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Master Thesis

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Abstract

In this study we compared Error Management Training (EMT) and Traditional Training by exploring its effectiveness in relation to trainees' intuitive and analytical processing. Next, we examined the degree to which stress levels and mindfulness influenced intuitive and analytical processing during training. A quasi-experiment comprising of a sample of 67 business students was conducted using a computer simulation as performance measure. Simultaneously, data from skin conductance response (SCR) sensors were used to capture stress levels of the trainees. We observed that trainees who received EMT scored higher on cognitive processing i.e., both on intuitive and analytical, than those who received traditional training. Further, we found that EMT works most effective for trainees who are high on analytical processing, while traditional training is most effective for those who are low on analytical processing. In addition, data from the skin conductance response sensors revealed that high stress levels during training hindered analytical processing. Our results also suggest relationships between mindfulness and cognitive processing.

Key words: error management training, cognitive processing, stress, mindfulness

Introduction

Errors occur in organizational settings and they cannot be eliminated fully (Reason, 1990), hence it is in this context that the management of errors becomes important. One way to deal with errors in organizations is to design effective training programs for employees, to prevent adverse organizational consequences. Effective training may therefore be crucial in order to save both lives, monetary and other forms of organizational resources since the occurrence of small errors over the longer term could potentially multiply into exponentially negative consequences (Hoffman and Frese, 2011).

The traditional view of training has held that a tight structuring of the training program and providing step by step instructions will help prevent errors during training and post- training (Bell & Kozlowski, 2008). An alternate view to this is the concept of Error Management Training (EMT) that views errors during training as a valuable source of feedback in order to help individuals to learn (Frese & Zapf, 1994; Keith & Frese, 2005), and is shown to have a great potential for the transfer of training (Keith & Frese, 2008). Differences exist in the effectiveness of this training and factors such as individual differences, cognitive ability (Gully, Payne, Koles & Whiteman, 2002; Loh, Andrews, Hesketh & Griffin, 2013), emotion regulation and meta-cognition (Keith & Frese, 2005) have been researched in the context of EMT. However, limited research exists on how individuals process information while making decisions during training and if this has implications on the learning outcome.

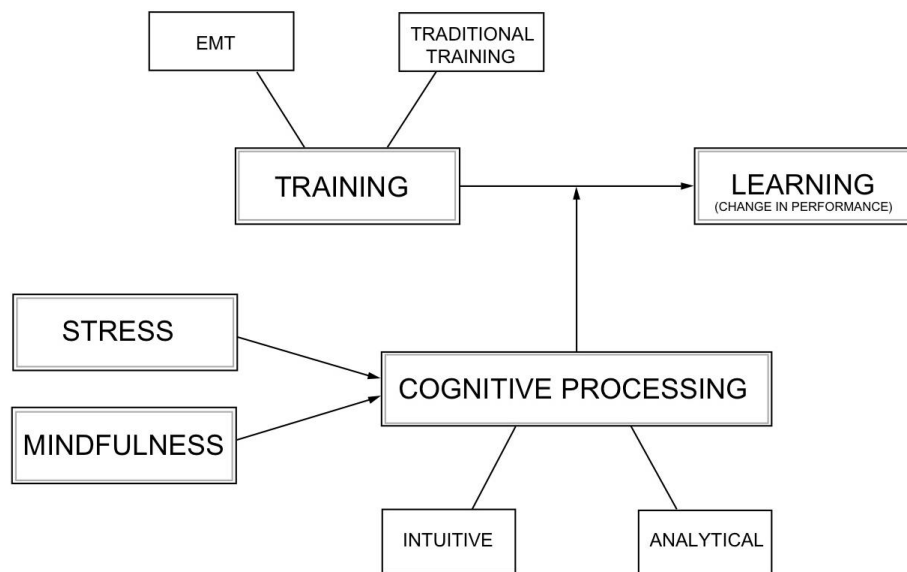
Research suggests that individuals make decisions using a dual system of information processing, intuitively and/or analytically (Evans, 2008). Intuition is characterized by a relatively effortless processing that is affective, minimally cognitive demanding and also automatically based on learning from experiences while analytical processing is characterized by conscious reasoning, being affect free, effortful and cognitively demanding (Epstein, 2010). In organizational settings, individuals are often faced with the need to make rapid decisions under time pressure. Since stress influences cognitive processes (Arnsten, 2009), it becomes an important factor for decision making (Simon, 1987), and therefore we find it relevant to investigate with respect to intuitive and analytical processing in a training context. Another concept that may influence how decisions are taken during training is mindfulness, which refers to individuals' attention and awareness of the present situation (Brown, Ryan & Creswell, 2007). While

research on mindfulness is abundant in areas concerning well-being (Brown & Ryan, 2003), it is still limited with regard to task performance in organizational settings (Dane, 2011). We would therefore like to investigate mindfulness in relation to cognitive processing.

The aim of the study is to gain understanding of training effectiveness in relation to cognitive processing. We did this by conducting a quasi- experiment that tested decision making under time pressure. We used change in task performance as an objective measure for learning, data from skin conductance response (SCR) sensors as an objective measure for stress during training, surveys measuring cognitive processing and mindfulness on our experiment. We define our research question to be:

How does cognitive processing influence the relationship between error management training and traditional training to learning outcome? And how is stress and mindfulness related to cognitive processing during training?

On this basis, we hope that this study will help contribute to broadening the understanding of error management training, by connecting it with cognitive processing. We also hope it provides insights into how decisions are taken with relevance to dynamic and complex organizational learning environments, characterized by time pressure, unavailable information and changes in resource allocation (Eisenhardt, 1989). This study will be organized as follows: first, the research model will be presented followed by theoretical background and hypothesis. Next, we describe the methodology and present the results from the study. Finally, discussion and concluding remarks will follow.

Research Model

In our research model the independent variable is training, with the two treatment groups being EMT and traditional training. This is observed in relation to learning, which is measured as the trainees' change in performance from a baseline simulation to a post-training simulation. This relationship is moderated by cognitive processing: intuitive and analytic. Further, stress and mindfulness are studied as two separate constructs that influence cognitive processing. Theory and hypothesis will be presented in the following section.

Theory and Hypotheses

Transfer of training

Transfer of training refers to the "learning of a response from one situation that influences the response in another" (Adams, 1987). Transfer of training is crucial because the main objective of training is emphasized to be its contribution to post-training performance and the potential for its transferability of skills and knowledge to different situations and contexts (Schmidt & Bjork, 1992). Transfer of training is of two types: analogical transfer and adaptive transfer. Analogical transfer occurs in the case of analogous tasks, i.e., when tasks are structurally similar to each other (Gick & Holyoak, 1983). Adaptive transfer may be understood as adapting knowledge or skills from one task and applying it on a different task (Hesketh, 1997).

Error Management Training & Traditional Training

Traditional training has been considered to be an effective form of training that emphasizes a structured form, centered on the elimination of errors (Gully, et al., 2002; Lorenzet, Salas & Tannenbaum, 2005). The trainee is often provided with guided feedback for solving the tasks with control being retained by the learning environment, thus placing a passive role for the trainee (Bell & Kozlowski, 2008). Throughout this study, we will refer to the methods of structured error avoidant training with guided instructions as traditional training.

In contrast, the error management training (EMT) was proposed as an alternative to traditional training (Frese, Brodbeck, Heinbokel, Mooser, Schleiffenbaum & Thiemann, 1991). Whereas the traditional training approach adopts a negative view towards errors, EMT treats errors positively and as naturally occurring out of learning processes (Keith & Frese, 2008). EMT is considered to be a form of active learning, i.e., where trainees are naturally exploring and unrestrictedly looking for solutions (Frese et al., 1991; Keith & Frese, 2008). One of the main underlying principles behind EMT is based on using errors as a source of positive feedback i.e., committing errors and learning from them (Keith & Frese, 2008; Keith, 2011). EMT is therefore suggested to comprise of explicit positive instructions emphasizing the exploratory nature of errors, such as the following: “errors are a part of the learning process”, “errors inform you about what you can still learn”, “the more errors you make, the more you learn” (Frese et al., 1991; Keith & Frese, 2008).

What are Errors?

From the above, it can be understood that the basic contrast between the two training approaches is due to the emphasis placed on errors. But what are errors? Errors may be defined as unintentional deviations from goals (Reason, 1990; Hofmann & Frese, 2011, Keith, 2011) which present themselves in several ways in daily work settings (Brodbeck, Zapf, Prumper & Frese, 1993; Reason, 1990; Hofmann & Frese, 2011), especially during training where new skills and knowledge need to be acquired. Errors are observed as goal oriented in nature as specific lapses that occur when a particular sequence of actions is not fulfilled, and the goals initially planned for are not achieved (Reason, 1990), while unforeseen and unplanned events beyond human control are not classified as errors (Zapf, Brodbeck, Frese, Peters & Prumper, 1992). So when errors occur

during training, how can they be treated effectively to enhance the learning outcome?

Effectiveness of Training

The effectiveness of training is characterized by its ability to impact the post-training performance, both for near and far transfer of training (Heimbeck, Frese, Sonnentag & Keith, 2003). Near transfer is understood as that in which the post-training task follows the training task immediately, while in far transfer trainees have more time in between training and post-training, typically about a week or more (Heimbeck et al., 2003). A meta-analysis by Keith & Frese (2008) comprising of 24 studies compared the effectiveness of EMT and traditional training on both adaptive and analogical transfer tasks, and indicated that EMT is more effective. However, the evidence for this is two folded. Studies have also shown that EMT may not always be superior to traditional training, and in some situations traditional training is considered to be more effective than EMT (Gully et al., 2002). Relevant to this, the generation of clear feedback from the task environment has been found to be an important criterion for the effectiveness of EMT. In the absence of clear feedback from the training task itself, EMT may not be an appropriate training approach to use (Keith & Frese, 2008; Keith, 2011), and instead traditional training may be used since it provides guided instructions. Research on EMT is still developing and gives us an opportunity to compare its effectiveness with traditional training. In this study we expect that trainees receiving the traditional training would show more learning i.e., larger change in task performance from a baseline computer simulation to a post-training simulation on an analogical transfer task, compared to the ones receiving EMT. Our expectation is that under EMT condition, trainees would spend time in obtaining the feedback necessary to solve the task by active exploration and formulating the problem. But conversely, we also expect that trainees receiving traditional training will use guided instructions to familiarize themselves faster to the task and consequently show a larger change in performance. We therefore would like to observe this on an analogical transfer task and hypothesize the following:

Hypothesis 1: Traditional training will lead to a larger change in performance than EMT

Cognitive Processing & Cognitive Styles

When making decision, there is a difference in how individuals process information. A common notion is that the „heart“ or the „head“ is being used, indicating that there exists two different ways of making decisions. Herbert Simon (1979) presented the influential concept of bounded rationality for which he was awarded the Nobel Prize. The principle of bounded rationality states that humans are limited by their cognitive capacities while making decisions in complex and uncertain conditions, and hence will not be able to consider all the possible alternatives adequately to solve the problem (Simon, 1979). Branched under the same concept is intuition which Simon described as quick patterns of recognition, required for solving problems that demands allocation of cognitive resources in complex organizational environments (Simon, 1987).

