Creating Adaptive Emotional Experience During VE Training

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ABSTRACT

Warfighters are required to effectively perform under intense negative emotional states, and military training programs should be designed to prepare them for those conditions. Virtual Environment (VE) training is being leveraged to support this goal because it allows access to complex or dangerous environments. Although VE systems have successfully been used to enhance the affective experience (Insko, 2001), due to the individualized nature of emotional responses, it remains difficult to create training conditions that elicit a targeted emotional response across a wide range of trainees. To address this limitation, a series of emotional induction techniques (EITs) have been identified and consolidated into a framework, which also captures when and how each EIT should be employed in a VE to optimize training, both for individuals as well as teams. The Adaptive Framework For Emotionally Charged Training – Design and eXecution (AFFECT-D/X) framework uses these EITs to generate an appropriate lesson plan based on participant's real-time performance and emotional states to drive a desired emotional state while not overwhelming trainees. This paper outlines the challenges associated with influencing emotional state during VE training, outlines the advantages of leveraging an adaptive framework that takes into account emotional state and performance, and presents the results of two studies that demonstrate the effectiveness of leveraging EITs to create negative emotional states during VE training. In Study 1, 52 participants were evaluated to determine the effects of EITs on the presence and intensity of targeted emotions. The results demonstrated that EITs are effective at eliciting targeted emotional responses within VEs. Leveraging these validated EITs, a use case study was completed that demonstrated enhanced training transfer to a live exercise when EITs were used to create an adaptive, emotionally charged simulated training environment. Results presented are applicable to designers, developers and instructors focused on creating emotionally charged VE training.

ABOUT THE AUTHORS

David Jones is the Director of Medical Innovations at Design Interactive, Inc. His previous research efforts have focused on the development of adaptive virtual, mixed reality, and constructive training platforms for domains ranging from Close Quarters Battle to medical care and evacuation. David's training and operation system design research has led to the development of a guiding science on how to effectively integrate audio cues into multimodal systems to reduce user's cognitive demand and he is currently leading an effort to create a validated approach to optimize the integration of olfactory cues into medical training applications. David applies his experience with multimodal design and neuroergonmics when designing training platforms to provide advanced performance metrics and advanced usable system interfaces.

Kelly Hale is Sr. Vice President of Technical Operations at Design Interactive, Inc., and has over 12 years experience in human systems integration research and development. Her R&D efforts are focused in augmented cognition, adaptive, personalized systems, multimodal interaction, training sciences, and virtual environments. Through these efforts, Kelly and her team have developed advanced neurophysiological measurement techniques and have advanced real-time mitigation strategy framework and induction techniques to optimize training, situation awareness, and operational performance through optimization of user cognitive and physical state. She received her BSc in Kinesiology/Ergonomics Option from the University of Waterloo in Ontario, Canada, and her Masters and PhD in Industrial Engineering, with a focus on Human Factors Engineering, from the University of Central Florida.

Sara Dechmerowski is a Research Associate at Design Interactive, Inc. Her work focuses on training systems design and evaluation, performance assessment, and next generation human systems integration. She has worked on a number of projects relating to extensible interfaces for training, including a system to integrate emotion induction techniques into virtual environments, an adaptive training system for baggage screeners, a training aid to monitor pilot interactions with the F-35 HMD, and novel systems for medical and team training. Her work has also focused on using multimodal design science to optimize operator situational awareness and workload, and the development of neurophysiological metrics to assess performance. She received both her B.S. in Human Factors and Master of Science in Human Factors and Systems Engineering degrees from Embry-Riddle Aeronautical University Daytona Beach Florida. She has over four years experience in the design, development, and evaluation of human-interactive systems.

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INTRODUCTION

Affective environments (whether positive or negative) may be developed using virtual environment (VE) technology to further enhance learning and training transfer to real-world tasks. Of particular interest to the military is implementation of negative affective factors into VEs that mimic real-world experiences such as the theater of war (including live fire, excessive noise, and dynamic threats that impact operations at a moment's notice). A primary advantage of VE training systems over alternative training methods (e.g., classroom) is the ability to recreate the fidelity and realism of live military training to trigger negative affective experiences through multimodal cue presentation within scenario-based training (Morie, et al., 2002). Such VE scenario-based training has resulted in substantially better training transfer. For example, Wilfred et al. (2004) used the sound of random explosions in a search and rescue task to create an affectively intense environment, and found that those who trained therein performed substantially better in a live environment than those who trained in an affectively neutral environment.

