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Finding Ender: Exploring the Intersections of Creativity, Innovation, and Talent Management in the U.S. Armed Forces

by Susan F. Bryant and Andrew Harrison



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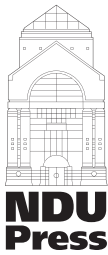
Finding Ender

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Executive Summary

Current national-level strategic documents exhort the need for creativity and innovation as a precondition of America's continued competitive edge in the international arena. But what does that really mean in terms of personnel, processes, and culture? This paper argues that an overlooked aspect of talent management, that of cognitive diversity, must be considered when retooling military talent management systems. Going one step further, talent management models must incorporate diversity of both skill set and mindset into their calculus. Specifically, the Department of Defense (DOD) needs to recruit, retain, and utilize Servicemembers and civilians with higher than average levels of creativity and a propensity for innovative thinking. It needs "enders."

There is an inherent tension between encouraging creativity within the Armed Forces and maintaining military discipline. Academic studies have shown that military personnel score lower on average for creativity than their civilian counterparts and that those Servicemembers with higher levels of creativity are more likely to leave than remain for a career. Furthermore, this paper argues that there is an embedded bias in favor of critical thinking at the expense of creative thinking at all levels of professional military education (PME). Finally, given that military culture is authoritarian by nature, creativity can only flourish if commanders are open to out-of-the-box suggestions. Studies of military officers indicate that "openness" among officers actually decreases as rank increases.

The mandates of the 2018 National Defense Strategy, which stresses the need for innovation, require change in military culture, processes, education, and talent management if they are to be fully accomplished. To that end, the authors propose eight recommendations to leverage the creative potential of the DOD workforce. These include recognizing that cognitive diversity is multifaceted, adopting a commercial off-the-shelf instrument to test all personnel for creativity and innovation potential, determining the jobs in which highly creative individuals are most necessary, adopting industry best practices for achieving innovative outcomes, introducing design thinking and divergent thinking earlier in PME to reduce "convergence bias," making sure leaders are exposed to the idea of cognitive diversity as part of their PME, actively recruiting personnel with high creative potential, and continuing to study small number (*n*) populations within DOD for high concentrations of cognitive outliers.

Introduction

*The creativity and talent of the American warfighter is our greatest enduring strength, and one we do not take for granted.*¹

—Summary of the 2018 National Defense Strategy

*Organizations don't innovate—people do.*²

—Robert B. Rosenfeld, Gary J. Wilhemi, and Andrew Harrison, *The Invisible Element*

Orson Scott Card's award-winning 1985 science fiction novel, *Ender's Game*, is ultimately about the power of creativity and innovation under tremendous physical and emotional stress, as well as the resilience of the human spirit.³ The protagonist, a young boy named Ender Wiggin who is a physically uninspiring social misfit, defies the odds by not only surviving grueling military training, but also in the end saving Earth by innovating new approaches to warfare. On its face, *Ender's Game* is an engrossing and diverting story of heroism for science fiction fans. But it is more than that; it is also a parable for defense policymakers who are confronting the multifaceted problem set of recruiting, training, educating, and retaining military personnel capable of fighting and winning the Nation's wars in a time of technological change and international volatility.

Ender is an unlikely hero. He displays none of the stereotypical traits of a military leader or warrior. He is small and physically unimposing. Nonetheless, Ender possesses exactly “the right stuff” as a result of his ability to innovate in the face of unforeseen circumstances. His creativity and willingness to ignore established doctrine and process make him an outlier in a culture that requires conformity. His success is representative of the conundrum facing the military today: How to resolve the inherent tension between the twin requirements of conformity and creativity in 21st-century warfare.

The unclassified summary of the 2018 National Defense Strategy (NDS) urges the Department of Defense (DOD) to reexamine what constitutes the right stuff in contemporary conflict. It demands the “broad revision of talent management among the armed services,” while simultaneously emphasizing “intellectual leadership and military professionalism in the art and science of warfighting.”⁴ The strategy also promises to “explore streamlined, nontraditional pathways to bring critical skills into service, expanding access to outside expertise, and devising new public-private partnerships to work with small companies, start-ups and universities.”⁵

Finding appropriate “Enders” for the current environment requires shifts in both DOD processes *and* culture, which the authors acknowledge. The question is how. What are the processes by which this can occur? Who are today’s Enders? What combination of skills, traits, and talents is required? And what metrics and measures should be used to ensure that the Servicemembers tasked with a mission have them in the correct balance? Does the right stuff vary by adversary and conflict type? And finally, how does DOD balance the ideal of individual talent management with the requirement for an armed force of nearly 3 million Servicemembers, never mind an additional 742,000 civilian employees?⁶

To truly optimize the Nation’s Armed Forces for the increasingly complex international environment, real talent management must be developed and harnessed as a force multiplier for everyone, not just for certain military specialties. There is no more fertile ground for finding excess capacity within the existing force than within the sphere of personnel management. The authors further argue that an overlooked aspect of talent management, that of cognitive diversity—specifically as it relates to diverse mindsets—must be considered when retooling military talent management systems.⁷

Cognitive diversity is often calculated in terms of differentiated background, knowledge, or skill sets. These are necessary but not sufficient measures of diversity in the current environment. In order to truly capitalize on the latent talent of the DOD workforce and to meet the requirements of the 2018 NDS, talent management models must incorporate diversity of both skill set and mindset into their calculus. Skill sets are comprised of acquired experience, knowledge, and abilities, while mindsets are comprised of personality preferences, ideas, and attitudes.

This paper briefly explores the multifaceted intersections of the increased pace of technological change and its impacts on the changing character of war as depicted in current strategic documents. It then considers the variable of cognitive diversity, specifically as it relates to creativity and the propensity for disruptive innovation, as well as its critical role in successful adaptation to the changing character of war. It then investigates the conclusions of a series of studies that analyzes the creative levels and innovative styles among the current force. Finally, this paper offers specific recommendations for incorporating cognitive diversity with particular respect to differences in creativity into existing talent management models. These changes should allow DOD and the Services to more effectively leverage the talent *currently present within the system*, as well as offer greater insight into the mindsets of potential recruits. This could help DOD meet the challenges of contemporary warfare, both today and in years to come.

The Changing Character of War and the Increasing Need for Innovation

*The security environment is also affected by rapid technological advancements and the changing character of war. The drive to develop new technologies is relentless, expanding to more actors with lower barriers of entry, and moving at accelerating speed. . . . New commercial technology will change society, and, ultimately, the character of war.*⁸

—Summary of the 2018 National Defense Strategy

*The competition for innovation has become a priority for the world's major powers. The United States and China are leading a global race in the development of new generations of technological capabilities, business approaches, and operational constructs.*⁹

—Tai Ming Cheung, Thomas G. Manhken, and Andrew L. Ross,
“Understanding and Assessing the State of Defense Innovation”

There has been no dearth of reporting on the changing character of war and the potential for disruption by new technology to alter the landscape of conflict. The White House, Office of the Secretary of Defense, Intelligence Community, Joint Staff, and individual Services publish periodic long-term forecasts on the nature of the future operating environment and its implications for the military.

At the apex is the National Security Strategy (NSS), which was published most recently in December 2017. It considers U.S. military capabilities to have eroded and the competitive advantage relative to its adversaries to have declined. It states, “Our adversaries will not fight us on our terms. We will raise our competitive game to meet the challenge.”¹⁰ To accomplish this, the NSS advocates streamlining bureaucracy and increasing the innovative potential of the defense industrial base. In line with the NSS, the 2018 NDS requires that DOD establish “an unmatched twenty-first century National Security Innovation Base that effectively supports Department operations and sustains security and solvency.”¹¹ The NDS stresses that in order to remain competitive as warfighters, the U.S. military should improve talent management, create a culture of innovation and creativity, and reestablish rigorous professional military education (PME).

The Army, Marine Corps, and Air Force have also done Service-specific analyses of the future operating environment and have unsurprisingly developed equally bleak and challenging visions of future combat. U.S. Army Training and Doctrine Command Pamphlet 525-3-1, *The Army Operating Concept: Win in a Complex World*, mandates the Service to “develop agile and innovative leaders who thrive in conditions of uncertainty and chaos.”¹² The current

Marine Corps Operating Concept “puts a premium on attracting and recruiting individuals with high levels of intelligence and aptitude and cultivating their skills and knowledge through specific training, dedicated PME, and a command culture that expects creativity and rewards initiative.”¹³ The Air Force Operating Concept argues that “advantages will be transient and belong to persons and organizations that display bold, adaptive, and innovative leaders.”¹⁴

The 2017 Navy Leader Development Framework recognizes three critical values: courage, compliance, and creativity.¹⁵ In remarks addressing these values, Chief of Naval Operations Admiral John Richardson stated, “It’s not uncommon for discussions of competence and character to put creativity and compliance in tension.”¹⁶ Of the three values, Richardson regards creativity as the most difficult for the Service to inculcate. He states that creativity is challenging because it “defies easy characterization” and “represents divergence from the traditional values associated with developing Navy leadership.”¹⁷ Again, both the need and inherent tension are highlighted. How does the system recognize and encourage innovation in a culture that reveres discipline and convergence?

Defining Creativity and Innovation: Why Are They So Critical?

*I personally think that there is going to be a greater demand in 10 years for liberal arts majors than there was for programmers. To remain competitive in the future job market . . . employees will need one critical skill: to think creatively.*¹⁸

—Mark Cuban

Current national strategic documents exhort the need for creativity and innovation as a precondition of America’s continued competitive edge in the international arena. But what does that really mean in terms of personnel, processes, and culture? As with all terms that appear frequently in documents, *creativity* and *innovation* are in danger of becoming buzzwords, devoid of precision and used as incantations to ward off strategic ills. Both words require careful examination and definition.

In *The Invisible Element: A Practical Guide for the Human Dynamics of Innovation*, Robert Rosenfeld, Gary Wilhemi, and Andrew Harrison begin by introducing the relationship between creativity and innovation, explaining that although complementary, the two are distinct. They define *creativity* as “the generation of new/novel ideas,” while *innovation* “is a creative act or solution that results in a quantifiable gain.”¹⁹ Therefore, creativity is most often the result of individual inspiration, while the quantifiable gain is more likely to occur as a result of teamwork.

Although creative ideas are the product of individual inspiration, their potential is only recognized in the context of the prevailing social and cultural environments. In his work *Creativity: Flow and the Psychology of Discovery and Invention*, Mihaly Csikszentmihalyi explores the social dimensions of creativity. He argues, “Creativity does not happen inside people’s heads but in social context. It is a systemic rather than individual phenomenon.”²⁰ He explains that creative ideas developed individually “vanish unless there is a receptive audience.”²¹ For Csikszentmihalyi, turning creative ideas into innovative solutions depends on the interaction of three elements: culture, the individual with the novel idea, and the “field of experts who recognize and validate the innovation.”²²

For DOD, this is a critical insight with significant implications. First, the Department and individual Services must be able to identify, recruit, and retain creative individuals—those who generate novel ideas. Second, leaders must be capable of recognizing and rewarding divergent thoughts in the right circumstances. Third, the organization must have processes in place that are capable of nurturing rather than crushing creativity. And, finally, the culture of the organization must be capable of recognizing the potential of the novelty and making use of it.

In “How to Kill Creativity,” Teresa Amabile argues that the most “deceptively simple” thing an organization can do is to match the person with the right assignment. She argues that matching people with jobs that combine their expertise, their creativity level, *and* for which they are intrinsically motivated will result in the best output.²³ Conversely, keeping a tight control of the process will lead to suboptimal/noncreative outcomes. In *Creativity in Context*, Amabile observes, “Social and environmental factors have a large influence on creative outcomes and the productivity and creativity of outstanding individuals.”²⁴ If the organization is hostile to creative ideas, the likelihood that they will be translated into quantifiable gain is substantially reduced. In turn, those with an innovative mindset become increasingly frustrated and seek environments more in line with their predisposition for divergent thinking.

Driving Innovation in a Culture of Disciplined Conformity

*To put it bluntly, we need to find a way to make it less Herculean for innovative change to flourish in our armed forces.*²⁵

—Rear Admiral David Oliver, USN (Ret.)

Military culture, regardless of Service, is authoritarian by nature. In his article “Innovation: Past and Present,” Williamson Murray defines *military culture* as “the sum of the intellectual,

professional, and traditional values possessed by the officer corps.”²⁶ In *The Soldier and the State*, Samuel Huntington famously categorizes American military culture as one of “conservative realism” and further opines that the military “exalts obedience as the highest virtue.”²⁷ In their respective works on Service cultures, *The Masks of War* and *Four Guardians*, Carl Builder and Jeffrey Donnithorne examine the individual cultures of the four military Services. Taken together, their two books, published 30 years apart, paint a remarkably consistent picture of Service-specific idiosyncracies linked by a common frame of obedient service to their commanders, elected civil authority, and to the Nation.²⁸ Even Donnithorne’s title elicits a vision of protectors of the current system rather than change agents.

Builder vividly portrays the Navy’s ideal of “independent command at sea,” while Donnithorne extolls the centrality of command within the Army.²⁹ Though Builder also comments on the relatively democratic tendencies of Air Force culture as compared with those of the other Services, command and rank still convey an authority that is unlike that found in civilian professions.³⁰ The result is that within the military, commanders and strategic leaders set culture. Therefore, meaningful cultural shifts within the Services are contingent on cultural shifts within military leadership.

