STRESS EXPOSURE TRAINING: AN EVENT-BASED APPROACH

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It is important to define, at least in a broad sense, what we mean when we use the term *stress.* According to Driskell, Salas, and Johnston (2006), stress is defined as a high demand, high threat situation that disrupts performance. It is time-limited, events occur suddenly and often unexpectedly, quick and effective task performance is critical, and consequences of poor performance are immediate and often catastrophic. Thus, at a very general level, we use the term *stress* to refer to high-demand, high-risk task conditions. It is also important to note that stress is a multi-dimensional construct, and this general term may be used to refer to any number of specific stressors or demands that may be present in a given task setting, including stressors such as noise, threat, time pressure, task load, coordination requirements, fatigue, and other task and environmental demands. In brief, we equate stress with high demand and high risk—a stressful task situation is one that imposes high demands and high risks on the operator. For greater precision, we adopt the definition of stress proposed by Salas, Driskell, and Hughes (1996): Stress is a process whereby environmental demands evoke an appraisal process in which perceived demand exceeds resources, and that results in undesirable physiological, psychological, behavioral, or social outcomes.

The purpose of this chapter is to discuss stress training—training that is designed to counter stress effects. Despite the general tendency for authors to note the lack of progress in any given field, we feel that research on stress training has been quite promising. In fact, we know a great deal more about stress training than we did a decade ago. There have been a number of valuable books (Cannon-Bowers & Salas, 1998; Driskell & Salas, 1996), book chapters (Johnston & Cannon-Bowers, 1996; Keinan & Friedland, 1996), technical reports (Helmus & Glenn, 2005; Kavanagh, 2005; Staal, 2004), and research articles (Morris, Hancock, & Shirkey, 2004; Saunders, Driskell, Salas, & Johnston, 1996) that represent a considerable advance over previous conceptualizations of stress training.

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One factor that underlies the current renaissance in stress research is the enhanced military requirement that reflects the realities of the high-technology battlefield. However, the current military emphasis on performance under stress has not always been the case, and it is somewhat paradoxical that although military combat operations epitomize a high-demand environment, the military has been slow in embracing the stress training concept. We believe that there are several reasons for this hesitance. The first problem is the ambiguity of the stress construct itself. Driskell, Salas, and Johnston (2001) conducted a database search of the term "stress management" and uncovered over 1,900 articles in PsychINFO related to stress management published since 1990. These articles covered topics as diverse as aerobic conditioning, biofeedback, yoga, play therapy, hypnosis, diet, and transcendental meditation. It seems that the terms *stress* and *stress training* have been used so broadly as to mean almost anything. It is no wonder that the military officer or program manager may be hesitant to slog through this mixed bag of psychological techniques.

Second, stress research had its genesis in medical/biological research and still retains many of the trappings of a psychoanalytic paradigm, with an emphasis on abnormal behavior and coping mechanisms. The consequence of this approach is that early stress research led to a preoccupation with illness and with those individuals who are overcome with chronic stress. As Salas et al. (1996) have noted, the study of illness is only marginally related to the understanding of stress and performance in a normal population. Therefore, stress research has historically emphasized disordered behavior and coping behaviors, and almost ignored the effects of stress on performance, effectiveness, and productivity in real-world environments. Accordingly, many military managers equate the term *stress* with illness or psychological deficiency and fail to see how it relates to their day-to-day concerns. On the other hand, if stress is discussed in terms of task demands and efforts to maintain performance in operational environments, then the military manager will often immediately recognize this as a critical requirement.

A third problem is that, frankly, stress training is hard to do in a military environment. It is difficult enough, aboard a ship or in a company of soldiers, to accomplish the basic training that is required on a day-to-day basis. In other words, it is a difficult enough task to ensure that personnel are trained to "classroom" standards, so that they can perform basic tasks proficiently. It is another, and more difficult, thing altogether to require that they can perform those tasks under the demands of high time pressure, noise, and smoke, with multiple other tasks demanding attention, and with sudden and unexpected events impinging on the operator. Granted, this is "real-life" in a combat environment, but in many cases it is just too difficult to deal with this, and easier to conduct training so that at least basic skills are learned in a standard operating environment.

Nevertheless, ignoring the requirement for specialized stress training in a military environment would be a grave error. Consider the demands of the modern electronic battlefield. The network-centric warfare environment requires dispersed, distributed forces to communicate, collaborate, and achieve joint outcomes across services, agencies, allies, and coalition partners. At the core of this concept is the networked team: A network of dispersed, decentralized, semi-autonomous, often ad hoc teams that must perform proficiently to achieve desired outcomes both within the team itself and in collaboration with other coalition teams. This performance environment is characterized by a high pace of operations, high task load, and the requirement to operate with multiple coalition partners in an isolated networked environment making high-stakes decisions with little feedback of outcomes. Clearly, this places a high demand on these military personnel, and military experts have noted the severe challenges that arise from these operational requirements. In fact, there are very few settings outside of the military that impose such a high demand on personnel and in which there is such a substantial potential for risk, harm, or error.

