Effects of Big 5 Personality Traits on Outcomes for Error Encouragement and Error Avoidant Training

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By

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I HEREBY RECOMMEND THAT THE THESIS PREPARED UNDER MY SUPERVISION BY Keith A Leas ENTITLED Effects of Big 5 Personality Traits on Outcomes for Error Encouragement and Error Avoidant Training BE ACCEPTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF Master of Science

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ABSTRACT

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Effects of Big 5 Personality Traits on Outcomes for Error Encouragement and Error Avoidant Training.

The purpose of this study was to examine the effects of the type of training used (error avoidant or error encouragement) as a moderator of the relationship between personality variables and training outcomes. Specifically, we hypothesized that we would observe stronger effects of personality (i.e., conscientiousness and openness) on performance (Hypothesis 1) and affectivity (Hypothesis 2) for individuals in the error encouragement condition than for individuals in the error avoidant condition. Further, we hypothesized that we would see stronger moderating effects for training type for the above personality variables than for extraversion or agreeableness (Hypothesis 3). We recruited 257 participants from a Midwestern university and randomly assigned them to either error encouragement or error avoidant training conditions. Unexpectedly, the only significant moderating effect found involved extraversion such that individuals with higher levels of extraversion performed significantly worse than those with lower levels of extraversion in the error avoidant condition but not in the error encouragement condition. Our manipulation check indicated that we induced the intended psychological effects on the participant, yet we failed to detect a significant main effect for training type on either training performance or affect. Additionally, our results bring into question the assumption that performing errors lead to frustration, as we observed a significant overall reduction in frustration during the task. These results suggest that more research is needed to identify the mechanisms through which error encouragement training approaches lead to different training outcomes when compared to error avoidant training.
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Effects of Big 5 Personality Traits on Outcomes for Error Encouragement and Error Avoidant Training

Introduction

Organizations spend considerable resources to train their employees. However, do companies spend their resources on the most effective method of training? Researchers have approached training traditionally by walking trainees step-by-step through how to perform the task while avoiding any mistakes (e.g., Bandura, 1997). This approach to training will teach the trainee how to perform the task but might not adequately prepare him/her to handle mistakes or unexpected events while performing the task.

Frese, Brodbeck, Heinbokel, Mooser, Schleiffenbaum, and Thiemann (1991) recently proposed an alternative method of training in which trainees are encouraged to explore the task and to make mistakes in order to learn from the process of identifying and correcting those mistakes. This error encouragement method of training should lead the trainee to develop a more comprehensive schema of the task than that which trainees develop during an error avoidant approach and better prepare the trainee to handle abnormal occurrences while performing the task.

Research comparing error encouraging and error avoidant training approaches has shown mixed results (e.g., Debowski, Wood, & Bandura, 2001; Wood, Kakebeeke, Debowski, & Frese, 2000). Several attempts have been made to identify moderators which can explain these mixed results, including variables such as clarity of feedback (Keith & Frese, 2008) and metacognition (Keith & Frese, 2005). I suggest that situational and dispositional factors may also be influencing the effects of the two training approaches. In this study, I will examine personality as a dispositional factor influencing training outcomes. I will use the Big 5 model of personality,
a widely accepted model of personality, as the framework for examining influences on training outcomes. I posit that personality variables related to achievement or cognitive ability will have substantial differential effects on performance depending on training type. Specifically, I expect that conscientiousness and openness will have a stronger effect on training performance for the error encouragement training type than the highly structured error avoidant training approach. The lower level of structure imposed in the error encouragement training approach allows for more freedom for the need-for-achievement subfacet of conscientiousness and the intelligence subfacet of openness to influence the performance outcome of the training. Similarly, I posit that personality variables related to anxiety will have substantial effects on affective outcomes of training and differential effects depending on training type. Specifically, I expect that neuroticism will have a stronger effect on trainees’ affect towards the training for the error encouragement approach than the error avoidant approach. The lower level of structure imposed and increased number of errors committed in the error encouragement approach may lead to increased anxiety for the trainee. Finally, I posit that personality variables unrelated to achievement, anxiety, or cognitive ability will not differentially affect training outcomes for different training types. Specifically, I expect that extraversion and agreeableness will have smaller differential effects on performance or affective outcomes for the two training types.

Review of Training Literature

Noe (1999) indicated that contemporary corporate views of training posit that training programs can lead to increased financial performance and better enable companies to compete when faced with difficult challenges. Through training, companies gain the benefits of having a workforce with the diverse skills that companies need to compete while employees gain skills needed to remain valuable to the company or aid them in seeking other opportunities. Arthur,
Bennett, Edens, and Bell (2003) noted that training is one of the most often used ways of enhancing worker productivity and disseminating the goals of the organization to new workers and that U.S. companies spend tens of billions of dollars annually to implement and maintain such training programs. Salas and Cannon-Bowers (2001) noted that training is the process of imparting of knowledge, skills, and abilities to trainees. Because of the amount spent on training, researchers have focused substantial attention on the transfer of training, that is, the retention of knowledge skills and abilities learned in training over time for use in the job environment (see Goldstein & Ford, 2002, for a discussion).

As companies embrace the value of training more and more and begin to seek new ways to train and motivate, the question of what are the best approaches to training arises. Arthur et al. (2003) noted that trainers and researchers have control over four aspects of training: the type of evaluation criteria used, the implementation of training needs assessment, the skill or task characteristics trained, and the match between the skill or task characteristics and the training delivery method. This study will focus primarily on the last item on this list by examining two alternative forms of training delivery.

*Error Avoidant Training*

Traditional training programs typically involve teaching individuals how to perform a given task by teaching the individual step-by-step instructions on how to perform the task (Frese, et al., 1991). One approach to this traditional style of training is guided mastery training (Bandura, 1997). This approach starts trainees at an easy level on the task and guides them step-by-step through completing that task. Once trainees complete a given level of difficulty, they progress to progressively more difficult levels of the task. Substantial research exists demonstrating that traditional training has beneficial effects on performance (e.g., see Goldstein
& Ford, 2002, for a review). However, one limitation to this approach is that the only thing trained is how to do the task properly. Hutchins (1995) indicated that error is inevitable in any task. The question then arises as to how someone trained to do things the “correct” way would handle a problem or error. Curiously enough, until relatively recently training research has not considered the potential positive role of errors in training.

Error Encouragement Training

Until recently, relatively little research had been published in the training literature considering the role of errors in the training process (Frese et al., 1991). Frese and colleagues suggested that we have traditionally viewed errors in a negative light because of two influences, the behaviorist and the humanistic perspectives. Both perspectives have a negative view of errors, so traditional training approaches have emphasized doing things the “correct” way and avoiding errors. As Frese et al. (1991) pointed out, from a behaviorist perspective errors are associated with the concept of punishment in operant conditioning. That is, desired behaviors are reinforced and undesired behaviors are either punished or placed on an extinction schedule. Frese et al. (1991) also suggested that the humanistic approach discouraged errors in training. The rationale behind this belief is that committing errors leads to frustration and is anxiety provoking, thus training programs should avoid errors to minimize frustration and anxiety.

In contrast, Frese et al. (1991) pointed to the potential positive effects of errors in training. They suggested that trainees who make errors have the opportunity to develop and incorporate problem-solving strategies into their schemas for the task. With these more comprehensive schemas, the trainees, in theory, would be equipped to handle problems that may arise when performing the task outside of the training environment. Such persons would already
be familiar with useful troubleshooting techniques and knowledge of what approaches are unlikely to yield results, which could save both time and valuable resources.

Various error-based learning approaches have emerged in recent years (see Table 1). One type of error-based learning approach is exploratory learning (e.g., Keith & Frese, 2005; Lazar & Norcio, 2003). This type of learning allows users to interact with the task to be trained (i.e., computer program, driving simulator, etc.) with only minimal structure provided by the trainer or experimenter. Lazar and Norcio (2003) used this approach to train novice users in the use of the World Wide Web. These users, who were non-university students who had never taken a class on the Internet and did not use the Internet as part of their job, were informed about the fundamentals of using a personal computer with Netscape Navigator Internet browsing software. Lazar and Norcio (2003) then gave the users a list of ten questions for which they were to use the Internet to find the answers. They found that participants who trained using exploratory learning techniques alone were able to answer the questions more quickly as well as answer more questions correctly than participants trained using more traditional, error-avoidant strategies or other error-based learning techniques alone or in combination.
Table 1  

*Summary of Training Types*

<table>
<thead>
<tr>
<th>Training Type</th>
<th>Error Approach Type</th>
<th>Uses Error Framing Statements</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guided Mastery Training</td>
<td>Avoidant</td>
<td>No</td>
<td>Trainees guided step-by-step through all task procedures. Focuses only on correct methods to perform task.</td>
</tr>
<tr>
<td>Exploratory Learning</td>
<td>Encouragement</td>
<td>No</td>
<td>Trainees receive minimal instruction on how a task works and then experiment with task.</td>
</tr>
<tr>
<td>Error Management Training</td>
<td>Encouragement</td>
<td>Yes</td>
<td>Trainees receive minimal instruction on how a task works and then experiment with task. Different from Exploratory Learning in that trainees also receive framing statements outlining positive functions of errors in learning.</td>
</tr>
<tr>
<td>Enactive Exploration</td>
<td>Avoidant initially, then shifts to Encouragement (see description)</td>
<td>Yes</td>
<td>Combination of Guided Mastery and Error Management Training approaches. Trainees start with Guided Mastery training to develop basic skills for task, then switch to Error Management Training to further explore task and develop and refine skills.</td>
</tr>
</tbody>
</table>

Another error-based learning approach is *error management training* (Frese et al., 1991). Similar to exploratory learning, trainees experimented with the focus object of the training such as a computer program with relatively minimal direction given by the trainer or experimenter.

Keith and Frese (2005) defined specific characteristics in error management training that are not
in exploratory learning training. First, the goals set for the task are relatively difficult for the participants (Keith & Frese, 2005). By setting difficult goals, the researchers ensured that the probability of errors was very high (Keith & Frese, 2005). Through solving problems that arise from the errors, the trainee develops a comprehensive schema for the task (Frese et al., 1991). The second and perhaps more definitive characteristic of error management training is the use of a set of several framing statements that try to portray errors in a positive light (Keith & Frese, 2005). Examples of these framing statements for a computer program training situation, typically posted on a card on or near the computer terminal itself, are statements such as “I have made an error. Great!”, “There is a way to leave the error situation”, “Look at the screen”, and “I watch what is on the screen and what is changing” (Chillarege, Nordstrom, & Williams, 2003). These framing statements highlight the positive aspects of negative feedback as well as combat frustration and anxiety that may result from committing errors (Frese et al., 1991).

A study by Heimbeck, Frese, Sonnentag, and Keith (2003) tested the effectiveness of the framing statements used in error management training in relation to error management training without framing statements (which would essentially be exploratory learning with a difficult task) and traditional, error-avoidant training. They found that when they used the framing statements, error management training led to significantly better performance than the other two types of training. They found no significant differences in performance between error management training without framing statements and error-avoidant training.

Another form of error encouragement training is enactive exploration (Debowski, Wood, & Bandura, 2001; Wood, Kakebeeke, Debowski, & Frese, 2000). Enactive exploration is a training approach that tries to incorporate two of the different training approaches already discussed. Because a trainee needs some basic knowledge of a task in order to perform the task,
enactive exploration begins with guided mastery training (Wood et al., 2000). After the trainees have developed sufficient fundamental skills under the guided mastery training, they begin to train in a more exploratory fashion. This exploration phase is very similar to error management training and includes the use of the same or similar framing statements as error management training to try to alleviate the frustration and anxiety that might result from making errors and framing errors as potential learning experiences (Wood et al., 2000). Wood et al. found that enactive exploration was significantly better than guided mastery training alone for performance on a CD-ROM database search task, and participants had significantly higher intrinsic motivation for the task during the training tasks even though there was no difference during a pre-training screening of the participants. They found no significant differences in search strategies between the two training conditions. Curiously, Debowski et al. (2001) found no significant differences for intrinsic motivation but found that guided mastery led to higher self-efficacy and greater task satisfaction than an enactive exploration approach on the same type of CD-ROM database search task. They also found that participants using an error avoidant guided mastery approach had more effective search strategies, used less effort, made fewer errors, rejected fewer lines of search, and had higher overall performance than participants using the error encouraging enactive exploration approach. These results are nearly the opposite of the results reported by Wood et al. (2000). This is unusual in that many aspects of the Wood et al. and Debowski et al. studies were similar, such as using the same CD-ROM database search task and university student samples. Debowski et al. in all respects appeared to be an attempt to extend upon the Wood et al. study by adding additional measures to the ones used in the former study. However, as noted before, Wood et al. found significant benefits for enactive exploration on intrinsic motivation but found no differences in strategy or performance, but Debowski et al.
found significant benefits for guided mastery training on performance and strategy and no
differences in intrinsic motivation.

Comparison of Error Avoidant and Error Encouragement Approaches

Ohlsson (1996) defined errors as inappropriate actions taken when performing a task or as actions that are not on the shortest or most direct path to the desired outcome. Both Ohlsson (1996) and Hutchins (1995) described errors as an inevitable part of any system. Hutchins (1995) noted that a training system should try to minimize these errors. Because one cannot eliminate these errors, Hutchins (1995) outlined four key considerations in examining systems. The first consideration is access, or the idea that in order to detect an error an individual must be able to access the behavior in error or have some indication of it. In other words, there must be some type of feedback. Noe (1999) suggested that feedback ideally should focus on the specific behavior in question. Hutchins’ (1995) second consideration is knowledge or expectation, which is the idea that the individual must have knowledge of the process or some expectation of the correct outcome to judge when something is in error. The third consideration is attention, which he described as the process of attending to an error and monitoring it in terms of expectations. Finally, there is the consideration of perspective. Hutchins (1995) described this as the notion that some approaches are better than others at cueing attention-related expectations relevant to the evaluation of the behavior.

Hutchins (1995) indicated that it is possible that we can learn from errors through three different modes. First, we can learn from detecting and correcting an error, either an error we ourselves committed or one we catch another committing. Ohlsson (1996) suggested that we detect these errors through comparing our expectations of the outcome with the actual outcome. By detecting or diagnosing the error, we have the opportunity to gain new insights regarding the
system and develop new skills. The second mode of learning that Hutchins (1995) described is learning from the correction of our own mistakes, which differs from detecting and correcting an error in that we may not have initially detected the error when it occurred. He proposed that even when feedback lacks instructional content, the correction process might increase our understanding of the requirements of a task beyond simply understanding correct performance alone. Finally, we can learn from the correction of mistakes committed by others. By observing the processes that another individual goes through to correct an error when it occurs, we can gain a better understanding of the system. Noe (1999) suggested that optimally the person observed should share characteristics with the trainee, and the trainee should be able to identify with the task.

If we examine the error encouragement and error avoidant training approaches discussed in the previous section in terms of Hutchins’ (1995) four considerations, we find that there are strengths and weaknesses in each approach. Bandura’s (1997) guided mastery training approach focuses heavily on developing a trainee’s knowledge of a process. The design of both the training and the task can influence the access to errors and the attention given to them. Guided mastery training could conceivably incorporate some basic troubleshooting instructions, but the emphasis of this style of training is on how to perform the task in the correct manner. If one incorporates a troubleshooting component into this style of training at all, it receives only limited attention. Guided mastery training is weakest in terms of Hutchins’ (1995) consideration of perspective. Because guided mastery training inherently focuses on showing the trainee the “correct” way to perform a task, the training fails to prepare a trainee to be able to evaluate the potential effectiveness of one given approach over another. Indeed, because guided mastery
training is relatively narrow in focus a trainee may entirely lack the skills and knowledge needed to evaluate or correct a problem that was unanticipated during training.

Exploratory learning may be just the opposite of guided mastery training in terms of strengths and weaknesses in terms of Hutchins’ (1995) four considerations. By its nature, exploratory learning allows a trainee the opportunity to try different approaches and see the results of those differing approaches. Through this, the trainee is more adequately prepared in terms of perspective. Problems may arise for the other three considerations however. Because exploratory learning focuses on allowing the trainees to experiment on their own, it gives little emphasis to providing the trainee with knowledge or expectations. Without this emphasis, there is a danger that the trainee may lack access to an error through ignorance of the error. If the nature of the feedback for the task is subtle, the trainee may not realize that what they are doing is wrong and not know that they need to give attention to the behavior in question and attempt to make corrections to it.

Error management training has strengths and weaknesses similar to those of exploratory learning approaches in terms of Hutchins’ (1995) four considerations. Similar to exploratory learning, error management training’s emphasis on experimenting with the task can allow a trainee to develop more fully in terms of perspective than traditional training approaches such as guided mastery training. However, this emphasis on self-guided exploration can lead to unprepared trainees in terms of knowledge of the task or expectations of what a correct outcome should be. Likewise, access may or may not be an issue depending on the quality of the feedback that the task provides the trainee. Probably the main area where error management training is stronger than exploratory learning is in the area of attention. Because the defining attribute of error management training is the framing statements that error management training
provides that frame errors in a positive light and as a learning opportunity, the trainee may try to be more aware of any errors they make simply because this type of training emphasizes errors.

