2003

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Scholarly Commons Citation
Cuevas, Haydee M. (2003) "Mitigating the Negative Effects of Stress in Space Flight: ATransactional Approach," Journal of Human Performance in Extreme Environments: Vol. 7: Iss. 2, Article 13. DOI: https://doi.org/10.7771/2327-2937.1038

Journal of Human Performance in Extreme Environments

Volume 7 | Issue 2 Article 13

Published online: 10-1-2003

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Recommended Citation

Cuevas, Haydee M. (2003) "Mitigating the Negative Effects of Stress in Space Flight: A Transactional Approach," *Journal of Human Performance in Extreme Environments*: Vol. 7: Iss. 2, Article 13.
DOI: http://dx.doi.org/10.7771/2327-2937.1038

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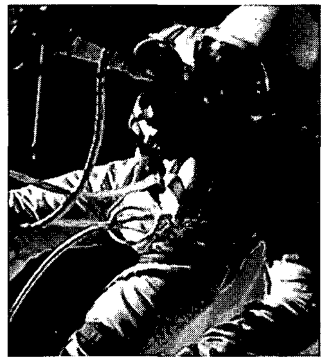

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The primary goal of this theoretical paper is to highlight how a *transactional* approach to investigating stressor effects during space flight can lead to a greater understanding of the complex processes by which humans adapt psychologically and physically to the adverse conditions encountered in this extreme environment.Transactional approaches conceptualize stress as occurring in the nature of the "transaction" (i.e., interaction) between the individual and the stimulus environment, emphasizing the role of *cognitive appraisal* (i.e., perceived ability to cope with the situation). Interventions that positively influence this cognitive appraisal process may, therefore, lessen the experience of stress and optimize human performance in space. This paper begins with a theoretical overview of the transactional model, followed by a brief review of several major environmental, physiological, and psychological stress-provoking factors encountered during space flight. The final section discusses interventions, within the context of cognitive appraisal, for selection, training, in-flight support, and design.

> *Space flight is the prototypical example of an extreme environment. During a space mission, humans are exposed to a plethora of psychological, and environmental stressors.*

Introduction

Extreme environments are defined as "environments in which humans are not naturally suited and which demand complex processes of psychological and physiological adaptation" (Manzey & Lorenz, 1999, p. 8). Space flight is the prototypical example of an extreme environment. During a space mission, humans are exposed to a plethora of psychological, physiological, and environmental stressors (Suedfeld, 2001). Some of these are common in other domains (e.g., fatigue, task load, time pressure). Others are specific to that environment (e.g., microgravity, macrogravity, isolation). To optimize human performance in such complex operational environments, such as space, it is necessary to explore the underlying mechanisms by which these stressors may negatively impact the human operator.

Toward this end, the primary goal of this theoretical paper is to highlight how adopting a transactional approach to investigating stress may identify potential interventions to facilitate performance in these domains. This paper begins with a theoretical overview of the transactional model. The following two sections, then, review several major environmental, physiological, and psychological factors that may lead to stress during space flight. Although the emphasis will be on domain-specific factors, stressors common to most complex operational environments will also be discussed. The final section discusses interventions, within the context of cognitive appraisal, for selection, training, in-flight support, and design.

Transactional Model

Approaches to investigating stress have traditionally revolved around three fundamental components: the individual, the environment, and the interaction between the two (Salas, Driskell, & Hughes, 1996). Stress has been viewed in terms of the external environmental stimuli (e.g., noise, motion) that cause the individual to experience stress (stimulus-based approach) or in terms of the internal physiological and psychological reactions (e.g., increased heart rate, anxiety) that an individual experiences in response to a stressor (response-based approach). Though both these views have significance in

http://dx.doi.org/10.7771/2327-2937.1038

terms of cause and effect, they do not address the critical issue of why two individuals will respond differently to the same situation or why the same individual will respond to a situation one way on a given day and then respond differently to the same situation on a different day (Wickens, Gordon, & Liu, 1999).