Moreover, failure to prepare for these conditions can exact a high price. Stress may result in *physiological changes* such as increased heartbeat, labored breathing, and trembling (Rachman, 1983); *emotional reactions* such as fear, anxiety, frustration (Driskell & Salas, 1996); *cognitive effects* such as narrowed attention (Combs & Taylor, 1952; Easterbrook, 1959), decreased search behavior (Streufert & Streufert, 1981), longer reaction time to peripheral cues and decreased vigilance (Wachtel, 1968); and *social effects* such as a loss of team perspective (Driskell, Salas, & Johnston, 1999) and decrease in prosocial behaviors such as helping (Mathews & Canon, 1975). Helmus and Glenn (2005) note that, during intense combat operations, rates of stress casualties may nearly equal the number of physical causalities in some units.

Stress Training

In order to organize the following discussion, we wish to present three straightforward and fairly simple propositions. First, there is a significant difference in what it takes to perform a task such as troubleshooting or bomb disposal in a benign environment and what it takes to perform that task in a hazardous or high-demand environment such as the military combat setting. This difference is the *contextual environment*—the organizational, environmental, social, and task demands that are imposed upon the operator. Consideration of the contextual factors that impinge on task performance is critical to maintaining effective performance in real-world settings.

Second, the distinction between *training* and *stress training* is the extent to which the training attends to these contextual factors. The primary goal of training is skill acquisition and retention. Most training takes place under conditions designed to maximize learning, such as a classroom setting, under predictable and uniform conditions. Thus, the primary purpose of *training* is to ensure the acquisition of required knowledge, skills, and abilities. However, many tasks must be performed in the real world in conditions quite unlike those encountered in the training classroom. For example, high stress environments include specific task conditions (such as time pressure) and require specific responses (such as the flexibility to adapt to novel events) that differ from those found in the normal task environment. Thus, the primary purpose of *stress training* is to prepare the individual to maintain effective performance in a high stress operational environment.

Third, the primary objectives of stress training are to provide pre-exposure to the high-demand conditions that may be faced by the trainee in the operational environment and provide the specialized skills training required to maintain effective performance under stress conditions. Kavanagh (2005) has noted that stress training can moderate the effects of stress on military performance and that attention should focus on "developing training that realistically represents the environment that the soldier will be expected to perform, is targeted on particular skills, (and) builds the soldier's ability to adapt" (p. xiv).

Driskell and Johnston (1998) have developed an integrated stress training approach, termed *stress exposure training* (SET), that provides a structure for designing, developing, and implementing stress training (see also Johnston & Cannon-Bowers, 1996; Saunders, Driskell, Johnston, &

Salas, 1996). According to Driskell and Johnston, an integrated stress training approach must achieve three objectives:

- *Enhance familiarity with the task environment*. Training must provide trainees with basic information on stress, stress symptoms, and likely stress effects in the performance setting.
- *Impart high performance skills*. Training must incorporate specialized skills training to enhance those skills that are required to maintain effective performance in the stress environment.
- *Practice skills and build confidence*. Training must allow gradual exposure to the high-stress environment to promote practice of skills under realistic conditions and build trainee confidence to perform.

The stress exposure training approach incorporates three stages or phases of training. The first stage is *Information Provision*, in which information is provided to the trainee regarding stress, stress symptoms, and likely stress effects in the performance setting. The second stage is *Skills Acquisition*, in which specific cognitive and behavioral skills are taught and practiced. These are called *high performance* skills, representing those skills required to maintain effective performance in the stress environment. The third stage is *Application and Practice*, the application and practice of these skills in a graduated manner under conditions that increasingly approximate the criterion environment.

In the following, we elaborate the stress exposure training approach by examining the specific activities that comprise each stage.

Phase 1: Information Provision. Clausewitz (1976) wrote, "It is immensely important that no soldier, whatever his rank, should wait for war to expose him to those aspects of active service that amaze and confuse him when he first comes across them. If he has met them even once before, they will begin to be familiar to him" (p. 122). Phase 1 of stress exposure training includes two primary components: (a) indoctrination, or discussion of why stress training is important, and (b) preparatory information on stress effects.

The first component of Phase 1 training is trainee indoctrination. The purpose of indoctrination is to increase trainee attention and training motivation. This is accomplished in several ways. First, trainees need to know the objectives of training and why stress training is important. This may be achieved by discussing operational incidents or case histories in which stress had a significant impact on performance. These "lessons learned" emphasize the rewards and costs of effective and ineffective performance in real-world stress environments. Indoctrination serves to ensure "user buy-in"—that is, the trainee should understand the purpose and value of stress training and how stress training can support mission accomplishment.

