

INTRODUCTION: WHAT IS DESIGN THINKING AND HOW IS IT OF USE TO THE AUSTRALIAN DEFENCE FORCE?

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One of the first problems encountered when attempting to discuss design thinking is that there is no general consensus as to what it is. If one were to ask twenty self-identified 'designers' what design thinking was one would probably get at least twenty-one different answers. Nevertheless, in the last few years the term has become vogue. Whatever design thinking is, it promises innovation. It does this by offering a means to enable people to break free from existing mental models and to redefine their understanding of complex problems. It then provides a means to enable them to employ models, or even to develop entirely new models, that might be more suitable to addressing these problems.

Militaries are not exempt from the need to innovate and to address complex problems. Perhaps it is therefore no surprise that design thinking has entered military as well as civilian parlance. But what is the substance behind the term? And how might the Australian Defence Force (ADF) employ design thinking to achieve genuine improvements beyond what it does already? These questions, or more precisely answers to these questions, are the subject of this volume.

First, however, it is pertinent to introduce design thinking, its history and some of the methodologies it encompasses. This introduction constitutes the first section of this chapter. It is followed by another section containing a history of the application of design thinking within the ADF, which shows that the ADF, and Defence more broadly, have from time-to-time employed, and even developed, design thinking methodologies to innovate in a range of ways. However, this has occurred on an ad hoc basis, with different design efforts tending to occur in isolation from one another.

Through its presentation of this introductory information it is hoped that this chapter will leave the reader asking an additional question about design thinking: where to next? Possible answers to this question are proposed in several of the chapters contained in this volume, which elaborate different design thinking methodologies that might assist the ADF to innovate by designing. Accordingly, this volume is likely to be of interest to a range of Defence and ADF members who are seeking ways to innovate by deconstructing current frames of understanding and creating new frames in their place, but who are also keen to ensure that they are applying conceptually rigorous design thinking methodologies rather than just another fad or collection of buzz words. As will be demonstrated throughout this volume, there is definitely substance behind the term design thinking. However, achieving genuine innovation by designing is a difficult undertaking that requires sustained intellectual effort, deep and often-difficult self-reflection and self-doubt, and the acceptance of increased uncertainty and risk. Accordingly, the final thing this volume sets out to achieve is to show that in the case of design thinking, as the saying goes 'the juice is worth the squeeze'.

What is design thinking?

Having opened this chapter by acknowledging that there is general disagreement over what design thinking is, posing the question ‘what is design thinking?’ immediately thereafter may seem contradictory. Yet it is necessary to examine various answers to this question, conflicting though some of them are, to establish in readers’ minds what exactly this volume is about. It is important to understand that design thinking is in the eye of the beholder; in other words, none of the definitions discussed here is either right or wrong, even when those definitions are inconsistent or conflicting. Despite the differing understandings of design thinking, two things seem to unify it as a field. First, it is multidisciplinary in nature. Second, it is intended to help designers to address, manage or overcome complex situations and problems.

One of the broadest definitions of design thinking is that given by Harold G. Nelson and Erik Stolterman, who define ‘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’. By this definition design thinking is as old as human cognition, although its recognition has been very recent. Indeed, Nelson and Stolterman open their book about design thinking with the assertion that ‘humans did not discover fire—they designed it’, and they go on to assert that ‘Design is the first tradition among the many traditions of inquiry and action developed over time, including art, religion, science and technology’.¹

Looking at design thinking in the military context and attempting to capture its diversity, one of the authors featured in this volume, Ben Zweibelson, has previously adapted Nelson and Stolterman’s definition to the military context, defining military design as: ‘Creating what is needed but does not yet exist...so that the military organization gains relevance and advantage in the future system that is emerging’.²

In a different definition, the multidisciplinary nature of military design was captured by Ofra Gracier, who defined it as ‘the art of critical movement between cognitive frames’.³ Philippe Beaulieu-B and Philippe Dufort elaborated what types of frames may be employed in their introduction to a special edition of *Journal of Military and Strategic Studies* that focused on the evolution of design thinking approaches in several militaries:

*Military design thinking means the capability to understand a current conflict environment from a holistic perspective, to imagine a desired post-conflict environment and to realize it with counterintuitive military and non-military means. In short, military design thinking is an umbrella term for a more or less consistent assemblage of reflexive approaches including complexity theory (e.g. John Holland, Yaneer Bar-Yam, Robert Axelrod), systems thinking (e.g. Peter Checkland, Fritjof Capra, Humberto Maturana) and postmodern social theory (e.g. Michel Foucault, Gilles Deleuze & Felix Guattari, Jacques Ranciere) to name a few.*⁴

Outside of militaries, design methodologies have been prominently applied in the fields of architecture, ergonomics, industrial design (i.e. consumer product and service development), urban planning, and computer sciences.⁵ The ‘assemblage of reflective approaches’ these methodologies have drawn upon include those originating in the disciplines of psychology (especially cognitive psychology and organisational psychology), anthropology, business management, engineering,

phenomenology, and complexity and systems sciences.⁶ Linking this eclectic range of fields and methodologies has been an underlying conviction that, in the words of early design thinker Herbert Simon, ‘everyone designs who devises courses of action aimed at changing existing situations into preferred ones’.⁷ Incidentally, Simon’s understanding of the nature of design thinking is applied by Anne-Marie Grisogono in her chapter in this volume.

Design thinking emerged in these civilian disciplines from the 1960s, over thirty years before it emerged in the military literature. Initially, design was construed as a form of science, applicable to problem solving within the artificial (‘social’ may be a better term) environment.⁸ In the early 1970s, design thinkers—including Horst Rittel and Melvin Webber, and Victor Papanek—reconceptualised design thinking entirely by linking it to art and creativity.⁹ This has since led to the current situation in which design is often framed explicitly in contrast to science, and objective scientific method in particular.¹⁰

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 design thinking, which shifted the focus from development of design methods to analysing and explaining individual and collective creative thought and innovation, and what enables them.¹¹ Donald Schön, in particular, introduced the idea of reflective practice, or conscious self-reflection, to design thinking, shifting the focus from outwards to introspective, and from *problem solving* to *problem framing*.¹² Thus Schön introduced another understanding of design thinking, conceiving it as ‘a personal and internal conversation between the object designed and the designer’.¹³

Since the mid-1990s, teaching of design thinking methods has proliferated within higher education institutions, accompanied by a revival of its processual aspects.¹⁴ This revival was triggered by Richard Buchanan’s influential 1992 article, *Wicked Problems in Design Thinking*, which broadened the focus of private-sector design from *product* to *service* design.¹⁵ Buchanan also substantially developed a two-tiered process of problem definition and problem solution that had been advocated by various earlier design thinkers, popularising this approach to the point where it has since become central to the design methodologies taught by most civilian higher education institutions. These methodologies include *participatory design*, *user-centred design*, *interaction design*, *transformation design* and *service design* (Figure 1.1), to give merely a few examples. While their details differ, each of these design methodologies includes a problem defining (also called problem framing) component and a problem solving component.¹⁶

Yet the most prolific of this cluster of design methodologies is *human-centric design*, which was initially popularised by the company IDEO in the mid-1990s and which is now taught at the Stanford University d.school, the most prominent of the higher education institutions that has a design education program.¹⁷ Even within this one methodology, design thinking remains ambiguous and difficult to precisely define. On one hand, various design thinkers have asserted that human-centric design is primarily a reflexive mindset (or philosophy), which is enabled by a process. They also observe that human-centric design has again shifted the focus of design thinking, this time from *service* to *social systems* design.¹⁸ On the other hand, the design thinking method taught by the Stanford d.school is very processual in nature and consists of five *modes*, each of which includes several components. The modes are: empathise; define; ideate; prototype; and test (Figure 1.2).¹⁹

Figure 1.1: *Service design* ‘double diamond’ methodology developed by the UK Design Council (2014)²⁰

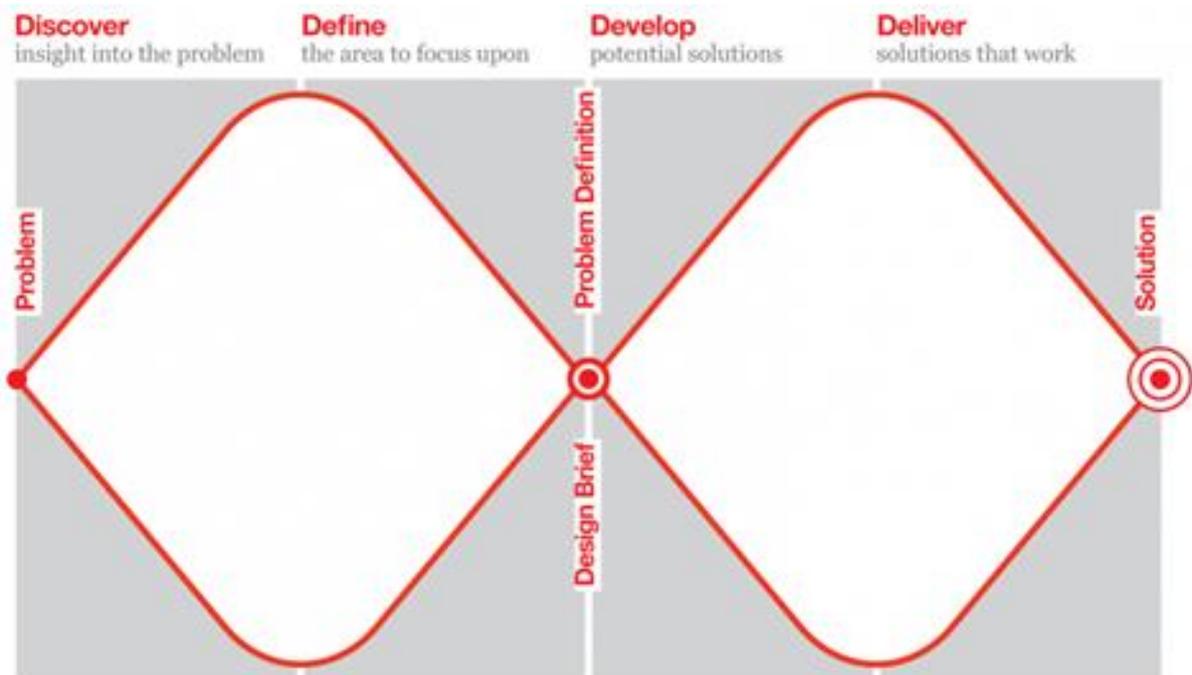
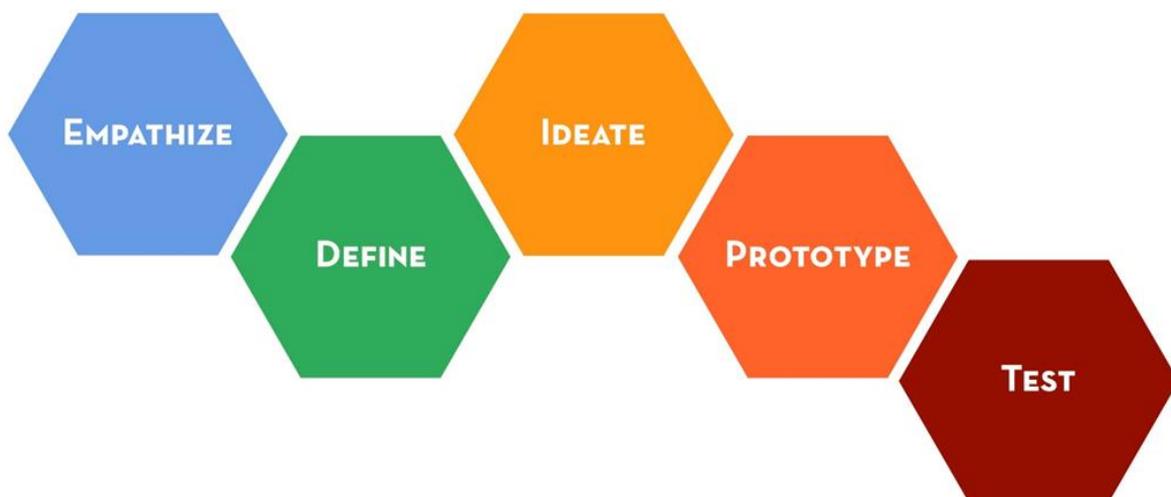