In “On Military Creativity,” Milan Vego opines, “Military culture is not conducive to finding a drastic solution to some new challenge. It tends rather to resist any changes, or in the best case, slightly modify the existing situation.”³¹ He concludes, “Conformism is a major obstacle to creativity in a military organization, especially during peacetime.”³²

To truly embrace the creativity and cognitive diversity demanded by the National Defense Strategy, cultural change among the Services is required, and thus it is required among their leadership. This is no small task, nor is this the first work that has recognized the need. In their 2015 article “Toward a Smarter Military: Intellectual Capital, A Case for Cultural Change,” Everett Spain, J.D. Mohundro, and Bernard Banks argue, “the 2014 Army Operating Concept implores that the Army broaden its approach to learning . . . such an approach may require a fundamental shift in how our Army selects and develops future leaders.”³³ The authors recommend the Army critically examine the manner in which it assesses, develops, selects, and sets the culture for future leaders. Doing so is especially important in order to foster officers’ conceptual abilities.³⁴

The article quantitatively demonstrates a “systemic bias against cognitive ability in the U.S. Army officer promotion and selection process,” resulting in officers with the highest levels of cognitive capacity being promoted at lower levels than those of their less intelligent peers.³⁵ They posit four potential reasons for this. Two of them are related to culture. First, the authors

argue that Army officers may have an ingrained bias against intellectual ability. Second, they argue that Army culture places the greatest value on ability to “take the hill” and that officers with higher cognitive capacity may exhibit lower levels of “compliance,” which makes them more likely to consider alternatives rather than exhibit reflexive compliance to orders.³⁶

In the end, the three authors assert that the fundamental cultural bias is toward action-oriented officers who exhibit “motivation and tactical ability,” rather than in favor of conceptual ability.³⁷ The crux of the problem, however, is that officers are selected for promotion to the strategic level on the basis of tactical mastery, with a bias against cognitive capacity. Ironically, at the strategic level, the need for cognitive capacity eclipses the need for tactical competence.

Sea Service officers have observed similar phenomena among their ranks. In *The Creativity Conundrum*, John Buser argues that Navy strategic leaders have no time to consider change given the tyranny of the operational tempo, nor are they psychologically predisposed to do so in the first place.³⁸ As evidence, Buser cites a study of Navy leaders at the Navy Command Leadership School ($n = 8,997$) in which the majority of the respondents fell in the “traditionalist” temperament of the Myers-Briggs continuum (sensing/judging).³⁹ Individuals who fit this category value dependability, reliability, thoroughness, responsibility, duty, trustworthiness, and service to society. Furthermore, their thought processes are “based more on details and experience than intuition, ideas, or analysis of what could be.”⁴⁰

Given that the military is an organization that thrives on discipline and conformity, largely out of operational necessity, the question that arises is whether to expect creative and innovative thinking from its personnel at all. In “Military Personnel as Innovators: An Unrealistic Expectation,” Michelle Ewy investigates this question in great detail, examining both military culture and cutting-edge neuroscience to derive her conclusions. Ewy argues, “Current research in neuroscience and organizational psychology . . . indicates that it is unrealistic for U.S. military leaders to routinely expect their personnel to be innovators within an organizational culture that reinforces self-restraint, rewards groupthink, and treats white space as wasted time.”⁴¹ She concludes that to create an environment that fosters innovation, the military must undergo a significant cultural change. It must retool its incentive structure to reward creativity and support divergent thinking. Finally, she argues that the military must also create time and space for both to occur.⁴²

Each of these articles investigates an aspect of “learning agility.”⁴³ According to a combined study between Columbia University’s Teacher’s College and the Center for Creative Leadership (CCL), learning agility is comprised of five facets: innovating, preforming, risking, reflecting, and defending.⁴⁴ The study finds learning-agile individuals tend to be more “social,

creative, focused, and resilient” and less interested in accommodating others. They are not afraid to challenge norms. Finally, learning-agile leaders tend to be more open and less defensive than nonagile ones.⁴⁵

Defensiveness, cited by CCL as a byproduct of low levels of openness, tends to create conformist cultures in which more open and innovative individuals are either stifled or ultimately leave the organization.⁴⁶ Using Amabile’s logic, defensiveness “kills creativity.” Returning to Buser’s lament regarding the prevalence (sensing/judging) types among Navy leadership, learning agility correlates highly with a Myers-Briggs Type Indicator (MBTI) pairing of intuitive/thinking, which is far less prevalent than a pairing of sensing/judging within the officer corps.⁴⁷

Spain, Mohundro, and Banks also specifically link higher levels of cognitive capacity to greater learning agility.⁴⁸ They argue that individuals with higher levels of cognitive capacity are more open and less defensive. In terms of innovation, the agile leader is more likely to value the potential of a creative idea and less likely to crush innovative behavior.⁴⁹ It is important to note, however, that creativity and cognitive capacity are not synonymous. Highly creative people do not necessarily possess genius IQs, nor are highly intelligent people necessarily highly creative.⁵⁰ However, if cognitive capacity co-varies with openness, then having military leaders with higher levels of capacity increases the chance that creative ideas will be recognized rather than crushed.

The evidence cited herein presents a picture of a culture that is predisposed toward finding efficiencies and maintaining the status quo, managed by a leadership that is psychologically predisposed toward order and incremental change. Nonetheless, the 2018 NDS mandates cultural change to increase the levels of creativity and innovation across DOD.

Convergence Bias in PME

Convergent thinking is associated with problem-solving, while divergent thinking is associated with creativity. In the parlance of the Stanford Design School, “divergent thinking styles are designed to explore many possibilities, deferring judgment and creating an open ideations space to allow for the maximum number of ideas and points of view to surface.”⁵¹ In contrast, convergent thinking “isolates potential solution streams, combining and refining insights and more mature ideas, which pave a path forward.”⁵² Both are necessary to design thinking. But they are used at different points in the design process.

Military operations, education, and planning processes are based on developing preponderantly critical/convergent thinking skills at the expense of the development of creative/divergent skills. In his School of Advanced Military Studies thesis “Creativity in Complex Military Systems,” Matthew Furtado examines this phenomenon. He concludes, the “bias [toward critical thinking]

is reinforced in the operational Army by exposure to predominantly tactical-level formations that employ the Military Decision-Making Process (MDMP). . . . In short, through training and experience most officers are molded to be critical at the expense of being creative.”⁵³

This issue extends beyond the Army into the other Services. Rather than MDMP, the Marine Corps uses the Marine Corps Planning Process. Although at first glance it appears more balanced than the Army process given its adoption of design thinking as the underpinning frame, the actual methodology is heavily weighted to critical rather than creative thinking. This is to be expected as critical thinking is the backbone of the detailed planning required for success at the tactical level.⁵⁴

Critical thinking is a requirement at the tactical level and is also often sufficient for success at this level. However, the calculus changes at the strategic level in the face of growing complexity and the emergence of wicked problems. Officers who, early in their careers, have been overwhelmingly instructed in convergent thinking to develop tactical competence will have difficulty shifting the paradigm to employ the mix of divergent and convergent thinking necessary to manage strategic problem sets, particularly if they are psychologically predisposed toward incremental thinking and immersed in a culture that prefers it.

Changing the way that officers think entails changing the way they are trained and educated *throughout* their careers. Using a progressive continuum that molds them overwhelmingly in critical problem-solving early in their careers and introducing them to complexity and design only later on develops an overreliance and comfort with convergence. This in turn produces the tactical preferences some authors decry as fundamentally problematic within the current officer corps.⁵⁵ Furthermore, waiting until late in an officer’s career to introduce creativity and design thinking into problem-solving risks failing to identify natural strategic thinkers at points in their careers where they can be nurtured rather than discarded by a system that rewards tactical competence.

The Propensity for Creativity and Innovation among DOD Personnel

*They are certainly smart enough, but they have trouble being creative. Even when you remove the guardrails, they just can’t get out of the box.*⁵⁶

—A serving U.S. Ambassador describing students at the National Defense University

Over the past two decades, researchers both inside and outside DOD have undertaken multiple studies on the prevalence of creativity and the success of innovation in the military. One particularly interesting study investigated the creativity of Midshipmen entering the U.S.

Naval Academy in the mid-1990s. The research examined whether an innovative mindset was a factor in initial success or failure at the Academy by administering the Kirton Adaption Innovation Inventory on the initial reporting day and tracking plebe progress during the first year.⁵⁷

Two findings stand out. First, researchers found the mean innovation cognitive style score for the plebes to be about one standard deviation lower than that of the incoming freshman at five similarly competitive nonmilitary universities.⁵⁸ Second, the 98 plebes who voluntarily withdrew from the Academy during their first year scored an order of magnitude higher for innovation than those who remained.⁵⁹ Although the researchers cautioned that there were too many factors involved to draw definitive conclusions, the findings appear to indicate that military service attracts a smaller “creative element” than is present within the general population. They also indicate that those with creative inclination who are inspired to serve leave at a higher rate than their less innovative peers.

In 2013, Stephen Gerras and Leonard Wong produced another illustrative study on the subject. In *Changing Minds in the Army: Why It Is So Difficult and What to Do about It*, the authors posit, “recent history reveals that Army strategic leaders continue to struggle with changing their minds.”⁶⁰ Their research relies on the Five-Factor Personality Model for potential explanation.⁶¹ Specifically, the authors concentrate on the factor of *openness*, which is “the recurrent need to enlarge and examine experience.”⁶² People with a high degree of openness exhibit a high level of intellectual curiosity, creativity, and comfort with novelty and ambiguity. Those who are less open prefer the familiar over the novel and tend toward more conventional and traditional pursuits and interests.⁶³

Gerras and Wong’s work focused on Army War College students (predominantly Army officers in the ranks of lieutenant colonel and colonel) rather than entering Naval Academy plebes. Nonetheless, the similarities in the findings are striking. The authors determined that “most successful officers score lower in openness than the general U.S. population.”⁶⁴ Furthermore, those students selected for brigade command (meaning those most likely to be promoted into the general officer ranks) score even lower on openness than the overall Army War College average.⁶⁵

Juxtaposed, the two studies illustrate a story of relative cognitive homogeneity greater than that present in the U.S. population as a whole. Moreover, this high level of homogeneity is characterized by low levels of openness and a lower than average predisposition for innovative thinking. Finally, it appears that this homogeneity and lack of openness become more prevalent as military personnel increase in rank. Given that the military is an authoritarian culture, the less open senior leaders are, the less receptive the culture will be to nonconforming ideas. Thus,

according to the CCL, leaders who exhibit low degrees of openness will be much more likely to engage in “defensive thinking” and resist new ideas that are not their own.⁶⁶

The Army’s Mission Command Center of Excellence also investigated this topic in 2015. An unpublished paper titled “Creativity in the Army: Creative Process, Creative People, and the Creative Climate” concludes that junior leaders are not “being placed in situations that allow them to be innovative, and that this appears to be a contributing factor in their decision to leave the Army.”⁶⁷ The study further asserts that Army senior leaders appear to believe that they have the responsibility for creativity and innovation for their subordinates.⁶⁸ In essence, senior leaders create and subordinates do as they are told. Creativity among subordinates is often stifled, as Amabile’s research predicts. The study also found that junior officers do not believe their superior officers are succeeding in their mandate for creativity and innovation. In an annual survey of leadership, Army officers are asked to rate their leaders’ success in demonstrating 13 different attributes. Innovation is consistently one of the two lowest rated items.⁶⁹

The authors of this paper conducted a related study in 2017, undertaken at the behest of the Army G3/5. The research was designed to determine whether an “archetype” or “archetypes” of a successful Army strategist exist to improve initial assessment and selection of future Army strategists.

Army strategists (Functional Area 59) are a small cohort of field-grade officers (fewer than 400 total) who work on plans and policy at the strategic level, predominantly for very senior defense leaders (three- and four-star general officers/flag officers or their civilian equivalents). Strategists are selected after the completion of company command (the 7- to 9-year mark), having proved they can succeed as a “basic branch” Army officer. The study relied on the Innovation Strengths Preference Indicator (ISPI) as a basis for comparison.⁷⁰

The findings were both consistent and surprising. The data revealed that on average, Army strategists have a significantly higher level of openness and intellectual curiosity than Army officers overall, using Gerras and Wong’s work as a benchmark. As a group, the FA 59s also demonstrate a high level of comfort with ambiguity and a mindset more in line with innovative and creative professionals than with serving military officers.⁷¹ Also notable is that the majority of the officers interviewed stated that if they had not been able to transfer into the strategist functional area, they would most likely have left the Army at the rank of captain or junior major.⁷² This is consistent with the findings of both the Naval Academy plebe study and the MMCOE study on creativity, as well as with Amabile’s research in *Creativity in Context*.

The study suggests that the Army has inadvertently, but positively created “incubators” for outliers, specialties in which nonstandard thinking not only survives but also thrives. At

the time of this writing, additional research using the ISPI has begun on Army foreign area officers. Initial indications are that they too possess an uncommon, but different set of cognitive preferences than those demonstrated by strategists.⁷³ The authors recommend that more studies like these be undertaken to determine whether other small (*n*) populations in DOD—such as special operations forces, public affairs, civil affairs, cyber operations, and military information support operations—have “counterculture” profiles and demonstrate relatively high levels of creativity and innovation.

