Evolution of Military Design

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Abstract

The origins of design are linked to humanity's strategic ability to leverage imagination for advantages. Furthermore, the link between the design discipline and security affairs is reinforced by how design (in its various forms) co-evolved with military art and science. Their tangled relationship is particularly evident during the so-called modern period in which design became its own discipline, when military power and industrialization melded into the new character of politics, and all of it was reflected in the shifting character of warfare.

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Reimagining Design

> Military design has emerged as a significant field for design research, with surprising connections to the larger design environment. . .It is one of the few fields in which working practitioners share their thoughts widely. . .This makes military design one of the most open and accessible bodies of work by design thinking practitioners. (Ken Friedman, editor, She Ji Journal of Design, Economics, and Innovation)

> Come with me and you'll be in a world of pure imagination. Take a look and you'll see. . .into your imagination. (Gene Wilder as Willy Wonka)

Design is an innate capacity some have honed into an interdisciplinary profession, distinguishable from art and science, but accessible to all by virtue of humanity's evolved fitness for navigating and nudging a dangerous and disorderly world. And while the world has always been "wicked once over," a cauldron of increasing complexity and competition over the last two centuries has forged new forms of design (Trew et al. 2022, pp. XX-XX).

Whether military design should be considered one of these branches or if its origins lie much deeper in the design "family tree," it is undeniably a part of design today. Yet, it is often ignored. This oversight does not just create an incomplete picture, oblivious to how military designers continuously sharpen the discipline; it distorts the very nature of design. In other words, addressing complexity and disorder without attending to the competitive, dangerous aspects that are ever present twists what design has been, what it has become, and what it could be. Nevertheless, this omission occurs even among the most vocal proponents of reimagining design; those who otherwise advocate, for example, "fluid, evolving patterns of practice that regularly traverse, transcend, and transfigure historical disciplinary and conceptual boundaries" (Rodgers and Bremner 2017, pp. 1–2). This chapter is as useful as a corrective to such narrow perspectives as it is to defense professionals who sense that design can help realize competitive advantages.

This narrative begins by briefly sketching the strong bonds between warfare and design that existed before the Industrial Revolution. At that historical juncture, their interdependence is examined in more detail, with heavy emphasis on the evolution of military design over last few decades.

Brains, Bonds, and Bards: The Prehistoric to the Premodern

Some civilian designers – the few that even acknowledge military design – find the link between design and warfare to be problematic or even abhorrent. Yet, because the origins of design lay in humanity's capacity for abstraction, they are inherently

connected. Imagination, played out in integrative and expedient ways, not only conceives of ways to prevail over others but also is responsible for the very conditions that nurture violent competition.

One of the central themes in human history is the scale of community. Broadening abstractions of identity – a product of imagination – enhanced social bonds, enabling human organization to move from clan to tribe to city to the "imagined community" of the modern nation state (Harari 2018, pp. 31–37, 171). As expanding groups competed for influence and resources in a dangerous and competitive world, warfare became one mechanism employed to survive and thrive. In turn, the ways humans use organized violence to secure themselves and what they value is an ever-present influence shaping design.

First, consider the artifacts commonly associated with humanity's heritage as *homo faber* or "the making animal." Stone tools were designed to manipulate materials, but also can be wielded as weapons. There is a similar duality in weaving branches together, another example of early technology. What could form artificial shelter could also be employed as defensive structures or even traps to imprison. In fact, the word "trap" is semantically linked to "design" (Flusser and Cullars 1995, p. 51). "Design" and "technology" are also linked – linguistically and logically.

"Technology" comes from the Greek word *techne* (itself based on an Indo-European word for fabricating, especially the interlacing of branches). Greeks prior to Plato used it to convey the know-how of the craftsman more than the effect that it produced (Roochnik 1998, p. 17). Technologies, and the technical knowledge to realize them in mind and material, are always simultaneously shaping and being shaped by social forces. To wit, civilizations facilitated novel levels of specialization in woodworking and stone craft and other trades (though to honor the recurring theme of interdependence, note that causality also ran the other way: specialization enabled civilization). Social structures are, of course, in a similar interdependent relationship with warfare. To support a civilization's elite, for example, individuals with mastery of a craft (*techne*), now included a new type of specialized laborer, the dedicated soldier. Furthermore, even "civilian" innovations manufactured by "armies" of workers, such as roads, enabled military mobilization and the expansion of empires.

Finally, the story of design and security is not limited to examples of physical creations or organizational schemes. The origins of design are in the species' capacity for abstraction; design is about *becoming aware of possibilities* to enable changes in the physical world. Imagination is a strategic skill because it enables one to realize advantages mentally before attempting to do so materially (Trew et al. 2022, pp. XX-XX). A direct example is the *strategos* (Greek general) employing their *techne* by devising operational maneuvers.