Finally, there is the enactive exploration approach. In terms of the four considerations that Hutchins (1995) described, this training approach may be the most complete and well rounded of the four approaches discussed in this paper. Because it begins with a guided mastery training approach, the trainee learns basic knowledge of the task and the expectations of what correct outcomes should be. The error management training style exploration component should also give the trainee the opportunity to develop more fully in terms of perspective and as discussed above may lead to better attention because of the inherent focused emphasis on errors. The most questionble of the four considerations may be that of access, because access is heavily dependent on the nature of the task itself and how well the training highlights how the task provides feedback.

Given these evaluations in terms of Hutchins’ (1995) framework, I suggest that enactive exploration, in theory, is the best training approach because it is the most comprehensive in terms of these four key considerations. However, we saw earlier that whereas Wood et al. (2000) found better results in terms of performance over guided mastery training alone, they found no significant difference in terms of search strategy. This suggests that perhaps there is not much of a difference in terms of perspective after all. Alternatively, this could be simply an issue with the task itself and the method they chose to evaluate search strategy. They defined the answers to their task by having librarians who were experts at the task determine which articles in the databases were relevant to answer the search question. By doing this, Wood et al. may have been evaluating some effect of expert/novice differences for the task rather than evaluating the cognitive processes the participants had been going through to determine the answers.
Indeed, for this particular task Wood et al. (2000) made no mention as to whether the expert librarians tried the same ineffective searches when they were determining which searches lead to the correct articles. Perhaps even more puzzling are the findings of Debowski et al. (2001). Debowski et al. (2001) found an opposite pattern in terms of performance and several other characteristics. Again, perhaps the pattern of results might have been influenced by the nature of the task itself and how Debowski et al. defined correct outcomes. Because Debowski et al. (2001) also used a CD-ROM database search task, their findings may have been biased by the use of expert librarians to define the “correct” answers and strategies, definitions which may be subjective in nature and may not take into consideration ineffective searches which the experts themselves may have tried when determining the correct answers. It raises the question of whether a plausible but ineffective search strategy is really the same as an implausible, ineffective one.

**Performance, Affect, and Motivation Outcomes of Training**

Much of the present body of literature has focused on performance outcomes resulting from training. Of particular note for this type of training are the multiple distinctions made regarding performance, i.e., the distinction between training for performance speed versus training for performance accuracy and training to increase speed of skill acquisition versus maximize retention and generalization. Frese, Brodbeck, Heinboke, Mooser, Schleiffenbaum, and Thiemann (1991), the earliest research study on error management training, indicated that error management training had beneficial effects in non-speeded performance only. Further, they proposed that error management training leads to better mental representations of the task, but the emphasis on exploration tends to be detrimental to learning to perform quickly on the task. Thus, error management training, and by extension enactive exploration, should be
expected to have the most beneficial effects on performance accuracy, and may improve retention and generalization at the cost of skill acquisition speed.

However, training can have effects beyond direct performance outcomes. For example, training could affect training satisfaction. The only studies on error management training that have included measures of affect have done so as manipulation checks to ensure that the framing statements used in error management training have the psychological effect of reducing frustration resulting from committing errors during training. Enactive exploration research also has produced mixed results in terms of task satisfaction. For example, Wood et al. (2000) found no significant effects on satisfaction, yet Debowski et al. (2001) found that enactive exploration led to significantly higher levels of satisfaction than the guided mastery training approach.

Another possible outcome that may result from training is motivation. For example, Nordstrom, Wendland, and Williams (1998) predicted that error training type would interact with goal orientation in its effects on intrinsic motivation. They failed to find a significant interaction but did find significant main effects for error training and goal type, with error management training and learning goal orientation resulting in higher intrinsic motivation. However, Chillarege, Nordstrom and Williams (2003) found no significant effects when they examined intrinsic motivation and error management training. As mentioned before, there are similarly conflicting results observed for enactive exploration. That is, Debowski et al. (2001) reported no significant effect on intrinsic motivation, yet Wood et al., (2000) reported a significant effect, again with the error encouragement training approach linked to higher intrinsic motivation than the error avoidant approach. These conflicting results may point to the influence of moderator variables.

Mechanisms Underlying Error Encouragement and Error Avoidant Training Approaches
Another area where further research is needed is in terms of identifying and examining mechanisms underlying error encouragement and error avoidant training approaches. Keith and Frese (2005) attempted to explore potential mechanisms underlying error encouragement training. They found full mediation effects for both metacognition and emotional control, yet they noted possible bias in their measure of emotional control due to the timing of that measure in the study. Further research to confirm or disconfirm this finding would be beneficial and could suggest instances where an error encouragement approach may be preferable to a more traditional error avoidant approach.

*Potential Moderators of Error Encouragement and Error Avoidant Training Approaches*

Finally, additional research is needed examining the role of moderators in error encouragement and error avoidant training approaches. Indeed, one possible explanation for contradictory research results may be unexamined moderators. There could be several plausible sources for moderation effects in different types of training.

*Personality.* Personality reflects another set of individual differences that might moderate training type effects on outcomes. Funder (2001) described the mission of personality psychology as accounting for patterns of thoughts, emotions, and behaviors and understanding the psychological processes behind those patterns. Funder (2001) noted also that the “Big Five” framework is the dominant trait approach in current research on personality though he noted that persistent opposition to this framework continues. The “Big Five” is a five-factor model of general human personality, consisting of the factors of agreeableness, conscientiousness, extraversion, neuroticism, and openness (McCrae & Costa, 1987). Funder (2001) discussed two issues with this framework for personality. One is the independence of these five constructs. These factors were originally derived using orthogonal rotations, but they continue to show
intercorrelations when assessed with various personality scales. A second issue is that the Big Five may not be a comprehensive perspective of personality. Despite these limitations, the Big Five constructs of agreeableness, conscientiousness, extraversion, neuroticism, and openness to experience continue to reflect a dominant and well-established approach to personality.

Barrick and Mount (1991), in meta-analytic research, found that extraversion, openness, and conscientiousness predicted training proficiency and that conscientiousness predicted job performance as well. Barrick, Mount, and Judge (2001) drew similar conclusions from their meta analysis of more recent data. However, none of the current studies on error encouragement training have included measures of Big Five personality variables. Thus, this study will examine the role of Big Five personality traits in the effects of error avoidant and error encouragement training on training outcomes.

Personality variables are likely to play different roles in error avoidant and error encouragement training because of the nature of the situations those types of training create. More specifically, Mischel (1968) suggested that strong situational factors can diminish the influence of personality variables. Effectively, he proposes that proximal variables with strong effects on the outcome variable that are present in a specific context may mask or counteract the effects of more distal predictors such as personality. Further, because error avoidant training traditionally follows a step-by-step guided approach, I suggest that error avoidant training reflects a strong situation, as following the task instructions step-by-step should represent a strong proximal predictor. Error encouragement training allows much more flexibility on the part of the trainee, therefore it should present a weak situation and thus personality variables to have a greater influence.
Type of error. A second potential moderator of the training type-training outcome relationship is the types of errors that are committed. It could be the case that it may be more beneficial for trainees to make some types of errors over others (Frese et al., 1991). Further, Keith and Frese (2005) suggested the need to develop a taxonomy of errors to identify whether different types of errors provide differing benefits in terms of learning and performance.

Type of task. As with the possibility of some errors being more beneficial than others for learning, another possible moderator is whether the content of the training may moderate the relationship between training type and outcomes. Lazar and Norcio (2003) found that exploratory learning was more effective than other approaches such as traditional error avoidant training or error management training when teaching individuals how to use the World Wide Web. They suggested that the reason exploratory learning was most effective is that exploratory learning is most similar to the nature of the World Wide Web itself. In contrast, Debowski, Wood, and Bandura (2001) found that a traditional error avoidant style of training worked better in an electronic database search task, but they suggested that a task with more informative feedback might benefit more from an error encouraging approach such as enactive exploration. Thus, there may be certain aspects or features inherent to a given task that makes it more favorable in terms of training outcomes to use one training approach over others.

Cognitive ability. Another individual difference factor which may influence the relationship between training type and training outcomes is cognitive ability. Practitioners in industrial/organizational psychology commonly use measures of cognitive ability in selection processes (e.g., Cascio & Aguinis, 2005) as cognitive ability influences an individual’s ability to acquire task knowledge both quickly and accurately. In general, the term ability has been used to refer to a more stable characteristic of individuals whereas the term achievement has been used
to refer to the amount or content of knowledge or skills individuals have acquired over time, a more malleable characteristic. Focusing on ability, in general, we would expect individuals with higher levels of cognitive ability would generally perform better than individuals with lower levels of ability. Gully, Payne, Koles, and Whiteman (2002) argued that cognitive ability and personality could influence the effectiveness of error encouragement training styles.

**Goal orientation.** Further, individual differences relating to motivation and achievement striving might be moderators of training type effects, including goal orientations. Dweck (1986) suggested that individuals with learning goals seek to increase their competence or to understand or master something new. In contrast individuals with performance goals seek to demonstrate their competence to others and avoid negative judgments of their competence. Subsequently, researchers (e.g., Button, Mathieu, & Zajac, 1996) have suggested that learning and performance goal orientations reflect two dimensions. Moreover, other researchers (e.g., Elliot & Harackiewicz, 1996; Vandewalle, 1997) argued that one could subdivide performance goal orientation into approach and avoidance components, with performance-approach being the tendency to seek favorable feedback and performance-avoidance being the tendency to avoid negative feedback. Gully et al. (2002) argued that goal orientation might play a role in error encouragement training effects. However, to date, research has considered goal orientation only as a main effect in error encouragement training and with mixed results (Heimbeck, Frese, Sonnentag, & Keith, 2003; Chillarege, Nordstrom, & Williams, 2003).

**Experience.** A few studies have attempted to examine experience as a moderator of the two training types. Lazar and Norcio (2003) only included participants who had no previous experience with computers, whereas other studies (i.e., Nordstrom, Wendland, & Williams, 1998) took measurements of experience with computers in general. Heimbeck, Frese,
Sonnentag, and Keith (2003) was one of the only studies reviewed here that examined computer experience as a variable, and they tested experience as a main effect. Whereas they excluded individuals with prior experience with Microsoft Excel (the computer software being trained in their study), they found that general computer experience was related to performance and thus they used general computer experience as a covariate in their analyses.

Proposed Research

The preceding review of the literature reveals two important implications that form the basis of the current study. First, the literature has indicated that error encouragement training has the potential to produce more beneficial effects on training outcomes (e.g., performance), relative to error avoidant training. That is, some research has indicated that error encouragement training produces better results than error avoidant training (e.g., Wood et al., 2000). I have suggested above that the greater potential might exist because error encouragement training does a better job of addressing key considerations in training (e.g., access, attention, Hutchins, 1995). Second, the conflicting research results observed for error encouragement training (e.g., Debowski et al., 2001; Wood et al., 2000) might be explained by the presence of moderators. In the current study, I focus on personality factors as possible moderators. Further, I suggest that personality factors are likely to play a more important role in error encouragement training than in error avoidant training because the latter is more structured. One would expect to observe a stronger effect for personality factors on outcomes (e.g., performance) in situations that are less structured. More specifically, one would expect that personality factors (e.g., conscientiousness) would have a stronger effect on outcomes in error encouragement than in error avoidant training. Thus, whether one observes a more beneficial effect for error encouragement than error avoidant training on outcomes might depend on how high or low individuals are on relevant personality
factors. Finally, I suggest that personality factors related to achievement striving and ability (e.g., conscientiousness and openness, respectively) are likely to be relevant in training effects on performance outcomes and that factors related to anxiety (e.g., neuroticism) are likely to be relevant in training effects on affective outcomes.

The error avoidant training approach requires trainees to perform the task step-by-step, to follow task instructions closely. Specifically, I would expect conscientiousness and openness to have little effect on training outcomes in error avoidant training as it is more structured and thus a stronger situation. In contrast, the error encouragement training approach is more flexible in nature. Trainees have more choice in how to proceed through the task and are given more opportunities to make, examine, correct, and learn from errors. In this less structured situation, I would expect that individuals who have higher levels of conscientiousness or openness would benefit more from opportunities to learn from errors and perform better in error encouragement training.

H1: Conscientiousness and openness will have stronger beneficial effects on training performance in an error encouragement training approach than in an error avoidant training approach.

Similarly, because of the structured nature of the error avoidant training approach, I would expect neuroticism to have little effect on training outcomes. In contrast, because of the flexible nature of the error encouragement training approach, I would expect to observe a stronger effect of neuroticism on training outcomes in that training approach. Specifically, I would expect to observe a stronger effect of neuroticism on affective outcomes. I would expect that individuals who are higher in neuroticism would experience more negative affect and anxiety in error encouragement training.
H2: Neuroticism will have a stronger negative effect on affective outcomes in an error encouragement training approach than in an error avoidant training approach.

In contrast, I anticipate that personality factors unrelated to achievement, ability, or anxiety would not have differential effects depending on training approach. The key difference between the two training approaches is the role of errors in training. In situations in which individuals are encouraged to make errors, there is more opportunity to learn from those errors and possibly also more anxiety or frustration resulting from errors. Opportunities to learn and possible anxiety are more relevant to factors related to achievement, ability, and anxiety. Thus, I expect that other factors, such as extraversion or agreeableness, will have smaller interactive effects with training type on training outcomes relative the effects observed for factors related to achievement, ability or anxiety.

H3a: Training type will have stronger moderating effects on the relationships between conscientiousness or openness and performance than on the relationships observed for either extraversion or agreeableness

H3b: Training type will have will have a stronger moderating effect on relationship between neuroticism and affect than on the relationships observed for either extraversion or agreeableness

In addition, we are including measures of several additional variables in order to test for alternative explanations based on some of the other potential moderators identified earlier in this paper.
Method

Participants and Design

I recruited participants (*N* = 260) from introductory psychology classes at a medium-sized Midwestern university. Participants received extra credit in their class in exchange for their participation. I randomly assigned participants to either the error avoidant or the error encouragement training condition. Participants completed nine total trials of the task (see Training Task below for details). These trials were divided into three blocks. The first block consisted of three trials intended to allow participants to become familiar with the task. The second block consisted of four trials where participants trained for the task under either error avoidant or error encouragement instructions (see below). The final block consisted of two trials for which participants attempted to ship as many orders as possible.

Induction of Training Type

I induced the training type condition prior to each of the training trials of the task. For the error avoidant training condition, I showed a message on the computer screen telling participants to avoid making mistakes as much as possible. For the error encouragement training condition, I showed a message on the computer screen telling participants that when they make mistakes, they are to try to learn from their errors. The appropriate message appeared on the trainee’s computer screen immediately prior to the start of each trial of the task. Participants were instructed to read the message and press a key on the keyboard when they were finished reading the message. See Appendix A for specific instructions for each condition.

In addition to these computer messages, I attached framing statements to the computer terminal that participants could view throughout the experiment. For the error encouragement condition, I provided framing statements notifying participants of the benefits of making errors
and learning from them (see Appendix B). These statements were used by Keith and Frese (2005). Further, I attached a set of framing statements in the error avoidant condition. Previous studies have not provided error avoidant framing statements, so framing statements for that condition were developed for use in the current study. Providing framing statements in both conditions avoided a potential confound created by unequal amounts of instruction. The framing statements used in the error-avoidant condition instructed participants to follow the provided task instructions and avoid errors as much as possible (see Appendix B). We examined the effectiveness of these framing statements in pilot research (see Appendix C).

Training Task

For this study, I used a computer-based truck dispatching simulation (Steele-Johnson & Perlow, 1989). Participants are unlikely to have experience with this type of task. The task is of medium complexity. The task is difficult enough that the participant will not be able to master the task immediately, thus avoiding a range restriction in our performance outcome measure due to a ceiling effect in performance. At the same time, the task is easy enough that participants will be able to demonstrate large increases in performance scores within relatively few trials on the task. Prior research (Palumbo, 2007) has identified a version of the task with these attributes.

Each trial of the task was 10 minutes in length. During the task, participants were awarded points for each order correctly shipped, and points were deducted for violations of task rules. Participants could obtain a negative final score should they make more violations of the task rules than they shipped orders in any given trial. At the end of each trial, the simulation presented each participant with a screen displaying participants’ performance scores, the total number of errors made, and a feedback message relating to the most frequently occurring error
(see Appendix D). In order to control for possible confounds, participants in both training conditions received the same task instructions (see Appendix E) and feedback information.

