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Effects of Preparatory Information on Enhancing Performance Under Stress

Carolyn M. Inzana and James E. Driskell
Florida Maxima Corporation

Eduardo Salas and Joan H. Johnston
Naval Air Warfare Center Training Systems Division

Research conducted largely in medical and clinical settings suggests that receiving preparatory information prior to a stressful event can reduce negative responses to stress. Although results within this domain have been promising, little research has examined the efficacy of preparatory information on enhancing performance in a more applied task environment. This study examined the effect of preparatory information on reducing stress reactions and enhancing performance on a realistic decision-making task. Results indicated that those 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.

Stressful, threatening, or demanding situations can lead to a number of undesirable consequences, including heightened anxiety and decrements in performance (see Driskell & Salas, 1991, 1996; Keinan, 1987). There is some evidence, especially from medical studies, that preparatory information can lessen negative reactions to stress. In one of the earliest tests of the effects of preparatory information, Egbert, Battit, Welch, and Bartlett (1964) provided surgery patients with information regarding an impending operation, how they would feel, and what they could do to cope with these feelings. Those who received this preparatory information required less medication and were released from the hospital sooner than controls. Since this time, preparatory information strategies have been implemented to mitigate the effects of stress in a wide range of medical procedures, including surgery (Mavrias, Peck, & Coleman, 1990), endoscopic examination (Johnson & Leventhal, 1974; Wilson, Moore, Randolph, & Hanson, 1982), dental extraction (Auerbach, Martelli, & Mercuri, 1983), cardiac catheterization (Kendall et al., 1979), nasogastric intubation (Padilla et al., 1981), and diagnostic colposcopy (Miller & Mangan, 1983). Some researchers have concluded from reviewing this literature that the effects of preparatory information on reducing stress are consistent and positive (see Suls & Fletcher, 1985; Taylor & Clark, 1986), whereas others are more cautious in noting that the evidence is not unequivocally supportive (see Ludwick-Rosenthal & Neufeld, 1988; Yap, 1988).

Given the widespread use of preparatory information for reducing stress effects in health care settings, it is surprising that there has been relatively little evaluation of the effectiveness of this approach in other nonclinical applied settings. Moreover, the available research has focused on a somewhat narrow range of health-related outcome measures of adjustment or well-being, whereas the use of this approach to enhance *performance* in stressful environments has not been well documented. In one of the few studies conducted outside of a health care setting, Girodo and Roehl (1978) examined the use of preparatory information to counter negative reactions to a simulated flight emergency. Although there was no assessment of performance, results indicated no positive effect of preparatory information on subjective anxiety. More recently, Olson (1988) examined the effect of preparatory information on speech anxiety. Results indicated no significant effect of preparatory information on self-reported anxiety or number of speech errors.

There has been a recent resurgence of interest in human performance under stress and in approaches to enhance performance in high-stress task settings (see Driskell & Salas, 1991, 1996; Keinan, 1987; Tomaka, Blascovich, Kelsey, & Leitten, 1993). Although preparatory information has been shown to be a promising stress

Carolyn M. Inzana and James E. Driskell, Florida Maxima Corporation, Winter Park, Florida; Eduardo Salas and Joan H. Johnston, Naval Air Warfare Center Training Systems Division, Orlando, Florida.

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Correspondence concerning this article should be addressed to James E. Driskell, Florida Maxima Corporation, 147 East Lyman Avenue, Winter Park, Florida 32789. Electronic mail may be sent via Internet to james.driskell@rollins.edu.

intervention within the medical and clinical domains, little research has examined the efficacy of preparatory information on enhancing performance in a more applied task environment. This study examines the effect of preparatory information on reducing stress reactions and enhancing performance on a realistic decision-making task.

Preparatory Information

Imagine a prototypical emergency, high-stress event, such as an airplane crew responding to a mechanical failure in flight, a power plant operator reacting to a system accident, a military crew commanding a shipboard radar center under combat conditions, or even a more mundane example of a work team deliberating a task under extreme deadline pressure. There are several common characteristics of these high-stress events. First, those involved are likely to experience a number of novel and unpleasant sensations, such as a pounding heart, muscle tension, and feelings of anxiety, confusion, or frustration. Second, stress may produce a qualitative change in the task environment. Huey and Wickens (1993) called this change a transition event, in which stressors such as noise, time pressure, threat, and other demands occur suddenly, and individuals are faced with a transition from routine conditions to emergency conditions. Thus, the nature of the task environment may change dramatically, from a relatively benign environment to one that is fast paced, aversive, or threatening. Finally, in many cases, these stressors and the individual reactions to stress disrupt goal-oriented behavior, and task performance must be adapted to meet these new demands. For example, to maintain effective performance under stress, individuals may need to selectively attend to task-relevant stimuli to counter the attentional overload imposed by stress conditions (see Singer, Cauraugh, Murphey, Chen, & Lidor, 1991).