Another, more indirect, manifestation of the gift for imagination is the ability to make sense of – and influence – the world through stories. In ancient society, for example, the ideals of leadership and craftsmanship portrayed in Homer's epics highly influenced Greek civilizations spreading across the Mediterranean Sea. *The Iliad* and *The Odyssey* not only centered on warfare but also showcased characters using their imagination to design maneuvers or telling stories to foster strategic

advantages. The doubly crafty Odysseus, for example, exemplified the cunning strategist and technical innovator, as evidenced in the Trojan Horse. Indeed, the audience comes to know Odysseus's skills because his character is the one narrating most of these stories, which he is telling in hopes of gaining assistance for his journey home. How Homer's story is interpreted by later readers is equally useful for understanding changing conceptions of design and security. In Roman culture, Odysseus became an untrustworthy, treasonous *trickster* (Virgil 1994, pp. 24–28) (both crafty and trickster are related to the etymology of design).

In contrast to Athens' messy pluralism, Rome's empire was built upon principles of centralized power, rational administration, and monolithic ideology (Burbank and Cooper 2011, pp. 34, 38–42). The imperial model worked well until the fifth century CE, when chaos at the empire's edge created an overwhelming centrifugal force that Rome could no longer contain. The political landscape shifted and, as a result, the Catholic Church expanded into areas previously handled by Rome – including military affairs. The religious influence on medieval militaries strengthened some existing ideas (obedience to a centralized hierarchy) and introduced new ones (sanctified justifications for political violence). It also primed the Western military mind for dogmatic adherence to hallowed doctrine.

Doctrine and dogma, as words and concepts, existed prior to the Roman Empire. What shifted in the Middle Ages was the sense of mystical revelation as a dependable source of knowledge, including guidance for military matters. Reason, of course, was not excluded (just as Romans themselves entertained the supernatural). Still, the medievalist's appeal to spiritual inspiration was reminiscent of *métis*, which was literally taken from the Greek goddess of that name and implied divine intervention on behalf of a mortal. Much like *techne*, cultural appreciation of the goddess of strategic wisdom waned as a result of Plato's disrespect for craft knowledge and tacit intelligence (Letiche and Statler 2005, p. 3). The philosopher's preference for objectivity and rationality would again dominate in the wake of another inflection point in European history.

Modernity Emerges

The early modern period of European history is marked by multiple significant changes, neatly captured in historiographical labels of the period: the Age of *Reason*, the Age of *Discovery*, and the *Scientific* Revolution. Plato's ideas about rationality, order, and control were "reborn" in the Renaissance; the authority of the Roman Catholic Church was curtailed by the Protestant Reformation; and the Peace of Westphalia institutionalized the sovereignty of states as well as their exclusive rights to political violence, a right they regularly invoked.

Not only did states conceive of geopolitical security in new ways, but they also altered designs for securing advantages. Ideals of strategy progressed further from classical conceptions that would have been recognizable to Homer, the sophists who recited him, the generals and admirals who emulated his heroes, and the master craftsmen who – like military leaders and their sophist tutors – also embodied

cunning intelligence. Instead, modern era militaries turned increasingly towards rationality, professional experts, and the opposite of *métis*: brute force.

This new character of war became its own engine of change. According to historian Azar Gat, military competition among European states "played a central role in propelling forward the process of modernization" (Gat 2006, p. 495). One example is how designing for military advantage fed into the biggest inflection point in the history of design, the Industrial Revolution.

Industrialization changed design, which served a role in mass production as well as its management. In both cases, the story's setting is the factory. This system was predicated on replaceable parts. And that innovation was first pioneered in the design and manufacturing of weapons (Smith 1985, pp. 46–78). Firearms actually offer a useful thread to continue tracing the intertwined histories of design and warfare.

A broad-ranging, strategic example is firearms. The widespread use of such weapons started in twelfth century China and then diffused westward across the Mughal, Safavid, and Ottoman empires in the fifteenth, sixteenth, and seventeenth centuries. This "gunpowder revolution" then intensified in the competitive political environment of post-Westphalian Europe and the intellectual atmosphere of the Enlightenment. Technology is never just about the physical artifact, however. Along with new weapons came innovations in the way resources were managed and how leaders organized and employed forces. In other words, an entire technological system emerged to help realize advantages in a world now competing, economically and otherwise, on a global scale. Consequently, eighteenth century European powers aggressively undertook the "bureaucratization of violence" (foreshadowing similar changes in nineteenth century commercial management) (McNeill 1984, pp. 144, 156–162).

