

Deploying Mindfulness to Gain Cognitive Advantage: Considerations for Military Effectiveness and Well-being

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ABSTRACT

Mindfulness involves paying attention to present moment experience without discursive commentary or emotional reactivity. Mindfulness training (MT) programs aim to promote this mental mode via introduction to specific mindfulness exercises, related in-class discussion, and ongoing engagement in mindfulness exercises. MT is being increasingly offered to high-demand, high-stress military/uniformed and civilian cohorts with a wide array of reported benefits. Herein, we begin by discussing recent theoretical models regarding MT's mechanisms of action from a cognitive training/cognitive neuroscience perspective, which propose that MT engages and strengthens three key processes [e.g., 1]. These are: 1) attentional orienting, which is the ability to select and sustain attention on a subset of information while remaining undistracted; 2) meta-awareness, which is the ability to monitor one's ongoing experience with an awareness of doing so; and 3) decentering, which is the ability to view one's experience at a psychological distance so that biases, mind-sets, and interpretations are viewed as mental processes rather than accurate depictions of reality. Next, we review evidence of MT's beneficial effects on cognitive, social, and emotional dimensions of human behavior, which are aligned with military frameworks describing the human dimension [e.g., 2]. We then discuss attitudinal impediments to broad adoption of MT in military settings, and propose counter-arguments so as to facilitate its implementation. We end by arguing that MT should be considered a key cognitive training tool by which to achieve cognitive advantage in the service of improved operational readiness and effectiveness, as well as greater resilience and well-being in military/uniformed cohorts.

1.0 INTRODUCTION

The United States (U.S.) military has identified global challenges that the U.S. and allied nations will likely face over the next two decades. These will range from: 1) increasing global proliferation of advanced technologies; 2) increased cyberthreats and data manipulation; 3) an uptick in the pace and intensity of human interactions in increasingly dense urban environments, that lack historical notions of a “front” and “rear”; and 4) discontinuity over the multiple environments comprising active war zones [2]. As described in recent discussions on the future of war, “A common trend across these characteristics is the complex, massive volume of stimuli soldiers will face, and the decentralized decision making required to gain and maintain the initiative in the future.” [3, pg. 1]

In a future where the ‘fog of war’ is typified by too much information too fast, mission success will rely on individual service members being able to efficiently decide what is most critical in the moment, in order to then determine if and how to engage with it, all while remaining undistracted by irrelevant information. Concurrently, ever-shifting situational challenges will require individuals or isolated small teams to be agile and adaptive while acting with autonomy, and simultaneously engaging in decisive problem solving and decision making.

In anticipation of such a future, militaries acknowledge the mission-critical role that individuals’ cognitive abilities will play. This has been detailed in military writings on the cognitive domain of the human dimension [4]. While the value of exceptional cognitive abilities is acknowledged, very little guidance has been provided on what or how this should be pursued. Indeed, in striking contrast to the considerable time and resources militaries invest in training individuals and teams in tactical, operational, and strategic scenarios to achieve military advantage, the cognitive domain has not been broadly conceptualized as malleable and trainable [5 for discussion]. As a result, many cognitive abilities are viewed as immutable, and valued primarily for selection (i.e. for elite forces) or assignment to military occupational specializations. When the malleability of cognitive abilities is acknowledged in military writings, it is most often in the context of functional degradation due to brain injury (e.g., TBI). In those circumstances, cognitive training is viewed as therapy in the service of recovery [5].

Relatedly, despite a pervasive emphasis on operational readiness [2], there is little discussion regarding the

potential for healthy individuals to suffer cognitive compromise due to persistent and intensive demands tied to military readiness training [6]. Indeed, there is a paucity of guidance regarding training methods for cognitive sustainment or enhancement for optimized readiness [5]. This begs the question: if cognitive training is to be pursued, which cognitive abilities should be prioritized as targets for such training?

Cognition refers to information processing in the service of gaining knowledge and achieving comprehension. A survey of military writings on the cognitive domain reveals that cognitive abilities, broadly categorized as ‘thinking skills’ (e.g., judging, strategizing, and problem solving) [e.g., 4] are highly valued and seen as the preferred route by which to gain knowledge and achieve comprehension. Indeed, traditional military education, including strategic leadership education, [7] aims to formally hone such skills and encourages formal analysis of leadership lessons from the past to inform and further drive military strategic thinking along these lines.

Yet, if the operational climate of the future is even more information-dense, fast-paced, volatile, ambiguous, uncertain, and decentralized than present day, educating and training future warfighters in ‘thinking skills’ alone may be insufficient for achieving mission success. We suggest that agile and adaptive warfighters must utilize adjunctive information processing modes, including those in which cognition is, in fact, antithetical to thinking.

Mindfulness typifies such a cognitive mode. Mindfulness is described as paying attention to present moment experience without conceptual elaboration, discursive editorializing, or emotional reactivity. We suggest that deploying mindfulness will allow individuals to gain cognitive advantage over their own information processing by expanding the quantity and quality of knowledge they gain, comprehension they achieve, and capacity to respond.

