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Developing situation awareness capacity to improve executive judgment and decision making under stress

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DEVELOPING SITUATION AWARENESS CAPACITY TO IMPROVE EXECUTIVE JUDGMENT AND DECISION MAKING UNDER STRESS

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by

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DEDICATION

To Derek.

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ABSTRACT

This study examined multiple factors that underlie a key component of leadership resilience, situation awareness (SA), and its role in executive judgment and decision making under stress. SA, researched for over 30 years in military and critical incident professions by researchers from the field of Naturalistic Decision Making (NDM), has increasing relevance to leaders in organizations, particularly those who are challenged by high uncertainty and accelerating change, traditionally addressed by the field of organization development (OD).

The study specifically examines the Transcendental Meditation™ technique within the context of a 10-week intervention for developing SA capacity in emerging leaders (N = 35), for which pre- and post-data were collected and analyzed. The research approach involved an intervention group (n = 18) trained in the twice-daily practice of the Transcendental Meditation™ technique and a control group (n = 17) with no intervention. Participants in both groups completed three instruments, Trail Making B, Wisconsin Card Sort Test, and Constructive Thinking Inventory, as a means to measure the three elements of SA (perception, comprehension, projection). Analyses of covariance (ANCOVA) showed that TM practice produced significant effects (p levels ranged from .033 to .047) on two of the three measures, specifically, perception and projection.

The results of the study support a positive relationship between the Transcendental Meditation technique on the improvement of SA capacity in emerging leaders, and advances the body of research on the use of meditation as an intervention in leadership resilience development programs to prepare leaders for high-demand settings.

Chapter 1: Introduction

In response to challenges from a world in constant flux, leadership resilience has grown exponentially as a topic in the popular press. Yet, due to a large gap in our understanding of what exactly resilience is, the means by which resilience operates, and how it is obtained in the work setting, much remains unknown about how to develop resilience in leaders (Meadows, Shreffler, & Mullins-Sweatt, 2011; Zellars, Justice, & Beck, 2011). What is known is that, for the past decade, today's leaders have been living with more stress, uncertainty, disruption, and insecurity than in any time in history (Bennis, 2001; Conner, 1995; Hargrove & Sitkin, 2011; Salas, Stagl, Burke, & Goodwin, 2007). According to a study on the stress of leadership, 88% of leaders (N = 230) report that work is a primary source of stress in their lives, with over two-thirds also reporting that the stress in their lives is higher than it was five years ago (Center for Creative Leadership, 2007).

Studies on leadership and stress indicate that not only are leaders becoming more susceptible to stress, but also that their organizations are failing to provide them with the tools that they need to manage stress (Center for Creative Leadership, 2007, p. 3; Selart & Johansen, 2011). One of the most critical consequences of leaders' becoming more susceptible to the high pressure and urgency of stress is its effect on leaders' ability to think clearly (Endsley, 1995a). The effects of overload, fatigue, and other stressors on leaders' judgment and decision making has been known to lead to impulsive decisions or decision-making paralysis (Everly, Strouse, & Everly, 2010). The consequence of such debilitated judgment is errors which can have significant and detrimental impact (Flin, 1966).

Scholars and researchers of resilient leadership consistently point to the need for leaders to manage stress as part of their resilience. Research on the use of meditation as an intervention to address the impact of stress and to improve cognitive capacity has been conducted by the U.S. military (Jha, Stanley, Kiyonaga, Wong, & Gelfand, 2010; Rosenthal, Grosswald, Ross, & Rosenthal, 2011). With this research as a foundation, the current study focuses on the use of meditation to develop cognitive capacity as a means to improve executive judgment and decision making under stress.

General Areas Under Study

Preparing leaders to operate effectively under conditions of uncertainty, ambiguity, and complexity has become a growing concern (Archibald & Munn-Venn, 2008). The topic of resilience as related to judgment and decision making is complex, involving multiple contributing factors (Endsley, 1995a). Due to the breadth of the topic, a multi-disciplinary approach is taken to understand the factors that contribute to executive judgment and decision making under stress and to explore ways of developing leadership resilience.

General areas of study related to the topic of executive judgment and decision making under stress include the fields of organization development (OD), naturalistic decision making (NDM), and research on meditation techniques. Each of these domains offers theories, constructs, and frameworks by which to understand the underlying factors of as well as techniques to develop leadership resilience. The three domains are relatively new, with the field of OD originating after WWII (Cummings & Worley, 2001), the field of NDM originating in the mid-1980s (Schraagen, Klein, & Hoffman, 2008), and research on the meditation techniques starting in the mid- to late 1960s

(Murphy, Donovan, & Taylor, 1997). Each discipline provides compelling findings that make possible a comprehensive exploration of the topic of leadership resilience: what it is, how to develop it using meditation as an intervention, and implications for future research for the broader population of leaders who operate in high-demand settings. Each of these areas is introduced here but presented in greater detail in Chapter 2.

For over 60 years, OD theorists have addressed the individual and cultural factors related to change. Constructs from the field of OD, such as dynamics of organizational change, mental models, sensemaking, and transformational leadership, have been incorporated into the subject of leadership resilience since the topic entered the literature in the early 1990s. The field of OD is the study of an organization's response to change so that it can better adapt to new technologies, markets, challenges, and the accelerated rate of change itself (Bennis, 1969). Practitioners schooled in the field of OD are knowledgeable in the development of complex educational strategies intended to assist leaders in changing the beliefs, values, and structures of their organizations.

Leadership theorists from the field of OD have addressed the importance of judgment under stress as a key element of leading change. According to Tichy and Bennis (2007),

> The essence of leadership is judgment. The single most important thing that leaders do is make good judgment calls. In the face of ambiguity, uncertainty, and conflicting demands, often under great time pressure, leaders must make decisions and take effective actions to assure survival and success of their organizations. (p. 12)

The demand for organizational change management methodologies, intervention strategies, and analytical frameworks that reflect the current realities of accelerating

change is an ongoing challenge for planned organizational change and OD theorists (Marshak, 2009; Worren, Ruddle, & Moore, 1999).

A great deal of research on and many models of real-time decision making have been developed over the past 30 years by researchers in the field of Naturalistic Decision Making, or NDM (Endsley & Garland, 2000; Endsley, Hoffman, Kaber, & Roth, 2007; Klein, 2000, 2004). NDM is the study of how people use their experience to make decisions in field settings (Zsambok & Klein, 1997), a field of study regarded by Tichy and Bennis (2007) as important for offering insights for leaders. NDM, an offshoot from the larger field of judgment and decision making (JDM), is distinguished by its methods of studying decision making in dynamic settings, using approaches that differ from those used in the classical decision making methods (e.g., option generation and comparison) currently taught in universities (Crandall, Klein, & Hoffman, 2006). Leadership experts Tichy and Bennis (2007) emphasize the importance of judgment throughout their writings on leadership:

> No study of leadership is complete without an understanding of judgment. The relatively new discipline of Judgment and Decision Making that is just now beginning to show up in the curricula of better business schools still falls short of the Vilfredo Pareto's 80/20 rule; we haven't reached the 20 percent understanding needed to predict 80 percent of the success or failure of judgments. One of the reasons we and other students of leadership haven't written a lot about judgment is that it is a hard subject. (pp. 11-12)

Decision making failures are responsible for many accidents, as well as other unintended consequences, in critical and complex systems (Sandoval, 2005). Researchers from the domain of NDM have found that the key for effective decision making in such systems is the awareness of evolving situations in the environment. This awareness, an antecedent of decision making, is known as situation awareness (SA, also

defined as “knowing what is going on so you can figure out what to do” (Adams, Tenney, & Pew, 1995, p. 10). SA in knowledgeable experts and leaders operating in dynamic, stressful settings has been researched extensively since the 1980s (Flin & Arbuthnot, 2002). To date, studies on SA have focused on experts’ decision making in dynamic environments such as flight decks, aviation, military operations, wildfire grounds, hospital trauma centers/intensive care units, and high-hazard industries such as nuclear plant control rooms (Andre, Wickens, & Moorman, 1991; Durso et al., 1997; Endsley, 1988a, 1988c, 1995a, 1999; Haas, Nelson, & Repperger, 2001; Omodei, Taranto, & Wearing, 2005).

Consequences of impaired or debilitated SA lead to development of SA model. Studies have shown that loss of SA can have disastrous consequences on executive judgment and decision making. In pilots, loss of SA has been associated with debilitated judgment and decision making, resulting in 88% of major air carrier accidents (Endsley, 1995b), as well as 60% of operational errors in air traffic controller operations (Rodgers & Mogford, 2000). Numerous studies that link the loss of SA to accidents (Endsley, 1990;2000b; Endsley et al., 2000) that involve decision makers whose SA has been impaired have led researchers to develop a comprehensive framework that includes both individual factors (e.g., abilities, experience, training) and external factors (e.g., interface design, stress and workload, stress, complexity, system compatibility, automation; (Endsley, 1988b, 1988c). Sandoval (2005) proposed the inclusion of social factors (i.e., organizational culture) as an extension to the Endsley model, which contributes an area of potential interest to practitioners and scholars in the field of OD.

The Endsley (1995c) and Sandoval (2005) models both provide a framework for exploring the dynamics of leadership resilience and are therefore central to this study.

SA linked to the development of consciousness. The study of consciousness has been the domain of meditation and meditative practices for more than 5,000 years (Walters, 2002). The scientific study of meditation, in particular, has become a subject of increasing interest over the past 40 years (Murphy et al., 1997).

Transcendental Meditation (TM) is the most widely researched meditation technique (Murphy et al., 1997). More than 600 studies over the past 40 years have been conducted at over 250 independent universities and research institutions worldwide, and many of these studies, published in peer-reviewed journals, have shown significant improvements in the development of cognitive capacity in various populations (Roth, 1994). The abundance of research on TM holds potential relevance for researchers who study the development of SA for improved judgment and decision making in leaders who operate in high-demand settings.

TM is a technique derived from the Vedic tradition of India by Maharishi Mahesh Yogi (Alexander, 1994). *Veda* is a Sanskrit word that connotes complete or unified knowledge, and Vedic Science (theoretical aspect) is the 5,000-year-old study of the development of consciousness through the TM technique (the practical aspect).

A multi-disciplinary approach to the study of executive judgment and decision making under stress across the domains of organization development, NDM, and research on meditation practices is therefore intended to provide insight into not only the dynamics of leadership resilience, but also the role of meditation in developing SA capacity to improve executive judgment and decision making under stress. The

following section provides a comprehensive discussion of the problem that this study seeks to address.

Background of the Problem

This section provides an overview of the effect of impaired or debilitated SA on executive judgment and decision making. The four areas addressed include (a) factors that contribute to leadership stress, (b) the impact of stress on leadership judgment and decision making, (c) the escalating nature of the problem of susceptibility to stress in the workplace at a national level, and (d) current use of meditation practices by leaders for developing resilience against stress.

Factors contributing to leadership stress. Characteristics of the settings in which decision makers studied in the field of NDM include ill-defined goals, ambiguity, shifting and competing goals, multiple stakeholders, and high stakes (Orasanu & Connolly, 1993). Growing evidence of increased susceptibility of organizational leaders to stress would indicate that a case can be made that these same characteristics are similar to those affecting current and emerging organizational leaders. Challenges introduced by global competitiveness (Friedman, 2005), rapid technological advancement (Klein, 1996), and the uncertainty and complexity introduced by the fluidity of work environments (Cannon-Bowers & Salas, 2006; Hargrove & Sitkin, 2011) have created a need for continuous change, as well as a need to "do more with less, faster" (Center for Creative Leadership, 2007).

Impact of stress on leadership judgment and decision making. Studies on the aftermath of large-scale disasters have highlighted the growing concern that increased levels of stress on leaders are taking a toll on their capacity for judgment and decision

making. Commissioned post-mortem reports of natural disasters consistently report debilitated, incapacitated, or impaired leadership judgment and decision making during large-scale disasters such as earthquakes and tsunamis (Hocevar, Jansen, & Thomas, 2004), flooding (Fillmore, Ramirez, Roth, Robertson, & Peek-Asa, 2011), pandemics (Duley, 2005), and terrorist attacks (Pfeifer, 2005). Impaired situation SA has consistently been identified as one of the primary factors in accidents (Endsley, 1995a). During the 1990s, there was limited literature on the effects of stress on leaders at the time of an emergency, with more written on the subject of stress effects immediately after the event and longer term (Flin, 1966). Studies of common negative symptoms experienced by leaders document fatigue, exhaustion, sadness, guilt, recurring images, intrusive thoughts, inability to sleep, loss of appetite, reduced interest in everyday events, diminished concentration, depression, and loss of confidence (Hodgkinson & Stewart, 1991). Subsequent research has since documented the variety of symptoms experienced by leadership in dynamic settings caused by stress, which are enumerated in greater detail in Chapter 2.

Increased susceptibility to stress in the workplace. In 2003, stress claims in the United States cost the U.S. $66 billion per year or roughly 2% of the Gross National Product (Tisza, Motti, & Matthews, 2003). In Canada stress claims in the workplace is estimated to be between $2.97 billion and $11 billion, and financial awards for damages caused by job-related mental stress claims in Canada have increased over the past five years by as much as 700% (Agrell, 2010).

Current use of meditation practices by leaders for developing resilience against stress. The study on the stress of leadership (Center for Creative Leadership,

2007) referenced earlier includes a wide variety of stress reduction strategies employed by leaders surveyed (N = 230) ranging from exercise/physical workout (22%); boundary maintenance (13%); outdoor hobbies (9%); gaining focus (9%); maintaining a support network (8%); rest/breaks/R&R (7%); indoor hobbies (7%); other miscellaneous e.g., sleep, drive, shopping, etc. (7%); eat/cook/drink (7%); technical sensory pursuits, e.g., TV, movie, videogame, music, etc. (5%); retreat/reflect (3%); meditation/breathing/prayer (3%); and confronting issues (1%). As can be seen from this study, meditation as a practice for stress reduction is not a widely-used strategy, employed by only 3% of the sample. This study points to the relative infancy of the introduction of corporate-sponsored stress management programs that use meditation practices in the workplace. Research on corporate-sponsored meditation programs involving the Transcendental Meditation program have been going on since the mid-1990s (Schmidt-Wilk, 1996). Research on corporate-sponsored meditation programs that use the TM technique have been published in the literature for over 15 years (Schmidt-Wilk, 2003; Schmidt-Wilk, Alexander, & Swanson, 1995, 1996). Appendix A provides a short list of companies that have conducted corporate-sponsored TM programs, and corresponding citations for studies published. Additionally, research on the regular practice of TM has shown statistically significant improvements in areas relevant to the study of SA, including executive judgment, comprehension, and problem solving (Dillbeck, 1982; Orme-Johnson, Kolb, & Hebert, 1977), reduced anxiety caused by stress (Rainforth et al., 2007; Rees & Leffler, 2008; Rosenthal et al., 2011), and improved emotional well-being (Gelderloos, Walton, Orme-Johnson, & Alexander, 1991; Hawkins et al., 2003; So & Orme-Johnson, 2001).

If research on TM has been shown to improve the cognitive functions underlying SA (i.e., perception, comprehension, and projection), what specifically is the impact of TM on developing SA capacity for improved executive judgment and decision making in emerging leaders, and, more broadly, in what ways might the development of improved contribute to the dynamics of leadership resilience? Literature from the fields of OD, NDM and meditation research suggests possible answers to these questions, addressed in Chapter 2.

In summary, impaired or debilitated SA in leaders is becoming a chronic problem, not only for decision makers in high pressure settings of the military, emergency response, and incident command, but for organizational leaders in general who operate within the current environment of uncertainty, complexity, and accelerated change. Toffler (1970) defined the term "future shock" as "the shattering stress and disorientation that are induced in individuals by subjecting them to too much change in too short a time" (p. 10). Conner (1995) posits that the single most important factor to managing change successfully is resilience, or "the capacity to absorb high levels of change while displaying minimal dysfunctional behavior" (p. 6). NDM research has demonstrated that the impairment or debilitation of SA has the potential to negatively impact judgment and decision making. Therefore, the ability to develop the capacity for improved judgment and decision making under stress is a key component of resilience, and the problem addressed by this study.

Purpose, Objectives, and Significance of the Study

The purpose of this research study was to determine whether the SA capacity in emerging leaders can be developed through a novel intervention—the Transcendental

Meditation technique—as determined by objective, "hard measures" of the three elements of SA, perception, comprehension, and projection.

Objectives. The objectives of the study are to (a) introduce the construct of SA from the cognitive sciences for applied use in the field of OD and Change, (b) introduce a cognitive model from ancient Vedic Science (the study of consciousness) and relevant research on the Transcendental Meditation technique as a means of exploring the development of cognitive capacity, (c) test a hypothesis regarding the regular practice of TM and improved SA capacity through a 10-week experiment with emerging leaders, and (d) extend the existing model of SA (Endsley, 1995c) to incorporate development of consciousness as a factor (or not, depending on the outcome of the empirical study).

Significance of the study. The role of impaired or debilitated SA as a result of stress has not yet been fully addressed in organizational change management texts. While the role of stress has been addressed in leadership resilience articles and texts, systematic research on intervention methods that help leaders develop SA capacity remains an open area of research. Therefore, this study aims to contribute to the current literature in four areas.

First, this study explores the many factors (e.g., individual, organizational, task/system) contributed by two constructs of SA (Endsley, 1995c; Sandoval, 2005) from the field of NDM. This represents the first introduction of the construct of SA to the field of OD.

Second, the study adds to the literature on SA by measuring the effects of a well-researched intervention on the development of SA capacity in emerging leaders. Experts in the field of SA report that SA research to date has been largely descriptive, with little

research on techniques that develop SA capacity (Bryant, Lichacz, Hollands, & Baranski, 2004; Endsley, 2004; Rousseau, Tremblay, & Breton, 2004). This study is among the first to formally measure the impact of meditation as an intervention using NDM constructs, thereby contributing to the growing body of prescriptive research on interventions involving meditation to develop SA capacity. Research within the U.S. wildland firefighter community that involves the use of Vipassana meditation or mindfulness meditation has, thus far, been anecdotal (Putnam, 2001).

Third, traditional ways of measuring SA within the NDM research communities involve either the use of high-fidelity, real-time simulation in natural settings, or computerized simulations using real-time structured interview methodologies to measure SA (Endsley, 1987, 1988c, 2000a). This approach is generally time-consuming and labor intensive. This study offers a novel way of measuring SA capacity that is both low cost and easy to administer, thereby supporting the replication of this study to the broader population of organizational leaders.

Finally, the study is significant in that it contributes a multi-disciplinary view of SA, using the perspectives of NDM, OD, and Vedic Science. This multi-disciplinary treatment introduces fresh perspectives into an understanding of the dynamics of leadership resilience and interventions that may impact organizational leaders' ability to better deal with stress known to impair judgment and decision making in high-demand settings.

Research Questions

The research questions for this study are as follows: (a) What is the relationship, if any, between the regular practice of Transcendental Meditation and the development of

SA capacity in emerging leaders?, and (b) Based upon research study findings, is the TM technique a potentially viable intervention for leadership resilience programs aimed at developing SA to improve judgment and decision making under stress?

General Hypothesis

This study tests the main hypothesis that regular (twice daily) practice of the TM technique develops SA capacity, which further affects executive judgment and decision making. This hypothesis was tested within a sample of emerging leaders at the oldest military college in the US, Norwich University, using an intervention group instructed in TM technique and a control group with no intervention. The sample was comprised of both civilian and military full-time students in training.

The sub-hypotheses predict the effect of specific changes to SA using a framework developed by Sandoval (2005), and adapted from the original work of Endsley (1995c). This framework categorized three measures of SA, perception, comprehension, and projection, which are each measured in pre- and posttests in the 10-week study. The construct of SA has high validity and reliability and is based upon 30 years of empirical research (Endsley, 1988b) and extensive theory. Both SA frameworks are presented in detail in Chapter 2.

The following are the hypotheses:

Hypothesis 1. Regular (twice-daily) practice of TM improves situation awareness measures (perception, comprehension, projection).

Sub-hypothesis 1A. Regular (twice-daily) practice of TM is positively associated with perception measures (i.e., reduced response time and errors) as compared to a control group.

Sub-hypothesis 1B. Regular (twice-daily) practice of TM is positively associated with comprehension measures (i.e., reduced errors) as compared to a control group.

Sub-hypothesis 1C. Regular (twice-daily) practice of TM is positively associated with projection measures (i.e., increased constructive thinking and emotional coping) as compared to a control group.

Definition of Terms

The terms in this section are defined in alphabetical order.

Change. This study concerns itself with high demand, high uncertainty, and rapid, dynamic change. In the field of OD, such dynamic change is characterized as *gamma level* or *transformational* change, involving a radical shift from a pre-change state to a post-change state. Transformational, or gamma level, change involves a radical alteration, or paradigm shift, from the status quo (Golembiewski, 1990). According to Golembiewski, gamma level change differs from *alpha* (incremental) change and *beta* change (characterized by emerging issues unknown at the outset of a planned change initiative that result in the altering of the course of a change initiative itself). Gamma level change brings with it, by definition, the element of time pressure, which is frequently associated with high levels of stress by the individual undergoing the change.

Consciousness. From the domain of Vedic Science, the definition of consciousness is, "the underlying field from which matter arises" (Wallace, 1993, p. 42). The Vedic "levels of the mind" model provides an architecture of increasingly abstract, functionally integrated faculties (Yogi, 1969, p. 65) with which to situate the unified field of consciousness referenced by modern quantum physics. The model describes *consciousness* as a silent, unified field that has awareness of no content other than itself.

Decision making. The act of choosing once an initial situation has been assessed. It is a determination after judgment and consideration and refers to a single moment when a leader makes a decision (Endsley, Bolte, & Jones, 2003). This is a non-standard definition of the term *decision*, used by researchers in the field of NDM, the study of how people use their experience to make decisions in field settings.

Executive judgment. The word *executive* in executive judgment refers to those functions of the brain, which are important for successful adaptation in the face of challenges preceding the act of decision making. Executive functions of the brain include a "set of neurologically-based skills and processes involving mental control and self-regulation processes that have to do with managing oneself and one's resources in order to achieve a goal" (Cooper-Kahn & Dietzel, 2008, p. 10). Executive functions are high level abilities that influence more basic abilities like attention, memory, and motor skills necessary for goal-directly behavior and both anticipation of outcomes and adaptation to changing situations. Goia, Isquith, Kenworthy, and Barton (2002) delineate specific abilities under the term of executive functioning as the capacity to hold information in the mind for the purpose of completing a task, as well as planning, organizing, and the ability to think flexibly in response to a need to move from one situation to another. As it pertains to leadership, judgment is defined as "a process unfolding over time (preceding decision making) affecting people, strategy, and crises" (Tichy & Bennis, 2007, p. 86). In NDM, the processes of executive judgment precede the act of decision making.

High-reliability organizations (HROs). Reliability-seeking organizations are organizations that have succeeded in avoiding catastrophes in an environment in which accidents can be expected due to risk factors and high degrees of complexity such as

multiple stakeholders, conflicting demands, and time pressure (Weick, Sutcliffe, & Obstfeld, 1999, p. 14). High Reliability Organizations that are frequently studied include aircraft carriers, air traffic control, wildland firefighters, and nuclear power operations.

Naturalistic decision making (NDM). Initially, NDM was defined as "the study of how people make decisions in the 'real world', under difficult conditions, in order to help them do a better job" (Orasanu & Connolly, 1993, p. 3). Since its inception in 1989, the NDM community has expanded its mission from the definition developed by Orasanu & Connelly (1993) to include the study of pre-decision cognitive functions (i.e., sensemaking, planning, re-planning, mental modeling, and the formation, use and repair of "common ground" by teams) carried out in natural settings under conditions of ill-defined goals, high stakes, organizational constraints, time pressure and uncertainty (McLennan, Holgate, Omodei, & Wearing, 2006). NDM researchers use methods that include structured interviewing, simulation, and task retrospection to explore the types of decision making strategies people use in dynamic, high-demand conditions difficult to capture in the laboratory (Schraagen et al., 2008).

Organization development (OD). OD is "the long-range efforts to improve an organization's problem-solving and renewal processes, particularly through a more effective and collaborative diagnosis and management of an organization's culture through the use of theory and applied behavioral science such as psychology, sociology, cultural anthropology, and organizational behavior" (French, Bell, & Zawacki, 2005, p. 35). Broadly speaking, "OD means organizational change" (Burke, 1982, p. 3).

Resilience. "The capacity to absorb high levels of change while displaying minimal dysfunctional behavior" (Conner, 1995, p. 6). This definition of resilience is

centered on the role of the leader and therefore differs from other, more general definitions of resilience that describe responses to change over longer time cycles, e.g. "to recover, learn from, and developmentally mature when confronted by chronic or crisis adversity" (Patterson, Goens, & Reed, 2009, p. 8). This study supports a definition of resilience as "the ability to bounce back from or cope successfully despite exposure to substantial adversity" (Rutter, 1999, p. 119) as opposed to "an individual trait or characteristic" (p. 135).

Sensemaking. According to Weick, Sutcliffe, and Obstfield (2005), sensemaking is:

> the continued redrafting of an emerging story so that it becomes more comprehensive, incorporates more of the observed data, and is more resilient in the face of criticism, and is about the interplay of action and interpretation rather than the influence of evaluation on choice. (p. 409)

Situation awareness (SA). The operational definition for this study is provided by Endsley (1995c) as "The perception of the elements in the environment within a volume of time and space, the comprehension of their meaning and the projection of their status in the near future" (p. 36). SA is both a state, as well as the activities leading up to the point of decision making that deals with judgment. As this study addresses the development of consciousness through the use of meditation, a supplementary definition of SA is "adequate, externally directed consciousness" (Smith & Hancock, 1995, p. 137), the product of which is a person's knowledge about a situation. Situation awareness can be individualized or shared as members of a team. Team SA is defined as "the degree to which every team member possesses the SA required for his or her responsibilities (Endsley, 1995c, p. 39).

Situation. A set of environmental conditions and system states within which the participant interacts that can be characterized uniquely by a set of information, knowledge, and response options (Endsley, 1995c).

Stress. Stress can include both positive stressors ("eustress") or debilitating stressors (Selye, 1936, 1974, 1978). The operational definition used in this study, developed by NDM researchers Salas, Driskell, and Hughes (1996), is as follows: "a process by which certain environmental demands exceed cognitive resources, resulting in undesirable physiological, psychological, behavioral, or social outcomes" (p. 6). Environmental demands studied in the field of NDM include: (a) incomplete, conflicting information, (b) multiple information sources, (c) rapidly changing, evolving scenarios, (d) requirement for team coordination, (e) performance pressure, (f) time pressure, (g) high work/information load, (h) auditory overload/interference, and (i) threat (Salas et al., 2007).

Transcendental Meditation technique. The Transcendental Meditation technique (TM) is an easily learned mental technique practiced 15 to 20 minutes twice daily sitting comfortably. TM practice involves a mantra (a sound whose effects are known). However, unlike most mantra meditations, any possible meaning of the mantra is not part of TM practice (Travis et al., 2009). Rather, the TM training instructs the individual to appreciate the sound value of the mantra at more "refined levels" (Yogi, 1969, p. 23). Unlike most mantra meditations, TM is not a process of concentration. It is a dynamic process characterized by: (a) movement of attention from the active, surface level of thinking and perception to the more silent and abstract levels of thought, (b) transcendence of the subtlest thinking level to a state of fully awake self-awareness

(called Transcendental Consciousness), and (c) movement of attention back to more active levels (Travis, 2001, p. 1705). These three phases cycle many times in each TM session, and define a state of restful alertness, resulting in deep rest for the body and increased alertness for the mind. The state of restful alertness releases mental and physical stress (Travis & Pearson, 2000).

Summary

This chapter presented the problem addressed by the research study—the impact of impaired or debilitated SA on executive judgment and decision making under stress. The chapter included two key premises: (a) all leaders operating in high-demand settings require SA at the basis of their executive judgment and decision making, and (b) the use of meditation as an intervention to develop SA is not yet widely understood or a part of leadership resilience strategies. Also presented in this chapter was the rationale for a multi-disciplinary treatment of SA from the perspective of the three fields of study.

Organization of the Study

Chapter 2 presents the relevant literature concerning the construct and underlying theories of SA, OD, and TM and the research in these areas. Chapter 3 provides the study methodology, including the research design, procedures, and data analysis. Chapter 4 presents the findings, while the conclusions, implications of the findings, and recommendations for future research are provided in Chapter 5.

Chapter 2: Review of Relevant Literature

The purpose of this multi-discipline literature review is to properly place this study in the context of the existing fields of research that address the topic of executive judgment and decision making as it pertains to leadership resilience, and to confirm the study's unique contribution to the field. Chapter 2 presents multi-discipline theory, constructs, and research that underlie the factors of SA (Sandoval, 2005) from the perspectives of three domains: (a) the study of decision making under stress, NDM; (b) the study of organizations' (and thereby organizational leaders') response to change to better adapt to challenges, OD; and (c) the study of the development of consciousness, Vedic Science, and the theoretical constructs that underlie the mechanics of the TM technique. This chapter also provides a review of the broader research literature on other meditation practices as they relate to leadership resilience.

The construct of SA is used as a unifying theme across each of the three domains. Background on the construct of SA with the emerging field of NDM is first presented in contrast to the older field of Judgment and Decision Making (JDM), from which NDM has broken away (Beach, Chi, Klein, Smith, & Vicente, 1997). Next, grounding in the frameworks of SA is provided. Contributions from the field of OD are then presented, using the SA models as a frame, in the context of organizational and individual factors from the perspective of leadership resilience. The underlying theory and constructs of Vedic Science follow, drawing upon similarities to the SA model (Sandoval, 2005) and theory. Finally, a review of the emerging field of research on meditation as an intervention in the context of cognitive development in leaders is presented.

SA in the Context of Judgment and Decision Making (JDM)

The field of JDM is moving rapidly, and it is a daunting task to comprehend its scope (Goldstein & Hogarth, 1997). Contributors of theory to the field of JDM include decision researchers from cognitive psychology, social psychology, economics, sociology, political science, and anthropology (Ross & Shafer, 2004). Schneider and Shanteau (2003) cite that, due to the complex and multi-disciplinary characteristics of the field of JDM, no single universally accepted framework has emerged.

Beginning in the mid-1980s, research contributions were published regarding how people make decisions in field settings that are characterized by stress, time pressure, and uncertainty from the perspective of a new field of study decision making in dynamic settings instead of the lab. Supported by funding by the military and aviation communities that sponsored behavioral science research, the study of decision making in dynamic settings required more applied methodologies to explore areas such as (a) building resilience to the cognitive demands faced by decision makers within field settings, (b) understanding the abilities of successful leaders in picking up cues in demanding environments, (c) exploring the strategies of experienced decision makers, (d) being aware of the types of errors likely to be made in high demand settings, and (e) understanding how decision makers in applied settings perform their jobs (Klein, Ross, Klein, Hoffman, & Hollnagel, 2003, p. 94).

Field-based contributions of the NDM community grew relatively rapidly through the study of how successful leaders accomplish what they do in dynamic settings without the use of traditional "option generation and comparison" decision-making methods taught in classical decision theory. Over a period of 30 years, NDM researchers

attempted to learn how skilled performers make decisions to identify ways to improve the quality of decision processes and outcomes (Crichton & Flin, 2002). NDM research thus resulted in numerous models related to the NDM perspective. As cited in Schraagen, Militello, Ormerod, and Lipshitz (2008), several of the models include Pennington and Hastie's theory of explanation-based decision making; Montgomery's work on dominance structures; Beach's Image Theory; Hammond, Stewart, Brehmer, and Steinmann's work on Social Judgment Theory; Rasmussen's decision ladder; Cohen, Freeman, and Thompson's Critical Thinking Model; Klein, Calderwood, and Clinton-Cirocco's Recognition-Primed Decision model; and Endsley's Situation Awareness Model.

This study builds upon the SA Model developed by Endsley (1995c) and extended by Sandoval (2005) to include organizational culture as a new factor. Originally developed as a part of military research, SA is part of every aviator's vocabulary, no matter the level of the aviator's flight experience (Prince & Salas, 1998). SA is recognized in multiple disciplines that rely on judgment and decision making in dynamic situations such as manned flight, aviation, military operations, incident command, and emergency response, which require a continuous need to recognize and understand the requirements of a dynamic situation (Prince & Salas, 2000) .

NDM studies focus almost exclusively on populations of decision makers in high-demand settings under stress (Joiner & Josephs, 2007; Klein, 1996; Thompson, 2010; Weick & Sutcliffe, 2007). NDM studies are highly varied, ranging from individual SA in fire-ground commanders who supervise teams of firefighters (Klein, Calderwood, & Clinton-Cirocco, 1986), to team SA in Navy leadership command and control settings

(Wohl, 1981), and organizational SA regarding the nature of errors in nuclear power plants (Rasmussen, 1983). Researchers Pliske, McCloskey and Klein (2001) observe that what is clear to the NDM community is that (a) even though decision makers are required to work under time pressure, they are still often able to do a good job, and (b) decision makers do not have sufficient time to deliberate between a variety of options but instead are able to use a their experience to act quickly under time pressure even when there is a good deal of uncertainty about the outcome of their actions.

With the construct of SA situated within the field of Naturalistic Decision Making and the larger domain of Judgment and Decision Making, the review continues with the criteria for selecting the construct of SA as a central theme for this study. The review then continues with grounding in the framework of SA.