There is also a tactical dimension of the firearms story. Drill, the "rehearsal of prescribed movements," existed even before Plato's lifetime but took on greater prominence as states entered the modern era (*Military Drill*, Britannica n.d.). Complicated procedures for loading and firing, the requirement to offset inaccuracy with disciplined volleys of fire, and the need to organize a greater number of people involved in these operations all necessitated new levels of precision and efficiency. It also required increased control, reminiscent of Platonic logic that (lower class) individuals should heed whatever the experts tell them. Notably, these technical requirements co-evolved with similar cultural tendencies for centralized, bureaucratic management of human activities and a military leadership grounded more in competence than birthright.

These two examples stretch across a spectrum with geopolitical competition at one end and battlefield tactics at the other. In between, another important development materialized, feeding off the emerging inclinations to codify knowledge into doctrine and prioritize performance over social status. In fact, historian William McNeill identified this innovation as "one of the major achievements of the 17th century, as remarkable in its way as the birth of modern science or any other breakthroughs of that age" (McNeill 1984, pp. 133, 68, 123–124). He was referencing a newly formalized domain of knowledge: the use of engagements to

achieve the ends of war. Today this innovation is referred to as "military art and science."

At first glance, this phrase may indicate a clear reference to what the novelist and scientist C. P. Snow referred to as the "two cultures," art and science. In truth, it highlights the ambiguity of the former. "Art," in one sense, is expressive, subjective, and attuned to aesthetics (Trew et al. 2022, pp. XX-XX). Yet, the way the word is often used, especially in numerous works on military matters, is actually synonymous with design. The Greek *techne*, which is the etymological forebear of "design" and embodies many of the characteristics (e.g., expedient, integrative, embodied, crafty) – continued in Western culture as the Latin *ars*. According to the philosopher Vilem Flusser, its connotations include flexibility, twisting, cheating, manipulating, illusion, and conjuring. The prefix "art-" is derived from *ars* and is used in words related to a ruse ("artifice"), falsehood or something designed ("artificial" can be used for both), and mechanical engines for projecting large munitions ("artillery") (Flusser and Cullars 1995, p. 51). The last example is particularly relevant for this historical sketch as it continues to show how, instead of relying upon brute force, advantage in warfare can be *designed*.

Emergence

Scholars who study complexity cleverly note that "more is different." In other words, interactions among increasing numbers of subordinate components can create novel, "emergent" behaviors (Anderson 1972) especially when operating with few or loose constraints. Hence, complex systems are capable of becoming more than the sum of their parts (which is what distinguishes the *complex* from the *complicated*). Warfare in early modernity was clearly one example in which quantitative developments produced qualitative transformations. First, consider an obvious component, weapons. While projectile weapons have, like military drill and formation, existed for much of the history of warfare, the design and manufacturing of firearms intensified in the modern era. Simply put, more people had access to more destructive weapons. This increase in capacity and availability, coupled with the disorder in a wicked world, enabled a dangerous and disparate collection of emergent phenomena.

What is particularly relevant for this chapter is how closely developments in artillery (and countermoves in engineering to strengthen fortifications) are particularly associated with momentum towards an "art" of war that is based in science, or at least scientific approaches. "The ideal of Newtonian science excited the military thinkers of the Enlightenment," Gate notes, "and gave rise to an ever-present yearning to infuse the study of war with the maximum mathematical precision and certainty possible." This urge reached new levels with the "cold-blooded mathematicians" of French artillerists of the eighteenth century. Their aptitude for rigorous aiming calculations and regimented firing procedures – an extension and intensification of earlier small-arms drill – served France well when revolutionary activity

and then external threats necessitated a mass influx of inexperienced soldiers (McNeill 1984, pp. 171–173, 191–192).

In the spirit of the times, some attempted to translate the emerging character of warfare into enduring, rational principles. Baron Antoine-Henri de Jomini, influential in his time and still assigned in war colleges around the West, is a prime example. One of his many works, *Art of War* (1862), sought to use his firsthand experience of the Napoleonic Wars "to make instruction easier, operational judgment sounder, and mistakes less frequent." Jomini went on to write, "these rules thus become, in the hands of skillful generals commanding brave troops, means of almost certain success. The correctness of this statement cannot be denied" (Jomini 2008, p. 247).

French victories at the turn of the nineteenth century, however, cannot be solely explained by material designs or systemized knowledge. Again, design is fundamentally about imagination and abstraction, and is a strategic skill that creates the conditions for warfare as well as the means to prevail in it. Myths matter, strategies are essentially stories, and, in the case of Napoleonic warfare, culture can enable creative adaptations. French nationalistic fervor, for instance, supported the enlistment of the entire nation (*levée en masse*). How those armies were employed also relied upon those same subjective elements. Motivated troops moved faster and deserted less, which enabled aggressive tactical actions and strategic concentration. Some even suggest Napoleon's success was due, despite his background in artillery, to how he could creatively and intuitively improvise battlefield operations (Morillo et al. 2008, pp. 430–432).

