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Design Thinking
Applications for the Australian Defence Force

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DESIGN THINKING
APPLICATIONS FOR THE
AUSTRALIAN DEFENCE FORCE

Edited by
Aaron P. Jackson

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Dr Cara Wrigley is Professor of Design Innovation at The University of Sydney, residing within the School of Architecture, Design and Planning. Recently she has begun the role of Jericho Chair of Design Innovation where she is Director of the Defence by Design Lab and leads the Royal Australian Air Force in their design capability deployment across bases around Australia. She is an Industrial Designer who is actively researching the value that design holds in business—specifically through the creation of strategies to design business models which lead to emotive customer engagement. Her work to date has crossed research boundaries and appears in a wide range of high-quality disciplinary publications.

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AAJ	*The Australian Army Journal*
AARs	After-Action Reviews
ACSC	Australian Command and Staff College (ADC)
ADC	Australian Defence College
ADDP	Australian Defence Doctrine Publication
ADF	Australian Defence Force
ADM	Army Design Methodology (US)
ADRP	Army Doctrinal Reference Publication
ASPI	Australian Strategic Policy Institute
ATP	Army Technical Publication
CAF	Canadian Armed Forces
CALL	Center for Army Lessons Learned
CDSS	Centre for Defence and Strategic Studies (ADC)
CFC	Canadian Forces College
COIN	Counter-Insurgency
DIC	Design Innovation Catalyst
DSTG	Defence Science and Technology Group
EBO	Effects Based Operations
IDF	Israeli Defense Force's
JDC	Joint Doctrine Centre
JIATF	Joint Inter-Agency Task
JMAP	*Joint Military Appreciation Process*
JPP	Joint Planning Process
JSOU	Joint Special Operations University
JSOU	US Joint Special Operations University
LOCs	lines-of-communication
MDMP	Military Decision-Making Process
NATO	North Atlantic Treaty Organization
NCW	Network Centric Warfare
OODA	Observe, Orientation, Decide, Act
OPP	Operational Planning Process
OTRI	Operational Theory Research Institute (Israel)
PME	Professional Military Education
RAAF	Royal Australian Air Force
RMA	Revolution in Military Affairs
SAMS	US Army School of Advanced Military Studies

SOC   Systemic Operational Design
SPAD   Single Photo Avalanche Diodes

TCA   Transient Capability Advantage
TLPs   Troop-Leading Procedures
TRADOC   Training and Doctrine Command

UK   United Kingdom
US   United States

WoGTF   Whole of Government Task Force
wrt   'with-respect-to'

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

Aaron P. Jackson

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]**
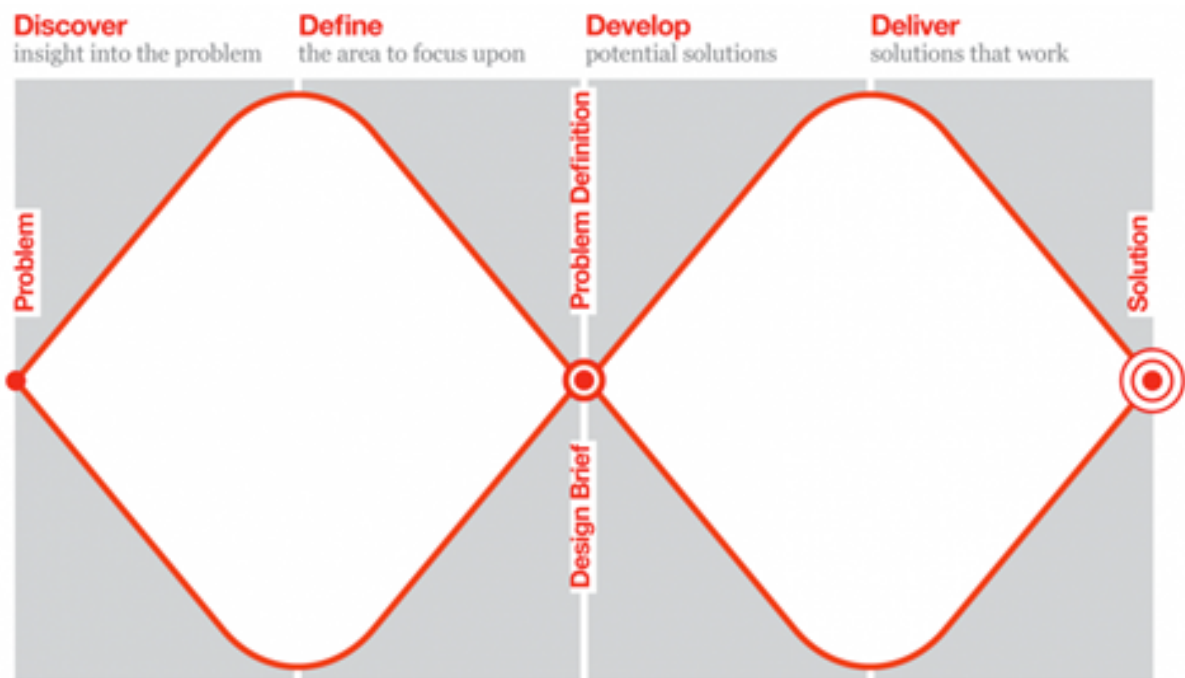
Figure 1.2: *Human-centric design* **methodology taught at the Stanford University d.school Bootcamp (2018)[21]**
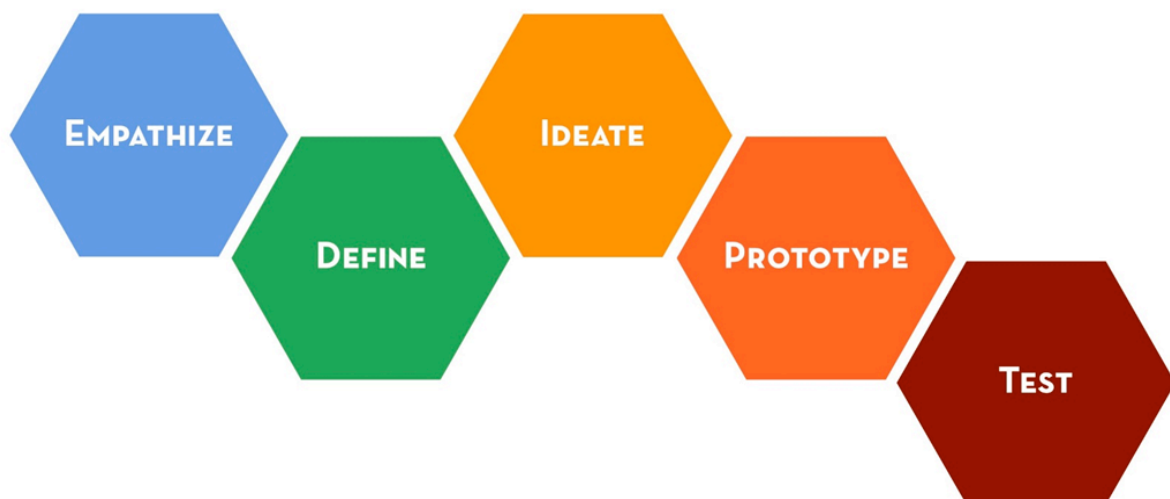
While these and other design thinking methodologies were proliferating in civilian industry, academic disciplines and higher educational courses during the 1990s, the term was entering military parlance. This was not, however, the simple adoption by militaries of a civilian business methodology, as has 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]
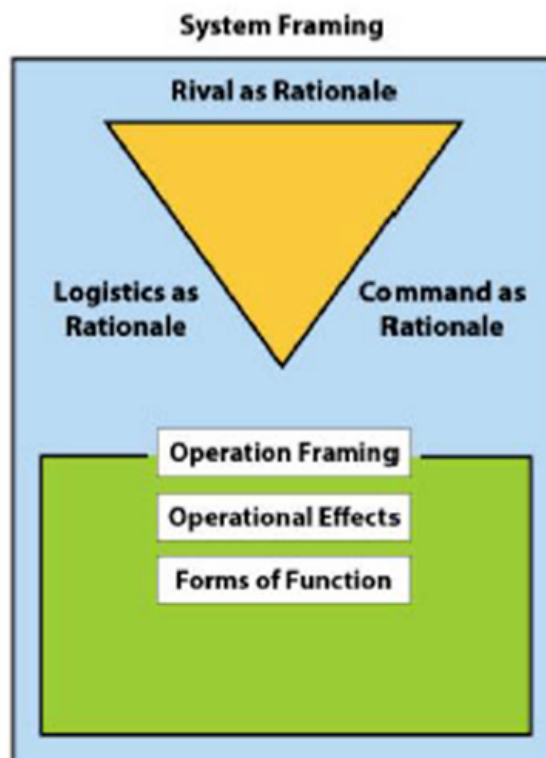
Meanwhile, in the mid-2000s, the US military began to take an interest in SOD as a possible methodology to better address the problems it was facing in Afghanistan and, especially, Iraq. This interest originated in both the US Army School of Advanced Military Studies (SAMS) and Training and Doctrine 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]
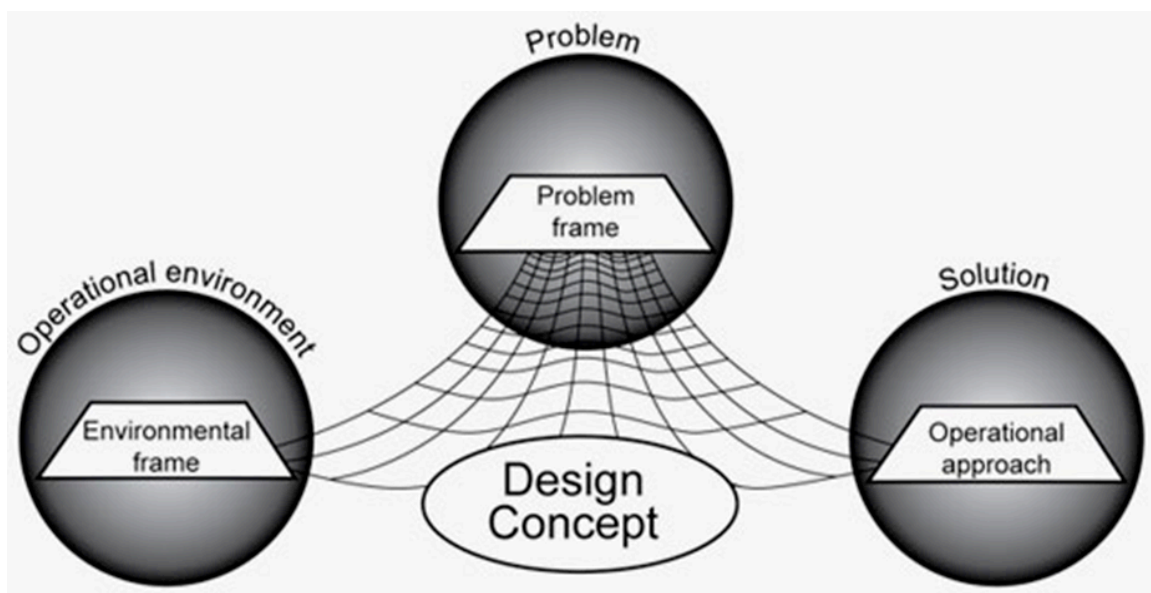
Both ADM and joint 'operational design' include the development of environment and problem frames to ensure adequate understanding, followed by development of a solution frame (referred to as 'the operational approach').[38] This is methodologically similar to Buchanan's two-tiered process of *problem 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]
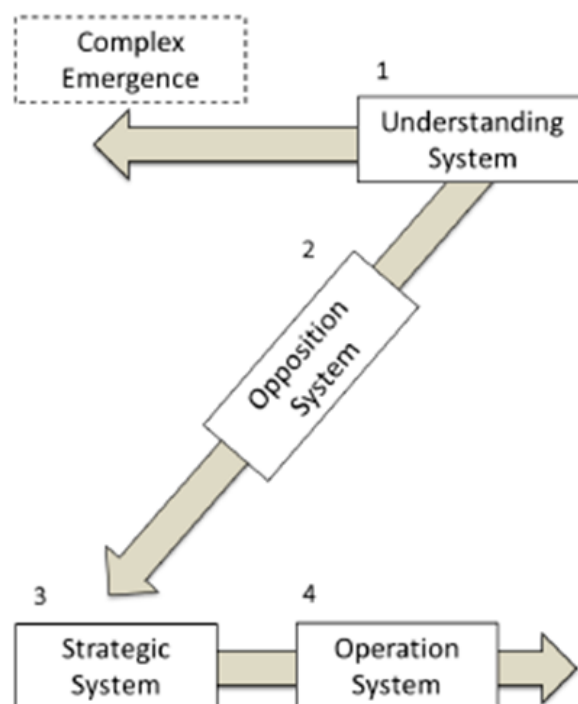
Also in 2013, Canadian Forces College (CFC) began to teach a design component as part of its O6 level National Security Program. This program drew on a mix of civilian and military design methodologies, including Naveh's early publications, civilian design thinking taught in the Rotman School of Management 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 Paparone. 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]
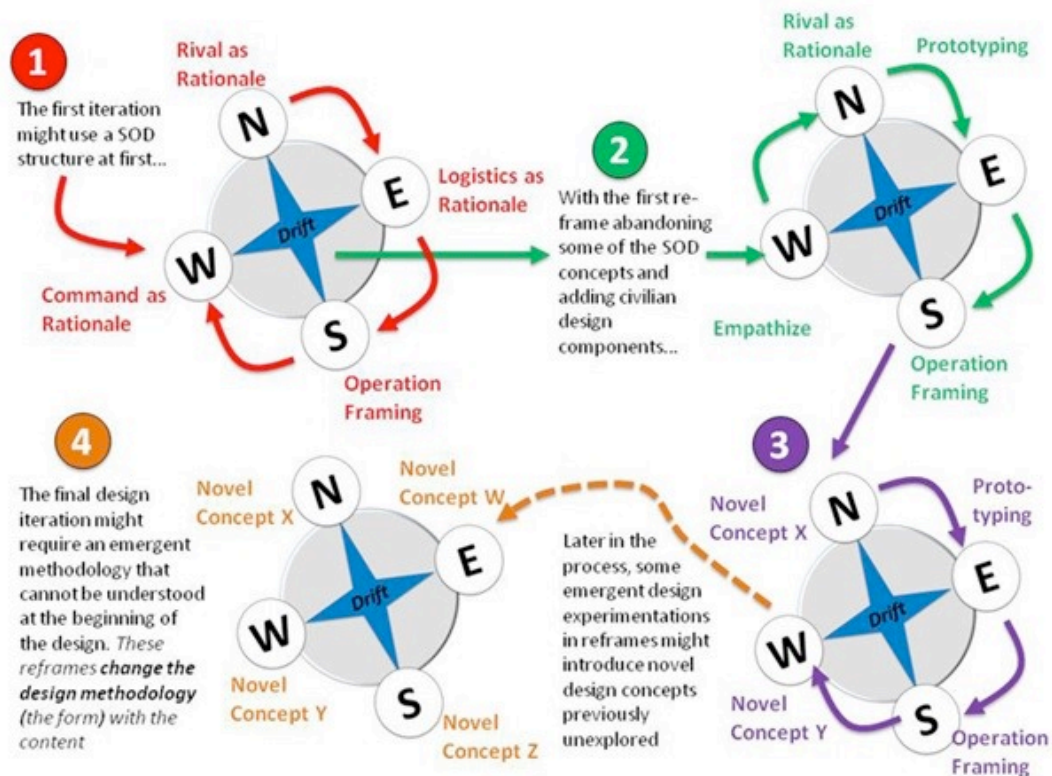
Paparone, another US Army veteran who is now Professor at the US National Defense University, offered a detailed sociological critique of the ingrained institutional biases of the US military, prior to reframing the notion of military professionalism by deconstructing these biases and then constructing 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]
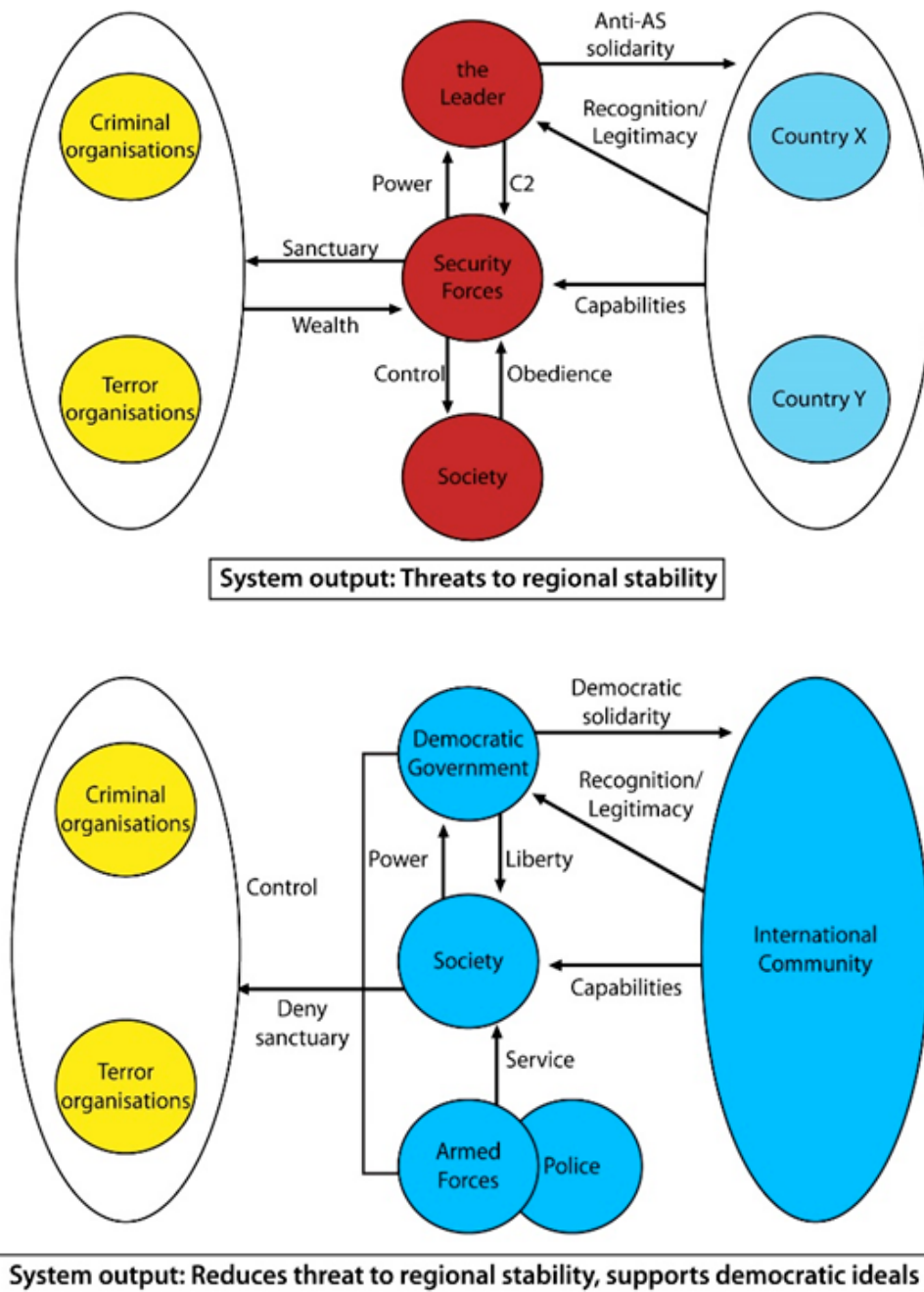
Like its US equivalent, the ADF's version of operational design also included a range of traditional operational art concepts including: identification of the desired end state, objectives and decisive points; the conduct of centre of gravity analysis; and the establishment of lines of operation.[88] 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]
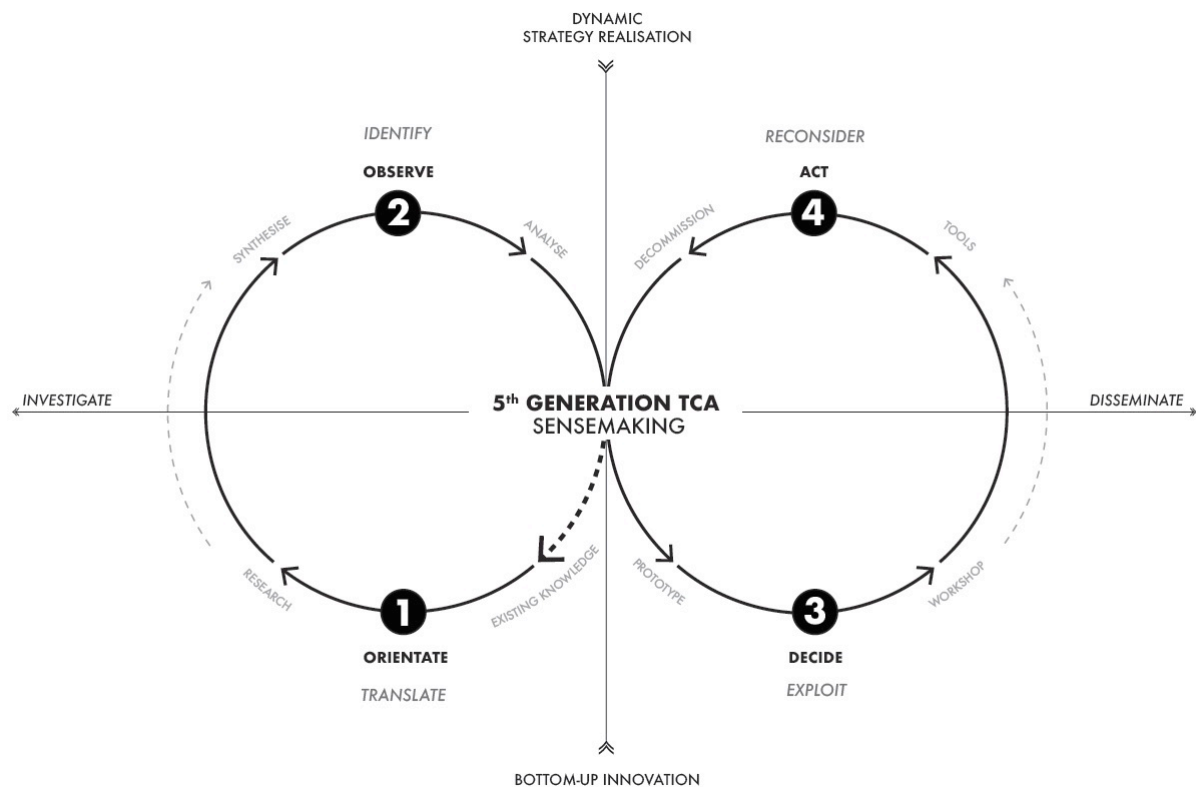
Notwithstanding that several individual ADF members have received an education in various design thinking methodologies either through attendance at foreign military PME courses or as a part of their civilian studies, to date the ADF has not developed a design thinking education course that goes beyond 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 though 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 Paparone, 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 Utley, *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 Utley, *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'.

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[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.

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

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

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[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.

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[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.

SYSTEMIC DESIGN OF A FORCE FOR THE AUSTRALIAN ARMY IN 2050

Brandon Pincombe, Alex Ryan, Nick Kempt, Ashley Stephens, Nikoleta Tomecko, Darryn J. Reid and Kim Tang

We cannot predict the future but we can prepare for it.[1] Future success depends upon ensuring the capability decisions we make today provide force options that are adaptable to the exigencies of an uncertain future. Defence Science and Technology (DST) Group has developed methods to identify critical uncertainties and construct a scenario space for future warfare;[2] to characterise capability options in light of their feasible scenario space[3] (i.e. the multi-dimensional surface covering the set of scenario parameters for which a given capability set can achieve success); and to design force options through iteratively evolving challenges and responses.[4] However, building options that are adaptive enough to survive whatever the future throws at them is a key challenge facing the Australian Army.

Design has recently been introduced into Australian Army doctrine as an approach for generating innovative solutions to complex, ill-structured problems.[5] Design thinking is an action-oriented, human-centred and collaborative approach for accelerating innovation. It aims to create better solutions to the challenges facing business and society.[6] Systems thinking is a multi-scale, multi-perspective, multidimensional adaptive approach to making sense of changing phenomena and reframing existing paradigms in order to be relevant so that we can act to change or transform them.[7] Systemic design integrates these two paradigms. It allows us to make more considered decisions about force and capability options and better able to adapt in an uncertain future.[8] Systemic design supports strategic adaptation and hence leads towards options that are more likely to be effective in the future.

Given DST Group's role in helping Army prepare for an uncertain future, DST Group staff explored the utility of systemic design in creating future force options. In this chapter, we document the process and results of a six-day workshop to apply a design methodology to the challenge of designing a future force in the 2050 timeframe.

The emphasis of the workshop was learning and trialling the design approach rather than producing a rigorous force structure for consideration by decision-makers, which would have required the participation of many more stakeholders and included intervening periods of research and analysis. In effect, the DST Group participants acted as proxies for a wide range of military and political stakeholders and, therefore, made their own judgements concerning certain aspects of the 2050 context. These constraints and the lack of time for significant iteration and refinement limited the ability of participants to develop a strong guiding logic to the change in paradigm for the 2050 force. Consequently, it will be apparent to readers that there is an incomplete strategic narrative underpinning the workshop outcomes and some variability in the richness of detail for the different steps in the process. Nonetheless, the collective activities in the workshop enabled a powerful synthesis of insights. This resulted in a plausible future force structure that represents a radical shift in culture,

structure and technology for the Australian Army. Importantly, this force structure emerged through the design process; it could not have been anticipated at the start of the workshop, nor was it produced incrementally through each step in the design process.

Introduction to systemic design

Systemic design builds on and integrates two interdisciplinary practices, systems thinking and design thinking, in order to appreciate and intervene in complex environments. Systemic design is best thought of as a toolset and a mindset rather than a well-defined process, as innovation in complex environments does not conform to a repeatable formulaic procedure. However, systemic design is a discipline that is informed by deep theory and enacted through participatory practice. Rather than a process, systemic design can be viewed as a field of possibility that connects reflection with action and a systemic perspective with designerly intent.[9] Within this field of possibility, many techniques from systems and design thinking can be recombined to craft a tailored approach to each unique challenge the systemic designer participates in.

Many operational analysis techniques originate from within a paradigm of scientific support to decision-making. We refer to this paradigm as technical rationality because it seeks a systematic, objective and rational approach to ends-means matching between strategic objectives and available resources. Within certain boundary conditions, technical rationality is a highly effective approach to problem solving. However, for extremely complex situations, where objectives are ambiguous and statistically significant data is not available, the assumptions of technical rationality begin to break down. It is here that systemic design offers an alternative and complementary approach to designing responses to situations that are volatile, uncertain, complex and ambiguous.[10]

Systemic design for force design

Systemic design was well-suited to the topic of the DST Group workshop, which was complex, ambiguous, and lacking in data or consensus. There is no explicit strategic guidance for the Australian Defence Force for 2050. There are no published horizon scans anticipating the specific challenges the Australian Army will face in 2050. There is not even a consistent definition of force design for the Australian Army. For example, the Army R&D plan 2014 states:

> *Army must ensure it is structured, manned and equipped so its force can adapt rapidly to current and future challenges. It is to be designed to be capable of conducting joint land combat in complex terrain against a lethal adversary (including a technologically equipped near-peer or a force reliant on superior force ratios).*[11]

The Defence Land S&T Strategy 2016 instead emphasises "the three main aspects of force design: concepts, major systems and force structures; at all times considering them in the context of Army's unit of action, the Reinforced Combat Brigade; providing objective evidence for capability decisions and to maximise operational effectiveness of future Land capabilities".[12]

Another reference to force design is found in CA Directive 50/13:

The Future Army design draws on the FLWR and the FLOC to provide aspirational modernisation goals for Army. Force design is an iterative activity that includes the analysis, design, validation and justification of future land force elements. The Future Army provides operating concepts and force structure options that Army may pursue to meet the range future challenges.[13]

The difficulty of force design increases as the time horizon for redesign is extended. The force design for 2020 will look very similar to 2019, since significant structural change takes years, cultural change takes decades, and major systems are acquired with 30 year tails. If force design only ever occurred with a one-year time horizon, the result would be incremental improvement through the replacement of individual platforms and processes. In a competitive threat environment, it becomes increasingly certain that such a strategy of predictable, incremental improvement would be leapfrogged by adversaries.

The further into the future we set the future force structure the less constrained we are by past force design decisions but also the less certain we can be about the future geopolitical, technological and threat landscapes. The redesign of the whole force 33 years in the future is an extremely complex challenge. Systemic design is worth exploring as an approach to generating more innovative force designs for the Australian Army of 2050. The time horizon creates fundamental uncertainty and increased complexity but also increases the opportunity for a more radical re-imagining of the Australian Army.

Beginning in 1994, the Israeli Defence Force was one of the first institutions to develop and implement systemic design as an expression of operational art that mediated military strategy and tactics.[14] The approach has since been adapted and adopted by the US Army and subsequently by many Western militaries, including the Australian Army and Joint Force. However, military applications to date appear to have been almost exclusively centred on operations and strategy. There are few documented examples of systemic design applications to force design, force structure, or even the non-operational components of the military. Consequently, the DST Group workshop represented something of a pilot study and a novel application of systemic design.

Framing question

The framing question for the design exercise was:

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 timeframe of 2050 was chosen as a date when current capabilities would be almost entirely replaced, providing the freedom to radically redesign the force rather than work within the constraints of legacy capabilities. 2050 is also beyond the scope of the current Defence White Paper, meaning the design is not constrained by official direction and, therefore, the scientists and technologists who participated in this process, and who are certainly not part of the policy forming echelons of the department, were free to explore novel and disruptive perspectives.

Environmental framing: Current system mapping

Prior to considering future force design, it is useful to appreciate the current force and why it is structured the way it is (i.e. the current paradigm). Knowing where we start from is of critical importance in the establishment of a transition arc to a new force structure and knowing the bounds of possibilities should the timeframe be shorter than the one considered here (i.e. where legacy systems need to be used in the final outcome) but the process that follows frees us to select revolutionary as well as evolutionary solutions.

Participants formed two groups to map the current force structure using different systems mapping approaches: systems mapping; concept mapping; rich pictures; and iceberg diagrams. Aides for four different systems mapping techniques were supplied, but participants were free to visualise the system in the way that best represented their understanding of the current force design.

The groups then cross-briefed to compare their products and fill gaps in each visualisation. This rapidly produced a 'roughly right' shared picture of the current force—essentially an organisation chart of Army within the higher Joint and ADO structure, together with a process diagram of the force generation cycle.

Of course, the current paradigm consists of more than just structures; consequently, participants reflected on the question: why is the Australian Army organised this way? Individual answers were shared and synthesised into two groups. The 1–2–4– All method was used to perform the synthesis.[15] One group was optimistic that there was a logic to the current force structure, while the other group saw a lack of direction and purpose. One of the synthesised statements was:

> *The current structure has evolved slowly in response to the operational environment and constraints and in spite of the absence of specific guidance, to manage the complexity of the Army system and enable performance of the functions required for a range of contexts.*

In the subsequent discussion, participants agreed that the design of the Australian Army was evolutionary rather than revolutionary and tended to be reactionary to past or current operational requirements. Two positive, intentional and sustained improvements to force design over the last decade were continuous force generation and expanding capacity for expeditionary operations.

Horizon scanning

In order to design a force for an irreducibly uncertain and complex future, it is useful to consider futures that look radically different to the present. This can be achieved through scenarios.[16] The scenario methodology DST Group used was strategic foresight, which is consistent with the design methodology. Strategic foresight was initially developed by Herman Kahn at the RAND Corporation and Pierre Wack at Royal Dutch Shell.[17] Strategic foresight seeks to anticipate the future rather than predict it. In contrast to forecasting, which attempts to extrapolate a probable future from historical data, foresight uses weak signals of disruptive change to explore multiple, divergent futures. Whereas forecasting employs deductive logic (inference of necessary implications from axiomatic assumptions), foresight uses abductive logic (inference to the best possible explanation) to generate plausible future

scenarios. By using the weaker logic of abduction, strategic foresight can expand the 'cone of plausibility' to consider more extreme futures (see Figure 2.1). This creates a more rigorous test for any future force design.

Figure 2.1: Strategic foresight expands beyond forecasting to explore plausible, possible and preferable futures
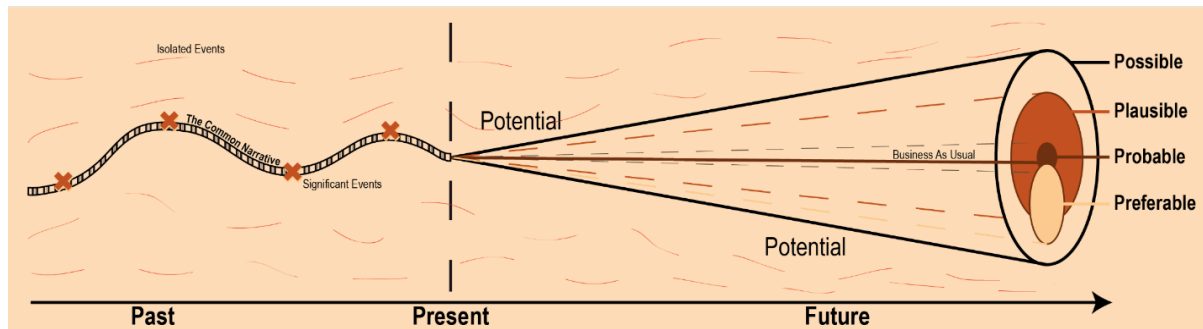
Signals and trends

For one week prior to the workshop, participants performed an environmental scan to identify signals of change in the following domains: Social, Technological, Economic, Environmental, Political, and Threats. This was a modification of the standard STEEPV and PESTEL horizon scanning frameworks.[18] Changes in Values were considered under Social signals and an additional category of Threats was added to specifically consider the security environment. Even though all participants had deep experience in defence science and technology, the scan broadened their awareness of changes occurring in other domains.

On the first day of the workshop, the participants brainstormed over 200 signals with the potential to transform the security environment by 2050.The signals were then randomly distributed onto whiteboards and clustered according to affinity. If two signals were similar they were placed close together; if they were different they were spread further apart. Clusters began to emerge that contained signals across multiple domains. To escape a limited set of categories it is important not only to be representative of all important stakeholder variation in the selection of participants[19] but also to consciously mitigate for cognitive bias and design distortion.[20] This makes it more likely that the group response will extend outside of the categories of its participants and allows potential future contexts to drive synthesis.

Drivers

Next, participants identified the drivers underlying the future trends. They did this by reflecting on the deeper motivations and sources of change. The group identified 20 drivers that were then mapped on an impact versus uncertainty graph (Figure 2.2). The high impact / low uncertainty drivers would become planning assumptions included in every scenario. They were, in order of decreasing impact: ubiquitous communications technology; unsustainable economic development; self-preservation; urbanisation; greed; desire for individualism and self-determination; technological transformation of the workplace; and emissions reduction. Obviously, this list is not exhaustive and with another set of participants, alternative or additional trends could have been identified (e.g., speed, ubiquity of presence and absence of distance).

Figure 2.2 simply shows the 20 trends that were identified as most important. Two of the high impact / high uncertainty drivers were chosen as the critical uncertainties that provide the dimensions for scenario planning. They were *Information Control* and *Population Integration* but it is important to remember that these are not linearly independent concepts and there are some shared aspects between any two pairings.

Figure 2.2: Impact vs uncertainty chart of the drivers of the future threat environment
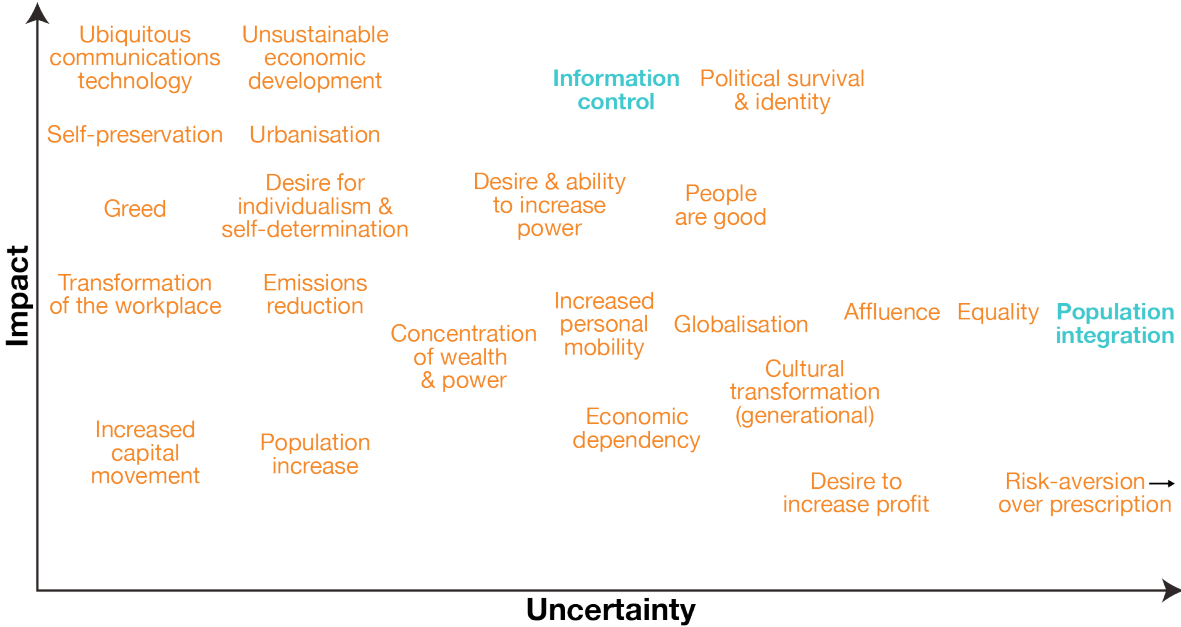
Critical uncertainty 1: Information control
Democratisation of information production and dissemination is in tension with new media monopolies and 'filter bubbles', which steer society towards control or polarisation and fragmentation. Will the next generation of social media platforms address these structural flaws and create an egalitarian information environment where truth is an emergent property of the network? Or will they promote the interests of a few powerful actors to control the narrative in a post-fact world composed of multiple, incommensurable belief bubbles?

Critical uncertainty 2: Population integration With globalisation, greater free movement of capital, goods and people has created stronger interdependencies between nations and increased contact between people from different cultures and with different worldviews. Liberalism and capitalism have created situations where people benefit from and celebrate diversity while nationalism and conservativism push towards stronger borders and protectionist trade policies. In the future, will communities live in harmony and close integration? Or will they revert to a tribal structure with strong class hierarchies divided by physical walls and informational firewalls?