Criteria for Selecting the SA Construct Over Other NDM Frameworks

The SA model (Endsley, 1995c) was selected over other NDM models as the key construct for this study for five reasons. First, the construct has a body of research that focuses on the study of decision makers in dynamic settings over the past 25 years and is, therefore, widely accepted within the NDM and human factors research literature. Second, the research methodology protocols for measuring SA have evolved over time, resulting in high validity and reliability scores. (Although the established methodologies for ascertaining SA area not used in this study, validity and reliability scores have been researched and verified in order to convey that the construct is sound and highly regarded in the field of NDM). Third, numerous textbooks and research studies also have been published on the construct and measurement of SA, using the SA Model developed by Endsley (Banbury & Tremblay, 2004; Endsley, 2004; Endsley et al., 2003; Endsley &

Garland, 2000). Fourth, the roots of the Endsley (1995c) and Sandoval (2005) SA frameworks have a high degree of compatibility with the continuum of levels of the mind model from Vedic Science (Alexander, Heaton, Chandler, Miller, & Cook-Greuter, 1994; Alexander & Langer, 1990). Vedic Science is the study of the development of consciousness (theory), supplemented by the TM technique, an easily learned procedure to effortlessly transcend thought (Alexander, Rainforth, & Gelderloos, 1991). Fifth, the construct of SA has been widely socialized in military training programs and, therefore, is familiar to the target population of emerging leaders who are enrolled in a leadership curriculum at Norwich University, a military college, where the research study was conducted.

Situation Awareness Models and Leadership Resilience

There are over 32 definitions of SA (Banbury & Tremblay, 2004). The construct encompasses components of sensory information (perception), memory, comprehension, and information integration. Though a highly researched construct, few models of SA have been found in the literature (Sandoval, 2005).

SA is grounded in the theories that posit that an individual's knowledge, capacities, and beliefs direct consciousness of the environmental state (Smith & Hancock, 1995). Smith et al., as cited in Sandoval (2005), use Neisser's (1976) model of the perceptual cycle to describe the fundamental dynamics of continuous interplay between the environment, knowledge, and action at the very basis of SA. The perceptual model developed by Neisser describes three components. These elements are (a) an individual's schema, defined by Bartlett (1932) as "a map or structure of knowledge stored in long-term memory" (p. 45), (b) the process of exploration of the environment by sampling of

information, and (c) the object of perception, about which available information further modifies the individual's map or structure of knowledge. New or updated schemata serve to direct attention and exploration associated with perception, which may alter the environment, which then further influences and updates the individual perceiver's schema. Smith and Hancock (1995) use the three-component Neisser model as a framework to show how the perceiver interacts with the environment in adapting to cues in the environment. Adams et al. (1995) also use this model to describe SA as both a product, i.e., "that state of the active schema" (p. 102) and a process, i.e., "the state of the perceptual cycle at any given moment" (p. 103). Weick (1995) refers to the three components of perception to describe the most fundamental processes that underlie sensemaking. In the Neisser model, cues inform the schema of the perceiver, causing an influence that contributes to the reshaping of the perceiver's mental map.

Overview of the Endsley SA Model From the Field of NDM

The abundance of research using Endsley's SA Model (1995c) points to its centrality in the field of NDM, making it the model most widely referenced by SA researchers. This model focuses on the cognitive view of SA and displays the relationship of SA with judgment, decision making, and performance (Sandoval, 2005). In Endsley's SA Model (1995c), three successive levels of SA are articulated, which are listed in order of their cognitive depth as perception, comprehension, and projection. Each successive level builds upon the preceding level. A hierarchy of three succeeding phases of SA depends on the successful completion of the previous phase. Perception first takes in the results of the exploration of the environment for cues, followed by the

process of sensemaking (comprehension), and finally, the projection of the future state (or anticipation of what will happen next).

Expressed in the language of the study of decision making in dynamic settings, the three levels of SA that contribute to judgment that lead up to the point of decision making are Level 1 SA (perception), Level 2 SA (comprehension, sensemaking, or understanding), and Level 3 SA (projection of the future state). Level 1 SA requires that the individual properly perceive "the status, attributes, and dynamics of relevant elements in the environment" (Endsley, 1995c, p. 36). The individual must be able to acquire all of the information relevant to the elements of the situation at hand. Level 2 SA involves the "sensemaking of the situation…based on a synthesis of disjointed Level 1 elements" (Endsley, 1995c, p. 37). This step requires the individual to correctly combine information perceived from various elements and arrive at an appropriate high level view. The environmental elements must be integrated with the goals of the individual relative to that situation at hand. Level 3 SA incorporates "the ability to project the future actions of the elements in the environment" (Endsley, 1995c, p. 37). This is achieved upon the successful acquisition of Levels 1 and 2 SA and often involves the use of "gut" feelings, and recognition of similar patterns from previous experiences (Klein & Hoffman, 1993).

The Endsley (1995c) model also presents an extensive set of internal and external factors that further affect the individual's SA. Since grounding in the SA model is foundational to this study, Figure 1 illustrates the complete visual depiction of the Endsley SA model. A brief review of the two groups of factors in the Endsley model, individual factors and task/system factors, follows. The study uses an adaptation of the

Endsley model (Sandoval, 2005) which includes a third group of factors, organizational culture.

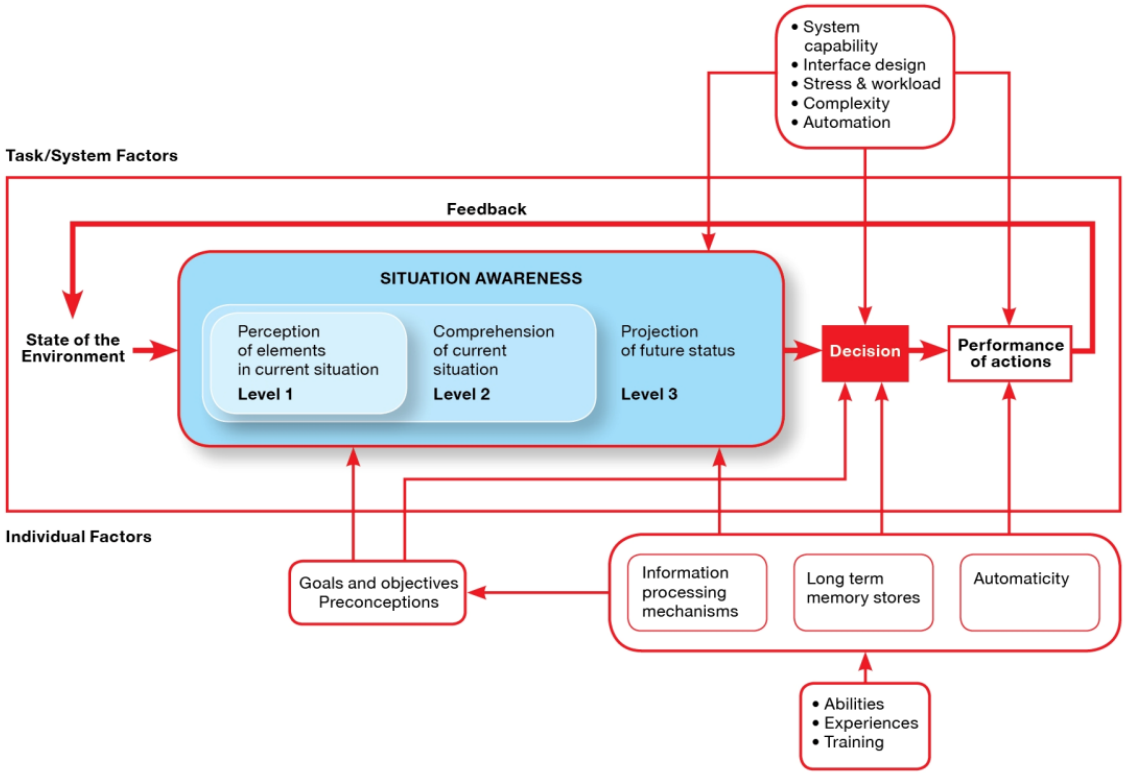

Figure 1. Model of situation awareness in dynamic decision making. Adapted from "Toward a theory of situation awareness in dynamic systems," by M. Endsley, *Human Factors, 37*(1), p. 35. Copyright 1995 by the Human Factors and Ergonomics Society. All rights reserved. Reproduced with permission.

Figure 1 shows three highlighted components of SA as antecedents of decision making and the performance of action. SA is a stage separate from decision making and performance and is depicted as the individual's internal model of the state of the environment (Endsley, 2000b). The other two elements described in the model depicted in Figure 1, external task/system factors and individual factors, are described briefly below.

Task/system factors. There are five Task/System factors in the SA model (Endsley, 1995c) that influence the individual's internal model of the state of the environment. These factors are described by Endsley (2000a) to include system capability, interface design, stress and workload, complexity, and automation, which are described here.

System capability is a factor which addresses technology features that are designed to support the individual to quickly find, sort, integrate, and process relevant information. Where this is a shortcoming or mismatch in technology features of the system and the information gathering needs of the individual, either inadequate information or information overload is likely to be experienced.

Interface design is a second factor which addresses the ease with which an individual can gather information based upon their capabilities and needs in a given situation. Poorly designed technological interfaces to systems intended to provide information result in either too little or too much information. An entire field of study called Human Factors is dedicated to molding technological interfaces around the individual's needs which prepares designers to effectively match the use of information to the needs of the individual.

Stress and workload are factors often abbreviated as WAFOS (Workload, Anxiety, Fatigue, and Other Stressors). NDM researchers have observed in the literature that elements of stress can become an issue not only when one's own well-being or others' lives are at stake, but also when factors like self-esteem, career advancement, or high-consequence events are involved. According to Endsley (2003a),

> Stressors can be physical in nature. Many environments have high levels of noise or vibration, excessive heat or cold, or poor lighting. Physical fatigue and working against one's circadian rhythm can also be a major problem for many people… Each of these stressors can significantly strain SA. First, they can act to reduce an already limited working memory by using up a portion of it. There are essentially fewer cognitive resources available for processing and information in memory to form SA. As reliance on working memory can be a problem anyway, stressors, such as these only exacerbate the problem. Second, people are less able to gather information efficiently under stress. They may pay less attention to peripheral information, become more disorganized in scanning information, and be more likely to succumb to attentional tunneling. People are more likely to arrive at a decision without taking into account all available information (termed premature closure). Stressors will undermine SA by making the entire process of taking in information less systematic and more error prone. (p. 35)

Complexity introduced into the design of products have made it difficult for people to form and retain a clear mental model of how the product or system works (Endsley, 2003b). This can result in annoyance and frustration in product or system usage and tragic loss of life in critical systems. For instance, Wiener (1993) has documented that pilots who have worked with automated flight management systems for a period of years report significant problems in understanding what the system on board their aircraft is doing and what they as pilots should do next.

Overseeing automation requires equally accurate SA as when individuals are working alone. Research has shown that people often are slow to detect that there is a problem with an automated system (Endsley, 2003a). Once a problem is detected, it can take considerable time to reorient oneself to the situation well enough to understand the nature of the problem and what should be done about it (Kessel & Wickens, 1982). This loss of SA can be deadly due to lag time in taking over via manual performance of automated systems (Endsley, 1993, p. 175).

Individual factors. These factors include goals and objectives and preconceptions that directly impact SA, as well as abilities, experience, and training that influence individuals' information processing mechanism, long-term memory stores, and automaticity (i.e., the degree to which an action is routine or internalized as second nature).

Goals, objectives, and preconceptions help to determine which environmental elements to pay attention to in the course of performing a task. Objectives create expectations that affect how attention is directed, how information is perceived, and how information is interpreted. An individual's goals and plans dictate which aspects of the surroundings are noticed. The perceived information is then incorporated and interpreted in light of these goals to form Level 2 SA (comprehension). If an individual pre-occupied with a set of goals is not responsive to cues which indicate that a new goal is more important (e.g., mechanical failure or an aircraft on the runway), a significant SA failure can occur. Endsley (2003b) delineates role of expectations thusly:

> Like goals, a person's predetermined expectations for a given situation can change the way SA is formed. Expectations are based upon mental models, prior experiences, instruction, and communication from other sources. Expectations guide how attention is directed and how an individual absorbs the information perceived. Expectations also provide a vital shortcut in mental processing, to enable them to process the large volume of data in the world. (p. 27)

Goals and objectives act as a perception filter, without which working memory would be overloaded in acquiring and interpreting information from the environment. In this way, pilots who have incorrectly matched landmarks to their expectations (i.e., operating from an incorrect filter) have been known to go seriously off course, sometimes with tragic results (Endsley, 1995b).

Deep subject matter expertise and experience that has been developed to a point of unconscious competence (also called automaticity) contributes significantly to SA by allowing individuals to develop the mental models, schema, and goal-directed processing (e.g., current goals, expectations) that are critical for SA in most domains. Examples of individual's highly developed skills based upon pattern-recognition/action-selection sequences that have become automatic are driving a car, flying an aircraft, or mastery of a sport. Automaticity frees up mental effort for more demanding tasks (Endsley, 2003b). Automaticity can also be a significant problem for SA when mental tasks are involved. Endsley (2003b) describes the impact of automaticity on SA thusly:

> Information outside of the scope of routinized sequences may not be attended to when automaticity of mental tasks is involved. Thus, SA suffers if that information is important. For example, when a new stop sign is erected on a well-traveled route home, many drivers will drive right past it, not even noticing this new and significant piece of information. Checklists are heavily emphasized in the aviation domain to help protect against the shortcomings of processes that can become too automatic and this prone to certain errors. (p. 29)

Abilities, experience, and training also enter into the SA model as individual factors within the SA model. Current interventions in aviation (Reason, 1997) and military populations (Bryant et al., 2004) designed to develop SA have relied most heavily on the individual factors of education (training) and simulation (experience) with some success. There is agreement in the research community that additional approaches to develop SA capacity are needed (Moray, 2004; Rousseau et al., 2004).

This high-level grounding in the theory and factors that comprise the SA model was intended to present a foundation for understanding the full extent of symptoms of debilitated SA in leaders during the time of judgment and decision making in the following section. Because SA is a contributor to executive judgment and decision

making under stress, understanding the factors of the SA model may also provide insight and understanding of several elements underlying leadership resilience.

Sandoval's (2005) extension of the Endsley SA model with the addition of organizational factors i.e., culture, is presented later in this section.

The Impact of Debilitated SA in Leaders' Judgment and Decision Making

Research on specific symptoms that affect leaders' judgment and decision making under stress is provided in this section in context of the theoretical construct of SA (Endsley, 1995c). These symptoms of debilitated SA will likely prove familiar to readers who have worked closely with organizational leaders engaged in sustained periods of transformational, or gamma level, change. Chapter 1 presented a definition of gamma level change as involving the deep restructuring of schemata (maps or structures of knowledge stored in long-term memory) within a short period of time (Golembiewski, Billingsley, & Yeager, 1976). It is important to note that these symptoms are not yet documented in the vast amount of OD literature on organizational change; however, they are frequently encountered in leaders who are susceptible to stresses brought about by sustained levels of transformational change, and well documented in research from the field of NDM and human factors. These symptoms are presented here.

Symptoms of debilitated SA in leaders. Increased susceptibility to sustained periods of chronic and acute stress effects manifest in a variety of ways, depending on the type of decision the leader is required to make (Svenson, 1997). The following symptoms of debilitated SA are often described in incident post-mortem debrief reports of high-demand situations, where the environmental demands of dynamically changing

conditions (e.g. stress) exceeded leaders' resources, resulting in undesirable physiological, psychological, behavioral, or social outcomes (Salas et al., 1996, p. 6).

Dekker (2006) describes two behaviors, attentional tunneling and regression, frequently observed in leaders who have become overwhelmed cognitively, usually by stress factors but sometimes by other conditions such as the requirement to rapidly drop existing beliefs or assumptions about the functioning of the outer world.

Dekker (2006) describes attentional tunneling as the tendency to see an increasingly narrow portion of one's environment. Bartlett (1943) describes attentional tunneling as locking in on certain aspects or features of the environment that the decision maker is trying to process and intentionally or inadvertently dropping his or her scanning behavior.

Another symptom of debilitated SA, known as regression, is defined as the tendency to revert to earlier learned routines even if not entirely appropriate to the current situation (Thompson, 2010). Weick describes the phenomenon of regression thusly:

> There is good evidence that when people are put under pressure, they regress to their most habituated ways of responding. What we do not expect under life-threatening pressure is creativity. (Weick, 1993, p. 45)

A number of post-hoc assessment reviews have addressed how debilitated SA influenced decision makers in their command decision making during the attacks on the World Trade Center on September 11, 2001. Specifically, several reports acknowledge instances of the phenomenon of regression among many front line responders such as hotline operators, resulting in either abandonment of or failure to execute procedures in which they were previously trained in the face of high demand and stress (Dayson, 2010; Hocevar et al., 2004; Pfeifer, 2005). These reports are addressed further in this section.

Endsley et al. (2003) describe seven additional detractors or "enemies" of SA. These include requisite memory trap, workload fatigue and other stressors (WAFOS), data overload, misplaced salience, complexity creep, errant mental models, and out-of-the loop syndrome. Each of these "enemies" of SA are defined by Endsley below.

Requisite memory trap. Defined as "features of the current situation, brought together into the central repository or short term memory, rapidly fading away due to limited caching that exceeds approximately seven plus or minus two chunks" (Endsley et al., 2003, p. 33).

Workload, anxiety, fatigue, and other stressors (WAFOS). Defined as "a taxing of SA due to environmental conditions within which a decision maker must operate when one's well-being is at stake. Stressors undermine SA by making the entire process of taking in information less systematic and more error prone, as well as arriving at decisions without taking into account all available information, or premature closure" (Endsley, 2003a, p. 35).

Data overload. Defined as "information intake that quickly outpaces the ability of the decision maker's sensory and cognitive system; when there is more data than can be processed by the human brain, the person's SA becomes outdated or contains gaps" (Endsley, 2003a, p. 36).

Misplaced salience. Defined as "many pieces of information vying for one's attention exceeding the decision maker's capacity to seek out information relevant to his/her goals" (Endsley, 2003a, p. 37).

Complexity creep. Defined as the "inability of the decision maker to form sufficient internal representations of the features making up a system and how it works due to feature escalation" (Endsley, 2003a, p. 39).

Errant mental models. Also called a representational error, a mental model is used to explain, combine disparate pieces of information, interpret the significance, and develop reasonable projections of what will happen in the future. A "false or errant internal representation or "map" makes it difficult for a decision maker to detect cues and explain away conflicting cues to fit the mental model they have selected" (Endsley, 2003a, p. 40).

Out-of-the-loop syndrome. Generally associated with automation, out-of-the-loop syndrome is defined as "a gap in understanding on how the automation is performing and the state of the elements the automation is supposed to be controlling" (Endsley, 2003a, p. 41).

These "enemies" of SA were documented by researchers in the field of NDM. However, they are equally applicable to organizational leaders in high-demand settings of uncertainty, ambiguity, and gamma level change, who are likely to experience similar demands that overwhelm their capacity to make judgment calls and decisions under stress.

Physiological bases of debilitated SA. This section describes the physiological bases of these "enemies" of SA and how stress incapacitates the human physiology and cognitive abilities. Research has found that stress and its impact on cognitive and emotional abilities may provide a partial explanation of debilitated SA on judgment and decision making (Thompson, 2005).

The process of response to stressful stimuli begins with a signal from the brain to the thalamus, which acts as an air traffic controller sending information to the prefrontal cortex (or CEO of the brain) and to the amygdala, the emotional center of the brain that responds quickly to incoming stimuli (Goldberg, 2001). The prefrontal cortex (PFC) controls higher level functioning such as logic, analysis, and decision making, while the amygdala plays a major role in emotional responses. A cascade of neurotransmitters and hormones are then released into an individual's physiology, resulting in a short-term increase in strength, concentration, and reaction time (Arnsten, 1998). If the stress remains at high levels for a long enough period of time, deleterious effects will follow. This deleterious effect causes the brain to figuratively hit the "reset" button and wipe out or diminish current capacity for short-term and long-term memory and the awareness of surroundings. The debilitating effect of chronic stress on the brain is described thusly:

> The initial release of neurotransmitters and hormones into a leader's system begins to affect major brain systems, particularly the prefrontal cortex (PFC) and the amygdala. Too much stress "turns off" the PFC, resulting in a drop in IQ and ability to control the amygdala. Stress temporarily reduces IQ! At the same time, the increased stress "turns on" the amygdala creating an overly-sensitive heightened state of emotion. A leader loses a significant ability to "control" his/her emotions, thus becoming not only temporarily cognitively impaired, but also less emotionally intelligent! (Thompson, 2007, p. 3)

An overload of the PFC results in sudden, dramatic changes in the leader's ability to judge and make decisions. Thompson (2010) refers to the impairment of SA due to stress by leaders with proven track records as Catastrophic Leadership Failure (CLF), symptomatic of mental paralysis or poor decision making. Everly et al. (2010) describe the phenomenon of acute prefrontal inhibition as the "dumbing down" effect (p. 114). Precipitated by the effects of stress due to high pressure and urgency, the leader's ability

to think clearly is impaired as the human "fight or flight" response releases adrenalin and noradrenalin in amounts so high that they cause certain neurological pathways in the brain to short-circuit. This short-circuiting functionally interferes with the biological processes involved in effective decision making and emerges when increasing demands, mounting pressure, and urgency to make an important decision overwhelms the leader's cognitive resources.

Thompson (2006) posits that successful leadership under stress requires both capacity and ability to use a blended response to stress with both the pre-frontal cortex (or Chief Executive Officer of the brain) and the amygdala (the emotional center). Thompson advocates that leaders arm themselves with best practice strategies for managing specific stressors that take the biggest toll of decision making, including meditation practices that have shown a correlation with the reduction of the effects of stress.

Sources of research from the NDM community. Post hoc reports of catastrophic events such as the 2001 terrorist attacks in New York and Washington, the 2005 category 5 hurricane (Katrina) in the Gulf of Mexico, and the 2004 tsunami in Thailand reveal a pattern of leaders' losing their ability to lead under conditions of overwhelming stress, severely impacting judgment and decision making to the point of rendering leaders incapacitated and ineffective (Denning, 2006; Hocevar et al., 2004; Jackson et al., 2001; Pfeifer, 2005).

In many emergency response settings, people work not just as individuals but as members of a team. NDM research also has included incidents that involve team SA, defined in Chapter 1 as "the degree to which every team member possesses the SA

required for his or her responsibilities" (Endsley, 1995c, p. 39). The aircraft carrier USS Vincennes' shooting down of a commercial airliner; the Three Mile Island nuclear plant accident; the collision between the Pan Am and KLM planes in Tenerife; the Flixborough chemical plant explosion; and the Pan Am 401 crash in Miami (Flin & Arbuthnot, 2002) are examples of NDM research involving team-level SA which led to critical errors in performance that was undermined by team members with poor SA. Individual and team SA has also been explored extensively in the wildland firefighter community (Omodei, McLennan, & Reynolds, 2005; Omodei, McLennan, & Wearing, 2005; Omodei, Taranto, et al., 2005; Omodei & Wearing, 1995; Omodei, Wearing, McLennan, & Clancy, 2005). The individual SA of leaders, studied in relation to the collective SA of individual team members, prompted the development of this definition of "team" from within the NDM research community. SA researchers define *team* as:

> A distinguishable set of two or more people who interact dynamically, interdependently, and adaptively toward a common goal and valued goal/objective/mission, who have each been assigned specific roles or functions to perform, and who have a limited life span of membership. (Salas, Dickinson, Converse, & Tannenbaum, 1992, p. 3)

SA is vital in the military and critical incident professions. Endsley's (1995c) SA framework highlights key individual and system/task factors that influence the level of SA in individuals who operate in high-demand settings.

Over the past 30 years, attempts by NDM experts to develop SA have yielded hundreds of studies, yet research is still in progress as the need to develop resilience in leaders in high-demand settings remains an area of open questions. The call from experts in the NDM community for more prescriptive research on approaches to develop SA capacity has created the impetus for this study. Before addressing interventions that can

be used to develop SA capacity and improve resilience under stress, a review of the contributions of the field of OD in the context of organizational leadership and change are presented, using the Sandoval (2005) model of SA to frame the literature review.

Organizational Culture as a Factor in Situation Awareness

Chapter 1 outlined the pressures for change that have resulted in an increase in leadership susceptibility to stress. Two of the key points presented were: (a) today's organizational leaders must operate in high-demand settings, characterized by uncertainty, complexity, and dynamic change, and (b) conditions marked by ill-structured problems; uncertain dynamic environments; shifting, ill-defined or competing goals; time stress; high stakes; and multiple players are no longer unique to or characteristic of the military, incident command, and emergency response management populations studied in NDM.

The field of OD and Change (ODC) has made many contributions to the literature on leadership and leadership resilience as they relate to the dynamics of stress, judgment, and decision making within transformational change (Cummings & Worley, 2001; Golembiewski et al., 1976; Worley & Feyerherm, 2003). The following section highlights some of these contributions in context of the SA model proposed by Sandoval (2005). The Sandoval model represents an important extension of the basic SA model (Endsley, 1995c) as it (a) proposes a new factor, organizational culture, and (b) provides the underlying framework for this study.

Overview of the SA Model Incorporating Culture

Sandoval (2005) measured the impact of organizational culture as a factor of SA in a doctoral dissertation that involved United Nations Peacekeeping soldiers who

participated in simulations. The results of the study found that organizational culture plays a key role as a filter in the process of soldiers' SA, and the Endsley (1995c) model was extended to include the new factor. Figure 2 provides the extension of social factors (i.e., organizational culture) to the Endsley model.

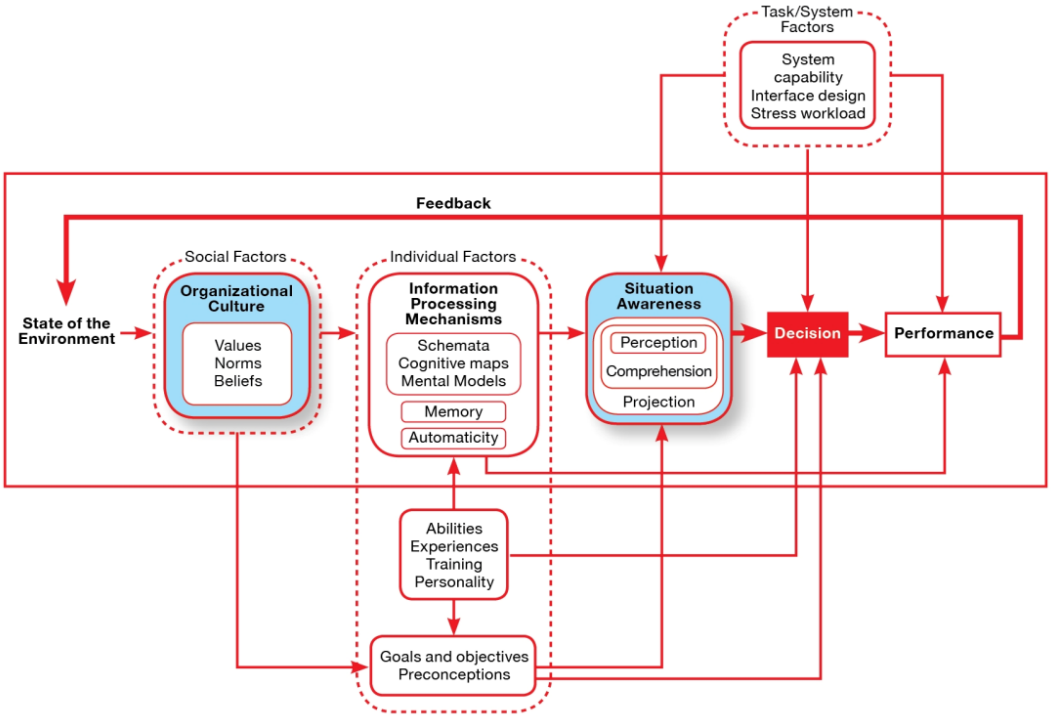

Figure 2. Model of situation awareness with organizational culture as a factor. Adapted from *The influence of organizational culture on situation awareness and decision making in a simulated peacekeeping environment*, Doctoral dissertation by A. Sandoval. Copyright 2005 by the author. Reprinted with permission.

Sandoval (2005) further deconstructed the individual factors identified by Endsley that influence SA. These elements include information processing mechanisms of schemata, cognitive maps, and mental models. Combined with other factors presented in the Endsley model (i.e., memory and automaticity), this extension of the SA model demonstrates the efforts of researchers from the human factors and NDM community to continually refine, define, and extend the term SA in ways that lead to useful, valid, and

reliable measurement (Karwowski, 2006; Stanton, Salmon, Walker, Baber, & Jenkins, 2005). Through the incorporation of social factors (organizational culture comprised of values, norms, and beliefs), Sandoval's SA framework becomes a useful framework for reviewing the multiple components of leadership resilience individually contributed by OD theorists and scholars. These contributions are reviewed within the context of the SA factors proposed by Sandoval, which extends the initial SA model developed by Endsley (1995c). A review of elements of the Sandoval SA model follows.

Task/System factors. These factors remain unchanged from the Endsley (1995c) model described earlier in this chapter.

Individual factors. These factors also remain unchanged from the Endsley (1995c) model described earlier in this chapter, but with the addition of schemata, cognitive maps, and mental models enumerated more explicitly. Ability, experiences, training, and personality are also components of this factor. These elements were also discussed previously in this section.

Social factors. Values, norms, and beliefs embedded in the organizational culture were explored by Sandoval (2005) as contributing factors. The Sandoval study adopted a definition of culture posited by Schein (1992), expressed as "implicit assumptions that guide behavior, that tell group members how to perceive, think about, and feel about things" (p. 22). Her research addressed the questions: Is there a general effect of organizational culture on SA and decision making? Do specific characteristics of organizational culture adversely affect SA and decision making? What cultural characteristics positively affect SA and what culture characteristics negatively affect

decision making? Are all levels of SA affected by organizational culture? Are all levels of SA affected by organizational culture in a similar manner? (Sandoval, 2005).

The results of Sandoval's SA research experiment support theories that demonstrate a relationship between culture and SA by affecting behavior specifically through influences on perception. Sandoval (2005) posits that culture simplifies information in the environment for the individual by filtering what to give attention to and what to ignore. Culture in turn influences perception and the definition of reality by establishing the filters that act as "preconditions of choice," (Vaughan, 2002, p. 46) which in turn affect an individual's interpretations and responses to potential danger signals in the environment. The findings of Sandoval (2005) with regard to the influence of culture on SA and decision making are summarized below.

First, the military sample groups that had the most military experience and training did not score as well in three of four SA and decision-making measures. These findings were posited as a reflection of errors or failures that may have resulted from culturally-shaped SA and decision strategies that are applied in contexts not in line with the organizational culture. Second, higher scores were found in another sample group of cadets who were yet to be fully acculturated into the military. Sandoval (2005) posited that the cognitive processes from which SA and decision making were based may not yet have been influenced by the military culture.

The following section highlights constructs common to NDM and OD that address the potential for debilitated or improved situation awareness in leaders.

Theoretical Constructs Common to SA and OD

The field of OD concerns itself with assessing, diagnosing, designing, and delivering interventions that positively affect the performance of individuals, teams, and the organization (Cummings & Worley, 2001). Such efforts are frequently sponsored or led by individuals in leadership roles whose judgments and decisions are made within environments characterized by uncertainty, complexity, and stress.

Theorists and scholars in the field of OD have explored factors that influence leadership, judgment, and decision making in the context of change (Lewin, 1935; Lewin, Lippitt, & White, 1939; Lippitt, Watson, & Westley, 1958). Several of the key constructs from the field of OD and Organizational Behavior (OB) are presented below.

Sensemaking (or Level 2 SA). As presented in Chapter 1, the organizational theorist Karl Weick (1996) has contributed seminal research on sensemaking through his work in the context of high-reliability organizations (Weick & Sutcliffe, 2001, 2007). Sensemaking is closely related to the NDM concept of Level 2 SA or comprehension (Endsley, 1995c, 2000b; Klein, 1993). The exploration of the construct of sensemaking has largely been based upon in-depth analyses of post hoc reviews of wildland firefighter fatalities associated with decision making under stress (Weick, 1993, 1996), medical triage and clinical nursing (Benner, 1994), and military friendly fire incidents (Snook, 2001). Additionally, Starbuck and Mezias (1996) and Starbuck, Milliken, and Hambrick (1988) have also studied perceptual filters in managers. These contributions, as well as the development of constructs on the role of schemata, cognitive maps, and mental models as limiting factors during dynamic, high-demand settings requiring change, define

a natural overlap and content affinity in the work of NDM and OD theorists and researchers.

Schemata, cognitive maps, and mental models. The role of schemata, cognitive maps, and mental models features prominently in the literature referenced in the field of OD. These constructs include *governing beliefs* (DeRubeis & Beck, 1988; Lau & Woodman, 1995; Markus & Zajonc, 1985), *paradigms* (Kuhn, 1996), *frames* (Goffman, 1974), *theories-in- use* (Argyris & Schon, 1978), *templates* (Bartunek & Moch, 1987), *prisms* (Marshak & Katz, 1991), as well as the original research on *cognitive maps* (Bougon, Weick, & Binkhorst, 1977). Organization change frameworks and change theory address the role of mindsets and competencies and are the very core of leadership in the design and execution of planned change initiatives. Other scholars in the field of OD who address the role of mindsets and levels of leadership development as it relates to change include Bion (1961), Bartunek (Bartunek & Moch, 1987;1994), Culbert (1996), Golembiewski et al. (1976), Schein (1983, 2003), and Torbert (2004), among others.

Transformational leadership. Transformational leadership is extensively referenced in the leadership resilience literature as a means of creating a culture resilient to gamma level stress (e.g., requiring paradigm change). Bass (1998) and Burns (1978) have addressed the role of culture created by transformational leaders in inspiring subordinates to higher levels of effort and commitment. Conceptually, their transformational leadership theory includes four elements: idealized influence, inspirational motivation, individualized consideration, and intellectual stimulation (Bass & Avolio, 1994). The transformational leader theory has been studied as a factor of resilience development, which is presented later in this section. Argyris et al. (1985)

have developed theories that address organizational dysfunction and resilience, using reflection as a means of surfacing implicit beliefs within the culture. Several organization theorists have advanced versions of models used by OD practitioners to help leaders surface implicit beliefs that are deeply embedded in the culture (Argyris, 1990, 1992; Daft & Weick, 1984; Gray, Bougon, & Donnellon, 1985; Mitroff, 1983; Morgan & Ramirez, 1984; Senge, 1990).

