ABSTRACT

Title of Document: CULTURE TRAINING MATCH: TESTING THE INTERACTION BETWEEN TRAINEE CULTURAL BACKGROUND AND TRAINING DESIGN ON STRESS REACTIONS AND TRANSFER OF TRAINING

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This study investigates how trainee cultural background interacts with training structure and error instructions to predict transfer of training. Previous research on training interventions relies largely on Western theories of learning, and few training techniques have been tested with samples outside of North America or Western Europe. The current research seeks to expand these perspectives to investigate the impact of different training interventions in face and dignity cultures, with a particular focus on how cultural differences in stress reactions affect training outcomes. Building on this foundation, I hypothesize that the match between trainee cultural background and training design elements will predict training effectiveness, as measured by training transfer. Specifically, trainees from dignity cultures are expected to benefit from training interventions with low structure and error encouragement instructions. In contrast, the same training design may be ineffective or even counterproductive for trainees from face cultures, who are hypothesized to benefit more from high structure training and error avoidant instructions. Further, I link culture-training match to physiological stress to suggest that this may be one mechanism through which the interaction between culture and training dimensions impacts training transfer. One study was conducted in which participants from dignity and face cultures (N = 212) were randomly assigned to training conditions varying on structure and error framing instructions. Participants were trained to perform a computer-based simulation, with heart rate and cortisol collected throughout the training intervention. Participants returned seven to 15 days after the training to complete transfer measures. The results showed the expected interactions between culture and training structure and between culture and error instructions for training transfer. Stress reactions did not mediate this effect as expected; in contrast, emotional control was the key explanatory mechanism. Implications for training design and implementation across cultures are discussed, along with possible extensions of this research.

CULTURE TRAINING MATCH: TESTING THE INTERACTION BETWEEN TRAINEE CULTURAL BACKGROUND AND TRAINING DESIGN ON STRESS REACTIONS AND TRANSFER OF TRAINING.

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Dissertation submitted to the Faculty of the Graduate School of the
University of Maryland, College Park, in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
2014

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Acknowledgements

I would like to thank my committee for their guidance and intellectual support during this process. Specifically, I am deeply grateful for the inspiration, feedback, and encouragement offered by my mentor and chair, Michele Gelfand. Finally, I would like to thank my husband, parents, sister, and friends for their unwavering support and encouragement during this process. This dissertation was supported by the U.S. Army Research Laboratory and the U.S. Army Research Office under Grant W911NF-08-1-0144. The equipment purchase and cortisol data analysis was made possible through a graduate student fellowship from the SIOP Foundation.

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Chapter 1: Introduction

Human errors are an inescapable reality of the workplace. In one study of nearly 3,000 practicing physicians in the United States and Canada, 57% reported that they had been involved in a serious error during their career (Waterman et al., 2007). Further, the Harvard Medical Practice Study found that adverse events occurred in 3.7% of inspected records, and 27.6% of those adverse events were due to negligence (Brennan et al., 2004). In the field of aviation, Wiegmann and Shappell (2003) suggest that up to 80% of accidents can be attributed at least in part to human error, and Wenner & Drury (2000) estimate that a typical airline may experience one to two hundred incidents of preventable damage to grounded aircraft each year. Errors are also extremely costly. Preventable medical errors are estimated to cost over 9.3 billion dollars in extra charges, 2.4 million days of extra hospitalization, and over 32,000 deaths each year in the United States alone (Zhan & Miller, 2003). One example of an aviation ground damage incident cost over $39,000 in aircraft repairs and $367,500 in lost passenger and cargo revenue (Wenner & Drury, 2000). While errors have tremendous time and monetary costs for organizations, clients, and the public at large, they also take a toll on the employees that them. Among physicians who had been involved in a serious error during their careers, 66% said that they experienced increased anxiety about the potential for future errors, 51% reported that their confidence in their abilities as physicians had decreased, and 48% reported difficulty sleeping (Waterman et al., 2007).

Given the high costs and devastating consequences of errors, it is not surprising that many organizations try to avoid them. However, such efforts ignore an ironic benefit of error occurrence; though errors incur costly negative outcomes, they are also excellent sources of information and learning. Errors can be particularly helpful during the training process, as they can point out problematic areas or behaviors for trainees to avoid in the future, help trainees identify incorrect assumptions and areas of their knowledge that need further development, and prepare trainees to deal with errors on the job (Frese, Brodbeck, Heinbokel, Mooser, Schleiffenbaum, & Thiemann, 1991; Smith, Ford, & Kozlowski, 1997). This conceptualization of errors is based on action theory, which holds that errors help identify incorrect assumptions and encourage correction in trainees' mental models, which can then be used to guide more successful future actions (Frese, 1995; Frese & Zapf, 1994; Heimbeck, Frese, Sonnentag, & Keith, 2003; Smith, Ford, & Kozlowski, 1997). Further, experiencing errors during training can help trainees develop a higher tolerance for errors, which facilitates future exploration and learning (Dormann & Frese, 1994; Ivancic & Hesketh, 1995/1996). Thus, it is not surprising that recent developments have lauded the intentional inclusion of errors in the training process. For example, medical schools integrate Simulation Based Medical Education (SBME) with other training approaches to prepare students for dealing with the complex experience of patient care. The SBME training allows students to practice their medical skills in simulated scenarios without risks to real patients. The simulations are designed to teach medical studies to understand the causes of mistakes in different scenarios and learn to cope with errors when they inevitably occur (Ziv, Ben-David, & Ziv, 2005).

SBME is one manifestation of Error Management Training, a form of exploratory training in which trainees are explicitly encouraged to make errors and learn from them (Ivanic & Hesketh, 1995/1996; Heimbeck et al., 2003; Keith & Frese, 2005). EMT conceptualizes an error as any avoidable action that deviates from the task goal (Heimbeck et al, 2003; Keith & Frese, 2005). Unlike traditional error-avoidant training techniques, which conceptualize errors as punishment (Skinner, 1953) or as undesirable opportunities to practice defective behaviors (Debowski, Wood, & Bandura, 2001), EMT considers errors to be natural and inevitable products of active exploration (Keith & Frese, 2008) that facilitate learning because they provide valuable feedback (Frese & Zapf, 1994; Heimbeck et al., 2003). EMT facilitates transfer of training, especially when trainees are required to apply their training to a new context or problem (Keith & Frese, 2008), and it has a positive effect on trainees' self-efficacy (Lorenzet, Salas, & Tannenbaum, 2005). EMT principles have also been incorporated into Crew Resource Management (CRM), a form of team and leader training designed to help high risk teams in fields like aviation manage errors effectively (Helmreich & Merritt, 1998). Salas, Burke, Bowers, & Wilson's (2001) qualitative review suggested that CRM enhanced trainee learning and produced positive trainee reactions.

Despite the considerable support for the effectiveness of EMT, previous theory on training interventions has largely drawn on Western perspectives on learning and training (Yang, Wang, & Drewry, 2009), and studies of training effectiveness have relied primarily on samples from the United States and Western Europe (c.f. Earley, 1994). This Western foundation is not unique to the training field; a recent analysis of top journals from six subfields in psychology revealed that 80% of the study samples were drawn from Western industrialized countries, and 84% of the first authors of papers in these journals work at universities in the US or Western Europe(Arnett, 2008). Nevertheless, the increase in globalization and intercultural business ventures highlights the need to consider cultural differences in our theories and use culturally diverse samples to test them. Broadening the focus of industrial/organizational psychology to consider the role of culture can strengthen our field. First, cross-cultural research can uncover a wider range of behavior for study (Gelfand, Erez, & Aycan, 2007). For example, Henrich, Heine, and Norenzayan (2010) suggest that the typical reliance on WEIRD (Western, Education, Industrialized, Rich, Democratic) samples limits the variability of behaviors studied in the behavioral sciences, and implies an implicit and unfounded assumption that there is little variation across populations. Examining the full range and diversity of behavior in organizations allows for a more complete picture of the targeted topic and may also elucidate underlying structures or patterns that may not be apparent when sampling is restricted to a single culture (Berry, 1980). Further, cross-cultural research may uncover emic, or culture-specific, variations in behavior, as well as potential boundary conditions that may not be apparent when research is confined within single cultures.

Cross-cultural research in industrial/organizational psychology can also reduce ethnocentrism and improve intercultural relations. For example, adopting a global perspective in research by forging cross-cultural research relationships can help expand the questions and priorities targeted by research (Gelfand, Leslie, & Fehr, 2008). Cross-cultural research can also reduce ethnocentrism "on the ground" by providing practitioners and workers with key information about cultural differences and suggestions for facilitating successful intercultural interactions. Further, the acknowledgement of cultural influences on behavior in organizations may help practitioners better understand their clients and tailor interventions or instruments for successful implementation in an increasingly globalized world.

The current study seeks to expand previous theory and research to investigate the impact of different training interventions in face and dignity cultures, with a particular focus on how cultural differences in error processes and reactions affect training outcomes. While previous studies on the effectiveness of EMT suggest that these interventions have positive effects on trainee learning outcomes and reactions, prior research has also uncovered several aptitude-treatment interactions which suggest that the effectiveness of training interventions vary based on trainee traits, including goal orientation and personality. These studies point to the need to match training interventions to trainee qualities to facilitate optimum training outcomes. I will extend this concept to hypothesize that training interventions should also be targeted to the trainee's cultural background; when a training intervention is designed to fit with the key cultural values and motivations of trainees, the training will be more effective. However, if there is a mismatch between the training intervention and the cultural background of the trainee, training outcomes will suffer.

In this dissertation, I will explore training interventions that vary along two dimensions, *Training Structure* and *Error Instructions.* Training structure captures how much control the trainee is given over his or her learning experience, as well as amount of external guidance provided by the training. Due to the relatively basic instruction and high trainee control provided by low structure training interventions, errors are more likely to occur in this type of training than in high structured trainings, which provide more external control and thus fewer opportunities for trainees to make mistakes. Error instructions address whether the training instructions encourage errors and frame them as valuable learning experiences (error encouragement), or describe errors as negative learning experiences that should be avoided (Gully et al., 2002; Bell & Kozlowski, 2008). Previous research has shown that EMT, which combines low structure training with error encouragement instructions, stimulates trainees' metacognitive activity and facilitates higher levels of emotional control (Keith & Frese, 2005, 2008), both of which lead to improved learning outcomes. To understand how cultural background interacts with the components of EMT, I will pull apart and manipulate both training structure and error instructions.

I will focus specifically on *face* and *dignity* cultural orientations, which are meaning systems built around different sources of individual worth (Kim & Cohen, 2010; Kim, Cohen, & Au, 2010; Leung & Cohen, 2011). Previous research has suggested that people from face cultures attempt to avoid potential error situations (e.g., Elliot, Chirkov, Kim, & Sheldon, 2001; Kim et al., 2010), as making an error leads to a loss of face (Hamamura, Meijer, Heine, Kamaya, & Hori, 2009; Hu, 1944; Early, 1997). In contrast, people from dignity cultures believe that their individual value and worth is internally anchored (Ayers, 1984; Kim et al., 2010; Leung & Cohen, 2011), and thus errors may not pose as great of a threat. In addition, previous research has suggested that there may be cultural differences in preferences for structured learning (e.g., Pratt and Wong, 1999) as well as the overall value placed on autonomy (e.g., Church, Katigbak, Locke, Zhang, Shen, Vargas-Flores et al., 2012).

On the basis of this research, I will suggest that training interventions that intentionally incorporate errors (i.e., those with low structure and/or error encouragement instructions) may be maladaptive for trainees from face cultures, whereas training interventions that minimize errors (i.e., those with high structure and/or error avoidance instructions) will be more effective for these trainees. In contrast, I expect training interventions that include and encourage errors (i.e., those with low structure and/or error encouragement instructions) to be particularly well-suited for trainees from dignity cultures, while training interventions that minimize errors (i.e., those with high structure and/or error avoidant instructions) will not be adaptive for these trainees. Further, I will argue that a key mechanism linking cultural background and training design to training effectiveness is physiological stress, measured using heart rate and cortisol reactivity. While research in industrial/organizational psychology has begun utilizing physiological measures of stress (e.g. Evans & Johnson, 2000; Gabriel & Dienfendorff, 2013; Sonnentag & Frese, 2013), this study is of the first known research to integrate physiological stress marker in the study of training. Due to the threat that errors can diminish self-worth in face cultures, I expect that face trainees will experience exacerbated stress responses in the training conditions that incorporate errors. Training conditions that incorporate errors are not expected to trigger the same level of stress response in trainees from dignity cultures; instead, dignity trainees may experience higher levels of stress in training conditions with high structure and error avoidant instructions. Stress responses, in turn, inhibit emotional control and metacognition during the training experience, which negatively impacts post-training transfer.

The following introduction will be divided into four sections. I will first review the definition of an error and the two dimensions of training design included in this study. I will also define several metrics of training effectiveness and discuss the previous research on the effectiveness of different levels of training structure and error instructions. Next, I will provide basic definitions of culture and the cultural syndromes of dignity and face to suggest that errors may have different psychological meanings and produce different reactions across these two cultures. I will go on to link these differences to hypotheses regarding the interaction between trainee cultural background and training design, focusing on how the congruence between culture and training dimensions facilitates positive learning outcomes. In the next section, I will introduce the physiological markers of stress that I will use in the proposed studies, and I will review previous literature on the impact of stress on learning. I will then link the sections on culture, training design, and stress together to present an overarching model predicting training effectiveness.

Integrating Errors into Training: Training Structure and Error Instructions

Errors

For the purposes of this paper, an *error* is defined as any unintentional but potentially avoidable failure to achieve a goal (Hofmann & Frese, 2011; Zapf, Brodback, Frese, Peters, and Prümper, 1992). This definition brings up several key points that differentiate errors from other concepts. First, errors are unintentional; an intentional or volitional deviation from the goal would qualify as a violation, not an error (Hofmann & Frese, 2011; Reason, 1990; Zapf et al., 1992). Second, errors are potentially avoidable, meaning that if a chance occurrence like a power failure or other outside disruption causes the deviation from the goal, the event should be considered an accident rather than an error (Hofmann & Frese, 2011; Norman, 1984; Zapf et al., 1992). Finally, and perhaps most importantly, errors occur in the process of goal-directed action (Hofmann & Frese, 2011; Zapf et al., 1992). The intended goal and the behaviors required to reach it thus provide a clear standard against which to compare the actual behavior. In the case of training, the intended goal is to acquire skills or knowledge that improve performance in the job environment (Goldstein, 1993). Any behavior that practices incorrect procedures or information would thus be considered an error in the training context.

Training Design

Training interventions can take many forms, ranging from classic instructional techniques like lectures and case studies to more innovative methods like EMT (Kraiger & Culbertson, 2013). For the purposes of this study, I will describe training methods using two dimensions, training structure and error instructions (Bell & Kozlowski, 2008). As discussed, training structure captures the amount of control and instructional guidance provided to trainees. In a high structure interventions, which are sometimes referred to as proceduralized training (e.g., Keith & Frese, 2008), the training provides clear, step-by-step instructions for completing the training task. The trainee takes a more passive role, in that he or she does not make decisions about how to proceed through the training task but rather is told how to complete the targeted task by an external manual or instructor (Bell & Kozlowski, 2008). In contrast, interventions with low structure, which are often called exploratory training (e.g., Keith & Frese, 2008) or active learning (e.g., Bell & Kozlowski, 2008, 2010), provide trainees with the opportunity to direct their own learning. The trainee is provided with minimal basic instructions and encouragement to experiment and explore the task. Thus, the majority of the learning activity is driven by the trainee's own decisions and actions within the task. Unlike high structure designs, in which the trainee is a passive recipient of knowledge from external sources, exploratory training pushes the trainee to explore the training task independently and infer the most effective strategies from trial and error (Bell & Kozlowski, 2008, 2010). Perhaps not surprisingly given the minimal instructions and emphasis on experimentation typical of low structure interventions, trainees typically make more errors under these conditions than they do in high structure training (Frese et al., 1991). The key differences between high and low structure training interventions is summarized in Table 1.

The second dimension under investigation, error instructions, addresses whether the intervention includes instructions that encourage errors and reframe them as learning opportunities, or instructions to avoid errors. Error encouragement instructions frame errors as a natural byproduct of the learning experience that can also help trainees build a better understanding of the training task (Dormann & Frese, 1994; Frese et al., 1991; Gully et al., 2002; Heimbeck et al., 2003; Keith and Frese, 2005). These instructions are designed to induce a mastery orientation during training to help trainees fully capitalize on the learning opportunities provided by errors (Bell & Kozlowski, 2008; Ivancic & Hesketh, 1995). These instructions also attempt to counteract the negative emotions, such as frustration or despair, that accompany errors (Brodbeck, Zapf, Prumer, & Frese, 1993). Error encouragement instructions both prepare trainees for the occurrence of errors during the learning process and attempt to help them positively reframe the errors as valuable feedback (Keith & Frese, 2008). Examples of error management instructions include, "The more errors you make, the more you learn," and "Errors are a natural part of the learning process" (Frese et al., 1991; Keith, 2011).

In contrast, error avoidant instructions frame errors as negative events that are detrimental to the learning process. These instruction eschew the role of errors because of their potential to elicit negative reactions that impede learning and performance (e.g., Bandura, 1986), and typically conceptualize errors as punishment (Skinner, 1953) or as undesirable opportunities to practice defective behaviors (Debowski, Wood, & Bandura, 2001). Error avoidant instructions typically induce a performance-avoid orientation in trainees (Bell & Kozlowski, 2008), meaning that the trainees avoid experiences that might display a lack of competence. An example of error avoidant instructions are "Errors are detrimental to the training process" (Gully et al., 2002; Bell & Kozlowski, 2008).[1] A comparison of how the two Error Instruction conditions frame errors during training is presented in Table 2.

This study will fully cross the two training structure and two error instruction conditions described above, creating four training conditions. While several of these conditions have established labels within the training literature (e.g., EMT, proceduralized training), these titles are not used consistently across every study (e.g., Debowski et al., 2001). To facilitate comprehension in the current research, I will refer to each training condition with its level of structure and error instruction, though I do include common labels for the relevant training conditions where applicable.

Training Outcomes

[1] In addition to the aforementioned error encouragement and error avoidant instructions, a set of control instructions were included in the study. The control instructions did not mention errors at all during training, but rather encouraged the trainees to do their best as they learned the task (Bell & Kozlowski, 2008). These control instructions were included as a neutral comparison group against which to test the error instructions. As will be discussed, these instructions did not act as an effective control condition in the current study, and thus were not included in the main analyses.

There are a number of metrics for evaluating the effectiveness of training interventions (Ford, Kraiger, & Merritt, 2010; Kraiger & Culbertson, 2013; Kraiger, Ford, & Salas, 1993). The first and most proximal outcome is *within-training performance*, or performance on the training task itself. A second metric of training effectiveness is post-training *transfer*, which occurs when the trainee is able to generalize what they have learned during training to new task contexts and maintain their learned behavior over time (Burke & Hutchins, 2007). Two types of training transfer have been discussed in the literature. *Analogical transfer* assess how well the trainee can take the information or skills he or she learned during training and apply it tasks that are similar to the training task. In contrast, post-training *adaptive transfer* addresses whether the trainee is able to adapt the strategies learned in training to *novel* situations or problems. The current study will assess within-training performance, as well as immediate and delayed (7-15 days after training) analogic and adaptive transfer.

Effectiveness of Training Design Elements

In this section, I will briefly outline previous research findings regarding the effectiveness of training structure and error instructions.[2] Not surprisingly given the minimal guidance in the training tasks, low structure training interventions tend to perform worse than high structure training interventions during the training period (Bell & Kozlowski, 2008; Keith & Frese, 2008). In contrast, low structure training tend to outperform high structure training on measures of post-training transfer, exhibiting significantly higher analogical and adaptive transfer (Bell & Kozlowski, 2008). Further,

[2] It is relevant to note that few studies have fully crossed training structure with error instructions and examined all of the resultant conditions (cf. Bell & Kozlowski, 2008). As such, I will present the effectiveness of the different conditions included in the current study as they are available.

low structure tasks combined with error encouragement instructions (i.e., EMT) outperform low structure tasks without error instructions (i.e., exploratory training) on post-training transfer, and the benefits of this combination are especially strong for adaptive transfer (Keith & Frese, 2008). The effectiveness of low structure training tasks has been in part attributed to its facilitation of metacognitive activity and emotional control (Bell & Kozlowski, 2008; Keith & Frese, 2005). *Metacognition* refers to self-regulatory behaviors like planning, monitoring cognitions and progress towards goals, and revising behavior as necessary (Bell & Kozlowski, 2008; Brown, Bransford, Ferrara, & Campione, 1983; Ford et al., 2010). Emotional control refers to emotional self-regulation, whereby the trainee is able to manage their anxiety and other negative emotions to stay focused on the training task (Kanfer, Ackerman, & Heggestad, 1996; Keith & Frese, 2005). By increasing metacognitive activity, low structure training facilitates post-training transfer (Bell & Kozlowski, 2008). The benefits of low structure + error encouragement instruction interventions (i.e., EMT) have been shown to be mediated by both metacognition and emotional control (Keith & Frese, 2005). Though many studies have supported the superior transfer effects of low structure and low structure + error encouragement interventions (EMT), several studies have explored potential moderators of the effectiveness of EMT. I turn to this topic in the next section

Attribute-Treatment Interactions

Broadly, attribute-treatment interactions explore how individual differences moderate the outcomes of various training interventions to predict outcomes. Such studies explore whether the same training design is more effective for some trainees than others, with the ultimate goal of providing guidance for matching instructional techniques to trainees' unique characteristics to maximize training outcomes (Cronbach, 1967; Goldstein, 1993). Previous studies manipulating training structure and error instructions have tested their interactions with individual differences in several key areas (Gully & Chen, 2010), including capabilities (e.g., cognitive ability; Bell & Kozlowski, 2008; Gully et al., 2002; Carter & Beier, 2010), demographics (e.g., age; Carter & Beier, 2010), personality (Gully et al., 2002), and self-concept traits (e.g., goal orientation; Bell & Kozlowski, 2008; Heimbeck et al., 2003). The findings uncovered in these studies suggest that it is important to match the training intervention to the trainee characteristics, particularly personality (Gully et al., 2002) and trait goal orientation (Bell & Kozlowski, 2008; Heimbeck et al., 2003). Goal orientation divides individual goals into two main categories. Learning goals, also called mastery goals, motivate the individual to increase his or her skills and mastery of a task (Button, Mathieu, & Zajac, 1996). In contrast, performance goals motivate the individual to demonstrate his or her competence to others to gain their approval (Button, et al., 1996). Performance goals have been further divided in to performance-prove goals, in which the individual is motivated to prove his or her competence to others, and performance-avoid goals, which motivate the individual to avoid situations that might lead to failure or demonstrate a lack of competence (VandeWalle, 1997).