Scenario development

By considering the plausible extremes for each critical uncertainty, a space can be created for developing a set of four divergent future scenarios. The scenarios are shown and named in Figure 2.3. This process of building scenarios from the two most important dimensions (or 'factors' or 'critical uncertainties') of the problem space

follows the scenario method of Wright and Cairns.[21] The low dimensionality of the resultant scenarios is better for selecting robust options than it is for selecting the adaptable options that we most desire because it is more possible to be robust to two features than it is to be robust to six or seven. Use of one[22] or more[23] scenarios set in a higher dimensional space is preferred in strategic military decision making because (1) there is time to make decisions in a considered manner in strategic contexts and (2) the problem space is a super-complex socio-technical system with information that is incomplete and continuously changing. These are requirements that are intricately interdependent yet often contradictory[24] and involve stakeholder perspectives that are competitive and frequently incommensurate.[25]

Figure 2.3: The four scenarios constructed to test the future force design
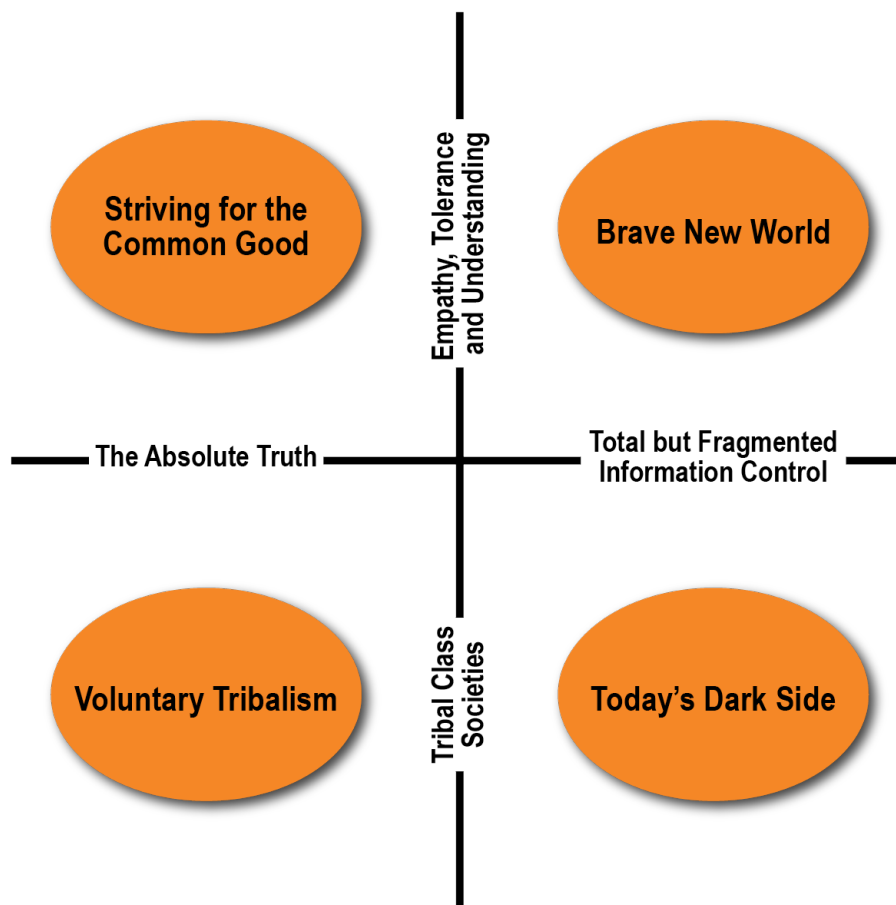
Participants created a timeline for each scenario to construct a plausible pathway from the present to their future world. This required a combination of back-casting from each scenario's future state and forecasting from the existing signals and trends.[26] The timelines provided a basis for composing a narrative description of each world.

The four narratives that were developed are presented below.

Scenario A: Striving for the common good

The absolute truth; empathy, tolerance and understanding Global society has never been as peaceful. Armed forces are not used against rival nation states but only as part of a global peacekeeping and counter-insurgency force. The information environment is egalitarian; all voices are heard. We have near total

cultural awareness. The global population, while retaining regional characteristics, is highly economically integrated. Convergence has led to all nations being economically developed. Communications technology is private and trustworthy. Adversaries hide by going dark, requiring a combination of low-tech and hi-tech methods to identify them. In 2050, the Australian Army is about to rotate into service in the global peacekeeping force and must combat a radical uprising to ensure localised terrorist attacks do not escalate into a global movement.

Scenario B: Brave new world

Total but fragmented information control; empathy, tolerance and understanding People feel empathy towards foreigners if they hear about them but each state exercises total information control. Capital and trade flow freely; labour only a little less so. This world is more *Brave New World* than *Nineteen Eighty-Four*. Nations have converged economically. Nuclear proliferation is universal but ABM systems are effective. Slowly the world is moving towards a single state through absorption; populations are enfolded or eliminated. Total information control facilitates this. It is important to be strong. In 2050, one neighbour is looking to consume another; how can the ADF give latitude to government to resist, join or weather this?

Scenario C: Today's dark side

Total but fragmented information control; new tribalism Nationalism is strong; countries face inward and are intolerant of difference. There is no flow of labour between nations. Flows of capital and goods are severely restricted; even resources are barely traded. Ethnic fragmentation creates large marginalised populations of those who 'don't belong'. An underdeveloped neighbour, our last external source of resources, is threatened by another technologically developed neighbour with lethal autonomous systems. We must defeat or deter the aggressor but the insular uninformed population of our 'friend' are largely ignorant of Australia and have a deep distrust of other cultures. Prolonged deployment means population problems and other nations may opportunistically attack.

Scenario D: Voluntary tribalism

The absolute truth; new tribalism. Nation states are weak; many people identify with sub- or super-national communities. Communities are largely self-governing, like Ottoman millets. Media is powerful and free, reporting everything, but this is interpreted in accordance with each group's philosophy, reinforcing group biases. Information pervasiveness makes surprise difficult. Minimising collateral damage is important as broadcast is immediate. However, kindnesses are also broadcast making honest hearts and minds campaigns effective. Movement of goods, capital and people between communities is minimal and contentious, often causing conflict. Small inter-communal conflicts in weaker regional states are escalating, causing suffering. Australia is part of a coalition trying to bring peace.

Idealised design

For the first two days of the workshop, the group built a shared understanding of the current force design, identified trends and drivers of disruptive change to the future threat environment, and developed four divergent possible future scenarios as a test

harness for the future force design. The group was now ready to redesign the Australian Army to meet the possible challenges of 2050.

The method of idealised design first developed by Russell Ackoff was used as a way to generate an order of magnitude improvement in force effectiveness.[27] Jamshid Gharadejaghi explains that in idealised design: 'Designing a solution starts by assuming that the system to be redesigned has been destroyed overnight but that everything else in the environment remains unchanged'.[28] Participants were given the following challenge:

Requirement: Redesign the Army's force structure from scratch.

Design objectives. Use the following design objectives:

a.   design an order-of-magnitude improvement over the present state

b.   create shared understanding among key subordinates

c.   build-in ownership and commitment

d.   anticipate resistance and dissolve conflict; convince the unconvinced

e.   convert real obstructions into potential opportunities.

Stakeholder identification

The first step for participants was to understand all of the actors who have an interest in, and are affected by, a force redesign of the Australian Army. The group brainstormed 57 actors and organisations and sorted them into clusters. They also brainstormed what purposes the Army served for these stakeholders, identifying 39 distinct purposes that were then clustered. This exercise reinforced the complexity of the challenge of designing a force that would meet the needs and interests of such a diverse stakeholder group. Stakeholder identification was an important element in deliberately mitigating personal and group biases.[29]

Empathy mapping

In pairs, participants then selected two diverse stakeholder perspectives and created empathy maps so they could better understand their hopes, fears and needs with respect to the future Army. They outlined what they thought these stakeholders would be seeing, saying, doing, feeling, hearing and thinking about the situation, as well as what their most pressing pain or challenge might be.[30] How people, groups and entities see themselves and how they are interpreted by others can enable synthesis and emergence of a strategic frame or story. Often in systemic design, empathy mapping is preceded by field research but in this case we asked participants to use their imagination. Ideally as many viewpoints as possible are represented through participants; but there is always a requirement to empathise with stakeholders who cannot be represented. This challenges the mental frames of participants, which improves outcomes.[31] The following perspectives were mapped: a soldier, an adversary, the Chief of the New Zealand Army, the Minister of Defence, a defence industry CEO, a DFAT diplomat, an Army spouse, and an Army educator. The perspectives were chosen for diversity rather than attempting to be comprehensive.

The group created a gallery of all the empathy maps. As they browsed the gallery, participants placed dots next to statements that they found to be authentic, non-obvious and revealing. Such statements are significant because they go beyond the stereotype to reveal latent needs and can provide design inspiration. In the subsequent discussion, participants remarked that most stakeholders are disempowered by the current force design process.

Design criteria

The design criteria canvas is a simple tool for making explicit the criteria by which design options will be evaluated.[32] Participants brainstormed criteria in four categories:

- **Must:** must-haves and non-negotiables

- **Should:** should-haves and important features

- **Could:** could-haves and optional features

- **Won't:** won't-haves and non-negotiables.

In a longer process this step would have been iterated with the previous steps (from horizon scanning onwards) so as to more closely tie these design criteria to the contexts chosen and more clearly link these to reasons 'why' a change in paradigm was required. In practice, participants loosely based this step on their current understanding of strategic guidance and the role of Army, modifying this to include criteria they believed relevant. This was not critical to the activity as a whole; as previously noted, it is not the output from each step that was critical but the discourse and synthesis of insights from the collective activities.

The criteria were ranked using dot voting.[33] Each participant was given three dots to select the most important criteria. Dot voting is not a rigorous prioritisation method: it can suffer from anchoring effects (first to vote influences others) and vote splitting (similar ideas get more total votes but low individual counts). However, in this case it allowed the group to quickly whittle down a long list of criteria to a set that was easier to remember and work with. The criteria that received at least one vote are shown in Table 2.1 below.

Table 2.1: Design criteria used to design the force for the 2050 Australian Army

Australian Army 2050 design criteria	
Must:	• Know its role in the defence of Australia
	• Conduct battle on a multi-domain battlefield
	• Interface with the Navy, Air Force, Joint and Whole of Government
	• Operate in diverse environments (jungle, mountain, desert, urban)
	• Deploy a Task Force in a reasonable time
	• Be able to win the information war
	• Be able to influence Joint and Whole of Government priorities and capabilities

Australian Army 2050 design criteria		
	•	Protect populations
	•	Have the ability to coordinate forces
	•	Remain technologically relevant
Should:	•	Shape the regional environment to make Australia indispensable
	•	Be able to rapidly identify and exploit adversary capability gaps
	•	Be able to expand rapidly to cope with large scale threats
	•	Be able to defeat peer forces three times its size when in Australia
	•	Be able to defeat insurgencies in the largest of our regional partners
	•	Forecast future needs
	•	Exploit IT/Cyber/EW to shape adversary outlook and behaviour
	•	Maintain an over-arching flexible transition strategy that is not susceptible to the whims of one present leader
Won't:	•	Use equipment, technology or tactics that break UN conventions
	•	Be a 'Mini-Me' of the US Army

From | To shift

The group used the design criteria to begin to map the ideal force design. Several tools for systems mapping were provided to participants, including Gharajedaghi's four systems perspectives and the creative problem-solving method SCAMPER.[34]

The group began creating a functional map of the future force but soon realised the functions were generic enough that they were no different from the current force. To emphasise how their new design was different, the group switched to creating a 'From|To' table (Table 2.2, below). The 'From|To' table provides a high level summary of the future force design concept, but it does not say how these characteristics will be achieved. In conducting this step, participants were forced to review the current force paradigm (previously considered in Current Force Mapping) in more detail; their insights reflected potential limitations in the current force, which better enabled the identification of creative options for the future force. A narrative for the future force started to emerge from these new elements.

Table 2.2: From|To table summarising the major differences between the force in being and the future force

Shifting From…	…To
Joint Planning starts after the event (not Whole of Government)	Joint Planning synched with Whole of Government
Global force projection	Regional force projection
Personnel only expected to speak English	Personnel are bilingual in regional languages

Shifting From…	…To
Ad-hoc regional military engagement	Reciprocal embedded Australian and regional army units
Service-based command	Functional-based command
Narrow career progression options	Multiple streamed career progression options
Pyramidal force hierarchy	Flat and autonomous force structure
Army shapes the region reactively	Army shapes proactively as a face of regional development
General purpose or specialised units	Degeneracy: multi-functional units
Ad-hoc mission command	Context-specific C2 doctrine
Domain-centric command and management of kinetic effects	Joint-centric command and management of Whole of Government effects
Single-domain manoeuvre	Multi-domain manoeuvre
Post-event evaluation	Real-time evaluation and response
Slow acquisition process	Acquisition on-demand in-theatre
Intelligence-led in counterinsurgency	Intelligence-led across the spectrum of operations
Physical situational awareness	Physical, human and cultural situational awareness underpinned by AI data analytics

This future force concept represents a radical shift in culture, structure and technology for the Australian Army. Many of the individual items in the 'To' column of Table 2.2 taken in isolation would be considered transformative. Together, they imagine a completely new kind of armed force with unprecedented adaptability, agility, robustness, and survivability. An adversary would encounter a force that had strong regional support and superior regional intelligence built through years of peace-time regional deployment experience and pervasive regional force integration. They would experience synchronised cognitive, cyber and physical multi-domain assault capability that would shock their military, economic, and social systems. The Australian Army, integrated as part of a Joint Interagency Task Force, would be formidable across the spectrum of operations. At this point in the design inquiry a shift from manned to autonomous systems for close combat was not identified, but it became increasingly central to the design concept as the group's thinking developed. The mindset of participants also became highly joint force focused.

Detailed design

Once the group had generated a vision for what they wanted the future force to do, they began to map out a more detailed design for how to realise it. The technique of GIGA-mapping enables collaborative mapping of extremely complex systems.[35] The defining characteristic of a GIGA-map is its scale. Most information design approaches rationalise complexity in favour of simplicity and comprehension. GIGA-

maps are oriented towards complexity and contain hundreds of entities and even more relationships between entities. The GIGA-map was created on 12 metres of butcher paper. Participants mapped each component of the new force design, working on different parts of the GIGA-map in parallel. The primary purpose of this GIGA-map was to enable the design team to have what Donald Schön calls a 'reflective conversation with the materials of a situation'.[36] By creating an explicit and shared map, participants could critically explore the implications of their initial design moves, leading to refinement and, sometimes, reframing. The GIGA-map is not intended for presenting the design to external stakeholders but is part of the design thinking process itself.[37]

The major components of the GIGA-map aligned with the major shifts summarised in Table 2.1. As the GIGA-map was developed, several new components were also added, as gaps in the design were identified. These components were: regional force projection; in-theatre on-demand acquisition; intelligence-led operations; functional-based command; recruitment; context-specific C2 doctrine; barbell strategy; joint planning synchronised; AI and data analytics; effects-based management; real time evaluation and response; multiple career progression options; flat and autonomous force structure; multi-domain manoeuvre; degeneracy; and signatures.

As participants developed the GIGA-map, they began to see how different aspects of the design reinforced one another. For example, AI and data analytics would enable intelligence-led operations, real-time evaluation and response, and true effects-based management. Functional-based command would also contribute to enhanced effects-based management. Multiple career progression options would complement the flat and autonomous force structure. A degenerate force, where elements are multi-rolled, would be leveraged by context-specific C2 doctrine to enable dynamic role switching. A renewed focus on regional force projection would facilitate early and proactive synchronised joint planning. The whole-of-government and fully joint operations would promote multi-domain manoeuvre. The barbell capability development strategy would maintain a fully operational conventional force while allowing aggressive investment in disruptive deep learning and robotics technologies. As each of the components were discussed and refined, a coherent whole force design began to emerge.

Presentation drawing

Architect and psychologist, Bryan Lawson categorises three types of sketching used in design: design drawings, production drawings, and presentation drawings.[38] The design drawings are intended for use by the designers themselves, as with the GIGA-map above. Production drawings are detailed drawings for the purposes of construction of the design. Presentation drawings are intended for the client as a way of visually communicating the design concept.

Following the production of the GIGA-map, one participant drew the presentation drawing shown in Figure 2.4. The drawing was an attempt to make sense of the messiness of the GIGA-map through a high-level synthesis. The drawing resonated with the group and generated a long and productive discussion. It led to the naming of the new force design as *Fire Ant*: a small, agile, swarming force that would strike terror into adversaries even if they were larger than us. The presentation drawing was also the key artefact used by the team to brief senior leaders on their design at the end of the workshop.

The presentation drawing for *Fire Ant* shows an integrated Joint Inter-Agency Task Force (JIATF) nesting within a Whole of Government Task Force (WoGTF). The WoGTF prepares an ongoing intelligence assessment that integrates data, human intelligence, futures horizon scanning, and advanced analytics to create a comprehensive and anticipatory picture of the regional operating environment. The WoGTF is also responsible for integrating whole-of-government effects, coordinating all instruments of national power to protect and promote Australia's interests. The WoGTF is continuously involved in Phase 0 operations, proactively shaping the region to our long-term strategic advantage.

Figure 2.4: Presentation drawing of the *Fire Ant* force design: a small, agile, swarming force that would strike terror into enemies
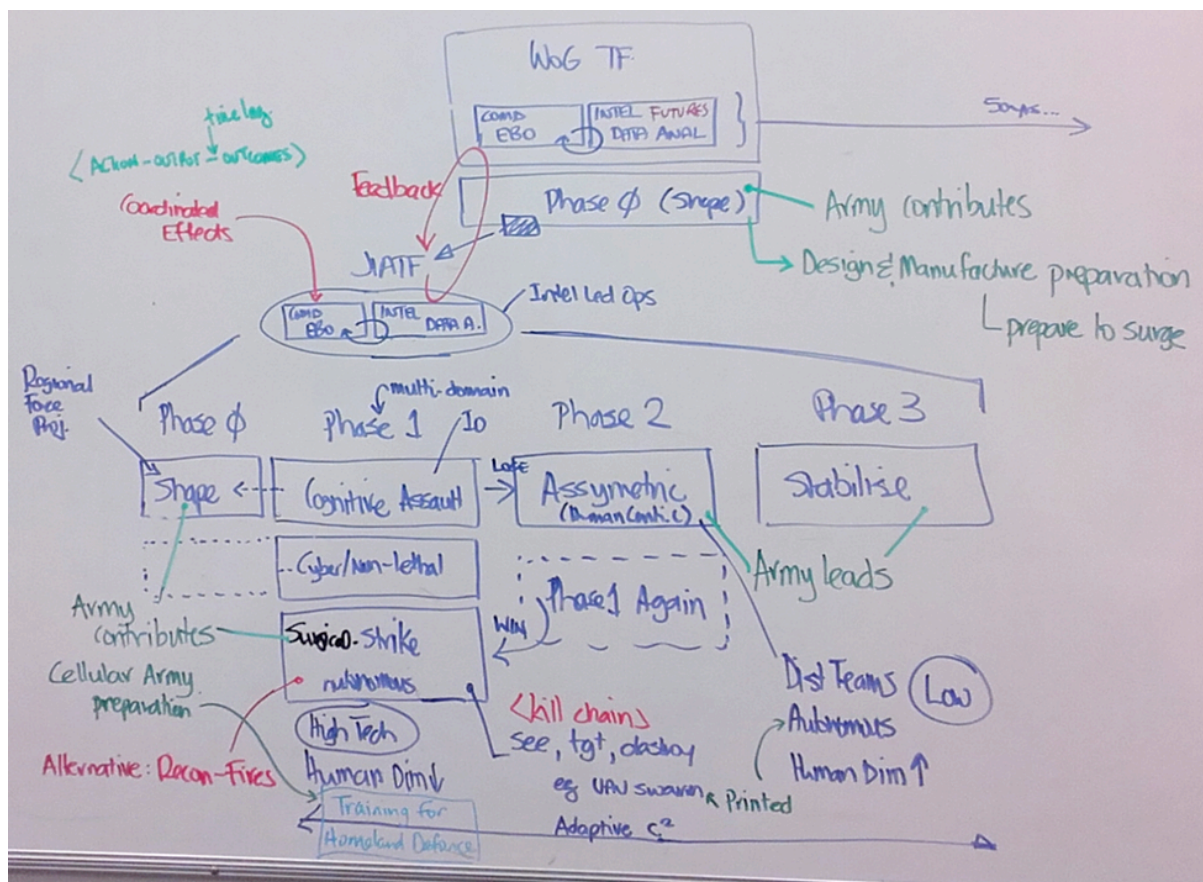
The JIATF would be prepared to project effects regionally should conflicts escalate. In Phase 1, multi-domain operations could integrate cognitive assault, cyber and non-lethal effects with surgical strike to generate systemic shock for the adversary. Structured as independent Battle Groups and freed from a logistics train—by foraging for local energy and 3-D printing munitions, food, spare parts and even whole vehicles from foraged materials—they could cooperate as needed to destroy the will and ability of the enemy to resist. By 2050, most strike functions will be performed by swarming autonomous systems that can be printed in near real-time in theatre. Indeed, use of 3-D printing enables the types of vehicles needed for the peculiarities of an operation to be printed in the numbers needed; with only those needed for prototyping and training printed beforehand.

This removes many of the problems of picking the future as the investment is in the plans and the printers and the ability to source the energy and base materials to implement them rather than investing in a set of physical platforms that may never be

needed. It is the military equivalent of being able to keep financial capital liquid for longer and apply it as needed in a crisis. The investment is mostly in the plans; enabling faster rates of evolution and adaption to be achieved. The human component of *Fire Ant* will operate as a recon-strike force but will also be capable of recon-fires operations using cheap, disposable drones to unmask adversary targets. The JIATF will be equipped and organised to win in a high-tech battlespace where humans are mostly out of the loop and outside the battlespace.

The transition from the high intensity, high tech warfare of Phase 1 to Phase 2 occurs when one side's offensive strike capability has been destroyed. If the ADF prevails in Phase 1, then the JIATF would continue to operate a high-tech, multi-domain strike on the enemy until a more just peace can be established. If the enemy prevails, the ADF will switch to an asymmetric mode of warfare. Phase 2 is characterised by low-tech warfare that is dominated by the human domain. During Phase 0 and Phase 1, preparation for the worst case in Phase 2 would include training a cellular Army for homeland defence. Caches of weapons and 3D printers would be distributed across the country. Austere and highly autonomous teams would fight a protracted, low-intensity battle to sap the adversary's will. At the end of combat operations, Phase 2 transitions to Phase 3, which is predominantly stability operations. In 2050, this phase evinces the least differences compared with stability operations in 2017.

As an integrated component of the JIATF, Army has a role to play in all phases. The current Adaptive Campaigning construct contains five lines of operation: Joint land combat, population protection, information actions, population support, and indigenous capacity building. These lines of operation remain relevant to *Fire Ant*, although their relative weighting will shift. In an autonomous battlespace, the distinction between Army, Navy and Air Force unmanned vehicles begins to blur and eventually disappears. Functional command re-organises combat power by effects, further blurring the lines between services. Therefore, the Army as a conventional land force has a reduced role in joint land combat in the autonomous battlespace. The Army has an increased role in Phase 2 and 3, particularly in information actions, population support, and indigenous capacity building.

Testing the *Fire Ant* force design

The new force design developed in the workshop had significant potential but there was uncertainty about whether it could work, and if so, in what contexts. The earlier that this uncertainty can be eliminated, the more design options become available, and the cheaper it becomes to make changes. Participants tested their initial design, using wind tunnelling, three horizons, and prototyping.

Wind tunnelling

Aerospace engineers use wind tunnels to test scale models of aircraft to see how well they fly in controlled conditions. Foresight analysts have adapted the concept of the wind tunnel, using scenarios to test how well a strategy or organisation performs in different conditions. Participants took the major components from their force design and tested each against the four scenarios developed on day two of the workshop (see Table 2.3). Overall, they judged most force design options to perform strongly across most scenarios. Several adjustments were made to the force design to improve the performance of options across all scenarios. For example, it was realised that it was much more important to be able to operate different C2 doctrine in different scenarios than it was to dynamically switch C2 doctrine within scenarios.

Dynamic switching is much more difficult to achieve and more costly to train for. Therefore, the group decided to train the force to the lesser requirement. Degeneracy scored low in Scenario A, Striving for the Common Good. The group was not concerned by this, however, because while a degenerate force would be expensive in Scenario A, where there are few threats to Australian interests, it would pay off in the more dangerous scenarios.

Table 2.3: Wind tunnelling force design options against the four scenarios

Force design option	Scenario A	Scenario B	Scenario C	Scenario D
Signature Management	H	M	H	M
Barbell Strategy	H	H	H	H
Joint Planning Synched	M	L	H	H
Context-Specific C2 Doctrine	M	M	M	M
AI Data Analytics	H	H	H	H
Functional Command	H	H	M	M
Real Time Evaluation and Response	H	H	H	H
Effects Management	M	L	H	H
Regional Force Projection	H	M	H	H
Intelligence-Led Operations	M	H	H	H
In-Theatre On-Demand Acquisition	H	M	H	M
Flat and Autonomous Force Structure	H	H	H	H
Multi-Domain Manoeuvre	H	M	H	H
Degeneracy	L	H	M	M

Three horizons

Another way to test force design options is using the three horizons technique.[39] Rather than thinking of innovation as an episodic event, this technique allows us to visualise innovation as a portfolio of three horizons, each successively more future-focused. Horizon one is about improving the efficiency and effectiveness of the present force structure (playing the same game with the same rules, better). Horizon two is a transition to a new force structure (adapting to the same game with different rules). Horizon three is the realisation of the new force structure (shaping the future in a new game with new rules).

For the force design challenge, the group placed each of the force design options on the three horizons chart and then labelled each horizon. The three horizons are:

1.   **Prepare to transform:** Refocus on the region, reduce signatures, develop and practise context-specific C2, and begin a barbell strategy to invest in horizon three technologies.

2.   **Command realignment:** Proactive and synched joint planning, flat and autonomous force structure, intelligence-led operations, in-theatre on-demand acquisition, and transition to functional command.

3.   **Robot wars:** Multi-domain manoeuvre, degenerate force design, AI and data analytics, real-time evaluation, and effects management.

The three horizons perspective (Figure 2.5) shows the force design has elements in all three horizons. It is an aggressive and forward-leaning portfolio, considering how many elements are focused on the speculative horizon three.

Figure 2.5: Force structure options shown as a portfolio of changes over three horizons of transformation
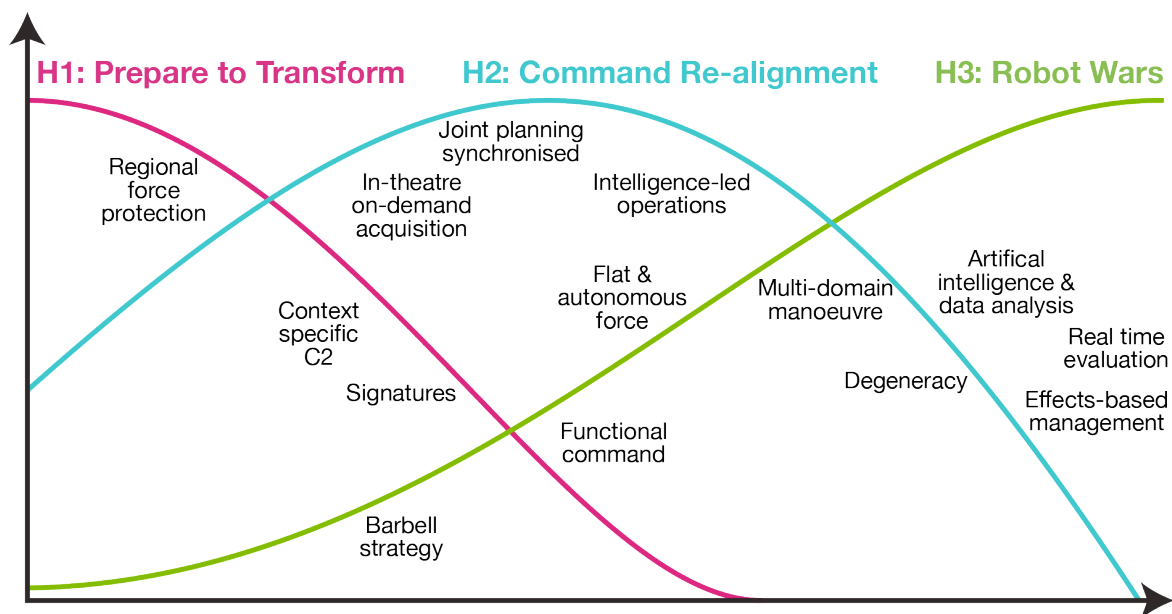
Prototyping

A prototype is a fast, cheap and generative test of a design concept. By generative, we mean, even if the prototype fails, it is rich in learning because it evokes a meaningful response from stakeholders or the environment. Prototyping occurs throughout the design process, but the kind and purpose of prototypes change as the design matures. Early prototypes are often low resolution to test broad concepts. Later prototypes may be higher resolution, including beta releases of final products or systems. The four main phases of prototyping are:

•   prototyping to challenge and provoke

•   prototyping to learn and inform

•   prototyping to invite participation

- prototyping to communicate and sell.

There are two main types of prototypes: horizontal and vertical. Horizontal prototypes build a façade of the solution without implementing any of the back-end functionality. They are useful for testing the user experience and the interface between the user and a solution. Vertical prototypes take one slice of the solution and build it out in depth; they are useful for testing the technical feasibility of a key subcomponent.

The other important distinction is between tabletop prototypes and field prototypes. Tabletop prototypes can be rapidly built, tested and iterated in the lab environment. Field prototypes are taken out into the real world for testing with real users. It takes more time to plan and deploy a field prototype, but field prototypes usually generate richer and more valid feedback.

Paper prototyping

The simplest form of prototyping is paper prototyping. The prototype is a 2D sketch of a design element. Participants created storyboards to test parts of the *Fire Ant* force design about which they were most uncertain. Prototypes test one or more key uncertainties. For example, one storyboard tested whether it was possible to coordinate forces in a flat and autonomous force structure. It explored the tension between discipline and responsiveness, and constructed an experimental test harness for new C2 methods. Paper prototyping allowed the group to quickly play out the new force structure in a specific situation, adding granularity and texture that went beyond the detailed design of the GIGA-map.

Field prototype dashboard

There was insufficient time in the workshop to perform field prototyping. However, participants created a plan for field prototyping by completing a simple field prototype dashboard. The planned field prototype would run a Command Post Exercise to test an effects-based approach to operations enabled by future technologies, including deep learning AI and data analytics. The human roles in the HQ would be role-played by representatives across all domains of national power. The future technology would be simulated to provide the human decision-makers with significantly more accurate assessments of first-, second-, and third-order effects. The field prototype would take one week to organise and run, and cost under $50,000. It would test key uncertainties around both the organisational and technological requirements to deliver on the promise of true effects-based operations.

Value of systemic design

On the final day of the workshop, participants reflected on the value proposition for systemic design and potential applications for DST Group.

What is the value of systemic design?

- **A discovery process:** Solutions emerge through designing that could not have been anticipated at the start of the process.

- **Participatory:** Issue owners and stakeholders at all levels can participate and collaborate to build on one another's ideas as they design together.

- **Simultaneous breadth and depth:** The rapid and iterative application of many systemic design tools builds breadth and depth of understanding.

- **Adapting in the face of complexity:** In complex systems, where complete solutions can never be known in advance, systemic design provides a way to accelerate learning and adaptation.

What makes systemic design different?

- **Guided not prescriptive:** The approach is facilitated without prescribing a rigid sequence or way of working together; it requires discipline, yet also encourages divergence.

- **Flexible toolkit:** Drawing from many fields, the toolkit for systemic design is open and reconfigurable to suit many different complex challenges.

- **Creative and visual:** Through the use of sketching and making, systemic design engages participants creatively and visually.

- **Good solutions:** Rather than a highly optimised but brittle solution, systemic design and foresight encourage satisficing across multiple demands and uncertainties to create robust solutions.

What are the future application of systemic design for LCA MSTC?

- **Force design:** Systemic design could provide a framework for the next Force Structure Review. A shorter term application could be to redesign the Army Brigade HQ.

- **Experimentation:** Systemic design could be used in the Land Warfare Lab to accelerate the translation of concepts into prototypes. SRI Immersive Environments could provide a test bed for systemic design options. Rapid prototyping approaches from systemic design could be used to frame and refine the design of large scale experiments.

- **Operational design:** Although not owned by LCA MSTC, there is a gap in enhancing the Joint Military Appreciation Process where systemic design tools could apply.

Summary

Over the course of six days, DST scientists learned systemic design by applying it to a complex, ill-structured challenge; practising multiple systemic design methods and developing a powerful synthesis—*Fire Ant,* which is very different to the present force. Many redesign efforts end up suggesting what is essentially still the current paradigm as the future paradigm because they have not reframed their context from what has happened in the past to what might happen in the future and simply predict that the future will be similar to the past.

Systemic Design allowed the team of scientists in the workshop to break free of many assumptions, to ignore the myriad questions of 'how can we change that' and reframe themselves in multiple contexts to develop a nuanced concept that prepares for likely futures in an adaptive manner. The scientists mapped the current force design; scanned for signals, trends and drivers of disruptive change to 2050;

constructed four scenarios; envisioned a new ideal force design; mapped out a detailed force design; prototyped key aspects of the force design; and presented their design to organisational leaders. However, it is not the individual steps or their outputs that are important. The important point is the cognitive attitude of exploration and preparation for multiple potential futures that underpinned the generation of new understanding. The final synthesis of understanding—*Fire Ant*—was the consequence of the discourse between participants throughout the activities that were undertaken. Just as it is the planning not the plan that makes teams adaptive in the face of contact with reality, it is the discourse not the activities that enabled this process to produce an adaptive outcome.

In addition to learning systemic design, the participants proposed a provocative new force design for the Australian Army that is unlike any existing military force: *Fire Ant*. The design is far from complete, but in six short days a significant new idea was conceived, mapped and tested. Systemic design has applicability to several DST Group and Army challenges, including force design, experimentation and operational design. Imagine what a broader group with deeper expertise and more time could do with Systemic Design!

Notes

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AIR FORCE BY DESIGN: APPLYING DESIGN FOR TRANSIENT CAPABILITY ADVANTAGES

Cara Wrigley, Genevieve Mosely, Matthew Gill and Jerome Reid

The Royal Australian Air Force (RAAF) is required to prepare for, and respond to, a rapidly changing environment that is characterised by high and constant contest. This contest will introduce a number of unprecedented challenges and unfold under conditions of increasing uncertainty and complexity. Significantly, these challenges cannot be adequately resolved by the traditional and functionalist approaches to strategy, force design and capability development that have served the Air Force well in the past. The game has changed. The Air Force needs to apply non-traditional methods to creatively develop and test new theories for how it will generate and leverage adversarial advantages in this new contest.

Rising to this challenge will require the Air Force to think with a dual focus. First, it will be necessary for the Air Force to acknowledge that existing approaches to air power strategy and force design present limitations in generating and applying adversarial advantages in an increasingly complex context. Resolving these limitations requires the understanding and integration of emergent paradigms of thinking that allow the Air Force to deal with complexity, uncertainty, ambiguity and contest in a way that is superior to that of any competitor.[1] Second, the Air Force needs to sharpen its focus on praxis. This will play a key role in the design, testing and iteration of new ways to understand and exploit *sensemaking* (the process of collectively working to understand issues or events that are novel, ambiguous and chaotic and assigning them meaning) for air power effects. Each of these two focus-areas represent considerable puzzles in themselves. However, to meaningfully engage with the challenges that lie ahead, the Air Force will be required to apply its focus on both areas in a manner that is simultaneous and iterative, with insights and learnings from one focus area interacting and shaping those of the other.

This chapter unpacks the contemporary challenges facing the Air Force; introduces Zweibelson's 'blended paradigm' of strategy as an ontological approach to guide the Air Force into the future;[2] and positions *design thinking* and *design innovation* as the methods and cognitive tools best suited to building the new sensemaking capabilities the Air Force needs. This then allows for an examination of praxis—a study will be made of the Air Force's engagement with design methods to build new capability advantages and reshape the relationship that exists between capability development, strategy and force design.[3] This chapter concludes with a series of provocations to inform future research focus areas.

The state of play

The Air Force exists within a context that has become defined by a state of *high and constant contest*. The models of political warfare, coercive diplomacy and grey-zone actions (winning without actually fighting) that are increasingly and effectively utilised by actors in the Indo-Pacific region deliberately blur the distinction between war and

peace.[4] The traditional, western dichotomy of war and peace (the placement of war and peace as opposing *states of being* that rest at opposite ends of a spectrum) no longer holds utility when applied to these realities—the notion of *constant contest* becomes a paradoxical element within this dichotomy, implying a simultaneous occupation of opposing states of being. Within this milieu, rival powers in the Indo-Pacific region demonstrate prowess in using political warfare and multi-domain conflict to win strategic objectives below current thresholds of military intervention—Australia's current military capabilities and force-in-being do not appear to be deterring this.[5] This understandably brings Australia's approach to building and projecting military power into question.

While the need for Australia to recalibrate its understanding of war and peace to better deal with constant contest is recognised within Australia's national security community,[6] models to navigate this construct remain nascent. This is of concern. Within this environment, Australia's potential adversaries range from near-peer sovereign state actors, with access to advanced technologies, warfighting strategies, tactics techniques and procedures—who can mobilise impressively fast and apply power through traditional and sub-war conflicts—through to non-state actors who are well-funded, trained and equipped, with unconstrained freedom of actions to operate in some, if not all, warfighting domains.

The nature of this environment introduces unprecedented complexity. The dominant, functionalist models of military strategy,[7] which are predicated by 'linear-causality, positivistic scientific methodology, reductionism, and the desired elimination of paradox and surprise',[8] cannot adequately explain or begin to deal with this state of play. Principles, rules and patterns—traditionally arrived at through deductive and rationalist strategies—cannot be applied in this new context in a way that offers the explanatory power that the Air Force requires.

Adding further dynamism and complexity to this state of play, the Air Force has embarked on a journey of transformation to become a fifth-generation force.[9] At its heart, this requires the Air Force to be capable of employing a *whole-of-force* approach to air power. Such a transformation enhances the combat potential of individual platforms through instantaneous networking across a joint force. This allows for sophisticated 'cooperative engagement effects by linking distributed sensors, and sharing mission critical data and situational awareness'.[10] While Air Force's fifth-generation journey has its genesis in the acquisition of advanced, fifth-generation aircraft, such as the F-35 Joint Strike Fighter (the term *fifth-generation* itself was originally only intended to describe the characteristics of specific aircraft), the nature of transformation that the Air Force seeks extends well beyond an ability to exploit fifth-generation platforms across domains. In fact, the transformation extends to the essence of the force itself (including force design, force structure and force generation) to deliver new air power effects through a suite of integrated capabilities operating in concert.

In the most contemporary of Australian security discourses the nomenclature of fifth-generation is now also applied to the methods used to shape and better understand the environment in which an integrated force will prepare and operate. The term *fifth-generation manoeuvre* is used to describe the Australian Defence Force's nascent ability to orchestrate a new way of fighting, characterised by increased tempo and new ways and means of projecting power[11] across domains, and the need to conduct an indirect approach to warfare.

The fifth-generation construct (in all its variations) brings a nature of change upon Air Force's strategy, force design, capability and preparedness systems (of systems) that is profound, and offers an encouraging vantage point from which to gaze back at Air Force's legacy approaches to the design, analysis and application of air power. The need for a fifth-generation Air Force to be integrated by design goes part-way to shift mindsets and the capability development emphasis away from the seductive pull of expensive, fast-moving, low-observable and technology-laden capabilities that deliver kinetic and non-kinetic combat effects. Instead, it compels a consideration of force modernisation though a transformation of thinking rather than through the replacement of platforms.

If the Air Force is to effectively operate as a fifth-generation force (a proposition that supposes that the Air Force will have completed the significant and ongoing work required to *integrate* its capabilities, structures, and approaches to force generation), two significant and interrelated complications would need to be overcome. These complications require Air Force to examine both the way it builds and moves pieces across the metaphorical *chess-board* that is its fifth-generation operating milieu and to also examine the nature of the game of chess itself—whether there are conventions that need to be revised in order to develop unorthodox advantages, or whether an entirely new type of game needs to be played instead.[12]

By examining how it builds and moves pieces across the chess-board, the Air Force needs to become increasingly skilled in identifying and deciding what new capabilities are needed to deliver relevant air power effects and ultimately place it in a position of advantage. This will see the Air Force work to fully exploit the potential of fifth-generation technology and concepts in increasingly volatile, complex and uncertain environments. To do so requires the Air Force to be faster, more connected and smarter than it has been in any previous epoch.[13] Importantly, the Air Force will need to decide what these new capabilities are, how they are situated relative to the design of objective and future forces, and how they relate to cycles of open-ended, constant and dynamic contestation with equally capable adversaries.[14] In this game adversaries will be making moves and counter moves to build or exploit advantages of their own, or to avert losses. Responding to this will require the Air Force to harness disruptive thinking in its pursuit of advantages.[15] This is a game and a way of thinking that the Air Force is not accustomed to, as its freedom of action has been uncontested for a generation or more.