Optimizing Creative and Innovative Teams Inside DOD

All tasks can't be fully accomplished by one individual . . . nor can they be accomplished as fully as possible by a team of like-minded innovators. In that kind of mind vacuum, one trait will inevitably rise to the fore.⁷⁴

—Mark E. Miller

*The dichotomy is this: Organizations want new, revolutionary ideas and innovations, but they don't work well with the people who produce them.*⁷⁵

—Excerpted from *The Invisible Element*

Creativity is most often the product of individual inspiration, but innovation and the quantifiable gain achieved by it is the result of a team effort that requires successfully navigating an organization's culture and decisionmaking labyrinth. Both militaries and large bureaucracies depend on effective teams to succeed. DOD and the individual Services each have well-established processes for planning and decisionmaking. However, this is not necessarily an advantage. The decisionmaking processes are consistently derided for being consensus-based and thus, too slow and incremental in nature to effectively manage the current security environment.⁷⁶ In “The Bureaucratization of the U.S. Military Decisionmaking Process,” Milan Vego investigates this phenomenon in detail. He argues that all of the Services' decisionmaking processes have become “rigid, cumbersome, and time-consuming” and that leaders and staff alike are too often “prisoners of the process.”⁷⁷ Furtado also argues that the endstate fixation of these teams leads to a requirement for early convergence at the expense of novel solutions.⁷⁸

In *Duty: Memoirs of a Secretary at War*, Robert Gates describes the consequences of this type of decisionmaking in the recounting of his battle to adopt the Mine-Resistant Ambush Protected (MRAP) vehicle over the objections of the Pentagon bureaucracy. Gates paints a picture of

an organization that cannot adapt to rapidly changing circumstances and as a result chooses to protect programming decisions rather than American lives. He observes, “as usual, in a huge bureaucracy, the villains were largely nameless and faceless people—and their leaders—who were wed to their old plans, programs, and thinking and refused to change their ways regardless of circumstances.”⁷⁹

In an attempt to mitigate the problems arising from bureaucratic, consensus-based decisionmaking, Congress, in an effort led by the late Senator John McCain, inserted a requirement for cross-functional teams (CFTs) into the 2017 National Defense Authorization Act (NDAA). In his article investigating the logic of this requirement, Christopher Lamb explains:

*Section 941 [of the NDAA] obligates the Secretary of Defense to produce an organizational strategy for improving DOD performance that would include CFTs; an organizational culture that is more collaborative, innovative, team- and results-oriented; and training and personnel incentives to support such teams and cultural changes. Most of the Section 941 language details how the CFTs are to be conceived and employed to overcome consensus decisionmaking.*⁸⁰

A 2018 Government Accountability Office report finds that 10 CFTs have been established, but the culture of the Pentagon has been slow to embrace the requirement and fully resource it. As a consequence, implementation has been incomplete and results to date have been disappointing.⁸¹

The case of the CFT is relevant for two reasons. First, it provides contemporary insight into the bureaucratic resistance to organizational and cultural change. Second, it highlights a missing variable in the DOD conception of cognitive diversity. Cross-functional expertise is absolutely required for developing innovative solutions and ensuring two elements of cognitive diversity are present—those of differentiated skill sets and experience. However, differentiated skill sets and experiences represent only one-half of the solution to the problem. The other half is comprised of the climate set by the team leader and the level of creative diversity present within the team itself. To optimize CFTs and increase their overall effectiveness, the authors suggest implementing Tri-Level Matching Theory.

Introduced by Dennis Brophy in 2006, Matching Theory is the relatively simple idea that people’s creative propensity should be “matched” to the type of problem they are trying to solve. In essence, different types of problems are better solved by people with different cognitive profiles. The key to the theory is to match the problem with the problem-solver and match the correct leader to the team.⁸² Brophy explains that a problem can be categorized according to

its subject, number of parts, importance, complexity, and uniqueness.⁸³ Many problems do not need disruptors to solve, but complex wicked problems often do. In these cases, knowing both the subject matter expertise (skill set) *and* creativity propensity (mindset) of the team members will significantly increase the chances of finding a solution to the problem.

Rosenfeld, Wilhemi, and Harrison build on Brophy's idea and liken the process of innovation to a relay race, in which different legs are run by personnel with different cognitive profiles.⁸⁴ They posit that those creative minds who have the initial idea to solve the problem are unlikely to be the people who actually develop and implement the solutions.⁸⁵ As a result, to operationalize disruptive innovation in DOD, both divergent *and* convergent thinking are required. Therefore, it is imperative to understand the cognitive styles of the individuals within the workforce to ensure the greatest chance that innovative solutions actually come to fruition. To do this, the authors introduce an Innovation Continuum (see figure), which sorts problems

THE INNOVATION CONTINUUM



and ideas by type, from evolutionary to revolutionary.

As previously explained, innovation is the quantifiable gain resulting from a creative idea. The different types of innovation categories are explained and plotted from left to right on the continuum. Evolutionary innovation is the most common and least disruptive type. An example of evolutionary innovation in DOD would be reorganizing unit standard operating procedures or applying Lean Six Sigma principles to improve efficiency. Expansionary innovation entails taking an existing item or process and putting it to a new use. The adoption of airmobile operations during the Vietnam War is an example of expansionary innovation, as is the creation of AirLand Battle to overcome Soviet conventional overmatch during the Cold War. Revolutionary innovation is the rarest type. It is also the most disruptive, as it either shifts or destroys an existing paradigm. A classic example of revolutionary military innovation is the

Manhattan Project and the subsequent atomic bomb. All three types of innovation are critical to maintaining competitiveness and are required in an organization that employs millions and operates with an annual budget of three-quarters of a trillion dollars.⁸⁶

Different mindsets are predisposed toward particular types of problems—and toward the development of particular kinds of solutions. People who are cognitively predisposed toward incremental concrete solutions will fail to see the possibility of revolutionary change, while those who tend to think in terms of large-scale visionary projects will not thrive solving problems that require evolutionary innovation. Therefore, to operationalize Matching Theory, we must understand the type of problem to be solved, as well as the mindset of the individual available to solve it.

The cognitive predisposition for solving problems on the revolutionary end of the continuum is rare.⁸⁷ To solve the revolutionary problems DOD is facing, it must identify and utilize its “Enders.” But it is also equally critical that these Enders are paired with other cognitive types predisposed toward seeing the concrete ways that revolutionary solutions can be successfully implemented and adopted across a large bureaucratic system. Furthermore, DOD must be led by people who can see the need for change. Cheung, Manhken, and Ross argue, “Top-level leadership support is crucial to the success of disruptive innovation. Leaders often must ensure that the innovation effort receives the economic, technological, and human resources it needs to be successful and also defend it against those who would kill or sideline it.”⁸⁸ The idea of matching problem types to problem cognitive predisposition is not new in industry and is currently being attempted inside DOD, particularly with problem sets on the expansionary or revolutionary end of the continuum.

Matching Theory in Defense Innovation

Raytheon currently leverages Matching Theory to improve innovation outcomes. For the past decade, Raytheon has been running the Raytheon Innovation Challenge (RIC), culminating in RIC Week. It brings together over 100 innovators from across the company’s many business units that have self-nominated to participate in creating novel solutions to unmet customer needs.⁸⁹ RIC Week is a 5-day event that employs multiple tools and techniques to enhance ideas and discover novel solutions. These include divergence and convergence methods coupled with the expertise of the participants. By the end of the week, ideas are selected for their high potential value.

During RIC Week, both skill set and mindset are leveraged, and subworking groups are formed to match each participant’s potential skills and passions. All participants complete a

background profile that includes their areas of technical and subject matter expertise, as well as answering the ISPI. This information is entered into a customizable teaming software solution called the Innovation Challenge Environment tool, which allows for in-the-moment team formation and adjustments by assigning the 100 participants into subgroups based on the activity of that portion of the week. The tool creates the working groups using a best-fit matching based on the goal of the team activity, ISPI results (individual and group), the participant's role at the event plus his or her technical, business, and customer knowledge.⁹⁰

RIC has enabled new products and services for Raytheon, including an adaptable cyber security technique, novel missile components based on additive manufacturing, augmented reality-based operations and maintenance, more efficient and higher throughput product test and acceptance enabled by machine learning, and reversible vehicle-stopping technology. There have been close to 100 funded projects that resulted from close to 2,000 RIC idea submissions. In addition to the project outputs, the RIC and RIC Week contribute to exposing employees to new customer needs, building networks and collaboration across the enterprise, energizing the participants, and fostering a strong culture of innovation.⁹¹

RIC Week continues annually because of the positive return on investment for Raytheon, and it has also had a positive cultural impact. Dr. John Zolper, Raytheon's Vice President for Research and Innovation, explains, "I find that the participants view the week as invigorating and valuable while building new insights and skills that they take back to their home business units to enhance a culture of collaboration and spark new levels of innovation in their daily work."⁹²

The U.S. Army Armament Research, Development, and Engineering Center (ARDEC), located at Picatinny Arsenal, New Jersey, is the Army's primary research and development arm for armament and munitions systems. Developing novel and innovative solutions for the warfighter is critical to its mission. To aid in this process, ARDEC leadership uses Matching Theory as a facet of their internal innovation system. As ARDEC's Chief Innovation Officer Anthony Pezzano relates:

Our system is people based. We link the primary inventor to a middle-level Idea Catalyst (a formal role at ARDEC). The Catalyst supports them to better define and understand the want, need, or potential for the idea, then assists them in developing the idea, including connecting them to the appropriate internal network, and finally finding the proper leadership to present the developed idea to.⁹³

ARDEC also utilizes personality testing as part of the process. Specific mindsets were sought when building the team of catalysts and champions.⁹⁴ As ARDEC innovates today, it maximizes cross-functional teams by leveraging people with different skill sets and mindsets for different types of projects. According to ARDEC's Chief Innovation Officer, "There is a portfolio of projects and there is a portfolio of people. To get the right distribution of personnel, you need to understand the framework and makeup of personalities and traits of who those personnel are. You just can't assign a number to a job. You have to assign a personality, value system, and skill set."⁹⁵

The Johns Hopkins University Applied Physics Laboratory (APL) has been applying Matching Theory principles to help achieve its goal of creating "defining innovations that ensure our nation's preeminence in the 21st century."⁹⁶ Some past APL innovations include the radio proximity fuse, the world's first global satellite navigation system (which evolved into today's GPS), and high-precision missile guidance and control. In 2017–2018, APL leadership used the Innovation Continuum framework to assess the type of work for major projects under way at the 6,000+ person lab. "We learned that our staff had somewhat differing views of what the different parts of the continuum [evolutionary, expansionary, revolutionary] meant. . . . It was an interesting and fruitful exercise," explained Jerry Krill, Assistant Director for Science and Technology and Chief Technology Officer.⁹⁷

APL works with various partners who have different types of needs and goals in relation to innovation. Dr. Krill explains that APL

*works across the continuum with our partners, but from our assessment we concluded that we should increase the percentage of our internal R&D [research and development] investments that was potentially revolutionary. We also concluded that our special innovation program of higher-risk grants, that we call Project CATALYST, was in fact leading to a high percentage of revolutionary ideas, as was our intent.*⁹⁸

Given the lab's goal of creating the next defining innovations, that is, innovations that are so profoundly revolutionary that they pose an inflection point in a given domain (like navigating by satellite), leadership decided that each of APL's 12 mission areas should invest more in revolutionary ideas. "It required each area to review its vision," Krill states. "You can't strive to be revolutionary without a long-term vision of what that looks like. We continue to use the continuum framework in our periodic R&D investment program management reviews."⁹⁹

While APL is driving toward revolutionary/defining innovations, the organization is utilizing Matching Theory in conjunction with the continuum in order to optimize output. “The framework has helped staff members from new hires to senior experts understand how they and their work fit into innovation and the innovation strategy of the organization,” explained John Burke, co-lead designer of APL’s new inclusion program, Mosaic.¹⁰⁰

In addition to the continuum, APL has explored the human dynamics of innovation. As a pilot, two teams engaged in developing innovation initiatives used the ISPI personality assessment to examine their collective innovation preferences. Both teams identified that they were skewed toward a pioneering orientation and that their performance could be enhanced by adding talent with preferences for implementation and design detail, which they proceeded to do. Burke related:

Many of APL’s defining innovations and key accomplishments came from teams whose members contributed broad skills and experiences. Because we are continually forming and evolving teams to address critical challenges, we explored a way to facilitate locating prospective team members from across the lab with diversities of thought and experience. Mosaic is about building more innovative and creative teams by increasing the cognitive diversity and inclusiveness of our teams. Research shows that if you can increase cognitive diversity on a team and teach people to take advantage of that diversity by creating an inclusive environment where everyone’s voice is heard and there is psychological safety, you will get more creative and innovative results. To take advantage of these learnings, Mosaic is APL’s program to facilitate the way that we form and run teams. We are seeing positive results.¹⁰¹

An offshoot of Mosaic is a teaming app that APL created called Lynx. The software uses existing APL databases to visualize team analytics and help leaders better understand the individuals on their team (skills, expertise, work experiences, backgrounds, organizational dimensions, and personality). Lynx also helps leaders search for new team members based on skill set and availability and then rank orders the responses based on how much cognitive uniqueness each individual adds to the current team (using the criteria just listed). In the selection process, the software removes names and photographs to reduce as much unconscious bias as possible.

A Mosaic/Lynx pilot program occurred in 2018 with 16 teams and 200 people. Results show a statistically significant increase in team inclusiveness. Krill explains the project this way:

“The Mosaic team applied design thinking and systems principles to methodically address the potential for boosting innovation output via cognitive diversity. This is not just an ad hoc philosophy; this is how we engineered a team forming approach.”¹⁰²

Matching Theory based on skill set and mindset is increasing performance and output in industry, military R&D centers, and university laboratories. The authors recommend that DOD integrate best practices in order to improve innovation outcomes across the Services and Department.