Decades of research on decision making has focused on both intuitive and analytic thinking (Dane & Pratt, 2007). Individuals“ stable preferences towards intuitive and analytical modes of thinking are studied through the Cognitive Experiential Self Theory (CEST) measured by the Rational Experiential Inventory (REI), developed by Pacini & Epstein (1999), which in turn is built on the scales of Need for Cognition and Faith in Intuition (Epstein, Pacini, Denes-Raj & Heier, 1996). Epstein refers to these thinking modes as experiential/intuitive and rational/analytic styles, Stanovich & West (2000) use the terminology "system 1" and "system 2" and Hogarth (2003) uses the terminology “tacit” and “deliberate” to refer to the same type of thinking modes. Even though minor differences in these conceptualizations exist, we will refer to these as intuitive and analytical styles. Intuition is characterized by “automatic learning from experience, affect laden, effortless and minimally demanding of cognitive resources”, while analytical style is characterized by “conscious and affect free reasoning, relatively effortful and demanding of cognitive resources” (Epstein, 2010). Based on this, we choose to follow Dane & Pratt“s (2007) definition of intuition as “affectively charged decisions that arise through rapid, non-conscious and holistic associations”, and analytical thinking as “decision making that consists of identifying and assessing relevant information, evaluating costs and benefits, and ultimately making a decision through deliberation” (Alexander, 1979 as cited in Dane, Rockmann & Pratt, 2012),

Bakken & Haerem (2011) emphasize that individuals can be high or low in intuitive and/or analytical processing across situations and contexts. Based on this

we understand that cognitive processing refers to the situation specific nature of cognitive styles and comprised of intuitive and analytical processing. In this study we investigate trainees' intuitive and analytical processing, and to what degree the type of training environment they are a part of influences their cognitive processing.

Learning Environments

According to Hogarth (2003), learning environments can be of two types: kind or wicked. Kind learning environment is that in which information that is tacitly processed leads to valid inferences, because the feedback is precise, accurate and is neither missed nor misleading (Hogarth, 2003). This can be likened to traditional training since it is characterized by obtaining specific and relevant step-by-step feedback for the individual to learn (Keith & Frese, 2008). In contrast, wicked learning environments are those in which feedback maybe missing or misleading (Hogarth, 2003). Since there is minimal guidance in EMT and trainees are encouraged to actively search for relevant information (Keith & Frese, 2008), EMT may be understood as being similar to wicked learning environment. Hogarth (2003) further proposes that valid intuitive decisions are best obtained in a kind learning environment, but not in wicked environments. Following this, we chose to draw a parallel between Hogarth's work on learning environments to the previous discussion on EMT and traditional training. To the best of our knowledge, we are yet to find empirical research that investigate what type of learning environments, EMT and traditional training, will lead to intuitive and analytical processing. We expect that in an EMT environment which we see as similar to wicked environments, relevant feedback to perform the task is not readily available. Hence trainees may actively be exploring for options with more rapid processing, while at the same time being oriented towards immediate action, which can be observed as features of intuitive processing. Following this, we hypothesize the following:

Hypothesis 2 (a): EMT will lead to a larger degree of intuitive processing than traditional training.

In contrast under traditional training, which is observed as being similar to kind learning environments, trainees are provided with guided instructions to help

solve the task. We expect that the trainees will follow these instructions step by step and analytically. Based on this, we hypothesize that:

Hypothesis 2 (b): Traditional training will lead to a larger degree of analytical processing than EMT.

Interaction between Type of Training & Cognitive Processing

We now proceed to investigate the interaction between types of training and cognitive processing, to understand its relationship to learning. Specifically, we are interested in finding what combination of training and cognitive processing is the most beneficial for enhancing learning of the trainees. We expect EMT and intuitive processing to be a beneficial combination in a learning environment characterized by time pressure and unavailability of information, because the trainees might be exploratory in nature. At the same time, we also expect them to use automatic and less cognitively demanding decisions to find solutions in a complex environment. In addition, EMT treat errors positively to enhance learning in a non- threatening learning environment (Frese et al., 1991), which may enhance the confidence of trainees and hence lead to intuitive decisions being made (Dane & Pratt, 2007). Based on this, we suggest that EMT is a type of training where intuitive processing is beneficial for learning and hypothesize the following:

Hypothesis 3 (a): Higher degree of intuitive processing leads to a larger change in performance when EMT is provided, than traditional training

Further, Riding (as cited in Sadler-Smith & Riding, 1999) suggests that individuals with an analytical nature will use a structured approach to solve problems, which can be understood as the features of traditional training. However research on this is conflicted and some researchers suggest that it is under EMT and not traditional training that trainees could use analytical processing, because EMT demands the adoption of more effortful processing to explore for solutions and requires the switch from automatic to a conscious processing (Heimbeck et al., 2003; Keith, 2011). However, we expect the interaction between analytical processing and traditional training to be a beneficial combination. We propose that the guided instructions component in traditional training could allow the trainees to use relevant information in an analytical

structured and optimal way without further searching for information to effectively solve the task. To seek clarity on this we hypothesize the following:

Hypothesis 3 (b): Higher degree of analytical processing leads to a larger change in performance when traditional training is provided, than EMT

In addition to investigating how cognitive processing moderates the relationship between training and change in performance, we will now seek some insights on how stress and mindfulness influences intuitive or analytical processing during training. We first begin by defining stress.

Stress & Cognitive Processing

Stress was a highly subjective concept. The earliest conceptualization of stress in purely biological terms was given by Hans Selye in 1936 as "a nonspecific response of the body to any demand made upon self" (American Stress Institute, 2013). Appropriate in the context of our study, we adopt the following definition of stress "environmental demands exceed the natural regulatory capacity", specifically in unpredictable and uncontrollable conditions, that can be viewed from a cognitive perspective expressed as a physiological response (Koolhaas, Bartolomucci, Buwalda, De Roer et al., 2011.) Here, the concept of stress must be clarified from the concept of arousal. Although the two terms are used interchangeably, researchers have clarified the independent nature of both these concepts (King, Burrows & Stanley, 1983; Cox & Mackay, 1985). Arousal maybe understood as the readiness or an activated state of the mind and the body that acts as a mediator to stress (Bourne, Jr & Yaroush, 2003).

Research suggests that under conditions characterized by time pressure where information is not adequately available, individuals adopt an information processing approach this is simpler in nature (Hammond, 2000). Stress has been found to be associated with activation of the amygdala (Figner & Murphy, 2010) which is the part of the brain responsible for processing of emotions and associated with switching from a demanding and effortful processing, to a more simpler way of faster, affect laden processing (Gupta, Kosciak, Bechara & Tranel, 2011), which may be understood as features of intuitive processing (Dane & Pratt, 2007; Sinclair, 2010; Epstein, 2010).

In a complex learning environment characterized by uncertainty and time pressure, stress can occur since information is not perfectly available. Moreover, even if the information were to be available, we expect that obtaining the relevant feedback will become a challenging process because trainees are not perfectly aware of what information to trust (Hogarth, 2003). We expect that under a dynamic task environment a fast and rapid processing of information that is minimally demanding of cognitive resources occurs, resulting in the production of non-specific physiological responses, i.e., stress. Even though the relationship between stress and cognitive processing has been investigated previously, we would like to observe the same relationship in a training context. In light of this we expect to find a relationship between stress levels during training and intuitive processing. We therefore hypothesize that

Hypothesis 4 (a): Higher the stress, higher the intuitive processing

The prefrontal cortex of the brain is responsible for the cognitively flexible processing which is characterized by conscious reasoning, thoughtful and deliberate processes (Arnsten, 2009), which may be understood as analytical processing (Epstein, 2010). Researchers have argued that when stress interferes with the prefrontal cortex, it hinders the flexible decision making and give way to the fast and emotion laden processing of the amygdala (Arnsten, 2009). Furthermore the prefrontal cortex of the brain has been found to be interconnected with other regions of brain responsible for decision making such as the dorsolateral prefrontal cortex which is responsible for higher level cognitive functioning and information processing including planning and reasoning, storage and utilization of information (Pochon, Levy, Poline, Crozier et al., 2001). The Prefrontal cortex has also been found to be interconnected with the lateral prefrontal cortex, which is responsible for information processing relating to goals (Tanji & Hoshi, 2008; Decision Neuroscience Laboratory, 2013). Therefore on this basis, we expect that stress may hinder the processes in the prefrontal cortex. In other words, we are interested in finding if stress levels can impact analytical processing during training. Hence we hypothesize that:

Hypothesis 4 (b): Higher the stress, lower the analytical processing

Mindfulness & Cognitive Processing

Mindfulness is an ancient concept that has its origins in Buddhism, sharing conceptual relationships with ideas from the philosophical and psychological traditions (Brown & Ryan, 2003). While traditionally being associated with meditation and being “Zen-like”, research on mindfulness has only just emerged, majorly in psychological well-being and to a limited extent in organizational settings (Dane, 2011). Hence, it is considered to be quite a recent construct and different conceptualizations exist. For example, Ellen Langer’s conceptualization of mindfulness in organizational settings is focused on the process of drawing out novel distinctions (Langer & Moldoveanu, 2000), whereas Brown & Ryan’s (2003) conceptualization of mindfulness emphasizes attention and awareness in the present moment (Dane, 2011). In our study we define mindfulness according to Brown & Ryan (2003) as: “a receptive attention to and awareness of present moment events and experience” (Dane, 2011). Following this, we set out to observe the relationship of mindfulness with cognitive processing in a dynamic training environment, in which individuals make decisions under time pressure.

Research suggests that to be mindful, individuals must gain a clear awareness of their inner selves and outer environments (Brown & Ryan, 2003). This implies that attention and awareness applied intuitively and analytically may need to be considered when making decisions, in the light of the present moment. Moreover, research from cognitive neuroscience also suggests that that mindfulness maybe associated with both emotional and unemotional processing (Ochsner, Bunge & Gross, 2002, as cited in Brown et al., 2007). Following this we expect that there may be a link between mindfulness and both intuitive and analytical processing.

It leads to our understanding that when individuals are mindful, they may be more oriented to noticing their intuitive decisions (Dane, 2011). In addition, Brown et al (2007) suggest mindfulness to be focused on the emotional aspects since emotions are considered to be an integral part of intuitive processing (Sinclair, 2010; Dane, 2011). In light of this, we consider mindfulness to be associated with intuitive processing. However, there are also theoretical arguments suggesting mindfulness to be associated with analytical processing. Attentional breadth is one important aspect of mindfulness, and is referred to as “the number and range of stimuli attended to during a given period of time” (Dane, 2011). We see this to be related to analytical processing because being

attentive to stimuli requires a degree of deliberation and effortful processing. Similarly, it has also been argued that mindfulness involves focusing on the situational details (Brown et al., 2007), which again can be seen as associated with analytical processing. Further, evidence points to mindfulness being moderately correlated with the external encoding processes, where external encoding is referred to as paying attention to the external stimuli (Herndon, 2008 as cited in Dane, 2011). Based on the above, we understand that mindfulness could influence the trainees to be actively conscious and being relatively effortful in paying attention. Taken together, we expect to find association between mindfulness and both intuitive and analytical processing. We therefore hypothesize that:

Hypothesis 5 (a): High degree of mindfulness will be positively related to intuitive processing

Hypothesis 5 (b): High degree of mindfulness will be positively related to analytical processing

Method

Research Design

In order to study the hypothesized relationships between type of training, learning, stress, mindfulness and cognitive processing, we use a quasi-experimental research design. The rationale being experimental methods provide a strong internal validity because they help isolating the variables from any confounding effects that are otherwise observable in a real world setting, while being generalizable to the external settings (Anderson, Lindsay & Bushman, 1999). The experiment was conducted in the research lab at BI Norwegian Business School, where one treatment group received EMT and the other traditional training instructions. Trainees belonging to both the groups were engaged in a computer simulation called Crisex (Bakken, 2011), which comprised of three simulations: baseline simulation, training simulation and post-training simulation. The first two simulations were similar to each other, while the post-training simulation was more complex in nature. This made it possible to measure learning as change in performance from the baseline simulation to the post-training simulation. In addition we measured the trainees physiological stress levels by means of skin conductance response (SCR) devices for the whole

experiment. We also administered surveys before and during the experiment. All in all, we conducted 19 experiments each lasting for about 100 minutes and having a maximum intake of 5 participants and a lower bound of 2 participants.