To thrive and win in this context, it will be necessary for the Air Force to fundamentally re-examine how it understands, interacts within, and shapes the milieu in which it operates. At the most basic level, this requires the adoption of non-traditional paradigms that explain subjective, non-linear and non-causal relationships as a means to reimagine the interplay between capability development, competitive advantage, force design and strategy. It will be necessary for the Air Force to think about the metaphorical game of chess at the metalevel and about the way the organisation understands its reality, orientates itself within this context, choses courses of action, despite ambiguity, and then makes moves within the game. Doing so adopts a similar heuristic to Boyd's 'OODA loop' and demands air power professionals consider new approaches to strategy design and operational artistry that offer utility in a digital, contested and complex age.[16]

Reimaging the paradigm of strategy in this manner is a considerable task. Nonetheless, it is necessary to consider the kind of thinking—at both ontological and epistemological levels—that should underpin how the Air Force determines the

content of its strategic knowledge construction and how types of strategy should unfold in reality and link with force design, capability development, and preparedness.

The application of the traditional and still-dominant paradigm that western militaries, including the Australian Defence Force, use to think about strategy has significant limitations in an epoch defined by unprecedented complexity. The term 'functionalist strategy',[17] as developed and unpacked by Zwiebelson,[18] is adopted herein to refer to this traditional paradigm. Functionalist strategy is highly useful for many military applications, especially those that are governed by linear, objective and causal relationships. For example, the rigidity of doctrine and traditional planning methods create many preconditions necessary to quickly cycle through an OODA loop.[19] Furthermore, in an Air Force context, the task of preparedness (including force generation) accords to a linear relationship. *Strategy* is able to be distilled to *ends,*[20] which can be linked to *ways* (i.e. preparedness and force generation directives) and *means* (i.e. force generation plans, objectives and activities) in a highly linear and systematic manner. Planners within Air Command's preparedness realm actively engage with functionalist and rational approaches that add predictability, measurability and repeatability to their processes. This is not to say that the task of preparedness design and management is simple—it is in fact a complicated beast. Rather, it is to demonstrate that there is still relevance and a strong need for scientific and functional approaches to strategy within a contemporary Air Force.

However, there are also areas where the paradigm of functionalist strategy offers reduced utility. This occurs when subjectivity and non-linearity are required to understand a particular reality. This applies when dealing with complexity, where no proportionality exists between cause and effect, elements of ambiguity and surprise are defining characterises of a context, and where future-states cannot be reasonably explained by past knowledge.[21] Within these contexts, 'even the notion of a military 'goal' or strategic 'end-state' becomes paradoxical or non-existent when we consider the non-linear and emergent process of systemic change and innovation'.[22] These circumstances make for an accurate representation of the context that the Air Force is facing. Dealing with this context requires a shift away from functionalist paradigms to new emergent paradigms of strategy (such as interpretivist strategy)[23] that allow for more fluid, context-based and dynamic approaches to military strategy geared for 'learning in motion'.[24]

This approach to understanding strategy does not require an either/or selection process between paradigms—both functionalist and interpretivist paradigms have utility in different contexts. It is instead necessary to find ways of reconciling the differences between the two and to understanding *when* to use a certain paradigm. This is especially important for the Air Force where there is a need to shift towards interpretivism for some of the ways it considers strategy, force design, and capability development, and towards greater functionalism for elements of capability and preparedness. The integrated, interdependent and increasingly dynamic nature of Air Forces' strategy, capability and preparedness systems (of systems) requires the ability to break out of the trappings of a single paradigmatic approach and 'blend' otherwise opposing paradigms.[25] The tension that exists within this union must be understood and embraced.

The need for design and new sensemaking

Air Force's requirement to simultaneously (1) identify and exploit new capabilities to deliver relevant air power effects, and (2) reimagine the interplay between capability development, competitive advantage, and strategy is steeped in non-linearity, creativity, and complexity. Dealing with these characteristics requires ways to make sense of the unknowable.

Edgar Morin, a French philosopher internationally recognised for his work on complex thought, outlined two predominant perspectives on complexity: restricted and general complexity.[26] The main difference between these two perspectives is that restricted complexity contemplates the exploration of multiple, interrelated processes that constitute complex systems to retroactively uncover the constituent elements that make up their complexity. In contrast, general complexity posits a view that it is impossible to construe the constituent parts of complexity by any means of reduction—*'one cannot simply "cut-up" complex systems in order to understand them, since what is of interest is the dynamic, local interrelations that exist between the parts of a complex system'.*[27] Regardless of whether one chooses to view complexity in restrictive or general terms, what is certain is that engaging with, and in, complexity and all its ambiguity has the potential to offer Air Force a significant warfighting advantage against an adversary who may have attained technological or tactical parity but is someway from achieving parity in the cognition of complexity.

There are number of different modes of thinking and operating that enable one to engage with complexity to a point where the possible range of solutions may be shifted from *unknowable* to *restrictedly knowable*. Design thinking is an effective vehicle to deal with complex problems in this manner. It does this by enabling effective *sensemaking* that aids in the navigation of complexity, particularly by facilitating the point of view of the end-user and the understanding of many different core and peripheral perspectives. For decades, design has been widely used as an innovative tool for organisations to remain competitive in an ever-increasing global economic environment. This approach is more commonly known as design-driven innovation.[28]

While design has often been associated with the successful development of new products and services, recent studies have demonstrated that design goes beyond the development of new products. Design is capable of playing a more pivotal role in building the strategic capabilities of an organisation and contributing to their core business values.[29] The key to competitiveness in today's global economy is for organisations to have well-designed strategies supported by deliberately designed organisations. In this ecology, sensemakers perform a critical function in reconciling top-down strategy to meet bottom-up creativity and innovation. This in turn is shown to give rise to new knowledge, new innovations, new paradigms, new designs and finally new capabilities. This draws strong parallels with an Air Force seeking to make sense of the complexity that lies before it.

This need for new sensemaking is unpacked in an Air Force context in the recent special report developed by the Australian Strategic Policy Institute (ASPI)—*Projecting Australian Air Power Strategy for an Age of High Contest.*[30] This report advances a shift in how Australian air power strategy might be conceived by moving away from a static capability or platform-based approach and towards a more dynamic *effects-based* approach. While the ASPI report provides non-binding public policy advice (and therefore does not prescribe how the Air Force will shift its

approach to strategy), the author of the report, Peter Hunter, who is the current RAAF Director of Air Force Strategy, is tasked with developing the next iteration of Air Force strategy to guide the Air Force into the future. It is therefore reasonable to expect that many of the conceptual underpinnings of the ASPI report may inform how Air Force shifts its strategic understanding and orientation into the future.

Hunter cites the need for the Air Force to adopt a new 'small, smart and many' approach to technology acquisition and deployment (compared to the current 'few, expensive, exquisite approach) coupled with a more agile approach to the integration of systems and capabilities.[31] The report also implies that an effects-based approach to Australian air power strategy would involve a more abductive relationship between innovative capability development and disruptive strategic realisation (and the two-way non-linear interplay that would exist between these domains). Neither top-down deductive models (where strategy is the exclusive determinant of how capability is developed) *nor* inductive approaches (where the capabilities of individual platforms define the kinds of effects they can or should generate) offer sufficient utility on their own.[32] Rather an abductive approach is required to take the best from both approaches. Hunter advocates the role for design thinking and innovative ideation methods to give substance to more useful Air Force strategies and capabilities.[33]

The ASPI report presents one of the most contemporary and compelling calls to action from outside the Air Force of the need for design, and the intricate way that Air Force needs to consider the role of design as a sensemaking function to help cut through complexity, identify novel solutions and build non-linear relationships between strategy, capability development and the pursuit of disruptive advantages.

The role of design

In previous decades, design has been widely used as a strategic and innovative tool for organisations to remain competitive in complex and globalised markets. Dealing with complexity requires a multidisciplinary approach—design plays a key role by bringing the perspectives of the end user to the forefront of the process to help frame problems and identify. Design employs a user-centric approach to problem solving that ensures the end user is in kept in mind from the very beginning of the design development of a product, system or service; that it can be adopted into the organisation; and that it is actually solving the problem at hand. Design allows for a magnitude of potential solutions to be developed quickly, prototyped, iterated upon, re-developed and tested again in order to provide users with scientifically sound solutions that address their latent needs.

One of the defining characteristics of the design thinking approach is the non-linearity of the process. Solutions are sought through an iterative process of discovering and identifying the problem, creating a solution, prototyping and then evaluating the feedback. This approach avoids the trap of investing too many resources too early in a project towards developing a specific single solution. Design innovation extends the reach of design thinking from an organisation's cultural philosophy to an executable, future-driven process with the potential to drive growth and develop future competitive advantage.[34] The design process applies the attributes of design thinking such as provocations to push the limits of knowability, the constructs of strategic alignment through the power of a user-centric why, through to empathy to gain deep insights into the user, their wants and needs.

Design thinking consists of methods to investigate and analyse ill-defined problems leading to proposed solutions.[35] But, there are many variations and uses of 'design' within military planning worldwide and currently there are few if any exhaustive summaries of military design movements or studies of design theory beyond a single service or doctrine.[36] The lack of comparative analysis of military design may contribute to this lack of understanding.

Design thinking provides a methodology to assist organisations with their practices in a more accurate and reliable fashion.[37] The methodology, which traces its early beginnings from architecture to product and industrial design, is now increasingly based on research findings, which to a large extent, influence the practical experiences previously accumulated by organisations. A growing number of modern design thinking initiatives are being applied in defence contexts internationally, stemming principally from the combat-focused Systematic Operational Design Model from the Israeli Defence Force.[38] According to Zweibelson, this model and similar design thinking initiatives have been used in what he refers to as the first-generation military design models since the 1990s.[39] The influence of design thinking methodology in defence projects, specifically within the American Army, is reflected in three major areas including: understanding the operational environment; understanding the problem; and the use of a design concept for the development of solutions.[40] It is recognised that defence planning alone is increasingly unable to satisfy the demands for the eclectic and multi-disciplinary constructs that require critical and creative thinking in areas. This promotes the need for effective procurement and acquisition, as well as operational planning and organisational change. To date, design thinking has been applied mainly as a tool for solving specific complicated or 'knowable' problems on a tactical or operational level.

Despite the growing number of projects seeking to integrate various methods of design thinking into military contexts, there still remains an uncomfortable fit.[41] Military organisations and their composition of education and training have traditionally excelled at equipping people to deal with left to right or deductive thinking. That is, problems are viewed from a known position and are reduced to manageable parcels of complexity; solutions are then explored from these known positions. Such thinking works well when the answer is knowable and is contained within a closed universe of possible solutions. Flying an aircraft, fixing a faulty piece of technology or building a bridge, while extremely complicated, are not complex and fall into this category of thinking. However, the fifth-generation future that the Air Force aspires to will be characterised by increasingly complex problems where the answer is unknowable, and only makes itself visible after much experimentation and 'prototyping for understanding'.

Frustratingly, once discovered, these dynamic complexities can very quickly change form yet again. Challenges such as multi-domain command and control, the integration of the space and cyber domains with the physical domain, or understanding China's strategic world view and consequential actions, or the causes of global human displacement are complex. While it is easy and seductive to accept the reductive, simpler and often binary expositions of solutions, such challenges require considered right to left thinking based on abductive reasoning.

Designers exercise an 'open' and complex productive reasoning pattern of abduction, focused on the end-value to be achieved without knowing how to achieve it.[42] Philosopher, Charles Sanders Peirce (1839-1941) first proposed the method of abductive reasoning, which begins with a hypothesis to explain what is going on with

a surprising, novel or puzzling phenomenon. Unlike detailed military planning, design as a practice brings with it eclectic combinations of philosophy, social sciences, complexity theory, and often improvised, unscripted approaches in a tailored or 'one of a kind' practice.[43] Ultimately, this manner of reasoning is often anathema to most military minds that are educated, trained, valued and rewarded for speed of decision to action, and are often seen as time consuming and overly esoteric. For this reason, there is a tendency within military applications of design thinking to apply methods in a manner that work to simply *reinterpret* traditional military planning processes through 'selecting element of design without disrupting the deeper epistemological structures' at play.[44]

Jericho and Air Force design

Plan Jericho was established in 2015 to realise the RAAF's fifth-generation ambition. Since this establishment, it has focused on harnessing the combat potential of the integrated and joint force, changing the way the Air Force acquires and sustains capability, and developing an empowered and innovative workforce. Plan Jericho is deliberately structured to reside outside of Air Force's business as usual running system, with its own funding sources and ability to bypass traditional military hierarchies and chains of command. Plan Jericho continues to leverage profound structural and operational advantage to act as a catalyst to support the whole of the Air Force and arguably the wider Australian Defence Organisation, including defence industry and academia to build a future force that is agile and adaptive, and fully immersed in the information age.

In 2019, Plan Jericho recognised that in order to address the unprecedented and complex problems of the future, a sole focus on the integration of the future force was insufficient. As a consequence, Plan Jericho moved to an implementation model based on 'The Edge' strategy, realising that disruption and the potential of the Air Force lies at and beyond its fifth-generation edges. Plan Jericho recognises that the future challenges will likely be defined by an acceleration of warfare's tempo where small advantages will be decisive and competition will be constant.[45] Rising to this challenge, Plan Jericho is advancing a new Augmented Intelligence to guide how the Air Force should fuse human creativity and flexibility with the precision, tempo and mass of machine processing. The efficacy of the Augment Intelligence concept hinges on the Air Force's ability to leverage human-machine augmentation to cognitively overwhelm its competitors by posing human-inspired dilemmas at machine tempo across multiple domains.[46]

Despite this recent evolution, three guiding principles continue to shape the implementation of Plan Jericho:

1. combining top-down design with bottom-up innovation

2. adopting a 'compass approach', which requires strategic planning and oversight as well as flexibility and a culture that values innovative thought

3. organisational change that is focused on integrated and joint combat effects and missions.[47]

The unpredictability of Air Force's future contests necessitates a need for the Air Force to better engage with risk and failure as a means to navigate ambiguity. In response, Plan Jericho has developed a bespoke sensemaking model. This model

offers new explanatory power for how the Air Force can transform knowledge into adversarial advantages (depicted below in Figure 3.1).[48] This sensemaking model exploits the value of design to assign meaning to novel issues or events, and connects the worlds of propositional and academic expertise with the practical expertise of the end user. Doing so, allows for proven methods to be applied to complex problems, to be developed into new knowledge, opportunities for organisational change and ultimately adversarial advantages.

Figure 3.1: Plan Jericho Sensemaking Model
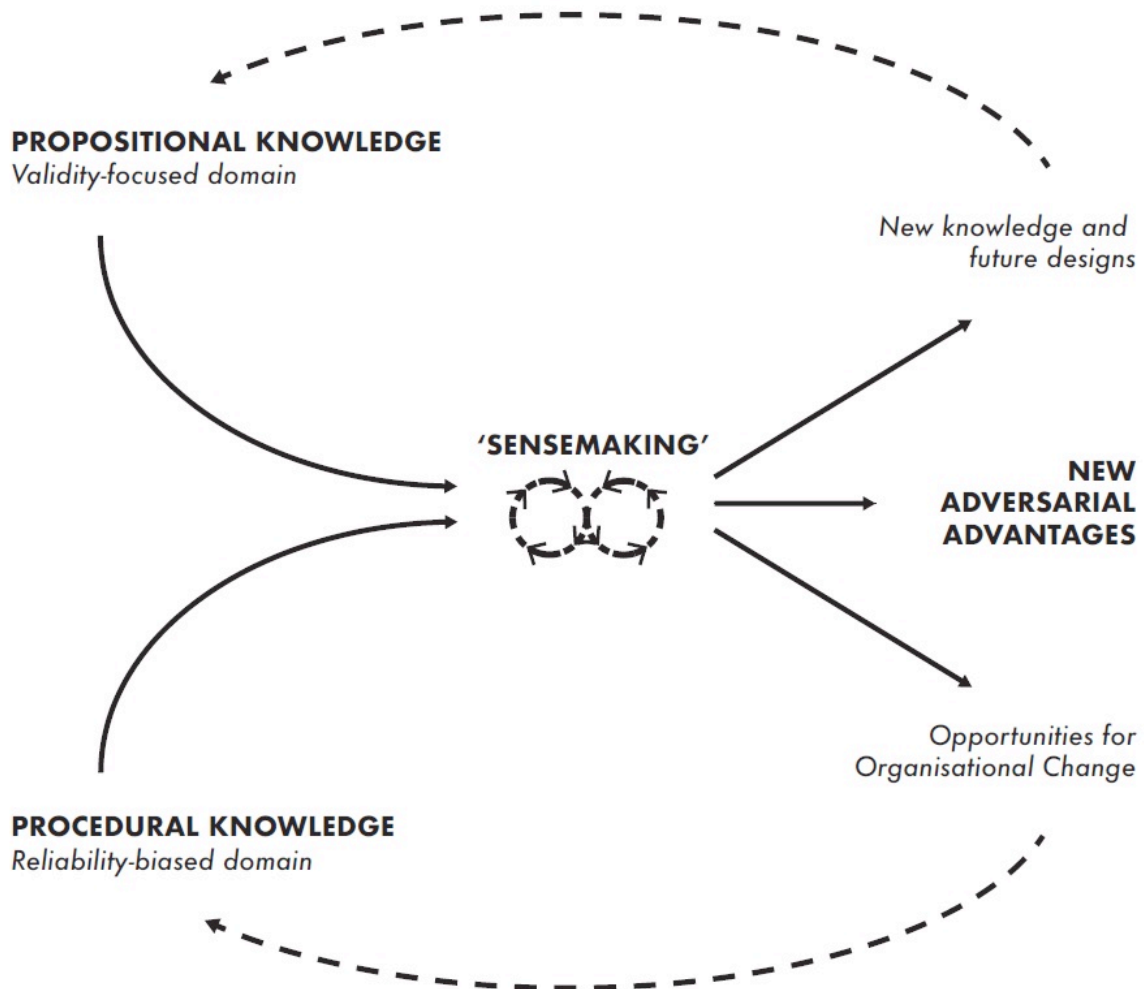
Leaning into constant contest: Fifth-generation Transient Capability Advantage

Where once it was possible for the ADF and Australia's allies and partners to achieve enduring capability overmatch, that's no longer the case. The phenomenon of 'transient advantage' means competitors can so quickly acquire and adopt peer-level systems that any advantage we might gain will only be temporary at best. With open global markets, including in the technology sector, those technologies will be 'user-agnostic'. Moreover, weaknesses in intellectual property law and other protections means that [Australia's] ability to keep technical superiority for [itself] is declining.[49]

This phenomenon of transient advantage makes for a considered shift to the dynamics in the Air Force's external environment. In this reality, any assumption of sustained and persistent military advantage by any one actor is an arrogant and potentially fatal folly. During the period 2016–2017, the Air Force—under the auspices of Plan Jericho—worked to reframe the phenomenon of transient advantage in a way that better allowed for exploitation by the Air Force, in order to generate disruptive effects and underpin the decisive *adversarial* advantages that the organisation is seeking to create.

Transient Capability Advantage (TCA) was the concept developed by Plan Jericho to help contextualise and situate the problem that 'sustainable competitive advantage, in either commercial or warfighting endeavours, is now the exception and not the rule. Transient advantage is now the new normal'.[50] The TCA concept draws from the wider and general phenomenon of transient advantage but applies an explicit 'capability frame' to give the concept greater relevance and descriptive power to the Air Force and the domain of air power professionals. This is to say that the kind of adversarial advantages the Air Force will be required to pursue in its new context will be based heavily on disruptive warfighting capabilities, and the link these capabilities have with dynamic strategies.

Air Force's TCA concept refers to how new knowledge and capability artefacts from technical to conceptual solutions can be developed using design methodologies to rapidly identify and transition science and technology into novel—even if transient—capability advantages in warfare. To fight and win in the future, the Air Force needs to excel at exploiting and integrating transient capability advantages faster than its adversaries.

The proposition at the core of the TCA concept compels the Air Force to consider developing a system of TCAs *alongside* traditional sustained capability advantages, such as major air power platforms and weapon systems. The simple contention is that these two elements of air power residing side-by-side and employed judiciously within in an integrated multi-domain construct will allow the expert holder of such a system to cycle through Boyd's OODA loop faster than the adversary. Doing so allows for the creation of an asymmetric, albeit transient, capability advantage by presenting the adversary with a continuous cycle of novel dilemmas resulting in a defeat calculus that acts at the level of both their decision cycle and the limits of the characteristics of their capabilities.

Figure 3.2 depicts a capability pathway model with two contrasting approaches. On the left-hand-side, the figure illustrates the gaining of, sustainment and then evolution of traditional long lead-time capability advantages that provide sustained overmatch in comparison to an adversary. On the right-hand-side, the figure illustrates the TCA concept; the rate of advancement of potential adversaries' capability (red line), based on current global realities, which can only be overmatched for fleeting or transient, periods with short-lived capability advantages. The proposition alluded to by this comparison is that Air Force needs to re-think its approach to generating air power based on sustainable capability advantage to a portfolio TCA approach based on the combination of both sustained and transient capability advantages.

Breathing life into the TCA concept will require a significant shift in thinking for the Air Force. Previous approaches to capability (including Capability Life Cycle processes) have seen Air Force respond to external contexts with slow and steady programs of *modernisation by replacement* to develop a sustainable advantage in a relatively

predictable environment. However, as the Air Force's adversaries continuously improve and develop new technology, there is a need to build, test and prove a TCA framework to allow Air Force to move more quickly to achieve transient capability advantages. It will be critical for the Air Force to continuously identify and deliver against the next source of transient advantage to maintain asymmetries. Indeed, it could be argued that at a more macro-level, the true advantage that Air Force would gain through the adoption of the TCA concept is not afforded by any discrete TCA, but rather it gains from Air Force's ability to have a system that can generate and integrate capability advantages more rapidly and consistently than its adversaries.

Figure 3.2: Integrated Model for Transient Capability Advantage
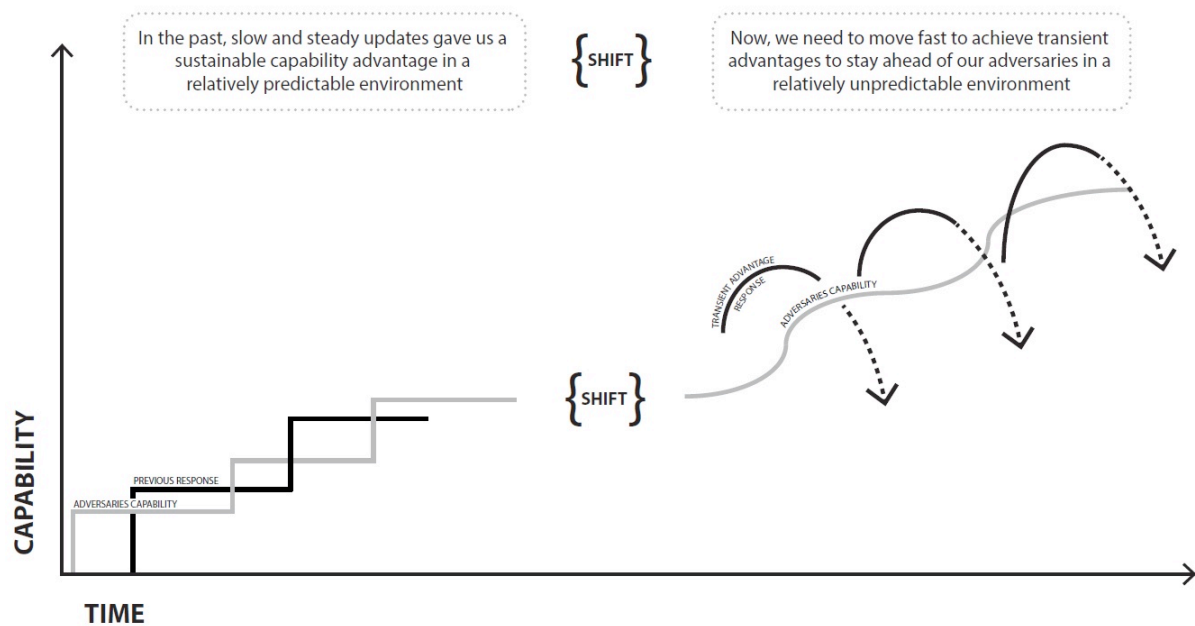
The base concepts underpinning the TCA concept are not particularly new. The concept has its origins in the same assumption that underlies the US 3rd Offset Strategy.[51] This strategy relates to the need to constantly develop flexible and dynamic capabilities that provide at least short-lived advantages over potential adversaries.

Significantly, the Air Force's conceptual and theoretical grounding for TCA is based on the concept of arbitrage. 'Arbitrage' is an economic concept that serves as a simple yet powerful way to understand this transient warfighting capability advantage, especially as it applies to the *Air Force Strategy: 2027*,[52] *Plan Jericho*,[53] and emergent ideas about future Australian air power strategy.[54] Arbitrage means to capitalise during a state of imbalance between two or more financial markets to take advantage of a price or value imbalance. In the past, an arbitrage advantage could last several minutes before the technologies of the time such as phones and faxes caught up to it. Today, given the advances in information technologies, and the democratisation of knowledge leading to the open availability of information, an arbitrage advantage may only last a few seconds or less. It follows that those best able to profit from it must quickly identify the opportunity, rapidly acquire the knowledge and capacity to integrate it, and then exploit it without delay. The combination of features required for arbitrage advantage in modern markets is emblematic of the features that fifth-generation capabilities may provide to a modern air force. Rising to this challenge, Plan Jericho has been working towards building the networks, methodologies, skills, knowledge and attributes required for the foundations upon which to build a TCA framework.

As has been explored, navigating a context characterised by non-linearity and complexity requires the specialist skill-set of sensemakers to identify and exploit opportunities and drive change. For this reason, this key function lies at the centre of the design of a TCA framework and plays a central role in realising dynamic strategy. The utilisation of design thinking in the Air Force allows for the opportunity to develop this niche sensemaker skillset and propagate the behaviours and thinking that support its efficacy. Plan Jericho and its proponents have often needed to act as sensemakers or catalysts to assist disruptive ideas with potential for warfighting capability advantage take hold and grow roots. This is often done by establishing authentic relationships with a network of actors based on a high degree of trust, empathy, expert knowledge, credibility and professionalism. This foundation of authenticity is then leveraged to connect the problem with the potential solutions to drive transformation. Wrigley describes the comparable role of the Design Innovation Catalyst (DIC) as being to 'translate and facilitate design observation, insight, meaning and strategy for all facets of the organisation'.[55] The value of a design innovation catalyst to an organisation is crucial and a major component of their catalytic role is regular interaction with learning-teaching facilitators and industry-academia.

The DIC developed by Wrigley proposes a model to engage DICs to drive innovation and capability within organisations be adopted and applied to the design of the Air Force TCA framework.[56] Wrigley defines the four stages of the DIC Framework. The first stage is the *Absorb stage* referring to the DIC discovering knowledge and theory, critiquing and questioning existing research, case studies and business models within a learning environment. Following this, DICs *Investigate* within their current organisation and gather insights and information for their current project within the organisation. From there, DICs *Challenge* current ways of working within the organisation, generate discussion, debate and tensions to challenge and explore new possibilities. Results from the DIC efforts occur when the findings of the project are *Disseminated* and contribute to capability.

The proposed TCA framework draws its final conceptual underpinning from Boyd's OODA loop to establish five distinct and iterative phases of transient capability generation.[57] As has been explored, the linkage with the OODA framework holds a particular relevance in aligning Air Forces efforts to consider non-linear approaches to strategy design and operational artistry that offer utility in a digital, contested and complex age. OODA is a well-tested, design-based heuristic that is well suited for transitioning a framework into a useful heuristic for learning.[58]

The five iterative phases of the TCA framework are: identify, translate, exploit, reconfigure and decommission. A summary of each of these phases is provided below:

Identify the opportunity (or potential opportunity) and mobilise sufficient resources to capitalise on it. This requires a disciplined and deliberated process of strategic assessment that seeks to identify critical capability gaps that are tightly aligned to the strategic objectives.

Translate the research and/or technology to a usable Minimum Viable Product capability by mobilising the Air Force innovation ecosystem (Defence, industry and academia). This requires the sensemaker(s) to leverage their knowledge networks, both propositional and procedural, to translate the needs of the end user to the makers to commence the process of prototyping for understanding.

Exploit, experiment, test and prove Tactics, Techniques and Procedures required to mobilise the arbitrage either immediately or at a time and place of choosing. Exploitation is achieved when the TCA has been fully integrated into a usable capability and is ready to be deployed to generate warfighting effects.

Reconfigure the arbitrage to extend its advantage to something novel. This a crucial step where the TCA is either repurposed or adapted for new uses cases.

Decommission if the arbitrage cannot be further reconfigured it should be declared obsolete and decommissioned.

By combining these features, Air Force have been able to develop an integrated model with design-led sensemaking at its core.[59] This model remains conceptual, but it is currently being tested, evaluated and refined through practical application and applied research initiatives.[60]

This emergent TCA framework aims to provide a model that could design and integrate TCAs faster than Air Force's adversaries can. To develop a TCA, as shown in Figure 3.3, two axes must cross: 'investigate—disseminate' and 'dynamic strategy realisation—bottom-up innovation'. Importantly, at the intersection of these axis must lie deliberate sensemaking. The TCA framework highlights identifying and observing capability gaps or opportunities within Defence and strategic contexts (top-left quadrant) and orientating and translating those opportunities into capability (bottom-left quadrant). This capability is then exploited in a manner that is geared to provide a disruptive capability advantage in Air Force's external context and disseminated (top-right quadrant), then it is reconfigured in academia or industry to extend its advantage, which is then decommissioned once obsolete, with the process commencing another iterative cycle.

Figure 3.3: Fifth-generation Transient Capability Advantage (TCA) Framework
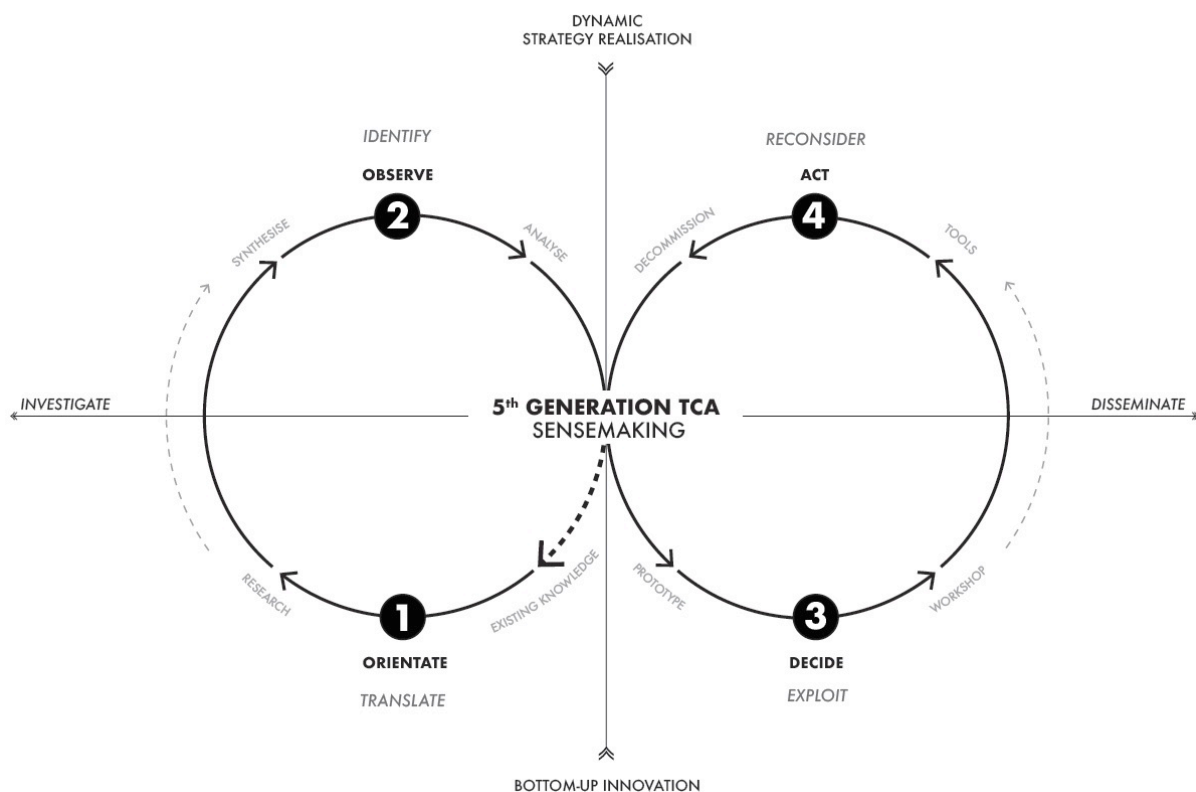
The cornerstone of success for the Air Force using the TCA framework to achieve dynamic strategy realisation is centred on 'capacity' and 'speed'. That is, being able to have a proven capacity that allows the Air Force to identify leading research or opportunities, turn it into usable capability, develop the capability into a warfighting concept, deploy it, exploit its temporal advantage and then be able to do it all over again. The capacity to do this constantly, and at speed, will afford an unassailable strategic advantage. Fast moving arbitrage requires the Air Force to be adept at achieving the TCA cycle at increasing levels of speed and sophisticated capacity.[61]

Summary, implications and future work

The challenges the Air Force faces have necessitated non-traditional, abstracted and design-based thinking about how new advantages can be generated and leveraged. However, this turn towards design methods and cognitive tools does not represent an end state, it is just the beginning. The need for non-linear approaches to address complex problems; the requirement for the Air Force to break-out of the trappings of a single paradigmatic approach to understanding strategy, capability and advantage and 'blending' otherwise opposing paradigms; and the need to adopt a new approach to fifth-generation sensemaking that builds better abductive relationships between innovative capability development and disruptive strategic realisation remain unprecedented issues for the Air Force.

From the concepts explained above a plethora of future work is needed to explore and validate the ideas presented in this chapter. Specifically, there is a need to test, validate and redesign many of the theoretical and practical underpinnings of the Air Force's TCA framework. This process of testing and validation needs to be guided by three broad lines of enquiry. The first is the need to understand how well the TCA framework builds inductive, bottom-up capabilities from within the Air Force, or from academic or industry partners. Second, the abductive sensemaking component, which is central to the TCA concept, needs to be explored in practice and how it would actually work in an Air Force context understood. Finally, the TCA framework will require establishing new types of relationships with the realm of strategy, where a two-way dynamic is developed (with emergent capabilities shaping strategies and strategies shaping emergent capabilities). To unpack these lines of enquiry, the authors propose three foundational research focus areas that require investigation.

First, there is a need to better explore how the Air Force can develop and exploit high-end science and new technologies. The Air Force is at the cutting edge of technology; however, new technologies will require unorthodox and highly original thinking. This provides a unique opportunity to disrupt current ways of working to turn high-end science into advantageous Defence capability. As design thinking is a systematic and collaborative approach for identifying and creatively solving problems, it is useful in markets that are quickly changing or where user needs are uncertain. This provides the following research questions to explore:

- How can design and high-end science fit together to design and prototype capability enhancements to counter adversary combat technologies in problem domains where unpredictability is inherent?

- What is the role of design in developing high-end science capability through prototypes taxonomies with the end user in mind?

- Do the range of scientific discoveries in the realms of SPAD, nanoscience, quantum computing, artificial intelligence and medical countermeasures vary in design approach?

- How can we design a sustained pathway for the Air Force to transform in the information age?

Second, the efficacy of the TCA framework lies in the ability to abductively link new and emergent concepts and technology, with dynamic strategy realisation (recognising that both elements will influence each other) through a process of sensemaking. The ability to create this abductive link in a meaningful way hinges on developing capabilities that can *actually* be applied for a disruptive effect to generate a transient advantage. If this cannot be achieved, there is a real risk that the Air Force will be unable to escape a rationalist trap. It would see the Air Force focus exclusively on the way it moves its chess pieces, without examining the game of chess at the metalevel. To overcome this, a very unique approach of sensemaking is required. We need to better understand how new approaches to sensemaking can be applied at the meso-level (operational and campaign design as distinct but interrelating processes), as well as at the macro-level (to the design of objective and future forces) and the development of air power strategy. This gives rise to the following research questions:

- What approaches to sensemaking are necessary to allow the Air Force to realise dynamic disruptive strategies and exploit capability advantages? How might this approach to sensemaking differ when integrated with established ecologies of operational design, campaign design, and force design?

- How can the Air Force exploit disruptive capability advantages as a consequence of fifth generation sensemaking within the TCA framework?

- How would a more interpretivist approach to strategy and force design be developed for the Air Force and how would this different paradigm be reconciled or 'blended' with the dominant functionalist paradigms the Air Force uses to underpin its capability and preparedness systems?

Thirdly, there is a need to better develop and test the TCA framework to understand how design capability should be built within the Air Force. Education plays a critical role in developing capability within individuals to enable cultural change and embed capacity within an organisation. Learning design and design thinking requires an understanding of its theoretical concepts, techniques *and* their practical application to real world problems. This requires an integrated approach to design thinking content delivery to build and develop next generation capability within individuals and create a culture of change across the Air Force. The following research questions provide an opportunity to explore:

- How is design knowledge, understanding and capability built within individuals across the Air Force?

- What factors affect the adoption of design thinking?

- How can design thinking help support organisational change and innovation?

In order to explore how successful design is at navigating complexity in these contexts, and enhancing capability across the organisation, focused, sustained and

empirically-minded modes of academic enquiry will be required. Investigating each of these areas to build capability will begin to enable the Air Force to address the challenges that lie ahead in an uncertain future.

Notes

1 A paradigm is 'a fundamental image of the subject matter within a science that serves to define what should be studied, what questions should be asked, how they should be asked, and what rules should be followed in interpreting the answers obtained'. For further discussion, see: Thomas Kuhn, *The Structure of Scientific Revolutions*, 3rd ed. (Chicago: University of Chicago Press, 1996).

2 Ben Zweibelson, 'Rose-Tinted Lenses: How American Functionalist Strategy Inhibits our Appreciation of Complex Conflicts', *Defence Studies*, Vol. 16, No. 1 (2016), pp. 68–88.

3 It is acknowledged that within an Australian Defence Force context, the term 'capability' has an assigned definition and meaning as 'the power to achieve a desired operational effect in a nominated environment within a specified time and to sustain that effect for a designated period' (Department of Defence, Australian Defence Doctrine Publication (ADDP) 00.2—*Preparedness and Mobilisation* (Canberra: Defence Publishing Service, 2013), p. 3.3). The authors utilise the term capability with an awareness of this context, but use the term with a strong emphasis on contemporary approaches to capability development as but one of many interrelated aspects within the Air Force's Capability Lifecycle Management System.

4 Peter Hunter, *Projecting National Power: Reconceiving Australian Air Power Strategy for an Age of High Contest* (Canberra: Australian Strategic Policy Institute, 2019), p. 8.

5 Peter hunter, 'More of the same isn't the answer to Australia's Security Challenges', *The Strategist* (blog), Australian Strategic Policy Institute, 7 August 2019. Online: https://www.aspistrategist.org.au/more-of-the-same-isnt-the-answer-to-australias-security-challenges/, accessed 26 August 2019.

6 Hunter, *Projecting National Power,* p. 9.

7 *Functionalist strategies* in this sense refers to the dominant paradigm of western military strategy, international relations theory and to a wider extent, sociology which are underpinned by rationalist and positivist philosophies. These philosphies seek to explain the actions of the social world through the adoptation of methodologies of natural sciences and have been generally discredited for their role in 'stifling debate over what the world is like and how we might explain it'. Steve Smith, Ken Booth & Marysia Zalewski, *International Theory: Positivism and Beyond* (Cambridge: Cambridge University Press, 1996), p. 11.