Design conferred material and mental advantages onto the French forces. Those who suffered defeat by Napleon's *Grand Armée* were primed to consider new ideas and thus began redesigning their own ways of warfare. Prussia was uniquely open to reform in the aftermath. Over the course of the next century, the state institutionalized innovations in military art and science that would have widespread influence on design even into the twenty-first century.

Among Prussia's reforms was the creation of a General Staff and their "modern" approach to planning campaigns (the origins, in some accounts, of today's military design). Prussian staff officers strove to "systematically apply reason and calculation to all aspects of army administration and operations" (McNeill 1984, pp. 216–218). By the mid-nineteenth century, they faced an increasingly complicated technological landscape. Indeed, innovations in transportation, manufacturing, and communications – and the managerial revolution that accompanied them – created new expectations of modern-era warfare. Judged against Prussia's regimented design for war, the US Civil War served as an example of what *not* to do. Neither side, muddling through what was arguably the first industrialized war, was able to achieve "professionally efficient management" of political violence (McNeill 1984, pp. 242–243). On the other hand, Prussian Chief of the General Staff General Helmut von Moltke – oft-cited for his definition of strategy as "a system of expedients" – offered a compelling counter example. His victories in the 1860s and 1870s seemed to definitively prove the value of detailed planning. Thereafter, his rationalized approach became an exemplar for the other armed forces of the West. Those militaries enabled near-global dominance during an age of imperialism, which

further strengthened a sense of progress, faith in technology, nationalistic identity, and techno-rationalistic way of design.

World War One: "The War to End All Wars"?

From the opening moments, the First World War was a display of the prowess of modern military planners. Complicated railroad synchronization schemes and mobilization timetables informed German plans to tackle a two-front war. By defeating France quickly, they predicted they could pivot east before Russian forces organized themselves. The "Schlieffen Plan" (named after the successor to von Moltke) was solidified as early as 1893, updated yearly, and modified for execution in 1914. From the perspective of recent criticisms of linear planning, "the irrationality of rational, professionalized planning could not have been made more patently manifest" (McNeill 1984, p. 306). This insight was, however, unappreciated at the time, and rationality was assumed to be the most important way to secure advantages.

On the domestic front, "design" was integral to both corporate management and industrialized production, which worked in tandem to mobilize national industrial enterprises and deliver new levels of devastation. In fact, the war generally drove a "managerial metamorphosis" as home fronts supported front lines with manpower and material that was produced and transported in the most efficient means possible (Morillo et al. 2008, p. 443). One indication of their "success" was the ability to overcome natural restrictions to fighting that had historically constrained war. In the past, economic, social, and geographical factors set limits on warfare. Land-based economies struggled to fund armies or tolerate the absence of their working force or to even sustain long distance deployments. Modernized warfare, however, was not as susceptible to limits on communication, the liabilities of animal power, or seasonal variations. Humanity had little experience with processing such sustained and intensified trauma, which leads to yet another example of how war has influenced design.

After WWI, a despondent German – not unlike Plato in his disappointments and ambitions following Athens' defeat – hoped that "through a new art, a new order could be created." Walter Gropius went on to found the Bauhaus School, which was highly influential in promoting the "unification" of design fields and the mass production of functional, bold artifacts. The design school was so influential across Europe that a suspicious Nazi regime, fearful of any potential threats to their power, pressured it into closing on the eve of the next world war (Droste 2019; Gossel 2019).

The fact that there would be another world war revealed the hubris of labeling the previous conflict as the "war to end all wars." It was as if the volatile mixture of violence and chance could be controlled by reason, the third element of Clausewitz's "wondrous yet paradoxical trinity" that characterized the nature of war (Clausewitz was considered too abstract to be read by practitioners) (Cole 2020, p. 42; Murray et al. 1996, p. 4). Still, the label reveals something of the spirit of the time, including

a reverence for rational, comprehensive, and objective predictions of a future that persistently resists such taming.

Even before WWI, the Prussian General Staff model replicated throughout Western society and was especially prominent in civilian management. Corporations designed hierarchical structures exercising "command and control" over individuals who were no more than "cogs in the machine." WWI did nothing to slow these trends. As Freedman notes, "behind the enthusiasm for the new engines of war. . .was a modernist fascination with the possibility of a rationalist, technocratic super-efficient society built around machines" (Freedman 2013, p. 126). The next world war was even more dependent upon linear thinking, attempts at comprehensive modeling, quantitative analysis, bureaucratic structures, and logistical efficiency (Bousquet 2009; Paparone 2017). Again, it was not just practical issues that gave credence to overly rationalized design and metaphorical images of organizations as machines; there was a supportive sociocultural perspective as well.