Expanding cognition to emphasize present-centered, moment-to-moment experience, while monitoring this experience and disengaging from editorializing about it, may allow information processing to be more agile and adaptive. In the sections that follow we discuss theoretical models of MT’s mechanisms of action and describe how mindfulness training (MT) exercises engage and strengthen specific cognitive processes. Next, we will review a growing body of evidence from civilian and military studies reporting MT-related salutary effects in cognitive, social, and emotional domains comprising the human dimension [4]. We then discuss attitudinal impediments to broad adoption of MT in military settings, and propose counter-arguments to encourage and support its implementation. We end by arguing that MT should be considered a key training tool by which to achieve cognitive advantage in the service of improved operational readiness and effectiveness, as well as a training and therapeutic modality for greater resilience and well-being in military/uniformed cohorts.

2.0 MINDFULNESS TRAINING AS COGNITIVE TRAINING

Recent theoretical models regarding MT’s mechanisms of action suggest that MT engages and strengthens three key functions [e.g., 1, 8]. These are: 1) attentional orienting, which is the ability to select and sustain attention on a subset of information while remaining undistracted; 2) meta-awareness, which is the ability to monitor one’s ongoing experience with an awareness of doing so; and 3) decentering, which is the ability to view one’s experience at a psychological distance so that biases, mind-sets, and conceptual interpretations are viewed as mental processes rather than accurate depictions of reality.

This theoretical perspective of MT, aligns well with the subjective insights that MT practitioners convey regarding shifts in their information processing after repeated engagement in MT exercises. As U.S. Army Major General (MG) Walter Piatt recently commented:

“Mindfulness exercises are like ‘push-ups for the mind’. They have helped me focus and stay focused on a situation or person more easily, without getting lost-in-thought or distracted by information being thrown at me. I can watch my mind and pull it back if it gets stuck in a memory or worry. I can drop the story of what I think should be happening so I don’t become blind to what is happening.”

In this comment, MG Piatt, who currently serves as Commanding General of Fort Drum, New York and the 10th Mountain Division (Light Infantry) and served as Deputy Commanding General of U.S. Army Europe and the Commanding General of U.S. Army NATO from 2014 to 2015, is succinctly describing the multiple ways in which mindfulness enhanced his information processing in his role as a military leader. MT increased his capacity for present-centered focus and reduced his susceptibility to external and internal sources of distraction and bias. How might such shifts in information processing promote agile and adaptive thinking? Note that none of the processes he describes (“focus”, “watch”, “drop the story”) are akin to thinking, *per se*. Yet, one’s thinking (i.e., ability to judge, strategize, and problem solve) may benefit from greater moment-to-moment attentional stability when challenged by distraction, heightened meta-awareness to catch rumination and mental time traveling to past- or future-focused thoughts, and better decentering to be able to step back from one’s biases and pre-conceived frameworks. Indeed, adaptive leadership has been described as having three hallmark features. These are the ability to: 1) observe events and patterns as they are occurring; 2) interpret events without an overreliance on fixed schemas or assumptions; 3) respond to crises with action plans based on immediate needs, but not at the expense of long-term objectives [9]. From this perspective, MT may promote cognitive advantage by shifting information processing in support of adaptive leadership.

To understand how one’s engagement in MT exercises may lead to such shifts requires insight into the processes engaged during these exercises. A cognitive training perspective predicts that cognitive processes which are engaged by a particular activity may be amenable to being strengthened by repeated engagement in that activity [10]. Below we review instructions for two categories of MT exercises which are foundational to most MT programs. These are: 1) focused attention (FA) and, 2) open monitoring (OM). In FA, practitioners are instructed to select a particular object of focus for the practice period (e.g., breath-related sensations), and sustain selective attention, moment-by-moment, on the object with a fairly narrow focus (e.g., the specific sensations caused by the breath at the nostrils or abdomen). When they notice that their attention has wandered away from the object, they are to redirect it back to the object. As such, this practice involves orienting attention toward breath-related sensations, being meta-aware of moment-to-moment experience by monitoring the quality of attention, detecting the arising of distraction, and when distractions arise, disengaging the mind from this mental content in order to reorient to the object of focus.

During OM, the practitioner is to remain in a receptive and open monitoring state, attending moment-by-moment to anything that arises in one’s conscious experience, without focusing and elaborating on the content of any particular object, including the breath. In OM, if attention becomes engaged in a particular thought, memory, emotion, or sensation (such that the occurrence of newly arising phenomena is obscured), the practitioner is to disengage his/her attention from this mental content. Thus, whereas FA emphasizes attentional orienting (toward the target object and away from distraction), OM emphasizes meta-awareness to ensure that information processing remains ‘at the ready’ (i.e., nonconceptual and nonelaborative) [see 1].