While results such as Wilfred et al. (2004) have been reported, other studies have found that training in VEs has shown limited transfer effects for tasks that require "emotional conditioning necessary to operate with the stress of physical, emotional, and lethal threats" (Smith, et al., 2002, p. 23) and/or when students are not optimally motivated and engaged in training (Pugh & Bergin, 2006). Such lack of significant transfer results may be attributed to inadequate representation of the appropriate affective environment within the VE training system, as training VEs to date have focused more on physical and functional fidelity, and less on recreating emotional experiences of the battlefield. Thus, there is a need to determine how multisensory information can be used to support the development of an affectively appropriate environment, i.e., to create stress and invoke affective responses similar to responses experienced in live operations. Past work suggests that this is a challenge for VE designers, in that targeted affective responses are not always experienced in VEs, regardless of the fidelity of the system, leading to reduced transfer of skills (Smith, et al., 2002). By identifying how affective cues impact training in a virtual training environment as well as training transfer to real-world performance, designers can incorporate appropriate affective cues into environments to increase training effectiveness, particularly for high stress, emotionally charged military environments.

Opportunity

An opportunity exists to enhance VE training systems that are limited in their ability to create affective operational cues and dynamically present such cues to trainees in real time. Specifically, there is a need to integrate affective components into systems that currently lack qualities designed to enhance user presence, personal involvement, and negative consequences for inappropriate actions in order to more effectively target training goals and optimize transfer of training. This is particularly important for military training systems where the adaptation to negative affective factors such as the theater of war (including live fire, excessive noise, and dynamic threats that impact operations at a moment's notice) are critical for optimal performance in the transfer environment.

To address this issue of affective VE training design, it is essential to develop a framework that guides the introduction of affective components into a VE training environment through appropriate implementation of training scenario design strategies and real-time system mitigation that take into consideration performance levels and individual differences among trainees. Such a framework should guide system and scenario design based on multimodal and training design science to ensure sensory and training requirements meet human processing capabilities and appropriate knowledge levels. Integrating appropriate affective experiences into training for an individual or team should better prepare trainees for live training and operations more efficiently and effectively by increasing levels of engagement and more closely matching the cognitive and affective components experienced in the transfer environment.

BACKGROUND

Emotion-Induction Techniques

Although previous research suggests that there is benefit in creating a targeted emotional response during training, the task of creating scenarios that instantiate the targeted response is not trivial. To support this process, a set of generalized scenario modification strategies (emotion-induction techniques (EITs)) was developed for both task-specific and global implementation within the military domain. In addition to performing a review of emotion-induction literature, EITs were derived via a review of field manuals and training guides to ensure that approaches were applicable to the targeted training objectives (e.g. information exchange, decision making, spatial knowledge, procedural knowledge, temporal-episodic knowledge). The EITs were targeted at creating an aroused state of emotion with negative valence (leading to the experience of stress, anxiety, or anger) and an aroused state of emotion with positive valence (leading to the experience of being alarmed or excited). A total of 59 EITs were identified and classified into 15 categories to create the targeted states.

Adaptive Emotional Training

One of the challenges with stress exposure training is that all individuals react differently to environmental stressors based on past experiences and their appraisal of the situation (Scherer, Shorr, & Johnstone, 2001). It is therefore critical that a training system presents an adaptive training environment to individuals and teams based on their emotional states. This ensures that the environment is modified if presented stressors do not have the targeted effect on individuals and teams. By developing a system that is continuously modified based on trainees' emotional state, the pace of virtual stress exposure training can be optimized for each trainee and team. The AFFECT-D/X system that was leveraged in the studies presented herein uses a combination of voice and facial characteristics to quantify emotional state and modifies scenarios in real-time based on the detected state and performance levels (see Jones, D.L., Fuchs, S. & Del Giudice, K., 2010).

Team-Based Emotions

In collocated teams performing coordinated tasks (with the same goal), affect induction cues are expected to lead to a similar appraisal and emotional response across all team members. For example, if an incoming communication suggests that an enemy ambush is eminent, a level of fear/negative excitement is expected from each of the trainees due to danger to their team and selves. When a single team member reacts differently from his teammates, team coordination may decrease. Being able to monitor team emotional state and direct scenario adjustments in real-time to optimize team emotional responses could substantially improve team coordination training transfer to operational tasks. Following this rationale, there is an opportunity to develop methods to use team affective responses to evaluate and improve the team-based skill development process

In order to ensure emotionally charged training could be provided across teams of trainees, the framework of EITs was extended to include strategies to elicit targeted emotional states from groups of trainees. To support the extension of the framework to provide team-based training, an evaluation of team emotion and group emotion elicitation was conducted and used to drive a method of modifying scenarios based on the group's performance and state. Study one below outlines the evaluation of a subset of these EITs on trainee state.