Sample

Our sample consisted of 67 participants from the BI Norwegian Business School. 95.5 % of the participants were master students and the rest were undergraduate students. Of the participants, 32% were males and 68% were females. The nationalities were mixed with 58% comprising of Norwegians, and 42% from other nationalities. The average age of the participants was 25 with range being from 21 years to 39 years. About 22% of these participants reported that they had no gaming experience, 67% some gaming experience and 11 % extensive gaming experience.

Simulation

Throughout the simulations the trainees had a map of the Southern part of Norway on their computer screen with options for resource allocation being shown on the left side of the screen. During 24 hours of 'game-time' and between 24-30 minutes of 'real-time', the trainees were responsible for making decisions related to public, military and environmental safety in Norwegian territories on both sea and ground. There were 12 missions on each simulation and trainees were required to allocate the available resources to each of these missions. The participants were equipped with a cursor connected to a computer screen, and each of the 12 missions showed up as a "blinking sign" followed by prescheduled information relevant to the mission. Time was constantly running and the trainees needed to allocate one or more of the resources available and then drag and drop these resources using the cursor. The 12 missions were of varying nature and degree of complexity. 5 were related to rescue where assistance was needed to transport wounded people. Another 5 were related to security where surveillance or confrontation was needed. And the final 2 were a combination of the two above mentioned types of missions. The less complex missions could be solved directly by following the information on the screen while the more complex ones did not provide any specific cues to identify the correct resources, but required a more thorough understanding of what kind of situations the trainees faced and which resources to allocate.

The resources available were three Bell helicopters, three Sea-King helicopters, two Orion airplanes and two Fighter airplanes (Appendix 1). Each of these had various functions which needed to be specified before they were used. The final score on the simulation was calculated using a pre-specified algorithm on the basis of how well the participants performed. Maximum performance score was given when the participant allocated the correct resources or combination of resources in the given situation, within the required time frame. Some missions involved several possible solutions that could yield a full score, and the cost of resources used was not counted for towards the final score.

Procedure

Pre -Experiment

Before the experiment began, we sent out invitational emails to the participants to confirm their attendance, with information on the expected duration of the experiment, a request to answer a pre-questionnaire containing the REI inventory (Pacini & Epstein, 1999), and other control questions. The participants were assigned to either EMT or the traditional training before they arrived. Upon showing up, they were wired up to the Skin Conductance Response (SCR) sensors. In order to minimize external disturbances, participants were requested to turn off their mobile phones. In accordance with the APA guidelines (APA, 2013) we then informed the participants about the aim of our study, and about their rights to withdraw their data from the sample. Related to the APA guidelines, a post experiments debrief followed and all the data were treated with complete confidentiality.

Introduction & Warm-up

Participants were given basic instructions about the agenda of the simulation, the various resources, their capabilities and how to technically maneuver the simulation with the cursor. The introduction was visualized in a Power Point presentation. Next, the participants were engaged in an approximately three minute long warm-up session in order to familiarize with the technical features of the simulation. Questions regarding technical issues and how to maneuver the various resources on the missions were answered but those on strategic issues relating to the performance of the missions were not answered.

Baseline Simulation

The first run of the simulation was given right after the basic instructions and warm-up. We instructed the participants to do their very best, and let them know that their performance would be measured. The rationale behind the baseline simulation was to have a neutral comparison for each participant, before the training phase (manipulation) of the experiment. This simulation lasted for about 24 minutes.

Training Simulation

In order to provide the two groups with two types of training, the manipulation concerning EMT or traditional training, i.e., training instructions, were introduced right after the participants completed the first simulation (baseline). A total of 34 participants received EMT, and 33 received traditional training. The two different types of training instructions were communicated through instructions visualized on a Microsoft Power Point presentation (Appendix 2). The EMT group was provided with instructions in line with the recommendations of Frese et al. (1991) that encouraged them to explore and treat errors as positive feedback. Trainees were also instructed that their performance during training was measured, but did not matter. On the other hand, traditional training group was provided with instructions on a Power Point presentation that encouraged them to follow step-by-step guidelines handed out on a A4 size paper (Appendix 3) in order to help them solve the 12 missions with as few errors as possible. These guidelines were created and based on the score calculation-matrix of the Crisex simulation (Bakken, 2011). The training simulation was similar to the baseline simulation, but lasted for approximately 5 to 6 minutes more than the baseline simulation in order to give the trainees additional time in the training phase. To sum up, the two training groups received two types of instructions on how to train, but followed the same training computer simulation.

Post-Training Simulation

The training phase was followed by administering the Intuitive Analytical Processing Inventory (Bakken, Haerem & Kuvaas, 2013) before they began the post-training simulation. This simulation was slightly different than the two previous ones and was somewhat more complex in order to test the effectiveness of the training between the groups. The mission structure was the same with 12 missions including 5 rescues, 5 security and 2 combination missions respectively,

thus maintaining compatibility with the principles of analogical transfer. All the trainees independent of their training group were instructed to do their best and aim for enhancing their performance. The post-training simulation was followed by the administration of the Mindfulness Attention Awareness Scale (Brown & Ryan, 2003) which ended the experiment.

Measures

Learning

Trainees' performance was calculated for each of the 12 missions on the 3 simulations, which was given by a continuous decimal score between 0 and 1, with 1 being the best performance score and 0 being the lowest. Only 7 of the 12 missions were considered for analysis. In order to measure the learning we identified the change in performance from the baseline simulation to the post-training simulation, we used the residualized scores instead of the true scores. Taking the simple difference of the absolute scores is not recommended because it leads to inaccurate conclusions as a result of measurement error (Cronbach & Furby, 1970). On the other hand, the residualized scores predict the "deviation of performance from the actual performance scores" and are considered to be truly indicative of changes in the performance (Cronbach & Furby, 1970). To enhance the statistical power of this sample, we followed the recommendations of Hollenbeck, Ilgen & Segó (1994) and use the multiple observations measure for each of the 7 missions on the 3 simulations on the experiment, with the rationale being that statistical power enhances as the number of observations increases (Hollenbeck et al., 1994).

Stress

Stress was measured by means of Skin Conductance Responses (SCR), and is considered to be one type of electro dermal activity (EDA) (Benedek & Kaernbach, 2010; Figner & Murphy, 2010). The EDA is referred to as the changes in the sweat glands, which in turn is triggered by the firing of neurons of the sudomotor fibres (Figner & Murphy, 2010), the nerve fibres responsible for sweating. The SCR is used in judgment and decision making research because it is considered to be a good indicator of the sympathetic nervous system, which is primarily responsible for stress (Benedek & Kaernbach, 2010). The SCR is defined to as the skin's capability to conduct electricity through itself and is

directly related to changes in the sweat gland activity (Figner & Murphy, 2010). The SCR data on our experiment have been collected using Sudologger devices. The electrodes from the sudologgers are placed on the palms of the hands, also termed as the volar surfaces, where the density of the sudomotor fibres is the highest (Benedik & Kaernbach, 2010^b). The volar surfaces are recommended to be used for capturing the skin conductance responses since sweating in this region is directly associated with affective processes, (Boucsein 1992, as cited in Figner & Murphy).

The data collected from the SCR devices were extracted into excel files for preprocessing. The SCR data was synchronized with the performance data obtained from the CRISEX simulation. Specifically, data was drawn out of each of the three simulations. The next step involved the separation of the "active" time from the "passive" time. The active time here is referred to as the time when the participant was actively involved in performing the missions on the simulation, whereas the passive time is referred to the time where the participants were receiving instructions and answering questionnaires. The raw data now synchronized, was further preprocessed on Matlab using the Ledalab custom software code developed by Benedek & Kaernbach (2010). Specifically, the continuous decomposition analysis (CDA) was used, referred to as the process that decomposes the skin conductance data into continuous tonic and phasic activity using a time integral (Benedik & Kaernbach, 2010). Tonic activity refers to the continuous activity of the neuronal responses (Springer reference, 2013) and reflects long term orientation (Figner & Murphy, 2010) whereas phasic responses are understood to be nervous system activities occurring in short bursts (Benedik & Kaernbach, 2010). The CDA is considered to be a preferred method for measuring skin conductance because it measures the SC data in a one single measure of the continuous phasic activity and moreover it resembles the actual activity of the sudomotor fibres (Benedik & Kaernbach, 2010).

This step was followed by investigating the SCR data. We found that the stress levels of participants showed the highest activity in the first 10 seconds of the missions in of each of the three simulations. Furthermore, we also captured and analyzed the data for the first 10 seconds before the first mission of the simulation began since the participants were observed to be in an alert state. Specifically high activity was observed for the first 10 seconds before the first mission, 10 first seconds of the first mission (RES01) and the 10 first seconds of

the third mission (RES03). Hence, we chose to consider data from these missions to investigate our hypothesized relationships. We chose to include the third mission, i.e., RES03 because it was first one in the series of missions that demanded a more complicated approach to the performance, and we expected these missions chosen to give us the best representation of the stress levels (Appendix 4).

Cognitive Processing (Intuitive & Analytical)

The Intuitive Analytical Processing Inventory or the IAPI was developed by Bakken, Haerem & Kuvaas (2013) that measures the situation specific nature of intuitive and analytical processing. It is a 26 item inventory that is comprised of 5 subscales namely: heuristic, affect and urgency that represent the intuitive dimension while the caution and rationality subscales reflect the analytical dimension. The items were scored on a 5 point Likert scale.

Cognitive Styles (Intuitive & Analytical)

Intuitive cognitive style was assessed by using the long form 40 item version of Rational Experiential Inventory (REI: Pacini and Epstein, 1999). This measure consists of two subscales of 20 items each, on measuring individuals' preferences towards analytical (Rational scale) and the other to intuitive (Experiential scale) processing. It is a questionnaire central in the development of Cognitive Experimental Self Theory (CEST), which emphasizes the two different information processing systems to be a personality like construct that measures individuals' preference towards making intuitive and/or analytical decisions (Pacini & Epstein, 1999). The items were scored on a 5 point Likert scale.

Mindfulness

Mindfulness was measured by the Mindful Attention Awareness Scale (MAAS) developed by Brown & Ryan (2003). The MAAS comprises of 15 questions, shows an internal consistency of .80 (Brown & Ryan, 2003) and is scored on a 6 point Likert scale.