Figure 1.2: *Human-centric design* methodology taught at the Stanford University d.school Bootcamp (2018)²¹



While these and other design thinking methodologies were proliferating in civilian industry, academic disciplines and higher educational courses during the 1990s, the term was entering military parlance. This was not, however, the simple adoption by militaries of a civilian business methodology, as has happened so many times since Robert McNamara introduced systems analysis into the US Department of Defense in the early 1960s.²² Instead, military design thinking first appeared in Israel and was influenced from the outset by a diverse interdisciplinary approach that included foremost an analysis of Soviet operational art using general systems theory, informed by a critical reading of military history.²³ This was accompanied by references to academic disciplines as diverse as urban planning, psychology, cybernetics, and

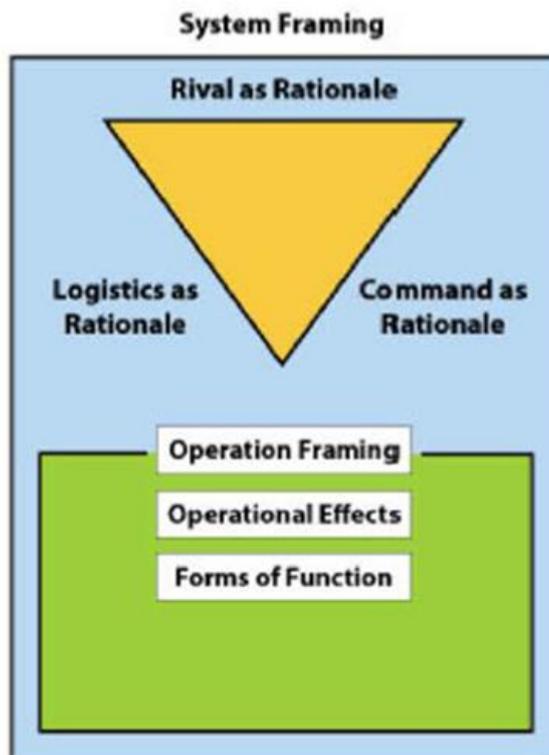
post-modern and post-structural philosophy. The work of Gilles Deleuze and Felix Guattari has since been frequently cited as an example of the latter.²⁴

This design method, which was coined Systemic Operational Design (SOD; Figure 1.3), began with the Israeli Defense Force's (IDF's) establishment of the Operational Theory Research Institute (OTRI) in February 1995. The head of OTRI, Brigadier General Shimon Naveh, had such a strong influence on the development of SOD that Zweibelson has since 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'. Zweibelson went on to summarise what happened next:

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 action to purge SOD from the military; they largely eliminated the majority of SOD practitioners from their ranks, with Naveh himself excommunicated and OTRI disbanded. This transpired just before the [2006] Hezbollah War which ended up being a political and military failure. Yet the genie was out of the bottle, and Naveh is distinctly credited with uncorking it for militaries in the 21st century.²⁵

Whether the implementation of SOD was to blame for the Israeli failure in Lebanon in 2006, and if so, to what extent and precisely why, remains contentious.²⁶

Figure 1.3: The Israeli Defence Force's Systemic Operational Design methodology (1995)²⁷



Meanwhile, in the mid-2000s, the US military began to take an interest in SOD as a possible methodology to better address the problems it was facing in Afghanistan and, especially, Iraq. This interest originated in both the US Army School of Advanced Military Studies (SAMS) and Training and Doctrine Command (TRADOC), and began in January 2005 with six SAMS students being selected to begin working with Naveh to research SOD. In May of that year these students employed SOD during a major exercise (Unified Quest), which generated further interest in SOD due to the radically different nature of their solution to the exercise problem.²⁸ In 2006, SAMS offered an elective course in SOD, with students on this course again participating in Exercise Unified Quest. In the same year general interest in SOD grew, leading to the production of several monographs by SAMS students about SOD or related topics. In 2007, the elective SOD course expanded and, in 2008, it became part of the core curriculum.²⁹

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 edition of Field Manual (FM) 3-24 *Counterinsurgency* in 2006; the publication of TRADOC Pamphlet 525-5-500 *Commander's Appreciation and Campaign Design* in 2008; publication of *Art of Design: Student Text, Version 1.0* by SAMS in 2008 (*Version 2.0* followed in 2010); the release of FM Interim 5-2 *Design* in 2009; *Design: Tools of the Trade*, published by the US Army Combined Arms Center in 2009; and the incorporation of a chapter about design thinking into FM 5-0 *The Operations Process* in 2010.³⁰ Subsequently design thinking expanded into the joint space in the early 2010s, where it was labelled *operational design*.³¹

This array of US military publications discussing design thinking ultimately served to further obfuscate the meaning of the term and the methodologies it encompassed. As Alex Ryan explained, in the process of developing these publications 'a curriculum of 3,000 pages of reading on design at SAMS was eventually distilled down to 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'.³² In response, Naveh, along with Jim Schneider and Tim Challans, authored *The Structure of Operational Revolution: A Prolegomena*, which was published by Booz Allan Hamilton in 2009.³³ This publication offered an alternative design methodology for the US Army that was much closer to SOD than the distilled version of design that was included in the doctrine.

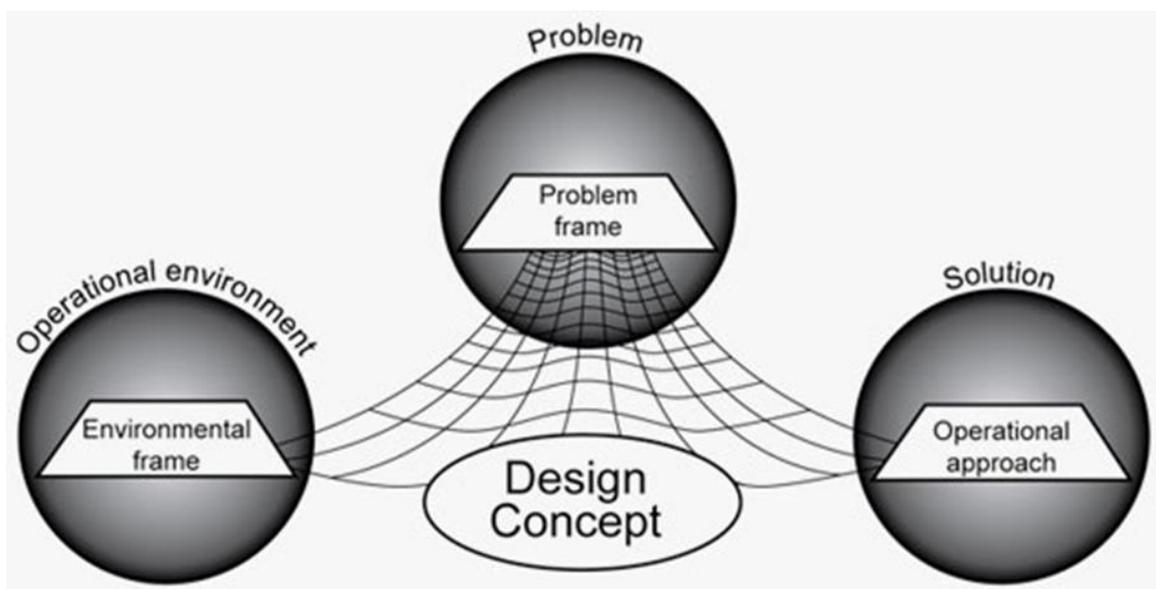
Ryan further explains that by the early 2010s 'proponents of [military] design basically fell into two camps'. The first of these were the design purists, who strictly adhered to a complicated multidisciplinary design thinking methodology that required military personnel to reframe their understanding of a situation through questioning their core beliefs about it, leading to innovative and adaptive solutions. They asserted that as a result of this methodology design thinking 'is not for everyone', and most military officers 'will never get it'. The second camp were the pragmatists, who saw a need to make design thinking as simple and as accessible as possible. They were the ones who gradually 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. Their design projects simply perpetuated the dominant instrumental approach to problem solving. ... Neither [camp] was able to transform the dominant institutional culture [of the US Army].³⁴

The design thinking approach included in US Army doctrine has since evolved into the 'US Army Design Methodology', or ADM for short (Figure 1.4), and is now contained within a dedicated Army Technical Publication (ATP), a supporting document to *The Operations Process*. This ATP, which was released in 2015, defines ADM as 'a methodology for applying critical and creative thinking to understand, visualize, and describe unfamiliar problems and approaches to solving them'.³⁵ This definition is a minor but significant simplification of the initial doctrinal definition of 'design' that was given in the 2010 edition of *The Operations Process*: the earlier definition had referred to 'complex, ill-structured problems' rather than 'unfamiliar problems'.³⁶

