Supportive Behavior, Frustration, and Mental Demand: Implications for Perceived and Actual Team Performance

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Abstract
Investigations of behaviors and processes taking place in complex team decision-making environments are important to assure optimal performance and prevent negative effects of stress in individuals and teams. Because various types of stress, such as increased workload or time pressure, often lead to decrements in team performance in the absence of protective factors, the present study explored social support as a moderator in the stress-performance relationship. The present study hypothesized that the frequency of socially supportive exchanges between members would predict lower levels of frustration and mental demand, as well as be related to a better overall team performance on a 30-minute computer-based task. A secondary hypothesis stated that frustration levels and perceived mental demand (workload) of individual members would be related to lower team performance. Limitations of this study, suggestions for future research, and implications for team training will also be discussed.

Introduction
Recent trends and structural changes in modern tasks have imposed additional demands (both mental and physical) that may be difficult, if not impossible, for individuals to handle alone (e.g., Salas, Dickinson, Converse, & Tannenbaum, 1992). Salas et al. (1992) also note that technical developments and global competition has made the ability of individuals to function together as a productive team increasingly important. Furthermore, over the past few decades, as the body of research investigating complex team decision-making environments has grown, the relationship between stress and team processes has become more clearly defined. In general, the team literature indicates that various types of stress, such as increased workload or time pressure, often lead to decrements in performance in the absence of protective factors (e.g., Bowers, Weaver, and Morgan, 1996; Glaser, Tatum, Nebeker, Sorenson, and Aiello, 1999; Urban, Weaver, Bowers, and Rhodenizer, 1996). In recent years, investigators have highlighted the importance of optimizing team performance in areas of aviation, military and emergency operations, as well as other stressful and complex environments where teams are utilized (Weaver, Bowers, Salas, 2001).

Team Definition and Interdependence. To describe “team” in the present study, we employ the common definition proposed by Salas, Dickinson, Converse, and Tannenbaum (1992), where a team refers to two or more individuals who interdependently are working toward a common goal. Teams most often investigated in this line of research involve those with requirements of coordination and a high degree of interdependence (Weaver et al., 2001). In addition to the obvious differences, Weaver et al. (2001) note that stress may affect teams differently compared to individuals in that both interactions between team members and individual performance must be maintained during a task. The type of team interdependence in focus of the present investigation can best be described as “sequential interdependence” (Saavedra, Earley, & Van Dyne, 1993). Under sequential interdependence, Saavedra et al. (1993) proposes that “one group member must act before another can act” (p. 62). Furthermore, team members have “different roles and perform different parts of the task in prescribed order” (Saavedra et al., 1993, p. 62-63).
**Team Stress.** Extending the Lazarus et al. (1984) definition of stress, team stress involves an interaction between the team and its environment where perceived demands outweigh resources (e.g., Weaver et al., 2001). Furthermore, Griffith (1997) investigated stress, strain, and group disintegration in 9013 U.S. Army soldiers, and found that all three factors added significant variance to perceived individual and group performance. Although results regarding the effects of various types of stress on team performance are somewhat inconclusive, the literature appears to agree that adaptability plays a key role (e.g., Serfaty, Entin, & Volpe, 1993).

**Temporal Demand.** As noted by Weaver et al. (2001), time pressure (temporal demand) is the one stressor that has received most of the attention in the team performance literature. Most studies have indicated that time pressure has a detrimental effect on team performance, however, the relationship is not always linear (e.g., Serfaty, Entin, & Volpe, 1993). The present study investigated variables related to team performance during a 30-minute task where participants were given feedback regarding “time remaining for completion of mission objectives”.

**Hypotheses.** The present study hypothesized that the frequency of socially supportive verbal exchanges between members would predict lower levels of frustration and perceived mental demand, as well as be related to a better overall team performance on a 30-minute computer-based task designed to simulate a reconnaissance mission. A secondary hypothesis stated that higher frustration levels and higher perceived mental demand of individual members would be related to lower overall team performance, both actual and perceived. Our conceptual framework and main study variables will be described in more detail below.