The second component of Phase 1 training is the provision of preparatory information. As we noted earlier, stress can lead to a number of adverse effects, including physiological effects such as a pounding heart and sweating, emotional effects such as anxiety or confusion, and cognitive effects such as attentional deficits and loss of focus. Research suggests that preparatory information regarding a potential threatening event can less negative reactions to that event. For example, Vineberg (1965) found that, in training soldiers for nuclear warfare, the communication of accurate information was critical in clarifying misconceptions, reducing fear of the unknown, and increasing a sense of personal control over these events. Unfortunately, this approach often runs counter to military practice, which is to give the individual the least amount of information necessary for a given situation. Nevertheless, a National Research Council study on enhancing military performance concluded that "stress is reduced by giving an individual as much knowledge and understanding as possible regarding future events" (Druckman & Swets, 1988, p. 21).

It is likely that preparatory information reduces negative reactions to stressful events in several different ways, by enhancing familiarity, predictability, and controllability. First, by providing a preview of the stress environment, preparatory information renders the task less novel and unfamiliar. Familiarity enhances self-efficacy, which has been shown to be a significant predictor of performance (Locke, Frederick, Lee, & Bobko, 1984). Second, knowledge regarding an upcoming event increases predictability, which can decrease the attentional demands and distraction of having to monitor and interpret novel events in real-time (Cohen, 1978). Third, preparatory information may enhance the sense of behavioral or cognitive control over an aversive event by providing the individual with an instrumental means to respond to the stress. That is, information regarding the nature of an aversive event can provide us with information on how to respond in that setting.

A comprehensive preparatory information strategy should provide information on the nature of the stress environment and typical physiological, emotional, and cognitive reactions to stress, how stress is likely to affect performance, and how the individual may adapt to these changes. Accordingly, Driskell and Johnston (1998) defined three primary types of preparatory information that should be incorporated in the *Information Provision* phase of training. *Sensory information* is information regarding how the individual is likely to feel when under stress, including typical physiological and emotional responses to stress. When confronted with a threatening or novel situation, the individual is likely to experience a number of unpleasant or intrusive physical and emotional reactions, such increased heart rate, labored breathing, and feelings of fear or confusion. These are normal "fight or flight" stress reactions, but they present several problems. First, they are distracting and divert attention from the task. Second, people often tend to misinterpret or over interpret these "normal" stress reactions as catastrophic, leading to a spiral of arousal, distress, and loss of attention. Worchel and Yohai (1979) found that when individuals were able to label or identify physiological reactions (that is, they were able to attribute their physiological reactions to some reasonable cause), they were less distressed or aroused by those reactions. Therefore, it is likely that providing personnel with accurate information regarding typical stress effects and stress reactions—on how the individual is likely to feel in a high-stress situation-- will lessen the negative impact of these reactions in the operational task environment.

Procedural information describes the events that are likely to occur in the stress environment, including a description of the setting, the types of stressors that may be encountered, and performance effects the stressors may have. For example, procedural information for a task such as manning a checkpoint may include a description of the contextual environment in which this task may take place, the noise and other distractions that may be present, and how these factors may impact decision making. Janis (1951) observed a reduction in negative stress reactions among combat aircrews when descriptive information on air attacks was provided in advance.

Instrumental information describes what to do to counter the undesirable consequences of stress. That is, it is useful for the individual to know not only how he or she will feel when under stress and the events that are likely to occur, but also how to respond to counter these negative effects. For example, it may be valuable to know that as threatening events unfold in a particular task environment, there will be a significant increase in background noise that can be distracting and mask task-relevant information, but also what one can do to overcome the effects of these distractions. This type of information has instrumental value in that it provides the individual with a means to resolve the problems posed by the stress environment.

Inzana, Driskell, Salas, and Johnston (1996) tested the effectiveness of preparatory information, examining the performance of Naval personnel on a command-and control decision-making task under high stress conditions. The preparatory information intervention included sensory information (e.g., "Stressors such as high task load may cause you to feel distracted or hurried."), procedural information (e.g., "These are normal reactions, but may lead you to misinterpret specific data fields."), and instrumental information (e.g., "Try to match the pace of the task, but pay close attention to the information in those fields."). Results indicated that the personnel who received preparatory information prior to performing under high stress conditions reported less anxiety, were more confident in their ability to perform the task, and made fewer performance errors than those who received no preparatory information.