STUDY 1 METHOD

A research study was designed and conducted in order to ensure that EITs developed can effectively create the targeted negative emotional states across individuals. Specifically, the following two hypotheses were evaluated under this lab-based study:

Hypothesis 1: Virtual training scenarios with EITs integrated lead to increased occasions of negative emotions reported compared to scenarios without EITs integrated.

Hypothesis 2: Virtual training scenarios with EITs integrated lead to more intense negative emotions reported than scenarios without EITs integrated.

Participants

Fifty-two participants (46 men, 6 women, M_{age} = 27, age range 19-47 years) with no military background were recruited for this experiment.

Stimuli

Military room-clearing training scenarios were developed using Virtual Battlespace 2 (VBS2). After developing baseline VE scenarios (no EITs added), identical mirrored scenarios were developed with 1 of 6 EITs integrated within (EITs added experimental condition). The scenarios were presented on a large

FOV projection screen in order to elicit and evaluate the trainees' emotional states during the exercises.

The presence and absence of emotional states and the intensity of targeted emotional states were evaluated using the EmoPro® self-report emotion evaluation tool. EmoPro® allows users to classify how intensely their emotional reaction matches those represented by emotion icons on a scale of 0-5 (0 meaning the emotion was not elicited, 5 representing strong emotional reactions).

Task

During the practice and evaluation scenarios, the overall goal of the participant when interacting with VBS2 was to search and eliminate enemy threats in an urban environment (e.g., a building or street). To accomplish this, the participant was required to enter a building, move rapidly along a hallway and through rooms, evaluating people encountered along the way and engaging them if they are considered to be hostile (i.e. holding a weapon and firing). The number of hostiles was held within a constant range across scenarios, with the exception of the increasing enemies EIT condition (number of hostiles doubled).

Procedure

Upon arrival at the laboratory, participants completed an informed consent and demographics questionnaire. They were then introduced to VBS2 (input devices and how to control their avatar movement), their task, and the EmoPro® data collection tool. Participants were given two practice scenarios to familiarize themselves with the environment and task. After completing the practice scenarios, participants were instructed to begin the experimental task, and were randomly assigned to one of two groups: Baseline (no EITs) or EITs. Participants completed a series of scenarios within the VBS2 VE. At the midpoint during each scenario, participants were prompted with EmoPro® to gather their current emotional state and intensity of the emotions that were elicited.

Experimental Design

The study was a 2x6 within subjects design, where independent variables were EIT condition (no EITs present versus EITs present), and the EITs that were used to create the targeted emotional states (limiting visual perception [fog], music, increasing enemies, annoying sounds, malfunctioning equipment, and dead civilians). The dependent variables were self-reported emotions and related intensity of emotions that were captured using EmoPro® at pause points within each scenario as well as after scenarios were completed. Each of the 52 participants completed three scenarios with no EITs present and three scenarios with EITs present, creating a database of 156 measures of emotional state in the control environment and 156 measures of emotional state in the experimental environment.

STUDY 1 RESULTS

In order to evaluate H_1, the measures of negative emotion intensity were classified into two conditions for each rating that participants provided (emotion not experienced or emotion experienced). Because this variable led to 156 categorical measures, a chi-square analysis was performed to test H_1. Specifically, the proportion of responses that reported experiencing each negative emotion (anger, sadness, surprise, and fear) in the baseline condition was compared to the proportion of responses in the EIT condition. The proportion of responses that reported experiencing anger, surprise, and fear in the EIT condition were significantly greater than the proportion of responses for experiencing the same emotional state in the baseline condition ($p < 0.05$; see Table 1 for results). However, the proportion of responses experiencing sadness did not differ between the EIT and baseline conditions, so a chi-square analysis was not performed.