**Stress and Performance**

As previously discussed, effects of different types of stress or stressors on individual performance has received extensive attention over the past decades (e.g., Weaver, Bowers, & Salas, 2001). Adopted from Lazarus and Folkman (1984), the most commonly used definition of stress in the area of human performance suggest that stress is an interaction between an event and an individual’s perception or interpretation of the particular event (Weaver et al., 2001; Driskell and Salas, 1996). The ways in which stressors, such as time pressure, affects team performance, however, is a relatively new area of investigation (Weaver et al., 2001). Other constructs associated with stress in the literature include, but are not limited to, strain, mental load, burnout, and fatigue (e.g., Tepas & Price, 2001). From a more global perspective, it appears that stress and stress prevention are widely recognized as important issues in terms of safety and health of workers (Kompier and Cooper, 1999).

**Social Support**

One variable that has garnered interest as a potential moderator in the stress - performance relationship is social support. Many different definitions of social support exist, but Searle, Bright, and Bochner (2001) operationalize the concept as "a variety of resources that assist an individual in their work and daily life, such as task-relevant information or praise” (p. 328). In a recent study, Brotheridge (2001) investigated co-worker support, workload, and emotional exhaustion in 680 Canadian government employees. Findings suggested that coping resources (i.e., social support) protected workers from experiencing strain regardless of their pre-existing levels of stress. Furthermore, several studies have suggested that higher levels of social support is related to less burnout (e.g., Fielding & Weaver, 1994) and higher satisfaction among workers (e.g., Decker, 1985). Previous studies have viewed social support as a subcomponent of team cohesion, a variable that has been identified as “an important ingredient for combat effectiveness and performance” (Griffith, 1997, p. 1489). Griffith (1997) further divided the cohesion/support variable into team task support and peer emotional support. In social and organizational psychology, researchers have also found a relationship between group cohesion and productivity (e.g., Evans & Dion, 1991).

**Frustration**

By definition, novel performance environments, such as the one encountered by participants in the present study, entail unfamiliar aspects (e.g., Marks, 1999). Such environments are also believed to be less predictable and more challenging (Marks, 1999). When expectations for individual or team performance are not met, a person is likely to experience dissatisfaction or frustration. Reber (1995) suggests that the technical use of the term frustration in psychology generally refers to one (or both) of the following two definitions: 1) “the act of blocking, interfering with or disrupting behaviour that is directed toward some goal” (p. 301) (e.g., the behaviour may be anything from overt, physical movement to covert, cognitive process), or 2) “the emotional state assumed to result from the act in the first definition” (p.301). Furthermore, Reber (1995) states that “it is typically assumed that this emotional state has motivational properties that produce behaviour designed to bypass or surmount the block.” (p. 301). In lieu of this definition of frustration, it makes sense to believe that the concept will be related to team performance.

**Mental Demand**

Mental demand and stress are closely related in that both concepts focus on the balance between demands and resources, however, mental demand (also referred to as
mental load) specifically targets the task and the internal resources needed to perform it (Gaillard, 2001). Stress on the other hand describes “the fit between the person and the environment” (Gaillard, 2001, p. 628). Although different definitions exist, mental demand most often refers to the relationship or ratio between an operator’s capacity and the capacity required by the task for execution (e.g., Hancock, 1987).

**Method**

**Participants.** A total of 24 undergraduate students at the University of Central Florida who volunteered to participate in the experiment were randomly assigned to one of two roles (computer navigator or map reader), and formed 12 two-person distributed teams. Although not required for participation, all team members had some experience with playing computer games, however, none of the participants had encountered the particular game or task at hand. Following a training session where participants were given the opportunity to become familiar with the key-board commands, specific standardized task instructions were given until teams displayed competency (as indicated by completion of a trial mission). Participants were also informed about the overall performance objective, and the time-limit for completing the task.