**Study Measures**

*Manipulation check.* I used a six-item measure to determine if the induction of training type condition was successful (see Appendix F). This measure assessed participants’ beliefs and attitudes about the role of errors in the learning process. Participants responded to these items on a 7-point Likert type scale, with responses ranging from 1 = Strongly Disagree to 7 = Strongly Agree. The scale composite was computed as the average of responses to the six items with higher scores reflecting a more positive attitude toward errors. We developed these for use in the current study and examined in pilot research (see Appendix C).

*Personality measure.* I assessed the Big Five personality traits using scales developed for the International Personality Item Pool (Goldberg, Johnson, Eber, Hogan, Ashton, Cloninger, & Gough, 2006; see Appendix G). I used 10-item measures of Agreeableness, Conscientiousness, Extraversion, Neuroticism, and Openness. Participants responded on a 5-point scale with responses ranging from 1 = “very inaccurate” to 5 = ”very accurate”. The subscale score for each of the five constructs was computed as the sum of the 10 relevant items. A higher score reflected higher levels of that construct. Reliabilities for the scales are: Agreeableness (alpha = .77), Conscientiousness (alpha = .81), Extraversion (alpha = .86), Neuroticism (alpha = .86), and Openness (alpha = .82; International Personality Item Pool, 2007).

*Affect measure.* I used the Positive and Negative Affect Schedule (PANAS) described by Watson, Clark, and Tellegen (1988; see Appendix H) to assess affective outcomes of training. Participants responded to each of the 20 items using a 5-point Likert-type scale with a response of 1 meaning the respondent feels the emotion stated in the item “very slightly or not at all” and
a response of 5 meaning the respondent feels the emotion “extremely”. The subscale score for the positive and negative constructs was computed as the sum of the 10 relevant items. Watson, Clark, and Tellegen (1988) developed the scale for use in several time frames, including “at this moment”, “today”, “past few days”, “week”, “past few weeks”, “year”, and “general”. I measured positive and negative affect experienced “at this moment” in the specific context of the truck-dispatching simulation. Higher scores reflected higher levels of the constructs. Prior research has indicated that this measure had adequate reliabilities: alpha = .89 and alpha = .85 for positive and negative affectivity, respectively (Watson, Clark, & Tellegen, 1988).

I also used a second affect measure, addressing frustration and anxiety (see Appendix I). This measure was developed by Cron, Slocum, Vandewalle, and Fu (2005) and had an adequate reliability of .92. However, pilot research (see Appendix C) indicated that this measure had substantial overlap with the negative affectivity scale of the PANAS. Thus, the frustration and anxiety scale was not administered in the full study.

Demographics. I used a six-item measure to assess age, gender, race, class rank (freshman, sophomore, etc.), college GPA, and major field of study for each participant (see Appendix J).

Exploratory Measures

I included the following measures to enable tests of alternative explanations for my results.

Cognitive ability. I used the Shipley Institute of Living Scale to assess participants’ cognitive ability (Shipley, 1940; see Appendix K). The Shipley measure is designed to assess general intellectual functioning. It includes a verbal and an abstraction (i.e., reasoning) test. Each test has a 10-minute time limit. The verbal test consists of 40 multiple choice questions.
The abstraction test consists of 20 fill-in-the-blank questions. The vocabulary raw score is the total number of correct answers plus the total number of blank items divided by four (Correct + (Blank/4)). The abstraction raw score is the total number of correct answers multiplied by two (Correct * 2). Shipley (1940) reported a reliability coefficient for the scale of .92 for a sample of 322 army recruits. Pringle and Haanstad (1971) found that the Shipley scale raw scores correlated .83 with the Wechsler Adult Intelligence Scale (WAIS) IQ scores and .85 with WAIS scaled scores.

*Computer anxiety.* I assessed computer anxiety using a 7-item measure based on a scale developed by Ceaparu, Lazar, Besslere, Robinson, and Shnelderman (2004; see Appendix L). This measure includes seven multiple choice questions assessing affective experiences with computers. Ceaparu et al. did not report any psychometric information for these items.

*Task-specific self-efficacy.* I assessed self-efficacy using an adaptation of the Personal Efficacy Beliefs Scale (Riggs, Warka, Babasa, Betancourt, & Hooker, 1994; see Appendix M). The 10 item measure has been revised to address the truck dispatching task rather than one’s job. Participants responded to the items using a 7-point Likert-type scale with a response of 1 meaning the respondent “strongly disagrees” with the statement and a response of 7 meaning the respondent “strongly agrees” with the statement. The score for the construct was computed as the sum of the ten items. Riggs et al. reported support for one factor with loadings for these items ranging from .40 to .75.

*Core self-evaluations.* I assessed core self-evaluations using the 12-item Core Self-Evaluations Scale (Judge, Erez, Bono, & Thoresen, 2003; see Appendix N). Participants responded to the 12 items using a 5-point Likert-type scale with a response of 1 meaning that the respondent “strongly disagrees” with the statement and a 5 meaning that the respondent
“strongly agrees”. Judge et al. (2003) reported that the scale had internal consistency reliabilities ranging from .81 to .87 across four different samples and a test-retest reliability of .81. The score for the construct was computed as the average of the 12 items.

Task Knowledge. I assessed task knowledge using a 30-item multiple choice task understanding test developed by Palumbo (2007) specifically for the truck dispatcher task being used in this study (see Appendix O). A test performance score for this measure was computed for each participant by counting the number of correct responses generated by the participant.

Performance

We operationally defined performance as the performance score earned at the end of each trial. Participants earned 10 points for each correctly shipped unit and lost 5 points for each error made. As stated earlier, negative scores can be attained if the penalty points earned exceeded points earned for correctly shipped orders. We computed performance scores as the sum of points earned for units shipped and points deducted for errors.

Procedure

We conducted the first phase of this study online. After reading a cover letter informing them of the purpose of the study (Appendix P), participants initially completed an online survey in which they completed the Big 5 personality measures, the Core Self-Evaluations Scale, and the demographics measures.

After completing the online study, participants signed up for the second part of the study conducted in a lab setting. After obtaining informed consent (Appendix Q) from participants, I gave the participants the instructions for the performance task. Following the instructions, participants completed three 10-minute practice trials of the task to familiarize themselves with the task. After the third trial, participants were given an initial measure of the PANAS scale
(Appendix H) as well as an initial measure of their task understanding (Appendix P). Following the completion of these measures, I presented participants with the appropriate computer message for the induction (Appendix A), which they were instructed to read and transcribe onto a blank piece of paper we provided to them. They received either the error avoidant or the error encouragement message, depending on their assigned training type condition. Next, I administered the manipulation check measure to assess the effects of the training type induction (Appendix F). Then, we instructed participants to keep the induction message in mind as they completed four training trials of the task.

After these four training trials, we instructed participants to complete two final transfer trials of the task. During these transfer trials, we instructed participants to focus on shipping as many orders as they could. Following the transfer trials, we administered the PANAS (Appendix H), the task understanding measure (Appendix O), the computer anxiety measure (Appendix L), and the modified Personal Efficacy Beliefs scale (Appendix M). After these measures were completed, participants completed the cognitive ability measure (Appendix K). Finally, participants were debriefed (Appendix R) and dismissed.
Results

Descriptive Statistics

Two hundred and sixty subjects participated in the study. We removed three of these subjects from the analyses due to outlier scores on the task performance measure. Table 2 indicates the reasons for these deletions.

Table 2

Subjects Deleted from Study

<table>
<thead>
<tr>
<th>Subject #</th>
<th>Reason for Deletion</th>
</tr>
</thead>
<tbody>
<tr>
<td>B401</td>
<td>Extreme performance scores (more than 5 SDs above mean)</td>
</tr>
<tr>
<td>E301</td>
<td>Extreme performance scores (more than 5 SDs above mean)</td>
</tr>
<tr>
<td>E302</td>
<td>Extreme performance scores (more than 5 SDs above mean)</td>
</tr>
</tbody>
</table>

Table 3 lists demographic characteristics of the sample. As indicated in Table 3, approximately 70% of the sample was female. Ages of participants ranged from 16-38 years with a mean of 19.28 and a standard deviation of 2.59. These demographics are typical of the university subject pool from which they were recruited.

Table 4 lists the frequencies of demographic categories by experimental condition. An independent samples t-test using individuals’ reported ages (e.g., “18”) indicated no significant differences in age for each training type condition, \( t(255) = -.128, p = .90 \). Table 5 indicates the performance scores overall and by training condition. Table 6 indicates the distribution of cognitive ability and personality variables across conditions. We conducted independent samples t-tests on all variables listed to determine if participants in one training condition
significantly differed from the other on any of the measured variables. We found no significant differences for overall cognitive ability, $t(255) = .05, p = .96$, the verbal, $t(255) = .61, p = .54$, or abstraction, $t(255) = -.65, p = .51$, subscale scores, agreeableness, $t(255) = .25, p = .81$, conscientiousness, $t(255) = .87, p = .39$, extraversion, $t(255) = -.89, p = .37$, neuroticism, $t(255) = .88, p = .38$, openness, $t(255) = -1.45, p = .15$, or core self-evaluations, $t(255) = .12, p = .91$.

This indicates that our use of random assignment of participants to each training condition was successful in evenly distributing individuals of varying levels of each variable to each condition.

Finally, Tables 7 through 9 provide intercorrelations between study variables. Specifically, Table 7 indicates the correlations between the Big 5 personality traits. Table 8 indicates the correlations between the four training trials and two transfer trials. Table 9 indicates the correlations of each of the Big 5 traits with the four training and two transfer trials.

**Psychometric Analysis of Measures**

We conducted scale reliability analyses on the various measures used in the study. The positive affectivity scale of the PANAS had an internal consistency reliability of $\alpha = .90$ during the initial administration and $\alpha = .91$ during the second administration. The negative affectivity scale of the same measure had a reliability of $\alpha = .82$ during the initial administration and $\alpha = .77$ during the second administration. The IPIP Big 5 scales had the following reliabilities: agreeableness $\alpha = .75$, conscientiousness $\alpha = .77$, extraversion $\alpha = .84$, neuroticism $\alpha = .82$, and openness $\alpha = .78$. The core self-evaluations scale had a reliability of $\alpha = .84$. The task-specific self-efficacy scale had a reliability of $\alpha = .81$. Finally, the error management subscale of the manipulation check measure had a reliability of $\alpha = .65$ and the error avoidant subscale had a reliability of $\alpha = .57$.  

30
Table 3

**Demographic characteristics of the sample**

<table>
<thead>
<tr>
<th>Sex</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>78</td>
<td>179</td>
</tr>
<tr>
<td>Percent</td>
<td>30.4%</td>
<td>69.6%</td>
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<table>
<thead>
<tr>
<th>Age*</th>
<th>16-18</th>
<th>19-21</th>
<th>22-24</th>
<th>25-27</th>
<th>28 or older</th>
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</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>132</td>
<td>99</td>
<td>15</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Percent</td>
<td>51.4%</td>
<td>38.5%</td>
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<table>
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<tr>
<th>Race</th>
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<th>Hispanic</th>
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<th>Other</th>
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</thead>
<tbody>
<tr>
<td>Frequency</td>
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<td>7</td>
<td>4</td>
<td>183</td>
<td>16</td>
</tr>
<tr>
<td>Percent</td>
<td>18.3%</td>
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<td>2.7%</td>
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* Although participants reported actual ages, in the above table ages were reported within categories for ease of interpretation. For the 16-18 group, only 1 participant was 16 years old and 7 were 17 years old.
Table 4

Demographics by Training Condition

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<th></th>
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</thead>
<tbody>
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<td>Error Avoidant</td>
<td>Error Encouragement</td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td></td>
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</tr>
<tr>
<td>Male</td>
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<td>43</td>
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</tr>
<tr>
<td>Female</td>
<td>87</td>
<td>92</td>
<td>179</td>
</tr>
<tr>
<td>Total</td>
<td>122</td>
<td>135</td>
<td>257</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age</th>
<th>Training Type</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Error Avoidant</td>
<td>Error Encouragement</td>
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</tr>
<tr>
<td>16-18</td>
<td>66</td>
<td>66</td>
<td>132</td>
</tr>
<tr>
<td>19-21</td>
<td>43</td>
<td>56</td>
<td>99</td>
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<tr>
<td>22-24</td>
<td>8</td>
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<td>15</td>
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<tr>
<td>25-27</td>
<td>3</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>28 or older</td>
<td>2</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>122</td>
<td>135</td>
<td>257</td>
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</table>
Table 4 (continued)

<table>
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<tr>
<th>Race</th>
<th>Error Avoidant</th>
<th>Error Encouragement</th>
<th>Total</th>
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</thead>
<tbody>
<tr>
<td>African-American</td>
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<td>47</td>
</tr>
<tr>
<td>Asian-American</td>
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</tr>
<tr>
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<td>White</td>
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<td>94</td>
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</tr>
<tr>
<td>Other</td>
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<td>9</td>
<td>16</td>
</tr>
<tr>
<td>Total</td>
<td>122</td>
<td>135</td>
<td>257</td>
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</tbody>
</table>
Table 5

*Task Performance Scores by Training Type and Overall*

<table>
<thead>
<tr>
<th>Performance Scores</th>
<th>Training Type</th>
<th></th>
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<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Error Avoidant</td>
<td>Error Encouragement</td>
<td>Overall</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>Practice Trial 1</td>
<td>-23.85</td>
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</tr>
<tr>
<td>Practice Trial 2</td>
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<td>138.19</td>
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</tr>
<tr>
<td>Practice Trial 3</td>
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<td>866.94</td>
<td>379.37</td>
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<td>412.24</td>
</tr>
<tr>
<td>Training Trial 1</td>
<td>534.92</td>
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<td>870.88</td>
<td>526.93</td>
</tr>
<tr>
<td>Training Trial 2</td>
<td>776.93</td>
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<td>758.89</td>
<td>938.73</td>
<td>767.45</td>
</tr>
<tr>
<td>Training Trial 3</td>
<td>957.13</td>
<td>921.07</td>
<td>901.48</td>
<td>913.31</td>
<td>927.90</td>
</tr>
<tr>
<td>Training Trial 4</td>
<td>1038.11</td>
<td>976.54</td>
<td>954.63</td>
<td>926.23</td>
<td>994.26</td>
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<tr>
<td>Transfer Trial 1</td>
<td>1250.70</td>
<td>882.26</td>
<td>1093.00</td>
<td>1041.53</td>
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<tr>
<td>Transfer Trial 2</td>
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<td>1217.43</td>
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</table>


<table>
<thead>
<tr>
<th>Measure</th>
<th>Training Type</th>
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<tbody>
<tr>
<td></td>
<td>Error Avoidant</td>
<td>Error Encouragement</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
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<tr>
<td>Shipley Verbal</td>
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<td>Shipley Total</td>
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<tr>
<td>Agreeableness</td>
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<td>Conscientiousness</td>
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<td>.61</td>
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<td>Extraversion</td>
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<td>Neuroticism</td>
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<td>Openness</td>
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<td>.62</td>
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<tr>
<td>Core-Self Evaluations</td>
<td>3.63</td>
<td>.58</td>
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</table>
Table 7

*Big 5 Personality Trait Correlation Matrix*

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<thead>
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<th>Variable</th>
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<th>2</th>
<th>3</th>
<th>4</th>
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<tr>
<td>2 Conscientiousness</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Extraversion</td>
<td>.10</td>
<td>.16*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Neuroticism</td>
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<td>-.34**</td>
<td>-.31**</td>
<td></td>
</tr>
<tr>
<td>5 Openness</td>
<td>.08</td>
<td>.07</td>
<td>.24**</td>
<td>-.03</td>
</tr>
</tbody>
</table>

* p < .05  ** p < .01
Table 8

*Training and Transfer Performance Score Correlation Matrix*

<table>
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<tr>
<th>Variable</th>
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<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
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</thead>
<tbody>
<tr>
<td>1 Transfer Trial 1</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Transfer Trial 2</td>
<td>.89**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Training Trial 1</td>
<td>.62**</td>
<td>.62**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Training Trial 2</td>
<td>.77**</td>
<td>.75**</td>
<td>.76**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 Training Trial 3</td>
<td>.83**</td>
<td>.83**</td>
<td>.73**</td>
<td>.90**</td>
<td></td>
</tr>
<tr>
<td>6 Training Trial 4</td>
<td>.83**</td>
<td>.84**</td>
<td>.69**</td>
<td>.80**</td>
<td>.88**</td>
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* p < .05 ** p < .01
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<th>Extra</th>
<th>Neuro</th>
<th>Open</th>
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<td>-.01</td>
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<td>.02</td>
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<td>Training Trial 2</td>
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<td>-.05</td>
<td>-.08</td>
<td>-.05</td>
<td>.05</td>
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<tr>
<td>Training Trial 3</td>
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<td>-.06</td>
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<td>.04</td>
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<tr>
<td>Training Trial 4</td>
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<td>-.03</td>
<td>-.07</td>
<td>.06</td>
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<td>Transfer Trial 1</td>
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<td>-.04</td>
<td>-.02</td>
<td>.00</td>
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<tr>
<td>Transfer Trial 2</td>
<td>-.03</td>
<td>-.05</td>
<td>-.02</td>
<td>-.01</td>
<td>.02</td>
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</tbody>
</table>

Variables: Agree = Agreeableness, Consc = Conscientiousness, Extra = Extraversion, Neuro = Neuroticism, Open = Openness. * $p < .05$ ** $p < .01$
Manipulation Check

To assess whether the training type induction had the intended psychological effect, participants responded to the 6-item measure developed for this study to assess attitudes towards making errors. A factor analysis of this measure indicated that questions loaded onto two factors. As expected, Items 1, 4, and 5 of the measure loaded onto one factor. These questions generally assessed how strongly participants believed that committing errors presented opportunities for learning to occur. As such, we would expect participants in the error encouragement condition to have higher scores on this subscale when compared to the error avoidant condition. An independent samples t-test indicated significant differences in the responses to this scale, \( t(255) = 3.48, p < .001 \). Participants in the error encouragement condition answered more favorably to this scale (\( M = 5.32, SD = 1.12 \)) than individuals in the error avoidant condition (\( M = 4.79, SD = 1.31 \)). This produces a Cohen’s \( d = .43 \) for the difference between these two groups, suggesting a medium-sized effect for training type on this measure.