Low structure training tasks and those that include error instructions are most effective for trainees who tend to be more comfortable in error situations, such as those with high openness to experience (Gully et al., 2002). In contrast, trainees who are dispositionally inclined to be wary of error situations, either due to high conscientiousness (Gully et al., 2002), low openness to experience (Gully et al., 2002), or trait avoidance or prove orientation (Bell & Kozlowski, 2008; Heimbeck et al., 2003), benefit more from highly structured training tasks and instructions that either do not mention errors or that discourage errors. When these trainees are placed in training situations in which they are encouraged to make errors, they may become even more fearful of making mistakes and failing, which increases exacerbates anxiety and decreases self-efficacy (Bell & Kozlowski, 2008).

In the next section, I will argue that, as previous literature has shown that training interventions effectiveness varies based on personal characteristics, it is necessary to also examine how training interventions interact with other factors, specifically the cultural background of the trainee. Previous research has shown that culture influences a wide variety of processes and outcomes in organizations (Gelfand, Erez, & Aycan, 2007; Hofstede, 1980; House, Hanges, Javidan, Dorfman, & Gupta, 2004). However, culture has received relatively little attention in the empirical training literature outside of the field of cross-cultural training (e.g. Black & Mendenhall, 1990), which teaches trainees to interact with people from other cultures, studies on individual versus group targeted training (e.g. Earley, 1994), and Crew Resource Management training (e.g., Helmreich, & Merritt, 1998). Further, as with many studies in the training field, prior research on training structure and error instructions has used samples primarily from the United States and Western Europe. Extending this research to include non-Western trainees is critical, as previous findings may not generalize outside of the West due to a variety of cultural differences (Henrich et al., 2010). North American and Western European participants differ from other populations on a number of factors that may impact training effectiveness. For example, previous research has suggested that participants from East

Asian cultures may be more likely to adopt avoidance goals, which focus on forestalling negative outcomes, whereas participants from Western cultures like the United States tend to adopt approach goals, which involve moving towards positive outcomes (Elliot et al., 2001). Previous research has also uncovered differences in affective processes (e.g., Matsumoto & Hwang, 2012), concepts of the self (Markus & Kitayama, 1991; Heine, Lehman, Markus, & Kitayama, 1999), discomfort in the face of ambiguity (Sully de Luque & Javidan, 2004), and preferred methods for learning (Li, 2005). These differences may make training interventions that are effective in one cultures less effective, or even counterproductive, in another. The next section will introduce the concept of culture and explore two cultural logics, face and dignity, that are expected to impact the effectiveness of training interventions.

Cultural Perspectives on Errors and Training: The Role of Face and Dignity

The concept of societal or national culture is necessarily broad and complex. As such, cross-cultural researchers have forwarded a number of definitions of culture. Early definitions of the concept described culture as a complex set of reinforcements (Skinner, 1953), or as a set useful ideas adopted by increasing numbers of people (Campbell, 1965). Triandis (1972) elaborated and expanded the definition, describing culture as consisting of both the objective and subjective parts of the human-made environment. Within this definition, Triandis identified subjective culture as the characteristic ways that groups perceive man-made parts of the environment, which include aspects such as beliefs, attitudes, and norms. Later conceptualizations of culture also focused on its shared nature; Hofstede (1980) defined culture as the “collective programing of the mind” (p. 25), and Triandis & Suh (2002) describe culture as shared standard operating procedures. The current paper defines culture as “shared motives, values, beliefs, identities, and interpretations or meanings of significant events that result from common experiences of members of collectives that are transmitted across generations” (House, 2004, p. 15). Error reactions flow from learned interpretations, values, and beliefs regarding errors, as well as perceptions of other people's interpretations, values, and behavior, all of which stem in part from the larger shared meaning system of culture.

Given the multifaceted nature of culture, it is not surprising that a number of frameworks have proliferated to describe its underlying dimensions. While it is possible to link a number of these dimensions to individual error reactions (Gelfand, Frese, & Salmon, 2011), I focus on the concepts of *face* and *dignity*. Face and dignity are psychological concepts that tap how people claim, manage, and maintain a sense of worth within a given social structure (Leung & Cohen, 2011). In the following sections, I will review previous conceptualizations of face and dignity, including the relationship between these values and other cultural values and dimensions. I will go on to establish the relationship between face, dignity, and error situations to argue that face and dignity offer a unique lens for predicting cultural differences in reactions to errors.

Face and Dignity: Cultural Logics

Face and dignity are two concepts that figure prominently in Cohen & colleagues’ (Kim & Cohen, 2010; Kim et al., 2010; Leung & Cohen, 2011) concept of cultural syndromes and logics. Leung and Cohen (2011) describe cultural syndromes as "constellations of shared beliefs, values, behaviors, practices [...] that are organized around a central theme" (p. 508). Cultural logics build a consistent set of practices and patterns around these central themes to produce a coherent system of meaning for people within the culture. It is important to note that cultural syndromes are not housed only within the individual members of a culture, but are present in the situation, descriptive norms, and institutions within the culture (Leung & Cohen, 2011). Face and dignity are two cultural logics that can be used to address the critical social issue of determining the basis of a person's value within society.[3] The current study focuses on contrasting face and dignity logics to predict cultural differences in individuals' reactions to different training designs, particularly as they relate to error responses.

In one of the earliest descriptions of face, Hu (1944) provided an anthropological review of the concept in Chinese culture. Hu delineates two avenues through which face, or prestige, is achieved in China. The first, *mien-tzŭ*, refers to “a reputation achieved through getting on in life, through success and ostentation” that is accessed on the basis of personal effort (p. 45). *Mien* can refer to success in terms of material goods, title, or status, as well as to displays of person’s ability. In contrast, *lien* is face or prestige based on the group’s judgment of the quality of the target’s moral character. While *lien* has implications for individual behavior, especially as it relates to transgressions of morality or integrity, the *mien-tzŭ* concept is more closely related to errors processes that might occur in organizations. Hu discusses two figurative meanings of *mien* that further establish its relationship to error processes. The first, *ku mien-tzŭ*, means “to consider *mien-tzŭ*,” and can refer to consideration of either one’s own face or the prestige of others (p. 55). For example, Hu describes how Chinese teachers and supervisors often display

[3] Honor is a third cultural logic that can address issues relating to the basis of individual worth within society. Honor tends to have both internal and external components, and honor cultures are typically built on strong norms for reciprocity. Due to the relevance of errors to the conceptions of self-worth and value in face and dignity cultural logics, I focus on these concepts in the current paper. Nevertheless, reactions to errors and training interventions that incorporating them within honor cultures pose interesting questions for future research.

extreme care and tact when addressing mediocre work, even going so far as to avoid discussing the issue at all, as an insensitive confrontation over the issue might damage the student or subordinate's *mien-tzŭ*. In addition to processes that protect other's *mien-tzŭ*, Hu also discusses methods for giving someone face, or *kie mien-tzŭ*. To increase another's face, one might praise him or her or stress his or her ability. Increasing another person's face may, in turn, encourage that person to work harder. While these two expressions relate to preserving another person's face, the preservation of one's own face is of paramount concern (Hamamura et al., 2009). Hu's (1944) paper formed the basis for discussions of face in European American settings (e.g., Goffman, 1955; Brown & Levinson, 1978), as well as later conceptualizations of face in East Asia (e.g., Ho, 1976). Face cultures, such as those in East Asia, are marked by the pervasive belief that a person's worth is socially conferred; an individual's worth in a face culture is fundamentally tied to how other see him or her (Kim et al., 2010; Leung & Cohen, 2011). Face is lost when someone fails to fulfill the socially held expectations based on his or her role.

In contrast to face, dignity is a person's inherent and intrinsic value. In dignity cultures, like the United States, every person is born with an inalienable worth that is both equal to that of other people and completely unrelated to other people's perceptions (Ayers, 1984; Kim et al., 2010). Within this cultural logic, every person has value, and this value does not differ based on social status or the fulfillment of other's expectations (Leung & Cohen, 2011). A person with dignity is guided by the internal conscience or moral compass, and the only way in which an individual can lose dignity is if he or she does not behave consistently with this internal code (Leung & Cohen, 2011). Unlike face cultures, wherein one's worth can be lost, in dignity cultures, a person's inherent value cannot be taken away based on a loss of prestige in the eyes of others (Leung & Cohen, 2011).

Face and dignity logics are related to but distinct from another common set of cultural values, individualism and collectivism (Hofstede, 1980), which capture the extent to which people are autonomous versus embedded within groups (Schwartz, 1994). In individualist cultures, individuals value their autonomy and their individual rights, needs, and interests. In collectivistic societies, people are tightly embedded in their social groups, and thus value harmony and the fulfillment of duties and obligations to the group over personal needs or desires (Gelfand, Bhawuk, Nishii, & Bechtold, 2004). While there are relationships between face and collectivism and between dignity and individualism, it is important to note that these concepts do not completely overlap. Rather, face cultures are but one example of a collectivist culture; other collectivistic cultures that do not follow a face logic include Israel (Oyserman, Coon, & Kemmelmeier, 2002) and Latin American and Middle Eastern societies, which tend be characterized by honor logics. This view is consistent with Triandis (1994), who argued that there are differences within individualist and collectivist cultures, and that not all societies of each type follow the same pattern.

Face and dignity logics have important implications for a number of organizational constructs and behaviors, including feedback seeking (Ashford & Cummings, 1983 from Morrison & Bies, 1991) and learning. Further, face has been linked to hierarchical and bureaucratic organizational structures (Earley, 1997), indirect conflict management strategies (Gelfand, Nishii, Holcombe, Dyer, Ohbuchi, & Fukuno, 2001), and attributions for individual and company performance (Hooghiemstra, 2008). The current study will focus on the impact of face and dignity on training effectiveness. Training structure and error instructions offer a fertile testing ground for exploring the differences between face and dignity cultures, as low structure and error encouragement instructions both produce errors during training. Errors are expected to threaten an individual's feeling of worth in a face culture but not a dignity culture. Face is lost when a person fails to maintain his or her image or fulfills the expectations his or her role (Ho, 1976; Lin & Yamaguchi 2011); making an error at work qualifies as a face loss situation because the error-maker's competence and ability to fulfill his or her work role are called into question (Early, 1997; Lim & Bowers, 1991).

Indeed, previous research has shown that people from face cultures, as compared to people from dignity cultures, may be more likely to engage in avoidant or defensive maneuvers in response to face-threatening situations. For example, Hwang, Francesco, & Kessler (2003) found that students who were concerned with losing face were less likely to ask questions in classroom settings, as doing so could result in embarrassment or revealing a lack of knowledge. Further, Hepper, Seikides, and Cai (2011) found that Chinese participants were more likely to use defensive strategies, such as making external attributions or discounting negative feedback, to protect their self-concept, whereas Americans were more likely seek out and capitalize on positive feedback from others. These findings are consistent with previous research showing that people from East Asia are generally more likely to adopt avoidant, or prevention-oriented, goals as compared to Americans, who report more promotion-focused goals (Elliot et al., 2001; Kim et al., 2010; Ohbuchi, Fukushima, & Tedeschi, 1999). These findings suggest that there may be fundamental differences between face and dignity cultures that affect approaches and reactions to errors, and thus training interventions that incorporate them.

Additional research within psychology and education also suggests that there are key cultural differences in approaches to learning, particularly with regards to preference for structure and learner-controlled experiences. Much of this research has compared American learners to learners from East Asia, particularly China and Japan. The Socratic-Confucian framework (Tweed & Lehman, 2002) is one guide for understanding these cultural differences in learning preferences. In this model, Western approaches to learning are informed by the methods of Socrates, who used techniques including questioning and evaluation in his teachings (Tweed & Lehman, 2002). Socrates valued self-generated knowledge over commonly-held beliefs, and he frequently used his conversation partners' errors to enhance the learning process. The Socratic framework for learning thus centers on learner-generated questions, expressions of personal hypotheses about key concepts and processes, and a desire for learner controlled activities (Tweed & Lehman, 2002, p. 93). In contrast, the Confucian framework for learning centers on focused effort to acquire fundamental knowledge and skills, rather than questioning and generating ideas. Further, Confucius pointed to respected authority figures as sources and models for learning, and largely eschewed individual quests for uncovering personal truths.

Empirical work supports some of the primary assertions of the Socratic-Confucian framework. For example, Pratt and Wong's (1999) qualitative study suggested that Chinese students and instructors were more likely to view textbooks and instructors as the primary authoritative source for basic learning and knowledge, whereas Western respondents placed less value on these sources. Further, the Chinese respondents believed that faculty members should provide more structure for students, as learning is perceived as a long and methodical process of memorizing, understanding, application, and modification. In another study, Hess and Azuma (1991) showed that European American and Japanese children were socialized with different learning orientations; European American children were taught to value originality and independence, whereas Japanese children were taught to value persistence and diligence. These differences in cultural learning orientations were found in preschool-aged children, and the extent to which individual learning orientation matched the respective cultural learning orientation in kindergarten predicted better grades in 5th and 6th grade. This research suggests that cultural conceptualizations of learning are transmitted to children at a very young age, and that different cultures value distinct instructional methods.

Another source of information on culture and learning tendencies comes from studies on the effectiveness of transported pedagogical and training interventions. Many of these studies report difficulties when a method of teaching or training developed in one culture is implemented in a different culture. For example, several studies have noted issues transporting Problem-Based Learning (PBL), a learner-directed method in which students use problem solving to learn about a new topic, to non-Western medical schools (e.g., Frambach, Driessen, Chan, & van der Vleuten, 2012). PBL is based on the assumption that the learner is motivated and comfortable directing the experience with minimal input from instructors. PBL was developed in Canada, and efforts to implement it in other cultures are often met with resistance from students and other problems. For example, Frambach et al. (2012) found that medical students in Hong Kong reported anxiety about the PBL format, as it created uncertainty about the "correct" way of doing things and did not provide enough input from trusted authorities.

Taken together, previous research suggests that there are cultural differences in perceptions of and reactions to errors in the training context. Further, cultures differ in their preference for learner-directed activities and training structure. Based on these perspectives, I expect that the effectiveness of training interventions will vary based on the cultural background of the trainee. Broadly, I expect that the fit between trainee cultural background and the training intervention will predict training effectiveness, particularly adaptive transfer. The idea of fitting organizational and human resource management practices to societal culture has gained increasing traction (e.g., Aycan, Kanungo, & Sinha, 1999; Erez, 2000; Newman & Nollen,1996), and this concept has already been applied to other areas related to training (e.g., Earley, Gibson, & Chen, 1999; Peretz & Rosenblatt, 2011). For example, Aycan et al. (1999) found that societal-level culture shapes the internal work cultures of organizations, which in turn creates and sustains human resource management practices, such as job design, supervisor practices, and reward allocation, that reflect the higher level societal culture values. Further, Erez (2000) argued that in order for multinational companies to be successful, they must match organizational practices to the culture of the local branch. The overarching concept of matching organizational practices to national culture has been applied to many areas within I/O psychology, though little research has explored culture fit within a training context (c.f. Earley, 1994; Yang et al., 2009). The current research seeks to address this void. I propose that training intervention effectiveness will vary to the extent that the structure and error instructions in the training task match the cultural background of the trainee. Higher levels of training transfer are expected when the structure and error instructions match the cultural background of the trainee; conversely, training transfer should suffer when there is a mismatch between structure and error instructions and trainee cultural background.

Based on the culture-training match described above, I expect that participants from face cultures will find error encouragement instructions and unstructured training tasks threatening, which will negatively impact training transfer. Participants from face cultures will likely be uncomfortable and anxious in situations in which they may potentially make an error as errors pose a threat to self-worth. Error encouragement instructions, which focus additional attention on making errors, may be ineffective or even counterproductive for face trainees, as these instructions may induce trainees to become even more fearful of failure than usual. In contrast, error avoidant instructions may produce less fear of failure in these participants (Bell & Kozlowski, 2008). Face trainees are also expected to react negatively to training tasks with low structure; these interventions are not only likely to produce more errors during training, but also rely on the individual learner to control to training experience. Based both on the decreased likelihood for errors and the desire for structured learning experiences, I expect that high structure training will be more effective for face participants than low structured training interventions.

On the other hand, I expect the opposite pattern for participants from a dignity culture. Since errors do not pose a threat to dignity trainees' fundamental self-worth, they should be able to benefit from interventions that encourage trainees to make and learn from errors, as well as those that have less structure. Trainees from dignity cultures should be less threatened by errors, and thus more receptive to error encouragement instructions. In contrast, error avoidant instructions should be ineffective for dignity participants, as these instructions are unnecessarily restrictive. Further, dignity trainees should also benefit from training tasks with low structure. Dignity trainees should prefer tasks in which they can control their learning experience, generate and test their own hypotheses, and develop personal knowledge. These desired characteristics are closely aligned with the features of low structure training interventions; thus I expect that dignity trainees will benefit from low structure training tasks. However, training effectiveness should suffer when dignity participants are placed in high structure training tasks, which do not provide the desired level of trainee control and user latitude.

Hypothesis 1. There will be a two-way interaction between trainee cultural background and error instructions predicting training transfer.

Hypothesis 1a. For face trainees, error avoidant instructions will result in better training transfer than error encouragement instructions.

Hypothesis 1b. For dignity trainees, error encouragement instructions will results in better training transfer than error encouragement instructions.

Hypothesis 2. There will be a two-way interaction between trainee cultural background and training structure predicting training transfer.

Hypothesis 2a. For face trainees, high structure training will result in better training transfer than low structure training.

Hypothesis 2b. For dignity trainees, low structure training will results in better training transfer than high structure training.

In addition to the expected two-way interactions, the matching hypothesis also suggests a potential three-way interaction between culture, training structure, and error instructions, such that training transfer is maximized when both training structure and error instructions match the cultural background of the trainee. Conversely, training transfer should be inhibited when both training structure and error instructions do not match the cultural background of the trainee.

Hypothesis 3. There will be a three-way interaction between trainee cultural background, training structure, and error instructions predicting training transfer.

Hypothesis 3a. For face trainees, training transfer will be maximized when the training intervention combines high structure and error avoidant instructions. In contrast, training transfer will be minimized when the training intervention combines low structure and error encouragement instructions.

Hypothesis 3b. For dignity trainees, training transfer will be maximized when the training intervention combines low structure and error encouragement instructions. In contrast, training transfer will be minimized when the training intervention combines high structure and error avoidant instructions.

In addition to the above effects, which are expected based on the culture-training matching hypothesis, it is important to highlight that there will differences in actual error occurrence across the high and low structure training conditions; more errors should occur in the low structure training than in the high structure training. This difference may moderate the effect of the error instructions, such that the impact of these instructions is greater when errors actually occur. The high structure training condition may dampen the effects of the error instructions, since errors are unlikely to occur regardless of whether they are encouraged or discouraged.

Stress, Culture, and Training Effectiveness

Thus far, I have proposed a theoretical founding for hypothesizing differences in training intervention effectiveness based on trainee cultural background and training design. In the following section, I will highlight stress reactions as one mechanism that may produce the hypothesized performance differences. I will first define stress and provide a brief overview of the stress reaction in humans. I will go on to discuss the components of stress that I examine in the study. Next, I will discuss the role that culture may place in stress reactions. Finally, I will close this section by reviewing the impact of stress on learning and memory to suggest that stress should inhibit learning during training.