A number of OD theorists have advanced the premise that adaptive behavior and/or problem solving in individuals and organizations are guided by sets of conscious, but implicit, governing beliefs (Argyris, 1976, 1990; Senge, 1990; Senge, Jaworski, Scharmer, & Flowers, 2005). Approaches contributed by organizational theorists from the field of OD include action learning and single-loop (incremental learning of new skills and capabilities); double-loop (reframing or reshaping patterns of thinking); and triple-loop (significant shift in context or point of view) learning to inform, surface, and identify implicit beliefs that can incapacitate an individual or organization (Argyris et al., 1985; Nielsen, 1993). Several of the leadership resilience programs presented in this literature review have been influenced by and built upon the "frame" provided by organizational theorists in the field of OD. The role of organizational culture as a factor in situation awareness (perception, comprehension, and projection of the future state) would therefore appear to be a natural extension of the topics that concern practitioners, scholars, and researchers in the field of OD. The following section reviews examples of three current leadership resilience models in the literature based upon OD constructs, and one which has moved toward incorporating the use of meditation practice to develop SA capacity.

Review of Leadership Resilience in the Context of SA

Four factors that support resilience have been proposed: hardiness, self-confidence and self-efficacy; positive emotion; emotional intelligence; and age, experience, and education (Dalzell, 2009).

Using the Sandoval (2005) SA model as a way to frame the examples of leadership resilience programs from the literature, examples selected include programs based upon individual factors such as personality (hardiness); abilities and training (transformational leadership); the leader's preferred schemata, cognitive maps, and mental models (constructive thinking, emotional intelligence); and programs emphasizing the critical importance of experience, goals, and objectives. Only one of the resilience programs highlighted directly addresses the development of SA capacity through meditation practices to reduce stress and improve cognitive ability under stress.

Leadership resilience. As might be expected for a relatively recent phenomenon, there is little agreement in the literature as to what makes up the construct of leadership resilience and less agreement as to the dynamics which underlie resilience. According to the Zellars et al. (2011),

> Despite the well-documented evidence that resilience can lead to benefits in multiple life domains, researchers continue to struggle to identify the mechanisms by which resilience can contribute to positive outcomes for individuals, groups, and organizations. Some of this difficulty likely occurs in the lack of agreement between scholars regarding what exactly resilience is and how it is obtained. (p. 8)

Zellars et al. (2011) have conducted an extensive review of leadership resilience development programs. The definition of resilience that serves as the basis for their research views resilience as neither a state (trait) nor a process. Chapter 1 set forth the

definition used by Zellars and supported by this study, i.e., "the ability to bounce back from or cope successfully despite exposure to substantial adversity" (Rutter, 1999, p. 119) as opposed to "an individual trait or characteristic" (p. 135). This perspective is at odds with the "hardiness personality trait" view of resilience, which is presented in the following section. In the Sandoval (2005) model of SA, personality is one of several individual factors that would influence the degree to which an individual maintains SA under stress.

Hardiness, Abilities, and Training

Bartone (2006) has conducted research on hardiness as a personality trait to protect military professionals from the ill effects of stress on health and performance. Hardiness is viewed as "a characteristic sense that life is meaningful, we choose our own futures, and change is interesting and valuable" (Bonanno, 2004, p. 84). Bartone and colleagues (Bartone, 1999; Bartone, Johnson, Eid, Brun, & Laberg, 2002; Bartone & Snook, 2000) posit that hardiness as a personality trait, coupled with transformational leadership skills, improves resiliency in military cadets and that hardiness is a stronger factor than transformational leadership as a pathway to resiliency in groups. Using constructs of transformational leaders developed by Bass (1998), Bartone's research on resilience combines and explores (a) hardiness, a personality trait, as a predictor of resilience, as well as (b) the degree to which leaders who are high in hardiness and transformational leadership influence their subordinates in interpreting stressful experiences in characteristics of high-hardy persons. This seminal research on leadership resilience in the military population builds upon the work of OD theorists Bass and Avolio (1990) and Burns (1978) and key studies are highlighted in Table 1.

Bartone's research combines both personality trait (hardiness) and leaders' abilities and training in transformational leadership, the second component of resilience as defined by Dalzell (2009). The next category of leadership resilience addressed is positive emotion.

Table 1

Hardiness and Resilience Findings

SA Element	Resilience Factor Measured	Sample Size/Population	Findings
Personality/ Culture	Hardy leader effect on groups (Bartone, 1999; Milan, Bourne, Zazanis, & Bartone, 2002)	n = 435; West Point cadet seniors	Hardiness, transformational leadership style and other variables are significant independent predictors of leader performance. Using 15-item scale (shortened version of the Dispositional Resilience Scale), average leader performance ratings were evaluated across 4 years (multiple R = .23, $F(8, 1141) = 11.95$, $p < .001$).
Personality	Hardiness (Bartone & Snook, 2000)	n = 362; West Point cadets (female)	Hardiness is a strong predictor of leader performance.
Culture	Hardy leader effect on groups (Bartone et al., 2002)	Norwegian Navy officer cadets	Hardiness and small unit leadership positively influence cohesion; hardiness and leadership interact to influence cohesion.

Positive Emotion (Constructive Thinking and EI)

Leaders' preferred schemata, cognitive maps, and mental models have been shown to play an important role in resilience (Dalzell, 2009). Two examples of leadership resilience from the literature, one which employs constructive thinking and

one which focuses on emotional intelligence, are presented here. Referencing the Sandoval (2005) SA model as a contextual frame, positive emotion approaches to leadership resilience represent examples of the individual factors of abilities, experiences, training and personality.

Constructive thinking during problem solving has been linked to leadership resilience (Hede, 2010). Atwater (1992) investigated the prediction of leadership performance from measures of intellectual ability, personality traits, and constructive thinking in 86 students at the U.S. Naval Academy. Intellectual ability was not significantly related to training performance ($r = .01$), whereas Behavioral Coping was ($r = .25$, $p < .01$). Epstein (1998) has developed a Constructive Thinking Inventory (CTI) based upon empirical research in high-stress populations that involved battered women, college and university students, as well as professions associated with high occupational stress such as emergency room (ER) nurses, executives, and school administrators. This study incorporates the use of the CTI inventory as a measure of emotional coping skills in the Level 3 SA, projection.

The constructive thinking approach to leadership resilience is based on Epstein's (1998) cognitive-experiential self-theory (CEST) which assumes that individuals have two parallel, interactive information-processing systems: (a) an automatic, preconscious, emotionally driven learning system, and (b) a conscious, verbal, deliberate, rational system (Stacciarini & Troccoli, 2004). In resilience programs, measurement of constructive thinking refers to the degree to which a person's automatic thinking in the experiential system facilitates problem-solving in everyday life at a minimum cost in stress (Epstein & Meier, 1989). Constructive thinking, or preconscious decision making

and interpretive processes that are separate from intellectual ability, can be measured using the Constructive Thinking Inventory instrument, regarded by Hurley (1991) as "a promising tool for probing non-intellective cognitive behaviors" (p. 234).

The second component of the positive emotion approach to leadership resilience is emotional intelligence (EI). Over the past decade, there has been increasing acknowledgement of the role of emotional competence in effective management. In 2006, the U.S. Army leadership doctrine was introduced in Field Manual (FM) 6-22, which includes 12 leader attributes and 8 leader competencies (Sewell, 2011). According to Sewell, resilience, listed as a subset of EI, is included as one of the 12 leadership attributes, and is "the first recognition of the importance of resilience in Army leadership doctrine" (p. 79).

The Chief of Staff of the Army, General George W. Casey, Jr., describes this recognition in the rollout of the U.S. military's first Comprehensive Soldier Fitness Program: "We needed to bring mental fitness to the same level of attention that we give to physical fitness because we're dealing with the realities of war" (Millerrodgers, 2010, p. 1). This quotation acknowledges the impact of eight years of war and the stress of multiple tours of duty, and illustrates the increased importance that Army leadership has placed on soldier resiliency. According to the program's website, the vision of the Comprehensive Solider Fitness (CSF) program is to create "an Army of balanced, healthy, self-confident Soldiers, families and Army civilians whose resilience and total fitness enables them to thrive in an era of high occupational tempo and persistent conflict" (p. 1). The CSF initiative encompasses five core areas, or "Five Dimensions of

Strength" that concentrate on physical, emotional, social, family, and spiritual components.

Leadership resilience and emotional intelligence are assessed by certified coach/counselors, taught by master resiliency trainers who attend a 10-day course in how to assess, train, and coach leaders on methods to install resilience in their subordinates. The work is based on emotional intelligence theory, which encompasses emotional, personal, social, and survival aspects of intelligence. Components of the Bar-On (1997) model of emotional intelligence adopted by the U.S. Army are discussed here. This model defines emotional intelligence competencies in five key composite realms with 15 subscales. These realms and subscales highlight major areas of focus for improving soldier resiliency. The five key composite realms in this model are intrapersonal, interpersonal, adaptability, stress management, and general mood. Competencies for each realm are (a) intrapersonal (emotional independence, self-awareness, assertiveness, self-regard, and self-actualization); (b) interpersonal (empathy, social responsibility, interpersonal relationship); (c) adaptability (reality testing, problem solving, flexibility); (d) stress management (stress tolerance, impulse control); and (e) general mood (optimism, happiness).

The U.S. Army has begun to integrate resilience training into each of its officer and enlisted professional military education courses. Sewell (2011), an assistant professor of military leadership at the Command and General Staff College, Fort Leavenworth, Kansas involved in the delivery of the program, posits that key opportunities to change to the Army's culture are missing from the current iteration of the CSF program, specifically leaders' modeling of strength and acknowledging the soldiers'

emotions in order to support soldiers' collective ability to develop resiliency. The program is less than 2 years old and still a work in progress. The Comprehensive Soldier Fitness model is the first large scale, comprehensive leadership resilience program to address stress management through the ongoing studies of use of interventions involving meditation, such as the Transcendental Meditation program. This program addresses three of the factors in the Sandoval (2005) SA model: social, individual and task/system. The U.S. military is also currently exploring the factor proposed by this study through research on meditation techniques as a means of develop SA through the development of consciousness.

Age, Experience, and Education

The leadership resilience program proposed by the national government of Canada provides an example of a leadership resilience program that emphasizes age, experience, and education as key factors of resilience. A report by the National Conference Board of Canada (Archibald & Munn-Venn, 2008) identifies six core governance principles required to respond to national security and public safety incidents: leadership and accountability, cooperation and coordination, mandate and resources, communication and transparency, fairness, and continuous learning. This government report focuses specifically on the principles of leadership and accountability and identifies the pre-selection of leaders as a key opportunity. According to the Archibald and Munn-Venn (2008),

> There is no substitute for experience when responding to crises. Selection of leadership should be blind to politics and focus on credibility, legitimacy, and knowledge. While no one can be 100 percent ready for every crisis, selecting individuals who have extensive experience will ensure they have a deep background of practices and relationships on which to draw when they are facing

> the unfamiliar. Likewise, the credentials of these individuals will reassure the public in times of emergency and encourage trust. (p. iii)

Archibald and Munn-Venn (2008) posit that the top three recommendations for building resilience are to (a) base leadership selection on experience; (b) lead locally, and (c) exercise, exercise, exercise. In the context of the Sandoval (2005) SA model, this approach to developing SA and leadership resilience favors the influences of experience, abilities, and training to develop automaticity.

The following section introduces literature on research on meditation as an intervention to develop cognitive capacity.

Current and Proposed Interventions to Develop Situation Awareness Capacity

This section addresses (a) current, more traditional interventions from the NDM literature for developing SA to better manage oneself in high-demand settings; (b) emerging research on meditation practices in general as a means to develop cognitive capacity; and (c) research and theoretical constructs on the specific intervention selected for this study, the TM technique, from Vedic Science. The emphasis on leaders' need to manage their cognitive capacity to be effective in dynamic environments, presented as a key component of adaptive leadership by Heifetz, Grashow, and Linsky (2009), is presented thusly:

> To practice adaptive leadership, you have to help people navigate through a period of disturbance as they sift through what is essential and what is expendable, and as they experiment with solutions to the challenges at hand. This disequilibrium can catalyze everything from conflict, frustration, and panic to confusion, disorientation, and fear of losing something dear. Consequently, when you are practicing adaptive leadership, distinctive skills and insights are necessary to deal with this swirling mass of energies. You need to be able to do two things: (1) manage yourself in that environment and (2) help people to tolerate the discomfort they are experiencing. (p. 28)

Current Approaches to Develop SA from the Field of NDM

In the NDM community, significant efforts over the past 40 years have focused on developing an understanding of SA, acquiring conceptual and methodological knowledge on how to measure SA, and developing developmental theories of SA that explore factors related to individual differences in SA (Endsley & Garland, 2000). To date, the majority of SA research has been descriptive rather than prescriptive (Banbury & Tremblay, 2004). Interventions to date have primarily included training and simulations to apply theory in practical settings. Examples of these approaches include training to develop SA in flight crews on commercial transport aircraft at British Airways (Robinson, 2000), airline pilots at Alitalia and Aero Lloyd (Hoermann, Blokzijl, & Polo, 2004), hazard awareness in drivers in the UK and Australia (McKenna & Crick, 1994), and army platoon leaders (Strater et al., 2004). Other interventions to support (rather than develop) SA have included numerous research studies on the design of technological interfaces to reduce complexity of information for the decision maker (Banbury & Tremblay, 2004). Human factors researchers have also completed numerous studies addressing the impact of physiological factors such as WAFOS (workload, anxiety, fatigue, and other stressors) on decision making through interventions involving rest, diet, and exercise (McLennan et al., 2006; Omodei, McLennan, & Reynolds, 2005; Omodei, Taranto, et al., 2005).

Arbuthnot (2002) posits that decision making under stress is the main area in which scientists have done a great deal of high-quality work and reached some clear conclusions, but that relatively little of it has been assimilated into the training and selection of leaders. While research has been translated into various techniques in training, simulation, post hoc reviews, and human factor design, the ability to develop

cognitive improvement at the individual level required for improved judgment and decision making under dynamic and stressful conditions has remained an open challenge in the field (Butler et al., 1998; Endsley & Robertson, 2000; Putnam, 2001). SA researchers (Endsley, 2004) report that relatively few programs have attempted to specifically train SA to date, and that training programs directed at enhancing the most fundamental cognitive skills, and at boot-strapping the acquisition of knowledge bases, can improve on the hit-or-miss processes currently in play.

Research on Meditation Practices as Context for Proposed Intervention

This section provides a review of the challenges in researching meditation, a review of the different categories of meditation in general, and a review of meditation research as an intervention to developing cognitive capacity in leadership contexts.

The study of consciousness has been the domain of meditation and meditative practices for more than 5,000 years (Walters, 2002). The scientific study of meditation has become a subject of increasing interest over the past 40 years (Murphy et al., 1997), as evidenced by the increase in the therapeutic uses of meditation in health care since the mid-1990s. A 2007 study funded by the U.S. Department of Health and Human Services (DHHS) documented the rate of publication of studies involving meditation as interventions in the health care sector thusly,

> Eight hundred and thirteen studies provided evidence regarding the state of research on the therapeutic use of meditation practices. The studies were published between 1956 and 2005, with half of the studies published after 1994. Most of the studies were published as journal articles. Studies were conducted mainly in North America (61 percent). Of the 813 studies included, 67 percent were intervention studies (286 randomized-control studies, 114 non-randomized-control, and 147 before-and-after studies) and 33 percent were observational analytical studies (149 cohort and 117 cross-sectional studies). (Ospina et al., 2007, p. 3)

The DHHS study is thought to be significant, according to its authors, as being the first systematic examination of the components of and training for individual meditation practices (Cassel, 1974; Ospina et al., 2007). Shear (2006) supports this finding in his overview of meditation practices as becoming increasingly popular in western culture.

Meditation practices primarily have been adapted to the specific interests of Western culture as a complementary therapeutic strategy for a variety of health-related problems (West, 1980). As of 2007, there were an estimated 10 million practitioners of meditation in the United States and hundreds of millions of practitioners worldwide (Duerr, 2008) .

Meditation is an umbrella term that encompasses a family of practices that share some distinctive features but vary in important ways in their purpose and practice. There are several challenges in studying the diverse range of meditation practices, not the least of which is reaching an inclusive definition of the term *meditation*. For example, Ospina et al. (2007) report challenges of cross-tradition research on meditation with regard to confusion and lack of consensus around the definition of the term. According to the study authors,

> Despite the lack of consensus in the scientific literature on a definition of meditation, most investigators would agree that meditation implies a form of mental training that requires either stilling or emptying the mind, and that has as its goal a state of "detached observation" in which practitioners are aware of their environment, but do not become involved in thinking about it. (p. 16)

The definition of meditation developed by Ospina et al. (2007) reflects the current challenge of attempting to explore the nature of different meditation procedures in such a manner that takes into consideration the wide variety of practices. As not all meditation

practices require effort, stated goal end states, or result in *detached observation*, this definition would be viewed as problematic or inaccurate by expert researchers in the field of meditation research. To address the challenge of a procedure-neutral framework with which to discuss the variety of meditation practices, meditation researchers Travis and Shear (2010) developed a classification system from the abundance of research using electroencephalogram (EEG) measurement of electrical activity of the brain. Published EEG research on 9 different meditation practices (i.e., loving-kindness compassion, Qigong, Zen-third ventricle, Diamond Way Buddhism, Vipassana meditation, ZaZen meditation, Sahaja yoga, concentrative Qigong, and the Transcendental Meditation technique) were analyzed to identify characteristics of each practice, with regard to differences in attentional control, subject/object relation, and procedures. Using existing research, Travis and Shear (2010) proposed three categories of meditation practices, each distinguished by its EEG markers and cognitive processes used by the practitioner. The resulting three categories are presented here to advance the understanding of the diversity of meditation practices and to clarify the selection of the meditation intervention selected for this study within a context of other practices. The three categories of meditation practices defined by Travis and Shear (2010) based upon EEG markers were focused attention, opening monitoring, and automatic self-transcending. Each category is described here.

Focused attention. In focused attention or concentrative styles of meditation, voluntary control of attention and cognitive processes is maintained by the meditator at all times through sustained attention focused on a given object. When attention is found to be wandering, the meditator brings the mind back to the object of attention (Cahn &

Polich, 2006). According to Travis and Shear (2010), EEG research on meditation practices in the focused attention category are characterized by brainwave activity measured in the gamma (30-50 Hz) and beta2 (20-30 Hz) range. Meditation practices in is category of meditation using focused attention include loving-kindness compassion, Qigong, Zen-3rd ventricle, and Diamond Way Buddhism.

Open monitoring. In open monitoring or mindfulness-based meditation, the individual practice involves reflection and awareness of the nature of emotional and cognitive patterns of ongoing experience. Research involving EEG and meditation practices for this category were grouped around the 5-8 Hz bandwidth, and include Vipassana meditation, ZaZen meditation, Sahaja yoga, and concentrative Qigong (Travis & Shear, 2010).

Automatic self-transcending. Meditation practices in this category involve minimal cognitive control and transcend or go beyond the procedures of the meditation. Research on meditation practices within this category have EEG markers in the alpha1 (8-10 Hz) range, and include the Transcendental Meditation technique and Qigong. According to Travis and Shear (2010), a characteristic of automatic self-transcending meditation procedures is the involvement of minimal cognitive control or effortlessness, since cognitive control increases mental activity.

The analysis of meditation practices using EEG markers characterizing each practice by Travis and Shear (2010) found that "each of the three meditation categories–focused attention, open monitoring, and automatic transcending–included different meditation practices with different degrees of attention control, different degrees of subject/object relations, and different procedures" (p. 1116). Research from which the

research study was in all cases developed using non-equivalent or matched control group designs, with the exception of the first four studies on the practice of the TM technique, which used random assignment designs.

Table 2

Three Categories of Meditation Characterized by EEG Band

Meditation Category/ EEG Band	Category Elements	Different Meditation Practices

Focused attention Gamma (30-50 Hz) Beta (20-30 Hz)	Voluntary control of attention and cognitive processes	• Loving-kindness-compassion: increased frontal-parietal gamma coherence and power (Lutz, Rawlings, Ricard, & Davidson, 2004)
		• Other studies with singe group or case study designs
		  • Qigong: (Litscher, Wenzel, Nidederweiser, & Schwarz, 2001)
		  • Zen–3rd ventricle: (Huang & Lo, 2009)
		  • Diamond Way Buddhism: (Lehmann et al., 2001)

Open monitoring Theta (5-8 Hz)	Dispassionate, non-evaluative awareness of ongoing experience	Vipassana meditation (Cahn, Delorme, & Polich, 2010): decreased frontal delta, increased frontal midline theta and increased occipital gamma power Zen meditation (ZaZen) (Murata, Koshino, & Ormari, 1994): increased frontal midline theta Sahaja Yoga (Aftanas & Golocheikine, 2001): increased frontal midline theta and coherence Concentrative Qigong (Pan, Zhang, & Xia, 1994): increased frontal midline theta
Automatic self-transcending Alpha1 (8-10 Hz)	Automatic transcending of the procedures of the meditation practice	• Transcendental Meditation (TM) technique (Dillbeck & Bronson, 1981): increased frontal alpha coherence • TM technique (Travis et al., 2010): increased frontal alpha1 power and decreased beta1 and gamma power: increased alpha1 and beta1 frontal coherence; and increased activation in the default mode network • TM technique (Travis & Wallace, 1999): increased frontal coherence in the first minute of TM and continued high coherence throughout the session • TM technique (Travis, Tecce, & Durchholz, 2001): higher frontal alpha coherence during transcending • TM technique (Travis & Arenander, 2006): higher frontal alpha1 coherence (cross-sectional design) and increasing frontal alpha coherence (1 year longitudinal design) • TM technique (Hebert, Lehmann, Tan, Travis, & Arenander, 2005): enhanced anterior/posterior alpha phase synchrony • Other case study: Qigong (Qin, Jin, & Hermanowicz, 2009)

Note. Adapted from "Summary of meditation-categories and associated EEG frequency bands (left column), characteristic elements of each meditation-category (middle band), and meditation practices that fit into each category as determined by the published EEG patterns," by F. Travis and J. Shear, 2010, *Consciousness and Cognition*, *19,* 1110-1118. Copyright 2010 by Elsevier. Reprinted with permission.

With the framework of categories of meditation practices provided by Travis and Shear (2010), examples from the literature on the use of meditation practices currently in use to develop cognitive capacity in decision making contexts are reviewed here.

The role of mindfulness meditation, an open monitoring meditation procedure, was first introduced to the wildland firefighter community in the mid-1970s. Dr. Ted Putnam, an experimental psychologist and retired smokejumper with the U.S. Forest Service, contributed to the research on stress and fatigue on wildland firefighters by introducing the use of breathing techniques to develop SA capacity (Bell, 1999). Putnam, who participated on several post hoc assessment reports of fire disasters such as the Mann Gulch and South Canyon fires (2000), which claimed the lives of several highly experienced firefighters, promoted the importance of human factors and the development of SA capacity as a means to address the challenge of debilitated judgment under stress (Maclean, 1999, p. 270). Weick and Putnam (2006) have since continued to promote the use of practices such as mindfulness and Vipassana meditation (both open monitoring meditation procedures) in the literature as a means of developing situation awareness. The widespread adoption of the use of meditation practices in the U.S. Forest Service an intervention to develop SA capacity is in the early experimental stages. No formal research on meditation as an intervention has been published in the wildland firefighter community to date.

In the U.S. military, the rollout of the Comprehensive Solider Fitness program has catalyzed research efforts on meditation as both a stress reduction technique and an intervention to develop cognitive capacity under stress (Gregg, 2008; Pargament &

Sweeney, 2011; Reivich, Seligman, & McBride, 2011; Vujanovic, Niles, Pietrefesa, Schmertz, & Potter, 2011). Mindfulness meditation, an open monitoring meditation procedure, has recently been studied in relation to data overload and decision making in the military personnel (Shanker & Richtel, 2011), as well as in improved resilience to stress to support compassion fatigue and burnout in military care providers (Duerr, 2008).

While there is an abundance of research that links the efficacy of meditation to stress reduction and cognitive improvement, the use of meditation as an intervention is still in its infancy with regard to it application in leadership resilience programs. To accelerate interest in meditation research with regard to developing SA capacity, this study therefore proposed (a) an experiment designed to measure the effects of the Transcendental Meditation technique on SA capacity, and (b) depending on the results of the study, an extension to the SA model used in this study (Sandoval, 2005) introducing development of consciousness as a factor. The literature review continues with an overview of the research on the Transcendental Meditation technique, the intervention proposed for this study on development of SA capacity to improve judgment and decision making under stress for improved leadership resilience.

Proposed Approach to Develop SA Capacity Using the TM Technique

Recent studies in the U.S. military have been published that focus on the use of the TM technique as an intervention to restore cognitive impairment linked to Post-Traumatic Stress Syndrome (Rosenthal et al., 2011). The TM technique, practiced for 15 to 20 minutes twice daily, is one of the most widely used mind-body approaches to reduce psychological distress.

Research studies on the TM technique have been conducted and published in peer-reviewed journals, which screen out studies that may have been biased by the orientation of the investigators (Schneider & Fields, 2006). Research institutions that have conducted studies on the TM technique include universities and medical schools such as Harvard Medical School, Yale Medical School, University of Virginia Medical Center, University of Michigan Medical Center, University of Chicago Medical Center, University of Southern California Medical Center, UCLA Medical School, and Stanford Medical School. The numerous published studies on the TM program have met the high standards of peer review (Shear, 2006).

Research on the TM technique has included relevant studies on leadership resilience in the form of reported benefits of improved holistic thinking in managers in Sweden (Gustavsson, 1992); greater ability to manage work-related stress (Schmidt-Wilk et al., 1995); reduced trait anxiety, job tension, insomnia, and fatigue (Alexander et al., 1993); improved reaction time and field independence, which is a measure of broader comprehension (Pelletier, 1974); increased brain coherence and improved functioning (Travis & Arenander, 2006); and increased orderliness of cognitive capacity through the measure of brain wave coherence (Travis & Arenander, 2006; Travis et al., 2009; Travis, Tecce, Arenander, & Wallace, 2002).

Table 3 highlights several of the studies on cognitive development most relevant to the development of SA capacity mapped to the three elements of SA i.e., perception, comprehension, and projection, from existing models from Endsley (1995c) and Sandoval (2005). Table 3 cites relevant studies and their respective outcomes within the context of these three elements of SA.

Table 3

Selected Research on the TM Technique and SA Elements

SA Element	Measure	Sample Size/Population	Findings
Perception	Reaction time (Orme-Johnson et al., 1977)	*N* = 50; college students (25 TM meditators; 25 control group)	Students practicing the TM technique have faster reactions than non-meditators ($p < .01$).
Comprehension	Culture Fair Intelligence Test (So & Orme-Johnson, 2001)	*N* = 362; high school students in Taiwan	TM practice produced significant effects on all variables (compared to no-treatment controls (*p* levels ranged from .035 to <.0001.
	Fluid intelligence (Dillbeck, Assimakis, Raimondi, Orme-Johnson, & Rowe, 1986)	*N* = 15; college students over 4-year period	Findings: Increased fluid intelligence, $p < .001$; and field independence (growth of a more stable internal frame of reference, increased perceptual acuity), $p < .005$).
Projection	Culture Fair Intelligence Test (So & Orme-Johnson, 2001)	*N* = 362; high school students in Taiwan	See above

Studies have also shown significant results which can be linked to resilience such as reductions in blood pressure (Anderson, Liu, & Kyrscio, 2008; Rainforth et al., 2007), anxiety (Eppley, Abrams, & Shear, 1989; Sheppard, Staggers, & John, 1997), depression (Sheppard et al., 1997), improved coping ability (So & Orme-Johnson, 2001), and brain functioning and stress reactivity (Travis et al., 2009) in students and adults.

The following section reviews the definition of TM and presents the constructs underlying the TM technique from Vedic Science.

TM technique. TM was defined in Chapter 1 as an effortless technique that brings about a deep physiological rest called *restful alertness* or a hypometabolic functioning of the mind and body (Roth, 1994). TM is defined in the Corsini Encyclopedia of Psychology and Neuroscience as,

> a dynamic process characterized by: (a) movement of attention from the active, surface level of thinking and perception to the more silent and abstract levels of thought; (b) transcendence of the subtlest thinking level to a state of fully awake self-awareness (called Transcendental Consciousness, or Atman, in Sanskrit); and (c) movement of attention back to more active levels (Wallace, 1986).

TM comes from the Vedic tradition of India, introduced to the West by Maharishi Mahesh Yogi in the 1950s (Alexander, 1994). During TM, a state of deep rest in the physiology is achieved through the use of a mantra, or sound, which is used to effortlessly move the attention from the active, surface level of thinking and perception to the more silent, abstract levels of thought and back to more active levels many times throughout the course of the meditation (Wallace, 1986). It is the absence of concentration (i.e., effortlessness) in using the mantra and the ease in dealing with thoughts that may arise during TM that distinguishes it from other forms of meditation (Shear, 2006, p. 32). This point is in direct contrast to the definition of a mantra by Ospina et al. (2007) as "a sound, word, or phrase that is recited repetitively, usually in an unvarying tone, and used as an object of concentration" (p. 27).

TM gets its name from the process of transcending the subtlest thinking level to a state of fully awake self-awareness (called Transcendental Consciousness, or Atman, in Sanskrit) as the awareness gradually settles down, remaining silently awake within itself

(Schneider et al., 2001). The founder of the Transcendental Meditation technique, Maharishi Mahesh Yogi (1995), has explained how the TM technique functions thusly:

> During this technique the individual's awareness settles down and experiences a unique state of restful alertness; as the body becomes deeply relaxed, the mind transcends all mental activity to experience the simplest form of awareness – Transcendental Consciousness – where consciousness is open to itself. This is the self-referral state of consciousness. (p. 174)

This state of awareness is described as the simplest form because the consciousness is fully awake. It is described as transcendental because it is beyond thought and perception and as a self-referral state because the consciousness refers only to itself (Farrow & Hebert, 1982) .

The ancient study of consciousness, called Vedic Science, refers to this dynamic of the experience of Transcendental Consciousness that underlies the finest level of thought as the simultaneous experience of knower, known, and the process of knowing (Alexander, Davies, Dixon, Dillbeck, Druker, Oetzel, Muehlman, & Orme-Johnson, 1990). *Veda* is a Sanskrit word that connotes complete or unified knowledge, which is said to be gained only at the highest level of development, in which knower, known, and the process of knowing are fully integrated (Yogi, 1986). Parallels with the three-component perceptual model proposed by Neisser (1976) which underlies SA theory are presented in Figure 3. In Vedic Science, the schema of the knower, explores objects of perception (the known) through the process of knowing.

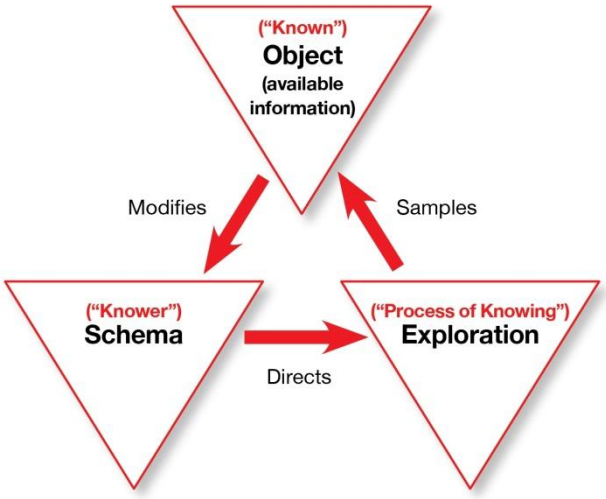

Figure 3. Knower, known, and process of knowing in Vedic Science.

The full potential of the mind is said to be available in the simplest state of awareness, or Transcendental Consciousness. Experiencing it has practical value for leaders. The term *organizing power* as used here refers not only to skill in action (Yogi, 1969), but also to the ability to accomplish things, described the author thusly:

> The experience of Transcendental Consciousness develops the individual's latent creative potential while dissolving accumulated stress and fatigue through the deep rest gained during the practice. This experience enlivens within one's awareness creativity, dynamism, orderliness, and organizing power, which results in increasing effectiveness and success in daily life. (Yogi, 1995, pp. 174-175)

TM requires no change in beliefs, philosophy, religion, or lifestyle (Schneider et al., 2002). Although understanding of the underlying theoretical constructs plays no role in the practice, the following theoretical grounding is provided to understand its similarities with the construct of SA.

The most frequently referenced theoretical construct used to understand the mechanics of TM is expressed in Figure 4, in the form of the model of the mind from

Vedic Science. The explicit goal of Vedic Science is to promote advanced stages of development of the knower (Dillbeck, 1983; Orme-Johnson, 1988; Yogi, 1969).

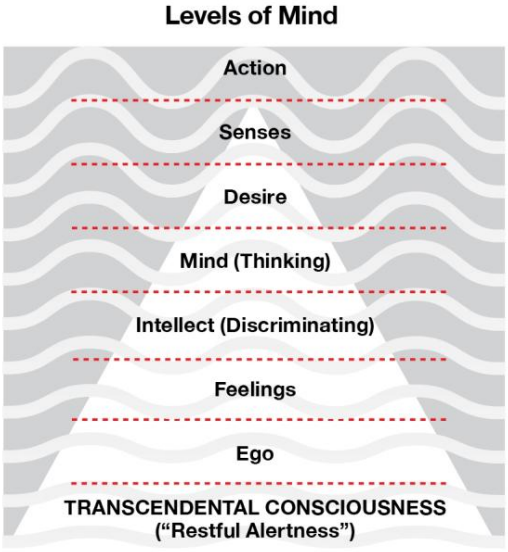

Figure 4. Model of the mind according to Vedic Science.