Table 1: Hypothesis 1 Results (*Indicates significance)

Emotion	Proportion of responses experiencing emotion		Results
	Baseline condition	EIT condition	
Anger	.429	.51	χ^2 (1,*N*= 156) =5.127, $p = .0236$*
Sadness	.115	.115	Analysis not performed
Surprise	.288	.36	χ^2 (1,*N*= 156) = 4.497, $p = .0339$*
Fear	.346	.49	χ^2 (1,*N*= 156) =15.017, $p = .0001$*

A median test was used to evaluate whether the median score of emotional intensity differed significantly between the baseline and EIT conditions. The median test achieves this by testing the hypothesis that the probability of a negative emotional response being greater than the overall median of negative emotional responses is the same for all populations. A new variable was created (negative emotions) which aggregated all negative emotions identified for this study. The variable ignores all responses that reported not experiencing a negative emotion. This variable was created to evaluate if the EIT conditions reported more intense emotional responses than the baseline condition. The results for H_2 were not significant, χ^2 $(1, N = 417) = .278$, $p = .598$, indicating that there was not a significant difference in emotion intensity reported between baseline and EIT conditions.

STUDY 1 DISCUSSION

As can be seen in Table 2, results of this study demonstrated that the integration of EITs are effective at eliciting an emotional response when one was not already present during VE training, although they are not effective at significantly increasing the intensity of negative emotional states reported. These results are promising, as they suggest that the goal of creating negative emotional states during training is possible, at least for emotional states that have a positive arousal level associated with them (i.e. anger, surprise [alarm], and fear).

Converse to the effects of EITs on all other emotional responses evaluated, the elicitation of sadness was not successful for the EITs that were selected for evaluation within this study. It is critical to note that this result could be due to the appraisal of the integrated EIT designed to elicit sadness. Specifically, the addition of dead civilians was expected to lead to an emotional appraisal of sadness. Because this evaluation group had a great deal of gaming experience (mean hours of game play a week equal to 18.9 hours), it is possible that they don't respond negatively to that cue because they are either desensitized to it or because it does not pose a direct threat to themselves or the team.

Table 2: Results Summary

Emotion	Comparisons: EITs vs. Control	
	Occurrence	Intensity
Anger	Increase	No Change
Sadness	No Change	No Change
Surprise	Increase	No Change
Fear	Increase	No Change

STUDY 2 METHOD

After demonstrating that negative emotions can effectively be elicited within VEs by presenting EITs during performance, a use case analysis was conducted to evaluate the effects of adaptively activating EITs within a team setting during training on trainee performance in a live transfer environment.

Participants

Six male police officers (M_{age} = 33, age range 23-41 years) with 8.1 mean years of experience in their positions were recruited to participate in this use case evaluation. Each participant was randomly assigned to either the experimental group (with adaptive EITs during training) or to the baseline group (no adaptive EITs integrated) to create two teams of three.

Stimuli

Training was conducted on a series of 3 networked desktop computers, and the participants interacted with a standard 3 button mouse and keyboard. The scenarios for both groups included enemy forces that engaged at 4 locations along the traveled route. Emotional state was captured in real-time using RADIS (Real-time Affective Detection Induction System), which captures emotional state using a webcam to detect changes in facial expression.

Based on the results of Study 1, the three EITs integrated into the scenarios were (1) the addition of fog and rain, (2) increased enemy forces during attacks, and (3) dead civilians.

During the live evaluation scenario, teams were equipped with semi-automatic air soft weapons and were required to complete a mission that consisted of a movement to a building through a wooded/field environment. Participants were engaged at three points along their traveled route by opposing forces with airsoft weapons, and performed a final engagement once they reached their destination building.

Task

In both the computer-based training session and the live transfer evaluation session, participants were instructed to engage all enemies that they encountered while keeping team dispersion at a minimum. Specifically, team members were instructed not to disperse more than 10 meters (between each team member) during the scenarios. To meet this requirement, each team member was required to maintain high situational awareness in regards to the locations of each of their team members.

Procedure

Each participant completed an informed consent and demographics form upon arrival at the test site. During the use case evaluation, each team completed a series of computer-based scenarios followed by a live training transfer evaluation (see Table 3). Prior to completing training scenarios within VBS2, the baseline group and experimental group each completed a series of scenarios within VBS2 designed to familiarize them with the system and the movements they were required to complete during training. Once they effectively completed all familiarization scenarios, participants completed a scenario to evaluate their pre-training performance levels.

After recording initial performance levels, each group trained with four VBS2 scenarios. The baseline group trained with a static VBS2 scenario that did not react to their performance or emotional states. The experimental group trained with a VBS2 scenario that was modified in real-time by the AFFECT-D/X system based on their performance. To compare the training effectiveness of the training scenarios, a final, high intensity scenario was performed by both groups. During the initial and final scenarios, each group was evaluated based on their team's dispersion throughout each segment in the environment as well as two measures of situational awareness (MARS; Matthews, Beal, and Pleban, 2002; SABARS; Matthews, Pleban, Endsley, and Strater, 2000) taken upon scenario completion.