Postwar Designs

WWII military art and science generally achieved the intended effect. To be sure, many of the challenges were well-suited for the rationalized way of design. Planning convoy defense routes, the invention and use of radar, and the Manhattan Project are all well-known examples amenable to linear planning, compartmentalization, and scientific precision. A lesser known, and even more appalling example is how the Nazis tackled the complicated problem of genocide. In order to efficiently transport Jews from "right out of a boxcar and into a waiting gas chamber," IBM provided thousands of punch-card machines (precursors to computers) (Black 2012, p. 9). Design, as its etymology reminds us, certainly can be twisted.

After WWII, warfare continued to influence design. Innovative approaches to solving complicated problems, such as operations research, seemed to contribute so much to Allied victory that "technocratic" approaches were applied to other issues, such as atomic energy and space exploration. Of course, not all problems responded to such logic. Literacy, poverty, and a host of other dilemmas did not improve and sometimes even worsened with the application of mechanical mindsets and management practices showcased in WWII. This class of problems became known as "wicked problems," a phrase coined for the very purpose of highlighting the absurdity of importing "best practices" from *complicated* military operations to address *complex* social messes (Rittel and Webber 1973, pp. 155–169; Snowden 2020). While the limits of this approach became increasingly evident to (some) civilian designers, geopolitical tensions kept Western militaries firmly focused on rational approaches.

During the Cold War, the high stakes of nuclear conflict meant that civilian strategists were now making decisions on military strategy. They brought along their training in social sciences (especially economics), analytical approaches (including operations research), and a "hyper-rationalist belief in control." Many came from the RAND Corporation, a think tank captivated by a techno-rational

approach to designing advantage. Consequently, they rejected anything close to the virtues of warfare personified by Odysseus. With their "insouciant disregard" for conventional military *techne*, they put their faith in quantitative methods and game theory. Deterrence or victory would come through "rationalizing our choices and increasing our control over our environment" (Freedman 2013, pp. 190, 145–150). While traditional military art and science may honor, or at least reference strategic vision from *métis* or *coup d'œil* ("stroke of the eye"), such tacit, intuitive, and spontaneous wisdom was presumed unreliable by these "whiz kids." Wars could (supposedly) be planned, executed, and reliably won only through the brute force of pure mathematical precision and prediction.

Eventually, military leaders were encouraged to adopt the same paradigm. "Desk bound and far from the scenes of actual conflict," Freedman writes, they became "as proud of their degrees in business administration and economics as they were forgetful of the ways of military strategy" (Freedman 2013, pp. 199–200). Tellingly, this is also when political scientist and presidential advisor Samuel Huntington popularized the idea that professional military officers are the "*managers* of violence" (Huntington 1981, p. 32).

Robert McNamara, mentioned in "Roots of Military Design: Designing Advantage," continues to serve as a telling example of these shifts. As previously stated, he taught at Harvard's business school and eventually entered the corporate realm. For rhetorical effect, the narrative deliberately omitted his military connections: during World War II, he left his faculty position to serve as an Army Air Corps statistician, and he ended his tenure at Ford Motor Company to become President Kennedy's Secretary of Defense. In that later role, he was the "epitome of the rational strategic man in his mastery of. . .analytical techniques" (Freedman 2013, p. 149).

McNamara recruited many from RAND to join him in Washington, DC. Together, they would promote an antiheroic, managerial, and objective approach to designing advantages in war. Within two decades, however, the limits of McNamara's corporate approach were becoming just as obvious in national security settings as similar approaches were in civilian applications. As a case in point, the urge for predictability led to burdensome command and control (C2) procedures that succeeded mostly in increasing dependence upon centralized decision-making and stifling battlefield creativity. Furthermore, the linear, quantitative, materialistic approach was a model for industrialists and economists, not for those seeking to "shatter the enemy's cohesion, organization, command, and psychological balance" (USMC *Warfighting* 1989, p. 29). Military leaders grew progressively suspicious of the "conformist practices and the risk-averse culture of large corporations" and "the corporatist culture" that had displaced metic wisdom with the myth of objective, intellectual force (Freedman 2013, pp. 199–200).