Vedic Science postulates that the mind is hierarchically structured in layers (see Figure 4) from active, gross levels at the surface to increasingly more subtle, settled, and progressively abstract levels (Yogi, 1972). From more active to subtle levels, these levels of the mind are correspondingly linked to the faculties of action and the senses, desire, the thinking mind, the discriminating intellect, feeling and intuition, and the active knower or individual ego (Yogi, 1969). According to Vedic Science, the emergence of a thought from the least excited level of consciousness results from the interaction of sensory input with "the storehouse of impressions" (Yogi, 1969, p. 284; i.e., long-term memory store) associated with the individual ego at the finest level of the mind. The thought comes to be experienced at a more or less precipitated level of its development, depending primarily on one's current level of cognitive development and state of the

physiology (Alexander, Davies, Dixon, Dillbeck, Druker, Oetzel, Muehlman, & Orme-Johnson, 1990). Vedic Science also posits that these progressively subtler levels of the mind display greater capacity to order and integrate experience (Dillbeck & Alexander, 1989). These progressively subtler levels of the mind may typically lie outside of conscious awareness because they operate at finer levels of excitation, comparable to finer time-distance scales or higher frequency modes than are those currently accessible to awareness (Alexander, Davies, Dixon, Dillbeck, Druker, Oetzel, Muehlman, & Orme-Johnson, 1990). In the model of the mind provided by Vedic Science, when the mind transcends the subtlest level of thought and experiences Transcendental Consciousness, knower and known are no longer linked through the excited, localized processes of knowing. The knower is the known, and hence self-knowledge is direct and immediate. Familiarity with the quieter levels of the thinking process throughout the period of 20 minutes twice a day is said to enliven the qualities of energy, creativity, and intelligence, which has been measured extensively in the literature on TM (Orme-Johnson & Farrow, 1977).

The introduction of Vedic Science (the study of consciousness) and its experiential mental technique for developing human consciousness (the TM technique) incorporates vast knowledge on the mechanics of human cognition. The mapping of the ancient cognitive model postulated by Vedic Science to SA framework developed by Endsley (1995c) and extended by Sandoval (2005) provides a starting point for understanding the dynamics of resilience. In Figure 5, Level 1 SA, perception, is mapped to the most active level of the mind, the senses. Level 2 SA, comprehension, is mapped

to the discriminating faculties of the mind and intellect; and Level 3 SA, projection, is mapped to feelings and intuition.

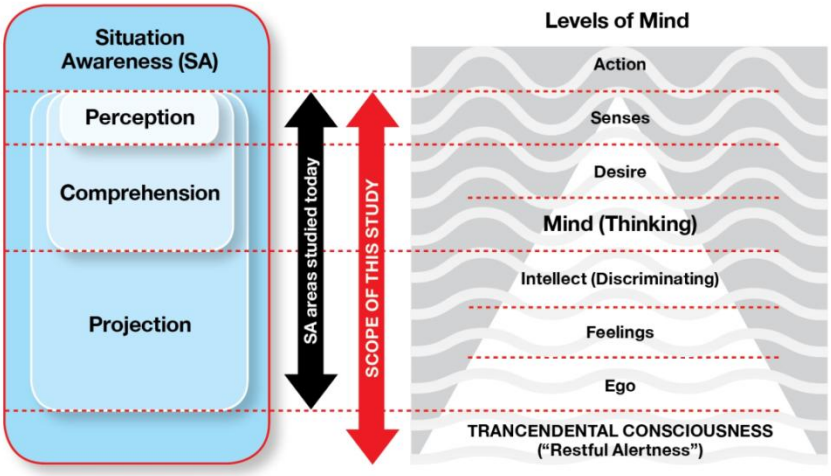

Figure 5. Levels of mind from Vedic Science mapped to situation awareness.

The hypothesis of the study is that regular practice of the TM technique for 20 minutes twice a day enlivens and develops these levels of the thinking process, resulting in measurable improvements in perception capacity, comprehension capacity, and projection capacity. To explore the development of SA capacity, a repeatable, evidence-based meditation intervention is required. The following section provides the criteria for selection of the TM technique as the intervention of choice for this study on the development of SA capacity and the improvement of judgment and decision making under stress.

Vedic Science has been chosen as a framework for discussion on the development of SA capacity for several reasons: (a) this ancient knowledge has been presented in scientific, testable terms and has sought to relate its fundamental principles systematically

to those investigated by the modern sciences (Chandler, 1987); (b) Vedic Science makes available a uniform set of procedures, e.g., the TM technique, that are simple to practice, require no change in lifestyle or belief system, and are predicted to accelerate development of consciousness markedly without altering its basic form or sequence (Alexander, Davies, Dixon, Dillbeck, Druker, Oetzel, Muehlman, Orme-Johnson, et al., 1990); and (c) more than 6 million people worldwide have been instructed in this procedure across cultures, many of whom have made themselves available for scientific study, resulting in the largest existing body of empirical research that investigates the impact of meditation techniques on human development (Orme-Johnson & Farrow, 1977). Each of these three criteria is discussed further in the following section.

Scientifically testable approach. Murphy and Donovan (1997) posit that the most prolific research on meditation in the United States in sheer numbers of published studies has been and continues to be on the TM technique. The TM technique is one of several meditation techniques that have generated a great deal of research interest and government funding over the years. The U.S. National Institutes of Health (NIH) has funded over $24 million in research grants to study the effects of the Transcendental Meditation technique on health, medicine, and other areas of research (Schneider & Fields, 2006, p. 76). Over the past two decades, David Orme-Johnson, PhD, one of the key investigators of TM, and his colleagues have compiled and edited over 600 studies on TM (Wallace, Orme-Johnson, & Dillbeck, 1976-1990), arranged approximately in chronological order under the headings of physiology, psychology, sociology, and then in either theoretical or review-oriented papers. Experimental studies are divided between articles in refereed journals and those from TM conferences and in-house publications.

Uniform instruction and procedures. Detailed procedures on the process of instruction in the TM technique are provided in Chapter 3. This section provides an overview of the course in light of selection criteria for a technique that is easily learned. TM is usually taught in a course that comprises five to six hours of instruction, including personal instruction and follow-up, over four days (Ferguson, 1975). General information about the technique is presented in a 1-1/2-hour lecture. More specific information on the origin of TM and how it compares with other practices is given in a second, 1-hour lecture. Those interested in learning the technique meet with a certified teacher for a 5- to 10-minute interview. The participant learns the technique on a separate day in a 1- to 1-1/2-hour session, following a short ceremony in which the mantra is given to the prospective practitioner.

The next three sessions consist of 1-1/2-hour meetings held over the following three days, in which the teacher explains the practice of the technique in more detail, corrects practice if necessary, and explains practical arrangements (e.g., when to practice), the benefits of practice, and personal development through the technique. In addition, the technique is regularly checked by the teacher, or an individual trained in the process of regular checking, in the first months of practice to ensure correct practice, and the student is advised to continue with periodic checks thereafter (Broome, 1995). Clinical reports indicate that this technique can be learned easily by individuals of any age, level of education, occupation, or cultural background (Schneider et al., 2002). The technique requires systematic instruction by a qualified teacher to ensure effortless and correct practice (Ferguson, 1975). The technique is practiced twice daily for 15 to 20

minutes, usually once in the morning before breakfast, and once in the evening before dinner.

Large population of meditators. In addition to research on individual measures of improvement, e.g., intellectual problem solving ability, thinking and recall, field independence, creativity, self-esteem and self-actualization, a large body of applied social research has been generated over the past 40 years that draws attention to the effects of TM on the populations of police, military, juvenile offenders, incarcerated adults, high school students, athletes, and managers in the corporate environment. Research by Schmidt-Wilk (1996) suggests that over 100 companies have provided company-sponsored TM programs for management and employees (see Appendix A for a partial list) .

In summary, the TM technique was selected over other meditation interventions due to (a) an abundance of research on cognitive improvement and stress reduction, (b) the ease of instruction and effortlessness of the technique, with no lifestyle change, and (c) the ability to conduct research from over 6 million meditators globally.

Development of Consciousness as a Proposed Extension of the SA Model

The purpose of the study is to explore the impact of an intervention—the Transcendental Meditation technique—on leadership resilience, and more specifically, whether the regular practice of TM improves SA capacity in emerging leaders. A quantitative experiment, outlined in Chapter 3, tests the hypothesis that the regular practice of TM develops SA capacity in emerging leaders. Based upon the outcome of the study, a new factor called the development of consciousness, is proposed to the existing SA models by (Endsley, 1988b) and Sandoval (2005). Figure 6 depicts the

extension of the SA model to include the development of consciousness factor. Chapter 5 concludes with a discussion of the results of the study.

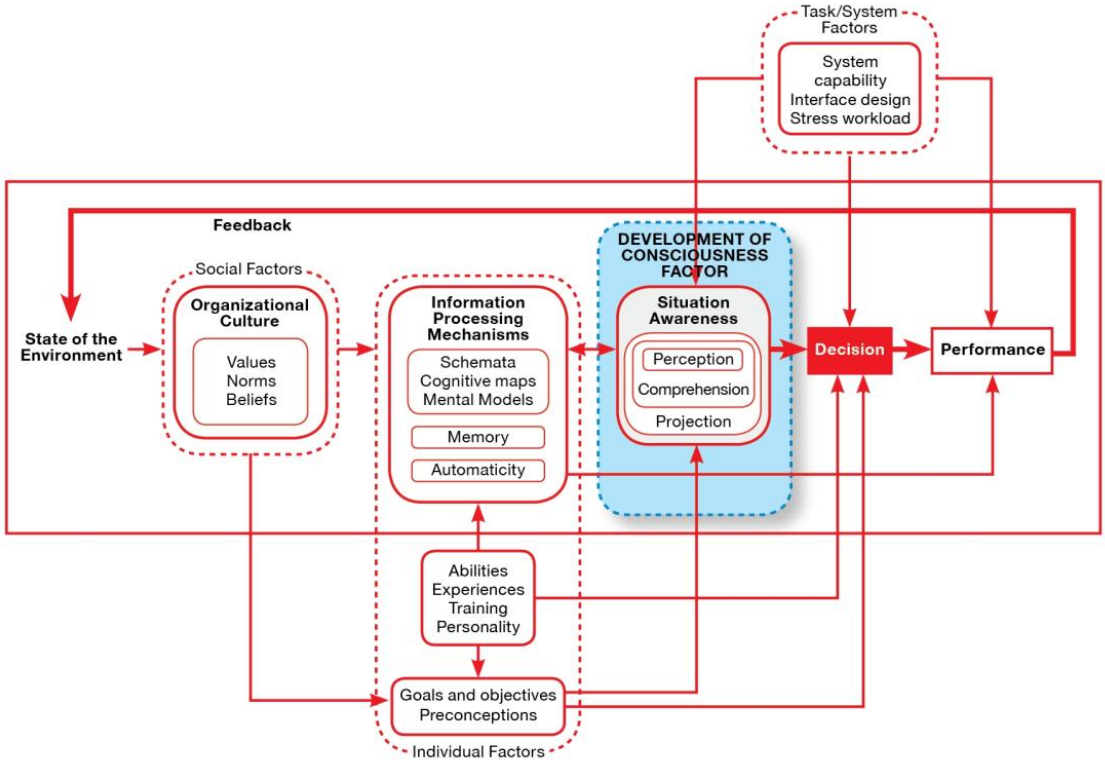

Figure 6. Proposing development of consciousness as a new factor of SA.

Summary

A comparison of literature from both the field of NDM and the field of OD shows a natural overlap of study of several of the factors underlying the construct of SA, and their role in transformational change, judgment under stress, and leadership resilience.

Using the Sandoval (2005) framework of SA, several large-scale leadership resilience programs were highlighted, presenting the factors which they address. The review also pointed to one of the programs which has incorporated research on the use of meditation as an intervention to develop SA capacity. The emerging trend of research

into the use of meditation as an intervention to develop cognitive capacity was introduced, with an overview of categories of meditation as a basis for contextualizing and differentiating various practices. Finally, literature on the TM technique was reviewed, the intervention selected for the experiment in this study, including an enumeration of criteria, relevant research, theoretical constructs, and compatibility of Vedic Science models with SA constructs (Sandoval, 2005) used throughout this study.

The following chapter outlines the research methods and experiment designed to tests the hypothesis that regular, twice-daily practice of the TM technique improves three measures of SA: perception, comprehension, and projection.

Chapter 3: Methods

This chapter presents the methods used in the study. The chapter begins with restatement of the purpose and research questions. Then the research design is presented in detail, and the variables, participants, instrumentation, and recruitment and sampling procedures, including human subject rights and consent are discussed. The chapter continues with a presentation of data collection and recording procedures, data processing and analysis, and limitations, and concludes with a summary of key points presented.

Restatement of the Purpose of the Study

The purpose of this research study was to determine whether the SA capacity in emerging leaders can be developed through a novel intervention—the Transcendental Meditation technique—as determined by objective, "hard measures" of the three elements of SA, perception, comprehension, and projection.

Restatement of the Research Questions

The research questions for this study are as follows: (a) What is the relationship, if any, between the regular practice of Transcendental Meditation and the development of SA capacity in emerging leaders?, and (b) based upon research study findings, is the TM technique a potentially viable intervention for leadership resilience programs aimed at developing SA to improve judgment and decision making under stress?

Nature of the Study

This research design was developed to be a component of a larger, multi-phase research project that investigated the effects of TM on leadership resilience at the oldest military college in the U.S., Norwich University.

The objectives of the multi-year study, entitled *Building Resilience: Reaching Excellence as a Military Professional* study are to: (a) introduce cadets, sports teams, and student cadet veterans at Norwich University to TM as a technique for developing adaptive, competent leaders; (b) improve student retention; (c) maximize academic performance, mental resiliency, and capacity; (d) increase self-sufficiency and self-reliance; (e) prevent or reduce the damaging effects of stress; and (f) prevent or reduce symptoms of post-traumatic stress disorder (PTSD).

Phase 1 of the project included instruction of Norwich University's senior administration staff in the TM technique. Phase 2, of which this study was a part, was a 10-week pilot study of 40 subjects referred to as *emerging leaders* (military and civilian leaders in training) that determined the extent to which the TM technique helps to develop SA capacity for improved judgment and decision making under stress. The principal investigator of the pilot study that concerned changes in stress levels was Dr. Sarina Grosswald, who served on the dissertation committee. The principal investigator for the portion of the pilot study that pertained to the impact of TM on changes in situation awareness capacity was this study's author. Data collection for both pre- and post-test measures of stress and SA capacity were conducted in tandem on the same participants using different instruments on the same testing dates. Analyses of results for each of the three measures of SA (perception, comprehension, and projection) were conducted independent of one another in order to determine the impact of the independent variable (TM technique) on each of the three dependent variables (three measures of SA capacity) to determine testing of individual sub-hypotheses.

Research Approach and Design

Research approach. The foundation of the study is provided by postpositivism and critical realism, which emphasize that data, evidence, and rational considerations help to shape knowledge. Postpositivism is based upon the premises that (a) no research can be considered completely and consistently accurate when studying human actions and behaviors, but can, at best, be used to generalize probable outcomes within given parameters; and (b) all observation is imperfect, fallible, and subject to error (Creswell, 2003). Based on these premises, postpositivistic research emphasizes the need to incorporate multiple measures and observations, all of which may have some level of error. To compensate for such error, the researcher triangulates the data (Phillips & Barbules, 2000). Creswell (2003) describes the approach of postpositivistic research as characterized by (a) quantitative approaches and experimental designs that involve an intervention or treatment; (b) the testing of a theory by specifying a narrow hypothesis; (c) pre- and posttest measurement methods; and (d) collection of data to support or refute the hypothesis.

Research design. This quantitative study involved the collection and analysis of three types of data related to the three components of situation awareness (perception, comprehension, and projection) from a sample of emerging leaders (military and civilian) enrolled at Norwich University. An overview of each of the phases of the study design is presented here.

Phase 1: Preparation. The preparation phase involved (a) proposing an Institutional Review Board (IRB)-approved research design to organizers of the Building Resilience program at Norwich University, (b) obtaining an organization release for

access to students for solicitation purposes, (c) recruiting of a sample pool from which randomly selected participants would be assigned to either an intervention or control group, and (d) obtaining of informed consent (Appendix B) from participants randomly selected for the intervention and control groups, comprised of 20 participants each.

Phase 2: Pre-test. This phase involved administration of three instruments designed to measure the components of SA capacity, namely (a) perception (Trail Making Part B); (b) comprehension (Wisconsin Card Sort Test); and (c) projection (Constructive Thinking Inventory).

Phase 3: Intervention. This phase involved providing TM instruction by certified teachers of the TM program to participants in the intervention group.

Phase 4: Trial period. In this phase, which lasted 10 weeks, participants in the intervention group were instructed to continue practicing their TM technique twice daily. For the control group, participants were instructed to continue their daily activities.

Phase 5: Post-test. This phase involved re-administration of the instruments designed to measure the three components of SA capacity, as noted in Phase 2.

Phase 6: Data analysis. This phase involved (a) the processing and analysis of data and (b) the posting of data analysis results in the form of a presentation given to the research sponsors.

Research Hypotheses

Research hypotheses first presented in Chapter 1are restated in Table 4 using the null hypothesis form.

Table 4

Research Hypotheses

	Situation Awareness Capacity Null Hypotheses
Hypothesis 1	There is no relationship between regular (twice daily) practice of TM and SA capacity measures (Perception, Comprehension, Projection), as compared to a control group.
Sub-Hypothesis 1A	There is no relationship between regular (twice daily) practice of TM and SA Perception capacity measures, as compared to a control group.
Sub-Hypothesis 1B	There is no relationship between regular (twice daily) practice of TM and SA Comprehension capacity measures, as compared to a control group.
Sub-Hypothesis 1C	There is no relationship between regular (twice daily) practice of TM and SA Projection capacity measures, as compared to a control group.

Participants

The population for this study is limited to emerging leaders (military and civilian) enrolled at Norwich University. The student population at Norwich University is currently 1,958 undergraduate students, of whom 73% are men and 27% are women. The sample representation matched the male-to-female ratio.

Student academic life at Norwich University includes the pressures associated with juggling courses with extracurricular involvement, e.g., sports, volunteer activities. Additionally, military students feel the pressure associated with newly acquired authority and command roles in the university's various military corps.

Variables

Instruction in the TM technique was the independent variable, and the three measures of SA (perception capacity, comprehension capacity, and projection capacity) were the dependent variables. Instrumentation for each of the three measures is addressed in greater detail within this chapter. A brief overview of each of the three variables is provided here and summarized in Table 5.

Perception capacity. This variable pertains to attention and perceptual flexibility and is intended to measure both response time and number of errors using a real-time, computer-based and interactive cognitive measure called Trail Making Part B.

Comprehension capacity. This variable pertains to the executive functions of the brain involved with real-time problem solving in a dynamic setting where the "rules" of a presenting problem are unfolding and continually changing ("set shifting"). The measure selected also uses a real-time, computer-based and interactive cognitive measure called the Wisconsin Card Sort Test and is intended to measure a variety of errors in comprehension.

Projection capacity. This variable pertains to practical intelligence involved in problem solving using the emotions in contrast to measures of executive functioning and discriminative capacity used in problem solving. The measure selected also uses a real-time, computer-based and interactive cognitive measure called the Constructive Thinking Inventory and is intended to measure emotional coping capacity.

Table 5

Dependent Variables in the Study

Dependent Variables	Type of Measure	Instruments
Perception Capacity	Perceptual (attention, flexibility)	Trail Making B (standalone, PC-based interactive software)
Comprehension Capacity	Executive function of the brain (measures "set-shifting", the ability to display flexibility in the face of changing "rules" and reinforcement).	Wisconsin Card Sort Test (standalone PC-based interactive software
Projection Capacity	Constructive Thinking (emotional coping capacity)	Pen-and paper inventory: Constructive Thinking Inventory (CIT)

Instrumentation

Each of the three instruments in the design was selected for its demonstrated ability to measure the cognitive functions associated with the three levels of SA (i.e., perception, comprehension, and projection). Each instrument was evaluated for (a) validity and reliability, (b) its contribution to the literature, (c) commercial availability, (d) cost, (e) time to administer no more than 20 minutes, and (f) the likelihood of posing minimal risk to subjects. Instrument validity and reliability for each of the measures used is addressed at the end of this chapter.

SA Level 1 or perception capacity: Trail making part B. The Trail Making Part B Test (TMPB), which explores visual-conceptual and visual-motor tracking, is a frequently used neuropsychological test because of its high test-retest reliability and ease

of administration (Giovagnoli, 1996). TMBP is an interactive, computer-based perception test that measures flexibility, speed, and the components of executive functioning that are responsible for complex visual scanning and the ability to shift sets (McGough et al., 2011). Set-shifting is the ability to display flexibility in the face of changing schedules of reinforcement (Berg, 1948). TMPB also is used to measure visio-motor coordination, visual-conceptual and visio-spatial tracking as well as task alternation (Lezak, 1995). TMPB is a good general indicator of perception due to the real-time cognitive demands of the test, which include sustained attention adequate enough to understand, on an ongoing basis, the alternating pattern of numbers and letters (Bradford, 1992).

TMPB captures length of time to link ascending numbers and letters in order. It is an easy and quickly administered test that takes 3-4 minutes to complete. Completion time and errors are automatically captured by the software. PC-based software to measure TMPB is available commercially for licensing, which can be used on standalone PCs. In this study, participants were allowed to take the test only once (i.e., no warm-up trial).

TMPB is one of the most popularly used cognitive tests and is part of the U.S. Army Individual Test Battery (Bradford, 1992, p. 4). Instant scores and feedback enable on screen review in real time. TMPB has been used as a measure of cognitive functioning in studies of decision-making ability in anorexia nervosa patients (Abbate-Daga et al., 2011), decision making and self-reported impulsivity in gambling patients (Alvarez-Moya et al., 2011), and neuropsychological performance in Operation Iraqi Freedom/Operation Enduring Freedom veterans (Spencer, Drag, Walker, & Bieliauskas,

2010), as well as served as an assessment in the evaluation of treatments in numerous brain injury and brain disease studies.

SA Level 2 or Comprehension Capacity: Wisconsin Card Sort Test (WCST). The WCST is a test of "set shifting," i.e., the ability to display flexibility in the face of changing schedules of reinforcement (Monchi, Petrides, Petre, Worsley, & Dagher, 2001). The WSCT engages parts of the brain associated with executive functioning, such as strategic planning, sorting strategy, hypothesis testing, working memory, visual identification, organized searching, and response to external feedback to direct behavior toward achieving a goal (Berman, Ostrem, & Randolph, 1995). These processes are a close approximation of the comprehension component of SA, which concerns itself with real-time sensemaking in dynamic settings. The WCST is generally regarded as a prototype abstract reasoning task, associated with the frontal lobes as well as the more complicated cortico-basal ganglia circuits linked to cognition (Nicoullin, 2002).

WCST is an interactive, computer-based instrument that takes 10-20 minutes to complete. WCST presents a number of stimulus cards (resembling playing cards) to the participant. The shapes on the cards are different in color, quantity, and design. The computer automatically presents a new card after the participant has made a match with one of the four stimulus cards. The participant is not told how to match the cards; however, the computer announces whether the particular match is right or wrong. During the course of the test, the matching rules are changed, and the time taken for the participant to learn the new rules and the mistakes made during this learning process are analyzed to arrive at a score. This study used the commercially available, PC-based 64-

card version of the WCST instead of longer 128 card version administered manually with a trained tester.

WCST is one of the most widely used tests of executive functioning (Heaton & Thompson, 1995; Manchester, Priestley, & Jacksons, 2004). WCST is regarded as clinically useful for detecting executive dysfunction of the dorsolateral prefrontal cortex, using perseverative responses (Robinson, Heaton, Lehman, & Stilson, 1980). It has been used extensively in research to evaluate cognitive functioning related to brain injury (Damasio, 1998) but is increasingly being used in research on decision making, including moral decision making (Koven, 2011), everyday problem solving among young and older adults (Artistico, Cervone, & Pezutti, 2003), executive control of cognitive processes during multi-tasking (Rubinstein, Meyer, & Evans, 2001), and dynamic assessment of problem-solving ability (Uprichard, Kupshik, Pine, & Fletcher, 2009).

SA Level 3 or Projection Capacity: Constructive Thinking Inventory (CTI). The CTI is designed to assess "practical intelligence" (Epstein & Meier, 1989). Specifically, CTI measures broad, generalized coping variables that enable people to cope with their ongoing experiences with minimal stress (Hoyer et al., 1998).

The 108-item CTI inventory is a hierarchically-organized test that provides scales at three levels of generality and takes approximately 10 minutes to complete. It contains scales that measure both positive and negative thinking patterns. Participants respond to questions using a 5-point Likert-type scale format, with 1 = definitely false, 2 = mostly false, 3 = undecided or equally false and true, 4 = mostly true, and 5 = definitely false. The Global Constructive Thinking scale is a composite of all other CTI scales except Esoteric Thinking, and it is therefore used as a primary indicator in this study. Epstein

(2001) states that the Global Constructive Thinking scale includes almost all aspects of good constructive thinking and an absence of almost all aspects of poor thinking. The empirical validity of the CTI has been demonstrated in a wide variety of studies (Epstein, 2001), including research on coping ability in high school students and college students as well as in the workplace environments of nursing, business leaders, military, and higher education administration (Epstein & Meier, 1989).

In summary, the expected direction in values measured (increase/decrease) for each of the three tests is presented in Table 6, reflecting improvement in SA capacity.

Table 6

Expected Direction: Development of SA Capacity Measures

Measure	Expected Direction from Pretest to Posttest
Perception: (Trails B)	
Time	Decrease
Errors	Decrease
Comprehension: (WCST)	
Total Correct	Increase
Total Errors	Decrease
Perseverative Responses	Decrease
Perseverative Errors	Decrease
Non-perseverative Errors	Increase
Conceptual Level Responses	Increase
Projection: CTI	
Global Constructive Thinking	Increase
Emotional Coping	Increase
Behavioral Coping	Increase
Personal Superstitious Thinking	Decrease
Categorical Thinking	Decrease
Esoteric Thinking	Decrease
Naïve Optimism	Decrease

Recruitment and Sampling Procedures

The sampling frame was limited to full-time students enrolled in the civilian and military leadership programs at Norwich University, referred to as "emerging leaders" because of their training in on-campus military leadership programs including Army, Navy, Air Force, and Coast Guard Reserve Officer Training (ROTC) programs. Students enrolled in the non-military track curriculum represent a minority (35%) of the total student population on the Norwich University campus. Its nearly 200 year tradition of preparing students for service and leadership is stated in the University's mission statement as "qualifying students for high responsibilities resting upon a citizen of this free republic" (Schneider, 2005, p. ii).

No monetary compensation was offered to participants in either group (intervention or control). However, the research design included instruction in the TM technique (considered a $750 value). To provide comparable value and to incentivize the control group members to complete both pre- and post-tests, participants in the control group were given extra credit for their participation in the pre- and post-test data collection. One point of extra credit was awarded after successful completion of the pre-test, and a second point of extra credit was awarded for the completion of the post-test. To achieve the target of 40 randomly-assigned participants (20 for the treatment group, 20 for the control group), required by the study, an internal communications to faculty and students by Norwich University administration and the University President regarding the Building Resilience program and pilot research project were designed and implemented by Norwich staff.

Step 1 of the recruitment process involved building awareness of the 2-year study, *Building Resilience: Reaching Excellence as a Military Professional*. An invitation for faculty, trustees, and student leader representatives to attend a dinner hosted by the university president was sent from the Office of the President to faculty and student representatives prior to the study launch. Attendance at the dinner was optional. The dinner was followed by a presentation by speakers about the study and the TM technique as well as a presentation by two soldiers who had both served in Operation Iraqi Freedom and Operation Enduring Freedom on their experiences with TM in relation to leadership resilience and PTSD.

In step 2, the director of academic achievement and effectiveness, on behalf of the university president, sent an invitation, via email, to the Norwich study body to attend a student assembly on the topic of the study. Attendance at the student assembly was optional. The Norwich University president, faculty, administration, student leaders, and TM researchers as well as guest speakers from the military (veterans and active duty) who had presented at the faculty dinner were in attendance. The same presentations were delivered.

Recruitment. All students who attended the assembly were briefed three times (i.e., via an email from the university president, presentation at the assembly by the university president, and by the author when reviewing the informed consent process) during the recruitment process that their participation was optional and that voluntary withdrawal from the study at any time would not result in any negative consequences. At the conclusion of the assembly, an invitation was extended by the university president to all full-time students enrolled at Norwich University to participate in the study. A Q&A

session followed the presentations, during which students were provided an opportunity to address the presenters directly or to meet one-on-one with them to have their questions addressed. The director of academic achievement and her staff were available immediately following the presentation, at a table in the back of the hall, to answer questions. The director and her staff subsequently provided details of the study (e.g., study overview, blank copies of the informed consent forms) for prospective subjects to review and gathered contact and scheduling information from interested students via sign up-sheets.

Sampling. The list of available students, their schedules, and the schedule of time slots for orientation and pre-testing were then coordinated by the director of academic achievement and her staff. This yielded a total of 38 students, each of whom received a confirmation email that included information about the location and time of testing.

The initial design approved by the Pepperdine IRB called for random assignment of participants to the intervention or control group by the director of academic achievement after pretest data was recorded from the pool, based on their availability. It is important to note that a change to the initial research design was precipitated by an executive decision by the University to offer TM instruction to all 38 emerging leaders that volunteered for the study after pre-test. This had an impact on the design requirement of random sampling procedures for the study. As a result, a design modification was presented to Pepperdine University's IRB, and a second group of emerging leaders were recruited for the control group using the equivalent presentation materials as the initial pool of candidates. The decision by the University Building

Resilience program sponsors was in response to the demand of students to be selected for the intervention group, and in alignment with the broader objectives of the university to prepare resilient leaders. The subsequent step of re-soliciting participants for the control group after the pre-test was completed consisted of presentations by Norwich faculty from the psychology department containing the same information about the study as the initial recruitment step, with the difference of two extra credit points offered to the control group for completion of the pre- and post-test phases as control group participants. This re-recruitment step of control group volunteers yielded a total of 23 emerging leaders volunteering as participants. Three weeks after the initial pre-test data collection, a second pre-test data collection was conducted for the control group participants. The same orientation, informed consent, and pre- and post-test procedures were followed.

Instruction in the TM technique. Instruction in the TM technique was provided after the study orientation and pre-test data collection were completed. All TM instruction was provided by certified teachers from the David Lynch Foundation. Those who delivered the TM instruction were required to provide certificates of completion of Human Subjects training as part of the Pepperdine University's IRB process. The study author participated in the orientation and data collection of pre- and post-test data for the intervention and control groups but not in any aspect of the procedures for recruitment, selection, scheduling, or delivery of the instruction.

Human Subjects Rights and Consent Procedures

The study involved no risk to human subjects and met criteria established by Pepperdine University's IRB in compliance with Federal Guidelines for Category 7

research that requires Expedited IRB review (U.S. Department of Health & Human Services, 1991). The Pepperdine University IRB reviewed and approved the initial and subsequent revisions to the research proposal as exempt from review. Norwich University's IRB also approved of the research proposal, deferring to the Pepperdine University IRB guidelines in the event of any issues.

The informed consent form (Appendix B) designed for this study was deemed compliant with federal human subjects rights guidelines and approved by the Pepperdine University IRB. All Norwich University study participants who arrived for orientation and testing were, after signing in with positive identification, provided with an opportunity to read and review the informed consent form and to have any questions answered before testing commenced. Participants were then provided an opportunity to sign the consent form, after which they were given a copy of the signed form for their records. The orientation included an additional reminder that participation in the study was voluntary and that voluntary withdrawal from the study at any time would have no negative consequences.

Data Collection and Recording Procedures

All data collection and recording procedures were approved by the IRB of both Pepperdine University and Norwich University, and participants were treated in accordance with the standards of the IRB guidelines. Both pre- and post-test data collection followed the same procedures, with the exception of informed consent review and execution in the pre-test. In both pre- and post-test data collection, participants arrived individually at the designated locations (i.e., campus computer lab and conference room) and time, signed in after presenting their student identity card verification,

received their unique random code assignment to protect confidentiality, completed the three instruments, and returned the completed CTI questionnaire to the study author. Because the control group participants were to receive 1 point of extra credit in exchange for the completion of participation in each of the data collection sessions (1 point for pre-test and 1 point for post-test), a letter signed by the study author addressed to the student's professor was provided that certified completion of testing and authorized extra credit.

Study volunteers from both the intervention and control groups were scheduled for appointments for pre and posttest through email, with instructions concerning dates, on-campus testing facility, and times. Each was scheduled with enough time to complete all three instruments at both pretest (prior to instruction of intervention group member in the Transcendental Meditation technique), and again at posttest after the completion of the 10-week study. Data collection was administered by the study author in the designated locations on the Norwich University campus.

The three instruments were administered in random order to maximize the processing of students who were scheduled to arrive at the lab at 15-minute intervals. Participant data collection in both pre- and posttests took place with upwards of 7 other participants in the room at any one time. The testing took approximately 30 minutes per participant. The posttest occurred during the University's finals week, a time of maximum stress for students.

TM Instruction

The protocol for instruction in TM calls for delivery by certified teachers. For this study, qualified teachers were identified by the David Lynch Foundation, and

instruction in the TM technique was provided under the auspices of the TM organization. Instruction followed a 7-step protocol that is universally used.