Recommendations

*You can't flip a switch and say that we are going to do a massive, wholesale cultural change. That doesn't happen. It takes weeks, months, and years to instill and transform a culture. It happens by finding a subculture that impacts and influences the major body of people. . . . It is finding the subcultures and subpersonalities that can address the smaller percentage of the portfolio that needs to innovate to accelerate technology, especially when the environment is changing so rapidly.*¹⁰³

—Anthony Pezzano, Chief Innovation Officer, ARDEC

DOD struggles with accepting and tolerating the level of risk and change required for revolutionary innovation to occur. Conservatism in military operations is understandable and often appropriate. However, in the current environment of reemerging great power competition coupled with rapid technological change, risk aversion and cultural preference for evolutionary change are impeding consideration of solutions that reside on the expansionary and revolutionary end of the Innovation Continuum. For Matching Theory to work within DOD, both culture and processes must adapt. DOD must sustain its capacity for evolutionary innovation, while simultaneously increasing its tolerance for expansionary and revolutionary ideas, as well as its tolerance for the personnel who generate those ideas.

There is capacity within the existing force structure to accomplish this. However, it must be acknowledged and effectively leveraged. Moreover, DOD must develop or reinvigorate organizations dedicated to exploring revolutionary innovation. The recent creation of organizations such as the Defense Innovation Unit and Army Futures Command demonstrate that DOD has identified the problem. But the critical variable of cognitive diversity as it relates to creativity has been thus far largely absent from the discussion. In order to integrate and operationalize a

holistic concept of cognitive diversity within DOD, the authors present the following recommendations.

Recognize the Multiple Facets of Cognitive Diversity

There must be a recognition across DOD that cognitive diversity is multifaceted. In addition to differences in backgrounds and skill sets, cognitive diversity also encompasses differentiated mindsets. To accomplish the mandate for innovation present within the current strategic documents, DOD must institute a method to differentiate innovative *outliers*, defined as those personnel with high levels of creativity and tolerance for ambiguity. It must then utilize them to develop innovative solutions to complex problems and give them space and time to do so.

Given the studies conducted to date, one can assume there are lower levels of creativity within DOD than in society as a whole. However, given the innovation mandate in the NSS and NDS, creative outliers must be identified and effectively leveraged.

Adopt a Commercial Off-the-Shelf Method for Differentiating Cognitive Types and Test All New Recruits, Both Military and Civilian

There are multiple tools available commercially for differentiating among cognitive types. This paper has relied on four of them: the Myers-Briggs Type Indicator, the Big Five Personality Test, the Kirton Adaption Innovation Inventory, and the Innovation Strengths Preference Indicator. DOD should investigate the range of options commercially available and license one or more for use. From there, it should test all of its personnel for cognitive type and propensity for revolutionary ideation and innovation.

Furthermore, DOD should develop an Additional Skill Identifier for rare cognitive types regardless of rank, Service, or position. Finally, DOD and the Services should develop searchable databases—much like those that exist for language skills—to have the ability to query for cognitive outliers when truly revolutionary problem sets arise. This undertaking should become a line of effort within objective eight of the 2018 National Defense Strategy: “Establish an unmatched twenty-first century National Security Innovation Base that effectively supports Department operations and sustains security and solvency.”¹⁰⁴

Determine the Jobs Where High Levels of Creativity Are Most Needed

Matching Theory succeeds when people are matched to the jobs that best utilize their skill sets and mindsets. Current talent management initiatives appear preponderantly concerned

with one variable in this equation: the individual. There is little attention being paid to the requirements of the jobs themselves. In addition to the individual and composition of the team itself, talent management efforts must account for the requirements of the job in order to effectively employ Matching Theory. Commands should consider which positions require higher levels of creativity and make efforts to match these jobs with creative individuals.

Study the Ongoing Use of Matching Theory within DOD and Industry and Adopt Best Practices

Raytheon, ARDEC, and APL have applied Matching Theory with quantifiable success. Furthermore, the Air Force is working to apply it to its annual Commander's Innovation Challenge, an event designed to develop the most innovative ideas and technologies for adoption inside the Service.¹⁰⁵ These efforts should be studied and best practices determined. DOD organizations whose missions are devoted to developing innovative solutions should adopt these practices as part of their innovation processes.

Reduce Convergence Bias by Introducing Design Theory and Divergent Thinking Earlier in PME

There is no question that tactical decisionmaking models require critical thinking. And tactical competence is the sine qua non for military leadership. However, the tactical decision-making models taught early in an officer's career focus on critical thinking at the exclusion of other problem-solving paradigms, particularly ones that employ design theory and require divergent thinking. This results in unsatisfying outcomes when officers are confronted with complex problems that defy linear problem-solving. It also reinforces mental models that are difficult to discard when officers are assigned to strategic- and operational-level posts where nonlinear problems are a daily occurrence.

By complementing training programs with exercises that require design thinking and divergent thinking skills from the outset, officers will be educated to consider the problem type first and whether convergent and/or divergent thinking are required to resolve it. Moreover, by introducing the requirement for nonlinear problem-solving from the outset, leaders will have more opportunities to determine who among their subordinates demonstrates higher levels of creativity.

Introduce the Concept of Cognitive Diversity in PME

Leadership sets and drives culture. By providing early training for current and future leaders about their cognitive mindset, they will have another lens to see their personal strengths

and potential blind spots. This training can lead to better learning agility, more openness, and less defensiveness. Also, educating leaders about the different types of mindsets that they will encounter in their careers will expand their zone of tolerance for both people and ideas that they see as different. Some of these leaders will be able to go one step further and unleash the different cognitive strengths found in their teams at the appropriate times, helping put Matching Theory into practice.

Recruit Enders

The authors believe there is an immense amount of untapped innovation potential in the current Armed Forces. Yet to flourish in the 21st century, the Services will need to attract, train, and retain many different types of people and personalities. Based on the top-level calls to maintain and grow our competitive advantage via new technologies and disruptive ways of thinking, DOD should be a viable and attractive option for outliers to work on revolutionary challenges. The more revolutionary and wicked the problem is, the more likely the need for revolutionary and wicked problem-solvers.

Continue to Study the Cognitive Composition of Small (*n*) Populations within DOD

Small studies undertaken by the authors indicate that there are populations inside DOD whose cognitive profile deviates significantly from the mean. The studies of Army strategists and foreign area officers remain nascent. However, preliminary conclusions indicate that these two populations contain a high percentage of cognitive outliers when compared to the center mass of Army officers. This makes sense when one takes into consideration that these officers have to self-select out of the mainstream and into functional areas where assignment patterns, required skill sets, and promotion opportunities differ from those of “Big Army.” As DOD continues its search for innovative solutions and personnel, it should consider further study of small (*n*) populations such as these in order to potentially uncover “incubators” for higher-than-average levels of creativity.

Conclusion

There is an inherent tension between the need for creativity within the military and the need for military discipline. However, it is possible for them to productively coexist. The 2018 National Defense Strategy mandates a fundamental change in PME and increases in the development of disruptive innovations to meet the challenges posed by America’s competitors. These mandates are intertwined. Greater disruptive innovation within DOD is far more

likely to be realized if the entire force understands what disruptive innovation entails and the conditions under which revolutionary breakthroughs are most likely to occur.

Cultural change is difficult and occurs slowly, if at all. However, these facts do not diminish the requirement for cultural change, nor do they relieve leaders of their responsibility to shepherd them. There is sufficient talent and creativity within the existing force to accomplish these shifts. Those DOD members who demonstrate a high propensity for creativity on the expansionary to revolutionary end of the continuum must be identified and harnessed rather than marginalized or crushed. Likewise, systems and processes must be changed to optimize the contributions of all personnel, regardless of where they fall on the Innovation Continuum. Finding the Enderers among us is necessary for success in the current environment. But Ender alone will never be sufficient to meet the multifaceted challenges DOD confronts on a daily basis.

Appendix A: The Innovation Strengths Preference Indicator Theoretical Background and Influences

This paper relies on four psychometric tools to develop its argument regarding innovative thinking within the Department of Defense (DOD): the Myers-Briggs Type Indicator (MBTI), the Kirton Adaption Innovation Inventory (KAI), the Big Five Personality Traits, and the Innovation Strengths Preference Indicator (ISPI). Although each of these tools is useful in forecasting an individual's preferences in dealing with innovation, the authors chose to use the ISPI because it deals most specifically and holistically with innovation.

This appendix is included to provide a detailed explanation of the ISPI and a brief explanation of the science that underpins it. For practitioners and researchers who are looking for greater detail regarding this instrument, the authors recommend *The Invisible Element* by Robert Rosenfeld, Gary Wilhemi, and Andrew Harrison, as well as at the Web site <www.my-humangrid.com>.

Introduced in 2008, ISPI was developed by Rosenfeld and Larry Van Etten. The tool was developed specifically to look at psychological characteristics related to innovation preferences. It was the result of decades of experience dealing with innovation in industry. Rosenfeld was the founder and director of the Office of Innovation for Eastman Kodak from the late 1970s to the late 1980s, exactly the period when Kodak decided not to pursue investment in digital cameras.¹⁰⁶ Affected by the digital camera experience, Rosenfeld left Kodak in 1988 to open a consulting firm, Idea Connection Systems, Inc. There he undertook a comprehensive study of innovation and, in conjunction with Van Etten, eventually built ISPI to understand how personality type directly influences an individual's innovation preferences and style.

Rather than breaking entirely new ground, ISPI builds on well-established psychological assessment theories and brings them together into a single assessment initially focused exclusively on innovation. It integrates the foundational theories of the previously mentioned KAI, as well as the Fundamental Interpersonal Relations Orientation (FIRO-B), Kolbe Conation Indexes, and MBTI personality test.

Rosenfeld and his organization used each of the theories and tools in isolation prior to the creation of ISPI. As Rosenfeld states, "I studied the tools that were out there, but they were laborious to take. And there was not a way for them to integrate and interact with each other."¹⁰⁷ As a result, Rosenfeld and Van Etten created ISPI to integrate the theories and measures derived by the tools listed above with specific regard to an individual's innovation preferences.

The ISPI is a 64-question indicator and is scored along a continuum using a Likert-type scale ranging from 1 to 7:¹⁰⁸

1. Very Seldom True of Me
2. Seldom True of Me
3. Sometimes True of Me
4. In the Middle
5. Usually True of Me
6. Often True of Me
7. Very Often True of Me.

It combines the three different psychological axes (cognitive, affective, conative) into a single indicator, highlighting an individual's predisposition toward a certain type of innovation as well as his or her preferences for interacting with others. ISPI results cover 12 different orientations:

Innovation Orientation (iO)—Individual Innovation Preference

1. Overall ISPI (the aggregated score for ideation, risk, and process)
2. Ideation (approach toward generating new ideas)
3. Risk (approach toward risk-taking)
4. Process (approach for establishing and following processes)

Innovation Orientation Modifiers (iOM)—Innovation Preferences Regarding Other People

5. Control (individual approach for taking charge or allowing others to do so)
6. Relationship (approach for establishing personal relationships)
7. Networking (approach for establishing and maintaining networks)
8. Input (preference for concrete vs. visionary thinking)
9. Flow (preference for converging quickly on a single idea vs. keeping options open)
10. Passion (preference for taking action quickly vs. waiting for more information)
11. Output (the extent to which individual decisions are based on emotion vs. logic)
12. Energy (preference for solitary problem-solving vs. group work).¹⁰⁹

ISPI results are displayed in a *totem*, which tells the story of an individual via the 12 orientations of the tool. When analyzing a group, ISPI data could also be looked at in aggregate to develop teams optimized for solving the problem at hand.

The ISPI totem framework is shown in figure 1. The *XB* stands for extreme builder, *B* for builder, *MB* for mid-builder, *MP* for mid-pioneer, *P* for pioneer, and *XP* for extreme pioneer.

Figure 1. Innovation Strengths Preference Indicator Totem

Your ISPI™ Totem with Explanations								
Name								
Assessment on								
iO™ Innovation Lens								
		XB	B	MB	MP	P	XP	
Total	I prefer to work on incremental change						I prefer to work on breakthrough challenges	
Ideation	I prefer to improve existing things						I prefer to create new things	
Risk	I prefer to work within the rules and norms						I prefer to challenge the rules and norms	
Process	I prefer to work within established processes						I prefer to develop my own processes	
iOM™ Innovation Filters								
		No		Flex		Yes		
Control	<i>I Initiate</i>	I prefer not to be in charge of projects / people					I prefer to be in charge of projects / people	
	<i>Others Initiate</i>	I prefer no oversight of my projects					I prefer others provide oversight of my projects	
Relationship	<i>I Initiate</i>	I am indifferent about getting to know other people					I want to know other people	
	<i>Others Initiate</i>	I want to be left alone					I want others to know me	
Networking	<i>I Initiate</i>	I tend not to include others in my activities					I want to include others in my activities	
	<i>Others Initiate</i>	I am indifferent whether or not others include me in their activities					I want others to include me in their activities	
Input			Concrete		Flex		Visionary	
		I look at the parts before the whole and prefer tangible ideas and things						I look at the whole before the parts and prefer abstract ideas and things
Flow			Converge		Flex		Diverge	
		I prefer to bring ideas together for closure and see time as fixed						I prefer to explore options for discovery and see time as flexible
Passion			Prudent		Depends		Action	
		I prefer to consider outcomes and evaluate hurdles before they arise						I am quick to implement and comfortable re-orientating when hurdles arise
Output			Head		Flex		Heart	
		I prefer to make decisions with facts and logic						I prefer to make decisions with values and the impact on people
Energy			Self		Flex		People	
		I prefer to recharge my energy and process information when alone						I prefer to recharge my energy and process information when with others

The edges of the totem have explanations of each side. The MB and MP are grouped into a term called *connector*, meaning the ability to live across the continuum. For the iOMs, the term *flex* means that people's preferences are situationally dependent.