Figure 1.4: The US Army Design Methodology (2010)³⁷

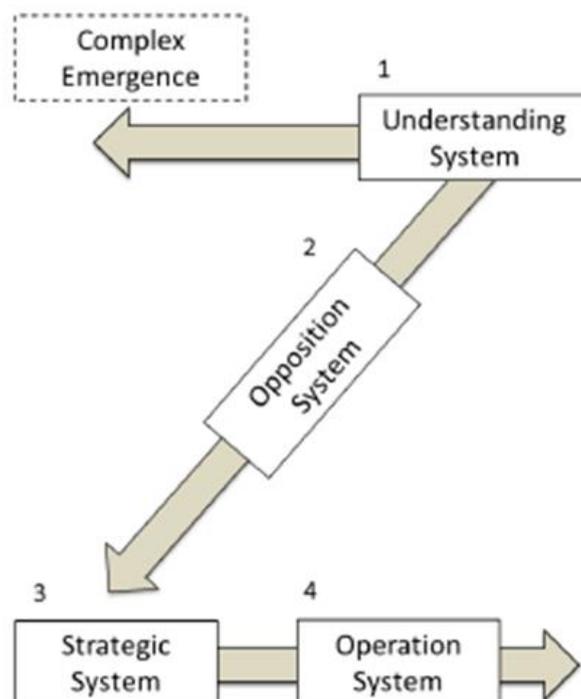


Both ADM and joint 'operational design' include the development of environment and problem frames to ensure adequate understanding, followed by development of a solution frame (referred to as 'the operational approach').³⁸ This is methodologically similar to Buchanan's two-tiered process of *problem definition* and *problem solution* that has become prominent within several civilian design methodologies.³⁹ A key point of departure from the civilian methodologies, however, is that the solution frame in ADM and operational design is completed using several military planning concepts that pre-date the introduction of design. These include the identification of the desired end state, objectives and decisive points; the conduct of centre of gravity analysis; and the establishment of lines of operation or lines of effort.⁴⁰ This inclusion is a direct result of the pragmatic approach identified and criticised by Ryan as perpetuating the dominant instrumental approach to problem solving, which does not require military personnel to challenge or 'really reframe' their fundamental beliefs.⁴¹

Since design thinking was introduced into SAMS in the mid-2000s, it has received growing attention in other US services and in allied militaries. In 2014, the US Naval Postgraduate School began to teach a design thinking course based on the human-centric design methodology taught by the Stanford d.school.⁴² In 2017, the US Marine Corps published its own doctrine detailing the 'Marine Corps Design Methodology', which unsurprisingly has more commonalities with ADM than differences.⁴³

Outside of the US, the British 'have provided doctrine to their military that expresses many design concepts while avoiding the word "design" entirely'.⁴⁴ Instead, these British doctrine publications, the first of which was published in 2010, discuss the development of 'understanding' in a similar way to how the US Army doctrine discusses ADM.⁴⁵ In 2013, the IDF invited Naveh back to teach a one-star level design course, as 'there seemed to be no one else who could fill a decade of operational vacuum' in IDF thinking. Using a new design approach called Systemic Inquiry in Operational Mediation, teaching of design in the IDF now focuses on triggering strategic and operational innovation through guided self-disruption and exploitation of identified tensions (Figure 1.5).⁴⁶

Figure 1.5: The Israeli Defence Force's *Systemic Inquiry in Operational Mediation* methodology (2013)⁴⁷



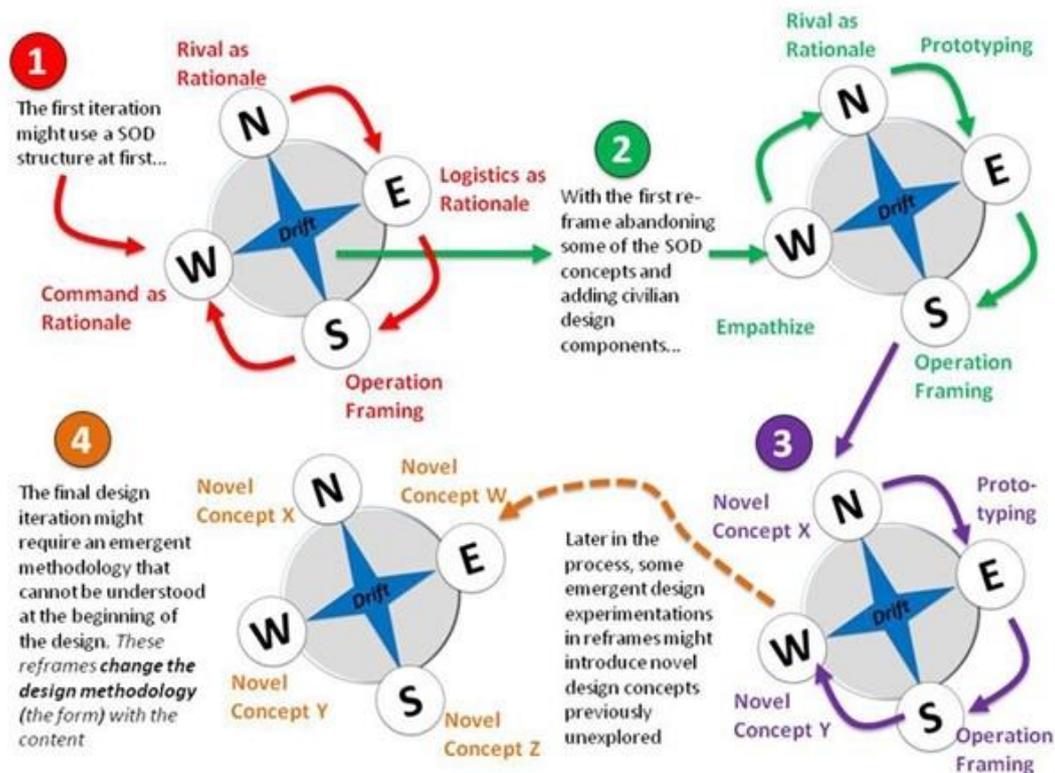
Also in 2013, Canadian Forces College (CFC) began to teach a design component as part of its O6 level National Security Program. This program drew on a mix of civilian and military design methodologies, including Naveh's early publications, civilian design thinking taught in the Rotman School of Management at the University of Toronto, and US Army design thinking. A similar design module has since been added to the Advanced Joint Warfare Studies module of the O4 level Joint Command and Staff Program. Both courses at CFC continue to evolve an 'epistemological agnosticism for design methodology' by reframing the course syllabus on an annual basis and by providing students with instruction in multiple design methodologies of both military and civilian origin.⁴⁸ Because of this unique approach, CFC today quietly

delivers arguably one of the most comprehensive military design thinking education programs in the world.⁴⁹

The last few years have seen the establishment of design education courses, the publication of design doctrine, or both, within various NATO militaries. These militaries include the Netherlands, Poland, Sweden, Norway and Hungary.⁵⁰ NATO, as an organisation, incorporated design into its doctrine in 2010, using a very similar definition and methodology to that which appeared in US joint doctrine and also calling it 'operational design'.⁵¹ It has more recently been argued that the alliance now needs to move beyond operational design by expanding the range of areas where design thinking is applied to include organisational transformation.⁵² This proposed application of design thinking is similar to the example contained in the chapter in this volume by Brandon Pincombe *et al*, which details the design of a future Australian Land Force of 2050.

In addition to these institutional publications and officially-endorsed design methodologies, several prominent military design thinkers have published their own contributions to military design thinking. Noteworthy among them are two of the contributors to this volume, Ben Zweibelson and Christopher Papparone. Zweibelson, a multiple-tour US Army veteran of Afghanistan and Iraq, was instrumental in developing a design methodology tailored to suit the unique requirements of US Special Operations Command.⁵³ He is currently Director of the Design Program at the US Joint Special Operations University (JSOU). An example of his design thinking is shown in Figure 1.6, wherein Zweibelson has deliberately blended several military and civilian design methodologies to form a unique new methodology that builds upon them. He has also, perhaps by accident, chronicled the spread of military design thinking via his prolific authorship of papers about the development of different design thinking methodologies in various militaries.⁵⁴

Figure 1.6: Zweibelson's proposed *second generation military design methodology* (2017)⁵⁵



Paparone, another US Army veteran who is now Professor at the US National Defense University, offered a detailed sociological critique of the ingrained institutional biases of the US military, prior to reframing the notion of military professionalism by deconstructing these biases and then constructing alternative frames. His application of design thinking was greatly shaped by Donald Schön's ideas about 'displacement of concepts' and 'reflective practice'. Indeed, 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.⁵⁶ This approach to design is evident in Paparone's chapter in this volume, which presents Schönian reflective practice as a means to address frame rigidity through developing frame awareness as a precursor to innovation.

Of course, Zweibelson and Paparone are not the only prominent military design thinkers. The growing body of these thinkers seems to have hit the critical mass required for the establishment of disciplinary self-awareness a few years ago (perhaps 'interdisciplinary self-awareness' better suits). The path to self-awareness began with the establishment of an informal email group in 2009, initially consisting of Paparone, Zweibelson and US Army Lieutenant Colonel Grant M. Martin.⁵⁷ Other military design thinkers were gradually added, and the group now includes over a hundred military design thinkers from several countries and has moved on to communication via other platforms such as *Slack*.⁵⁸

Research into the development of military design thinking by CFC faculty member Philippe Beaulieu-B led to him organising an international military design thinking conference in 2016, which was followed by others in 2017, 2018 and 2019.⁵⁹ Selected papers presented at the 2016 and 2017 conferences were subsequently published in special editions of *Journal of Military and Strategic Studies* and *The Blue Knight Review*.⁶⁰ In partnership with Philippe Dufort of St Paul's University in Ottawa, Beaulieu-B also established *The Archipelago of Design* website in 2017 as a repository for military design thinking research. At the time of writing this chapter, the site features over 100 papers written by more than twenty military design thinkers, as well as hosting its own blog and video recordings of over a dozen military design-themed presentations.⁶¹

These recent developments indicate a growing interest in military design thinking internationally, which has resulted from increasing recognition of design thinking's utility as an inter-disciplinary methodology that enables military practitioners to confront complexity. Yet recognition of these developments also brings us back to where this chapter started. That is, with the need to acknowledge that amongst the ever-growing number of military designers, and despite the burgeoning range of military design methodologies and resources, there is still no general agreement as to what precisely 'design thinking' is. All of the design methodologies briefly summarised here are as valid as each other, even where contradictory or conflicting. This is not necessarily a problem, however; on the contrary, it may actually be a strength because complex systems are emergent and therefore require constant adaptation by those seeking to act within them.⁶² This adaptation is often referred to as 'reframing' within the design methodologies discussed herein. To paraphrase Martin, maintaining methodological agnosticism about design thinking is likely the best approach one can take.⁶³

Design thinking in the Australian Defence Force to date

Given the extent of the recent growth of military design thinking internationally, one is compelled to ask whether any design thinking has occurred in the ADF? The answer is that it has but in an ad hoc manner, involving several different design efforts occurring in isolation from one another. This section summarises the history of these efforts.