Phase 2: Skills Acquisition. The objective of the *skills acquisition* phase of stress exposure training is skill acquisition and rehearsal. The goal of training at this stage is to build high performance skills that are required to maintain effective performance under stress. A number of stress training strategies or techniques may be incorporated in this phase of training. These may include the training of general skills such as cognitive control or mental practice strategies to more task-specific training strategies such as decision making training. Johnston and Cannon-Bowers (1996) have noted that these strategies may include developing metacognitive, cognitive, psychomotor, and physiological control skills. Specific stress training techniques may include the following.

Cognitive Control Techniques. Wachtel (1968) noted that when a person is under stress, attention is diverted inward to interpret novel or unfamiliar stress-related reactions, and less attention is devoted to external task-related stimuli. The term *cognitive control* subsumes a number of training approaches that attempt to train individuals to recognize task-irrelevant thoughts and emotions that degrade task performance and to replace them with task-focused cognitions. The primary emphasis of cognitive control techniques is to train the individual to regulate emotions (e.g., worry and frustration), regulate distracting thoughts (self-oriented cognitions), and to maintain task orientation. Singer, Cauraugh, Murphey, Chen, and Lidor (1991) have proposed an attentional-training approach that attempts to train individuals to maintain attentional focus on task-relevant stimuli in the face of external distractions. This approach includes training that describes how attention may be distracted during task performance, followed by practice in performing the task under stress, focusing attention, and refocusing attention after distraction. Empirical results indicated that this type of training, by focusing directly on enhancing attentional focus, could overcome the distraction and perceptual narrowing that occurs in stress environments.

Physiological Control Techniques. Physiological control techniques attempt to provide the trainee with control over negative physiological reactions to stress. These types of approaches attempt to train the responses that are characteristic of effective performance: being calm, relaxed, and under control. Training may include relaxation training (awareness and control of muscle tension, breathing, etc.), biofeedback, and autogenic-feedback training, which has been used successfully in alleviating space motion sickness (Cowings & Toscano, 1982). All of these techniques have in common an effort to increase the extent to which the individual's physiological reactions are under conscious control.

Overlearning. The term *overlearning* refers to deliberate overtraining of a performance beyond the level of initial proficiency (Driskell, Willis, & Copper, 1992). Researchers have noted that overlearning may be a useful stress training technique: Janis (1949) noted that "Drills of this type, when repeated so that the response is overlearned, tend to build up an automatic adaptive response" (p. 223). Tasks that are overlearned become more routinized or automatic, require less active attentional capacity, and are less subject to disruption by increased attentional demands. In that one effect of stress is to reduce or restrict attentional capacity, tasks that are overlearned should be more resistant to degradation. In fact, much military training attempts to reduce the impact of stress in combat through the use of repetitive drill, providing soldiers with a set of habitual responses that are less subject to degradation under stress.

Mental Practice. Mental practice refers to the cognitive rehearsal of a task in the absence of overt physical movement (Driskell, Copper, & Moran, 1994). In a meta-analysis of research on the effects of mental practice, Driskell et al. (1994) found that mental practice was an effective means for enhancing performance, although somewhat less effective than physical practice. Furthermore, mental practice may be a particularly effective technique for training complex cognitive tasks, for rehearsing tasks that are dangerous to train physically, or for training tasks such as emergency procedures where the opportunity for actual practice occurs very seldom.

Time-sharing Skills. Time-sharing, or multi-tasking, can be defined as the capacity to perform concurrent tasks or to interleave multiple tasks (Fischer & Mautone, 2005). High stress environments often involve an increase in task load, stemming from the imposition of additional tasks (e.g., a radar operator whose task suddenly expands from monitoring several targets to monitoring multiple targets while answering outside queries and requests for information) or may result from having to attend to novel or unfamiliar stimuli (e.g., a soldier may engage one target while scanning for additional threats). Heggestad, Carpenter, O'Shea, DeLosh & Clegg (2002) argue that timesharing is a skill that can be improved with practice. For example, Hirst, Spelke, Reaves, Caharack and Neisser (1980) found when subjects were asked to read aloud prose while taking dictation, performance dropped dramatically. However, with substantial dual task practice--over 50 hours--subjects could more readily read while taking dictation, achieving reading and comprehension rates similar to that of the single-task control subjects. Therefore, significant improvement in multi-tasking ability can be made when tasks are paired during training. However, time-sharing is considered a task-specific skill that must be practiced in the context of the real-world operational environment.

Guided Error Training. We generally try to train correct responses and avoid errors in training. However, there may be value in experiencing how things can go wrong or how errors can be made, especially when the criterion situation in one in which errors may abound. Lorenzet, Salas, and Tannenbaum (2003) have noted that errors may occur in training on the basis of several strategies: (a) errors may be avoided in training, (b) errors may be allowed in training but not specifically triggered, (c) errors may be induced or evoked in training, or (d) errors may be designed intentionally in training to guide skill development. In an empirical test of the guided error approach, Lorenzet et al. identified common errors that occurred on a training task, and then designed a training procedure that guided trainees through these errors and provided corrective feedback. Results indicated that those who received guided error training performed better and developed greater self-efficacy than those who received error-free training. Thus, allowing trainees to experience likely errors and receive error correction may be an effective approach to enhancing performance in a high stress, high error task environment.