The US Air Force Colonel John Boyd is a notable example of those who pushed back against "technowar" and is sometimes portrayed as an early military designer. While he did not conceive of himself in those terms, nor did he focus on operational warfare, the "undisciplined" integration of diverse sources certainly hints at his "designfulness" (Trew 2022). And it was not simply his appetite for linking disparate concepts; often the very same ideas are now commonly discussed among both

military and civilian designers: mental agility, bias to action, experimentation, empowering networks, anticipating surprise, leveraging ambiguity, and attention to "orientation" (perceptions, paradigms, narratives, etc.) (Osinga 2006, pp. 19, 32, 86–88, 106). Yet, while Boyd and his fellow reformers drew inspiration from the same ideas influencing the formal design field at the time (e.g., the role of subjectivity and emergence in complex adaptive systems), they also honored military classics. Of course, they often reframed those ideas, yielding, for example, novel perspectives of Clausewitz's "general theory of friction" (Watts 1996) or his well-known "trinity" (Bassford n.d.).

The fighter pilot-turned-philosopher is an insightful example for other reasons, too. "Roots of Military Design: Designing Advantage" described design as expedient, invoking multiple meanings of that word, and Boyd unapologetically endorsed opportunism ("explore and exploit"), outwitting an opponent, and winning through outright speed. He sensed that advantage – whether in aerial combat or grand strategy – comes from outmaneuvering the enemy in a dynamic, self-reflective process that would become his trademark: "observe, orient, decide, act." Boyd's sophisticated ideas quickly became simplified to just two words ("OODA loop") and shortened to a single graphic (foreshadowing similar modifications to civilian and military design).

While Boyd constantly pushed the boundaries of the status quo, some post-Vietnam reforms simply resurrected old concepts. Specifically, many began to revisit past military designs on the use of tactical engagements to secure campaign objectives. This was construed as something beneath the strategic level of war, the level at which political "interference" seemed unavoidable. The impact was to cordon a field in which professional warfighters could claim exclusive expertise. Hence, in the 1980s, revisions to the US Army's *Field Manual (FM) 100-5, Operations* were explicit about importing "operational design" and then "operational art" into doctrine. According to a US Army War College report,

> [FM 100-5] introduced to the English-speaking world the idea of an operational level of war which encompassed the planning and conduct of campaigns and major operations. . .This conception of an identifiably separate level of war that defined the jurisdiction of the profession of arms was, for a number of historical and cultural reasons, attractive to US practitioners and plausible to its English-speaking allies. As a result, it and its associated doctrine spread rapidly around the world. (Kelly and Brennan 2009, p. v)

The operational level of warfare – which has become ingrained as a sacred truth ever since – was actually based on an extension of Soviet (and potentially German) doctrine earlier in the century. Again, this was when linear rationality dominated most design methods and certainly had mesmerized military organizational decision-making methods (Naveh 1997; Zweibelson 2019). This conception of an operationally focused variant of design would subsequently "spread through the Anglophone world like a virus" and be well ensconced by the time it was put to the test in the first conventional battles since the end of the Cold War (Kelly and Brennan 2009, pp. 61–62).

"The Sand Box"

The interdependent histories of design and warfare reveal that changes in one area are tightly coupled with the other. Unsurprisingly then, operational doctrine co-evolved with great leaps in technologies such as "smart" bombs, space-based surveillance, and robust C2 of air, sea, and land forces. Originally designed for Western militaries to counter the Soviet Union, all were used to great effect against Iraqi forces during the 1991 Gulf War. Overwhelming tactical supremacy – displayed in continuous televised coverage – seemed to certify the contemporary paradigm of operational design. Even the enemy seemed to accommodate doctrine and its unstated dependence upon "freezing the context"; by keeping the tactical situation practically unchanged, designers were free to indulge in comprehensive analysis and complicated planning on their own timeline. When the coalition finally decided to unleash its hyper-advanced forces, it easily overwhelmed an enemy whose tactics and equipment were well known and whose officers had been indoctrinated into the same Western paradigm of warfare.

In the validation of victory, the current state of military art and science lacked any impetus to reexamine its methods or mindsets. For a moment, the triumph restored faith that the methods that brought success in the World Wars were still valid. Consequently, there was no inspiration to follow the trend of other designers toward decentralized and human-centered approaches. To the contrary, doctrine proceeded further down the path of techno-rationalism. Soon there were predictions, such as one from the previous Vice Chairman of the US Joint Chiefs of Staff Admiral Owens, that information age advancements would "lift the fog of war" (Owens 2001). Once again, however, it would become clear that practices from the complicated domain of science and engineering do not transfer to the messy complexity of a doubly wicked world.

The terrorist attacks of 2001 and the subsequent conflicts in Afghanistan and Iraq demonstrated the limits of doctrinal design. A relatively small number of "low-tech" enemies became the anomaly that grew, for some, into a paradigmatic crisis. The entire presumption of objective, scientific ways of warfare seemed questionable, and along with it, the obsession with efficiency, control, and perfect intelligence (McCrystal et al. 2015, p. 20). Around this time the acronym "VUCA" (volatile, uncertain, complex, and ambiguous) gained popularity in military circles and official documents started importing the concept of "wicked problems." More recently, even the notion of a predetermined end state – central to modern-era planning – has been critiqued as inaccurate and harmful (de Czege 2014).