8 Zweibelson, 'Rose-Tinted Lenses', p. 70.

9 Royal Australian Air Force (RAAF), *Air Force Strategy: 2027* (Canberra: Defence Publishing Service, 2017).

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12 The metaphor of the chess game draws inspiration from that developed in: Ben Zweibelson, 'Seven Design Theory Considerations', *Military Review*, Vol. 92, No. 6 (2012), pp. 80-89.

13 Genevieve Bell, 'Fast, Smart and Connected: What is it to be Human, and Australian, in a Digital World', *Boyer Lecture Series* (Australian Broadcasting Corporation, 2017). Online: https://www.abc.net.au/radionational/programs/boyerlectures/series/2017-boyer-lectures/8869370, accessed 26 August 2019.

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[15] Hunter, *Projecting National Power*, p. 19.

[16] Aaron P. Jackson, 'A Brief History of Military Design Thinking', *Medium* (blog), 6 February 2019. Online: https://medium.com/@aaronpjackson/a-brief-history-of-military-design-thinking-b27ba9571b89, accessed 26 August 2019.

[17] Zweibelson, 'Rose-Tinted Lenses', pp. 68–88.

[18] Ben Zweibelson, 'One Piece at a Time: Why Linear Planning and Institutionalisms Promote Military Campaign Failures', *Defence Studies*, Vol. 15, No. 4 (2015), pp. 360-374.

[19] Ofra Gracier, '"Beware the Power of the Dark Side": The Inevitable Coupling of Doctrine and Design', *Expertica Militar*, October 2017, pp. 30–37.

[20] For example, the ends articulated in Defence Planning Guidance (specifically, Strategic Response Options), Australian Military Strategy, Chief of the Defence Force's Preparedness Directive, and the Quarterly Strategic Review.

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[22] Ben Zweibelson, 'The Multidisciplinary Design Movement: A Frame for Realizing Industry, Security, and Academia Interplay', *Small Wars Journal*, 10 January 2019. Online: https://smallwarsjournal.com/jrnl/art/multidisciplinary-design-movement-frame-realizing-industry-security-and-academia-interplay#_edn15, accessed 11 January 2019.

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[24] Gracier, '"Beware the Power of the Dark Side"'.

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[29] Tim Brown, *Change by Design* (New York: Harper Collins, 2008); Roger Martin, *The Design of Business* (Boston: Harvard Business Press, 2009).

[30] Hunter, *Projecting National Power*.

[31] Hunter, *Projecting National Power*, p. 21.

[32] Hunter, *Projecting National Power*, p. 14.

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[43] Zweibelson, 'An Awkward Tango', p. 12.

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57 Jackson, 'A Brief History of Military Design Thinking'.

58 Zweibelson, 'An Application of Theory'.

59 RAAF, *At the Edge*.

60 Examples include research collaborations with the University of Sydney Jericho Lab and Jericho Smart Sensing Lab.

61 McGrath, 'Transient Advantage'.

ON THE ROLES OF DESIGN IN DEFENCE

Anne-Marie Grisogono

How should we think about design in defence? This publication is an opportunity to take stock of what has been said, tried and learned so far, and also to explore some paths not taken. Ideally the outcome will be to recalibrate the way forward and reenergise implementation of design approaches in the service of improving defence effectiveness.

The origin, history and practice of design thinking in defence will no doubt be amply covered by several of the other chapters in this publication. What this chapter proposes is a fresh perspective on the value and roles of design in defence, based on first principles, systems thinking and complexity science.

But a situation appreciation is called for first. One cannot expect that the introduction of new ideas into large organised enterprises with long histories and proud hard-earned traditions will be easy or smooth. One of the founders of quantum physics, Max Planck, claimed that science progresses one funeral at a time.[1] That is much too slow for defence.

About new ideas in defence

Defence is risky business—the costs and stakes are very high, while the benefits are often elusive, difficult to measure and even more difficult to attribute. There is no end point, just an ever-evolving competitive struggle for an edge that can only be temporary. This dynamic creates an imperative for innovation, for an unflinching, realistic appraisal of what works and what doesn't, what should be retained, reinforced and proliferated, and what should be pruned, eliminated and replaced—in theory.

In practice, there are a few things that get in the way. Human nature is one, for a start—with all the well-known cognitive biases and heuristics, which channel our thinking in familiar ways and raise anxiety about change, contradiction, loss, ambiguity and the unknown, unconsciously distorting judgement as a result.[2] And, then there are inherent difficulties in separating the wheat from the chaff in the marketplace of ideas.

A reason for this difficulty stems from language itself. Words are powerful, evocative, and make it possible to discuss and reason about abstract and hypothetical ideas—but they are also often vague, ambiguous, and lacking precision where nuanced distinctions are necessary, hindering rather than enabling effective dialogue. The attachments people feel to their own interpretation of a word's meaning, deriving from associations accrued through their own experiences, contribute to the amount of effort wasted in semantic arguments. Korzybski told us we should not conflate the map and the territory.[3] The same goes for words and the concepts they represent. A map needs to be precise enough to enable accurate exploration of the territory. And, the words we use should do the same for the conceptual territory.

Then there's complexity, a commonplace motif these days in fora that discuss defence concepts—but rarely go beyond superficial nods to non-linearity, fog and friction, and black swans— acknowledging the challenges posed, but often short on practical support. We will have more to say about this in the following section.

Throw in time and workload pressures, and natural suspicions about the hidden agendas of those who stand to benefit from the latest 'big new thing', and the unfortunate consequence of all these factors is that new concepts in defence are often subject to a predictable life-cycle from which little of real value is ultimately extracted.

A new idea is launched, with some fanfare and hype, and a web of jargon grows around a catchy phrase or acronym. Then, some people drink the Kool-Aid and become enthusiastic proponents while a backlash slowly mounts from those who see it as no more than established wisdom in new clothes; or worse, see it as an assault on established wisdom and an attempt to replace it with a slick but unsubstantiated new fad. So, battle lines are drawn and the cycle plays out. If the new idea has high-ranking support then the tactics are to pay lip service as required and wait it out till the next posting cycle, perhaps white-anting its implementation at ground level. If the new idea lacks high-level sponsorship, then it's easier to ignore, and ridicule.

Meanwhile, both sides may attract new adherents but often through the aforementioned lenses of heuristics and biases, which draw us emotively to one pole or the other rather than through thoughtful deliberation and judgement. As a result, the debate is often polarised and, therefore, generates more heat than light. Over time, as people jump on the bandwagon, the concept and its associated jargon are heard more frequently. Then, its popularity peaks, eventually slides into obscurity, and it becomes passé or even off-limits. Think RMA (Revolution in Military Affairs),[4] EBO (Effects Based Operations),[5] NCW (Network Centric Warfare),[6] and COIN (Counter-Insurgency).[7]

But was there a baby in the bathwater? Of course, some new ideas do deserve to be discarded, or to be correctly identified as revamped old ones. But equally, new language is sometimes necessary to make a new distinction, or a new concept, accessible, and it pays to invest in the effort required to discover and develop its value.

The potential value of a new idea will not generally be immediately obvious or available. It needs to be discovered, developed and protected from premature rejection, until enough is understood to make a proper assessment of its benefits against its costs and risks. Just because they have different views, both proponents and opponents have important contributions to make. The former because they envisage its possibilities; the latter because they recognise its hazards. These two frames need to be appreciated as complementary not contradictory and woven into a more robust, comprehensive and nuanced view. Opponents whose concerns are heard and addressed can become supporters. And, fans whose enthusiasms are tempered by reality checks can work more effectively towards realising an idea's potential.

Admittedly, design thinking is not exactly new, even in defence, but one thesis of this chapter is that despite its successes so far there is much potential value yet to be developed. In the meantime, it is arguably still at risk of being prematurely discarded in favour of some yet-to-be-named new idea.

The other thesis, to be developed below, is that accessing the full potential value of design requires understanding that design is the logical and necessary complement of an adaptive approach to navigating complex situations successfully; that it is applicable across many domains and scales, not just at the operational level; and that much greater value can be derived when they are judiciously applied in concert, because each enables and depends on the other.

Complex problems

Complexity stems from interdependence between the elements of a situation. Because these interdependencies create many possible pathways through which consequences of changes and events can propagate, it becomes impossible to correctly anticipate all the relevant consequences of a proposed action or a hypothetical event. Conversely, it is similarly impossible to be sure of exactly what conditions to set and actions to take to achieve specified desired outcomes while also averting unwanted outcomes. This observation applies not only to the operational context but also to capability development and to the broader contexts within which defence is embedded.

Since complex problems by definition do not lend themselves to obvious solutions, it is necessary to pay attention to *how* approaches and solutions are going to be developed or, in other words, to a strategy for dealing with complexity. The outcome or product of such a strategy is also a strategy, but a specific one—the concept of how the actual situation in question will be handled.

To avoid confusion, we use the word *stratagem* to denote the strategy for the particular situation, and *meta-strategy* to denote the strategy used to develop the stratagem. While a stratagem is necessarily situation specific, a meta-strategy is couched in more generic terms.

For example, one obvious aspect of a meta-strategy for dealing with complexity is the need to take an adaptive approach,[8] which translates to an iterative evidence-based and goal-oriented engagement with the problem situation, enabling one to continuously learn about its essential dynamics and to develop, trial and adapt approaches to deal with it. In other words, the situation specific operational stratagem needs to be developed in an adaptive fashion. This is discussed in more detail below, but note here that this is only one part of an overall adaptive approach: there are several other aspects that need to be developed adaptively including goals, capability and execution of the stratagem.

There are many advantages to an adaptive approach – it does not depend on having complete information about the situation (rarely possible); when comprehensively applied it is inherently a risk-management approach, and it is the only way known to cope with situations which are rapidly evolving. Furthermore, if a complex organisation that is dealing with a large scale problem situation adopts what we have called an Adaptive Stance,[9] then it is able to effectively leverage the detailed local knowledge, insights and intelligence of all its distributed agents in the situation—a huge effectiveness multiplier. Western defence forces have increasingly recognised these benefits and the consequent need to embrace adaptivity as a response to the complexity challenges they face.[10]

However, while it is necessary to take an adaptive approach in dealing with a complex situation, it is not sufficient; and indeed, there is a hidden danger in it, if

taken to an extreme and in isolation. To illustrate, consider a humanitarian relief operation. Those contributing to international assistance efforts after a natural disaster might individually all be taking an adaptive approach to identifying local actions they can take to help victims. Nevertheless a whole situation assessment might find areas of desperate need without any assistance, and over-servicing in other areas of lesser need. Worse, the actions taken by one group may clash with those of another (e.g. one laying a road through another's building site), and natural competition between aid agencies and between individuals may lead to outright conflict, and bidding wars for local staff who can facilitate their projects. Despite best intentions locally, the overall outcome may be quite negative. Similarly, any organisation that enthusiastically embraces the need to be adaptive by instructing all its personnel to go forth and adapt without any constraint runs the risk of rapid disintegration if they do. Evidently an enterprise that seeks to deal with a complex situation has to confront the inherent tension between the alignment necessary for coherence, and the diversity necessary for adaptivity.

The answer is not to abandon the adaptive approach but to place it within a design construct that makes intelligent use of adaptive approaches and, at the same time, frames them so as to provide coherence. A major mechanism whereby this can be done is through design of the enterprise's operational stratagem, and especially two of its aspects: the adaptation architecture of the enterprise and its hierarchy of intents and associated metrics framework.

In order to flesh out this claim, we turn next to looking at the nature of design from first principles and then, in the subsequent sections, examine its importance and applications to defence operations in complex situations.

Fundamentals of design

Design takes many forms in many domains, but what is the core essence they have in common?

> [Design is a] specification of an object, manifested by an agent, intended to accomplish goals, in a particular environment, using a set of primitive components, satisfying a set of requirements, subject to constraints.[11]

This proposed definition recognisably refers to the outcome of design as being something functional, which aligns closely to the everyday intuitive meaning of design. However for our purposes in defence, it is perhaps too restrictive in implying that the designed object is material, that it is the product of a singular agent, that it is intended for a particular environment, and that its component parts are primitive. Even the implication of a well-defined set of requirements may be too optimistic in a genuinely complex situation. So we will need to generalise most of these provisos but retain the essence of what design is—the creation of something functional, something that works—and allow variability in how goals, options and constraints are determined. The outcome of design could be any combination of processes, tools, networks, strategies, tasks and so on. But, for simplicity we use the term 'system' to imply them all. Herbert Simon probably said it best: 'Everyone designs who devises courses of action aimed at changing existing situations into preferred ones'.[12] To investigate the process of design we now need the following concepts:

Design parameters are the variables that specify the essential characteristics of the system that enable its useful functions. Changing the values of design parameters results in changing what functions can be performed, how it performs them, maybe even whether it performs them, and can also change the performance outcomes. Changing the design of the system by removing or adding features also changes the set of design parameters that are needed to describe the system.

Design space is the set of all possible combinations of values of all the design parameters. The design parameters are therefore the dimensions of this virtual or conceptual space. Since the number of design parameters is very large for real systems, design space is a hyper-dimensional space. Innovation that leads to new design parameters changes the dimensionality of the design space. A particular instantiation of the system is represented by a single point in the space, i.e. a set of values specifying each of the design parameters, and an evolving system therefore carves out a trajectory through design space.

In practice, not all design parameters are equally available or suitable for modification, for example because any change in them is too costly or too harmful, or because the designer does not have the authority to change them. So it can be more useful to consider a subspace defined by those design parameters that actually are design degrees of freedom. Even with this useful reduction in the number of possibilities to be considered, it is still an immensely vast hyperspace, permitting a vast number of possible designs.

Therefore choosing values for the design degrees of freedom is not something that can generally be done in a sequential or deductive way such that there is clearly only one right answer. Rather, *design is a creative process drawing on many sources and can therefore appropriately be described as an art*.

Action decisions have their primary intended effect on/about the actual situation of interest, whether to change something in it or to discover something about it. Examples include: decisions to build, modify or destroy something in the situation; to measure or observe events in it; and to give information to, or ask for information from a participant in the situation.

Design decisions, in contrast, have their primary intended effect on what future action decisions will be possible by enabling or constraining future sensing options, action options, decision rights and responsibilities. In other words, design decisions are primarily intended to affect what outcomes are going to be possible to affect in the future, by affecting what action decisions are going to be available.

Design decisions therefore determine objectives, stratagems, capabilities, distribution policies for information and material resources, distribution of responsibilities, authority and autonomy, task procedures and doctrine, training programs, and so on. Specific examples include: decisions to develop improved sensors for finding survivors; to acquire or deploy new search equipment; to hire or fire individuals with specialised skills; or to change delegations of authority.

Such design decisions clearly impact on the subsequent action decisions that can be made about employing the capabilities that are actually available as a result of those design decisions, to do particular things in the situation of interest; for example, where to deploy rescuers and how to distribute the available emergency supplies. The projected timeframe of design decisions may be the near future in a particular

situation or it may be very far-reaching and intended to impact in a wide range of future situations that are yet to emerge. Of course real-world decisions may not neatly fall into one category or the other. But, even though there will often be impacts on both the complex situation and on what later decisions will be possible, one can in principle think about these two types of consequences separately.

Thus design decisions are about making choices that remove some degrees of freedom in the system (by assigning specific values to them so that they are no longer free) in such a way as to modify the degrees of freedom available for action decisions later. Good design then, translates into improved chances of success in those later action decisions.

There is an important design issue here—those making the action decisions later do not necessarily need as many degrees of freedom as possible, since (a) that would place too great a decision burden on them as they deal with an actual situation, (b) they may not have sufficient decision support (e.g. relevant information) and (c) the timescales required to implement some of the necessary design decisions may be too long for operational timescales. Therefore many design decisions need to be made well in advance of any intended application timeframe. This observation highlights a special class of design decisions, which we will call *meta-decisions* because they *are decisions about decisions*; in other words the decisions about *what* design decisions need to be made, *when* they need to be made, and *how* and *by whom*.

Meta-decisions are further discussed below but here we simply observe that from the perspective of those making action decisions in a particular operation these meta-decisions, and the design decisions that are consequently made prior to the operation, contribute to determining the range of options that will be available to them in the operation. If that range is too narrow and prescriptive their effectiveness may be hampered but, equally, if it is too wide and open-ended it may hamper efficiency and responsiveness. Good meta-decisions mean good design, which will translate into getting that balance right.

Why design is important—Part 1: Managing the risk in the art

The concept of design decisions presented here is much broader than a traditional interpretation of design, implying that many decisions routinely made in an organisational or operational context are in fact design decisions. There are two reasons for claiming it is important to explicitly identify such organisational decisions as design decisions:

a.   design decisions may have a large impact on future outcomes

b.   design decisions are based on conjectures and therefore entail risk.

The first point follows from the definition of design decisions: since the impacts of each design decision will be generated by all the subsequent action decisions that it makes possible (for as long as the design decision remains in force) plus, indirectly, the consequences of the inability to make the action decisions that it precluded.

The second point follows from the earlier observation that choosing the values of design parameters out of a vast hyperspace of possibilities is necessarily a creative not a deductive process.

We can also frame this in the converse: for a decision to qualify as a design decision (in this conceptualisation) there must be an element of creative choice being made. If there is not, for example if the value of that design parameter is constrained such that there is only one acceptable value for it, then setting it to that value is not a design decision but rather the logical consequence of earlier design decisions (which created the constraints). Similarly, action decisions can be seen as either calling for choices to be made or as logically deducible from existing facts.

To the extent that there is an element of necessarily free choice in either action or design decisions, the decision-maker is exercising what we can call 'art'. In the domain of defence operations, this is called 'operational art' for both operational design and operational execution/action. As intimated earlier, the use of the word 'art' is very appropriate because it is a creative process and cannot be rigorously defined, described or prescribed.

However, to the extent that such an element of free and necessary choice exists, the quality of the decision made will depend on the quality of the decision-maker's understanding of:

a.   the complex situation of interest

b.   the relevant high-level objectives or measures of success and failure

c.   the available options (for action decisions this means the capabilities that can be called upon, and therefore the available actions that can be taken; for design decisions this means the possibilities implied by the design degrees of freedom)

d.   their own experience, intuition (generalised experiences), education and creativity.

Since (a), (b) and (c) are all complex, multi-dimensional and multi-scale their understanding will necessarily be imperfect (incomplete, and incorrect in parts) and so the choice that is made as a result (through exercising operational art) is a *conjecture about what will work*, rather than a logical consequence of known facts.

Making conjectural decisions is unavoidable when one must deal with sufficiently complex problems and situations. But it is equally necessary to recognise them as conjectures and not mistake them for certain knowledge. Failing to do so amounts to taking possibly very significant but unknown risks. On the other hand, acknowledging and managing those risks invites one to ask (and act on) two very important questions:

•   How would I know? i.e., what plausibly observable evidence would indicate the conjecture was wrong?

•   How much would it matter? i.e., what would have to be changed if evidence implied the conjecture was wrong?

Expressing design decisions as conjectures means that instead of just stating what the decisions are (with or without supporting evidence, such as analytical studies) there is an additional statement expressing the underlying conjectures about how the design choices are anticipated to result in observable benefits without unwanted

outcomes, thereby also specifying what would constitute contradictory evidence, a critical enabler of a fully adaptive approach.

When the design choices are implemented, this then permits not only implementation monitoring (*were the design decisions correctly executed?*), but also conjecture testing as proposed above (*does the implementation result in the expected positive impacts and not in the unwanted negative ones?*).

Rather than waiting for good or bad news, agility calls for rapid discrimination of which of the possible paths to both wanted and unwanted outcomes are being activated, so that appropriate adaptive action can be taken promptly. The design process should therefore also identify the earliest indicators and proxies that can be monitored for such evidence, and the relevant timescales over which they can be expected to develop.

Obviously monitoring just the implementation is not sufficient to avert the risks inherent in the conjectures but just monitoring for impacts is not sufficient either—one needs both to be able to conclude that, *yes, the design was correctly implemented*, and, *no, it did not pan out as expected in the situation*, and therefore there is something important to be learned. Seeking such feedback from the complex situation and being prepared to act on it by adapting the design and action decisions that depended on the newly-refuted conjectures amounts to taking an adaptive approach to both design and action/execution.

This means that the design process never ends—it has to continue throughout an operation, continually setting up and evolving the conditions for successful action. Doing so provides some insurance against unknown risks inherent in acting on imperfect knowledge about complex situations. But, like real insurance, it depends on full disclosure—being able to identify all the conjectures (and hence risks) that are made. An unconscious conjecture, implicit in an unrecognised (design) decision, is unlikely to be critically examined and therefore the decision-makers, and the enterprise they are part of, are blind to the consequent risk it creates—until it materialises into what might by then be an emerging disaster. By that time, earlier windows of opportunity to avert the disaster, which might have been taken if an adaptive approach had been in place, are often closed.

The combination of design and adaptive approaches therefore provides an effective meta-strategy for dealing with complex situations; fostering rapid learning about what is relevant in the situation, at both the individual and enterprise level; and increasing the probability of success by enabling the operational design to continually adapt to the relevant realities of the situation.

In summary, our arguments so far for explicitly taking a broad view of design are: that it provides an integrating framework within which adaptive approaches can be exploited; and that the design process can be harnessed to elicit the otherwise implicit underlying conjectures and subject them to explicit risk management through an adaptive design process.

But there is a third argument that further strengthens the nexus between design and adaptivity. The extent of a system's ability to exploit the power of adaptation across the full range of conditions requiring it depends to a large degree on design decisions that are generally not recognised as such, and therefore often not oriented towards

enabling adaptivity. To set the context for developing this third argument, we first address the following question.

What needs to be designed?

A system is a set of interdependent elements forming a complex whole that act together in a common purpose. An operation is a coordinated set of activities undertaken (by a system) to achieve a common purpose. Operations are systems in action and systems are the means by which operations can be implemented, each providing both context and constraints for the other. This deep duality suggests that systems and operations should ideally be co-evolved in an iterative fashion.

They also both have multi-scale structure. Systems consist of functional subsystems connected in various ways, and those subsystems may also be resolved into networks of component systems with more limited functionality, etc., thereby creating a multi-scale system-of-systems view. At each scale, it is both the properties of the components and the topology of their interconnection that are important in determining the functionality that is thereby enabled. Similarly, operations can be broken down into functional lines of operations connected in different ways, which can then be broken down into networks of interlinked tasks, then procedures etc., so also creating a multi-scale and multi-dimensional view of a complex operation.

But design proceeds in the opposite direction, building up complex multi-scale networks of simpler elements. And, it is evident that the number of possible ways to select subsets of components and to assemble them into multiscale networks of various topologies is vast, for both systems and operations. Most of those possibilities will not make any sense, nevertheless there will be many possibly effective solutions, so design is essentially the problem of finding 'good enough' needles in the haystack-hyperspace of all possible designs.

Applying an adaptive approach to the multi-scale nature of both systems and operations helps structure complex design problems and make them more tractable. The system and the operation can be co-evolved through a combination of top-down sketching out of the stratagem (the highest level of the operational design) and of the system-of-systems concept (the highest level of the system design), and middle-up build and test of the possibly useful contributing plans and capabilities, with many up and down iterations between them to resolve discrepancies, alleviate identified problems, and exploit identified opportunities.

Since the lower scales of elementary procedures and functions are less situation specific and are likely to have been evolved over a long period and many previous experiences, it will generally not be useful to revisit them unless there is some innovation or identified problem at those scales calling for a reappraisal.

There are intimate linkages between successive scales: the functionality of the lower scales enables the range of possibility in the higher; the higher scales set goals for, and constraints on, the functioning of the lower. Thus changes at any scale have potential impacts at all other scales. The design process therefore needs to be iterative, not only between the system and the operation but also up and down the scales of each.

Moreover, and as discussed above, because of the necessarily conjectural nature of design decisions and the complex dynamics of the situation itself the design process

needs to be placed within an adaptive construct that seeks relevant evidence to test and evolve the underlying conjectures; and hence, evolve the designs to better fit the real situation. This amounts to a continuous learning process about the complex situation but one that is focused on the aspects that are most relevant to the success of the operation. Since success also requires avoiding many possible failure modes, which are not simply the absence of success, the relevant aspects of the situation that need to be continuously learned about are much wider in scope than those that can be directly deduced from a proposed stratagem. A devil's advocate appraisal of designs, for example of a new policy initiative, is an important tool therefore for identifying such failure modes and evolving the robustness of the design. In the defence domain, where hostile elements of the situation can be expected to look for and foster failure modes, red-teaming is employed to identify and mitigate those risks and hence develop more robust operational and system designs.[13]

It is not just the design process that needs to continue throughout an operation, co-evolving the two 'pillars' of design: the system design and the operational design. There also needs to be continuous learning about the situation, which in general will be very rapidly evolving, partly in response to the operation but also because of its own inherent dynamics. The conceptual model of the situation is the third pillar that needs to co-evolve with the operational and system designs. Finally, one more co-evolving pillar is implied by the approach described here: the collection plan to provide the information needed from the situation to feed the required adaptive processes.

Since the adaptive processes are testing and evolving the conjectures about the situation (the conceptual model) and also the conjectures about what will lead to success and avoid failure (the operational and systems designs) and since these are all multi-scale and multi-dimensional, it follows that the information that needs to be continuously collected to provide the relevant feedback for those adaptive processes can also be organised into a multi-scale and multi-dimensional framework of measures and information; or, for brevity: a metrics framework.

Putting all these threads together, we arrive at a meta-strategy that co-evolves four multi-scale pillars: the operational design, the system design, the conceptual model of the situation, and the supporting metrics framework, as illustrated in Figure 4.1. The diagram also shows some detail about the co-evolutionary cross-impacts.

Thus both design and execution are very dynamic processes, intimately engaged with each other and with the complex situation. This approach encompasses everything we would want to include in design. It relates design to operational consequences (for operational design) and to capability consequences (for system design), and helps clear thinking about design. It also helps focus the effort to learn about the situation and, hence, make best use of limited information resources.

While the diagram in Figure 4.1 illustrates the co-evolutionary relationships, it does not show how these are implemented in an ongoing engagement with the situation nor how the co-evolution proceeds temporally. The simplified schematic diagram in Figure 4.2 attempts to paint that picture.

Figure 4.1: The continuous co-evolution of situational understanding, system design, operational design and design of the supporting metrics framework[14]
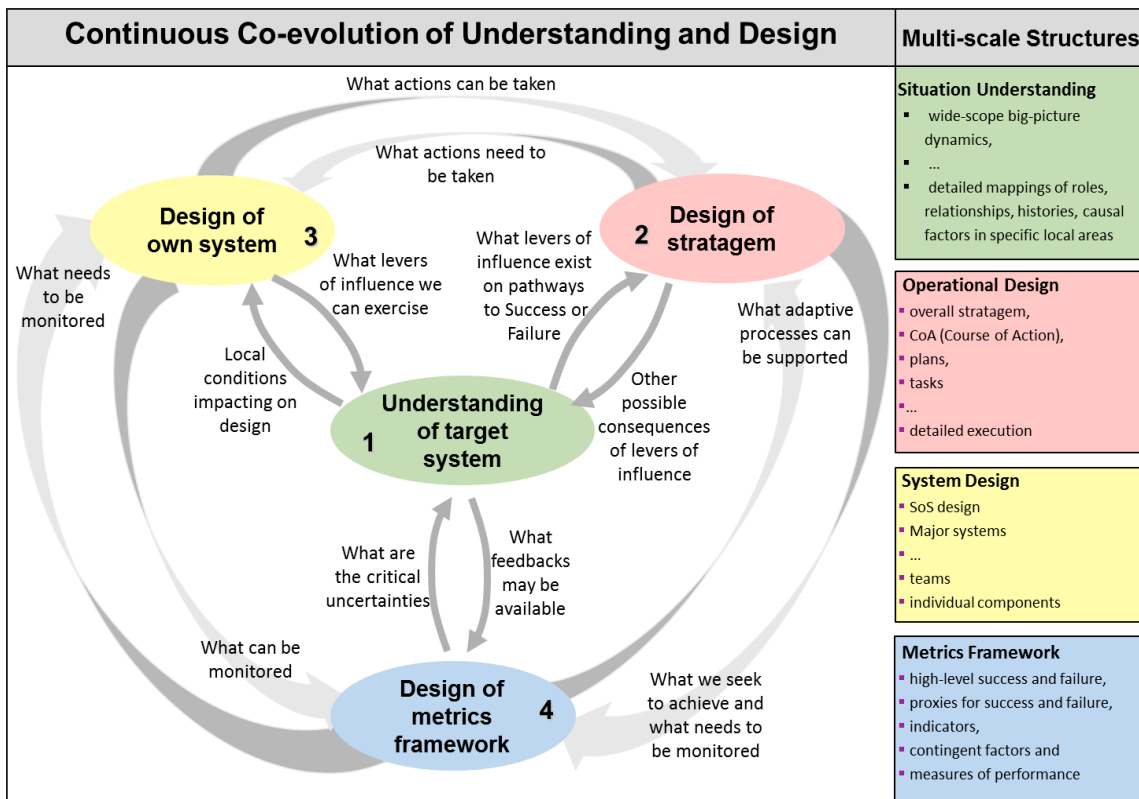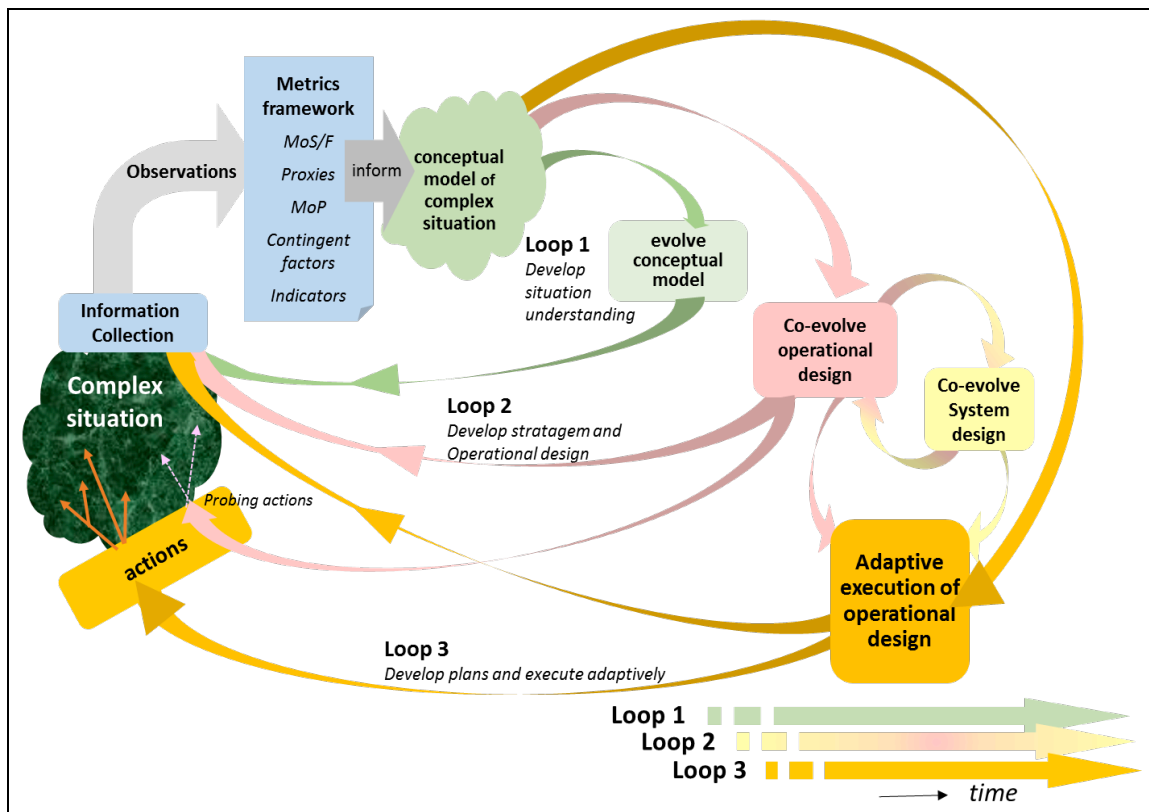

Figure 4.2: Three nested loops of co-evolution of (1) the conceptual model, (2) the system and operational designs and (3) the adaptive implementation and execution of the designs[15]

In Figure 4.2, Loop 1 begins with observing the complex situation and developing a conceptual model of it by identifying significant aspects, the causal and influence pathways leading to them, and hence relevant contingent factors and indicators (observables which convey useful information about the dynamic state of the situation). The cycle implied by the loop is one of using the current understanding of the situation to interpret the information collected, and hence forming expectations about how the situation will develop, adapting the information collection plan as a result to ensure that the subsequent relevant developments are actually observed, and then comparing them with expectations to inform the adaptive evolution of the conceptual model. One of the goals of this process is also to reduce the initially vast number of situational measures that might be observed into a succinct manageable set of indicators that is adequate to support all the necessary adaptive processes.

Loop 2 uses the conceptual model to explore how the desired high-level goals will translate into observable success and failure measures, and what intervention opportunities exist on the causal and influence pathways that lead to them. This is the cycle in which the co-evolution of operational design and systems design occurs. As design conjectures for feasible elements of the stratagem are identified, their possible positive and negative consequences through various causal and influence pathways need to be explored. Any critical uncertainties resolved through probing actions and further targeted information collection as well as cross impacts between the options being considered also need to be explored. At the same time the system design takes shape and thereby informs the feasibility assessment of options generated. The goal here is to arrive at a stratagem whose elements work together in a synergistic way to identify and mitigate the consequent risks and to identify the additional metrics (measures of performance and proxies for success and failure) needed to support the testing and adaptive refinement of the operational and system design conjectures.

When sufficient confidence is reached to begin execution of the designs, Loop 3 is initiated. To support adaptive execution, monitoring of performance and proxy measures begins in earnest. Monitoring of any additional indicators required to flag conditions arising that call for an adaptive response also begins, looking in particular for reductions in capability calling for a resilience response, and significant changes to the conceptual model (either because of new understanding, or because the situation has changed in a significant way) that would call for an agility response, i.e. a change in approach or stratagem.

As the time arrows in the diagram suggest, the three loops begin in fairly quick succession and all continue in parallel, since much of the evidence needed to test and evolve the conjectures has to come from actual interaction with the situation.

We are now in a position to give a more detailed and systematic reply to the question of what exactly it is that needs to be designed. There are two parts.

- The first part conforms to a traditional interpretation of design, and relates to what is intended to be done, and can be done. Thus at the highest scale, on the system side it calls for specifying the overall structure and functions of the system, including the relationships architecture (with partners, external stakeholders, service providers, etc. that all form parts of the extended 'system'), while on the operational side it calls for a description of the higher level success and failure measures for the situation, and the stratagem— what aspects of the situation it is intended to influence, and how doing so is

expected to transform the situation towards success and away from failure. At successively lower scales, more detail is filled in about the subsystem components and the tasks and procedures needed to use the system to implement the stratagem in the particular situation. *Together, these design aspects define the kinds of outcomes that `can` be generated in a given situation.*

- The second part relates to the adaptive properties of the systems and operations: their ability to understand themselves (their purposes, their capabilities and their current state) and their current context well enough to determine what outcomes they should be generating, when they should change what they are doing, how they need to change themselves in order to do so, and their ability to make those changes smoothly and quickly enough in the context of the situation. In other words, it is how the system and operational designs adapt in a given situation. *Together these design aspects define what outcomes `will` be generated over time, and hence how well the overall high level goals are achieved.*

Although these two design aspects are equally important, we will pay more attention now to the second part because although the need to adapt and learn is widely acknowledged, adaptibility is the part that is generally much less well understood and addressed, particularly from a design perspective.

Why design is important—Part 2: Design *for* adaptivity

Being adaptive is part of the evolutionary heritage of human beings, just as it is for all life forms to varying degrees. The extent of human adaptivity is amply demonstrated by our successes, including our remarkable recoveries from various failures. But adaptivity is clearly not limitless, and it has proved difficult, for many reasons, to engender the necessary levels of adaptivity in larger-scale human organisations.

The basic algorithm underlying adaptivity is very simple: iteration of a cycle of introducing change, testing it in real-world interaction (or realistic enough simulation) generating success-relevant feedback, which then informs a selection decision—to retain or discard?—and is followed by implementation of the selection decision.

The capability to execute the interaction testing and feedback steps of such a cycle is vested in the system design. But, the processes and authorities to introduce changes into the designs, to direct that success-relevant tests are performed, and to make judgments and implementation decisions as a result, are vested in aspects of the operational design. Most particularly, they are vested in what we term the *meta-decision architecture of the designs*.

As introduced in the previous section, meta-decisions are those design decisions that determine what kinds of decisions should be made when, and by whom, and how they will be supported. Examples of meta-decisions include the allocation and delegation of authorities to individuals and the mandating of particular decision processes; for example: how defence procurement decisions are to be made, or how decisions about recruitment and selection of staff in an enterprise are to be made. So, meta-decisions are decisions about future decisions. Some of the future decisions that will be needed are those that the adaptive processes require i.e. decisions about what changes to introduce, how to evaluate them, whether to retain

them and how to implement that decision. For that reason, meta-decisions have the power to both limit and enable the adaptive potential of the enterprise.

The reason for calling it a meta-decision *architecture* is that decisions are rarely independent. As we have seen, both action decisions and design decisions create and destroy possibilities, necessities and opportunities for later decisions, thus creating networks of interconnected decisions. The connection pattern of decisions can be important, especially in the context of adaptive processes, which call for both action and design decisions in particular patterns. The meta-decisions will determine what decision patterns are possible.

This is particularly relevant in the context of design as an integrating concept that can resolve the tension described earlier between, on the one hand, the diversity that adaptation needs and the divergence that can cause and, on the other hand, the coherence that is needed for a complex enterprise to achieve complex inter-dependent outcomes in a complex situation. The way in which design can be used to resolve that tension is through two key avenues: the design of the enterprise's multi-scale metrics framework, and the design of its adaptation architecture.

The multi-scale metrics framework was introduced above as the fourth pillar of a co-evolutionary meta-strategy for dealing with a complex situation. At its highest scale it articulates the values-based measures of success and failure in the situation, i.e. what is really important, in and of itself, to achieve or avert in the situation. Successive scales flesh out the conjecture-based proxies that become the progressively more detailed positive and negative objectives for action, until we arrive at the scale of measures of performance that indicate progress and quality of task implementation, and indicators that convey something significant about the state of the situation and may trigger the need for an adaptive response.

As such, the multi-scale metrics framework is a distillation of the essential structure of the stratagem and its subsidiary courses of action, plans and tasks, identifying:

a.   the aspects of the situation that need to be monitored to provide feedback for the various adaptive processes

b.   the intermediate goals or proxies at each scale that are therefore built in to the relevant adaptive processes as their selection criteria.

In other words, the elements of the metrics framework provide the direction-setting selection criteria for the adaptive processes as well as guiding the collection of feedback data for the adaptive processes—feedback data in the form of both implementation measures for adaptive refinement of action and effects measures for adaptive refinement of the design conjectures. It is through these two important roles that the design of the metrics framework is such a powerful means of enabling and focusing the power of adaptation in a coherent way onto the enterprise's overall high-level goals.

The second key avenue for doing that is through the design of the adaptation architecture, which describes how all the many adaptive processes, operating in parallel, are put together.

It is evident that adaptive processes in a complex situation can interact in many different ways. For example, they may interact on particular elements of the situation either synergistically (producing cumulative aligned effects) or antagonistically (their

separate effects are opposed), one may indirectly modify the impacts or the operation of another, they may interact spatio-temporally to produce oscillations or more complex patterns and so on. In the absence of an organising architecture, the potential for chaos and disintegration is significant. The role of the adaptation architecture is therefore to establish the necessary relationships between the adaptive processes, by such means as nesting them temporally and hierarchically, automating necessary linkages, e.g. to create a trigger for deliberate resolution if one adaptive process results in changes to the operating conditions of another, and creating additional adaptive processes where needed to resolve inconsistencies arising from the separate operations of parallel adaptive processes. Of course, many such relationships, linkages and processes already exist in any complex organisation or enterprise, but the point of calling them out as elements of an adaptation architecture is to pay them the attention they deserve and thus more explicitly shape and enable the adaptive potential of the enterprise in a coherent way.

