



DESIGN THINKING IN COMMERCE AND WAR:

Contrasting Civilian and Military Innovation Methodologies

Dr. Aaron P. Jackson

LEMAY PAPERS



Air University

James B. Hecker, Lieutenant General, Commander and President

LeMay Center for Doctrine Development and Education

Brad M. Sullivan, Major General, Commander

AIR UNIVERSITY

**LEMAY CENTER FOR DOCTRINE
DEVELOPMENT AND EDUCATION**



**Design Thinking in Commerce and War:
Contrasting Civilian and Military
Innovation Methodologies**

DR. AARON P. JACKSON

LeMay Paper No. 7

Air University Press
Academic Services
Maxwell Air Force Base, Alabama

Air University Commander and President
Lt Gen James B. Hecker

*Commandant and Dean, LeMay Center for
Doctrine Development and Education*
Maj Gen Brad Sullivan

Director, Air University Press
Maj Richard T. Harrison

Project Editor
Kimberly Leifer

Illustrator
Daniel Armstrong

Print Specialist
Megan N. Hoehn

Air University Press
600 Chennault Circle, Building 1405
Maxwell AFB, AL 36112-6010
<https://www.airuniversity.af.edu/AUPress/>

Facebook:
<https://www.facebook.com/AirUnivPress>

and

Twitter: <https://twitter.com/aupress>

Accepted by Air University Press June 2020 and published December 2020.

Disclaimer

The views expressed in this publication are the author's own and do not necessarily reflect the views or policies of any organization with which he is, or has been previously been, affiliated.

This LeMay Paper and others in the series are available electronically at the AU Press website: <https://www.airuniversity.af.edu/AUPress/LeMay-Papers/>.



The LeMay Papers

The LeMay Papers and other scholarly works published by Air University Press provide independent analysis and constructive discussion on issues important to Air Force commanders, staffs, and other decision makers. Each paper can also be a valuable tool for defining further research. These studies are available electronically or in print via the Air University Press website at <https://www.airuniversity.af.edu/AUPress/LeMay-Papers/>. To make comments about this paper or submit a manuscript to be considered for publication, please email Air University Press at aupress@us.af.mil.

The LeMay Papers are dedicated to developing, assessing, and promoting Air Force doctrine and education and advocating airpower doctrine in joint and multinational arenas. These papers are published by the Air University Press and broadly distributed throughout the US Air Force, the Department of Defense, and other governmental organizations, as well as to leading scholars, selected institutions of higher learning, public-policy institutes, and the media around the world.

Contents

List of Illustrations	<i>v</i>
About the Author	<i>vi</i>
Abstract	<i>vii</i>
1 Introduction	1
Structure	3
Framework for Analysis	4
2 Civilian Design Thinking	13
The Evolution of Civilian Design Thinking	13
Paradigms Underlying Key Civilian Design Methodologies	21
3 Military Design Thinking	29
The Evolution of Military Design Thinking	30
Paradigms Underlying Key Military Design Methodologies	38
4 Comparing Civilian and Military Design Thinking	48
Divergence, Tensions, and Convergence	49
Possible Near Futures for Design Thinking	56
5 Conclusion	65
Abbreviations	68
Bibliography	69

List of Illustrations

Figures

1.1. Multiparadigmatic framework for analysis	9
2.1. The evolution of key civilian design thinking methodologies	20
2.2. Relationship between civilian design methodologies and underlying paradigms	23
3.1. The evolution of key military design thinking methodologies	37
3.2. Relationship between military design methodologies and underlying paradigms	40
4.1. Interparadigmatic divergence and tension, with methodological convergence	50
4.2. Multiparadigmatic convergence with methodological divergence	54

Table

1.1. Paradigms used for analysis of civilian and military design thinking	6
--	----------

About the Author

Dr Aaron P. Jackson is Senior Researcher, Joint Planning and Design in Defence Science and Technology (DST) Group, part of the Australian Department of Defence. A civilian defence employee since 2010, he was previously Joint Operations Planning Specialist in DST and joint doctrine developer at the Australian Defence Force Joint Doctrine Centre. He held a second civilian appointment as Academic Year 2018–19 Distinguished Visiting Professor in the Defence Studies Department at Canadian Forces College in Toronto, Canada, where he instructed on the Advanced Joint Warfare Studies stream of the Joint Command and Staff Program, and facilitated during the Program's culminating military design activity, Exercise Shifting Sands. In addition to these civilian appointments, Aaron has served in the Australian Army Reserve since 2002. He has deployed as a Defence Civilian on Operation Accordion (Middle East region), and as a military officer on Operation Astute (Timor Leste), Operation Resolute (Australian border security), Operation Okra (Iraq) and Operation COVID-19 Assist (domestically within Australia).

Aaron holds a Doctorate of Philosophy (International Relations) and his research interests include operational art, joint planning, military design thinking, military culture, military doctrine and international relations. He is extensively published in these fields, and he is the author of: *The Four Aspects of Joint: A Model for Comparatively Evaluating the Extent of Jointness within Armed Forces* (Australian Defence Publishing Service, 2018); *The Roots of Military Doctrine: Change and Continuity in Understanding the Practice of Warfare* (US Army Combat Studies Institute Press, 2013); *Doctrine, Strategy and Military Culture: Military-Strategic Doctrine Development in Australia, Canada and New Zealand* (Canadian Forces Aerospace Warfare Centre, 2013); *Keystone Doctrine Development in Five Commonwealth Navies: A Comparative Perspective* (Sea Power Centre—Australia, 2010); and numerous journal articles and other academic papers. Most recently, he edited the book *Design Thinking: Applications for the Australian Defence Force*, which was published in December 2019.

Abstract

This monograph addresses how military design thinkers can maximize the utility of the design methodologies they select for employment when designing military operations. Presently, Western militaries apply a mix of two distinct types of design thinking, each with a different origin and employing different paradigms, yet most military practitioners remain unaware of this situation. The result is confusion, obfuscation through inappropriate conceptual overlap, and suboptimal outcomes when overlapping types of design are simultaneously applied to identify and solve operational problems. These two types of design thinking come from different arenas: one has a background in various “civilian” disciplines, and in commerce and industry; the other originates within militaries themselves. This monograph attempts to untangle these two types of design thinking from each other through the provision of a detailed historical account, followed by a paradigmatic analysis of each. It then addresses the two types together, examining how a deliberately cultivated awareness of both can lead to enhanced design thinking outcomes, and exploring how military design thinking might evolve in the near future.

Chapter 1

Introduction

This monograph addresses how military design thinkers and military practitioners in general can maximize the utility of the design methodologies they select for employment when designing military operations. It does this by elaborating the history and then analyzing two related yet distinctly different types of design thinking, which Western militaries currently apply in a mixed and largely ad hoc manner. The first type of design thinking has a background in various civilian disciplines and in commerce and industry. The second originates within militaries themselves. Each of these types of design thinking contains an array of methodologies that have different origins and view the world through different paradigmatic lenses. Furthermore, each methodology tends to understand design thinking differently, presenting a range of opportunities in addition to potentially causing confusion among military practitioners who do not specialize in design thinking.

Lack of awareness of these different types of design thinking and of their constituent methodologies has brought about a tendency for military practitioners to inadvertently confuse, or inappropriately blend methodologies. When overlapping types of design are simultaneously applied to identify and solve operational and other military problems, the results can be conceptually inappropriate and suboptimal. For example, the author has recently witnessed conceptually shallow and under-developed civilian design methods being used within the military to do poorly what existing military planning methodologies could have done well. He has also witnessed constraints placed on the scope of what a military design team was permitted to explore, which negated any possibility of genuine innovation. The use of design in this instance was an attempt to employ the latest vogue problem solving methodology, but without accompanying development of a genuine understanding of what that methodology is, where it comes from, or whether its use was appropriate in the situation where it was applied.

At the other end of the spectrum of military design thinking experiences, a small but growing cadre of individuals are increasingly blending various civilian and military design methodologies to form their own “meta-design” methodologies, while concurrently reaching out to civilian design thinkers to forge mutually beneficial linkages between fields.¹ These military design thinkers have developed detailed knowledge of a range of different civilian and military design methodologies, yet their methodological blending has emerged quite recently and is still in its early conceptual stage. These design

thinkers may therefore also benefit from an enhanced historical and paradigmatic knowledge, which will help enable even greater innovation to occur as they expand and further develop their meta-design methodologies.

On the other side of the fence, most civilian design thinkers remain unaware of the existence of military design thinking. Among those that are aware of it, their understanding is often quite shallow. This author has read publications by civilian design thinkers that purport to summarize the entirety of military design thinking, but merely demonstrate their author's ignorance of it.² These publications tend to make assumptions about the entire field based on incomplete research, often citing only one or a few military design thinking publications. Unless alternative and detailed accounts of the history of military design thinking are made available, this practice of incomplete research threatens to proliferate, and may bring about widespread misunderstanding of military design thinking among civilian design thinkers. This monograph is therefore likely to be of benefit to civilian as well as to military design thinkers.

The analysis of civilian and military design thinking contained herein aims to fill a significant gap in the existing literature on this subject. This is because design thinking, in both its civilian and military incarnations, tends to be ahistorical. Design thinkers focus on innovation and creativity, an endeavor that has a distinct future-orientation. Yet knowledge of what has come before, as well as the paradigms underlying this history, enables development of a much richer and more holistic knowledge of the field.

The benefit of developing a better knowledge of the history of design thinking for military practitioners in general is that such knowledge will help prevent confusion regarding the use of various design methods and will increase the likelihood of good design practice. The benefits for specialist military design thinkers are that it will help determine potential future developments, to evaluate which design methodologies are rigorous and which are not, and to consider how to better implement rigorous design methodologies by more comprehensively learning from those that have come before.³

To untangle civilian and military design thinking from each other, this monograph offers a detailed historical account of both types of design thinking, followed by a paradigmatic analysis of each. The two types are then addressed together to enable an examination of areas of divergence and convergence to occur, before discussion turns to what this may mean for the future of design thinking.

Astute readers will have noticed that no attempt has yet been made to define "design thinking." This is intentional, because the definition of design thinking itself has been subject to change over time, as well as varying be-

tween many of the different design methodologies that will be elaborated. As a result, subsequent discussion herein will include descriptions of significant understandings of design thinking, their similarities and differences, and how these have evolved. For now, it is sufficient to note that, somewhat simplistically, design thinking offers a means to innovate and to think creatively, and is often undertaken in relation to a problem or set of problems that design thinkers are confronting.⁴

Structure

This monograph consists of five chapters. The next section of this chapter elaborates a comprehensive framework that supports the analysis that will occur in later chapters. This framework consists of nine paradigms, which together enable a meaningful comparison to be made between different civilian and military design methodologies.

Chapters 2 and 3 focus respectively on civilian and military design thinking. Each of these chapters is divided into two parts. The first provides a detailed history of the type of design thinking discussed in that chapter. This historical discussion includes the origins of the type of design thinking, how it has evolved since its emergence, key understandings of design thinking and how these have changed over time, and details of the works of the most prominent design thinkers and methodologies of each epoch. The second section of each of these chapters contains a paradigmatic analysis of these key works, design thinkers, and methodologies, using the framework for analysis elaborated below. This paradigmatic analysis enables development of a more comprehensive understanding of the evolution of each type of design thinking.

For the purposes of this monograph, the civilian or military origin of different design methodologies is determined by the primary intended usage of the methodology according to its key developer(s). If it is intended for application primarily by civilians in a nonmilitary context, it is considered a civilian design methodology; likewise, if it is intended for application primarily by military personnel in a military context, it is considered a military design methodology. Of course, this division is not perfect. As will be seen in chapters 2 and 3, several methodologies grouped into one of these categories have been influenced by other methodologies that fit within in the other category. In such cases, the intended application of the methodology rather than the influences on its development has been used as the factor determining its grouping. Additionally, it is important to note that the terms “civilian design thinking” and “military design thinking” are each used in reference to many different design methodologies, and neither term is synonymous with any

one methodology in particular. For example, the US Army Design Methodology (ADM) is only one of many military design methodologies, none of which has preeminence over any of the others.

A detailed comparative discussion is undertaken in chapter 4. This highlights the key similarities and differences between civilian and military design thinking, showing that earlier design thinking within the two fields led to the development of methodologically similar approaches, but which were paradigmatically separate. These methodologies existed in a state of interparadigmatic tension within each field, and the analysis in chapter 4 begins by explaining how this came about, and what its manifestation and ramifications were within each field of design thinking. More recent design thinking in both fields has transitioned to a multiparadigmatic approach, yet the methodologies themselves now differ regarding how this approach is manifest within each field of design thinking. The ramifications of this recent transition are also discussed, to facilitate the formation of hypotheses about potential future directions in which both civilian and military design thinking might develop.

Chapter 5 addresses the implications specifically for military designers. Historical and paradigmatic awareness can lead to enhanced design thinking outcomes, and further, enhanced operational and organizational outcomes. Highlighting the importance of understanding where ideas originate better positions design thinkers to further develop and enhance them in the future. Such development is likely to be beneficial to several Western militaries in their desire to successfully innovate and encourage creative thinking within their ranks.

Framework for Analysis

This monograph analyzes and compares civilian and military design thinking using a multiparadigmatic framework. The framework employs nine paradigms that are described within four different sources, one each from the disciplines of sociology, business management, military strategy, and complexity science.⁵ It should be noted that these paradigms do not necessarily originate in these sources. The sources have been selected for reference herein because they provide an accessible description of each paradigm.

For the purposes of this discussion, a paradigm is the “constellation of beliefs, values, techniques and so on shared by the members of a given [scientific, academic or disciplinary] community.”⁶ This definition originated in Thomas Kuhn’s book *The Structure of Scientific Revolutions*. Although this book popularized the contemporary meaning of the term paradigm, it only addressed how they function within the natural sciences. When discussing the application of paradigms in the context of design thinking, it is useful to

also consider their applicability and operation within the social sciences and humanities. According to Margaret Masterman, the social sciences can be considered “multiple paradigm sciences,” wherein most paradigms cover a narrower area of research than their equivalents in the natural sciences. This leads to a greater rate of localized paradigm shifts, accompanied by the longer endurance of what Kuhn called “global paradigms,” which are the kinds of paradigms that best fit the definition of a paradigm used herein.⁷

Different global paradigms employ different ontological, epistemological, and methodological approaches to enable their adherents to come to an understanding of their subject matter. Simply defined, epistemology is the branch of philosophy that addresses theories of knowledge. It deals with issues such as how humans acquire knowledge, what is considered legitimate knowledge, and what separates knowledge from unsubstantiated belief and opinion.⁸ Ontology examines the nature of being and the first principles, or categories, involved. Ontological questions include those addressing the nature of reality, what determines human understanding or construction of reality, and the essence of phenomena.⁹ Finally, a methodology is a system of related methods; a method simply being a legitimate way to do something. Coming full circle, a method can also be understood as a “local” paradigm, as defined in Masterman’s discussion of paradigms within the social sciences as well as by Kuhn himself in his later works.¹⁰

The nine paradigms selected for use herein have been chosen due to their combined applicability as a framework for understanding the “constellation of beliefs, values, techniques and so on” that underlies each of the civilian and military design thinkers and methodologies that are discussed.¹¹ This is because each has a distinct ontology and epistemology, and a distinct preference for certain methodologies. Together, they cover a broad enough range of fields of intellectual inquiry that all the design methodologies and thinkers discussed fit within at least one, but usually more than one, of the paradigms. This relationship between design thinkers and methodologies, and the paradigms contained in this framework will be explored in detail. By intention, the paradigms selected for use within this monograph’s analytical framework are also sufficiently global in scale that they have been enduring. This characteristic of these paradigms has maximized their utility for enabling comparative observations despite the broad scope of this monograph’s historical discussion.

Table 1.1 provides a short description of each of the nine paradigms that are employed within the analytical framework. The description of each paradigm focuses on the way its epistemology and ontology enable adherents to frame problems and, where applicable, to solve them. This focus is important for the subsequent analysis of alternative design thinking methodologies be-

cause it enables these methodologies to be contrasted to both one another and to these different paradigms, based upon the different ways and extent that each focuses on problem framing and solving. The descriptions contained in the table have been kept intentionally simple. While they are adequate for the purposes of this monograph, readers seeking additional information are encouraged to consult the relevant sources listed.

Table 1.1. Paradigms used for analysis of civilian and military design thinking

Paradigm	Description	Source
Interpretivism	Emphasizes individual and group interpretations of events, structures and processes, and acknowledges that people and groups socially construct their own realities. People are unavoidably part of the problems that they examine, and patterns can be discerned from qualitative data collected in an iterative, cyclical, and nonlinear process.	Burrell & Morgan (1979)
Radical Humanism	Methodological pluralism leads to the development of multiple irreconcilable perspectives of the same problem. Reality is socially constructed and must be deconstructed through these perspectives, which enable people to determine and critique the self-understanding of different actors. This enables radical problem solving by overturning existing biases, hierarchies, and power structures.	Burrell & Morgan (1979)
Radical Structuralism	Structures, processes and problems are viewed as independent of people, and can be understood through holistic structural analysis using historical, dialectical, and critical methodologies. However, there is no permanent knowledge. Instead, all knowledge is temporary. Sooner or later current “truth” will be proven “false” and rejected or replaced by a new truth.	Burrell & Morgan (1979)
Heroism	Groups of peers establish expectations of performance, rules of behavior and systems of rewards and punishments for “good” and “bad” behavior. These expectations are then applied during events, including problem solving. Individual adherence to the collective moral code is considered paramount—the individual is inseparable from their deeds.	Joullié (2016)
Technical Rationalism	Thinking rationally and applying logic leads to an understanding of the world “as it is” rather than “as it appears to be.” Analysis is conducted via deductive reasoning. People can employ reductive methods to break problems into component parts and analyse these to derive an understanding of the whole as the sum of its parts.	Joullié (2016)
Romanticism	This paradigm rejects the existence of universal laws and instead values knowledge derived from human experience, imagination, and creativity. Problems cannot be reduced to component parts or understood through rational analysis; however, they can be understood through subjective interpretation of immeasurable factors such as emotion, imagination, and freedom of action.	Joullié (2016)

Paradigm	Description	Source
Postmodernism	Objective reality and empiricism as a means to understand it are both illusory and must be rejected. Deconstruction of these illusions is achieved through perpetual reinterpretation of metanarratives and their language. There is no definitive meaning and openness to alternative and even competing interpretations is paramount when seeking understanding. All perspectives are equally legitimate, even if utterly contradictory. Perceived problems may therefore both exist and not exist at once.	Joullié (2016)
Participation	Meaning is derived through interpretation of social interactions, and ongoing interactions between actors causes negotiation leading to shared meanings. A dialectical methodology, wherein unstructured processes are facilitated by empathy, accommodates different initial views of a problem and eventually leads to mutual understanding.	Paparone (2010)
Complex Adaptive Systems (CAS) Theory	Problems cannot be broken down into component parts for analysis, as the sum is always greater than its parts. A holistic understanding of open systems in which problems exist, and their interactions with one another, is therefore required. However, open systems are always subject to transformation. Problems can never be truly resolved, only understood and managed within the context of the ever-changing open systems around them.	Mitchell (2009)

Before proceeding, some clarification is necessary regarding two of these paradigms. The first is postmodernism. Due to its nature, this paradigm has a far broader range of meanings than the others included in the analytical framework. This is in part because it can be applied to a range of ideas that are linked only by virtue of coming after *modernism*. It is also in part because “it was never entirely clear exactly just what postmodernism was (is?).” Finally, it is in part because “postmodernism not only affected each of the different disciplines to quite varying degrees but it made its impact upon them at different times. Some, perhaps, are only now beginning to come to terms with it.”¹² This statement was penned by Garry Potter and José López in 2001, in a text asserting that postmodernism was “in a state of decline” and that *critical realism* had emerged a key post-postmodern philosophy.

The first military engagement with postmodernism that was both earnest and impactful did not occur until the mid-1990s, when Israeli Brig Gen Shimon Naveh developed Systemic Operational Design (SOD).¹³ Having only considered postmodernism very recently, militaries are still struggling to come to terms with it. Even though a growing body of civilian scholars consider postmodernism to have, in the words of Potter and López, “gone out of fashion,” it is therefore still relevant that this paradigm be included in this monograph’s framework for analysis.¹⁴

One of the ideas that comes after modernism, and which is captured under the broader label of postmodernism as applied herein, is *poststructuralism*. Poststructuralism is noteworthy because many—but not all—of the postmodern philosophers that have prominently shaped what little military engagement there has been with postmodernism would perhaps be more comfortable being labeled as poststructuralist—to the extent that any would be comfortable with labels being applied to them at all. These philosophers include Gilles Deleuze, Félix Guattari, and Michel Foucault.¹⁵ Chris Paparone, a key military design thinker whose *magnum opus* is assessed in chapter 3 as being interdisciplinary but nonetheless aligning more closely to radical structuralism than the other paradigms that constitute this study's analytical framework, has previously expressed to the author that he considers his own work to more closely align with poststructuralism, to the extent that it can be paradigmatically categorized at all.¹⁶

Because poststructuralism is viewed herein as a type of postmodernism, the two are not considered as being in conflict. The categorization of some design thinkers influenced by poststructuralism as instead being postmodern is therefore acceptable and does not adversely influence the outcome of the comparative analysis of different design thinkers and methodologies that is presented later in this monograph. The key difference between poststructuralism and postmodernism is that the former arose as a critique of *structuralism*, which emphasizes that meaning originates in structures rather than individuals (*radical structuralism*, another of the paradigms contained in this monograph's analytical framework, is a variant of structuralism). Poststructuralism did not reject the existence of structures but did reject the idea of meaning.¹⁷ Postmodernism, as defined and employed herein in a general sense, may or may not involve the rejection of structures as well. Ergo, poststructuralism can be considered as aligning with postmodernism, insofar as postmodernism is defined and applied within this monograph's analytical framework.

The second paradigm that requires clarification is technical rationalism, because of its similarity to functionalism. Functionalism is the fourth paradigm outlined in *Sociological Paradigms and Organizational Analysis* by Gibson Burrell and Gareth Morgan. It is the only paradigm they discuss that is not also included in this monograph's analysis.¹⁸ An explanation as to why technical rationalism and not functionalism has been selected for inclusion herein is necessary.