Stressors and the Adaptive Stress Response in Humans

Salas, Driskell, and Hughes (1996) define stress as "a process by which certain environmental demands (i.e. performing in front of others, taking an examination, industrial noise) evoke an appraisal process in which perceived demands exceeds resources and results in undesirable physiological, psychological, behavioral, or social outcomes” (p. 6). This definition is based in Lazarus (1966) and Lazarus and Folkman's (1984) transactional conceptualization of stress, which suggests that stress arises out of the interaction between the environment and the individual (Sonnentag & Frese, 2012). In such a model, an actual or potential disturbance in the environment (a *stressor,* Jöels &

Baram, 2009, p. 459*)* is perceived by the individual, who then evaluates the extent to which this environmental event poses a threat or a challenge (primary appraisal) and expectations for reacting to the stressor (secondary appraisal; Lazarus & Folkman, 1984). If the event is perceived as threatening, a set of physiological, emotional, and behavioral responses is triggered (Salas et al, 1996).

On a biological level, stress reactions are extraordinarily complex, with multiple molecular mediators and interconnected systems involved in the stress response (Jöels & Baram, 2009). As the current study focuses on cardiovascular responses, specifically heart rate, and cortisol as indicators of stress, I will provide a brief overview of the processes affecting them. First, heart rate is controlled by the sympathetic and parasympathetic nervous systems, two parts of the autonomic nervous system. The sympathetic nervous system controls the body's fight-or-flight response, activating a variety of changes that prepare the body for threat. The parasympathetic nervous system promotes the body's rest-and-digest activities under non-stressful situations. Both of these systems impact major organs like the heart, and their effects oppose one another. In stressful situations, the sympathetic nervous system dominates, leading to an increase in heart rate along with other changes like pupil dilation, digestive inhibition, and increased alertness (Sherwood, 2010).

Cortisol secretion in response to stress is governed by the hypothalamic-pituitary-adrenocortical (HPA) axis. Once a stressor is perceived, emotional responses are generated in the limbic system. The changes within the limbic system activate the hypothalamus to release corticotropin releasing hormone (CRH), which in turn leads to the secretion of adrenocorticotropin hormone (ACTH) by the pituitary gland. ACTH then triggers the adrenal glands to release cortisol into the blood (Dickerson & Kemeny, 2004; Lovallo & Thomas, 2000). Cortisol, which is released in pulses based on circadian rhythm and in large bursts in response to stress, functions to control metabolism and the release of energy reserves, inhibit immune function, and affect neural circuits involved in processing stressful stimuli.

Stress and Culture

Thus far, I have not addressed questions regarding potential cultural differences in stress responses. In the following section, I will suggest that culture may impact cognitive appraisals of emotional stimuli, aspects of the stress response, and coping mechanisms. First, culture can affect the cognitive appraisal process (Scherer, 2000), in that culture can produce differences in whether a situation is appraised as a challenge or a threat (Lazarus, 1995). Research on regulatory focus suggests that there may be pervasive cultural differences in the general tendency to appraise a stressor as a challenge or a threat (Chun, Moos, & Cronkite, 2006), such that individualists are more likely to appraise stressors as challenges while collectivists are more likely to appraise stressors in terms of threats and potential losses (Aaker & Lee, 2001; Chun et al., 2006). The face-dignity cultural difference also suggests that culture may impact whether an event is considered a stressor. Specifically, previous research on cultural logics suggest that there are differences in the perception of an identical event based on the core values of the cultural system. Within a face culture, individuals are prone to attend to potential face-loss situations, as such situations may trigger a danger to the individual's inherent worth. In contrast, individuals from a dignity culture may not be as sensitive to these situations as they do not pose a threat to their value. Face loss situations, including errors, threaten self-worth in face cultures. Thus, participants from face cultures are expected to appraise errors as threats. In contrast, worth in dignity cultures is not tied to other's perceptions, and errors may not be appraised as serious threats by dignity participants.

Indeed, previous research has shown that face loss is associated with a number of psychological and physical reactions related to stress. For example, Redding and Ng's (1982) survey of Chinese managers found that face loss was accompanied by feelings of shame, worry, uneasiness, anxiety, and tension. Face loss was also found to increase depressiveness in a sample of Japanese participants (Lin & Yamaguichi, 211). However, it is not only actual experiences of face loss that induce these negative psychological outcomes; concern for ones face has been found to be positively related to distress in samples Chinese Americans (Mak & Chen, 2006), Mainland Chinese, and Hong Kong Chinese (Mak et al., 2009). In addition to the negative psychological responses to face loss, previous research has also suggested that face loss is accompanied by physical changes and behavioral displays, including blushing (Buss, 1980; Edelmann, 1994), reduced eye contact (Modigliani, 1971), increased movement, and speech disturbances (Edelmann & Hampson, 1979, 1981). Based on the above literature, I suggest that participants from face and dignity cultures will react to errors differently. While people from both cultures likely experience stress following error occurrence, because of the greater concern for face in face cultures (e.g., Mak, Chen, Lam, & Yiu, 2009), I expect that people from face cultures will experience more stress in response to training conditions that incorporate errors (i.e., lower structure and error encouragement instructions).

Though trainees from dignity cultures may be less threatened by errors than face trainees, they may also experience high levels of stress when training design does not match their cultural background. In this case, the driver of exacerbated stress responses in mismatched conditions may be the lack of trainee control and higher external constraints in high structure and error avoidant conditions. As previously discussed, people from dignity cultures tend to value autonomy and freedom from outside control (Kim et al., 2010). High structure training and error avoidant instructions restrict dignity trainees from controlling their own learning experience, which is at odds with one fundamental value in this culture. Further, these training designs may also be appraised as hindrances by dignity trainees, since the externally imposed restrictions may be viewed as obstacles to learning.

Based on this premise, I expect that stress reactions will vary based on cultural background and training design. Face trainees will experience greater stress when they are pushed to make errors, either by the error encouragement training instructions or low task structure. In contrast, training interventions that encourage error avoidance and minimize error occurrence should result in lower stress levels. On the other hand, dignity trainees should experience less stress when given more latitude to control their own training experience, as is the case in low structure interventions and those with error encouragement instructions. Dignity trainees should exhibit exacerbated stress responses when training structure is high or error avoidant instructions are included in the intervention.

Hypothesis 4. There will be a two-way interaction between trainee cultural background and error instructions predicting stress, as measured by average heart rate and cortisol reactivity.

Hypothesis 4a. Face trainees will experience higher stress in the error encouragement condition than in the error avoidant condition.

Hypothesis 4b. Dignity trainees will experience higher stress in the error avoidant condition than in the error encouragement condition.

Hypothesis 5. There will be a two-way interaction between trainee cultural background and training structure predicting stress, as measured by average heart rate and cortisol reactivity.

Hypothesis 5a. Face trainees will experience higher stress in the low structure training than in the high structure training.

Hypothesis 5b. Dignity trainees will experience higher stress in the high structure training than in the low structure training.

Hypothesis 6. There will be a three-way interaction between trainee cultural background, training structure, and error instructions predicting stress, as measured by average heart rate, and cortisol reactivity.

Hypothesis 6a. Face trainees will exhibit the highest levels of stress when the training intervention combines low structure and error encouragement instructions. In contrast, stress will be minimized when the training intervention combines high structure and error avoidant instructions.

Hypothesis 6b. Dignity trainees will exhibit the highest levels of stress when the training intervention combines high structure and error avoidant instructions. In contrast, stress will be minimized when the training intervention combines low structure and error encouragement instructions.

Stress, Learning, and Training Effectiveness

I have thus far discussed the interaction of culture and training design on stress reactions. I now turn to the impact of these stress reactions on training transfer. I will describe both the direct effects of stress on training transfer, as well as the possible mediating mechanisms of metacognitive activity and emotional control. Stress can directly inhibit learning by interfering with flexible task exploration and the use of negative feedback during learning. For example, stress appears to force a shift from flexible to rigid cognitive processes. Plessow, Kiesel, & Kirschbaum (2012) found that stress impairs participants' ability to be flexible as they attempted to pursue a goal. This finding raises questions about trainee's abilities to use flexible strategies to move through a task when they have little guidance or when they must correct for an error. Plessow et al.'s (2012) findings are consistent with current perspectives on stress and memory, which have suggested that stress may induce participants to form rigid, simple stimulus-response ("habit") memories rather than more flexible goal-directed memories, a position supported by neuroimaging data (Schwabe & Wolf, 2013). Finally, Petzold, Plessow, Goschket, & Kirschbaum, 2010 found that stress impacts feedback-based learning, such that stress inhibited the use of negative feedback during learning compared to a control condition in which participants did not experience stress. Stress did not affect the use of positive feedback.

Stress can also negatively impact learning indirectly though important cognitive and affective channels. As mentioned previously, low structure + error encouragement training (EMT) affects training transfer outcomes through two main self-regulatory mechanisms, metacognitive activity and emotional control (Keith & Frese, 2005). Metacognitive activity includes behaviors like planning, monitoring cognitions and progress towards goals, and revising behavior as necessary (Bell & Kozlowski, 2008; Brown, Bransford, Ferrara, & Campione, 1983; Ford et al., 2010). Emotional control refers to processes that regulate negative emotional reactions during the learning process. Stress-induced resource depletion is a major inhibitor of both cognitive and emotional regulation; previous research has shown that stress diverts self-regulatory resources as the person to attempts to cope with the stressor, depleting the finite resource pool and potentially leading to subsequent cognitive and affective regulation failures (e.g., Baumeister & Heatherton, 1996; Gross & Levenson, 1997; Muraven, Tice, & Baumeister, 1998; Vohs & Heatherton, 2000). For example, Salas et al. (1996) discuss how stress can lead to cognitive distraction and decreased search activity; these effects may account for Frese & Altmann's (1989) observation that trainees who faced errors in one pilot study did not notice changes on the screen that might have otherwise provided value feedback (Heimbeck et al., 2003). Additional research has also found that stress limits participants' ability to control their cognitions, weakening their ability to suppress competing erroneous responses (Keinan, Friedlan, Khaneman, and Roth, 1999; Plessow, Schade, Kirschbaum, & Fischer, 2012). These results suggest that stress can inhibit the cognitive and emotional control mechanisms necessary to properly allocate attentional resources to cognitive and affective regulation activities.

Thus, I expect that stress will inhibit training effectiveness, and that its effects will be mediated by metacognitive activity and emotional control. Stress may decrease exploratory behavior and consideration of negative feedback, causing a direct negative impact on learning. Stress may also deplete cognitive resources, thus indirectly inhibiting learning through failures of metacognitive activity and emotional control.

> *Hypothesis 7:* Stress reactions, as measured by average heart rate, and reactivity, will predict both metacognitive activity and emotional control, such that higher stress levels will inhibit metacognition activity and emotional control
>
> *Hypothesis 8.* Metacognition and emotional control will predict training transfer, such that higher metacognition and emotional control will facilitate training transfer.

A diagram of the expected model predicted by Hypotheses 1 though 8 is displayed in Figure 1. In this model, the interactions between culture, training structure, and error instructions are specified to predict the two included measures of stress, heart rate and cortisol reactivity. These relationships are expected to follow the matching theory as described in Hypotheses 4 through 6. In turn, stress is specified to negatively predict both emotional control and metacognition (Hypothesis 7). Finally, emotional control and metacognition are specified to positively predict training transfer, as measured by both analogic and adaptive transfer (Hypothesis 8).

Chapter 2: Method

Study Overview

The study was completed in three parts. Part 1 was an online questionnaire containing the study consent form, individual and cultural difference measures, and demographics. Part 2 was a 2.5 hour training session, during which participants received training on a computerized task. Participants were randomly assigned to one of four experimental conditions during the Part 2 session. The four conditions were created by fully crossing the two levels of training structure (structured, exploratory) and the two levels of error instructions (error avoidant, error encouragement).[4] During Part 2, participants watched a tutorial video that explained the training task, and then completed 9 training cycles of the task, an immediate analogic transfer trial, and an immediate adaptive transfer trial. The participants provided three saliva samples for cortisol analysis and wore a heart rate monitor throughout the training. The participants also answered questions about metacognition and emotional control. Part 3 was a follow-up performance session scheduled seven to 15 days after the Part 2 session. During Part 3,

[4] An additional error instruction condition, labelled "Control" was also used. In this condition, participants were told to try to do their best during the training. An additional 54 participants were included in the structured + control condition (27 Dignity participants, 27 Face participants), and 54 participants were included in the exploratory + control condition (29 Dignity participants, 25 Face participants). When included in the analyses with the other error instruction conditions, this control condition produced a significant culture main effect for performance, such that face participants performed significantly worse than dignity participants. When the control condition was dropped, this culture main effect disappeared. Additional analyses showed an extremely large performance differential based on culture in the control condition. This difference suggests that the control instructions in fact induced a separate manipulation that did not provide an appropriate comparison group to the two other error instruction conditions. Further, the manipulation check items showed that the control instructions were ineffective; contrary to previous studies (e.g., Bell & Kozlowski, 2008), participants in the control condition did not report trying their best during the training to a greater extent than participants in the other error instruction conditions. As such, this condition has not been included in the current analyses.

participants completed a delayed analogic transfer trial and a delayed adaptive transfer trial. Participants also answered a debriefing questionnaire.

Participants

Participants were 214 students from a large public university in the mid-Atlantic region of the United States. Two participants (.93% of the sample) were dropped from the analyses for failing to follow the study instructions during the training session, providing a final sample size of 212. The dignity group was comprised of 106 participants (34 male, 72 female) who self-identified as white or Caucasian American. The mean age of the Dignity group was 20.02 years old (SD = 2.45). The face group was comprised of 106 participants (43 male, 63 female) who self-identified as Asian or Asian American. Within the face group, 64 participants (60.3%) were born outside of the United States, and 57 (53.8%) reported that they had spent the majority of their childhoods outside of the United States. The mean age of the face group was 22.22 years old (SD = 3.37). There was a significant difference in the ages of the two samples ($t(210) = 5.44$, $p < .01$).[5] Table 3 shows a comparison of the education level of the dignity and face groups. The participants were recruited using posts to university-affiliated listservs, blogs, and Facebook groups, and flyers and handbills distributed across the university campus. Participants received $50 USD for completing the entire 3.5 hour study.

Of the 212 participants included the final sample, 55 participants were assigned to the structured + error avoidant condition (28 dignity participants, 27 face participants).

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[5] Due to the significant difference in age across the two samples, the effect of age on the performance metrics was examined. There was a significant negative correlation between age and training performance in the full sample (r = -.22, p < .01); however, age was not significantly correlated with the immediate analogic transfer score (r = -.06, p = .34), immediate adaptive transfer score (r = -.12, p = .08), delayed analogic transfer score (r = -.08, p = .22), or delayed adaptive transfer score (r = -.10, p = .15). Further, controlling for age in the analyses of these variables did not impact the reported results.

Fifty-two participants were assigned to the structured + error encourage condition (26 dignity participants, 26 face participants). Fifty-two participants were assigned to the exploratory + error avoid condition (25 dignity participants, 27 face participants), and 53 were assigned to the exploratory + error encourage condition (27 dignity participants, 26 dace participants).

Out of the 212 participants who completed Part 1 and Part 2, 95 of the dignity participants (89.6%) and 102 of the face participants (96.2%) returned to completed Part 3. The remaining 11 dignity and four face participants are included in the analyses of the Part 2 outcomes, but they are missing data for the Part 3 delayed transfer session and thus are not included in the analyses of the Part 3 outcomes.

Procedure

Part 1: online questionnaire.

Part 1 began with the study consent form (see Appendix A). If the participants completed the consent form, they went on to answer a series of individual and cultural difference measures, including scales measuring dignity and face cultural logics (see Appendix B. At the end of Part 1, participants provided detailed demographic information (see Appendix C) and were provided with a link to sign up for a Part 2 session.

Part 2: training session.

The Part 2 training session was scheduled at least 24 hours after the completion of the Part 1 online questionnaire. Part 2 sessions lasted 2.5 hours, and were completed between noon and 7:30pm.[6] The participants were instructed to avoid eating, drinking beverages other than water, ingesting caffeine, smoking, and engaging in vigorous physical exercise for one hour prior to their Part 2 appointment. Each of these behaviors is known to affect cortisol levels, and the activity restrictions were similar to those used in other studies on physiological stress.

The participants completed Part 2 in a private room with a desktop computer. Prior to each Part 2 session, a heart rate monitor was prepared for the participants. The clock on the heart rate monitor was synced with the computer clock so that the heart rate data could be matched to the training session data.

At the start of the Part 2 session, each participant was escorted into a private room. The experimenter first asked the participants if they had engaged in any of the prohibited behaviors in the previous hour. If a participant engaged in any of the behaviors, he or she was required to either reschedule the Part 2 session or wait until an hour had elapsed since the behavior ended.

The experimenter then provided verbal instructions and a demonstration for putting on the heart rate monitor strap. Written instructions were also provided. The experimenter left the room so that the participant could put on the strap. After the participants put the chest strap on, the experimenter checked the connection between the strap and the monitor watch. If a successful connection was made, the participant was asked to put on the watch. If the watch could not connect with the strap, the experimenter

[6] Dickerson & Kemeny's (2004) meta-analysis suggested that cortisol reactivity is to psychosocial stress is maximized in the afternoon hours. The participants' session start time was noted as a potential future control variable.

reiterated the instructions for putting on the strap and left the participant to adjust the strap so that it was in the correct position.

The participants were then asked to provide the resting saliva sample and were given instructions and demonstration for using the Salivette saliva swabs. The participants were instructed to keep the swab in their mouths for approximately two minutes, or until the swab was extremely wet. The participants were instructed to remain still during this period to facilitate the later recording of resting heart rate. At this point, the participants were instructed to start recording their heart rate. The display on the training computer was set to show only the time of day, and did not display the participants' heart rate. After starting the recording, the participants were left alone in their room and instructed to remain seated during for a two minute period. During this period, participants completed measures resting state affect to provide baseline stress measures.

After two minutes had elapsed, the experimenter opened the tutorial video. The participants were instructed to watch the video one time. They were able to follow along with their paper training manual if desired, and they were also provided with blank paper for note-taking. The tutorial video lasted approximately 10 minutes.

After the tutorial video, the experimenter opened the TANDEM training program and entered the participant number. The experimenter explained that the training program would provide the participants with their instructions for the remainder of the study period. The experimenter left the room and closed the door.

The training program first guided the participants through an initial study period and a two-minute hands-on trial, which was designed to allow the participants to become familiar with the layout and controls of the TANDEM program. The participants then began the first of nine training cycles. Each training cycle consisted of a 2.5 minute manual study period, and 4 minute TANDEM trial, and 1.5 minute feedback review period. At the start of each training cycle, the training program displayed an objective for the training cycle (e.g., learn to make TYPE decisions), referred the participant to the relevant portion of the paper training manual, and reiterated the structure and error instruction manipulations. At the start of the first training cycle, the experimenter began a 30-minute timer. At the end of thirty minutes, the participants provided the second saliva sample. The third and final saliva sample was provided thirty minutes after the second saliva sample.

After completing the third training cycle, the participants answered a questionnaire including manipulation checks. After the participants completed the third questionnaire, they were allowed to take a five minute break. If the participant elected to take the break, he or she was instructed to pause the heart rate recording. The recording was restarted at the end of the break.

After the break, the participants completed another three training cycles followed by a questionnaire. This questionnaire included measures of emotional control and metacognition. The participants then completed the final three training rounds and another questionnaire, which included items checking the participants' perceptions of privacy during the training. At the end of this questionnaire, the participants turned in all of their study materials, including their paper manuals and any training notes. The participants were again offered a five minute break.

Following the break, the participants began the immediate analogic transfer trial, which was set at the same level of difficulty as the training cycles. Finally, the participants completed the immediate adaptive transfer trial, which was programmed at a higher difficulty level as compared to the training cycles and the immediate analogic transfer trial. Once the participants finished the immediate adaptive transfer trial, they removed the heart rate monitor and were given instructions for scheduling a Part 3 appointment.

Part 3.

Part 3 was held seven to 15 days after Part 2. Part 3 took approximately 30 minutes. During Part 3, participants completed a delayed analogic transfer trial and a delayed adaptive transfer trial. After completing the second performance round, the participants answered a series of study debriefing questions.

TANDEM Task

Participants were trained to perform the TANDEM task (Tactical Navy Decision Making System; Dwyer, Hall, Volpe, Cannon-Bowers, & Salas, 1992), a PC-based radar simulation that has been used extensively in previous studies on training intervention effectiveness. TANDEM requires trainees to develop and deploy basic and strategic skills in a dynamic, high-fidelity environment. The TANDEM simulation was designed to mimic the types of tasks performed in naval combat information centers (CICs).

In TANDEM, participants are presented with a simulated radar screen (Figure 2). The participants are told that they must defend their fleet and their ship, which is at the center of the radar screen. Surrounding the ship are a number of other vessels, called “contacts,” which are indicated with asterisks on the screen. When the trial begins, the asterisks begin moving around the screen. Further, new contacts, called “pop-up contacts,” appear randomly on the screen throughout each trial. The participants are given two circular perimeters around their ship and the fleet, which they must defend by engaging targets before they cross the perimeters.