In most enterprises the actual meta-decision architecture is likely to be largely an accidental by-product of decisions made for reasons of local efficiencies, tradition, administrative convenience, short-term cost-cutting and so on, all of which may have been justifiable within the frames of those decisions, but which do not necessarily combine to produce the most agile and effective use of resources to address overall goals and higher objectives in complex dynamically changing situations. Unfortunately, organisations also have the tendency to invest heavily in the structures and processes they develop to implement their meta-decisions, which then become costly and difficult to modify, resulting in organisational inertia. The complexity of existing enterprises will generally be too great for pure top-down restructuring to be effective, therefore changing the meta-decision architecture will usually be best addressed adaptively as structural and business process design issues at all scales of the enterprise.

Concluding remarks

In summary, what needs to be designed is not just the operation to be performed in the complex situation and the system capabilities that are needed to do it, but also, very importantly, the adaptation architecture i.e. what adaptive processes operate at every scale and throughout the enterprise, how they are linked up, how they themselves can evolve, and the closely related meta-decision architecture.

Together the meta-decision architecture and the adaptation architecture form a significant aspect of the stratagem and determine how the enterprise (both its systems and its operations) are able to evolve over time. So, as environments and social and organisational contexts develop and change, the enterprise can keep learning and adapting itself to achieve and maintain high levels of effectiveness in the eyes of its stakeholders. The overall process that integrates all these aspects is the co-evolution of the four pillars as depicted in Figures 4.1 and 4.2.

A key task at the enterprise level is therefore to empower and support its own systems and operations to develop their own meta-decision and adaptation architectures so that they can keep learning about their own complex changing environments, and keep adapting their own operational and system designs and the metrics frameworks needed to support them.

The benefits of design richly applied in this fashion are many. Not only does it provide an antidote to the dangers of a mechanistic approach, through stimulating

systems thinking and eliciting more comprehensive analyses of risks and their mitigations but, even more importantly perhaps, it legitimises the essential characteristics of adaptation: self-correction, tolerance of ambiguity and the restraint necessary to simultaneously pursue a particular approach in a complex situation while also resisting the temptation for total commitment to it, the better to be poised for strategic agility in response to rapid situational learning.

On the other hand, we should not underestimate the inherent difficulties in fully implementing a design approach in an organisational culture that has not yet learned to value these essential characteristics, which might easily (if superficially) be seen as contrary to traditional doctrine. Small steps in the right direction may have more chance of success than attempting culture re-appraisal on a large scale.

To close, and in keeping with these observations, we reflect on the prospects for this broader conceptualisation of design to inform defence thinking and for its full potential to eventually be realised. The inroads that have been made so far under the banner of operational design are important but, from the perspective offered here, they are only part of the story. And in order to escape the bandwagon treadmill and transition into enduring capability and practice they still have to navigate the hazards discussed in the opening section. The other part of the story rests in what the arguments presented here can contribute to buttressing the case for both design writ large and for the nascent practice of operational design, in particular.

There are two obvious opportunities. Firstly, the current practice of operational design relies extensively on discourse to explore multiple perspectives, surface assumptions and generate a richer systemic picture within each of its frames. But, if we acknowledge that the products of these dialectical processes are conjectures then it is evident that there is scope to increase their effectiveness and accelerate learning by more systematic application of an Adaptive Stance to robustly test the conjectures and evolve them in the light of real-world evidence.

Secondly, and conversely, creating the degree of adaptivity required of the defence enterprise at every scale could be greatly enhanced by more deliberate application of operational design thinking, to explore the opportunities and the risks through multiple system frames, and thereby arrive at a better prioritisation of the requirements for adaptivity, and more robust initial designs for them that can be more rapidly evolved to harvest the opportunities, and to be hardened to the risks.

Design thinking and the Adaptive Stance can each stand alone but taken together they are much more powerful. It is worth the effort to save them both from the fad cycle.

Notes

[1] 'A new scientific truth does not triumph by convincing its opponents and making them see the light, but rather because its opponents eventually die, and a new generation grows up that is familiar with it'. Max Planck, *Scientific Autobiography and Other Papers*, referenced in: P. Azoulay, C. Fons-Rosen and J.S. Graff Zivin, 'Does Science Advance One Funeral at a Time?', *NBER Working Paper No. 21788*, December 2015, revised October 2016, p 1.

[2] See, for example: D. Kahneman, *Thinking—Fast and Slow,* New York: Farrar, Straus and Giroux, 2011.

[3] 'A map *is not* the territory it represents, but, if correct, it has a *similar structure* to the territory, which accounts for its usefulness'. Alfred Korzybski, *Science and Sanity: An Introduction to Non-Aristotelian Systems and General Semantics* [1st ed. 1933], Institute of General Semantics, 1994, hardcover, 5th edition, ISBN 0-937298-01-8., p. 58. (Emphases in the original).

[4] E. A. Cohen, *A Revolution in Warfare*, Foreign Affairs, March–April 1996, pp. 37–54.

[5] E.A. Smith, *Effects-Based Operations* Command & Control Research Publications (CCRP), Washington, 2003; P.K. Davis, *Effects-Based Operations (EBO): A Grand Challenge for the Analytical Community.* RAND, Santa Monica, 2001.

[6] D. Alberts, J, Gartska and F. Stein, *Network Centric Warfare*, DOD Command and Control Research Program, Oct. 2003

C. Wilson, "Network centric operations: background and oversight issues for congress", DTIC Document, 2007.

[7] K. Friis *Revising COIN – The Stakeholder Centric Approach.* in S. Gates and K. Roy (eds.): War and State-Building in Afghanistan: Historical and Modern Perspectives. London: Bloomsbury, 2014.

[8] A. M. Grisogono & A. J. Ryan, *Operationalising Adaptive Campaigning*, 12th ICCRTS (International Command and Control Research and Technology Symposium), Rhode Island, 2007; A. M. Grisogono, M. Spaans, M. Spoelstra, E. Douze, & R. Pieneman, *Learning to be Adaptive*, 14th ICCRTS, Washington, 2009; The Technical Co-operation Program, Joint Systems and Analysis Group, Action Group 14: Complex Adaptive Systems Science for Defence. *Synthesis Report: A Conceptual Framework for Adaptation,* DOC–AG14 - CFA #3-2010, 2010.

[9] In brief the Adaptive Stance consists of four elements: (1) ambiguity tolerance; (2) willingness to have one's ideas proved wrong and changing them as a result; (3) turning conjectures and assumptions into explicit expectations, and deliberately seeking disconfirming evidence; and (4) supporting peers and subordinates in doing the same. For more details, see: A. M. Grisogono & V. Radenovic, *The Adaptive Stance– steps towards teaching more effective complex decision-making*, International Conference on Complex Systems, Boston, 2011.

[10] Examples include: US Office of the Chairman of the Joint Staff, *Joint Publication 5-0 Joint Planning*, 2017; Australian Army, *Adaptive Campaigning: Future Land Operating Concept*, Canberra: Defence Publishing Service, 2009; and various implementations of Systemic Operational Design.

[11] P. Ralph & Y. Wand, 'A proposal for a formal definition of the design concept' in: K. Lyytinen, P. Loucopoulos, J. Mylopoulos & W. Robinson (Eds.), *Design Requirements Workshop,* Cleveland, OH, USA, June 3-6, 2007: Lecture Notes in Business Information Processing,.Springer-Verlag 2009, pp. 103–136.

[12] H. A. Simon, *The sciences of the artificial*, Cambridge, MA: MIT Press, 1996.

[13] For example, see: Ministry of Defence, *Red Teaming Guide* (2nd ed.), Shrivingham, UK: Development, Concepts and Doctrine Centre, January 2013. Available online:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/142533/20130301_red_teaming_ed2.pdf, accessed 28 May 2018.

[14] *Notes about Figure 4.1:* Labelled arrows indicate the primary impacts of changes in one area on another. The multi-scale structure of each is illustrated in the tables on the right.

[15] *Notes about Figure 4.2:* The supporting metrics framework evolves throughout in response to the needs for feedback and information that arise in the three loops. Each loop is shown to provide direction to the information collection plan, and to be informed by the information collected and structured by the evolving conceptual model. The sequence of initiation is shown but once commenced, all three adaptive loops continue concurrently in an ongoing engagement with the complex situation through both actions taken in it, and information collection from it.

DESIGNING MEANING IN THE REFLECTIVE PRACTICE OF NATIONAL SECURITY: FRAME AWARENESS AND FRAME INNOVATION

Christopher Paparone[1]

> *…objects, events, and situations do not convey their own meanings, [rather] we confer meaning on them.*
>
> Herbert Blumer, *Symbolic Interactionism*, 1969[2]

One of the key criticisms of the recent national security design movement has been how to translate divergent, seemingly boundless, multiparadigmatic, and transdisciplinary social science concepts—a continuously open array—into effective professional practice. On one hand, design theorists complain that due to the underpinning postmodern and antipositivist philosophies associated with the movement you cannot create institutionalised frames of reference that inappropriately result in a relatively stable, 'how-to' design doctrine.[3] On the other hand, national security practitioners protest that without a design methodology complete with well-articulated standards of performance, professional schools cannot train and educate their members in a replicable and assessable fashion.

This tension between being open to exploring unrestricted and incommensurate ways of framing and desiring a technique-based, standardised learning framework is a perplexing and recurrent issue that must be addressed by design-oriented members of the national security community. I attempt to do so here by applying Donald A. Schön's decades of work dedicated to finding ways to address this contradiction (he calls the 'crisis of professions'), which culminated in his seminal two volumes describing his theory of reflective practice.[4] Centred on creative design and critical reasoning, the logic behind Schön's theory of reflective practice is well suited for the multi-disciplinary field of national security and is based in the following two assumptions.

The first is *contextuality*. As Herbert Blumer asserts in the epigraph above, professionals should acknowledge that objects, events, and situations involving national security do not convey meaning; rather, national security practitioners and their institutions construct and impose meanings on them. The national security professional would not need to address ambiguous and unique challenges if institutionalised frames of reference were sufficient to guide their practice across all situations; they would then simply be technicians. The metaphoric idea of 'framing' (like that of a 'window' through which we 'see' the 'world'—a worldview) indicates the ways we are socialised to interpret objects, events, and situations. Reflective practice requires (1) the never-ending morphing and designing of meanings we use to conceptualise objects, events, and situations and (2) demands that professionals make heedful judgments about institutionalised frames, and when necessary strive to deinstitutionalise them, and that they seek to create modified or replacement frames while reflecting in- and on- action.[5]

The second assumption is *transdisciplinarity*. Reflective practitioners critically explore frames that purposefully go beyond the otherwise stove-piped applied arts and science disciplines that typify professional schools; that is, Schön examines the learning strategies required *across* and *beyond* professions, highlighting applications in music, divinity, psychiatry, social work, architecture, urban development, law and others in his books and related articles. He draws attention away from using the so-called 'proven' techniques of professional practice as the sole source of teachable methods. Schön demands that the educator's responsibility rises above such 'technical rationality' that unbendingly demands performance with institutionalised frames of reference, extant knowledge, and pre-set competencies.

My purpose henceforth is to present some practical ways to achieve reflexivity in practice that can be facilitated in professional schools associated with national security, namely describing ways to help student-practitioners learn how to become better nquirers.[6] Professional schools that embrace reflective practice emphasise the faculty's facilitation role in exposing *frame rigidity* and encouraging *frame reflection*.[7] This coaching role helps the practitioner (1) reflect critically on their personally or institutionally accepted concepts that guide their professional practice i.e. frame awareness; and, (2) cope creatively with unfamiliar situations by (a) learning to extend and displace old frames into new frames and (b) conducting thought experiments with a multiplicity of non-traditional frames i.e. *frame innovation*.

Facilitating frame awareness and innovation

> *When a practitioner becomes aware of his frames, he also becomes aware of the possibility of alternative ways of framing the reality of his practice…. Once practitioners notice that they actively construct the reality of their practice and become aware of the variety of frames available to them, they begin to see the need to reflect in action on their previously tacit frames.*

> Donald A. Schön, *The Reflective Practitioner*, 1983[8]

Frame awareness begins by exposing frame rigidity. Frame rigidity refers to a blindness to alternative conceptualisations of objects, events and situations that artificially set 'a boundary that cuts off part of something from our view while focusing our attention on other parts'.[9] Reflective practice offers a holistic antidote, entertaining multiple and simultaneous frames, that is to say it embraces a plurality of concepts that seek to assist the practitioner to recognise frame rigidity and insightfully design revised or new meanings onto objects, events and situations.[10] The intent of design in professional practice, then, is to emancipate oneself from, or at least remain sceptical about, personally—and institutionally—habitualised frames and purposefully diverge into the process of innovating new meanings while facing or anticipating unique situations where traditional frames do not seem to work.

To stimulate frame awareness and innovation, I recommend four approaches to facilitating andragogy in professional school settings; two are *linguistic* and two are *relational*. To be clear, these stem principally from a meta-philosophy associated somewhere among the neighbourhoods of postmodernism and antipositivism, and particularly with the interpretivist methods derived from the Sociology of Knowledge discipline and the Social Construction of Reality theory.[11] I must caution the reader that I am not suggesting these approaches are mutually exclusive as there are neither logical borders among them nor do they represent a complete set of

approaches to frame awareness and innovation. There are other philosophies, disciplines and theories that may yield important and disruptive understandings. Linguistic approaches involve (1) having students explore how they may reflexively exercise *onomasiological* exposure as an antidote to frame rigidity; and, (2) exposing practitioners to their tendency to frame while that they are uncritically exercising *metaphoric framing*. Relational approaches involve (3) *multiparadigm* inquiry by students; and, (4) exploring how *paradoxical reasoning* provides values-based ways to detect conflictual interpretations of the same phenomena.

Onomasiological exposure

> And so in every way they would believe that the shadows of the objects we mentioned were the whole truth….Then think what would naturally happen to them if they were released from their bonds and cured of delusions.

<div align="right">

Plato, *The Republic*, ~360BC[12]

</div>

Detecting onomasiological meanings refers to methods of *linguistic historiography* that expose how theorists produce variants on an extant concept conveying roughly the same meaning. What better exemplar could I employ here than one of the principal subjects of this article, that is, to onomasiologically expose the repeated use of the concept *frame rigidity*? We can arguably go back in textual history to at least 360BC, when the Athenian, Plato, wrote *The Republic*, and find more evidence of the same idea of human false consciousness framed with shared objectivations about reality. Plato's allegory of the cave tells the story of groups of 'prisoners' who believe they are witnessing the real world not knowing that these were but 'shadows of the object'.

In other words, the allegory speaks to the problem of concepts that become rigid precepts indicating an unreflexive process of reality construction. Fast forward two millennia, onomasiological analysis reveals Max Weber's simile, the 'iron cage', which he uses to describe how bureaucratic rationality (legalistic, mindless rule-following) may blind practitioners from considering other ways of framing their social world. Figure 5.1 is a sample of how writers across history and many social science disciplines have published variants on the same logic of Plato's 'shadows of the object' that 'imprison' our minds from seeking alternative conceptualisations of objects, events, and situations.

One classroom approach would be to have student-practitioners research the onomasiological historiography of national security concepts that convey the same basic meanings with different words. Modern militaries have a history of operational frames that mean roughly the same thing. For example the US Marine Corps published its *Small Wars Manual* in 1940, framing war through the logic of a scaled continuum; that is, if you have small wars then you must also have medium and big wars. In 1959, Rear Admiral Eccles, while on faculty at the Naval War College, produced a 'spectrum of conflict' graphic (Figure 5.2).[13] In his 1960 book, *The Uncertain Trumpet*, General Maxwell Taylor developed a similar idea that led to the Kennedy Administration's 'flexible response' and the establishment of the Green Berets for the 'irregular' wars.

Figure 5.1: Onomasiological exposure of the meaning of frame rigidity. These are different naming conventions of roughly the same concept of Plato's shadows of the object[14]

1. "shadows of the object" Plato (~360 BC/1974)
2. "signs of mind" Peirce (1885)
3. "iron cage" Weber (1921/1958)
4. "schema" Piaget (1923/1928)
5. "reification" Lukács (1926/1971)
6. "ideology" Mannheim (1936)
7. "frame of reference" Sherif (1936)
8. "standard operating procedure" War Department (1942)
9. "self-fulfilling prophecy" Merton (1948)
10. "orientation of action" Parsons & Shils (1951)
11. "logic of action" Austin (1957)
12. "paradigmatic" Kuhn (1962)
13. "organizational imprinting" Stinchcombe (1965)
14. "theories-in-use" Argyris (1976)
15. "mental models" Johnson-Laird (1980)
16. "groupthink" Janis (1982)
17. "technical rationality" Schön (1983)
18. "routines" Perrow (1986)
19. "habitus" Bourdieu (1990: 53)
20. "authoritative response" Heifetz (1994)
21. "competency traps" March (1994)
22. "institutional action frames" Schön & Rein (1994)
23. "habituated action patterns" Weick (1995)
24. "red tape" Bozeman (2000)
25. "entrainment thinking" Snowden & Boone (2007)
26. "epistemic scripts" Boxenbaum & Rouleau (2011)

Figure 5.2: The Scaled Continuum Frame from Henry Eccles' 1959 book
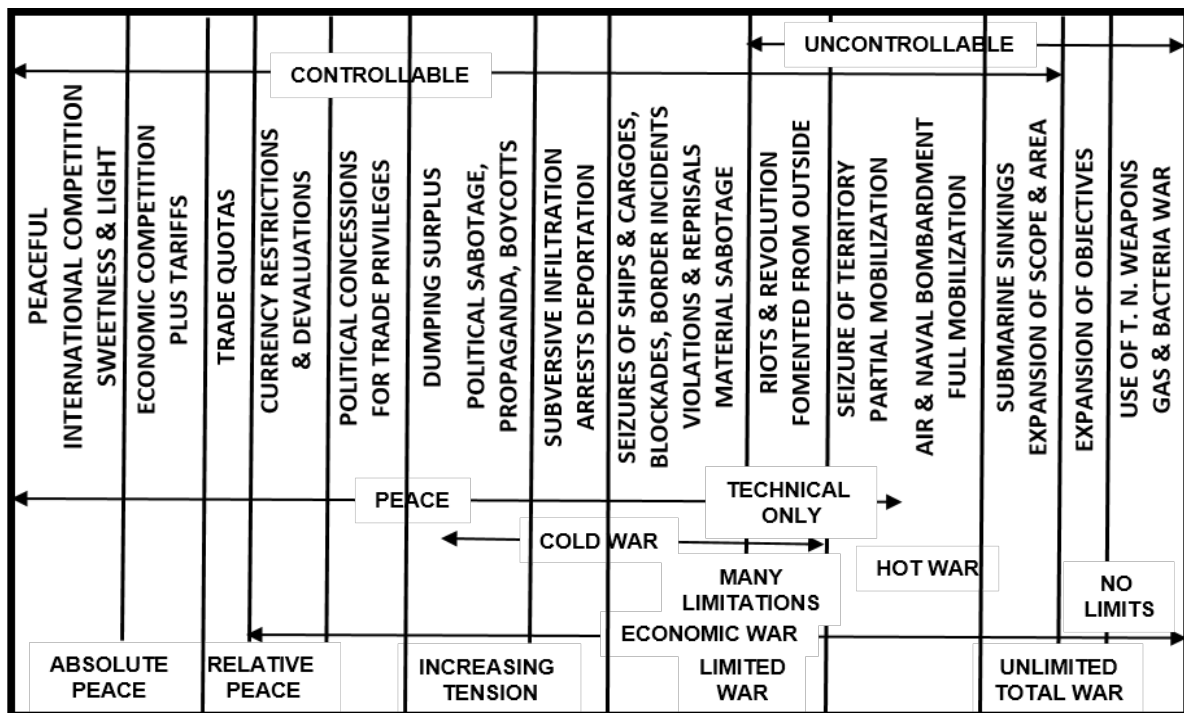
In 1962, the US Army published its operations doctrine that included a 'spectrum of conflict'—where at 'one end of the spectrum, are those conflicts in which the application of national power short of military force is applied'.[15] Using the same logic, by 1986, doctrine spoke to a scaled continuum ranging across 'high-, mid-, and low intensity conflicts'.[16] Today, US joint operations doctrine describes the same basic concept of 'the range of military operations' as a hallmark idea, which is another variant of the original scaled continuum idea.[17] US Special Operations Command contends that the 'Gray Zone' (the space between the peace and war continuum) is a concept innovation worthy of a white paper (usually reserved for ground-breaking concepts).[18] The latest Chairman of the Joint Chiefs of Staff publication, *Joint Concept for Integrated Campaigning*, makes claims to a 'new' framework in this, presumed futuristic, document (see Figure 5.3).[19]

Figure 5.3: 'The Competition Continuum'

Onomasiologically, the idea of a scaled continuum of conflict has been repeated in several variants in US operational doctrine for almost 80 years.

The unreflexive learner may view 'ROMO', 'Gray Zone', and 'The Competition Continuum' as recent frame innovations if they are not versed in frame awareness through the onomasiological historiography of like-meanings. The value of this form of research is to create 'aha moments' as the more reflective practitioners begin to realise that the technically-rational professional school of thought may be 'stuck' in the 'same old' concepts from the past and that frame innovation, fostered by neologisms that mask ideas already expressed. The onomasiological approach leads student-practitioners into critical frame awareness thereby recognising when a proposed frame has the qualities of being truly innovative. They can learn to allegorically step outside the shadows of 'Plato's cave' and into the 'sunlight' of imaginative framing. Highly related to allegories, the next linguistic approach involves creative excursions through metaphoric reasoning.

Metaphoric reasoning

> *In reading…organizations it is important to place ourselves in an active mode. We are not passive observers interpreting and responding to the events and situations that we see. We play an important role in shaping those interpretations, and thus the way events unfold.*

> Gareth Morgan, *Images of Organization*, 2006[20]

In the last three decades, we have begun to see the value of studying metaphors that serve as frames of reference. While not yet a mainstream approach in professional schooling in national security or international relations programs, some pioneering

authors and professors have made this their principal course of study, drawing from the field of cognitive linguistics.[21] For example, Michael Marks has written three books dedicated to metaphoric-based theorising in the field of International Relations (IR). He traces many theoretical constructs to root metaphors and asserts that scholars of IR should be aware of these root meanings in order to judge the strengths and limits of these extended meanings and further he suggests that confining theory to a single or narrow assortment of metaphors may preclude frame innovation. Likewise, modern military operational concepts are based in root metaphors, particularly derived from displaced Napoleonic concepts of 'combined arms' and from the logics of mechanical (closed systems) and biological (open systems) systems theory.[22] See Figure 5.4 for sample summaries based on each metaphor.

Figure 5.4: Eight images offer 'lenses' through which to assess organisations, each offering a valuable view

Machines — My agency has a bureaucratic or mechanistic image of modern twentieth century organization with emphasis on control through legalistic, hierarchical authority. Organizations in this agency are designed with block and wire diagrams that reflect unambiguously who has power and who does not. Officers, civil servants, and contractors are "cogs in the wheels" of activity, and senior management views the organization and its members as an instrument of (insert *raison d'être*) and that "alignment" of all members "rowing in the same direction" is paramount to success. Changing direction is a matter of formal authority or coercion, because change is not only predictable, but must be controlled.

Organisms —Like biological organisms, my agency is an "adaptive system" that must evolve by adjusting to its environment or face mal-alignment issues or death. The agency members view organization design as a problem of envisioning the alignment of subsystems with a well-studied environment in order to grow by obtaining resources to optimize its performance with a clear advantage over other organizations that have like missions. Changing direction is a result of "self-organizing" around a "self-organizing" process that is responsive to ecological forces and while usually evolutionary, but may also be punctuated.

Brains—My agency is best conceived as a "learning organization" as it is a "neural network" seems holographic-like with redundant systems of learning with emphasis on multi-purpose teams. Designing the organization is a matter of ensuring the communication of understanding exists for learning equally across the entire network. "Lessons-learned" and "best practices" are accumulated and accessible by all. Changing direction is a learning process that is based on wholesale interpretations of nonlinear or dynamic feedback.

Cultures—My agency is a distinct culture that has varying degrees of unifying beliefs and values that guide day-to-day activities. The agency also has multiple subcultures that reflect sources of intra-agency conflict. Organizational design must appreciate the culture. Organizational transitions reflect transformational change in values.

Political Systems —My agency is a composite of political entities within a larger political environment, with individuals and groups having competing interests. The design challenge is to minimize conflicting interests and get the job done by negotiating, building consensus, and creating coalitions. The approved design is a matter of factional power struggles in a (pick one: democratic, authoritarian, socialist…) political process.

Psychic Prisons —My agency is comprised of people with collective "hidden psyches." It designs itself so that organizational power is configured to suppress ideological differences without acknowledging the existence of these ideologies. Organizational change is possible only through deep probing into the "psyche" of the most powerful organization members and finding their hidden motivations.

Flux and Transformation—My agency morphs in a radical, complex, and unpredictable ways. It can be studied only through perceiving patterns of paradoxical decision tradeoffs in a uninterpretable world. Change is about understanding the paradoxes, and leaders strive for large, bifurcated changes with small, innovative initiatives that may have unpredictable, amplified effects. Like with the "organism" and "brain" image, design emerges through and adaptive and learning process, but this emergence is more radical and mostly not understandable.

Instruments of domination —My agency has a seamy or Machiavellian side that uses and abuses people, groups, both inside and outside its boundaries for its own interest. Design is a matter of manipulating conditions in the interests of the organization, but the employees may revolt! Organizational change is a manipulation through power and controlling the "meta-narrative" which controls the way employees see and act in the world.

I have employed Gareth Morgan's book, *Images of Organization, a*s part of a quest for achieving frame awareness and to stimulate frame innovation as part of reflective practice. Morgan recommends having a compounded view of organisations, relating many views on the same phenomenon. Student-practitioners choose at least two of Morgan's eight images to compare and contrast their last job setting and write a three

to five page assessment describing dominant cultural values, decision making, change management, leadership, and overall beliefs about organisation effectiveness from those points of view.[23] The learning outcome is focused on the student-practitioners gaining confidence and competence in interpreting organisations from several very different perspectives and learning how such appreciative inquiry can serve them well as reflective practitioners in sizing up their own and other stakeholders' organisations in their careers ahead.

Similar to linguistic approaches, relational methods may serve as a source of frame awareness and innovation in at least two other ways: multiparadigm inquiry and paradoxical reasoning.

Multiparadigm inquiry

> *Multiparadigm inquiry fosters intense reflexivity…, helping researchers examine their work and selves at new depths. This is not to say that reflexivity is the ultimate goal, as it may, if taken to its extreme, encourage the formation of 'navel-gazing' scholarly communities - excessively introspective and egotistical. Given such precautions, however, one of the greatest values of multiparadigm inquiry is the potential for personal learning, even enlightenment. From our own, first-hand experiences as well as the writings of other multiparadigm researchers, we believe that the exploration of alternative worldviews opens powerful doors of perception. Researchers often note that multiparadigm inquiry forever altered their perspective, impacting their future research even when attempting to return to more single-paradigm concerns.*
>
> Marianne W. Lewis & Mihaela L. Kelemen, *Multiparadigm Inquiry: Exploring Organizational Pluralism and Paradox*, 2002[24]

Figure 5.5 shows four sociological paradigms developed by Gibson Burrell and Gareth Morgan, each having very different purposes, logics and methods associated with a particular worldview.[25] In other words, relationalism requires conceptualising national security empathetically, giving voice to contrarian ways while demanding that no paradigm is ignored.

Application is possible in a professional school setting. One technique is to divide a graduate seminar into four groups and assign each group to inquire into a national security issue (such as US involvement in the recent Syrian civil war) and ask the student-practitioners to argue for a policy based on their assigned paradigmatic position. When student-practitioners present their findings to each other, in written or oral form, they experience relational empathy while interpreting situations and events through profoundly different frames. The target learning outcome is not only to improve frame awareness but also to realise frame innovation can emerge through the 'bracketing' of paradoxical perspectives, which is also the intent of the next relational approach.

Figure 5.5: Four sociological paradigms for national security inquiry[26]

Sociological Paradigms	Purpose	Assumptions	Methods of Inquiry
Functionalism	Remove dysfunctionalities or unruliness in an otherwise stable national security system	The world is objectively deterministic and the restoration of system equilibrium is inevitable (e.g., a realist view that contends a balanced nation-state ecology exists to prevent chaos)	Argue how nations (agents or actors) strategize decisions to deter, enter, or exit war and procure human and material means as needed. This sort of inquiry should be familiar for staff and war college students as it represents the rational actor model of how national security functions as a system.
Radical humanism	Sweepingly emancipate the masses from alienating and oppressive power arrangements	Reality is subjective and radical social change is motivated by emotional and voluntaristic collective action in response to elitist power/knowledge (like colonialism, empire-building, occupation, etc.)	Deconstruct text or dominant narratives; conduct post-territoriality/colonial analyses; expose powerful institutional objectivations that are tied to social injustice (like spending too much on defense and too little on socialistic programs); give voice where voice is being suppressed.
Radical structuralism	Anticipate transformative, material changes in systems of warfare due to economics and technological "waves," and the emergence of national power asymmetries	Reality is objective and systemic; radical change in the system is possible usually associated with breakthroughs with both technological ways and economic means	Investigate historic discontinuities or revolutionary disruptions of national security stasis; find the surprising irregularities (such as nonstate actors, terrorists, hackers, and covert foreign defense industrialists who infiltrate our nations' critical technologies) that punctuate the otherwise regularity of national security; project that there will be more surprises in the future; look for the next technological breakthrough that will change national security as we know it
Interpretivism	Induce or confirm repeating patterns of meaning in the stream of human events over time	Reality is subjective; hence, cultural constancy and habits of mind are appreciable, particularly if viewed over long periods	Conduct hermeneutic studies of national security documents and history texts; pay attention to onomasiological meanings, uses of metaphor as frames of reference; and, employ anthropological methods to make sense of contemporary human conflict and national security issues

Paradoxical reasoning

> *Relationalism is a thought system in which concepts and entities enjoy no final definition, but are constantly redefined by their context. In such a system, paradox is not an irrational state; that is, a paradox need not be rendered rational through the cancellation of one or the other of opposing entities of which it is composed. Instead…entities simply exist with respect to and within the context of another.*
>
> Ming-Jer Chen & Danny Miller, *The Relational Perspective*, 2011[27]

Similar to the reasoning through simultaneous and conflicting paradigms, the use of paradoxical reasoning can be traced at least to 18th and 19th centuries' German philosophers Immanuel Kant and Georg Hegel, who also had a strong influence on Carl von Clausewitz's portrayal of metaphysical contradictions or dialectics in the study of war.[28] These are not 'either-or' propositions, rather, these are polar opposites 'with-respect-to' (wrt) each other.

How does one go about shifting from expecting categorical ways of framing to a more flexible, patterned way of framing?

One technique is to create a four-square demonstrating simultaneous yet opposing frames. For example, Chris Paparone and James Crupi published a 2005 article portraying the principles of war as paradoxical patterns, demonstrating that when two continua are crossed (external-wrt internal-opposites; initiative-wrt command and control-opposites), they create relational patterns which one can apply to referential situations. These patterns become useful for creating multi-frame awareness, showing graphically when principles of war (a.k.a. values) relationally 'compete'.[29]

One idea is to have a seminar facilitator direct their students to plot historic campaigns on a 'radar-like' scale and, in lieu of the typical comparative 'campaign analyses', have them conduct comparative 'campaign syntheses'. For example, Figure 5.6 compares a pattern associated with the 1942 Marine Corps Guadalcanal campaign with the Desert Storm campaign's ground force operations in February 1991. Note how economy of force (particularly for logistics support) was relationally a trade-off for mass in the initial battles of Guadalcanal while mass (force build up) was achieved before offensive operations commenced in Desert Storm. Compare the relationships between security and manoeuvre for both campaigns. Examine the 'patterns' when considering all of the principles in relation to the others.

Figure 5.6: The principles of war as paradox: comparative campaign patterns[30]

Guadalcanal Campaign
Initial Operations August 1942

Desert Storm Campaign
Ground Operations Late February 1991
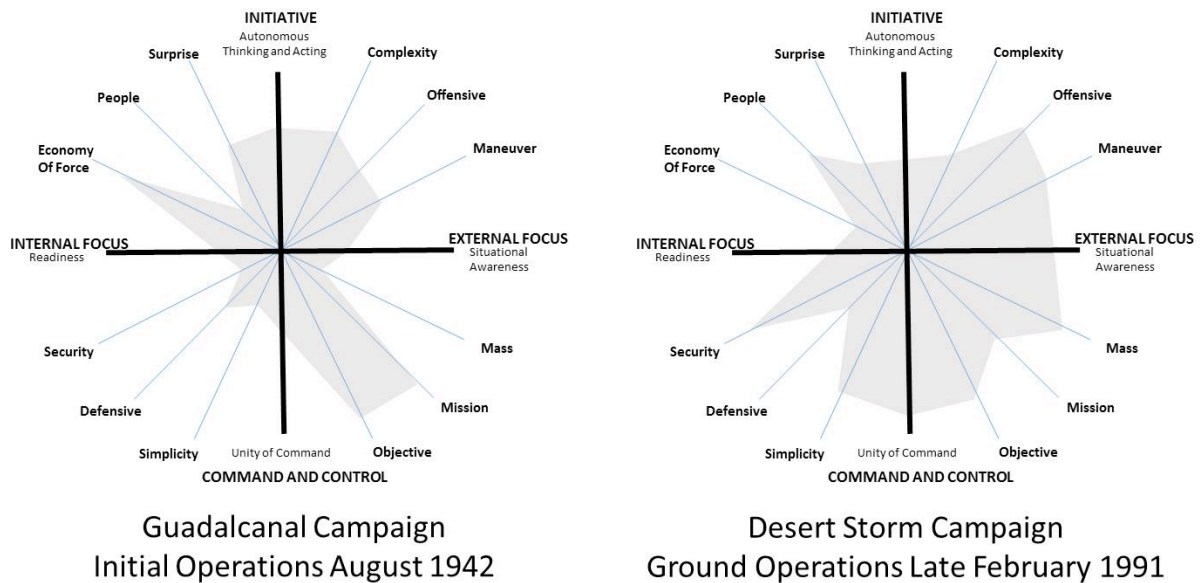
The same could apply to whole-of-government patterns associated with interagency approaches to both domestic and foreign interventions if we were to create a four-square with two crossing continua: interdependency wrt independency and competition wrt human rights. While military and homeland security professionals may be framing with *security* as the dominant purpose for which the institution is designed to upkeep, patterning would require them to 'step out' of that institutional frame to consider other ways of appreciating the messy situation at hand. For example, one relational frame to *security* wrt *liberty*. For instance, the more security forces provide the more people may feel their locale is securely 'occupied' (i.e. they are not at liberty to do as they please), such as when community organising in Los Angeles, California went badly (leading to urban rioting) or in a foreign province experiencing a violent insurgency.

The Defense and Justice departments, perhaps now pleased that the locale/target area has greater *security*, may see a need for a 'pattern shift', bowing to the American Civil Liberties Union (representing domestic social justice) or US Agency for International Development (overseas assistance encouraging human rights) values to reframe toward more liberty. At the same time, the Departments of Education, and Health and Human Services tilt their programs associated with *equity/welfare*; that is, assuring the central and local governments are legitimately providing services common to all the population, regardless of social and economic status (e.g. providing funds for public schools and assuring basic 'safety net' income

and health care for those in need). The more *liberty* and *equity/welfare* conditions that the community organisers or the counterinsurgents set the less there seems a chance for a market economy to develop, which is arguably more sustainable because of its comparative market-based *efficiency*.

So perhaps the departments of Commerce and Treasury professionals have to 'weigh in' with suggested actions associated with free market values that lean toward building a sustainable and growing economy. As a result of these competing values across diverse institutions, various laws and policies emerge to balance their otherwise conflicting agendas (the result of political processes). As facilitators, we can charge our students to construct a four-square diagram that demonstrates the mosaic framework that exceeds our stove-piped, institutionally-focused, single frames like those shown in Figure 5.7. The Pre 9–11 'policy paradox' is indicated in the solid line, showing emphases on equity and liberty, while the post 9–11 policy paradox is shown with the dotted line, showing emphases shifting more toward security and efficiency. Think of the policy pattern metaphorically—like a live amoeba continuously reshaping over time.

Figure 5.7: Paradoxical reasoning that seeks 'balance' among four simultaneous opposing views of us institutions, laws and policies[31]
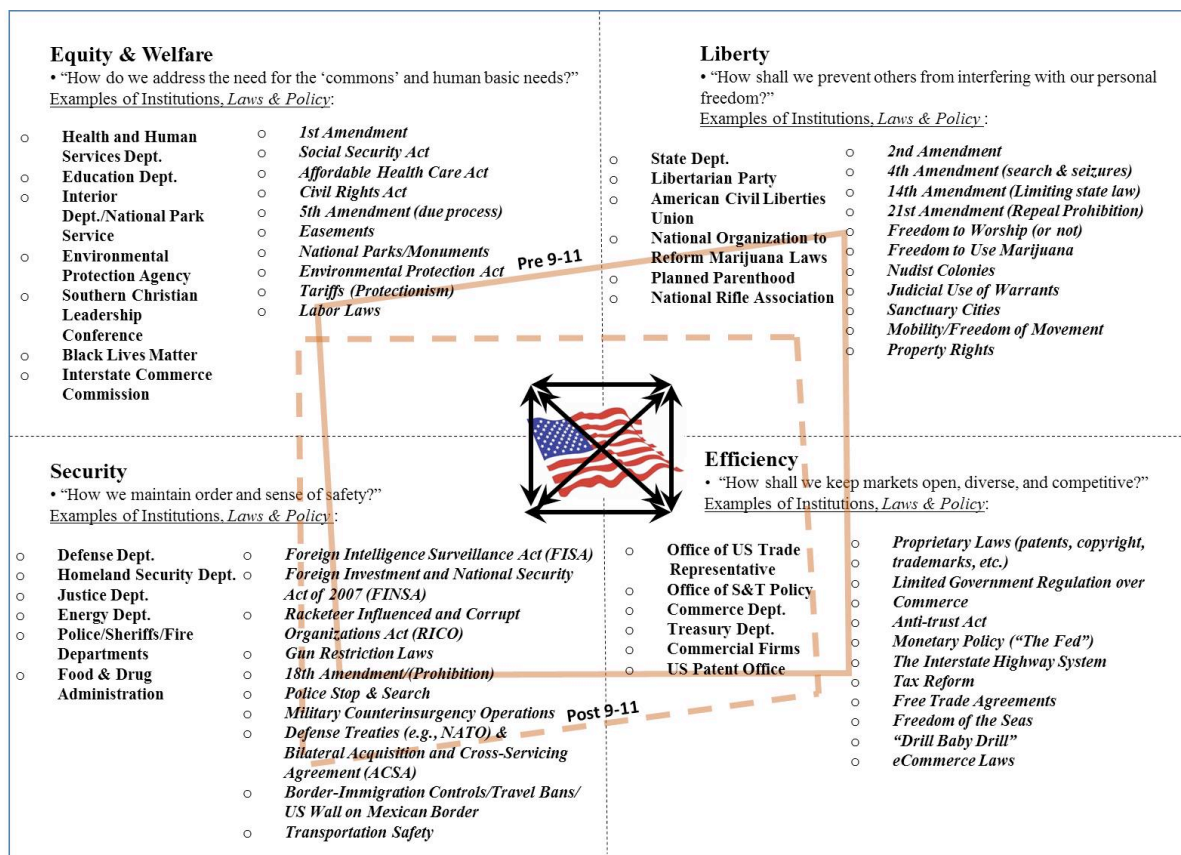
Key to successful 'whole-of-government' sensemaking would be to notice pattern shifts and perhaps diagnose when policy patterns *need* to shift. Leadership in this complex political milieu becomes more like the music playing of an improvisational jazz band (an analogy signifying that designation of the 'lead agency' must be dynamic, both in light of the pattern shifts and also to shape the emergence of new patterns) than the carefully directed music of an orchestra and a single designated conductor (a metaphoric frame about leadership that strives to get everyone on the

'same sheet of music' that does not convey the same complexity and need to improvise as does the jazz band).