The key difference between these paradigms is that functionalism is epistemologically empiricist, whereas technical rationalism is epistemologically rationalist. The implications of this difference notwithstanding, both paradigms are ontologically objectivist and both employ deductive and reductive method-

ologies that generally develop knowledge of a whole through a study of its parts.¹⁹ Their manifestation is therefore similar enough that discussing both under the same paradigmatic label suffices for the purposes of this monograph. Technical rationalism has been included as its epistemology aligns slightly better with most of the related design thinkers and methodologies discussed in subsequent chapters, although one must probe deeply to determine this. The resultant inclusion of some functionalists within this alternative paradigm is therefore acceptable as it has no adverse impact on the results of the study.

As the subsequent analysis of different civilian and military design thinking methodologies will reveal, a common theme between methodologies is a dual tension between emphasis on problem defining/framing, and problem solving/solution; and between emphasis on design primarily as a mindset or primarily as a process. A key commonality in the literature on both civilian and military design thinking is that oscillation between emphases within both areas of tension can be observed over time. To turn the list of paradigms in Table 1.1 into a framework for analysis, it helps to imagine these two sets of tensions as a quad chart, with process or mindset orientation on the vertical axis and relative emphasis on either problem solving or problem framing on the horizontal axis. This enables the nine paradigms to be relatively positioned based on their orientation and emphasis in these two key areas of tension. This quad chart, and the relative position of each paradigm, is shown in Figure 1.1. Of note, this quad chart represents a two-dimensional spectrum that is not linked to numerical data. It is not mathematical, and the center of the chart does not represent zero.

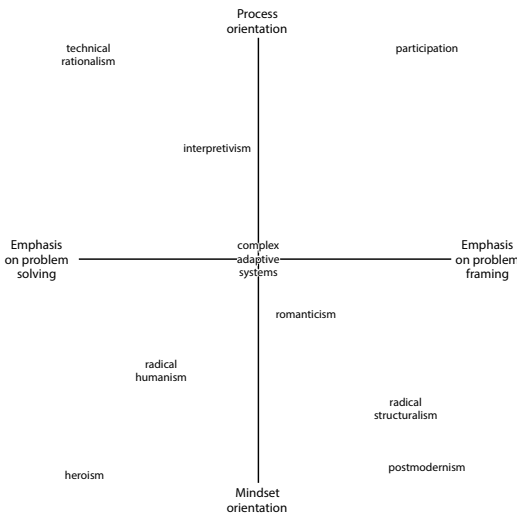


Figure 1.1. Multiparadigmatic framework for analysis

It can be seen in the quad chart that four of the nine paradigms are situated in the corners. Technical rationalism is at top left, being the paradigm most focused on process as a means of problem solving and employing deductive reasoning via reductive methods. Its opposite is postmodernism, which implicitly emphasizes problem framing and has a relative orientation toward mindset over process. By acknowledging multiple interpretations as equally legitimate, postmodernism enables multiple understandings, or framings, of the same situation, including simultaneous acceptance and rejection of the existence of a problem, which necessitates a mindset orientation. Heroism is at bottom left, having a mindset orientation because it emphasizes the importance of individual behavior relative to group expectations, as demonstrated to peers during problem solving. Its opposite is participation, which encourages mutual understanding (acceptance of different problem frames) via social interactions, which are viewed as unstructured processes.

Of the remaining five paradigms, CAS theory sits central to the chart because it emphasizes the need for holistic understanding of complex systems and ongoing management of irresolvable complex problems. It thereby necessitates flexible reorientation between problem solving and framing, and between mindset and process, considering the current nature of ever-changing open systems. The remaining four paradigms sit in between at spots on the chart that are most appropriate to their own preferred outlooks and methodologies.

In the forthcoming analysis of civilian and military design thinking, different design methodologies will also be mapped onto this quad chart, revealing the relationship each has to these paradigms as well as to each other. This framework also enables a paradigmatic mapping of the evolution of design thinking over time. General trends, divergence, tensions, and convergence between civilian and military design thinking that can be observed because of this mapping are addressed in chapter 4.

An additional point of comparison between these paradigms is the type and range of data and evidence that each considers legitimate. Some paradigms, like technical rationalism, heroism, and CAS theory, accept only a limited range of data and evidence as legitimate. For these paradigms, legitimate knowledge must be derived from observations of this type of data and evidence.²⁰ Other paradigms contained in the framework accept progressively broader ranges of data and evidence as legitimate, with radical humanism and postmodernism accepting the broadest range. This is because these two paradigms respectively emphasize methodological pluralism and multiple reinterpretations of metanarratives, meaning that they concurrently accept as legitimate observations based on multiple types of sometimes conflicting data and evidence, or even observations based on no data or evidence at all.²¹

Although this difference between paradigms is not shown in the quad chart in Figure 1.1, and is not as prominent or as significant to the analytical framework as the contrasts represented in this figure, it is nevertheless useful for developing a more nuanced understanding of the nature of the different paradigms. Due to their relationship to the design methodologies, this difference between paradigms is also useful when contrasting some of the design methodologies. This difference in the scope of data and evidence that is considered legitimate will therefore be occasionally revisited during the analysis in subsequent chapters.

Notes

1. The most prominent of the military design thinkers who have developed these recent meta-methodologies are Ben Zweibelson of the US Joint Special Operations University, who developed a design methodology he called “second generation military design,” and Paul T. Mitchell and Philippe Beaulieu-Brossard of the Canadian Forces College, who instruct there using an approach they call “epistemological agnosticism for design methodology.” These methodologies are explored in detail in chapters 3 and 4 of this monograph. Ben Zweibelson, “An Application of Theory: Second Generation Military Design on the Horizon”; Philippe Beaulieu-Brossard and Paul T. Mitchell, “Challenge-Driven: Canadian Forces College’s Agnostic Approach to Design Thinking Education.”

2. For example, see Tony Fry, *Unstaging War, Confronting Conflict and Peace*, 93–101.

3. The intended roles for this monograph are similar to those advocated within Krippendorff’s proposed “science for design,” which is concerned with the conduct of “post-design research” that may assist in improving future iterations of design processes and assisting in the development of new design methodologies. This connection is purely coincidental, since this author was not aware of Krippendorff or his work until well after the project that led to this monograph had commenced. Krippendorff is discussed in more detail in chapter 2. Klaus Krippendorff, *The Semantic Turn: A New Foundation for Design*, 192–252.

4. For the purposes of this monograph, “innovation” is the combination of existing ideas in novel ways that creates emergence. As will be seen in chapters 2 and 3, design methodologies of both civilian and military origin effectively achieve this.

5. Gibson Burrell and Gareth Morgan, *Sociological Paradigms and Organisational Analysis*; Jean-Etienne Joullié, “The Philosophical Foundations of Management Thought,” 157–179; Christopher R. Paparone, “Beyond Ends-Based Rationality: A Quad-conceptual View of Strategic Reasoning for Professional Military Education,” 309–340; Melanie Mitchell, *Complexity: A Guided Tour*.

6. Thomas S. Kuhn, *The Structure of Scientific Revolutions*, 174.

7. Margaret Masterman, "The Nature of a Paradigm" 59–89. For a detailed analysis of how paradigms function specifically within the field of strategic studies, see also: Aaron P. Jackson, "Paradigms Reconsidered," 26–31.
8. Michael Williams, *Problems of Knowledge: A Critical Introduction to Epistemology*, 1–12.
9. Burrell and Morgan, *Sociological Paradigms and Organizational Analysis*, 1–4.
10. Masterman, "The Nature of a Paradigm," 59–89; Thomas S. Kuhn, *The Essential Tension: Selected Studies in Scientific Tradition and Change*, 293–301.
11. These nine paradigms, along with six others not discussed herein, are also employed in one of the author's other research projects. This project examines the application of methodologies from within different paradigms as possible alternatives to "traditional" military planning processes. Aaron P. Jackson, "Towards a Multi-paradigmatic Methodology for Military Planning: An Initial Toolkit."
12. Garry Potter and José López, "After Postmodernism: The New Millennium," 4–5.
13. Ofra Gracier, "Self Disruption: Seizing the High Ground of Systemic Operational Design (SOD)," 24–27; Ben Zweibelson, "Changing Change while it Changes: The Rise of Disruptive Military Thinking (Part 2 of 3)." Systemic Operational Design's development and methodology is elaborated in chapter 3.
14. Potter and López, "After Postmodernism," 4.
15. Beaulieu-Brossard and Philippe Dufort, "Introduction: Revolution in Military Epistemology," 2n3.
16. Paparone, conversation with the author on 28 February 2019. This information was provided to me in response to the presentation of an earlier version of this monograph at a conference that Paparone also attended. Details of the conference paper are: Jackson, "Civilian and military design thinking: A comparative historical and paradigmatic analysis, and its implications for military designers."
17. Bernard E. Harcourt, "An Answer to the Question: 'What is Poststructuralism?'" 17–20.
18. Burrell and Morgan, *Sociological Paradigms and Organizational Analysis*, 41–120.
19. Burrell and Morgan, *Sociological Paradigms and Organizational Analysis*, 41–120; Joullié, "The Philosophical Foundations of Management Thought," 158–161; Jackson, "Towards a Multi-paradigmatic Methodology for Military Planning."
20. Burrell and Morgan, *Sociological Paradigms and Organisational Analysis*, 41–226; Joullié, "The Philosophical Foundations of Management Thought," 158–161; Melanie Mitchell, *Complexity*, 94–111.
21. Burrell and Morgan, *Sociological Paradigms and Organisational Analysis*, 279–325; Joullié, "The Philosophical Foundations of Management Thought," 172–175.

Chapter 2

Civilian Design Thinking

This chapter examines the evolution of civilian design thinking from its emergence in the 1950s until the present. It does this in two sections. In the first section, a chronological discussion of key civilian design thinkers and methodologies summarizes the contributions of each to establishing then advancing the field. In the second section, the analytical framework elaborated in chapter 1 is applied to analyze the different civilian design thinkers and methodologies described in its first section. This includes mapping the most significant of these thinkers and methodologies onto the two-dimensional spectrum that was shown in Figure 1.1.

As a result of this mapping, several observations are made about the nature of civilian design thinking and its evolution over time. For example, it is confirmed that civilian design thinking is an interdisciplinary field and that its scope has broadened considerably over time, from product design to service design to social systems design, and most recently to design of meaning. These and other observations made in the second part of the chapter enable several conclusions to be made about the nature of civilian design thinking and its relationship to the paradigms contained in this monograph's analytical framework. Key among these conclusions is that the paradigms that have been most influential on the development of civilian design thinking are technical rationalism in its early years, and more recently radical structuralism, interpretivism, and CAS theory.

The Evolution of Civilian Design Thinking

Civilian design thinking emerged in unrelated ways in the United States and Germany during the 1950s, and in Scandinavia during the 1960s. During this period in the US, R. Buckminster Fuller at MIT developed a product design process that he called "design science," which used interdisciplinary teams of experts to design solutions to systemic problems. In Scandinavia, teams of laymen (not necessarily experts) met to address problems of a similar nature under the coordination of facilitators who applied "cooperative design" to assist the team to generate new ideas.¹ In Germany, Horst Rittel taught architectural and product design to students at Ulm University before moving to the University of California at Berkeley in 1963. His interdisciplinary framework, which he called "operational knowledge," blended aspects of sociology, economics, cultural history, psychology, and mathematics.² During the 1960s and 1970s, key civilian designers included Herbert Simon, Bruce

Archer, Victor Papanek, and Melvin Webber, the latter of whom in collaboration with Rittel, coined the term “wicked problem” in 1973.³

Early examples of design thinking are more technically rationalist than their contemporary equivalents. For example, Simon, who was the first to assert that “everyone designs who devises courses of action aimed at changing existing situations into preferred ones,”⁴ adhered to the same concept as Fuller that design was a form of science. Simon’s major work delineated between natural and artificial environments (man-made or social may be better terms to describe what Simon meant by artificial), and compared the human brain to a computer with insufficient processing power to adequately understand the complexities of the artificial environment. He addressed ways to overcome this insufficiency, proposing a range of alternatives that varied from breaking large problems into component parts to help understand the whole, to designing without final goals in mind, stating that designers should instead to be guided by interestingness or novelty.⁵

Fuller and Simon were in alignment with current design thinkers in that they advocated the need to understand the perspectives of multiple stakeholders in social issues, and the need to be open and adaptive in light of an evolving complex problem. But their linkage between design and science contrasts with most contemporary conceptions, which find links between design and creativity or art, often framed explicitly in contrast to science (and objective scientific method in particular).⁶ It has been suggested that this early association of design with science was because of the inspiration that early design thinkers like Fuller and Simon took from operations research, systems engineering, and systems analysis approaches that were developed during the Second World War. These approaches were largely based on the then-emerging field of mathematics of open systems, which also went on to greatly influence the development of the field of cybernetics during the 1950s to the 1970s.⁷

The association between design, art, and creativity began with Rittel and Webber, who emphasized that addressing wicked problems required a form of art rather than a science. They asserted this in relation to policy making and planning, not to design thinking.⁸ It was Papanek who explicitly linked design with creativity in his 1973 book *Design for the Real World*. He also emphasized the importance of environmental and social sustainability and introduced the idea of moral responsibility to design thinking.⁹ Importantly, his design thinking model moved away from the technical rationalism of his predecessors, emphasizing instead different ways to trigger innovation, build and test prototypes, and then re-design and adjust as required until a final design emerged.¹⁰

Archer, in a series of articles as well as his doctoral thesis, addressed “design science” in a similar way to Fuller and Simon. While Archer is noteworthy for being the first who “suggests that design is human-centred, arguing for an account of ‘human values,’”¹¹ he also drew heavily on cybernetics and algorithmic approaches in his early design thinking. Although his concepts of design changed dramatically over his 25-year publishing career, he tended to maintain a focus on industrial design and commercial product development.¹² Eventually, he came to view design thinking as “a third way,” distinct from both art and science but incorporating aspects of both.¹³ He is also the first to lament that design thinking suffers because of the inability of designers to come to “use of an agreed terminology,” observing that instead designers “each have their own favorite models, techniques, and jargon.”¹⁴ Over half a century later this criticism is still leveled at design thinking regularly.

Despite their differences, this early group of design thinkers established some of the key characteristics that still apply to the field today, including its interdisciplinary nature and its attempts to address what are now called complex or wicked problems. Civilian design methods have spread and evolved, and while design thinking has maintained its interdisciplinary nature, the development and application of design methods have become more prominent within some fields than others. These fields include architecture, ergonomics, industrial design (i.e., consumer product and service development), urban planning, and the computer sciences.¹⁵ In turn, design methods have drawn upon a range of disciplines; most frequently cited among them are psychology (especially cognitive psychology and organizational psychology), anthropology, business management, engineering, phenomenology, and complexity and systems sciences.¹⁶

In the 1980s, key design researchers began to focus on what separated innovative thinkers from their peers. This significant change in focus brought about what has been called “the second wave” of (civilian) design thinking.¹⁷ Key texts from this era, including Nigel Cross’s *Designerly Ways of Knowing* and Donald Schön’s *The Reflective Practitioner*, endeavored not to develop new design methods or processes, but instead to explain individual and collective creative thought and innovation, and what enabled them.¹⁸ Schön in particular introduced the idea of reflexivity, or conscious self-reflection, to design thinking. In doing so, he shifted the focus of design thinking from outward to inward, and from a technical rationalist focus on *problem solving* to a more paradigmatically fluid focus on *problem framing*. “When ends are fixed and clear,” Schön wrote, “then the decision to act can present itself as an instrumental problem. But when ends are confused and conflicting, there is yet no ‘problem’ to solve.”¹⁹

It is during these latter situations that design thinking relies on the intuition of designers. As a result, “the design process for Schön is a personal and internal conversation between the object designed and the designer. This examination directed him to discuss the ‘reflective’ nature of designing.”²⁰ Ulla Johansson-Sköldberg, Jill Woodilla, and Mehves Çetinkaya elaborated on the extent of the difference between Schön and earlier designers, asserting for example that “Simon created an objective framework for the field of design, while Schön fleshed it out with descriptions of designers in practice. Their writings, therefore, belong to quite different worlds from an epistemological point of view.”²¹ Schön’s conceptualization of design thinking also contrasted to that of designers like Simon and Archer in another way, in that it led Schön to strongly reject the possibility of any links between science and design. This was something Schön had in common with Cross.

For his own part, Cross agreed with Archer that “Design with a capital ‘D’” constituted a “third culture” that sat alongside the sciences and the humanities.²² Further developing another key aspect of design thinking, Cross built on Simon’s concept of “satisficing,” the idea that quickly arriving at a satisfactory solution to a complex and ever-changing problem is preferable to attempting prolonged, deep analysis that seeks a perfect solution.²³ Like Schön, Cross emphasized the need for designers to frame the problem and the need for internal self-reflection to enable this to occur.²⁴

The teaching of design thinking within civilian educational institutions, ongoing at MIT since the 1950s and in a few other higher education institutions since the 1960s, proliferated during the 1990s.²⁵ This followed a revival of the attention paid to its processual aspects, beginning in 1992 with Richard Buchanan’s *Wicked Problems in Design Thinking*, which broadened the emphasis of industrial and business design thinking from product design to service design. He also popularized the term Rittel and Webber had coined 20 years earlier, further developing the two-tier problem definition (framing) and problem solution process advocated by earlier designers, to the point where it became not only central to design thinking but its only aspect:

Design problems are “indeterminate” and “wicked” because design has no special subject matter of its own apart from what a designer conceives it to be. The subject matter of design is potentially *universal* in scope, because design thinking may be applied to any area of human experience. But in the process of application, the designer must discover or invent a *particular* subject out of the problems and issues of specific circumstances.²⁶

As a result of this scope, Buchanan identified that a “discipline of design thinking” had emerged within the liberal arts over the course of the twentieth century.

Following the combination of Buchanan's infinite expansion of the legitimate scope of design thinking and the proliferation of educational institutions offering design thinking courses, civilian design thinking became so prolific that from the late 1980s on, it becomes impossible to summarize the works of each key author. Instead, the need emerges to discuss particular schools of design thinking, each being associated with a particular methodology or process for designing.²⁷ The need for this transition is explained by Johansson-Sköldberg, Woodilla, and Çetinkaya, who observed that early design thinking tended to be entirely theory-driven, whereas from the mid-1980s, "management scholars" and researchers in other professional fields became interested in the application of design thinking within these fields. This led to a transition in the nature of the design thinking literature, from a collection of individually-authored theoretical works to a broad range of texts that also included "recipes" for 'how to do design thinking' for practitioners, or textbooks for students, with simplified arguments, diagrams, and check-lists, but little theory development."²⁸

In testament to the interdisciplinary nature of design thinking, each of the schools summarized below could be subjected to a separate historical study about what influenced it. Although each school is not necessarily linked to the design thinkers described above, at least some of these earlier thinkers have influenced most of the schools that emerged since the late 1980s. Regarding the extent of the history of design thinking, at the extreme end of the spectrum Harold G. Nelson and Erik Stolterman have argued that "*design is the first tradition* among the many traditions of inquiry and action developed over time, including art, religion, science, and technology." Defining design as "the ability to imagine *that-which-does-not-yet-exist*, to make it appear in concrete form as a new, purposeful addition to the real world," their book *The Design Way* opens with the assertion that "humans did not discover fire—they designed it."²⁹ Suffice to say, this assertion is commensurate with the perception of many design thinkers that the discipline is as old as human cognition, even though its recognition has been very recent.³⁰

First among the most prominent schools of design thinking that emerged during or after the late 1980s is participatory design. This was based on the Scandinavian cooperative design methods that had been evolving since the 1960s, but because of the language barrier had remained virtually unknown in the Anglosphere until the late 1980s. This school's method emphasized the designer's identification of user needs during product development, followed by extensive product prototyping and testing.³¹ User-centered design evolved from participatory design by changing its emphasis from prototyping and product testing to developing a deeper understanding of user expe-

rience. This change in focus, which was led by Don Norman in his book, *The Design of Everyday Things*, helped to enshrine product users at multiple stages in the design process, instead of waiting until the testing stage to involve them.³²

Other design methods introduced during this period include interaction design, which originated in the late 1980s but remained low key until the mid-2000s; transformation design, which was introduced by the UK Design Council in 2006; and service design, which emerged in the early 2000s. Each of these incorporated several aspects of the preceding methods, but varied them in important ways.³³ For example, service design emphasized user experience in the same way as user-centered design, but differed because it considered this in terms of values and culture rather than needs.³⁴

In 1991, the method of human-centered design originated in William B. Rouse's book *Design for Success*.³⁵ It later underwent significant further development to become what it is today. At first, "user-centered and human-centered were often interchangeable terms used for methods that integrated end users into the design process."³⁶ Elizabeth Sanders and Peter Stappers explain what had changed by the early 21st century:

But it is now becoming apparent that the user-centred design approach cannot address the scale or the complexity of the challenges we face today. We are no longer simply designing products for users. We are designing for the future experiences of people, communities, and cultures who now are connected and informed in ways that were unimaginable even 10 years ago.³⁷

Put simply, human-centered design shifted the focus from designing products and services to designing social systems. Echoing Cross and Schön, Rouse moved away from process and toward conceiving design thinking as a philosophy.³⁸ In Stefanie Di Russo's words, human-centered design is "a design methodology that was manifested as more of a mindset than a physical set of tools."³⁹

It is also significant that human-centered design has been highly popularized by IDEO, a company that was formed in 1991.⁴⁰ The company has achieved fame for its application of human-centered design to develop a range of products and services, and its affiliates have authored several books on design thinking and taught several design courses.⁴¹ Although this fame has significantly boosted the profile of, and interest in, civilian design thinking, it is noteworthy that IDEO's publications are "most often without theoretical grounding, at best they provide insightful anecdotes or lists of best practices that readers may wish to try for themselves."⁴² In addition to popularizing human-centered design, another result of this approach has been to over-

simplify the general understanding of it. The theoretical or “mindset” aspects of design thinking in particular have been glossed over within several subsequent publications, especially those written for a corporate management audience.⁴³ In contrast to Rouse’s initial conception of human-centered design, these publications tend to treat human-centered design as a processual toolkit whose contents can be applied piecemeal and without catering to the specific context of each situation.⁴⁴

Human-centered design has also been further developed and popularized by the Stanford University d.school, which uses a human-centered design methodology consisting of five modes, each of which includes several components. The modes are: empathize, define, ideate, prototype and test. Despite the philosophical aspects emphasized in the literature accompanying the d.school’s human-centered design methodology, in application it appears to be procedural, and is accompanied by an extensive toolkit of practical methods to assist designers within each mode and component.⁴⁵ In contrast to much of the corporate management literature elaborating various human-centered design methods, the Stanford d.school methodology is intended to be applied as a complete process, and several of the tools in its toolkit are designed to build contextual understanding (particularly those associated with the empathize mode).