Decision-Making Training. Formal, analytic decision making approaches require the decision maker to carry out an elaborate and exhaustive procedure characterized by a systematic, organized information search, thorough consideration of all available alternatives, evaluation of each alternative, and re-examination and review of data before making a decision. Although this procedure is often taught as the decision making ideal, some researchers have argued that under conditions of high demand or high time pressure, decision makers do not have the luxury to adopt a time-consuming analytic strategy. Moreover, encouraging the decision maker to adopt a structured, analytic decision making model could undermine behavior that may more adequately fit the requirements of the task situation (see Cannon-Bowers & Salas, 1998). Johnston, Driskell, and Salas (1997) found that on a time-pressured, realistic military task, those who were trained to use a less analytic decision-making strategy performed more effectively than those who used a formal, analytic decision strategy. Thus, one goal of decision making training for stressful environments is to emphasize the use of simplifying heuristics to manage effort and accuracy, and to improve the capability of the decision maker to adapt decision making strategies to high demand conditions.

Enhancing Flexibility. Hackman and Morris (1978) have noted that one of the few universally effective task strategies is flexibility or adaptability. Flexibility has been defined as the ability to adjust one's behavior to suit changing task conditions, or as "the ability and willingness to respond in significantly different ways to correspondingly different situational requirements" (Zaccaro, Gilbert, Thor, & Mumford, 1991, p. 322). Pulakos et al. (2002) have identified several critical dimensions of adaptive performance, including flexibility in handling uncertain task conditions, interpersonal flexibility, and flexibility in problem solving.

Research indicates that stress can lead to a loss of flexibility or to greater problem-solving rigidity (Cohen, 1952). Rigidity refers to the tendency to approach a problem with a restricted attentional focus and expectancy that there is a single solution that does not vary. However, high-stress environments require flexibility to respond to novel and varied task contingencies. Certain training procedures can enhance flexible behavior. Gick and Holyoak (1987) argue that positive transfer (i.e., the extent to which training results transfer from the training setting to the real-world setting) is more likely when a variety of different examples were provided during training. Schmidt and Bjork (1992) refer to this as practice variability, noting that intentional variation during skills practice can enhance the transfer of training. Thus, presenting training material or training activities in various contexts, from different perspectives, and with diverse examples can result in more flexible use of a skill under novel and variable task conditions.

Team Training. One of the more well-established findings in psychology is that as stress increases, the individual's breadth of attention narrows (Easterbrook, 1959). Perhaps the earliest statement of this phenomenon was the assertion by William James (1890) that, under stress, the individual's field of view is reduced from a broad perspective to a narrower, restricted focus. Driskell, Salas, and Johnston (1999) extended this proposition to the group level of analysis, arguing that the narrowing of attention or "tunnel vision" that occurs under stress may result in a shift from a broader, team perspective to a narrower, individualistic focus. Results of an empirical test supported this assumption, indicating that stress results in a narrowing of team perspective. Under stress, team members were shown to be more likely to shift from a team-level to an individual-level task perspective, resulting in degraded team performance. Interventions that attempt to reinforce teamwork skills may be applicable for teams that perform in high stress environments.

Phase 3: Application and Practice. Helmus and Glenn (2005) cite a conversation between two Marines at Iwo-Jima, drawn from the book *Flags of Our Fathers*:

> "Did you see those Japanese firing at us?" he screamed to the guy next to him. "No," the leatherneck answered, deadpan. "Did you shoot them?" "Gee, no," Buchanan replied, "That didn't occur to me. I've never been shot at before." (Bradley & Powers, 2000, p. 156)

The classic *American Soldier* studies were conducted during World War II to examine battlefield performance (Stouffer et al., 1949). Military researchers asked combat veterans from the Italian and North African campaigns what type of training they lacked. The most common answer was that they lacked training under realistic battlefield conditions (Janis, 1949). Effective military performance requires that the skills learned in training be transferred to the operational setting. The novelty of performing even a well-learned task in a high-stress real-world environment can cause severe degradation in performance. Therefore, the final phase of stress training requires the application and practice of skills learned in training under conditions that approximate the operational environment.