Conclusion

I have presented Schönian reflective practice to address frame rigidity, specifically through facilitating frame awareness and frame innovation. I have offered four approaches in the professional schooling of student-practitioners: two from the field of linguistics and two from the patterned view of relationalism. *Onomasiological exposure* involves having student-practitioners perform a historiography of concepts. This enables the unmasking of claims of frame innovation to reveal them, more accurately, to be promoting an old logic with a new linguistic twist. *Metaphoric reasoning* is about helping student-practitioners become aware of the use of metaphors in many extant concepts and theories associated with national security institutions and that metaphors also serve as the roots for frame innovation.

The relational approach for *multiparadigm inquiry* facilitates empathy-building (essential to frame awareness and innovation) as it forces student- practitioners to argue positions, at least temporarily, through very diverse sets of purpose and logics that underlie sociological paradigms. Likewise, the investment in *paradoxical reasoning* helps the student-practitioner employ patterned approach to frame awareness and innovation that incorporate competing principles or values.

These Schönian attitudes are philosophically underpinned by postmodernism and antipositivism, and the interpretivist methods drawn from the Sociology of Knowledge discipline and the Social Construction of Reality theory.[32] Professional schools that undertake this turn toward a 'designing meaning' school of thought should prepare the faculty, as well as the student practitioners, with a basic understanding of the inherent assumptions associated with these approaches to framing. They are: (1) contextuality (that we socially construct meaning on objects, events and situations); and, (2) transdisciplinarity (that this critical and creative construction effort must be across and beyond traditional disciplines). These underpinnings are intended to purposefully disrupt the traditional notions of technical rationality, presently overemphasised in professional schools associated with national security. Openness to unrestricted and incommensurate ways of frame innovation is a key to reflexivity in, and an aspiration toward, professional reflective practice.

Notes

[1] Disclaimer: The views expressed herein are the author's and do not necessarily reflect the official policy or position of the National Defense University, the US Department of Defense or the US Government.

[2] H. Blumer, *Symbolic Interactionism: Perspective and Method* (Berkeley, CA: University of California, 1969), p. 134.

[3] For a thoughtful discussion on institutionalisation processes that lead to sedimentation of concepts (a.k.a. frame rigidity), see: P.S. Tolbert & L.G. Zucker, 'The institutionalization of institutional theory' in: S.R. Clegg & C. C. Hardy (Eds.), *Studying Organization Theory and Method* (London: Sage, 1996), pp. 169-184.

[4] D.A. Schön, *The Reflective Practitioner: How Professionals Think in Action* (New York: BasicBooks, 1983); D.A. Schön, *Educating the Reflective Practitioner: Toward a New Design for Teaching and Learning in the Professions* (San Francisco: Jossey-Bass, 1987).

[5] Tsoukas called this deliberate process 'self-distanciation', which he defines as the practitioner 'taking distance from their customary and unreflective ways of acting…. [where they] gain critical insight into their practice, which potentially facilitates the making of new distinctions'. H. Tsoukas, 'A dialogical approach to the creation of new knowledge in organizations', *Organization Science*, Vol. 20, No. 6 (2009), pp. 941-957 (quote p. 943).

[6] The meaning of reflexivity has been debated widely in philosophy (e.g., relational interpretation), sociology (e.g. reflexive anthropology), linguistics (e.g., the study of anaphor) and, for the last thirty years, organization and management literature. From a Schönian constructionist view, professional inquiry must exceed a quest for proven technique and relies also on scepticism about the state of professional knowledge and correspondent ontological and epistemological assumptions about how professionals should perceive and conceive of reality and practice (how they should improve their 'thinking in action'). In this regard, the present article focuses on frame reflexivity.

[7] D.A. Schön & M. Rein, *Frame Reflection: Toward the Resolution of Intractable Policy Controversies* (New York: Basic Books, 1994), p. 33.

[8] Schön, *The Reflective Practitioner*, pp. 310-311.

[9] D. Stone, *Policy Paradox: The Art of Political Decision Making*, 3rd ed. (New York: WW Norton & Company, 2012), pp. 252-253.

[10] By plurality, I mean based in a variety of ontological, epistemological and methodological assumptions associated with the social construction of reality. For a sociological view of this philosophical terms, see: G. Burrell and G. Morgan, *Sociological Paradigms and Organizational Analysis: Element of the Sociology of Corporate Life* (Portsmouth: Heinemann, 1979). My applications of social construction theory in this article are derived from the classic book: P.L. Berger & T. Luckmann, *The Social Construction of Reality: A Treatise in the Sociology of Knowledge* (New York: Anchor, 1967).

[11] Both antipositivism and postmodernism are introduced in the context of public administration in: N. M. Riccucci, *Public Administration: Traditions of Inquiry and Philosophies of Knowledge* (Washington, DC: Georgetown University, 2010), pp. 46-48 & 90-93. See also: J. Lyotard, *The Postmodern Condition: A Report on Knowledge*, Trans. G. Bennington & B. Massumi (Minneapolis, MN: University of Minnesota, 1984; original French edition in 1979). Interpretivism (closely related to antipositivism) is well documented in: P. Ricœur, *Interpretation Theory: Discourse and the Surplus of Meaning* (Fort Worth, TX: The Texas Christian University, 1976). The Sociology of Knowledge discipline was seminally introduced in: K. Mannheim, *Ideology and Utopia*, Trans. L. Wirth & E. Shils (New York: Harcourt Brace, 1936; original German edition 1929).

[12] Plato, *The Republic*, 2nd ed. (rev.), Trans. Desmond Lee (London: Penguin, 1987; original version ~360 BC), p. 318.

[13] H. Eccles, *Logistics in the National Defense*, republished in: Fleet Marine Force Reference Publication 12-14, p. 16. Online: http://www.marines.mil/Portals/59/Publications/FMFRP%2012-14%20%20Logistics%20in%20the%20National%20Defense.pdf, accessed 27 February 2018.

[14] Below are the corresponding citations for Figure 5.1 in last name and year order.

1.   Plato, *The Republic*, p. 318.

2.   C.S. Peirce, 'On the algebra of logic: A contribution to the philosophy of notation', *American Journal of Mathematics*, Vol. 7, No. 2 (1885), pp. 180–196.

3.   M. Weber, *The Protestant Ethic and the Spirit of Capitalism*, Trans. Talcott Parsons (New York: Charles Scribner & Sons, 1958; original German edition 1921), p. 181. Weber's metaphor was referring to machine-like economic and technical rationality. This phrase was also adopted by institutional theorists DiMaggio and Powell. See: P. DiMaggio & W. W. Powell, 'The Iron Cage Revisited: Collective Rationality and Institutional Isomorphism in Organizational Fields', *American Sociological Review*, Vol. 48, No. 2 (1983), pp. 147-60.

4.   J. Piaget, *Judgment and Reasoning in the Child* (London: Routledge & Kegan Pau, 1928; original French edition 1923).

5.   G. Lukács, *History and Class Consciousness: Studies in Marxist Dialectics*, Vol. 215 (Boston: MIT Press, 1971), p. 83.

6.   K. Mannheim, *Ideology and Utopia* (London: Routledge, 1936).

7.   M. Sherif, *The Psychology of Social Norms* (Oxford: Harper, 1936).

8.   War Department, Army Air Forces Field Manual 1-75, *Combat Orders* (Washington DC, 1942), p. 29. According to this manual, SOPs ensure 'making many of the activities … *automatic* …' (emphasis added).

9.   R.K. Merton, 'The self-fulfilling prophecy', *The Antioch Review*, Vol. 8, No. 2 (1948), pp. 193-210.

10. T. Parsons & E. Shils (Eds.), *Toward a General Theory of Action* (Cambridge, MA: Harvard University, 1951), p. 4.

11. J.L. Austin, *How to Do Things with Words* (Oxford: Oxford University Press, 1957).

12. T.S. Kuhn, *The Structure of Scientific Revolutions* (Chicago: University of Chicago Press, 1962).

13. A.L. Stinchcombe, & J.G. March, 'Social structure and organizations', *Handbook of Organizations*, No. 7 (1965), pp. 142-193.

14. C. Argyris, *Increasing Leadership Effectiveness* (New York, John Wiley, 1976).

15. P.N. Johnson-Laird, 'Mental Models in Cognitive Science', *Cognitive Science*, Vol. 4, No. 1 (1980), pp. 71-115. See also: P.N. Johnson-Laird, 'The History of Mental Models' in: K. Manktelow & M. Chung (Eds.), *The Psychology of Reasoning: Theoretical and Historical Perspectives* (New York: Psychology Press, 2004): 179-212.

16. I.L. Janis, *Groupthink: Psychological Studies of Policy Decisions and Fiascoes* (Boston: Houghton Mifflin, 1982).

17. Schön, *The Reflective Practitioner*, p. 21.

18. C.P. Perrow, *Complex Organizations: A Critical Essay* (Glenview, IL: Echo Point, 1986).

19. P. Bourdieu, *The Logic of Practice* (Stanford, CA: Stanford University, 1994).

20. R.A. Heifetz, *Leadership Without Easy Answers* (Harvard: Harvard University Press, 1994).

21. J.G. March, *A Primer on Decision Making: How Decisions Happen* (New York: The Free Press, 1994).

22. Schön & Rein, *Frame Reflection*, p. 33.

23. K.E. Weick, *Sensemaking in Organizations* (Thousand Oaks, CA: Sage, 1995), pp. 71-75.

24. B. Bozeman, *Bureaucracy and Red Tape* (Upper Saddle River, NJ: Prentice Hall, 2000), p. 12.

25. D.J. Snowden & M.E. Boone, 'A Leader's Framework for Decision Making', *Harvard Business Review,* Vol. 85, No. 11 (2007), p. 69.

26. E. Boxenbaum, & L. Rouleau, 'New Knowledge Products as Bricolage: Metaphors and Scripts in Organization Theory', *Academy of Management Review*, Vol. 36, No. 2 (2011), pp. 272-296.

[15] Department of the Army, Field Manual 100-5, *Field Service Regulations: Operations* (1962), p. 5.

[16] Department of the Army, Field Manual 100-5, *Operations* (1986), p. 1.

[17] US Department of Defense, Joint Publication 3-0, *Joint Operations* (2017), p. V-4.

[18] US Special Operations Command White Paper, *The Gray Zone* (2015). Online: https://info.publicintelligence.net/USSOCOM-GrayZones.pdf, accessed 18 March 2018.

[19] Chairman of the Joint Chiefs of Staff, *Joint Concept for Integrated Campaigning* (Washington DC, 16 March 2018), p. 8. Online: http://www.jcs.mil/Doctrine/Joint-Concepts/Joint-Concepts/, accessed 16 May 2018.

[20] G. Morgan, *Images of Organization*, updated ed. (Thousand Oaks, CA: Sage, 2006).

[21] Examples include: G. Lakoff, 'Metaphor and War: The Metaphor System Used to Justify War in the Gulf', *Peace Research*, Vol. 23 (1991), pp. 25-32; Y.F. Khong, *Analogies at War: Korea, Munich, Dien Bien Phu, and the Vietnam Decisions of 1965* (Princeton, NJ: Princeton University Press, 1992); M.J. Medhurst, R.L. Ivie, P. Wander & R.L. Scott (Eds.) C*old War Rhetoric: Strategy, Metaphor and Ideology*, 2nd ed. (East Lansing, MI: Michigan State University, 1997); C.R. Paparone, 'Reflecting on Metaphors we are Led By', *Military Review*, Vol. 88, No. 6 (2008), pp. 55-64.

[22] C. Paparone, 'How we Fight: A Critical Exploration of US Military Doctrine', *Organization: The Critical Journal of Organization, Theory, and Society*, Vol. 24, No. 4 (2017), pp. 516-533. See also: A. Bousquet, *The Scientific Way of Warfare: Order and Chaos on the Battlefields of Modernity* (New York: Columbia University, 2009).

[23] Morgan, *Images of Organization*, p. 365.

[24] M.W. Lewis & M.L. Kelemen, 'Multiparadigm Inquiry: Exploring Organizational Pluralism and Paradox', *Human Relations*, Vol. 55, No. 2 (2002), pp. 269.

[25] Burrell & Morgan, *Sociological Paradigms and Organizational Analysis*.

[26] Adapted from: C.R. Paparone, 'Red teaming: A Multiparadigm Approach', in G. Moore (Ed.), *The Encyclopedia of US Intelligence*, Vol. 2 (Boca Raton, FL: CRC Press, 2015), p. 6.

[27] M. Chen & D. Miller, 'The Relational Perspective as a Business Mindset', *Academy of Management Perspectives*, Vol. 25, No. 3 (2011), pp. 6-18.

[28] As traced in detail in: Y. Courmier, *War as Paradox: Clausewitz and Hegel on Fighting Doctrines and Ethics* (London: McGill-Queen's University Press, 2016).

[29] C.R. Paparone & J.A. Crupi, 'The principles of war as paradox', *Proceedings*, Vol. 31, No. 1 (2005), pp. 39-44.

[30] Paparone & Crupi, 'The principles of war as paradox', p. 43.

[31] Adapted by the author from the five goals contained in: D. Stone, *Policy Paradox*, chap. 2-6. I placed equity and welfare in the same quadrant as they share similar attributes, such as belief in basic human rights and the role of nondiscretionary government spending. In this book, Stone's third edition, welfare was an added goal to the original four.

[32] See endnotes 3, 9, and 10 for suggested primers.

FOSTERING DEEP INSIGHT
THROUGH SUBSTANTIVE PLAY[1]

Ben Zweibelson[2]

In the Machine Age, life, and every aspect of it, was taken apart by analysis. Work, play, and learning were separated and kept separate by institutions dedicated exclusively to one of them…In the Western world attitudes towards business and work have been dominated by the Protestant, if not Puritan ethic. This ethic separates work from play and learning, and views it as an ascetic, not an aesthetic, activity.

Russell Ackoff[3]

A person willing to fly in the face of reason, authority, and common sense must be a person of considerable self-assurance. Since he occurs only rarely, he must seem eccentric (in at least that respect) to the rest of us…For best purposes, there should be a feeling of informality. Joviality, the use of first names, joking, relaxed kidding are, I think, of the essence—not in themselves, but because they encourage a willingness to be involved in the folly of creativeness.

Isaac Asimov[4]

I don't know what you think you're trying to do, but the krauts ought to pin a medal on you for helping them mess up discipline for us.

George S. Patton, during meeting with
cartoonist Bill Mauldin in March 1945, where
Patton complains about the 'Willie and Joe' comics[5]

Why don't military organisations welcome the incorporation of 'play' into planning or military design activities? The concept of play is not often of much serious interest in military organisations, perhaps due to a variety of cultural and institutional tensions that associate play with immaturity, a lack of seriousness, or worse yet a breakdown in professional discipline. This chapter explores these barriers and where these institutional fears may be altered through deliberate military design engagement. The socially pervasive fear of being taken as a fool tends to isolate 'play' into sanctioned spaces where small groups of military professionals are allowed to relax, bond with trusted agents, or participate in socialised events for physical, social and ritualised activities. We in the military are careful and quite aware of the locations, contexts, and with whom we engage in playfulness. This doesn't mean that the military is devoid of personality or a sense of humour; rather the application of work, play and learning remain strictly regimented and independent within military organisational forms and functions.

Philosophically, this may harken back to the Puritan traditions that founded much of the modern Western world[6] and that remain well entrenched in existing hierarchical forms for education, business, militaries and law.[7] Any notion of diversion, playfulness, or exercising experimentation outside of sanctioned processes becomes both disruptive and professionally hazardous for career-minded military professionals. Play is allowed, as long as it occurs within a tightly regulated box, complete with rules and other rituals. Play within military culture often includes competition, whether overt or implied. Play may occur within very specific contexts and social cues, often without us reflecting much on why this is or why it matters. If they do not approach these challenges with great consideration the disruptive thinker and military provocateur may present innovation to the organisation yet suffer remarkable resistance, backlash, and even their own demise.[8]

As the Program Director for Special Operations education on military design and innovation at the Joint Special Operations University, my faculty and I continue to explore how traditional military planning processes interact with broader military efforts in design, innovation and organisational transformation within complex environments.[9] Over the last few years of design education for a variety of international, conventional and special operations military students in different settings, my faculty and I have experimented with this somewhat forbidden notion of 'play' with 'serious' military challenges.

The term 'forbidden' may seem slightly provocative, however when we consider some of the design concepts and techniques offered in this chapter their relevance towards military improvements will likely produce scepticism. Yet, complex systems are rarely going to provide any clear cause-effect relationship between play and innovation. A more interesting social concern addressed here is on the significant barriers already in place to prevent most play from being conducted in the first place. This chapter provides recent observations, the results of various experiments, and my own professional opinion on how play is not only useful *but essential in design praxis for the most challenging of society's military applications*.

'Surely you can't be serious?' 'I am serious, and don't call me Shirley'

One significant area where play is frequently discouraged is in the spaces where organisations prepare detailed plans for military activities within complex, dangerous (and quite serious) contexts. Within traditional military planning practices written doctrine, as well as sanctioned application of said doctrine, reflects the belief systems of Armed Forces.[10] In a powerful culture, filled with what some describe as a 'suck it up and drive on' mentality, military planners often are challenged to hold concentration for extended periods with little rest, recovery or distraction.[11] In many of the military organisations most closely associated with direct combat applications (such as the Infantry), there is usually an implied competition among members to equate greater adherence to lengthy concentration and focus over any reprieve or rest; a mantra of 'sleep and food is a crutch' is frequently uttered with a dash of institutional sarcasm. One may have a sense of humour while going about difficult and serious work but only within the societally accepted rules for playfully obeying with the sanctity of the work at hand.

When a military organisation is charged with entering a dynamic and wildly complex environment with vague and contradictory guidance, it is expected to perform under tremendous pressures and excel. These pressures reflect the challenges of all complex dynamic systems—where emergence, nonlinearity and rapid change feature

prominently.[12] But, there are additional self-imposed social pressures. Militaries also tend to apply cognitive barriers in how and why they approach and interact with complexity, including their preferred paradigms for making sense of complex reality,[13] as well as their rather rigid toolboxes filled with sanctioned methodologies, language and values, which they rummage through when confronting a challenge.[14] Adding new conceptual tools is nearly as difficult as tossing out old or irrelevant ones, as over time militaries often cover favourite tools with deeply ritualised and culturally self-defining elements.[15]

While methodologies and favourite cognitive tools are perhaps easy to identify for the critically reflective military professional, many of the deeper social and organisational aspects remain elusive. Why is 'play' so repugnant, particularly in the most demanding cognitive contexts? How does working excessively and frequently to the point of mental confusion and exhaustion somehow become an attribute of strength, dedication, and even admiration?[16] Are there any areas within military decision-making and problem management where 'play' could definitively offer tremendous benefit, if it was more socially accepted by military culture? In this chapter, military design applications may be the first area where substantive play is not only cognitively suitable but also likely essential for innovation and organisational transformation.

'The only thing that matters is work and productivity'

In the maze of military cubicles within almost all western military organisations, there are many humorous cartoons, memes and printed documents hung around office areas for the familiar purpose of group humour and amusement. I noticed one in my office area recently because it took a self-deprecating take on the intense work focus expected of military professionals, in this case specifically of military planners performing operational planning and campaign design. It lampooned some common socially encouraged behaviours across military staffs, groups and teams by decreeing a list of rules that needed to be obeyed by those undertaking the duties of operational planning. The poster was placed up for humour and thus it represented one of the accepted forms of play while also helping to reveal the frames and limitations of military playfulness. Where, when, and in what contexts these posters are allowed or restricted also provides elements of military boundaries for the notion of a 'playful' frame.

The poster had the title of 'perspectives' and listed the five bullet points below:

• A balanced life is a myth perpetrated by liberal arts schools. Don't be foolish; the only thing that matters is work and productivity.

• Your body serves your mind, and your mind serves the Army. Push the mind and the body will follow.

• Never say no to anything. It shows weakness.

• Always attempt to do everything. You ARE responsible for it all.

• If you feel something is dragging you down, suppress those thoughts. This is a weakness. Drink more coffee.

The first statement, printed in bold font, directed that 'the only thing that matters is work and productivity'. I found this statement significant because it addressed at a rather fundamental level a powerful military forcing function that saturates into most aspects of military culture. There are many variations of this; for instance, when many Army graduates of the US Army School of Advanced Military Strategies, as well as other similar planning courses, utter the quote from the movie, '*Ben Hur*': 'We keep you alive to serve this ship. Row well, and live'. This view is not just deeply engrained into military culture; it manifests within American culture and arguably across many societies that associate with Protestant and even Puritan origins. With the arrival of the Machine Age, man moved from doing the labour himself into overseeing the production of labour through manmade machines; the development of machines to do that labour only validated the prominence of these categorisations for work, education and play into separate and reducible elements.[17] The division of work, education and play are formalised in militaries in this Machine Age effort of maximising productivity, efficiencies and reducing risk.[18]

The rise of the Industrial Revolution inevitably brought with it modern management theory and the goal to maximise human labour towards greater and more efficient levels of production and benefit.[19] This is not a cause-effect relationship where industrialisation must bring with it a positivist, mechanistic-minded form of managerial control. Rather, the first popular managerial methodologies, which emerged to span vast command and control of industrialised economies, attempted to displace natural science metaphors and concepts into managerial disciplines where natural science laws ended up being entirely lacking in quantification or scientific rigor.

This hardly mattered in the 20th century. Military organisations got swept up in the broader rush to adapt pseudo-scientific methodologies into managerial practices in an attempt to validate hierarchical structures of control, power, and decision-making. Military organisations, in particular, capitalise upon a power relationship across the social system where both the means and ends are autocratic,[20] and thus the centralised hierarchical form becomes a rigorously enforced power structure for controlling and influencing behaviour. The early fad of wrapping natural scientific concepts into entirely unscientific applications has now been perpetrated in civilian business thinking, as well as parallel military management doctrine, so that they now are institutionalised, and often off limits for critical inquiry or criticism at the epistemological level.

This prioritisation of emphasising hard work and productivity is expressed in military organisations through the convergent processes espoused in most military doctrine. Doctrine, as a reflection of a military's belief system, uses authoritarian logic to drive conformity and predictability through a measured adherence to doctrinal form, which in the case of operational planning is whether that organisation has effectively done their decision-making and problem management in accordance with the procedures and structure within doctrine.[21] Beyond the doctrinal adherence, military organisations are also implying their paradigmatic preferences on how to make sense of reality.

Militaries almost exclusively adhere to the functionalist paradigm where analytic reasoning generates optimised problem solutions within what might be framed a positivist epistemology.[22] In laymen's terms, militaries view reality as a system that can be categorised and reduced into smaller, more manageable components. By taking a snapshot of a complex reality, they can reduce things down into fundamental or elemental components where one can establish and prove a set of universal laws,

principles, or at least a working theory.[23] These smaller elements can then be re-assembled into the whole, so that more control and understanding is gained of the larger system. End states are established into the frozen snapshot of the complexity and planners can reverse engineer a sequence of deliberate planned activities that link back to the present state. Once planning is completed, the entire system can be released to begin moving and, while some variations will occur, the optimisation and analysis will stabilise the established plan so that the desired end state is eventually reached.[24]

Functionalists require a stable reality so that these rules can persist in a timeless sense across all of space, and the gradual accumulation of more information will lead to greater understanding of the complexity.[25] Further, the military force expects to be able to assess all feasible options for solving a problem and that accumulating deeper knowledge from past experience should make future challenges tamer. Working harder within this paradigm has a deductive logic in that more work completed within the approved military methodology (through doctrinal adherence) results in greater progress towards the desired ends. The greater the complexity, the more work is required to accumulate information, gain greater control, and eventually capitalise on past experience in order to be productive. Productivity means that one moves closer towards the goal, instead of falling behind or wandering off. If the old goal is changed midway through planners create branch plans to reorient the hard work towards the newly reverse-engineered goal, with the same link of activities nested between the desired end state and where the organisation currently stands.

Although some of this requires abstract thought, most military planning endeavours essentially follow this format due to the broad adherence to a single military paradigm and the powerful social forces that shape the military profession. Within these social forces, the element of 'play' becomes quite difficult to tolerate in anything but periods of approved relaxation or further social conforming activities. Were professionals to engage in playful activities they would need to experiment and potentially disrupt both the desired accumulation of more control and information, and also the perpetual single-direction focus on progress towards previously engineered end states.[26]

'Drink more coffee'

The next line in that playful planner meme on the wall was 'if you feel something is dragging you down, suppress those thoughts. This is a weakness. Drink more coffee'. Again, while it is a rather tongue-in-cheek critique of a common shared military sentiment, the deeper sociological aspects of military culture are represented here. With the increasing complexity and reduction of military resources creating a pressure cooker for overexertion of military forces, political and senior leadership have finally begun to take notice.[27]

Although military organisations can quickly assemble a series of risk reduction procedures drawing from the same functionalist paradigm and analytic methodologies, there is a significantly deeper issue here worth exploring. The mindset of 'suppress weakness, drink more coffee' is superficially a sarcastic nod towards a systemic military institutionalisation of working convergent towards the paradoxical goal of innovation when we consider design.[28] These socially playful elements in military life are well known within the profession, although rarely discussed in any academic study or within established military doctrine on leadership or organisational management.

A group of military planners organise along Napoleonic-inspired staff compartments, where each staff element follows a convergent organising logic and the positivist epistemology to seek analytically optimised problem solutions as framed through an ends-ways-means construct. Progress is measured by accomplishment of standardised sequences of indoctrinated methodology, typically a formal decision-making model such as the Joint Planning Process (JPP) or the Military Decision-Making Process (MDMP) or other similar structure.[29] Militaries have woven a culture of intensive production timelines upon these models where military staffs commit extensive time and resources with long hours and perpetual adherence to the model rules.

The outputs of these endeavours are legendary in military organisations, with some PowerPoint presentations for decision briefs measuring into the hundreds of slides. Operations orders become extensive documents measuring in the hundreds of pages, often published on shared servers with large numbers of annexes and appendixes that frequently require many more hours of digestion from the receiving subordinate organisations. In the various pressures to follow this methodology and complete the lengthy busywork of hundred-slide presentations, military professionals are compelled to 'suppress those thoughts' and 'drink more coffee' to produce rather ineffective presentations that military senior leadership grow increasingly frustrated over.[30]

Distinctions between military design and traditional reductionist planning

The military design movement has spread across Anglo-Saxon militaries and beyond since it was first implemented by the Israeli Defense Force in the late 1990s.[31] Over the past two decades, and within the most recent generation of military professionals, many different interpretations of 'design' for military application have been expressed in theory, practice and, in some cases, codified into doctrine. Regardless of what design methodology or mixture of design processes one supports, the application of design thinking towards military matters signals a significant departure from traditional and highly convergent military analytical approaches to decision-making in complex environments. Design represents for the 21st century what the rise of scientific thinking represented for pre-Industrial military societies; the design approach to complexity ushers in novel ways to appreciate complex environments and generate divergent and innovative military transformations.[32]

In military applications, design represents an iterative and highly emergent process where systemic perspectives provide disruptive and transformational consequences that challenge established forms and functions. Design can radically reconfigure not just the military formations on the ground, but also inside of minds and shared organisational understanding of complex topics.[33] For innovation to be expressed through military design, the process should emerge through an iterative blend of critical and creative thinking; sociologists offer the term 'reflective practice' for what the military attempts to do in these highly challenging cognitive, as well as tangible, contexts.[34]

When military professionals attempt to conduct design applications towards complex military environments they are challenged to generate innovative and organisationally disruptive deliverables that provide a military force with what does not yet likely even exist but it *now* needs. However, these creative practitioners must also fight through

institutional resistance as well. Further, the intellectual burdens for deeply self-reflecting upon oneself and one's institution as well as highly dynamic and ill-structured contexts makes for perhaps the most challenging military enterprise of all.

Designers need to become comfortable with uncertainty. They need to be able to travel between the abstract and the structured, and persuasively deliver novel concepts across an entire organisation, which likely remains tightly wedded to outdated or irrelevant concepts. While Columbus only needed to bring back physical artefacts of his New World discovery to persuade sceptical Spaniards, military designers are only able to convince with the certainty of their new understanding and ability to evoke new meaning through metaphors and narrative.[35] Many organisations are not prepared to receive innovation, particularly when it disrupts established practices and has no history or 'proof' of past success; innovation by its very definition is something novel and unproven.[36]

The design challenge for military practitioners is a steep one; yet, the reflective practitioner need not fall into the rote machinations of the unwitting planner. Designers do not need to pursue working harder to gain in productivity. Complexity does not yield to repeated efforts to simplify it, and imagination cannot be reduced to a sequential process or checklist. Novice military designers tend to follow the same imposed social forces that drive military planning activities, if only because they are conditioned to, and potentially they are dual-tasked to be both a planner and a designer.

Military leaders in key positions such as a Command or Chief of Staff role may also misunderstand the vast epistemological differences between analytic-based decision-making and the more abstract and innovative design approach to complexity.[37] Thus, many design endeavours *turn into planning*, with the design team seeking a sequential and highly analytic process for design in order to experience a sense of accomplishment towards the predetermined goals of innovation and organisational transformation. However, design is iterative as well as emergent. Innovation does not work in a sequential manner, where trying to work harder is supposed to yield additional results.

This is where the paradox of substantive play enters the conversation. In order to get more innovation potential out of a design team, the facilitator and all associated leadership must encourage them to work differently as well as under significantly dissimilar conditions. A design team will likely not accomplish any additional development towards innovation or novel discovery through forced iterations and additional time alone. If anything, the deliberate application of 'suppress those thoughts…drink more coffee' can potentially discourage innovation and instead drive the design team towards the embrace of mediocrity to justify completion of task. Focusing a group towards a set sequence of analytic planning is not the same as expecting a design team to have increasingly divergent iterations of ideation that are meaningful. They are entirely distinct, and military leaders should avoid conflating the two.[38]

At this point, dedicated military traditionalists might reject the consideration that professionals attempting to plan and achieve goals in complex environments are single-focused lemmings unaware and unable to break out of the aforementioned processes. Jack Nicholson's character in Stephen King's '*The Shining*' warned that 'all work and no play makes Jack a dull boy'. Yet everyone knows how to take a break and blow off steam while working hard at a task or complex project, including

military professionals. The difference here is that 'play' is not accepted within the work context. Or to express this by modifying Nicholson's famous line, 'Jack cannot avoid becoming dull by playing while he works because work is about being productive towards established goals'. What if 'play' were substantive to the work progress, particularly in the dynamic, complex environments that today's military forces routinely encounter? This is where design provides a useful vehicle for organisational transformation.

'I was just playing catch with a UAE Officer in the rain, here on the grass!'

While I have experimented with blending design and substantive play in a variety of applications with US conventional forces, Special Forces, as well as international military and other large organisations, my opportunity to apply this concept extensively occurred with several seminars of Field Grade officers at the Canadian Forces College (CFC) in 2017.[39] Previously, the CFC had invited me to facilitate design education with seminars in 2015–2016; however in 2017, I was able to incorporate the concept of substantive play deliberately into the entire design practicum. This desire to experiment with rather radical play concepts was the direct result of several years of educating design students and witnessing their gradual cognitive exhaustion when performing deep design activities within the traditional military contexts of long hours with infrequent rest breaks.[40]

Substantive play is what I term the essential balance of cognitive exertion towards design coupled with an opposing exertion towards play. The play periods should not feature any of the cognitive stimulation associated with the design work or any other associated work. It is in this period of substantive play where the military designer rests, regains mental energy, and potentially makes some subconscious efforts that later become realised in the consciousness as a 'eureka' moment relating to the design challenge at hand.

The Canadian Forces College assigned each of the design educators to a specific seminar for the two-week period, under the overarching strategy to expose the entire class of students to a variety of design methodologies and educational approaches. Along with my own design preferences and philosophy towards design education, the CFC had designers from civilian design fields teaching human-centric design models, post-modern military design as well as advocates of variations of both US Army Design Methodology and its parent form, the Israeli developed 'Systemic Operational Design'. Aside from daily coordination meetings and some broad training objectives, each of the design educators had a wide aperture to consider their design educational approach for their assigned seminar of a dozen field grade officers.

Along with the design lessons and the overarching 'second generation design methodology' that I applied for the seminar's design educational journey, I implemented a deliberate 'play period' that would occur approximately every two or three hours during the eight-hour duty day. Each play period would last a minimum of 30 minutes, and the students had to plan and coordinate for an activity they would do. As this was a military campus, we were fortunate to have access to sports equipment, playing fields, and various other areas that supported student play.

During the design course, students engaged in softball catch, croquet, basketball, and other familiar sporting activities. Further, I added some more unusual events,

which were intended to bring the students further out of their comfort zone while still providing a mental distraction from the design work. Students from multiple seminars participated in an Aikido balance drill activity, where partners faced one another on their knees and attempted to push the other over without falling over as well. In another play activity, students meditated at the indoor coy pond in the Canadian Forces College's greenhouse. These play events were deliberate break periods aligned with providing mental rest and distraction for the students while they conducted a military design inquiry concerning a demanding military topic. Students were told to just 'let go' and to not think much about the previous design challenges that had taxed their intellects during the day.

Introducing play within design education

At the Joint Special Operations University (JSOU), as well as in many civilian design educational courses, facilitators bring 'play' into the classroom directly. While the substantive play examples from the CFC represented a specific time period for mental decompression and relaxation, the JSOU design faculty also utilises play within certain classes and practical exercises. Faculties provide students with play dough, tinker-toys, Lego, coloured post-it notes, picture cards and other objects intended for play sessions. This is in addition to the overlooked playful aspects concerning whiteboards and dry-erase markers that the design students use to draw pictures and concepts for the courses. These objects are provided to students informally. As they conduct design discussions or collaborative activities around the whiteboards students begin to play with these objects and many become comfortable with objects that frequently caused apprehension or nervous laughs when they first arrived.

The design education for Special Operations professionals through the Joint Special Operations University employs active play activities during the design courses, including sessions where students are led through outdoor play activities with a facilitating faculty member providing some structure. The design course is arranged in a flexible framework with a high emphasis on student practical exercise periods, multiple media and sensory engagement, as well as a variety of stimulus during the program, such as classical music piped into the classrooms during student group design work.

One particular feature of the JSOU design family of programs involves the principle of getting students up and drawing on the whiteboards within the first 15 minutes of the course. During this initial design exercise, students are instructed to watch a short video and to then attempt to frame and explain the scene without using words. By forcing them to 'drop their tools' and express their ideas in pictures, this first experience in the JSOU design program quickly challenges them while also establishing a very distinct educational environment. The introduction of 'play' into this design context appears easier and relaxes the students by potentially marginalising some of the strong military institutional functions that are removed immediately and symbolically distanced.[41]

Scepticism, cultural resistance, and general apprehension

The introduction of substantive play has not been without setbacks, resistance or institutional confusion. At the Canadian Forces College, some participants from other seminars were curious about our seminar's play activities while others regarded it as

a waste of valuable time, or even unprofessional. By the middle of the first week, several other seminars, as well as design faculty, became interested in the substantive play concept, with some perhaps interested in whether the process enhanced their own design struggles in the classroom. In particular, the Aikido balance session on a large grassy space in front of the college dining facility featured four seminars and a large number of observing faculty. Some students felt that the play activities were a bit of a gimmick and did not make a strong connection between the play activities and enhanced design innovation in practice.[42] As of this article's writing, the CFC has not only endorsed a continuation of substantive play sessions during the June 2018 'Shifting Sands' design exercise, but has expanded the substantive play experiment across all of the student seminars to open up a wider target audience for faculty observation and study.

As a brief anecdote, the comments and experiences of a senior retired Canadian General Officer during the June 2017 design exercise are worth mentioning for this section. The CFC assigns a senior mentor to these major exercises, and for the 'Shifting Sands' design activity in 2017, the retired General expressed curiosity, as well as scepticism, on how our seminar conducted substantive play sessions daily. These retired Generals are termed 'Gray Beards' in military vernacular, and our Gray Beard came out to observe the play sessions for the first two days without participating. By the third day, when the group had softball gloves and began playing catch in the damp Toronto weather, the students managed to equip the Gray Beard with a glove and get him into a game of catch. As I and other design faculty observed, we had our own concerns, as we could not readily determine his enthusiasm or whether he was simply playing along.

As a light rain and cloudy skies hung over our students, softballs whizzed through the air as officers in a variety of uniforms played catch. One of the international students (from the UAE) tossed the ball to the General for several minutes as they exchanged throws. Towards the end of the session, the General turned to me with a smile and a determined look in his eyes that indicated some sort of epiphany. 'I just realised that I am here at the CFC, playing catch in the rain with a United Arab Emirates student', he exclaimed. Our Gray Beard had gone from sceptic to a believer in the process, it seemed. While this experience is anecdotal and these observations are only mine and those of my fellow design educators present, we all were relieved to see that the senior military leader assigned to the entire exercise had at least experienced something stimulating during one of the play sessions.

Concerning the design education at the Joint Special Operations University, a majority of students in end-of-course surveys provide positive feedback on the various play activities, since the significant inclusion of these activities in late 2017 through 2018. Although initial student results remain inconclusive due to a small sampling size as of the date of this article, by late 2018 enough iterations of the revised design program have occurred to provide potentially more conclusive feedback on increasing design play activities within the family of five-day design courses and custom design inquiry sessions.[43]

How to introduce substantive play to enhance design applications

Design facilitators seeking to implement substantive play into design sessions should consider the following in order to enhance design outputs as well as improve the ability for the unit to express the desired traits of a learning organisation. These are

not rules; however, there are some overarching patterns that appear to apply in many design applications for military professionals.

Balancing design work sessions with play sessions requires deliberate planning and time management by the design facilitator. Although each design context will remain unique, a useful planning consideration would be a 30 minute play session for every two or three hours of design work, or potentially a longer play session associated with half of a duty day dedicated towards design activities. Introducing design play activities within the design space can reduce some stressors, however it is essential that the design facilitator monitor and manage the design team to determine when they require a significant break.

Design play sessions are not necessarily formalised, but they do require the distinction of playfulness over work. When distinct play sessions are unavailable, design facilitators may instead insert play activities within practical exercise periods or formal lecture sessions. The inclusion of play objects, informal classroom environments, deliberate group activities that disrupt traditional military educational formats, and the utilisation of mixed methods for design education are all useful. Design lessons that feature video clips, blogs, podcasts, and other mixed-media engagements provide a useful change of pace within what can otherwise become a traditional 'sage on the stage' format. Efforts to reduce PowerPoint or provide alternative educational presentation formats appear to produce quite positive results in design education. Some design teams even engage in playful activities and challenge the traditional military briefing form by presenting their design concepts in alternative delivery means.[44]

When design faculty shape a design course or a design inquiry event, the application of 'play' becomes a critical contextual factor for setting the conditions for design innovation. Humans express humour through play and thus, in some regard, design without humour is essentially 'play' without any sustenance or soul. Again, all military professionals can demonstrate a sense of humour when doing even the most routine or stressful of tasks; potentially humour is enhanced at times through these tensions. When designers attempt to create the conditions for design innovation, they ought to be mindful of where humour can ease institutional pressures and foster divergent thinking. In many of my design lessons, I prefer non-military examples as well as comedic elements to not only place students in unfamiliar contexts but also to use humour as a necessary vehicle to introduce rather disruptive and controversial design concepts. While the inclusion of humour in design education remains a highly subjective and stylistic choice, every design facilitator must be reflective on how they practice design for military applications.