The second subscale of the manipulation check measure consisted of Items 2, 3, and 6 of the measure. These items all indicated that errors were detrimental to performance. As such, we would expect that individuals in the error avoidant condition would respond more favorably to these statements as compared to those in the error encouragement condition. Again, an independent samples t-test indicated significant differences in the responses to this scale, \( t(255) = 4.26, p < .01 \). Participants in the error avoidant condition responded more favorably to these questions (\( M = 4.94, SD = 1.23 \)) than in the error encouragement condition (\( M = 4.27, SD = 1.28 \)). This produces a Cohen’s \( d = .53 \) for the difference between these two groups, again suggesting a medium-sized effect for training type on this measure. Thus, both subscales of the
manipulation check measure indicated that we successfully induced the intended psychological effects in the study.

Test of Hypothesis 1

To test the effects of training type and the personality variables of conscientiousness and openness on performance, we conducted a two-step regression analysis on the average of the two transfer performance scores, with training type and the mean-centered personality variable entered in Step 1 and the interaction term entered in Step 2. Hypothesis 1 will be supported if a significant interaction effect is found which indicates that higher levels of conscientiousness or openness for individuals in the error encouragement condition is associated with better performance, but the same is not true for those in the error avoidant condition.

First, we tested the predictors of training type and conscientiousness. For the average of the transfer trial performance scores as the outcome, the main effects of training type and conscientiousness overall failed to explain significant variance in performance, $R^2 = .01$, $F(2, 254) = 1.064$, $p = .35$. Neither training type, $\beta = -.08$, $t = -1.38$, $p = .20$, nor conscientiousness, $\beta = -.05$, $t = -0.77$, $p = .44$, were significantly related to performance. When the interaction term was added in Step 2, no significant change in $R^2$ was observed, $\Delta R^2 = .01$, $F(1, 253) = 3.55$, $p = .06$. The interaction between training type and conscientiousness was not significant, $\beta = .82$, $t = 1.89$, $p = .06$.

The second set of regression analyses substituted openness for conscientiousness and the interaction between training type and openness for the interaction between training type and conscientiousness. For the average performance scores across transfer trials as the outcome, the main effects of training type and openness overall failed to explain significant variance in performance, $R^2 = .09$, $F(2, 254) = .96$, $p = .38$. Neither training type, $\beta = -.08$, $t = -1.29$, $p = .20$,
nor openness, $\beta = .04$, $t = 0.62$, $p = .54$, were significantly related to performance. When the interaction term was added in Step 2, no significant change in $R^2$ was observed, $\Delta R^2 = .01$, $F(1, 253) = 3.02$, $p = .08$. The interaction between training type and openness was not significant, $\beta = - .73$, $t = -1.74$, $p = .08$.

Based on these analyses, we found no evidence supporting the moderation proposed in Hypothesis 1 during transfer. In general, participants in both the error avoidant and error encouragement conditions performed similarly well, and we found no significant interactions between training type and conscientiousness or openness. Next, we conducted post hoc analyses to analyze whether differences occurred during the four training trials.

Again we first tested the predictors of training and conscientiousness. For the average performance scores of the training trials, the main effects of training type and conscientiousness overall failed to explain significant variance in performance, $R^2 = .00$, $F(2, 254) = 0.24$, $p = .79$. Neither training type, $\beta = -.03$, $t = -.44$, $p = .66$, nor conscientiousness, $\beta = -.04$, $t = -.56$, $p = .58$, were significantly related to performance. When the interaction term was added in Step 2, we observed no significant change in $R^2$, $\Delta R^2 = .01$, $F(1, 253) = 1.99$, $p = .16$. The interaction between training type and conscientiousness was not significant, $\beta = .62$, $t = 1.41$, $p = .16$.

Last, we tested the effects of training type and openness during training. For the average performance scores of the training trials as the outcome, the main effects of training type and openness overall failed to explain significant variance in performance, $R^2 = .00$, $F(2, 254) = 0.37$, $p = .69$. Neither training type, $\beta = -.03$, $t = -.47$, $p = .64$, nor openness, $\beta = .05$, $t = .76$, $p = .45$, were significantly related to performance. When the interaction term was added in Step 2, we observed no significant change in $R^2$, $\Delta R^2 = .01$, $F(1, 253) = 3.08$, $p = .08$. The interaction between training type and conscientiousness was not significant, $\beta = -.74$, $t = -1.76$, $p = .08$. 
Again, we failed to find support for Hypothesis 1. We conducted further post hoc analyses related to this hypothesis on a trial-by-trial basis. We report the results of these analyses in Appendix S. We found no support for this hypothesis in these additional analyses.

Test of Hypothesis 2

In Hypothesis 2, we proposed that neuroticism would have a stronger negative effect on affective outcomes in an error encouragement training approach than in an error avoidant training approach. To test this hypothesis, we conducted a two-step regression analysis with training type and mean-centered neuroticism entered in during Step 1 and the interaction term entered in Step 2. Hypothesis 2 will be supported if a significant interaction effect is found which indicates that individuals with higher levels of neuroticism in the error encouragement condition report more negative affectivity or less positive affectivity but the same is not true for those individuals the error avoidant condition. The first outcome variable tested is negative affectivity.

The main effects of training type and neuroticism overall explained significant variance in negative affectivity, $R^2 = .03, F(2, 254) = 3.40, p < .05$. Training type was not significantly related to negative affectivity in Step 1, $\beta = .00, t = .02, p = .98$. Neuroticism was significantly related to negative affectivity, $\beta = .16, t = 2.61, p < .01$. Individuals who were higher in neuroticism tended to report higher levels of negative affectivity. When the interaction term was added in Step 2, we observed no significant change in $R^2$, $\Delta R^2 = .00, F(1, 253) = .36, p = .55$. The interaction between training type and neuroticism was not significant, $\beta = .18, t = .60, p = .55$.

As an alternative test, we examined the effects of training type and neuroticism on positive affectivity, such that a negative effect would reduce levels of positive affectivity. The
main effects of training type and neuroticism overall explained significant variance in positive affectivity, $R^2 = .01$, $F(2, 254) = .02, p = .98$. Training type was not significantly related to positive affectivity in Step 1, $\beta = .00, t = .05, p = .96$. Neuroticism was also not significantly related to positive affectivity, $\beta = .01, t = .20, p = .83$. When the interaction term was added in Step 2, we observed no significant change in $R^2$, $\Delta R^2 = .01, F(1, 253) = 2.19, p = .14$. In Step 2, the interaction between training type and neuroticism was not significant, $\beta = -.44, t = -1.48, p = .14$. Thus, we did not find support for Hypothesis 2.

*Test of Hypothesis 3a*

In Hypothesis 3a, we proposed that training type will have a stronger moderating effect on the relationship between conscientiousness or openness and performance relative to relationships involving extraversion or agreeableness. Given that Hypothesis 1 was not supported (no significant interactions were detected; see above), we have no way of supporting Hypothesis 3a. Thus, the tests conducted here will examine if there were any effects for the interactions between training type and extraversion or training type and agreeableness to determine if they were similarly ineffective or if in fact a significant and thus stronger effect was observed for either extraversion or agreeableness.

First we tested the predictors of training type and extraversion. For the average of the transfer trial performance scores as the outcome, the main effects of training type and mean-centered extraversion overall failed to explain significant variance in performance, $R^2 = .08, F(2, 254) = .79, p = .45$. Neither training type, $\beta = -.08, t = -1.23, p = .22$, nor extraversion, $\beta = -.01, t = -0.22, p = .83$, were significantly related to performance. When the interaction term was added in Step 2, we observed a significant change in $R^2$, $\Delta R^2 = .02, F(1, 253) = 5.79, p < .05$. The interaction between training type and extraversion was significant, $\beta = .89, t = 2.41, p < .05$. 43
To further examine this significant interaction, we examined the simple slopes for extraversion for each training condition. In the error avoidant condition we found $\beta = -0.17$, $t(120) = -1.89$, $p = 0.06$ while in the error encouragement condition we found $\beta = 0.13$, $t(133) = -1.56$, $p = 0.12$. Thus, there is a marginal detrimental effect for individuals with higher levels of extraversion in the error avoidant condition but no significant effect for extraversion for individuals in the error encouragement condition.

Next we tested the predictors of training type and agreeableness. For the average of the transfer trial performance scores as the outcome, the main effects of training type and mean-centered agreeableness overall failed to explain significant variance in performance, $R^2 = 0.00$, $F(2, 254) = 1.02$, $p = 0.36$. Neither training type, $\beta = -0.08$, $t = -1.25$, $p = 0.21$, nor agreeableness, $\beta = -0.04$, $t = -0.71$, $p = 0.48$, were significantly related to performance. When the interaction term was added in Step 2, we observed no significant change in $R^2$, $\Delta R^2 = 0.01$, $F(1, 253) = 3.69$, $p = 0.06$. The interaction between training type and agreeableness was significant, $\beta = 0.93$, $t = 1.92$, $p = 0.06$.

Next we conducted exploratory analyses for the training type and extraversion effects during training. For the average of the training trial performance scores as the outcome, the main effects of training type and mean-centered extraversion overall failed to explain significant variance in performance, $R^2 = 0.06$, $F(2, 254) = 0.38$, $p = 0.68$. Neither training type, $\beta = -0.02$, $t = -0.36$, $p = 0.72$, nor extraversion, $\beta = -0.05$, $t = -0.77$, $p = 0.44$, were significantly related to performance. When the interaction term was added in Step 2, we observed a significant change in $R^2$, $\Delta R^2 = 0.02$, $F(1, 253) = 4.55$, $p < 0.05$. The interaction between training type and extraversion was significant, $\beta = 0.79$, $t = 2.13$, $p < 0.05$. 
To further examine this significant interaction, we examined the simple slopes for extraversion for each training condition. In the error avoidant condition we found $\beta = -.18$, $t(120) = -2.03$, $p < .05$ while in the error encouragement condition we found $\beta = .09$, $t(133) = -1.04$, $p = .30$. Thus, there is a significant detrimental effect for individuals with higher levels of extraversion in the error avoidant condition but again no significant effect for extraversion for individuals in the error encouragement condition.

Finally, we conducted exploratory analyses for the training type and agreeableness effects during training. For the average of the training trial performance scores as the outcome, the main effects of training type and mean-centered agreeableness overall failed to explain significant variance in performance, $R^2 = .00$, $F(2, 254) = .53$, $p = .59$. Neither training type, $\beta = -.03$, $t = -.42$, $p = .67$, nor agreeableness, $\beta = -.06$, $t = -.95$, $p = .35$, were significantly related to performance. When the interaction term was added in Step 2, we observed no significant change in $R^2$, $\Delta R^2 = .01$, $F(1, 253) = 2.12$, $p = .15$. The interaction between training type and agreeableness was significant, $\beta = .71$, $t = 1.45$, $p = .15$.

**Test of Hypothesis 3b**

In Hypothesis 3b, we proposed that training type would have a stronger moderating effect on the neuroticism-affective outcome relationship relative to the relationships involving extraversion or agreeableness. As with Hypothesis 3a, we found no significant interaction between neuroticism and training type in Hypothesis 2 and thus are unable to support Hypothesis 3b. Therefore, we tested the interactions between extraversion and training type and agreeableness and training type to determine if they were similarly ineffective as we found with neuroticism and training type or if one or both of these interactions were significant for either positive or negative affectivity and thus stronger than the effects observed for neuroticism.
First we tested the predictors of training type and extraversion. For negative affectivity as the outcome, the main effects of training type and mean-centered extraversion overall failed to explain significant variance in negative affectivity, $R^2 = .00, F(2, 254) = .06, p = .94$. Neither training type, $\beta = -.01, t = -.13, p = .90$, nor extraversion, $\beta = .02, t = .32, p = .75$, were significantly related to negative affectivity. When the interaction term was added in Step 2, we observed no significant change in $R^2$, $\Delta R^2 = .00, F(1, 253) = .06, p = .94$. The interaction between training type and extraversion was not significant, $\beta = .03, t = .08, p = .94$.

Next we tested the predictors of training type and agreeableness. For negative affectivity as the outcome, the main effects of training type and mean-centered agreeableness overall failed to explain significant variance in negative affectivity, $R^2 = .01, F(2, 254) = .62, p = .54$. Neither training type, $\beta = -.01, t = -.13, p = .90$, nor agreeableness, $\beta = -.07, t = -1.11, p = .27$, were significantly related to negative affectivity. When the interaction term was added in Step 2, we observed no significant change in $R^2$, $\Delta R^2 = .00, F(1, 253) = .06, p = .80$. The interaction between training type and agreeableness was not significant, $\beta = -.12, t = -.25, p = .80$.

We then tested the predictors of training type and extraversion on positive affectivity. The main effects of training type and mean-centered extraversion overall failed to explain significant variance in positive affectivity, $R^2 = .00, F(2, 254) = .06, p = .94$. Neither training type, $\beta = .00, t = .02, p = .99$, nor extraversion, $\beta = .02, t = .35, p = .73$, were significantly related to positive affectivity. When the interaction term was added in Step 2, we observed no significant change in $R^2$, $\Delta R^2 = .00, F(1, 253) = .41, p = .52$. The interaction between training type and extraversion was not significant, $\beta = .24, t = .64, p = .52$.

Finally, we tested the predictors of training type and agreeableness. For positive affectivity as the outcome, the main effects of training type and mean-centered agreeableness
overall failed to explain significant variance in positive affectivity, $R^2 = .01$, $F(2, 254) = .69$, $p = .50$. Neither training type, $\beta = .00, t = .02, p = .98$, nor agreeableness, $\beta = -.07, t = -1.18, p = .24$, were significantly related to positive affectivity. When the interaction term was added in Step 2, we observed no significant change in $R^2$, $\Delta R^2 = .00$, $F(1, 253) = .77, p = .38$. The interaction between training type and agreeableness was not significant, $\beta = .43, t = .88, p = .38$. 
Discussion

Our results provide two main contributions to error encouragement research. First, though we found that the training type inductions had the intended psychological effects, individuals performed similarly in both training types with no significant differences in performance or affective outcomes. The other main finding of this study was that extraversion had an unexpected interaction with training type, such that extraversion was negatively related to performance for individuals in the error avoidant condition both during training and during transfer, but extraversion was unrelated to performance for individuals in the error encouragement condition during both training and transfer. Taken together, these findings raise new questions about the mechanisms through which error encouragement training approaches such as Error Management Training and Enactive Exploration have an effect on training outcomes.

Hypothesis 1

We failed to find support for Hypothesis 1. One possible explanation was the lack of a main effect for conscientiousness on performance. Previous research (e.g., Barrick, Mount & Judge, 2001) has indicated that conscientiousness is a valid predictor of performance across numerous types of jobs. Thus, our failure to find either significant betas or significant bivariate correlations between conscientiousness and any performance trial is unusual. There may have been some unexpected characteristic of the task that negated the effects of conscientiousness that are normally observed, and by extension suppressed any potential interaction effects.

For openness, we found no overall main effects or interactions. The relationship between openness and various aspects of work are weaker than those typically observed for conscientiousness (Barrick, Mount, & Judge, 2001), so the lack of a main effect is not
necessarily unusual. Unexpectedly, in our trial-by-trial analysis (see Appendix S for details) we found a significant interaction between openness and training type on performance in the final training trial. When further examined, this interaction indicated that in the error avoidant condition, individuals with higher levels of openness tended to perform better compared to individuals with lower levels of openness. In the error encouragement condition, individuals performed similarly regardless of level of openness. This was contradictory to the direction of the effect proposed in our hypothesis. That is, we expected to observe a stronger effect for openness on performance for individuals in the error encouragement condition than in the error avoidant condition. This could be evidence of an emergent effect for openness, though given the number of tests performed, we cannot rule out that this effect occurred by chance.