There are currently over 19,000 ISPI totems in the Idea Connections Systems database coming from industries such as energy, pharmaceuticals, nonprofits, education (colleges, universities, high schools), government, DOD, startups, food, finance, manufacturing, retail, insurance, finance, airline, aerospace, and communication.¹¹⁰ Some ISPI totems are more common than others. In a general distribution curve for the IO continuum, the MBs and MPs make up approximately 34 percent each, while Ps and Bs each make up about 14 percent. Finally, the extreme personality types XB and XP are only 2 percent of the population. This curve will likely shift depending on the type of population. As an example, National Aeronautics and Space Administration (NASA) scientists trying to envision the next version of space flight will look different from Army planners trying to operationalize a multilocation supply chain project.

Given previous studies of military personnel, the authors would expect that the ISPI percentages would shift to the left on the iO continuum, making the number of Ps and XPs even lower in the military community than in society as a whole. Therefore, when considering the question of finding Ender, one would look for personnel on the P and XP side of the scale, the edge of the continuum that prefers to work on breakthrough changes and tends to ignore established paradigms processes.

Using the ISPI to Match Talent to Roles

The ISPI is designed to leverage matching theory in organizations. Bs are naturally drawn to evolutionary innovation, while Ps are drawn to revolutionary projects. Given the likelihood that DOD has a lower percentage of Ps and XPs and a higher percentage of Bs and XBs than the overall population, it follows that DOD would prefer to engage in incremental innovation and that it excels at solving these types of problems. Likewise, it follows that DOD culture would embrace incremental change and shun revolutionary ones.

By adopting ISPI (or another tool) and identifying both problem type and the innovative preferences of the available personnel, DOD can more effectively match personnel and problem sets to improve outcomes, particularly for those problems that are revolutionary in nature. When people are matched to their preferred type of projects, it is a win for all involved. Personnel are working in areas they naturally enjoy, which means they will be more productive and derive higher levels of professional satisfaction with the work. The organization also wins, as the likelihood of a solution improves.

ISPI Statistical Reliability and Cronbach's Alpha

The relevant question for practitioners considering ISPI is whether this mash-up of previously existing assessment theories into a single model produces a demonstrably reliable result—that is, has the tool been independently validated? The answer is yes. It has passed a social science's Cronbach's alpha examination and it has also been adopted for use by the Center for Creative Leadership (CCL).¹¹¹ In addition to CCL, ISPI has been used by multiple companies and governmental agencies in the 10 years since its development. These include the Office of the Secretary of Defense and each of the individual military Services in addition to NASA, the Environmental Protection Agency, Raytheon, Rolls-Royce Motor Cars, ExxonMobil, Hallmark Cards, Carnegie Mellon University, and Michigan State University.

The intended balance of the ISPI assessment is between creating scales that are dynamic with multiple visible behaviors within an orientation, as is often the reality within the innovation space, while maintaining efficiency of completion experience and relevance of outcomes. All measurable behaviors within the orientations achieve alphas above the 0.70 and 0.80 thresholds.¹¹² All 12 orientations are measures of independent behaviors. However, these figures are important, as they demonstrate the relationship of the underlying items for each orientation.¹¹³

In a project commissioned by Force Training (in the Office of the Assistant Secretary of Defense for Readiness), which studied the use of ISPI as a training module in two programs—Ministry of Defense Advisors and Civilian Expeditionary Workforce—ISPI was correlated with assessments based on the previously mentioned theories (see figure 2).

The above and following information is taken from the *ISPI Technical Manual*.¹¹⁴ The data show the correlation statistics.

ISPI and KAI

- There is a significant correlation ($r = 0.65$) between the iO factor Ideation and KAI factor of Originality, based on $n = 50$.
- There is a significant correlation ($r = 0.78$) between the iO factor Risk and KAI factor of Rule/Group Conformity, based on $n = 50$.
- There is a low correlation ($r = 0.23$) between the iO factor Process and KAI factor Efficiency, based on $n = 50$.

Figure 2. ISPI Correlations to Other Instruments

Your ISPI™ Totem with Explanations							
Name							
Assessment on							
iO™ Innovation Lens							
		XB	B	MB	MP	P	XP
Total	I prefer to work on incremental change	T				I prefer to work on breakthrough challenges	
Ideation	I prefer to improve existing things	O				I prefer to create new things	
Risk	I prefer to work within the rules and norms	GC				I prefer to challenge the rules and norms	
Process	I prefer to work within established processes	E				I prefer to develop my own processes	
iOM™ Innovation Filters							
		No	Flex	Yes			
Control	<i>I Initiate</i> I prefer not to be in charge of projects / people			eC	I prefer to be in charge of projects / people		
	<i>Others Initiate</i> I prefer no oversight of my projects	wC		wC	I prefer others provide oversight of my projects		
Relationship	<i>I Initiate</i> I am indifferent about getting to know other people	eA		eA	I want to know other people		
	<i>Others Initiate</i> I want to be left alone	wA		wA	I want others to know me		
Networking	<i>I Initiate</i> I tend not to include others in my activities	eI		eI	I want to include others in my activities		
	<i>Others Initiate</i> I am indifferent whether or not others include me in their activities	wI		wI	I want others to include me in their activities		
Input	I look at the parts before the whole and prefer tangible ideas and things	Concrete	Flex	Visionary	I look at the whole before the parts and prefer abstract ideas and things		
		S		N			
Flow	I prefer to bring ideas together for closure and see time as fixed	Converge	Flex	Diverge	I prefer to explore options for discovery and see time as flexible		
		J		P			
Passion	I prefer to consider outcomes and evaluate hurdles before they arise	Prudent	Depends	Action	I am quick to implement and comfortable re-orientating when hurdles arise		
Output	I prefer to make decisions with facts and logic	Head	Flex	Heart	I prefer to make decisions with values and the impact on people		
		T		F			
Energy	I prefer to recharge my energy and process information when alone	Self	Flex	People	I prefer to recharge my energy and process information when with others		
		I		E			

Key: KAI: T = Total, O = Originality, GC = Group Conformity, E = Efficiency
 FIRO-B: eC = Expressed Control, wC = Wanted Control, eA = Expressed Affection, wA = Wanted Affection, eI = Expressed Inclusion, wI = Wanted Inclusion
 MBTI: S = Sensing, N = Intuition, J = Judging, P = Perceiving, T = Thinking, F = Feeling, I = Introverted, E = Extroverted.

ISPI and FIRO-B

- There is a significant correlation ($r = 0.53$) at the 0.05 level between the iOM subfactor Initiate Control and FIRO-B subfactor Expressed Control, based on $n = 38$.
- There is a significant correlation ($r = 0.70$) at the 0.01 level between the iOM subfactor Initiate Relationship and FIRO-B subfactor Expressed Affection, based on $n = 38$.
- There is a significant correlation ($r = 0.50$) at the 0.01 level between the iOM subfactor Others Initiate Relationship and FIRO-B subfactor Wanted Affection, based on $n = 38$.

ISPI and MBTI

- There is a significant correlation ($r = 0.71$) at the 0.01 level between the iOM factor Input and MBTI factor Sensing/Intuition, based on $n = 30$.
- There is a significant correlation ($r = 0.53$) at the .01 level between the iOM factor Flow and MBTI factor Judging/Perceiving, based on $n = 30$.
- There is a significant correlation ($r = 0.85$) at the 0.01 level between the iOM factor Output and MBTI factor Thinking/Feeling, based on $n = 30$.
- There is a significant correlation ($r = 0.67$) at the 0.01 level between the iOM factor Energy and MBTI factor Introversiion/Extraversion, based on $n = 30$.

Appendix B: Cognitive Archotyping Inside DOD?

The Pilot Study for Army Strategists (FA 59)

In 2015, Dr. Susan Bryant, one of the authors of this paper, became the Chief of Staff of the Army Strategic Studies Group (SSG), an organization chartered in 2012 by then-Chief of Staff of the Army General Raymond T. Odierno to consider problems from different perspectives. The SSG mission was to “conduct independent, unconventional, and revolutionary research and analysis.”¹¹⁵ This was a Herculean task, which was to be undertaken by what amounted to a hand-selected “pickup team” that had a 90 percent annual turnover rate.

A significant task of the leadership that oversaw these cohorts was annually recruiting and selecting the right mix of people who could fulfill the mandate. What quickly became obvious during this process was that higher than average cognitive capacity was necessary but not sufficient to thrive as an SSG fellow. There was also a particular mindset that was equally necessary, one that was neither described nor captured by the Army’s evaluation system. Over time, the SSG’s desired attributes became shorthanded as “comfort with ambiguity,” “fundamental intellectual curiosity,” and an ability to “create.”

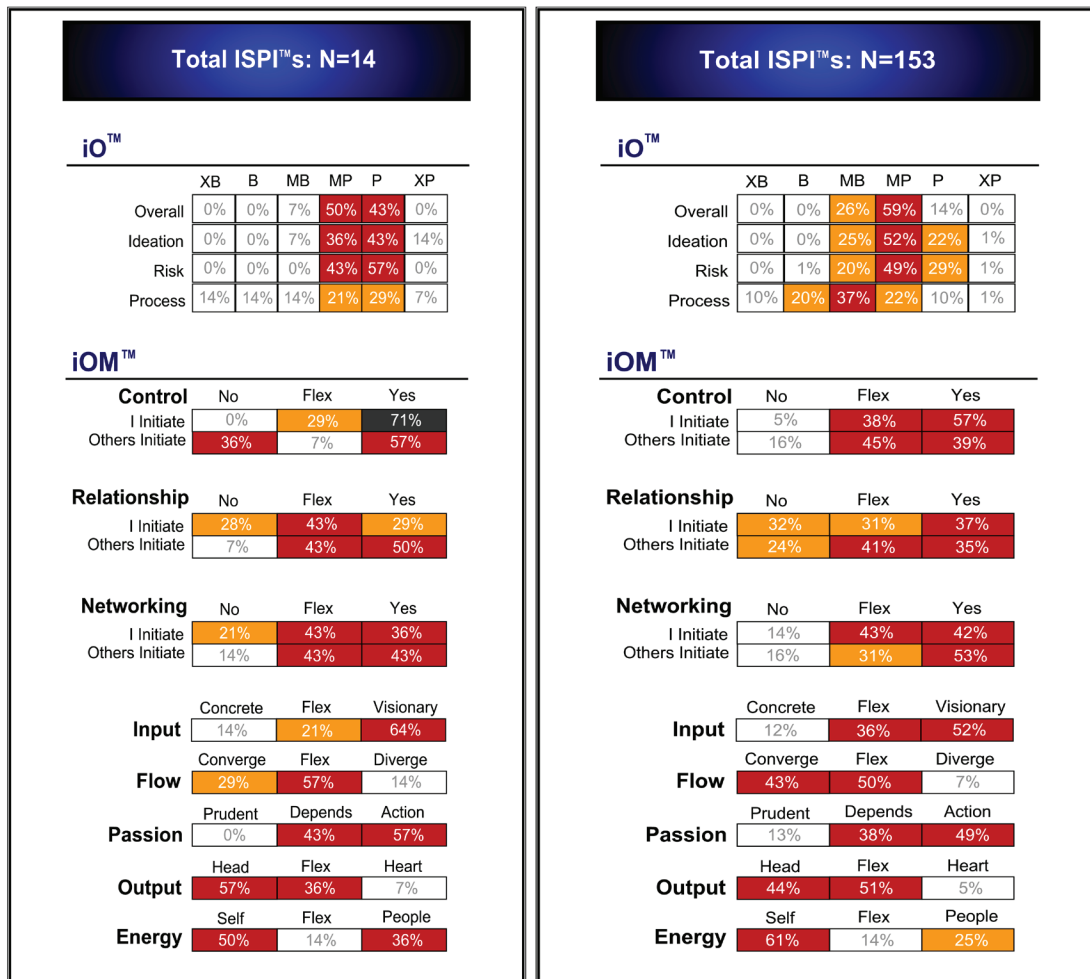
As the organization was being asked to think differently about problem sets, it became obvious that the qualitatively different products coming out of the organization were being met with significant resistance in certain quarters of the Army staff. This resistance extended beyond simple “not invented here” concerns. In discussion, it appeared that many people simply did not recognize the potential utility of the ideas being promulgated. They were too different, too strange. In essence, some people did not see the potential application of the new ideas at all, while others immediately grasped their potential. Again, this ability to see was separate from cognitive capacity and could not be dismissed as simple protection of turf. Rank was not a predictive factor in whether the potential utility of an unfamiliar idea was recognized.

After departing the SSG to become the Army Senior Fellow in the Center for Strategic Research, Institute for National Strategic Studies, at the National Defense University, Dr. Bryant made the determination to study the idea of cognitive outliers in detail. This was the genesis of the Finding Ender project. The research began with a study of Army strategists (FA 59) sponsored by the Army G3/5.