To address this issue, relationship-based or transactional approaches conceptualize stress as occurring in the nature of the "transaction" (i.e., the interaction) between the individual and the stimulus environment (Salas et al., 1996; Stokes & Kite, 1994). Perhaps the most often cited research on the transactional approach to understanding stress is the work of Lazarus and Folkman (1984). They defined psychological stress as "a particular relationship between the person and the environment that is appraised by the person as taxing or exceeding his or her resources and endangering his or her well-being" (p. 19).

Thus, Lazarus and Folkman's (1984) definition of stress emphasizes the role of *cognitive appraisal* in the individual's response to a potentially stress-provoking situation. Stress occurs when one perceives an event as threatening and/or perceives one's ability to cope with the threat (i.e., resources available) as insufficient. Note that it is the individual's *perception* that leads to the experience of stress (Baum, Singer, & Baum, 1981). Therefore, this model views stress, not in terms of an external set of causes or an internal set of symptoms, but rather in terms of the psychological variables that influence the individual's reaction in a given situation. The focus is on the subjective nature of stress and the mental processes that mediate one's response (Stokes & Kite, 1994).

Adopting such an approach to investigating stressor effects has significant implications for performance in extreme environments. Interventions that positively influence one's cognitive appraisal of the situation may improve performance by reducing the level of uncertainty in one's ability to cope with the stressor, and thus, mitigate its potentially negative effect. The next section briefly reviews several key stressors encountered in space flight, summarizing both the physiological and psychological effects they may have on the human operator. Interventions that may facilitate adaptation to these adverse conditions will then be discussed in the final section.

Physiological and Environmental Stressors in Space Flight

Microgravity

The most obvious environmental stressor that humans experience in space flight is *microgravity* or weightlessness (Manzey & Lorenz, 1999). This change in the force of gravity may produce *space sickness* (similar to normal motion sickness), with symptoms including vomiting, nausea, dizziness, and sweating (Connors, Harrison, & Akins, 1985; Griffin, 1997). As it takes between 2 to 4 days for astronauts to eventually adapt to these conditions, scheduling of tasks may need to accommodate this adaptation period (Albery & Woolford, 1997).

Physiological changes due to long exposure to microgravity include a significant decrease in muscular strength (Albery & Woolford, 1997; Jackson & Newman, 2000). Countermeasures are necessary to minimize the physiological stress imposed by the resulting decreased work capacity. Another change is a shift of the body fluids to the upper parts of the body, which may have adverse effects on cardiovascular system functioning (Manzey & Lorenz, 1999). Further, in space, the body adopts a neutral body posture, akin to a fetal position (Albery & Woolford, 1997). This change considerably affects the design of equipment used at workstations and, therefore, training is necessary to work under these unusual posture conditions.

Microgravity may also affect other task-related functioning, such as information processing (via effects on vision, vestibular changes, and proprioceptive processes), although these effects are less well documented (Manzey & Lorenz, 1999). Perceptual-motor tasks (e.g., tracking performance) and tasks that place comparatively high demands on attentional processes (e.g., dual-task performance) have also been shown to be susceptible to microgravity-related changes, particularly during early adaptation to the microgravity environment (Manzey, 2000).

Macrogravity

During launch or landing, astronauts are also exposed to conditions of *macrogravity*, or sustained acceleration of gravitational forces greater than one ($G > 1$) (Albery & Woolford, 1997). Physiological effects under sustained acceleration can be severe, the most common of which is a decrease of blood flow to the brain (O'Hare & Roscoe, 1990). This can result in grayout, blackout, or G-induced loss of consciousness (GLOC) (Howard, 1965). Confusion and disorientation usually occur when recovering from these episodes. Protective devices and techniques have been developed to minimize these effects (e.g., Eiken, Kolegard, Lindborg, Mekjavic, & Linder, 2003; Perez, Charles, Fortner, Hurst, & Meck, 2003).