**Hypothesis 2**

For Hypothesis 2 we expected that neuroticism would interact with the type of training received in its effects on affective training outcomes. Whereas we found a main effect for neuroticism when only training type and neuroticism were used to predict negative affectivity, we failed to find a significant interaction between neuroticism and training condition and thus failed to support Hypothesis 2. We additionally tested the effects of neuroticism and training type on positive affectivity but failed to find any significant relationships.

One possible explanation for these findings is that any negative affect generated by committing errors in the task may have been offset by the enjoyment of the task. In fact, a paired-comparison t-test indicated that participant’s negative affectivity overall significantly decreased between the initial assessment immediately preceding the training trials and the second assessment immediately following the last transfer trial, \( t(256) = 10.05, p < .001 \). Previous research (e.g., Frese et al., 1991; Nordstrom, Wendland, & Williams, 1998) has
suggested that committing errors will cause trainees to become increasingly frustrated with a
given task over time, particularly in the error avoidant condition where trainees were not
specifically directed to focus on the positive aspects of errors but instead were induced to have a
more negative perspective towards errors. Because we observed a significant decrease in
negative affectivity over time, either the assumption that errors cause greater frustration is
inaccurate, or other variables, such as the aforementioned task enjoyment possibility, are
offsetting any negative affective effects that may be induced by errors committed by the trainees.

A related possibility is that committing errors did not elicit the proposed frustration
suggested by Frese et al. (1991) and Nordstrom et al. (1998). Frese and colleagues measured
frustration using a 6-item scale they developed specifically for their study, and that same
measure was used in the study carried out by Nordstrom and colleagues. Whereas the full
measure was not published in either study, the sample items listed by Frese and colleagues ask
participants questions such as “Work with the computer is now frustrating” and “I would like to
stop working on the computer now”. Both of these sample items are directed at the computer in
general rather than being directed towards the task being trained. Therefore, it is unclear
whether the frustration being measured is associated with the task or if it is confounded with the
participants’ attitudes towards using computers in general. This potential confound also may
explain why Chillarege, Nordstrom, and Williams (2003) failed to find significant between-
or within-subject effects on frustration, as they were using a measure of frustration adapted from
the ones used by Frese et al. (1991) and Nordstrom et al. (1998). Thus, we suggest that future
measures of frustration should be task-specific rather than oriented towards computers in
general.

_Hypothesis 3a_
In Hypothesis 3a, we proposed that training type would have stronger moderating effects on the relationships between conscientiousness or openness and performance than on the relationships observed for either extraversion or agreeableness. Given that neither conscientiousness nor openness interacted with training type, we could not find support for Hypothesis 3a. Unexpectedly, we found that during both training and transfer there was a significant interaction effect between extraversion and training type on performance. In both cases, individuals in the error avoidant condition performed significantly worse if they were higher in levels of extraversion than individuals who were lower in extraversion in this condition. Meanwhile, individuals in the error encouragement condition performed equally well regardless of level of extraversion.

One possible explanation for this unexpected effect may lie in the sensation seeking aspect of extraversion (e.g., McCrae & Costa, 1987). Given that data was collected in a controlled lab setting over a three-hour period and 50% of that time was spent performing the task, the only environmental stimulation offered by most of the experiment came through performing the task.

We instructed individuals in the error avoidant condition to follow the task instructions as closely as possible. Because of this, the task likely became monotonous. For individuals lower in extraversion this likely was not a problem, but for those individuals who were higher in extraversion there may have been a higher probability of onset of boredom due to the relative lack of external stimulation, and this boredom may have inhibited their performance.

The error encouragement condition may have mitigated this boredom because we encouraged trainees to explore the task rather than follow the instructions. This continuous challenge to make mistakes and learn from them may have maintained the interest of individuals
high in extraversion sufficiently to keep those individuals motivated and thus not show the same performance decrement.

**Hypothesis 3b**

In Hypothesis 3b, we proposed that training type would have a stronger moderating effect on the neuroticism-affective outcome relationship relative to the effects of extraversion and/or agreeableness. As with Hypothesis 3a, we found no significant moderation effects involving neuroticism on affective outcomes. Similarly, we found no moderation effects involving extraversion or agreeableness.

**Future Research**

This study raises several interesting issues for future research related to error avoidant and error encouragement training.

*Feedback.* Previous research has suggested that in order for Error Management Training to be effective, clear feedback must be provided (e.g., Keith & Frese, 2005). In the present study, we kept the type and quality of feedback consistent for both training conditions. However, one possible explanation for the general lack of main effects for the type of training used is that the task used in this study provided this clear feedback about the types and quantities of errors made during any given trial only at the end of a trial. Making some types of errors while the task is in progress will provide some feedback (e.g., attempting to ship a pickup order on a delivery truck or sending delivery orders to the pickup window will not remove the order from the active order queue) whereas other types of errors do not provide any immediate visible feedback (e.g., if you slightly overload a truck, the truck will still leave even though the trainee made a capacity error). Thus, even though clear performance feedback is provided, the feedback is not immediate, and therefore it may be difficult for trainees in the error encouragement
condition to make the connection between the errors committed and the actions taken which lead to those errors. Future research should examine the effects of varying the timing and amount of feedback provided by the task being trained.

Effects of errors on trainee frustration. One fundamental issue that may warrant future examination is the underlying assumption that making errors during training leads to increased frustration over time. Indeed, one of the proposed functions of the error framing statements (along with encouraging trainees to learn from mistakes) is to counteract the frustration supposedly associated with making errors. Whereas we observed effects in the expected direction on attitudes towards errors in our participants, these induced attitudes did not have any significant effects on affective outcomes. Thus, our study along with the Chillarege et al. (2003) findings raises new questions as to the validity of this basic assumption.

One possible approach to examining this effect is to vary the consequences associated with committing errors. In our study error feedback was kept constant across conditions, and participants were rewarded with extra credit on the basis of time spent, not on performance or errors, so in this study there were no lasting benefits or detriments associated with errors. However, in a setting where errors may have more lasting effects, such as a classroom where errors typically lead to lower grades or in the workplace where errors often have financial penalties or could mean termination of employment, errors may have the proposed frustrating effects. Additionally, future research should examine other potential effects which may negate the effects of frustration that may be caused by errors, such as task enjoyment, task satisfaction, or other variables.

Effects for Extraversion. A significant finding of this study is that there is evidence that training type can influence the relationship between extraversion and performance outcomes.
Further research is needed to examine if this effect is repeatable in different tasks. Additionally, research should examine if global personality variables such as the Big 5 or if more narrow subfacets of personality can better account for the effects seen in this study.

**Amount of instruction.** Finally, previous research on the topic of error management training and other error encouragement training types has been relatively unclear about exactly how much or how little basic instruction about a given task should be given before a trainee is asked to perform that task. The specific amount of knowledge needed will be influenced by the nature and complexity of the task being trained but may be influenced also by the training type, i.e., error encouragement versus error avoidant. By varying the amount of instruction provided we may be able to better assess whether there are relative differences in the amount of instruction needed for each type of training.

Previous research generally has presumed that one can or perhaps even should provide less task instruction in error management training than in error avoidant training. Indeed, trainees in error management training are generally taught basic guiding principles of the task and possibly some basic functions that they may use. Much of the rest of their instruction is focused on changing a trainee’s attitudes towards errors. On the other hand, trainees in an error avoidant training condition usually are given instructions specifically focused on how they should perform the task. Given that most of the previous research on the topic of error avoidant and error encouragement training has favored error encouragement training in terms of performance outcomes, less instruction appears to be initially the more favorable option. However, given the relatively vague nature of the descriptions of the amount of instruction provided in many of these studies, this point is not very clear.
In this study, we used the Enactive Exploration approach. This approach provides participants in the error encouragement training conditions with the same initial task instructions as those in error avoidant training approaches. Further, we provided both training conditions with equivalent error framing instructions. Additionally, because in our pilot testing we observed that some participants in both training conditions spent considerable time whereas others spent virtually no time reviewing task instructions, we elected to strictly control the amount of time each participant was allowed to spend looking over the instructions to the task, regardless of training condition.

To our knowledge, these steps have not been taken in previous studies and address a potential confound in prior research between instruction and training type. That is, some previous research has provided different amounts of instructions depending on training type and/or allowed continued exposure to task instructions during task performance in error avoidant training. This creates a potential confound between amount of or exposure to task instructions and training type that is difficult to assess because prior research has not reported information about the amount of time participants spent performing the task versus reviewing instructions. For example, Keith and Frese (2005) stated that participants were allowed to look at their instructions throughout the training process but not during transfer. However, they failed to report any data about how long participants spent looking at those instructions. Because of this, it is unclear if performance differences can be attributed to the type of training used or the ratio of time spent reading instructions to time spent performing the task. The superior performance reported in the Keith and Frese (2005) study for the error management trainees thus may be a result of more practice with the task because by definition they were instructed to practice with the task in an effort to make mistakes and learn from them. The error avoidant trainees would
instead be oriented more to spending more time examining the instructions because their training condition specifies that they are to follow the instructions closely to perform optimally and thus would need to be more familiar with the details of those instructions than error management trainees.

To control for this possibility, the amount of instruction and amount of exposure to that instruction must be controlled. However, it is possible that there may indeed be differences in the amount of instruction or amount of exposure to the instructions for each type of training condition. Therefore, future research should examine the effects of varying the amount and exposure times to task instructions to see if there are relative differences in the optimal levels of each for each training condition.

**Limitations.** One limitation of this study is that we recruited our participants from introductory university classes, thus our sample may not be representative of the general population, for example with respect to cognitive ability levels. However, the university from which these participants were recruited has an open-enrollment policy that allows for the inclusion of students who may otherwise not be able to attend college. Thus, our sample may be representative of the general population in terms of cognitive ability. Moreover, given that our participants were, in general, nontraditional students who hold part- or full-time jobs while they attend school, they may be representative in this way also of a population of working young adults.

Another limitation of our study may relate to the task used in the study. The skills we trained participants to perform in this task likely have limited practical use beyond the lab setting, so participants may not have been as motivated to learn this task as one that may have
been of more use to them beyond just the lab setting. However, we chose this task specifically to create a novel task in order to avoid potential confounds with task experience.

**Conclusions.** Although results failed to support our hypotheses, we contributed to our knowledge of the effects of error encouragement and error avoidant training in two important ways. First, even though we observed the intended psychological effects on attitudes towards errors, these effects did not lead to differences in training outcomes. This suggests that further work is necessary to examine the mechanisms through which each type of training approach influences training outcomes. Additionally, we found an unexpected but significant moderating effect of training type on extraversion effects on performance. This effect suggests that error encouragement training actually might work through maintaining trainee interest in the task longer by allowing them to explore the task rather than attempting to follow a set of instructions repeatedly over a long period of time. This raises the possibility that the differing effects of error avoidant and error encouragement training on training outcomes may be due to differences in motivational factors between the two types of training rather than differences in the amount of knowledge gained during training as has been previously theorized.
References


Appendix A

Induction Messages

Error Avoidant Message

When performing the task, try to avoid making mistakes. Follow the instructions carefully. If you follow the directions, you can perform the task with few mistakes. Try to perform this task correctly.

Error-Encouragement Message

Errors are a natural part of learning. Errors inform you about what you still can learn. The more errors you make, the more you learn. If you make a mistake, try to figure out how to fix the problem.
Appendix B

Framing Statements for Training Type Induction

Error Encouragement
1. Errors are a natural part of the learning process.
2. There is always a way to leave the error situation.
3. Errors inform you about what you still can learn.
4. The more errors you make, the more you learn.

Error Avoidant
1. Try to avoid making mistakes.
2. Try to follow the directions given for this task closely.
3. If you follow directions, then you won’t make mistakes.
4. Try to perform this task correctly.
Appendix C

Description of Pilot Studies

Pilot Study I

The purposes of the initial pilot study were 1) to assess whether our framing statements were having the intended psychological effects on participants (either priming them to avoid errors or to attempt to learn from them), 2) to assess if the manipulation check measure indicated differences in attitudes towards errors between the error avoidant and error encouragement conditions, 3) to determine if there was a significant difference in performance in the error avoidant and error encouragement conditions, and finally 4) to obtain estimates of the average time necessary for participants to complete some of the measures to be used in the study.

Method

Participants

We recruited thirty participants who were enrolled in introductory psychology courses at a Midwestern university. Participants ranged in age from 17 to 25 years with a mean age of 19.30 years and a standard deviation of 1.97 years. There were seventeen females and thirteen males in the sample.

Procedure

We randomly assigned participants to either the error avoidant or error encouragement condition at the outset of the experiment. We seated participants in a room with six computers and instructed them to follow along in the instruction packet provided for the truck dispatcher task while we played an audio recording of the instructions. After the audio recording finished, we provided participants with the induction message for their appropriate condition and asked them to complete a trial of the task. After the first trial, participants completed the manipulation
check (Appendix F), the PANAS (Appendix H), and the Anxiety (Appendix I) measures. We then administered the induction again and asked participants to perform another trial of the task. After this second trial, participants completed the manipulation check, PANAS, and Anxiety measures again. After participants completed these questionnaires, they completed the Task-specific Self-efficacy (Appendix L), IPIP Big Five measures (Appendix G), computer anxiety measure (Appendix C), and a measure of demographics (Appendix J).

Results

Reliability Analyses

For the positive affectivity subscale of the PANAS, we found an internal consistency alpha of .84 during the initial administration of the measure and .89 during the second administration. For the negative affectivity subscale, we found an internal consistency alpha of .85 during the initial administration and .93 during the second administration. We found internal consistency alphas of .62 for agreeableness, .83 for conscientiousness, .87 for extraversion, .67 for neuroticism, and .64 for openness. The frustration measure had an internal consistency alpha of .91 at the first administration and .93 at the second administration. For the task-specific self efficacy measure we found an internal consistency alpha of .84. Finally, an exploratory factor analysis of our manipulation check measure indicated that the measure contained two subscales of three items each for both administrations of the measure. Items 2, 3, and 6 loaded onto one factor, forming an error avoidant subscale, and Items 1, 4, and 5 loaded onto the second factor, forming and error encouragement subscale. Higher scores on each of these subscales indicated stronger acceptance of the associated attitude towards errors. The error encouragement subscale had an internal consistency reliability of .74 at Time 1 and .86 at Time 2. The error avoidant subscale had an internal consistency alpha of .70 at Time 1 and .69 at Time 2.
Analysis of Frustration and Anxiety Measures

When we analyzed the correlation between the frustration measure and other study variables, we found a strong correlation between the negative affectivity subscale and the frustration scale measures. During the initial administration of both measures, we found a correlation of \( r = .91, p < .001 \), and during the second administration, we found a correlation of \( r = .86, p < .001 \). Given this high degree of correlation between the two measures, we elected to drop the anxiety scale (Appendix I) from the study.

Analysis of Manipulation and Effects

An independent-samples t-test analysis of our manipulation check indicated no significant differences between participants in the two training conditions in their responses to either the error encouragement subscale, \( t(28) = -.96, p = .35 \), or the error avoidant subscale, \( t(28) = 1.47, p = .15 \), at Time 1. At Time 2, we also failed to observe significant differences in responses to the error encouragement subscale, \( t(28) = -.47, p = .64 \), and the error avoidant subscale, \( t(28) = .57, p = .58 \). Similarly, we found no significant training type condition effects in performance in Trial 1, \( t(28) = .83, p = .41 \), or in Trial 2, \( t(28) = -.32, p = .75 \).

Pilot Study I Discussion

The initial pilot study revealed several issues of concern. The first issue raised was the lack of a condition effect, suggesting that the induction may not have had the intended psychological effect. However, because the participants completed a trial of the task between the induction messages and the manipulation check, we could not clearly assess the effect of the induction messages. However, participants who answered the manipulation check between Trial 1 and 2 in a way that indicated that they were more favorable to learning from mistakes performed better on the subsequent performance trial of the task. This result suggested that
whereas the induction may not have worked, those individuals whose attitudes towards errors were in line with error management training philosophy were performing significantly better than those whose attitudes were more in line with error avoidant training. This provided support for the notion that the error management and error avoidant training attitudes have differential effects on performance but suggested that our induction was ineffective in creating the relevant attitudes.

The second issue raised by the first pilot study was a potential confound due to the amount of instruction received by each participant, as it was noted that some participants would keep referring back to the instruction packets for the task throughout the study whereas others did not. To address this issue, we decided to restrict participants to being able to look at the instruction packets only during the initial audio recording playback at the outset of the experiment session.

A third observation from this pilot study was that there was a very high positive correlation between the anxiety scale and the negative affectivity scale of the PANAS. Based on this finding, we decided to remove the anxiety measure from subsequent studies.