To engage a contact, the participants must “hook” it by clicking on it with the mouse, and then use the drop-down menus on the screen to gather information on it. Using this information, the participants must classify the contact Type (aircraft, ship, or submarine), Class (civilian or military), and Intent (friendly or hostile). For each of these three Classification Decisions, the participants are provided with three pieces of information, or “cues.” The participants must learn how to use the cue information to make classification decisions. After classifying the contact type, class, and intent of the contact, the participants must make a final engagement decision to either shoot down or clear the contact from their radar field. Ultimately, the participants must learn to monitor the screen for contacts, prioritize contacts based on which ones will threaten the defensive perimeters first, hook the contacts, and tap the relevant information fields in the menus quickly and accurately to determine the nature of the contact and the best course of action for engaging it.

One of the benefits of the TANDEM program is its flexibility; it can be adapted to change the location, direction, and speed with which the contacts move. The information available to the participants can also be adjusted. The complexity of the simulation can be increased by adjusting the number of contacts, the availability and accuracy of the informational cues, and setting the number of contacts that will cross the defensive perimeters if they are not engaged.

TANDEM training trial settings

The basic settings used the in current study were based on those used in Bell & Kozlowski (2008). During each of the training cycles, there were a total of 20 contacts, four of which were “pop-up contact.” Three of these contacts were programmed to cross the outer perimeter if they were not engaged, and an additional three contacts would cross the inner perimeter if not engaged. The type, class, and intent of each contact were randomly assigned. Further, eight of the contacts were randomly assigned to have either ambiguous or conflicting cue information for one classification decision, and two were randomly assigned to have ambiguous or conflicting cue information for two classification decisions. An example of ambiguous cue information would a value of “Unknown” for the countermeasures cue for the intent classification decision; this cue is ambiguous because its value does not indicate whether the contact is hostile or friendly. An example of conflicting cue information for the type classification could be a value of “Greater than 35 knots” for the speed cue (indicating an airplane), a value of “0 feet” for the altitude cue (indicating a surface vessel), and a value of “0-40s” for the communication time cue (indicating an airplane).

The scoring for the training trials is described below in the TANDEM Performance Measures subsection of the Measures Section. The trial characteristics and scoring were the same for the training cycles. However, the location and type, class, and intent of each target was varied across the trials.

Analogic transfer trial settings.

The TANDEM settings and scoring used for the analogic transfer trials were identical to those of the training trials.

Adaptive transfer settings.

The adaptive transfer trial settings and scoring were designed to be more complex and difficult than the training trials or the analogic transfer trial. The adaptive transfer trial lasted 10 minutes, as opposed to the 4-minute training trials. Further, the adaptive trial featured 60 contacts, 19 of which were pop-up contacts. Of these contacts, 34 were randomly assigned to provide ambiguous or conflicting information for one classification decision, and 12 were randomly assigned to provide ambiguous or conflicting information for two classification decisions. Finally, the scoring for the adaptive transfer trial increased the point deduction for inner and outer penalty circle violations. The scoring for the adaptive transfer trial is described below in the TANDEM Performance Measures subsection of the Measures Section.

Apparatus

Heart rate was recorded during a two-minute resting period and throughout the training with a Polar RCX5 ambulatory heart rate monitor. The Polar heart rate monitors have been validated against electrocardiography (ECG); the Polar monitor and ECG typically show significant correlations (e.g. Goodie, Larkin, & Schauss, 2000; Sharpley & Gordon, 1999), and a number of studies measuring heart rate as a stress marker have used the Polar heart rate monitor (e.g., Hellhammer & Schubert, 2012; LeBlanc, Jin, Obert, & Siivola, 1997; Nater, Marca, Florin, Moses, Langhans, Koller et al., 2004; Utsey & Hook, 2007). The Polar RCX5 consists of an elastic chest strap with electrodes, which is put against the skin on the participant's chest, and a training watch that records the heart rate. Heart rate was recorded in five second intervals.

Experimental Manipulations

Participants were randomly assigned to one of four experimental conditions during the Part 2 session. The four conditions were created by fully crossing the two levels of training structure (structured, exploratory) and the two levels of error instructions (error avoidant, error encouragement). The manipulations for training structure and error instructions were first introduced in the video tutorial. These manipulations were reiterated throughout the training manuals, and the training program also displayed them during the study period of each training cycle. The manipulations were developed based on materials from previous studies of error management training, including Keith and Frese (2005), Gully et al. (2002), and Bell & Kozlowski (2008).

Training structure was manipulated such that participants in the structured condition received a set of step-by-step instructions for making classification decisions and final engagement decisions. Further, participants in the structured condition received explicit strategies for prioritizing contacts and defending the perimeters. These participants were instructed to follow these directions carefully, and they were told that following the provided instructions would lead them to the correct information and strategies in the shortest period of time.

In contrast, participants in the exploratory condition were not given step-by-step instructions or any information linking the cue values to the correct classification and engagement decisions. These participants were encouraged to experiment and explore the task to learn how to make classification decisions and final engagement decisions, and to develop other task strategies. They were also told that exploring the task would help them learn the information and strategies necessary to complete the task successfully.

The error instructions were manipulated so that participants were either told to avoid errors or to make errors. In the error avoidant condition, the participants were told to try to avoid making mistakes, and that errors could inhibit their learning. In contrast, participants in the error encouragement condition were told that they should try to make mistakes during the training, and that making errors would help them learn the task information and strategies. The specific error instructions in each condition were adapted from prior research, including Keith & Frese (2005), Gully et al. (2002), Carter & Beier (2010), and Bell & Kozlowski (2008). The error instructions were only used during the training cycles; during the performance trials, participants were instructed to try their best (Bell & Kozlowski, 2008).

Measures

Individual and Cultural Difference Measures (Part 1)

Honor, Dignity, and Face Scale.

Endorsement of the cultural logics of dignity and face were measured during the Part 1 online questionnaire using the 18-item Honor, Dignity, and Face Scale (Severance & Gelfand, in preparation). This measure is framed at the descriptive norm level, which focuses on the extent to which the individual believes their broader social entity endorses a given belief. Given that a sizeable portion of the current sample was made up of international students, the participants were prompted to respond to the items with the extent to which they believed their parents, while the participants were growing up, endorsed each statement. The 18-item scale was developed from a larger pool of items taping the key facets of dignity (e.g., equal worth, internal worth, resisting social influence) and face (e.g., humility/harmony, public image, status), as well as honor, which was not of primary interest in the current study. Example items tapping dignity include "People should make decisions based on their own opinions and not based on what others think" and "People should be true to themselves regardless of what others think." Example items tapping face were "It is important to maintain harmony within one's group" and "People should be extremely careful not to embarrass other people." Participants responded using a five-point scale (1 = *Not at All*, 5 = *Very Much*).

Training Measures (Part 2)

Manipulation checks.

Manual structure.

Participants responded to three manipulation check items about manual structure and task exploration after the third training cycle. The items were "The task manual laid out clear instructions for how to complete each part of the task," "I experimented to find the best way to complete the radar task," and "I explored the task on my own to develop my own understanding of the task" (Bell & Kozlowski, 2008). In addition, participants in the structured condition responded to the item "I followed the step-by-step instructions provided in the task manual." The participants responded to these items on a seven-point Likert scale (1 = *strongly disagree*, 7 = *strongly agree*).

Error instructions.

Participants also responded to manipulation check items regarding the error instructions after the third training cycle. Two items from Bell & Kozlowski (2008) were included to tap the extent to which the participants tried to make errors ("I tried to make errors as I practiced the radar task") and tried to avoid errors ("I tried to avoid errors as I practiced the radar task"). The participants responded to these items on a seven-point Likert scale (1 = *strongly disagree*, 7 = *strongly agree*).

In addition, items from the Error Orientation Questionnaire (Rybowiak et al., 1999) were adapted to measure the extent to which the error instructions impacted the participants' error orientations during the training (Keith & Frese, 2005). Specifically, three adapted items from the Error Strain subscale ("I felt embarrassed when I made an error on the radar task," "I was often afraid of making mistakes on the radar task," and "During the radar task, I found it stressful when I made an error"), two items from the Thinking about Errors subscale ("When a mistake occurred during the radar task, I analyzed it thoroughly," "After a mistake happened in the radar task, I thought long and hard about how to correct it"), and two items from the Learning from Errors subscale ("Mistakes on the radar task provided useful information for me to carry out my work," "My mistakes on the radar task help me to improve my work") were included. Participants responded to the items using a five-point scale (1 = *not at all*, 5 = *totally*).

Privacy.

At the end of the training, participants responded to two questions tapping perceptions of privacy during the training. These items were included to ensure that the participants felt that they were alone and unmonitored while completing the training, and thus were unlikely to be motivated by self-presentation concerns during the training. The items were "I had adequate privacy to complete the training on my own" and "I felt like the experimenter was occasionally watching over my shoulder during the training" (reversed). The participants responded to these items on a seven-point Likert scale (1 = *strongly disagree*, 7 = *strongly agree*).

Emotional Control.

Emotional Control was measured following the sixth training cycle using the eight-item measure from Keith and Frese (2005; Keith 2005). The questions were introduced with the prompt “Sometimes difficulties may have arisen while you were working on the last three training blocks. Please choose the response that best describes your reaction to these difficulties during the last three training blocks._When difficulties arose during the last three training blocks…” Example items include “I calmly considered how I could continue the task.” And “I let myself become distracted” (reversed). Participants responded using a five-point scale (1 = False, 5 = True).

Metacognition.

Metacognition was measured following the sixth training cycle using a twelve-item scale adapted specifically to the TANDEM context (Ford et al., 1998). The questions were introduced with the prompt “For each of the items below, rate the extent to which you were thinking about these issues during the past three training blocks.” Example items include “I used my performance on the previous trial to review how I would approach the task on the next trial” and “I thought ahead to what I would do next to improve my performance.” Participants responded using a five-point scale (1 = *Never* and 5 = *Always*).

Control Variables.

To assess and control for possible influences on emotional control that were not related to the variables of interest, resting emotional state was measured at the start of

Part 2 (Folkman & Lazarus, 1990). Resting affect was measured using the Positive and Negative Affect Schedule (Watson & Clark, 1994). Participants used a five-point scale to rate the extent to which they felt different emotions at the start of the study, before any of the experimental manipulations had been implemented (1 = *very slightly or not at all,* 5 = *extremely*). These emotions were selected to tap the reactions most relevant to the current study and those that may inhibit or facilitate emotional control during the training. Fear was assessed with six items (frightened, shaky, afraid, scared, nervous, jittery), and serenity was assessed with two items (calm, relaxed). The scale was used to measure state affect by instructing participants to respond based on how they felt in the moment.

TANDEM Performance Measures

Training Performance

The scoring for the training trials was set such that the participants gained 100 points for each contact with correctly classified type, class, and intent decisions and a correct final engagement decision. If a participant misidentified the type, class, or intent of a contact, or if the participant made an incorrect final engagement decision, 100 points were deducted from the participant's score for the cycle. Finally, the participants lost 40 point for each contact they allowed to cross the inner or outer perimeter.

Analogic Transfer Performance

The scores for both the immediate and delayed analogic transfer trials was calculated using the same rules as the training trials.

Adaptive Transfer Performance

The adaptive transfer trial scoring increased the point deduction for inner and outer penalty circle violations. One-hundred and twenty-five points were deducted for each outer perimeter intrusion the participants allowed, and 175 points were deducted for each inner penalty circle violation. The points awarded and deducted for correct and incorrect classification and engagement decisions were not changed in the adaptive transfer trial.

Scale Factor Analyses and Reliabilities

Individual and Cultural Difference Measures (Part 1)

Honor, Dignity, and Face Scale.

The HDF scale was submitted to an exploratory factor analysis. Based on an examination of the scree plot and eigenvalues from the separate sample EFAs for the Honor, Dignity, and Face Scale, three factors were retained. In the full sample EFA, the loadings of each item on its factor exceeded .30. One item, “Men need to protect their women’s reputation at all costs,” cross-loaded on Factor 2 (“Face,” factor loading = .45) and Factor 3 (“Honor,” factor loading = .43). This item was deleted, and the EFA was rerun with the remaining items. The final factor structure indicated three factors (see Table 4). The first factor that emerged contained six items tapping a dignity cultural logic, and thus was labelled “Dignity.” The Cronbach’s alpha for the subscale was .82 (Dignity sample $\alpha = .78$; Face sample $\alpha = .85$). The second factor contained six items related to a face cultural logic and was labelled “Face.” The Cronbach’s alpha for the subscale was .72 (Dignity sample $\alpha = .70$; Face sample $\alpha = .69$). The final factor contained five items related to an honor cultural logic, and thus was not assessed in the current study.

Training Measures (Part 2)

Emotional Control.

Based on an examination of the scree plot and eigenvalues from the separate sample EFAs and the full sample EFA, a single factor was retained. This scale showed acceptable reliability in the full sample (overall sample α = .83. Dignity sample α = .85; Face sample α = .82).

Metacognition.

Based on an examination of the scree plot and eigenvalues from the separate sample EFAs and the full sample EFA, a single factor including all of the scale items was retained. This scale showed acceptable reliability (overall sample α = .94. Dignity sample α = .92; Face sample α = .95).

Control Variables

The single-factor state affect scales showed sufficient reliability in the overall sample and in the two subsamples. Both the Fear subscale (overall sample α = .75, Dignity sample α = .79; Face sample α = .69) and the Serenity subscale (overall sample α = .86, Dignity sample α = .88; Face sample α = .84) showed sufficient reliability.

Data Preparation and Aggregation

Heart Rate

The heart rate data for the training session was imported into Microsoft Excel. The descriptives for each participants' heart rate data were inspected for indications of gaps within the heart rate recordings. These gaps were usually the result of a loss of contact between the electrodes on the chest strap and the participants' skin. Thus, any recordings of zero beats per minute were deleted from the data. Further, a visual analysis of the heart rate data suggested that a loss of contact between the strap and the participants' skin may have created instabilities within the recorded heart rates surrounding the loss of contact; that is, if a participant's chest strap lost contact with his or her skin, the recordings immediately before and after the loss of contact varied outside of the expected range. To set a standard for excluding extreme datapoints, the mean heart rate for each participant across of the TANDEM trials in Part 2 were calculated. A mean of these means was computed, as well as a standard deviation of the individual means. The mean of the individual heart rate means was 74.78, and the standard deviation was 10.07. These values were used to create a range of three standard deviations above and below the mean, corresponding to a range of 44.57 and 105.00 beats. Any heart rate measurement point that fell outside of this range was deleted. Heart rate was then averaged within each TANDEM training trial.

To determine whether the TANDEM trial heart rate data could be aggregated to an individual-level mean, the ICC(1) and ICC(2) values were calculated on the means from the nine TANDEM training cycles using the R program and the Multilevel library. The ICC(1) value was high (.837) and significant ($F(211, 1908) = 52.41$, $p < .01$), indicating that the individual accounted for 83.7% of the variance in the heart rate trials means. The ICC(2) value was high as well (.98), indicating that individuals can be reliability differentiated based on the average heart rate. Thus, the nine heart rate trial means were averaged for each individual.

Cortisol

Saliva samples were frozen and stored at -20 degrees C until analysis. After thawing, the salivettes were centrifuged at 3,000 rpm for 5 min, which resulted in a clear supernatant of low viscosity. Salivary concentrations were measured using commercially available chemiluminescence-immunoassay with high sensitivity (IBL International, Hamburg, Germany).The intra and interassay coefficients for cortisol were below 8%.

TANDEM Data

The TANDEM program records a number of metrics related to the participant decisions and performance. The primary outcome in the current study is the participants' scores. To determine whether the TANDEM trial scores could be aggregated to an individual-level mean, the ICC(1) and ICC(2) were calculated on the means from the nine TANDEM training trails using the R program and the Multilevel library. The ICC(1) value was .29, and the one-way ANOVA was significant ($F(211, 1696) = 4.68$, $p < .01$). The ICC(2) value was .79. Thus, the participants' training scores were aggregated to the individual level by averaging the scores across the nine training trials.

Chapter 3: Results

Means and standard deviations for all measured variables are presented in Table 5. The correlation table is presented in Table 6.

Group Differences on Cultural Values

Honor, Dignity, and Face Scale

The groups showed the expected differences on the dignity and face subscales of the Honor, Dignity, and Face scale. Consistent with expectations, the dignity sample endorsed the dignity cultural orientation (M = 3.82, SD = .60) to a greater extent than the face sample (M = 3.55, SD = .85, $t(209) = 2.61$, $p = .01$, $d = .37$, $r = .18$). Further, the face sample endorsed the face cultural orientation (M = 3.94, SD = .57) to a greater extent than the dignity sample (M = 3.54, SD = .66, $t(212) = 4.64$, $p < .01$, $d = .65$, $r = .31$).

Manipulation Checks

Training Structure

An analysis of the Training Structure manipulation checks indicated that the Structure manipulation was successful. The participants in the Structured condition believed that the task manual laid out clear, step-by-step instructions for completing the task as compared to the participants in the exploratory condition (Structure M = 5.99, SD = 1.14, Exploratory M = 4.42, SD = 1.66, $t(210) = 8.07$, $p < .01$, $d = 1.10$, $r = .48$). Participants in the Structured condition agreed that they followed the step-by-step instructions provided in their manuals (*M* = 5.22, *SD* = 1.51). Participants in the exploratory condition were not asked this question.

Compared to participants who received the Structured training, participants who were in the Exploratory condition reported that they were significantly more likely to experiment to find the best way to complete the task (Exploratory *M* = 5.83, *SD* = .98, Structured *M* = 4.97, *SD* = 1.64, *t*(210) = 4.61, $p < .01$, *d* = .64, *r* = .30), and that they explored the task on their own to develop their understanding of it (Exploratory *M* = 5.50, *SD* = 1.13, Structured mean = 4.92, *SD* = 1.65, *t*(210) = 2.98, $p < .01$, *d* = .41, *r* = .20).

Error Instructions

The error instructions were also successful. Participants in the error encouragement condition reported that they were significantly more likely to try to make errors as they practiced the task as compared to the error avoidant condition (Error Encouragement *M* = 2.41, *SD* = 1.52, Error Avoidant *M* = 1.97, *SD* = 1.34, *t*(210) = 2.23, *p* = .03, *d* = .31, *r* = .15). However, this main effect was qualified by a significant interaction with the Structure manipulation ($F(1, 204) = 5.53$, $p < .01$, $\square_p^2 = .02$). For participants in the structured training condition, there was no difference between the error avoidant and error encouragement conditions in responses to this item (Error Avoidant *M* = 2.00, *SD* = 1.47, Error Encouragement *M* = 2.00, *SD* = 1.50, t(105) = .00, *p* = 1.00, *d* = 0.00, *r* = .00). However, in the exploratory condition, participants in the error encouragement were more likely to report that they tried to make errors as compared to participants in the Error Avoidant condition (Error Encouragement *M* = 2.81, *SD* = 1.46, Error Avoidant *M* = 1.94, *SD* = 1.20, *t*(105) = 3.34, $p < .01$, *d* = .65 *r* = .31).

Additional evidence supports the unexpected impact of the Structure manipulation on participants' error behavior and the participants' perceptions of their errors. Participants in the structured condition reported that they tried to avoid errors during the task to a greater extent than participants in the exploratory condition (Structured *M* = 6.27, *SD* = .92, Exploratory *M* = 5.84, *SD* = 1.19, t(210) = 2.96, $p < .01$, *d* = .40, *r* = .20). Further, the subscales adapted from the Error Orientation questionnaire also showed significant main effects for structure. Participants in the exploratory condition reported higher scores on the Learning from Errors items (Exploratory *M* = 4.10, *SD* = .97, Structured Mean = 3.81, *SD* = 1.04, *t*(210)= 2.04, *p* = .04, *d* = .29, *r* = .14). Participants in the exploratory condition also reported higher scores on the Thinking about Errors items (Exploratory *M* = 3.25, *SD* = 1.01, Structured Mean = 2.98, *SD* = 1.13, *t*(210) = 1.84, *p* = .07, *d* = .25, *r* = .12). The error instruction condition did not affect responses to these items, and there were no significant interactions between the structure and error instruction manipulations. There were no differences for the structure manipulation or the error instruction manipulation for the Error Strain manipulation checks.

The TANDEM program recorded the number of points each participant lost due to errors in classifying and engaging contacts. An analysis of these errors showed that the Structure manipulation was a significant predictor of points lost due to errors, but the Error Instruction manipulation was not significant. Participants in the exploratory condition lost more points due to incorrect classification and engagement decisions than participants in the structured condition (Exploratory *M* = 275.78, *SD* = 111.43, Structured *M* = 141.85, *SD* = 131.10, *t*(210) = 8.01, $p < .01$, *d* = 1.10, *r* = .48).

Perceptions of Privacy

Regarding the checks on perceptions of privacy during the study, the participants indicated that they felt they had adequate privacy to complete the training (*M* = 6.63, *SD* = .87), and that they did not feel like the experimenter was watching over their shoulders during the training (*M* = 1.41, *SD* = .96). There were no significant differences between the culture groups on the two privacy items.