The first step is a 90-minute introductory lecture that offers a review of scientific research on the benefits of regular TM practice. The second step is a 90-minute preparatory lecture that provides a review of the mechanics and origins of the TM technique. These two steps are presented in a group setting. The third step is an individual interview with the TM instructor so that he or she can gather basic information from the student to aid in the personalization of instruction. The fourth step, which occurs within a day or two of the interview, is an individual instruction meeting of about 90 minutes for the purpose of learning the TM technique. The fifth through seventh steps are as follows: There are three 90-minute "checking" sessions on consecutive days, beginning the first day after instruction. On the first "checking" day, verification of the correctness of the practice and further instruction takes place. On the second "checking" day, student understanding of the mechanics of the TM technique is reviewed by the instructor in light of the personal experiences of the students. On the third "checking" day, an understanding of the mechanics of the development of higher states of consciousness through the TM program is presented by the instructor, as well as a recap of the material presented in the first lecture, and general points for maintaining regularity of the practice.

Data Process and Analysis

For each variable, intra-group correlations, means, and standard deviations were calculated. Then the data were analyzed for normality as a requirement for analysis of variance (ANOVA), analysis of covariance (ANCOVA), and multivariate analysis of

covariance (MANCOVA). The effects of TM practice on each of the three measures of SA capacity were analyzed, using ANCOVA of post-test scores, with pre-test scores as the covariate. ANCOVAs were performed on all the data. Correlation matrices among measures were computed for pre-test, post-test, and change scores. Within- and between-group correlations, as well as for all participants in both groups, were computed. Wilks' Lambda-adjusted probabilities were used for the correlations because they are appropriate for evaluating small numbers of correlation coefficients.

Assumptions

The following assumptions were made:

1. Sample groups are representative of their populations.
2. Participants in the TM intervention group practiced TM twice daily (20 minutes each) over a 10-week period. (At the conclusion of the study, a survey was provided to intervention group participants on which to enter the estimated frequency of meditation practice per week for the entire study and for the previous week. These data were used to create the covariate of Average TM per Week used in the MANCOVA analysis).
3. Control group participants did not practice meditation techniques; rather, they participated in their usual routines.
4. Participants truthfully and accurately responded to the instruments.

Limitations

Participants of this study were emerging leaders attending a military college enrolled in either military leadership training programs or civilian leadership training

programs. As such, the results cannot be generalized beyond the specific populations from which the samples are drawn. Additional research in various settings with a variety of participants is needed to be able to make generalizations.

Methodological Issues

The following section addresses methodological issues that were essential to the results of this study including reliability, validity, bias, and representativeness of the sample.

Reliability. Reliability addresses the consistency of measurement, and the extent to which the results can be replicated using the same measurements with different samples within the same target population (Sandoval, 2005). Reliability was addressed by the use of tested instruments and methods. Published reliability scores for the Trail Making Part B instruments is .78 (Giovagnoli, 1996), .91 for the Wisconsin Card Sort Test (Ozonoff, 1995), and a range from .85 to .59 for each of the main subscales of the Constructive Thinking Inventory . The instruments selected for this study were intended to measure SA capacity versus SA (Epstein, 2001). The procedures used to administer the instruments were similar to those procedures that have been tested and most widely accepted by cognitive researchers from published studies.

Validity. Validity refers to how closely the measures are to what is intended to be measured. Internal validity is concerned with knowing that independent variables (i.e., regularity of TM practice in this study) really affected changes in the dependent variables (i.e., changes to perception capacity, comprehension capacity, and projection capacity). This study design addressed internal validity by considering the effects of

possible covariates such as Median TM Practice and service (military leadership training track versus civilian leadership training track) across both intervention and control groups. These covariates were included as variables in the analysis to control for their possible effects. In addition to controlling for effects of covariates, precautions were made for consistent procedures throughout the testing within each sample group such the use of verbatim instructions read aloud by the study author to each of the subjects in both pre- and posttests. Each subject was also consistently requested to check for complete entries on all items of the Constructive Thinking Inventory, a pen and paper test, in order to avoid invalidating results. External validity is determined by whether results can be generalized to other situations and populations. External validity was addressed by obtaining sample groups from the actual population from which outcomes were generalized (e.g. emerging leaders in military training operating under high levels of stress).

Bias. Based upon extensive exposure to the research on the Transcendental Meditation technique, the researcher of this study conducted this study with preconceptions of intended outcomes. Possible effects of internal bias in the study was mitigated by (a) reviewing data sampling and collection procedures with external researchers such as the Principal Investigator of the larger Building Resilience study; (b) suspending data analysis until all data from all sample groups was collected; and (c) using procedures for anonymous coding of scores in data collection and evaluation steps.

Representativeness of the sample. Representativeness was addressed in the selection of sample group populations by first identifying a pool of candidates from which random selection of subjects into an intervention and control group was to take

place. As stated earlier, a design change introduced by the study sponsors after the commencement of data collection required the re-solicitation of subjects and the need to drop random assignment into the intervention and control groups from the study design. However, subject demographics in the study were representative of the larger population of emerging leaders at Norwich University i.e., distribution of male and female emerging leaders in the sample relative to the University's total student population.

Summary

The intention of this study was to explore the impact of a nontraditional intervention through an experiment to test the hypothesis that regular practice of the Transcendental Meditation technique improves SA capacity in emerging leaders. In this 10-week study, pre and posttest data was collected from two groups: an intervention group who received instruction in the Transcendental Meditation technique, and a control group who did not receive an intervention. This researcher's hope was to provide an empirical evaluation of the potential impacts of this particular intervention and to provide a bridge in NDM and OD researchers' efforts in understanding the multiple factors underlying leadership resilience and proven methods to improve SA, an antecedent to judgment and decision making under stress. In the following chapter, data collected from subjects in pre- and posttests are analyzed in an effort to determine impacts as well as discuss their implications. A summary of findings and recommendations for future research are presented in Chapter 5.

Chapter 4: Results

This chapter presents the results of the data analysis. The chapter contains two main sections. The first section concerns the data screening process used to prepare the data for analysis. The second section presents the results of the data analysis. The chapter concludes with a summary.

Data Screening and Preparation

This section describes the steps taken prior to analyzing the data, as well as the preliminary analysis to explore the nature of the variables as preparation for conducting specific statistical techniques that address the research questions.

Data from pre- and posttests for the Trail Making Part B, Wisconsin Card Sort Test, and Constructive Thinking Inventory were collected for analysis. Before any statistical analyses were performed, the pre- and posttest data for Trail Making Part B (auto-generated by the software), Wisconsin Card Sort Test (reports provided by the software) and Constructive Thinking Inventory (manually scored pen and paper test) needed to be processed and entered into the SPSS statistical software. A computerized version of the Trail Making Part B and Wisconsin Card Sort Test was administered, which removed common inter-rater reliability problems and difficulties that can arise, especially due to the complicated nature of the Wisconsin Card Sort Test scoring system. All responses on the Constructive Thinking Inventory questionnaire, as well as scores from the other tests, were manually entered into the SPSS program and double-checked for accuracy.

Missing data. Screening of the data showed that there were no missing data in either the pre- or post-test data collection. There was, however, a 43% attrition rate in the

intervention group, and a 26% attrition rate in the control group. Specifically, 17 men and 1 woman dropped out of the intervention group, and 7 men dropped out of the control group.

Outliers. To identify outliers, boxplots were used for all dependent variable data to prepare the normal dataset required by the ANCOVA and MANCOVA analyses per recommendations by Pallant (2007) in the SPSS manual. The suggested approach for addressing outlier data involves assigning to each case one score more or less than the next extreme score, depending on the direction of the mean. This method considers the direction from the mean without disproportionately influencing the fitted model (Goia, Isquith, Guy, & Kenworthy, 2000). Using this approach, data were brought within acceptable ranges (skewness and kurtosis values between 1 and -1) for meeting requirements to perform statistical analysis.

Normality. Multiple Analysis of Variance (MANOVA) and Multiple Analysis of Covariance (MANCOVA), statistical analyses used in this research, require normal distribution of scores on the dependent variable (Pallant, 2007). After resolving outlier data, normality was confirmed by determining skewness and kurtosis values in SPSS. Skewness, or the symmetry of the distribution, provides information on the clustering of the distribution around high and low values. Positive skewness values indicate scores clustered to the left, at the low values. Negative skewness values indicate a clustering of scores to the left, at the high values. Kurtosis, or the "peakedness" of the distribution, provides information about the clustering of the distribution. Positive kurtosis values indicate that the distribution is clustered in the center, with long thin tails. Kurtosis values below 0 indicate a distribution that is relatively flat (too many cases in the

extreme). After addressing outliers, as discussed above, the skewness and kurtosis values indicated normal distributions for the variables. The following section presents preliminary data analysis of normal data.

Preliminary Data Analysis

During this step, data were processed and analyzed to test the hypotheses. The data analysis is discussed further in the section following results of the hypothesis tests. This step also includes a post-analysis that explores effects of variables and combinations of sample groups that are not considered in the main analysis.

Sample demographic statistics. The sample (N = 35) was distributed as follows: TM intervention group (n = 18), and a control group (n = 17). Participants in both groups ranged from 18 to 22 years in age, with a mean of 20.43 years and a standard deviation of 1.119. Men comprised 83% of the sample and women comprised 17%, which approximates the male-to-female ratio of the student population at Norwich University. The percentage of military service leaders in each of the two groups was 89% in the intervention group, and 59% in the control group, respectively. No statistical significance was observed for military services as a factor in the analysis of variance between intervention and control groups (p=.266). Gender was not a significant factor for improved scores (p=.095).

Regularity of TM Practice. In the intervention group, the median TM practice of participants was 12 times per week. Table 7 summarizes the distribution of meditation practice for intervention group subjects (n=18).

Table 7

Average TM Practice of the Intervention Group (n =18)

Average TM Practice Between Pre- and Post-Tests	*n*
2 times / day, 5 to 7 days a week	1
2 times / day, 3 to 5 days a week, and at least 1 time the other days	7
1 time / day, 5 to 7 days a week	2
1 time / day, 3 to 5 days a week	3
Less than 1 time / day, 3 to 5 days a week	1
Occasionally	3

The following presents general univariate descriptive statistics along with ANOVA tests comparing sample group means. All descriptive statistics were calculated using raw scores for each measure.

Descriptive statistics by instrument across both groups. Table 8 reflects pre- and posttest score descriptive statistics across both groups for the Perception capacity measure (Trail Making Part B). Note that all scores were normally distributed (skewness and kurtosis between 1 and -1) meeting requirements for statistical analyses.

Table 8

Descriptive Statistics for Perception Capacity Measure: TMPB (N =35)

						Skewness		Kurtosis	
Measure	*N*	Min.	Max.	*M*	*SD*	Statistic	*SE*	Statistic	*SE*
Time_Pre	35	37000	67300	56634.29	9089.72	-.678	.398	-.516	.778
Errors_Pre	35	0	3	1.03	1.098	.790	.398	-.651	.778
Time_Post	35	28500	78400	55014.29	11596.1	-.003	.398	.044	.778
Errors_Post	35	0	6	1.54	1.884	.965	.398	-.395	.778

Next, Table 9 summarizes pre- and posttest score descriptive statistics across both groups for the Comprehension capacity test (Wisconsin Card Sort). All scores were

normally distributed (skewness and kurtosis between 1 and -1), a requirement for both ANOVA and MANCOVA analyses.

Table 9

Descriptive Statistics for Comprehension Capacity: WCST (N =35)

		.				Skewness		Kurtosis	
Measure	*N*	Min	Max.	*M*	*SD*	Statistic	*SE*	Statistic	*SE*
Total Correct_Pre	35	47	58	53.14	3.423	-.591	.398	-.902	.778
Total Errors_Pre	35	6	17	10.86	3.423	.591	.398	-.902	.778
Perseverative Responses_Pre	35	3	10	6.0	2.169	.715	.398	-.730	.778
Perseverative Errors_Pre	35	3	10	5.80	1.997	.833	.398	-.375	.778
Nonperserverative Errors_Pre	35	2	10	5.31	2.423	.662	.398	-.430	.778
Conceptual Level Responses_Pre	35	39	58	51.14	5.611	-.894	.398	-.267	.778
Total Correct_Post	35	53	60	55.97	1.723	.010	.398	.029	.778
Total Errors_Post	35	4	11	8.03	1.723	-.010	.398	.029	.778
Perseverative Responses_Post	35	3	6	4.20	.964	.618	.398	-.393	.778
Perseverative Errors_Post	35	3	6	4.20	.964	.618	.398	-.393	.778
Nonperserverative Errors_Post	35	1	8	4.03	1.823	.542	.398	-.333	.778
Conceptual Level Responses_Post	35	51	60	54.91	2.442	.092	.398	-.721	.778

Table 10 reflects pre- and posttest score descriptive statistics across both groups for both of the Perception capacity measure (Trail Making Part B). Note that all scores were normally distributed (skewness and kurtosis between 1 and -1), required for ANOVA and MANCOVA analyses.

Table 10

Descriptive Statistics for Projection Capacity: CTI (N =35)

Measure	*N*	. Min	Max	*M*	*SD*	Skewness Statistic	Skewness *SE*	Kurtosis Statistic	Kurtosis *SE*
Pre									
Global Constructive Thinking	35	80	132	100.2	12.762	.405	.398	-.475	.778
Emotional Coping	35	52	112	80.89	14.712	-.001	.398	-.536	.778
Behavioral Coping	35	43	66	54.17	5.322	.256	.398	-.082	.778
Personal Superstitious Thinking	35	9	30	17.63	5.259	.310	.398	-.107	.778
Categorical Thinking	35	23	60	42.74	9.144	-.459	.398	-.437	.778
Esoteric Thinking	35	15	42	29.54	7.326	.316	.398	-.404	.778
Naïve Optimism	35	39	62	50.17	6.252	-.073	.398	-.962	.778
Post									
Global Constructive Thinking_	35	70	129	101.94	12.877	-.394	.398	.072	.778
Emotional Coping	35	59	113	84.09	13.096	-.269	.398	-.329	.778
Behavioral Coping	35	42	64	54.74	5.414	-.269	.398	-.235	.778
Personal Superstitious Thinking	35	7	27	17.43	5.198	.062	.398	-.628	.778
Categorical Thinking	35	23	61	43.40	9.169	-.162	.398	-.211	.778
Esoteric Thinking	35	14	50	28.60	8.928	.770	.398	.100	.778
Naïve Optimism	35	33	66	51.23	7.100	-.281	.398	.135	.778

Descriptive statistics for tests between groups. Table 11 presents the means and standard deviations for each SA measure between the intervention and control group. Overall descriptive statistical findings show that the intervention group had the highest mean score compared to controls for the total time to complete Perception capacity measure (Trail Making Part B), with both groups increasing in total error scores between pre- and posttest. Both intervention and control group Comprehension capacity scores improved somewhat between pre and posttest. Lastly, the Projection capacity (Wisconsin Card Sort Test) mean scores for the intervention group improved in the expected direction from pre-test to post-test for two scales—Global Constructive Thinking and

Emotional Coping—as compared to controls. The statistical analysis between groups factoring for regular TM practice as a covariate between groups follows.

Results of Statistical Analysis

The following presents the statistical analyses on study data using Multiple Analysis of Covariance (MANCOVA), with GROUP (intervention and control) as the "between" factor and Average TM Practice as the covariate. ANCOVAs analyzed contribution of individual variables to the effect.

Table 11

Means and Standard Deviations Between Groups

SA Element	Variable	Group	Pre-test *M*	Pre-test *SD*	Posttest *M*	Posttest *SD*	(Pre - Post) *M*
Perception	**TMPB**						
	Time	Control	56729.4	10792.634	59228.9	10459.9	-2558.83
		Intervention	56544.4	7456.479	50977.7	11421.2	5566.66
	Errors	Control	1.12	1.219	1.76	1.855	-0.64
		Intervention	.94	.998	1.33	1.940	-0.39
Comprehension	**WCST**						
	Total Correct	Control	53.76	1.12	55.82	1.944	-2.06
		Intervention	52.56	.94	56.11	1.530	-3.55
	Total Errors	Control	10.24	1.12	8.18	1.944	2.06
		Intervention	11.44	.94	7.89	1.530	3.55
	Perseverative Responses	Control	5.35	1.12	1.12	1.115	1
		Intervention	6.61	.94	.94	.802	2.55
	Perseverative Errors	Control	5.24	1.12	1.12	1.115	0.89
		Intervention	6.33	.94	.94	.802	2.27
	Non Perseverative Errors	Control	5.18	1.12	1.12	1.886	1.12
		Intervention	5.44	.94	.94	1.815	1.44
	Conceptual Level Responses	Control	52.12	1.12	1.12	2.773	-1.64
		Intervention	50.22	.94	.94	2.155	-2.34

(continued)

SA Element	Variable	Group	Pre-test *M*	Pre-test *SD*	Posttest *M*	Posttest *SD*	(Pre - Post) *M*
	CTI						
Projection	Global Constructive Thinking	Control	97.94	11.189	98.19	12.596	-0.25
		Intervention	102.33	14.075	105.5	12.439	-3.17
	Emotional Coping	Control	78.88	15.215	81.82	13.376	-2.94
		Intervention	82.78	14.396	86.22	12.832	-3.44
	Behavioral Coping	Control	52.82	4.050	53.71	5.987	-0.89
		Intervention	55.44	6.138	55.72	4.775	-0.28
	Personal Superstitious Thinking	Control	19.41	4.823	19.59	4.459	-0.18
		Intervention	15.94	5.218	15.39	5.124	0.55
	Categorical Thinking	Control	44.71	10.005	44.53	9.592	0.18
		Intervention	40.89	8.094	42.33	8.892	-1.44
	Esoteric Thinking	Control	31.12	7.390	31.12	9.867	0
		Intervention	28.06	7.149	26.22	7.748	1.84
	Naïve Optimism	Control	48.76	5.540	49.29	6.989	-0.53
		Intervention	51.50	6.741	53.06	6.898	-1.56

Perception capacity measure (Trail Making Part B). Table 12 shows significant effects for the covariate (Average TM Practice) and Group for completion time, but no significant change in number of errors for either group. Time to complete the Trail Making Part B decreased for the intervention group, but not for the control group, p=.033.

Table 12

Perception Capacity Measures Between Groups (Pre minus Post)

			Descriptive Statistics					
	Pre-test minus Post-test	Group	*N*	*M*	*SD*	*SE*	*f*	*p*
Perception: Trail Making Part B	Time	Control	17	-594.12	9325.33	2261.73	4.965	.033
		Intervention	18	5566.67	10977.41	2587.40	.107	.745
		Total	35	2574.29	10532.56	1780.33		
	Errors	Control	17	-0.47	1.91	0.46271	8.517	.066
		Intervention	18	-0.33	2.52	0.59409	.022	.883
		Total	35	-0.40	2.21	0.37		

Table 13 presents MANCOVA results for the Comprehension capacity measure (Wisconsin Card Sort Test) between groups. There were no statistically significant changes between the intervention and control groups from pretest to posttest for any of the variables.

Table 13

Comprehension Capacity Measures Between Groups (Pre minus Post)

		Descriptive Statistics						
	Pretest-Posttest	Group	*N*	*M*	*SD*	*SE*	*f*	*p*
Comprehension: Wisconsin Card Sort Test (WCST)	Total No. Correct	Control	17	-2.0588	3.4364	0.83345	.008	.931
		Intervention	18	-3.5556	3.29388	0.77638	.531	.471
		Total	35	-2.8286	3.3997	0.57465		
	Total No. Errors	Control	17	2.0588	3.4360	0.83345	.008	.931
		Intervention	18	3.5556	3.29388	0.77638	.531	.471
		Total	35	2.8286	3.39970	0.57465		
	Perseverative Responses	Control	17	1.000	1.69558	.41124	.193	.663
		Intervention	18	2.5556	2.12055	.49982	3.235	.082
		Total	35	1.8000	2.05512	.34738		
	Perseverative Errors	Control	17	.8824	1.53632	.37261	.002	.969
		Intervention	18	2.2778	2.02355	.47696	1.839	.185
		Total	35	1.6000	1.91281	.32332		
	Total No. Non-Perseverative Errors	Control	17	1.1176	2.68985	.65238	.080	.780
		Intervention	18	1.4444	2.63957	.62215	.196	.661
		Total	35	1.2857	2.62982	.44452		
	Total No. Conceptual Level Responses	Control	17	-2.6471	5.81959	1.41146	.066	.799
		Intervention	18	-4.8333	5.32751	1.25571	.252	.619
		Total	35	-3.7714	5.59982	.94654		

Wisconsin Card Sort Test variables included total number correct, total number of errors, number of perseverative responses, number of perseverative errors, total number of non-perseverative errors, and total number of conceptual responses.

Table 14 presents MANCOVA results for the Projection capacity measure (Constructive Thinking Inventory) between groups. There were statistically significant changes between the intervention and control groups from pretest to posttest for Global Constructive Thinking (p=.047) and Emotional Coping (p=.038) scales, with no significant changes between groups for the remaining subscales of Behavioral Coping, Personal Superstitious Thinking, Categorical Thinking, Esoteric Thinking, and Naïve Optimism.

Table 14

Projection Capacity Measures Between Groups (Pre-minus Post)

		Descriptive Statistics						
	Pre-test minus Post-test measure	Group	*N*	*M*	*SD*	*SE*	*f*	*p*
Projection: Constructive Thinking Inventory (CTI)	Global Constructive Thinking (GCT)	TM	18	.2353	9.04523	2.19379	4.276	.047
		Control	17	3.1667	17.17471	4.04812	1.500	.230
		Total	35	1.7429	13.71848	2.31885		
	Emotional Coping (EC)	TM	18	2.9412	7.42016	1.79965	4.697	.038
		Control	17	3.4444	15.33248	3.61390	2.650	.113
		Total	35	3.2000	11.97989	2.02497		
	Behavioral Coping (BC)	TM	18	.4706	6.58709	1.59760	1.135	.295
		Control	17	.2778	7.41862	1.74859	.791	.380
		Total	35	.3714	6.92432	1.17042		
	Personal Superstitious Thinking (PST)	TM	18	.5294	2.85302	.69196	1.109	.320
		Control	17	-.5556	4.90165	1.15533	.094	.762
		Total	35	-.0286	4.01824	.67921		
	Categorical Thinking (CT)	TM	18	.0588	5.73880	1.39186	.077	.783
		Control	17	1.4444	5.69026	1.34121	.428	.518
		Total	35	.7714	5.67288	.95889		
	Esoteric Thinking (ET)	TM	18	.3529	6.11291	1.48260	.012	.912
		Control	17	-1.8333	4.47542	1.05487	.419	.522
		Total	35	-.7714	5.36922	.90756		
	Naïve Optimism (NO)	TM	18	.5294	6.14530	1.49045	.443	.510
		Control	17	1.5556	4.00327	.94358	.027	.870
		Total	35	1.0571	5.10446	.86281		

The discussion and implication of study findings follows in this section after a review of the implications of findings on study hypotheses presented in null form along with test statistics.

Results of Hypothesis Tests

Two out of the three measures of SA capacity (i.e., Perception and Projection capacity measures) showed statistically significant results. The results of the hypothesis test are provided in Table 15.

Table 15

Hypothesis Test Results

	Effects of TM on Situation Awareness (Null Hypotheses)	Result
Hypothesis	There is no relationship between regular (twice daily) practice of Transcendental Meditation (TM) and situation awareness (SA) capacity measures (Perception, Comprehension, Projection).	Data partially supports the hypothesis for Perception (Time, p=.033), and Projection (Global Constructive Thinking, p=.047), Emotional Coping (p=.038).
Sub-Hypothesis 1A	There is no relationship between regular (twice daily) practice of TM and SA Perception capacity measures, as compared to control group.	Data partially supports the hypothesis (Completion Time, p=.033).
Sub-Hypothesis 1B	There is no relationship between regular (twice daily) practice of TM and SA Comprehension capacity measures, as compared to a control group.	Data does not support the hypothesis.
Sub-Hypothesis 1C	There is no relationship between regular (twice daily) practice of TM and SA Projection capacity measures, as compared to a control group.	Data partially supports the hypothesis (Global Constructive Thinking, p=.047); Emotional Coping, (p=.038)

Findings Related to the Hypothesis

A summary of the study's overall findings is presented in Table 16.

Table 16

Summary of Results: Development of SA Capacity Measures

Measure	Expected Direction from Pre- to Posttest	Actual Study Results
Perception: (Trails B)		
TIME	Decrease	Time: Decrease ($p < .038$) in
ERRORS	Decrease	TM Group*; Increase (Controls)
		Errors: Slight increases in both groups (ns), possibly due to the instrument's sensitivity to distractions of finals' week (2 min. test).
Comprehension: (WCST)		
Total Correct	Increase	Both groups increased and
Total Errors	Decrease	decreased according to
Perseverative Responses	Decrease	expected values between
Perseverative Errors	Decrease	pre- and post-tests, with no
Non-perseverative Errors	Decrease	significant changes observed
Conceptual Level Responses	Increase	between groups.
Projection: CTI		
Global Constructive Thinking	Increase	TM Group increased in both
Emotional Coping	Increase	Global Constructive
Behavioral Coping	Increase	Thinking ($p = .047$) and
Personal Superstitious Thinking	Decrease	Emotional Coping ($p =$
Categorical Thinking		.038), as compared to
Esoteric Thinking	Decrease	controls. All other variables
Naïve Optimism	Decrease	increased or decreased in
	Decrease	direction of expected values.
	Decrease	

Perception capacity findings. The MANCOVA results for Level 1 SA Perception capacity revealed an improvement for the intervention group compared to the control group, whose mean completion time increased. This result indicates a significant

($p < 0.05$) difference in the time variable (total time to complete the test) at post-test between the TM group and the control group ($p = .033$). No significant difference was found between the two groups for total errors at post-test. The results for differences between the TM intervention group and the control group for TMPB completion time are depicted in Figure 7. One possible explanation of increases in post-test mean scores for completion time for the control group is the increased schedule demands on subjects during finals week at Norwich University leading to higher stress levels. Posttest data collection for this study was scheduled and completed during finals week. Similar instances of comparisons between TM intervention groups and controls tested during finals week with decreased performance by the control group have been documented, such as the study on the effects of Transcendental Meditation on brain functioning and stress reactivity in college students (Travis et al., 2009).

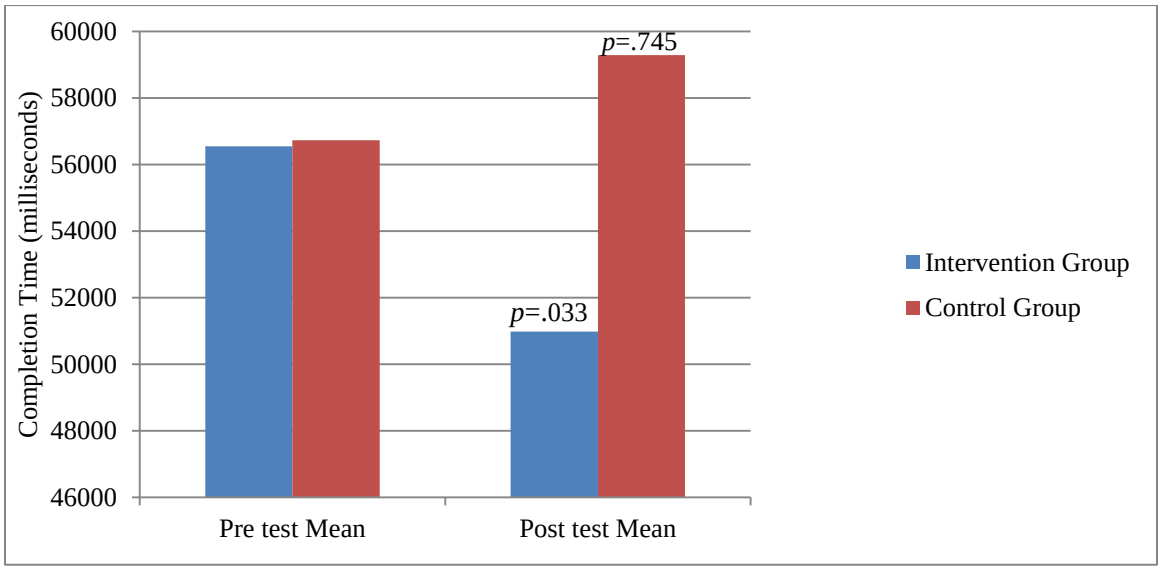

Figure 7. Differences between groups in completion time (TMPB).

A significant decrease in performance by the control group in comparison to the TM intervention group was not observed in the other two tests. The following results from the SA Level 2 measure of Comprehension capacity is a case in point.

Comprehension capacity findings. Figures 8 and 9 present results of pretest and posttest Comprehension score differences for intervention and control groups, respectively. The results of the MANCOVA analysis show no significant effects for the covariate median TM per week with Group as the "between" factor. Scores for both groups changed in expected directions, with no statistically significant improvement.

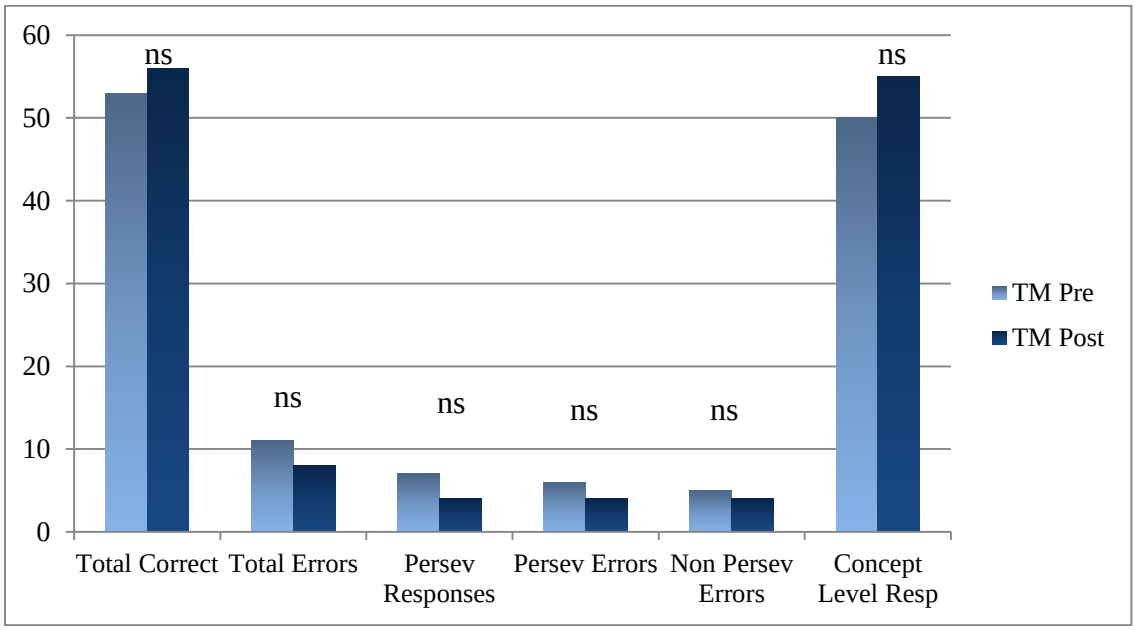

Figure 8. Differences within TM group: SA Comprehension measures (WCST).

Directionally, differences in scores from pretest to posttest within each group changed in the expected direction for improvement to have occurred. Specifically, both groups increased total correct responses; decreased total number of errors; decreased perseverative responses (reflecting an increased ability to inhibit the tendency to persist or perseverate with a sorting principle based upon feedback from the software to

determine the new, correct sorting principle); decreased non-perseverative (i.e., unambiguous) errors, and increased conceptual level responses (reflecting insight into correct sorting principles).

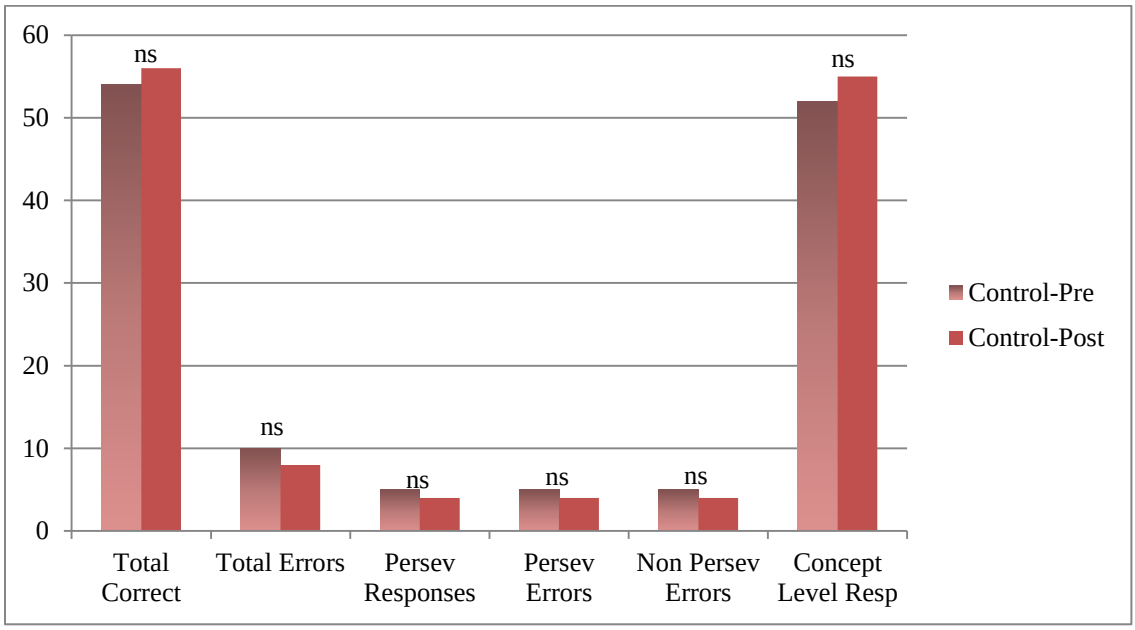

Figure 9. Differences within control group: SA comprehension measures.

