# THREAT-RIGIDITY EFFECTS ON PLANNING AND DECISION MAKING IN TEAMS

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ABSTRACT

In an experimental study, the effects of external threat on team processes and performance were investigated during a complex planning and decision making task. Results showed that teams under threat suffered from rigidity effects in their information processing, leadership, team perspective and performance.

PRESS PARAGRAPH

Many of today's tasks require team-based work. These teams often face threats. Understanding how teams react to these threats is vital to improving their performance. The literature suggests that teams react with various forms of rigidity. In this study, we experimentally investigated the effects of physical threat on planning and decision making in teams. The results indicated that teams under threat in comparison with teams under normal circumstances suffered from rigidity. They processed information in a restricted manner, were less team-focused, their leaders exerted more control, and they performed worse on their task.

# Threat-Rigidity Effects on Planning and Decision Making in Teams

In today's organizations, teams are omnipresent. Teamwork is necessary because of the complexity of many tasks. The characteristics of these tasks and the circumstances under which they have to be executed, however, often pose threats to the teams. In work settings, teams may encounter possible financial loss or negative publicity. Aircrews may face technical problems with potentially disastrous consequences, and in the military, teams are sent on dangerous missions and risk losing their lives. A great number of events show that these teams under pressure have a risk of giving way and making faulty decisions that may lead to catastrophic outcomes (see Kanki, 1996). The understanding of the factors that play a role in this is only just beginning to develop (e.g., Driskell, Salas, & Johnston, 1999; Ellis, 2006; Turner & Horvitz, 2001). We conducted an experiment to gain greater insight into the influence of threat on team performance. Three-person teams worked on a complex planning and decision making task under a physical threat. In this paper, we will demonstrate that threat negatively affects the manner in which teams process information and control is exerted. In addition, we will show that threat weakens the team perspective, and degrades team performance.

## *Threat*

Threat is often loosely defined as an impending event with possible negative consequences (e.g., Argote, Turner, & Fichman, 1989; Lazarus, 1966; Staw, Sandelands, & Dutton, 1981; Turner & Horvitz, 2001). This definition, however, is unclear as to what is meant by negative consequences and does not take into account that threat emerges from the interplay between an individual and his or her environment. We therefore define threat as *a possible impending event perceived by an entity as potentially causing material or immaterial loss to, or*

*the obstruction of one or more of the goals of that entity*. Lazarus and Folkman (1984) consider threat to be one of the major determinants of stress appraisals.

*The Threat-Rigidity Thesis*

The most comprehensive theory addressing the effects of threat on performance is the threat-rigidity thesis (Staw et al., 1981), which states that a common reaction to threat exists at the individual, group, and organizational level. This reaction consists of two types of rigidity: a restriction in information processing and a constriction in control. Restriction in information processing may manifest itself in a narrowed field of attention and reliance upon prior expectations. Constriction in control may consist of a centralization of authority, increased cohesiveness, and pressure toward uniformity (cf. Janis's (1972) concept of groupthink). Together these effects cause a system to emit its most well learned or dominant response (Zajonc, 1966). This dominant response may be adaptive in an unchanged environment, because a previously successful response can be produced fast and may prove to be successful again. When the environment has changed radically, however, the dominant response will be maladaptive, because it is no longer appropriate (Staw et al., 1981). In addition, the dominant response will also be maladaptive when it is not aimed at the task that has to be performed. This will be the case when the threat is not related to task performance. A threat in an unchanged environment that is unrelated to the task that has to be performed, invokes a response that may well be functional to counter the threat, but will also lead to a detriment in performance on the system's central task, because of a loss of attention for that task (cf. Driskell & Salas, 1991; Turner & Horvitz, 2001).

Many studies in different domains investigated individual level reactions to stress and support the effects proposed by the threat-rigidity thesis (e.g., Baddeley, 1972; Easterbrook,

1959; Keinan, 1987; Ozel, 2001; for a review see Staal, 2004). Considerably less research has been done to investigate the effects of stress on the performance of teams (Driskell et al. 1999; Burke & Hancock, 2004).

*Team Performance and Threat*

Teams can be defined as distinguishable sets of individuals who have each been assigned specific roles or tasks to perform and who work interdependently toward a common, valued goal (Dyer, 1984; Rasker, 2002; Salas, Dickinson, Converse, & Tannenbaum, 1992). At the team level, there is a need for coordination, synchronization, and exchange of information between team members with different roles and responsibilities. Therefore, team performance is qualitatively different from individual performance and individual level effects of different 'stressors' cannot be simply translated to the team level (Kanki, 1996). Several researchers have tested propositions derived from the threat-rigidity thesis at the team level in both field settings and laboratory experiments (e.g. Argote, Turner, & Fichman, 1989; Chattopadhyay, Glick, & Huber, 2001; D'Aunno, & Sutton, 1992; Driskell & Salas, 1991; Gladstein & Reilly, 1985; Harrington, Lemak, & Kendall, 2002). Most studies support the idea of a restriction in information processing. With regard to a constriction in control results are more equivocal. Gladstein and Reilly (1985), for example, did not find evidence for a constriction in control in a management simulation. Driskell and Salas (1991) even found that team leaders in a laboratory study became more receptive to information provided by their team members when under anticipatory threat of tear gas.