For both FA and OM, when attention becomes inadvertently engaged or “stuck” on an object, such as distracting content during FA or any object during OM, decentering is offered as a strategy by which to ‘unstuck’ attention. Decentering involves acknowledging that the mental content that hijacked attention is not ‘reality’ but instead simply content that the mind generated, which is not relevant for the task at hand [8]. Thus, across both practices attentional orienting, meta-awareness, and decentering are repeatedly engaged. This observation leads to the prediction, from a cognitive training perspective, that MT may strengthen these processes.

In line with this prediction, there is growing evidence for improvements in selective and sustained attention

and affiliated executive control processes such as working memory with MT [11]. In addition, MT-related reductions in mind-wandering and self-reported improvements in meta-awareness have been reported in civilian [12,13] and military [14] cohorts. As well, many studies of MT in clinical populations have found that MT improves decentering [8]. Thus, examination of the processes engaged during MT exercises and evidence of the strengthening of these processes with MT, lends support to theoretical accounts [e.g., 1,8] of MT's mechanisms of action. In the next section, we discuss the impact of MT programs on the cognitive, social, and emotional domains of the human dimension.

3.0 SALUTARY EFFECTS OF MT ON COGNITIVE, SOCIAL, AND EMOTIONAL DOMAINS OF THE HUMAN DIMENSION

There is considerable evidence amassing in support of the salutary effects of MT on cognitive, social, and emotional processing [see 15 for review]. While promising, we caution that this literature is in its infancy and many more, and better controlled studies are required. In addition, while the cognitive, social, and emotional domains are conceptualized as independent in military writings [2, 4], psychological theories acknowledge that these domains depend on a shared set of core cognitive functions. One function that is known to be critical for aspects of information processing across multiple domains is attention. It is well

established that the integrity of attention and affiliated executive control processes such as working memory, is closely related to successful social abilities [16], emotion regulation [17], decision making [18, 19], perspective taking [20, 21], learning, and academic performance [22, 23]. As such, given its important role for many domains, if attention is compromised, the functioning of multiple domains may become compromised.

Attentional degradation is pronounced in high-stress conditions, not only in civilians during high-demand periods [24, 25] but also in the U.S. and other countries' military cohorts during high-demand intervals. Indeed, degradation in attention has been observed in U.S. active-duty service members during intense combat training/predeployment intervals [6, 14], in Spanish Army warfighters during simulated combat maneuvers [26], as well as in Belgian Special Forces candidates in high-intensity military training [27]. In light of the pivotal role played by attention and its influence on a myriad of processes, there has been great interest in determining if MT can protect against declines in attention over high demand intervals.

Accumulating evidence shows that MT programs can benefit the cognitive domain by enhancing as well as protecting cognitive processes such as attention and working memory [see 11 for review]. The protective effects of MT have been reported in civilians over high-demand intervals [24, 25] as well as in active-duty conventional forces over the predeployment interval [28, 29] for MT programs in which in-class and at-home engagement in MT exercises are emphasized. From this perspective, MT can be considered an effective form of cognitive resilience training. Further, the magnitude of MT's protective effects is commensurate with the amount of time individuals spend engaging in daily MT practice [14]. More recently, in offering MT to elite forces who are selected for their high cognitive and physical ability, whereas control participants' attention and working memory performance remained stable over an 8-week predeployment interval, those offered a 4-week MT program demonstrated significant cognitive improvements over this time interval [30]. In addition to attention and working memory, there is growing support from the civilian literature that MT benefits other aspects of the cognition domain. As reviewed by Creswell [15], MT reduces bias, improves performance on decision making tasks, increases cognitive flexibility, and improves real-world cognitive performance (e.g., in academic and workplace settings).

For the social domain, there is scant-yet-emerging evidence of MT-related benefits [31]. Of the few studies conducted to specifically investigate if MT results in salutary effects beyond the individual, most studies have been conducted in the civilian healthcare context or in the context of marital relationships [31]. Studies

also suggest that MT programs emphasizing collective mindfulness skills [32] may benefit team cohesion and collaboration [33, 34], interpersonal communication quality [35], and emotional intelligence and awareness of oneself and others [36]. No studies of MT have yet been published with such metrics in military cohorts.

Within the emotional domain, there is a robust civilian literature demonstrating MT-related improvements in self-reported positive emotion and well-being, and reductions in negative emotion, perceived stress, and anxiety in psychologically healthy individuals [see 15 for review]. These emotional benefits have also been found to be ‘dose-dependent’ in that greater benefits are observed with greater daily MT practice engagement [37]. Examination of the emotional domain in psychologically healthy military cohorts reveals a pattern similar to that observed for cognitive functions, such that over high-demand intervals, mood and well-being declined, but with MT they were maintained, with dose-dependent benefits. Specifically, MT was associated with protection against elevation in negative affect [38] and perceived stress [39] over high-demand intervals. Relatedly, MT was associated with greater well-being and reduced perceived stress in the German Armed Forces [40]. A similar pattern of improvements in well-being and reductions in perceived stress was reported in members of the Dutch Military [41]. In addition, MT-related decreases in anxiety were reported in a study with a Norwegian combat aircraft squadron [42]. In military cohorts suffering from active clinical disorders, emotional benefits are observed as psychological health benefits, with symptom reductions in disorders such as PTSD and depression [43]. Thus, MT-related salutary effects in the emotion domain have been found in civilians and military cohorts from the U.S. and abroad.