Pilot Study 2

Based on the results of the initial pilot study, we decided to conduct a second pilot study to address the amount of instruction and induction/manipulation check issues from the first pilot study. Because the focus of the second pilot study was specifically on the induction, the manipulation check, and the effect of the induction on performance, we omitted all other measures from this pilot study.

Method

Participants
We recruited 25 participants for the second pilot study. We again recruited participants from introductory psychology courses in exchange for extra credit.

Procedure

As with the first pilot study, we randomly assigned participants to either the error avoidant or error encouragement condition at the outset of the experiment. We seated participants in a room with six computers, told the participants that they would complete a few trials of a computer-based task, and instructed them to follow along in the instruction packet provided for the truck dispatcher task while we played an audio recording of the instructions. After the audio recording finished, we asked participants to put away the instruction packets and told them that they were not allowed to look at the packets again for the rest of the experiment. We then administered the induction messages for their training condition to participants. Immediately following the induction messages, participants completed the manipulation check questionnaire. After completing the manipulation check, participants performed one trial of the task. After completing the trial, we administered the induction message again to participants and asked to them complete the manipulation check. After completing the second manipulation check, we informed participants that the experiment was complete, and we debriefed them.

Results

We again used independent-samples t-tests to test for significant difference between training conditions. For the manipulation check, we found no significant differences between groups in their responses to the error encouragement subscale, t(23) = -1.28, p = .21, or the error avoidant subscale, t(23) = .49, p = .62. Similarly, we observed no significant differences in responses at Time 2 to the error encouragement subscale, t(28) = .61, p = .55, or the error...
avoidant subscale, \( t(23) = .89, p = .38 \). Finally, we observed no significant differences between training conditions in task performance, \( t(23) = .04, p = .97 \)

Pilot Study 2 Discussion

Whereas we designed Pilot Study 2 to address problems in measuring the effect of the induction and the induction’s effect on task performance, the results of this study indicated that the induction messages still were not having the intended psychological effect. To address these continuing problems with the induction, we devised a third pilot study.

Pilot Study 3

The purpose of Pilot Study 3 was to assess the effect of strengthening the inductions used in the study and to investigate the possibility of an emergent effect over time rather than an immediate effect of training condition on performance.

Method

Participants

We recruited 17 participants from introductory psychology courses. Participants received extra credit in exchange for their participation.

Procedure

As in the previous pilot studies, we randomly assigned participants to either the error avoidant or error encouragement condition at the outset of the experiment. We seated participants in a room with six computers, told participants that they would complete a few trials of a computer-based task, and instructed them to follow along in the instruction packet provided for the truck dispatcher task while we played an audio recording of the instructions. After the audio recording finished, we asked participants to put away the instruction packets and told them that they were not allowed to look at the packets again for the rest of the experiment. We then
administered to participants the induction messages for their training condition. To strengthen
the effect of the induction, we asked participants to write down the induction message that
appeared on their computer screen to ensure that participants were paying attention to the
induction. Immediately following the induction messages, participants completed the
manipulation check questionnaire. After completing the manipulation check, participants
performed four trials of the task. Then, we readministered to participants the induction message
and asked them to complete the manipulation check again. After completing the second
manipulation check, participants completed four more trials of the task.

Results

Manipulation Check

We used independent-samples t-tests to test for a significant difference between training
conditions on the manipulation check measure. This time we found significant differences
between groups in their responses to the error encouragement subscale, \( t(15) = -2.81, p < .05 \), but
not the error avoidant subscale, \( t(15) =- 60, p = .56 \), during Time 1. Participants in the error
couragement training condition responded more favorably (\( M = 5.95, SD = .62 \)) to questions
indicating that they could learn from errors when compared to participants in the error avoidant
condition (\( M = 5.17, SD = .53 \)). At Time 2, we found significant differences for participant
responses on the error encouragement subscale, \( t(15) = -2.71, p < .05 \), but again failed to detect
significant differences in participant responses to the error avoidant subscale, \( t(15) = 1.02, p =
.32 \). Participants in the error encouragement condition responded more favorably to the items on
the scale (\( M = 6.24, SD = .85 \)) than participants in the error avoidant condition (\( M = 4.67, SD =
1.35 \)). Based on these findings for the error encouragement subscale, we found support that the
strengthened induction was having the intended psychological effect on participants’ attitudes towards errors.

Analysis of Performance

To analyze the effects of the type of training used on performance, we conducted independent-samples t-tests comparing performance scores in the error avoidant and error encouragement conditions. For Trials 1, 2, 3, and 4, participant performance was not significantly different between training conditions, \( t(15) = .23, p = .82 \), \( t(15) = 1.23, p = .24 \), \( t(15) = 1.54, p = .14 \), and \( t(15) = 1.35, p = .20 \), respectively. In Trial 5 we found a significant difference in participant performance between training conditions, \( t(15) = 2.29, p < .05 \).

Participants in the error avoidant condition \((M = 1216.50, SD = 769.15)\) outperformed participants in the error encouragement condition \((M =76.43, SD = 1287.98)\). In Trials 6, 7, and 8, we failed to find significant differences in performance for participants in our two training conditions, \( t(15) = 1.09, p = .29 \), \( t(15) = 1.51, p = .15 \), and \( t(15) = 1.96, p = .07 \), respectively.

Discussion of Pilot Study 3

Based on the results of the third pilot study, we were satisfied that the steps taken to strengthen the induction messages were sufficient to induce the desired psychological effects on the participants. Further, it appeared that these effects were altering performance outcomes. Even though only one of the eight trials were statistically significant, given that we were able to detect significant differences with the very small sample size used in this pilot study, we felt confident enough to begin the full study.
Appendix D

Feedback Screen Example

YOUR PERFORMANCE ANALYSIS:

Performance Score : 1175
No. Points Earned : 1335
No. Penalty Points : 160
No. Pickup Shipments: 7
No. Trucks Shipped : 6
No. Times Shipped: Truck 1: 2
                   Truck 2: 2
                   Truck 3: 2
No. Total Errors : 36

You sent a truck to more than 3 zones. Assign each truck to 3 zones. Then load that truck only with items from those zones.

STOP and wait here for further instructions ...
Appendix E

INTRODUCTION

The task you are about to work on simulates some of the activities a truck dispatcher would perform. We are interested in collecting information on how individuals perform this task.

Truck dispatchers perform several duties. They must first accept the orders that are being received from various places. Each order is placed into a waiting queue until the dispatchers accept the order. The dispatchers then must decide the manner in which these orders are to be shipped out of the warehouse. One way they decide how to ship the orders is by looking at what part of the city each order must be shipped to. This information will be used in deciding which truck to place the order on. They must also know how many orders each truck can hold. They also see whether or not the order is to be picked up by a customer, in which case, the order must be sent to the pick-up window so that the customer can pick up the order. The dispatchers must also see whether the order is a rush order or not and when an order needs to be shipped.

The purpose of this task is to accept incoming orders for processing, process those orders appropriately, and dispatch trucks quickly and efficiently. You will receive points for each unit you ship correctly. Points will be subtracted for certain types of errors. As you work, you will receive information about your performance.

Also, at various points during the task we will ask you to complete short questionnaires. It is important that you follow the instructions given and answer all the questions.

PLEASE READ ALL THE TASK INSTRUCTIONS GIVEN BELOW VERY CAREFULLY. YOU WILL NEED THIS INFORMATION TO PERFORM THE TASK. If at any time you have a question, raise your hand, and an experimenter will help you.

TASK DESCRIPTION

We will now describe each part of the task and the task performance rules.

To perform this task you must first learn what to do and how to perform actions using the keyboard. The next section explains the purpose of each key and how to use the keys.

The following keys will be used:

**UP ARROW**: moves cursor up
**DOWN ARROW**: moves cursor down
**RIGHT ARROW**: moves cursor to the right
**LEFT ARROW**: moves cursor to the left
**F1**: moves cursor between top and bottom windows
**CTRL-A**: accepts an order out of the queue
**CTRL-Y**: dispatches a truck
**CTRL-P**: delivers an order to the pick-up window
1-8: displays rules
ENTER: selects and unselects an order to be shipped

To use the control key (CTRL) commands, hold down the CTRL key while you press the letter key.

In this task you will perform three basic activities:
1) accepting incoming orders for processing
2) processing orders
3) dispatching trucks

The next section explains the information presented on the screen.
Please refer to the screen diagram as needed.

The screen display contains 3 windows: a command window, a processing window, and a dispatch window.

The command window is located at the left side of the screen. The commands you can use are shown in the upper portion of the window. The lower portion of the command window shows the number of incoming orders awaiting processing (Orders in Queue) and the number of orders currently in the processing window (Active Orders). The time at which each order arrived into the queue (Queue Time) is shown at the bottom of this window as each order is accepted.

The processing window is located in the bottom section of the screen. This window shows the orders you have accepted for processing. The invoice number for an order (INV#), customer name (CUSTOMER), quantity (QTY), and item (ITEM) are shown for each order. The Truck/P column shows the numbers of the 3 trucks on which orders may be placed (1,2,3) and P, which indicates the pick-up window. The Zone column shows which of 5 city areas the order is to be shipped to. The Message (M) column shows whether a special request has been made by the customer: "0" indicates the customer has made no special request; "1" indicates the customer requests the order be sent to the pick-up window (P); and "2" indicates the customer requests a rush shipment. You may keep up to 20 orders in the processing window.

The dispatch window is located at the top section of the screen. This window displays the status of each truck. There are three trucks. The current quantity of items loaded on each truck is given (Number of Units Loaded) as well as the capacity (in units) of each truck. This window also shows whether orders have been shipped: YES indicates that a truck is delivering orders; No indicates that a truck is available for loading.

You can move between the processing window and dispatch window by pressing the F1 key.

The time at which each order was accepted into the processing window (Invoice Number) is shown on the top line of the screen. The invoice number and time of acceptance is displayed for the order the cursor is pointing to. The current day and time is also displayed in the highlighted area on the top line of the screen.
The next sections describe each of the three activities: accepting orders, processing orders, and shipping trucks.

As orders come in they are placed in a queue to await processing. Orders in Queue in the command window indicates how many orders are awaiting processing. To accept an order for processing, press CTRL-A. The order you accepted will then be displayed at the bottom of the processing window.

You select which orders to load on trucks from the processing window. Use the up, down, right, and left arrow keys to move the cursor in the window. The cursor is shown in the Truck/P column. Use the up and down arrow keys to point to the order (the invoice number) you wish to ship. Use the left and right arrow keys to point to where you want to send the order: Truck 1, 2, or 3 or P (pick-up window). Then press the return key to select that location. The truck number or P will be highlighted. To unselect a truck/P, move the cursor back to the highlighted area and press return again. The processing window shows you only some of the orders in the window. You may see other orders by using the down arrow key to scroll to the bottom of the window.

The third activity is shipping trucks. Once you have selected the orders you wish to ship, you may ship a truck(s). This is performed in the dispatch window. The cursor is displayed in the row labelled SHIPPED?. Use the left and right arrow keys to point to the truck you want to ship. Then press CTRL-Y. The row labelled SHIPPED? will change from NO to YES to tell you the truck has been shipped. Also, the orders your shipped will disappear from the processing window.

The orders that are Pickups can be shipped directly from the processing window. To ship an order to the pick-up window, use the left and right arrow keys to point to P (pick-up). Then press the return key to select the pick-up window. To ship the order, press CTRL-P. The order will then disappear from the window.

The current day and time can be viewed throughout the task in the top right corner of the screen. The task begins at 9:00 Monday and ends at 5:00 Friday. Each hour interval in the task is equivalent to 15 seconds in real time. When the task is completed, you will be given information about your performance. You will then be asked to answer some questions.

There are eight rules to follow while performing this task. They represent the type of rules followed by truck dispatchers in general. Please note that every rule is enforced and will affect your performance. The rules guide your decisions in shipping orders. Points will be deducted from your total score when a rule is broken. IT IS IMPORTANT THAT YOU FOLLOW ALL OF THE RULES.

Each rule number corresponds with a number located at the top of the keyboard. You can view the rules while you perform the task by pressing the appropriate number on the keyboard. For instance, if you want to view rule one, press the key marked 1 on the keyboard. When you view the rules, the number of penalty points for breaking that rule will also be shown.
The eight rules are described below.

RULE 1: A PICK-UP ORDER MUST BE SHIPPED TO THE PICK-UP WINDOW. ALL OTHER ORDERS MUST BE SHIPPED ON A TRUCK.

RULE 2: ALL ORDERS MUST BE SHIPPED ON SCHEDULE. THAT IS, REGULAR ORDERS MUST BE SHIPPED WITHIN 2 DAYS; RUSH ORDERS MUST BE SHIPPED WITHIN 1 DAY; PICK-UPS MUST BE SHIPPED WITHIN 1 DAY.

RULE 3: A TRUCK MAY NOT DELIVER ORDERS TO MORE THAN THREE ZONES.

RULE 4: WHOLE (NOT PARTIAL) ORDERS MUST BE SHIPPED.

RULE 5: TRUCK LOADS SHOULD NOT EXCEED TRUCK CAPACITY.

RULE 6: TRUCK LOADS EXCEEDING TRUCK CAPACITY BY MORE THAN 20% MAY NOT BE SHIPPED.

RULE 7: ORDERS MUST NOT REMAIN IN THE QUEUE FOR MORE THAN 1 DAY.

RULE 8: ORDERS ACCEPTED FOR PROCESSING MUST BE SHIPPED BY THE END OF THE TASK.

Remember, you can look at any rule by pressing the appropriate number on the keyboard. There is no penalty for looking at a decision rule. You can review any rule as often as you want. The rules will help you to perform the task.
Appendix F

Manipulation Check

Rate your agreement with the following statements using the following scale.

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Disagree</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Strongly Agree</td>
</tr>
</tbody>
</table>

1. I believe that making mistakes helps me learn how to perform the task better.
2. The best way to perform the task is to make as few mistakes as possible.
3. I’m doing better on the task if I am not making mistakes.
4. The task gives me a chance to correct my mistakes.
5. Errors provide useful information.
6. It’s bad to make mistakes.
Appendix G

IPIP Scales

On the following pages, there are phrases describing people's behaviors. Please use the rating scale below to describe how accurately each statement describes you. Describe yourself as you generally are now, not as you wish to be in the future. Describe yourself as you honestly see yourself, in relation to other people you know of the same sex as you are, and roughly your same age. So that you can describe yourself in an honest manner, your responses will be kept in absolute confidence. Please read each statement carefully, and then fill in the bubble that corresponds to the number on the scale.

<table>
<thead>
<tr>
<th></th>
<th>1: Very Inaccurate</th>
<th>2: Moderately Inaccurate</th>
<th>3: Neither Inaccurate nor Accurate</th>
<th>4: Moderately Accurate</th>
<th>5: Very Accurate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Have a good word for everyone.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Waste my time.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Feel comfortable around people.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Rarely get irritated.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Believe in the importance of art.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Have a sharp tongue.</td>
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<tr>
<td>7</td>
<td>Am always prepared.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Have little to say.</td>
<td></td>
<td></td>
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<tr>
<td>9</td>
<td>Often feel blue.</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Am not interested in abstract ideas.</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>11</td>
<td>Believe that others have good intentions.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Find it difficult to get down to work.</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>13</td>
<td>Make friends easily.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Seldom feel blue.</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
15. Have a vivid imagination.
16. Cut others to pieces.
17. Pay attention to details.
18. Keep in the background.
19. Dislike myself.
20. Do not like art.
21. Respect others.
22. Do just enough work to get by.
23. Am skilled in handling social situations.
24. Feel comfortable with myself.
25. Tend to vote for liberal political candidates.
26. Suspect hidden motives in others.
27. Get chores done right away.
28. Would describe my experiences as somewhat dull.
29. Am often down in the dumps.
30. Avoid philosophical discussions.
31. Accept people as they are.
32. Don't see things through.
33. Am the life of the party.
34. Am not easily bothered by things.
35. Carry the conversation to a higher level.
36. Get back at others.
37. Carry out my plans.
38. Don't like to draw attention to myself.
39. Have frequent mood swings.
40. Do not enjoy going to art museums.
41. Make people feel at ease.
42. Shirk my duties.
43. Know how to captivate people.
44. Am very pleased with myself.
45. Enjoy hearing new ideas.
46. Insult people.
47. Make plans and stick to them.
48. Don't talk a lot.
49. Panic easily.
50. Tend to vote for conservative political candidates.
Appendix H

The PANAS

This scale consists of a number of words that describe different feelings and emotions. Read each item and then mark the appropriate answer in the space next to that word. Answer the following in regards to when you were performing the truck-dispatcher task. Use the following scale to record your answers.