Training Score

To explore the impact of culture, training structure, and error instructions on performance during the training, the mean training score was analyzed using a 2 (Training Structure: Exploratory, Structured) x 2 (Error Instructions: Error Avoid, Error Encourage) x 2 (Culture: Face, Dignity) ANOVA. The results showed that the structure manipulation produced a significant effect ($F(1, 204) = 17.39$, $p < .01$, $\eta_p^2 = .08$), such that the structured condition outperformed the exploratory condition during the training (Structured *M* = 574.12, *SD* = 302.74, Exploratory *M* = 397.86, *SD* = 306.61). However, there were no other significant main effects or interactions for the training score outcomes. See Table 7.

<u>Hypothesis Tests</u>

TANDEM Score Outcomes.

The TANDEM outcomes were each analyzed using a 2 (Training Structure: Exploratory, Structured) x 2 (Error Instructions: Error Avoid, Error Encourage) x 2 (Culture: Face, Dignity) ANOVA. The following results section is organized by hypothesis. See Tables 8, 9, 10, and 11 for the results for immediate analogic transfer, immediate adaptive transfer, delayed analogic transfer, and delayed adaptive transfer, respectively.

Hypothesis 1.

Hypothesis 1 suggested that there would be a significant two-way interaction between culture and error instructions, such that Face participants would show higher training transfer in the error avoidant condition than in the error encouragement condition, whereas Dignity participants would show higher training transfer in the error encouragement condition as compared to the error avoidant condition.

Hypothesis 1 was confirmed for both the immediate adaptive transfer trial and the delayed adaptive transfer trial (see Table 9 and Table 11, respectively). For the immediate adaptive transfer trial, there was a significant interaction between the error instructions and culture ($F(1, 204) = 5.50$, $p = .02$, $\eta_p^2 = .03$), such that face participants in the error avoidant condition outperformed face participants in the error encourage condition (Error Avoidant $M = -1461.11$, $SD = 1120.33$, Error Encouragement $M = -1928.85$, $SD = 1362.77$, $t(104) = 1.93$, $p = .06$, $d = .37$, $r = .18$). Conversely, dignity participants in the error encourage condition outperformed dignity participants in the error avoidant condition, but this difference was not significant (Error Encourage $M = -1499.53$, $SD = 1055.81$, Error Avoidant $M = -1767.92$, $SD = 1054.48$ $t(104) = 1.30$, $p = .19$, $d = .25$, $r = .13$). A graph of this interaction is displayed in Figure 3.

Hypothesis 1 was also supported in the delayed adaptive transfer trial. There was a marginal interaction between error instructions and culture ($F(1, 189) = 2.87$, $p = .09$, $\eta_p^2 = .02$), such that dignity participants in the error encourage condition outperformed dignity participants in the error avoidant condition (Error Encourage *M* = -1546.36, *SD* = 1042.79, Error Avoidant *M* = -1912.77, *SD* = 1068.36, *t*(93) = 1.70, *p* = .09, *d* = .34, *r* = .17). Conversely, face participants in the error avoidant condition outperformed face participants in the error encourage condition, though this difference was not significant (Error Avoidant *M* = -1797.17, *SD* = 1246.42, Error Encourage *M* = 2015.82, *SD* = 1485.82), *t*(100) = .81, *p* = .42, *d* = .16, *r* = .08). A graph of this interaction is displayed in Figure 4.

Hypothesis 1 was not supported by either the immediate analogic transfer task (see Table 8) or the delayed analogic transfer task (see Table 10).

Hypothesis 2

Hypothesis 2 suggested that there would be a two-way interaction between culture and training structure, such that Face participants would show higher training transfer in the high structure condition than in the low structure condition, whereas Dignity participants would show higher training transfer in the low structure condition as compared to the high structure condition.

Hypothesis 2 was supported by the delayed adaptive transfer task (see Table 11). For this outcome, there was a significant interaction between structure and culture (*F*(1, 189) = 5.44, *p* = .02, η_p^2 = .03), such that face participants in the structured condition outperformed face participants in the exploratory condition (Structured *M* = -1674.04, *SD* = 1234.81, Exploratory *M* = -2139.50, *SD* = 1461.65, *t*(100) = 1.74, *p* = .09, *d* = .34, *r* = .17). Conversely, dignity participants in the exploratory condition outperformed dignity participants in the structured condition, though this difference did not reach significance

(Exploratory *M* = -1563.54, *SD* = 1067.96, Structured *M* = -1895.21, *SD* = 1048.64, *t*(93) = .97, *p* = .13, *d* = .31, *r* = .15). A graph of this interaction is displayed in Figure 5.

Hypothesis 2 was not supported by the immediate analogic transfer task (see Table 8), the immediate adaptive transfer task (see Table 9), or the delayed analogic transfer task (see Table 10).

Hypothesis 3

Hypothesis 3 suggested the possibility of a three-way interaction between culture, training structure, and error instructions. For the Face participants, transfer was expected to be maximized when the training condition combined high structure and error avoidant directions. Transfer for face participants was expected to be minimized when the training combined low structure with error encouragement instructions. The opposite pattern was expected for dignity participants. Hypothesis 3 was not supported in any of the transfer tasks (see Tables 8-11).

Additional Effects

This section reviews main effects and interactions that were present in the data but that were not the subject of the reviewed hypothesis.

For the immediate analogic transfer trial, there was a main effect for training structure, though the effect was marginal (*F*(1, 204) = 3.49, *p* = .06, $\square_p^2$ = .02). As in the training trials, the structured condition outperformed the exploratory condition (Structured *M* = 905.41, *SD* = 352.86, Exploratory *M* = 817.51, *SD* = 328.59). There were no significant main effects for error instructions (*F*(1, 204) = .86, *p* = .35, $\square_p^2 < .01$) or culture (*F*(1, 204) = .07, *p* = .79, $\square_p^2 < .01$). There were no significant two-or three way interactions (see Table 8).

For the immediate delayed transfer trial, there were no significant main effects for structure (F(1, 204) = 2.06, p = .15, $\square_p^2$ = .01), error instructions (F(1, 204) = .38, p = .54, $\square_p^2$ < .01 .), or culture (F(1, 204) = .15, p = .70, $\square_p^2$ < .01). There were no significant interactions other than the previously reported interaction between culture and error instructions (see Table 9).

For the delayed analogic transfer session, there was a marginal main effect for culture (F(1, 189) = 3.52, p = .06, $\square_p^2$ = .02), such that dignity participants outperformed face participants (Dignity M = 706.85, SD = 301.26, Face M = 604.89, SD = 436.21). None of the two-way interactions were significant, nor was the three-way interaction (see Table 10).

For the delayed adaptive transfer session, there were no significant main effects for structure (F(1, 189) = .23, p = .64, $\square_p^2$ < .01), error instructions (F(1, 189) = .14, p = .71, $\square_p^2$ < .01), or culture (F(1,189) = 1.10, p = .30, $\square_p^2$ = .01). There were no significant interactions other than the previously reported interactions between culture and structure and between culture and error instructions (see Table 11).

Dignity and Face Scale Scores as Predictors of Training and Transfer Performance.

To test the findings above using participants' responses to the Face Subscale, rather than self-reported ethnicity, a median split of the scores on the Face Subscale was used to divide participants into high and low face groups.[7] The median of the Face Subscale scores was 3.83. A series of 2 (Training Structure: Exploratory, Structured) x 2

[7] The Dignity Subscale was not used to divide participants into high and low dignity groups, as the two cultural groups included in the study did not show significant differences on the subscale.

(Error Instructions: Error Avoid, Error Encourage) x 2 (Face: High, Low) ANOVAs were conducted on the training and transfer outcomes.

The results largely supported the findings that used self-reported ethnicity as a proxy for culture. For the training score outcome, there was again a significant main effect for training structure ($F(1, 203) = 15.23$, $p < .01$), such that participants in the structured condition outperformed participants in the exploratory condition. However, this main effect was qualified by a marginal interaction between training structure and face ($F(1, 203) = 3.01$, $p = .08$). See Table 12. This interaction showed that participants in the high face group that completed the exploratory training performed worse than high face participants in the structured training (Exploratory $M = 362.64$, $SD = 327.52$, Structured $M = 600.34$, $SD = 237.41$, $t(111) = 4.44$, $p < .01$). However, there was no difference between the structured and exploratory conditions for low face participants (Exploratory $M = 434.59$, $SD = 281.29$, Structured $M = 529.00$, $SD = 360.15$, $t(96) = 1.45$, $p = .15$). See Figure 6.

The analyses for Hypothesis 1 did not show the same patterns as reported above. Contrary to Hypothesis 1 and the above analysis using self-reported ethnicity as a proxy for culture, there was no significant interaction between error instructions and face for any of the transfer outcomes. However, there was support for Hypothesis 2. For the immediate adaptive transfer trial, the interaction between face and training structure ($F(1, 203) = 3.92$, $p < .05$). See Table 13. Consistent with Hypothesis 2, high face participants did worse in the immediate adaptive transfer trial when they had completed the exploratory training as compared to the structured training (Exploratory $M = -1897.22$, $SD = 1200.46$, Structured $M = -1410.59$, $SD = 1116.44$, $t(111) = 2.23$, $p = .03$). The low face participants showed lower immediate adaptive transfer when they had completed the structure training rather than the exploratory, but this difference was not significant (Exploratory *M* = -1633.28, *SD* = 1081.76, Structured *M* = -1776.06, *SD* = 1196.95, $t(96) = -.59$, $p = .56$). See Figure 7.

For the delayed adaptive transfer outcome, there was a significant interaction between face and training structure (F (1, 188) = 4.98, $p = .03$). See Table 14. High face participants did worse in the delayed adaptive transfer trial when they had completed the exploratory training as compared to the structured training (Exploratory *M* = -2102.39, *SD* = 1406.80, Structured *M* = -1687.41, *SD* = 1179.12, $t(104) = 1.67$, $p < .10$). In contrast, low face participants did better on this trial when they completed the training in the exploratory condition rather than the structured condition, but this difference was not significant (Exploratory *M* = -1612.76, *SD* = 1168.61, Structured *M* = -1966.45, *SD* = 1064.31, $t(88) = 1.48$, $p = .14$). See Figure 8. Finally, the analyses for Hypothesis 3 did not show support for a three-way interaction between face, training structure, and error instructions for any of the training or transfer outcomes. See Tables 15 and 16.

Stress Reactions.

Hypothesis 4, 5, and 6 suggested that the two- and three-way interactions between culture, structure, and error instructions would predict stress responses. None of these hypotheses were supported for either heart rate or cortisol reactivity.

Hierarchical multiple regressions were conducted to assess the impact of culture, training structure, and error instructions on stress. For the training heart rate outcome, the mean training heart rate was regressed on resting heart rate in Step 1. In Step 2, effects coded variables for culture (-1 = Dignity, 1 = Face), training structure (-1 = Structured, 1

= Exploratory), and error instructions (-1 = Error Avoidant, 1 = Error Encouragement) were entered to test the main effects of culture and the training design manipulations. In Step 3, the two way interactions between culture, structure, and error instructions were entered, and finally, the three-way interaction between these variables was entered in Step 4. Both the change in R-square and the significance of the overall model were assessed at each step. Resting heart rate was a significant predictor of training heart rate (b = .67, t = 19.46, p < .01; overall model F(1, 207) = 378.93, p < .01, R^2 = .65). However, the main effects for culture, Structure, and error instructions, the two-way interactions, and the three-way interaction were not significant predictors of training heart rate when resting heart rate was included in the model. See Table 17. These results were not affected when the responses to the Face Subscale were used in place of self-reported ethnicity.

To assess the cortisol outcome, the level of cortisol at Time 2 was regressed on resting cortisol (Step 1), the effects coded variables for culture, training structure, and error instructions (Step 2), the two way interactions (Step 3), and the three-way interaction (Step 4). Using all of the available data, these results indicated that resting cortisol was a significant predictor of Time 2 Cortisol (b = 3.18, t = 37.77, p < .01; overall model F(1, 210) = 1426.52, p < .01, R^2 = .87). The main effects for culture, structure, and error instructions were not significant in Step 2, nor were any of the two way interactions in Step 3. The three-way interaction between culture, structure, and error instructions was marginal in Step 4 (b = -2.97, t = -1.69, p = .09; Step 4 delta R-squared = .002 F(1, 203) = 2.85, p = .09; overall model F(8, 203) = 180.87, p < .01, R^2 = .88). However, the significance of the three-way interaction was driven by two participants with abnormally high resting cortisol (i.e., that exceeded 3 standard deviations from the sample mean); when these two participants were dropped from the analysis, the three-way interaction was no longer significant. These results were not affected when study start time was entered as a control in Step 1. See Table 18. These results were also not affected when the responses to the Face Subscale were used in place of self-reported ethnicity.

The analysis of Time 3 cortisol was identical to that of Time 2, with the exception that both resting cortisol and Time 2 cortisol were entered in Step 1. Using the full sample, both resting and Time 2 cortisol significantly predicted Time 3 cortisol (Resting $b = .04$, $t = 2.00$, $p = .046$; Time 1 Cortisol $b = .75$, $t = 122.60$, $p < .01$; overall model $F(2, 209) = 60367.99$, $p < .01$, $R^2 = .99$). Given that the prior two cortisol levels predicted 99.9% of the variance in Time 3 cortisol, the additional effects were not interpreted.

Exploring the Relationships between Training Design and Training Outcomes

Hypothesis 7 suggested that stress reactions would mediate the relationship between trainee cultural background, training structure, error instructions, and metacognition and emotional control. Since there were no significant effects for culture, error instructions, structure, or their interactions on either heart rate or cortisol, heart rate and cortisol were dropped from the model analyses.

To assess whether culture, error instructions, structure, and their interactions directly impacted emotional control, a hierarchical regression was conducted. In the first step, resting serenity and fear were entered as control variables to ensure that the subsequent effects were due to experimental manipulations and not to differences in participants' affective state at the start of the study. In Step 2, effects coded variables for culture (-1 = Dignity, 1 = Face), training structure (-1 = Structured, 1 = Exploratory), and error instructions (-1 = Error Avoidant, 1 = Error Encouragement) were entered to test the main effects of culture and the training design manipulations. In Step 3, the two way interactions between culture, structure, and error instructions were entered, and finally, the three-way interaction between these variables was entered in Step 4.

As shown in Table 19, both resting fear (b = -.23, t = 2.42, p = .02) and resting serenity (b = .15, t = 2.75, p < .01) significantly predicted emotional control during training (Step 1 delta R-squared = .09, $F(2, 209)$ = 9.98, p < .01; overall model $F(2, 209)$ = 9.99, p < .01, R^2 = .09). There were no main effects for culture, structure, or error instructions in Step 2. However, the interaction between culture and structure was significant in Step 3 (b = -.09, t = 2.17, p = .03, Step 3 delta R-squared = .04, $F(3, 203)$ = 3.08, p = .03; overall model $F(8, 203)$ = 4.27, p < .01, R^2 = .15), such that emotional control for face participants was higher in the structured condition than in the exploratory condition (Structured M = 4.27, Exploratory M = 4.19). Conversely, the dignity participants experienced higher emotional control in the exploratory condition than in the structured condition (Exploratory M = 4.43, Structured M = 4.15). A graph illustrating these differences at the mean values of resting fear (M = 1.45) and resting serenity (M = 3.59) is displayed in Figure 9.

The analysis of emotional control also indicated a marginal interaction between culture and error instructions (b = -.07, t = 1.18, p = .08; Step 3 delta R-squared = .04, $F(3, 203)$ = 3.08, p = .03; overall model $F(8, 203)$ = 4.27, p < .01, R^2 = .15). Face participants reported higher emotional control in the error avoidant condition as compared to the error encouragement condition (Error Avoidant *M* = 4.37, Error Encouragement *M* = 4.09), whereas dignity participants experienced similar levels of emotional control across the two conditions (Error Avoidant *M* = 4.37, Error Encouragement *M* = 4.30). A graph illustrating this interactions at the mean values of resting fear (*M* = 1.45) and resting serenity (*M* = 3.59) is displayed in Figure 10. No other two- or three-way interactions were significant for emotional control.

The metacognition outcome was analyzed using a 2 (Training Structure: Exploratory, Structured) x 2 (Error Instructions: Error Avoid, Error Encourage) x 2 (Culture: Face, Dignity) ANOVA. There were no significant main effects or interactions for culture, error instruction, or structure. See Table 20. Controlling for resting fear and resting serenity did not impact significance of the effects. Since there were no significant effects for this outcome, metacognition was dropped from the model analyses.

Based on the reviewed results, an abbreviated mediation model was tested. In this model, the culture by structure interaction was specified to predict emotional control, controlling for resting fear and serenity. Emotional control in turn was specified to predict delayed adaptive transfer score. Delayed adaptive transfer was used as the outcome because it most closely captures the two major characteristics of transfer; namely, that the trainee is adapting his or her knowledge to a new, more difficult context, and that the trained knowledge and skills are retained over time (Burke & Hutchins, 2007). The culture by error instruction interaction was not included in the model, as the earlier regression analyses indicated that this interaction was marginal for both emotional control and delayed adaptive transfer.

The abbreviated model was tested in Lisrel 9.10 (Student Edition, January 2013). The path relationships were assessed for significance, and fit was assessed using the Chi-square, RMSEA, and CFI. In an initial run of the model, a LISREL error code indicated that the original standard deviation of the delayed adaptive performance trial (*SD* = 1229.46) was too large. To address this issue, the delayed adaptive performance trial score were divided by 100. This transformation adjusted the standard deviation while maintaining the same correlations between the score and the other variables.

The produced model is displayed in Figure 11. This model showed good fit to the data ($\chi^2 = 7.39$, $df = 5$, $p = .19$, RMSEA = .05, CFI = .96). In the model, the paths from the culture x structure interaction, resting fear, and resting serenity predicting emotional control were significant, and the included variables accounted for 11.50 percent of the variance in emotional control. Emotional control in turn was positively related to delayed adaptive transfer, and it accounted for 6.81 percent of the adjusted variance in this outcome.

Chapter 4: Discussion

In an increasingly globalized word, it is important to test whether theories and research within industrial/organizational psychology hold across cultures. The current study represents the first known research to test specific training interventions with samples outside of the United States and Western Europe. Further, the significant interactions between culture and training design elements speaks to the need to expand the focus within the training literature on attribute-treatment interactions. This literature has previously been limited to individual differences, including personality, goal orientation, age, and cognitive ability. The current study suggests that additional factors, especially societal culture, may also interact with training design to predict transfer. In addition, though the expected effects for stress were not supported, this study offers a first step towards integrating physiological reactions into the study of organizational training. This study also contributes to the growing literature on matching organizational practices to societal culture values in order to promote effectiveness (Aycan, Kanungo, & Sinha, 1999; Erez, 2000; Newman & Nollen, 1996).

The results of the current study lend support to the concept of culture-training match; the effectiveness of the two aspects of training interventions did indeed vary based on the cultural background of the trainee. The interactions between error instructions and trainee cultural background found in both the immediate and delayed adaptive transfer tasks shows that though error encouragement instructions are effective at increasing transfer for dignity trainees, they are actually counterproductive for face trainees. Further, the significant interaction between training structure and trainee cultural background on delayed adaptive transfer suggests that participants from face cultures benefit more from high-structure training than from low-structured, exploratory training interventions. This finding is consistent with the previous research on learning and education reviewed in the introduction. The interaction between training structure and trainee cultural background was also supported using the Face Subscale from the Honor, Dignity, and Face Scale (Severance & Gelfand, in preparation). Consistent with the theory presented in the introduction, these findings suggest that face drives the cultural differences in responses to different training structures.

Interestingly, the expected three-way interaction between trainee cultural background, error instructions, and training structure was not supported. Based on the current study, is unclear why the alignment of both structure and error instructions with cultural background did not produce superior transfer. One possibility is that the error instructions were overwhelmed when they were combined with the structure manipulation. An examination of the manipulation check items suggests that the structure manipulation may have been more salient than the error instructions, and there was “spillover” such that the structure manipulation inadvertently affected the trainees’ attitudes towards errors and their actual errors during training. An alternative theory is that the effects of the error instructions are dampened in the high structure condition, such that participants who are in this condition, regardless of their error instruction condition, feel they have less latitude to try to make errors. In contrast, when participants are encouraged to explore the task, the relatively lower levels of constraint provided by the instructions allow the participants in this condition to then follow the error instructions. This explanation is supported by the participant’s self-reported attempts to make errors during the training, though this manipulation check item did not map on to actual error behavior during the training.

In addition to the support for the culture-training match hypothesis, the current study also provides an elucidation of the mechanisms that link the culture, error instructions, and structure with training transfer. Contrary to expectations, physiological stress was not directly predicted by culture, error instructions, training structure, or the interaction of these variables. However, consistent with previous research, emotional control was found to be a key mediator in the path from training intervention to transfer (Keith & Frese, 2005). This finding suggests that emotional regulation is an important mechanism of training effectiveness that operates across multiple cultures.

Limitations and Future Directions

There are several limitations of the study that should be noted. First, though the error instructions were modeled after previous studies in which they were used successfully, the error instructions in the current study were not effective at altering participants' error behavior and error perceptions. Instead, as discussed, the structure manipulation seemed to overwhelm the error instruction manipulation. Future research could address whether this spillover is due to differing levels of constraint between the high- and low-structure training, as discussed above, or if there are other viable explanations based on trainee reactions and priorities. Nevertheless, though they did not show a significant main effect on most of the manipulation checks regarding error behavior and perceptions, the error instructions still produced a significant interaction with cultural background to predict adaptive transfer.