Conclusion

The resistance to this topic remains vast, and potentially daunting. A misapplied institutional fear remains: 'We must remain professional…and playing is unprofessional for serious military affairs'. Yet the most difficult, complex, and wickedly tangled challenges appear to reject everything we throw at them through the conventional way endorsed by our profession. We end up failing but all agreeing in the seriousness of our efforts as they fail. We implicitly do this and thus agree as an institution that our military content is less significant than our preferred military form. Work, education and play remain traditionally distinct and compartmentalised in our customs, traditions and military rituals.

The solution frames, as well as the problem statements themselves, are entirely unscientific in the current methodological applications nearly all militaries promote in their planning doctrine across the industrialised West, due largely to a pseudo-scientific approach that is set solidly within a positivist way of making sense of reality. Coupled to this is a mechanistic managerial style that overemphasises a false notion of 'seriousness' in the application of these single-paradigm decision-making methods, while underemphasises 'play' to suppress not just the right conditions for innovation and divergent thinking but the essential qualities of epistemological self-reflection and critical inquiry into *why we do what we do*. Twenty-first century militaries require a genuine scientific approach where these failing and entirely positivist constructs for 'military science' and management are debunked and marginalised. Doing this would likely disrupt a significant portion of traditional military education, training, doctrine and schooling. Yet until it occurs, militaries will continue to fight off innovation and be largely unaware of why they remain static and reactive to radical changes.

In military design applications, form needs to follow an emergent relationship dependent upon novel content …this is innovation. To open these pathways, we need to free up our minds; especially when stressing them with the hardest possible challenges a military will ever face. Military playfulness seems like an oxymoron, yet when design is done for highly complex and adaptive contexts we tend to discover that the strangest of bedfellows are often the very things we need and have the hardest time realising. Substantive play, done within a structured design process of framing and ideation, will enhance and enable our profession to transform into the next future force that is essential for the accomplishment of our enduring national security desires. Finally, without senior leadership's awareness, acceptance, and dedication towards shaping substantive play sessions in their organisations these concepts will remain largely unrealised.

Notes

1 An earlier version of this chapter was presented as a keynote paper at the 'Innovation Methodologies for Defence Challenges' conference held at Saint Paul University, Ottawa, Canada from 30 January to 1 February 2018.

2 Disclaimer: The views and opinions expressed in this chapter are those of the author and do not reflect the opinions or any official position of the US Department of Defense or the US Government.

3 Russell Ackoff, *Creating the Corporate Future* (New York: John Wiley & Sons, 1981), p. 43.

4 Isaac Asimov, 'Isaac Asimov Asks, "How Do People Get New Ideas?"', *MIT Technology Review*, 20 October 2014.

5 *Mauldin at War, 1943-1945*. Online: https://www.loc.gov/rr/print/swann/mauldin/mauldin-atwar.html, accessed 26 January 2018.

6 Ackoff, *Creating the Corporate Future*, pp. 43-45.

7 Christopher Paparone, *The Sociology of Military Science: Prospects for Postinstitutional Military Design* (New York: Bloomsbury Academic Publishing, 2013), p. 14; Geoffrey Sloan, 'Military Doctrine, Command Philosophy and the Generation of Fighting Power: Genesis and Theory', *International Affairs*, Vol. 88, No. 2 (2012), pp. 244; Earnest Gellner, *Plough, Sword and Book: The Structure of Human History* (Chicago: University of Chicago Press, 1989), p. 70.

8 Michel Foucault, *Discourse and Truth: The Problematization of Parrhesia* (University of California at Berkeley, November 1983), p. 65. Online: http://foucault.info//system/files/pdf/DiscourseAndTruth_MichelFoucault_1983_0.pdf, accessed 26 January 2018; Shimon Naveh, Jim Schneider & Timothy Challans, *The Structure of Operational Revolution: A Prolegomena* (internally produced publication: Booz Allen Hamilton, 2009), p. 9; John Nagl, *Learning to Eat Soup with a Knife: Counterinsurgency Lessons from Malaya and Vietnam* (Chicago: University of Chicago Press, 2002), p. 9.

9 This design experimentation occurs within JSOU-CCE (Center for Continuing Education) design faculty, outreach to other military organisations and academia, as well as through research and implementation within military and intergovernmental design challenges.

10 Aaron P. Jackson, *The Roots of Military Doctrine: Change and Continuity in Understanding the Practice of Warfare* (Fort Leavenworth, KS: Combat Studies Institute Press, 2013).

11 Wendy Troxel, et al., *Sleep in the Military: Promoting Healthy Sleep among U.S. Service Members* (Santa Monica, CA: Rand Corporation, 2015), pp. 103-6.

12 Jeff Conklin, *Dialogue Mapping: Building Shared Understanding of Wicked Problems* (West Sussex: Wiley & Sons, 2006), pp. 3-40; Antoine Bousquet & Simon Curtis, 'Beyond Models and Metaphors: Complexity Theory, Systems Thinking and International Relations', *Cambridge Review of International Affairs*, Vol. 24, No. 1 (2011): pp. 43–62.

13 Gibson Burrell & Gareth Morgan, *Sociological Paradigms and Organisational Analysis: Elements of the Sociology of Corporate Life* (Portsmouth, NH: Heinemann, 1979); Majken Schultz & Mary Jo Hatch, 'Living with Multiple Paradigms: The Case of Paradigm Interplay in Organizational Culture Studies', *Academy of Management Review*, Vol. 21, No. 2 (1996), pp. 529–57; Paparone, *The Sociology of Military Science*.

14 Paparone, *The Sociology of Military Science*, pp. 19-21; Austin Long, *The Soul of Armies: Counterinsurgency Doctrine and Military Culture in the US and UK* (Ithaca, NY: Cornell University Press, 2016), p. 16.

[15] Sociologist Karl Weick provides significant studies on firefighter culture that parallels with military culture as framed in this article. Weick used the 'dropping tools' metaphor for cognitive reluctance in replacing favoured methods with novel and unfamiliar ones. See: Karl Weick, 'Drop Your Tools: An Allegory for Organizational Studies', *Administrative Science Quarterly*, Vol. 41, No. 2 (1996), pp. 301–13; Karl Weick, 'The Collapse of Sensemaking in Organizations: The Mann Gulch Disaster', *Administrative Science Quarterly*, Vol. 38, No. 4 (1993), pp. 628–52.

[16] Stephen Flanagan, 'Losing Sleep', *Armed Forces Journal*, Vol. 149, No. 5 (December, 2011), pp. 12-39.

[17] Ackoff, *Creating the Corporate Future*, p. 43.

[18] Russell Ackoff, 'Science in the Systems Age: Beyond the IE, OR and MS', *Operations Research*, Vol. 21, No. 3 (May-June 1973), pp. 661-671.

[19] Stephen Waring, *Taylorism Transformed: Scientific Management Theory since 1945* (Chapel Hill, NC: The University of North Carolina Press, 1991), pp. 9–19.

[20] Ackoff, *Creating the Corporate Future*, pp. 46–47.

[21] Jackson, *The Roots of Military Doctrine*; Markus Mader, *In Pursuit of Conceptual Excellence: The Evolution of British Military-Strategic Doctrine in the Post-Cold War Era, 1989-2002* (Bern, Germany: Peter Lang, 2004), p. 31; Paparone, *The Sociology of Military Science*, pp. 10–14.

[22] Donald Schön, 'The Crisis of Professional Knowledge and the Pursuit of an Epistemology of Practice' in: Louis Bames, C. Roland Christensen & Abby Hansen (Eds.), *Teaching and the Case Method: Instruction Guide* (Boston, MA: President and Fellows of Harvard College, 1987), pp. 6–8; Anders Sookermany, *On Developing (Post)Modern Soldiers: An Inquiry into the Ontological and Epistemological Foundation of Skill-Acquisition in an Age of Military Transformation* (Oslo, Norway: University of Oslo, 2013), p. 85.

[23] Chris Doran, 'Jumping Frames: Reflexivity and Recursion in the Sociology of Science', Social Studies of Science, Vol. 19, No. 3 (1989), p. 156; Marianne Lewis & Andrew Grimes, 'Metatriangulation: Building Theory from Multiple Paradigms', *Academy of Management,* Vol. 24, No. 2 (1999) p. 685; Antoine Bousquet, 'Chaoplexic Warfare or the Future of Military Organization', *International Affairs*, Vol. 84, No. 5 (2008), pp. 919-920.

[24] Aaron Wildavsky, 'If Planning is Everything, Maybe It's Nothing', *Policy Sciences*, Vol. 4, No. 2 (1973), pp. 127-129.

[25] Henry Mintzberg, 'The Fall and Rise of Strategic Planning', *Harvard Business Review*, February 1994, pp. 107–14; Henry Mintzberg, 'Patterns in Strategy Formation', *Management Science*, Vol. 24, No. 9 (1978), pp. 934–48.

[26] Wildavsky, 'If Planning is Everything, Maybe It's Nothing', pp. 129-132.

[27] Karen Jowers, 'McCain: Military Personnel's 100-Hour Work Weeks Must Stop', *Military Times*, 14 November 2017. Online: https://www.militarytimes.com/news/pentagon-congress/2017/11/14/mccain-military-personnels-100-hour-work-weeks-must-stop/, accessed 26 January 2018.

[28] Troxel, et al., *Sleep in the Military*, pp. 103–8. Although this study focuses on military culture and sleep, the conclusions reinforce the argument that military culture embraces an unhealthy work-to-life balance, complete with social and cultural forces compelling adherence to risky positions on rest.

[29] Ackoff, *Creating the Corporate Future*, p. ix.

[30] Elisabeth Bumiller, 'We Have Met the Enemy and He is PowerPoint', *New York Times*, 26 April 2010. Online: http://www.nytimes.com/2010/04/27/world/27powerpoint.html,

accessed 26 January 2018. Bumiller quotes multiple senior military leaders attacking PowerPoint and the lack of critical thinking, synthesis, and depth of understanding as demonstrated in the modern military digital briefing process.

[31] Ofra Gracier, 'Self Disruption: Seizing the High Ground of Systemic Operational Design (SOD)', *Journal of Military and Strategic Studies*, Vol. 17, No. 4 (2017), pp. 21–37; Ofra Gracier, 'Between Teaching and Learning: What Lessons Could the Israeli Doctrine Learn from the 2006 Lebanon War?', *Experticia Militar*, October 2017, pp. 22–29.

[32] Alex Ryan, 'A Personal Reflection on Introducing Design to the U.S. Army', *Medium* (blog), 4 November 2016. Online: https://medium.com/the-overlap/a-personal-reflection-on-introducing-design-to-the-u-s-army-3f8bd76adcb2, accessed 26 January 2018; Shimon Naveh, *The Australian SOD Expedition: A Report on Operational Learning*, unpublished manuscript dated 10 December 2010; Grant Martin, 'Deniers of "The Truth": Why an Agnostic Approach to Warfare Is Key', *Military Review*, February 2015, pp. 42-51.

[33] Philippe Beaulieu-Brossard, 'Encountering Nomads in Israel Defense Forces and Beyond', unpublished draft chapter in: P. Ish-Shalom (Ed.), *Concepts at Work*, edited volume in preparation, draft version dated 2018, pp. 3-7.

[34] Philippe Beaulieu-Brossard & Philippe Dufort, 'Introduction to the Conference: The Rise of Reflective Military Practitioners', conference paper presented at the *Hybrid Warfare: New Ontologies and Epistemologies in Armed Forces* conference, Canadian Forces College, Toronto, Canada, 2016; Christopher Paparone & George Reed, 'The Reflective Military Practitioner: How Military Professionals Think in Action', *Military Review*, April 2008, pp. 66–76; Willemien Visser, 'Schön: Design as a Reflective Practice', *Collection, Art+Design & Psychology*, No. 2 (2010): pp. 21–25; Donald Schön & Martin Rein, *Frame Reflection: Towards the Resolution of Intractable Policy Controversies* (New York: Basic Books, 1994).

[35] Haridimos Tsoukas & Mary Jo Hatch, 'Complex Thinking, Complex Practice: The Case for a Narrative Approach to Organizational Complexity', *Human Relations*, Vol. 54, No. 8 (2001), pp. 979–1013; Karl Weick, 'The Role of Imagination in the Organizing of Knowledge', *European Journal of Information Systems*, vol. 15 (2006), pp. 446–52; Karl Weick, 'Reflections: Change Agents As Change Poets: On Reconnecting Flux and Hunches', *Journal of Change Management*, Vol. 11, No. 1 (2011), pp. 7–20.

[36] Karl Weick, 'Drop your Tools: An Allegory for Organizational Studies', *Administrative Science Quarterly*, Vol 41, No. 2 (1996), pp. 301-313.

[37] 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. 127–40.

[38] Zweibelson, 'Change Agents for the SOF Enterprise', pp. 127–40.

[39] One seminar was the primary design group for my instruction while in several opportunities, the substantive play sessions expanded to multiple seminar groups as well as design faculty. These seminar groups were composed of predominantly Canadian Armed Forces professionals, with several additional international students per seminar.

[40] Over the past ten years I have led, facilitated or participated in multiple design inquiries, education events, courses and activities where the length of time and complexity of tasks and balance of work and play largely mirrored traditional military planning activities instead of design ones. This pattern exists across militaries, Western and non-Western cultures, and across services as well as inter-governmental and para-military organisations.

[41] Other deliberate efforts by the JSOU faculty include a business casual uniform for the military members, first name utilisation and no rank or status for students, and the removal of doctrine as well

as military planning language and methodologies except for specific design learning objectives on design-planning integration.

[42] Informal student feedback to multiple design cadre and CFC faculty after the 2017 'Shifting Sands' design exercise provided to the author. However, CFC faculty also greatly emphasised the observation that Seminar 12 (the seminar performing play activities) produced a novel design deliverable with a level of design self-reflection and innovation outperforming all other seminars. (Observation taken from personal correspondence between Philippe Beaulieu-Brossard and the author in June 2017 after the design exercise).

[43] At the Joint Special Operations University, each class requires the students to complete a survey at the end of the course. These critiques are categorised along with student demographics to compile statistics for course evaluation and validation over time. As the inclusion of substantive play activities were applied for the late 2017 JSOU-CCE design program, by October 2018 a large enough sample size will be available to make conclusive comparisons between the new program and the earlier program that emphasised traditional military educational practices, formal lectures, and extensive PowerPoint presentations (this data was not yet available at the time of writing of this paper).

[44] JSOU design faculty have observed students present design concepts through a scripted play format as well as using props and costumes. Many groups use a combination of white board drawings, written narratives, as well as additional models, props, and non-standard deliverables that express innovation as well as disruptive thinking.

A SURVEY OF CREATIVITY IN COMPLEX MILITARY SYSTEMS[1]

Matthew Furtado[2]

> *We need to entertain every prospect of novelty, every chance that could result in new combinations, and subject them to the most impartial scrutiny. For the probability is that nine hundred and ninety-nine of them will come to nothing, either because they are worthless in themselves or because we shall not know how to elicit their value; but we had better entertain them all, however skeptically, for the thousandth idea may be the one that will change the world.*

> Alfred North Whitehead,
> *Dialogues of Alfred North Whitehead*, 2001[3]

There is no standard definition for the phenomenon of creativity. The creativity research field is varied, with contributions from such diverse fields as cognitive science, psychology, systems science, and the visual and applied arts. There are two primary attributes common to most modern definitions of creativity: the concepts of novelty and value in use. Noticeably absent in military doctrine and literature is a comprehensive discussion of a theory of creativity.

The United States Army clearly values the phenomenon. Creativity is present in doctrine, which defines operational art as 'the cognitive approach by commanders and staffs—supported by their skill, knowledge, experience, *creativity*, and judgment—to develop strategies, campaigns, and operations to organise and employ military forces by integrating ends, ways, and means'.[4] The Army's most comprehensive doctrinal discussion of creativity occurs in its publication series devoted to mission command. Army Doctrinal Reference Publication (ADRP) 6-0 devotes one subparagraph to creativity. In it, it states the value of adopting novel approaches to operations assuming enemy forces have studied US forces' previous actions. It further states that creativity drives adaptation, the process of adjusting previous approaches to apply to a current problem, as well as innovation, the process of developing new approaches to a particular problem.[5]

The Army's doctrinal treatment of creativity leaves some confusion as to the relationship between creativity, innovation, adaptation and agility. In fact, the term most often appears in conjunction with another term, such as innovation or critical thought. Its treatment leaves readers certain that creativity is valuable but does not indicate ways in which to operationalise it or exploit it, short of making it the responsibility of a commander. Also absent from doctrine or military literature is a discussion of how creativity may influence military perspectives differently. For example, does creativity perform the same role in strategic thought as it does in operational or tactical thought? Furthermore, how do different planning methodologies and organisational structures associated with them affect the potential to employ creativity?

This confusion is exacerbated in the operational Army by exposure to predominantly tactical-level formations that employ the Military Decision-Making Process (MDMP). This methodology operationalises critical thinking into a process designed to produce viable solutions to relatively well-defined tactical problems. Absent is a concerted effort to employ a complementary thinking process that leverages imagination and visualisation to generate new ideas rather than adapt existing concepts into viable solutions. In short, through training and experience most officers are moulded to be critical at the expense of being creative.

A better understanding of creativity will address this organisational imbalance. It will allow leaders and planners to make better decisions concerning how they will employ the operations process and conduct planning. For commanders who drive the operations process, a deeper understanding of creativity will allow them to assess how their organisational leadership skills and command environment either promote or inhibit creative thought. It will also allow them to be more deliberate with their planning guidance and problem-solving framework. For planners and staff, a deeper understanding of creativity will sharpen the distinction between criticality and creativity, facilitating more purposeful use of each set of cognitive skills. In short, understanding creativity will help the Army move to a more deliberate process of adaptation or innovation.

Any concept of military creativity must address how the phenomenon influences thinking and planning differently from the strategic, operational and tactical perspective. This indicates that creativity is variable depending on both the echelon of the organisation and the planning methodology it employs. Creativity from the tactical perspective focuses on problem-solving and is limited to adaptive behaviours due to the prescriptive nature of doctrine. Creativity from the operational and strategic perspective focuses on both problem finding and learning. For these perspectives, organisational structure, process and individual attributes drive creative outcomes. These are different in function and logic and necessary to each other in the practice of strategic and operational design. A systems-definition of military creativity will help illustrate these concepts.

A systems definition of military creativity

The broadest definition applicable to a military context found in reviewing creativity research literature defines creativity as 'the interplay between ability and process by which an individual or group produces an outcome or product that is both novel and useful as defined within some social context'.[6] To adapt the above to a specific military context, this chapter proposes that military creativity is the interplay between expertise and organisational process by which military personnel or organisations produce outcomes or products that are novel and useful in achieving some form of purposeful relative advantage. This definition distinguishes creativity by expertise, process, and the military context in which actions occur.

The sections that follow will evaluate creativity from various military perspectives to discern how each of the elements from this section influence the nature, value and purpose of creative outcomes. This chapter argues that the unique ecological structure of military operations from the tactical, operational, and strategic perspective will yield differing opportunities for creative outcomes in both propensity and use.

Creativity and strategy

The proposed systems-definition of creativity illustrates the propensity and nature of creativity in the strategic context. There are numerous definitions of military strategy; most of them in some manner define strategy as the alignment of ends and means in pursuit of political objectives.[7] Put simply, the function of strategy, rather than its process, provides a better definition for evaluating other concepts as they relate to strategy. Therefore, for the purposes of this chapter, strategy is the logic and actions that guide military efforts to gain or maintain perpetual advantage. This definition provides a basis to illustrate the importance of creativity in the context of strategy. Creativity demands novel ideation to generate theories of advantage and action in executing strategic thought. These theories provide the foundation for developing novel artefacts that guide action and influence the ecology of strategy.

Strategy relies on creative potential to both perceive the strategic environment and develop a guiding logic to act within it. It follows that a strategist must first develop a theory of the environment, both its current state and future possibilities, before considering how to generate some form of advantage. This process requires two specific types of theorising: descriptive and normative. The ability to perceive and describe accurately the environment and rivals will influence the creative space that will guide subordinate action. Broadly, originality, flexibility and fluency characterise novel ideation.[8] Those skilled in divergent thinking will produce ideas that stress one or more of the characteristics above and lead to higher probabilities of creative outcomes. The value of divergent thinking is evident in thinking about the strategic environment itself. Divergent thinking allows a strategist to more accurately perceive the environment, develop original theories to explain why it is so, and challenge cognitive bias that distorts thought.

Lateral thinking, a specific form of applied divergent thinking, influences how readily a planner can avoid the influence of patterned thought. Recall that humans access knowledge stores in response to information before deciding whether to apply a previously-developed solution or generating a new idea to govern action.[9] This knowledge access process relies on thought structures called schemas to organise and interpret information observed in the environment.[10] Humans are prone to either ignoring contradictory information that fails to conform to the dominant schema or subconsciously fabricating missing details in order to match the schema pattern.[11] Those skilled in lateral thinking are conscious of this potential for bias and deliberately look for different ways to reinterpret their observations.[12] Individuals can also use disciplined critical thinking tools to identify and account for biased thought.[13] Such individuals expand the space for critical and creative thought by ensuring accuracy of perception.

This is particularly important since such perception influences the foundation of a theory of advantage that guides strategic thought. It is important to note that such a theory must account for both the environment and a rival. Such thinking demands second-order understanding of a rival, which accounts for the rival's understanding of the environment and its influence on its strategic logic and capabilities.[14] It is clear that strategists must develop new ideas to account for the contextual nuance of the environment when developing a strategic estimate. These ideas will influence how strategists define, assess, and ultimately seek to influence advantage. Only original thinking can conceptualise the foundational theory of advantage that should guide strategic action. History provides an example of the value of lateral thinking and second-order understanding in strategy.

T. E. Lawrence demonstrated the power of lateral thinking in perceiving strategic advantage during the Arab Revolt. Following the Arab seizure of Wejh, Lawrence paused to consider the strategic environment. Prussian-influenced Western convention indicated the next logical step for the Arabs would be to attack the Turks concentrated in Medina. This conformed to Clausewitz's idea that war was a duel between forces seeking to overthrow each other.[15] In this manner, armies became the objectives of operations aimed at their destruction. However, Lawrence perceived new insight into the Arab position by considering the environment from the Turkish perspective, a critical first step in developing second-order understanding. This led him to see the unique advantage the Arabs possessed due to circumstances. First, the Turks were compelled to secure their lines-of-communication (LOCs), especially the railway, to maintain their modern force. This created an insurmountable math problem for the Turks since they lacked the manpower required to guarantee their LOCs over such distances. This forced them to become sedentary, a position exacerbated over time by their need to consume their horses to compensate for disruptions to their supply lines, further eroding their mobility and thus their ability to contest rebel influence.[16]

This dynamic created the dilemma that Lawrence perceived as advantageous. Rather than rivals, he conceptualised armies as 'plants, immobile, firm-rooted, nourished through long stems to the head'.[17] Here is evidence of how affordance is both objective and subjective in generating meaning. The physical disposition of the Turkish force generated a specific insight to Lawrence, as the observer, but only because he was able to alter his interpretation of the nature of a modern army. This demonstrates the integrated nature of cognition and how 'affordance points both ways, to the environment and to the observer. This new knowledge results from novel perception and ideation, both creative acts that result from the expertise and thinking abilities of the individual strategist'.[18] However, strategists still require a theory of action to exploit this novel insight.

In addition to novel insight about the environment, divergent thinking influences the development of theories of action to achieve or maintain strategic advantage. Two things become evident in following this logic. First, any logic of action must be novel due to the contextually-dependent theory of the environment it is to influence. Lawrence again provides an example of novel ideation in how he envisioned the Arabs capable of exploiting the advantage described earlier. To exploit the immobility of the Turks, Lawrence advocated that the Arabs attack their materiel and lines of communications. In his words, the Arabs should fight a 'war of detachment' in which '[t]he death of a Turkish bridge or rail, machine or gun or charge of high explosive, was more profitable to us than the death of a Turk'.[19] This kind of war exploited the detrimental tension the Turks faced in sustaining a modern military on an extended logistical tether. Their mass forced them to safeguard their LOCs, which in turn made them more sedentary and less capable of imposing their preferred kind of war on the Arabs.

In addition to requiring a novel theory to guide action, the temporal nature of the strategic environment is indefinite and thus requires perpetual reframing to account for change. Complexity theorists would describe this dynamic as a complex adaptive system in which all actors seek a superior fit within the competitive environment.[20] This indicates that as rivals put their strategies in action, relationships will change the environment and potentially alter the original guiding theory of the environment. Thus, the goal of strategy is not to simply achieve advantage; it is to maintain perpetual advantage in light of changes induced by rivals or the environment itself.

This explains why strategic advantage equates to degrees of freedom in action. An actor with a greater capacity to induce or react to change has a competitive edge in the evolutionary context of conflict. This results from their ability to create more variation or to perceive more aptly which variations will be advantageous in the changing environment. Two prominent strategic theories illustrate how creativity and the ability to induce novelty is at the heart of strategy.

Ancient Chinese strategy seeks to exploit superior adaptability to the potential created by *shi*, or environmental disposition, relative to a rival. Rather than focus on actions, Chinese strategy focused on the set-up and efficacy of a complex adaptive system.[21] This provides an advantage for the actor who can better adjust and manipulate the structure of the environment to employ *shi*.[22] This corroborates modern theories that focus on the structure of competition as a lever to create and exploit strategic advantage.[23] This theory seeks to shape the environment to gain certainty of victory should a rival choose to fight rather than accept defeat. Thus, adaptation to the environment is what denotes superior strategy in the mind of ancient Chinese strategists. While theories on efficacy seek advantage through outright superior adaptation to circumstances, other theories seek advantage by limiting a rival's ability to understand the environment and cope with change.

John Boyd developed a theory that equates strategy to purposeful actions that deny a rival the ability to adapt to change. His theory rests on an ability to secure an advantage early and prevent a rival from recovering and compensating.[24] Actors do so by continuously introducing novelty within the environment, adding both energy and complexity to the system. Over time, variation compounds and prevents the rival from accurately perceiving or understanding the environment. This prevents a rival from acting with cohesive logic due to the mismatch between their perception of the environment and the reality being enacted by the actor.[25] In short, the two theories above demonstrate the central role that creativity plays in strategic thought. Both equate advantage with a superior ability to create and exploit variation within the strategic environment. The novel ideas guiding those variations along with guiding strategic logic are creative outcomes. Strategy also has a dialectic influence on the forces that shape the strategic environment.

In summary, creativity is central to strategy. Strategists seek to gain and maintain perpetual advantage. Strategists develop novel theories to describe and guide action within a competitive environment to account for the contextually-unique circumstances. This environment favours the actor who can introduce more influential, purposeful variation into the system, thus inducing advantageous change. This difference yields learning for the actor creating the change while potentially inducing shock on a rival. Actors maintain coherence when their actions are congruent with their strategic logic and environment. An inability to perceive and adapt to change will limit freedom of action over time, ceding advantage to a rival. In short, the creative process itself, tempered with judgment, is what yields strategic advantage.

Creativity and operational art

Operational art has both a theoretical and doctrinal foundation that influences the nature and manifestation of creativity. In general, theory defines operational art as 'the grey area between strategy and tactics, operational art spans the theory and practice of planning and conducting campaigns and major operations aimed at accomplishing strategic and operational objectives in a given theatre of operations'.[26]

Similarly, Army doctrine defines operational art as 'the pursuit of strategic objectives, in whole or in part, through the arrangement of tactical actions in time, space, and purpose'.[27] Both definitions indicate that operational art is an intermediate process that uses synthesis to translate the logic of strategy into an operational form that employs the functions and capabilities of tactics. The purpose of operational art, its constituent processes, and the unique ecology of operations creates opportunities for creativity related to theorising and developing novel operational approaches.

Foremost, the contextually-dependent nature of operational planning ensures all operational approaches are novel. This is evident when one considers the difference between tactics and operations. From the tactical perspective, friendly forces and rivals have intersubjective understanding as both understand their rival and environment through similar contexts of tactics. Both seek to impose a specific outcome relative to their rival or the environment and both understand those effects in the same light.[28] In contrast, planners use operational art to develop an approach that reconciles the guiding logic of strategy with the influences of a rival's actions. Since rivals are subject to different strategic guidance, one cannot assume that rivals hold intersubjective understanding as each rival may view himself, the environment, and the meaning of their interactions differently. Thus, the purpose of operational art is to develop a unique approach congruent with the logic of strategy relative to an understanding of a rival. In short, operational art demands the continuous development of contextually-dependent, novel theories capable of directing practical action. Operational art still requires a process to put form to those theories and guide purposeful action.

As discussed above, operational art is closely associated with ambiguous, difficult problem sets due to the unique nature of synthesising strategic logic into a contested environment. This interaction creates complex, ill-defined problems, indicating that operational art demands a conceptual approach to planning. Design processes are one method of conceptualising ill-structured problems.[29] As a process, design promotes creativity throughout its conduct and in its resultant artefacts.

Foremost, the design process requires developing both descriptive and prescriptive theories, both of which require novel idea generation in the context of operational art. The Army's design process, Army Design Methodology (ADM), corresponds to the theoretical treatment of design as a method of inquiry focused on seeing oneself in the environment, envisioning a desired future state, and developing a way to bring about the desired change of states.[30] Environmental and problem framing equate to developing theories that describe the environment. Thus, theorising is synonymous with idea-generation.

Furthermore, these ideas must be novel to account for the contextual nuance of the complex interaction between oneself, a rival, and the environment. This contextual distinction further prevents planners from using a 'search' methodology, available to tactical planners, for solving the operational problem. Tactical planners can select, from an existing array of tactical tasks, the appropriate combination of effects to achieve their mission. In contrast, operational artists develop approaches that use more conceptual tools to communicate requirements. In short, operational artists create new knowledge when using ADM as a sense-making and conceptual planning tool. While the steps of ADM will always yield novel insight and approaches when used for operational planning, how planners conduct those steps also contributes to creativity.

The non-prescriptive and collaborative nature of ADM extends the pool of expert knowledge and promotes divergent thinking, both critical elements in determining creative outcomes. Army design doctrine advocates that planners conduct framing activities collaboratively.[31] It follows that this alone extends the pool of expert knowledge available to planners; however, this collaboration, combined with the loose guidelines outlining design steps, creates more opportunities to apply that knowledge creatively. Recall that in tactical planning, there is pressure for planners to only look at a problem through the lens of their particular warfighter function for the purpose of creating a predefined deliverable. In design, doctrine is less prescriptive about what those deliverables are, demanding only that the presentation products include both a narrative and a graphic.[32]

This type of collaboration allows planners to abandon their specific functional expertise and engage other knowledge stores and experiences during framing activities. This impacts the propensity for creativity in two important ways. First, this framing-focused collaboration reduces the 'norming' pressure that would exist if a team member could claim expert knowledge.[33] Second, this plurality of views creates tension between ideas that can lead to new knowledge (also a creative outcome) when the group explores the rationale behind the divergent views to reconcile the differences.[34] Collaboration is the medium that coordinates the distributed knowledge and experience of a design team; however, knowledge alone does not guarantee a novel outcome. It is how an individual perceives the environment and uses knowledge that contributes to creative outcomes. This illustrates the earlier discussion of divergent thinking techniques.

Divergent thinking contributes to creative outcomes during design by enabling individuals to minimise and mitigate thought-constraining bias and more accurately interpret information. Framing is synonymous with perceiving the environment and theorising why it is so. Lateral thinking confers the same benefits to operational artists as to strategists in that it enables a more precise interpretation of information during framing activities and reduces the chance for perceptual error. Those skilled in lateral thinking use techniques to question their initial understanding of the environment and purposefully look for alternative explanations or interpretations for what they perceive.[35] This leads to a more accurate and deeper understanding of the environment during framing. This in turn can lead to 'creative destruction' in which long-held patterns of thought give way to more novel understanding and generate more options for action.

One particular method of lateral thinking is 'escape' thinking. The 'escape method' advocates examining that which we take for granted and questioning 'if they are the only and best way of doing things'.[36] The Israeli Defense Force attack on the Kasbah of Nablus in April 2002 demonstrate the value of this method. The Israelis, determined to clear guerrilla fighters from the Kasbah and a nearby refugee camp, reconceptualised how they saw the urban terrain that housed their enemy. This led to a novel operational form in which the Israelis developed a new understanding of the environment. In the words of their commander at the time:

> *This space that you look at, this room that you look at, is nothing but your interpretation of it. Now, you can stretch the boundaries of your interpretation, but not in an unlimited fashion, after all, it must be bound by physics, as it contains buildings and alleys. The question is: how do you interpret the alley? Do you interpret the alley as a place, like every architect and every town planner does, to walk*

through, or do you interpret the alley as a place forbidden to walk through? This depends only on interpretation. We interpreted the alley as a place forbidden to walk through, and the door as a place forbidden to pass through, and the window as a place forbidden to look through, because a weapon awaits us in the alley, and a booby trap awaits us behind the doors. This is because the enemy interprets space in a traditional, classical manner, and I do not want to obey this interpretation and fall into his traps.[37]

In this instance, the Israelis developed a new understanding of the environment. Rather than view the open urban spaces as manoeuvre corridors through which they must pass to attack the enemy, they instead viewed them as forbidden areas. This led them to see the very structures that used to indicate cover and concealment as the very medium of warfare, a three-dimensional space of constant change and opportunity.[38] This is evidence of the value of breaking patterned thought and the novel ideas that result from changing perspectives.

Doctrine further advocates a deliberate sequencing of divergent and convergent thought to generate creative outcomes. This is evident in how it recommends groups approach brainstorming during framing activities. Doctrine recommends deliberately breaking brainstorming into distinct divergent and convergent phases. During the divergent phase, individuals generate as many ideas as possible to describe the environment or identify relevant actors or relationships. It recommends that individuals work alone before meeting rather than working simultaneously as a group.

When complete, doctrine advocates adopting a convergent approach to making sense of the pool of ideas and concepts. It recommends using affinity mapping to logically cluster ideas for discussion and practical synthesis.[39] This conforms to research that indicates individual efforts (divergent thinking) best support idea generation while group efforts (convergent thinking) best supports evaluation.[40] This balance reduces some of the barriers to creativity. Working separately reduces the influence of bias and cognitive blocking inherent in group work. This expands the breadth and flexibility of ideas.[41] Using groups to evaluate and explore ideas adds depth to ideas. Research indicates this is an optimal division of labour for generating ideas.[42] In short, divergent thinking promotes novel ideation in two critical ways: it helps break the trap of patterned thought to perceive an environment more precisely, and helps inculcate habits of thinking that generate more creative ideas. Both influence how operational artists understand their environment and attempt to act purposefully within it.

The final element to consider in the operational design process is the resultant design concept itself. Examining the specific form of this artefact exposes additional applications of creativity. The design narrative and sketch create meaning and context for those uninvolved in the design process but who must translate its logic into operational outcomes.

The design narrative does more than just describe the environment and direct action—narrative shapes the perception of the environment and communicates the operational artist's understanding of it. It translates contextually-specific knowledge into communication, increasing the likelihood of creating shared understanding with those who will execute the design concept.[43] Further, it 'defines the dimensions in which the reader is likely to view the mentioned artifact [sic]'.[44] The important role language plays in narrative and cognition explains how this occurs. Language

constructs, such as metaphor and analogy, build the context for subordinates to interpret the novelty of the desired operational form. They capitalise on existing conceptual frameworks and schemas as a foundation to interpret the new artefacts.[45] Recall the IDF's new way of viewing urban terrain in Lebanon for an example of this process. The commander relied on metaphor to describe how he envisioned the IDF operating within Nablus. He used terms like 'infestation' and 'swarming' to help subordinates adopt a similar view of urban terrain as a navigable, three-dimensional space. It further indicated that he desired his forces to attack targets simultaneously from multiple directions and then quickly disaggregate.[46] Thus, these metaphors described both an alternate way of sensing the environment as well as a new way of manoeuvring within it.

In addition to helping subordinates understand new concepts, narratives explain the meaning behind an operational form as a whole. Humans rely on narrative as a device to make sense of the environment or concepts. Language builds realities that provide context for understanding an artefact.[47] Narratives carry 'ideas and judgments' that construct that meaning.[48] This is apparent in how narratives address the element of time. Time is a critical element of operational art that differentiates operational art from tactics. In tactics, planners focus on bringing discrete, singular events to a successful conclusion. Operational artists may arrange numerous events in time and space to enact its strategic logic. Narratives offer planners a way to present an operational form that indicates its temporal construct as well communicate its foundational logic. This temporal construct implies a causal link between events and their antecedents.[49] The aggregation of events represents a pattern that constitutes a plot, which is synonymous with the foundational theory of action tied to that specific potential reality.[50] Thus, narratives are a vehicle for creating new ways of making sense of an environment and are themselves creative artefacts.

Planners also use graphical sketches as a means to create shared understanding. Graphical expression employs a different set of skills than narrative expression. It offers the unique ability to visually depict the spatial, conceptual, and temporal relationships within an environment. This creates a 'virtual world' that allows for experimentation in support of theorising.[51] As artefacts, drawings support both the planning and presentation aspects of design. They complement design narratives and extend the medium of dialogue during collaboration. The drawings themselves offer opportunities for novel expression and can promote lateral thinking by influencing perception and conceptualisation of the environment. Finally, design graphics codify the requisite theories of the environment that promote organisational learning.

Summarising the discussion above will illustrate why creativity in the context of operational art is more sensitive to individual attributes than the tactical perspective. Operational artists face less-structured problems open to variable individual interpretations. Design processes rely on collaboration for framing and product development, which increases the chance for divergent opinions resulting from individual perception and expertise. It follows that the amount of expert knowledge and capacity for divergent and lateral thinking will influence that individual's ability to shape the framing activities of design.

Creativity and tactics

There are two primary interpretations of tactics and tactical thought: a theoretical perspective from scholarly military literature and the doctrinal perspective captured in

current Army doctrine. This chapter incorporates both perspectives to address more comprehensively how a systems definition of creativity reconciles with tactical operations and thought. From a theoretical perspective, tactics relates to the control and employment of forces for individual engagements.[52] Tacticians seek to achieve a specific end state, the achievement of which represents victory.[53] Army doctrine defines tactics as 'the employment and ordered arrangement of forces in relation to each other'.[54] Doctrine further defines a tactical mission task as 'a specific activity by a unit while executing a form of tactical operation or form of manoeuvre. It may be expressed as either an action by a friendly force or effects on an enemy force'.[55] These statements indicate the Army's view that tactics correspond to discrete, finite actions intended to achieve specific purposes relative to an enemy or the environment.

This specific ecology of tactics will influence the propensity of creative outcomes as described in the previous sections. To review, creativity is an emergent outcome resulting from the interaction of expertise, process, and environment. Creativity in the tactical context is restricted to adaptive behaviour and outcomes and not truly creative ones. This occurs due to the prescriptive planning methodologies used in conducting tactical actions, lack of organisational learning processes, and the nature of interactions at the tactical level.

The purpose and nature of tactical planning methodologies restricts opportunities for theorising, learning and collaboration which are integral to generating creative outcomes. Foremost, tactical thinking and planning seeks to conduct a specific action or series of actions that results in a specific effect on either the enemy or the environment.[56] Thus, tactical planning methodologies develop the orders that focus actions within the environment and synchronise resources to bring about the desired end states. In short, tactical planning drives action and focuses on operating within a specific space with known physical, temporal and logical boundaries.