In terms of psychological effects, macrogravity has been shown to negatively affect the human visual system, resulting in increased reaction times in visual discrimination, increased errors in instrument readings, and decreases in contrast and color sensitivity (Albery & Woolford, 1997; Howard, 1965; Whitton, 1992). Memory and central processing impairment include increased errors in memory tasks and increased subjective ratings of workload.

Motor functioning is also affected, as shown by increases in tracking errors (Albery & Woolford, 1997; Howard, 1965). Clear impairments in single-task tracking and dual-task performance have been demonstrated and explained as resulting from disturbances in psychomotor processes and higher attentional processes produced by the space environment (Manzey, Lorenz, Schiewe, Finell, & Thiele, 1995). Further, high levels of sustained acceleration, such as those encountered in space flight, have also been shown to produce somatogravic and oculogravic illusions that result in misperceptions and spatial disorientation, which in turn may lead to a rapid deterioration in performance and accidents, often fatal (USAF, 1995; Whiteside, 1965; Whitton, 1992).

Noise and Ambient Stressors

In additional to gravity, other environmental factors such as noise, thermal temperature, and air quality also place stress upon the human operator in space. Noise levels onboard the space shuttle, arising from equipment or others, can disrupt communications, decrease working memory capacity, interfere with sleep, and generally cause a feeling of annoyance (e.g., Albery & Woolford, 1997; Gomes, Martinho Pimenta, & Castelo Branco, 1999). Such stressor effects may disrupt the operator's concentration, hindering performance on critical cognitive tasks. Other noise-induced stressor effects include hearing loss, headaches, and fatigue (Crocker, 1997; Jones, 1983).

Hypoxia (i.e., lack of oxygen) and thermal stress (i.e., excessive heat or cold) are additional ambient factors that represent potential threats in extreme environments (Bensel & Santee, 1997; Ramsey, 1983). Although space transport vehicles offer astronauts a controlled atmosphere, breakdowns in air conductance may affect air quality (e.g., oxygen levels) and breakdowns in thermal regulation may adversely affect the climate for these operators (e.g., the extreme cold experienced by the Apollo 13 mission). Such unfavorable conditions have been associated with performance degradation and health problems (Ramsey, 1983; Wickens et al., 1999).

Circadian Rhythm Disruptions

Other stressors unique to the space environment include changes in the natural dark-light cycle, which affect the individual's circadian rhythm (or internal clock) (Albery & Woolford, 1997; Connors et al., 1985). Normal sleep patterns are disrupted, resulting in a decrease in sleep quality and quantity (Connors et al., 1985). This is an issue of significant concern as sleep loss has been found to adversely affect task performance (Wickens et al., 1999). Another related factor is altered work-rest schedules, that is, how rest breaks are incorporated into the work schedule (Connors et al., 1985; Holland, 2000). Inadequate work-rest schedules, when combined with sleep loss, have also been shown to result in degraded performance (e.g., Connors et al., 1985; Smith, Totterdell, & Folkard, 1995).

Fatigue

Fatigue is another factor that must be considered in the space environment. Space missions are often of long duration. Studies have shown that fatigue produces decrements in motivation, subjective reports of psychological stress, performance degradation on monotonous tasks, and skill deterioration (Connors et al., 1985; Holding, 1983; Wickens et al., 1999). Fatigue can result as much from task overload during a critical mission phase as from monotony and boredom during a vigilance task, both common situations in space flight (Manzey & Lorenz, 1999).

Psychological Stressors in Space Flight

Social Stressors

Due to the tremendous cost and planning involved, most space missions are planned for long duration, anywhere from several weeks to six months or longer. Consequently, astronauts may experience psychological stress arising from extended isolation from their family and friends. For example, crewmembers may feel that they are 'losing touch' with what is happening back home on Earth, and as a result, may become withdrawn or experience episodes of depression (Manzey & Lorenz, 1999; Suedfeld, 2001).