Although the IDEO and Stanford d.school versions of human-centered design have become the best-known and most frequently applied civilian design methodologies during the past few decades, it is worth remembering that many different design methodologies have proliferated during the same period and that many of these are still utilized today. The examples mentioned above are merely a few of the most prominent. These are shown in Figure 2.1, which provides a graphic representation of the evolution of the different civilian design thinking methodologies that have been described in this section.⁴⁶ The individuals whose images are shown are Fuller (at the bottom) and Buchanan (at center). The book covers shown are the key texts associated with the establishment or popularization of each methodology, and their horizontal location roughly aligns with their year of publication.⁴⁷ The smaller dashed arrows indicate where earlier civilian design thinking methodologies have directly influenced those that came later.

II. History of civilian design thinking

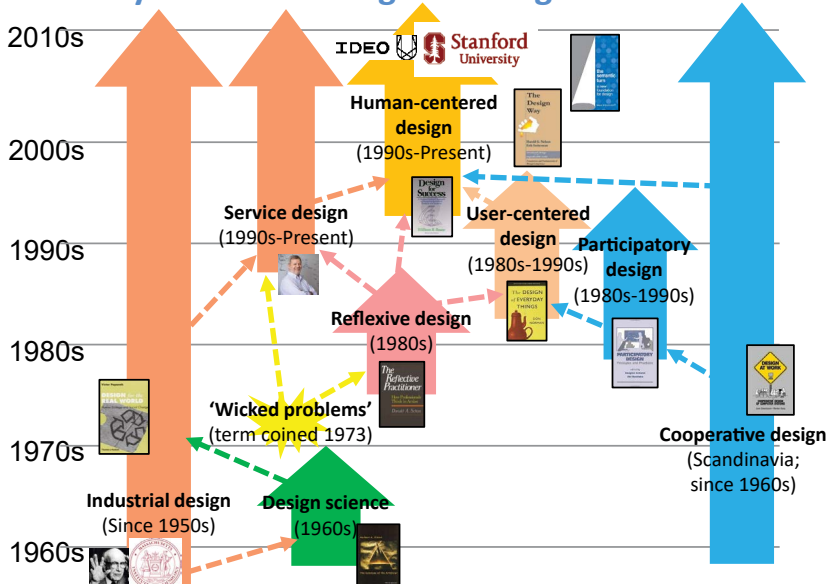


Figure 2.1. The evolution of key civilian design thinking methodologies

The most recent significant theoretical advancement in civilian design thinking is contained in Klaus Krippendorff's 2006 book, *The Semantic Turn: A New Foundation for Design Thinking*. This book, which is the uppermost of the book covers shown in Figure 2.1, is not linked to any of the arrows in the figure as it is arguably still too soon to determine what its ultimate impact on the field will be. In this book, Krippendorff defines design as "making sense of things," before specifying that the "things" he is referring to are human creations, and that making sense of them requires design thinkers to focus on the meaning that they give to artifacts.⁴⁸ Krippendorff thus changes the emphasis of design thinking, as explained by Johansson-Sköldberg, Woodilla, and Çetinkaya:

Compared with Simon, one could say that Krippendorff reversed the relationship between the design object and its intention. For Simon the artefact is at the core, and he would probably say that meaning is an attribute, while for Krippendorff meaning is the core of the design process and the artefact becomes a medium for communicating these meanings.⁴⁹

That Krippendorff is compared to Simon in this explanation is unsurprising, as Krippendorff presented his own argument partially in response to Simon's 1969 book *Sciences of the Artificial*.⁵⁰ Similarly to Simon (but at odds

with most other recent design thinkers), Krippendorff postulated the possibility of “science for design,” thus re-establishing a connection between design and science.⁵¹ Importantly though, Krippendorff maintained that because design thinking is future focused, design methodologies cannot mimic those of the sciences unless research is being conducted to critically evaluate the results of design thinking after the completion of its application. Krippendorff’s science for design is therefore concerned primarily with post-design research, which might assist in improving future iterations of design processes and developing new design methods. During the implementation of these design processes and methods, the necessity of the future focus ensures that scientific methods cannot be applied.⁵² Currently, it is implied that design thinking must remain more akin to art than science.

Paradigms Underlying Key Civilian Design Methodologies

From the preceding section one can observe several related themes underlying the generally eclectic collection of prominent civilian design thinkers. Foremost among these is that design thinking is interdisciplinary. Initially linked explicitly to the sciences, over time it has been linked instead with increasing frequency to art or the humanities.⁵³ Also with increasing frequency it has alternatively been construed as “a third area” that is separate from but linked to both the sciences and the humanities.⁵⁴ The interdisciplinary evolution of design thinking has been accompanied by a move away from early methodologies that were rooted in technical rationalism, toward more recent subjective approaches that are often paradigmatically flexible.

The scope of civilian design thinking has also broadened considerably. This could be summarized as a shift in emphasis from product design to service design to social systems design to design of meaning. Complex or wicked problems have long been credited as the focus of design thinking, although not all design thinkers have focused exclusively on these types of problems. Buchanan, for example, discussed “the four broad areas in which design is explored throughout the world by professional designers.” These areas are: “the design of symbolic and visual communications . . . the design of material objects . . . the design of activities and organized services . . . and the design of complex systems or environments for living, working, playing, and learning.” Of note, each of these areas is more complex than the last.⁵⁵

In the same vein, Di Russo developed a “stratification of design” to visualize the progressively greater complexity of the areas to which design thinking has been applied. Her stratification includes (from low to high complexity): design of artefact, artefact and experience, systems and behavior, and large

scale systems.⁵⁶ To this could be added Krippendorff's design of meaning, which Krippendorff discussed primarily in relation to artifacts, but which could potentially operate at any scale.⁵⁷ These divisions indicate that design thinking is suitable for addressing both relatively complex and relatively simple problems, although different design methodologies may be better suited to certain types of problems.

Another facet of the evolution of design thinking has been its oscillation between an external emphasis on design processes and an internal focus on designers themselves. Initially, design thinking focused on design processes.⁵⁸ Emphasis then shifted to conscious self-reflection by designers;⁵⁹ then back to processes, but this time incorporating users as well as designers;⁶⁰ then to the mindset of the designer as a philosophy or enabling attitude.⁶¹

More recently, the human-centered design method popularized by IDEO and the Stanford d.school seems to have incorporated aspects of all the above, being at once a mindset guiding practice and the design process itself.⁶² This may go some way toward explaining both the popularity of this particular design methodology and ongoing accusations leveled at design thinking that the discipline is definitionally confused. It is also indicative of a major ongoing area of debate between design thinkers emphasizing the relative importance of mindset and those emphasizing the relative importance of process.⁶³ Krippendorff, the most recent of the major design thinkers examined, explicitly refers to the design process on several occasions, despite his emphasis on design of meaning seemingly indicating the importance of a mindset orientation.⁶⁴ In addition to this changing emphasis in civilian design thinking between process and mindset orientations, the prominence of empathy and human centrality has generally increased over time.

A final common theme in the literature is the tension between problem framing/defining and problem solving/solution, and which ought to be the most important aspect of designing. Again, emphasis has oscillated over time. At one end of the spectrum, Simon elaborated on design science as a means of complex problem solving, referring to aspects of what would later be called problem framing only to the (albeit considerable) extent required to prepare designers for this problem solving.⁶⁵

At the other end of the spectrum, Schön disliked the term "problem" because it implies definability that he thought too straightforward for the types of complex situations design thinking addresses. His concept of "design as a reflective conversation with the situation" is intended for use by designers seeking to change their understanding of situations (i.e., to reframe them) once all possible problem solving or solution seeking has failed.⁶⁶ To once again use human-centered design as an example of more recent developments, it appears

that the processual aspects of this design methodology emphasize a roughly even mix of problem framing and problem solving, although like Simon, this process subordinates the former (framing) as a means to better prepare for the latter (solving).⁶⁷ Krippendorff, who focuses on design of meaning that subsequently becomes manifest in artifacts, seems to tend slightly the other way, as problem framing (designing meaning) is a fundamental precursor to problem solving (designing artifacts to embody this meaning).⁶⁸

The relationship between civilian design methodologies and their underlying paradigms is shown in Figure 2.2, wherein key civilian design thinkers and methodologies have been incorporated into the quad chart developed as this monograph’s framework for analysis. In this figure the paradigms are shown using black text (as they are in Figure 1.1) and the key design thinkers and methodologies are shown in red text. The years in which these design thinkers were writing, or methodologies were initially developed, are also shown in red text. The red arrows in the figure map the intellectual development of civilian design thinking as it has oscillated between a process or mindset orientation and between emphasizing either problem solving or framing. These arrows indicate the evolution of design thinking over time, not the intellectual influences upon, or relationships between, the design thinkers and methodologies shown.

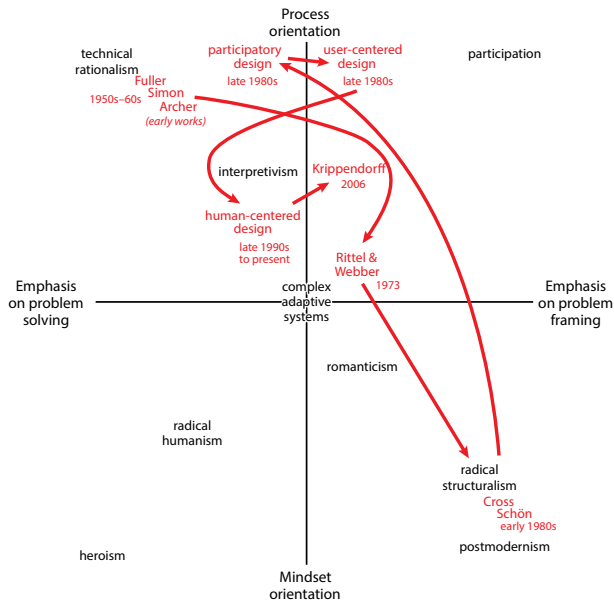


Figure 2.2. Relationship between civilian design methodologies and underlying paradigms

Figure 2.2 shows the progression of the development of civilian design thinking from design science during the 1950s and 1960s (Fuller, Simon, and the early works of Archer), which focused on processes for problem solving, to the perception of design as conscious self-reflection by designers during the 1980s (Cross and Schön), to a mixed emphasis on both areas of tension during the period from the 1990s to today (shown by the positioning of human-centered design and Krippendorff close to—but importantly not at—the center of the chart).⁶⁹ Along the way, design thinking has focused increasingly on complex problems (beginning in 1973 with Rittel and Webber), and has gone through a period of significant focus on process rather than mindset, to either solve problems via framing (participatory design) or to frame problems before solving them (user-centered design)—a subtle but important methodological difference.

Regarding the relative situation of the design thinkers and methodologies shown in the chart to the paradigms shown, it should be noted that the alignment implied by proximity is both relative and approximate. No single design thinker has aligned exclusively with any single paradigm, although some are more closely aligned than others. Rittel and Webber, for example, are almost (but not quite) entirely influenced by CAS theory, while Krippendorff's design of meaning is closely (but not exclusively) aligned with interpretivism. By contrast human-centered design, which occupies a similar position near the center of the chart, is influenced by most paradigms in roughly similar ways owing to its broad (one might say loose) conceptualization. At its core, however, this design methodology is a means to address problems within CAS, and its emphasis on empathy and creating future user experience in social systems design could be considered interpretivist. Hence it is positioned in the chart between these two paradigms and relatively closer to them despite its employment of several of the others within its large toolkit of methods.⁷⁰

From a paradigmatic viewpoint, CAS theory has had some level of influence on almost all the design thinkers and methodologies shown—Fuller and Simon are perhaps the only exceptions. On the other hand, heroism has had the least influence on any of the design thinkers and methodologies, being evident in Papanek's discussion of moral responsibility in design thinking, which is only one of several aspects of his work, and not featuring prominently in the other works examined herein. Hence, the design thinkers and methodologies shown in Figure 2.2 are positioned away from it. When developing the figure, it was relatively difficult to determine which paradigm should be situated more closely to Cross and Schön (ultimately determined to be radical structuralism). Conversely, it was relatively easy to determine which paradigms should be closest to Fuller, Simon, Rittel and Webber, and

Krippendorff. This is due to the methodologies for designing advocated by each, and the relationship between these and the preferred outlooks and methodologies of each paradigm.

Overall, it is an important enabler for discussion in chapter 4 of this monograph to conclude this chapter by observing that at various points in its history, civilian design thinking has been most closely aligned with technical rationalism, radical structuralism, interpretivism, and CAS theory.

Notes

1. Jo Szczepanska, "Design Thinking Origin Story plus Some of the People who Made it all Happen."
2. Jean-Pierre Protzen and David J. Harris, *The Universe of Design: Horst Rittel's Theories of Design and Planning*, 7–8.
3. Herbert A. Simon, *Sciences of the Artificial*; Victor J. Papanek, *Design for the Real World: Human Ecology and Social Change*; Horst W. J. Rittel and Melvin M. Webber, "Dilemmas in a General Theory of Planning," 155–169.
4. Simon, *Sciences of the Artificial*, 111.
5. Simon, *Sciences of the Artificial*, 128, 162–163.
6. Stephanie Di Russo, "A Brief History of Design Thinking: The Theory [P1]."
7. Protzen and Harris, *The Universe of Design*, 3–4.
8. Rittel and Webber, "Dilemmas in a General Theory of Planning," 155–169.
9. Papanek, *Design for the Real World*, 159–178.
10. Papanek, *Design for the Real World*, 275–319.
11. Di Russo, "Understanding the Behaviour of Design Thinking in Complex Environments," 20.
12. Stephen Boyd Davis and Simone Gristwood, *The Structure of Design Processes: Ideal and Reality in Bruce Archer's 1968 Doctoral Thesis*.
13. Di Russo, "Understanding the Behaviour of Design Thinking," 19–21.
14. Quoted in Di Russo, "Understanding the Behaviour of Design Thinking," 21.
15. Szczepanska, "Design Thinking Origin Story"; Richard Buchanan, "Wicked Problems in Design Thinking," 11; Harold G. Nelson and Erik Stolterman, *The Design Way: Intentional Change in an Unpredictable World*, 1–2; Donald Schön, *The Reflective Practitioner: How Professionals Think in Action*, 76.
16. Di Russo, "Understanding the Behaviour of Design Thinking," 12–13; Szczepanska, "Design Thinking Origin Story"; Buchanan, "Wicked Problems in Design Thinking," 9–10; Nelson and Stolterman, *The Design Way*, 1–2; David Sless, *Transitions in Information Design: A History*.
17. Di Russo, "A Brief History of Design Thinking: The Theory [P2]."
18. Nigel Cross, "Designerly Ways of Knowing," 221–227; Schön, *The Reflective Practitioner*.
19. Schön, *The Reflective Practitioner*, 41.

20. Di Russo, "Understanding the Behaviour of Design Thinking," 26.
21. Ulla Johansson-Sköldberg, Jill Woodilla and Mehves Çetinkaya, "Design Thinking: Past, Present and Possible Futures," 125.
22. Cross, "Designerly Ways of Knowing," 221.
23. Cross, "Designerly Ways of Knowing," 224; Simon, *Sciences of the Artificial*, 27–30.
24. Cross, "Designerly Ways of Knowing," 221–227.
25. Szczepanska, "Design Thinking Origin Story."
26. Buchanan, "Wicked Problems in Design Thinking," 16. Emphasis in original.
27. The most prominent of these are concisely summarized by Di Russo in both her doctoral thesis and related blog post. Discussion in the next few paragraphs draws strongly on these sources, which are highly recommended to readers seeking further information. Di Russo, "Understanding the Behaviour of Design Thinking," 29–35; Di Russo, "A Brief History of Design Thinking: How Design Thinking Came to 'Be.'"
28. Johansson-Sköldberg, Woodilla and Çetinkaya, "Design Thinking," 122.
29. Nelson and Stolterman seem to have paraphrased Buchanan in their definition of design thinking, although they do not credit him. It is therefore unknown whether their definition's similarity to Buchanan's earlier statements was deliberate or coincidental. Buchanan's own statements were that "scientists are concerned with understanding the universal properties of what is, while designers are concerned with conceiving and planning a particular that does not yet exist;" and "The problem for designers is to conceive and plan what does not yet exist, and this occurs in the context of the indeterminacy of wicked problems, before the final result is known." Nelson and Stolterman, *The Design Way*, 1–2; emphasis in original. Buchanan, "Wicked Problems in Design Thinking," 17–18.
30. Di Russo, "A Brief History of Design Thinking"; Nelson and Stolterman, *The Design Way*, 9–15.
31. Elizabeth B. N. Sanders and Pieter Jan Stappers, "Co-creation and the New Landscapes of Design," 7; Di Russo, "A Brief History of Design Thinking"; Di Russo, "Understanding the Behaviour of Design Thinking," 29–30.
32. Don Norman, *The Design of Everyday Things: Revised and Expanded Edition*. The first edition, published in 1988, was titled *The Psychology of Everyday Things*. See Di Russo, "A Brief History of Design Thinking"; Di Russo, "Understanding the Behaviour of Design Thinking," 31.
33. Sanders and Stappers, "Co-creation and the New Landscapes of Design," 10.
34. Di Russo, "A Brief History of Design Thinking"; Di Russo, "Understanding the Behaviour of Design Thinking," 32–34.
35. William B. Rouse, *Design for Success: A Human-Centred Approach to Designing Successful Products and Systems*.
36. Di Russo, "Understanding the Behaviour of Design Thinking," 34.
37. Sanders and Stappers, "Co-creation and the New Landscapes of Design," 10.
38. Rouse, *Design for Success*, 2.
39. Di Russo, "A Brief History of Design Thinking."

40. IDEO, *About IDEO*.
41. Szczepanska, "Design Thinking Origin Story."
42. Johansson-Sköldberg, Woodilla and Çetinkaya, "Design Thinking," 128.
43. These over-simplified versions of human-centered design have led to several of the criticisms that are now levelled at design thinking. For example, see Lee Vinsel, "The Design Thinking Movement is Absurd."
44. Johansson-Sköldberg, Woodilla and Çetinkaya, "Design Thinking," 127–131. For examples of such sources, see Vijay Kumar, *101 Design Methods: A Structured Approach for Driving Innovation in your Organization*; Bella Martin and Bruce Hanington, *Universal Methods of Design: 100 Ways to Research Complex Problems, Develop Innovative Ideas, and Design Effective Solutions*. In addition to finding the entries in these and many similar texts relatively superficial, based on his research into the history of design thinking the author is also inclined to question whether many of the methods included in these texts actually originate in the design thinking literature, as opposed to being borrowed from other fields—becoming what Schön would call "displaced concepts." See Donald Schön, *Displacement of Concepts*.
45. Scott Doorley et al., *Design Thinking Bootleg*.
46. Figure 2.1 is inspired by a diagram produced by Ben Zweibelson to show the evolution of military design thinking. The author thanks Zweibelson for his permission to reproduce the format of the diagram in this monograph. Zweibelson's original can be found in: Ben Zweibelson, "Changing Change while it Changes: The Rise of Disruptive Military Thinking (Part 2 of 3)."
47. From bottom to top, the books shown in Figure 2.1 are: Simon, *Sciences of the Artificial*; Papanek, *Design for the Real World*; Schön, *The Reflective Practitioner*; Joan Greenbaum and Mortein Kyng, eds., *Design at Work: Cooperative Design of Computer Systems* (this is one of the more prominent texts that has introduced cooperative design to an English-speaking audience); Douglas Schuler and Aki Namioka, *Participatory Design: Principles and Practice*; Norman, *Design of Everyday Things*; Rouse, *Design for Success*; Nelson and Stolterman, *The Design Way*; Krippendorff, *The Semantic Turn: A New Foundation for Design*.
48. Krippendorff, *The Semantic Turn*, xiii–xv.
49. Johansson-Sköldberg, Woodilla and Çetinkaya, "Design Thinking," 126.
50. Simon, *Sciences of the Artificial*.
51. Krippendorff, *The Semantic Turn*, 192–252.
52. Krippendorff, "Professor Klaus Krippendorff on the Key Concepts of The Semantic Turn," YouTube video. This monograph could be said to align with Krippendorff's "science for design," as it aims to help improve future military design methodologies through analyzing current and past methodologies. This connection is purely coincidental, since this author was not aware of Krippendorff or his work until well after the project that led to this monograph had commenced. (See also note 2 in chapter 1).
53. For instance, contrast Fuller and Simon with Papanek, and Rittel and Weber. See Szczepanska, "Design Thinking Origin Story"; Simon, *Sciences of the Artificial*;

Papanek, *Design for the Real World*; Rittel and Webber, "Dilemmas in a General Theory of Planning," 155–169.

54. Quoted in Davis and Gristwood, *The Structure of Design Processes*, 13. See Nelson and Stolterman, *The Design Way*, 9–15; Di Russo, "A Brief History of Design Thinking."