This focus on action frames tactical thinking on specific outcomes such as a decision, mission, course of action or order, rather than on understanding alone.[57] Doctrine defines planning as 'the art and science of understanding a situation, envisioning a desired future, and laying out effective ways of bringing that future about'.[58] Doctrine further states that planning primarily addresses barriers or conditions that prevent the commander from achieving the desired future state. This frames planning as a component of a broader problem-solving methodology.[59] In fact, Army doctrine recognises three distinct planning methodologies: ADM, MDMP, and Troop-Leading Procedures (TLPs).[60]

Doctrine further ties its planning activities to problem-solving by recommending which methodology to use as a function of the complexity of the problem it addresses. Doctrine recommends staffs to use MDMP to address well-structured and medium-structured problems and to use ADM to address ill-structured problems. Doctrine defines medium-structured problems as problems in which the problem and end state are clear but there is disagreement in 'how to apply doctrinal principles to a specific piece of terrain against a specific enemy'.[61] This doctrinal framework relegates tactical planning to a 'search' framework of problem solving in which commanders select a series of actions from a set of pre-existing capabilities to best address the unique circumstances of the unit, environment, and enemy that seeks to apply an existing set of potential actions. In short, a selection process does not require generating new ideas or solutions, rather it requires the judicious application of tactical tasks to solve a presented or anticipated problem.

Tactical planning methodologies further restrict opportunities for novelty by constraining its knowledge base and inhibiting effective collaboration. The search nature of tactical problem-solving restricts potential actions to an existing set of options. In military terms, this set of options corresponds to tactical tasks, enabling tasks, and forms of manoeuvre found in Army doctrine. Thus, the tactical doctrine itself serves as the knowledge base from which ideation or solutions emerge. Because tactical planning is a search methodology, the process would require additions to or recombination of existing knowledge to generate a novel outcome. The temporal nature of tactics prevents timely additions to the knowledge base to create novelty within the tactical planning cycle. This would require additions to the current set of doctrine, which is beyond the time constraints of tactical ecology. Furthermore, the prescriptive nature of tasks themselves prevents their recombination into new tactical tasks or outcomes. Tactical tasks are not aggregated into some new task by echelon, rather commanders arrange tasks in time and space to achieve a specific outcome. Because commanders frame end states in doctrinally-precise, existing terms, these outcomes cannot be novel.

The planning process further restricts collaboration and opportunities for novel ideation and perception, elements which contribute to creative outcomes. Rigid guidelines govern almost every aspect of the MDMP. Doctrine specifies the sequential steps of the MDMP in Chapter 9 of FM 6-0. This chapter further specifies the key inputs, processes, and outputs along each of the seven steps of MDMP. This prescriptive framework has two critical influences on creativity. First, it removes any need to develop new ideas about how to approach the planning process due to its myopic focus on the end-state. Additionally, dividing work steps and outputs by functional expertise reduces the need to collaborate. Knowledge management literature indicates collaboration can promote creativity via idea generation because groups will need to develop new ideas or adopt new perspectives to resolve tension created by competing theories about an environment or a solution.[62]

This division of efforts and compartmentalised approach to planning also inhibits an organisation's ability to generate new knowledge or learn, both of which require creativity. Organisational learning requires a unit to produce a formalised hypothesis of its environment.[63] Organisations must also institute 'rules for learning' to apply abstracted experiences or theories with a communication strategy that distinguishes future behaviour as adaptation and not 'rote iteration of past successful actions'.[64] Army doctrinal tactical planning lacks the requisite formalised communications framework to coordinate distributed experiences for higher-level abstraction due to its reliance on mission-oriented orders and the prescriptive structure of unit after-action reviews (AARs).

Foremost, orders are the primary means of communicating at the tactical level. Paragraph one (Situation) or Annex Bravo come closest to presenting a formalised hypothesis of the environment; however, it is descriptive in nature and limited to discussing anticipated actions of a rival or other actor. Furthermore, doctrine prescribes units to present the higher headquarters' understanding and visualisation of the enemy as a part of its intelligence annex.[65] This could potentially lead to conformity bias if subordinate staffs accept such inputs uncritically. This organisational nesting and the one-way nature of orders results in efficient use of resources; however, it removes flexibility for subordinate units to operate with a divergent view of the environment. The lack of formalised assessments to invalidate an operating hypothesis, combined with the short-duration nature of tactical engagements, further restrict a unit's ability to increase organisational knowledge.

The doctrinal structure of after-action reviews, the one formal procedure in doctrine aimed at learning, also fails to promote organisational learning. The Army's AAR procedure does not require abstracting experiences for higher-level synthesis. This is evident in doctrine's overall focus on the unit's performance relative to its plan rather than a focus on the plan's merits relative to an enemy or the environment. Doctrine states that AARs aim to reconcile observations of performance with what the unit planned to do for the sake of correcting task performance deficiencies. It further recommends updating unit standard operating procedures or capturing updates as lessons-learned. However, it stops short of clarifying how best to dispose of after-action reports beyond stating that they should be sent to other units conducting a similar mission, doctrinal proponents, generating force agencies, and the Center for Army Lessons Learned (CALL).[66] Doctrine does not specify what actions to take beyond sending reports, such as how to coordinate disparate reports to create refined understanding. This lack of a forcing function to abstract experience to refine environmental understanding limits learning to the tacit domain of the individuals who participate in a specific AAR. This restricts any learning that does occur to enhancing organisational memory, but not organisational knowledge.

Some readers may sense a biased argument in this section's sole focus on MDMP as the process that supports tactical planning. Doctrine does in fact permit the use of ADM to support tactical planning.[67] However, the context of tactics prevents tactical planners from leveraging novel outcomes from design processes. While design can lead to a better understanding of the environment, tacticians still employ a search-model of decision-making framework in which they select tasks and forms of manoeuvre from an existing body of doctrinal knowledge.

To review, the ecology of tactics and the organisational approach to planning limit the opportunity for tactical creativity. The teleological nature of tactics attempts to remove uncertainty and variation in outcomes, reducing the value of novel action or outcomes. The MDMP, as a prescriptive planning process, does not incentivise collaboration of a nature that leads to novel ideation or organisational learning. This procedural approach also anchors planners within their specific area of expertise, further inhibiting conceptual exploration. Finally, doctrine's teleological treatment of tactics focuses organisational learning activities on process improvement and best practices rather than the creation of new knowledge.

Conclusion

The discussion above addressed creativity in the context of military operations. It seeks to inform readers of the mechanics governing creative outcomes and how the value and propensity of creativity depends on perspective. Neither Army doctrine nor literature adequately addresses the phenomenon. Both treat creativity as a specific way of thinking to complement critical thought, effectively reducing it to an individual attribute that should lead to better judgment or ideas. This 'black-box' understanding fails to inform commanders and staffs about ways to promote or exploit novel outcomes or artefacts.

This paper uses systems theory to define creativity as novel outcomes resulting from the interplay between expertise, cognitive ability, process, and ecological context of operation. This definition illustrates how the nature and value of creativity changes with perspective. From a strategic perspective, creativity is manifest in the novel theories that provide the guiding logic for operational planning. Similarly, operational artists develop novel theories to describe the environment and guide action;

however, creativity most influences organisational learning. Finally, the ecology and logic of tactics creates a system that favours adaptation over novelty.

Notes

[1] This chapter is based on the following US Army School of Advanced Military Studies monograph: Major Matthew Furtado, 'Creativity in Complex Military Systems', 2017.

[2] Disclaimer: The views and opinions expressed in this chapter are those of the author and do not reflect the opinions or any official position of the US Army, the US Department of Defense or the US Government.

[3] Alfred North Whitehead, *Dialogues of Alfred North Whitehead*, Ed. Lucien Price (Boston: David R. Godine, 2001), pp. 280-281.

[4] Emphasis added. Army Doctrine Reference Publication (ADRP) 5-0, *The Operations Process* (Washington, DC: US Government Printing Office, 2012), pp. 2-4.

[5] ADRP 6-0, *Mission Command* (Washington, DC: US Government Printing Office, 2012), pp. 2-8.

[6] ADRP 6-0, *Mission Command*, p. 156.

[7] Basil Henry Liddel Hart, *Strategy,* 2nd ed. (New York: Meridian, 1991), p. 322.

[8] E. Paul Torrance, 'Education and Creativity' in: Albert Rothenberg & Carl R. Hausman (Eds.), *The Creativity Question* (Durham, NC: Duke University Press, 1976), pp. 219-223.

[9] Bernard A. Nijstad, Michael Diehl & Wolfgang Stroebe, 'Cognitive Stimulation and Interference in Idea-Generating Groups' in: Paul B. Paulus & Bernard A. Nijstad (Eds.), *Group Creativity: Innovation Through Collaboration* (Oxford: Oxford University Press, 2004), p. 145.

[10] Stanley G. Harris, 'Organizational Culture and Individual Sensemaking: A Schema-Based Perspective' in: James R. Meindl, Charles Stubbart & Joseph F. Porac (Eds.), *Cognition Within and Between Organizations* (Thousand Oaks, CA: Sage Publications, 1996), p. 287.

[11] Harris, 'Organizational Culture and Individual Sensemaking', p. 287.

[12] Edward de Bono, *The Mechanism of Mind* (New York: Simon and Schuster, 1969), p. 230.

[13] *The Applied Critical Thinking Handbook, v. 8.0* (Fort Leavenworth, KS: University of Foreign Military and Cultural Studies, 2016), pp. 108-155.

[14] Krippendorf defines second-order understanding as understanding that accounts for how the user of a design artefact will interpret its meaning. In this context, second-order understanding applies to how a rival views and interprets the environment. Klaus Krippendorf, *The Semantic Turn: A New Foundation for Design* (Boca Raton, FL: Taylor & Francis, 2006).

[15] Carl von Clausewitz, *On War*, Ed. and Trans. Michael Howard & Peter Paret (Princeton: Princeton University Press, 1976), p. 75.

[16] T. E. Lawrence, *Seven Pillars of Wisdom: A Triumph* (New York: Random House, 1991), pp. 188-189.

[17] Lawrence, *Seven Pillars of Wisdom*, p. 192.

[18] There are formal individual and group processes to actively seek alternative interpretations of the environment, such as Four Ways of Seeing and Analysis of Competing Hypothesis. See *The Applied Critical Thinking Handbook v. 8* for an expanded discussion of these processes.

[19] Lawrence, *Seven Pillars of Wisdom*, p. 194.

[20] Robert Axelrod & Michael D. Cohen, *Harnessing Complexity: Organizational Implications of a Scientific Frontier* (New York: Basic Books, 2000), p. 8.

[21] Francois Jullien, *The Propensity of Things: Toward a History of Efficacy in China*, Trans. Janet Lloyd (New York: Zone Books, 1999), p. 37.

[22] Jullien, *The Propensity of Things*, pp. 33-34.

[23] Everett Carl Dolman, *Pure Strategy: Power and Principle in the Space and Information Age* (New York: Frank Cass, 2005), p. 157.

[24] Frans P. B. Osinga, *Science, Strategy, and War: The Strategic Theory of John Boyd* (New York: Routledge, 2007), p. 125.

[25] Osinga, *Science, Strategy, and War*, pp. 125-126.

[26] John Andreas Olsen & Martin van Creveld, 'Introduction' in: John Andreas Olsen & Martin van Creveld (Eds.), *The Evolution of Operational Art* (Oxford: Oxford University Press, 2011), p. 1.

[27] Army Doctrine Publication (ADP) 3-0, *Operations* (Washington, DC: US Government Printing Office, 2016), p. 4.

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[29] Brian Logan & Tim Smithers, 'Creativity and Design and Exploration' in: John S. Gero & Mary Lou Maher (Eds.), *Modeling Creativity and Knowledge-Based Design* (Hillsdale, New Jersey: Lawrence Erlbaum Associates, 1993), p. 140.

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TEACHERS, LEAVE THEM KIDS ALONE: DEBATING TWO APPROACHES FOR DESIGN EDUCATION IN MILITARY ORGANISATIONS[1]

Ben Zweibelson, Aaron P. Jackson and Simon Bernard[2]

The guidance in this publication is authoritative; as such, this doctrine will be followed except when, in the judgment of the commander, exceptional circumstances dictate otherwise.

Joint Publication 5-0 *Joint Planning*,
16 June 2017, Preface[3]

Every assumption we hold, every claim, every assertion, every single one of them must be challenged…the structure and organization of our Army, both operational and institutional, may change drastically.

General Mark A. Milley,
39th U.S. Army Chief of Staff, October 2016[4]

Introduction: Simon Bernard

The Canadian Armed Forces, like our allies, are facing a level of complexity in operations never seen before. The Operational Planning Process (OPP) remains a reliable strategic or operational planning tool for conventional operations, but the linear approach it establishes for campaign planning does present limits for an operating environment where militaries are engaged in multi-domain operations in a whole-of-government construct.

Systems thinking and design have proven to be innovative ways to look at complex or wicked problems. Yet military design has a reputation for being elitist, too dense and abstract for utility across the forces. Few Canadian Armed Forces (CAF) officers have had the opportunity to become 'design thinkers' and even fewer have held positions to apply it. Educating practitioners to enable them to conduct creative or divergent thinking is crucial for this innovative approach to overcome its poor reputation and gain momentum, and for it to become part of our toolbox for military planning and decision making. But how should the profession of arms conduct its professional military education (PME) to foster an environment where innovation and creative thinking can grow and be part of our DNA?

In this chapter, two subject matter experts on design thinking, Ben Zweibelson and Aaron P. Jackson, debate different approaches to integrate design thinking into our PME model. Should we teach junior members what 'the box' is before we teach them at mid-career level to think outside of it or reshape it? Or should we integrate design education across the Forces at entry-level to foster a culture change and embrace this approach CAF wide? In the debate below, Jackson advocates the first of these positions while Zweibelson advocates the latter.

This debate is important because design thinking has proven to be an effective way to face a complex environment and tackle a wicked problem. It is clear that we cannot afford to maintain the status quo and hope that our next war will be conventional by nature and that the OPP will suffice. Our recent operations in Afghanistan have demonstrated clearly that a linear approach to planning and the sequential conduct of operations has its limits. Each of the PME approaches debated here proposes a way to overcome these limits. It is hoped that this debate will stimulate further thinking about the best place for military design education within our PME model, and that it will provide impetus for reforms that will give the CAF the best chance for success in future operations.

The Case for Entry-Level Design Education: Ben Zweibelson

Making the case for favouring entry-level versus a specialised-level design educational approach for military organisations requires a few critical positions be provided to readers. First, it ought to be demonstrated that there is little to no distinction between inexperienced or junior military professionals and senior professionals in learning and applying design in practice. While some may persuasively argue the value of experience and maturity within established professions, such as the military, with those attributes may also come the very barriers to innovative thinking and critical reflection in complex, emergent situations.

At a deep pedagogic level, the tension here is whether experienced senior professionals are better positioned to learn something radically different within the institution or if young and quite inexperienced professionals might be better positioned through fresh perspectives and an 'institutional innocence' of sorts. Albert Einstein did his ground-breaking work as a young patent clerk, not as a seasoned and senior professor in a university. Innovation and creativity hardly belong to the top floors of corporations or to general officer billets; an argument could be made that those locations are rather devoid of such things more often than we wish to admit.[5]

Secondly, a compelling case favouring entry-level military design ought also to provide examples of how the traditional military emphasis on controlling education and knowledge access is actually inhibitive for design pedagogy. These traditional forms feature a rigid hierarchical 'factory methodology' for military education.[6] This is no easy task, in that an additional institutional barrier exists within the military profession concerning the essence of introspective pondering beyond methodology and output. Militaries frequently are unaware of their own paradigm and its limitations,[7] and institutional efforts to justify the continued use of a single 'technical rationalist' approach tend to create a paradox of avoidance.[8] Militaries relish critical thinking within the confines of never questioning deeper institutional beliefs, tenets, and organisational behaviours.[9] This makes for many deck chair arrangements on the ship without considering the journey.

Militaries know how to plan through rationalised, analytic processes, as well as how to reliably critique adherence to or deviation from these processes. Yet rarely does a military 'think about its thinking' and explore alternative paradigms and learning processes that disrupt and challenge institutional norms. In this context, how might a process such as design, which operates beyond and outside rationalism and analytical structure, work within a military that tends to approach everything using universal and standardised processes for optimisation? Further, how might the suggestion be received that a new cognitive tool–such as design–should be introduced not at the higher levels of the profession but rather at the bottom? This

would contradict most existing military pedagogical norms across nations, services, and units within what military researchers term the 'modern military era'.[10] This is precisely why military design is needed broadly and systemically across all military professional education programs, so that organisational change might flourish through these reflective practitioners.[11]

The modern military era spans from the mid–17th century to the present day. Essentially, it commenced when the first military professional academies were established and written doctrine began to be published.[12] This coincided with the Industrial Revolution, as well as the Age of Enlightenment, which cumulatively developed the military organisation into a large bureaucratic and centralised hierarchy that focuses on analytic reasoning and a scientific management process oriented exclusively upon reductionism.[13] That assembly-line and efficiency-based management style is termed 'Taylorism' after its leading proponent.[14] Underneath all of this, militaries continued to educate through the pedagogy of essentialism. Essentialism dominated during the 20th century and is a teacher-cantered model for standardised learning. Essentialism largely defines the majority of military professional education approaches and pairs strongly with the preferred organisational form of the military hierarchy that favours rigidly structured training, extensive procedural rules, and a resistance to divergent thinking.[15]

Traditional military education through essentialism categorises students by peer groups, where each group is taught the same material and evaluated with uniform metrics and scoring through a tiered system.[16] While the essentialist form is one of centralised hierarchies that mirror military command and control structures, the content for this educational approach consists of an analytic based optimisation model where students memorise facts and experience a single curriculum (regardless of class offerings, an infantry officer receives the same training as all other infantry officers, and so on). Students obey the teacher, and the teacher controls the distribution of knowledge as well as controlling the progression and development of all students.[17] The factory assembly line metaphor is aptly applied to all military career paths, through selection, tiers of education, performance evaluation as well as essential positions needed to open subsequent 'gates' to advancement.

The attraction of essentialism for the military seems obvious, in that the entire military decision-making methodology from strategy to tactical action is encapsulated in an 'ends-ways-means' objective-fixated logic.[18] This logic is rationalised in that deductive reasoning with linear cause-effect relationships provide the observer with the ability to soundly (rationally) predict consequences of potential actions prior to those actions being taken. Whether one considers the Joint Planning Process, Military Decision-Making Process, Adaptive Campaigning, Military Appreciation Process, NATO Operational Planning Process or other related decision-making methodology, these models all match the undertones of a rationalist and analytical approach to reality. Planning never had it so well, and thus military educational approaches integrate a functionalist planning epistemology within the teacher-centric essentialist pedagogy. The priority remains one of creating convergence, conformation and reliability, which make militaries remarkably effective and resilient in several (but not all) common military contexts.

Military design does not replicate planning, nor should it. Design is distinct from planning, although planning is also considered a form of designing within linear and reductionist constructs.[19] Planners do a focused form of design, while designers have greater freedom to design, as well as design for planning. Both design and 'planning

design' are cognitive processes that enable individuals as well as organisations to create and apply deliberate changes in the future that result in consequences that can be further considered. Yet formal military planning is oriented on predicting desired future 'end states' while design creates that which does not exist but is needed in future and emergent contexts. In other words, when a military plans it seeks out 'déjà vu' experiences where the emergent future appears to express relationships that the organisation has already seen. Hence, it can draw predictive reasoning from history, analysis, experience and wisdom.[20] What happens when an organisation experiences 'that which it has never seen before', or Vu' Jàde?

Design, whether used by a military or otherwise, is oriented on divergence, innovation, creativity and a wholesale rejection of the rigid and essentialist pedagogy.[21] While most military planning courses continue to employ largely essentialist pedagogical processes, a number of design schools of thought use either a form of constructivism or humanism.[22] These alternative pedagogies remove the teacher from the position of centralised control,[23] place students in an entirely different context and maintain a fluid and emergent outlook where students critically self-reflect, self-assess and self-motivate. In design, students are on their own journeys, often to novel and emergent destinations that neither the student nor teachers can predict. The 'ends-ways-means' logic is disrupted, in order to create the contexts for innovation and divergent thought.

Constructivism emphasises student experience with self-reflection, where one learns to 'think about one's thinking'. Humanism, also termed 'human-centric design' approaches design education with a focus on human empathy, contextual self-awareness and iterative framing.[24] Teachers use indirect approaches, emphasising a personalised and frequently emergent process of student self-motivation, personalised study, and a self-actualising process where grades are irrelevant as analytic measurements of entirely subjective and qualitative contexts.[25] With constructivism and humanism in design education, the entire frame (including self-described roles, structures and progression) change for students, teachers, and the process of new knowledge construction.

How do organisations teach their young? Do they teach their older members differently? For the military, what differences exist between basic training for entry-level recruits and that of seasoned executives, such as senior non-commissioned officers in the Sergeant Major's Academy? How is the basic officer's course different in form and function from war colleges educating senior officers? While the contexts and individuals are clearly different, the form and function actually remain quite similar, regulated within the overarching military educational system underpinned by a teacher-centric essentialist pedagogy.[26] Instructors at senior military schools might protest this comparison, however a careful examination of the form and function of the entire PME system illustrates a Taylorism-inspired educational management model for the career path of all officers and enlisted personnel, using a largely essentialist pedagogy manifest through standardised academic scoring, reports, school options, metrics, timelines, peer groups, and other manufacturing metaphors.[27]

Considering the length of time that a military professional experiences a particular methodology for education over a two or three-decade career, would the length of exposure to the essentialist pedagogy possibly create resistance towards alternative education through which design is best administered?[28] Would a war college student with 20 years of education and experience be more likely to reject and resist design

because it is explained and facilitated through a different and potentially opposing pedagogy? Would an entry-level recruit in their basic training or a cadet entering officer initial training be more open to alternative concepts such as design administered in alternative pedagogical approaches?

Unfortunately, there are no significant examples of junior or entry-level recruits being taught design in military organisations at the time of this writing, however there are indications of some design experimentation that may be implemented at some military academies.[29] In universities that emphasise the constructivist and humanist pedagogy as well as multi-disciplinary experiences, basic design courses are required for freshmen and sophomore classes, indicating that at least in non-military organisations design can be taught to the most junior and least experienced professionals.[30]

Why would this be of value for a military? Innovation is costly, and it remains a high-demand and low-availability cognitive commodity in organisations. Design thinking becomes for the military a useful process for fostering diversity of thought, creativity as well as critical self-reflection. When a military demands innovation from itself, it currently expects senior leaders to be 'generalised'—in that, upon reaching the maturity and high level of experience and success that the top performers accomplish over decades of service, these general officers must now become organisational change agents and 'out-of-the-box' thinkers. Yet, the one thing that most of them share is the ability to conform better than their peers at every critical career advancement gate along the path; they are masters of convergence and efficiency.

There is an increasingly popular argument that divergent thinkers, innovators and mavericks are being removed or driven away by the competitive process of military promotion and advancement, with only a minority remaining to command at high levels.[31] Paradoxically, it is at the strategic level that senior leaders are suddenly expected to not be the best in their peer group at convergence and conformity. Instead, they are supposed to be divergent and reflective practitioners able to generate major organisational developments into forms that are novel and lacking a performance history.[32] Would a senior leader unfamiliar and unexposed to an alternative way of sense making,[33] such as design, be more or less willing to accept it, or would that leader already be rather conditioned in a essentialist pedagogical methodology, so much that they may not tolerate design's constructivist or humanist approach?[34]

Design could be provided to all entry-level military professionals, both in schooling as well as during their first assignments through a variety of courses, exercises, and cycles of theory and practice. However, to do this requires the acceptance of humanist and constructivist pedagogical processes into rather rigid and formalised traditional military programs. Time and resources are limited, and the inclusion of design should not cause the elimination of another essential lesson. Further, teaching design requires a non-traditional approach for design educators, which is yet another requirement causing more investment and training.

We, in military organisations, demand a flexible and adaptive force led by senior leaders that are able to innovate and encourage necessary change while also enforcing relevant practices and traditions. Yet, we deny design education largely until some mid-career officers are exposed to it, and the enlisted corps are predominately absent from any formal design education despite making up the vast

majority of the armed forces. Meanwhile, entry-level students in several other fields and disciplines do receive design education, particularly in those fields with complex and challenging contexts such as public services, architecture, advertising, urban planning and social services. Militaries instead prepare only select senior and mid-grade leaders with design education, implying perhaps that everyone else need only focus on less dynamic problems.

The platoon leader as well as the squad leader on today's irregular battlefield faces just as many complex and highly emergent contexts as any general officer in a command post. Why are militaries essentially denying junior leaders a more comprehensive tool for thinking about complexity, while simultaneously providing limited design education only to populations of senior professionals already conditioned to one standardised mode of thinking, within peer groups already purged of most divergent thinkers and mavericks through years of institutionalisation? Perhaps it is more terrifying to the military institution writ large that design education at junior levels would be disruptive not just to traditional military pedagogic forms but to the entire form and function of the military enterprise.

The Case for Specialised Design Education: Aaron P. Jackson

The intent of this chapter is to debate the most appropriate point at which design thinking should be situated within the PME continuum, and therefore where in a military career practitioners should start to learn design methodologies. Underlying this debate is a significant assumption: that the military practice of design thinking is desirable in the first place. On this assumption the authors of this chapter are in agreement and, accordingly, we are also in agreement about the nature of design thinking and how it ought to be taught.

To summarise what was elaborated in the previous section; design thinking is oriented on divergence, innovation and creativity, often employing constructivist or humanist epistemologies to guide student learning. These pedagogies are student- rather than teacher-centric and encourage students to self-reflect, self-assess and self-motivate. As students learn to design, assessment becomes both subjective and personalised because the emphasis is on student self-actualisation rather than on quantitative measurement.[35] Design as a methodology may include 'eclectic combinations of philosophy, social sciences, complexity theory, and often improvised, unscripted approaches in a tailored "one of a kind" practice'.[36] Accordingly, the emphasis is tripartite and is on the background and prior knowledge of the designer, the understanding they develop of the situation, and their exploration of possible solutions.

Just as the authors of this chapter agree on what design thinking is and how it ought to be taught, we also agree on how it differs from traditional military planning. Planning generally employs a technical-rationalist epistemology that focuses on 'ends-ways-means', and a methodology that reverse-engineers a plan by first determining a desired end state, then breaks this down into components, then linearly sequences these components as steps to achieve the desired end state. This assumes linear and predictable cause-effect relationships and is reductionist in that it also assumes that a desired end state is merely the sum of its component parts.[37] Both design and planning have appropriate roles and uses within militaries, and when best to employ one or the other is usually situation dependent.

The question concerning us in this chapter, then, is a rather narrow one: at what point in one's military career is it better to commence design thinking education? Although narrow, this question is nevertheless vitally important because the answer reflects who a military organisation would be willing to open the design 'tool kit' for, and when and how the tools within it ought to be used.[38]

Zweibelson's preceding argument for opening this tool kit to entry-level military practitioners is essentially two-fold. First, there is little-to-no distinction between the application of design thinking by junior or senior personnel, in terms of how effective they may be at applying it. Since some higher education institutions teach undergraduate students design, and since militaries require innovative junior leaders, why not teach military practitioners design thinking early and universally? Second, the current PME system at all levels—from recruits to general officers—is based on an essentialist paradigm that delivers uniform educational programs to each cohort of students in a teacher-controlled environment. The experience of this type of education system over the course of a career, and the radically different pedagogical paradigm necessitated by design thinking, results in a resistance to design thinking education when it is introduced at mid-career and senior levels.

In this section, I advocate instead that design thinking should be taught to field grade officers at the mid-career (O4 and O5) level and that, while educating for a general awareness of design thinking is desirable, it should be taught in detail only to a select group of 'military designers'. The reasons for this relate to the key role requirements of military practitioners at different levels. Specifically, what do militaries require their commanders and planners to do at different stages of their careers? This question is explored in detail in Alan Okros' broad-ranging study of Canadian Forces leadership,[39] which addresses the requirements established in Leadership in the Canadian Forces for military leaders to transition from 'leading people' to 'leading the institution' as they move to more senior ranks.[40]

Very briefly summarised, Okros observes that at the entry-level military practitioners have a pressing need to learn their core trade and develop knowledge of the core aspects of the profession.[41] For senior non-commissioned members and junior-to-mid level officers, the focus shifts to developing an understanding of broader issues beyond one's own core trade, for example how the joint force works, developing deeper solutions to more wider-ranging and more complex problems (Okros notes that 'the operational planning process dominates') and updating the core professional aspects learned at more junior levels. Finally, at senior levels, managing the institution requires analysing 'wicked problems' and developing strategic guidance to enable the organisation to function despite the often intractable nature of these problems.[42] Education requirements for these three areas can be respectively analogised to education in the disciplines of engineering, the natural sciences and the social sciences.

The problem with PME that Okros identifies, and which is echoed above by Zweibelson, is that at all levels it is based on pedagogical approaches that mirror those found in engineering; what Zweibelson labelled 'essentialist'. At lower levels, where the focus needs to be on learning core trades and being socialised into the profession and its accompanying norms, this approach is appropriate—especially in light of the limited time available to instruct new inductees. At mid and senior levels, however, this pedagogical approach becomes a hindrance. Continuing Okros' analogy, militaries are trying to teach natural and social sciences using an engineering approach.

The result is that contemporary strategic problem-solving tends to mirror tactical problem-solving but is merely grander in scale, and this approach does not work. Coincidentally, this is the reason why this author has recently come to prefer Guibert's term 'grand tactics' to the Soviet term 'operational art' when describing operations planning processes.[43] What we ought to be doing instead is teaching mid and senior level officers methodologies that are epistemically and ontologically suitable to solving wicked problems, using a pedagogical approach that is suited to teaching them. Design thinking is an excellent example of such a methodology.

Put simply, militaries first need to teach their members what 'the box' is, before they teach them to think outside of it or reshape it. Although junior personnel could apply design thinking itself just as well as senior personnel, the outcomes of this thinking may add much less value precisely because junior personnel do not yet have enough exposure to the core aspects of the profession. As Uhl-Bien, Marion and McKelvey explain:

> *The significance of an adaptive moment is related to the expertise of the agents who generate that moment and to their capacity for creative thinking. Expertise and creativity are not necessarily co-resident in an adaptive event, of course. Quite obviously, creative individuals without training in physics are not going to advance that field, but neither are, one might argue, two physicists who are unable or unwilling to break out of their paradigmatic assumptions. Complex systems depend on the former (expertise) and stimulate the latter (creativity).[44]*

In the military context, design thinking is more likely to achieve desirable outcomes when it is applied by mid or senior level personnel who have already developed a thorough knowledge of the military profession.

The above quote by Uhl-Bien et al also highlights another aspect, which is that design thinking is only likely to work if applied by creative military personnel who are both able and willing to break out of existing paradigms. Not all military personnel are capable of this, and even less seem to be willing. However, as Zweibelson highlights above, there is a need to overcome resistance to new paradigms, such as design, when military personnel are taught at mid and senior levels—indeed, this is a core component of his argument for introducing design education at junior levels. Yet there may be another way to achieve this and, somewhat ironically, the introduction of the now-dominant technical-rationalist paradigm itself may serve as a guide.

This paradigm was introduced progressively over about 150 years from the early 19th century, coming to the point of near-universal dominance it has reached today after, and perhaps because of, the Second World War. This paradigm's gradual introduction is tied into two broader developments: the establishment and rise in the importance of military staff colleges;[45] and the progressive dominance of positivism and rationalism within society more broadly.[46] For the purposes of this chapter, what is important to remember is that initially these colleges were attended by only a small percentage of officers. Those officers, after graduation and once in a position of influence, demonstrated the utility of the skills they had been taught through the victories they achieved, the success of the Prussian general staff in planning the wars against Denmark, Austria and France in the 1860s–1870s providing an excellent example.[47] A more recent example is the role School of Advanced Military

Studies (SAMS) graduates played during the 1990–91 Gulf War. In the words of Robert Scales:

> During its formative period in the early 1980s, many in the [U.S.] Army leadership resisted the SAMS program mightily… All of these antibodies evaporated when the combat commanders realized the value SAMS graduates brought to their plans and operational staffs. After Desert Storm, SAMS went from a liability to a priceless asset.[48]

As has been said numerous times before, history never repeats but it does seem to rhyme. A specialised mid-level design thinking course may have a similar effect to these historic examples, providing that its graduates are employed in positions where they can influence command decisions. Such a course would therefore need to be accompanied by, firstly, a generalised design thinking awareness program that teaches all military personnel what capabilities the specialist brings and, secondly, a specific career management stream for design thinking specialists that ensures they are not excluded from promotion and command appointments due to their specialisation. Providing these measures can be achieved, specialised design thinking education for mid-level personnel would maximise the value design thinking would add to contemporary militaries.

Rebuttal: Zweibelson

Jackson offers an insightful argument that is the ideal substitute for widespread design education at all levels. While the cost to introduce design education appropriate to entry-level forces (both enlisted and officers) would undoubtedly be high, Jackson's proposition would be both cost-effective and in keeping with existing military special skill investments. Militaries select out of wide candidate pools the most promising contenders for filling high-skill positions, such as in aviation, medical and legal fields. For military design, candidates ought to be rigorously evaluated based upon design-centric selection criteria and, once educated in a long-term design certifying course, those military designers should be managed separately within a service for a career of specialised design application.

There are some problems with this approach. Unlike prospective medical students or aviators, the military has no true civilian parallel for developing a military design educational pipeline. While a military might chose to assimilate a purely civilian design educational program (such as Stanford University's 'd-school' or human-centric design at UC Berkeley), these civilian design methodologies are not directly exchangeable with military design applications in the way the medical, legal, and aviation fields largely are. The only military design programs that currently exist are military sponsored ones that differ by service, school, methodology, doctrine and theory.

Secondly, while junior grade professionals already have clear motives for pursuing well-defined careers in specialised skill areas such as the legal, medical or aviation fields, the military would need to develop the entire career timeline for military designers and determine what that even means. As design can readily be applied to strategic, operational, and even tactical constructs, a military design professional could potentially have myriad career directions to include leadership opportunities. If pursuing a military design career path eliminated senior command opportunities due to the specialisation requirements, a military might be intentionally preventing senior

leaders from possessing the necessary creative skill sets that we demand of senior leaders!

Lastly, Jackson takes a popular yet hard-to-demonstrate position on the value of military experience coupled with demonstrated prior success as an enabler for design education to a target population. Essentially, to be willing and able to break out of the military paradigm, only mid or senior professionals have the necessary experience and institutional familiarity to possess both of those mindsets. No matter the willingness of the junior professional, they lack the ability to properly frame the system in order to disrupt it in a novel and productive way.

In military design educational practice, the opposite has occurred quite frequently. Shimon Naveh, widely considered the father of military design, has stated in multiple interviews that teaching design to senior leaders tends to fail in part because it is too difficult to convince a highly successful (or possibly arrogant) professional that their past three decades of experience will not work with learning design, and they likely will impede it.[49] However, Naveh currently in practice appears to support Jackson's position, as he exclusively teaches military design to senior Israeli leadership on a monthly basis.[50] Dr Paul Mitchell, while developing the military design program for the Canadian Forces at the Canadian Forces College, came to similar conclusions on senior military professionals resisting design more than junior ones. Mitchell suspected that career progression likely influenced this; colonels (O6) within striking distance of promotion to general officer had less tolerance of the disruptive nature of design than field grade officers (O4 and O5, as well as warrant officers and senior non-commissioned officers) with far more manoeuvre room in their careers to experiment and deviate from socialised norms.[51]

In my personal experience developing design education in American, Canadian, and European military establishments, from the entry-level and junior professional level through to war college (senior professional) levels, military design suitability remains an elusive and problematic concept. Jackson's position is supported by several largely successful military design education programs, such as the Israeli Defense Force, the US Army at Fort Leavenworth, Kansas, and the Canadian Forces College. Yet prominent design facilitators in each of these programs express reservations on this narrow design educational approach and whether it is sufficient. Further, none of these programs or Services have experience with design at junior levels beyond isolated individual cases. Of these, the Joint Special Operations University (JSOU) in support of US Special Operations Command does provide design education to a wider range of students, accepting professionals at the enlisted rank of sergeant (E5) and officers at the rank of lieutenant (O2) or captain (O3). JSOU design classes frequently have students from all levels of experience, rank and specialisation within the special operations enterprise. While these JSOU design courses are shorter in length, there does not appear to be any measurable difference in aptitude or ability in students learning design.

On the matter of establishing a specialised class of 'design masters' for utilisation within a military organisation, there is ample room for caution here. Military design already has a reputation for being elitist, or too dense and abstract for utility across the forces.[52] The US Army already has specialised fields for strategists, operational researchers, operational planners, as well as tactical level trainers. As design can be utilised in all of these areas as well as others, a separate military 'design field' might create confusion and institutional in-fighting over identity, role and responsibilities. Perhaps the best way to consider military design might be as a flexible meal,

prepared for military consumers of all varieties, instead of focusing on a specific restaurant that provides 'design meals' for very precise clientele and diets. To take a page from nearly all children's breakfast cereal advertisers, 'military design should be a part of every complete breakfast', where that breakfast is analogous to a military confronting complexity. Learning military design concepts and theory provides all professionals at the tactical through strategic levels with what is needed for 'complete' cognitive abilities to navigate through complexity in human conflict.

Rejoinder: Jackson

Having the last entry in this chapter, it falls on me not to rebut but instead to synthesise. While Zweibelson and I have herein engaged in a (hopefully lively) debate about where design thinking education may best be situated within the overarching PME continuum that follows military personnel from enlistment to retirement, our overall point of agreement is that military design education is currently under-emphasised and undervalued, as are paradigms outside of technical-rationalism in general. This imbalance is a matter that requires urgent redress, regardless of which of our arguments the reader may agree with.

One theme that has emerged in both of our arguments is the lack of data available in support of either of them. This indicates another area for urgent redress that we have not been able to confront in this discussion: it is time for an international survey of military design education courses. Such data collection and analysis would enable mutual learning and could become a stepping stone to best-practice implementation of second-generation design initiatives,[53] regardless of whether this is implemented at entry-level, mid-level, or both.

In overcoming this lack of evidence in support of one argument or the other within this chapter, I have perhaps had the easier task. While, to quote Zweibelson's rebuttal, 'the only [mid-level] military design programs that currently exist are military sponsored ones that differ by service, school, methodology, doctrine and theory', there are at least some examples of the implementation of mid-level design thinking education. Combined with my leveraging of historical examples of successful paradigm changing mid-level PME programs in 19th century Prussia and 1980s America, I have at least had something to refer to, disjointed and inconclusive though it may be.

Zweibelson, on the other hand, has had no examples to refer to at all. The closest he can draw on is that of JSOU, and although teaching design to personnel at E5, O2 and O3 levels is different to teaching it to those at O4 and O5 levels, it is also different to teaching it to personnel at entry-level. What Zweibelson is proposing is unprecedented, although he is right to point out that examples from civilian education programs indicate that his ideas may well work if militaries apply them rigorously and faithfully (and do not attempt to employ essentialist teaching methods to teach design education programs!).

Indeed, were any military to implement what Zweibelson proposes, it would by default become the world leader in implementing military design education at junior levels, particularly if it were to extend this education to junior enlisted personnel as well as to junior or trainee officers. While I have proposed a relatively conservative (read: safe) and by Zweibelson's own admission financially prudent approach to military design education, the sheer audacity of his own proposal is much truer to the radical innovation that design thinking itself intends to encourage in the face of

wicked problems. There is, in my view, additional merit in his argument due to this aspect.

Whether one agrees with Zweibelson's argument or my own, the most important point of this debate, and one that deserves reinforcement in this closing paragraph, is that there is an urgent need to consider where PME for design thinking should go next. The status quo is that design thinking is not being effectively practiced or taught outside of a small group of dedicated professionals who seem to have self-selected into it. As a result, the military application of design has to date been haphazard and, at best, the results have been sub-optimal.[54] This situation needs to be addressed, and the starting point for effectively addressing it is likely to be the delivery of effective PME for design thinking. Whichever of the above arguments readers agree with, doing something to invigorate PME for design thinking will be better than doing nothing.

Notes

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2 Disclaimer: The views and opinions contained in this chapter are exclusively those of the authors and do not necessarily reflect those of any organisation with which any author is, or has previously been, affiliated.

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