Results

In all we had 71 participants on the experiment but due to technical issues on the simulation, data for 4 participants was not captured fully and hence was not considered for further analysis. The data were checked for assumptions of

multiple regression concerning independence of variables, multi-collinearity, and detection of outliers, skewness and kurtosis (Hair, Black, Babin & Anderson, 2010). Data showed independence of variables when regressed for change in performance where we reported a Durbin-Watson coefficient of 1.980. However for the regressions concerning intuitive processing and analytical processing respectively the Durbin-Watson coefficients were found to be .346 and .304, indicating dependence of variables (Field, 2009). We inspected the histograms to check for skewness and kurtosis and found that the linear regression was quite robust towards minor departures from normality and hence continued with the analysis (Hair et al., 2010). We also observed some outliers on the stress data but did not exclude them since our sample size was large (Hair et al., 2010).

Descriptives and Correlations

Table 1

Means, Standard Deviations and Intercorrelations of All Variables

	Variable	Mean	SD	1	2	3	4	5	6	7	8
1	Training (EMT or TT)	0.52	0.50	-							
2	Intuitive Processing	3.15	0.57	-.096*	-						
3	Analytical Processing	2.90	0.62	-.113*	.203**	-					
4	Mindfulness	3.92	0.83	0.04	0.02	-0.07	-				
5	Stress Baseline Task	4.35	3.19	.106*	-0.05	0.05	.192**	-			
6	Stress Training Task	3.98	3.11	0.00	-0.01	0.02	.097*	.568**	-		
7	Stress Post-Training Task	4.24	4.28	-0.05	.223**	.188**	.154**	.321**	.572**	-	
8	Change in performance (unstandardized residuals)	-	0.26	0.05	-0.02	-0.02	-0.02	0.00	0.03	0.03	-
	p < .10. *p < .05. **p < .01.										

Table 1 shows the descriptive statistics and the inter-correlations among the variables included in the research model. Note that the independent variable „Training“ is coded as dummy variables (0 = EMT and 1 = Traditional training). Some preliminary results for the hypothesis can be drawn from this table. It seems that there are no significant differences in the performance change from baseline simulation to the post-training task simulation, depending on whether the participants received EMT or traditional training. Further, it can also be observed those who have received EMT have a stronger preference towards both intuitive and analytical processing, compared to those who received traditional training. To investigate the hypothesized relationships further, we ran multiple regressions.

We first regressed type of training, cognitive processing and the interaction of these two variables on change in performance. Next we regressed stress during training simulation and mindfulness on intuitive and analytical processing respectively. The results are illustrated in table 2.

Multiple Regression Analysis

Table 2

*Summary of Regression Analysis Predicting Change in Task Performance,
Intuitive & Analytical Processing*

	Change in Performance	Intuitive Processing	Analytical Processing
Constant	-.116 (.022)	.963** (.308)	.34 (.323)
Treatment (EMT or TT)	.009 (.024)	-.361** (.054)	-.25** (.056)
Intuitive processing	-.019 (.021)		
Analytical processing	-.002 (.020)		
Mindfulness	-.022 (.014)	.017 (.029)	-.097** (.030)
Stress run 2		-.012 (.008)	-.019* (.008)
Treatment x intuitive	-.011 (.043)		
Treatment x analytical	-.089* (.040)		
Adjusted R2	.014	.354	.427
N (repeated)	406	399	399
F	13.737	25.224	33.974

Note. The regression parameter appears above the standard error (in parentheses), and then the standardized coefficient is given. * p .05. ** p .01.

Hypothesis 1 suggested that traditional training would lead to a larger change in performance than EMT. To measure change in performance between the baseline simulation and post-training simulation due to type of training provided, we analyzed the unstandardized residuals while controlling for mindfulness and performance on the baseline and training simulations respectively. From the regression table, we observed that the type of training did not seem to predict change in performance ($b = .009$, $p > .05$). Hypothesis 1 was therefore not supported.

Hypothesis 2 (a) proposed that participants who received EMT would use intuitive processing to a larger degree than those that received traditional training. We controlled for age, gender, gaming experience, nationality, and the two scales of the REI inventory: REI rational and REI experiential. We found statistical support for the hypothesis 2 (a), ($b = -.361$, $p < .01$), indicating that participants receiving EMT used a larger degree of intuitive processing during training than those in traditional training. Hypothesis 2 (b) suggests that participants who received traditional training would use a larger degree of analytical processing than those who received EMT training. The same control variables as above were used. We found the opposite of what was originally hypothesized ($b = -.250$, $p < .01$) indicating that participants who received EMT also showed a larger degree of analytical processing. Therefore even though we had significant findings, hypothesis 2 (b) was rejected.

Hypothesis 3 (a) proposed an interaction effect between EMT and intuitive processing on change in performance. We tested this hypothesis by regressing EMT, intuitive processing and the interaction between intuitive processing and EMT on change in performance. We also controlled for mindfulness, performance on simulations 1 and 2 respectively. From the table, we observed that there were no significant main effects for type of training ($b = .009$, $p > .05$) for intuitive processing ($b = -.019$, $p > .05$), and for the interaction effect ($b = -.011$, $p > .05$). Hypothesis 3 (a) was not supported.

Hypothesis 3 (b) similarly proposed an interaction between traditional training and analytical processing on change in performance. We tested this hypothesis by regressing type of training, analytical processing, and the interaction between analytical processing and type of training on change in performance. Mindfulness and performance on simulations 1 and 2 was again controlled for as in hypothesis 3 (a). From the table, we observed that there were

no significant main effects between type of training ($b = .009$, $p > .05$) and analytical processing on change in performance ($b = -.002$, $p > .05$). The interaction effect was ($b = -.089$, $p < .05$) hence the hypothesis was rejected. However we reported statistically significant findings that EMT will interact with high analytical processing and traditional training with low analytical processing on change in performance. Following this, we chose to visually inspect the two way interaction plot (Figure 1) using the recommended procedures (Aiken & West, 1991; Dawson, 2013). The interaction plot shows the change in performance for EMT and traditional training relative to each other. We observed that trainees receiving EMT benefited from high analytical processing while those who were in traditional training would benefit from low analytical processing. Note that the interaction plot shows a negative change in performance which is because the post-training simulation was more difficult and complex than the baseline simulation.

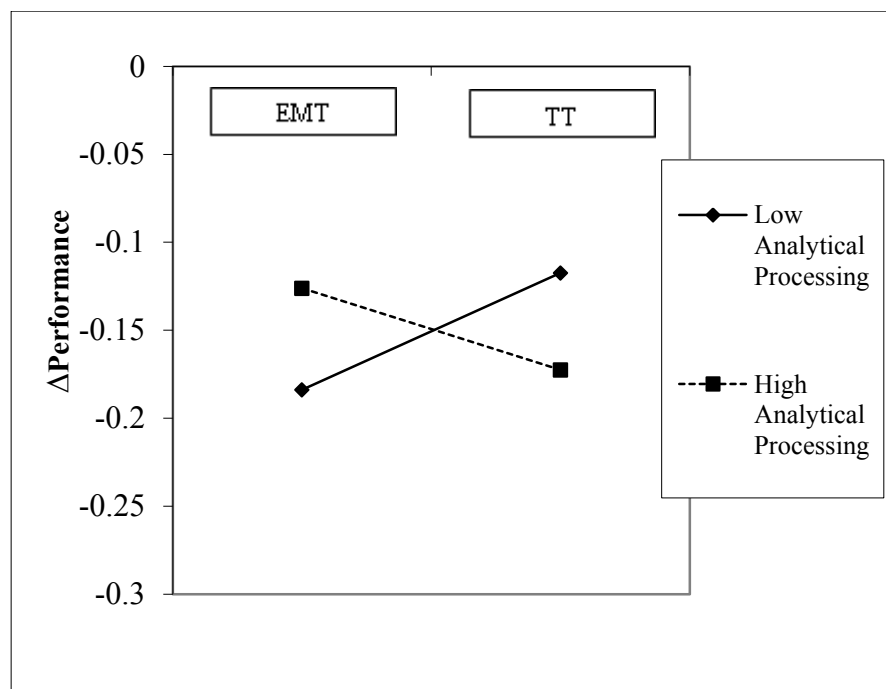


Figure 1: Interaction Plot

Next, we proceeded to investigate the second part of our research model, i.e. the relationships between stress, mindfulness and cognitive processing. Regressions were run testing stress during training simulation and mindfulness with respect to intuitive and analytical processing. We controlled for gaming experience, type of training, nationality, age, gender, and the REI scales: REI rational and REI experiential. The following results were obtained:

Hypothesis 4 (a) proposed that participants with high degree of stress during training would show higher intuitive processing. From the table 2, we observed that higher the stress on the training task, lower is the intuitive processing on the training simulation given by ($b = -.012$, $p > .05$). This hypothesis was not supported. In addition we proposed in hypothesis 4 (b) that participants with high degree of stress during training would show lower analytical processing. We found that this hypothesis was supported ($b = -.019$, $p < .05$).

Concerning mindfulness and cognitive processing, we proposed on hypothesis 5 (a) that higher mindfulness will be associated positively with intuitive processing, but we found no support for this ($b = .017$, $p > .05$). In addition on hypothesis 5 (b) we expected that higher mindfulness will be positively associated with analytical processing. This hypothesis was rejected. However, the results were statistically significant and we found that higher mindfulness is associated with lower degree of analytical processing, ($b = -.097$, $p < .01$) contrary to what was originally hypothesized.

Discussion

The first hypothesis proposed that traditional training would lead to a larger change in performance than EMT and found that the two types of training were not significantly different from each other in terms of effectiveness. This hypothesis was conducted in order to replicate previous studies and also to complement existing research in the field of EMT (Keith & Frese, 2005). Findings indicate that exploring and using errors as feedback worked approximately equally good as following guided instructions provided. The finding is in line with previous research that suggests EMT and TT to be equally effective on analogical transfer tasks (Keith, Richer & Naumann, 2010). We opine that the quality of the guided instructions could have been more precise and pedagogical since the effectiveness of the traditional training will depend on the quality of the instructions provided. Another possible explanation is that neither personality nor cognitive abilities are controlled for in this analysis, which can be important for whom and to what degree EMT or traditional training is beneficial (Gully et al., 2002; Loh, et al., 2013).

In hypothesis 2 we proposed that trainees who received EMT would be more intuitive, and those who received traditional training would be more

analytical during training. However, we found that EMT trainees scored significantly higher on both intuitive and analytical processing. A possible explanation is that the trainees could have used their intuitive decisions confidently in the more positive and non-threatening training environment of the EMT condition that treats errors as positive feedback. A possible explanation for why EMT trainees were high on analytical process is because they were engaged in exploration while dealing with errors which could possibly increase their attention and lead them into using a more conscious process regarding the cause and effect relationships of errors (Frese & Zapf, 1994; Keith, 2011). In contrast, those who received traditional training instructions may rely more on the guided instructions provided, following them step by step and therefore engaging in less cognitively demanding processes (Keith, 2011). In other words, we observe that finding solutions by analyzing through exploration is more cognitive demanding than following instructions.