Therefore, a comprehensive preparatory information strategy should address how the person is likely to feel in the stress setting, describe the events that are likely to be experienced in the transition from normal to stress conditions, and provide information on how the person may adapt to these changes. Accordingly, we may define three types of preparatory information: sensory, procedural, and instrumental. *Sensory information* is information regarding how the individual is likely to feel when under stress. Under stress, the individual may perceive a number of intrusive physical and emotional sensations. Typical physiological reactions include increased heart rate, sweating, shallow breathing, and muscle tension. Emotional reactions to stress may include fear, frustration, and confusion. Although the relationship of physiological and emotional state to performance is complex, these reactions are common and are, at the least, a source of interference and distraction to the task performer. In a meta-analysis of studies in which subjects were given sensory preparatory information prior to a stressful event, Suls and Fletcher (1985) reported an overall positive effect of sensory information on reducing stress reactions.

Procedural information describes the events that are likely to occur in the stress environment. Procedural information may include a description of the setting, the types of stressors that may be encountered, and what effects the stressors may have. For example, procedural information provided to a novice parachutist may include a description of the activities that will take place prior to a jump, the noises and time pressure that may be present, and information regarding the distraction and lapses of attention that these stressors may cause. In an early study of combat aircrews, Janis (1951) found a reduction in negative stress reactions when descriptive information on air attacks was provided in advance.

Finally, we may identify a third type of preparatory information, which we term *instrumental information*. Instrumental information describes what to do to counter the undesirable consequences of stress. For example, Egbert et al. (1964) provided individuals with information on how they would feel following a medical operation, as well as what they could do to relieve the discomfort. Preparatory information may be most effective, especially in a performance environment, if it has instrumental value; that is, if the information provides the individual with a means to resolve the problems posed by the stress environment. Thus for example, it may be of value to know not only how noise may contribute to distractions during task performance but also what one can do to overcome the effects of these distractions. However, there has been little research to examine the role of instrumental information in reducing stress effects.

Although data supporting the value of preparatory information has primarily been drawn from clinical and medical studies (see Taylor & Clark, 1986), this concept has been the subject of broad theoretical interest in psychology. It is likely that preparatory information mitigates negative reactions to stress in several different ways. First, preparatory information, by providing a preview of the stress environment, renders the task less novel and unfamiliar (Ausubel, Schiff, & Goldman, 1953). This may lead to a more positive expectation of self-efficacy, which research has shown to be a strong predictor of actual performance (Bandura, Reese, & Adams, 1982; 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 informa-

tion, especially instrumental 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 (Keinan & Friedland, 1996; Thompson, 1981).

The present study was undertaken with two goals. It is of both practical and theoretical value to determine whether the benefits of preparatory information extend beyond the clinical setting. Therefore, the first overarching concern was to examine the effectiveness of preparatory information as a stress-training intervention in an applied task environment. Second, we were interested in the effects of preparatory information not only on subjective response but also on enhancing performance under stress. Accordingly, we implemented a comprehensive preparatory information intervention that incorporated sensory, procedural, and instrumental information. We predicted that those who received preparatory information prior to performing in a stressful environment would experience less subjective stress, develop greater task confidence, and perform more effectively than those who received no preparatory information.

Method

Participants

Participants in this study were 92 Navy enlisted personnel assigned to a Naval technical school. Participants volunteered to take part in a study of tactical decision making and were randomly assigned to one of four experimental conditions.

Design

The study was a 2 (stress; high vs. normal) × 2 (task information; general vs. preparatory) experimental design. Participants performed a computer-based decision-making task under either high-stress or normal-stress conditions. They were given either general task instructions or instructions that included specific preparatory information regarding the stress environment.

Procedure

Study participants arrived at the experimental laboratory and were given detailed instructions on how to perform the experimental task. During an approximate hour-long training period, task instructions were presented on videotape, after which participants received individualized instruction and practice. The experimental task was an actual simulation used to train in preparation for Naval decision making. The participant's role was to monitor a radar screen that contained their own ship at the center and contained numerous unidentified contacts positioned at concentric rings away from the ship. The participant's task was to identify and label each contact according to three classifications: the type of craft (aircraft, surface craft, or subsurface); its status (civilian or military), and the intentions of the craft (hostile or peaceful). To make each classification, the participant accessed one of three information fields or menus: A, B, and C, corresponding to these headings. For example, Menu A contained five items of information regarding the type of craft. Within Menu A, the participant could access an altitude item to ascertain whether the contact was above the surface, on the surface, or below the surface of the water. After determining the type of craft, the participant then proceeded to gather identifying information from Menus B and C. Once the contact had been labeled as to the type of craft, its status, and its intentions, the contact was then cleared from the screen if it had been determined not to be a threat or engaged if it had been determined to be hostile. Participants were told to work as quickly and as accurately as they could in order to identify and engage or clear each contact before it reached their ship.