For the WCST, the Wilks' Lambda for the variable Average TM per week was $p = .255$, for the variable Group, the p value was $p = .166$. There was no statistical significance, and therefore not a true change, difference, or improvement. Possible explanations for these results include chance, the passage of time (maturation), or requirement of a larger group to see a statistically significant effect size with this instrument.

Projection capacity findings. Data from the Level 3 SA Projection capacity scores (CTI) are presented below in Figure 10. The MANCOVA results for projection in Figure 10 indicate a significant difference ($p < .05$) between the TM group and the control group for two of the seven CTI scales (global constructive thinking, $p = .047$;

emotional coping, p = .038), with TM Median per Week as the covariate and Group as the "between" factor. No significant differences were found between the remaining five scales. Wilks' Lambda for median TM week is .226 (partial Eta squared) and for Group is .119 (partial Eta squared).

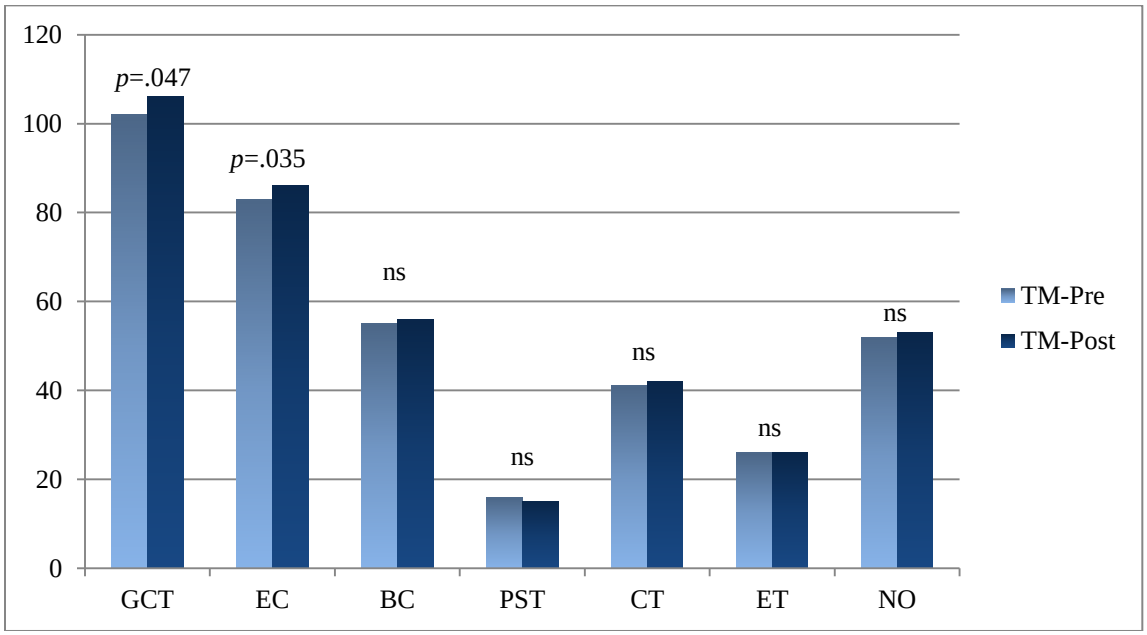

Figure 10. Differences within TM group: Projection measures (CTI).

A possible explanation for a statistically significant improvement in the Global Constructive Thinking (GCT) scale is that this scale is a broad bipolar scale that includes items from all of the main scales except esoteric thinking. Chapter 3 included the statement by the developer of the instrument that subjects with high scores on Global Constructive Thinking are flexible thinkers who can adjust their behavior to appropriately meet the requirements of different situation (Epstein, 2001). Higher GCT scores between pre and posttest could therefore reflect an improvement in Level 3 SA in the TM Intervention group, pointing to an improvement in leadership resilience. The Emotional Coping (EC) scale is a bipolar scale that is more strongly associated with the GCT scale

than any of the other scales. The control group showed no change between pre- and post-test on the constructive thinking scale or for the emotional coping subscale (Figure 11).

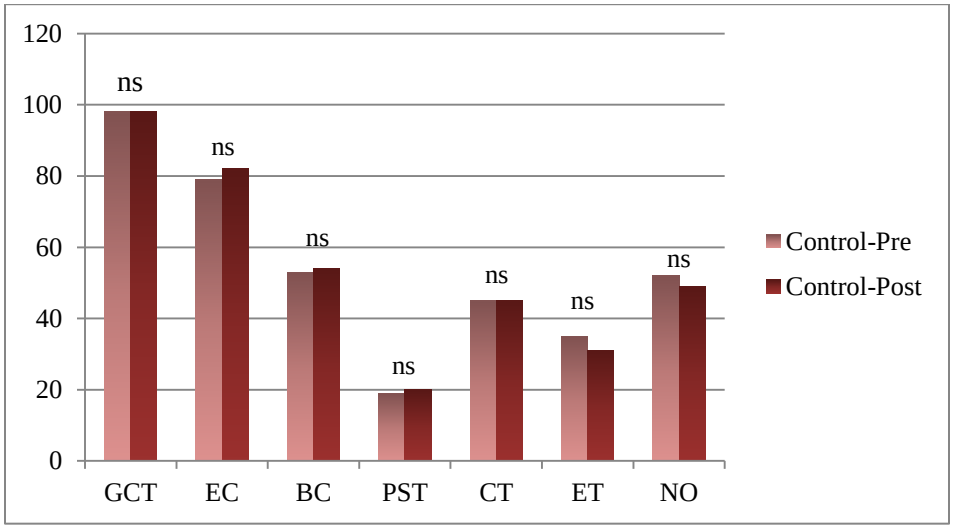

Figure 11. Differences within control group: Projection measures (CTI)

Differences between groups from pre- to post-test measures for each of the two groups are highlighted for Global Constructive Thinking (Figure 12) and Emotional Coping (Figure 13). In the intervention group, statistically significant improvement (p=.047) was measured in the difference between pretest and posttest scores, as compared to control group measures post-test means, which remained unchanged.

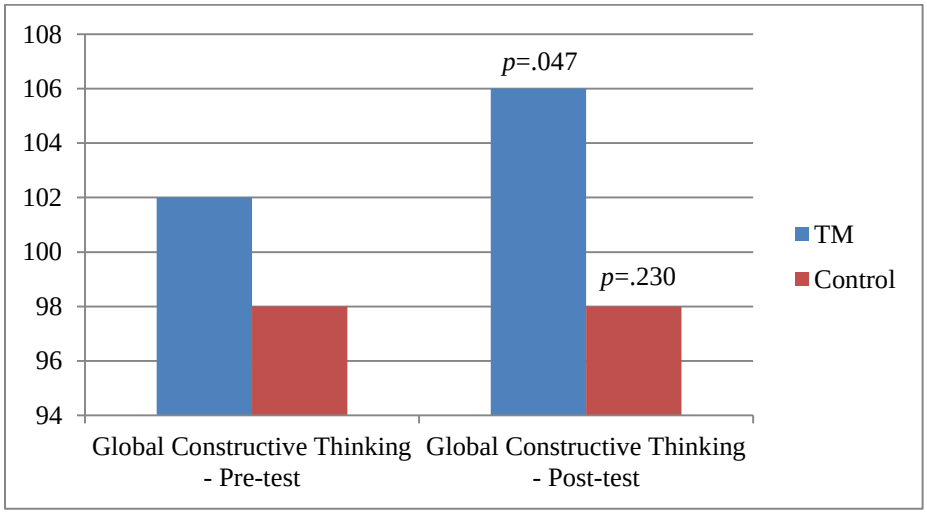

Figure 12. Differences between groups: Global constructive thinking (CTI)

Similarly, the intervention group revealed statistically significant improvement (p=.0387) between pretest and posttest scores, as compared to control group measures post-test means, which increased but with scores that were not statistically significant.

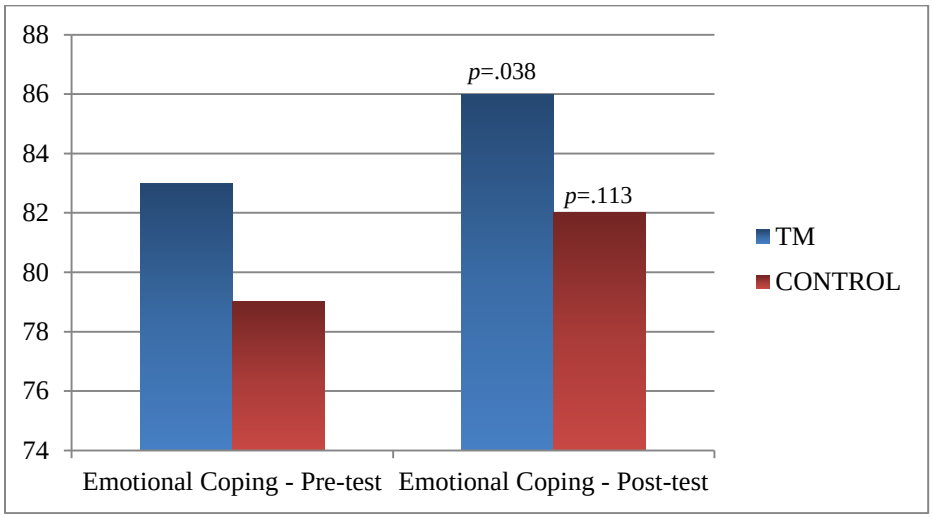

Figure 13. Differences between groups: Emotional coping (CTI).

Both intervention and control groups had increased emotional coping scores between pre- and post-test; however, the improvement for the control group was not statistically significant.

Summary

This chapter examined the impact of the regular practice of Transcendental Meditation technique on the development of SA capacity in a sample of 35 emerging leaders at Norwich University. Specifically, it analyzed the impact of regular practice of TM as an intervention to develop the three elements of SA defined as: (a) perception capacity (b) comprehension capacity; and (c) projection capacity.

Analysis of primary source data collected in pre and posttests for a sample (N=35) divided into an intervention group instructed in the TM technique (n=18) and a control group (n=17) revealed statistically significant improvements in pre- and post-test scores in perception capacity (p=.033) and projection capacity (p=.047, p=.038) using a MANCOVA analysis between groups with Average TM Practice as the covariate. An analysis of the military service vs. civilian status variable as a covariate was not a significant factor in the differences between intervention or control groups for any of the three tests.

These analyses document the occurrence of important changes in emerging leaders in this exploratory study, and that Transcendental Meditation as an intervention to improve SA, an element of leadership resilience had strong correlations with, and explanatory improvements in two of the three measures of SA tested. While not implying causality, the direction and strength of the findings were promising, and sufficiently addressed the study's two research questions. The specific meanings and implications of these results for developing SA capacity relevant to leadership resilience, along with recommendations for future research, are addressed in the next chapter.

Chapter 5: Discussion

This chapter presents a summary of the study as well as conclusions and recommendations. The chapter begins with a summary of the study, including a restatement of the study's purpose, objectives, research questions, and methodology. Limitations of this research study are presented, as well as contributions of the study's findings to the literature. The chapter concludes with recommendations for future research.

Summary of the Study

The development of resilience is of critical importance to leaders in high-demand settings. Sustained levels of stress, workload, and fatigue have been shown to contribute to SA impairment or debilitation, which can negatively affect a leader's judgment and decision making leading to errors. Empirical data directing leaders to practices such as meditation for developing SA capacity is a recent occurrence. However, research on the effects of meditation practices on cognitive improvement has been published in peer-reviewed journals for the past 40 years, particularly in the area of cognitive development. Using a multi-discipline approach, this exploratory study was designed to explore the components of leadership resilience and situation awareness from the perspectives of NDM and OD, and to test the effects of a well-researched and novel intervention on the development of SA capacity.

Purpose statement, objectives, and research questions. The purpose of this research study was to determine whether the SA capacity in emerging leaders can be developed through the Transcendental Meditation technique as determined by objective,

"hard measures" of the three elements of SA capacity, i.e., perception, comprehension, and projection.

The objectives of the study were to (a) introduce the construct of SA from the cognitive sciences for applied use in the field of OD and Change, (b) introduce a cognitive model from ancient Vedic Science (the study of consciousness) and relevant research on the Transcendental Meditation technique as a means of exploring the development of cognitive capacity, (c) test a hypothesis regarding the regular practice of TM and improved SA capacity through a 10-week experiment with emerging leaders, and (d) to extend the existing model of SA (Endsley, 1995c) to incorporate development of consciousness as a factor (or not, depending on the outcome of the empirical study).

The study addressed two research questions. What is the relationship, if any, between the regular (twice-daily) practice of Transcendental Meditation and the development of SA capacity in emerging leaders? Based upon research study findings, is the TM technique a potentially viable intervention for leadership resilience programs aimed at developing SA to improve judgment and decision making under stress? The research methodology for this quantitative study is described next.

Study methodology. The study employed the use of two established measures of executive functioning (Trail Making Part B and Wisconsin Card Sort Test) and one established measure of emotional intelligence (CTI). These measures were selected for their high reliability, validity, and fit with regard to the variables of interest. After random assignment was precluded by modification to the original design, the sample of emerging leaders (N=35) self-selected into two assigned groups: intervention and control.

The study took place at the oldest military college in the US, Norwich University, over a 10-week period. Data collection and recording were in compliance with IRB guidelines from both Norwich and Pepperdine Universities. Data were analyzed using standard statistical methods, including ANOVA, ANCOVA, and MANCOVA.

The major findings of the study. There were two major findings from this study. Following the presentation of these findings, an analysis of their relationship to the existing literature is described.

The first significant finding addressed the study's first research question: "What is the relationship, if any, between the regular (twice daily) practice of Transcendental Meditation and the development of SA capacity in emerging leaders?" This study found statistically significant improvements in measures of two of the three elements of SA (Level 1 SA or perception, and Level 3 SA or projection) in the intervention group, as compared to controls. As stated previously in Chapter 4, completion time for intervention group members increased by almost 10%, while the control group decreased by 5% over the 10-week period. Two of the key scales of the Level 3 SA capacity measures, Global Constructive Thinking and Emotional Coping also showed statistically significant improvement in the intervention group, as compared to controls, which did show statistically significant improvements over the same time period. There was no statistical improvement in the Level 2 SA measure for comprehension. Given the preponderance of positive development among two of the three measures of SA, and support for two of the of the three sub-hypotheses, the study's author reasonably concludes that Level 1 and Level 3 SA is improved as a result of regular TM practice. Existing research on the TM technique published in the literature strongly suggests such

statistical significance is typical for improvements in perception (Banquet & Lesevre, 1980; Beresford, Jedrczak, Toomey, & Clements, 1983; Holt, Caruso, & Riley, 1978) and constructive thinking (Orme-Johnson, Wallace, Dillbeck, Alexander, & Ball, 1981; So & Orme-Johnson, 2001) in student populations. The research on TM also points to significant improvement in Level 2 SA comprehension and problem solving (Dillbeck et al., 1986; Gelderloos, Lockie, & Chuttoorgoon, 1987; Jedrczak, 1984; Schecter, 1977), although this study did not find significant change in Level 2 SA measures (WCST) in either group. This finding is discussed further in the limitations of the study and recommendations for future research.

The second major finding of the study addressed the second research question: "Based upon research study findings, is the TM technique a potentially viable intervention for leadership resilience programs aimed at developing SA to improve judgment and decision making under stress?" The statistically significant data (*p* levels ranging from .033 to .047) for improvement of SA capacity in two of the three measures supports the hypothesis that regular practice of the TM technique develops SA capacity in emerging leaders in the Building Resilience program at Norwich University. Therefore, statistically significant increases in two of the three measures strongly supports directionally correct research in support of TM as an intervention worthy of future consideration in leadership resilience programs aimed at developing SA.

At a general level, this finding also contributes to the extension of the SA model with the proposed new factor, the development of consciousness, for future research and validation within the NDM community. This finding is significant as it contributes much needed prescriptive research in the NDM field on viable methods to develop SA capacity.

At a more specific level, the finding of a direction relationship between two of the three elements of SA capacity and regular practice of the Transcendental Meditation technique in emerging leaders supports a small, growing body of empirical evidence involving the impact of meditation practices and leadership resilience (Jha et al., 2010; Rees & Leffler, 2008; Rosenthal et al., 2011). This study finding also provides new information in two areas: (a) SA can be measured in leadership settings where high-demands and stress present conditions with a high likelihood of impacting leaders' SA, and (b) the novel approach for measuring SA capacity using Transcendental Meditation is transferrable to leadership resilience programs within organizational settings (not requiring expensive and time-consuming simulation and measurement).

In sum, this study offers clear, strong, statistically supported findings in two of the three measures as well as a viable methodology for measuring the improvement of SA capacity in leaders. Additionally, the intact delivery modality for measuring SA capacity is a promising idea worthy of additional research and consideration as an OD intervention for leaders in settings characterized by high complexity, high uncertainty, and continuous change. Before exploring how this study's findings relate to existing literature and future research, the general conclusions of the study are summarized, followed by a discussion of the limitations of the study.

Summary of General Conclusions

The following is a summary of the general conclusions that are supported from the findings of this research.

1. Emerging leaders who practiced the TM technique over a 10-week period improved Level 1 SA capacity (perception) scores by 9% (p=.033), as compared to controls, whose scores decreased by 4.5%.

2. Emerging leaders who practiced the TM technique over a 10-week period improved Level 3 SA capacity (projection) as measured by Global Constructive Thinking (p=.047) and Emotional Coping (p=.038), as compared to controls, who did not reflect a statistically significant change.

3. Service status of the emerging leader (military or civilian training track) was not a significant factor for improvement in either intervention or control group.

4. For emerging leaders at Norwich University, the Transcendental Meditation technique is positively correlated with improvements in Level 1 and Level 3 SA (perception and projection).

5. Data from the study partially support the addition of the Transcendental Meditation technique as a factor of improving two of the three elements of SA capacity.

Limitations of the Study

Generalizability of findings. Given that this study is the first attempt to explore the effects of Transcendental Meditation on the development of SA capacity in emerging leaders in a military training program, it should be noted that the conclusions should not be generalized outside the framework of the research design and methodology until the results have been repeatedly validated by future studies. The following is a list of research design and methodology issues that should be considered in the interpretation of the results.

1. Sample group: results should not be generalized to sample groups other than those used in this study.

2. Self-selection versus random assignment of groups: Changes in research design imposed by constraints introduced by research sponsors required two separate recruitment processes, with pre-test data spaced 3 weeks apart for the intervention group and the control group. Both groups ended up with self-selecting group members versus a randomly assigned sample, which may have affected results.

3. Simulated environment: Interpretation of results should consider that the environment of measuring changes due to the effects of the intervention on SA capacity in emerging leaders at Norwich University did not allow results to reflect the influence of factors that exist in a natural environment, such as stress and workload. Stress and workload associated with a high demand academic setting were approximations of naturalistic settings under which executive judgment and decision making under stress are conducted. This may have affected results.

4. SA measures: The results of this study do not intend to encompass SA and decision making under stress in general. Rather, the results are intended to address the specific measures that address SA capacity and the challenge represented by stress levels on SA, judgment, and decision making at Norwich University.

5. Regular practice of TM by intervention group subjects: The study was based on the assumption of regular (twice daily) practice of TM by members of the intervention group. Fifty percent of the intervention group sample was not able to fit in twice daily meditation practice due to schedule demands and constraints. Interpretation of results should take this into consideration. This limitation of the design protocol has been

addressed in future phases of the multi-year Building Resilience study at Norwich University, of which this research study was a component in the pilot phase.

6. Impact of retention on sample size: Due to various and conflicting demands of academic schedule commitments and the scheduling of posttest data collection during finals week, 43% of the TM intervention group and 26% of the control group were not present for posttest measures. This limitation in design protocol has been incorporated into future phases of the Building Resilience research study at Norwich. A larger sample size on which to base the analysis may also have provided different results.

7. Comprehension measure: Results from the tests of the sub-hypotheses failed to show the expected result for the directional effect of regular practice of TM comprehension scores (Level 2 SA). Results for insignificant changes in the comprehension data could have been due to a larger size of sample required to observe an effect required by the Wisconsin Card Sort Test (Cohen, 1988). Another reason may be that a 10-week test-retest interval is insufficient to see a statistically significant change in neurologically normal adults using the Wisconsin Card Sort Test (Collie, Maruff, Darby, & McStephen, 2003). Future studies should continue to research high reliability measures of dynamic problem solving by (a) replicating the study using the identical three tests to verify results, and (b) substituting different real-time comprehension tests for WCST. Possible Level 2 SA comprehension measures of executive cognitive processes from the literature that could be explored as substitutes for the WCST include the California Card Sort Test (Beatty & Monson, 1996), the Behavioural Assessment of Dysexecutive Syndrome (BADS), and the Hayling Brixton tests, developed to assess executive functioning abilities considered central to executive functioning, including

planning and self-directed organization, temporal judgment, set shifting, inhibition of established responses, and novel problem solving (Manchester et al., 2004).

With the study's methodology, findings, and limitations described, its relationship to the existing body of literature is presented here.

Findings Related to the Literature

This study involves a novel approach for developing SA capacity to improve executive judgment and decision making under stress as a means to build leadership resilience. As such, this study extends the literature in four areas: (a) it is one of the first studies of the development SA capacity, using TM, in the military college setting; (b) it is the first quantitative study grounded in NDM theory using meditation as an intervention to develop SA; (c) it is the first study to propose the factor of the development of consciousness, using TM, as an extension of the SA model (Sandoval, 2005); and (d) it is the first study to integrate constructs from NDM on decision making under stress, organizational culture change from OD, and research on developing SA using TM. Each of these areas is discussed in greater depth here.

Research on the development SA capacity, using TM, in the military college setting. This study was a component within the pilot phase of a larger, multi-year study entitled, *Building Resilience: Reaching Excellence as a Military Professional*, involving the study of the effects of Transcendental Meditation as a technique for developing adaptive, competent leaders. The focus of this research study design, centered on the construct of SA and its novel measurement approach, enabled the measurement of the three elements of SA as defined by Endsley (1995c). As described in Chapter 2, although the construct of SA itself has a robust body of evidentiary work, this construct has

remained largely within the field of NDM and its areas of study. By introducing the framework and novel approach to the measurement of SA to a broader leadership audience, a construct familiar to most military personnel (Orasanu & Backer, 1996) advances interest in developing leadership resilience including other military colleges, within the larger population of the U.S. military, and the leadership resilience literature. As stated in Chapter 1, leadership resilience is a topic of great concern within the U.S. military (Millerrodgers, 2010) and has equally relevant potential for application with leaders engaged in organizational change in environments characterized by uncertainty, complexity, and stress (Heifetz et al., 2009).

Quantitative study grounded in NDM using meditation as an intervention to develop SA. The literature to date on the development of SA centers almost entirely on the interventions of training and simulation. Mindfulness meditation programs have begun to be introduced into the wildland firefighting community (Saveland, 2011); however, no quantitative research has been undertaken to measure the effects of meditation on the development of SA in the NDM community. Researchers in the NDM community have expressed an interest in results and methodology of this study for application in other critical incident professions and high reliability organizations. Examples of NDM research subjects that may benefit from the measurement of the development of consciousness through Transcendental Meditation, as well as other practices, include the development of SA in pilots, wildland firefighters, emergency response personnel, and other populations traditionally studied by the field of NDM.

Proposing the factor of the development of consciousness, using TM, as an extension of Sandoval's SA model. The results of this study partially support the

hypothesis that regular practice of the Transcendental Meditation technique develops SA capacity (perception, comprehension, and projection) by demonstrating improvement in two of the three areas of SA capacity. Given the significance of the data in Level 1 and Level 3 SA (i.e., perception and projection), the study proposes the addition of the factor of development of consciousness to the existing SA models of Endsley (1995c) and Sandoval (2005). In doing so, this study contributes to a growing body of applied research validating and extending the improvement of cognitive capacity across numerous populations, based upon 40 years of research on the Transcendental Meditation technique specifically, and meditation practices in general.

Integration of constructs from NDM on decision making under stress, organizational culture change from OD, and research on developing SA using TM. Leadership resilience is a complex subject, with multiple factors contributing to the phenomenon. This study's contribution of the multi-disciplinary perspective of leadership resilience, bridging the literature from OD theorists (organizational culture) and NDM researchers provides insight into the range of factors that have heretofore been addressed singly in the research. Organizations such as the U.S. military have developed comprehensive theoretical frameworks to understand leadership resilience, complemented by research using interventions such as Transcendental Meditation to develop resilience capacity. By introducing the familiar and widely-accepted construct of SA developed by the U.S. military over 40 years ago (Spick, 1988), future research into a broad range of interventions is possible to address the growing challenge of leadership susceptibility to stress and its impact on debilitated executive judgment and decision making, an area of increasing importance to current and emerging leaders. Research into

SA using interventions such as Transcendental Meditation in the Comprehensive Soldier Fitness program (Pargament & Sweeney, 2011) provides a model for broader use in the OD field.

Recommendations for Future Research

This study and its findings present four important opportunities for future research into leadership resilience using the SA framework and interventions to develop SA capacity involving well-researched meditation practices: (a) replication of this study using the same instruments, as well as substituting different instruments for Level 2 SA (real-time executive processes related to problem solving and comprehension), (b) replication of this study in multiple leadership settings and cultures, and (c) comparative studies of well-researched meditation practices and SA capacity measures, and (d) studies on the use of meditation as an intervention to develop Team SA. Each is described in greater depth below.

Replication of this study using the same instruments as well as substituting different instruments for Level 2 SA (real-time executive processes related to problem solving and comprehension). In addition to a more rigorous repetition of this study addressing current study limitations, future study of SA capacity incorporating the use of the same instruments as well as substituting different comprehension instruments which measure the executive functioning corresponding to Level 2 SA is warranted. The purpose of such research would be to validate the effectiveness of the methods used in this study, using similar hypotheses for testing the effect of Transcendental Meditation on the development of SA capacity. This would serve to strengthen the findings and further advance the use of the SA construct as a framework with which to understand the

complexity of factors underlying SA. The Building Resilience study at Norwich University has already embarked on this recommendation in the subsequent phase of the multi-year study through the use of the same instruments used in this study that measured Perception and Projection.

Replication of this study in multiple leadership settings and cultures. The underlying premise of this study is that improved SA is critical for all leaders operating in complex, high demand settings. Therefore, in order to research the applicability of improved SA capacity and its development using the Transcendental Meditation technique, this study could be replicated in different populations of leaders, and in different cultures. Additional studies that explore the role of SA in judgment and decision making under stress outside of the field of NDM will further develop the leadership resilience literature in the direction of applied intervention as well as theory.

Comparative studies of evidence-based meditation practices and SA capacity measures. Replication of this study on the development of SA capacity using well-researched meditation practices as an intervention within the NDM community would extend and accelerate the general understanding of the efficacy of different meditation practices as interventions to develop SA capacity. While empirical studies are just beginning to emerge, a concentrated, focused research effort on the role of meditation as an intervention to develop SA could contribute to shortened adoption cycles in mainstream leadership resilience programs.

Studies on the use of meditation as an intervention to develop Team SA. Research within the NDM community on the study of team SA (Bolstad & Endsley, 2003; Cannon-Bowers & Salas, 2006) provides a rich opportunity for the application of

meditation as an intervention to study the effects on improvements to Team SA in high-demand settings. The results of this area of research may greatly assist the choice of interventions available to all leadership teams in organizations that work to address critical situations.

Concluding Remarks

This study evaluated the impact of the development of SA capacity on executive judgment and decision making under stress in emerging leaders. It involved two areas of interest to the study's author: an exploration of the frequently observed symptoms of debilitated SA observed firsthand in leaders undergoing gamma level change by this consultant in the field of OD and change, and the acquisition of research skills needed to incorporate the use of meditation as an intervention to develop improved judgment and decision making in leaders. Its conclusions give direction and energy to ongoing research in two seemingly unrelated fields, NDM and OD, as its novel methodologies open up the possibility of measurable interventions design to help leaders develop the SA capacity that is so fundamental to resilient leaders. It further highlights the extraordinary commitment already made by the Norwich University faculty and staff who are deeply committed to preparing the next generation of resilient leaders for military and civilian service with tools to help improve executive judgment and decision making – the essence of leadership. By exploring and extending the work of NDM, OD, and TM researchers in the areas of SA, leadership development, and leadership resilience through the systematic development of consciousness, respectively, it is hoped that this study generates new perspectives and possibilities in order to address the challenges of current and emerging leaders, everywhere, as they prepare for uncertainty and change ahead.

REFERENCES

Abbate-Daga, G., Buzzichelli, S., Amianto, F., Rocca, G., Marzola, E., McClintock, S., & Fassino, S. (2011). Cognitive flexibility in verbal and nonverbal domains and decision making in anorexia nervosa patients: A pilot study. *BMC Psychiatry, 11*, 162-169. doi:10.1186/1471-244X-11-162

Adams, M., Tenney, Y., & Pew, R. (1995). Situation awareness and the cognitive management of complex systems. *Human Factors, 37*(1), 85-104. doi:10.1518/001872095779049462

Aftanas, L., & Golocheikine, S. (2001). Human anterior and frontal midline theta and lower alpha reflect emotionally positive state and internalized attention: High resolution EEG investigation of meditation. *Neuroscience Letters, 310*(1), 57-60. doi:10.1016/S0304-3940(01)02094-8

Agrell, S. (2010, October 30). Stress: How your busy life is killing you, *Toronto Globe and Mail*, pp. A14-A15.

Alexander, C. (1994). Transcendental meditation technique. In E. Craighead & C. Nemeroff (Eds.), *Corsini Encyclopedia of Psychology and Neuroscience* (pp. 545-546). New York, NY: John Wiley & Sons.

Alexander, C., Davies, J., Dixon, C., Dillbeck, M., Druker, S., Oetzel, R., . . . Orme-Johnson, D. (1990). *Higher stages of human development: Perspectives on adult growth*. New York, NY: Oxford University Press.

Alexander, C., Davies, J., Dixon, C., Dillbeck, M., Druker, S., Oetzel, R., . . . Langer, E. (1990). Growth of higher stages of consciousness: Maharishi's vedic psychology of human development. In C. Alexander & E. Langer (Eds.), *Higher stages of human development: Perspectives on adult growth*. New York, NY: Oxford University Press.

Alexander, C., Heaton, D., Chandler, H., Miller, M., & Cook-Greuter, S. (1994). Advanced human development in the vedic psychology of Maharishi Mahesh Yogi: Theory and research. In M. Miller & S. Cook-Greuter (Eds.), *Transcendence and mature thought in adulthood: The further reaches of adult development*. New York, NY: Rowman & Littlefield.

Alexander, C., & Langer, E. (Eds.). (1990). *Higher states of human development*. New York, NY: Oxford University Press.

Alexander, C., Rainforth, M., & Gelderloos, P. (1991). Transcendental Meditation, self-actualization, and psychological health: A conceptual overview and statistical meta-analysis. *Journal of Social Behavior and Personality, 6*(5), 189-247.

Alexander, C., Swanson, G., Rainforth, M., Carlisle, T., Todd, C., & Oates, R. (1993). Effects of the transcendental meditation program on stress reduction, health, and employee development: A prospective study in two occupational settings. *Anxiety, Stress & Coping, 6*(3), 245-262. doi:10.1080/10615809308248383

Alvarez-Moya, E., Ochoa, C., Jimenez-Murcia, S., Aymami, M., Gomez-Pena, M., Fernandez-Aranda, F., . . . Menchon, J. (2011). Effect of executive functioning, decision making and self-reported impulsivity on the treatment outcome of pathologic gambling. *Journal of Psychiatry Neuroscience, 36*(3), 165-175. doi:10.1503/jpn.090095

Anderson, J., Liu, C., & Kyrscio, R. (2008). Blood pressure response to transcendental meditation: A meta-analysis. *American Journal of Hypertension, 21*, 310-316. doi:10.1038/ajh.2007.65

Andre, A., Wickens, C. D., & Moorman, L. (1991). Display formatting techniques for improving situation awareness in the aircraft cockpit. *International Journal of Aviation Psychology, 1*(3), 205-214. doi:10.1207/s15327108ijap0103_2

Arbuthnot, K. (2002). Key issues in incident command. In R. Flin & K. Arbuthnot (Eds.), *Incident command: Tales from the hot seat* (pp. 10-31). Aldershot, England: Ashgate Publishing Limited.

Archibald, A., & Munn-Venn, T. (2008). *Building resilience: Leadership and accountability.* New York, NY: Conference Board of Canada.

Argyris, C. (1976). Single-loop and double-loop models in research on decision-making. *Administrative Science Quarterly, 21*(3), 363-375. doi:10.2307/2391848

Argyris, C. (1990). *Overcoming organizational defenses: Facilitating organizational learning*. Boston, MA: Allyn and Bacon.

Argyris, C. (1992). *On organizational learning*. Cambridge, MA: Blackwell.

Argyris, C., Putnam, R., & Smith, D. (1985). *Action science*. San Francisco, CA: Jossey-Bass.

Argyris, C., & Schon, D. (1978). *Organizational learning*. Reading, MA: Addison-Wesley.

Arnsten, A. (1998). The biology of being frazzled. *Science, 280*, 1711-1713. doi:10.1126/science.280.5370.1711

Artistico, D., Cervone, D., & Pezutti, L. (2003). Perceived self-efficacy and everyday problem solving among young and older adults. *Psychology and Aging, 18*(1), 68-79. doi:10.1037/0882-7974.18.1.68

Atwater, L. (1992). Beyond cognitive ability: Improving the prediction of performance. *Journal of Business & Psychology, 7*, 27-44.

Banbury, S., & Tremblay, S. (Eds.). (2004). *A cognitive approach to situation awareness*. Burlington, VT: Ashgate.