Hypothesis 3 dealt with the interaction between type of training and cognitive processing on the change in performance. We rejected hypothesis 3 (b) even though we found statistically significant results, because it was contrary to what was hypothesized. We observed that trainees in EMT that were high on analytical processing and trainees who received traditional training and were low on analytical processing, had a significant positive change in performance. This finding is of interest and supports the premise advanced by Frese that under EMT conditions, trainees actively searching for solutions will adopt a more effortful processing than using automatic, fast and effortless processing (Frese & Zapf, 1994; Heimbeck et al., 2003; Keith, 2011). A possible explanation for this is that the trainees who received EMT would in fact differentiate and integrate information using a systematic and effortful approach than a less cognitively demanding approach whereas in contrast, trainees in the traditional training group that were low on analytical processing need to only apply the strategies they were instructed without highly differentiating or highly integrating the information (Heimbeck et al., 2003; Keith, 2011).

In hypothesis 4 we inquired into the relationship between stress levels on the training simulation with respect to both intuitive and analytical processing. We found no support for the relationship between stress and intuitive processing. However we found statistically significant support for the relationship that higher stress levels will lead to lower analytical processing. This is in line with Arnsten's

(2009) findings that stress causes the thoughtful prefrontal cortex activity to be hampered thereby resulting in an impaired flexible cognitive thinking, seen as similar to analytical processing.

Next, in hypothesis 5 we examined mindfulness in relation to cognitive processing. We did not find support for the hypothesized relationships that high mindfulness will be positively associated with higher intuitive processing and higher analytical processing respectively. On the contrary, we found significant support for high mindfulness to be associated with lower analytical processing. From this finding, we infer that the trainees on our experiment were less deliberate and effortful in their processing of attentional stimuli emerging from the task environment. Thus a possible explanation could be that the processing may have been less intentional and non-judgmental (Dane, 2011), which still reflects the deliberate and effortful part of analytical processing, although to a lower degree. The hypothesized relationships were possibly not supported maybe because the MAAS scale (Brown & Ryan, 2003) has a better applicability in clinical settings and is perhaps less suitable in organizational settings.

Limitations

No study is perfect and our study too suffers from some inherent limitations, which will be presented below. On the experiment, 58% of the sample was comprised of Norwegians and the rest from other countries. The computer simulation used the map of Southern Norway and the non-Norwegian participants may have had a disadvantage in not being as familiar with the map and geography as compared with the Norwegian participants.

Some trainees faced technical issues with the computer simulation during the 3 minute warm-up session before the baseline simulation began and hence had to go through it twice. This could have either created frustration and/or provided them with an opportunity to familiarize to the simulation better as compared with the others. Therefore in the case of a few individuals, identical and uniform conditions were not provided.

Even though we did our best to control the experiment as free as possible from external influences, there might have been some factors not controlled for that could have influenced the results. Specifically, the data from the skin conductance response sensors were gathered to obtain an objective and quantitative measure of the trainees' stress levels. The SCR sensors capture the

skin conductance irrespective of the source of stress (Figner & Murphy, 2010). Therefore, the stress levels may not be fully attributable to be emerging from the experiment, but instead could also emerge from other sources.

The effectiveness of training transfer depends on the quality of feedback (Grossman & Salas, 2011). Those who received the EMT training were depending on feedback from the training simulation itself in order to explore and learn from the errors they made to enhance effectiveness. However, the simulation may have some limitations in terms of how it communicates with the trainees. For example, trainees may get an increase in percentage score when they complete the mission, but they are not aware if that increase in percentage is the maximum possible score for that specific mission or not. The traditional training group was provided with guided instructions which were based on our understanding of the score calculation matrix used on the computer simulation. Also we handed the guidelines in a written form. Some participants may have preferred oral instructions instead. Therefore we have reasons to believe that the quality and the form of the guided instructions could have been more precise and easier to interpret for the trainees.

Finally, the mindfulness measured by MAAS was administered at the end of the post-training simulation but we made the assumption that the trainees' state of mindfulness was captured for the experiment retrospectively as a whole, including the training simulation. It may have been an advantage to administer it right after the training instead to get a more true picture. We also believe that the mindfulness measure given by the MAAS, which has shown high reliability in the clinical settings (Brown et al., 2007; Shao & Skarlicki, 2009) may not fully be suitable in organizational settings. Perhaps the conceptualization and the scale developed by Langer (Dane, 2011) could be a more appropriate tool to test out given its origins in organizational settings.

Implications

We believe this study provides some implications regarding training and cognitive processing. It may be valuable for organizations to understand the cognitively engaging nature of EMT for trainees with respect to both intuitive and analytical processing. We also believe that on the basis of our observations EMT is a type of training which may be most beneficial when trainees are conscious and effortful. Organizations could use EMT as a method for those who are high on

analytical processing since we found it to be most effective for those trainees. On the other hand, traditional training could be most effective for those who are low on analytical processing (Gully et al., 2002). Also, organizations need to be aware that stress levels during training may hinder trainees to solve problems analytically. Reducing their stress by creating a non-threatening training environment could be valuable in terms of training effectiveness. However, we note that this will be dependent on the objective of the training program and the nature of business the organization is operating in.

Future research directions

Previous research on EMT training has suggested that personality type and cognitive abilities influence the degree to which EMT is successful (Gully et al, 2002; Loh et al., 2013). This can be investigated in relation to stress, mindfulness and cognitive processing to gain a better understanding of the importance of individual differences for training effectiveness.

Also, future research should investigate both EMT and traditional training from the perspective of learning outcomes on an adaptive transfer task, to understand the extent to which differences exist between EMT and traditional training differ from each other. It would be interesting to observe the learning outcomes when the post-training task is significantly different than the training. One specific suggestion would be to run EMT at an individual level and then observe the effectiveness at a group level setting in the post-training using the principles of adaptive transfer. Also on EMT, far transfer has been proven to be a good indicator of transfer of training (Heimbeck et al, 2003) but our study only inquires about near transfer. Future research should also inquire into the far transfer nature of adaptive transfer tasks.

Regarding mindfulness, Langer's conceptualization is centered on the process of drawing novel distinctions or in other words, being able to differentiate cognitively (Langer, 2009) and is known for being applicable to an organizational setting (Dane, 2011). Future research should investigate how Langer's conceptualization of mindfulness relates to cognitive processing and tasks performance in a training setting, to observe the differences from Brown & Ryan's (2003) conceptualization.

Conclusion

This study aimed to investigate the effectiveness of EMT and traditional training when influenced by trainees' cognitive processing. In addition, we also investigated the degree to which stress during training and mindfulness influenced cognitive processing. We found that EMT and traditional training are almost equally effective on an analogical transfer task, in line with some of the previous research conducted. Also we found that trainees engaged in EMT scored higher on both intuitive and analytical processing, indicating that EMT was a more cognitively engaging form of training than the traditional type where trainees followed step by step instructions. On the interaction hypotheses, we observed that trainees who scored high on analytical processing under EMT and trainees who scored low on analytical processing under traditional training, showed the most learning indicated by a positive change in performance. Further we found support that high stress during training impaired analytical processing and that trainees scoring high on mindfulness were low on analytical processing during training. Our lab study confirmed existing research as well as offering some new insights on constructs that were previously not researched in relation to one another, to the best of our knowledge.

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Appendix

Appendix 1

3 x Bell Helicopters

- Primary function:

TRANSPORT

- Secondary function:

RESCUE & FIRE FIGHTING



3 x Sea King Helicopters

- Primary function:

RESCUE

- Secondary function:

TRANSPORT

- Features:

Large capacity (3-4 people)

Extensive medical assistance on board

Operates in extreme weather conditions at sea



2 x Orion Airplanes

- Primary function:

SURVEILLANCE

- Secondary function:

SEA RESCUE MISSIONS

- Features:

Often used for inspections of fishing vessels etc.
Can drop down life rafts at sea



2 x Fighter Airplanes

- Primary function:

AIR INTERCEPT

- Secondary:

SURVEILLANCE, AIR PATROL, GUIDED MISSILES

- Features:

- Speedy



Appendix 2

Error Management Training Manipulation:

Explore & Experiment



- The next simulation is only for training, where you shall explore and experiment to discover the best strategies for handling the incidents
- During this simulation, you are free to make as many errors as you want to learn as much as possible
- Errors are natural! Don't get demotivated or stressed by errors
- When you make errors, try your best to learn from mistakes to develop a better understanding of the scenario
- Try to see the errors as a positive part of the training process, and treat them as valuable feedback
- Performance will be measured in this simulation, but does not matter. However, your performance will matter in the last simulation

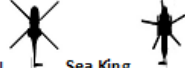
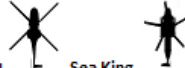

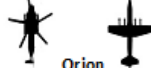

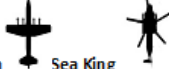
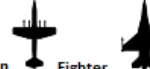
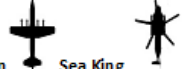


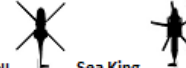
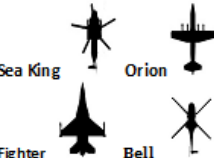
Traditional Training Manipulation:

Avoid Making Errors



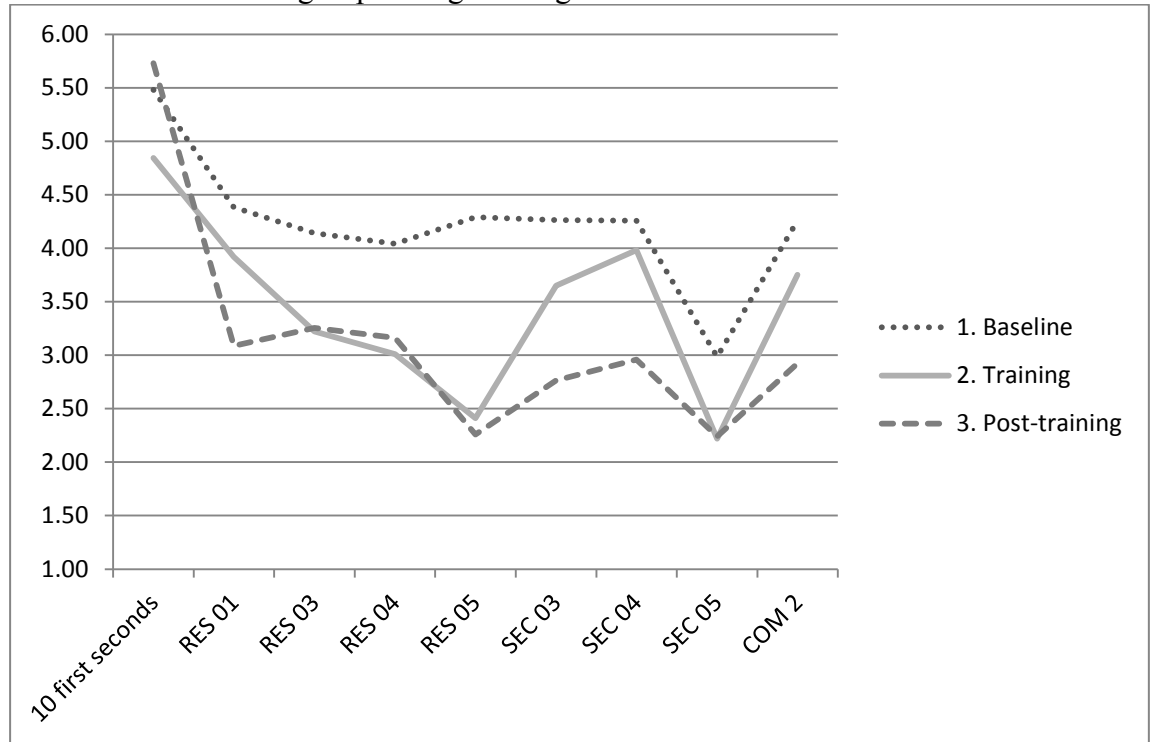
- The next simulation is for training where you should practise getting as high score as possible
- Try to make as few errors as you can during this simulation
- Making errors will reduce your learning and performance
- Your performance will be measured
- To help increase your performance, follow the step-by-step guidelines for each 12 tasks that you have received