Clearly, the adage “train as you fight” is a well-established military axiom, and the goal of “realistic training” is accepted by most military trainers. However, several specific issues are critical in implementing realistic stress training. The first questions that arise are: “How realistic should it be?” or “How can we simulate real-world conditions in a training environment?” Training fidelity refers to the extent to which the characteristics of the training environment are similar to the characteristics of the criterion setting. Given that the ultimate criterion of military training is combat, there are few who think that the characteristics of combat can be closely approximated outside of combat. This is likely the case, and some would argue that because the training environment cannot capture all that is relevant to a combat setting, it has limited value in preparing personnel for combat. However, it is not necessarily true that higher fidelity always leads to better training. In fact, Friedland and Keinan (1992) note that for complex, high-demand military tasks, training that incorporates no stress and training that incorporates constant high intensity stress are both likely to be counterproductive. Training that incorporates no stress or that does not involve the contextual factors that characterize the criterion setting does not provide the trainee with pre-exposure or skills practice in this operational environment. Training that incorporates stressors of very high intensity is likely to overload all but the most experienced trainees and may interfere with skill development and lead to loss of confidence.

Friedland and Keinan (1996) have found evidence to support the effectiveness of *phased training* as an approach to manage training for complex, high stress environments. Based on the assumption that a high degree of complexity in the training environment may interfere with initial skill acquisition, phased training is an approach to maximize training effectiveness by partitioning training into separate phases: During initial training, trainees learn basic skills in a relatively low-fidelity or low-complexity environment; and latter stages of training incorporate greater degrees of complexity or realism.

Graduated exposure to real-world stressors in the *application and practice* phase of stress exposure training provides several advantages. First, it serves as a complement to the preparatory information provided in phase 1 of training. Whereas the goal of phase 1 is to provide knowledge regarding the stress environment, one goal of phase 3 is to allow pre-exposure to these conditions. This reduces anxiety and uncertainty regarding this environment and enhances a sense of individual control and increases confidence to perform in this setting. Second, graduated exposure to stress events in training allows the individual to become more familiar with relevant stressors without being overwhelmed, and is less likely to interfere with the acquisition and practice of task skills than would exposure to intense stress. Finally, allowing skills practice in a graduated manner across increasing levels of stress increases familiarity with the types of performance problems that can occur in this setting. Trainees can experience errors, receive guidance and feedback, develop work-arounds, and have the opportunity to bring performance back to baseline levels using the skills learned in phase 2 of training.

A second problem unique to implementing stress exposure training relates to training design. It is important to note that stress exposure training is a model for stress training rather than a specific training technique. The stress exposure training model describes three stages of training, each with a specific objective. However, the specific content of each stage will vary according to the specific task requirements. Both the type of stressors and the skills required for effective performance depend on the task to be trained. Therefore, stress training must be context-specific, and a careful needs analysis is required to define the specific tasks to be trained, determine the types of stress in the task environment, and develop training content.

Moreover, there is another factor that differentiates stress exposure training from traditional training, and that is that stress exposure training is event-based. In a traditional training design approach, a task analysis is performed to define the task and identify the characteristics of the work and of the worker required for successful performance. These identified knowledge, skills, abilities, and other attributes (KSAOs) form the basis for the training curriculum. Event-based training is unique in that the event itself is the curriculum (see Cannon-Bowers, Burns, Salas, & Pruitt, 1998). An event is defined as a specific task procedure (e.g., *execute emergency action plan*) with corresponding performance conditions (e.g., organizational, environmental, social, and task demands). Events may be discrete and singular, or multiple events may be connected into a series representing a longer scenario. In event-based training, events are embedded into training to achieve desired training objectives and provide the opportunity for trainees to apply skills in an environment representative of real-world operational conditions.

Developing event-based training is a multi-step procedure (see Cannon-Bowers et al., 1998; Salas, Wilson, Burke, & Priest, 2005). The first step is the identification of training requirements, tasks, and competencies, based on a traditional needs/task analysis. This information is used to determine training objectives. The next step is the development of specific events ("trigger" events or scenarios) to be embedded into the training. These events are based on training objectives and may be derived from critical incident data or on input from subject matter experts. In brief, key events are defined to act as cues that trigger essential actions or behaviors, and provide the basis on which the trainee is instructed and evaluated. These events create opportunities for performance measurement, and therefore performance measures are established and trainee performance is observed, evaluated, and incorporated into feedback.

There are several advantages of the event-based approach for stress exposure training. First, events can be defined to represent real-word events and contextual demands. In fact, events that are realistic, allow the trainee to respond in multiple ways, and that unfold over time can engage the trainee in a "real-world" scenario without actually requiring perfect fidelity. Second, in a complex task or training environment, not all behaviors have to be observed, just those pre-defined behaviors that are reactions to scripted events. Thus, instructors know a priori when "trigger" events occur and key behaviors are exhibited. Finally, training events can be varied so that they require different responses under different conditions, enhancing flexibility of response and adaptability. Events can be scripted to trigger errors so that trainees can experience likely sources of error under realistic conditions. Multiple events can allow a progression through graduated levels of intensity in a multi-event scenario.