<table>
<thead>
<tr>
<th></th>
<th>1 very slightly or not at all</th>
<th>2 a little</th>
<th>3 moderately</th>
<th>4 quite a bit</th>
<th>5 extremely</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>__interested</td>
<td>__irritable</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>__distressed</td>
<td>__alert</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>__excited</td>
<td>__ashamed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>__upset</td>
<td>__inspired</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>__strong</td>
<td>__nervous</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>__guilty</td>
<td>__determined</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>__scared</td>
<td>__attentive</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>__hostile</td>
<td>__jittery</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>__enthusiastic</td>
<td>__active</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>__proud</td>
<td>__afraid</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix I

Frustration and Anxiety

As you were performing the truck dispatcher task, how intensely did you feel each of the following ten emotions. Use the following scale to answer.

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Not at all</td>
<td>Very Much</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

____ angry
____ frustrated
____ guilt
____ shame
____ sad
____ disappointed
____ depressed
____ worried
____ uncomfortable
____ fearful
Appendix J

Demographics

Please provide the following information.

Age:______________

**Gender (mark one):**

- Male________  Female:_________

**Race (mark one):**

- African-American _____
- Asian-American _____
- Hispanic _____
- Native American _____
- White _____

Other (please specify):_________________________

**Class Rank (mark one):**

- Grad Student:    _____
- Senior:          _____
- Junior:          _____
- Sophomore:       _____
- Freshman:        _____
- Other/Nondegree: _____

**Major (please specify):**________________________

**College GPA (please specify):**________________________
Appendix K

Shipley Institute of Living Scale
SHIPLEY INSTITUTE OF LIVING SCALE
Administration Form
Walter C. Shipley, Ph.D.

Name: ________________________ Sex: M F Age: __________
Education: ___________________ Usual Occupation: ______________ Today's Date: __________

Part I

Instructions: In the test below, the first word in each line is printed in capital letters. Opposite it are four other words. Circle the one word which means the same thing, as the first word. If you don't know, guess. Be sure to circle the one word in each line that means the same thing as the first word.

EXAMPLE:

<table>
<thead>
<tr>
<th>LARGE</th>
<th>red</th>
<th>big</th>
<th>silent</th>
<th>wet</th>
</tr>
</thead>
<tbody>
<tr>
<td>TALK</td>
<td>draw</td>
<td>eat</td>
<td>speak</td>
<td>sleep</td>
</tr>
<tr>
<td>PERMIT</td>
<td>allow</td>
<td>sew</td>
<td>cut</td>
<td>drive</td>
</tr>
<tr>
<td>PARDON</td>
<td>forgive</td>
<td>pound</td>
<td>divide</td>
<td>tell</td>
</tr>
<tr>
<td>COUCH</td>
<td>pin</td>
<td>eraser</td>
<td>sofa</td>
<td>glass</td>
</tr>
<tr>
<td>REMEMBER</td>
<td>swim</td>
<td>recall</td>
<td>number</td>
<td>defy</td>
</tr>
<tr>
<td>TUMBLE</td>
<td>drink</td>
<td>dress</td>
<td>fall</td>
<td>think</td>
</tr>
<tr>
<td>HIDEOUS</td>
<td>silvery</td>
<td>tilted</td>
<td>young</td>
<td>dreadful</td>
</tr>
<tr>
<td>CORDIAL</td>
<td>swift</td>
<td>muddy</td>
<td>leafy</td>
<td>hearty</td>
</tr>
<tr>
<td>EVIDENT</td>
<td>green</td>
<td>obvious</td>
<td>skeptical</td>
<td>afraid</td>
</tr>
<tr>
<td>IMPOSTOR</td>
<td>conductor</td>
<td>officer</td>
<td>book</td>
<td>pretend</td>
</tr>
<tr>
<td>MERIT</td>
<td>deserve</td>
<td>distrust</td>
<td>fight</td>
<td>separate</td>
</tr>
<tr>
<td>FASCINATE</td>
<td>welcome</td>
<td>fix</td>
<td>stir</td>
<td>enchant</td>
</tr>
<tr>
<td>INDICATE</td>
<td>defy</td>
<td>excite</td>
<td>signify</td>
<td>bicker</td>
</tr>
<tr>
<td>IGNORANT</td>
<td>red</td>
<td>sharp</td>
<td>uniformed</td>
<td>precise</td>
</tr>
<tr>
<td>FORTIFY</td>
<td>submerge</td>
<td>strengthen</td>
<td>vent</td>
<td>deaden</td>
</tr>
<tr>
<td>RENOWN</td>
<td>length</td>
<td>head</td>
<td>fame</td>
<td>loyalty</td>
</tr>
<tr>
<td>NARRATE</td>
<td>yield</td>
<td>buy</td>
<td>associate</td>
<td>tell</td>
</tr>
<tr>
<td>MASSIVE</td>
<td>bright</td>
<td>large</td>
<td>speedy</td>
<td>low</td>
</tr>
<tr>
<td>HILARITY</td>
<td>laughter</td>
<td>speed</td>
<td>grace</td>
<td>malice</td>
</tr>
<tr>
<td>SMIRCHED</td>
<td>stolen</td>
<td>pointed</td>
<td>remade</td>
<td>soiled</td>
</tr>
<tr>
<td>SQUANDER</td>
<td>tease</td>
<td>belittle</td>
<td>cut</td>
<td>waste</td>
</tr>
<tr>
<td>CAPTION</td>
<td>drum</td>
<td>ballast</td>
<td>heading</td>
<td>ape</td>
</tr>
<tr>
<td>FACILITATE</td>
<td>help</td>
<td>turn</td>
<td>strip</td>
<td>bewilder</td>
</tr>
<tr>
<td>JOCOSE</td>
<td>humorous</td>
<td>paltry</td>
<td>fervid</td>
<td>plain</td>
</tr>
<tr>
<td>APPRISE</td>
<td>reduce</td>
<td>stew</td>
<td>inform</td>
<td>delight</td>
</tr>
<tr>
<td>RUE</td>
<td>eat</td>
<td>lament</td>
<td>dominate</td>
<td>cure</td>
</tr>
<tr>
<td>DENIZEN</td>
<td>senator</td>
<td>inhabitant</td>
<td>fish</td>
<td>atom</td>
</tr>
<tr>
<td>DIVEST</td>
<td>dispossess</td>
<td>intrude</td>
<td>rally</td>
<td>pledge</td>
</tr>
<tr>
<td>AMULET</td>
<td>charm</td>
<td>orphan</td>
<td>dingo</td>
<td>pond</td>
</tr>
<tr>
<td>INEXORABLE</td>
<td>untidy</td>
<td>inviolable</td>
<td>rigid</td>
<td>sparse</td>
</tr>
<tr>
<td>SERRATED</td>
<td>dried</td>
<td>notched</td>
<td>armed</td>
<td>blunt</td>
</tr>
<tr>
<td>LISSOM</td>
<td>moldy</td>
<td>loose</td>
<td>supple</td>
<td>convex</td>
</tr>
<tr>
<td>MOLLIFY</td>
<td>mitigate</td>
<td>direct</td>
<td>certain</td>
<td>abuse</td>
</tr>
<tr>
<td>PLAGIARIZE</td>
<td>appropriate</td>
<td>intend</td>
<td>revoke</td>
<td>maintain</td>
</tr>
<tr>
<td>ORIFICE</td>
<td>brush</td>
<td>hole</td>
<td>building</td>
<td>lute</td>
</tr>
<tr>
<td>QUERULOUS</td>
<td>maniacal</td>
<td>curious</td>
<td>devout</td>
<td>complaining</td>
</tr>
<tr>
<td>PARIAH</td>
<td>outcast</td>
<td>priest</td>
<td>lentil</td>
<td>locker</td>
</tr>
<tr>
<td>ABET</td>
<td>waken</td>
<td>ensue</td>
<td>incite</td>
<td>placate</td>
</tr>
<tr>
<td>TEMERITY</td>
<td>rashness</td>
<td>timidity</td>
<td>desire</td>
<td>kindness</td>
</tr>
<tr>
<td>PRISTINE</td>
<td>vain</td>
<td>sound</td>
<td>first</td>
<td>level</td>
</tr>
</tbody>
</table>

Turn over this sheet and continue with Part II when instructed to do so.
Part II

Instructions: Complete the following by filling in either a number or a letter for each dash (______). Do the items in order, but don’t spend too much time on any one item.

EXAMPLE: A B C D E

(1) 1 2 3 4 5 ____
(2) white black short long down ____
(3) A B C D E ____
(4) Z Y X W V U ____
(5) 1 2 3 2 1 2 3 4 3 2 3 4 5 4 3 4 5 6 ____
(6) NE/SW SE/NW E/W N/ ____
(7) escape scape cape ____
(8) oh ho rat tar mood ____
(9) A Z B Y C X D ____
(10) tot tot bard drab 537 ____
(11) mist is wasp as pint in tone ____
(12) 57326 73265 32657 26573 ____
(13) knit in spud up both to stay ____
(14) Scotland landscape scapegoat ____
(15) surgeon 1234567 snore 17635 rogue ____
(16) tam tan rib rid rat raw hip ____
(17) tar pitch throw saloon bar rod fee tip end plank ____
(18) 3124 82 73 154 46 13 ____
(19) lag leg pen pin big hog rob ____
(20) two w four r one o three ____

Summary Scores

V: Raw _____ T _____ At Raw _____ T _____ Total: Raw _____ T _____
CQ: _____ AQ: _____ Est. IQ: ______
Appendix L

Computer Anxiety Measure

1. Of the following, did you feel:
   ___ angry at the computer   ___ angry at yourself   ___ helpless/resigned
   ___ determined to fix it   ___ neutral   ___ other: ___________

2. Computers make me feel:

   1  2  3  4  5  6  7  8  9
   Very Uncomfortable   Very Comfortable

3. When you run into a problem on the computer or an application you are using, do you feel:

   1  2  3  4  5  6  7  8  9
   Anxious   Relaxed/Indifferent

4. When you encounter a problem on the computer or an application you are using, how do you feel about your ability to fix it?

   1  2  3  4  5  6  7  8  9
   Helpless   Confident that I can fix it

5. How will the frustrations that you experienced affect the rest of your day?

   1  2  3  4  5  6  7  8  9
   Not at All   Very Much

6. Are the incidents that occurred while you were recording your experiences typical of your everyday computer experience? (Circle One)

   Yes   No

7. In general, do you experience more or less frustrating incidents while using a computer on an average day?

   1  2  3  4  5  6  7  8  9
   Less   More
Appendix M

Personal Efficacy Beliefs Scale (Riggs, et al., 1994)

Think about your ability to do the tasks required by your job. When answering the following questions, answer in reference to your own personal work skills and ability to perform your job.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Strongly Disagree</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Strongly Agree</td>
<td></td>
</tr>
</tbody>
</table>

1. I have confidence in my ability to do the truck-dispatcher task.
2. There are some tasks required by the truck-dispatcher task that I cannot do well.
3. When my performance is poor, it is due to my lack of ability.
4. I doubt my ability to do the truck-dispatcher task.
5. I have all the skills needed to perform the truck-dispatcher task very well.
6. Most people can do the truck-dispatcher task better than I can.
7. I am an expert at the truck-dispatcher task.
8. My future in a job like the truck-dispatcher task is limited because of my lack of skills.
9. I am very proud of the truck-dispatcher task skills and abilities.
10. I feel threatened when others watch me work.
Appendix N

The Core Self-Evaluations Scale (CSES)

Instructions: Below are several statements about you with which you may agree or disagree. Using the response scale below, indicate your agreement or disagreement with each item by placing the appropriate number on the line preceding that item.

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Disagree</td>
<td>Disagree</td>
<td>Neutral</td>
<td>Agree</td>
<td>Strongly Agree</td>
</tr>
</tbody>
</table>

1. I am confident I get the success I deserve in life.
2. Sometimes I feel depressed, (r)
3. When I try, I generally succeed.
4. Sometimes when I fail I feel worthless, (r)
5. I complete tasks successfully.
6. Sometimes, I do not feel in control of my work, (r)
7. Overall, I am satisfied with myself.
8. I am filled with doubts about my competence, (r)
9. I determine what will happen in my life.
10. I do not feel in control of my success in my career, (r)
11. I am capable of coping with most of my problems.
12. There are times when things look pretty bleak and hopeless to me. (r)

\( r = \) reverse-scored.
Appendix O

Task Knowledge

Subject Number: __________                                                                  Date: ________________

Directions: Please circle the letter that corresponds to the answer that best completes the question.
IMPORTANT!!! Please DO NOT SKIP ANY QUESTIONS or leave any questions unanswered.

1. Order activation, identification, & assignment are:
   a. The activities that are required for successful task verification.
   b. The activities that are required for successful task identification.
   c. The activities that are required for successful order packaging.
   d. The activities that are required for successful order identification.
   e. None of the above is true in this task.

2. When the task begins, the first activity you may do is:
   a. Press CNTRL-A.
   b. Press CNTRL-Y.
   c. Use the arrow and ENTER keys.
   d. You may do either a. or c. at this time.
   e. None of the above is the correct activity.

3. When the task begins, you may:
   a. Accept, select, and/or package orders for shipping.
   b. Select, verify, and/or package orders for shipping.
   c. Activate, identify, and/or assign orders for shipping.
   d. Both a and b are true in this task.
   e. None of the above is true in this task.

4. If orders are not processed quickly, what will occur?
   a. Penalties may be assigned because of delay in processing orders.
   b. Penalties may be assigned because you correctly followed task rules.
   c. Your overall score will be decreased because of penalties.
   d. Both a and c are true in this task.
   e. Only a is true in this task.

5. To activate waiting orders (orders in queue), you must:
   a. Determine that there is room for more orders in the bottom, left-hand window.
   b. Determine that there is room for more orders in the bottom, right-hand window.
   c. Have space for more orders in the top, right-hand window.
   d. Both a and b are true in this task.
   e. None of the above is true in this task.
6. When you accept waiting orders, you are:
   a. Selecting those orders for a truck.
   b. **Activating those orders for processing.**
   c. Accepting those orders for the pickup window.
   d. Shipping those orders on a truck or via the pickup window.
   e. None of the above is true in this task.

7. To activate waiting orders (orders in queue), you must:
   a. Have space for more orders in the top, left-hand window.
   b. Have space for more orders in the bottom, left-hand window.
   c. Have space for more orders in the top, right-hand window.
   d. You may not activate waiting orders at any time during the task.
   e. **None of the above is true in this task.**

8. To activate waiting orders (orders in queue), you must:
   a. Have space for more orders in the bottom, left-hand window.
   b. Have space for more orders in the top, right-hand window.
   c. **Have space for more orders in the bottom, right-hand window.**
   d. You may activate waiting orders at any time during the task.
   e. None of the above is true in this task.

9. What does a "1" in the M column designate?
   a. That the order is a rush order.
   b. That the order is a regular order.
   c. **That the order is a pickup order.**
   d. That the order should be sent to zone 1.
   e. None of the above is true in this task.

10. To determine if an order is a rush order, you should first:
    a. Look for a "1" in the M column.
    b. **Look for a "2" in the M column.**
    c. Look for a "3" in the M column.
    d. Look for a "0" in the M column.
    e. None of the above is the correct activity.

11. How do you determine that an order is not a partial order?
    a. By looking at the order's invoice number(s).
    b. By looking at the order's identification number(s).
    c. By looking at the order's schedule number(s).
    d. By looking at the information in the M column.
    e. None of the above is the correct activity.
12. What does an order's zone number determine?
   a. **Where to ship the order by truck.**
   b. The order's delivery schedule for delivery.
   c. How soon the order must be shipped.
   d. When to send the order to the pickup window.
   e. None of the above is the correct activity.

13. To determine if an order should be sent to the pickup window, you should first:
   a. Look for a "3" in the M column.
   b. Look for a "0" in the M column.
   c. Look for a "2" in the M column.
   d. **Look for a "1" in the M column.**
   e. None of the above is the correct activity.

14. How do you know that an order should be sent to the pickup window?
   a. There is a "1" in the zone column for the order.
   b. **There is a "1" in the M column for the order.**
   c. The order has been accepted for processing.
   d. There is a "5" in the QTY column for the order.
   e. None of the above is true in this task.

15. To ship a pickup order:
   a. Press ENTER.
   b. Press CNTRL-A.
   c. Press F1.
   d. Press CNTRL-Y.
   e. **None of the above is the correct activity.**

16. For pickup orders, you can use the arrow and ENTER keys to:
   a. Select and assign the order to a truck.
   b. **Select and assign the order to the pickup window.**
   c. Ship the order via the pickup window.
   d. Ship the order according to zone.
   e. None of the above is true in this task.

17. In order to ship an order by truck, you must first:
   a. Determine that a truck is available for a pickup order.
   b. Determine that a truck is loaded to its capacity.
   c. Determine that a truck is currently delivering orders.
   d. Determine that there is room in the queue.
   e. **None of the above is the correct activity.**
18. To determine if an order may be shipped with other orders, you should:
   a. Look at the information in the M column.
   b. Look at the order's zone number and invoice number(s).
   c. Look at the number of orders in queue.
   d. Look at the order's truck capacity and weight information.
   e. None of the above is the correct activity.