Appendix 3

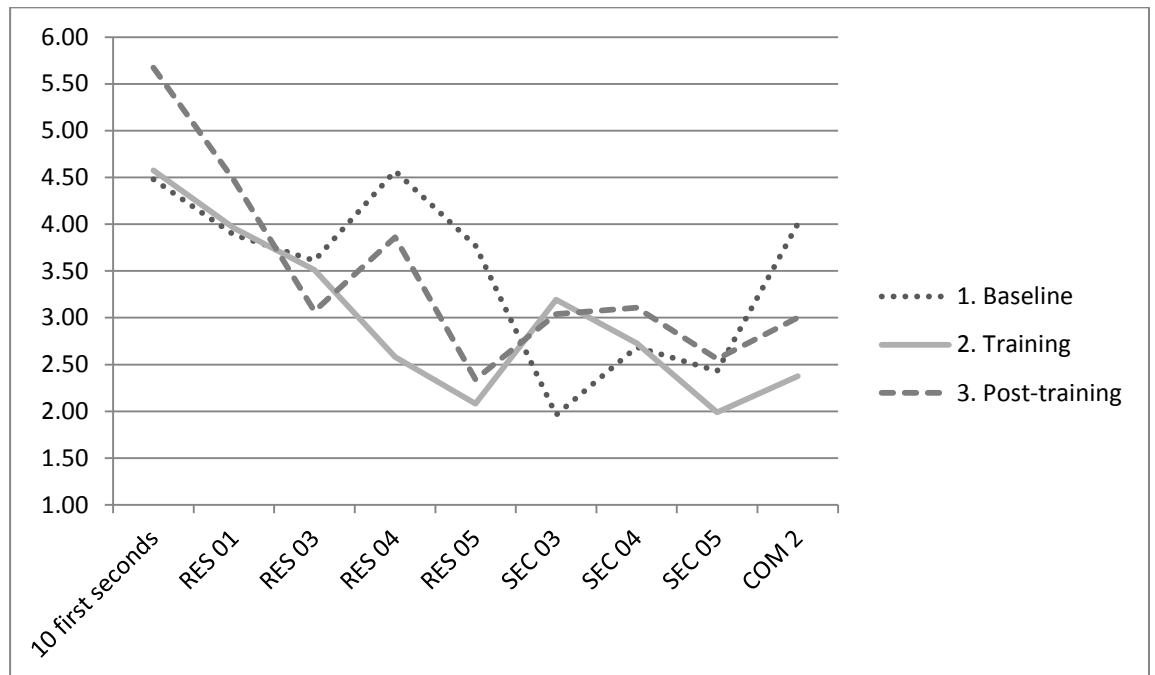
<p>1: Rescue Mission Car crash Odda</p>  <p>Bell Sea King Low resources mission</p>	<p>2: Rescue Mission Car crash Gol</p>  <p>Bell Sea King Low resources mission</p>	<p>3: Rescue & Transport Mission Bus and car crash Stryn</p>  <p>Bell Sea King High resources mission</p>	<p>4: Sea Rescue Mission Boat capsized Risør</p>  <p>Sea King Orion High resources mission</p>
<p>5: Transportation & Rescue Flood in Glomma River</p>  <p>Sea King High resources mission</p>	<p>6: Sea surveillance/transport Illegal fishing in outside Florø</p>  <p>Orion Sea King Medium resources mission</p>	<p>7: Sea surveillance/defense Unknown submarine Smøla</p>  <p>Orion Fighter Medium resources mission</p>	<p>8: Sea rescue SOS signals from submarine</p>  <p>Orion Sea King High resources mission</p>
<p>9: Defense Terror attack on military camp</p>  <p>Fighter Low resources mission</p>	<p>10: Defense Terror attack nuclear reactor</p>  <p>Fighter Low resources mission</p>	<p>11: Sea transport/ rescue Possible bomb on oil platform</p>  <p>Bell Sea King Medium resource mission</p>	<p>12: Sea rescue/trans/defense</p>  <p>Sea King Orion Fighter Bell High resources mission</p>

Appendix 4

Stress levels for EMT group during training



Stress levels for Traditional Training group during training:



Preliminary Thesis Report

Preliminary Thesis

Exploring Error Management Training, Cognitive Processing Style and Mindfulness

Hand-in date:
15.01.2013

Campus:
BI Oslo

Examination code and name:
GRA 1900 Master Thesis

Programme:
Master of Science in Leadership and Organizational Psychology

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Abstract

The purpose of our study will be to investigate two different training approaches, respectively traditional error avoidant and error management training in relation to analytical processing style and intuitive processing style. We will also look into the relationship between cognitive processing styles and mindfulness as a situational specific construct. An experiment will be conducted where one group will be provided with error avoidant conditions and another group will be provided with error management training instructions. The experiment will have two tasks: training task and post training task, where the change in learning between the two tasks is measured as performance. We hope this study will contribute to the field of decision making, training and mindfulness.

1.0 Introduction

It has been proposed that the characteristic of feedback is especially important as it determines the relevance of the learning received by an individual (Hogarth 2001). Feedback is concerned with informing the decision maker about the structure of the task (Hogarth, Gibbs, McKenzie & Marquis, 1991). Traditionally feedback has been conceptualized as error avoidant, which placed emphasis on obtaining specific feedback to solve tasks. In contrast, Error Management Training (EMT) is a relatively new concept that entered management literature which improves upon the existing methods and has been found to be having great potential for the transfer of training as compared to traditional methods of training. The effectiveness of EMT has been attributed to it being more “active” and holistic in nature, which means that it is easier to transfer the learning to a new scenario.

Individuals’ preference for cognitive styles may assume an important role in absorbing the type of feedback necessary for a better performance of the task. Cognitive styles may be understood as trait related (Pacini & Epstein, 1999), meaning that they are long term in nature. Cognitive processing styles, on the other hand are considered to be more situation specific (Bakken, Haerem & Kuvaas). In our study we are considering the literature of both cognitive styles and processing styles, however in our research model focus we will be on processing style. Mindfulness has been traditionally conceptualized to be an attentive state of mind (Dane & Pratt, 2009). Using this viewpoint, we would like to observe the linkage between mindfulness as situational dependent state and cognitive processing styles.

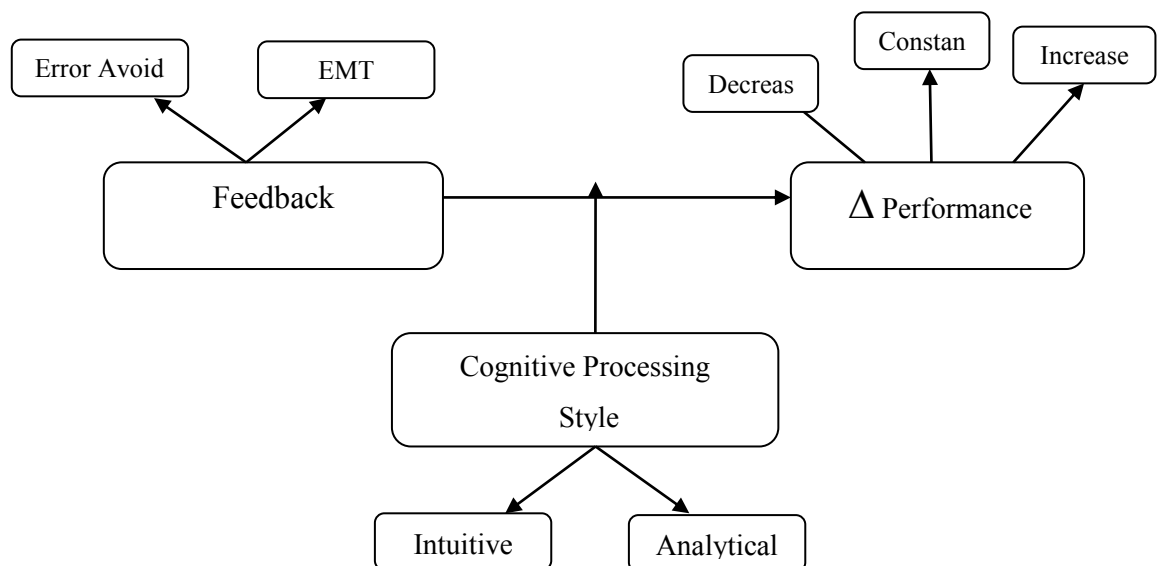
The main purpose of our study will be to investigate about the interaction between cognitive processing styles and the feedback provided, i.e., observe what type of cognitive processing style is used when EMT or error avoidant training is provided. To the best of our knowledge, this link has not been explored yet and hence it presents us with an opportunity to investigate this specific relationship. At the same time, the link between mindfulness and cognitive processing will also be explored, in the hope that this will possibly contribute to the field of mindfulness and cognitive processing. We also hope that this study will have some practical contributions relating to how feedback is provided depending on what kind of cognitive processing style that is preferred by the individual. This

might give opportunities to design customized training programs that includes a tighter design between feedback provided and cognitive processing styles of the learner, to maximize the learning outcome.

The paper will be organized as follows: We will begin by introducing the research model, then we present and discuss the theory and hypotheses concerning the relationships between feedback and task performance, feedback and cognitive processing styles, the cognitive processing style as moderator between feedback and performance. We will also look at mindfulness and cognitive styles. At the end we will discuss the planned methodology of our study.

2.0 Research Model

The research model is presented here graphically. The theoretical discussion and hypotheses concerning the research model follow the illustration.



3.0 Hypothesis 1

3.1 What are errors?

Errors present themselves in several ways in trainings and in daily work settings, and we need to deal with them in one way or the other. Errors may be defined as unintentional deviations from goals (Reason, 1990; Hofmann & Frese, 2011, Keith, 2012). Errors here are conceptualized as actions in goal orientation (Reason, 1990), they can arise from many different mechanisms and are primarily

unintentional (Hofmann & Frese, 2011). The goal oriented nature of errors is highlighted here because errors are seen as specific lapses when a particular sequence of actions is not fulfilled and the goals initially planned for are not achieved (Reason, 1990). Here, errors are distinguished from violations which are construed to be intentional deviations from task goals (Reason, 1990). Another distinguishing feature is that unforeseen and unplanned events occurring beyond human control may not be classified as errors (Zapf, Brodbeck, Frese, Peters & Pruemper, 1992). At the same time, the inevitability of errors is also highlighted (Brodbeck, Zapf, Prumper & Frese, 1993; Reason, 1990; Hofmann & Frese, 2011) in the sense that errors are difficult to eliminate fully.