Banquet, J., & Lesevre, N. (1980). Event-related potentials in altered states of consciousness. *Motivation, Motor and Sensory Processes of the Brain, Progress in Brain Research, 54*, 447-453. doi:10.1016/S0079-6123(08)61659-3

Bar-On, R. (1997). *Emotional quotient inventory: Technical manual* (2nd ed.). New York, NY: Multi-Health Systems.

Bartlett, F. (1932). *Remembering: A study in experimental and social psychology*. Cambridge, England: Cambridge University Press.

Bartlett, F. (1943). *Fatigue following highly skilled work.* Paper presented at the *Proceedings of the Royal Society of Biological Sciences, Series B 131*, 247–257. doi:10.1098/rspb.1943.0006

Bartone, P. (1999). *Personality hardiness as a predictor of officer cadet leadership performance*. Paper presented at the International Military Testing Association Meeting, Monterey, CA.

Bartone, P., Johnson, B., Eid, J., Brun, W., & Laberg, J. (2002). Factors influencing small unit cohesion in Norwegian Navy officer cadets. *Military Psychology, 14*(1), 1-22. doi:10.1207/S15327876MP1401_01

Bartone, P., & Snook, A. (2000, June). *Gender differences in predictors of leader performance over time*. Paper presented at the American Psychological Society Convention, Miami, FL.

Bartunek, J., & Moch, M. (1987). First-order, second-order, and third-order change and organizational development intervention: A cognitive approach. *Journal of Applied Behavioral Science, 23*(4), 483-500. doi:10.1177/002188638702300404

Bartunek, J., & Moch, M. (1994). Third-order organizational change and the Western mystical tradition. *Journal of Organizational Change Management, 7*, 24-41.

Bass, B. (1998). *Transformational leadership*. Mahwah, NJ: Lawrence Erlbaum Associates.

Bass, B., & Avolio, B. (1990). The implications of transactional and transformational leadership for individual, team, and organizational development. *Research in Organizational Change and Development, 4*, 231-272. doi:10.1016/0090-2616(90)90061-S

Bass, B., & Avolio, B. (1994). Introduction. In B. Bass & B. Avolio (Eds.), *Improving organizational effectiveness through transformational leadership*. Thousand Oaks, CA: Sage.

Beach, L., Chi, M., Klein, G., Smith, P., & Vicente, K. (1997). Naturalistic decision making and related research lines. In C. Zsambok & G. Klein (Eds.), *Naturalistic decision making* (pp. 29-36). Mahwah, NJ: LEA.

Beatty, W., & Monson, N. (1996). Problem solving by patients with multiple sclerosis: comparison of performance on the wisconsin and california card sorting tests. *Journal of the International Neuropsychological Society, 2*, 134-140. doi:10.1017/S1355617700000989

Bell, K. (1999). *Fire in their eyes: Wildfires and people who fight them*. Orlando, FL: Harcourt.

Benner, P. (1994). The role of articulation in understanding practices and experiences as sources of knowledge in clinical nursing. In J. Tully (Ed.), *Philosophy in an Age of Pluralism: The philosophy of Charles Taylor in Question* (pp. 136-155). New York, NY: Cambridge University Press.

Bennis, W. (1969). *Organization development: Its nature, origins, and prospects*. Reading, MA: Addison-Wesley.

Bennis, W. (2001). Leading in unnerving times. *MIT Sloan Management Review, 42*(2), 97-103.

Beresford, M., Jedrczak, A., Toomey, M., & Clements, G. (1983). EEG coherence, age-related psychological variables, and the transcendental meditation and tm-sidhi program. *Scientific Research on Maharishi's Transcendental Meditation and TM-Sidhi Program: Collected Papers, 3*, 1743-1748.

Berg, E. (1948). A simple objective technique for measuring flexibility in thinking. *Journal of General Psychology, 39*, 15-22. doi:10.1080/00221309.1948.9918159

Berman, K., Ostrem, J., & Randolph, C. (1995). Physiological activation of a cortical network during performance of the Wisconsin Card Sorting Test: A positron emission tomography study. *Neuropsychologia, 33*, 1027-1046. doi:10.1016/0028-3932(95)00035-2

Billingsley, L. (1991). Sony employees enjoy transcendental meditation. *MIU Review, 6*(2), 2.

Bion, W. (1961). *Experiences in groups and other papers*. New York, NY: Routledge.

Bolstad, C., & Endsley, M. (2003, May). *Tools for supporting team situation awareness and collaboration in army operations*. Paper presented at the Collaborative Technology Alliances Conference, Advanced Decision Architecture Conference, College Park, MD.

Bonanno, G. (2004). Loss, trauma, and human resilience: Have we underestimated the human capacity to thrive after extremely aversive events? *American Psychologist, 59,* 20-28. doi:10.1037/0003-066X.59.1.20

Bougon, M., Weick, K. E., & Binkhorst, D. (1977). Cognitions in organizations: An analysis of the Utrecht Jazz Orchestra. *Administrative Science Quarterly, 22*, 606.

Bradford, D. (1992). *Interpretive reasoning and the Halstead-Reitan tests*. Brandon, VT: Clinical Psychology Publishing.

Broome, J. (1995). *Stress management and organisation development: Effects of Transcendental Meditation on psychological, physiological, and organisational variables at the worksite* (Doctoral dissertation). Retrieved from Dissertation Abstracts International. (OCLC No. 122274071)

Bryant, D., Lichacz, F., Hollands, J., & Baranski, J. (2004). Modeling situation awareness in an organizational context: Military command and control. In S. Banbury & S. Tremblay (Eds.), *A cognitive approach to situation awareness: Theory and application*. Burlington, VT: Ashgate.

Burke, W. (1982). *Organizational development: Principles and practices*. Boston, MA: Little, Brown & Co.

Burns, J. (1978). *Leadership*. New York, NY: Harper & Row.

Butler, B., Bartlette, R., Bradshaw, L., Cohen, J., Andrews, P., Putnam, T., & Mangan, R. (1998). *Fire behavior associated with the 1994 south canyon fire on Storm King Mountain, Colorado*. Washington, DC: US Department of Agriculture - US Forest Service.

Cahn, B., & Polich, J. (2006). Meditation states amd traits: EEG, ERP, and neuroimaging studies. *Psychological Bulletin, 132*(2), 180-211. doi:10.1037/0033-2909.132.2.180

Cannon-Bowers, J., & Salas, E. (2006). Individual and team decision making under stress: Theoretical underpinnings. In J. Cannon-Bowers & E. Salas (Eds.), *Making decisions under stress: Implications for individual and team training* (pp. 17-38). Washington, DC: American Psychological Association.

Cassel, R. (1974). Basic fundamentals of mind control and transcendental meditation. *Psychology: Journal of Human Behavor, 11*(2), 26-33.

Center for Creative Leadership. (2007). The stress of leadership. In M. Campbell, J. Baites, A. Martin & K. Meddings (Eds.), (pp. 1-16). Colorado Springs, CO: .

Chandler, H. (1987). Modern science and vedic science: An introduction. *Modern Science and Vedic Science, 1*(1), 5-26.

Cohen, J. (1988). *Statistical power for the behavioural sciences* (2nd ed.). Hilsdale, NJ: Lawrence Erlbaum.

Collie, A., Maruff, P., Darby, D., & McStephen, M. (2003). The effects of practice on the cognitive test performance of neurologically normal individuals assessed at brief test-retest intervals. *Journal of the International Neuropsychological Society, 9*, 419-428. doi:10.1017/S1355617703930074

Conner, D. (1995). *Managing at the speed of change: How resilient managers succeed and prosper where others fail*. New York, NY: Villard.

Cooper-Kahn, J., & Dietzel, L. (2008). *Late, lost, and unprepared*. Bethesda, MD: Woodbine House.

Crandall, B., Klein, G., & Hoffman, R. (2006). *Working minds: A practitioner's guide to cognitive task analysis*. Cambridge, MA: MIT Press.

Creswell, J. (2003). *Research design: Qualitative, quantitative, and mixed methods approaches*. Thousand Oaks, CA: Sage.

Crichton, M., & Flin, R. (2002). Command decision making. In R. Flin & K. Arbuthnot (Eds.), *Incident command: Tales from the hot seat* (pp. 201-238). Burlington, VT: Ashgate.

Culbert, S. (1996). *Mind-set management: The heart of leadership*. New York, NY: Oxford University Press.

Cummings, T. G., & Worley, C. G. (2001). *Essentials of organization development and change*. Cincinnati, OH: South-West.

Daft, R., & Weick, K. (1984). Toward a model of organizations as interpretation systems. *Academy of Management Review, 9*, 284-295. doi:10.5465/AMR.1984.4277657

Dalzell, S. (2009). *Building the resilience of front-line nurses* (Masters thesis). Retrieved from Proquest Dissertations & Theses. (Publication No. MR52113)

Damasio, A. (1998). *Descartes' error: Emotion, reason, and the human brain*. New York, NY: Bard/Avon Books.

Dayson, D. (2010). *A phenomenological examination of the role of situation awareness in command decision making during the events of September 11, 2001* (Unpublished doctoral dissertation). Walden University, Minneapolis, MN.

Dekker, S. (2006). *The field guide to understanding human error*. Burlington, VT: Ashgate.

Denning, P. (2006). Hastily formed networks: Colloboration in the absence of authority. *Reflections: The Society of Organizational Learning Journal, 7*(1), 1-8. doi:10.1145/1121949.1121966

DeRubeis, R., & Beck, A. (1988). Cognitive therapy. In K. Dobson (Ed.), *Handbook of cognitive-behavioral therapies* (pp. 273-306). New York, NY: Guilford Press.

Dillbeck, M. (1982). Meditation and flexibility of visual perception and verbal problem solving. *Memory and Cognition, 10*(3), 207-215. doi:10.3758/BF03197631

Dillbeck, M. (1983). The vedic psychology of the bhagavad-gita. *Psychologia, 26*, 62-72.

Dillbeck, M., & Alexander, C. (1989). Higher states of consciousness: Maharishi Mahesh Yogi's Vedic psychology of human development. *Journal of Mind and Behavior, 10*(4), 307.

Dillbeck, M., Assimakis, P., Raimondi, D., Orme-Johnson, D., & Rowe, R. (1986). Longitudinal effects of the transcendental meditation and the TM-Sidhi program on cognitive ability and cognitive style. *Perceptual and Motor Skills, 62*, 731-738. doi:10.2466/pms.1986.62.3.731

Duerr, M. (2008). *The use of meditation and mindfulness practices to support military care providers: A prospectus.* Northampton, MA: Center for Contemplative Mind in Society.

Duley, M. (2005). The next pandemic: Anticipating an overwhelmed health care system. *Journal of Biological Medicine, 78*(5), 355-362.

Durso, F., Hackworth, C., Truitt, T., Crutchfield, J., Nikolic, D., & Manning, C. (1997). Situation awareness as a predictor of performance for en route traffic controllers. *Air Traffic Control Quarterly, 6*(1), 1-20.

Endsley, M. (1987). SAGAT: A methodology for the measurement of situation awareness. Hawthorne, CA: Northrup.

Endsley, M. (1988a). *Design and evaluation for situation awareness enhancement.* Paper presented at the 32nd Annual Meeting of the Human Factors Society, Santa Monica, CA.

Endsley, M. (1988b). *Design and evaluation for situation awareness enhancement.* Paper presented at the Proceedings of the human factors society 32nd Annual meeting, Santa Monica, CA.

Endsley, M. (1988c). *Situation awareness global assessment technique (SAGAT).* Paper presented at the National Aerospace and Electronics Conference (NAECON), New York, NY.

Endsley, M. (1990). *Situation awareness in dynamic human decision making: Theory and measurement* (Unpublished doctoral dissertation). University of Southern California, Los Angeles.

Endsley, M. (1993). Automation and situation awareness. In M. Endsley, B. Bolte & D. Jones (Eds.), *Designing for situation awareness: An approach to user-centered design* (pp. 174-191). Boca Raton, FL: CRC Press, Taylor & Francis Group.

Endsley, M. (1995a). Measurement of situation assessment in dynamic systems. *Human Factors, 37*(1), 65-84. doi:10.1518/001872095779049499

Endsley, M. (1995b). The 'out of the loop' performance problem and level of control in automation. *Human Factors, 32*(2), 381-394. doi:10.1518/001872095779064555

Endsley, M. (1995c). Toward a theory of situation awareness in dynamic systems. *Human Factors, 37*(1), 32-64. doi:10.1518/001872095779049543

Endsley, M. (1999). *Situation awareness and human error: Designing to support human performance*. Paper presented at the High Consequence Systems Surety Conference, Albuquerque, NM.

Endsley, M. (2000a). Direct measurement of situation awareness: Validity and use of SAGAT. In M. Endsley & D. J. Garland (Eds.), *Situation awareness analysis and measurement* (pp. 147-173). Mahwah, NJ: Lawrence Erlbaum.

Endsley, M. (2000b). Theoretical underpinnings of situation awareness: A critical review. In M. R. Endsley & D. J. Garland (Eds.), *Situation awareness analysis and measurement* (pp. 3-32). Mahwah, NJ: Lawrence Erlbaum.

Endsley, M. (2003a). SA demons. In M. Endsley, B. Bolte & D. Jones (Eds.), *Designing for situation awareness: An approach to user-centered design* (pp. 31-42). Boca Raton, FL: Taylor & Francis.

Endsley, M. (2003b). User-centered design. In M. Endsley, B. Bolte & D. Jones (Eds.), *Designing for situation awareness: An approach to user-centered design* (pp. 1-11). Boca Raton, FL: CRC Press, Taylor & Francis Group.

Endsley, M. (2004). Situation awareness: Progress and directions. In S. Banbury & S. Tremblay (Eds.), *A cognitive approach to sitation awareness: Theory and application* (pp. 317-341). Burlington, VT: Ashgate.

Endsley, M., Bolte, B., & Jones, D. (2003). *Designing for situation awareness: An approach to human-centered design*. London, England: Taylor & Francis.

Endsley, M., & Garland, D. (2000). *Situation awareness analysis and measurement*. Mahwah, NJ: Lawrence Erlbaum.

Endsley, M., Hoffman, R., Kaber, D. B., & Roth, E. (2007). Cognitive engineering and decision making: An overview and future course. *Journal of Cognitive Engineering and Decision Making, 1*(1), 1-21. doi:10.1177/155534340700100101

Endsley, M., Holder, L., Leibrecht, B., Garland, D., Wampler, R., & Matthews, M. (2000). *Modeling and measuring situation awareness in the infantry operational environment.* Alexandria, VA: Army Research Institute.

Endsley, M., & Robertson, M. (2000). Training for situation awareness in individuals and teams. In M. Endsley & D. Garland (Eds.), *Situation awareness, analysis and measurement* (pp. 349-365). Mahwah, NJ: Lawrence Erlbaum.

Eppley, K., Abrams, A., & Shear, J. (1989). Differential effects of relaxation techniques on trait anxiety: A meta-analysis. *Journal of Clinical Psychology, 45*, 957-974. doi:10.1002/1097-4679(198911)45:6<957::AID-JCLP2270450622>3.0.CO;2-Q

Epstein, S. (1998). Emotions and psychopathology from the perspective of cognitive-experiential self-theory. In W. Flack & J. Laird (Eds.), *Emotions in psychopathology: Theory and research*. New York, NY: Oxford University Press.

Epstein, S. (2001). *Constructive thinking inventory: Professional manual.* Lutz, FL: Psychological Assessment Resources.

Epstein, S., & Meier, P. (1989). Constructive thinking: A broad coping variable with specific components. *Journal of Personality & Social Psychology, 62*(2), 302-340. doi:10.1037//0022-3514.57.2.332

Everly, G., Strouse, D., & Everly, G. (2010). *The secrets of resilient leadership*. New York, NY: DiaMedica.

Farrow, J., & Hebert, J. (1982). Breath suspension during the transcendental meditation technique. *Psychosomatic Medicine, 44*(2), 133-153.

Ferguson, P. (1975). The psychobiology of transcendental mediation: A review. *Journal of Altered States of Consciousness, 2*(1), 15-36.

Fillmore, E., Ramirez, R., Roth, L., Robertson, M., & Peek-Asa, C. (2011). After the waters receded: A qualitative study of university official's disaster experiences during the great iowa flood of 2008. *Journal of Community Health, 36*(2), 307-315. doi:10.1007/s10900-010-9312-z

Flin, R. (1966). *Sitting in the hot seat: leaders and teams for ciritical incident management*. Chichester, England: Wiley.

Flin, R., & Arbuthnot, K. (Eds.). (2002). *Incident command: Tales from the hot seat*. Ashgate, England: Aldershot.

French, W., Bell, C., & Zawacki, R. (2005). *Organization development and transformation*. New York, NY: McGraw-Hill.

Friedman, T. L. (2005). *The world is flat: A brief history of the twenty-first century*. New York, NY: Farrar, Straus and Giroux.

Gelderloos, P., Lockie, R., & Chuttoorgoon, S. (1987). Field independence of students at Maharishi School of the Age of Enlightenment and a Montessori school. *Perceptual and Motor Skills, 65*, 613-614. doi:10.2466/pms.1987.65.2.613

Gelderloos, P., Walton, K., Orme-Johnson, D., & Alexander, C. (1991). Effectiveness of the Transcendental Meditation Program in preventing and treating substance misuse: A review. *Substance Use & Misuse, 26*(3), 293-325. doi:10.3109/10826089109058887

Giovagnoli, A. (1996). Trail Making Test: Normative values from 287 normal adult controls. *Italian Journal of Neurological Sciences, 17*(4), 305-310. doi:10.1007/BF01997792

Goffman, E. (1974). *Frame analysis*. New York, NY: Harper.

Goia, G., Isquith, P., Guy, S., & Kenworthy, L. (2000). *Behavior rating inventory of executive function, professional manual*. Odessa, FL: Psychological Assessment Resources.

Goia, G., Isquith, P., Kenworthy, L., & Barton, R. (2002). Profiles of everyday executive function in acquired and developmental disorders. *Child Neuropsychology, 8*(2), 121-137.

Goldberg, E. (2001). *The executive brain: Frontal lobes and the civilized mind*. New York, NY: Oxford University Press.

Goldstein, W., & Hogarth, R. (Eds.). (1997). *Research on judgment and decision making*. Cambridge, England: Cambridge University Press.

Golembiewski, R. (1990). *Ironies in organizational development*. New Brunswick, NJ: Transaction.

Golembiewski, R., Billingsley, K., & Yeager, S. (1976). Measuring change and persistence in human affairs: Type and change generated by OD designs. *Journal of Applied Behavioral Science, 12*, 133-157. doi:10.1177/002188637601200201

Gray, B., Bougon, M., & Donnellon, A. (1985). Organizations as constructions and destructions of meaning. *Journal of Management, 11*, 83-95. doi:10.1177/014920638501100212

Gregg, Z. (2008, October 7). Pentagon researches alternative treatments, *USA Today*. Retrieved from http://www.usatoday.com

Gustavsson, B. (1992). *The transcendent organization* (Unpublished master's thesis), University of Stockholm, Stockholm, Sweden.

Haas, M., Nelson, W., & Repperger, D. (2001). Applying adaptive control and display characteristics to future air force crew stations. *International Journal of Aviation Psychology, 11*(2), 223-236. doi:10.1207/S15327108IJAP1102_06

Hargrove, D., & Sitkin, S. (2011). Next generation leadership development in a changing and complex environment: An interview with General Martin E. Dempsey. *Academy of Management Learning & Education Journal, 10*(1), 528-533. doi:10.5465/amle.2011.0006

Hawkins, M., Alexander, C., Travis, F., Camelia, C., Walton, K., Durchholz, C., & Rainforth, M. (2003). Consciousness-based rehabilitation of inmates in the Netherlands Antilles: Psychosocial and cognitive changes. *Journal of Offender Rehabilitation, 36*(1), 205-210. doi:10.1300/J076v36n01_10

Heaton, S., & Thompson, L. (1995). *Wisconsin card sort test: Individual practice in administration and scoring.* Lutz, FL: Psychological Assessment Resources.

Hede, A. (2010). The dynamics of mindfulness in managing emotions and stress. *Journal of Management Development, 29*(1), 94-110. doi:10.1108/02621711011009090

Heifetz, R., Grashow, A., & Linsky, M. (2009). *The practice of adaptive leadership: Tools and tactics for changing your organization and the world*. Boston, MA: Harvard Business Press.

Hocevar, S., Jansen, E., & Thomas, G. (2004). *Building collaborative capacity for homeland security*. Washington, DC: U.S. Government Office of Management and Budget.

Hodgkinson, P., & Stewart, M. (1991). *Coping with catastrophe*. London, England: Routledge.

Hoermann, H., Blokzijl, C., & Polo, L. (2004). *ESSAI -- A european training solution for enhancing situation awareness and threat management on modern aircraft flight decks.* Paper presented at the 16th Annual European Aviation Safety Seminar of the Flight Safety Foundation and European Regions Airline Association, Barcelona, Spain.

Holt, W., Caruso, J., & Riley, J. (1978). Transcendental meditation versus pseudo-meditation on visual choice reaction time. *Perceptual and Motor Skills, 46,* 726. doi:10.2466/pms.1978.46.3.726

Hoyer, J., Averbeck, M., Heidenreich, T., Stangier, U., Pohlmann, K., & Rossler, G. (1998). The constructive thinking inventory: Factorial structure in healthy individuals and patients with chronic skin disease. *European Journal of Psychological Assessment, 14*(3), 226-233. doi:10.1027/1015-5759.14.3.226

Hurley, J. (1991). Related measures of constructive and rational thinking. *Journal of Psychology, 125*(2), 229-235. doi:10.1002/1097-4679(199107)47:4<576::AID-JCLP2270470417>3.0.CO;2-R

Jackson, B., Peterson, D., Bartis, J., La Tourette, T., Brahmakulan, I., & Houser, A. (2001, December 9-11). *Protecting emergency responders: Lessons learned from terrorist attacks.* Paper presented at the Conference of the National Institute of Occupational Safety and Health, New York, NY.

Jedrczak, A. (1984). The TM-Sidhi programme and field independence. *Perceptual and Motor Skills, 59,* 999-1000. doi:10.2466/pms.1984.59.3.999

Jha, A., Stanley, E., Kiyonaga, A., Wong, L., & Gelfand, L. (2010). Examining the protective effects of mindfulness meditation training on working memory capacity and affective experience. *Emotion, 10*(1), 54-64. doi:10.1037/a0018438

Joiner, B., & Josephs, S. (2007). *Leadership agility*. San Francisco, CA: Jossey-Bass.

Karwowski, W. (Ed.). (2006). *International encyclopedia of ergonomics and human factors* (2nd ed. Vol. 1). London, England: Taylor & Francis.

Kessel, C., & Wickens, C. (1982). The transfer of failure-detection skils between monitoring and controlling dynamic systems. *Human Factors, 24*(1), 49-60.

Klein, G. (1993). A recognition-primed decision (RPD) model of rapid decision making. In G. Klein, J. Orasanu, R. Calderwood & C. Zsambok (Eds.), *Decision making in action: Models and methods* (pp. 136-147). Norwood, NJ: Ablex.

Klein, G. (1996). The effect of acute stressors on decision making. In J. Driskell & E. Salas (Eds.), *Stress and human performance* (pp. 49-88). Hillsdale, NJ: Lawrence Erlbaum.

Klein, G. (2000). Analysis of situation awareness from critical incident reports. In M. R. Endsley & D. J. Garland (Eds.), *Situation awareness analysis and measurement* (pp. 51-71). Mahwah, NJ: Lawrence Erlbaum.

Klein, G. (2004). *The power of intuition*. New York, NY: Doubleday.

Klein, G., Calderwood, R., & Clinton-Cirocco, A. (1986). *Rapid decision making on the fireground.* Paper presented at the Proceedings of the Human Factors and Ergonomics Society 30th Annual Meeting, Dayton, OH.

Klein, G., & Hoffman, R. (1993). Seeing the invisible: Perceptual/cognitive aspects of expertise. In M. Rabinowitz (Ed.), *Cognitive science foundations of instruction* (pp. 203-226). Mahwah, NJ: Lawrence Erlbaum.

Klein, G., Ross, K. G., Klein, D. E., Hoffman, R., & Hollnagel, E. (2003). Macrocognition. *IEEE Intelligence Systems, 18*(3), 81-85. doi:10.1109/ MIS.2003.1200735

Koven, N. (2011). *Emotion, 11*(5), 1255-1261. doi:10.1037/a0025616

Kuhn, T. (1996). *The structure of scientific revolutions* (3rd ed.). Chicago, IL: University of Chicago Press.

Lau, C., & Woodman, R. (1995). Understanding organizational change: A schematic perspective. *Academy of Management Journal, 38*(2), 537-554.

Lehmann, D., Faber, P., Acherman, P., Jeanmond, D., Gianotti, L., & Pizzagali, D. (2001). Brain sources of EEG gamma frequency during volitionally meditation-induced, altered states of consciousness, and experience of the self. *Psychiatric Research, 108*(2), 111-121. doi:10.1016/S0925-4927(01)00116-0

Lewin, K. (1935). *A dynamic theory of personality: Selected papers*. New York, NY: McGraw-Hill.

Lewin, K., Lippitt, R., & White, R. K. (1939). Patterns of aggressive behavior in experimentally created social climates. *Journal of Social Psychology, 10*, 271-279. doi:10.1080/00224545.1939.9713366

Lezak, M. (1995). *Neurophysiological assessment* (3rd ed.). New York, NY: Oxford University Press.

Lippitt, R., Watson, J., & Westley, B. (1958). *The dynamics of planned change*. New York, NY: Harcourt Brace and World.

Maclean, J. (1999). *Fire on the mountain: The true story of the South Canyon fire*. New York, NY: Simon & Schuster.

Manchester, D., Priestley, N., & Jacksons, H. (2004). The assessment of executive functions: Coming out of the office. *Brain Injury, 18*(11), 1067-1081. doi:10.1080/02699050410001672387

Markus, H., & Zajonc, R. (1985). The cognitive perspective in social psychology. In G. Lindzey & E. Aronson (Eds.), *The handbook of social psychology* (Vol. I, pp. 137-230). New York, NY: Random House.

Marshak, R. (2009). *Organizational change: Views from the edge*. Bethel, MN: Lewin Center.

Marshak, R., & Katz, J. (1991). Covert processes at work. *Chesapeake Bay Organizational Development Network Newsletter, 6*(2), 1-5.

McGough, E., Kelly, V., Logsdon, R., McCurry, S., Cochrane, B., Engel, J., & Teri, L. (2011). Associations between physical and executive function in older adults with mild cognitive impairment: Gait speed and the timed "up and go" test. *Physical Therapy, 91*(8), 1198-1210. doi:10.2522/ptj.20100372

McKenna, F., & Crick, J. (1994). *Development in hazard perception*. London, England: Department of Transport.

McLennan, J., Holgate, A., Omodei, M., & Wearing, A. (2006). Decision making effectiveness in wildfire incident management teams. *Journal of Contingencies and Crisis Management, 14*(1), 27-37. doi:10.1111/j.1468-5973.2006.00478.x

Meadows, M., Shreffler, K., & Mullins-Sweatt, S. (2011). Occupational stressors and resilience in critical occupations: the role of personality. In P. Perrewe & D. Ganster (Eds.), *The role of individual differences in occupational stress and well-being: Research in occupational stress and well being* (Vol. 9, pp. 39-61). Bingley, England: Emerald Group.

Millerrodgers, M. (2010, September 27). Comprehensive soldier fitness marks change in army culture, *Army News*, pp. 1-2. Retrieved from http://www.army.mil/article/45723/comprehensive-soldier-fitness-marks-change-in-army-culture

Mitroff, I. (1983). *Stakeholders of the organization mind*. San Francisco, CA: Jossey-Bass.

Monchi, O., Petrides, M., Petre, V., Worsley, K., & Dagher, A. (2001). Wisconsin card sorting revisted: Distinct neural circuits participating in different stages of the task identified by event-related functional magnetic resonance imaging. *Journal of Neuroscience, 21*(19), 7733-7741. doi:10.1016/S1053-8119(01)91791-4

Moray, N. (2004). Ou sont les neiges d'antan? ("Where are the snows of yesteryear?"). In D. Vincenzi, P. Mouloua & P. Hancock (Eds.), *Human performance, situation awareness, and automation: Current research and trends* (pp. 1-31). Mahwah, NJ: Lawrence Erlbaum.

Morgan, G., & Ramirez, R. (1984). Action learning: A holographic metaphor for guiding social change. *Human Relations, 37,* 1-28. doi:10.1177/001872678403700101

Murphy, M., Donovan, S., & Taylor, E. (1997). *The physical and psychological effects of meditation: A review of contemporary research with a comprehensive bibliography 1931-1996* (2nd ed.). Sausalito, CA: Institute of Noetic Sciences.

Neisser, U. (1976). *Cognition and reality*. San Francisco, CA: W.H. Freeman and Company.

Nicoullin, A. (2002). Dopamine and the regulation of cognition and attention. *Progressive Neurobiology, 67*, 53-83.

Nielsen, R. (1993). Woolman's "I am we" trip loop action-learning: Origin and application in organization ethics. *Journal of Applied Behavioral Science, 29*(1), 117-138. doi:10.1177/0021886393291007

Omodei, M., McLennan, J., & Reynolds, C. (2005). *Identifying why even well-trained firefighters make unsafe decisions: A human factors interview protocol*. Paper presented at the Eighth International Wildland Fire Safety Summit, Missoula, MT.

Omodei, M., McLennan, J., & Wearing, A. (2005). How expertise is applied in real-world dynamic environments: Head-mounted video and cued-reall as a methodology for studying routines in decision-making. In T. Betsch & S. Haberstroh (Eds.), *The routines of decision making* (pp. 271-188). Mahwah, NJ: Lawrence Erlbaum.

Omodei, M., Taranto, P., & Wearing, A. (2005). *Understanding the reasons even good firefighters make unsafe decisions: A human factors interview protocol.* Melbourne, Australia: La Trobe University, School of Psychological Science.

Omodei, M., & Wearing, A. (1995). Decision making in complex dynamic settings: A theoretical model incorporating motivation, intention, affect, and cognitive performance. *Sprache und Kognition, 14*, 75-90.

Omodei, M., Wearing, A., McLennan, J., & Clancy, J. (2005). More is better?: Problems of self-regulation in naturalistic decision making situations. In H. Montgomery, R. Lipshitz & B. Brehmer (Eds.), *How professionals make decisions* (pp. 29-42). Mahwah, NJ: Lawrence Erlbaum.

Orasanu, J., & Backer, P. (1996). Stress and military performance. In J. Driskell & E. Salas (Eds.), *Stress and performance*. Hillsdale, NJ: Lawrence Erlbaum.

Orasanu, J., & Connolly, T. (1993). The reinvention of decision making. In G. Klein, J. Orasanu, R. Calderwood & C. Zsambok (Eds.), *Decision making in action: Models and methods* (pp. 3-20). Norwood, NJ: Ablex.

Orme-Johnson, D. (1988). The cosmic psyche -- An introduction to Maharishi's vedic psychology: The fulfillment of modern psychology. *Modern Science and Vedic Science, 2*(2), 113-163.

Orme-Johnson, D., & Farrow, J. (1977). *Scientific research on the transcendental mediation program: Collected Papers* (Vol. 1). Rheinweiler, Germany: MERU Press.

Orme-Johnson, D., Kolb, D., & Hebert, J. (1977). An experimental analysis of the effects of the transcendental meditation technique on reaction time. In D. Orme-Johnson & J. Farrow (Eds.), *Scientific research on the transcendental meditation program: Collected papers* (Vol. 1, pp. 316-321). Rheinweiler, West Germany: MERU Press.

Orme-Johnson, D., Wallace, R., Dillbeck, M., Alexander, C., & Ball, O. (1981). *Improved functional organization of the brain through the Maharishi Technology of the Unified Field as indicated by changes in EEG coherence and its cognitive correlates: A proposed model of higher states of consciousness.* Paper presented at the American Psychological Society Annual Convention, Los Angeles.

Ospina, M., Bond, T., Karkhaneh, M., Tjosvold, L., Vandermeer, B., Liang, Y., . . . Klassen, T. (2007). Meditation Practices for Health: State of the Research. In P. b. t. U. o. A. E.-B. P. Center (Ed.), (pp. 473). Rockville, MD: Agency for Healthcare Research and Quality.

Ozonoff, S. (1995). Reliability and validity of the Wisconsin Card Sort Test in studies of autism. *Neuropsychology, 9*(4), 491-500. doi:10.1037//0894-4105.9.4.491

Pallant, J. (2007). *SPSS survival manual* (3rd ed.). Maidenhead, Berkshire, England: Open University Press/McGraw-Hill House.

Pargament, K. I., & Sweeney, P. J. (2011). Building spiritual fitness in the Army: An innovative approach to a vital aspect of human development. *American Psychologist, 66*(1), 58-64. doi:10.1037/a0021657

Patterson, J., Goens, G., & Reed, D. (2009). *Resilient leadership for turbulent times*. New York, NY: Rowman & Littlefield.

Pelletier, K. (1974). Influence of Transcendental Meditation on autokinetic perception. *Perceptual and Motor Skills, 39*, 1031-1034. doi:10.2466/pms.1974.39.3.1031

Pfeifer, J. (2005). *Command resiliency: An adaptive response strategy for complex incidents* (Master's thesis) Retrieved from http://library.nps.navy.mil/uhtbin/hyperiod/05Sep%5Pfeifer.pdf

Phillips, D., & Barbules, N. (2000). *Postpositivism and educational research*. Lanham, MD: Rowman & Littlefield.

Pliske, R., McCloskey, M., & Klein, G. (2001). Decision skills training: Facilitating learning from experience. In E. Salas & G. Klein (Eds.), *Linking expertise and naturalistic decision making* (pp. 37-53). Mahwah, NJ: Lawrence Erlbaum.