Table 3: Transfer Evaluation Procedure

	No AFFECT-D/X (Baseline)	Low Threshold AFFECT-D/X (Exp)
Familiarization	VBS2 Familiarization Scenarios	VBS2 Familiarization Scenarios
Initial (Baseline)	High Intensity Initial Scenario	High Intensity Baseline
Training Task	VBS2 Virtual Training	AFFECT- D/X Modified Virtual Training
Final (Evaluation)	High Intensity Final Scenario	High Intensity Evaluation
Live Training Transfer	Live Transfer Evaluation	Live Transfer Evaluation

Upon completion of VBS2 scenarios, the teams completed a live scenario to evaluate transfer of training. During performance, the teams were evaluated to determine their mean dispersion within four segments of the environment, and upon completion of the scenario they completed the MARS and SABRES situational awareness (SA) questionnaires.

Experimental Design

The case study evaluation was conducted in two sessions, a training session and transfer session. The case study was designed to directly compare the performance of the two teams across average team dispersion, and team and individual SA during virtual training and live transfer performance. Because team data was used and only two teams (one team that received preplanned virtual scenarios and one team that received adaptive virtual scenarios) were evaluated, statistical analyses were not conducted on the data. Instead, direct comparisons of the performance and SA data were used to describe the results for this single use case.

STUDY 2 RESULTS

Due to the size of the study (two teams evaluated), the following sections present the patterns that emerged across the two teams during training and transfer performance.

Training Effectiveness

It was hypothesized that the integration of emotion-based adaptive training would support the development of teams that could more effectively perform in emotionally charged VEs. Mean dispersion, the metric used to evaluate performance in this study, was calculated to determine how well the team met the goal of reducing the dispersion between team members. The standard deviation of dispersion across the segments provided a measure of the consistency of their formation throughout the scenario. As can be seen in Table 4, the mean dispersion of the baseline group increased from initial to final scenarios while the mean dispersion of team members in the experimental moved closer to the targeted dispersion distance. Similarly, variation in group dispersion followed the same trend, with the baseline group's dispersion distance becoming less consistent after training while the experimental group's dispersion distance became more consistent across scenario segments.

Table 4: Team Dispersion Within VE

		Initial	Final
Baseline	Mean Dispersion	50.05	61.04
	Dispersion SD	14.14	39.79
Experimental	Mean Dispersion	33.34	25.80
	Dispersion SD	19.56	7.04

A similar pattern was found when the two measures of SA were compared between the groups across the initial and final scenarios. As Table 5 shows, the level of SA within the baseline group decreased after training and increased for the experimental group, providing insight into why they may have been more prepared to perform during high-stress scenarios.

Table 5: SA Measures During VE Performance

	Initial		Final	
	MARS	SABRE S	MAR S	SABRE S
Baseline	21.67	103.33	20.00	75.00
Experimenta l	20.33	86.33	24.00	95.33

Transfer Performance

It was hypothesized that the emotion-based adaptive training provided by the AFFECT-D/X framework would transfer to better performance in a live environment. To evaluate this, the same measures of performance (team dispersion) and SA (SABRE and MARS) that were calculated during training were calculated during live performance. As Table 6 shows, higher SA ratings were evident on both SA measures for the experimental team compared to the baseline team. The measures of mean dispersion across scenario segments and dispersion SD demonstrate that performance was also better for the experimental team, leading to them being twice as effective at containing their team (mean dispersion of 10.49 feet vs. 21.72 feet) and more consistently containing the team (standard deviation of dispersion of 9.28 vs. 20.08). These results were consistent with the results of the training performance, suggesting that the increase in performance transferred to the live environment.

Table 6: Transfer Performance and SA

	SA		Dispersion	
	MARS	SABRES	Mean	SD
Baseline	22.67	102.33	21.72	20.08
Experimental	26.00	108.67	10.49	9.28

In order to further investigate where performance breakdowns occurred within the transfer scenario, team dispersion levels were calculated across four segments that were associated with the level of opposing force that they met in each. In segments 1 and 3, the teams encountered light resistance consisting of 1-2 opposing forces in the open. Segment 2 consisted of a more coordinated attack with 3 people to engage who used buildings and structures as cover. The final segment (segment 4) was designed to create the highest level of stress, and consisted of a team of 4 opposing members who were bunkered down in a large building. As Figure 1 shows, in the segments where the engagement was designed to create lower levels of stress on the team (segments 1 and 3), the two teams performed at a similar level. As the intensity of the scenario increased slightly (segment 2) the baseline team dispersed more. The breakdown of performance was even more noticeable within the final segment where the intensity of the scenario was highest.