History demonstrates that innovative thinking is often nurtured by anomalies, frustration, and outright defeat. Amid a struggle against insurgents in the Middle East who were technologically disadvantaged yet "human-centered," the Western military establishment was once again receptive to new ideas. They would not have to go far.

From Military and Design to Military Design

Facing complex security issues, with counterinsurgency fights on multiple fronts and globalization challenging Westphalian sovereignty, some security professionals in the West still harbored a hope for technological salvation. Others, however, questioned the entire way of war that had emerged since the Industrial Revolution, including how militaries applied (or misapplied) various manifestations of design. Those more willing to entertain heretical ideas found that a small group within the Israeli military had already begun crafting an innovative approach to operational design.

Much as Boyd had done, and in the integrative spirit of design, this group of radicals engaged an electric array of sources well outside the canon of military art and science. This included sociology, philosophy, and architecture, as well as less obvious sources such as poetry, literature, and medicine (Wrigley et al. 2021). They also examined the same evolving theories of design and organizational management as sketched here and elsewhere (see Trew et al. 2022). What emerged from this strange mixture became a formal design methodology, "Systemic Operational Design" (SOD). And similar to Boyd, they inspired a small, but vocal, counterculture movement.

SOD advocated practices rare in the conventional military paradigm of the West. Their praxis included critical self-reflection, discourse mapping, and visual thinking, and their ideas would eventually "trigger controversy, intense debate, and international intrigue" (Zweibelson 2019, para. 15). Critics decried it as eccentric, disruptive, and even dangerous. Some reacted as if defending sacred laws (Graicer 2017). Proponents, on the other hand, believed the novel approach could help radically reframe how militaries make sense of the operational environment. In their view, adopting SOD's esoteric mindsets and methods could yield opportunities that traditional military planning was incapable of perceiving, given the strictures of the conventional paradigm. Harkening back to the notion of cognitive agility as a strategic advantage, advocates sensed that SOD was "distinctly Sun Tzu-like in its attempt to outthink the enemy, exploit surprise, and seek asymmetric opportunities" (Blomme 2015, p. 39).

SOD attracted international attention. The main architect, Israeli Brigadier General Shimon Naveh, traveled to the USA to share his ideas. By 2005, he had found fertile ground in the heart of the US Army's intellectual center at Fort Leavenworth, Kansas. There he taught future planners studying at the US Army's School of Advanced Military Studies (SAMS). Students, encouraged to repeatedly reframe situations, crafted orders using narratives, metaphors, and graphics instead of stale doctrinal templates (Davison 2006; Lauder 2009). The successful pilot program led to more SAMS courses in SOD, more student papers on the topic, and a self-published text, *Art of Design* (2005).

SAMS is one of a handful of Advanced Studies Groups (ASGs) that are collectively the most intellectually rigorous schools in the US Department of Defense. Each ASG has a particular niche, and for SAMS, the focus – as it was for Naveh and his team – is planning at the operational level of war. Unsurprisingly then, this

particular revolution in design found its way into the US Army publications on operational warfare, as opposed to any number of other military functions that could be "designed" (e.g., logistics, weapons technology, force development, etc.) (Wrigley et al. 2021, p. 109).

The introduction of unconventional ideas into a large institution is naturally difficult because continuity and coherence are the basis of any organization's culture. Design may be particularly problematic given that it is, at its core, disruptive and, for many defense professionals, counterintuitive (Beaulieu-Brossard and Dufort 2017a, p. 2). Predictably, it proved difficult for SOD-inspired philosophy to gain widespread momentum in the US military and the Army in particular.

By the end of the first decade of the new century, it was evident that a lack of consensus was hampering efforts to nurture a novel form of design in the West's largest army. By then, two competing perspectives had emerged (similar to the debate over pure design thinking versus Design Thinking, see Trew et al. 2022, pp. XX–XX). For the so-called "purists," design only works (or works well) if the teams responsible for crafting operations fully embody the postmodernist, playful, and seemingly mysterious practices of SOD. For example, one must not only learn to reframe external situations but also to reframe their own internal, abstract understanding of what is known or even knowable (Ryan 2016, para 27). This required a degree of mental agility, humility, and adventurism that naturally limited who was interested and capable of designing in this spirit. Naveh himself said design "is not for everyone," and most military officers "will never get it" (Naveh 2007). The crucible of the torturous intellectual journey to the summit was the path to design; awarding participation trophies at base camp was simply inconceivable.