Thus, as reviewed above, studies investigating MT’s effects on cognitive, social and emotional domains are amassing at a rapid rate. Yet, the current literature is unable to fully explain with specificity, how MT’s proposed mechanisms of action, as described in Section 2.0, result in such a broad array of benefits, from improvements in academic performance, improved team cohesion, to reductions in PTSD. One proposal is that MT-related strengthening of core cognitive functions (i.e. attention and working memory, [11] may mediate emotional benefits, for example. But very few studies have yet been conducted to address such mechanistic questions. While studies of brain function and MT-related neuroplasticity are advancing our understanding [see 1], much more research is necessary and warranted. Nonetheless, extant evidence in support of MT’s salutary effects from both civilian and military cohorts is promising.

Given the urgent need for innovative training to protect and enhance the effectiveness and well-being of military/uniformed cohorts, we suggest that there should be a significant increase in research and dissemination of MT programming to military cohorts. Yet there are attitudinal biases against its broad adoption in these settings. Below we discuss these biases from a military leadership perspective, and provide counter-arguments.

4.0 ADOPTION OF MT IN MILITARY COHORTS: ATTITUDINAL IMPEDIMENTS AND COUNTER-ARGUMENTS

As discussed at the outset, war is getting faster. Advances in technology have increased the speed of sensor to shooter links to the point where human decision making is the slowest part of the cycle. As such, the *human* must be trained to optimize decision making and performance – at speed. This understanding has motivated senior military leaders to acknowledge the centrality of the human dimension [2,4], and the limitations in human information processing. These limitations apply to decision making by the warrior on the battlefield, the CEO of a high performing company in a rapidly changing business and technologic environment, the healthcare team in an intensive care unit, and many others.

This concept is not new. John Boyd created the OODA loop – observe, orient, decide and act -- as the critical components to operating inside an enemy fighter pilot’s decision making process [see 44]. If a pilot’s OODA loop is faster than the enemy’s OODA loop, there is a much higher probability of winning. That said,

increasing complexity through improved sensor technologies, advanced targeting systems, advanced command and control systems, and advanced munitions, combined with the increasing complexity of the battlefield with urbanization, social media and peer adversary-like capabilities are increasing an already heavy information processing load (i.e., cognitive load) on leaders and their followers, throughout our formations.

If a leader's mind is not focused –and is mind wandering to task unrelated thoughts [see 12 for discussion] for example, the full OODA loop will be compromised, which can have dramatic consequences, especially if speed is an essential factor. Fortunately, there is growing evidence, as reviewed in this paper, that shows that MT has the potential to make leaders better, by giving them the tools to gain cognitive advantage. Mindfulness training has the potential to help leaders sustain attention [14], notice their own mind wandering and distractibility [12], and give them the mental flexibility to be able to step outside of their current framework of 'thinking' and shift perspectives in the service of problem solving and decision making [8]. This is not trivial – this is the equivalent of discovering the edge on physical fitness – we now know one of the tools for cognitive fitness and well-being.

There is an added benefit to mindfulness: existing research shows that there are social and emotional advantages of MT. While more difficult to describe, this training can help with resilience. The social and emotional load that leaders experience is highly dependent on a number of factors such as personality, sleep, diet, life history, family demands, cognitive capacity, and team dynamics. As studies are beginning to demonstrate, across a wide range of these factors, MT can help protect against degradation in cognitive functions and well-being over high demand training environments, and by implication, these vulnerabilities and the power of MT to protect against them, would also apply to combat. Thus, MT addresses a pressing need for innovative training to protect and enhance the effectiveness and well-being of military/uniformed cohorts. Yet, there are attitudes and biases against MT, which we point out and argue against below.

1. It's not 'worth' the time

Despite the benefits now known (and described above), militaries have been slow to adopt MT as a tool for enhanced human performance. One reason is time – the practice of mindfulness requires dedicated time on a regular and ongoing basis, just like physical fitness requires dedicated time to engage in physical exercise. For an action-based profession, it is hard to implement the idea that mindfulness, which cannot be seen, can deliver the same outcomes as another iteration of live-fire training, for example. Therefore, leaders do not feel compelled to dedicate continuous time to something that is hard to see, hard to prove as an *advantage*, and is preventative in nature in a profession that prides itself on surviving through hardiness and grit.

Yet, hardiness and grit may not be enough in complicated and complex environments that require a high degree of cognition for successful decision making at speed. There is a saying, "Slow is smooth, and smooth is fast." While there are numerous interpretations, the idea of "slow is smooth" is about understanding time with a holistic view of the present environment and the mission set. It calls for clarity. "Smooth is fast" is about how that clarity and understanding translates into better decisions, especially in the face of chaotic situations. Engaging in numerous training repetitions, while helpful, is insufficient as a leader's mind is struggling for clarity and understanding. In such a state, the leader may need to spend time repeating information, struggle with multi-tasking, and exhibit other behaviours associated with cognitive and emotional overload. Such cognitive inefficiencies are actually wasting valuable training time, and can have detrimental effects during operations, at multiple levels. There is an imperative now to develop cognitive skills that broaden cognitive capacity. This broadening should include having better attention, an ability to monitor what is happening-- not just in the external environment--but in one's own conscious experience, to be able to catch moments of mind wandering or unsuccessful multi-tasking, and account for decision bias.