In summary, stress exposure training provides a comprehensive model of stress training. It incorporates three stages. In Phase 1, trainees receive preparatory information regarding stress, stress effects, and stress reactions. In Phase 2, trainees acquire specific skills required to maintain effective performance in high-stress environments. In Phase 3, trainees have the opportunity to apply and practice these skills in an event-based scenario that approximates the criterion environment. Research indicates that this stress training approach can reduce negative reactions and enhance performance under stress (Saunders et al., 1996). In the following, we describe a laboratory application and a more applied real-world application of stress exposure training.

A Laboratory Application

Driskell, Johnston, and Salas (2001) conducted an experimental research study to examine the extent to which stress training generalizes to novel stressors and to novel tasks. The problem these researchers addressed is this: Given that a primary goal of stress training is to provide practice under conditions similar to those likely to be encountered in the real-world setting, it is often difficult to anticipate the specific to-be-encountered events in training. In other words, on one hand, we have the general prescription that stress training should anticipate the conditions of the operational environment. On the other hand, we are faced with the realization that many real-world environments of interest are dynamic and emergent, and it is difficult to provide practice and training for potential scenarios that are themselves unpredictable or unanticipated.

Therefore, one question that has considerable applied as well as theoretical implications is the extent to which stress training is generalizable to novel stressors and to novel tasks. That is, if the design of a particular stress training intervention requires trainees is to practice Task A under time pressure, a critical question is whether the positive effects of this training intervention generalize to a task situation in which time pressure is not salient, but that involves a novel stressor such as noise? Moreover, if the design of a particular stress training intervention requires trainees is to practice Task A under time pressure, a related question is to what extent do the positive benefits gained in training generalize to a task setting in which trainees face not Task A (the training task), but a novel task, Task B? In brief, do the beneficial effects of stress training generalize to novel stressors and novel tasks, or does a unique stress training intervention have to be targeted for each type of stressor and each type of task that the trainee may face?

Driskell et al. (2001) designed a series of laboratory studies to address this question. Study 1 was designed to address the question of generalizability of stress training from stressor to stressor. Research participants performed a laboratory task over three trials: (1) performance was assessed pre-training, in which participants performed the task under either time pressure or noise, (2), performance was assessed post-training, in which participants who received "noise stress" training performed under noise stress, and participants who received "time pressure" training performed under time pressure, and (3) performance was assessed under novel stressor conditions, where the participants who received noise stress training now performed under time pressure, and the participants who received time pressure training now performed under noise stress.

Study 2 was similar, except that the goal was to examine the generalizability of stress training from one task to another. Study 2 also included three performance trials: (1) performance was assessed pre-training, in which participants performed either task A or task B under stress, (2), performance was assessed post-training, in which participants who received stress training and practice for task A then performed task A under stress, and participants who received stress training and practice for task B then performed task B under stress, and (3) performance was assessed under novel task conditions, where the participants who received stress training for task A now performed task B under stress, and the participants who received stress training for task B now performed task A under stress.

For each study, the stress training implemented consisted of a brief stress exposure training (SET) intervention. The training intervention consisted of three stages: (a) preparatory information, (b) skills training, and (c) application and practice. In the preparatory information phase, participants were given (a) descriptive information on the type of stressors that they would encounter in performing the task, (b) sensory information on typical physical and emotional reactions they were likely to feel when under stress, and (c) procedural information on how stress may impact task performance. For example, those who received SET-noise training were given information on the types of noise they would encounter and how it would be presented, they were told how noise can lead to frustration and distraction, and they were told that noise can lead to increased errors as task performers have to allocate attention to the noise and the task.

The goal of the second phase of training, skills training, was to teach skills to counter the negative effects of stress. A brief attentional training intervention (see Singer et al., 1991) was implemented that focused on three points: (a) stress can be distracting (b) to counter the distraction, individuals should selectively attend to task-relevant stimuli, and (c) the key to effective performance is to ignore distracting stimuli and maintain focus on the task. In the third phase of training, participants applied these skills while performing the task. Participants first practiced the task under either noise stress or time pressure for 30 seconds. The experimenter then discussed with each participant whether they were able to apply the skills learned, and reemphasized the key points presented in training. Participants again practiced the task under stress for a 30-second period, after which the experimenter again discussed application of skills and key training points. Participants then performed the task for a 3-minute period, again followed by refresher training.

The results of both studies indicated that the improvement in performance realized from pre- to post-training and the reduction in subjective stress realized from pre- to post-training were sustained when participants performed under a novel stressor (Study 1) and performed a novel task (Study 2). These results indicate that, under certain conditions, the positive gains from stress exposure training can generalize to novel settings.