Army strategists are a small cohort (fewer than 400 total) whose job it is to think strategically at the direction of senior leaders (officers and civilians serving at the three- and four-star levels). The hypothesis was that the research would show a definable cognitive profile among the strategist community that was different from that of the Army center mass.¹¹⁶ This hypothesis

was generated from more than 20 years of experience as an Army strategist and the fact that to become a strategist required self-selecting out of the mainstream, which is an uncommon decision as functional area officers (those who have left their branch) constitute only 14 percent of the total field-grade officer population.¹¹⁷ This appendix provides a summary of the FA 59 study, detailing both the methodology and results. It then makes a brief comparison of the strategist profile to those of three other discrete Department of Defense (DOD) populations currently represented in the Innovation Strengths Preference Indicator (ISPI) database. Finally, it makes recommendations for further research.

Figure 1. ISPI Data of "Top" Strategists (n = 14) and ISPI Data of Strategist Population (n = 153)



Key: White = 0–19%, Yellow = 20–32%, Red = 33–67%, Purple = 68–100%

Research Questions and Methodology

The research questions that guided the study were:

- What traits, behaviors, and characteristics combine to make a successful Army strategist?
- Is there a common personality profile or profiles among them?
- Is there an archetype (or archetypes) of an FA 59?¹¹⁸
- Are these profiles reasonably common in society, or are they relatively rare?

The study was heavily influenced by research begun within the SSG. In 2014, General Odierno tasked the organization with a study on human performance optimization from physical, cognitive, and social perspectives. It was in this capacity that the organization became acquainted with ISPI. The study was also influenced by the experience of cohort interview and selection. The twin ideas of comfort with ambiguity and a creative mindset were both relatively rare among candidates and essential to success as an SSG fellow. It was also clear that these two characteristics were related to success as an Army strategist.

The study included both quantitative and qualitative methods. The researchers began by asking the Army's senior strategist (a major general) who his top 10 strategists were at the rank of colonel. From there, the researchers conducted a round of interviews asking standard questions, including who each of these strategists believed were the best in the Army. This yielded a total of 14 interviews (12 colonels and 2 lieutenant colonels) and a consolidated ISPI profile for this group.¹¹⁹ In addition to this group of 14, ISPI has since been administered to 41 percent of the current Army strategists ($n = 153$). The findings have been relatively consistent, and the profile that has emerged is rare within the ISPI database (~19,000) and counterculture to the profile of the Army writ large.¹²⁰

ISPI Research Data Findings

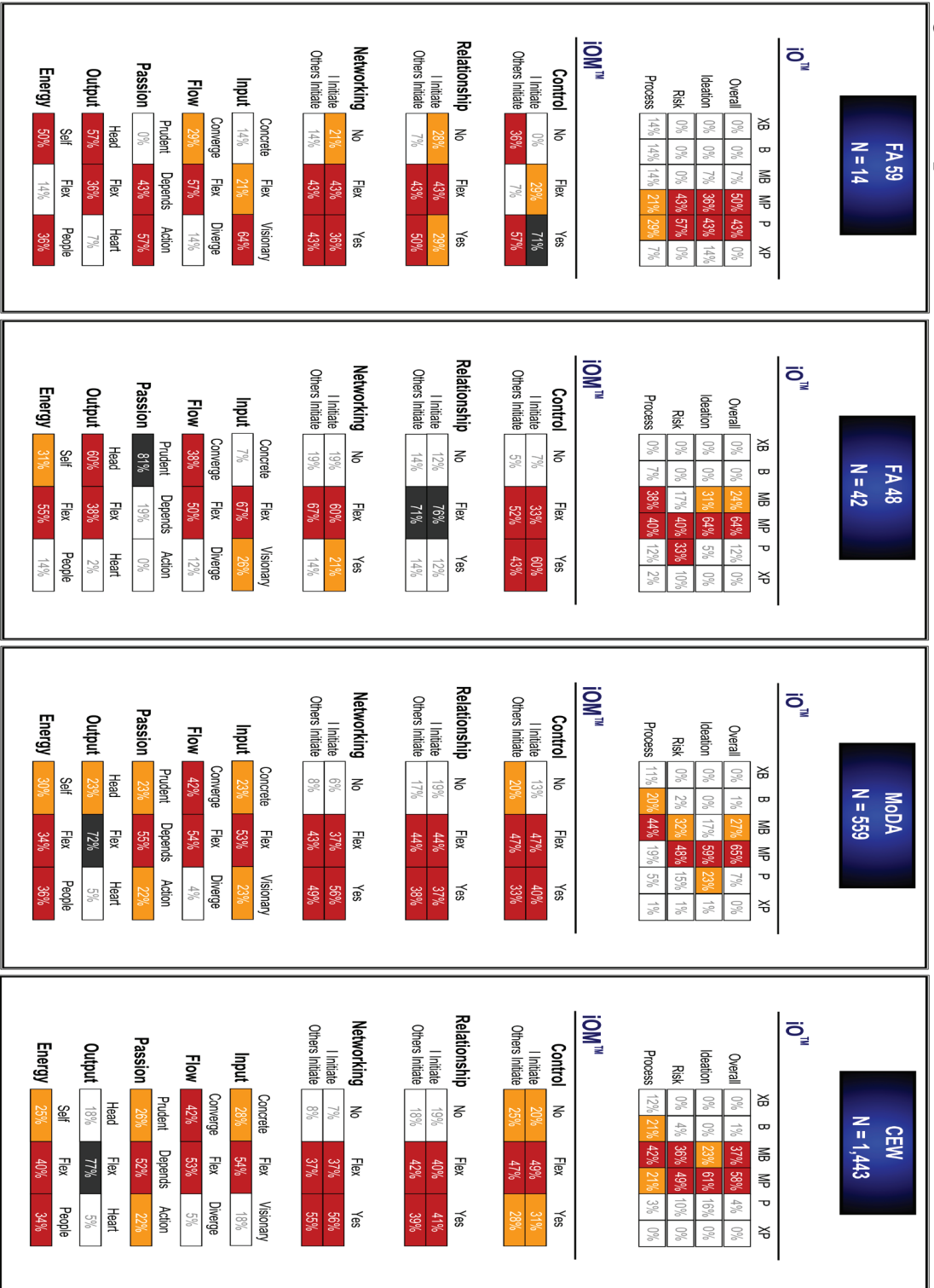
As stated, ISPI was administered to a group of 14 top-performing officers. Figure 1 shows the ISPI totem of the top-level FA 59 population ($n = 14$) in addition to the FA 59 population that has taken the ISPI ($n = 153$).

The two totems show that as a group the strategists display the following tendencies:

- Strong tendency for generation of novel thought in high frequency. Ideation (the ability and tendency to generate novel thought) shows the group of 14 consists of 43 percent P and 14 percent XP. This pioneering tendency decreases within the broader set of 153 to 22 percent P and 1 percent XP. In the overall ISPI database, XPs represent less than 2 percent of the population, while Ps represent less than 20 percent. What is interesting is that those who were determined to be among the best strategists were 14 percent more likely to fall into the XP range than those who were part of the general strategist population.
- Comfortable challenging existing systems and taking risks. The risk orientation of the high-performing group is 43 percent MP and 57 percent P. Once again, there is a decrease when moving to the larger group of 153 (49 percent MP and 29 percent P). The overall Risk orientation among strategists is not as divergent from the mean as the Ideation orientation is, but it remains interesting in the broader DOD context. As a group, strategists tend to push boundaries and take calculated risks in higher numbers than that of the general population. In a mature organization that is generally risk averse, boundary pushing is necessary but runs counter to the dominant culture. Risk orientation is also interesting when viewed in context of the answers provided in the qualitative interviews. In nearly every interview with the high performers (12 out of 14), the subjects described a desire for ambiguity rather than a fear of it because of the freedom of action that ambiguity provides. This was encapsulated by one strategist who responded, “Ambiguity equals opportunity. With it there is no box.”¹²¹ This comment is in stark contrast to the findings of Stephen Gerras and Leonard Wong and their work on openness among students at the Army War College.¹²²
- Strong preference for being in a role of authority, but also comfortable with not being the decisionmaker. In terms of Control, 71 percent of the $n = 14$ and 57 percent of the $n = 153$ strategists tested indicate a preference for being in charge (Control-I initiate). This is not a surprising finding given that the entire tested population consisted of field-grade Army officers. What is perhaps more telling in the category of Control is that more than one-half of the $n = 14$ group (57 percent) is also comfortable having someone else in charge (Control-others initiate). This means that as a whole, the strategists are open to taking charge but also to taking orders, as well as having a high tolerance for collaboration.

- Network-driven, both in seeking and being sought. The networking area of the totem shows that strategists, as a whole, are not loners. They are interested and active networkers who work to grow and maintain their connections to others. Again, there is not a significant difference among the $n = 14$ group and the wider population. Fewer than 21 percent of strategists overall were uninterested in networking.
- Visionary thinkers. The majority of the 59s are *visionary thinkers*. They much prefer to consider the big picture rather than manage the details (64 percent among the $n = 14$ group and 52 percent among the larger group). This is unsurprising in a group of self-selected strategists. This finding is also particularly significant when compared to the other three DOD populations in the ISPI database. As a group, the strategists are three times more likely to be visionary thinkers than the other represented populations (see figure 2).
- Action-Oriented. With 57 percent in Action and 43 percent in Depends, the $n = 14$ group is comfortable starting quickly, moving fluidly, and adapting. This orientation decreases slightly in the larger population (49 percent) but still remains above the 33-percent average across the database. The researchers would expect that this stronger than average action orientation is consonant with that of military service, broadly speaking.
- Driven by logic and facts when decisionmaking. With 57 percent of the high-performing population scoring as Head and only 7 percent scoring as Heart, there is a clear preference for analytical vs. emotional thinking among the top strategists. That is only slightly lessened in the group as a whole (44 percent). Even with this diminution of strictly Head-based thinking from 57 to 44 percent, it is equally interesting that the number of Heart-based thinkers actually decreases in the larger population (from 7 to 5 percent). This particular section of the ISPI highly correlates to the Myers-Briggs Type Indicator (MBTI) Thinking/Feeling choice. The fact that the majority of strategists prefer Thinking to Feeling is also unsurprising in terms of the broader Army culture.¹²³
- Prefers to recharge and process information independently. The Self (50 percent in $n = 14$ and 61 percent of $n = 153$) shows a need for personal time when working and ties to a more introverted preference. The ISPI Self/People continuum correlates with the MBTI Introversion/Extraversion scale. In studies of military officers, Extraversion is somewhat more common among leaders, but Introversion is not unusual.¹²⁴

Figure 2. Comparison of ISPI Data



Key: White = 0-19%, Yellow = 20%-32%, Red = 33%-67%, Purple = 68%-100%

It is interesting to compare the ($n = 14$) 59 population with the ($n = 153$) 59 population and note the differences. In addition to being further to the right (pioneering side) of the continuum, the high performers are also older and have more time in the military and more time as strategists than the overall group. It is hard to draw definitive conclusions with such a small number, but the data suggest there is fertile ground for further research.

Additional ISPI Data: Comparing the Strategist Population to That of Other DOD Groups

As stated previously, there is significant extrapolation when drawing conclusions in this paper. Too often the data are not an “apples to apples” comparison, meaning that different researchers used different assessments to study similar phenomena. Or, in the cases where direct comparisons can be made, the n is small, and thus a caveat must be made about the strength of the overall findings.

However, there are four direct comparisons that can be made among different DOD populations utilizing the existing ISPI database. The strategists can be compared with a group of Army foreign area officers (FAOs), FA 48 ($n = 42$), OSD Ministry of Defense Advisors (MODA) ($n = 559$), and Civilian Expeditionary Workforce (CEW) ($n = 1,443$). Each new cohort of MODA and CEW takes the ISPI as part of its initial training. Comparing the four datasets reveals significant differences among them. See figure 2 and following explanations:

- The Ideation of the high-performing FA 59 group shifts towards the P side, with 43 percent P and 14 percent XP. Having 57 percent in the P or XP means that the strategists will produce numbers in greater volume and more diverse type than those of the other groups. The FA 48, MODA, and CEW Ideation profile is much more midrange. MR scores account for more than half the overall population in the ISPI database. These types are referred to as *connectors* and bridge between those who tend toward incremental change and those who tend toward disruptive ones. When one considers the role of the MODA or those within the CEW, a midrange profile is probably an advantage.
- Compared with the FA 48, MODA, and CEW groups, the 59s have a greater tolerance for risk-taking. Pioneering in Risk can be both good and bad in military operations, but a higher than average risk tolerance is an absolute requirement for implementation of revolutionary and even expansionary innovation. Again, midrange is not wrong and is often necessary to broker deals and reach consensus in groups with divergent thought.

- The Visionary preference among the FA 59 stands out in comparison with the other datasets, with 64 percent of strategists beginning work with the big picture in mind. Strategists self-select into their field. It is unsurprising that they would self-select into big picture thinking.
- The Passion orientation could tie into the FA 59's higher than normal tolerance for ambiguity, as they have 0 percent in Prudence and 57 percent in Action. The continuum between Prudence and Action aligns with how much detailed information is required before a decision is made and action is taken. The strategists are likely to act without a lot of detail available. This means they are likely to start something without a clear path forward and be comfortable pivoting and adapting as they go.
- The Head result of the 59 group is almost triple the MODA and CEW datasets at 57 percent. The FA 48 group is similar to that of the FA 59 at 60 percent. This means the 59 and 48 will be looking at decisions and problems in a logical and analytical way. Again, in terms of the broader Army culture, the uniformed personnel are much more analytical than their civilian counterparts. This is not an unexpected result.