This history begins with the development of the 'complex warfighting' and 'adaptive campaigning' concepts that were published in 2004 and 2006 respectively. Development of these concepts was a response to the ADF's operations of the early 21st century, with those in East Timor, Afghanistan and Iraq in particular likely to have been influential. Beginning in early 2003, two of the authors featured in this volume, Anne-Marie Grisogono and Alex Ryan, commenced a multi-year Defence Science and Technology Organisation research project applying complex adaptive systems theory in military and defence contexts.⁶⁴ It is probable that this research influenced early Army conceptual development in response to the new operational environment; however, this relationship could not be established with certainty in the case of complex warfighting.

That particular future land operating concept was authored by (then) Lieutenant Colonel David Kilcullen and was published by the Australian Army in 2004. In it, Kilcullen delivered a detailed assessment of the emerging operational environment of the early 21st century, making the then novel but now clichéd observation that warfare was becoming increasingly complex. In response, he called for forces that were 'optimised for versatility, agility and orchestration'.⁶⁵ Notably, complex warfighting seems to have had some influence on US conceptual developments, with *The Military Balance* observing in 2005 that 'large portions of the new US future land warfighting concept seem to have been drawn directly from the Australian Complex Warfighting doctrine'.⁶⁶ This impact seems to have been short-lived, however, and there is no indicator that this concept went on to directly influence the US Army's design-related publications detailed above.⁶⁷

The 2006 draft publication *Adaptive Campaigning: The Land Force Response to Complex Warfighting* elaborated five lines of operation that focused on the host nation population, capacity building or fighting the enemy. It declared that 'the key to the Land Force's success will be its ability to effectively orchestrate effort across the five lines',⁶⁸ and it established an 'adaption cycle' to encourage rapid adaption within a complex warfare setting, including by transitioning within and between its lines of operation.⁶⁹ The final version of this publication, released in 2009, included an enhanced diagrammatical representation of the adaption cycle that linked it to mission command (Figure 1.7). It also asserted that complex warfare is 'a competitive learning environment'.⁷⁰ The adaption cycle was designed to help 'ensure the Land Force is solving the right problem' by applying an iterative process to conduct problem framing, a term it borrowed from the work of Martin Rein and Donald Schön.⁷¹ This publication was influenced by Kilcullen's previous conceptual work, as it was written explicitly in response to the operating environment identified in complex warfighting, and also by Grisogono and Ryan, who directly contributed to its development.⁷²

Figure 1.7: The Australian Army's *adaption cycle* (2009 version)⁷³

Between the publication of the draft version of *Adaptive Campaigning* in 2006, and about a year or so after the final version had been published in 2009, the Australian Army went through a period of public discussion and exploration of the concept. This included, most notably, the incorporation of a summary of the adaption cycle into the Army's keystone doctrine in 2008;⁷⁴ the publication of a special edition of *The Australian Army Journal* (AAJ) themed 'the Adaptive Army' in summer 2009, which featured a dozen papers on both complex adaptive systems theory and its application via adaptive campaigning;⁷⁵ and production of a detailed account of the concept's application in Iraq and Afghanistan.⁷⁶

Despite all of this activity, the period of rapid innovation had ended with the production of the concept itself in the mid-2000s. The sentiment underlying the Army's intellectual transition away from this period was concisely captured in the editor's message at the start of the February 2009 edition of Army's *Senior Officer Professional Digest*, which stated that: 'For the Australian Army... the time for debate over broad conceptual direction has ended, and all officers must shift their focus to implementing the many changes arising from the Adaptive Army initiative and the Adaptive Campaigning concept'.⁷⁷ The subsequent period of discussion regarding conceptual implementation petered out around the end of 2011. By August 2012, Albert Palazzo was able to publish a paper titled *The Future of War Debate in Australia: Why has there not been one? Has the need for one now arrived?* In this paper, Palazzo charged that there had been a lack of debate within the Australian Army about the future of warfare. This was a stark contrast to the praise *The Military Balance* had bestowed upon Army conceptual development a mere seven years

earlier, and it indicated the end of the Army's development of this unique design methodology.⁷⁸

With the development of adaptive campaigning over, the ADF has since predominantly engaged with design thinking by applying externally-developed methodologies in preference to developing its own. The first instance of this occurred sometime between 2006 and 2008, when Shimon Naveh visited Australia to conduct a SOD workshop for selected Special Forces personnel.⁷⁹ While the workshop appears to have been successful, in that the design team was able to successfully implement SOD during an exercise scenario, no evidence could be found regarding the subsequent impact, if any, of the introduction of these personnel to SOD.

From the mid-2000s, ADF engagement with design thinking also occurred through selected personnel attending US professional military education (PME) courses. Two of these students, who had also published papers about adaptive campaigning in the summer 2009 special edition of AAJ, published monograph-length studies about design in 2011. In the first, (then) Lieutenant Colonel Trent Scott advocated the ADF's implementation of a design thinking methodology similar to the US' joint 'operational design'.⁸⁰ In the second, (then) Lieutenant Colonel Christopher Smith elaborated several design methods that ADF planners could use to improve their practice of operational art. These methods were primarily, but not exclusively, based on those in the US ADM.⁸¹

Independently of these other activities, elements of the US' joint 'operational design' methodology were adapted for the Australian context and incorporated into the second editions of Australian Defence Doctrine Publication (ADDP) 5.0—*Joint Planning* (2014) and Australian Defence Force Publication (ADFP) 5.0.1—*Joint Military Appreciation Process* (JMAP; 2015).⁸² Of note, the first draft of *Joint Planning* was written by a contractor who had previously been a student at the US Army War College. Presumably they had been exposed to SOD during their attendance at this College, as their draft of this publication contained many elements of SOD—including the much-criticised dense and obscure philosophical language. As a result, this draft was rejected by Joint Doctrine Centre (JDC) staff as too esoteric for implementation by the ADF. This author, then working as a doctrine developer at JDC, was assigned to completely re-write this publication, before going on to co-author the JMAP publication with Squadron Leader James Rea.⁸³

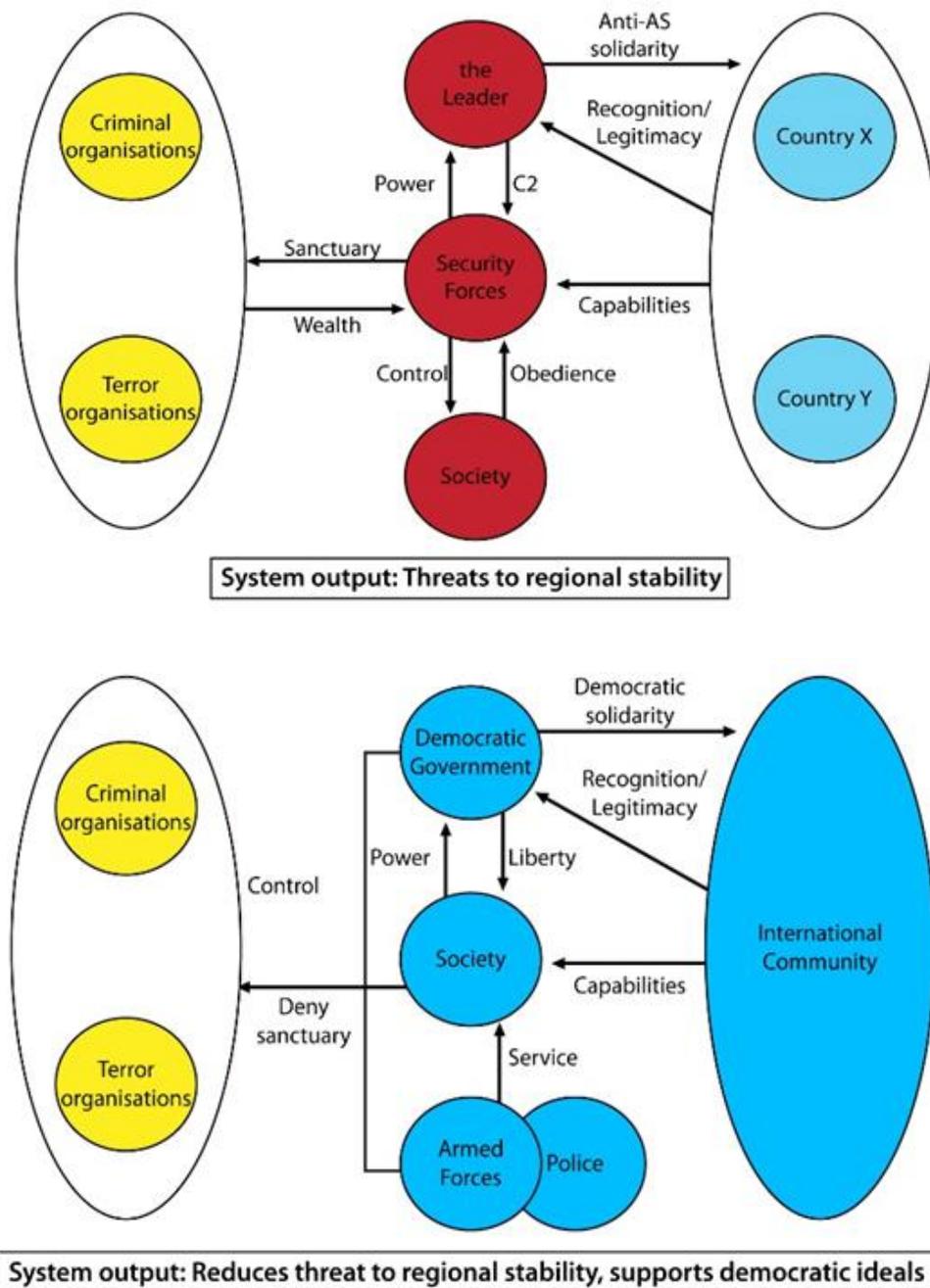
The re-write included incorporation of an Australian adaption of elements of operational design. This version of operational design came from a range of sources, primarily including: the equivalent US joint doctrine publication; elements of the few design thinking methods that were already being taught during courses at the Australian Command and Staff College (ACSC) and the ADF Joint Warfare Training Centre (primarily framing, in addition to several pre-existing aspects of operational art); and a range of theoretical writings about operational art, design thinking and complexity theory, which were evaluated against an assessment of the ADF's contemporary operational needs.⁸⁴ Although it did not define operational design, the JMAP doctrine did assert that:

Operational design produces a schematic that articulates the contemporary application of operational art. It constitutes a synthesis between classical notions of operational art, developed during the late nineteenth and twentieth centuries when armed conflict was dominated by large industrialised forces, and selected aspects of