According to Alex Ryan, who himself was a student of Naveh and would go onto teach with him at SAMS, 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" (Ryan 2016, para 29). In contrast, the "pragmatists" preferred to institutionalize some less controversial elements than to have a bolder stance face complete rejection. Thus, while the SAMS faculty and students produced a dense manifesto laden with exotic theory, doctrine writers rejected it as inaccessible. Following the example of early modern writers who translated (perverted?) the art of military strategy into enduring, rational principles, they distilled 3000 pages of SAMS design material into 13 pages of superficial constructs that never challenged the current paradigm. That was followed by a slim chapter in *FM 5-0* that codified a sequential and rather mechanical "Army Design Methodology" model (Army 2010, p. 1.3).

Like Jomini centuries earlier, the formulaic products offered by the pragmatists successfully influenced the status quo. Still, though design was now part of doctrine, it was shortened, sterilized, and subordinated to the opening steps of planning (see Grigsby et al. 2011). Absent was any sense of design as pervasive or provocative or anything else that purists had found meaningful. Ryan's observations at SAMS corroborated the results of the dulled version. "Because none of these students were required to challenge their fundamental beliefs," he wrote, "their design projects simply perpetuated the dominant instrumental approach to problem solving" (Ryan 2016, para. 29).

In 2016, Ryan concluded that neither approach had yet achieved the change they wanted to see in the institution. Almost a decade later, design is still an ambiguous term with an ambiguous reception across the defense establishment. What is clear, however, is that most Western militaries contain at least a small group of individuals who consider themselves to be part of an international military design movement. It is important to note, however, that they are a subset of a larger community of defense professionals engaged with all the uses of design applied to all aspects of security (intelligence, education, logistics, research, etc.). Military design, in other words, is not the same as military and design.

Summary: The End. . . Or Just the Beginning?

Perhaps the distinction that "military and design" is not limited to "military design" is unnecessary. Perhaps military design, with its attention on persistent innovation, is the means by which militaries can adopt and adapt all sorts of foreign concepts – from art, science, and design – to realize an advantage in violent competitions. Perhaps the movement is not actually hampered by the vagueness of the concept, given the expedient and integrative nature of design (Trew et al. 2022, pp. XX-XX). After all, designers do not wait patiently for perfect clarity, which they know will never come, but instead "perform this little dance around a problem, taking stabs at it from different sides" (Lawson and Dorst 2009, p. 26).

This playful image does appear to capture the current situation of military design, which continues to move and morph (much as Design Thinking has in civilian work). And the movement is expanding in ways that strive to respect the context. In fact, the leading international network of military designers, the Archipelago of Design, is so named to evoke the metaphorical imagery of loosely connected, but independent, islands (Beaulieu-Brossard and Dufort 2017b; Jackson 2018). Indeed, this suggests one final reason why all students of design, whether military and civilian, may benefit from learning more about the emergence and evolution of military design.

Though perhaps it does not represent the totality of how design is used in military settings, military design has been a vector through which "designerly ways" of knowing and acting are spreading around the globe. Numerous publications – including multiple chapters in the *Springer Handbook of Military Sciences* – showcase this trend, with specific "case stories" on how design has altered the way military organizations plan; how it has impacted military education and training; and how it has influenced the ways military members think, talk, and even write. Indeed, this chapter as well as another, "Roots of Military Design," were themselves intended to exemplify designfulness. For example, they were crafted by a diverse group, some insiders to this movement and some not. Ideas diverged wildly before converging into their final form. The works are consciously *partial* (as in both incomplete and biased). They intentionally use frames that readers (and even other designers) may not be familiar with or even accept: the use of "big history," the characterization of management theory as a field of design, and a focus on the essence of design instead of what distinguishes military from civilian design (ground

well covered elsewhere by one of the coauthors). As with any history, themes are knowingly smoothed over to clarify the narrative, anachronistic constructs are used (the Athenians would not recognize the label "Greek"), and paradigms are presented as overly uniform (when really there were always contemporary critics). Other frames may be so transparent that they are accepted automatically. Consider the presumptions implicit in terms such as "Middle East" (middle in relation to those who set the discourse), "Industrial Revolution" (which emerged gradually), or "the West" (which assumes a monolithic entity and no small amount of Eurocentrism).

There is one frame that was not used, however. Despite promoting "human-centered design" and mentioning some key individuals by name, the individual designer is a character who has remained in the background. Yet, it is the individual who must answer the call into a heroic journey of learning, who must live into a design practice and who – in dialogue and debate with others – will face the dilemma of designing advantages for a world that is wicked once over.

Cross-References

► Roots of Military Design: Designing Advantage

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