A Real-World Application

The Federal Law Enforcement Training Center (FLETC) provides training to law enforcement personnel from numerous federal, state, and local agencies. A law enforcement officer's survival requires that he or she is able to quickly assess a situation and respond with appropriate actions in dynamic, life-threatening, time-pressured situations that are likely to be encountered in carrying out their duties. Accordingly, a research program has been initiated to examine the extent to which stress training can better prepare law enforcement officers to perform under highly stressful conditions. Initial results from the research program have been reported in a technical report entitled the *Survival Scores Research Project* (FLETC, 2004).

This research program has several goals. Law enforcement officers must perform in an environment that may transition from routine to critical within seconds. Violent and life-threatening events often take place in poorly lit settings, with multiple suspects and innocent bystanders at close range, and require critical decisions within seconds. Thus, one primary goal of this research program is to develop a scenario that reflects the challenges faced during law enforcement duty. In other words, is it possible to develop a realistic scenario that simulates the high-stress demands of a law enforcement encounter? A second goal of this research program is to incorporate this scenario into an effective training program to enhance performance under stress.

In pursuit of the first research goal, FLETC researchers developed a scenario designed to replicate real-world law enforcement situations. Law enforcement subject matter experts were interviewed to gather actual experiences reflecting high-risk encounters. A multiple-event scenario was developed that included a series of 7 events, including (1) call-in to establish radio communications, (2) non-emergency vehicle operation, (3) emergency vehicle operation, (4) vehicle spin-out, (5) entry into building to question suspect, (6) gun take-away and shoot-out, and (7) post-shooting interview. This fast-flowing (approximately 35 minute), realistic scenario incorporated environmental stressors (noise, time pressure, lethal threat), high task load, social stressors (the trainee's partner was a confederate who performed scripted errors in the scenario), and critical task errors (e.g., a misfiring weapon).

All of the research participants previously received and completed basic training on these tasks, including emergency driving, shoot/no-shoot judgment situations, managing assault and resistance, and exchange of fire. However, none of the participants had completed exercises specifically designed to evoke the high stress demands of the real-world environment. Thus, one goal of this phase of the research program was to quantify the stressfulness of the research scenario and to examine the relationship between stress and trainee performance.

All performances were videotaped, and a battery of physiological and psychological measures were administered during the scenario to measure stress response. Trainee performance was also assessed via a series of performance measures, including threat recognition, latency to respond, weapons handling, tactical movement, and other measures. Results indicated that the scenario was perceived by trainees as highly stressful. Moreover, as stress demands increased in the scenario, there was a corresponding increase in physiological measures of heart rate, blood pressure, and cortisol levels. Significant decrements in performance were observed. For example, during the gun take-away and shoot-out event, weapons handling skills were seriously degraded as trainees were unable to perform complex motor skills, performed them in the wrong sequence, or performed the wrong function altogether. In many cases, decision-making ability was impaired, with some trainees observed pulling the trigger up to 10 times before initiating a reload of an empty weapon. While the research scenario was shown to be highly successful in evoking high stress, outside the generalization that as physiological measures increased, trainee performance declined, there was little empirical evidence linking physiological measures to successful trainee performance.

There are several important benefits of this initial research study. The first was the development of an event-based scenario, developed by experienced subject matter experts, representing critical law enforcement events. Second, this research scenario was shown to be a realistic and highly stressful simulation of these real-life incidents. Third, this research identified a number of performance deficiencies in a research population that had previously received comprehensive basic training on these tasks. These deficiencies included poor decision making, tunnel-vision or perceptual narrowing, memory deficits, use of improper procedures, and poor communications.

One further implication of this initial research was the establishment of the requirement to develop stress training interventions to offset the observed performance deficiencies. Current research efforts in the second phase of this research program are being devoted to developing event-based stress training procedures, modeled on the stress exposure training paradigm, to optimize law enforcement officers' performance in stressful encounters. In brief, this research program represents one of the most ambitious and comprehensive applied research efforts to examine stress effects and stress training in a real-world setting.

Summary

In conclusion, we return to the optimistic note with which be began this chapter: We know quite a bit about stress training. A substantial body of stress research has accumulated over the past decade that provides sound guidance for designing and implementing stress exposure training. Moreover, this work has expanded beyond the experimental laboratory to the field, which is the ultimate testing ground for applied research. Current research on stress exposure training approximates Berger's (1988) concept of a *theoretical research program*, an integrated body of research that consists of theory development, experimental research to test and elaborate theory, and applied research that applies or extends theory to an identified real-world problem (see Driskell & King, in press). Maintaining effective performance under high stress conditions is a daunting challenge. We ask our military personnel and law enforcement officers to face this threat. It is imperative that they have the preparation and training necessary to carry out these duties.

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