*complex adaptive systems theory that have emerged during the early twenty-first century.*⁸⁵

The key elements of design thinking that were included were methods for conducting environment and problem framing (Figure 1.8), and discussions about the need for critical thinking and for circularity during planning, including by the conduct of reframing when required.⁸⁶

Figure 1.8: Examples of observed (top) and desired (bottom) system diagrams used for environment framing in the Joint Military Appreciation Process (2015)⁸⁷



Like its US equivalent, the ADF's version of operational design also included a range of traditional operational art concepts including: identification of the desired end state, objectives and decisive points; the conduct of centre of gravity analysis; and the establishment of lines of operation.⁸⁸ Hence, it fell within the auspices of the

pragmatic approach to military design thinking identified by Ryan and it can therefore be subjected to Ryan's criticisms of this approach, specifically that it does not require personnel to challenge or 'really reframe' their fundamental beliefs.⁸⁹ Nevertheless, the inclusion of operational design in the second edition of ADF joint planning doctrine, framing in particular, has been credited as 'a great improvement over the first edition because it has given [the ADF] the cognitive framework to deal much better with complex planning problems'.⁹⁰

In the last few years, the application of design thinking methodologies outside of activities directly related to operations planning has increased in frequency across Defence. The chapter in this volume by Pincombe *et al* presents one example, detailing the conduct and outcomes of a six-day design workshop run by Defence Science and Technology (DST) Group in late 2017. This workshop examined the question 'how can we design a Land Force that can meet the likely 2050 Australian strategic defence objectives in an irreducibly uncertain and complex future?' The range of design methods used at the workshop included systems mapping, horizon scanning, empathy mapping, GIGA-mapping, wind tunnelling and prototyping. These methods and others are elaborated in Pincombe *et al*'s chapter, which presents an excellent example of the application of design thinking methods to address force design challenges. In early 2018, a similar design workshop was held to explore how robotic autonomous systems might influence warfare in the land domain in 2035. This second workshop was a collaboration between Army's Land Warfare Lab and DST.⁹¹

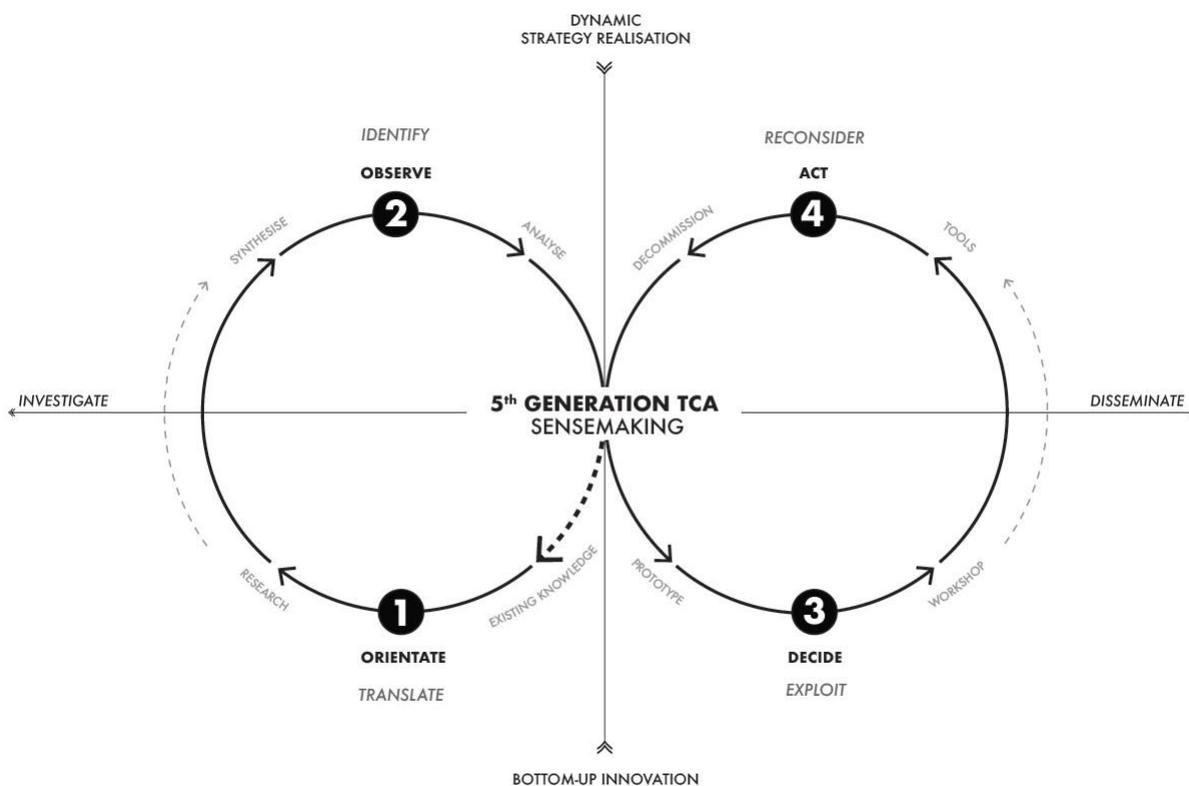
Design thinking methodologies were also applied by the Royal Australian Air Force during the development of Plan Jericho, which is a plan to enable Air Force to transition into a 'fifth generation air force' through the adoption of a range of advanced technology-enabled platforms.⁹² Its development involved the use of design to develop new approaches to capability acquisition; to develop a science and technology strategy in collaboration with DST; to develop a training and education strategy for Air Force; and to find ways to accelerate research into potentially disruptive technologies.⁹³ This design thinking effort was undertaken in partnership with University of Sydney's School of Architecture, Design and Planning, where a Defence by Design Lab has recently been established. The Lab is directed by one of the authors featured in this volume, Cara Wrigley, who is also the inaugural Jericho Chair of Design Innovation.⁹⁴

Under the auspices of this collaboration, and with the additional involvement of the Royal Australian Navy in areas requiring joint cooperation,⁹⁵ Air Force has blended the concept of 'arbitrage' from economic theory, 'Design Innovation Catalysts' from Wrigley's work in the field of industrial design, and John Boyd's 'OODA loop', to form a unique Air Force design methodology. This methodology is called the Transient Capability Advantage Framework (Figure 1.9). Both the Framework and its evolution are discussed in detail in Wrigley *et al*'s chapter in this volume.

Introductory education about design thinking began within the ADF in 2018. This author was invited to give presentations on the JMAP's version of operational design and on design thinking more broadly at ACSC and the Centre for Defence and Strategic Studies (CDSS), which respectively conduct the ADF's peak joint PME courses for O4 and O6 level officers.⁹⁶ Updated versions of these presentations were delivered in 2019. In November 2018, the Air Force's Air Warfare Centre offered a 'crash course in design thinking', which was delivered by a civilian contractor using selected components of a human-centric design methodology.⁹⁷ While these

presentations indicate both a growing awareness of and interest in design thinking within the ADF, each was only 90 minutes in duration except for the 2019 CDSS presentation, which was three hours and included a practical activity. As such, none of these presentations were able to go beyond an introductory-level explanation of design thinking and a few of its constituent methods.

Figure 1.9: *Transient Capability Advantage Framework*, a design methodology applied by Air Force during development of Plan Jericho (2019 version)⁹⁸



Notwithstanding that several individual ADF members have received an education in various design thinking methodologies either through attendance at foreign military PME courses or as a part of their civilian studies, to date the ADF has not developed a design thinking education course that goes beyond cursory awareness-raising. Nor has it conducted a detailed, comparative evaluation of different design thinking methodologies to determine their relative value and utility to the organisation. Furthermore, there is no ADF organisational approach to developing design thinking expertise and capacity. As a result, the examples of the ADF's application of design thinking given here are indicative of an ad hoc approach that has no doubt been accompanied by some missed opportunities.

Future prospects

That several of the examples given in the last section have occurred relatively recently indicates that the ADF may currently be on the cusp of applying design thinking more broadly across the force. If this is to occur, it needs to be done by the application of conceptually rigorous design thinking methodologies, not by simply 'doing design' in name only because the ADF wants to innovate and design is the vogue methodology of the day. This author already has concerns about some of the design activities the ADF has undertaken from having seen first-hand examples of

shallow design methods, originating in the private sector, being applied to do poorly what the application of JMAP would have done well, and constraints being placed upon the scope of what a design team has been allowed to explore that negated any possibility of them being genuinely innovative. If the ADF is going to continue to apply design methodologies, it needs to ensure that it is adequately applying the right methodologies in the right ways and to address the right challenges.

The chapters in this volume by Brandon Pincombe *et al* and by Cara Wrigley *et al* both present excellent examples of the ADF having effectively applied design thinking. These chapters offer different yet complementary perspectives, since the chapter by Pincombe *et al* provides a detailed example of the conduct of a single design workshop that supported Army's future force development, while that by Wrigley *et al* discusses the development of a design methodology for use across Air Force under the auspices of Plan Jericho. Despite the different micro- and macro-perspectives that these chapters offer, it is illuminating that the authors of both chose to include discussions about areas where design thinking could be effectively applied by the ADF to enhance current practice across a range of areas.

In the same vein, the other chapters in this volume examine different design methodologies that the ADF may apply to continue to 'get design right'. Anne-Marie Grisogono explores the relationship between design and adaptation, asserting that there is a need for Defence to consciously design both system architecture for adaptation and meta-decision making processes; that is, decision making regarding who can make decisions. Design is necessary in both of these areas to enable Defence to maximise the chances not only of adapting, but of doing so as quickly as possible while also maximising the potential benefits derived from doing so.

Christopher Paparone seeks to find balance in the tension between organisational needs to explore emergent new frames through embracing methodological flexibility and instability while, concurrently, requiring a technique-based learning framework that is replicable enough to be uniformly teachable. He attempts this balance through an application of Schön's 'reflective practice', which can be achieved through the teaching of *frame reflection*—to expose and deconstruct *frame rigidity*—and then enabling practitioners to conduct *frame innovation*, which involves reaching new understandings of unfamiliar situations. He subsequently discusses four tools that can be applied in a PME setting to help students achieve frame reflection and frame innovation. The approach to PME he advocates is known as 'designing meaning' and this chapter will no doubt be of interest to a range of PME institutions within the ADF and the Services.