19. After assigning orders to a truck, you may:
   a. Select orders according to invoice number(s).
   b. Assign those orders to the pickup window.
   c. Assign different orders to another truck.
   d. Accept those orders into the active (processing) window.
   e. None of the above is true in this task.

20. After an order has been assigned to a truck, you may:
   a. Continue selecting orders for the same truck.
   b. Ship the truck.
   c. Unload the pickup window.
   d. Both a. and b. are possible.
   e. None of the above is the correct activity.

21. If you attempt to ship a truck that is overloaded:
   a. The truck may go out, but the orders remain in the window.
   b. The truck may go out, but the orders remain in the queue.
   c. The truck may go out, but a penalty is assessed.
   d. The truck will not go out, and a penalty is assessed.
   e. None of the above is true in this task.

22. Immediately after shipping a truck, you should:
   a. Accept new orders for processing for processing.
   b. Ship new orders.
   c. Assign orders to a specific truck(s).
   d. You may do either a. or c. at this time.
   e. None of the above is the correct activity.

23. Why would you remove orders from a truck?
   a. To avoid getting a penalty because the truck is underloaded.
   b. To avoid getting too many orders in the queue.
   c. To get more orders from the queue.
   d. To avoid a penalty for having too many orders in the queue.
   e. None of the above is true in this task.
24. If truckload exceeds truck capacity, you should:
   a. **Remove excess pieces according to invoice number & QTY information.**
   b. **Remove excess units according to zone number & QTY information.**
   c. Both a and b are correct.
   d. Assign more orders to the truck.
   e. None of the above is the correct activity.

25. Immediately after shipping a truck, you should:
   a. Press CNTRL-A.
   b. Press CNTRL-P.
   c. Use the arrow and ENTER keys.
   d. **You may do either a. or c. at this time.**
   e. None of the above is the correct activity.

26. How do you determine which order(s) should be loaded onto which truck?
   a. **By looking at the order's zone number.**
   b. By looking at the M column.
   c. By looking at the order's delivery schedule.
   d. By looking at the order's capacity number.
   e. None of the above is true in this task.

27. After an order has been assigned to the pickup window, you may:
   a. Use the CNTRL-Y key(s) to assign the order to a truck.
   b. **Use the arrow and ENTER keys to select another pickup order.**
   c. Use the number and ENTER keys to select another order by zone.
   d. Use the CNTRL-Y key(s) to ship the order on a truck.
   e. None of the above is the correct activity.

28. How do you determine the number of pieces in an order?
   a. **By looking at the information in the QTY column.**
   b. By looking at the order's invoice number(s).
   c. By looking at the information in the zone column.
   d. By looking at the information in the M column.
   e. None of the above is the correct activity.

29. After an order has been assigned to the pickup window, you may:
   a. Press CNTRL-A to ship the pickup order.
   b. Press CNTRL-Y to ship the pickup order.
   c. Press CNTRL-S to ship the pickup order.
   d. Press ENTER to ship the pickup order.
   e. **None of the above is the correct activity.**
30. If orders are not processed accurately, what will occur?
   a. Penalties may be assigned because of rule violation(s).
   b. Your overall score will be decreased because of penalties.
   c. **Both a and b are true in this task.**
   d. Penalties may be assigned because you correctly followed task rules.
   e. Both a and c are true in this task.
Appendix P

COVER LETTER
Department of Psychology
Wright State University
Dayton, OH 45435

My name is Keith Leas. I am a graduate student in the Department of Psychology conducting this research project, entitled “Effects of different types of training on performance”, to complete my thesis requirement. The purpose of this research study is to examine different types of training on performance. I invite you to complete several online questionnaires. These questionnaires should take approximately \( \frac{1}{2} \) hour to complete. There is minimal risk and discomfort anticipated as part of or as a result of this research study. The primary risk is fatigue resulting from responding to the questionnaires. Any information about you obtained from this study will be kept strictly confidential and you will not be identified in any report or publication. In exchange for participation, you will receive 1 extra credit point towards one of your classes. You are free to refuse to participate in this study or to withdraw at any time. Your decision to participate or to not participate will not adversely affect your standing at this institution or cause a loss of benefits to which you might otherwise be entitled. There is no penalty of any kind for either non-participation or withdrawal at any time. A summary of the results of this study may be requested by contacting the researchers listed below by June 2009. The summary will show only aggregate (combined) data. No individual results will be available. If you have questions or concerns about this research study, you can contact the researcher Keith Leas at leas.3@wright.edu or my faculty advisor, Dr. Debra Steele-Johnson, at debra.steele-johnson@wright.edu. If you have general questions about giving consent or your rights as a research participant in this research study, you can call the Wright State University Institutional Review Board at 937-775-4462.

___________________________________________
Keith Leas, Primary Investigator

___________________________________________
Debra Steele-Johnson, Faculty Advisor
CONSENT TO PARTICIPATE IN RESEARCH
Department of Psychology
Wright State University
Dayton, OH 45435

TITLE OF THE STUDY: Effects of different types of training on performance

AGREEMENT TO PARTICIPATE: This signed consent is to certify my willingness to participate in this investigational (research) study.

PURPOSE OF STUDY: The purpose of this study is to examine different types of training on performance

ACTIVITIE(S)/PROCEDURE(S): I understand that during this experiment I will be given a computer-generated task. I will be given a specific set of instructions to follow, and I will be asked to complete four 10-minute trials of the task. I will also be asked to complete written tests and survey questionnaires, which will be provided to me at different times during the study. The entire study will take about 2 hours. There will be no breaks during the session.

BENEFITS AND RISKS: I understand that there is minimal risk and discomfort anticipated as part of or as a result of this experiment. The primary risk is fatigue resulting from responding during the simulated task. Although an injury is extremely unlikely, I understand that only emergency medical treatment is available if a research-related injury occurs.

CONFIDENTIALITY: I understand that any information about me obtained from this study will be kept strictly confidential and that I will not be identified in any report or publication.

COMPENSATION (check all that applicable) In exchange for my participation, I will receive, for each half hour or part thereof, the following compensation:

- __4__ extra credit(s)
- $_________ (before withholding, if applicable)
- _______ None
- Other ________________________________

FREEDOM TO WITHDRAW: I understand that I am free to refuse to participate in this study or to withdraw at any time. My decision to participate or to not participate will not adversely affect
my standing at this institution or cause a loss of benefits to which I might otherwise be entitled. There is no penalty of any kind for either non-participation or withdrawal at any time.

AVAILABILITY OF RESULTS: A summary of the results of this study may be requested by contacting the researchers listed below by June 2008. The summary will show only aggregate (combined) data. No individual results will be available.

INVESTIGATOR AVAILABILITY: If I have questions or concerns about this research study, I can contact the researcher Keith Leas at leas.3@wright.edu. If I have general questions about giving consent or my rights as a research participant in this research study, I can call the Wright State University Institutional Review Board at 937-775-4462.

CONSENT: My signature below means that I have freely agreed to participate in this investigational study.

SIGNATURE/DATE LINES: __________________________________________
(Typed Name/Signature of Participant)

_____________________________________
(Date)

Keith Leas                                      Date
(Principal Investigator)

Debra Steele-Johnson, Ph.D.                    Date
(Faculty Advisor)
Appendix R

Subject Debriefing

The experiment you just completed examines the effects of personality traits on training outcomes resulting from different types of training. We asked you to complete the computer-simulated trucking dispatch task. Then, you answered questions about your opinions about the task, your task preferences, personality, cognitive ability, and demographics.

We are interested in seeing how differences in personality traits will affect the relationship between training types and their outcomes. Recent research as suggested that encouraging trainees to make mistakes during training and learn from their mistakes may lead to better results than if errors are avoided. However, previous research has shown mixed results. Therefore, in this study, we wanted to examine the possibility that personality traits may be influencing the effects of training types on outcomes.

With data from you and other individuals, we are discovering more about how personality influences the training-type-performance relationship. With this information, more effective training programs can be designed.

Please do not discuss these questionnaires or the trucking dispatch task with anyone else because it is important that future participants know nothing about the experiment before they begin it.

The data you provided today is important to us, and we appreciate your help. If you have any questions or comments about today’s experiment, please talk to the experimenter, Keith Leas, at leas.3@wright.edu or contact Debra Steele-Johnson, Ph.D., Department of Psychology, 339B Fawcett, (937) 775-3527.
Appendix S

Trial-by Trial Analysis of Hypothesis 1

This appendix is a summary of the trial-by-trial tests of the relationships indicated in Hypothesis 1.

First, we tested the predictors of training type and conscientiousness. For the first transfer trial, the main effects of training type and conscientiousness overall failed to explain significant variance in performance, $R^2 = .01, F(2, 254) = 1.092, p = .34$. Neither training type, $\beta = -.08, t(255) = -1.34, p = .18$, nor conscientiousness, $\beta = -.04, t(255) = -0.70, p = .49$, were significantly related to performance. When the interaction term was added in Step 2, no significant change in $R^2$ was observed, $\Delta R^2 = .01, F(1, 253) = 3.43, p = .07$. The interaction between training type and conscientiousness was not significant, $\beta = .81, t(255) = 1.85, p = .07$.

For the second transfer trial, the main effects of training type and conscientiousness again failed to explain significant overall variance in performance, $R^2 = .01, F(2, 254) = .93, p = .40$. Neither training type, $\beta = -.07, t(255) = -1.15, p = .25$, nor conscientiousness, $\beta = -.05, t(255) = -0.79, p = .43$, were significantly related to performance. When the interaction term was added in Step 2, no significant change in $R^2$ was observed, $\Delta R^2 = .01, F(1, 253) = 3.27, p = .07$. The interaction between training type and conscientiousness was not significant during the second transfer trial, $\beta = .79, t(255) = 1.81, p = .07$.

The second set of regression analyses substituted openness for conscientiousness and the interaction between training type and openness for the interaction between training type and conscientiousness. For the first transfer trial, the main effects of training type and openness overall failed to explain significant variance in performance, $R^2 = .01, F(2, 254) = 1.134, p = .32$. Neither training type, $\beta = -.09, t(255) = -1.36, p = .17$, nor openness, $\beta = .05, t(255) = 0.76, p =
.45, were significantly related to performance. When the interaction term was added in Step 2, no significant change in $R^2$ was observed, $\Delta R^2 = .01$, $F(1, 253) = 2.06, p = .15$. The interaction between training type and openness was not significant during the first transfer trial, $\beta = -.61$, $t(255) = -1.44, p = .15$.

For the second transfer trial, the main effects of training type and openness again failed to explain significant overall variance in performance, $R^2 = .01$, $F(2, 254) = .71, p = .49$. Neither training type, $\beta = -.07$, $t(255) = -1.14, p = .25$, nor openness, $\beta = .03$, $t(255) = 0.44, p = .66$, were significantly related to performance. When the interaction term was added in Step 2, no significant change in $R^2$ was observed, $\Delta R^2 = .02$, $F(1, 253) = 3.27, p = .05$. The interaction between training type and openness was not significant during the second transfer trial, $\beta = -.82$, $t(255) = -1.94, p = .05$.

Based on these analyses, we found no evidence supporting the moderation proposed in Hypothesis 1 during transfer. In general, participants in both the error avoidant and error encouragement conditions performed similarly well, and we observed no significant interactions between training type and conscientiousness or openness. Next, we repeated these analyses to examine whether differences occurred during the four training trials.

Again we first tested the predictors of training and conscientiousness. For the first training trial, the main effects of training type and conscientiousness overall failed to explain significant variance in performance, $R^2 = .00$, $F(2, 254) = 0.03, p = .97$. Neither training type, $\beta = -.01$, $t(255) = -.15, p = .88$, nor conscientiousness, $\beta = -.01$, $t(255) = -.21, p = .83$, were significantly related to performance. When the interaction term was added in Step 2, no significant change in $R^2$ was observed ($\Delta R^2 = .00$, $F(1, 253) = .01, p = .92$). The interaction between training type and conscientiousness was not significant, $\beta = .05$, $t(255) = .11, p = .92$. 

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For the second training trial, the main effects of training type and conscientiousness overall failed to explain significant variance in performance, $R^2 = .00$, $F(2, 254) = 0.32$, $p = .72$. Neither training type, $\beta = -.01$, $t(255) = -.20$, $p = .84$, nor conscientiousness, $\beta = -.05$, $t(255) = -.79$, $p = .43$, were significantly related to performance. When the interaction term was added in Step 2, no significant change in $R^2$ was observed, $\Delta R^2 = .01$, $F(1, 253) = 3.00$, $p = .08$. The interaction between training type and conscientiousness was not significant, $\beta = .76$, $t(255) = 1.73$, $p = .08$.

For the third training trial, the main effects of training type and conscientiousness overall failed to explain significant variance in performance, $R^2 = .00$, $F(2, 254) = .23$, $p = .79$. Neither training type, $\beta = -.03$, $t(255) = -.51$, $p = .61$, nor conscientiousness, $\beta = -.03$, $t(255) = -.48$, $p = .63$, were significantly related to performance. When the interaction term was added in Step 2, no significant change in $R^2$ was observed, $\Delta R^2 = .01$, $F(1, 253) = 3.05$, $p = .08$. The interaction between training type and conscientiousness was not significant, $\beta = .77$, $t(255) = 1.75$, $p = .08$.

For the final training trial, the main effects of training type and conscientiousness overall failed to explain significant variance in performance, $R^2 = .00$, $F(2, 254) = 0.40$, $p = .67$. Neither training type, $\beta = -.05$, $t(255) = -.73$, $p = .47$, nor conscientiousness, $\beta = -.04$, $t(255) = -.56$, $p = .58$, were significantly related to performance. When the interaction term was added in Step 2, no significant change in $R^2$ was observed, $\Delta R^2 = .01$, $F(1, 253) = 2.49$, $p = .12$. The interaction between training type and conscientiousness was not significant, $\beta = .69$, $t(255) = 1.58$, $p = .12$.

Last, we tested the effects of training type and openness during training. For the first training trial, the main effects of training type and openness overall failed to explain significant variance in performance, $R^2 = .00$, $F(2, 254) = 0.09$, $p = .92$. Neither training type ($\beta = -.01$, $t(255) = -.17$, $p = .87$) nor openness ($\beta = .03$, $t(255) = .39$, $p = .70$) were significantly related to
performance. When the interaction term was added in Step 2, no significant change in $R^2$ was observed ($\Delta R^2 = .01, F(1, 253) = 1.79, p = .18$). The interaction between training type and conscientiousness was not significant, $\beta = -.57, t(255) = -1.34, p = .18$.

For the second training trial, the main effects of training type and openness overall failed to explain significant variance in performance, $R^2 = .00, F(2, 254) = 0.34, p = .71$. Neither training type, $\beta = -.01, t(255) = -.23, p = .81$, nor openness, $\beta = .05, t(255) = .81, p = .42$, were significantly related to performance. When the interaction term was added in Step 2, no significant change in $R^2$ was observed, $\Delta R^2 = .01, F(1, 253) = 1.52, p = .22$. The interaction between training type and conscientiousness was not significant, $\beta = -.52, t(255) = -1.23, p = .22$.

For the third training trial, the main effects of training type and openness overall failed to explain significant variance in performance, $R^2 = .00, F(2, 254) = 0.30, p = .74$. Neither training type, $\beta = -.03, t(255) = -.54, p = .59$, nor openness, $\beta = .04, t(255) = .61, p = .54$, were significantly related to performance. When the interaction term was added in Step 2, no significant change in $R^2$ was observed, $\Delta R^2 = .01, F(1, 253) = 2.40, p = .12$. The interaction between training type and conscientiousness was not significant, $\beta = -.66, t(255) = -1.55, p = .12$.

Finally, for the last training trial, the main effects of training type and openness overall failed to explain significant variance in performance, $R^2 = .01, F(2, 254) = 0.71, p = .49$. Neither training type, $\beta = -.05, t(255) = -.79, p = .43$, nor openness, $\beta = .06, t(255) = .96, p = .34$, were significantly related to performance. When the interaction term was added in Step 2, a significant change in $R^2$ was observed, $\Delta R^2 = .02, F(1, 253) = 5.28, p < .05$. The interaction between training type and openness during the last transfer trial was significant, $\beta = -.96, t(255) = -2.30, p < .05$. 

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To further examine the interaction effect observed between openness and training type during the final training trial, participants were divided into high and low groups by performing a median split on openness scores. For participants in the error avoidant condition, participants who were high in openness tended to perform better ($M = 1195.97, SD = 794.77$) than participants low in openness ($M = 875.00, SD = 1117.78$). For participants in the error encouragement condition, participants who were low in openness to experience performed better ($M = 975.17, SD = 995.66$) than people who were high in openness ($M = 939.16, SD = 876.66$). Thus, even though we found a significant interaction, this interaction is actually in the opposite direction than we proposed in Hypothesis 1.