An additional limitation of this study is its reliance on a student sample, and in particular, its reliance on an American-based face sample. As described, special efforts were taken to recruit face trainees who were born and raised outside of the United States. Though these efforts were successful, the use of face participants studying abroad raises questions regarding the generalizability of the results. Foreign students studying abroad may differ from students studying within their home country on a number of factors that may impact their openness to errors and their reactions to the training interventions, including academic ability and openness to experience. Further, the experience of studying abroad may further impact sojourning students in ways that have downstream impacts on training. For example, research suggests that the experience of studying abroad may make sojourners more creative (Lee, Therriault, & Linderholm, 2012). Future research should attempt to deploy training designs in participants' home countries to attempt to sample a more diverse population within the targeted cultures.

A related limitation is the inability of the current design to isolate face as the driving mechanism behind the reported results. The significant interaction between scores on the face subscale and the training structure intervention lend credence to the theory that face is the mechanism driving the differences between the cultures in training transfer under different training structures. Nevertheless, it is possible that other variables may have impacted the results. For example, group differences in fatalism, tightness-looseness, or uncertainty avoidance may also impact reactions to training structure and error instructions (Gelfand, Frese, & Salmon, 2011). Further, the sample differences in language proficiency may also have impacted training transfer.

In addition, the unexpected lack of support for the hypotheses regarding stress measures was disappointing. Though the hypotheses were based on the extant literature within the fields of stress and culture, the lack of support may be due to more complex processes linking errors to stress reactions than were included in a current study (Folkman & Lazarus, 1985). For example, the current analyses did not explore how cognitive appraisals of challenge, threat, and resources may moderate stress reactions. It is possible that participants from dignity and face cultures have different construals of errors and mistakes. Specifically, there may be cultural differences in what actions are considered to be “errors” (versus, for example, “accidents”). Though the TANDEM system provides a concrete conceptualization of an error (i.e., incorrect classification decisions or violations of the defensive perimeters), cultural differences in error construals could have a significant impact of training structure and error instructions in other training environments. For example, in more ambiguous training contexts, the same action may be considered an error in one culture but not in another. Cultural differences in error construals, as well as whether the training is viewed as a challenge or threat, may have important implications for both stress responses during training as well as training transfer. Thus, future research could begin with more basic research on cultural differences in error construals, and then link these differences to immediate stress reactions following errors.

The inability to link error occurrence with the physiological metrics may be another explanation for the lack of findings in the current study. Though the TANDEM system can count the number of errors made during training, it does not provide a timestamp for these errors; perhaps a task that allows the analyses to temporally yoke error occurrence and stress measures, particularly heart rate, may provide support for the hypothesized relationships. In addition, the TANDEM system does not provide immediate feedback when a participant makes an error. Instead, the participant only finds out whether he or she made a mistake when a final engagement decision is made, and feedback on the number of errors made during trial is only presented at the end. The presence or absence of immediate feedback may moderate stress responses, such that immediate error feedback will show a significant relationship with stress responses. Further, other stress responses, such as galvanic skin response or even immediate neurological changes, should also be explored, as they may be a more sensitive metrics of stress reactions than the ones included in the current study. Finally, in the current research, the inclusion of only two cortisol measurements may not have provided sufficient sensitivity to understand stress responses to errors.

In addition to the previous points, future research should also explore how the social context of the training impacts training intervention effectiveness for face and dignity trainees. Since social presence is an amplifier of face concerns, the current student went to great lengths to ensure that the participants completed the training and transfer measures in private; this study thus provides a conservative test of presented hypotheses. It is likely that the differences found in the current study would be exacerbated if the training was completed in the presence of an evaluative authority, such as a trainer, or even simply in the presence of other trainees. That is, the cultural differences between the structure and unstructured conditions and the error avoidant and error encouragement conditions is expected to be even greater when training is completed in a public setting, especially if the trainee’s performance is being monitored and evaluated throughout the training. Given that many training studies use a classroom or computer lab with multiple trainees and at least one trainer, the social context of training may be an important factor to consider when exploring the interaction between trainee cultural background and training design.

Finally, future research should expand the cultures under investigation, and test the possibility of creating alternative interventions that can help participants benefit from the positive function of errors. The current study provides only a first foray into the possible interactions between trainee culture and training design. Future studies could explore the roles of cultural values such as fatalism and uncertainty avoidance in determining reactions to errors and training interventions that incorporate errors. Within the confines of the cultures included in this study, future research could test alternative instructional approaches in an attempt to incorporate errors into training in a nonthreatening way. For example, instructions that specifically address concerns over face and self-presentation may help face trainees better capitalize off of the learning opportunities provided in low-structure training interventions.

Conclusion

This study provides key extensions of previous research on training effectiveness. By exploring how participants from face and dignity cultures react to and learn under different training conditions, this study introduces cultural background as a new variable to explore within the training literature. This inclusion not only broadens the theories relating to training effectiveness, but the results of the study also suggest that organizations should avoid a “one-size fits all” approach to training their employees and instead consider trainee culture when developing and implementing training interventions.

Tables

Table 1

Summary of Key Differences between High- and Low-Structure Training Interventions

Dimension	High-Structure Training	Low Structure-Training
Trainee Role	Passive	Active
Source of Control	External (e.g., trainer, manual)	Trainee
Trainee Role	Receive transmitted information	Trial and error, infer strategies
Examples	Manuals, lectures, etc.	EMT, Active Training

Table 2

Comparison of Training Error Framing in Error Encouragement and Error Avoidant Instructions

Error-Avoidant Instructions	Error Encouragement Instructions
Errors to be avoided	Errors encouraged and normalized
Errors impede the learning process	Errors natural to learning process
Errors as punishment/bad practice	Errors aide learning

Table 3

Self-Reported Education Level of Dignity and Face Groups

Year	Dignity	Face	Total
Freshman	38	14	52
Sophomore	23	10	33
Junior	21	21	42
Senior	20	13	33
Graduate – Master's	4	42	46
Graduate - Doctoral	0	6	6
Total	106	106	212

Table 4

Factor Loadings for Exploratory Factor Analysis with Varimax Rotation of Honor, Dignity, and Face Scale

Item	Dignity	Face	Honor
People should make decisions based on their own opinions and not based on what others think.	.60		
People should NOT care what others around them think	.64		
How much a person respects himself is far more important than how much others respect him	.59		
People should stand up for what they believe in even when others disagree	.79		
People should be true to themselves regardless of what others think	.73		
People should speak their mind	.65		
It is important to maintain harmony within one's group		.60	
People should be very humble to maintain good relationships		.55	
People should minimize conflict in social relationships at all costs		.62	
People should be extremely careful not to embarrass other people		.64	
People should never criticize others in public		.49	
People should control their behavior in front of others		.43	
People must always be ready to defend their honor			.52
If a person gets insulted and they don't respond, he or she will look weak			.60
You must punish people who insult you			.60
It is important to promote oneself to others			.39
People always need to show off their power in front of their competitors			.61

* Factor loadings below .30 are not displayed.

Table 5

Means and Standard Deviations

Measure	*M*	*SD*
1. Dignity Subscale	3.69	0.75
2. Face Subscale	3.74	0.65
3. Emotional Control	4.26	0.64
4. Metacognition	3.62	0.89
5. Resting Fear	1.44	0.46
6. Resting Serenity	3.59	0.81
7. Mean Training Heart Rate	74.79	10.00
8. Resting Heart Rate	83.02	11.92
9. Resting Cortisol	13.55	21.06
10. Time 2 Cortisol	13.10	71.61
11. Time 3 Cortisol	10.82	54.48
12. Mean Training Score	486.76	316.57
13. Immediate Analogic Transfer Score	861.98	343.07
14. Immediate Adaptive Transfer Score	-1662.15	1161.99
15. Delayed Analogic Transfer Score	654.52	379.59
16. Delayed Adaptive Transfer Score	-1818.02	1229.46

Table 6.

Correlation Table

Measure	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	1															
2	.064	1														
3	.123	.114	1													
4	.017	.144*	.437**	1												
5	-.010	-.012	-.233**	-.021	1											
6	.136*	.055	.248**	.260**	-.329**	1										
7	.076	.022	-.027	-.042	.092	-.191**	1									
8	.061	.003	-.017	-.120	.030	-.107	.804**	1								
9	-.010	-.077	-.171*	-.094	-.007	.075	.043	-.009	1							
10	-.019	-.034	-.148*	-.068	.008	.079	-.009	-.067	.934**	1						
11	-.016	-.039	-.151*	-.069	.006	.082	-.012	-.073	.935**	.999**	1					
12	.047	.028	.161*	.033	-.007	.106	.072	.050	-.032	-.020	-.024	1				
13	.046	.104	.319**	.116	-.140*	.232**	.022	.013	-.122	-.090	-.091	.664**	1			
14	.051	.053	.283**	.110	-.053	.146*	-.011	-.042	-.040	-.032	-.035	.684**	.617**	1		
15	.024	-.027	.207**	.065	-.089	.064	-.002	-.060	-.079	-.058	-.058	.524**	.591**	.486**	1	
16	.066	.013	.261**	.113	-.060	.094	-.050	-.073	-.118	-.099	-.106	.584**	.491**	.670**	.632**	1

1 = Dignity Subscale, 2 = Face Subscale, 3 = Emotional Control, 4 = Metacognition, 5 = Resting Fear, 6 = Resting Serenity, 7 = Mean Training Heart Rate, 8 = Resting Heart Rate, 9 = Resting Cortisol, 10 = Time 2 Cortisol, 11 = Time 3 Cortisol, 12 = Mean Training Score, 13 = Immediate Analogic Transfer Score, 14 = Immediate Adaptive Transfer Score, 15 = Delayed Analogic Transfer Score, 16 = Delayed Adaptive Transfer Score, * $p < .05$, ** $p < .01$

Table 7

ANOVA Summary Table: Training Score by Structure, Error Instructions, and Culture

Source	*SS*	*df*	*MS*	*F*	η_p^2	*p*
Structure	1644844.70	1	1644844.70	17.39	0.08	0.00
Error Instructions	441.68	1	441.68	0.00	0.00	0.95
Culture	166547.27	1	166547.27	1.76	0.01	0.19
Structure x Error Instructions	5979.04	1	5979.04	0.06	0.00	0.80
Structure x Culture	18277.80	1	18277.80	0.19	0.00	0.66
Error Instructions x Culture	524.10	1	524.10	0.01	0.00	0.94
Structure x Error Instructions x Culture	10027.16	1	10027.16	0.11	0.00	0.75
Residual	19291409.75	204	94565.73			
Total	71377313.89	212				

Note. $N = 212$, $R^2 = .09$, Adjusted $R^2 = .06$

Table 8

ANOVA Summary Table: Immediate Analogic Transfer Trial Score by Structure, Error Instructions, and Culture

Source	*SS*	*df*	*MS*	*F*	η_p^2	*p*
Structure	412804.05	1	412804.05	3.49	0.02	0.06
Error Instructions	101326.82	1	101326.82	0.86	0.00	0.36
Culture	8622.98	1	8622.98	0.07	0.00	0.79
Structure x Error Instructions	18079.65	1	18079.65	0.15	0.00	0.70
Structure x Culture	9772.33	1	9772.33	0.08	0.00	0.77
Error Instructions x Culture	67462.88	1	67462.88	0.57	0.00	0.45
Structure x Error Instructions x Culture	90834.01	1	90834.01	0.77	0.00	0.38
Residual	24128529.28	204	118277.10			
Total	182353200.00	212				

Note. N = 212, R^2 = .03, Adjusted R^2 = .00

Table 9

ANOVA Summary Table: Immediate Adaptive Transfer Trial Score by Structure, Error Instructions, and Culture

Source	*SS*	*df*	*MS*	*F*	η_p^2	*p*
Structure	2734923.65	1	2734923.65	2.07	0.01	0.15
Error Instructions	501135.74	1	501135.74	0.38	0.00	0.54
Culture	197013.09	1	197013.09	0.15	0.00	0.70
Structure x Error Instructions	2912367.36	1	2912367.36	2.20	0.01	0.14
Structure x Culture	245182.39	1	245182.39	0.19	0.00	0.67
Error Instructions x Culture	7265351.83	1	7265351.83	5.49	0.03	0.02
Structure x Error Instructions x Culture	1497864.93	1	1497864.93	1.13	0.01	0.29
Residual	269743698.19	204	1322273.03			
Total	870596875.00	212				

Note. $N = 212$, $R^2 = .05$, Adjusted $R^2 = .02$

Table 10

ANOVA Summary Table: Delayed Analogic Transfer Trial Score by Structure, Error Instructions, and Culture

Source	*SS*	*df*	*MS*	*F*	η_p^2	*p*
Structure	25595.25	1	25595.25	0.18	0.00	0.68
Error Instructions	78094.22	1	78094.22	0.54	0.00	0.46
Culture	510590.06	1	510590.06	3.52	0.02	0.06
Structure x Error Instructions	8731.97	1	8731.97	0.06	0.00	0.81
Structure x Culture	105010.26	1	105010.26	0.72	0.00	0.40
Error Instructions x Culture	660.90	1	660.90	0.01	0.00	0.95
Structure x Error Instructions x Culture	80564.18	1	80564.18	0.55	0.00	0.46
Residual	27437316.58	189	145170.99			
Total	112635600.00	197				

Note. $N = 197$, $R^2 = .03$, Adjusted $R^2 = .00$

Table 11

ANOVA Summary Table: Delayed Adaptive Transfer Trial Score by Structure, Error Instructions, and Culture

Source	*SS*	*df*	*MS*	*F*	η_p^2	*p*
Structure	329857.92	1	329857.92	0.23	0.00	0.64
Error Instructions	201280.87	1	201280.87	0.14	0.00	0.71
Culture	1601498.82	1	1601498.82	1.09	0.01	0.30
Structure x Error Instructions	3122407.80	1	3122407.80	2.13	0.01	0.15
Structure x Culture	7961277.79	1	7961277.79	5.44	0.03	0.02
Error Instructions x Culture	4202378.99	1	4202378.99	2.87	0.01	0.09
Structure x Error Instructions x Culture	2612729.65	1	2612729.65	1.79	0.01	0.18
Residual	276457801.32	189	1462739.69			
Total	947392500.00	197				

Note. N = 197, R^2 = .07, Adjusted R^2 = .03

Table 12

ANOVA Summary Table: Training Score by Structure, Error Instructions, and Face

Source	*SS*	*df*	*MS*	*F*	η_p^2	*p*
Structure	1403627.97	1	1403627.97	15.23	0.07	0.00
Error Instructions	1021.83	1	1021.83	0.01	0.00	0.92
Face	1.93	1	1.93	0.00	0.00	1.00
Structure x Error Instructions	6860.70	1	6860.70	0.07	0.00	0.79
Structure x Face	277437.59	1	277437.59	3.01	0.01	0.08
Error Instructions x Face	139155.15	1	139155.15	1.51	0.01	0.22
Structure x Error Instructions x Face	22061.79	1	22061.79	0.24	0.00	0.63
Residual	18703964.62	203	92137.76			
Total	70031713.89	211				

Note. N = 211, R^2 = .10, Adjusted R^2 = .07

Table 13

ANOVA Summary Table: Immediate Adaptive Transfer Score by Structure, Error Instructions, and Face

Source	*SS*	*df*	*MS*	*F*	η_p^2	*p*
Structure	1656867.80	1	1656867.80	1.25	0.01	0.26
Error Instructions	421317.78	1	421317.78	0.32	0.00	0.57
Face	98034.12	1	98034.12	0.07	0.00	0.79
Structure x Error Instructions	3371346.79	1	3371346.79	2.54	0.01	0.11
Structure x Face	5196355.99	1	5196355.99	3.92	0.02	0.05
Error Instructions x Face	132003.94	1	132003.94	0.10	0.00	0.75
Structure x Error Instructions x Face	90212.92	1	90212.92	0.07	0.00	0.79
Residual	269015145.53	203	1325197.76			
Total	870394375.00	211				

Note. N = 211, R^2 = .04, Adjusted R^2 = .01

Table 14

ANOVA Summary Table: Delayed Adaptive Transfer Score by Structure, Error Instructions, and Face

Source	*SS*	*df*	*MS*	*F*	η_p^2	*p*
Structure	50943.37	1	50943.37	0.03	0.00	0.85
Error Instructions	87129.29	1	87129.29	0.06	0.00	0.81
Face	598000.21	1	598000.21	0.41	0.00	0.52
Structure x Error Instructions	2968754.42	1	2968754.42	2.01	0.01	0.16
Structure x Face	7343840.72	1	7343840.72	4.98	0.03	0.03
Error Instructions x Face	793583.08	1	793583.08	0.54	0.00	0.46
Structure x Error Instructions x Face	1837797.56	1	1837797.56	1.25	0.01	0.27
Residual	277183409.01	188	1474379.84			
Total	947286875.00	196				

Note. N = 196, R^2 = .05, Adjusted R^2 = .01

Table 15

ANOVA Summary Table: Immediate Analogic Transfer Score by Structure, Error Instructions, and Face

Source	*SS*	*df*	*MS*	*F*	η_p^2	*p*
Structure	305063.41	1	305063.41	2.62	0.01	0.11
Error Instructions	104035.79	1	104035.79	0.89	0.00	0.35
Face	273284.00	1	273284.00	2.35	0.01	0.13
Structure x Error Instructions	20760.20	1	20760.20	0.18	0.00	0.67
Structure x Face	178689.11	1	178689.11	1.54	0.01	0.22
Error Instructions x Face	18836.12	1	18836.12	0.16	0.00	0.69
Structure x Error Instructions x Face	23409.78	1	23409.78	0.20	0.00	0.65
Residual	23614097.93	203	116325.61			
Total	180610800.00	211				

Note. N = 211, R^2 = .04, Adjusted R^2 = .01

Table 16

ANOVA Summary Table: Delayed Analogic Transfer Score by Structure, Error Instructions, and Face

Source	*SS*	*df*	*MS*	*F*	η_p^2	*p*
Structure	11406.03	1	11406.03	0.08	0.00	0.78
Error Instructions	70105.95	1	70105.95	0.48	0.00	0.49
Face	77346.37	1	77346.37	0.53	0.00	0.47
Structure x Error Instructions	6607.10	1	6607.10	0.05	0.00	0.83
Structure x Face	247986.50	1	247986.50	1.69	0.01	0.19
Error Instructions x Face	22849.53	1	22849.53	0.16	0.00	0.69
Structure x Error Instructions x Face	2.43	1	2.43	0.00	0.00	1.00
Residual	27536280.27	188	146469.58			
Total	111243200.00	196				

Note. $N = 196$, $R^2 = .02$, Adjusted $R^2 = .00$

Table 17

Hierarchical Multiple Regression Analyses Predicting Mean Heart Rate during Training from Structure, Error Instructions, and Culture Controlling for Resting Heart Rate

	Mean Heart Rate during Training											
	Step 1			Step 2			Step 3			Step 4		
Variable	b	SE	b*	b	SE	b*	b	SE	b*	b	SE	b*
Resting Heart Rate	.67**	.04	.80	.67**	.04	.80	.67**	.04	.81	.67**	.04	.80
Structure				.01	.41	.00	.01	.42	.00	.01	.42	.00
Error Instructions				-.28	.41	-.03	-.29	.42	-.03	-.29	.42	-.03
Culture				.05	.42	.01	.05	.42	.00	.05	.42	.01
Struct x Err							-.47	.42	-.05	-.48	.42	-.05
Struct x Cult							-.02	.42	.00	-.02	.42	.00
Err x Cult							.25	.42	.03	.25	.42	.03
Struct x Err x Cult										.40	.42	.04
R^2		.65			.65			.65			.65	
Adj R^2		.65			.64			0.64			.64	
F		378.93**			93.68**			53.41**			46.83**	
ΔR^2		.65			.00			.00			.0	
ΔF		378.93*			.16			.55			.92	

† $p < .10$, * $p < .05$, ** $p < .01$, Culture is coded: -1 = Dignity, 1 = Face; Structure is coded: -1 = Structured, 1 = Exploratory; Error Instructions are coded: -1 = Error Avoidant, 1 = Error Encouragement.

Table 18

Hierarchical Multiple Regression Analyses Predicting Time 2 Cortisol during Training from Structure, Error Instructions, and Culture, controlling for Resting Cortisol

	Time 2 Cortisol											
	Step 1			Step 2			Step 3			Step 4		
Variable	b	SE	b*	b	SE	b*	b	SE	b*	b	SE	b*
Resting Cortisol	3.17**	0.08	0.93	3.19**	0.09	0.94	3.18**	0.09	0.94	3.18**	0.09	0.93
Structure				1.21	1.78	0.02	1.26	1.78	0.02	1.23	1.77	0.02
Error Instructions				1.19	1.78	0.02	1.21	1.78	0.02	1.23	1.77	0.02
Culture				1.26	1.78	0.02	1.31	1.78	0.02	1.36	1.77	0.02
Struct x Err							1.33	1.77	0.02	1.34	1.76	0.02
Struct x Cult							1.14	1.77	0.02	1.12	1.76	0.02
Err x Cult							3.25	1.77	0.05	3.22	1.76	0.05
Struct x Err x Cult										-2.97	1.76	-0.04
R^2		.87			.87			.88			.88	
Adj R^2		.87			.87			.87			.87	
F		1426.52**			354.29*			204.45*			180.87*	
ΔR^2		.87			.00			.00			.00	
ΔF		1426.52**			.16			.55			.92	

† $p < .10$, * $p < .05$, ** $p < .01$

Table 19

Hierarchical Multiple Regression Analyses Predicting Emotional Control during Training from Structure, Error Instructions, and Culture, Controlling for Resting Fear and Resting Serenity.