55. Buchanan, "Wicked Problems in Design Thinking," 9–10.

56. Di Russo, "Understanding the Behaviour of Design Thinking," 40–44.

57. Krippendorff, *The Semantic Turn*.

58. Simon, *Sciences of the Artificial*.

59. Schön, *The Reflective Practitioner*; Cross, "Designerly Ways of Knowing," 221–227.

60. Buchanan, "Wicked Problems in Design Thinking," 5–21; Norman, *The Design of Everyday Things*.

61. Rouse, *Design for Success*.

62. Doorley, et al., *Design Thinking Bootleg*.

63. Di Russo, "Understanding the Behaviour of Design Thinking," 36–39.

64. Krippendorff, *The Semantic Turn*, see esp. chaps. 2–6.

65. Simon, *Sciences of the Artificial*, see esp. chaps. 5–7.

66. Schön, *The Reflective Practitioner*, 76–104.

67. Doorley et al., *Design Thinking Bootleg*.

68. Krippendorff, *The Semantic Turn*, see esp. chaps. 2–6.

69. Human-centered design is slightly off-center in the chart because in application (if not in theory) it has a more prominent emphasis on process than mindset; and on problem solving than problem framing. Doorley et al., *Design Thinking Bootleg*.

70. Doorley et al., *Design Thinking Bootleg*; IDEO, *Complex Problems are Best Solved Collaboratively*.

Chapter 3

Military Design Thinking

This chapter does for military design thinking what the previous chapter did for civilian design thinking. It is divided into two sections. In the first, it examines the evolution of military design thinking, beginning with a summary of different views about when exactly this emerged.¹ It then chronicles the development of military design thinking from the mid-1990s, which is when the majority of the few authors who have previously attempted to trace its history consider it to have originated. In the second section, the chapter applies the analytical framework elaborated in chapter 1 to analyze the different military design thinkers and methodologies described in its first section. This includes mapping the most significant of these thinkers and methodologies onto the two-dimensional spectrum that was shown in Figure 1.1.

Several observations can be made about the nature of military design thinking and its evolution over time. Like its civilian equivalent, it is confirmed that military design thinking is an interdisciplinary field, and that its development has been influenced by a mix of prominent individual theorists and organizations seeking to apply design methodologies in both education and practice. Yet the evolution of military design thinking is also distinct because it incorporates a third significant influence that is absent from the civilian literature, which is doctrine. In militaries, doctrine has (not without controversy) constituted a third significant means for developing and promulgating design methodologies, and there is no civilian equivalent to this. It is also observed that military design thinking differs from civilian design thinking in the nature and causes of its emergence, and in the extent of the critical self-reflection that it encourages and the means by which it does this. These differences, and their significance, are elaborated in the second section of this chapter.

Because of these observations, a key conclusion is made that the paradigms that have been most influential on the development of military design thinking are CAS theory, radical structuralism, and postmodernism. Technical rationalism can be added to this list, providing that one considers traditional military planning and operational art to be types of design thinking. As elaborated in the first section of this chapter, whether or not these are types of design thinking is dependent upon one's understanding of it.

The Evolution of Military Design Thinking

Despite the earlier proliferation of civilian design methodologies, military design thinking emerged independently. Its precise origins have been subject to debate, and three minority perspectives are worth mentioning. Operational art has been cited as the earliest example of military design, as this body of theory “implied that before ‘planning’ occurred where a series of operations could be linked toward some larger strategic goals, a broader ‘design’ ought to occur that required more systemic thinking over analytical reductionism.”² If this assertion is correct, then military design thinking emerged in Prussia in the 19th century, was significantly developed in the Soviet Union from the 1920s, and entered the vernacular of Anglosphere militaries during the 1980s.³

Another perspective posits that planning is a form of design and that, therefore, military planning is a form of military design.⁴ By this understanding military design, in the form of staff planning guidance, dates to at least the mid-19th century, when Western militaries began to incorporate planning processes into written doctrine.⁵ If one looks beyond doctrine to military theory and practice in general, then by this understanding military design is much older. Just as Harold Nelson and Erik Stolterman asserted that “humans did not discover fire—they designed it,”⁶ if planning is a form of design then our prehistorical ancestors did not discover organized violence—they designed it! Military design by this understanding may therefore predate militaries themselves, although the author knows no one who has yet explored the potential implications of this possibility.

A third perspective asserts that military design thinking was first evident in the theoretical works of US Air Force Colonel John Boyd, which were primarily developed during the 1980s.⁷ These works discussed military applications of complexity and chaos theory, evolutionary biology, and military history, among other less frequently referenced disciplines. Not only were Boyd’s works among the first to explicitly discuss chaos and complexity theory in the military context, the interdisciplinary nature of his enquiries has much in common with subsequent military design theory.⁸ Yet Boyd did not use the term “design thinking,” and it is unlikely he would have considered himself a designer. Ultimately, the accuracy or otherwise of these three perspectives depends on which definition of design thinking one employs.

The remainder of the few existing works that attempt to trace the origins of military design thinking assert that it originated in the mid-1990s with the work of Israeli Brigadier General Shimon Naveh.⁹ Ben Zweibelson, for example, has stated that “I consider Naveh the ‘father’ of the military design movement because he was the first to spearhead an entire new methodology

that was intended for the military to replace traditional military planning.”¹⁰ Naveh was also the first to explicitly consider himself as a military design thinker. His approach, called Systemic Operational Design (SOD), was developed at the Israeli Defense Force’s (IDF’s) Operational Theory Research Institute (OTRI), which Naveh headed after its establishment in February 1995.¹¹ This approach originated with an analysis of Soviet operational art using general systems theory, informed by a critical reading of military history.¹² This was soon accompanied by interaction with other academic disciplines including urban planning, psychology, cybernetics, and postmodern and poststructural philosophy, to form a unique design methodology.¹³

While interdisciplinary, SOD was much closer to postmodernism than to any of the other paradigms included in this monograph’s analytical framework. It was developed as an alternative to “traditional” military planning processes, which sit within the technical rationalist paradigm because of their tendency to break problems into component parts before problem solving via linear reverse engineering of solutions.¹⁴ Traditional military planning processes are, in this respect, similar to the early civilian design methodologies developed by Herbert Simon and Bruce Archer.¹⁵ In contrast, SOD employed “dialectic deliberation” between conflicting perspectives to enable extensive reframing, eventually developing an operational concept via multiple holistic considerations of problems.¹⁶ Linked to this was the idea that to create something genuinely different to what has come before, one first needs to destroy what already exists. This idea was inspired by Boyd’s presentation *Destruction and Creation* and was a radical means to encourage military personnel to understand their own biases by deconstructing them.¹⁷

The extreme paradigmatic dissimilarity between SOD and traditional military planning has resulted in a legacy wherein in military design thinking is often considered antithetical to military planning, and the two are often viewed as being in tension.¹⁸ Interestingly, a similar state of tension has been observed within civilian design thinking between Simon’s and Donald Schön’s approaches.¹⁹ Notwithstanding the minority view that planning is a form of design, debate about the impact of this tension remains an ongoing theme within military design thinking. This tension has also been evident in the implementation of military design methodologies. For example, Zweibelson summarized what happened after the IDF attempted to implement SOD:

SOD was so dense with philosophical language and these very abstract concepts, it was hard to translate and to disseminate to lower level forces. Further, it was only taught to senior leaders, and even then, only self-selecting leaders took it upon themselves to study it. Eventually, traditional IDF leaders, who wanted to protect the legacy system, took ac-

tion to purge SOD from the military; they largely eliminated the majority of SOD practitioners from their ranks, with Naveh himself excommunicated and OTRI disbanded.²⁰

This disbanding happened just before the 2006 Hezbollah War. Whether or not SOD was to blame for the Israeli failure in this war remains contentious to this day.²¹

Meanwhile, in the mid-2000s, the US military became interested in SOD as a possible methodology to help solve the problems it was facing in Afghanistan and Iraq. This interest originated in both the US Army School of Advanced Military Studies (SAMS) and Training and Doctrine Command (TRADOC) and began with the selection of six SAMS students in January 2005 to work with Naveh to research SOD. These students subsequently employed SOD during a major exercise in May 2005, drawing further interest in SOD because of the radically different nature of their solution to the exercise problem.²² In 2006, SAMS offered an elective course in SOD. In the same year general interest in SOD grew, leading to the production of several student monographs about SOD or related topics. In 2007, the elective SOD course expanded and, in 2008, it became part of the core curriculum.²³

Beginning in 2006, the expansion of SAMS courses in SOD was accompanied by a rapid succession of US Army publications addressing design thinking. These included a chapter in the best-selling 2006 edition of Field Manual (FM) 3-24, *Counterinsurgency*; the 2008 SAMS publication, *Art of Design: Student Text, Version 1.0* (Version 2.0 followed in 2010); TRADOC Pamphlet 525-5-500, *Commander's Appreciation and Campaign Design* in 2008; FM Interim 5-2, *Design* in 2009; the 2009 US Army Combined Arms Center publication, *Design: Tools of the Trade*; and the incorporation of a chapter about design thinking into FM 5-0, *The Operations Process* in 2010.²⁴ Design thinking then expanded into the joint space in the early 2010s, where it was labeled "operational design."²⁵

This array of US military publications ultimately obfuscated what military design thinking was and what methodologies it encompassed. As Alex Ryan explained, in developing these publications, "a curriculum of 3,000 pages of reading on design at SAMS was eventually distilled down into 13 pages of doctrine." The development of design doctrine "was controversial, given Naveh's widely expressed views on doctrine as antithetical to design, as well as the paucity of peer reviewed literature on [SOD] on which to base the doctrine."²⁶ In response, Naveh, along with Jim Schneider and Tim Challans, authored *The Structure of Operational Revolution: A Prolegomena*, which offered an alternative design methodology for the US Army that was much closer to SOD than the version included in doctrine.²⁷

By the early 2010s, Ryan further explained, “proponents of [military] design basically fell into two camps.” The first of these were the design purists, who strictly adhered to a complicated interdisciplinary design thinking methodology that required military personnel to reframe their understanding of a situation through questioning their core beliefs about it, leading to innovative and adaptive solutions. They asserted that because of this methodology design thinking “is not for everyone,” and most military officers “will never get it.” The second camp was the pragmatists, who saw a need to make design thinking as simple and as accessible as possible. They were the ones who adapted SOD into what appeared in doctrine, in the process creating a new and simplified design thinking methodology that greatly differed from SOD. The result was that:

[The purists were] mostly ignored or derided by Army leaders. For every 100 students, they would convert one or two devoted acolytes, but in the process they also generated active resistance to design. [The pragmatists were] better received by students. But because none of these students were required to challenge their fundamental beliefs, they were never able to really reframe. . . . Neither [camp] was able to transform the dominant institutional culture [of the US Army].²⁸

The design thinking approach included in US Army doctrine has since evolved into the “US Army Design Methodology” (ADM), the latest iteration of which is contained in a 2015 Army Technical Publication (ATP), a supporting document to *The Operations Process*. This ATP defines ADM as “a methodology for applying critical and creative thinking to understand, visualize, and describe unfamiliar problems and approaches to solving them.”²⁹ This definition is a minor but significant simplification of the initial doctrinal definition of design given in 2010: the earlier definition referred to “complex, ill-structured problems” rather than “unfamiliar problems.”³⁰

Both ADM and joint operational design include the development of environment and problem frames to ensure adequate understanding, followed by development of a solution frame (also called “the operational approach”).³¹ This is methodologically similar to Richard Buchanan’s two-tiered process of problem definition and problem solution that has become prominent within several civilian design methodologies.³² A key point of departure from the civilian methodologies, however, is that the solution frame in ADM and operational design is completed using several traditional military planning concepts that predate the introduction of design. These include identification of the desired end state, objectives, and decisive points; conduct of center of gravity analysis; and establishment of lines of operation or effort.³³

In other words, ADM and operational design subordinate the problem definition aspect of design as a step within a technical rationalist planning

methodology. Where SOD was developed as an alternative to traditional military planning processes and was viewed by some as irreconcilable with them, ADM and operational design were instead incorporated into them.³⁴ This incorporation is a direct result of the pragmatic approach identified and criticized by Ryan as perpetuating the dominant instrumental approach to problem solving.³⁵ Since the creation of this division between SOD and ADM in the late 2000s, subsequent military design thinking methodologies have tended to be the legacy of one or the other, perpetuating the paradigmatic and methodological divide.

More recent military design thinking is still manifest in the three distinct areas discussed above: military doctrine, the writings of individual military design thinkers, and andragogy and syllabi at military colleges. Developments in each of these areas since the late 2000s are most easily summarized separately.

Doctrinal military design thinking is easy to summarize as it has remained similar to the US Army's ADM. Doctrinal design methodologies tend to include a problem framing method, often coupled with an environment framing method, and a solution framing method that exclusively employs traditional military planning concepts to problem solve through linear reverse engineering. Such design methodologies are now included in the doctrine of all five US services, as well as in US joint doctrine.³⁶ Several US allies have incorporated similar design methodologies into their doctrine under various titles, including NATO, Britain, the Netherlands, and Australia.³⁷ Among this allied doctrine the British stands out because it "expresses many design concepts while avoiding the word 'design' entirely."³⁸ Instead, British doctrine discusses "understanding" similarly to how US doctrine discusses "design."³⁹

Since the late 2000s, an expanding number of individual military design thinkers have contributed to developing the field. In terms of written contributions, arguably the three most influential thinkers of this period are Alex Ryan, Chris Paparone, and Ben Zweibelson. This assertion is likely to be contentious, and several other military designers could easily be added to this list.⁴⁰ For brevity, discussion herein will be kept to these three. Interestingly, although each of the three has taken an interdisciplinary approach, a different single discipline has most heavily influenced the works of each.

Ryan, with co-author Anne-Marie Grisogono, was one of the earlier authors that examined military operational applications of CAS theory.⁴¹ He contributed to the initial development of the US Army's (pre-ADM) design doctrine.⁴² His most significant legacy has been to cement the linkage between military design thinking and CAS theory, particularly in the case of design methodologies contained within doctrine.⁴³

Paparone has been most heavily influenced by the sociology of knowledge. His 2013 book, *The Sociology of Military Science*, offered a detailed critique of the ingrained institutional biases of the US military before reframing military professionalism by deconstructing these biases then constructing alternative frames.⁴⁴ This reframing was greatly influenced by Schön's ideas about "reflective practice" and "displacement of concepts."⁴⁵ One may say that Paparone is to military design thinking as Schön is to civilian design thinking, in that both have prominently advocated the conception of design as primarily an internal reflexive conversation between the designer and the object designed.

By his own admission, Zweibelson's early works were most heavily influenced by postmodernism.⁴⁶ Recently, he has deliberately moved to an explicitly multiparadigmatic exploration of different types of design thinking, intentionally blending other design methodologies developed by a mix of military and civilian design thinkers.⁴⁷ He has also developed a nondoctrinal design methodology for US Special Operations Command,⁴⁸ and has (perhaps by accident) chronicled the spread of military design thinking via his prolific co-authorship of publications across the Occident.⁴⁹

The final area of rapid expansion since the late 2000s is the incorporation of design thinking into the andragogy and syllabi of several military colleges. This has involved application and in some cases development of a range of military design methodologies, and several of the most influential military design thinkers have manifest their ideas through their teaching rather than their writing.

In 2013, Naveh was invited back by the IDF to teach design at the general officer level, using a new methodology called Systemic Inquiry in Operational Mediation. This methodology focuses on triggering strategic and operational innovation through guided self-disruption and exploitation of identified tensions. He has been joined in this endeavor by Ofra Gracier, another prominent military design thinker.⁵⁰

After three years of experimenting with applying SOD (presumably in 2010–12),⁵¹ the Canadian Forces College (CFC) began teaching design thinking using its current approach in 2013. Drawing on a diverse mix of civilian and military design methodologies, CFC continues to evolve this "epistemological agnosticism for design methodology" approach by reframing the course syllabus annually and by providing students with instruction in multiple design methodologies of both military and civilian origin.⁵² Because of this approach, which was developed by now-prominent military design thinkers Paul Mitchell and Philippe Beaulieu-Brossard, CFC today quietly delivers one of the most comprehensive military design thinking education programs in the world.⁵³

The last few years have seen the establishment of design courses within various other NATO militaries, including the Netherlands, Poland, Sweden, Norway, Denmark, and Hungary.⁵⁴ Furthermore, some US military colleges now teach design courses that diverge from the methodologies contained in US military doctrine. For example, Zweibelson teaches a course at the US Joint Special Operations University based on his own design methodology.⁵⁵ Since 2014, the US Naval Postgraduate School has taught a design course based exclusively on the human-centered design methodology taught by the Stanford d.school.⁵⁶ Similarly, in 2018 the Royal Australian Air Force conducted short design courses that exclusively taught civilian design methods.⁵⁷ It has since developed its own design methodology in collaboration with Sydney University, by blending civilian design methods with elements of Boyd's so-called "OODA loop."⁵⁸ The increasing incorporation of unaltered civilian design methodologies into military curricula constitutes a noteworthy recent development in military design education. Like the rapid succession of US military design publications in the late 2000s, this development seems to have obfuscated what precisely military design thinking is and what methodologies it encompasses.

Another significant facet of military design thinking's history is its progress toward explicit recognition as a field of inquiry. While self-identified individual military design thinkers date back to Naveh in the mid-1990s, general recognition of the field itself is much more recent. The move toward this recognition arguably began with the establishment of an informal email group in 2009, initially consisting of Paparone, Zweibelson, and Grant Martin, who were all serving or retired US Army officers. This email group grew over the next eight years until it had over 100 members, before migrating after 2017 to other platforms such as Slack.⁵⁹ Concurrently, Beaulieu-Brossard's research into military design thinking led to him organizing an international military design conference in 2016, which has since become an annual event.⁶⁰ Two journal special editions were published in 2017 and 2018, as well as an edited book in 2019.⁶¹ A research-sharing website has also been established, lending further credibility to the field.⁶²

The 2018 conference symbolized the completion of military design thinking's establishment as an explicit field of inquiry, due to the breadth of conference participants. Nevertheless, the approximately 20-year lag between emergence and recognition remains a significant point of deviation from civilian design thinking, which was recognized as an explicit field of inquiry from its inception in the 1950s.

The relatively recent, and relatively messier, emergence of military design thinking is shown in Figure 3.1, which provides a graphic representation of

the evolution of the different military design methodologies that have been described in this section. This diagram modifies an earlier version by Zweibelson,⁶³ on which it is based, to take into account the diversity of civilian design methodologies that have influenced military design thinking, the possibility that operational art and planning may be types of design, and the impact of individual theorists as well as the application of design methodologies by the militaries of various countries. It is shown on the same time scale as Figure 2.1, which highlights just how recent the development of military design methodologies has been relative to the development of several civilian design methodologies.

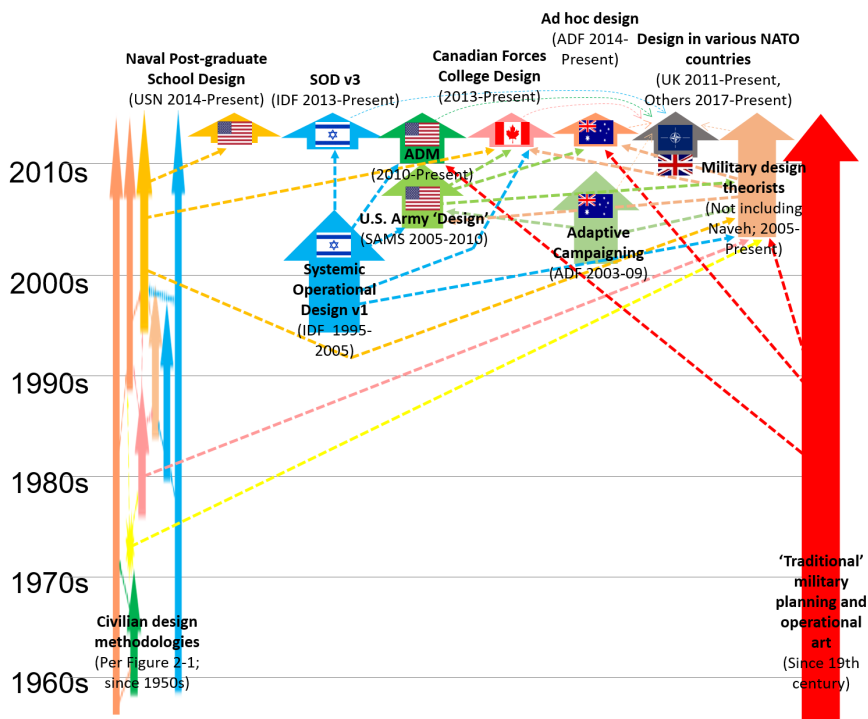


Figure 3.1. The evolution of key military design thinking methodologies

The smaller dashed arrows indicate where earlier design thinking methodologies have directly influenced those that came later. The high number of these arrows indicates the deliberate blending of multiple design methodologies by individuals like Zweibelson and institutions like CFC to form “meta-design methodologies,” as well as doctrinal attempts to blend design thinking with traditional military planning. In addition, the solid vertical arrows show-

ing the evolution of the civilian design methodologies in Figure 2.1 are reproduced in this figure. They are shown in condensed form at its left. This enables the influence these have had on military methodologies to be shown with more precision than would otherwise be the case. As can be seen, human-centered design has been the most influential, while Horst Rittel and Melvin Webber's wicked problems and Donald Schön's reflexive design have been particularly influential on various individual military design thinkers. This is in addition to the more numerous influences military design thinking methodologies have had on each other, particularly within the last decade.

Paradigms Underlying Key Military Design Methodologies

Like its civilian equivalent, there are several themes underlying the seemingly eclectic field of military design thinking. The two most obvious are the oscillation in emphasis over time between an external (process) focus and an internal (self-reflective) focus, and between problem framing/defining and problem solving/solution. These same themes can be observed in civilian design thinking, yet the way they are manifest constitutes a point of difference. This difference is largely due to an additional factor that exists in the case of military design thinking: its relationship with military doctrine. Civilian design thinking has been developed by a mix of prominent individual theorists and organizations applying design methodologies in both education and practice. In militaries, these two have been accompanied by doctrine as a third prominent avenue for the development and promulgation of design thinking methodologies. There is no civilian equivalent to this.