**Measures and Design.** Verbal communication (audio) and task performance (video) was recorded for each team, and participants completed the NASA-TLX (TLX; Hart and Staveland, 1988) as a measure of their perceived stress on six domains, including perceived mental demand, temporal demand, effort, physical demand, frustration, and performance. Bowers, Brown, and Morgan (1997) suggested that the use of the NASA-TLX, a subjective measure of workload, works well in team settings. The NASA-TLX has shown good psychometric properties in previous studies of workload (reported test-retest reliability = .83). In addition to the self-report measure of workload dimensions, a behaviours coding system was used to assess socially supportive exchanges, as well as negative exchanges, between team members during completion of the task. Specifically, with a modified version of Operation Flashpoint, a Commercial Off The Shelf (COTS) computer game as a test-bed, the team task involved verification of targets in the virtual environment. Separated by a divider in the laboratory, each distributed team had access to a game as a test-bed, the team task involved verification of Flashpoint, a Commercial Off The Shelf (COTS) computer exchanges, between team members during completion of the task. socially supportive exchanges, as well as negative task-related feedback, etc., and each team’s communication was coded by two trained research assistants. Next, relationships between social support frequency and variables such as Perceived Frustration, Perceived Performance, and Mental Demand (as indicated by scores on the NASA-TLX subscales) were investigated. Furthermore, Actual Team Performance on the computer-based task was calculated based on the number of targets a team was able to locate in the virtual environment during a “scavenger-hunt” type mission. Specifically, team performance was operationalized as the number of targets (out of 24 possible) identified during the 30-minute mission. For example, each team’s main objective was to verify the truthfulness of statements such as: “Terrorists have hidden a computer on the second floor of building 15” and “A civilian is hiding in the house across from the south fountain”.

**Results**

Results from initial analyses of the data indicated a significant negative correlation between team members’ level of frustration and their actual team performance score ($p=.007$). A positive correlation was found between frustration levels and perceived team performance ($p=.043$), with higher score on the perceived performance scale indicating worse performance. Frustration levels and mental demand variables were also positively correlated to a significant degree ($p=.003$). Perceived individual performance and actual team performance were negatively correlated ($p=.007$), again, note that higher scores on the individual performance sub-scale of the NASA-TLX indicates worse perceived performance. Finally, perceived team performance and perceived individual performance were significantly correlated at the .05 alpha level ($p=.001$). Contrary to our stated hypothesis, no significant relationship between the frequency of socially supportive behaviors and study variables was found. However, it is important to note that this absence of an effect may be due to the limited range of supportive behaviors expressed by team members in general. On average, teams exchanged 2.08 supportive statements ($SD=1.692$) and .50 negative (unsupportive) statements ($SD=.722$) per 30 minute session. Moreover, temporal demand, physical demand, and effort, as indicated by the NASA-TLX, did not show significant relationships with any variables in the present study. The inherent difficulty of the task was illuminated by the fact that only one team was able to identify all 24 target statements within the allotted time, while the average team performance score was 13.84, or approximately half of possible points. Further analyses of the data (i.e., multiple regression) will be conducted to investigate more refined relationships between study variables, as well as to shed light on the stress-performance relationship among sequential, distributed teams.
Summary

Previous research has suggested that supportive interactions among team members may buffer against stress effects and protect the team against performance decrements (e.g., Evans et al., 1991; Griffith, 1997). Although several definitions of stress related concepts, as well as moderators, have been proposed, enough evidence has been accumulated to support a relationship between task demand and performance, both perceived and actual. For example, various types of stress (e.g., unpredictability/ambiguity of a novel team-task and time pressure) may be related to increases in perceived mental demand and frustration, both of which has been found to affect performance negatively. Although the task at hand was believed to be inherently “stressful” due to the imposed variables described above, we hypothesized that receipt of socially supportive behaviours would ameliorate perceived mental demand and frustration, thereby protecting teams against performance decrements. Contrary to our beliefs, results of the present investigation indicate that receipt of supportive behaviors was not correlated with any of the study variables, such as performance, perceived mental demand, and frustration. However, as mentioned, the limited range (floor effect) of supportive behaviors is likely to have contributed to these findings. For future research, we suggest that social support is investigated as a manipulated independent variable, which will allow for group differences to be explored. In terms of team training, the present study addressed the importance of identifying variables that may moderate participants’ experience of mental demand and frustration. Mental demand and frustration were both found to be related to team performance, and although social support demonstrated no significant correlation with these variables in this investigation, we argue for its potential as a stress reducer based on previous research.

References