Participants completed a pretask questionnaire (containing the manipulation check items described below) and then performed the task. Following a 30-min performance period, participants completed a postexperimental questionnaire, received a full explanation of the study, and were thanked for taking part in the study.

Independent Variables

Stress. Participants performed the task under normal or high-stress conditions. Stress was manipulated by increasing task load, auditory distraction, and time pressure. Task load was induced by increasing the number of potentially threatening targets approaching the participant's ship. Auditory distraction was implemented by playing a multitrack audio recording of background noises over the participants' headphones during the task. Finally, time pressure was induced by the experimenters telling the participants to "hurry up" and "work harder" at 5-min intervals during the task.

Preparatory information. All participants received detailed instructions on how to perform the task during the initial training presented on videotape. Those who received specific preparatory information regarding the stress environment were shown an additional training segment. The preparatory information included sensory, procedural, and instrumental information. Sensory information was provided by describing typical stress reactions (e.g., rapid heartbeat and muscular tension) that they may experience in a stressful environment. Procedural information revealed what was likely to happen in the stressor environment, by describing the stressors they would experience (time pressure, task load, and auditory distractions) and likely task consequences (e.g., they may get distracted and feel rushed or pressured). Finally, we presented a simple form of instrumental information by describing to the participants what they could do to counter these effects. Instrumental information regarding the sensory effects of stress was provided by instructing participants to identify these feelings as normal reactions to stress and to focus on the task. Instrumental information regarding the effects of stress on task performance was provided by instructing participants to ignore the task-irrelevant distractions and refocus on the task.

Dependent Variables

Two types of performance measures were assessed in this study. Performance accuracy was recorded as the proportion of

information fields accurately identified. Performance speed was assessed by the number of information fields accessed. Two self-report measures were used. Subjective stress was assessed by a seven-item scale asking participants to rate the extent to which they felt excited, pressured, tense, nervous, stressed, distracted, and anxious. Because these items were found to be highly intercorrelated (Cronbach's alpha = .83), we combined them into a composite measure of subjective stress. Self-efficacy was assessed by two items asking participants how confident and competent they felt at the task. Because participants' ratings on these items were highly correlated (Cronbach's alpha = .89), we combined them into a composite measure of self-efficacy.

Results

Manipulation Checks

Stress manipulation. To gauge the effectiveness of the stress manipulation, we asked participants to rate the extent to which they found the task to be distracting on a scale from 4 = *very distracting* to 1 = *not distracting*. Those who performed under stress conditions rated the task as significantly more distracting (M = 3.13, SD = .88) than those who performed under the normal-stress conditions (M = 1.42, SD = .71), $t(90) = 10.37$, $p < .01$.

Information provision. Four items presented on the pretask questionnaire were used to gauge the success of the information provision manipulation. In each case, the preparatory information group scored higher than those who did not receive preparatory information. Those in the preparatory information group were more aware of the stressors to be encountered in the task setting (M = 4.66, SD = 1.61) than those who did not receive preparatory information (M = 2.47, SD = 1.42), $t(88) = 6.87$, $p < .01$. There was a marginally significant tendency for those who received preparatory information to identify typical reactions to stress more accurately (M = 2.47, SD = 1.38) than those who did not receive preparatory information (M = 2.04, SD = 1.51), $t(88) = 1.39$, p = .08. Finally, those in the preparatory information group were more likely to identify the proper response to distracting task events (M = .533, SD = .51 vs. M = .733, SD = .48), $t(88) = 1.99$, $p < .05$, and to identify the proper response to stress reactions (M = .333, SD = .48 vs. M = .788, SD = .42), $t(88) = 4.69$, $p < .01$, than did those who did not receive preparatory information.