The space habitat also presents psychological or social stress in terms of the lack of privacy and restricted or forced interpersonal contact (Manzey & Lorenz, 1999; Suedfeld, 2001). When two or more people must share an environment, they must coordinate their individual needs for resources, interpersonal interaction, and the physical space occupied (Epstein, 1983). Thus, *crowding* stress stems from the drain on attention caused by the presence of others, the potential problem in coordination of conflicting goals, and the scarcity of available resources (e.g., limited personal space) (Epstein, 1983).

These factors are compounded by the intercultural issues associated with multi-national crews (Kraft, Lyons, & Binder, 2003; Kring, 2001; Lozano & Wong, 2000). The cultural and language differences inherent in such heterogeneous crews may impede the development of group cohesiveness and trust as well as a shared understanding of member roles and the mission's goals (e.g., Gushin, Pustynnikova, & Smirnova, 2001).

Stress outcomes arising from social stressors run the gamut from physiological (e.g., increases in skin conductance level) and behavioral (e.g., lowered task performance) to social (e.g., lower tolerance for frustration and aggressiveness) and emotional (e.g., more negative mood and discomfort reported) (Epstein, 1983; Manzey & Lorenz, 1999). In sum, such psychological stressors may affect the mental and emotional well being of the crewmembers as well as their interpersonal relationships (Epstein, 1983; Kraft et al., 2003; Manzey & Lorenz, 1999).

Task Characteristics and Decision Making

Common to all complex, high-risk, high-demand domains are the presence of threat, time pressure, a degree of uncertainty, and the criticality of effective task performance (Salas et al., 1996; Suedfeld, 2001). During space flight, factors such as time pressure or threat may induce a strategic shift to simplify information processing, that is, prompt a sense of urgency in taking some action, resulting in a speed-accuracy tradeoff (Kring, 2001; Wickens, 2000). In other words, critical decisions may be made quickly at the expense of accuracy. Yet, the consequences of such errors are often times immediate and catastrophic and potentially fatal. There is little margin for error in space. As such, astronauts are under considerable psychological as well as physical stress due the precarious nature of the environment in which they operate (Holland, 2000; Suedfeld, 2001).

Further, under stressful conditions, operators may experience a loss in working memory capacity (though long-term memory is less affected), leaving them less able to perform the complex, attention-demanding mental processes required for expert decision making (Baddeley, 2000; Wickens, 2000). Poor performance under these conditions may also often be the result of perceptual and/or attentional narrowing leading to *cognitive tunneling* (i.e., the tendency to focus attention on only one explanation of the situation) (Baddeley, 2000). Since attention is restricted to a limited number of central cues, cognitive tunneling may result in poor decision making when faced with a stressful situation (Baddeley, 2000; Klein, 1996; Stokes & Kite, 1994; Wickens, 2000).

Mitigating the Effects of Stress

As made evident in the previous discussion, extreme environments such as space present human operators with a multitude of demanding conditions to which they must adapt, both psychologically and physiologically. As indicated by the transactional model, mitigating the negative effects of stress in space flight entails first achieving a better understanding of the human operator's cognitive appraisal of the situation in order to predict and/or explain how he or she will react. Once we discern the psychological processes underlying the stress response, interventions can then be introduced to reduce the level of uncertainty in the operator's perceived ability to cope with the event. Simply stated, the goal is to minimize the individual's *perceived* experience of stress. Ideally, this would improve performance, resulting in fewer errors and greater overall job satisfaction.

Two forms of interventions can be undertaken, focused either on fitting the individual to the task (e.g., personnel selection, training) or fitting the task to the individual (e.g., in-flight support, design) (Welford, 1973). However, what is central to any intervention is that it positively influences the cognitive appraisal process. Perhaps the single most salient mediator to accomplish this objective is enhancing the level of control the individual perceives that he or she has over the situation (Cox & Ferguson, 1991). This final section will, therefore, discuss interventions in the areas of selection, training, in-flight support, and design, focused on engendering a perception of control over one's response to these putative stressors. Although the focus is on facilitating performance in extreme environments such as space, many of these techniques can also be employed in other complex task domains.