With these skills, leaders are more likely to achieve greater clarity in the face of chaotic situations and circumstances. Allocating time to educate, train and develop a practice of mindfulness is critical to the concept of gaining and sustaining cognitive advantage.

Indeed, MT may allow time to be more efficiently spent; moreover, through MT, hardiness and grit may be more readily achieved and less likely to be compromised. Determining time-efficient routes by which to offer MT may help support the adoption of MT in time-pressured settings like the military. Through a series of studies conducted by our group, it has been possible to identify key program components necessary to achieve salutary cognitive effects. We found that in an 8-week, 8-hour MT program which primarily included didactic content (information and discussion), and little opportunity for in-class MT practice, the participants' performance was no different from getting no training at all. In contrast, when in-class time was spent primarily engaging in MT practice, protective effects on attention [28] and working memory [29] were observed over the predeployment interval. In a recent study, we investigated the cognitive effects of an 8-hour program called Mindfulness-Based Attention Training (MBAT) that was contextualized for ease of delivery over 8 hours to military cohorts. When MBAT was delivered over 4 weeks, it resulted in beneficial cognitive effects in elite military cohorts. But when the same program was delivered over 2-weeks, these effects were reduced or absent [30]. As such, there are lower limits for time-demands at which point MT is ineffective in producing salutary effects. Yet, the important counterpoint to spending the least amount of time possible on MT, is that the more time that individuals spend engaging in mindfulness exercises each day, the more their cognitive processing and emotional well-being benefit [25, 30, 37]. Thus, just like physical exercise for physical fitness, more time spent engaging in MT promotes greater cognitive fitness [see 38].

2. It makes you 'weak'

The second challenge is the perception that if you need to train your mind, it must mean that your mind is weak. Relatedly yet paradoxically, the 'strong' think the 'weak' are weak because they haven't been training hard enough, or even worse, that they will never achieve the standard required. This belief is perhaps even more tenaciously held in the biases around complex human behaviour. The perception that someone is not hard enough, not good enough, or not resilient enough is already embedded in military culture. As such, the notion that the mind, like the body, can be trained must overcome a culture of "the strong survive."

The myth of invincibility has been challenged over the years by another saying, "Everyone can be broken." Here, there are many parallels to physical training. It is possible to over-train (and under-train) or over-tax the human body which will cause significant short and potentially long-term health issues. Similarly, the mind can be overtaxed, cognitively and emotionally [38]. The research reviewed herein shows that MT results in better attention, better emotion regulation, better performance, and distress tolerance [see 15, 45] over high demand and depleting military training intervals. Indeed, it is possible that MT may even help establish the conditions to allow for longer periods of mission-related physical and mental training, with less compromise to the integrity of the body and mind.

3. It's not a 'modern technological' solution

There are many in today's militaries who hold a technology bias. There are those who believe technology can solve many of the problems facing leaders, and those who believe that technology will not work, especially when needed most. Those who think technology will help with decision making, hold the view that more data, supported by machine learning and artificial intelligence, will lead to cognitive offloading and is the key to faster, better decisions. From this perspective, MT may not be required, since machines can make decisions at speed. Yet, such a scenario may, in fact, increase the necessity for mindfulness. It is now well-established that more technology does not always result in cognitive off-loading. Instead, in many

cases, it results in different or new, complex demands on leaders [see 3 for discussion]. With greater reliance on machines, for example, it is incumbent upon the human to *remember* to monitor, and then to actually monitor the machines/sensors to ensure that they are operating as designed. In addition, the human must be able to notice and select which outputs necessitate a response and when to act. Thus, cognitive functions such as those cultivated by MT (i.e., attention, working memory, and monitoring) are critical in technology-saturated operating environments.

On the other hand, some military writings have suggested that the battlefield will be so disruptive, that many of our technologies will not work. Therefore, more training repetitions will be key. Indeed, training repetitions are beneficial for domain specific ‘muscle memory’ for specific procedural skills so that they become rote (see [5]). Yet, human cognition in the service of agile and adaptive information processing cannot be automated in a manner akin to ‘muscle memory’. As such, the use of MT in such scenarios provides ‘push ups for the mind’ to improve leaders’ ability to: observe with discernment, orient with precision, decide without bias, and act with awareness (vs. being on autopilot).