The relationship between military design thinking and doctrine has itself oscillated. On one side, some military designers assert that design is antithetical to doctrine. Some doctrinaires counter this by asserting that if a design method is not in doctrine, then it is not officially endorsed, and therefore the military should not be doing it. On the other side, some military design methodologies have been incorporated into doctrine, with ADM being most prominent.⁶⁴ Given the strong link between doctrine and modern Western militaries' cultural preferences regarding "how to fight,"⁶⁵ the unresolved tensions (and sometimes outright hostility) between proponents of doctrinal and non-doctrinal military design methodologies has the potential to be detrimental to both effective doctrine and effective application of design thinking.

Another key difference between civilian and military design thinking is the circumstances of their emergence. Civilian design thinking emerged in response to what are now commonly called complex or wicked problems, and has evolved by proposing a series of different means to either resolve or man-

age them.⁶⁶ Military design thinking, also a response to challenges posed by wicked problems, is usually considered as having emerged in response to observed failures of existing military planning processes to cope with these challenges.⁶⁷ Although early civilian design methodologies align with the same paradigm as traditional military planning (i.e., technical rationalism), civilian design constructively evolved away from it. By contrast, if one considers military design thinking as originating with Naveh, then its emergence constituted a sudden and deliberate paradigmatic break. A substantial break too, given that SOD aligns most closely with postmodernism, the paradigm within this monograph's analytical framework that is most dissimilar to technical rationalism. Even if one considers planning as a form of design, Naveh's sudden introduction of this new paradigm was still very disruptive.

That this sudden paradigmatic break triggered a conceptual backlash, leading within a short period to the development of doctrinal design methodologies that subordinate problem framing to technical rationalist doctrinal planning processes, is unsurprising. The divergence and parallel development of doctrinal and nondoctrinal military design methodologies with very different paradigmatic alignment is also unsurprising. The relatively rapid growth of military design thinking as a field of inquiry along with the role of doctrine as an additional factor driving advances within the field, have resulted in military design thinking being much "messier" than its civilian equivalent. Relatively speaking, there has been much more confusion over what exactly military design thinking is, when it is useful, and how to apply it.

The unique military requirements for design thinking have probably added to this confusion. Military design methodologies have proliferated as Western militaries have fought numerous wars against a backdrop of strategic uncertainty. Given that traditional military planning tends to begin by identifying the goal (called the "end state" in most contemporary planning doctrine), there has been a growing dissonance between this doctrine and strategic reality.⁶⁸ In light of these circumstances the emergence of military design thinking in the form of a sudden paradigmatic break is understandable. In contrast, civilian organizations attempting to apply design methodologies have not had to endure an equivalent existential questioning of their *raison d'être*. A civilian equivalent to what military design thinking has been required to do might look like, for example, a firm having to design under extreme time pressure a profitable product or service while concurrently questioning the effectiveness of the entire capitalist system and the role of the profit motive therein, all while recognizing that this system is rapidly changing but not knowing precisely what these changes or their outcome will be. This is a depth of critical self-reflection that civilian design thinking has not yet been called upon to provide.

The evolution of military design thinking and its relationship to the paradigms described in Table 1.1 is mapped in the quad chart in Figure 3.2. The horizontal and vertical axes, and the location of the paradigms (shown in black text) is the same as in Figure 1.1. In Figure 3.2, key military design thinkers and methodologies are shown in red text, with the years in which these thinkers were writing or methodologies developed shown adjacently, also in red text. The red arrows indicate the progression of time, not intellectual influences.

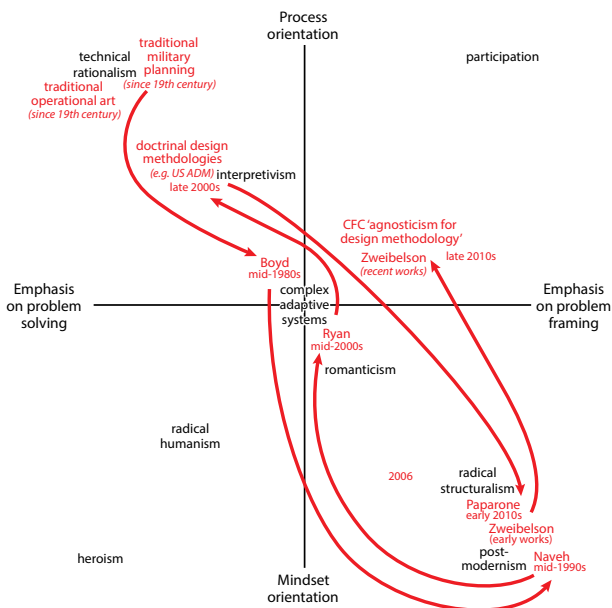


Figure 3.2. Relationship between military design methodologies and underlying paradigms

Like its civilian equivalent, military design thinking is interdisciplinary. The proximity between the design thinkers/methodologies and the paradigms shown in Figure 3.2 is therefore relative and approximate, and no single design thinker or methodology has aligned exclusively with any single paradigm. Of course, some of the thinkers/methodologies shown more closely align to one paradigm than to others. Traditional military planning is almost exclusively technically rationalist, and Ryan was very heavily influenced by CAS theory. By contrast, Zweibelson’s recent works and CFC’s “epistemological agnosticism for design methodology” are influenced by most paradigms due to their deliberate blending of multiple design methodologies

of both military and civilian origin.⁶⁹ Paparone, too, has been multidisciplinary in several of his works, often examining each of the paradigms developed by Gibson Burrell and Gareth Morgan, and their applicability to design or strategy, in equal measure.⁷⁰

The position of Zweibelson's recent works and CFC's agnostic design methodology in Figure 3.2 also indicates their slightly greater emphasis on process than mindset, as their blending of other design methodologies to create bespoke approaches is itself processual in application; and a slightly greater emphasis on problem framing, as the individual nature of each problem determines which other design methodologies may be best to add to the blend. Like civilian human-centered design, these methodologies are in theory both mindsets and processes, and involve both problem solving and framing. Unlike human-centered design, they achieve this mixed focus by blending several other design methodologies, rather than by constituting their own methodology. They may therefore be better termed "meta-design" methodologies.⁷¹ There is currently no civilian equivalent meta-design methodology and these approaches therefore represent an innovation across both fields of design thinking. This may explain why there has not yet been the same effort on the part of civilian designers to bridge the gap with their military counterparts as that which Zweibelson and the faculty at CFC have made in approaching civilian designers.

From a paradigmatic viewpoint, CAS theory has had some level of influence on every military design thinker/methodology shown in Figure 3.2 except for traditional military planning and operational art. This is understandable since the development of both predates the development of CAS theory by a considerable period. Heroism has had the least amount of influence on the military design thinkers and methodologies shown. The diagonally opposite location of several of the military design thinkers and methodologies shown, and the pronounced movement of the arrows from the top left to the bottom right of the figure, then back up and back down again, before finally moving closer to the center, is indicative of the conceptually "messy" emergence of military design thinking and the aforementioned factors contributing to this messiness.

Of the individual designers shown, Boyd and Ryan are both located near CAS theory, their different adjacent locations reflecting the slightly different process/mindset and problem framing/solving orientation of their works. Naveh is the most heavily influenced by postmodernism, with Zweibelson's early works also closely aligned to this paradigm.⁷² Paparone's close conceptual relationship to Schön has been given preference over his frequent multiparadigmatic discussions of Burrell and Morgan in determining his position

in Figure 3.2, which is nearest to radical structuralism—a location approximate to Schön’s location in Figure 2.2.⁷³ As discussed above, Zweibelson’s later works do not sit near any one particular paradigm. Of the doctrinal design methods shown, traditional military planning is closely aligned with technical rationalism. ADM and equivalent doctrinal design methodologies have been influenced by CAS theory more than the other paradigms shown, but as they are a step within technical rationalist planning processes, they are therefore still closest to this paradigm in application.

Overall, CAS theory, radical structuralism, and postmodernism have had the most influence on military design thinking, along with technical rationalism if one considers traditional military planning and operational art to be forms of design. The next chapter comparatively addresses the implications of this finding alongside the equivalent finding for civilian design thinking that was presented in chapter 2.

Notes

1. An earlier version of the first section of this chapter was published on *Medium*. See Aaron P. Jackson, “A Brief History of Military Design Thinking.”

2. Ben Zweibelson, “The Multidisciplinary Design Movement: A Frame for Realizing Industry, Security, and Academia Interplay.”

3. Dennis E. Shoalwater, “Prussian-German Operational Art, 1740–1943”; Jacob W. Kipp, “The Tsarist and Soviet Operational Art, 1853–1991”; John Andreas Olsen and Martin van Creveld, eds., *The Evolution of Operational Art: From Napoleon to the Present*, esp. chaps 2 and 3; Allan English, “The Operational Art,” 1–75; Justin Kelly and Mike Brennan, *Alien: How Operational Art Devoured Strategy*.

4. See Paparone, *The Sociology of Military Science: Prospects for Postinstitutional Military Design*, 90–91. Some have claimed the reverse, i.e., that design is a component of planning. However, these authors seem to have only understood “design” in terms of a narrow definition given within certain US Army doctrinal publications. As a result, their understanding of “design thinking” as a field of inquiry is not sufficiently developed to warrant their views being considered seriously herein. Wayne W. Grigsby, Jr. et al., “Integrated Planning: The Operations Process, Design, and the Military Decision Making Process,” 28–35.

5. Jackson, *The Roots of Military Doctrine: Change and Continuity in Understanding the Practice of Warfare*, 16–17.

6. Nelson and Stolterman, *The Design Way: Intentional Change in an Unpredictable World*, 1–2.

7. Jeffrey van der Veer, *The Rise of Design: Why an Innovative Concept is Emulated in Armies Around the Globe*, 25–26.

8. John R. Boyd, *A Discourse on Winning and Losing*, edited and compiled by Grant T. Hammond.

9. Gracier, "Self Disruption: Seizing the High Ground of Systemic Operational Design (SOD)," 22–27; Zweibelson, "Changing Change while it Changes: The Rise of Disruptive Military Thinking (Part 2 of 3)."
10. Zweibelson, "Changing Change while it Changes (Part 2 of 3)."
11. Gracier, "Self Disruption," 24–27; Zweibelson, "Changing Change while it Changes (Part 2 of 3)."
12. Shimon Naveh, *In Pursuit of Military Excellence: The Evolution of Operational Theory*, esp. xiii–xx.
13. Zweibelson, "Changing Change while it Changes (Part 2 of 3)."
14. Zweibelson, "Linear and Non-Linear Thinking: Beyond Reverse-Engineering," 28–30.
15. Simon, *Sciences of the Artificial*, 128; Davis and Gristwood, *The Structure of Design Processes: Ideal and Reality in Bruce Archer's 1968 Doctoral Thesis*, 1–15.
16. Gracier, "Self Disruption," 25.
17. Gracier, personal communication with the author, 24 June 2019. For Boyd's presentation, see *A Discourse on Winning and Losing*, 315–325.
18. Zweibelson, "An Awkward Tango: Pairing Traditional Military Planning to Design and Why It Currently Fails to Work," 11–41; Paparone, *The Sociology of Military Science*, 97.
19. Kees Dorst, *Frame Innovation: Create New Thinking by Design*, 183–185; Johansson-Sköldberg, Woodilla and Çetinkaya, "Design Thinking: Past, Present and Possible Futures," 125.
20. Zweibelson, "Changing Change while it Changes (Part 2 of 3)."
21. Exploration of this contention is tangential to the topic of this monograph and is not attempted herein. For further information, including examples of different arguments, see Van der Veer, *The Rise of Design*, 32–33; Gracier, "Between Teaching and Learning: What Lessons Could the Israeli Doctrine Learn from the 2006 Lebanon War?" 22–29; Matt Matthews, "Interview with Brigadier General (Ret.) Shimon Naveh"; Milan N. Vego, "A Case Against Systemic Operational Design," 69–75.
22. The outcomes of this research are captured in William T. Sorrels, Glen R. Downing, Paul J. Blakesley, David W. Pendall, Jason K. Walk and Richard D. Wallwork, *Systemic Operational Design: An Introduction*, iii–iv.
23. School of Advanced Military Studies, *Art of Design: Student Text, Version 2.0*, 1–3.
24. US Army, FM 3-24, *Counterinsurgency*, chap. 4; SAMS, *Art of Design*; US Army, TRADOC Pamphlet 525-5-500, *Commander's Appreciation and Campaign Design: Version 1.0*; US Army, Field Manual Interim 5-2, *Design* (Draft); Jack D. Kem, *Design: Tools of the Trade*; US Army, Field Manual 5-0, *The Operations Process*, chap. 3.
25. J. N. Mattis, Memorandum for US Joint Forces Command: Vision for a Joint Approach to Operational Design; Joint Staff J-7, *Planner's Handbook for Operational Design: Version 1.0*; Joint Chiefs of Staff, Joint Publication 5-0, *Joint Operation Planning*, chap. 3.
26. Ryan, "A Personal Reflection on Introducing Design to the U.S. Army."

27. Naveh, Jim Schneider and Tim Challans, *The Structure of Operational Revolution: A Prolegomena*.
28. Ryan, "A Personal Reflection on Introducing Design to the U.S. Army."
29. US Army, Army Technical Publication 5-0.1, *Army Design Methodology*, 1.3. The first use of the term "ADM" appeared in 2012 in a non-doctrinal text. Anna Grome et al., *Army Design Methodology: Commander's Resource*.
30. US Army, Field Manual 5-0, *The Operations Process*, 3.1.
31. US Army, ATP 5-0.1; Joint Chiefs of Staff, JP 5-0, chap. 3. See also US Army, FM 5-0, chap. 3.
32. Richard Buchanan, "Wicked Problems in Design Thinking," 5–21.
33. US Army, ATP 5-0.1, chap. 5.
34. This incorporation led some military practitioners to come to an erroneous understanding of military design as merely a component of military planning (see note 4). Grigsby, Jr. et al., "Integrated Planning," 28–35.
35. Ryan, "A Personal Reflection on Introducing Design to the U.S. Army."
36. US Army, ATP 5-0.1 *Army Design Methodology*; US Navy, Navy Warfare Publication 5-01, *Navy Planning*, Appendix D; US Marine Corps, Marine Air-Ground Task Force Staff Training Program Pamphlet 5-0.1, *Marine Corps Design Methodology*; US Air Force, Annex 3-0, *Operations and Planning: Operational Design Fundamentals*; US Air Force, US Air Force Doctrine Annex 3-0, *Operations and Planning: Methods of Operational Design*; Joint Chiefs of Staff, JP 5-0, *Joint Planning*, chap. 4.
37. UK Ministry of Defence, Allied Joint Publication-5/Joint Doctrine Publication 5-00, *Allied Joint Doctrine for Operational Level Planning*, 2.60–2.84; Royal Netherlands Army, Doctrinebulletin 2015-XX *Contextual Military Design: Study Draft Version 1.0*; Australian Defence Force, Australian Defence Doctrine Publication 5.0, *Joint Planning*, 2nd ed.; Australian Defence Force, Australian Defence Force Publication 5.0.1, *Joint Military Appreciation Process*.
38. Zweibelson, "Changing Change while it Changes (Part 2 of 3)." Jackson, *The Roots of Military Doctrine*, 77.
39. UK Ministry of Defence, Joint Doctrine Publication 04, *Understanding*; UK Ministry of Defence, Joint Doctrine Note 3/11, *Decision-Making and Problem Solving: Human and Organisational Factors*; UK Ministry of Defence, Joint Doctrine Publication 04, *Understanding and Decision-making*, 2nd ed.
40. For a broader list of military design thinkers, see *The Archipelago of Design: Researching Reflexive Military Practices*. This website contains the biographical details of over twenty prominent military design thinkers, links to over 100 of their papers, video recordings of a dozen military design-themed presentations and over 25 military design-related blog posts.
41. Anne-Marie Grisogono and Ryan, *Designing Complex Adaptive Systems for Defence*; Ryan and Grisogono, *Hybrid Engineered Complex Adaptive Systems: A Case Study in Defence*; Ryan, "About the Bears and the Bees: Adaptive Responses to Asymmetric Warfare," 588–595 (an earlier version of this chapter had been presented as a conference paper in 2006).

42. Ryan, "A Personal Reflection on Introducing Design to the U.S. Army."
43. See Stefan J. Banach and Ryan, "The Art of Design: A Design Methodology," 105–115; Ryan, "The Foundation for an Adaptive Approach: Insights from the Science of Complex Systems," 69–90; Ryan, *Applications of Complex Systems to Operational Design*.
44. Paparone, *The Sociology of Military Science*.
45. Donald Schön, *Displacement of Concepts*; Schön, *The Reflective Practitioner: How Professionals Think in Action*.
46. Zweibelson, "Blending Postmodernism with Military Design Methodologies: Heresy, Subversion, and other Myths of Organizational Change," 139–164. For examples of his early works, see Zweibelson, "Three Design Concepts Introduced for Strategic and Operational Applications," 87–104; Zweibelson, "Breaking Barriers to Deeper Understanding: How Post-modern Concepts are 'Value-added' to Military Conceptual Planning Considerations."
47. Zweibelson, "The Multidisciplinary Design Movement"; Zweibelson, "An Application of Theory: Second Generation Military Design on the Horizon."
48. Zweibelson, "Change Agents for the SOF Enterprise: Design Considerations for SOF Leadership Confronting Complex Environments," 127–140; Zweibelson, "Special Operations and Design Thinking: Through the Looking Glass of Organizational Knowledge Production," 22–32.
49. Imre Porkoláb and Zweibelson, "Designing A NATO that Thinks Differently for 21st Century Complex Challenges," 196–212; Zweibelson et al., "The Emergent Art of Military Design: Swedish Armed Forces and the Contemporary Security Environment," 83–97; Zweibelson, "'Design' goes Dutch: Army Considerations for Unconventional Planning and Sensemaking"; Zweibelson et al., "Disruptive Innovation Through Military Design," 139–160.
50. Gracier, "Self Disruption," 21–37; Gracier, "SO SOD: An Antidote to the Futility of Design in Militaries"; Gracier, "Why Generals Need to Forget Before They Can Become Generals."
51. John Anderson, "From Systemic Operational Design (SOD) to a Systemic Approach to Design and Planning: A Canadian Experience," 35–44.
52. Paul T. Mitchell, "Stumbling into Design: Action Experiments in Professional Military Education at Canadian Forces College," 84–102; Beaulieu-Brossard, *Joint Command and Staff Program 45: Design Thinking: The Golden Thread*; Beaulieu-Brossard and Paul T. Mitchell, "Challenge-Driven: Canadian Forces College's Agnostic Approach to Design Thinking Education"; Jackson, "Standing on the Shoulders of Giants to Reach a Cake: Observations about Military Design Facilitation."
53. This author witnessed the delivery of this course firsthand while appointed Academic Year 2018–19 Distinguished Visiting Professor in the Defence Studies Department at Canadian Forces College. This observation did not result from this visit, however, having been made verbatim in an earlier version of this paper that was published before the visiting period commenced. Jackson, "Civilian and Military Design

Thinking: A Comparative Historical and Paradigmatic Analysis, and its Implications for Military Designers.”

54. Zweibelson, “‘Design’ Goes Dutch”; Zweibelson et al., “The Emergent Art of Military Design,” 83–97; Zweibelson, “Changing Change While it Changes (Part 2 of 3)”; Anders McDonald Sookermany, “Military Education Reconsidered: A Postmodern Update,” 310–330; Zweibelson et al., “Disruptive Innovation Through Military Design,” 139–160.

55. Zweibelson, “JSOU Design Thinking Topics: Design Thinking for the Commander—Addressing Complexity, Change, and Military Innovation.”

56. US Naval Postgraduate School, *NPS Design Thinking Community*.

57. Royal Australian Air Force Air Warfare Centre and Business Models Inc., *Crash Course in Design Thinking*.

58. Cara Wrigley et al., “Air Force by Design: Applying Design for Transient Capability Advantages,” 51–70. OODA stands for “Observe, Orient, Decide, Act.”

59. This author was the fourth person to be added to the email group, in 2013. It was informally dubbed “the design cabal” by its members. For a detailed account of my involvement in this and other aspects of military design thinking, see Jackson, “A Tale of Two Designs: Developing the Australian Defence Force’s Latest Iteration of its Joint Operations Planning Doctrine,” 174–193.

60. For details of each conference, see: “Events,” *The Archipelago of Design: Researching Reflexive Military Practices*.

61. *Journal of Military and Strategic Studies*, 17, no. 4; *The Blue Knight Review*; Aaron P. Jackson, ed., *Design Thinking: Applications for the Australian Defence Force*, 2019.

62. *The Archipelago of Design: Researching Reflexive Military Practices*.

63. The author’s thanks to Zweibelson for his permission to replicate the format of the original diagram, and to modify it as shown herein. For Zweibelson’s original version, see Zweibelson, “Changing Change while it Changes (Part 2 of 3).”

64. US Army, *Field Manual 5-0: The Operations Process*, chap. 3.

65. Jackson, *The Roots of Military Doctrine*, 5–8.

66. Di Russo, “Understanding the Behaviour of Design Thinking,” 10–35.

67. Zweibelson, “Changing Change while it Changes (Part 2 of 3).”

68. During the same period that military design thinking has proliferated, there has been a growing body of literature questioning the utility, or even existence, of end states and related concepts. It is surprising that there has not so far been more overlap between this literature and the development of military design thinking. Jennie Carignan, “Victory as a Strategic Objective: An Ambiguous and Counter-Productive Concept for the High Command,” 5–14; Gal Beckerman, “In Modern Warfare, what does Victory mean?”; Anthony H. Cordesman, “The ‘End State’ Fallacy: Setting the Wrong Goals for War Fighting.”

69. Zweibelson, “An Application of Theory”; Zweibelson, “The Multidisciplinary Design Movement”; Beaulieu-Brossard and Paul T. Mitchell, “Challenge-Driven”; Paul T. Mitchell, “Stumbling into Design.”

70. Paparone, *The Sociology of Military Science*, 114–139; Paparone, “The Sociology of Strategy: Romancing the Image,” 81–101; Paparone, “The Sociology of the Military: A Multi-Paradigmatic Review,” 304–311; Paparone, “Red Teaming: Multi-Paradigm Approach.”