Prince, C., & Salas, E. (1998). Situation assessment for routine flight and decision making. *International Journal of Cognitive Ergonomics, 1*(4), 315-324.

Prince, C., & Salas, E. (2000). Team situation awareness, errors, and crew resource management: Research integration for training guidance. In M. Endsley & D. Garland (Eds.), *Situation awareness, analysis, and measurement* (pp. 325-347). Mahwah, NJ: Lawrence Erlbaum.

Putnam, T. (2000). *Fire safety: Up in smoke?* Retrieved from http://www.wildfirenews.com/putnam

Putnam, T. (2001). Mindful of safety. *Wildfire Magazine, 10*(3), 4-7.

Rainforth, M., Schneider, R., Nidich, R., Gaylord-King, C., Salerno, J., & Anderson, J. (2007). Stress reduction programs in patients with elevated blood pressure: A systematic review and meta-analysis. *Current Hypertension Reports, 9*, 520-528. doi:10.1007/s11906-007-0094-3

Rasmussen, J. (1983). Skills, rules, and knowledge. *IEEE Transactions on Systems, Man, and Cybernetics, 13*(3), 257-266.

Reason, J. (1997). *Managing the risk of organizational accidents*. Aldershot, England: Ashgate.

Rees, B., & Leffler, D. (2008, July 14-18). *Stress reduction using the transcendental meditation program: Solution to problems arising from combat stress.* Paper presented at the Academy International Conference on Armed Forces & Conflict Resolution in a Globalized World, Seoul, Korea.

Reivich, K. J., Seligman, M. E. P., & McBride, S. (2011). Master resilience training in the U.S. Army. *American Psychologist, 66*(1), 25-34. doi: 10.1037/a0021897

Robinson, A., Heaton, R., Lehman, R., & Stilson, D. (1980). The utility of the Wisconsin Card Sorting Test in detecting and localizing frontal lobe lesions. *Journal of Consultation in Clinical Psychology, 48*, 605-614. doi:10.1037//0022-006X.48.5.605

Robinson, D. (2000). *The development of flight crew situation awareness in commercial transport aircraft.* Paper presented at the Human Performance, Situation Awareness and Automation: User-Centered Disgn for a New Millienium Conference, Marietta, GA.

Rodgers, M. D., & Mogford, R. H. (2000). Post hoc assessment of situation awareness in air traffic control incidents and major aircraft accidents. In M. Endsley & D. J. Garland (Eds.), *Situation awareness analysis and measurement* (pp. 73-112). Mahwah, NJ: Lawrence Erlbaum.

Rosenthal, J. Z., Grosswald, S., Ross, R., & Rosenthal, N. (2011). Effects of Transcendental Meditation in veterans of Operation Enduring Freedom and Operation Iraqi Freedom with Posttraumatic Stress Disorder: A Pilot Study. *Military Medicine, 176*(6), 626-630.

Ross, K. G., & Shafer, J. L. (2004). *Macrocognitive knowledge representation and design*. Fairborn, OH: Klein Associates.

Roth, R. (1994). *Maharishi Mahesh Yogi's transcendental meditation*. Washington DC: Primus.

Rousseau, R., Tremblay, S., & Breton, R. (2004). Defining and modeling situation awareness: A critical review. In S. Banbury & S. Tremblay (Eds.), *A cognitive approach to situation awareness: Theory and application* (pp. 3-21). Burlington, VT: Ashgate.

Rubinstein, J., Meyer, D., & Evans, J. (2001). Executive control of cognitive processes in task switching. *Journal of Experimental Psychology: Human Perception and Performance, 27*(4), 763-797. doi:10.1037//0096-1523.27.4.763

Rutter, M. (1999). Resistance concepts and findings: Implications for family therapy. *Journal of Family Therapy, 21*, 119-144. doi:10.1111/1467-6427.00108

Salas, E., Dickinson, T., Converse, S., & Tannenbaum, S. (1992). Teams: Their training and performance. In R. Swezey & E. Salas (Eds.), *Toward an understanding of team performance and training* (pp. 3-29). Norwood, NJ: Ablex.

Salas, E., Driskell, J., & Hughes, S. (Eds.). (1996). *Introduction: The study of stress and human performance*. Mahwah, NJ: Erlbaum.

Salas, E., Stagl, K., Burke, C., & Goodwin, G. (2007). Toward an integrative theoretical framework. In J. Dienstbier, J. Shuart, W. Spaulding & J. Poland (Eds.), *Modeling complex systems: Motivation, cognition, and social processes* (Vol. 51, pp. 185-243). Lincoln, NE: University of Nebraska Press.

Sandoval, A. (2005). *The influence of organizational culture on situation awareness and decision making in a simulated peacekeeping environment* (Unpublished doctoral dissertation). Texas Technical University, Lubbock, TX.

Schecter, H. (1977). *The Transcendental Meditation program in the classroom: A psychological evaluation* (Doctoral dissertation). Retrieved from Dissertation Abstracts International (38 07)

Schein, E. (1983). *Corporate culture: What it is and how to change it*. Cambridge, MA: Alfred P. Sloan School of Management, Massachusetts Institute of Technology.

Schein, E. (1992). *Organizational culture and leadership*. San Francisco, CA: Jossey-Bass.

Schein, E. (2003). *Taking culture seriously in organization development: A new role for OD?* Cambridge, MA: MIT Sloan School of Management.

Schmidt-Wilk, J. (1996). *The Maharishi Corporate Development Program: Growth of experience and understanding in international top management teams* (Unpublished doctoral dissertation). Maharishi University of Management, Fairfield, IA.

Schmidt-Wilk, J. (2003). TQM and the Transcendental Meditation program in a Swedish top management team. *TQM Magazine, 15*(4), 219.

Schmidt-Wilk, J., Alexander, C., & Swanson, G. (1995). Introduction to the transcendental meditation program in a norwegian top management team. In B. Glaser (Ed.), *Grounded theory: 1984-1994* (pp. 563-587). Mill Valley, CA: Sociology Press.

Schmidt-Wilk, J., Alexander, C., & Swanson, G. (1996). Developing consciousness in organizations: The transcendental meditation program in business. *Journal of Business & Psychology, 10*(4), 429-444. doi:10.1007/BF02251779

Schneider, R. (2005). *I will try: Cadet handbook*. Northfield, VT: The Office of the Commandant, Norwich University, The Military College of Vermont.

Schneider, R., Alexander, C., Salerno, J., Robinson, D., Fields, J., & Nidich, S. (2002). Disease prevention and health promotion in the aging with a traditional system of natural medicine: Maharishi Vedic Medicine. *Journal of Aging and Health, 14*(1), 57-78. doi:10.1177/089826430201400104

Schneider, R., Castillo-Richmond, A., Alexander, C., Myers, H., Kaushik, V., Aranguri, C., . . . Nidich, S. (2001). Behavioral treatment of hypertensive heart disease in African Americans: Rationale and design of a randomized controlled trial. *Behavioral Medicine, 27*(2), 83-95. doi:10.1080/08964280109595775

Schneider, R., & Fields, J. (2006). *Total heart health: How to prevent and reverse heart disease with the Maharishi Vedic Approach to health*. Laguna Beach, CA: Basic Health.

Schneider, S., & Shanteau, J. (2003). *Emerging perspectives on judment and decision research*. Cambridge, MA: Cambridge University Press.

Schraagen, J., Klein, G., & Hoffman, R. (2008). The macrocognition framework of naturalistic decision making. In J. Schraagen, Militello, L., Ormerod, T., Lipshitz, R. (Ed.), *Naturalistic decision making and macrocognition*. Burlington, VT: Ashgate.

Selart, M., & Johansen, S. (2011). Ethical decision making in organizations: The role of leadership stress. *Journal of Business Ethics, 99*(2), 129-143. doi:10.1007/s10551-010-0649-0

Selye, H. (1936). A syndrome produced by diverse nocuous agents. *Nature, 138*, 32. doi:10.1038/138032a0

Selye, H. (1974). *Stress without distress*. Philadelphia, PA: Lippincott.

Selye, H. (1978). *The stress of life*. New York, NY: McGraw-Hill.

Senge, P. (1990). *The fifth discipline: The art and practice of the learning organization*. New York, NY: Doubleday.

Senge, P., Jaworski, B. J., Scharmer, & Flowers. (2005). *Presence*. New York, NY: Random House Books.

Sewell, G. (2011, March-April). How emotional intelligence can make a difference. *Military Review*, 79-83.

Shanker, T., & Richtel, M. (2011, January 16). In new military, data overload can be deadly, *New York Times*.

Shear, J. (2006). *The experience of meditation*. St. Paul, MN: Paragon House.

Sheppard, W. D., Staggers, F. J., & John, L. (1997). The effects of a stress management program in a high security government agency. *Anxiety, Stress & Coping, 10*(4), 341-350. doi:10.1080/10615809708249308

Smith, K., & Hancock, P. A. (1995). Situation awareness is adaptive, externally directed consciousness. *Human Factors, 37*(1), 137-148. doi:10.1518/001872095779049444

Snook, S. (2001). *Friendly fire*. Princeton, NJ: Princeton University Press.

So, K., & Orme-Johnson, D. (2001). Three randomized experiments on the longitudinal effects of the Transcendental Meditation technique on cognition. *Intelligence, 29*(5), 419-440. doi:10.1016/S0160-2896(01)00070-8

Spencer, R., Drag, L., Walker, S., & Bieliauskas, L. (2010). Self-reported cognitive symptoms following mild traumatic brain injury are poorly associates with neuropsychological performance in Operation Iraqi Freedom/Operation Enduring Freedom veterans. *Journal of Rehabilitation Research & Development, 47*(6), 521-530. doi:10.1682/JRRD.2009.11.0181

Spick, M. (1988). *The ace factor: Air combat and the role of situational awareness*. Annapolis, MD: Naval Institute Press.

Stacciarini, J., & Troccoli, B. (2004). Occupational stress and constructive thinking: Health and job satisfaction. *Nursing and Health Care Management and Policy, 46*(5), 480-487. doi:10.1111/j.1365-2648.2004.03022.x

Stanton, N. A., Salmon, P. M., Walker, G. H., Baber, C., & Jenkins, D. (2005). *Human factors methods: A practical guide for engineering and design*. Burlington, VT: Ashgate.

Starbuck, W., & Mezias, J. (1996). Opening pandora's box: Studying the accuracy of managers' perceptions. *Journal of Organizational Behavior, 17*, 99-117. doi:10.1002/(SICI)1099-1379(199603)17:2<99::AID-JOB743>3.0.CO;2-2

Starbuck, W., Milliken, F., & Hambrick, D. (1988). Executives' perceptual filters: What they notice and how they make sense. In D. Hambrick (Ed.), *The executive effect: Concepts and methods for studying top managers.* (pp. 35-65): JAI Press.

Strater, L., Reynolds, J., Faulkner, L., Birch, K., Hyatt, J., & Swetnam, S. (2004). *PC-Based tools to improve infantry situation awareness.* Paper presented at the Human Factors and Ergonomics Society, Santa Monica, CA.

Svenson, O. (1997). Differentiation and consolidation theory. In R. Flin, E. Salas, M. Strub & L. Martin (Eds.), *Decision making under stress: Emerging themes and applications* (pp. 55-65). Aldershot, England: Ashgate.

Thompson, H. (2005). *The impact of stress on the BarOn EQ-i reported scores and a proposed model of inquiry* (Vol. 15-5). Watkinsville, GA: High Performing Systems.

Thompson, H. (2006). Exploring the interface of the type and emotional intelligence landscapes. *Bulletin of Psychological Type, 29*(3), 14-19.

Thompson, H. (2007). *Catastrophic leadership failure: An overview* (Vol. 11, pp. 1-3): High Performing Systems.

Thompson, H. (2010). *The stress effect: Why smart leaders make dumb decisions -- and what to do about it*. San Francisco, CA: Jossey-Bass.

Tichy, N., & Bennis, W. (2007). *Judgment: How winning leaders make great calls*. New York, NY: Peguin.

Tisza, S., Motti, J., & Matthews, D. (2003). Current trends in workers compensation stress claims. *Current Opinion in Psychiatry, 16*, 571-574. doi:10.1097/00001504-200309000-00014

Toffler, A. (1970). *Future Shock*. New York, NY: Random House.

Torbert, W. (2004). *Action inquiry: The secret of timely and transforming leadership*. San Francisco, CA: Barrett-Koehler.

Travis, F. (2001). Transcendental meditation technique. In E. Craighead & C. Nemeroff (Eds.), *Corsini Encyclopedia of Psychology and Neuroscience* (pp. 1705-1706). New York, NY: John Wiley and Sons.

Travis, F., & Arenander, A. (2006). Cross-sectional and longitudinal study of effects of Transcendental Meditation on interhemispheric frontal symmetry and frontal coherence. *International Journal of Neuroscience, 116*(12), 1519-1538. doi:10.1080/00207450600575482

Travis, F., Haaga, D., Hagelin, J., Tanner, M., Nidich, S., Gaylord-King, C., . . . Schneider, R. (2009). Effects of Transcendental Meditation practice on brain functioning and stress reactivity in college students. *International Journal of Psychophysiology, 71*, 170-176. doi:10.1016/j.ijpsycho.2008.09.007

Travis, F., & Pearson, C. (2000). Pure consciousness: Distinct phenomenological and physiological correlates of "consciousness itself". *International Journal of Neuroscience, 100*, 77-89. doi:10.3109/00207450008999678

Travis, F., & Shear, J. (2010). Focused attention, open monitoring and automatic self-transcending: Categories to organize meditations from vedic, buddhist, and chinese traditions. *Consciousness and Cognition, 19*, 1110-1118. doi:10.1016/j.concog.2010.01.007

Travis, F., Tecce, J., Arenander, A., & Wallace, R. K. (2002). Patterns of EEG coherence, power, and contingent negative variation characterize the integration of transcendental and waking states. *Biological Psychology, 61*, 293-319. doi:10.1016/S0301-0511(02)00048-0

Travis, F., Tecce, J., & Durchholz, C. (2001). Cortical plasticity, cnv, and transcendent experiences: Replication with subjects reporting permanent transcendental experiences. *Psychophysiology, 38*, S95.

Travis, F., & Wallace, R. (1999). Autonomic and EEG patterns during eyes-closed rest and Transcendental Meditation practice: The basis for a neural model of TM practice. *Consciousness and Cognition, 8*, 302-318. doi:10.1006/ccog.1999.0403

Tuniga, N. (1991, May). Meditating your way to control. *Canadian Business*.

Uprichard, S., Kupshik, G., Pine, K., & Fletcher, B. (2009). Dynamic assessment of learning ability improves outcome prediction following acquired brain injury. *Brain Injury, 23*(4), 278-290. doi:10.1080/02699050902788444

Vaughan, D. (2002). Signals and interpretive work. In K. Cerulo (Ed.), *Culture in mind*. New York, NY: Routledge.

Veltman, L. (1990, Nov. 15). The management's mystical cure. *The Times*.

Visser, L. (1986). "Super meditation": The Japanese answer to "In search of excellence". *Human Potential, 3*, 1-3.

Vujanovic, A. A., Niles, B., Pietrefesa, A., Schmertz, S. K., & Potter, C. M. (2011). Mindfulness in the treatment of posttraumatic stress disorder among military veterans. *Professional Psychology: Research and Practice, 42*(1), 24-31. doi: 10.1037/a0022272

Wallace, R. (1986). *The physiology of consciousness*. Fairfield, IA: Maharishi University Press.

Wallace, R., Orme-Johnson, D., & Dillbeck, M. C. (Eds.). (1976-1990). *Scientific research on Maharishi's transcendental meditation and TM-Sidhi Program* (Vol. 1-5). Fairfield, IA: Maharishi University of Management Press.

Wallace, R. K. (1993). *The physiology of consciousness*. Fairfield, IA: Maharishi International University Press.

Walters, J. (2002). *The art and science of raja yoga: Fourteen steps to higher awareness*. Delhi, India: Motilal Banarsidass.

Weick, K. (1993). The collapse of sensemaking in organizations: The Mann Gulch disaster. *Administrative Science Quarterly, 38*(4), 628-652. doi:10.2307/2393339

Weick, K. (1995). *Sensemaking in organizations*. Thousand Oaks, CA: Sage.

Weick, K. (1996, June). Drop your tools: An allegory for organizational studies. *Administrative Science Quarterly*.

Weick, K., & Putnam, T. (2006). Organizing for mindfulness: Eastern wisdom and western knowledge. *Journal of Management Inquiry, 15*(3), 275-287. doi:10.1177/1056492606291202

Weick, K., Sutcliffe, K., & Obstfield, D. (2005). Organizing and the process of sensemaking. *Organization Science, 16*(4), 409-421. doi:10.1287/orsc.1050.0133

Weick, K., & Sutcliffe, K. M. (2007). *Managing the unexpected: Resilient performance in an age of uncertainty* (2nd ed.). San Francisco: Jossey-Bass.

Weick, K., & Sutcliffe, K. M. (Eds.). (2001). *Managing the unexpected: Assuring high performance in an age of complexity*. San Francisco: Jossey-Bass.

Weick, K., Sutcliffe, K. M., & Obstfeld, D. (Eds.). (1999). *Organizing for high reliability: Processes of collective mindfulness* (Vol. 21). Greenwich, CT: JAI.

West, M. A. (1980). The psychosomatics of meditation. *Journal of Psychosomatic Research, 24*(5), 265-273. doi:10.1016/0022-3999(80)90016-1

Wiener, E. (1993). Life in the second decade of the glass cockpit. *Aviation Psychology, 2*(1), 1-11.

Wohl, J. (1981). Force management decision requirements for Air Force tactical command and control. *IEEE Transactions on Systems, Man, and Cybernetics, 11*, 618-639. doi:10.1109/TSMC.1981.4308760

Worley, C., & Feyerherm. (2003). Reflections on the future of organization development. *The Journal of Applied Behavioral Science, 39*, 97-115. doi:10.1177/0021886303039001005

Worren, N., Ruddle, K., & Moore, K. (1999). From organizational development to change management: the emergence of a new profession. *The Journal of Applied Behavioral Science, 35*(3), 273-286. doi:10.1177/0021886399353002

Yogi, M. M. (1969). *Maharishi Mahesh Yogi on the Bhagavad-Gita: A translation and commentary* (Chapters 1-6). Baltimore, MD: Penguin Press.

Yogi, M. M. (1972). *The science of creative intelligence*. Livingston Manor, NY: Age of Enlightenment Press.

Yogi, M. M. (1986). *Life supported by natural law*. Washington, DC: Age of Enlightenment Press.

Yogi, M. M. (1995). *Maharishi University of Management: Wholeness on the move.* Vlodrop, Holland: Maharishi Vedic University Press.

Zellars, K., Justice, L., & Beck, T. (2011). Resilience: New paths for building and sustaining individual and organizational capacity. In P. Perrewe & D. Gansler (Eds.), *The role of individual differences in occupational stress and well being: Research in occupational stress and well being* (Vol. 9, pp. 1-37). Bingley, England: Emerald Group.

Zsambok, C., & Klein, G. (1997). Naturalistic decision making: Where are we now? In C. Zsambok & G. Klein (Eds.), *Naturalistic decision making* (pp. 3-16). Mahwah, NJ: Lawrence Erlbaum.

APPENDIX A

Corporate-sponsored TM programs in Organizations

Company	Citation
Apple Computer	(Schmidt-Wilk, 1996)
American Telephone & Telegraph	(Schmidt-Wilk, 1996)
Bankers Trust (Australia)	(Schmidt-Wilk, 1996)
Blue Cross Blue Shield	(Kory, 1976); (Oates, 1976)
Boston Consulting Group	(Schmidt-Wilk, 1996)
Bougain Villa (South Africa)	(Schmidt-Wilk, 1996)
British Columbia Telephone	(Schmidt-Wilk, 1996)
CAN Arkiteckkontor AB (Sweden)	(Bentsson, 1991)
Canovia Pharmaceuticals (Australia)	(Schmidt-Wilk, 1996)
Connecticut General Life Insurance Co.	(Ivancevich, Matteson, Freedman, & Phillips 1990; Kory, 1976))
Coors Brewing	(Ivancevich et al., 1990)
Dominion Mining (Australia)	(Schmidt-Wilk, 1996)
DWF Advertising (South Africa)	(Schmidt-Wilk, 1996)
Ericsson AB (Sweden)	(Bentsson, 1990)
Financial Guardian Group	(Schmidt-Wilk, 1996)
Fortune Motors Co. Ltd (Taiwan)	(So, 1991)
General Motors	(Marcus, 1977)
Geraldton Building Company (Australia)	(Schmidt-Wilk, 1996)
GTE Sylvania	(Schmidt-Wilk, 1996)
H.A. Montgomery Company	(Roth, 1994)
I-World Department Stores (Japan)	(Subramanian, 1989)
Imperial Life Insurance (Canada)	(Tuniga, 1991)
Kyocera Corp. (Japan)	(Subramanian, 1989)
Matsuya Department Stores (Japan)	(Subramanian, 1989)
McDonnell Douglas	(Schmidt-Wilk, 1996)
Monsanto Chemicals	(Ivancevich et al., 1990; Kory, 1976); (
Mountain Breeze Ionizers (Great Britain)	(Veltman, 1990)
P.A. Medical Corporation	(Kory, 1976)
Puritan Bennett Co.	(DeArmond, Alexander, & Stevens, 1994)
Shamrock Foods	(Schmidt-Wilk, 1996)
Shimada Fashion Co. (Japan)	(Visser, 1986)
Skylark (Japan)	(Wilson, 1991)
Sony Corporation (Japan)	(Billingsley, 1991)
South India Research Institute (India)	(Schmidt-Wilk, 1996)
Sternberger Motor Corporation	(Marcus, 1977)
Sumitomo Heavy Industries (Japan)	(Marcus, 1990; Subramanian, 1989)
Sunnydale Farms, Inc.	(Marcus, 1977)
Tata Tea (India)	(Schmidt-Wilk, 1996)
Tokyo Takara Corp. (Japan)	(Subramanian, 1989)
Toronto Dominion Bank (Canada)	(Wilson, 1991)
Tower Companies	(Chessher, 2005)
Transco	(Kory, 1976)
Upper Avenue National Bank	(Kory, 1976)
Volvo Corporation (Sweden)	(Bentsson, 1990)
Wesray Capital Management	(Schmidt-Wilk, 1996)
Xerox	(Ivancevich et al., 1990)

REFERENCES

Bentsson, W. (1990). Sitting quietly, doing nothing... *EX Magazine,* 44-49.

Chessher, M. (2005, October). Cubicle karma. *Southwest Airlines Spirit,* 66-69.

Ivancevich, J., Matteson, M., Freedman, S., & Phillips, J. (1990). Worksite stress management interventions. *American Psychologist, 45*, 252-261. doi:10.1037//0003-066X.45.2.252

Kory, R. (1976). *The transcendental meditation program for business people*. New York, NY: AMACOM.

Marcus, J. (1977). *TM and business: Personal and corporate benefits of inner development*. New York, NY: McGraw-Hill.

Marcus, J. (1990). *Success from within: Discovering the inner state that creates personal fulfillment and business success*. Fairfield, IA: MIU Press.

Oates, R. (1976). *Celebrating the dawn: Maharishi Mahesh Yogi and the TM technique*. New York, NY: G.P. Putnam.

So, K. (1991). *Maharishi corporate development program case study: Fortune Motors Co. Ltd.* Paper presented at the Maharishi Corporate Development Programme, Taiwan.

Subramanian, M. (1989). Transcendental meditation takes root in Japanese companies. *Tokyo Business Today, 57*(11), 54-55.

Tuniga, N. (1991, May). Meditating your way to control. *Canadian Business*.

Wilson, V. (1991). The new management tool. *Canadian Banker, 98*(6), 52-26. doi:10.1145/122167.122173

APPENDIX B

Pepperdine University IRB-approved Informed Consent Form

INFORMED CONSENT FOR PARTICIPATING IN DOCTORAL RESEARCH

Participant Name: _____

Principal Investigator: Martha M. Batorski, [redacted]

Title of Project: Developing Situation Awareness Capacity to Improve Executive Judgment and Decision Making Under Stress

1. I _____ , agree to participate in the research study being conducted by Martha M. Batorski, Principal Investigator, under the direction of Dr. Kenneth Murrell (Dissertation Committee Chair and Advisor, Pepperdine University).

2. The overall purpose of this research is: to empirically test a hypothesis that leaders who practice the Transcendental Meditation program twice daily develop improved Situation Awareness capacity over a 2.5-month period, as compared to controls (measured over a period of 1 month).

3. My participation will involve the following:
As a volunteer subject in this study, I will be asked to 1) participate in the selection of a random assignment to one of two groups – a treatment group that will be instructed in the Transcendental Meditation program, or a Control Group that will participate carry on with normal routines (no meditation intervention) throughout the course of the 2.5 month study. Both groups will be involved in pre- and post-testing. Pre-testing will take place before instruction in the TM program. Post-testing will take place after 2.5 months for the Intervention Group (TM instruction, and 1 month for the Control Group (no TM instruction). Testing consists of three cognitive tests: a) a 3-minute perception test (computer-based, interactive), b) a 10-minute comprehension test (computer-based, interactive), and c) a 10-minute constructive thinking test (paper and pencil).

I understand that if I am assigned to the treatment group. I will be instructed in the Transcendental Meditation program. I will receive instruction by a qualified teacher of the Transcendental program using a standard 7-step teaching protocol that involves the following 1) introductory lecture (60 min.); 2) preparatory lecture (60 min); 3) personal interview with the instructor (20 min.); 4) one-on-one instruction (90 min.); and 5-7) three consecutive 90-min. meetings following instruction of follow-on points to ensure correctness (effortlessness) of the practice and provide knowledge on the possible experiences in meditation and outside of meditation over time. I understand that if I am selected and assigned to the control group, I will not learn the Transcendental Meditation Program during the period of this study. I understand that as a volunteer subject in the Control

E1210D08

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PEPPERDINE UNIVERSITY

MAR 10 2012

VALID UNTIL
DATE ABOVE

V. 6/24/2011

INFORMED CONSENT FOR PARTICIPATING IN DOCTORAL RESEARCH

Group, I will be receive 1 point Extra Credit for completion of Pre-Test participation, and 1 point Extra Credit for completion of Post-Test participation.

Additionally, when the study is completed, if I would like to learn the Transcendental Meditation program, the Principal Investigator can provide suggestions and information about how you might proceed.

4. My participation in the study will take place over a 2.5-month period for the Intervention Group, and 1 month for the Control Group. The study shall be conducted in onsite at my organization's location and fully authorized by organization in conjunction with Pepperdine University's Doctoral Program in Organization Change, Graduate School of Education and Psychology, Los Angeles, CA.

5. I understand that the possible benefits to myself or society from this research are: 1) for myself -- the opportunity to learn the Transcendental Meditation program at no charge during the study (if in the treatment group). 2) for society -- the opportunity to participate in research exploring the viability of a well-researched mind-body stress reduction technique for use by current and future leaders preparing to operate under conditions of uncertainty that require dynamic judgment and decision making under stress.

6. I understand that there are no known risks associated with the practice of Transcendental Meditation, which is defined as a simple, natural, effortless mental technique performed twice daily for 20 minutes with the eyes closed.

7. I understand that my estimated expected recovery time after the experiment will be negligible.

8. I understand that I may choose not to participate in this research.

9. I understand that my participation is voluntary and that I may refuse to participate and/or withdraw my consent and discontinue participation in the project or activity at any time without penalty or loss of benefits to which I am otherwise entitled.

10. I understand that the investigator will take all reasonable measures to protect the confidentiality of my records and my identity will not be revealed in any publication that may result from this project. The confidentiality of my records will be maintained in accordance with applicable state and federal laws. Under California law, there are exceptions to confidentiality, including suspicion that a child, elder, or dependent adult is being abused, or if an individual discloses an intent to harm him/herself or others.

E1210 D08
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DATE ABOVE
V. 6/24/11

INFORMED CONSENT FOR PARTICIPATING IN DOCTORAL RESEARCH

11. I understand that the investigator is willing to answer any inquiries I may have concerning the research herein described. I understand that I may contact Dr. Kenneth Murrell, Dissertation Committee Chair, at (850)-474-2308 or email at KMurrell@uwf.edu if I have other questions or concerns about this research. If I have questions about my rights as a research participant, I understand that I can contact Ms. Jean Kang, Graduate School of Education and Psychology IRB Manager, [redacted]

12. I will be informed of any significant new findings developed during the course of my participation in this research which may have a bearing on my willingness to continue in the study.

13. I understand that in the event of physical injury resulting from the research procedures in which I am to participate, no form of compensation is available. Medical treatment may be provided at my own expense or at the expense of my health care insurer which may or may not provide coverage. If I have questions, I should contact my insurer.

14. I understand to my satisfaction the information regarding participation in the research project. All my questions have been answered to my satisfaction. I have received a copy of this informed consent form which I have read and understand. I hereby consent to participate in the research described above.

15. I attest that I have not previously been instructed in or currently practice the Transcendental Meditation program (this is important for both intervention and control group members).

_____
Participant's Signature

_____
Date

I have explained and defined in detail the research procedure in which the subject has consented to participate. Having explained this and answered any questions, I am co-signing this form and accepting this person's consent.

_____ _____
Martha Batorski Date
Principal Investigator

E1210D0

GPS IRB APPROVAL
PEPPERDINE UNIVERSITY

MAR 10 2012

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DATE ABOVE

v. 6/24/14

APPENDIX C

Norwich University IRB Approval Letter

NORWICH
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Expect Challenge. Achieve Distinction.

TO: Martha Batorski
[redacted]

FROM: Michael C. Andrew, Chair
Internal Review Board (IRB 00005859)

DATE: May 2, 2011

APPROVED
EXEMPT: May 2, 2011

RE: Research Proposal
"Developing Situation Awareness Capacity to Improve Executive Judgment and Decision Making Under Stress"

This proposal is approved as exempt from review by the Norwich University Internal Review Board. It is understood that the research will be conducted in the manner approved by the IRB at Pepperdine University. A copy of the approval letter from Pepperdine University is on file along with the research proposal. Please note that the approval terminates March 10, 2012.

Please notify the chair of the IRB if any subjects have an adverse reaction as a result of their participation in your project.

Please notify the chair of the IRB when you have completed your research project.

cc: File

DEPARTMENT OF POLITICAL SCIENCE
158 HARMON DRIVE NORTHFIELD VT 05663-1035 T 802.485.2360 F 802.485.2252 WWW.NORWICH.EDU

APPENDIX D

Pepperdine University IRB Approval Letter

PEPPERDINE UNIVERSITY

Graduate & Professional Schools Institutional Review Board

March 10, 2011

Martha Batorski
[redacted]

Protocol #: E1210D08
Project Title: *Developing Situation Awareness Capacity to Improve Executive Judgment and Decision Making Under Stress*

Thank you for submitting your revised IRB application, *Developing Situation Awareness Capacity to Improve Executive Judgment and Decision Making Under Stress*, to Pepperdine's Graduate and Professional Schools Institutional Review Board (GPS IRB). The IRB has reviewed your revised submitted IRB application and all ancillary materials. As the nature of the research met the requirements for expedited review under provision Title 45 CFR 46.110 (research category 7) of the federal Protection of Human Subjects Act, the IRB conducted a formal, but expedited, review of your application materials.

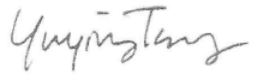
I am pleased to inform you that your application for your study was granted **Full Approval.** The IRB approval begins today, **March 10, 2011** and terminates on **March 10, 2012**. Your final consent form has been stamped by the IRB to indicate the expiration date of study approval. One copy of the consent form is enclosed with this letter and one copy will be retained for our records. **You can only use copies of the consent that have been stamped with the GPS IRB expiration date to obtain consent from your participants.**

Please note that your research must be conducted according to the proposal that was submitted to the GPS IRB. If changes to the approved protocol occur, a revised protocol must be reviewed and approved by the IRB before implementation. For ***any*** proposed changes in your research protocol, please submit a **Request for Modification Form** to the GPS IRB. Please be aware that changes to your protocol may prevent the research from qualifying for expedited review and require submission of a new IRB application or other materials to the GPS IRB. If contact with subjects will extend beyond **March 10, 2012**, a **Continuation or Completion of Review Form** must be submitted at least **one month prior** to the expiration date of study approval to avoid a lapse in approval. These forms can be found on the IRB website at http://services.pepperdine.edu/irb/irbforms/#Apps.

A goal of the IRB is to prevent negative occurrences during any research study. However, despite our best intent, unforeseen circumstances or events may arise during the research. If an unexpected situation or adverse event happens during your investigation, please notify the GPS IRB as soon as possible. We will ask for a complete explanation of the event and your response. Other actions also may be required depending on the nature of the event. Details regarding the timeframe in which adverse events must be reported to the GPS IRB and the appropriate form to be used to report this information can be found in the *Pepperdine University Protection of Human Participants in Research: Policies and Procedures Manual* (see link to "policy material" at http://www.pepperdine.edu/irb/graduate/).

Please refer to the protocol number denoted above in all further communication or correspondence related to this approval. Should you have additional questions, please contact me. On behalf of the GPS IRB, I wish you success in this scholarly pursuit.

Sincerely,



Yuying Tsong, Ph.D.
Clinical Professor/Research Methodologist
Psychology Division
Pepperdine University
Graduate School of Education and Psychology
[redacted]

cc: Dr. Lee Kats, Associate Provost for Research & Assistant Dean of Research, Seaver College
Ms. Alexandra Roosa, Director Research and Sponsored Programs
Dr. Yuying Tsong, Interim Chair, Graduate and Professional Schools IRB
Ms. Jean Kang, Manager, Graduate and Professional Schools IRB
Dr. Kenneth Murrell
Ms. Christie Dailo