3.2 EMT vs. Error Avoidant Training

Traditionally, training methodologies involved tight structuring over the learning environment, which also involved providing the participants with a step by step guided type of feedback (Ivancic & Hesketh, 1995). Thus, it can be said that the traditional approach to training places a passive role for the learner in which the control is retained by the learning environment and the instructor in general (Bell & Kozlowski, 2008). The traditional methods of error avoidant training can be considered to be a useful methodology in developing routine expertise (Frese 1995, as cited in Bell & Kozlowski, 2008). Seminal research in this area has indeed suggested that specific and guided feedback helps participants in acquire cognitive skills better and result in achieving a better performance (Anderson, 1982). Work by other researchers suggests that guided and step by step feedback is crucial in performing tasks (Adams 1968; Annett 1969, Cartledge & Koeppel, 1968, as cited in Ilgen, Fisher & Taylor, 1979).

In contrast to this approach, Error Management Training (EMT) was proposed as an alternative to the traditional error avoidant training (Frese, Brodbeck, Heinbokel, Mooser, Schleiffenbaum & Thiemann, 1991). Whereas the traditional error avoidant training approach assumes a negative view towards errors, EMT is an alternate methodology of training that treats errors positively and as naturally occurring out of learning processes (Keith & Frese, 2008). EMT is exploratory in nature in which participants unrestrictedly look for ideas (Frese at al., 1991; Keith & Frese, 2008). It is also considered to be an active learning approach in which the participant is imparted control over his/ her own learning

goals. In an active approach, the learner uses an exploratory approach to strategize learning related decisions (Bell & Kozlowski, 2008). At the same time, the aim of EMT is to acknowledge that errors cannot be avoided (Brodbeck, Zapf, Pruemper & Frese, 1993) but instead participants can be appropriately trained to embrace errors (Frese et al, 1991; Keith & Frese, 2008; Keith 2012). One of the main underlying principles behind EMT is that there is an explicit emphasis on the need to commit errors so that individuals use errors as a positive feedback process (Keith & Frese, 2008; Keith, 2011). Errors are treated as a source of positive feedback because a high degree of errors committed encourages novelty, i.e., leads to a high degree of new ideas generated (Homsma, Van Dyck, De Gilder, Koopman & Elfring, 2009), which in turn leads to a better learning (Keith & Frese, 2008) and embracing errors in organizations leads to increased performance in those organizations (Van Dyck, Frese, Baer & Sonnentag, 2005). There are some key features involving EMT suggested by Frese et al., (1991), that involves the following explicit positive instructions:

“Errors are a part of the learning process”

“Errors inform you about what you can still learn”

“The more errors you make, the more you learn”

Therefore, EMT is distinguished from error avoidant training in the sense that in the error avoidant approach the orientation is on the avoidance of making errors while EMT uses it as valuable feedback (Keith, 2011; Keith & Frese, 2008).

3.3 Transfer of training:

Transfer of training mainly refers to the amount of learning that is transferable to the job (Baldwin, Ford & Blume, 2009). Here, transfer is defined to be “knowledge or skills transferred from one task to another” (Hesketh 1997, p. 318 as cited in Keith & Frese, 2008, p. 61). In our study, we look at the transfer of training from both EMT and error avoidant perspective. In transfer of training, traditional research has focused on training design and external factors such as supervisor support but current research is now centered on individual level factors (Baldwin, Ford & Blume, 2009). It has also been found that there is a steady increase of technology based training (Baldwin, Ford & Blume, 2009) which uses technology as a medium of transfer. Our experimental task involves elements of technology based transfer, this factor assumes significance for maximizing performance. Advantages of technology based transfer include opportunities for

the customization of learning, availability of immediate feedback (Horton, 2000 as cited in Dane & Pratt, 2009) and cost savings involved. The degree of transfer of training on a task are distinguished in the training literature into analogical and adaptive transfer task, depending on complexity and similarity between the training task and post training task.

3.4 Analogical and Adaptive Transfer of Training:

Transfer of training could be either analogical or adaptive in nature. Analogical transfer tasks can happen when the tasks are similar referred to as “structure preserving nature” (Gick & Holyoak, 1983). Analogical transfer is conceptualized as finding correspondence from one area that can be used in the other, and occurs when there is transfer of problem solution from one situation to another (Ivancic & Hesketh, 2000; Gick & Holyoak, 1983). Adaptive transfer task on the other hand, involves the generation of solutions to completely new problems (Ivancic & Hesketh, 2000). They are also considered to be structurally more complex than analogical transfer tasks (Keith, 2011). In simplistic terms, adaptive transfer tasks involve distinct tasks but the tasks are solved using different knowledge bases. The focus of our study however will be on transfer of learning pertaining to analogical tasks, and not adaptive tasks.

3.5 Effectiveness of EMT and Error Avoidant Training on Performance:

A meta analysis conducted by Keith & Frese (2008) explored the effectiveness of EMT and error avoidant approaches on both adaptive transfer tasks and analogical tasks. It points out that participants receiving EMT feedback performed better on adaptive transfer tasks than for analogical transfer tasks (Dormann & Frese, 1994; Keith & Frese, 2008; Keith, 2012). One of the reasons for this is that EMT uses task generated feedback for participants to independently perform the tasks and learn from these tasks (Keith & Frese, 2008; Keith, 2012). Researchers also suggest that traditional error avoidant training or a guided feedback approach may lead to better performance on analogical transfer tasks. An important aspect to consider is cases where the tasks do not generate clear feedback, error avoidant training approach maybe a better to use than EMT (Keith & Frese, 2008; Keith, 2012). Let us for a moment consider the example of a developer who is working on developing a new software tool. The developer may be in the ideal case, able to assimilate concepts learnt in one scenario and apply it in an altogether new

scenario, if the developer went through exploring errors and trying out various strategies in a non threatening environment. It may be assumed that under these conditions, he would be able to better acquaint with the basic underlying knowledge required and apply it to a structurally more complex task (adaptive transfer task). But what if the scenario is a slightly similar one that the developer is encountering it for the first time? In this case, ideally a step by step explanation of the software development process maybe be better suited, since it is assumed that this experience will be helpful in tackling a similar situation better (analogical transfer task). Hence, we would like to suggest that the situation dictates the choice of training method and for an analogical transfer task, providing a detailed, step by step feedback will may be able to familiarize the learners to the task in a way that they will perform better. This would help us to examine which method is more suitable in the context of an analogical transfer task, and also inquire if providing guided feedback rather than EMT training leads to a better task performance. This will also help observe any replication of existing studies. We therefore hypothesize that:

Hypothesis 1: On an analogical transfer task, error avoidant training will lead to better performance, rather than when EMT feedback is provided.

4.0 Hypothesis 2:

4.1 Intuitive and cognitive style

Research done in the field of cognitive styles related to decision making distinguishes between two types: intuitive and analytical styles. The intuitive and analytical styles have been referred to by different names by different researchers. Stanovich & West (2000) have used the terminology "system 1" and "system 2", Hogarth uses the terminology "tacit" and "deliberate", whilst Epstein (1994) uses "experiential" and "rational" style. Whatever terminology used, the two cognitive styles have shown to be of importance in decision making, and in this study they will be referred to as "intuitive" and "analytical" respectively. The cognitive style is on a trait level whereas cognitive processing style is more situational dependent (Bakken, Haerem & Kuvaas).

In order to get an understanding of the concept of intuition cognitive style, it is first necessary to provide a definition. Martha Sinclar (2010) defines intuition as "knowing without reasoning or conscious processes". On a similar note, Kahneman (2003) defines intuition as "thoughts and preferences that come to mind quickly and without much reflection". Recent advances in cognitive science have suggested that there is nothing magical or mystical about intuition, but it is rather quick patterns of recognition based on perception of the problem and past experiences (Simon, 1987). According to Stanovich & West (2000), Hogarth (2003), Dane & Pratt (2007), intuition is characterized as automatically triggered, speedy, associative, affective, and it is not placing too much demands on cognitive capacity. Compared to intuition, the analytical cognitive style is described as being conscious and deliberative, slow, affect free and placing much demands on cognitive capacity (Stanovich & West, 2000; Hogarth, 2003; Dane & Pratt, 2007). Related to decision making process, this styles may lead the individuals to make decisions based on predicting and estimating the probability of various possible outcomes (Evans 2010), what is known as a rational decision making process. These two cognitive styles both have their strengths and weaknesses. An analytical cognitive style is related to a rational decision making process, whereas an intuitive style is associated with bounded rationality (Simon, 1987). Simon suggested that in scenarios where there is limited time and cognitive capacities available to process information, individuals are often bounded rational and using an intuitive style could be better.

4.2 Cognitive Processing Styles and Feedback

There has been done some research on intuitive and analytic cognitive styles related to learning. Hogarth (2001) introduced two general learning environments, which he has labeled *wicked* and *kind* learning structures. He defines kind environments as those in which information that is tacitly processed leads to valid inferences, and in which feedback is neither missed nor misleading (Hogarth, 2010). In contrast, feedback is not necessary representative of the environment and might be both missing and misleading in a wicked learning environment (Hogarth, 2001).

As previously explained EMT is recognized for providing minimal guidance (Keith & Frese, 2008), encourage active search for relevant information in an environment where it is not readily available. Since wicked learning

environment is characterized by delayed, missing or misleading feedback it may be treated akin to EMT. Similarly, traditional error avoidant training is characterized by obtaining specific and relevant step-by-step feedback. Since kind learning environment are described as where feedback is precise and accurate, it may be treated similar to traditional error avoidant training.

We have previously noted that intuition is a speedy, effortless process that does not place demands on the cognitive and information processing capacities of the human brain (Dane & Pratt, 2007; Stanovich & West, 2000; Sinclair, 2001). We contend that when a task is being provided with the use of guided feedback, it involves steps to be remembered in solving that task. This implies that while tackling the task, one cannot simply use unconscious processing, rather they have to use a conscious, deliberative and slow analytical type processing to follow the instructions as good as possible.

We will therefore observe from our experiment, what type of cognitive processing style (intuitive or analytical) will be used when either EMT or traditional error avoidant training is provided to the individuals. We hypothesize that:

Hypothesis 2a: When EMT feedback is provided, individuals prefer to use intuitive cognitive processing style.

Hypothesis 2b: When traditional error avoidant training is provided, individuals prefer to use analytical cognitive processing style.

5.0 Hypothesis 3:

As previously explained, the performance in our study is measured by the differences in the training and post-training task. Several explanations for good and bad performance have been offered in the literature of training. One possible explanation is whether individuals tend to solve problems in an analytic mode as opposed to a more intuitive one (Stanovich & West, 1998) related to task performance (Hogarth, 2005). In this study we want to investigate the causal relationship between feedback (EMT or Error avoidant training) and performance, when moderated by cognitive processing style (analytic or intuitive).

It has been suggested by Hogarth (2001) that when feedback is timely and precise, there exist kind feedback environments. Further he states that this type of environment will facilitate good intuitive judgments. Alternatively, if there exist a wicked feedback with little or low quality of the feedback, this environment may lead to poor intuitive judgments (Hogarth, 2001). As emphasized previously, a kind learning environments has similarities to what we has described as guided feedback. This indicates that when there is guided feedback, it may facilitate good intuition judgments. Conversely, when there is wicked feedback, which may be treated as similar to EMT, there will be poor intuitive judgments. This indicates that intuition is depending on a precise and timely step-by step feedback to be sufficient or superior to an analytical approach.