Subjective Stress

The data were analyzed in a 2 (stress: high vs. normal) × 2 (information: general vs. preparatory) analysis of variance (see Table 1). There was a significant main effect for stress on participants' reports of subjective stress, $F(1, 86) = 30.64$, $p < .001$. Those in the high-stress task conditions reported greater subjective stress (M = 3.62, SD = 1.01) than those in the normal-stress setting (M = 2.55, SD = 1.06). The analysis also revealed a significant main effect for preparatory information on subjective stress, $F(1, 86) = 6.06$, $p < .05$. Those who received preparatory information prior to the task reported less subjective stress (M = 2.74, SD = 1.06) than those who did not receive this information (M = 3.42, SD = 1.18). The interaction between preparatory information and stress was not significant, $F(1, 86) = 1.55$, $p > .1$.

However, the primary comparison of interest is the effect of preparatory information on moderating individual reactions under stress. An a priori comparison revealed that those who performed under stress and received preparatory information experienced less subjective stress (M = 3.17, SD = .90) than those who performed under stress and received no preparatory information (M = 4.20, SD = .86), $t(86) = 3.44$, $p < .001$.

Self-Efficacy

The analysis resulted in a significant main effect of stress on self-efficacy, $F(1, 83) = 20.38$, $p < .001$. Those who performed under high-stress conditions were less confident in their task ability (M = 4.65, SD = 1.56) than those who performed under normal-stress conditions (M = 5.66, SD = .81). The results also indicate a significant main effect of preparatory information on self-efficacy, $F(1, 83) = 9.28$, $p < .05$. Those who received preparatory information were more confident (M = 5.48, SD = 1.04) than those who were given no preparatory information (M = 4.89, SD = 1.50). There was a significant Information × Stress interaction, indicating that for those who performed under the stress conditions, preparatory information resulted in greater self-efficacy (M = 5.22, SD = 1.20) than when no preparatory information was given (M = 3.88, SD = 1.69), $t(38) = 2.92$, $p < .05$. There was no such pattern evident in the normal-stress conditions, $t(45) = .71$, $p > .1$.

Performance Accuracy

There was a significant main effect of stress on accuracy, $F(1, 88) = 122.65$, $p < .001$. Those who performed under stress were less accurate in identifying targets (M = 82.48, SD = 7.17) than those in the normal-stress conditions (M = 95.60, SD = 4.51). Results also indicated a significant main effect of preparatory information on accuracy, $F(1, 88) = 6.59$, $p < .05$. Those who received preparatory information prior to performance made fewer errors (M = 90.38, SD = 7.78) than those who did not receive this information (M = 88.22, SD = 9.81). There was no significant interaction, $F(1, 88) = .94$, $p > .1$.

Again, the primary comparison of interest is the effect

Table 1
Means and Standard Deviations for Self-Report and Performance Measures as a Function of Stress and Type of Information

	Stress level			
	Normal		High	
Measure	*M*	*SD*	*M*	*SD*
Subjective stress				
General information	2.80	1.04	4.20	0.86
Preparatory information	2.29	1.05	3.17	0.90
Self-efficacy				
General information	5.58	0.86	3.88	1.69
Preparatory information	5.75	0.77	5.22	1.20
Performance accuracy				
General information	94.68	5.01	80.15	8.22
Preparatory information	96.61	3.75	84.42	5.62
Performance speed				
General information	36.96	10.31	36.75	13.31
Preparatory information	40.17	11.47	40.38	13.00

Note. In the general information condition, for the normal stress group, $n = 25$, and for the high-stress condition, $n = 20$; in the preparatory information condition, for the normal stress group, $n = 23$, and for the high-stress group, $n = 24$.

of preparatory information on enhancing performance under stress. An a priori comparison revealed that those who performed under stress and received preparatory information were more accurate ($M = 84.42$, $SD = 5.63$) than those who performed under stress and received no preparatory information ($M = 80.15$, $SD = 8.22$), $t(88) = 2.44$, $p < .01$.

Performance Speed

There was no main effect for stress, $F(1, 88) = .00$, $p > .1$, or preparatory information, $F(1, 88) = 1.85$, $p > .1$, on the number of information fields accessed. Nor was there a significant interaction, $F(1, 88) = .007$, $p > .1$. Moreover, we found no significant difference in speed of performance between those who performed under stress and received preparatory information ($M = 40.37$, $SD = 13.00$) and those who performed under stress and received no preparatory information ($M = 36.75$, $SD = 13.31$), $t(88) = 0.99$, $p > .1$.

Discussion

This study examined the role of preparatory information in reducing negative stress effects in an applied task setting. We hypothesized that those who received preparatory information prior to performing in a stressful environment would experience less subjective stress, develop greater task confidence, and perform more effectively than those who received no preparatory information. The results of this study provide strong support for this position. As predicted, those who received preparatory information prior to performing under high-stress conditions reported less anxiety and greater confidence in their ability to perform the task and made fewer performance errors under stress.