Selection

In complex operational environments, several factors (i.e., intervening variables) may influence an individual's cognitive appraisal of a potentially stressful or threatening event, including task-relevant skill level and experience as well as individual differences in personality characteristics and coping strategies (see Table 1). Awareness of such variables would be useful in personnel selection and training for certain high-risk occupations in an effort to *fit the individual to the task* (Welford, 1973).

On the one hand, selection may involve identifying personnel that are both psychologically and physically able to successfully sustain performance under the typical stressor effects experienced in high risk operational environments, such as space flight (Hogan & Lesser, 1996; Holland, 2000; Suedfeld, 2001). For example, studies have found that personnel who demonstrated high levels of self-efficacy (i.e., the self-belief in one's ability to achieve a certain level of performance; Bandura, 1986) and hardiness (characterized by commitment, perceived control, and a positive attitude toward change) tend to exhibit a greater tolerance or resistance to the effects of stress (e.g., Allred & Smith, 1989; Cox & Ferguson, 1991; Steptoe, 1991; Stokes & Kite, 1994). Findings suggest that such personality variables may favorably influence one's perceived level of control over a potentially stressful event, both in terms of the degree of threat posed and in terms of one's resources to deal with the demands of the situation. Consequently, the resulting positive outcome of the cognitive appraisal process would be expected to mitigate the experience of stress and favorably impact performance.

Table 1: Individual Difference Factors Influencing the Cognitive Appraisal Process

Greater Vulnerability	Relevant Citations
high reactivity/trait anxiety	Strelau (1989) Stokes & Kite (1994)
introversion	Strelau (1989) Welford (1973))
external locus of control	Bowers et al. (1996) Milgram (1991) Stokes & Kite (1994)
low tolerance of ambiguity	Folkman et al. (1979) Stokes & Kite (1994)
Type A behavior pattern	Baum et al. (1981) Bowers et al. (1996) Stokes & Kite (1994)
emotion-focused coping strategies (e.g., denial, seeking emotional support)	Carver et al. (1989) Folkman et al. (1979) Steptoe (1991)
Greater Tolerance	
extraversion	Strelau (1989) Welford (1973)
internal locus of control	Bowers et al. (1996) Milgram (1991) Stokes & Kite (1994)
high self-efficacy	Bandura (1986) Bowers et al. (1996) Steptoe (1991)
"hardy" behavior pattern	Allred & Smith (1989) Cox & Ferguson (1991) Steptoe (1991) Stokes & Kite (1994)
problem-focused coping strategies (e.g., planning, information-seeking)	Carver et al. (1989) Folkman et al. (1979) Picano (1990)

On the other hand, selection may involve developing specific training interventions for personnel that are found to exhibit personality characteristics (e.g., high trait anxiety, external locus of control) and coping strategies (e.g., emotion-focused) associated with a greater vulnerability to stress (e.g., Bowers, Weaver, & Morgan, 1996; Carver, Scheier, & Weintraub, 1989; Strelau, 1989). Such interventions would focus on helping these individuals develop a more positive cognitive appraisal of their ability to cope with the situation, thereby facilitating a greater level of control over how they respond, leading to better performance. Examples of these training strategies will be discussed in the next section.

Careful personnel selection may also be warranted to minimize the effects of social stressors, such as crowding and interpersonal differences. For crews assigned to long-duration missions, in particular, it may be advisable to select crewmembers that are psychologically compatible with each other (e.g., in terms of emotionality, motivation) to foster positive interpersonal relationships (Holland, 2000; Kraft et al., 2003; Manzey & Lorenz, 1999).

