ground Task Force Staff Training Program Pamphlet 5-0.1, *Marine Corps Design Methodology*, suffer the same confusing language as joint doctrine. Both describe operational design methodology as a tool that supports the commander's use of operational art to develop an operational approach.[31] The *Department of Defense Dictionary of Military and Associated Terms* also captures operational design as a methodology and an operational approach as an output. However, there are perhaps more significant issues contributing to the misunderstanding of design's place in the environment.

Some overzealous advocates believe design will always attempt to provide solutions to problems in a complex environment. Those that oversell its usefulness have also contributed to the misunderstanding of what design is and how and when it should be used. These individuals are easily identified, as they present examples of tactical or operational success through the lens of design but fail to examine the long-term condition of the environment. What design advocates seem to imply is that "design" is the manner of thinking associated with the methodology (that is, divergent, creative, critical, iterative). These are laudable skills that should be used at all levels of planning and execution. However, design is focused on identifying underlying causes and testing hypotheses that have the potential to influence the environment over 5 to 20 years (versus a 12- or 24-month deployment). The resources required to fully frame a complex environment and develop a workable cause-and-effect understanding can be significant. Those resources are unlikely to be available below the unified command level.

Design also has opponents, who believe it simply does not work based on their experiences. However, one must question these opponents' exact experiences with design and how they measure success. For example, did they expect that simply assembling a group and labeling it a "design team" would provide a solution? Were they oversold on what design brings to the table? Design facilitates understanding and communication, but it will not solve problems. The resources put toward understanding an ill-structured problem will certainly help, and the quality of the designer is essential to good output. Just as asking someone with little to no training or talent to paint a portrait will probably result in a poor product, executing design without the proper resources will also result in a poor outcome.

Design methodology is suited for the operational and strategic levels because it is resource-intensive. However, there may be a time when leadership at those levels is pressured to move to action before a reasonable understanding of the environment is available. This is when the thinking that underpins design must be executed at the tactical level. This is not optimal, but it is a reality. A tactical unit will not be resourced to fully understand the cause-and-effect relationships of the theater, but they can use design thinking skills to better approach the problems at hand. This is an example not of fully executed design methodology, but rather of implementing design thinking.

Conclusion

Design methodology is not the panacea for problem-solving. Design facilitates discourse, enables questioning of guidance and assumptions, and enables the articulation of risk and opportunity to arrive at a pragmatic ends-ways-means balanced concept. Like operational art and the Joint Planning Process, design is one more tool or model that can foster better thinking skills and provide a common language between the joint force and civilian senior leaders. However imperfect, some models are fundamentally useful. Understanding the joint doctrinal version of design should demystify the concepts sur-

rounding it. Time and resources may be required to implement design, but it is simple enough to understand. It may take a large organization to properly resource a design team, and the team will likely require significant outside resources in order to achieve the acceptable cause-and-effect understanding of a complex environment, but the cognitive skills associated with design methodology and design thinking are useful at all echelons.

Implementing design methodology does not guarantee a solution, but it may help articulate the gap (the problem) between the desired state and the current state, as well as the gap in ends, ways, and means (the approach). There are certainly cases in which the ways and means are not available to achieve the desired ends (based on the strategic guidance). Design should help articulate those cases and further the discourse of either changing guidance or creating new ways and means. An honest discourse will at the very least help clarify the risks when forced to take action in an environment where ends-ways-means gaps exist.