	Emotional Control during Training											
	Step 1			Step 2			Step 3			Step 4		
Variable	b	SE	b*	b	SE	b*	b	SE	b*	b	SE	b*
Resting Serenity	.15**	.05	.19	.16**	.05	.20	.19**	.06	.25	.19**	.06	.25
Resting Fear	-.23*	.10	-.17	-.25*	.10	-.18	-.24*	.10	-.18	-.24*	.10	-.17
Structure				.05	.04	.09	.05	.04	.08	.05	.04	.08
Error Instructions				-.06	.04	-.10	-.07	.04	-.10	-.07	.04	-.10
Culture				-.03	.04	-.04	-.03	.04	-.05	-.03	.04	-.05
Struct x Err							-.05	.04	-.07	-.05	.04	-.07
Struct x Cult							-.09*	.04	-.15	-.09*	.04	-.15
Err x Cult							-.07†	.04	-.12	-.07†	.04	-.12
Struct x Err x Cult										-.02	.04	-.03
R^2		.09			.11			.14			.15	
Adj R^2		.08			.08			.11			.11	
F		9.98**			4.85**			4.27**			3.82**	
ΔR^2		.09			.02			.04			.00	
ΔF		9.99**			1.38			3.08*			.27	

† $p < .10$, * $p < .05$, ** $p < .01$, Culture is coded: -1 = Dignity, 1 = Face; Structure is coded: -1 = Structured, 1 = Exploratory; Error Instructions are coded: -1 = Error Avoidant, 1 = Error Encouragement.

Table 20

ANOVA Summary Table: Metacognition during Training by Structure, Error Instructions, and Culture Note. *N* = 212, R^2 = .02, Adjusted R^2 = .00

Source	*SS*	*df*	*MS*	*F*	η_p^2	*p*
Structure	0.84	1	0.84	1.05	0.01	0.31
Error Instructions	0.33	1	0.33	0.42	0.00	0.52
Culture	0.46	1	0.46	0.57	0.00	0.45
Structure x Error Instructions	0.51	1	0.51	0.64	0.00	0.42
Structure x Culture	0.08	1	0.08	0.10	0.00	0.75
Error Instructions x Culture	1.37	1	1.37	1.73	0.01	0.19
Structure x Error Instructions x Culture	0.22	1	0.22	0.27	0.00	0.60
Residual	162.11	204	0.79			
Total	2938.58	212				

Note. *N* = 212, R^2 = .02, Adjusted R^2 = .00

Figures

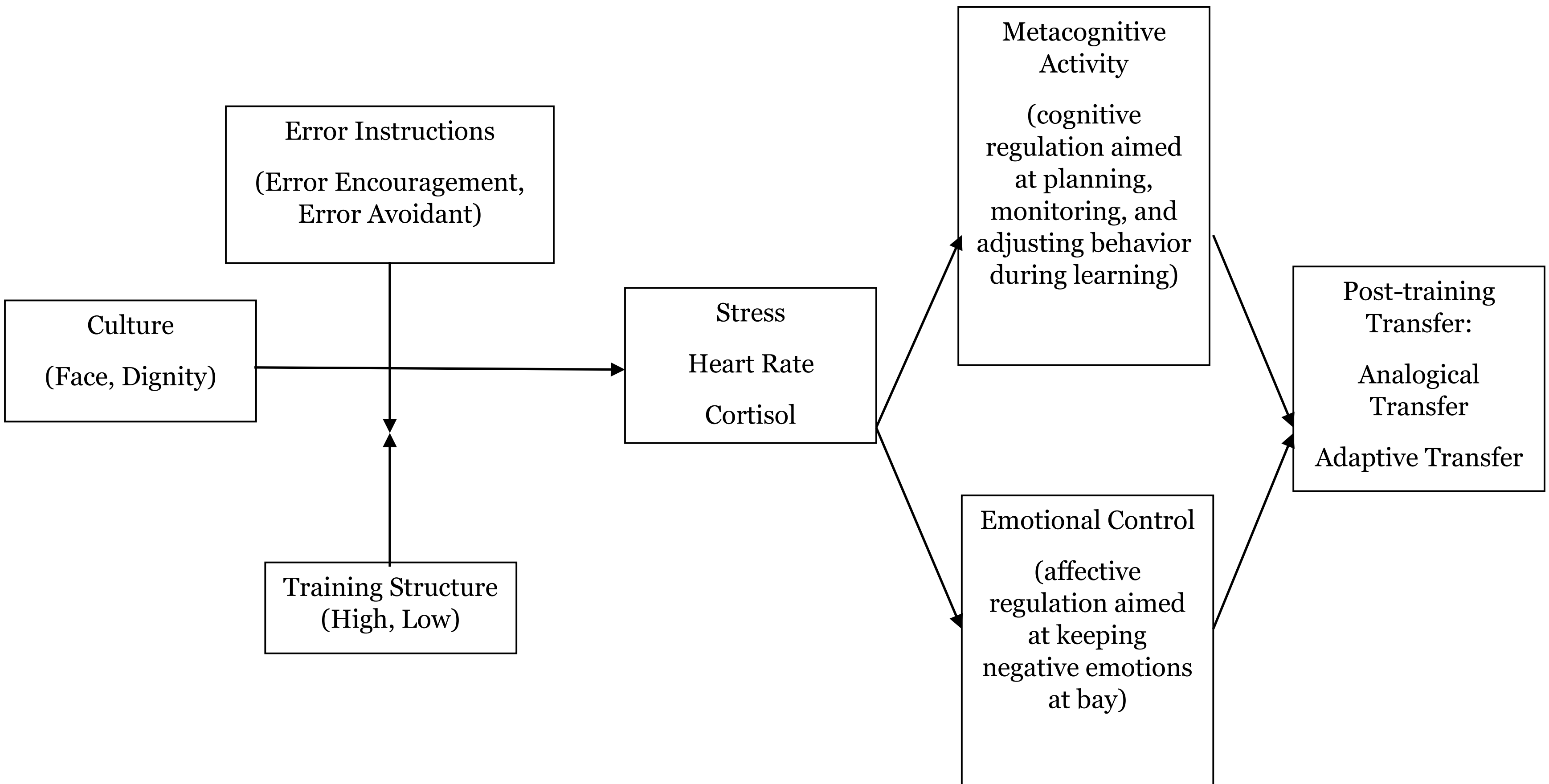

Figure 1. Proposed Model

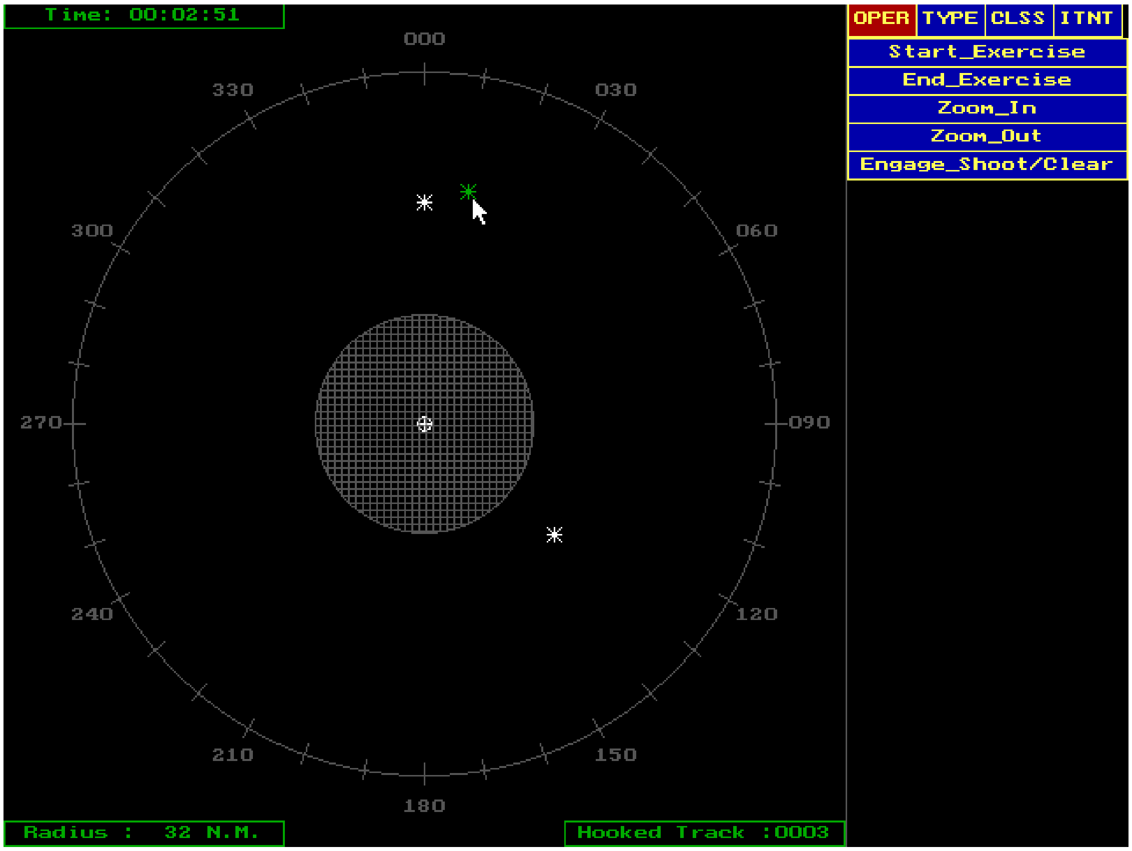

Figure 2. Sample TANDEM Screen

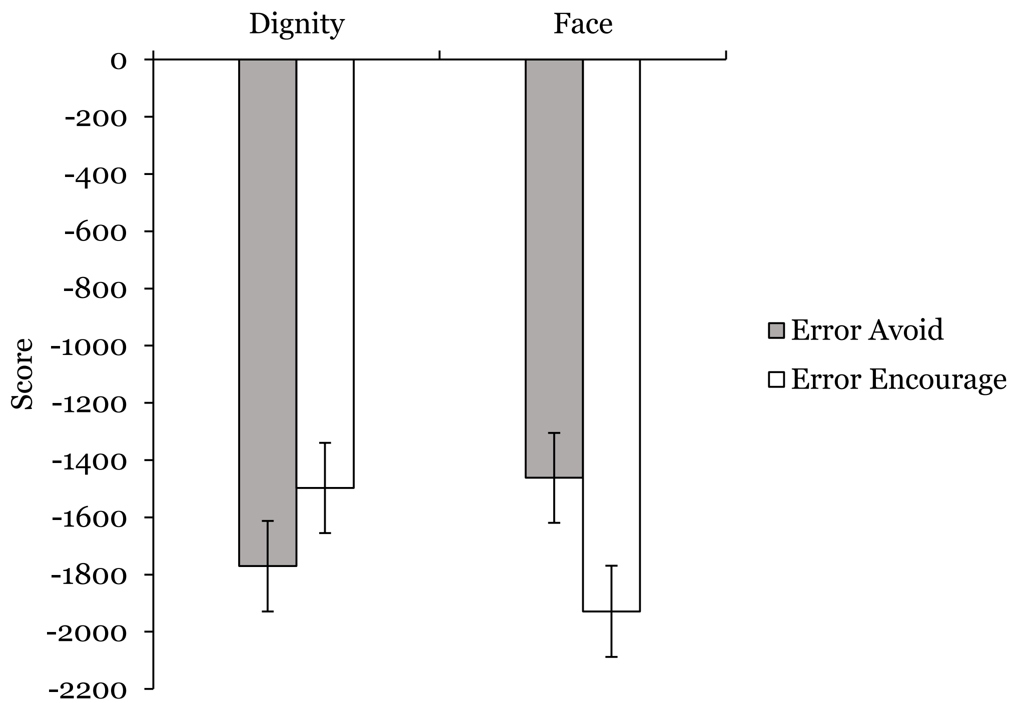

Figure 3. Graph of Significant Culture x Error Instruction Interaction for Immediate Adaptive Transfer Trial Score. Error bars represent standard errors.

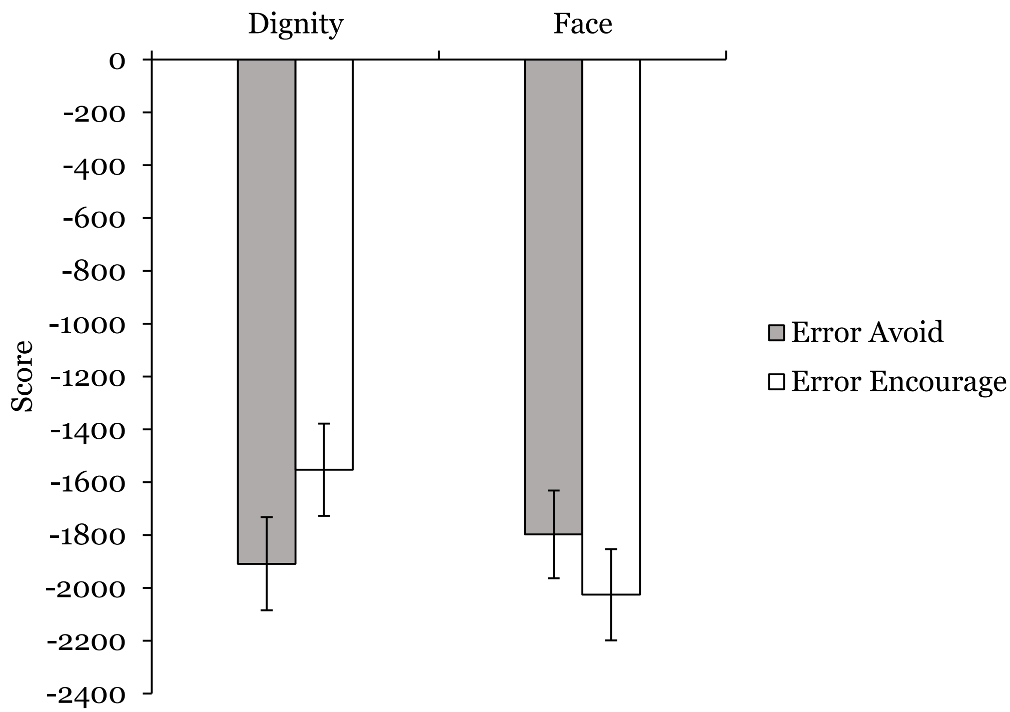

Figure 4. Graph of Marginal Culture x Error Instruction Interaction for Delayed Adaptive Transfer Trial Score. Error bars represent standard errors.

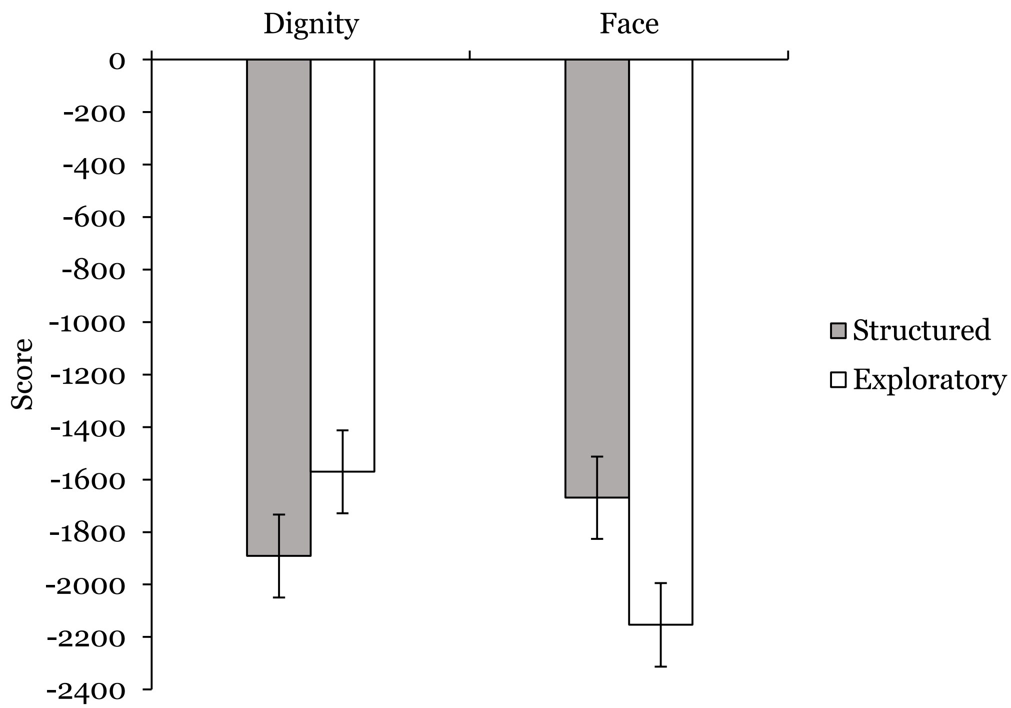

Figure 5. Graph of Significant Culture x Structure Interaction for Delayed Adaptive Transfer Trial Score. Error bars represent standard errors.

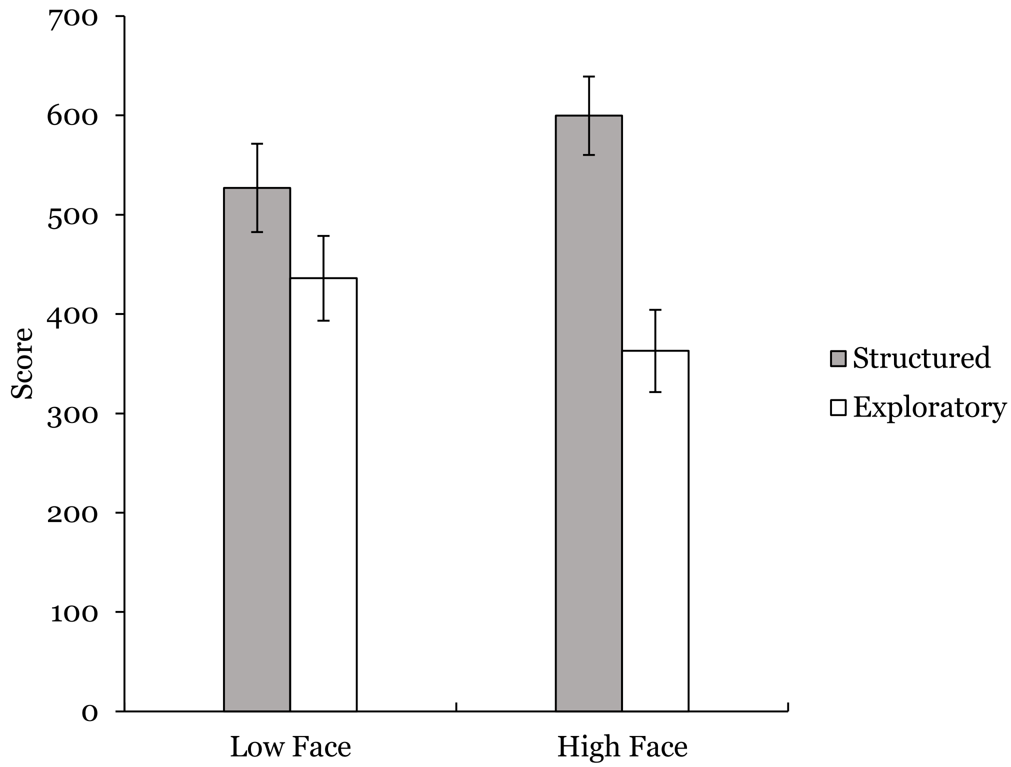

Figure 6. Graph of Marginal Face x Structure Interaction for Training Score. Error bars represent standard errors.