71. Zweibelson, “An Application of Theory.” Zweibelson used the alternate label “second generation military design.”

72. The paradigmatic similarity between Naveh’s works and Zweibelson’s early works is due to Naveh having directly mentored Zweibelson during 2010–11, while Zweibelson was a student at SAMS. Zweibelson later recounted how at that point Naveh had been banned from the SAMS campus, resulting in the two needing to meet secretly in a café in Fort Leavenworth. Zweibelson, personal communication with the author, 17 October 2019.

73. As discussed in chapter 1, Paparone considers his own work to most closely align with poststructuralism, which fits within this monograph’s definition of post-modernism. He is considered herein to be aligned slightly more closely to radical structuralism because of the parallels between his work and Schön’s, which has been viewed by this author as the paramount linkage within Paparone’s work, even though it is undeniably multiparadigmatic. See also note 15 in chapter 1.

Chapter 4

Comparing Civilian and Military Design Thinking

Though having different origins, emerging under different circumstances, and being applied in different conditions, the relationship between civilian and military design thinking is a complicated one, characterized by a mix of divergence, tensions, and convergence. Having now examined the evolution of, and paradigms underlying, both civilian and military design thinking, what remains is to examine the relationship between the two fields.

Immediately, one notices several similarities as well as differences in the evolution, intent, and constituent methodologies that have emerged within each field. Though more recently the similarities have arisen at least partly due to the influence of civilian design thinking on the development of military design thinking, coincidental yet significant similarities predate this cross pollination by a considerable period.

The first similarity between the two fields of design thinking is that they began by developing, employing and then breaking away from technical rationalist methodologies that attempted to understand the whole of complex (often social) systems through breaking them into parts, then independently determining how each part functioned. In civilian design thinking, Herbert Simon's *Sciences of the Artificial* is the most prominent example of this methodology; in militaries, it is traditional military planning and operational art.¹ Even if one does not accept these military methodologies as forms of design thinking, Shimon Naveh's SOD emerged as a direct challenge to them and offers a violent parallel to civilian design thinking's significant yet relatively peaceful move away from such methodologies during "the second wave" of civilian design thinking in the 1980s, which was led by Nigel Cross and Donald Schön.²

A second similarity is a trend within both fields in which complex and deeply philosophical methodologies with a narrow range of adherents gave way to shallower, simpler, and more popularized methodologies, which were in turn challenged by the emergence of newer methodologies that were again more philosophically-grounded. The most prominent manifestation of the first part of this process in civilian design thinking is the progression of human-centered design from a philosophy that "was manifested as more of a mindset than a physical set of tools," to a collection of "'recipes' for 'how to do design thinking' for practitioners . . . with simplified arguments, diagrams, and checklists, but little theory development," a change especially noticeable within much of the corporate management literature.³ The parallel development in military design thinking is the transition from SOD to the US ADM,

during which “a curriculum of 3,000 pages of reading on design . . . was eventually distilled down into 13 pages of doctrine” that did not require military personnel to “challenge their core beliefs” or “really reframe.”⁴

The second part of this trend, the emergence of newer philosophically-grounded design methodologies, is evident in the field of civilian design thinking in some of the more comprehensive human-centered design methodologies, such as that used by the Stanford d.school, and in Klaus Krippendorff’s book *The Semantic Turn* and his development therein of his theory about the “design of meaning.”⁵ The equivalents in military design thinking are Ben Zweibelson’s “second generation military design” methodology and CFC’s “epistemological agnosticism for design methodology,” both of which blend multiple other design methodologies of civilian and military origin to form what might be better termed meta-design methodologies.⁶

Beyond simple comparative observations such as these, a deeper analysis is required if this study is to yield more meaningful results. Ergo, the remainder of this chapter is dedicated to the conduct of such an analysis. The first section examines paradigmatic and methodological divergence, tensions, and convergence between the two fields of design, an examination enabled by further employment of the analytical framework that was developed in chapter 1 and previously applied in chapters 2 and 3. This analysis enables the second section of this chapter to offer a limited prognosis regarding how design thinking might evolve in the future.

Divergence, Tensions, and Convergence

Analysis in chapters 2 and 3 has shown the key paradigmatic convergences and divergences between civilian and military design thinking. The convergences are that radical structuralism and CAS theory have more prominently influenced both. The divergences are that interpretivism has more prominently influenced civilian design thinking, and postmodernism has more prominently influenced military design thinking. All the paradigms elaborated in Table 1.1 also influenced both fields of design thinking, as both fields are multidisciplinary; however, the other paradigms have not had the same *prominent* influence that these key paradigms have had within each field.

Another paradigmatic convergence is that technical rationalism has prominently influenced development of both fields, providing that one considers traditional military planning and operational art to be forms of design thinking. Regardless, this paradigm has formed a point of departure for subsequent design thinking in both fields, with a major tension existing between technical rationalism and design methodologies influenced most heavily by radical

structuralism and postmodernism. In the case of military design thinking, this tension underlies the antipathy that can often be observed between traditional military planning and several military design methodologies. In the case of civilian design thinking, this tension underlies the growing understanding of design methodologies as either a form of art or as a “third way,” rather than as a science.

These interparadigmatic divergences and tensions are shown in Figure 4.1. The paradigmatic alignment of clusters of key civilian and military design thinkers and methodologies are shown in this figure, wherein blue circles indicate the clusters around the most influential paradigms (which are shown in black text). Key civilian and military design thinkers and methodologies are shown in orange and pink text, respectively. The blue arrows show the interparadigmatic tensions that are manifest in different design thinking methodologies within both fields.

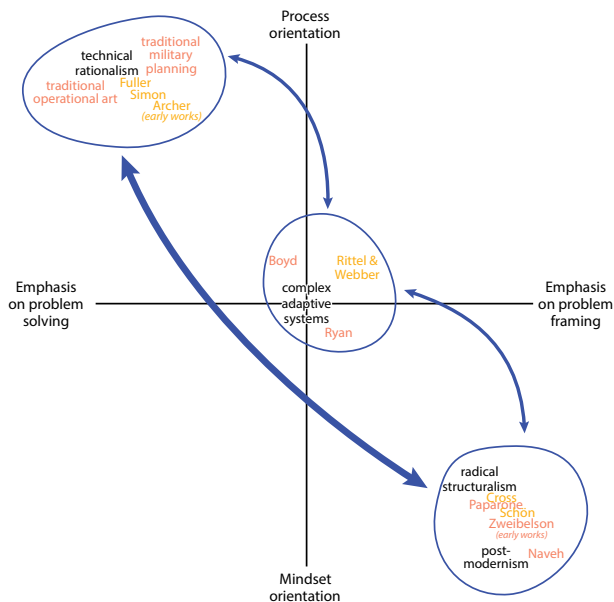


Figure 4.1. Interparadigmatic divergence and tension, with methodological convergence

Although these three clusters are paradigmatically divergent, the identification of the same clusters in both fields indicates major areas of methodological convergence between civilian and military design thinking. For example, methodologies that attempt to understand the whole of complex and social systems through breaking them into parts, then independently deter-

mining how each part functions, are common to the civilian design thinking of Simon and Bruce Archer, as well as to traditional military planning and operational art.⁷ At the opposite end of the figure, there are several methodological parallels between Schön's civilian and Chris Paparone's military design thinking, as both consider design primarily as a reflexive conversation between the designer and the object designed. This similarity should be expected, however, as Paparone has referred explicitly to the influence Schön has had on development of his own thinking.⁸ Finally, the hard science underlying CAS theory has led to methodological similarities when it has been applied as a tool for analysis within the social sciences, including within both fields of design thinking.⁹ As a result, methodological similarities are evident between Horst Rittel's and Melvin Webber's approach to addressing wicked problems, the parts of John Boyd's work that address complexity, and Alex Ryan's papers on "adaptive campaigning."¹⁰

The interparadigmatic tensions between these three areas of methodological convergence underlies the two trends observed in the introduction to this chapter, wherein design thinking in both fields has developed, employed, then broken away from technical rationalist methodologies; and wherein both fields have seen movement from deeply philosophical, theoretically grounded methodologies, toward simpler and more popularized methodologies, then back again. Employing this study's framework for analysis, it can now be seen that both trends were accompanied by, and perhaps even caused by, major paradigm shifts between different design methodologies and the paradigms that had the most influence upon them.¹¹ Yet there is no link between any particular paradigm and the tendency of its constituent design methodologies to be either philosophical or popularist. Instead, the likelihood of a design thinker or methodology to be either more philosophically-grounded or less theoretical and more popularist, seems instead to be linked to that thinker's or methodology's response to previous methodologies, as well as to the attitudes of the thinker in question toward the relative importance of broad accessibility.

These differences are most starkly evident in the examples presented above of the evolution of human-centered design within the corporate management literature, and the transformation of SOD into the US ADM. In each of these cases, a deeply philosophical methodology was made much more accessible, but only because many of the core aspects of the original methodology were stripped away. Ryan summed up the challenges posed by each approach, and their pros and cons, in his discussion of the tensions between military design purists and pragmatists within the US Army during the late 2000s.¹² In each case, there has been a response against the perceived over-simplicity of several

of the popular methodologies. The most recent developments in both fields have trended back toward more philosophically-grounded methodologies.¹³

Because there is no paradigmatic link between the philosophical or popularist tendencies of different design methodologies, no paradigm featured in this monograph's framework for analysis can be summarily dismissed for offering only a relatively shallow contribution to these fields. There is therefore a need for those applying design thinking to develop a better understanding of the difference in approach between design methodologies within each paradigm. This is necessary because the application of shallow or simplistic design methodologies, or the misapplication of more philosophically-grounded methodologies by those who do not fully understand their nuances, has the tendency to work against the overarching aim of design thinking to prompt innovation and creativity as a way to overcome a complex situation, problem, or set of problems. The application of shallow methodologies or the misapplication of deeper methodologies does not lead to the identification and questioning of core beliefs, nor does it lead to genuine reframing, which is necessary to bring about the desired innovation and creativity that design thinking promises.¹⁴

The result is the problematic applications of design thinking that this author has witnessed, and described in the opening paragraphs of chapter 1. In one of these cases, what can now be identified as a shallow method drawn from the corporate management literature on human-centered design was taught to a military audience as if it were the only design methodology in existence. From their responses to the author's subsequent questioning, it became clear that the contractors who delivered this instruction were unaware of the paradigms underlying their chosen design method. They were also unaware of the existence of any military design methodologies, including military planning processes, which would have performed better in the circumstances in which they were encouraging their military students to apply their particular design method. The result was a detrimental impact on the military students' understanding of design thinking, which is likely to give them a lasting misunderstanding of what design thinking is, and what its core strengths are.

This case presents an excellent example of why those seeking to effectively apply design thinking need to develop a thorough knowledge of the paradigms underlying their preferred design methodologies: there may be a deeper methodology within the same paradigm that can be applied in the same circumstances to achieve better results. It also highlights why those sponsoring design activities ought to develop this paradigmatic knowledge as well—in light of their clear lack of subject matter knowledge, the aforementioned contractors should not have been hired. However, it is likely in this

case that the military officers responsible for awarding the contract knew even less about design than the contractors did.

Explicit paradigmatic awareness also has other benefits. For example, it enables one to develop an understanding of the tensions between design thinkers and methodologies that fit within different paradigms. The underlying hostility between traditional military planning and SOD, for example, can be traced back to two core irreconcilable differences between the most prominent of the paradigms underlying these methodologies. The first is the stance of each paradigm regarding what constitutes valid evidence. The second is the stance of each paradigm regarding the nature of reality. Technical rationalism, the paradigm that underlies traditional military planning, values evidence in the form of facts and discards as illegitimate knowledge not factually derived. It regards reality as existing externally to individuals, as a separate entity that needs to be understood before it can be shaped.¹⁵ Conversely, postmodernism, which is the paradigm that underlies SOD, rejects the existence of objective facts and emphasizes instead the value of beliefs based on perceived truth. It regards reality as the reflection of individual and collective beliefs. As a result, the roles of narrative and meaning become paramount and reality is not shaped so much as it is constructed.¹⁶

Developing a deeper understanding of these differences enables each paradigm to be appreciated for what it is and for the perspective that it enables. No one paradigm is superior to any of the others; all are simply different. The same could be said for a range of very different design methodologies, providing that these methodologies are sufficiently philosophically grounded to avoid the problems associated with superficiality discussed above. As Stefanie Di Russo observed about civilian design thinking, different methodologies can be stratified based on the level of complexity that they are intended to address. Her “stratification of design” includes design of: artefact, artefact and experience, systems and behavior, and large scale systems.¹⁷ To this stratification could be added Krippendorff’s “design of meaning.”¹⁸ A similar stratification could no doubt be developed for military design, as traditional military planning is well suited to simple and complicated situations, whereas other military design methodologies are better suited to complexity.¹⁹ Recent attempts to develop multiparadigmatic military design methodologies seem to be attempting to take the resultant need for methodological flexibility into account.²⁰

These recent attempts, specifically Zweibelson’s recent works and CFC’s epistemological agnosticism for design methodology, were not shown in Figure 4.1. In the case of civilian design thinking, neither was human-centered design or Krippendorff’s design of meaning. This is because these methodologies conform to a different pattern to the interparadigmatic tensions accompa-

nied by methodological convergences that are illustrated in Figure 4.1. They are therefore shown instead as a separate cluster in Figure 4.2. In this figure, the blue circle shows this cluster of recent design thinkers and methodologies. The blue arrows now show the multiparadigmatic influence on this cluster. By incorporating different paradigms and earlier design methodologies to various extents, Zweibelson, CFC, and human-centered design largely overcome the interparadigmatic tensions shown in Figure 4.1. Krippendorff's design of meaning is an exception to this, being primarily (but not exclusively) interpretivist, however his work is included here because of the second factor that separates this cluster from the methodologies shown in Figure 4.1—between these more recent design thinkers exists a methodological divergence.

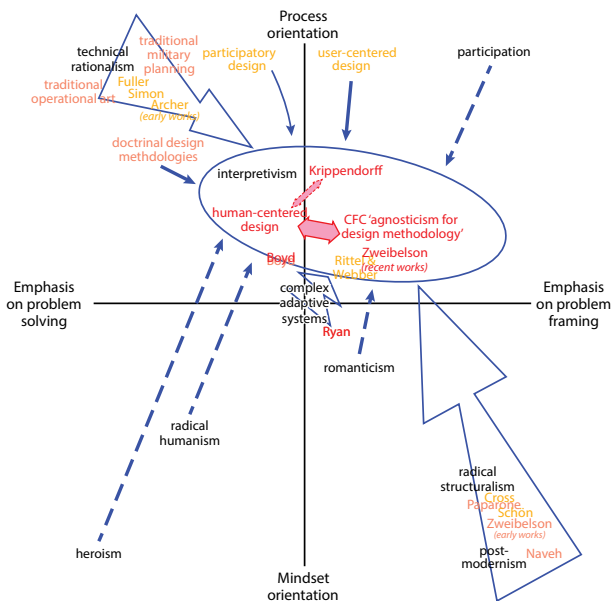


Figure 4.2. Multiparadigmatic convergence with methodological divergence

Whereas in Figure 4.1 a paradigmatic divergence indicated areas of methodological convergence between the fields of civilian and military design thinking, in Figure 4.2 a multiparadigmatic convergence indicates a methodological divergence between these fields. This is indicated by the thick red arrow between the civilian and military design methodologies constituting this cluster. A smaller red arrow with a dashed outline indicates a second area of tension within civilian design thinking, between more widespread multiparadigmatic human-centered design methodologies, and Krippendorff's more recent, more philosophical and less widely practiced design of meaning.

The identification of these divergences indicates possible next stepping stones in the path through the fog of design thinking methodology development.²¹

The first of these divergences is manifest in the different ways in which human-centered design, Zweibelson's design methodologies (including both his "second generation military design" and his US Special Operations Forces design methodology), and CFC's epistemological agnosticism for design methodology are applied. This is indicated by the different positions of these design thinkers and methodologies within the figure.

Whereas human-centered design has a relatively greater emphasis on problem solving, the two military design thinking methods instead have a relatively greater emphasis on problem framing. The cause of this divergence is that the military design methodologies were developed to deliberately blend elements of other design methodologies from both the civilian and military fields. This necessitates a higher emphasis on framing to enable selection of appropriate elements and makes them akin to being "meta-design" methodologies.

Human-centered design is a stand-alone design methodology. Although it was influenced by preceding civilian design methodologies, it does not attempt to deliberately blend them. It includes several methods within its methodology; however, this takes the form of a "toolkit" of practical methods that designers may select. Over the last few decades, multiple toolkits have been developed by different adherents of human-centered design. When a conceptually robust toolkit of methods is chosen for use, the toolkit approach effectively blends ease of access with flexibility to tailor the design process to different situations. Unfortunately, not all the toolkits or methods associated with human-centered design are robust, and as a result there is a tendency for some of these to be superficial and to yield mediocre outcomes as a result.

The military design methodologies shown in Figure 4.2 instead require designers to understand multiple paradigms and other design methodologies, before developing their own toolkit that they can employ to suit the situation they are confronting.²² Practitioners of these military design methodologies are therefore more explicitly aware of their own underlying paradigms, although the need to understand multiple alternative paradigms or methodologies can lead to a relatively high barrier to entry for design facilitation when military personnel do not have access to a specialist design facilitator.²³

For civilian designers, developing an equivalent multiparadigmatic and multiple-methodology awareness may in turn lead to renewed methodological innovation. The most recent developments in military design thinking may lead the way in this regard. Yet the opposite seems to be happening in civilian design thinking, where the latest major theoretical development (Krippen-

dorff's design of meaning) is less multiparadigmatic than human-centered design. This difference constitutes the second methodological divergence shown in Figure 4.2. Like the first divergence, this is shown by the different positioning of human-centered design and Krippendorff within the figure. In this instance, there is divergence in their relationship to the paradigms as well, since human-centered design is more extensively multiparadigmatic. This is an additional factor that is not present in the methodological divergence between human-centered design and the recent military design methodologies. Resolution of this tension within the field of civilian design thinking could take the form of development of a civilian design methodology that explicitly blends a multiparadigmatic and multi-methodology approach while maintaining Krippendorff's philosophical-grounding and depth. Employment of the evaluation aspects of Krippendorff's "science for design" to the field may potentially be able to facilitate development of such an approach.²⁴

Finally, it is worth highlighting why there is no arrow shown between Krippendorff and the recent military design methodologies shown in Figure 4.2. This author knows of no engagement to date between these design thinkers and their methodologies. This is despite military design having previously addressed the design of meaning without reference to Krippendorff. Instead, military design thinking's discussion of meaning has occurred from a post-modernist perspective, with narrative construction in particular being advocated as a way to generate a desired meaning in the minds of stakeholders in military activities.²⁵ This similarity indicates a potential area for future inter-paradigmatic development within both civilian and military design.

Possible Near Futures for Design Thinking

When taken together, the trends, divergences, tensions, and convergences observed in the previous section enable discussion to occur about possible developments in both civilian and, especially, military design thinking. Before this discussion is undertaken, however, it is worth remembering the limits of attempting to predict the future, particularly in complex, open and emergent systems such as the design thinking communities of practice that have been the subject of this monograph. Ergo, the following discussion has been kept intentionally vague and is focused only on the near-term. It is intended to be suggestive rather than proscriptive, and exploration is limited to five generalized observations.

First, for military design thinking there is a need to methodologically consolidate. The analysis above shows where recent military meta-design methodologies could potentially achieve this by incorporating or balancing meth-

ods aligning with some of the paradigms that have thus far had a relatively low influence, or by incorporating aspects of civilian methodologies developed during earlier periods but which have since fallen into disuse. The incorporation of new approaches based on historical as well as paradigmatic awareness will ultimately result in development of even more comprehensive military design methodologies. Such a deliberately cultivated awareness is likely to lead in turn to enhanced design thinking outcomes, providing it is combined with appropriate design thinking education.

Should this consolidation be pursued, it is likely that it will initially cause an even wider-ranging debate over what constitutes design thinking and its constituent methodologies. For example, a more thorough incorporation of heroism into military design thinking might lead first to a debate about military design ethics, or about the design of civil-military relations and expectations of contemporary military professionalism, similarly to how Victor Papanek addressed moral responsibility in civilian design thinking.²⁶ Similar discussions could well emerge regarding aspects of other paradigms and methodologies that are currently not as prominent in military design thinking. Ultimately, a “military design toolkit” might emerge to address this range of different methods more uniformly.²⁷

In developing such a toolkit, military design thinkers would do well to learn from the experience of the development of similar toolkits in the field of civilian design thinking, particularly those focused on human-centered design. This means taking measures to ensure that each method is thoroughly evaluated before being included in any military design toolkit, to ensure that it is not oversimplified and that it does not encourage the superficial employment of vogue terminology that is devoid of deep understanding. Such a toolkit should also be accompanied by thorough instruction in military design facilitation that involves its use, to minimize the possibility that the initial employment of a philosophically-grounded and comprehensive military design toolkit may devolve into a shallow facsimile when applied by personnel other than its developers.²⁸

The second observation is that there will be ongoing disagreement between design thinkers in both the civilian and military fields over the definition of “design thinking” and a range of accompanying terms. There will also be periodic attempts on the part of some design thinkers to resolve this disagreement, which will fail to unite the fields behind a common understanding, but which will instead be a useful means to trigger further debate that will ultimately help the fields to conceptually advance. Most recently, Chris Paparone has made such an attempt in the field of military design thinking. Although he acknowledges that his attempt to develop a vocabulary and reference of

terms and concepts for military design thinking “is not meant to be ‘settled knowledge’ and remains open to future enhancements and debate,” he is nonetheless endeavoring to develop “*the* vocabulary of a professional national security ‘designer.’”²⁹ Such endeavors are likely to be periodic in both civilian and military design thinking, and they are also likely to meet limited success because of the eclectic and greatly varied nature of design thinking as a broad field of inquiry. Their real value will therefore be in the debate they generate, rather than in the agreement that they foster.

Third, it can be observed that military design thinking methodologies outside of the US ADM and its derivatives in other doctrine publications are on the cusp of broader acceptance within several Western militaries (ADM is not included here as its incorporation into doctrine indicates acceptance). Contemporary military design methodologies will encounter the same challenge that was posed for SOD in the mid-2000s, and for human-centered design since the early 1990s. That is, the challenge of how to reach a broader audience without sacrificing the deeply philosophically-grounded components of the design methodology that is becoming popularized.