Have you ever been stumped while trying to solve a problem? So instead, you've stopped trying for a while and gone to do something else, such as going for a run, taking a shower, or winding down in some other mundane way. Then, suddenly, you have an 'aha moment' and see a way to solve the problem that you had never considered before? In design thinking, this occurrence could be said to constitute a form of emergence through unintentional disruption of the existing frame. In his article in this volume, Ben Zweibelson explores this phenomena and a possible means of deliberately achieving it during military design and planning activities. This means is called 'substantive play', which is exactly what the name makes it sound like: taking time to stop designing or planning and play for a while. Not only can this activity be easily added to most existing design methodologies but Zweibelson also recounts two instances of it having been successfully tested during design education courses at CFC and JSOU.

Next, Major Matthew Furtado, US Army, applies a systems definition of creativity to military thinking and planning at the strategic, operational and tactical levels. Conducting a survey of creativity at each level, he determines that it is manifest in strategic novelty prompted by perpetual contextual uniqueness; in operational framing and divergence through the application of lateral thinking; and in tactical adaptation that occurs primarily through improvement and best practices rather than through creation of novelty or divergence. Hence, at each level a different kind of creativity is required. Existing military design methods contained within doctrine, the US ADM in particular, are found to be best suited to the needs of operational level creativity. *Ergo*, Furtado exposes both the strengths and limitations of these design methodologies.

In the final chapter in this volume, Zweibelson and this author debate two approaches to design education for militaries in a discussion introduced by Canadian Army Brigadier General Simon Bernard. This chapter, which originally appeared in *The Blue Knight Review*, the journal of the Royal Military College St. Jean, is reproduced herein because of its relevance as the ADF's interest in design education increases. In this chapter, Zweibelson argues that military design education should be taught at entry level to maximise its chances of fostering a culture of innovation, whereas this author argues that it should be taught at the mid-career level to enable those who already know 'the box' to think outside of it. Regardless of which of these arguments readers agree with, it is hoped that inclusion of this chapter in this volume will prompt greater consideration of what form a robust and coherent approach to military design thinking education in the ADF ought to take.

Finally, it is worth noting that these contributions span a range of disciplines and paradigms. Grisogono and Furtado, for instance, take primarily a systems thinking approach to design while Papparone, on the other hand, takes an approach primarily influenced by sociology of knowledge. Yet none of these contributions is exclusively single-disciplinary. It is fitting, therefore, to conclude this introductory chapter with a reminder that one of the strengths of design thinking is that it is ill-defined and multidisciplinary. What is important is to ensure that whatever design methodology one employs, that methodology is conceptually robust and rigorously implemented. The chapters contained in this volume demonstrate just a few of the many ways the ADF can achieve this robustness as it applies design thinking methodologies to innovate in a range of contexts.

Notes

¹ Emphasis in original. Harold G. Nelson & Erik Stolterman, *The Design Way: Intentional Change in an Unpredictable World* (Englewood Cliffs, NJ: Educational Technology Publications, 2003), pp. 1-2.

² Ben Zweibelson, 'JSOU Design Thinking Topics: Design Thinking for the Commander – Addressing Complexity, Change, and Military Innovation', unpublished PowerPoint presentation, 7 July 2017, copy on file with author.

³ Ofra Gracier, 'Self Disruption: Seizing the High Ground of Systemic Operational Design (SOD)', *Journal of Military and Strategic Studies*, Special Issue: Reflexive Military Practitioners: Design Thinking and Beyond, Vol. 17, No. 4 (June 2017), p. 25.

⁴ Philippe Beaulieu-B & Philippe Dufort, 'Introduction: Revolution in Military Epistemology', *Journal of Military and Strategic Studies*, Special Issue: Reflexive Military Practitioners: Design Thinking and Beyond, Vol. 17, No. 4 (June 2017), p. 2, fn. 3.

⁵ Jo Szczepanska, 'Design Thinking Origin Story plus Some of the People who Made it all Happen', *Medium*, 3 January 2017. Online: <https://medium.com/@szczpanks/design-thinking-where-it-came-from-and-the-type-of-people-who-made-it-all-happen-dc3a05411e53>, accessed 25 July 2018; Richard Buchanan, 'Wicked Problems in Design Thinking', *Design Issues*, Vol. VIII, No. 2 (Spring 1992), p. 11; Nelson & Stolterman, *The Design Way*, pp. 1-2; Donald Schön, *The Reflective Practitioner: How Professionals Think in Action* (New York: Basic Books, 1983), p. 76.

⁶ Stephanie Di Russo, *Understanding the Behaviour of Design Thinking in Complex Environments* (PhD dissertation, Swinburne University of Technology, 2016), pp. 12-13; Szczepanska, 'Design Thinking Origin Story'; Buchanan, 'Wicked Problems in Design Thinking', pp. 9-10; Nelson & Stolterman, *The Design Way*, pp. 1-2; David Sless, *Transitions in Information Design: A History*, Communication Research Institute, 29 November 1997. Online: <https://communication.org.au/transitions-in-information-design-a-history/>, accessed 30 July 2018.

⁷ Herbert Simon, *Sciences of the Artificial* (3rd ed., Cambridge MA: MIT Press, 1996), p. 111.

⁸ Simon, *Sciences of the Artificial*, p. 128 & pp. 162-163; Szczepanska, 'Design Thinking Origin Story'.

⁹ Horst W. J. Rittel & Melvin M. Webber, 'Dilemmas in a General Theory of Planning', *Policy Sciences*, Vol. 4, No. 2 (June 1973), pp. 155-169; Victor J. Papanek, *Design for the Real World: Human Ecology and Social Change* (Toronto: Bantam, 1973).

¹⁰ Stephanie Di Russo, 'A Brief History of Design Thinking: The Theory [P1]', *I Think.: I Design* [blog], 18 January 2012. Online: <https://ithinkidesign.wordpress.com/2012/01/>, accessed 23 July 2018.

¹¹ Stephanie Di Russo, 'A Brief History of Design Thinking: The Theory [P2]', *I Think.: I Design* [blog], 31 March 2012. Online: <https://ithinkidesign.wordpress.com/2012/03/31/a-brief-history-of-design-thinking-the-theory-p2/>, accessed 25 July 2018.

¹² Donald Schön, *The Reflective Practitioner: How Professionals Think in Action* (New York: Basic Books, 1983).

¹³ Di Russo, *Understanding the Behaviour of Design Thinking in Complex Environments*, p. 26.

¹⁴ Szczepanska, 'Design Thinking Origin Story'.

¹⁵ Buchanan, 'Wicked Problems in Design Thinking', p. 16.

¹⁶ Elizabeth B.-N. Sanders & Pieter Jan Stappers, 'Co-creation and the New Landscapes of Design', *Co-Design*, Vol. 4, No. 1 (2008), p. 7; Stephanie Di Russo, 'A Brief History of Design Thinking: How

Design Thinking Came to “Be”, *I Think.: I Design* [blog], 8 June 2012. Online: <https://ithinkidesign.wordpress.com/2012/06/08/a-brief-history-of-design-thinking-how-design-thinking-came-to-be/>, accessed 27 July 2018.

¹⁷ Di Russo, ‘A Brief History of Design Thinking’; Szczepanska, ‘Design Thinking Origin Story’.

¹⁸ William B. Rouse, *Design for Success: A Human-Centred Approach to Designing Successful Products and Systems* (New York: John Wiley & Sons, 1991), p. 2.

¹⁹ Scott Doorley, Sarah Holcomb, Perry Klebahn, Kathryn Segovia & Jeremy Utle, *Design Thinking Bootleg*, Stanford d.school, 2018. Available online: https://static1.squarespace.com/static/57c6b79629687fde090a0fdd/t/5b19b2f2aa4a99e99b26b6bb/1528410876119/dschool_bootleg_deck_2018_final_sm+%282%29.pdf, accessed 30 July 2018.

²⁰ Source for Figure 1.1: UK Design Council, *The Design Process: What is the Double Diamond?*, 2018. Online: <https://www.designcouncil.org.uk/news-opinion/design-process-what-double-diamond>, accessed 12 November 2018.

²¹ Source for Figure 1.2: Scott Doorley, Sarah Holcomb, Perry Klebahn, Kathryn Segovia & Jeremy Utle, *Design Thinking Bootleg*, Stanford d.school, 2018. Available online: https://static1.squarespace.com/static/57c6b79629687fde090a0fdd/t/5b19b2f2aa4a99e99b26b6bb/1528410876119/dschool_bootleg_deck_2018_final_sm+%282%29.pdf, accessed 30 July 2018.

²² Abhijnan Rej, ‘The Other Legacy of Robert McNamara’, *War on the Rocks*, 10 June 2016. Online: <https://warontherocks.com/2016/06/the-other-legacy-of-robert-mcnamara/>, accessed 8 November 2018; Leo McCann ‘Management is the Gate’ – but to Where? Rethinking Robert McNamara’s ‘Career Lessons’, *Management & Organizational History*, Vol. 11, No. 2 (2016), pp. 166-188.

²³ Shimon Naveh, *In Pursuit of Military Excellence: The Evolution of Operational Theory* (Abingdon: Frank Cass, 1997), esp. pp. xiii-xx. The work of theorist John Boyd, which discusses military applications of complexity and chaos theory, evolutionary biology, and military history, amongst other less-frequently referenced disciplines, is sometimes cited as an even earlier example of military design thinking. Unlike the early Israeli military designers, however, there is no evidence that Boyd thought of himself as a design thinker. Hence this author does not consider Boyd to be an early originator of military design thinking, but instead to be an exceptionally insightful inter-disciplinary military thinker. For a summary of the case that Boyd was an early military designer, see: Jeffrey van der Veer, *The Rise of Design: Why an Innovative Concept is Emulated in Armies Around the Globe* (Master’s thesis, Royal Netherlands Defence Academy, 2015), pp. 25-26.

²⁴ Van der Veer, *The Rise of Design*, p. 32; Gracier, ‘Self Disruption’, p. 22; Daniel Q. Greenwood, *Reconstructing Operational Theory: A Framework for Emerging Threats in a Complex Environment* (Master’s thesis, US Marine Corps School of Advanced Warfighting, AY 2006-07), p. 12.

²⁵ Ben Zweibelson, ‘Changing Change while it Changes: The Rise of Disruptive Military Thinking (Part 2 of 3)’, *Over the Horizon* [blog], 11 June 2018. Online: <https://othjournal.com/2018/06/11/changing-change-while-it-changes-the-rise-of-disruptive-military-thinking-part-2-of-3/>, accessed 1 November 2018.

²⁶ Exploration of this contention is tangential to the topic of this paper and is not attempted herein. For further information, including examples of different arguments, see: Van der Veer, *The Rise of Design*, pp. 32-33; Ofra Gracier, ‘Between Teaching and Learning: What Lessons could the Israeli Doctrine learn from the 2006 Lebanon War?’, *Experticia Militar*, July-October 2017, pp. 22-29; Milan N. Vego, ‘A Case Against Systemic Operational Design’, *Joint Force Quarterly*, No. 53 (2nd Quarter 2009), pp. 69-75.