FA 48 Study

The Army G3/5 commissioned the authors to begin a study of FAOs to determine whether a distinct cognitive profile exists among them and how that profile differs from that of the Army strategists and that of the Army writ large. This study is not complete as of the time of this writing, and the dataset is currently very small. That said, a few characteristics have stood out in stark contrast to those of the strategists and other populations within the ISPI database. Thus, they are shown with caveats.

FAOs are similar to Army strategists in that they too self-select to leave the mainstream Army. The FAO mission is to be “expert on regional military capabilities and work with foreign military leaders and government officials to build partner capacity in support of U.S. goals and objectives.”¹²⁵ FAOs advise senior military and civilian leaders with regional expertise. They also function as political-military officers, security assistance officers, and Defense or Army attachés.¹²⁶ Over the course of their careers, they spend a significant amount of time working overseas in Embassies and interacting with and advising foreign military leaders.

Like Army strategists, the FAO population shows an uncommon personality profile compared to other ISPI profiles in the database. At this point, their distinguishing traits are:

- FAOs display a much higher than average percentage of flex in relationships and networking. This could relate well to their professional need to be selective with relationships and trust. As attachés, FAOs must be social and approachable, but they must also not be too open in their dealing with foreign nationals. Their flex networking profile can allow them to wear a mask when necessary, which was reported as a requirement for the population during qualitative interviews with senior FAOs.¹²⁷
- The FAO ISPIs thus far show an 81 percent preference for Prudence rather than Action. This percentage is unprecedented for any group in the ISPI database. FAOs prefer time to gather information and analyze options and will not act without feeling they have the appropriate amount of information. Where strategists are comfortable with ambiguity, FAOs seek clarity before acting. This high level of Prudence in taking action is also paired with a higher than average risk-taking profile. Although at first glance, a prudent yet open-to-risk archetype looks like an unlikely pairing; in daily life this combination results in extremely calculated risk-taking behavior.
- Like the strategists, most FAOs (60 percent) are driven by logic and facts (Head) and are therefore less likely to become emotionally involved. As stated, the authors would expect this to be reasonably common among military officers.

MODA

The MODA program is sponsored by the Defense Security Cooperation Agency. The advisors consist of civilian experts who partner with foreign counterparts to build core competencies within the ministries. These competencies can be in areas of personnel and logistics, strategy, planning, and finance.¹²⁸ Currently, there are 80 MODA personnel working in Afghanistan.¹²⁹ Given this job description, one could imagine overlap with the FAO totem.

Like the FAOs and the strategists, MODA personnel are natural networkers. However, they are less reserved than the FAOs in their networking relationships. Furthermore, as a group, MODA personnel are much less Head-based on average (22 percent) than either FAOs or strategists. These findings are reasonably common within the ISPI database as a whole, leading the authors to renew their hypothesis that military officers, on average, are more logic-based than their civilian counterparts.

CEW

The CEW program was established by DOD in 2009 to augment military units deployed on operational assignments globally. The CEW fills multiple roles globally, from maintenance to medical support and education.¹³⁰ Given this, it would be difficult to develop a single cognitive profile of a CEW employee as they are not drawn to a single profession, but rather prefer to serve abroad in dangerous and austere environments. However, this willingness to serve on operational deployments would logically indicate a higher than average risk tolerance, which 60 percent of them display, according to the aggregated (CEW) ISPI totem.

Conclusion

This appendix compares four distinct populations within DOD that have ISPIs available within the Idea Connections Systems database. Particular emphasis was given to the Army strategist because the authors have done more research with this community. The overall data are intriguing, but they are also preliminary. Thus caution must be exercised when forming conclusions. That said, there is every reason to believe that research should continue and further investigation of disparate populations should be undertaken.

The hypothesis that DOD contains “incubators” for counterculture cognitive types has been validated by initial investigation, though more research is necessary. Additionally, future research to develop methods to leverage the strengths of these diverse populations must occur. The 2018 National Defense Strategy has given DOD a clear mandate to change its talent management processes. It is incumbent on its leadership to develop a plan to implement this change. The authors recommend that this work continue according to the eight recommendations in the main portion of the paper.

Notes

¹ *Summary of the 2018 National Defense Strategy of the United States of America: Sharpening the American Military's Competitive Edge* (Washington, DC: Department of Defense, 2018), available at <www.defense.gov/Portals/1/Documents/pubs/2018-National-Defense-Strategy-Summary.pdf>.

² Robert B. Rosenfeld, Gary J. Wilhemi, and Andrew Harrison, *The Invisible Element: A Practical Guide for the Human Dynamics of Innovation* (Rochester, NY: Innovatus Press, 2011), 1.

³ Orson Scott Card, *Ender's Game* (New York: Tor Books, January 1985).

⁴ *Summary of the 2018 National Defense Strategy*.

⁵ *Ibid.*

⁶ "U.S. Military Personnel End Strength 2017," Globalsecurity.org, available at <www.globalsecurity.org/military/agency/end-strength.htm>; and "About the Department of Defense," Defense.gov, 2017, available at <www.defense.gov/About/>.

⁷ This paper delves much more deeply into the idea of *cognitive diversity* at a later stage, but for those readers unfamiliar with the term, a recent *Harvard Business Review* article defines it "as differences in perspective or information processing styles. It is not predicted by factors such as gender, ethnicity, or age. Here we are interested in a specific aspect of cognitive diversity: how individuals think about and engage with new, uncertain, and complex situations." See Alison Reynolds and David Lewis, "Teams Solve Problems Faster When They Are More Cognitively Diverse," *Harvard Business Review*, March 30, 2017, available at <<https://hbr.org/2017/03/teams-solve-problems-faster-when-theyre-more-cognitively-diverse>>.

⁸ *Summary of the 2018 National Defense Strategy of the United States of America*.

⁹ Tai Ming Cheung, Thomas G. Mahnken, and Andrew L. Ross, *Assessing the State of Understanding of Defense Innovation*, Study of Innovation in China Research Brief Series 10 (2018-1) (San Diego: University of California, May 30, 2018), available at <<https://escholarship.org/uc/item/3wt3613v>>.

¹⁰ *National Security Strategy of the United States of America* (Washington, DC: The White House, 2017), 28, available at <www.whitehouse.gov/wp-content/uploads/2017/12/NSS-Final-12-18-2017-0905.pdf>.

¹¹ *Summary of the 2018 National Defense Strategy of the United States of America*.

¹² U.S. Army Training and Doctrine Command (TRADOC) Pamphlet 525-3-1, *The U.S. Army Operating Concept: Win in a Complex World* (Fort Eustis, VA: TRADOC, 2014), 30.

¹³ *Marine Corps Operating Concept: How an Expeditionary Force Operates in the 21st Century* (Washington, DC: Headquarters U.S. Marine Corps, 2016), available at <www.mcwl.marines.mil/Portals/34/Images/MarineCorpsOperatingConceptSept2016.pdf>.

¹⁴ *Air Force Operating Concept: A View of the Air Force in 2035* (Washington, DC: Headquarters Department of the U.S. Air Force, 2015), 6, available at <www.ang.af.mil/Portals/77/documents/AFD-151207-019.pdf>.

¹⁵ *Navy Leader Development Framework* (Washington, DC: Headquarters Department of the U.S. Navy, 2017), available at <www.public.navy.mil/bupers-npc/support/inclusion/Documents/Navy%20Leader%20Development%20Framework.pdf>.

¹⁶ David Andre, "Embracing Creativity in the Navy: A Navy Leadership Challenge," *The*

Maritime Executive, March 3, 2017, available at <www.maritime-executive.com/editorials/embracing-creativity-a-navy-leadership-challenge>.

¹⁷ Ibid.

¹⁸ Ruth Umoh, “Mark Cuban Says This Skill Will Be Critical in 10 Years, Elon Musk Agrees,” CNBC, July 25, 2018, available at <www.m10sn.com/en-us/money/careersandeducation/mark-cuban-says-this-skill-will-be-critical-in-10-years-and-elon-musk-agrees/ar-BBL6DGN?ocid=iemptp>.

¹⁹ Rosenfeld, Wilhemi, and Harrison, *The Invisible Element*, xii.

²⁰ Mihaly Csikszentmihalyi, *Creativity: Flow and the Psychology of Discovery and Invention* (New York: HarperCollins, 1997), Kindle edition, 22.

²¹ Ibid.

²² Ibid., 28.

²³ Teresa Amabile, “How to Kill Creativity,” *Harvard Business Review*, September–October 1998, available at <<https://hbr.org/1998/09/how-to-kill-creativity>>.

²⁴ Teresa Amabile, *Creativity in Context: Update to the Social Psychology of Creativity* (Boulder, CO: Westview Press, 1996), Kindle edition.

²⁵ Jeffrey P. Bialos, Christine E. Fisher, and Stuart L. Koehl, *Against the Odds: Driving Defense Innovation in a Change-Resistant Ecosystem* (Washington, DC: The Paul H. Nitze School of Advanced International Studies, 2017), vii, available at <<http://transatlanticrelations.org/wp-content/uploads/2017/05/Against-The-Odds-Driving-Defense-Innovation-in-a-Change-Resistant-Ecosystem-Final.pdf>>.

²⁶ Williamson Murray, “Innovation: Past and Present,” *Joint Force Quarterly* 12 (Summer 1996), 54, available at <<https://ndupress.ndu.edu/Portals/68/Documents/jfq/jfq-12.pdf>>.

²⁷ Samuel P. Huntington, *The Soldier and the State: The Theory and Politics of Civil-Military Relations* (Cambridge: Harvard University Press, 1957), 79–81.

²⁸ For specific treatment of each of the Services, see Carl Builder, *The Masks of War: American Military Styles in Strategy and Analysis* (Baltimore: The Johns Hopkins University Press, 1989); and Jeffrey Donnithorne, *Four Guardians: A Principled Agent View of American Civil Military Relations* (Baltimore: The Johns Hopkins University Press, 2018).

²⁹ Ibid.

³⁰ Builder, *The Masks of War*.

³¹ Milan Vego, “On Military Creativity,” *Joint Force Quarterly* 70 (3rd Quarter 2013), 84, available at <https://ndupress.ndu.edu/Portals/68/Documents/jfq/jfq-70/JFQ-70_83-90_Vego.pdf>.

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³³ Everett S.P. Spain, J.D. Mohundro, and Bernard B. Banks, “Intellectual Capital: A Case for Cultural Change,” *Parameters* 45, no. 2 (Summer 2015), 77, available at <https://ssi.armywarcollege.edu/pubs/parameters/Issues/Summer_2015/10_Spain.pdf>.

³⁴ Ibid.

³⁵ Ibid., 82.

³⁶ Ibid., 85.

³⁷ Ibid., 82.

³⁸ John B. Buser, *The Creativity Conundrum* (Newport, RI: U.S. Naval War College, 2016), avail-

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⁴⁰ Ibid.

⁴¹ Michelle E. Ewy, *Military Personnel as Innovators: An Unrealistic Expectation?* (Maxwell Air Force Base, AL: Air War College, 2018), 1.

⁴² Ibid.

⁴³ Ibid.

⁴⁴ Adam Mitchinson and Robert Morris, *Learning about Learning Agility* (Greensboro, NC: Center for Creative Leadership, 2014), available at <www.ccl.org/wp-content/uploads/2015/04/LearningAgility.pdf>.

⁴⁵ Ibid.

⁴⁶ Ibid.

⁴⁷ Ibid.

⁴⁸ Spain, Mohundro, and Banks, "Intellectual Capital," 85.

⁴⁹ Ibid.

⁵⁰ Csikszentmihalyi, *Creativity*.

⁵¹ Rikke Dam and Teo Sang, "Design Thinking: A Quick Overview," Interaction Design Foundation, n.d., available at <www.interaction-design.org/literature/article/design-thinking-a-quick-overview>.

⁵² Ibid.

⁵³ Matthew Furtado, "Creativity in Complex Military Systems" (Master's thesis, School of Advanced Military Studies, 2017), available at <<https://apps.dtic.mil/dtic/tr/fulltext/u2/1038989.pdf>>.

⁵⁴ Marine Corps Warfighting Publication 5-10, *The Marine Corps Planning Process* (Washington, DC: Headquarters U.S. Marine Corps, 2016), available at <www.marines.mil/Portals/59/Publications/MCWP%205-10%20FRMLY%20MCWP%205-1.pdf?ver=2017-08-28-140131-227>.

⁵⁵ Spain, Mohundro, and Banks, "Intellectual Capital."

⁵⁶ This statement came from a conversation between the authors and a serving U.S. Ambassador who had been working with students at the National Defense University. He did not wish to be identified by name; however, he allowed the statement on background. The conversation took place on June 23, 2017.

⁵⁷ Tom Mitchell and Alice Cahill, "Cognitive Style and Plebe Turnover at the U.S. Naval Academy," *Perpetual and Motor Skills* 101, no. 1 (2005), 60. For this study, students entering ($n = 1,134$) the U.S. Naval Academy class of 2000 were administered the Kirton Adaption-Innovation Inventory on the first day of Plebe Summer, a 7-week nonacademic training program completed by all entering students in the summer prior to the freshman year.

⁵⁸ Ibid.

⁵⁹ Ibid.

⁶⁰ Stephen J. Gerras and Leonard Wong, *Changing Minds in the Army: Why It Is So Difficult and What to Do about It* (Carlisle, PA: U.S. Army War College Press, 2013), 3, available at <<https://ssi.armywarcollege.edu/pdffiles/PUB1179.pdf>>.