The experience of human-centered design might be informative for the field of military design thinking. In this instance, the human-centered design methodologies that have remained most faithful to their intellectual roots are those that are taught during tertiary-level design courses such as those offered by the Stanford University d.school. On the other hand, shorter courses and textbooks or introductory-level “how to design” manuals containing simplified descriptions of human-centered design tend to produce shallow thinking and do not prompt those applying design thinking to “really reframe.” This indicates that military design thinking methodologies outside of ADM and its derivatives can both be popularized within militaries and remain deeply philosophically-grounded. The key to achieving this mix is the delivery of comprehensive education in military design facilitation. Currently, this does not occur. Military design thinking is either taught in its doctrinal variant, as short (one or two week) courses, or as a relatively short component of longer professional military education courses. For instance, at CFC, instruction in military design thinking totals about four weeks, spread across a six-month period and rolled into modules of other courses.³⁰

Unfortunately, past institutional resistance to radically innovative military design methodologies indicates that there is also likely to be resistance to any attempt to create a longer-duration military design facilitation education program. This in turn may prevent the creation of such a course in the future, even though this course will be vital if the latest military design methodologies are to maintain their integrity in the face of broader application. As a re-

sult, military design facilitation will most likely remain the purview of a relatively small group of individuals who undertake additional design thinking education beyond what is currently offered by professional military education institutions. In the mid-term, this group of specialists may be successful in persuading their institutions to create longer-duration military design thinking courses; however, this will only be the result of sustained effort and there will be many institutional hurdles to jump along the way.

While military design thinking has begun to draw on civilian design methodologies, there has been little effort on the part of civilian design thinkers to draw on military design thinking to complement their own approaches. It is highly likely that most civilian design thinkers are not even aware of the existence of military design thinking. Among the few that are, there seems to have been little effort to develop a genuine understanding that goes beyond cursory awareness.

For example, one ill-informed civilian design thinker has gone so far as to label Zweibelson a functionalist, and because of their misreading of only three of Zweibelson's many papers, has arbitrarily dismissed military design thinking entirely.³¹ This dismissal seems to have been due to their belief that the nature of military organizations means that they are inescapably tied to a single world view, which no military thinker can ever truly break out of. In the hands of a better-informed critic, such an argument may well have had merit—Zweibelson himself has previously criticized militaries for their tendency to remain wedded to functionalist models despite evidence that these are not well suited to the complexity of contemporary conflicts.³² Alas, the civilian design thinker in question seems to have been motivated by an anti-military agenda, which has undermined their critique of military design thinking to the extent that one finds it difficult to take them seriously.

If taking a more inquisitive outlook, it is possible that civilian design thinkers may find the different context of military design thinking a useful starting point for exploration of alternative applications of their own methodologies. As discussed in the third chapter, civilian design thinking has not yet had to confront an existential questioning of the designer's *raison d'être*. Although more recent branches of civilian design thinking have expanded the discipline from product and service design to include the design of social systems, the focus of this design is still on the development something that can be sold for a profit. Civilian design thinking has not yet had to question the fundamentals of the capitalist system in which civilian design firms such as IDEO work, nor has it had to question the legitimacy of core components of modern business models, such as the profit motive or the fundamental nature of the global economic system. Inversely, military design thinking emerged because

militaries had to confront their own equivalents to such fundamental questions. Some military design methodologies, such as SOD, were developed specifically to enable such questioning to occur.

A fourth observation is that civilian design thinking could potentially be used to undertake such a fundamental questioning of civilian systems, and that certain military design methodologies provide indicators of which paradigms are best suited to do this. Given the systemic nature of several current issues at the broadest possible level, the impact of global climate change foremost among them, there is a potential for civilian design thinkers to position themselves to develop radical solutions. Imagine, for instance, a design inquiry leading to development of an environmentally sustainable economic system, which does not rely on perpetual growth to remain robust and avoid recession.³³

As grand as such an application of civilian design thinking would be, it is unlikely that this will occur. Civilian design thinking is generally applied in the private sector by large companies, leading to accusations that “at its core, [it is] a strategy to preserve and defend the status-quo.”³⁴ While this is not universally the case, there is a grain of truth in this observation and, as a result, if civilian design thinking turns to the confrontation of the global system-scale problems mentioned above, this will likely come from the more philosophically-grounded side of the discipline. It is likely that such an application of civilian design thinking would have difficulty in attracting the mass of adherents that would be required to achieve systemic level change.

Returning to military design thinking, the fifth and final observation is that the field is likely to cement into different methodological schools in the near future. Over the past 20 years military design thinking has become increasingly recognized by military institutions as a legitimate field of inquiry. Progress toward this state rapidly accelerated from the early 2010s, as an international community of military design thinkers became self-aware. This led to a rapid increase in collaboration and methodological cross pollination, during a period when the field was open to experimentation with a broad range of design methodologies.

In the last few years, different centers of military design thinking have begun to emerge, each developing and instructing in its own military design methodology. One is located at CFC, under the stewardship of Paul Mitchell, Philippe Beaulieu-Brossard and most recently, Mathieu Primeau.³⁵ Another is at the US Joint Special Operations University, driven by Ben Zweibelson’s design methodologies, and strongly supported during implementation by Nathan Schwagler.³⁶ A third is in Israel under the leadership of Shimon Naveh, who is accompanied by the increasingly accomplished Ofra Gracier.³⁷ Others

seem to be emerging in European countries, including most prominently the Netherlands, Sweden, Norway, Denmark, Hungary, and Poland.³⁸

As these “centers” further develop their own methodologies, it is likely that they will increasingly differ from one another. Although ongoing dialog and collaboration can be expected between these allied militaries, the period of intensive collaboration is probably winding down. It is likely that future methodologies employed by these centers will solidify, and the present state of collaboration will be increasingly accompanied by mutual critiques that will flow from a state of increased methodological divergence. Such critiques may curtail the current level of collaboration, though this need not be the case. On the contrary, they could also potentially lead to positive methodological developments, providing they are delivered in such a way that they remain constructive in their criticism. It will behoove the military design thinkers in each of these centers to ensure that this occurs, as conscious effort may soon be required to perpetuate the high level of collaboration that has hitherto occurred naturally within the field.

Notes

1. Simon, *Sciences of the Artificial*, 3rd ed. For a thorough exposition on traditional operational art that fits very much within the technical rationalist paradigm, see Vego, *Joint Operational Warfare: Theory and Practice*, 2nd ed.

2. Di Russo, “A Brief History of Design Thinking: The Theory [P2].” See Gracier, “Self Disruption: Seizing the High Ground of Systemic Operational Design (SOD),” 22–27; Cross, “Designerly Ways of Knowing,” 221–227; Schön, *The Reflective Practitioner: How Professionals Think in Action*.

3. Di Russo, “A Brief History of Design Thinking: How Design Thinking Came to ‘Be’”; Johansson-Sköldberg, Woodilla and Çetinkaya, “Design Thinking: Past, Present and Possible Futures,” 122.

4. Ryan, “A Personal Reflection on Introducing Design to the U.S. Army.”

5. Doorley et al., *Design Thinking Bootleg*; Krippendorff, *The Semantic Turn: A New Foundation for Design*.

6. Zweibelson, “An Application of Theory: Second Generation Military Design on the Horizon”; Beaulieu-Brossard and Paul T. Mitchell, “Challenge-Driven: Canadian Forces College’s Agnostic Approach to Design Thinking Education.”

7. Simon, *Sciences of the Artificial*; Davis and Gristwood, *The Structure of Design Processes: Ideal and Reality in Bruce Archer’s 1968 Doctoral Thesis*; Vego, *Joint Operational Warfare*; Zweibelson, “Linear and Non-Linear Thinking: Beyond Reverse-Engineering,” 27–35.

8. Schön, *The Reflective Practitioner*; Paparone, *The Sociology of Military Science: Prospects for Postinstitutional Military Design*.

9. Melanie Mitchell, *Complexity: A Guided Tour*.

10. Rittel and Webber, "Dilemmas in a General Theory of Planning," 155–169; Boyd, *A Discourse on Winning and Losing*; Ryan, "The Foundation for an Adaptive Approach: Insights from the Science of Complex Systems," 69–90; Ryan, "About the Bears and the Bees: Adaptive Responses to Asymmetric Warfare"; Directorate of Army Research and Analysis, *Adaptive Campaigning: Army's Future Land Operating Concept*. "Adaptive campaigning" was an Australian Army future operating concept developed in the mid-2000s, which with hindsight has been identified as the first military design methodology developed within the Australian Defence Force. See Jackson, "Introduction: What is Design Thinking and How is it of Use to the Australian Defence Force?" 11–12.

11. On paradigm shifts, see: Kuhn, *The Structure of Scientific Revolutions*, 4th ed.; Margaret Masterman, "The Nature of a Paradigm," 59–89.

12. Ryan, "A Personal Reflection on Introducing Design to the U.S. Army."

13. Krippendorff, *The Semantic Turn*; Zweibelson, "An Application of Theory"; Beaulieu-Brossard and Paul T. Mitchell, "Challenge-Driven."

14. Ryan, "A Personal Reflection on Introducing Design to the U.S. Army."

15. Jean-Etienne Joullié, "The Philosophical Foundations of Management Thought," *Academy of Management Learning and Education*, 157–179; Zweibelson, "Linear and Non-Linear Thinking," 27–35. See also: Gibson Burrell and Gareth Morgan, *Sociological Paradigms and Organisational Analysis*, 41–120.

16. Joullié, "The Philosophical Foundations of Management Thought," 157–179; Anders McDonald Sookermany, "Military Education Reconsidered: A Postmodern Update," 311–313.

17. Di Russo, "Understanding the Behaviour of Design Thinking," 40–44.

18. Krippendorff, *The Semantic Turn*.

19. Jackson, "Introduction to Operational Design (And Some Other Types of Design Thinking)." The framework for this critique was based upon the categorization contained in David Snowden, "The Cynefin Framework."

20. Zweibelson, "An Application of Theory"; Beaulieu-Brossard and Paul T. Mitchell, "Challenge-Driven: Canadian Forces College's Agnostic Approach to Design Thinking Education."

21. This analogy has been borrowed from: Kenneth O. Stanley and Joel Lehman, *Why Greatness cannot be Planned: The Myth of the Objective*, 29–31.

22. Interestingly, Zweibelson's methodologies tend to emphasize paradigm awareness to a slightly greater degree, whereas the CFC approach tends to emphasize understanding of methodologies to a greater degree. This subtle difference is a significant factor distinguishing between these two military design methodologies. Beaulieu-Brossard, *Joint Command and Staff Program 45: Design Thinking: The Golden Thread*; Beaulieu-Brossard, *Joint Command and Staff Programme 45: DS/CF548—Advanced Joint Warfighting Studies: Shifting Sands 2019*; Joint Special Operations University, *SOC3440: SOF Design and Innovation Basic Course: Student Guide*

Academic Year 2019; Joint Special Operations University, SOC4445: *SOF Design and Innovation Advanced Course: Student Guide Academic Year 2019*.

23. Jackson, "Standing on the Shoulders of Giants to Reach a Cake: Observations about Military Design Facilitation."

24. Krippendorff, *The Semantic Turn*, 192–252.

25. For an example, see Zweibelson, "Three Design Concepts Introduced for Strategic and Operational Applications," 87–104.

26. Papanek, *Design for the Real World: Human Ecology and Social Change*, 159–178.

27. This author has already taken steps towards developing such a toolkit; however, this project has since evolved in a different direction and the toolkit development is currently on hold. See Jackson, "Towards a Multi-paradigmatic Methodology for Military Planning: An Initial Toolkit."

28. Such a process has been observed by this author in the case of several military concepts, which start as innovative ideas and progressively degenerate into oversimplified caricatures of their former selves. Comprehensive education, combined with a willingness on the part of practitioners to develop a comprehensive understanding of the concept and its intended employment, seems to be the solution that can prevent this from occurring. Jackson, "The Perversion of Military Ideas: How Innovative Thinking is Inadvertently Destroyed."

29. Paparone, "A Primer for Key Terms and Concepts associated with Design Thinking." Emphasis added.

30. Jackson, *Military Design Thinking Education: What the Australian Defence College can learn from Canadian Forces College and the US Joint Special Operations University*.

31. Tony Fry, *Unstaging War, Confronting Conflict and Peace*, 93–101.

32. Zweibelson, "Rose-tinted Lenses: How American Functionalist Strategy Inhibits our Appreciation of Complex Conflicts," 68–88.

33. Creation of such an economic system has been posited before; however, ideas of this scale and magnitude have not yet been linked to the potential of civilian design thinking to further develop or to realize them. Jeremy Rifkin, *The Third Industrial Revolution: How Lateral Power is Transforming Energy, the Economy, and the World*.

34. Natasha Iskander, "Design Thinking Is Fundamentally Conservative and Preserves the Status Quo."

35. Mathieu Primeau, "How We Design."

36. Joint Special Operations University, SOC3440: *SOF Design and Innovation Basic Course*; Joint Special Operations University, SOC4445: *SOF Design and Innovation Advanced Course*.

37. Gracier, "Self Disruption: Seizing the High Ground of Systemic Operational Design (SOD)," 30–34.

38. Zweibelson, "'Design' Goes Dutch: Army Considerations for Unconventional Planning and Sensemaking"; Zweibelson et al., "The Emergent Art of Military Design: Swedish Armed Forces and the Contemporary Security Environment," 83–97;

Anders Mcdonald Sookermany, "Military Education Reconsidered: A Postmodern Update," 310–330; Imre Porkoláb and Ben Zweibelson, "Designing A NATO that Thinks Differently for 21st Century Complex Challenges," 196–212; Zweibelson et al., "Disruptive Innovation Through Military Design," 139–160.

Chapter 5

Conclusion

The combination of the very recent recognition of military design thinking as a distinct field of inquiry, the near-concurrent proliferation of different military design thinking methodologies over the past decade, and the increased blending of civilian and military design methodologies in andragogy and syllabi, has resulted in military design thinking arriving at an inflection point. It is now on the cusp of reaching an even broader audience through the establishment of further methodological links between civilian and military design thinking. As a result, this monograph, which has examined and compared civilian and military design thinking, is a timely one. The implications of its findings for military design thinkers are worth revisiting and expanding.

The current situation presents several exciting opportunities, but also several risks, for military design thinkers. As Ben Zweibelson highlighted: “Military planners operate in decidedly dissimilar complex security contexts than those of business planners, thus military designers must approach the uncommon security challenges with a different design methodology that does not function exactly as human-centered or industrial design applications.”¹ In seeking to achieve synergy with their civilian counterparts, military design thinkers need to be wary of maintaining quality. Military design thinking will benefit if it can successfully incorporate paradigmatically and conceptually sound, and philosophically-grounded, civilian design methods into its methodologies, but it will suffer if it incorporates conceptually unsound or shallow methods, or if it attempts to apply civilian design methodologies that have not been suitably altered to address unique military requirements. Explicit historical and paradigmatic awareness are vital to determining what is valuable to military design thinking and what should be discarded.

Explicit awareness of the history and paradigms underling design thinking also helps to identify areas for further development *within* the field of military design thinking. Several potential areas for the near future evolution of both civilian and military design thinking were proposed in chapter 4. For military design thinking, these include a need to strategically consolidate, to strengthen, and to balance recently emergent multiparadigmatic military meta-design methodologies. It is likely that this consolidation will be accompanied by the development of centers of military design thinking excellence that will each develop and instruct their own divergent military design methodologies. Recent developments indicate that the first half-dozen of these centers have emerged in Israel and North America, or are likely to

emerge in the next few years in Europe, where they are still undergoing the process of achieving recognition and developing their design thinking and related educational methodologies.

To ensure that these developments embrace paradigmatically and conceptually sound civilian and military design thinking, military design thinkers will have to revisit the relationship between design thinking and military doctrine. Advocates of nondoctrinal military design thinking methodologies, several of whom still consider design as antithetical to doctrine, are ultimately going to have to choose between finding a way to reconcile this tension or forever remaining a minority group of “inside outsiders.” While recent meta-design methodologies have benefited from their own paradigmatic self-awareness, these methodologies have not yet been fully reconciled with those contained in doctrine. Extending this self-awareness to doctrinal design methodologies, which is likely to require a significant amendment to both current doctrinal design and planning methodologies, is a vital future undertaking considering the strong links between military doctrine and military culture.

The history of military design thinking shows that the US ADM emerged after a failed initial attempt to integrate design thinking into doctrine through compromise.² Key members of the military design thinking community have since concentrated on developing their methodologies outside of doctrine. Renewed engagement between these thinkers, their methodologies, and doctrine is now required if military design thinking is ever going to target a broader military audience than that which can be taught at the limited number of military design thinking courses run each year. This may also involve a need to reconceptualize doctrine itself, to make it more flexible and conducive to the ill-defined and ever-evolving nature of design methodologies. Military design thinkers will likely need to build this new conception first, see if the right people then come, and be prepared to fail again along the way. And they will need to do this while concurrently managing the expanding extent of their engagement with civilian design thinking. If they can get all this right, then the future of military design thinking is an exciting one indeed.

Design thinking, in both its civilian and military incarnations, tends to be ahistorical. This is because design thinkers focus on innovation, which has a distinct future-orientation. Knowledge of what has come before, as well as the paradigms underlying this history, enables development of a much richer knowledge of the field. It helps to determine where future developments may go, which methodologies are rigorous, and which are not, and how to better implement design methodologies by more comprehensively learning from those who have come before. In short, it enables even greater innovation to occur. By providing such a historical and paradigmatic analysis, it is hoped

that this monograph will help military designers to achieve this enhanced innovation by enabling them to maximize the utility of the design methodologies they select for employment when designing military operations.

Notes

1. Zweibelson, "The Multidisciplinary Design Movement: A Frame for Realizing Industry, Security, and Academia Interplay."
2. Ryan, "A Personal Reflection on Introducing Design to the U.S. Army."

Abbreviations

ADM	Army Design Methodology
ATP	Army Technical Publication
CAS	Complex adaptive systems
CFC	Canadian Forces College
FM	Field Manual
IDF	Israeli Defense Force
OTRI	Operational Theory Research Institute
SAMS	School of Advanced Military Studies
SOD	Systemic Operational Design
SOF	Special Operations Forces
TRADOC	Training and Doctrine Command

Bibliography

- Anderson, John. "From Systemic Operational Design (SOD) to a Systemic Approach to Design and Planning: A Canadian Experience." *Canadian Military Journal* 12, no. 3 (Summer 2012): 35–44.
- The Archipelago of Design: Researching Reflexive Military Practices* (website). <http://militaryepistemology.com/>.
- Australian Defence Force. Australian Defence Doctrine Publication 5.0—*Joint Planning*, 2nd ed. 2015.
- . Australian Defence Force Publication 5.0.1—*Joint Military Appreciation Process*, 2nd ed. 2016.
- Banach, Stefan J., and Alex Ryan. "The Art of Design: A Design Methodology." *Military Review* (March–April 2009): 105–115.
- Beaulieu-Brossard, Philippe, Exercise Coordinator for Exercise Shifting Sands. *Joint Command and Staff Programme 45: DS/CF548—Advanced Joint Warfighting Studies: Shifting Sands 2019*. Unpublished exercise guidance. May 2019.
- . *Joint Command and Staff Program 45: Design Thinking: The Golden Thread*. 2019 course notes. Unpublished course material.
- Beaulieu-Brossard, Philippe, and Paul T. Mitchell. "Challenge-Driven: Canadian Forces College's Agnostic Approach to Design Thinking Education." *The Archipelago of Design: Researching Reflexive Military Practices* (blog), 13 January 2019. <http://militaryepistemology.com/>.
- Beaulieu-Brossard, Philippe, and Philippe Dufort. "Introduction: Revolution in Military Epistemology." Special Issue: Reflexive Military Practitioners: Design Thinking and Beyond, *Journal of Military and Strategic Studies* 17, no. 4 (June 2017): 1–20.
- Beckerman, Gal. "In Modern Warfare, What Does Victory Mean?" *Boston Globe*, 26 January 2013. <https://www.bostonglobe.com/>.
- Boyd, John R. *A Discourse on Winning and Losing*. Edited and compiled by Grant T. Hammond. Maxwell AFB, AL: Air University Press, March 2018. <https://www.airuniversity.af.edu/>.
- Buchanan, Richard. "Wicked Problems in Design Thinking." *Design Issues* 8, no. 2 (Spring 1992): 5–21.
- Burrell, Gibson, and Gareth Morgan. *Sociological Paradigms and Organizational Analysis*. Portsmouth: Heinemann Educational Books, 1979.
- Carignan, Jennie. "Victory as a Strategic Objective: An Ambiguous and Counter-Productive Concept for the High Command." *Canadian Military Journal* 17, no. 2 (Spring 2017): 5–14.