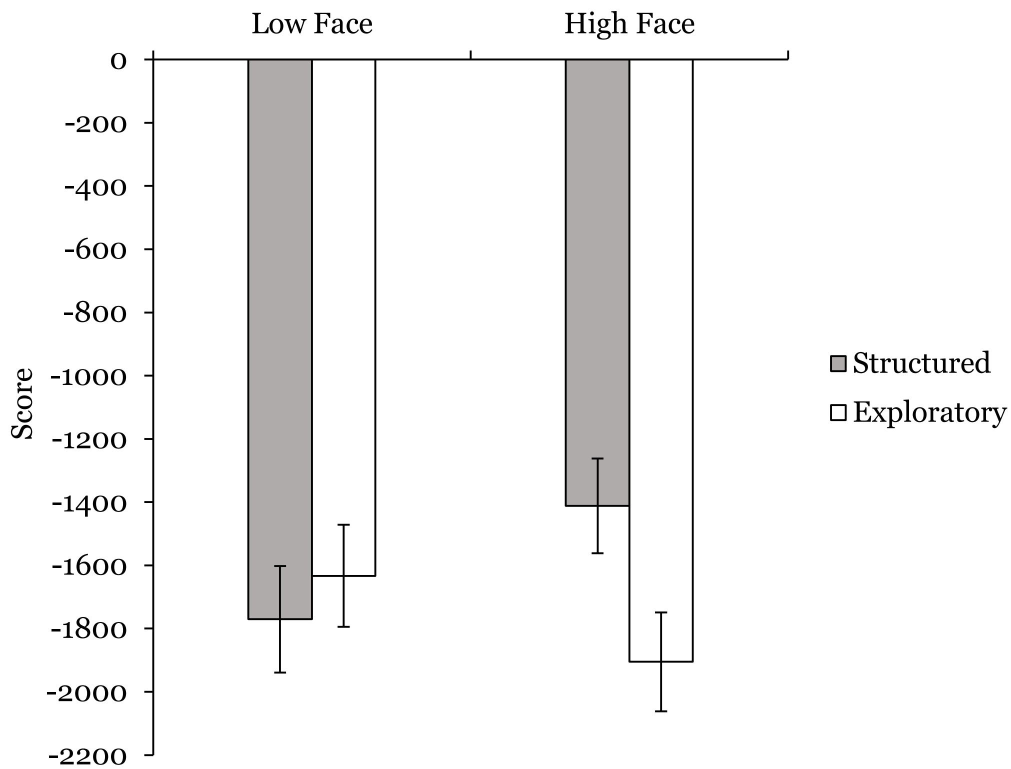

Figure 7. Graph of Significant Face x Structure Interaction for Immediate Adaptive Transfer Score. Error bars represent standard errors.

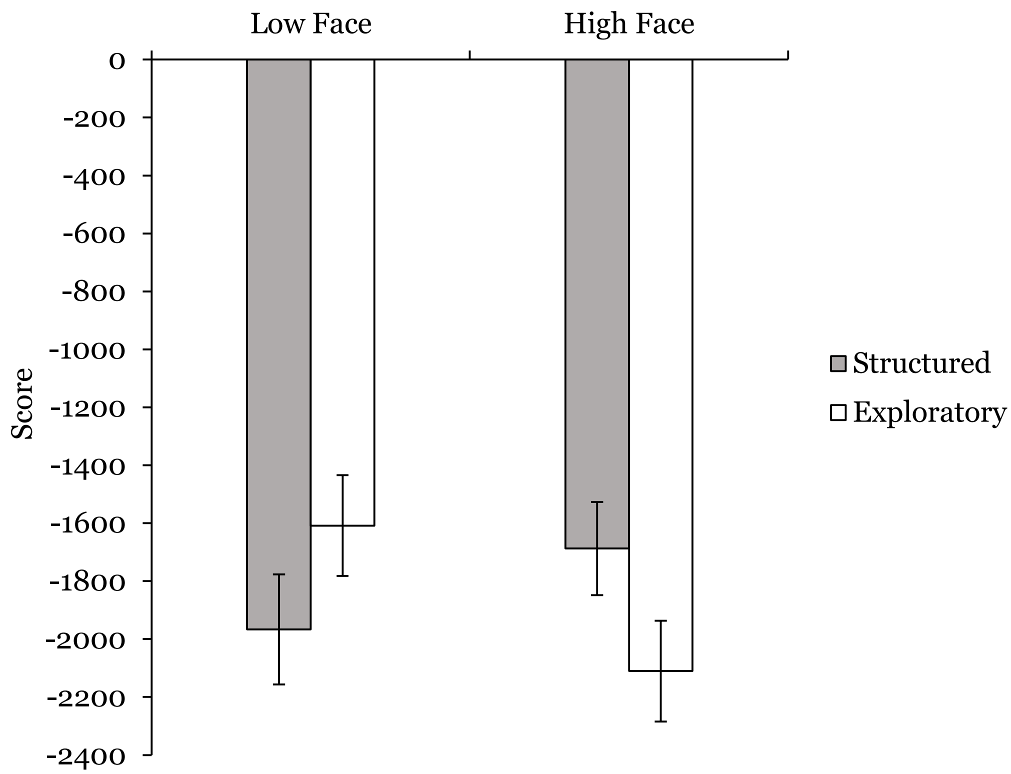

Figure 8. Graph of Significant Face x Structure Interaction for Delayed Adaptive Transfer Score. Error bars represent standard errors.

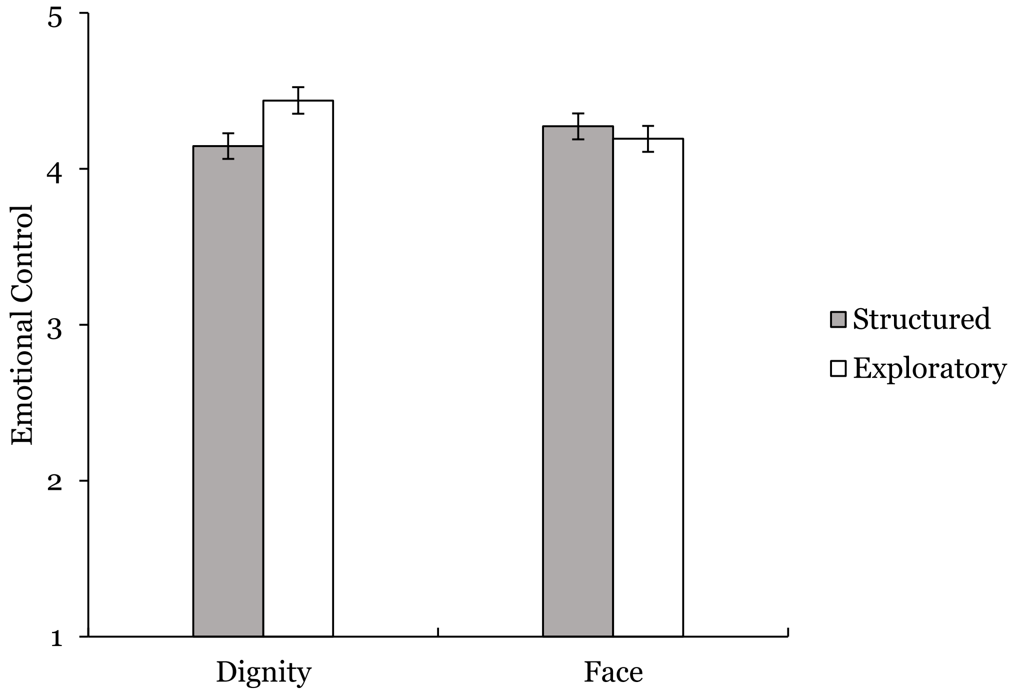

Figure 9. Graph of Significant Culture x Structure Interaction for Emotional Control, Controlling for Resting Fear and Resting Serenity. Error bars represent standard errors.

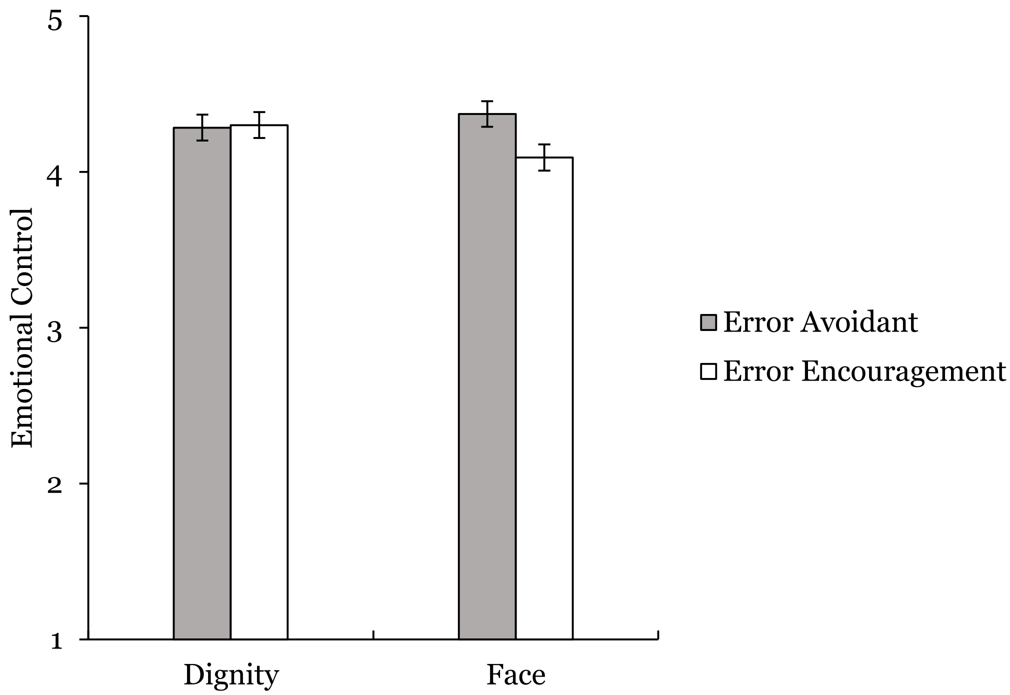

Figure 10. Graph of Marginal Culture x Error Instructions Interaction for Emotional Control, Controlling for Resting Fear and Resting Serenity. Error bars represent standard errors.

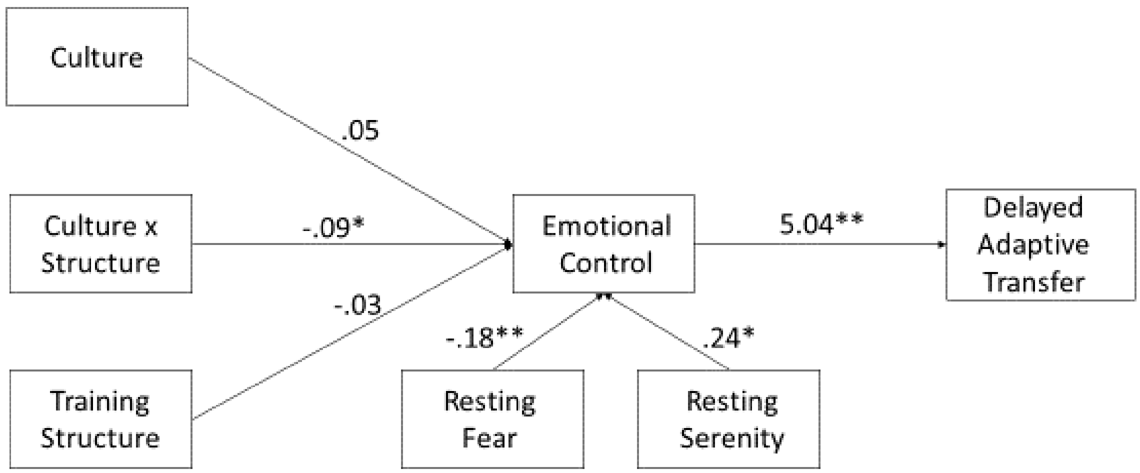

Figure 11. Path analysis results. Unstandardized path coefficients are reported. † $p < .10$ * $p < .05$ ** $p < .01$, Culture is coded: -1 = Dignity, 1 = Face; Structure is coded: -1 = Structured, 1 = Exploratory

Appendices

Appendix A
Study Consent Form

Project Title	Computer Task Training (Study 2; 3.5 hours)
Purpose of the Study	This research is being conducted by Dr. Michele Gelfand and Elizabeth Salmon at the University of Maryland, College Park, funded by the Department of Defense (FWA00005856). We are inviting you to participate in this research project because: 1) you are a University of Maryland student who is at least 18 years of age, and 2) you self-identify as European American, Caucasian American, White American, Asian American or Asian. The purpose of this research project is to understand how people from different backgrounds react and learn in organizational training contexts.
Procedures	This study will be conducted in three parts: **Part 1** is an online questionnaire. You will answer questions about yourself (e.g., *I often look for opportunities to develop new skills and knowledge.*), complete measures of logical reasoning, provide information on your performance on various standardized tests (e.g., SAT), and provide your demographic information (e.g., *In what country were you born?*). Part 1 should take approximately 20-30 minutes. **Part 2** will take place in laboratory spaces in the Biology-Psychology Building on the University of Maryland Campus. Part 2 will take place at least 24 hours after the completion of Part 1. In the second part of the study, you will be trained to complete a computerized task. You will also be asked to answer questions about your emotions (e.g., *To what extent do you feel excited?*), training experience (e.g., *After working at this activity for a while, I felt pretty competent.*), and reactions to the training (e.g., *I enjoyed doing this activity very much*), and you will answer questions assessing your knowledge of the training task. You will be asked to wear a heart rate monitor during Part 2 of the study. This monitor consists of a chest strap that will go under your clothes, and a wristwatch. You will be able to put on the chest strap in the privacy of a locked room. The chest strap will be sanitized between participants using alcohol wipes. You will also be asked to provide saliva samples for analysis of normal body chemistry (e.g., hormone levels). You will be provided with a cotton swab enclosed in a plastic vial. You will be asked to remove the swab from the vial and chew on it for 30 seconds, after which you will put the swab back into the plastic vial. You will be provided with gloves for handling the cotton swab and vial, and

	hand sanitizer will be provided. Part 2 will take approximately 2.5 hours (150 minutes). **Part 3** will take place approximately one week after Part 2, and will again be held in laboratory spaces in the Biology-Psychology Building on the University of Maryland campus. During Part 3, you will be asked to complete two trials of the computerized task that you learned during Part 2. You may also be asked to compete written items assessing your knowledge of the training task. Finally, you will answer questions about your experience of the training, and questions about the study in general. Part 3 will take approximately 20-30 minutes. Taken together, the entire study will take approximately 3.5 hours minutes (210 minutes).
Potential Risks and **Discomforts**	There are no known risks from participating in this research study. You may feel uncomfortable answering questions about yourself. You may skip any questions that make you feel uncomfortable. Though the researcher will make every effort to ensure confidentiality, a breach of confidentiality (i.e., the accidental release of participants' identity or data) is a risk. To mitigate the risks associated with a breach of confidentiality, the study will make every effort to protect your confidential information by not including your name on any collected data and storing the data on password protected computers in secure locations such as locked offices or storage rooms. Additional information on the steps taken by the study to protect your confidentiality can be found below in the section labeled "Confidentiality."
Potential Benefits	There are no direct benefits to participants. However, the results may help the researchers better understand learning and training in organizational contexts. The final report of the results of this study, whether the research yields significant new findings, will be shared with you upon request.
Confiden-tiality	Any potential loss of confidentiality will be minimized by 1) not including your name on collected data; (2) placing a code on collected data; (3) through the use of an identification key, the researcher will be able to link individual responses to participant identity; and (4) only the researcher will have access to the identification key. All data will be stored on password protected computers and in secure locations such as locked offices or storage rooms. The saliva samples you provide will be stored in freezers in locked storage rooms in the Biology-Psychology Building. The saliva samples may be stored for up to 5 years. The samples will be shipped to a laboratory for analysis. All samples will be destroyed

	after the hormonal analysis has been performed; the study team will keep the results of the hormonal analysis for ten years following the end of the study. If we write a report or article about this research project, your identity will be protected to the maximum extent possible. Your sensitive information may be shared with representatives of the University of Maryland, College Park or governmental authorities if you or someone else is in danger or if we are required to do so by law. Representatives of the U.S. Army Medical Research and Material Command (USAMRMC) are eligible to review research records for the purposes of protecting human volunteers. Even though we will take every effort to protect your privacy, a breach of confidentiality may become a risk due to unforeseen events.
Medical Treatment	The University of Maryland does not provide any medical, hospitalization or other insurance for participants in this research study, nor will the University of Maryland provide any medical treatment or compensation for any injury sustained as a result of participation in this research study, except as required by law.
Compen-sation	You will receive $50.00 for completing all three parts of the study. You will receive $5.00 for completing Part 1, $25.00 for completing Part 2, and $5.00 for completing Part 3, and you will receive an additional $15.00 bonus for completing the entire study at the end of Part 3. You will be responsible for any taxes assessed on the compensation. ☐ Check here if you expect to earn $600 or more as a research participant in UMCP studies in this calendar year. You must provide your name, address and SSN to receive compensation. ☐ Check here if you do not expect to earn $600 or more as a research participant in UMCP studies in this calendar year. Your name, address, and SSN will not be collected to receive compensation.
Right to Withdraw and Questions	Your participation in this research is completely voluntary. You may choose not to take part at all. If you decide to participate in this research, you may stop participating at any time. If you decide not to participate in this study or if you stop participating at any time, you will not be penalized or lose any benefits to which you otherwise qualify. Your grades or standing in the university will not be affected by your choice to participate or not participate in this study. If you decide to stop taking part in the study, if you have questions, concerns, or complaints, or if you need to report an injury related to the research, please contact the investigator:

<table>
<tr><td></td><td colspan="2">Principle Investigator: Michele J. Gelfand
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<tr><td>Participant Rights</td><td colspan="2">If you have questions about your rights as a research participant or wish to report a research-related injury, please contact:

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This research has been reviewed according to the University of Maryland, College Park IRB procedures for research involving human subjects.</td></tr>
<tr><td>Statement of Consent</td><td colspan="2">Clicking “I consent to participate” and filling out your name and date below indicates that you are at least 18 years of age; you have read this consent form or have had it read to you; your questions have been answered to your satisfaction and you voluntarily agree to participate in this research study. You may print a copy of this consent form.

If you agree to participate, please sign your name below.</td></tr>
<tr><td rowspan="3">Signature and Date</td><td>☐ I consent to participate</td><td>☐ I DO NOT consent to participate</td></tr>
<tr><td>NAME OF PARTICIPANT

[Please Type]</td><td></td></tr>
<tr><td>DATE</td><td></td></tr>
</table>

Appendix B

Honor, Dignity, and Face Scale (Severance & Gelfand, in preparation)

In the next few pages you will be asked your opinion about what **YOUR PARENTS, WHILE YOU WERE GROWING UP,** thought about various issues. Your responses are completely anonymous. Remember, these questions ask about what **YOUR PARENTS, WHILE YOU WERE GROWING UP,** thought.

TO WHAT EXTENT DID YOUR PARENTS, WHILE YOU WERE GROWING UP, BELIEVE THAT...

1	2	3	4	5
Not at all		**Somewhat**		**Very much**

1. People should make decisions based on their own opinions and not based on what others think
2. People should NOT care what others around them think
3. How much a person respects himself is far more important than how much others respect him
4. People should stand up for what they believe in even when others disagree
5. People should be true to themselves regardless of what others think
6. People should speak their mind
7. It is important to maintain harmony within one's group
8. People should be very humble to maintain good relationships
9. People should minimize conflict in social relationships at all costs
10. People should be extremely careful not to embarrass other people
11. People should never criticize others in public
12. People should control their behavior in front of others
13. Men need to protect their women's reputation at all costs
14. People must always be ready to defend their honor
15. If a person gets insulted and they don't respond, he or she will look weak
16. You must punish people who insult you
17. It is important to promote oneself to others
18. People always need to show off their power in front of their competitors

Appendix C
Demographics Items from Part 1 Online Questionnaire

1. What is your gender? Male Female (Please circle)
2. What is your age?________
3. What is your ethnicity? ______________________________
4. What is your nationality? ______________________________
5. Are you a citizen of the United States? YES NO
6. If you grew up in the United States, in what state did you spend the majority of your
7. childhood? __________________
8. In what country were you born? __________________
9. In what country did you spend the majority of your childhood? __________________
10. If you were not born in the United States, how long have you been living in the US? __________________
11. What is your first language? __________________
12. Do you speak any additional languages? YES NO
    a. If Yes, please indicate the additional languages you speak and your proficiently
       Language:
       Proficiency:
          Level 1 (Elementary proficiency; can fulfill travelling needs and conduct themselves in a polite manner

          Level 2 (Limited working proficiency; able to satisfy routine social demands and limited work requirements

          Level 3 (Professional working proficiency; able to speak the language with sufficient structural accuracy and vocabulary to participate effectively in most conversations on practical, social, and professional topics

          Level 4 (Full professional proficiency; able to use the language fluently and accurately on all levels and as normally pertinent to professional needs)

          Level 5 (Native or bilingual; speaking proficiency equivalent to that of an educated native speaker)

13. What language was spoken in your home when you were growing up? __________________

14. What is your religion? ___________________________

15. What is your marital status? (please mark one)

_____Single ______Engaged _____Married _____Separated _____Divorced _____Widowed

16. In your opinion, what socio-economic class do you belong to? (Please circle one)

Upper upper	(e.g., rich, influential, highly educated)
Lower upper	(e.g., professionals, such as physicians, lawyers; owner of a major business)
Upper middle	(e.g., professionals, such as teachers, social workers; owner of a good business; owner of a large farm)
Lower middle	(e.g., clerical, small entrepreneurs; farmer)
Upper lower	(e.g., skilled worker, small farmer)
Lower lower	(e.g., unskilled, unemployed)

17. What is your major? ____________________________

18. What is your year in school? (Circle one)

Freshman Sophomore Junior Senior Graduate

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