5.1 Training, Cognitive Processing Style & Performance

To succesfully use an analytical approach towards a task/ problem, individuals define the appropriate variables and measures to arrive at the "optimum formula" that will solve the task. They then use the optimum formula to match solutions with criteria provided to acheive better results (Hogarth, 2005). When error avoidant training is provided to help the individuals to reach the optimal solution, an analytical approach may be effective for performance, since it allows individuals to reason and evaluate the best possible solution. Research also suggests that individuals with analytical styles will take a structured approach to learning, and will prefer information that is set out in a clearly organized way (Riding, 1994). In other words, when error avoidant training is provided, the best way to reach for a solution might seem clearer when using analytical style. Following this we hypothesize that:

Hypothesis 3a: Error avoidant training leads to better performance moderated by analytical processing style (rather than intuitive processing style)

Conversely, under EMT conditions, intuitive processing style maybe superior to analytical processing style. When a task is performed under EMT conditions, it may lead to increased metacognitive abilities, which in turn positively affect adaptive transfer of training (Keith, 2005). Also, the nature of meta cognitive abilities maybe clarified here. Metacognition is defined as

"knowing about knowing" (Shimamura, 2008). Meta cognitive abilities maybe understood as being associated with analytical processes since they occur in the prefrontal cortex of the human brain (Shimamura, 1996; Stuss, Gallup & Alexander, 2002; Shimamura, 2008) and prefrontal cortex is considered to be the center of the brain where the analytical style (Stanovich & West, 2000; Evans 2008). In our study however, we focus on analogical transfer of training since they are structurally less complex and more similar. A slow and effortful processing on the other hand maybe more useful for adaptive training which are structurally more complex. Following this, we hypothesize that:

Hypothesis 3b: EMT leads to better performance moderated by intuitive processing style (rather than analytical processing style)

6.0 Mindfulness

6.1 From Buddhism to Academia

Mindfulness is an ancient concept that is rooted in Buddhist psychology, and shares conceptual relationships with ideas from philosophical and psychological traditions (Brown, Ryan & Creswell, 2007). From being viewed as mystical and "Zen-like", mindfulness has entered the scientific arena as a construct of interest the last decades (Dane, 2010) and has been studied in the context of organizations (Weick & Sutcliffe, 1999). Mindfulness is conceptually rooted in the fundamental activities of consciousness, namely awareness and attention (Brown et al., 2007). D. Westen (1999, as cited in Brown & Ryan, 2003) describes *awareness* as the background "radar" of consciousness that is constantly monitoring the inner and outer environment and *attention* is a process of focusing conscious awareness, providing highlighted sensitivity to a limited range of experience. This helps us understand mindfulness, since in a mindful processing mode the individual is in an open-minded state, where the attention is kept to a pure and objective registration of the facts observed. When this is used to extend the contact with the world, attention and awareness allows the individual to "be present" in reality and react to it in a non-habitually and unbiased way (Brown et al., 2007). Further, according to mindfulness thoughts and emotions must be accepted and acknowledged, and are considered as a part of the ongoing stream of consciousness (Brown et al., 2007). In other words, mindfulness gives a clear awareness of our outer and inner world (Brown et al., 2007), and from a Buddhist

perspective, mindfulness gives comprehension of the right purpose or sustainability of an action, and other considerations (Thera, 1972).

6.2 Mindfulness Defined

Mindfulness can be defined as "a receptive attention to and awareness of present moment events and experience" (Brown & Ryan, 2003). This definition also goes hand in hand along with one widely cited definition from Buddhist psychology. Nyanaponika Thera (1972) described mindfulness as "the clear and single-minded awareness of what actually happens to us and in us at the successive moments of perception". Both of the definitions emphasize an open and flexible attention with awareness of the present moment, instead of being preoccupied with thoughts about the past or the future (Brown & Ryan, 2003). Further, mindfulness is fundamentally a state-level construct, that also can be assessed at the trait level (Dane, 2011). This means that mindfulness is not something that an individual either possess or lack, it can be reached by everyone in different situations. And even though meditation is a well established technique to reach a mindful state, it is not required (Brown & Ryan, 2003), there are other ways to reach a mindful state.

It is important to note that different schools of researchers emphasize specific characteristics of mindfulness more than others, and the research platform is not fully established, since this still is a young area research area in the Western academia (Brown et al., 2007). Authors give overlapping and different meaning of the concept of mindfulness, and naturally investigate mindfulness in relation to different concepts. E.g. the influential work done by Langer (1989) on mindfulness has some conceptual distinctions from what has discussed been so far. The present formulations has highlighted the importance of attention receptivity to both inner and outer realities. Langer's formulation of mindfulness emphasizes cognitive processing of sensory input, such as the deliberate search for novelty, distinctions, and multiple perspectives on task performance and behavior (Brown et al., 2007). Because of this conceptual overlap, Langer's conceptualization of mindfulness can therefore be seen as a cognitive approach to external stimuli (Brown & Ryan, 2003).

Weick and Sutcliffe (2006) explains mindfulness as: "Eastern mindfulness means having the ability to hang on to current objects, to remember them, and not to lose sight of them through distraction, wandering attention, associative thinking, explaining away, or rejection" (Dane, 2011). They introduced mindfulness into organizational settings, and study mindfulness in relation to High Reliable Organizations or HROs. Furthermore, Weick, Sutcliffe and Obstfeld (1999) take Langer's interpretation of mindfulness to a group level, and highlight the importance of the quality of attention in HROs, as well as the quality of individuals' actions towards what they noticed. Specifically, they suggest that mindfulness mediates the relationship between the cognitive processes that are associated with HRO, and capability to discover and manage unexpected events (Weick et al., 1999).

Brown & Ryan (2003) have studied mindfulness in relation to psychological well being, and reviewed research evidence for several salutary effects on mindfulness. This includes mental health, physical health, behavior regulation, and interpersonal relationships (Brown et al., 2007). However, not much research has been done so far on mindfulness related to individual task performance in a workplace setting (Dane, 2011). Dane suggests that a mindful state of consciousness makes individuals acclimatize to a wide breadth of present moment phenomena occurring around and within them (Dane, 2011). This may lead to several beneficial outcomes for task performance, but it may also be more costly than beneficial, depending on the task environment and task expertise (Dane, 2011). Further, there are questioned how mindfulness is linked related to intuition.

There has been proposed that individuals that are in touch with non-conscious operations, which are associated with intuitive judgments, may be related to mindfulness (Brown & Ryan, 2003; Brown et al., 2007; Weick & Sutcliffe, 2006 cited in Dane, 2011). Dane states: "by attuning individuals to phenomena arising through non-conscious operations, mindfulness may enable individuals to notice more of their intuitions" (Dane & Pratt, 2009). They refer to a study conducted by Sadler-Smith and Shefy (2007) and define mindfulness according to Langer's conceptualization. The participants in their study reported they were better able to identify the context in which they were most in tune with their intuitions, became more confident in their ability to draw on their intuitions in decision making situations (Sadler-Smith & Shefy, 2007). This indicates that

there may be a relation between mindfulness, and intuitive cognitive processing. However, there has not yet been established a clear link.

6.3 Stress and Intuition:

Intuitive decisions as previously defined are characterized by little conscious effort, speedy processing and automatic (Hogarth, 2001; Kahneman, 2003; Meyers, 2010). The intuitive cognitive processing is therefore often used in situations that includes time pressure, where we must rely on short-cut strategies (Glückner & Witteman, 2009). Therefore, we think that when individuals are stressed, they tend to use intuition in decision making. Stress means different things to different people under different conditions and it also have several definitions. One way to describe stress is “the perception of threat, with resulting anxiety discomfort, emotional tension, and difficulty in adjustment” (Fink, 2010). If we reflect on how mindfulness is described, stress might seem like the total opposite state of mind. It is also suggested that individuals high on mindfulness clearly incur less stress. Further, they state that high scores on the trait Mindful Attention Awareness Scale (MAAS) have been associated with lower levels of emotional disturbance, e.g. stress (Brown & Ryan, 2003). These findings may indicate that if an individual is high on mindfulness, they might be tending to use their analytical cognition.

Because of the above mentioned, we think it will be interesting to contribute in establishing a relationship between mindfulness and cognitive processing styles. Therefore we hypothesize:

Hypothesis 4: Mindfulness is positive related to analytical cognitive processing style.

7.0 Method

We intend to perform an experimental task (CRISEX simulation exercise) since an experimental design offers the strongest foundation for making causal inferences (Mathieu and Taylor, 2006). The strength of an experimental design is based on obtaining strong causal inferences free from any other confounding variables that may be found in a real world setting. It has also been established

that experimental tasks conducted in a psychological laboratory setting offers external validity (Anderson, Lindsay & Bushman, 1999).

7.1 Measures

The following will be the measures to be used on the experiment in helping us finding support for our hypotheses:

Measure for intuitive processing: This measure was developed by Bjorn Bakken, Thorvald Haerem and Bard Kuvaas and addresses intuitive processing. In contrast to the REI which measures cognitive style as a trait, this instrument rather takes a situation specific viewpoint of cognitive styles (Bakken, Haerem & Kuvaas).

Galvanic Skin Response Sensor: The Galvanic Skin Response Sensor is an instrument that has been designed to measure the physiological change in arousal levels (Picard & Healey, 1997).

MAAS: Mindful Attention Awareness Scale developed by Brown & Ryan (2003) will help us measure mindfulness as a state.

In addition to the above stated, we will also look for correlations using the following:

REI: The Rational Experiential Inventory is an instrument developed by Epstein designed to measure cognitive style as individual trait (Epstein, 1994).

NEO-FFI: The NEO Five Factor Inventory provides a short and concise measure of the five factors of the personality (McCrae & Costa, 2004).

PNS: The Personal Need for Structure measure is an instrument designed to measure preferences for structure and clarity in most situations in life (Thompson, Naccarato, Parker & Moskowitz (2001).

7.2 Task Procedure and manipulation

The REI, NEO- FFI and the PNS questionnaires will be administered about 4 to 5 days before the experiment is conducted. In the experiment candidates will be randomly divided into two groups. The manipulation (EMT and error avoidant training instructions) will be provided to each of the groups, respectively before the training task. We will ensure that the conditions of EMT and error avoidant training are not violated, and use the guidelines recommended by the original researchers (Frese et al., 1991) as closely as possible. Further in the experiment, there will be given two tasks: one training task and another post training task. The

tasks will be scored on a scale of 0 to 100, and performance will be measured by the difference between scores on both the tasks. The measure developed by Bjorn Bakken, Thorvald Haerem and Bard Kuvaas will be handed out after the training task. The MAAS will be handed out after post training task .

7.3 Participants

The task participants would comprise of candidates recruited from the Masters level programs of BI Norwegian Business School and the sample size is intended to be between 60 and 80, with an equal division under both the conditions. Provided, there are no significant effect sizes observed, the sample may be increased suitably.

7.4 Data Analysis

Will be conducted using SPSS 19.0 or any other appropriate statistical package. One of the techniques for data analysis will involve using Hierarchical Linear Modeling (HLM) which is a multi level model. HLM is a powerful method which has been developed recently and is conceptually similar to the Ordinary Least Squares (OLS) regression technique, but improves upon it in the sense that it partitions the error variance into both individual and group components (Hofmann & Gavin, 1998; Hofmann, 1997; Gavin & Hofmann, 2002). It is used for analyzing nested data, therefore in this context HLM may be used to test individual performances over a group of tasks given out to the participants.

We thus hope that the theory and hypotheses performed using the appropriate experimental methodology as mentioned above will help us arrive at findings that will contribute to existing theory.

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