Is design thinking the right tool to apply to the next pandemic or to the next major large-scale military operation? Design thinking certainly has the benefit of forcing planners and experts supporting planning who have good ideas to articulate the logic of how their approach affects the environment, remains consistent with higher guidance, and ensures the problem is defined. Design thinking also allows planners and commanders to gain an appreciation for the perspective of, and impact on, other institutions and organizations. Deliberate, reflective, and structured thinking is essential to sound decisionmaking. Using a shared framework and vernacular that is understood by others makes discourse much easier. Most organizations will not be able to resource a sufficient design team to thoroughly understand an environment. However, applying the framework and thinking of design may highlight gaps in knowledge about the particular problem and avoid faulty intuition-based decisions. Design methodology is not a remedy for solving pandemics or all complex problems, but it does provide a structure that evolved from an effective (but quite complex) framework to one that can be easily understood by any reasonably educated person. And it is in joint doctrine, so why not try it? **JFQ**

Notes

[1] Joint Publication (JP) 5-0, *Joint Planning* (Washington, DC: The Joint Staff, June 16, 2017), III-6.

[2] Army Techniques Publication (ATP) 5-0.1, *Army Design Methodology* (Washington, DC: Headquarters Department of the Army, July 1, 2015), 4-2.

[3] Ibid., 4-1.

[4] JP 5-0, IV-1.

[5] Ibid., IV-1.

[6] Ibid., IV-1–IV-19.

[7] Ibid., IV-1.

[8] For a more thorough discussion of critical thinking, divergent thinking, heuristics, and biases, see Peter A. Facione, *Critical Thinking: What It Is and Why It Counts* (Hermosa Beach, CA: Measured Reasons, LLC, 2015).

[9] JP 5-0, IV-1–IV-2.

[10] *Planner's Handbook for Operational Design*, Version 1.0 (Suffolk, VA: The Joint Staff, October 7, 2011), V.

[11] Ibid., IV-1.

[12] JP 5-0, IV-*2*.

[13] *Planner's Handbook for Operational Design*, V-14.

[14] Ibid., V-15.

[15] Ibid., V-10.

[16] ATP 5-0.1, 1-4.

[17] *Planner's Handbook for Operational Design*, V-15.

[18] Ibid., V-5.

[19] JP 5-0, IV-1.

[20] Ibid., IV-14.

[21] *Planner's Handbook for Operational Design*, III-10.

[22] JP 5-0, xxi.

[23] Ibid., IV-6.

[24] Martin E. Dempsey, Letter to Senator Levin, July 19, 2013, available at <https://www.globalsecurity.org/military/library/report/2013/dempsey-syria-sasc-letter-130719.pdf>.

[25] Stefan J. Banach and Alex Ryan, "The Art of Design: A Design Methodology," *Military Review* (March–April 2009), 105–115.

[26] Ludwig von Bertalanffy, *General System Theory: Foundations, Development, Applications* (New York: George Braziller, Inc., 1968), introduction and chapter 4.

[27] For a better understanding of the evolution of the Operational Theory Research Institute's approach, see chapter 1 of Shimon Naveh, *In Pursuit of Military Excellence: The Evolution of Operational Theory* (London: Frank Cass Publishers, 1997).

[28] To develop a clearer picture of the influence of Naveh's work on U.S. Army doctrine, see the following: Matt Matthews, "Interview with BG (Ret.) Shimon Naveh," Operational Leadership Experiences, Combat Studies Institute, Fort Leavenworth, KS, November 1, 2007, available at <https://smallwarsjournal.com/documents/mattmatthews.pdf>; Alex Ryan, "A Personal Reflection of Introducing Design to the U.S. Army," *The Overlap*, November 4, 2016, available at <https://medium.com/the-overlap/a-personal-reflection-on-introducing-design-to-the-u-s-army-3f8bd76adcb2>.

[29] Milan N. Vego, "A Case Against Systemic Operational Design," *Joint Force Quarterly* 53 (2nd Quarter 2009), available at <https://apps.dtic.mil/dtic/tr/fulltext/u2/a515328.pdf>.

[30] JP 5-0, IV-6–IV-19.

[31] ATP 5-0.1, 1-4; Marine Air-Ground Task Force Staff Training Program Pamphlet 5-0.1, *Marine Corps Design Methodology* (Washington, DC: Headquarters Department of the Navy, May 2017).