Moreover, it is becoming critically important to understand the influence of cultural differences on the interpersonal group dynamics evolving among members of multinational crews, and how these factors impact crew performance (e.g., Gushin et al., 2001; Kraft, Inoue, Mizuno, Ohshima, Murai, & Sekiguchi, 2002; Kraft et al., 2003; Kring, 2001). For example, the crew assembly process may need to consider not only technical expertise, but also crew members' past experience with and attitudes toward personnel from differing cultural backgrounds (Holland, 2000; Kraft et al., 2003; Kring, 2001).

Training

Training for performance in extreme environments needs to be targeted at both the individual and team level. As previously discussed, personnel who may possess greater susceptibility to the negative effects of stress would be candidates for individual-level interventions aimed at fostering a more positive cognitive appraisal of their ability to cope with a difficult situation. But, such training interventions would be beneficial at the team level as well, as part of crew members' comprehensive preparation for a critical high-risk mission.

For example, stress reduction programs such as Stress Exposure Training (SET) have been shown to effectively mitigate the adverse effects of stress on performance in high-demand, high-risk conditions (Driskell & Johnston, 1998; Johnston & Cannon-Bowers, 1996). SET follows the general stress inoculation paradigm espoused by Meichenbaum and Cameron (1983) involving a specific set of operations organized around three phases: (1) education, where trainees are presented with relevant knowledge about typical reactions to stressors (e.g., physiological, cognitive, behavioral, emotional, etc); (2) skills training, where trainees develop and practice effective stress coping skills with extensive feedback; and, (3) application, where trainees are given the opportunity to apply their newly acquired skills in simulated scenarios, exposing them to the stressors that they would encounter in real world situations (Driskell & Johnston, 1998; Johnston & Cannon-Bowers, 1996).

By providing crew members with the knowledge, skills, and abilities needed to perform under stressful situations, such training may reduce the uncertainty and ambiguity associated with complex task performance, and as such, foster greater confidence and self-efficacy, leading to the development of positive performance expectations (i.e., positive cognitive appraisal) (Driskell & Salas, 1991; Johnston & Cannon-Bowers, 1996). This greater sense of control and positive appraisal of one's ability to cope with the demands of the situation would be expected to promote more successful task performance under stress (Driskell & Salas, 1991). For example, astronauts would be more attuned to detecting any changes in their mood prompted by social stressors, such as isolation from family or the lack of privacy in the space habitat, and would, therefore, by more likely to engage in positive activities to counteract these negative effects (Manzey & Lorenz, 1999).

Training for performance in extreme environments also needs to focus on team processes such as communication, coordination, decision making, and teamwork (Manzey & Lorenz, 1999). Such team process training is particularly critical to ensure the successful performance of multi-national crews, in light of the potential conflicts that may arise from intercultural differences in, for example, communication and management styles (Kring, 2001). As such, proven teamwork training programs such as Crew Resource Management (CRM) (Kanki, 1996) need to be adapted for and evaluated within a broader multicultural context (Kraft et al., 2003).

In-flight Support

The previous discussion highlighted interventions aimed at fitting the individual to the task, either via selection and/or training. Mitigating the negative effects of stress can also be achieved by *fitting the task to the individual*, namely via in-flight support and/or design. In this case, the task and/or task environment is modified to remove the source of the problem (Welford, 1973).

In-flight support primarily involves interventions developed to maintain the psychological well being (e.g., motivation and emotional stability) of crewmembers during prolonged space flight (Manzey & Lorenz, 1999). To minimize the psychological stress arising from extended isolation from their family and friends, astronauts are often provided with: news and information from home to allow crews to connect with familiar people and places; personal and private communications from family member or friends; and, choice of music or video selections (Holland, 2000; Manzey & Lorenz, 1999).

Further, studies have found that the extent to which individuals are *forced* into contact and interdependence upon one another determines the severity of the effects of crowding stress (i.e., limited personal space) (Epstein, 1983; Welford, 1973). As such, to deal with the social stress triggered by the lack of privacy and the restricted or forced interpersonal contact inherent in space flight, it is critical that astronauts perceive some level of control over their 'personal' time and private space. These issues can be addressed during the pre-mission planning phase to ensure that adequate procedures are in place to handle privacy issues and allow sufficient 'down' time for relaxation. Astronauts also need to have ready access to counseling, before, during, and after missions, to ensure successful coping.