4. It requires adopting a specific belief system/world view

Finally, there is an unfortunate and erroneous conflation of MT as being exclusively religious and spiritual. While there is no question that MT has cultural and historic roots in the wisdom traditions of the East, particularly Buddhism, there are elements of mindfulness, and other meditation practices in every major world wisdom tradition through the ages (e.g., in Western philosophical traditions, Marcus Aurelius and the Stoics provide an example). Yet, as discussed in Section 2.0, the core exercises that comprise MT programs require no particular religion, belief system, or world view. Mindfulness programs currently taught in thousands of medical, nursing, business, and more recently, military and civilian first-responder settings, are often referred to as ‘secular mindfulness’ programs. These programs emphasize the *mind training* aspects, to cultivate specific mental qualities such as attentional focus, meta-awareness, and decentering in the service of improved performance and wellbeing [see 1 for discussion].

5.0 SUMMARY AND CONCLUSIONS

Herein, we discussed the topic of mindfulness, and have argued for the broader adoption of mindfulness training in the service of improved effectiveness and well-being in military/uniformed cohorts. In support of this argument, we described the utility of mindful modes of information processing given that ‘thinking skills’ alone, may be insufficient for achieving mission success in the predicted operational climate of the future. We suggested that agile and adaptive warfighters must utilize adjunctive information processing modes, to gain cognitive advantage over their own information processing. Indeed, mindful modes of information processing promote many qualities which typify adaptive leadership. Beyond this theoretical argument regarding the utility of MT, we provided evidence for the salutary effects of MT in three critical domains of the human dimension (cognitive, social, and emotional). In both civilian and military cohorts, MT results in improvements in cognitive processes, and emotional metrics including psychological health symptom reduction for diseases for which military cohorts are vulnerable (e.g., PTSD, depression, and anxiety). We also reviewed encouraging evidence that MT benefits the social domain from studies in civilian cohorts. Despite these promising effects, there are attitudinal biases against the broader adoption of MT into military contexts. We provided counterarguments to misconceptions which contribute to some of these attitudinal challenges. In addition, we described the approach our group has implemented in creating and evaluating short-form MT programs, amenable to scalable and accessible delivery [see 30]. This approach is modelled after those used for introduction of novel training approaches in time-pressured settings. We suggest that next-generation studies should investigate the utility of such programs in selection and training courses to reduce attrition and improve resilience, as well as strategic leadership education, to promote

adaptive leadership qualities. In addition, we suggest that MT should be offered to senior leaders (i.e., general officers) and military spouses to bolster their effectiveness and resilience. Thus, prior evidence and present need strongly point to the utility of MT as a training tool by which to achieve cognitive advantage in the service of improved operational readiness and effectiveness, as well as greater resilience and well-being in military and other uniformed cohorts.

In conclusion, as mentioned at the outset of this paper, the future of war is predicted to be more complex and dangerous. We have suggested that MT may be a fruitful route by which to gain cognitive advantage in the service of mission readiness and success, including improved strategic leadership, team cohesion, and lethality as we face such a future. In addition, military and uniformed personnel are likely to be called upon for a broader range of missions, including those in which their service is necessary to tackle humanitarian and environmental challenges at home and abroad. Indeed, mindfulness has an important role to play in peace-promotion and peace-keeping, de-escalation of force, offering of greater compassion and civility in the face of human suffering and environmental devastation, and greater ease in efforts to build coalitions, alliances, and trust even when there has been a history of distrust, hatred, and violence. While MT may be *good for the mission*, it is equally important to acknowledge the personal utility of MT for greater well-being and psychological health, resilience, stress-reduction, and relationship satisfaction. While military/uniform personnel embody selfless service, their service must be honored by offering them access to the best evidence-based tools available in support of their ability to serve. As we have argued herein, mindfulness training is one such tool.