²⁷ Source for Figure 1.3: Matthew Lauder, ‘Systemic Operational Design: Freeing Operational Planning from the Shackles of Linearity’, *Canadian Military Journal*, Vol. 9, No. 4 (2009), p. 44.

²⁸ The outcomes of this research are captured in: William T. Sorrels, Glen R. Downing, Paul J. Blakesley, David W. Pendall, Jason K. Walk & Richard D. Wallwork, *Systemic Operational Design: An Introduction* (monograph, US Army School of Advanced Military Studies, 26 May 2005), pp. iii-iv.

²⁹ School of Advanced Military Studies, *Art of Design: Student Text, Version 2.0* (Fort Leavenworth: US Army School of Advanced Military Studies, 2010), pp. 1-3.

³⁰ Headquarters, Department of the Army & Headquarters, U.S. Marine Corps, Field Manual 3-24 / Marine Corps Warfighting Publication 3-33.5 *Counterinsurgency* (Washington, DC: U.S. Government Printing Office, 15 December, 2006), chap. 4; SAMS, *Art of Design*; Headquarters, Department of the Army, TRADOC Pamphlet 525-5-500 *Commander's Appreciation and Campaign Design: Version 1.0* (Fort Monroe: US Army Training and Doctrine Command, 28 January 2008); Headquarters, Department of the Army, Field Manual Interim 5-2 *Design (Draft)* (Washington DC: Headquarters, Department of the Army, 20 February 2009); Jack D. Kem, *Design: Tools of the Trade* (Fort Leavenworth: US Army Combined Arms Center, May 2009); Headquarters, Department of the Army, Field Manual 5-0 *The Operations Process* (Washington DC: U.S. Government Printing Office, March 2010), chap. 3.

³¹ J. N. Mattis, *Memorandum for US Joint Forces Command: Vision for a Joint Approach to Operational Design* (unpublished US Joint Forces Command memorandum, dated 6 October 2009); 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); Joint Chiefs of Staff, U.S. Department of Defense, Joint Publication 5-0 *Joint Operation Planning* (Washington DC: US Government Printing Office, 11 August 2011), chap. 3.

³² Alex Ryan, 'A Personal Reflection on Introducing Design to the U.S. Army', *Medium*, 4 November 2016. Online: <https://medium.com/the-overlap/a-personal-reflection-on-introducing-design-to-the-u-s-army-3f8bd76adcb2#.lqhycz1g7>, accessed 2 November 2018.

³³ Shimon Naveh, Jim Schneider & Tim Challans, *The Structure of Operational Revolution: A Prolegomena* (Fort Leavenworth: Booz Allan Hamilton Inc., 2009).

³⁴ Ryan, 'A Personal Reflection on Introducing Design to the U.S. Army'.

³⁵ Headquarters, Department of the Army, Army Technical Publication 5-0.1 *Army Design Methodology* (Washington DC: Headquarters, Department of the Army, 1 July 2015), p. 1.3. The first use of the term 'ADM' appeared in 2012 in a non-doctrinal text: Anna Grome, Beth Crandall Louise Rasmussen & Heather Wolters, *Army Design Methodology: Commander's Resource* (Fort Leavenworth: US Army School of Advanced Military Studies in Partnership with US Army Research Institute for the Behavioral and Social Sciences, February 2012).

³⁶ FM 5-0 *The Operations Process* (2010), p. 3.1.

³⁷ Source for Figure 1.4: FM 5-0 *The Operations Process* (2010), p. 3.7.

³⁸ ATP 5-0.1 *Army Design Methodology* (2015); JP 5-0 *Joint Operation Planning* (2011), chap. 3. See also: FM 5-0 *The Operations Process* (2010), chap. 3.

³⁹ Buchanan, 'Wicked Problems in Design Thinking', pp. 5-21.

⁴⁰ ATP 5-0.1 *Army Design Methodology* (2015), chap. 5.

⁴¹ Ryan, 'A Personal Reflection on Introducing Design to the U.S. Army'.

⁴² US Naval Postgraduate School, *NPS Design Thinking Community*, undated. Available online: <https://my.nps.edu/web/design-thinking-community/home>, accessed 9 November 2018.

⁴³ US Marine Corps, Marine Air-Ground Task Force Staff Training Program Pamphlet 5-0.1 *Marine Corps Design Methodology* (Quantico: US Marine Corps, March 2017).

⁴⁴ Zweibelson, 'Changing Change while it Changes (Part 2 of 3)'. See also: Aaron P. Jackson, *The Roots of Military Doctrine: Change and Continuity in Understanding the Practice of Warfare* (Fort Leavenworth, Kansas: Combat Studies Institute Press, 2013), p. 77.

⁴⁵ UK Ministry of Defence, Joint Doctrine Publication 04 *Understanding* (Shrivenham: Development Concepts and Doctrine Centre, December 2010); UK Ministry of Defence, Joint Doctrine Note 3/11 *Decision-Making and Problem Solving: Human and Organisational Factors* (Shrivenham: Development Concepts and Doctrine Centre, June 2011); UK Ministry of Defence, Joint Doctrine Publication 04 *Understanding and Decision-making*, 2nd ed. (Shrivenham: Development Concepts and Doctrine Centre, December 2016).

⁴⁶ Gracier, 'Self Disruption', pp. 30-34.

⁴⁷ Source for Figure 1.5: Ben Zweibelson, 'An Application of Theory: Second Generation Military Design on the Horizon', *Small Wars Journal*, 19 February 2017. Online: <http://smallwarsjournal.com/jrnl/art/an-application-of-theory-second-generation-military-design-on-the-horizon>, accessed 12 November 2018.

⁴⁸ Paul T. Mitchell, 'Stumbling into Design: Action Experiments in Professional Military Education at Canadian Forces College', *Journal of Military and Strategic Studies*, Special Issue: Reflexive Military Practitioners: Design Thinking and Beyond, Vol. 17, No. 4 (June 2017), pp. 84-102, quote p. 101; Philippe Beaulieu-Brossard, *JCSP 45 Design Golden Thread*, unpublished course material for Canadian Forces College National Security Program 2019, draft dated 31 October 2018, copy on file with author.

⁴⁹ For more information about recent course syllabus and content, see: Philippe Beaulieu-B. & Paul T. Mitchell, 'Challenge-Driven: Canadian Forces College's Agnostic Approach to Design Thinking Education', *The Archipelago of Design: Researching Reflexive Military Practices*, 13 January 2019. Online: <http://militaryepistemology.com/challenge-driven/>, accessed 27 August 2019; Aaron P. Jackson, 'Standing on the Shoulders of Giants to Reach a Cake: Observations About Military Design Facilitation', *The Archipelago of Design: Researching Reflexive Military Practices*, 24 June 2019. Online: <http://militaryepistemology.com/standing-on-the-shoulders-of-giants-to-reach-a-cake-observations-about-military-design-facilitation/>, accessed 27 August 2019.

⁵⁰ Stephan De Spiegeleire, Tim Sweijs, Peter Wijninga & Joris van Esch, *Designing Future Stabilisation Efforts* (The Hague: The Hague Centre for Strategic Studies, Research Project for the Dutch Ministry of Defense, 2014); Royal Netherlands Army, *Doctrinebulletin 2015-XX Contextual Military Design: Study Draft Version 1.0* (Netherlands: Land Warfare Centre, November 2015); Ben Zweibelson, 'Design goes Dutch: Army Considerations for Unconventional Planning and Sensemaking', *Atlantisch Perspectief*, 2015 No. 6 (December 2015). Online: https://www.atlcom.nl/ap_archive/pdf/AP%202015%20nr.%206/Zweibelson.pdf, accessed 9 November 2018; Ben Zweibelson, Lars Hedström, Magnus Lindström & Ulrica Pettersson, 'The Emergent Art of Military Design: Swedish Armed Forces and the Contemporary Security Environment', *Kungl Krigsvetenskaps-Akademiens: Handling ooh Tidskrift* [The Proceedings and Journal of the Royal Swedish Academy of War Sciences], July-September 2017, pp. 83-97; Zweibelson, 'Changing Change while it Changes (Part 2 of 3)'; Anders McDonald Sookermany, 'Military Education Reconsidered: A Postmodern Update', *Journal of Philosophy of Education*, Vol. 51, No. 1 (2017), pp. 310-330.

⁵¹ De Spiegeleire et al, *Designing Future Stabilisation Efforts*, pp. 32-34; UK Ministry of Defence, Allied Joint Publication-5/Joint Doctrine Publication 5-00 *Allied Joint Doctrine for Operational Level Planning* (Shrivenham: Development Concepts and Doctrine Centre, June 2013), pp. 2.60-2.84.

⁵² Imre Porkoláb & Ben Zweibelson, 'Designing A NATO that Thinks Differently for 21st Century Complex Challenges', *Defence Review*, No. 2018/1 (June 2018), pp. 196-212.

⁵³ For example, see: Ben Zweibelson, 'Change Agents for the SOF Enterprise: Design Considerations for SOF Leadership Confronting Complex Environments', *Special Operations Journal*, Vol. 3, No. 2 (2017), pp. 127-140; Ben Zweibelson, 'Special Operations and Design Thinking: Through the Looking Glass of Organizational Knowledge Production', *Special Operations Journal*, Vol. 2, No. 1 (2016), pp. 22-32.

⁵⁴ In evidence of this, readers are encouraged to check this paper's other endnotes to see how many times his name appears!

⁵⁵ Source for Figure 1.6: Zweibelson, 'An Application of Theory'.

⁵⁶ Chris Papparone, *The Sociology of Military Science: Prospects for Postinstitutional Military Design* (New York: Bloomsbury, 2013).

⁵⁷ For an early example of their collaboration, see: Ben Zweibelson, Grant M. Martin & Christopher Papparone, 'Frame Reflection: A Critical Review of US Military Approaches to Complex Situations', *OODA.com*, 12 September 2013. Online: <https://www.oodaloop.com/ooda-original/2013/09/12/frame-reflection/>, accessed 19 November 2018.

⁵⁸ This author was the fourth person to be added to the email group, in 2013. The group was later 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: Aaron P. Jackson, 'A Tale of Two Designs: Developing the Australian Defence Force's Latest Iteration of its Joint Operations Planning Doctrine', *Journal of Military and Strategic Studies*, Special Issue: Reflexive Military Practitioners: Design Thinking and Beyond, Vol. 17, No. 4 (June 2017), pp. 174-193.

⁵⁹ Details of the 2019 conference were still online at the time of writing. See: Lancaster University, *Innovation Methodologies for Military Challenges 2019*, undated but circa 2018. Online: <http://www.lancaster.ac.uk/security-lancaster/imdc2019/>, accessed 28 May 2019.