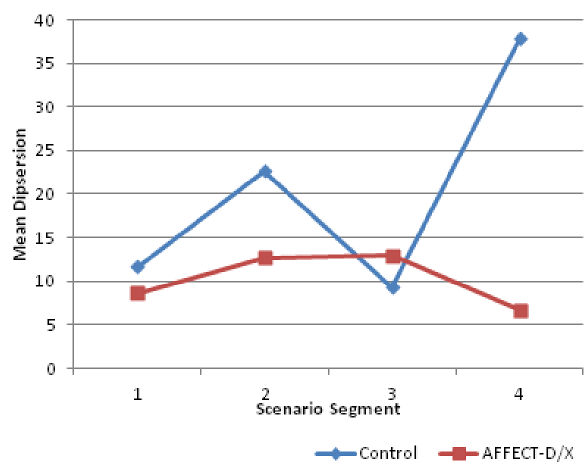

Figure 1: Live Scenario Dispersion Across Segments

STUDY 2 DISCUSSION

The results of the use case show promise for the application of adaptive emotionally charged training to support training transfer to live, high stress conditions. The comparison of the two teams demonstrated that by adapting training in real-time using a combination of the emotional state and performance of each team member, training performance and underlying SA levels can be enhanced. Furthermore, this performance enhancement extends to the live environment.

These results are in line with stress resilience studies (i.e. Epel, et al., 1998) that have shown that intermittent exposure to acute stress can lead to resilience to future stressors. Based on this theory, it is expected that the increases in training effectiveness were due to the experimental team being continually pushed to develop coping strategies for negative events in the scenario as it changed. Because the team was presented with a variety of stressors to respond to in the VE (after the system detected that they were prepared to deal with them), they were able to quickly adapt when they were faced with adversity in the live environment. This preparation to adapt and work together became more apparent as the level of engagement and stress was ramped up in the live environment, suggesting that the team learned to thrive under high-stress conditions as opposed to succumb to stress (Epel et al, 1998).

When evaluating the results of this case study, it is important to take into account the performance decrement associated with the control group from the initial to final scenarios. These results were not expected and could be due to a level of low motivation or inattentiveness during training which have been found when people become under loaded, leading to a decreased level of SA (Endsley, 1999). These results further highlight the need to develop and implement adaptive training to ensure that trainees remain engaged and the training benefit is maximized.

SUMMARY/CONCLUSIONS

Stress exposure theory states that training can be used to prepare trainees to perform under high-demand high-stress conditions (Driskell & Johnston, 1998). By exposing trainees to scenarios that elicit a negative state, it is possible for them to build a level of resilience that allows them to perform effectively when future stressors are present (Lazarus, 1966).

Many training designers have found that training provided in VEs has limited transfer effects for tasks that require "emotional conditioning necessary to operate with the stress of physical, emotional, and lethal threats" (Smith, et al., 2002, p. 23) and/or when students are not optimally motivated and engaged in training (Pugh & Bergin, 2006). One reason that VEs don't consistently prepare trainees to thrive under emotionally stressful situations is due to the individualized nature of emotional responses. Specifically, because humans base their emotional responses to cues on their past experiences with those cues and situations, it's critical to employ an approach that will adapt scenarios when the targeted emotional response isn't elicited.

The research described herein suggests that by integrating validated EITs into VE scenario-based training, targeted negative states can be consistently achieved throughout training. In addition, the results of the training effectiveness evaluation use case suggest that by adaptively integrating such validated EITs to elicit negative emotional states during training, it is possible to increase the training effectiveness and transfer increased performance to a live environment. The results in this study were exaggerated when trainees were placed in highly stressful conditions in the VE and live environments, suggesting that generalized coping strategies may be developed during VE training sessions that result in improved performance. The conclusions of this research could have a large impact on training costs given that there is the potential to reduce costly live training trials by creating adaptive emotionally charged VE training scenarios that can effectively prepare trainees to perform despite exposure to emotionally charged surroundings.

Although results presented here are promising, there is a need for future research to complete an expanded empirical TEE to accurately quantify the effects of emotionally charged adaptive training. The goal of future studies should be to calculate the number of live trials saved by leveraging this novel training approach.

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