REFERENCES

- [1] Lutz, A., Jha, A. P., Dunne, J. D., & Saron, C. D. (2015). Investigating the phenomenological matrix of mindfulness-related practices from a neurocognitive perspective. *American Psychologist*, 70(7), 632-658. doi:10.1037/a0039585
- [2] Department of the Army, TRADOC Pam 535-3-1. (2014). *The U.S. Army Operating Concept: Win in a Complex World*, (Fort Eustis, VA: U.S. Government Printing Office, October 2014)
- [3] Klein, G. M. (2015). Cognitive Training to Achieve Overmatch in the Future of War. Medium.Com. <https://medium.com/@garyklein/cognitive-training-to-achieve-overmatch-in-the-futureofwar-335cb7111ef1>
- [4] U.S. Army Combined Arms Center. (2014). *The Human Dimension White Paper: A Framework for Optimizing Human Performance*, (Fort Leavenworth, KS, October 9, 2014)
- [5] Blacker, K. J., Hamilton, J., Roush, G., Pettijohn, K. A., & Biggs, A. T. (2018). Cognitive training for military application: a review of the literature and practical guide. *Journal of Cognitive Enhancement*. doi:10.1007/s41465-018-0076-1
- [6] Lieberman, H. R., Bathalon, G. P., Falco, C. M., Kramer, F. M., Morgan, C. A., & Niro, P. (2005). Severe decrements in cognition function and mood induced by sleep loss, heat, dehydration, and undernutrition during simulated combat. *Biological Psychiatry*, 57(4), 422-429. doi:10.1016/j.biopsych.2004.11.014.
- [7] Eifler, S. B. (2011). *Developing Strategic Thinking Leaders in the US Army*. (Carlisle Barracks, PA: US Army War College)
- [8] Bernstein, A., Hadash, Y., & Fresco, D. M. (In Press). Metacognitive Processes Model of Decentering: Emerging Methods and Insights. *Current Opinion in Psychology*.
- [9] Heifetz, R. A., Grashow, A., & Linsky, M. (2009). *The Practice of Adaptive Leadership*. Boston, MA, Harvard Business Press. pp 14-17.
- [10] Simons, D. J., Boot, W. R., Charness, N., Gathercole, S. E., Chabris, C. F., Hambrick, D. Z., & Stine-Morrow, E. A. (2016). Do “Brain-Training” Programs Work? *Psychological Science in the Public Interest*, (17), 103-186.
- [11] Jha, A. P., Denkova, E., Zanesco, A. B., Witkin, J. E., Rooks, J., & Roger., S. L. (In Press). Does Mindfulness Training Help Working Memory “Work” Better? *Current Opinion in Psychology*.
- [12] Mrazek, M. D., Franklin, M. S., Phillips, D. T., Baird, B., & Schooler, J. W. (2013). Mindfulness training improves working memory capacity and GRE performance while reducing mind wandering. *Psychological Science*, (24), 776-781.
- [13] Morrison, A. B., Goolsarran, M., Rogers, S. L., & Jha, A. P. (2014). Taming a wandering attention: short-form mindfulness training in student cohorts. *Frontiers in Human Neuroscience*, 7(897). doi:10.3389/fnhum.2013.00897
- [14] Jha, A. P., Morrison, A. B., Parker, S. C., & Stanley, E. A. (2016). Practice is protective: mindfulness training promotes cognitive resilience in high-stress cohorts. *Mindfulness*, 7(1), 1-13.

doi:10.1007/s12671-015-0465-9

- [15] Creswell, J. D. (2017) Mindfulness Interventions. *Annual Review of Psychology*, 68(18), 1–18. doi 10.1146/annurev-psych-042716-051139
- [16] Frith, C. D., & Frith, U. (2012). Mechanisms of Social Cognition. *Annual Review of Psychology*, (63), 287-313. doi: 10.1146/annurev-psych-120710-100449. Epub 2011 Aug 11. Mechanisms of social cognition.
- [17] Schmeichel, B. J., & Tang, D. (2015). Individual Differences in Executive Functioning and Their Relationship to Emotional Processes and Responses. *Current Directions in Psychological Science*, (24), 93-98.
- [18] Bechara, A., & Martin, E. M. (2004) Impaired decision making related to working memory deficits in individuals with substance addictions. *Neuropsychology*, (18), 152-162.
- [19] Hinson, J. M., Jameson, T. L., & Whitney, P. (2003). Impulsive decision making and working memory. *Journal of Experimental Psychology: Learning, Memory, Cognition*, (29), 298-306.
- [20] Long, M. R., Horton, W. S., Rohde, H., Sorace, A. (2018). Individual differences in switching and inhibition predict perspective-taking across the lifespan. *Cognition*, (170), 25-30.
- [21] Wardlow, L. (2013). Individual differences in speakers' perspective taking: the roles of executive control and working memory. *Psychonomic Bulletin Review*, (20), 766-772.
- [22] Alloway, T. P., Alloway, R. G. (2010). Investigating the predictive roles of working memory and IQ in academic attainment. *Journal of Experimental Child Psychology*, (106), 20-29.
- [23] Cowan, N. (2014). Working Memory Underpins Cognitive Development, Learning, and Education. *Educational Psychology Review*, (26), 197-223.
- [24] Morrison, A. B., Goolsarran, M., Rogers, S. L., Jha, A. P. (2014). Taming a wandering attention: short-form mindfulness training in student cohorts. *Frontiers in Human Neuroscience*, (7), 897.
- [25] Rooks, J., Morrison, A. B., Goolsarran, M., Rogers, S. L., & Jha, A. P. (2017). “We are talking about practice”: the influence of mindfulness vs. relaxation training on athletes’ attention and well-being over high-demand intervals. *Journal of Cognitive Enhancement*, 1(2), 141-153. doi:10.1007/s41465-017-0016-5
- [26] Delgado-Moreno, R., Robles-Pérez, J. J., Clemente-Suárez, V. J. (2017). Combat Stress Decreases Memory of Warfighters in Action. *Journal of Medical Systems*, 41(8), 124. doi: 10.1007/s10916-017-0772-x.
- [27] Taverniers, J., Van Ruysseveldt, J., Smeets, T., and Von Grumbkow, J. (2010). High-intensity stress elicits robust cortisol increases and impairs working memory and visuo-spatial declarative memory in Special Forces candidates: a field experiment. *Stress* 13, 323–333. doi: 10.3109/10253891003642394
- [28] Jha, A. P., Morrison, A. B., Dainer-Best, J., Parker, S., Rostrup, N., & Stanley, E. A. (2015). Minds "at attention": mindfulness training curbs attentional lapses in military cohorts. *PLoS One*, 10(2), e0116889. doi:10.1371/journal.pone.0116889
- [29] Jha, A. P., Witkin, J. E., Morrison, A. B., Rostrup, N., & Stanley, E. A. (2017). Short-form mindfulness