⁶⁰ *Journal of Military and Strategic Studies*, Special Issue: Reflexive Military Practitioners: Design Thinking and Beyond, Vol. 17, No. 4 (June 2017); *The Blue Knight Review* (Journal of the Royal Military College St Jean), Special Edition No. 2: Systems Thinking and Design, 25 January 2018. Online: <http://www.cmrsj-rmcsj.forces.gc.ca/cb-bk/es-se/2018/e2/e2-eng.asp?idpage=2>, accessed 12 November 2018.

⁶¹ *The Archipelago of Design: Researching Reflexive Military Practices*. Online: <http://militaryepistemology.com/>, accessed 12 November 2018.

⁶² Alex Ryan, 'The Foundation for an Adaptive Approach: Insights from the Science of Complex Systems', *Australian Army Journal*, Vol. VI, No. 3 (Summer 2009), pp. 69-90.

⁶³ Grant M. Martin, 'Deniers of "The Truth": Why an Agnostic Approach to Warfare is Key', *Military Review*, January-February 2015, pp. 42-51.

⁶⁴ Anne-Marie Grisogono, 'The Implications of Complex Adaptive Systems for C2', conference paper presented at the Command and Control Research and Technology Symposium, San Diego, May 2006, pp. 2-3. For examples of their work during this period see: Anne-Marie Grisogono & Alex Ryan, *Designing Complex Adaptive Systems for Defence*, unpublished Defence Science and Technology Organisation research paper, 22 October 2003. Online: <http://militaryepistemology.com/designing-complex-adaptive-systems-for-defence/>, accessed 14 November 2018; Alex Ryan & Anne-Marie Grisogono, Hybrid Engineered Complex Adaptive Systems: A Case Study in Defence, unpublished Defence Science and Technology Organisation research paper, 1 April 2004. Online: <http://militaryepistemology.com/hybrid-complex-adaptive-engineered-systems-a-case-study-in-defence/>, accessed 14 November 2018; Alex Ryan, 'About the Bears and the Bees: Adaptive Responses to Asymmetric Warfare' in: Ali Minai, Dan Braha & Yaneer Bar-Yam (Eds.), *Unifying Themes in Complex Systems* (Berlin: Springer, 2010), pp. 588-595 (an earlier version of this chapter had been presented as a conference paper in 2006).

⁶⁵ David Kilcullen, *Future Land Operating Concept: Complex Warfighting* (Canberra: Australian Army, 7 April 2004), p. 19.

⁶⁶ International Institute for Strategic Studies, 'Complex Irregular Warfare: The Face of Contemporary Conflict', *The Military Balance*, Vol. 105, No. 1 (2005), p. 417. On the significance of this influence, see: Aaron P. Jackson, 'Moving Beyond Manoeuvre: A Conceptual Coming-of-Age for the Australian and Canadian Armies', *Australian Defence Force Journal*, No. 177 (November/December 2008), pp. 85-100.

⁶⁷ Maryanne Kelton & Aaron P. Jackson, 'Australia: Terrorism, Regional Security and the US Alliance' in: Stephen Grenier & Gale Mattox (Eds.), *Coalition Challenges in Afghanistan: The Politics of Alliance* (Stanford: Stanford University Press, 2015), p. 235.

⁶⁸ Department of Defence (Australia), Australian Army Concept, *Adaptive Campaigning: The Land Force*

Response to Complex Warfighting, Version 4.18, reproduced as Appendix 2 to: Scott Hopkins (ed.), Chief of Army's Exercise Proceedings 2006, Land Warfare Studies Centre, Duntroon, 2006, p. 7.

⁶⁹ This adaption cycle appears to have been at least partly-influenced by the simplified 'four arrows in a loop' version of the Boyd cycle (better known as the 'OODA loop'). See: John R. Boyd, *A Discourse on Winning and Losing*, edited and compiled by Grant T. Hammond (Maxwell: Air University Press, March 2018), Appendix, pp. 383-385.

⁷⁰ Directorate of Army Research and Analysis, *Adaptive Campaigning: Army's Future Land Operating Concept* (Canberra: Army Headquarters, September 2009), p. 32. This edition also included a note clarifying the relationship between the adaption cycle and the OODA loop, establishing that the two cycles are complimentary and that that the adaption cycle does not replace the OODA loop (p. 31).

⁷¹ Directorate of Army Research and Analysis, *Adaptive Campaigning*, p. 35 (fn. 75).

⁷² Department of Defence (Australia), Australian Army Concept, *Adaptive Campaigning*, p. 2; Ryan, 'A Personal Reflection on Introducing Design to the U.S. Army'.

⁷³ Source for Figure 1.7: Directorate of Army Research and Analysis, *Adaptive Campaigning*, p. 31.

⁷⁴ Australian Army, Land Warfare Doctrine 1 *The Fundamentals of Land Warfare* (Canberra: Australian Army, 2008), pp. 51-53.

⁷⁵ *The Australian Army Journal*, Vol. VI, No. 3 (Summer 2009). Other articles on adaptive campaigning or related topics appeared consistently in other editions of this journal from 2007 until early 2012, however the edition cited here was the only special edition on this topic.

⁷⁶ Michael B. Bassingthwaighe, *Adaptive Campaigning Applied: Australian Army Operations in Iraq and Afghanistan* (monograph, US Army School of Advanced Military Studies, 19 May 2011).

⁷⁷ Editors, 'Message from the Editors', *Senior Officer Professional Digest*, No. 68 (February 2008), p. 1.

⁷⁸ Albert Palazzo, *The Future of War Debate in Australia: Why has there not been one? Has the need for one now arrived?* Working Paper No. 140 (Land Warfare Studies Centre: Canberra, August 2012); International Institute for Strategic Studies, 'Complex Irregular Warfare', p. 417.

⁷⁹ Shimon Naveh, *The Australian SOD Expedition: A Report on Operational Learning*, unpublished paper, undated but likely to have been authored between 2006 and 2008. Copy on file with author.

⁸⁰ Trent Scott, *The Lost Operational Art: Invigorating Campaigning into the Australian Defence Force* (Canberra: Land Warfare Studies Centre, February 2011).

⁸¹ Christopher Smith, *Design and Planning of Campaigns and Operations in the Twenty-First Century* (Canberra: Land Warfare Studies Centre, April 2011).

⁸² ADF, ADDP 5.0—*Joint Planning*, 2nd ed. (Canberra, Defence Publishing Service, Amendment List 1, 2015); ADF, ADFP 5.0.1—*Joint Military Appreciation Process*, 2nd ed. (Canberra, Defence Publishing Service, Amendment List 2), 2016.

⁸³ The development of these publications was previously chronicled in detail by this author. See: Jackson, 'A Tale of Two Designs', pp. 174-193; Aaron P. Jackson, 'Innovative within the Paradigm: The Evolution of the Australian Defence Force's Joint Operational Art', *Security Challenges*, Vol. 13, No. 1 (June 2017), pp. 59-79.

⁸⁴ Jackson, 'Innovative within the Paradigm', pp. 59-79. For a very specific example of how the balance between operational art theory and ADF operational needs was achieved, see: Aaron P. Jackson, 'Center of Gravity Analysis "Down Under": The Australian Defence Force's New Approach', *Joint Force Quarterly*, No. 84 (1st Quarter 2017), pp. 81-85.

⁸⁵ ADFP 5.0.1 (2016), para 1.10.

⁸⁶ Jackson, 'A Tale of Two Designs', pp. 184-187.

⁸⁷ Source for Figure 1.8: ADFP 5.0.1 (2016), Figures 2.2 & 2.3. These figures were based on those included in a slide package developed by Lieutenant Commander Lorrae Blunden for use during Joint Warfare Training Centre courses.

⁸⁸ ADFP 5.0.1 (2016), para 1.11.

⁸⁹ Ryan, 'A Personal Reflection on Introducing Design to the U.S. Army'.

⁹⁰ Australian Command and Staff College instructor, correspondence with the author, 2014.

⁹¹ Alex Ryan, *2018 Land Experiment Campaign Plan: Robotics and Autonomous System Workshop One*, unpublished paper, undated but likely to have been authored in May 2018. Copy on file with author.

⁹² Jerome Reid, 'Air Force by Design', *Force of the Future: Towards the World's First Fifth Generation Air Force* (Plan Jericho magazine), 2017, pp. 6-7. Online: <http://jericho3d.com.au/magazine/mobile/index.html#p=6>, accessed 15 November 2018.

⁹³ Jerome Reid, Cara Wrigley & Genevieve Mosely, *Applying Design for Airpower Capability Advantage*, unpublished paper, undated but authored in mid-2018. Copy on file with author.

⁹⁴ University of Sydney, 'Air Force Engages Sydney Nanotech to Revolutionise Sensing Capability', *University of Sydney News*, 1 May 2019. Online: <https://sydney.edu.au/news-opinion/news/2019/05/01/air-force-engages-sydney-nano-to-revolutionise-sensing-capabilit.html>, accessed 27 August 2019.

⁹⁵ Reid, 'Air Force by Design', p. 7; Michael Noonan, 'Navy by Design', *Force of the Future: Towards the World's First Fifth Generation Air Force* (Plan Jericho magazine), 2017, pp. 10-11. Online: <http://jericho3d.com.au/magazine/mobile/index.html#p=10>, accessed 15 November 2018.

⁹⁶ The 2018 presentation at the Centre for Defence and Strategic Studies was part of a module entitled 'tools for strategic thinking', facilitated by Dr Leon Young. Young, a joint concepts strategist in ADF Headquarters, has also been involved in the application of design and systems thinking to futures forecasting. For example, see: Leon Young, 'Using Systems Thinking to Design Actionable Futures: A Nuclear Weapons Example', *European Journal of Futures Research*, Vol. 6, No. 10 (2018).

⁹⁷ Air Warfare Centre & Business Models Inc., *Crash Course in Design Thinking*, unpublished PowerPoint presentation, delivered 14 November 2018. Copy on file with author.

⁹⁸ Figure 1.9 is a direct copy of Figure 3.3 (see Chapter 3 for additional details). Air Force's Transient Capability Advantage Framework seems to be currently undergoing a similar evolutionary process to that of Army's Adaptive Campaigning concept during the mid-2000s. This evolutionary process involves the production of several iterations of the model as it is more thoroughly developed. For example, an earlier version of the Transient Capability Advantage Framework that was developed in 2017 is included in: Reid, Wrigley & Mosely, *Applying Design for Airpower Capability Advantage*, p. 9. This evolutionary process will no doubt be of interest to future historians of Australian air power.