We found no effect of either stress or preparatory information on speed of performance. In a series of meta-analyses examining the effects of various stressors on performance, Driskell, Mullen, Johnson, Hughes, and Batchelor (1992) found that individuals under stress tend to maintain speed of performance at the risk of increased errors. This speed–accuracy tradeoff has been observed by a number of other researchers (see Hockey, 1986; Huey & Wickens, 1993). Given that stress did not degrade performance speed in this study, it is not surprising that there was little effect of preparatory information on enhancing speed of performance.

One unexpected finding was the overall main effect of preparatory information on subjective stress and performance accuracy. That is, preparatory information had a positive effect on reducing anxiety and enhancing performance accuracy for both high-stress conditions (for which the preparatory information was targeted) and normal-stress conditions (in which the specific stress events described in the preparatory information did not occur). One likely reason for this unexpected result is that even under normal-stress conditions, events can be distracting. That is, the task was not a sterile laboratory task but a real-world simulation and was inherently taxing to some extent. Thus, even in the normal-stress conditions, the information that events may be distracting and that there are ways to deal with this was put to good use.

There are several noteworthy features of this study that we wish to emphasize. First, we noted earlier that the attempt to generalize results from prior research on the use of preparatory information was limited by the nature of the research setting (clinical or health care settings) and the nature of the outcome measures emphasized (measures of adjustment, coping, or well-being). The results of this study demonstrate the effectiveness of this approach in a more applied task environment. Furthermore, the results indicate that preparatory information is an effective intervention to enhance *performance* in stressful environments as well as to lessen anxiety. Second, the present study involved real people performing a real task. We do not wish to imply by this statement that this research setting is any more "real" than a visit to the dentist or other stressful medical experience. However, in contrast to most research on preparatory information, this study involved performance of a realistic task that had meaning and context for the participants (Navy personnel). This provides at least some degree of confidence that the results obtained are applicable to other applied task settings.

Third, we developed a comprehensive preparatory information intervention including sensory, procedural, and instrumental information. One explanation for the efficacy of preparatory information is that prior knowledge of and familiarity with the stress environment increases predictability, which may lessen the distraction of having to constantly monitor novel or threatening stimuli (Cohen, 1978). Others have distinguished between *predictability,* or knowledge about the nature of an aversive event, and *controllability,* which involves having some type of instrumental response to that event (see Ludwick-Rosenthal & Neufeld, 1988). In fact, Miller and Mangan (1983) suggested that preparatory information may be most valuable when it provides the individual with knowledge about the aversive event and allows the individual to exert control over the event. By incorporating sensory, procedural, as well as instrumental information components in the preparatory information intervention, we provided both descriptive and prescriptive information elements. It is likely that instrumental information, which provides information on how the individual may adapt to stress effects, may be particularly critical in a task performance environment. Further research should examine the relative effect of these specific types of information.

We should note some limitations of this study as well. The preparatory information intervention in this study was a somewhat generic one. That is, we provided information to the participants on general stress reactions and general effects of stress on performance. In any particular applied task setting, such as a flight cockpit or a Naval shipboard command center, the stress reactions that are likely to be experienced and task events that are likely to be encountered are specific to that setting. Therefore, preparatory information that is tailored to the specific events that are likely to occur in a specific task setting should provide a more precise intervention. The fact that the somewhat generic preparatory information provided in this study resulted in a significant positive effect on performance suggests the robustness of this approach.

Furthermore, although we examined the effects of preparatory information per se, it may be valuable to view preparatory information as one component of a well-designed and broader based stress training intervention. For example, stress-inoculation training is comprised of a three-phase intervention: One component of the initial educational phase is the presentation of information on the nature of stress and stress effects, the second phase of training focuses on skill acquisition and rehearsal, and the final phase involves the application and practice of coping skills under conditions that increasingly approximate the criterion stress environment. A recent meta-analysis of the stress inoculation training literature (Saunders, Driskell, Johnston, & Salas, 1996) indicated that this approach is an effective method for reducing anxiety and enhancing performance under stress.

Finally, the applicability of preparatory information as a stress intervention is likely to be limited in ways that were not examined in this study. Although the concept of preparatory information may be relatively well-accepted in some settings such as medical practice, it may run counter to standard procedure in other organizational settings. For example, it seems to be traditional practice in the military to provide personnel with as little information as possible for a given task. The results of this study suggest that the saying, "What you don't know can't hurt you" may be more appropriately rephrased, "What you do know can help you," especially when one is faced with a novel, stressful environment.

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