- training protects against working memory degradation over high-demand intervals. *Journal of Cognitive Enhancement*, 1(2), 154-171. doi:10.1007/s41465-017-0035-2
- [30] Zanesco A. P., Denkova, E., Rogers, S. L., MacNulty, W. K., & Jha, A. P. (2019). Mindfulness training as cognitive training in high-demand cohorts: An initial study in elite military servicemembers. *Progress in Brain Research*, 244, 323-354.
- [31] Good, D. J., Lyddy, C. J., Glomb, T. M., Bono, J. E., Brown, K. W., Duffy, M. K., . . . Lazar, S. W. (2016). Contemplating Mindfulness at Work: An Integrative Review. *Journal of Management*, 42(1), 114-142. doi:10.1177/0149206315617003
- [32] Sutcliffe, K. M., Vogus, T. J., & Dane, E. (2016). Mindfulness in Organizations: A Cross-Level Review. *Annual Review of Organizational Psychology and Organizational Behavior*, 3(1), 55-81. doi:10.1146/annurev-orgpsych-041015-062531
- [33] Cleirigh, D. O., & Greaney, J. (2015). Mindfulness and group performance: An exploratory investigation into the effects of brief mindfulness intervention on group task performance. *Mindfulness*, 6, 601-609. doi:10.1007/s12671-014-0295-1
- [34] Singh, N. N., Singh, S. D., Sabaawi, M., Myers, R. E., & Wahler, R. G. (2006). Enhancing treatment team process through mindfulness-based mentoring in an inpatient psychiatric hospital. *Behav Modif*, 30(4), 423-441. doi:10.1177/0145445504272971
- [35] Beckman, H. B., Wendland, M., Mooney, C., Krasner, M. S., Quill, T. E., Suchman, A. L., & Epstein, R. M. (2012). The impact of a program in mindful communication on primary care physicians. *Acad Med*, 87(6), 815-819. doi:10.1097/ACM.0b013e318253d3b2
- [36] Huston, D. C., Garland, E. L., & Farb, N. A. S. (2011). Mechanisms of Mindfulness in Communication Training. *Journal of Applied Communication Research*, 39(4), 406-421. doi:10.1080/00909882.2011.608696
- [37] Carmody, J., Baer, R. A. (2008). Relationships between mindfulness practice and levels of mindfulness, medical and psychological symptoms and well-being in a mindfulness-based stress reduction program. *Journal of Behavioural Medicine*, 31, 23-33.
- [38] Jha, A. P., Stanley, E. A., Kiyonaga, A., Wong, L., & Gelfand, L. (2010). Examining the protective effects of mindfulness training on working memory capacity and affective experience. *Emotion*, 10(1), 54-64. doi:10.1037/a0018438
- [39] Stanley, E. A., Schaldach, J. M., Kiyonaga, A., & Jha, A. P. (2011). Mindfulness-based mind fitness training: A case study of a high-stress predeployment military cohort. *Cognitive and Behavioral Practice*, 18(4), 566-576. doi: 10.1016/j.cbpra.2010.08.002.
- [40] Zimmermann, F. (2015). Mindfulness-Based Practices as a Resource for Health and Well-Being. *Medical Acupuncture*, 27(5). doi:10.1089/acu.2014.1080
- [41] Bijlsma, T., Muis, S., & van Tilborg, A. (2018). Mindfulness in Dutch Military Train Your Brain. In Á. Rocha & T. Guarda (Eds.), *Springer Nature* (Vol. 94, pp. 183-192): Springer.
- [42] Meland, A., Ishimatsu, K., Pensgaard, A. M., Wagstaff, A., Fonne, V., Garde, A. H., & Harris, A. (2015). Impact of Mindfulness Training on Physiological Measures of Stress and Objective Measures

- of Attention Control in a Military Helicopter Unit. *Int J Aviat Psychol*, 25(3-4), 191- 208. doi:10.1080/10508414.2015.1162639
- [43] Cushing R.E., Braun K.L. (2017) Military-Tailored Yoga for Veterans with Post-traumatic Stress Disorder. *J Altern Complement Med*. 24(2):106-114. doi: 10.1089/acm.2017.0176.
- [44] Higgins G, Freedman J. Improving decision making in crisis. (2013) *Journal of Business Continuity and Emergency Planning*. 2013 Autumn;7(1):65-76.
- [45] G. Lotan, G. Tanay, A. Bernstein (2013) Mindfulness and distress tolerance: Relations in a mindfulness preventive intervention. *International Journal of Cognitive Therapy* Vol. 6, No. 4, pp. 371-385. doi: 10.1521/ijct.2013.6.4.371