⁶¹ The Five-Factor Model of Personality is a set of broad trait dimensions or domains, often

referred to as the Big Five personality traits: extraversion, agreeableness, conscientiousness, neuroticism (sometimes called by its polar opposite, emotional stability), and openness to experience (sometimes called intellect). For a more detailed explanation, please refer to Christopher J. Soto and Joshua J. Jackson, “Five-Factor Model of Personality,” Oxford Bibliographies, February 26, 2013, available at <www.oxfordbibliographies.com/view/document/obo-9780199828340/obo-9780199828340-0120.xml>.

⁶² Gerras and Wong, *Changing Minds in the Army*, 8.

⁶³ Ibid.

⁶⁴ Ibid.

⁶⁵ Ibid., 9.

⁶⁶ Ibid.

⁶⁷ Human Capabilities Development Task Force, U.S. Army Mission Command Center of Excellence, “Creativity in the Army: Creative Process, Creative People, and the Creative Climate,” unpublished white paper, 2015, 2.

⁶⁸ Ibid., 14.

⁶⁹ Ibid., 3. Sadly, innovation consistently outranks only “tact” in the annual findings.

⁷⁰ The Innovation Strengths Preferences Indicator (ISPI) is a commercial off-the-shelf instrument that determines how people prefer to think, decide, and act along an Innovation Continuum. For specific information on the ISPI, please see appendix A.

⁷¹ Initial results of the Functional Area (FA) 59 study are published in Susan F. Bryant and Heidi A. Urben, *Reconnecting Athens and Sparta: A Review of OPMS XXI at 20 Years*, The Land Warfare Papers No. 114 (Arlington, VA: The Institute for Land Warfare, October 2017), available at <www.aula.org/publications/reconnecting-athens-and-sparta-review-opms-xxi-20-years>. At the time of this writing, approximately 170 Army strategists have taken the ISPI, and the profile has held stable as the number has risen. Furthermore, those strategists who have had exceptionally successful careers—promoted to full colonel and recognized by senior defense officials as having made outstanding contributions at the Department of Defense (DOD) and national levels—demonstrate, in the aggregate, even higher levels of openness and tolerance for risk and ambiguity than their less successful peers.

⁷² Aggregation of interviews performed with 14 top performing strategists between February and April 2017.

⁷³ An attempt to develop an archetype for Army foreign area officers (FAOs) is currently underway using the ISPI as the cognitive instrument. Preliminary findings show that FAOs in the aggregate are more prudent and less innovative than the strategists, but they are equally comfortable with ambiguity and have high tolerances for calculated risk-taking.

⁷⁴ Mark E. Miller, “The Power of Cognitive Diversity On Innovation,” Innovation Excellence blog, June 3, 2011, available at <www.innovationexcellence.com/blog/2011/06/03/the-power-of-cognitive-diversity-on-innovation-2/>.

⁷⁵ Rosenfeld, Wilhemi, and Harrison, *The Invisible Element*, 83.

⁷⁶ Christopher J. Lamb, *Cross-Functional Teams in Defense Reforms: Help or Hindrance?* INSS Strategic Forum 298 (Washington, DC: NDU Press, 2016), available at <<http://inss.ndu.edu/Media/News/Article/930208/cross-functional-teams-in-defense-reform-help-or-hindrance/>>.

⁷⁷ Milan Vego, “The Bureaucratization of the Military Decisionmaking Process,” *Joint Force*

Quarterly 88 (1st Quarter 2018), 35–37, available at <https://ndupress.ndu.edu/Portals/68/Documents/jfq/jfq-88/jfq-88_34-45_Vego.pdf?ver=2018-01-09-102340-350>.

⁷⁸ Furtado, “Creativity in Complex Military Systems.”

⁷⁹ Robert Gates, *Duty: Memoirs of a Secretary at War* (New York: Random House, 2014), 125.

⁸⁰ Lamb, *Cross-Functional Teams in Defense Reforms*.

⁸¹ *DOD Senior Leadership Has Not Fully Implemented Statutory Requirement to Promote Department Wide Collaboration*, GAO-18-5-13 (Washington, DC: Government Accountability Office, 2018), 1, available at <www.gao.gov/assets/700/692749.pdf>.

⁸² Dennis R. Brophy, “A Comparison of Individual and Group Efforts to Creatively Solve Contrasting Types of Problems,” *Creativity Research Journal* 18, no. 3 (2006), 293.

⁸³ *Ibid.*, 294.

⁸⁴ Rosenfeld, Wilhemi, and Harrison, *The Invisible Element*, 65.

⁸⁵ *Ibid.*

⁸⁶ Cheung, Mahnken, and Ross use a similar continuum in their monograph. Rather than *incremental*, *expansionary*, and *revolutionary*, they use the terms *sustaining innovation*, *architectural or technological breakthroughs*, and *disruptive innovation*.

⁸⁷ Using the dataset associated with the ISPI and maintained by Idea Connection Systems (ICS), the cognitive archetype associated with divergent thinking is present in less than 15 percent of the population. Given the ISPI testing that has been done among DOD personnel thus far, the authors estimate that the percentage within DOD itself is in the single digits. As an example of existing ISPI data, based on over 1,400 people who were part of Ministry of Defense Advisors and Civilian Expeditionary Workforce cohorts, the ISPI data show that only 4 percent have a divergent ISPI Orientation (prefer options), while 76 percent of people fall in the XB, B, or MB in Process, meaning that they would prefer to converge and work within existing paradigms.

⁸⁸ Cheung, Manhken, and Ross, *Assessing the State of Understanding of Defense Innovation*.

⁸⁹ Author interview with John Zolper, January 15, 2019.

⁹⁰ *Ibid.* The Innovation Challenge Environment was created by Raytheon Space and Airborne System’s retired innovation champion, Michael D. Vahey.

⁹¹ *Ibid.*

⁹² *Ibid.*

⁹³ Author interview with Anthony Pezzano, January 16, 2019.

⁹⁴ *Ibid.*

⁹⁵ *Ibid.*

⁹⁶ Web site of The Johns Hopkins Applied Physics Laboratory, available at <www.jhuapl.edu/>.

⁹⁷ Author interview with Jerry Krill, January 14, 2019.

⁹⁸ *Ibid.*

⁹⁹ *Ibid.*

¹⁰⁰ Author interview with John Burke, The Johns Hopkins University Applied Physics Laboratory, January 14, 2019.

¹⁰¹ *Ibid.*

¹⁰² *Ibid.*

¹⁰³ Authors' interview with Pezzano.

¹⁰⁴ *Summary of the 2018 National Defense Strategy of the United States of America*.

¹⁰⁵ Author conversation with the Air Force Chief Scientist, Dr. Richard Joseph, March 10, 2018.

¹⁰⁶ Author interview with Robert Rosenfeld, September 18, 2018.

¹⁰⁷ Ibid.

¹⁰⁸ *Innovation Strengths Preference Indicator Technical Manual*, October 2017, 7.

¹⁰⁹ Rosenfeld, Wilhemi, and Harrison, *The Invisible Element*, xii.

¹¹⁰ Author interview with Josh Kholjede, Idea Connections Systems, August 21, 2018.

¹¹¹ The Center for Creative Leadership has adopted the ISPI as a tool that it uses in its programs. The center has over 30 faculty members, coaches, and adjuncts certified in ISPI.

¹¹² J. Reynaldo Santos, "Cronbach's Alpha: A Tool for Assessing the Reliability of Scales," *Extension Journal* 37 (April 1999), available at <www.joe.org/joe/1999april/tt3.php/journal-current-issue.php>.

¹¹³ Ibid.

¹¹⁴ *Innovation Strengths Preference Indicator Technical Manual*, 9.

¹¹⁵ "eArmor Green-Gallus Side Bar," eArmor.com, available at <www.benning.army.mil/armor/eARMOR/content/issues/2015/OCT_DEC/Green-GallusSidebar.pdf>.

¹¹⁶ The authors have hypothesized the Army center mass based upon the study by Gerras and Wong, *Changing Minds in the Army*, using the Big Five Personality Model in conjunction with published Myers-Briggs Type Indicator findings of military personnel. The profile that appears is conservative, low on openness, and analytical in decisionmaking, with a slight tendency toward extraversion. This constitutes an educated guess on the part of the researchers.

¹¹⁷ As of May 2017, FA 59 Army officers comprise roughly 20 percent of the Active-duty competitive category force in the ranks of major through colonel. If we add in the medical specialties, the Judge Advocate General's Corps, and the Chaplain Corps, the number falls to just shy of 14 percent. These numbers were provided to the authors by the Army Staff G1, Directorate for Personnel Management, and were current as of May 31, 2017.

¹¹⁸ Archetypes describe combinations of characteristics of behaviors. In ISPI, archetypes are a combination of orientations from the totem.

¹¹⁹ Of the original top 10 list, 8 are represented in the group of 14. The other two were too busy to commit the time to the study. The additional six names were generated from the interviews with the initial eight. In cases where the same name was mentioned by more than three of the top eight, they were asked to interview. Again, there were several cases where additional names were mentioned for interviews by multiple high-performing strategists. However, the authors were unable to make the connection, or the officer was unable to make the time to conduct the interview.

¹²⁰ Currently, ICS has a database of approximately 19,000 ISPIs. It has aggregated six main archetypes from the data and has developed several less common subgroup archetypes. The archetype of the FA 59 is unique within its database. At this point, there is no definitive archetype of the "soldier" or "officer." That said, our characterization of the strategist as different from the mean is based on the research done in the study of Navy plebes, as well as the conclusions drawn by Gerras and Wong, *Changing Minds in the Army*.

¹²¹ Statement was taken from an interview with a top-performing strategist conducted by ICS employees, January 2017.

¹²² Gerras and Wong, *Changing Minds in the Army*, 1.

¹²³ Ronald Charles Johnson, "Study of the Relationship Between Cognitive Styles of Creativity and Personality Types of Military Leaders" (Ph.D. diss., University of Oklahoma, 2003), 27, available at <<https://hdl.handle.net/11244/670>>.

¹²⁴ Ibid.

¹²⁵ Army Pamphlet 600-3, *Officer Professional Development and Career Management* (Washington, DC: Headquarters Department of the Army, 2017), available at <https://armypubs.army.mil/epubs/DR_pubs/DR_a/pdf/web/ARN3272_DA_Pam_600-3_web_FINAL.pdf>.

¹²⁶ Ibid.

¹²⁷ As part of this research, the authors have undertaken a series of interviews ($n = 10$) with senior FAOs hand-selected by the Army G3/5. These interviews took place over the course of 1 week in June 2018 at the Joint FAO conference in Monterey, CA.

¹²⁸ "Minister of Defense Advisors (MoDA)," Defense Security Cooperation Agency, available at <www.dsca.mil/programs/ministry-defense-advisors>.

¹²⁹ Ibid.

¹³⁰ "The Civilian Expeditionary Workforce Overview," DOD, available at <www.cpms.osd.mil/expeditionary/cew/CEW-Program.html>.

About the Authors

Colonel Susan F. Bryant, USA (Ret.), Ph.D., is a 1989 graduate of the School of Foreign Service at Georgetown University. She currently teaches grand strategy and military history at Georgetown University and defense policymaking in the School of Advanced International Studies at The Johns Hopkins University. She is also a Visiting Research Fellow in the Center for Strategic Research, Institute for National Strategic Studies (INSS), at the National Defense University. She served 28 years in the Army, with more than 20 of those years in strategic-level assignments. Her military assignments include Senior Military Fellow in INSS; Chief of Staff of the Army's Strategic Studies Group; Deputy Chief of Staff for Plans, Programs, and Assessments for the U.S. Security Coordinator for Israel and Palestine; and Division Chief for the Strategy, Concepts, and Doctrine Division on the Army Staff. Her overseas tours include assignments in Israel, Afghanistan, and South Korea. Colonel Bryant's education includes a Master of Arts in International Relations from Yale University, a Master of Arts in Operational Planning from the School of Advanced Warfighting at the Marine Corps, and a Ph.D. in Liberal Studies from Georgetown University. She is also a former Council on Foreign Relations International Affairs Fellow, as well as a Columbia University Next Generation Fellow.

Mr. Andrew Harrison is a consultant, facilitator, trainer, and author who works with organizations from around the world on the topics of innovation, motivation, teamwork, and leadership. Over the course of his career, he has worked with clients including The Johns Hopkins University Applied Physics Laboratory; the National Aeronautics and Space Administration; the Environmental Protection Agency; Raytheon; Rolls-Royce; ExxonMobil; Walmart; Chief of Staff of the Army Strategic Studies Group; the Ministry of Defense Advisors; the Civilian Expeditionary Workforce; the U.S. Army Armament Research, Development, and Engineering Center; and the Center for Creative Leadership. Mr. Harrison is the Innovation Ambassador of Idea Connection Systems, Inc., the Founder of Bonfire Consulting, the author of *Love Your 84,000 Hours at Work: Stories on the Road from People with Purpose and Passion* (Dotted Lines, 2010) and writer of *The Invisible Element: A Practical Guide for the Human Dynamics of Innovation* (Innovatus Press, Ltd., 2011). He has a bachelor of arts in professional and technical writing from the University of Arkansas at Little Rock and Master of Arts in Mass Communication from the University of South Carolina. He is a former adjunct professor at St. John Fisher College and is Master Certified in the Innovation Strengths Preference Indicator. His work has been featured in various newspapers, television, radio, magazines, and trade publications around the United States.

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