Design

In-flight support can also take a more human factors approach. The expertise offered by specialists in human factors and environmental design is critical to ensure that the crew's physical environment is habitable and follows a user-centered design (Holland, 2000). For example, to counteract the effects of microgravity or weightlessness, exercise equipment is often incorporated into the space habitat for use during in-flight exercise regimens. Such activities give astronauts some control over minimizing the decrease in muscular strength associated with extended exposure to microgravity environments (Albery & Woolford, 1997; Connors et al., 1985).

Additionally, countermeasures for the effects of macrogravity would include the appropriate design of protective equipment and techniques (e.g., G-suit, active straining maneuver) that enable astronauts to maintain performance during launch and descent (Albery & Woolford, 1997). Design considerations must also be given to mission documents regarding the scheduling of both wake-sleep and work-rest cycles (Connors et al., 1985). Not only would this help counteract the effects of sleep loss and fatigue, but such planning would also mitigate the effects of social stress by providing astronauts with much-needed personal time (Holland, 2000; Manzey & Lorenz, 1999).

Finally, mission success is critically dependent upon the sound ergonomic design of controls, displays, and procedures that are compatible with the environmental conditions in which the human must operate (Albery &

Woolford, 1997; Connors et al., 1985; Wickens, 2000). For example, the weightless nature of this work environment dictates the unique design of controls to allow astronauts to successfully perform their task under such unnatural conditions (Albery & Woolford, 1997). Also during a stressful event, operators need displays designed to provide salient, task-relevant information, without overloading their working memory capacity or diverting their attention away from the task (Wickens, 2000).

And, as pointed out earlier, the success of missions involving multi-national crews is critically dependent upon the impact of cultural differences among crew members. This factor is just as critical for the design of the technology used during the mission as it is for understanding the group dynamics involved in crew interactions (Kring, 2001). Special consideration must be given to how well crew members with different cultural backgrounds are able to understand and utilize technologies developed by countries foreign to them. (Kring, 2001). Neglecting this factor would result in a great deal of frustration, higher levels of human error, and ultimately compromise mission success.

Conclusion

The primary goal of this theoretical paper was to highlight how the transactional model of the stress response may provide insight as to humans are able to adapt, both psychologically and physiologically, to environments in which they are not naturally suited. As made evident throughout this paper, the critical factor underlying this complex process of adaptation is one's cognitive appraisal of a potentially stressful event, with regard to both the level of threat posed and the resources one has available to deal with these demands.

Consequently, to positively influence this cognitive appraisal process and foster favorable performance expectations in extreme environments, interventions need to ensure that the individual perceives a strong sense of control over the situation. This can be accomplished through personnel selection, training, in-flight support, and design. Additionally, this paper also highlighted the importance of considering the impact of cultural factors on mission success.

In sum, enhancing human performance in the extreme environments, such as space flight, necessitates a thorough understanding of how stress emerges from the interaction between the individual and the stimulus environment. Stress is not an isolated cause or effect. It is not an end state, but rather a process, involving perception of the stressor, appraisal of the situation, coping responses, and outcomes (Lazarus, 1966). Many factors can potentially impact each stage of this process and may dramatically alter the course of the stress response. In conclusion, my goal with this paper was to demonstrate how the transactional model can guide the development of interventions to mitigate the negative effects of stress in space flight. I hope the ideas set forth here will inspire others to explore further ways to achieve this goal.

Acknowledgements

The views herein are those of the author and do not necessarily reflect those of the organizations with which the author is affiliated. Address correspondence to Haydee M. Cuevas, UCF Team Performance Laboratory, 12424 Research Parkway, Room 408, Orlando, FL 32826 or via email at ha651622@ucf.edu.

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