- Cordesman, Anthony H. "The "End State" Fallacy: Setting the Wrong Goals for War Fighting." *Centre for Strategic and International Studies Commentary*, 26 September 2016. <https://www.csis.org/>.
- Cross, Nigel. "Designerly Ways of Knowing." *Design Studies* 3, no. 4 (October 1982): 221–227.
- Davis, Stephen Boyd, and Simone Gristwood. "The Structure of Design Processes: Ideal and Reality in Bruce Archer's 1968 Doctoral Thesis." Presented at the 2016 Design Research Society 50th Anniversary Conference, Brighton, UK, 27–30 June 2016. <https://static1.squarespace.com/>.
- Di Russo, Stephanie. "A Brief History of Design Thinking: How Design Thinking Came to 'Be.'" *I Think::I Design* (blog), 8 June 2012. <https://ithinkidesign.wordpress.com/>.
- . "A Brief History of Design Thinking: The Theory [P1]." *I Think::I Design* (blog), 18 January 2012. <https://ithinkidesign.wordpress.com/>.
- . "A Brief History of Design Thinking: The Theory [P2]." *I Think::I Design* (blog), 31 March 2012. <https://ithinkidesign.wordpress.com/>.
- . "Understanding the Behaviour of Design Thinking in Complex Environments." PhD diss., Swinburne University of Technology, 2016. <https://researchbank.swinburne.edu.au/>.
- Directorate of Army Research and Analysis. *Adaptive Campaigning: Army's Future Land Operating Concept*. Canberra: Australian Army Headquarters, September 2009.
- Doorley, Scott, Sarah Holcomb, Perry Klebahn, Kathryn Segovia, and Jeremy Utley. *Design Thinking Bootleg*. Stanford d.school, 2018. <https://static1.squarespace.com/>.
- Dorst, Kees. *Frame Innovation: Create New Thinking by Design*. Cambridge, MA: MIT Press, 2015.
- English, Allan. "The Operational Art." In *The Operational Art: Canadian Perspectives: Context and Concepts*, edited by Allan English, Daniel Gosselin, Howard Coombs, and Laurence M. Hickey, 1–75. Kingston, ON: Canadian Defence Academy Press, 2005.
- Fry, Tony. *Unstaging War, Confronting Conflict and Peace*. Switzerland: Palgrave Macmillan, 2019.
- Gracier, Ofra. "Between Teaching and Learning: What Lessons Could the Israeli Doctrine Learn from the 2006 Lebanon War?" *Experticia Militar* (July–October 2017): 22–29.
- . "Self Disruption: Seizing the High Ground of Systemic Operational Design (SOD)." Special Issue: Reflexive Military Practitioners: Design Thinking and Beyond, *Journal of Military and Strategic Studies* 17, no. 4 (June 2017): 21–37.

- . “SO SOD: An Antidote to the Futility of Design in Militaries,” *The Archipelago of Design: Researching Reflexive Military Practices* (blog), 26 March 2018. <http://militaryepistemology.com/so-sod/>.
- . “Why Generals Need to Forget Before They Can Become Generals.” Video recording, *TEDx Tel Aviv University*, 23 February 2016. <https://youtu.be/>.
- Greenbaum, Joan, and Mortein Kyng, eds. *Design at Work: Cooperative Design of Computer Systems*. Hillsdale, NJ: Lawrence Erlbaum and Associates, 1991.
- Grigsby, Jr., Wayne W., Scott Gorman, Jack Marr, Joseph McLamb, Michael Stewart, and Pete Schifferle. “Integrated Planning: The Operations Process, Design, and the Military Decision Making Process.” *Military Review* (January–February 2011): 28–35. <https://www.armyupress.army.mil/>.
- Grisogono, Anne-Marie, and Alex Ryan. *Designing Complex Adaptive Systems for Defence*. Unpublished Defence Science and Technology Organisation paper. 22 October 2003. Online: <http://militaryepistemology.com/designing-complex-adaptive-systems-for-defence/>.
- Grome, Anna, Beth Crandall, Louise Rasmussen, and Heather Wolters. *Army Design Methodology: Commander’s Resource*. Fort Leavenworth, KS: US Army School of Advanced Military Studies in Partnership with US Army Research Institute for the Behavioral and Social Sciences, February 2012.
- Harcourt, Bernard E. “An Answer to the Question: ‘What is Poststructuralism?’” *Public Law and Legal Theory Working Paper No. 156*. Chicago: University of Chicago, 2007.
- IDEO. “About IDEO.” <https://www.ideo.com/about>.
- . “Complex Problems are Best Solved Collaboratively,” 2018. <https://www.ideo.com/>.
- Imbeault, Marc, ed. “Special Edition No. 2—Systems Thinking and Design.” *The Blue Knight Review*, 25 January 2018. <http://www.cmrsj-rmcjsj.forces.gc.ca/>.
- Iskander, Natasha. “Design Thinking Is Fundamentally Conservative and Preserves the Status Quo.” *Harvard Business Review*, 5 September 2018. <https://hbr.org/2018/09/>.
- Jackson, Aaron P. “A Brief History of Military Design Thinking.” *Medium* (blog), 6 February 2019. <https://medium.com/>.
- . “Civilian and Military Design Thinking: A Comparative Historical and Paradigmatic Analysis, and its Implications for Military Designers.” Paper presented at the Innovation Methodologies for Defence Challenges (IMDC) 2019 conference, Lancaster University, UK, 26–28 February 2019.

- , ed. *Design Thinking: Applications for the Australian Defence Force*. Joint Studies Paper Series No. 3. Canberra: Defence Publishing Service, 2019.
- . “Introduction to Operational Design (And Some Other Types of Design Thinking).” Presentation to Australian Command and Staff College Joint Operations Planning Module, Australian Defence College, Canberra. 9 October 2019.
- . “Introduction: What is Design Thinking and How is it of Use to the Australian Defence Force?” In *Design Thinking: Applications for the Australian Defence Force*, edited by Aaron P. Jackson, 1–26. Canberra: Defence Publishing Service, 2019.
- . *Military Design Thinking Education: What the Australian Defence College Can Learn from Canadian Forces College and the US Joint Special Operations University*. Unpublished report prepared for Dr. Paul T. Mitchel, Director of Academics, Canadian Forces College. 31 August 2019.
- . “Paradigms Reconsidered.” *Infinity Journal* 4, no. 1 (Summer 2014): 26–31.
- . “The Perversion of Military Ideas: How Innovative Thinking is Inadvertently Destroyed.” *Small Wars Journal*, 1 December 2014. <https://smallwarsjournal.com/>.
- . *The Roots of Military Doctrine: Change and Continuity in Understanding the Practice of Warfare*. Fort Leavenworth, Kansas: Combat Studies Institute Press, 2013.
- . “Standing on the Shoulders of Giants to Reach a Cake: Observations About Military Design Facilitation.” *The Archipelago of Design: Researching Reflexive Military Practices* (blog), 24 June 2019. <http://militaryepistemology.com/>.
- . “A Tale of Two Designs: Developing the Australian Defence Force’s Latest Iteration of its Joint Operations Planning Doctrine.” Special Issue: Reflexive Military Practitioners: Design Thinking and Beyond, *Journal of Military and Strategic Studies* 17, no. 4 (June 2017): 174–193.
- . “Towards a Multi-Paradigmatic Methodology for Military Planning: An Initial Toolkit.” *The Archipelago of Design: Researching Reflexive Military Practices* (blog), 4 March 2018. <http://militaryepistemology.com/>.
- Johansson-Sköldberg, Ulla, Jill Woodilla, and Mehves Çetinkaya. “Design Thinking: Past, Present and Possible Futures.” *Creativity and Innovation Management* 22, no. 2 (2013): 121–146.
- Joint Chiefs of Staff. Joint Publication 5-0 *Joint Operation Planning*. 11 August 2011.
- . Joint Publication 5-0 *Joint Planning*. 16 June 2017.

- Joint Special Operations University. SOC3440: *SOF Design and Innovation Basic Course: Student Guide Academic Year 2019*. Unpublished course material.
- . SOC4445: *SOF Design and Innovation Advanced Course: Student Guide Academic Year 2019*. Unpublished course material.
- Joint Staff J-7. *Planner's Handbook for Operational Design: Version 1.0*. Suffolk, VA: Joint Staff J-7, Joint and Coalition Warfighting, 7 October 2011.
- Joullié, Jean-Etienne. "The Philosophical Foundations of Management Thought." *Academy of Management Learning and Education* 15, no. 1 (2016): 157–179.
- Kelly, Justin, and Mike Brennan. *Alien: How Operational Art Devoured Strategy*. Carlisle, PA: US Army Strategic Studies Institute, 2009.
- Kem, Jack D. *Design: Tools of the Trade*. Fort Leavenworth, KS: US Army Combined Arms Center, May 2009.
- Kipp, Jacob W. "The Tsarist and Soviet Operational Art, 1853–1991." In *The Evolution of Operational Art: From Napoleon to the Present*, edited by John Andreas Olsen and Martin van Creveld, 64–95. Oxford: Oxford University Press, 2011.
- Krippendorff, Klaus. "Professor Klaus Krippendorff on the Key Concepts of The Semantic Turn." Video of 2012 conference presentation, *Annenberg School for Communication*, 2 December 2014. <https://youtu.be/>.
- . *The Semantic Turn: A New Foundation for Design*. Boca Raton, FL: CRC Press, 2006.
- Kuhn, Thomas S. *The Essential Tension: Selected Studies in Scientific Tradition and Change*. Chicago: University of Chicago Press, 1977.
- . *The Structure of Scientific Revolutions*, 4th ed. Chicago and London: University of Chicago Press, 2012.
- Kumar, Vijay. *101 Design Methods: A Structured Approach for Driving Innovation in your Organization*. Hoboken, NJ: John Wiley and Sons, 2013.
- Martin, Bella, and Bruce Hanington. *Universal Methods of Design: 100 Ways to Research Complex Problems, Develop Innovative Ideas, and Design Effective Solutions*. Beverley, MA: Rockport Publishers, 2012.
- Masterman, Margaret. "The Nature of a Paradigm." In *Criticism and the Growth of Knowledge*, edited by Imre Lakatos and Alan Musgrave, 59–89. Cambridge: Cambridge University Press, 1970.
- Matthews, Matt. "Interview with Brigadier General (Ret.) Shimon Naveh." *Operational Leadership Experiences Project*. Leavenworth, KS: US Army Combat Studies Institute, 1 November 2007. <http://smallwarsjournal.com/>.
- Mattis, Gen J. N. Unpublished memorandum for US Joint Forces Command. Subject: Vision for a Joint Approach to Operational Design. 6 October 2009.

- Mitchell, Melanie. *Complexity: A Guided Tour*. Oxford: Oxford University Press, 2009.
- Mitchell, Paul T. "Stumbling into Design: Action Experiments in Professional Military Education at Canadian Forces College." Special Issue: Reflexive Military Practitioners: Design Thinking and Beyond, *Journal of Military and Strategic Studies* 17, no. 4 (June 2017): 84–102.
- Naveh, Shimon. *In Pursuit of Military Excellence: The Evolution of Operational Theory*. Abingdon: Frank Cass, 1997.
- Naveh, Shimon, Jim Schneider, and Tim Challans. *The Structure of Operational Revolution: A Prolegomena*. Fort Leavenworth, KS: Booz Allan Hamilton Inc., 2009.
- Nelson, Harold G., and Erik Stolterman. *The Design Way: Intentional Change in an Unpredictable World*. Englewood Cliffs, NJ: Educational Technology Publications, 2003.
- Norman, Don. *The Design of Everyday Things: Revised and Expanded Edition*. New York: Basic Books, 2013.
- Papanek, Victor J. *Design for the Real World: Human Ecology and Social Change*. Toronto: Bantam, 1973.
- Paparone, Christopher R. "Beyond Ends-Based Rationality: A Quad-Conceptual View of Strategic Reasoning for Professional Military Education." In *Teaching Strategy: Challenge and Response*, edited by Gabriel Marcella, 309–340. Carlisle, PA: US Army Strategic Studies Institute, 2010.
- . "A Primer for Key Terms and Concepts associated with Design Thinking." *The Archipelago of Design: Researching Reflexive Military Practices* (blog), 23 August 2019. <http://militaryepistemology.com/terms/>.
- . "Red Teaming: Multi-Paradigm Approach." In *The Encyclopedia of US Intelligence, Vol. 2*, edited by Gregory Moore. Boca Raton, FL: CRC Press, 2015.
- . "The Sociology of the Military: A Multi-Paradigmatic Review." *Contemporary Sociology* 43, no. 3 (2014): 304–311.
- . *The Sociology of Military Science: Prospects for Postinstitutional Military Design*. New York: Bloomsbury, 2013.
- . "The Sociology of Strategy: Romancing the Image." In *Exploring Strategic Thinking: Insights to Assess, Develop, and Retain Army Strategic Thinkers*, edited by Heather M. K. Wolters, Anna P. Grome, and Ryan M. Hinds, 81–101. Washington, DC: United States Army Research Institute for the Behavioural and Social Sciences, February 2013.
- Porkoláb, Imre, and Ben Zweibelson. "Designing A NATO That Thinks Differently for 21st Century Complex Challenges." *Defence Review*, no. 2018/1 (June 2018): 196–212.

- Potter, Garry, and José López, "After Postmodernism: The New Millennium." In *After Postmodernism: An Introduction to Critical Realism*, edited by José López and Garry Potter, 1–16. London: Athlone Press, 2001.
- Primeau, Mathieu. "How We Design." *The Archipelago of Design: Researching Reflexive Military Practices* [blog], 7 July 2019. <http://militaryepistemology.com/>.
- Protzen, Jean-Pierre, and David J. Harris. *The Universe of Design: Horst Rittel's Theories of Design and Planning*. Abindon, Oxon: Routledge, 2010.
- Rifkin, Jeremy. *The Third Industrial Revolution: How Lateral Power is Transforming Energy, the Economy, and the World*. New York: Palgrave Macmillan, 2011.
- Rittel, Horst W. J., and Melvin M. Webber. "Dilemmas in a General Theory of Planning." *Policy Sciences* 4, no. 2 (June 1973): 155–169.
- Rouse, William B. *Design for Success: A Human-Centred Approach to Designing Successful Products and Systems*. New York: John Wiley and Sons, 1991.
- Royal Australian Air Force Air Warfare Centre and Business Models Inc. *Crash Course in Design Thinking*. Unpublished PowerPoint presentation, 14 November 2018.
- Royal Netherlands Army. *Doctrinebulletin 2015-XX Contextual Military Design: Study Draft Version 1.0*. November 2015.
- Ryan, Alex, "About the Bears and the Bees: Adaptive Responses to Asymmetric Warfare." In *Unifying Themes in Complex Systems*, edited by Ali Minai, Dan Braha, and Yaneer Bar-Yam, 588–595. Berlin: Springer, 2010.
- . "Applications of Complex Systems to Operational Design." Unpublished research paper, 1 July 2011. <http://militaryepistemology.com/>.
- . "The Foundation for an Adaptive Approach: Insights from the Science of Complex Systems." *Australian Army Journal* 6, no. 3 (Summer 2009): 69–90.
- . "A Personal Reflection on Introducing Design to the U.S. Army." *Medium* (blog), 4 November 2016. <https://medium.com/>.
- Ryan, Alex, and Anne-Marie Grisogono. *Hybrid Engineered Complex Adaptive Systems: A Case Study in Defence*. Unpublished Defence Science and Technology Organisation research paper, 1 April 2004. <http://militaryepistemology.com/>.
- Sanders, Elizabeth B. N., and Pieter Jan Stappers. "Co-Creation and the New Landscapes of Design." *Co-Design* 4, no. 1 (2008): 5–18.
- Schön, Donald. *Displacement of Concepts* [1963]. London: Routledge, 2007.
- . *The Reflective Practitioner: How Professionals Think in Action*. New York: Basic Books, 1983.

- School of Advanced Military Studies. *Art of Design: Student Text, Version 2.0*. Fort Leavenworth, KS: US Army School of Advanced Military Studies, 2010.
- Schuler, Douglas, and Aki Namioka. *Participatory Design: Principles and Practice*. Hillsdale, NJ: Lawrence Erlbaum and Associates, 1993.
- Shoalwater, Dennis E. "Prussian-German Operational Art, 1740–1943." In *The Evolution of Operational Art: From Napoleon to the Present*, edited by John Andreas Olsen and Martin van Creveld, 35–63. Oxford: Oxford University Press, 2011.
- Simon, Herbert A. *Sciences of the Artificial*, 3rd ed. Cambridge MA: MIT Press, 1996.
- Sless, David. *Transitions in Information Design: A History*. Communication Research Institute, 29 November 1997. <https://communication.org.au/>.
- Snowden, David. "The Cynefin Framework." Cognitive Edge. Video presentation, 11 July 2010. <https://youtu.be/>.
- Sookermany, Anders McDonald. "Military Education Reconsidered: A Post-modern Update." *Journal of Philosophy of Education* 51, no. 1 (2017): 310–330.
- Sorrels, William T., Glen R. Downing, Paul J. Blakesley, David W. Pendall, Jason K. Walk, and Richard D. Wallwork. *Systemic Operational Design: An Introduction*. Leavenworth, KS: US Army School of Advanced Military Studies, 26 May 2005. <https://apps.dtic.mil/>.
- Stanley, Kenneth O., and Joel Lehman. *Why Greatness Cannot be Planned: The Myth of the Objective*. Switzerland: Springer International Publishing, 2015.
- Szczepanska, Jo. "Design Thinking Origin Story Plus Some of the People Who Made It All Happen." *Medium* (blog), 3 January 2017. <https://medium.com/>.
- UK Ministry of Defence. Allied Joint Publication-5/Joint Doctrine Publication 5-00 *Allied Joint Doctrine for Operational Level Planning*. June 2013.
- . Joint Doctrine Note 3/11 *Decision-Making and Problem Solving: Human and Organisational Factors*. June 2011.
- . Joint Doctrine Publication 04 *Understanding*. December 2010.
- . Joint Doctrine Publication 04 *Understanding and Decision-Making*, 2nd ed. December 2016.
- US Air Force. Air Force Doctrine Annex 3-0 *Operations and Planning: Operational Design Fundamentals*. 4 November 2016.
- . Air Force Doctrine Annex 3-0 *Operations and Planning: Methods of Operational Design*. 4 November 2016.
- US Army. Army Technical Publication 5-0.1 *Army Design Methodology*. 1 July 2015.

- . Field Manual 5-0 *The Operations Process*. March 2010.
- . Field Manual Interim 5-2 *Design (Draft)*. 20 February 2009.
- . TRADOC Pamphlet 525-5-500 *Commander's Appreciation and Campaign Design: Version 1.0*. 28 January 2008.
- US Army and US Marine Corps. Field Manual 3-24/Marine Corps Warfighting Publication 3-33.5 *Counterinsurgency*. 15 December 2006.
- US Marine Corps. Marine Air-Ground Task Force Staff Training Program Pamphlet 5-0.1 *Marine Corps Design Methodology*. March 2017.
- US Navy. Navy Warfare Publication 5-01 *Navy Planning*. December 2013.
- US Naval Postgraduate School. *NPS Design Thinking Community*. Accessed 9 November 2018. <https://my.nps.edu/web/design-thinking-community/home>.
- Van der Veer, Jeffrey. "The Rise of Design: Why an Innovative Concept is Emulated in Armies Around the Globe." Master's thesis, Royal Netherlands Defence Academy, 2015. <http://militaryepistemology.com/>.
- Vego, Milan N. "A Case Against Systemic Operational Design." *Joint Force Quarterly*, no. 53 (2nd Quarter 2009): 69–75.
- . *Joint Operational Warfare: Theory and Practice*, 2nd ed. Newport, RI: US Naval War College, 2007.
- Vinsel, Lee. "The Design Thinking Movement is Absurd." *Medium* (blog), 27 November 2018. <https://medium.com/>.
- Williams, Michael. *Problems of Knowledge: A Critical Introduction to Epistemology*. Oxford: Oxford University Press, 2001.
- Wrigley, Cara, Genevieve Mosley, Matthew Gill, and Jerome Reid. "Air Force by Design: Applying Design for Transient Capability Advantages." In *Design Thinking: Applications for the Australian Defence Force*, edited by Aaron P. Jackson, 51–70. Canberra: Defence Publishing Service, 2019.
- Zweibelson, Ben. "An Application of Theory: Second Generation Military Design on the Horizon." *Small Wars Journal*, 19 February 2017. <http://smallwarsjournal.com/>.
- . "An Awkward Tango: Pairing Traditional Military Planning to Design and Why It Currently Fails to Work." *Journal of Military and Strategic Studies* 16, no. 1 (2015): 11–41.
- . "Blending Postmodernism with Military Design Methodologies: Heresy, Subversion, and other Myths of Organizational Change." Special Issue: Reflexive Military Practitioners: Design Thinking and Beyond, *Journal of Military and Strategic Studies* 17, no. 4 (June 2017): 139–164.
- . "Breaking Barriers to Deeper Understanding: How Post-Modern Concepts are 'Value-Added' to Military Conceptual Planning Considerations." *Small Wars Journal*, 21 September 2011. <https://smallwarsjournal.com/>.

- . “Change Agents for the SOF Enterprise: Design Considerations for SOF Leadership Confronting Complex Environments.” *Special Operations Journal* 3, no. 2 (2017): 127–140.
- . “Changing Change While it Changes: The Rise of Disruptive Military Thinking (Part 2 of 3).” *Over the Horizon* (blog), 11 June 2018. <https://othjournal.com/>.
- . “‘Design’ goes Dutch: Army Considerations for Unconventional Planning and Sensemaking.” *Atlantisch Perspectief* 2015, no. 6 (December 2015). <https://web.archive.org/>.
- . “JSOU Design Thinking Topics: Design Thinking for the Commander—Addressing Complexity, Change, and Military Innovation.” Unpublished PowerPoint presentation. 7 July 2017.
- . “Linear and Non-Linear Thinking: Beyond Reverse-Engineering.” *Canadian Military Journal* 16, no. 2 (Spring 2016): 27–35.
- . “The Multidisciplinary Design Movement: A Frame for Realizing Industry, Security, and Academia Interplay.” *Small Wars Journal* (website), 10 January 2019. <https://smallwarsjournal.com/>.
- . “Rose-Tinted Lenses: How American Functionalist Strategy Inhibits Our Appreciation of Complex Conflicts.” *Defence Studies* 16, no. 1 (2016): 68–88.
- . “Special Operations and Design Thinking: Through the Looking Glass of Organizational Knowledge Production.” *Special Operations Journal* 2, no. 1 (2016): 22–32.
- . “Three Design Concepts Introduced for Strategic and Operational Applications.” *Prism* 4, no. 2 (2013): 87–104.
- Zweibelson, Ben, Lars Hedström, Magnus Lindström, and Ulrica Pettersson. “The Emergent Art of Military Design: Swedish Armed Forces and the Contemporary Security Environment.” *Kungl Krigsvetenskaps-Akademiens: Handling ooh Tidskrift*, (July–September 2017): 83–97.
- Zweibelson, Ben, Karena Kyne, Robert Rosa, and Frank Rundus. “Disruptive Innovation Through Military Design: A Collaboration Between the US Joint Special Operations University and the Polish Army.” *Special Operations Journal* 6, no. 2 (2020).