Recent research into the effects of stress on team performance suggests that one way in which a restriction in information processing might affect team performance, is through a narrowing of social perspective. Driskell et al. (1999) argued that teams perform worse under

stress, because they fail to pay attention to social and team cues, resulting in a loss of team perspective, which they defined as a perception of the interrelations of actors and actions in a group system. Ellis (2006) even stated that under acute stress "instead of focusing less on secondary or peripheral tasks, team members become more self-focused and less team-focused" (p.578). In a command-and-control simulation study, he found that the negative relation between acute stress and team performance was fully mediated by *team mental models* and *transactive memory*. Team mental models are models that relate to a collective representation of the task, and the interdependent roles that comprise the task (Cannon-Bowers, Salas, & Converse, 1993; Driskell et al, 1999); transactive memory is a shared system for encoding, storing and retrieving information (Wegner, Giuliano, & Hertel, 1985).

*Present Study*

In this experiment, we investigated the effects of threat on teams performing a complex planning and decision making task. We focused on variables derived from the threat-rigidity thesis (information processing and (leadership) control) as well as on variables relating to the team members' focus on the team (team perspective). Team perspective in our conceptualization is indicated by, and encompasses transactive memory, team mental models, and backup behavior (Smith-Jentsch et al., 1998), because these concepts all concern to what extent individual team members are team-focused instead of self-focused. We manipulated an external, uncontrollable, physical threat. In line with the threat-rigidity thesis, we expected rigidity in reactions. Moreover, since the threat was not related to task performance, we expected that the reactions to the threat would impair performance (Turner and Horvitz, 2001). Specifically we expected that teams under threat would show: (1) a restriction in information processing; (2) a constriction in control; (3) a reduction in team perspective; and 4) a deterioration of performance. Finally (5),

we expected that the effects of threat on team performance would be mediated by information processing, degree of control, and team perspective.

## Method

### *Participants and Design*

Participants were 78 individuals (mean age: 23 years), recruited from a pool of volunteers of the research institute, who volunteered in participating in a four hour-long “performance on high altitudes”-study. The participants were arrayed into 26 three-person teams. These teams were randomly assigned to either the experimental ‘threat condition’ or to the control condition.

### *Threat Manipulation*

The threat manipulation consisted of letting participants believe that they were (going to be) performing a team task under reduced oxygen levels. No reduction of oxygen levels actually was used in this study. Therefore, the anticipation of having to perform under reduced oxygen levels and risking possible side effects constituted the threat manipulation. Teams in the control condition were told that they had been assigned to the control condition and that they would perform the tasks under normal conditions. Teams in the threat condition were told that they could not be informed to which condition they were assigned. During their instruction, participants in these teams were confronted with an anamnesis form and instructions by a physician concerning possible side effects, to corroborate the idea of having to perform under reduced oxygen levels. After having received instructions and training, teams in both conditions went to a ‘climatic chamber’, where they had to perform the team task. After the experiment, all participants were fully debriefed about the true nature of the experiment, and offered the possibility to withdraw their data from the study. None of the participants withdrew their data.

### *Task*

The task participants had to perform was the Planning Task for Teams (PLATT; Kamphuis & Houttuin, 2007). In PLATT, the assignment of the team is to develop a plan to evacuate a group of people from one place to another as quickly and safely as possible. They have to do this under time pressure. There are three roles within the team, one of which is the leader. Each role has its own expertise and responsibilities. Only when the team members combine their knowledge and information, they are able to deliver an optimal evacuation plan.

PLATT is a scenario based, computerized, complex planning task for three team members. Driven by a scenario, in real time, messages differing in relevance coming from sources differing in reliability are sent to the three participants. In addition, information is selectively made available to them on multiple websites. In this way, it can be determined exactly who has which information at what moment. Participants communicate with each other by e-mail. All actions participants perform are logged by the server. Afterwards, the log-file delivers detailed information about the processes during the task.

*Measures*

Each of the concepts described above was measured behaviorally (on the basis of the log files) and by means of questionnaires (see for the reliabilities of the scales Table 1). All questions were scored on 7-point Likert scales; a score of 1 indicated “complete absence” of the construct and a score of 7 “complete presence”. All concepts were measured at the individual level and then aggregated and analyzed at the team level (except for the manipulation checks, which were analyzed at the individual level).

*Information processing* was measured on the behavioral level by the degree of ‘Information searching’ on websites and ‘Attention to peripheral (e-mail) information’. The questionnaire concerning information processing was based on the information exchange

dimension of the Anti-Air Teamwork Observation Measure (ATOM, Smith-Jentsch, Johnston, & Payne, 1998), and measured 'Lack of overview' and 'Tunnel vision'.

*Degree of control* was measured behaviorally by the 'Amount of deliberation' that took place in the team, with much deliberation as a sign of a flat team structure, with low levels of control. The questionnaire concerning degree of control was a leadership questionnaire (based on Syroit, 1997) administered to the team members, measuring the degree of 'Participative leadership' and 'Leadership control'.

*Team perspective* was measured behaviorally by the total number of e-mails in which team members allocated role-specific information to both other team members instead of allocating it to the one team member with the relevant area of expertise ('Undifferentiated information allocation') and by the percentage of times participants forwarded wrongly-delivered e-mail messages to the right role ('Backup behavior'). The questionnaire concerning team perspective measured the 'Team mental model' (see Cannon-Bowers et al, 1993).

Finally, *team performance* was measured by the 'Completeness' of the evacuation plan delivered (scores between 0 (very incomplete) and 4 (fully complete) assigned by two judges (Cohens Kappa = .80) for each squad, on the basis of how much had been filled out on the evacuation plan form concerning deployment of these squads) and the number of 'Errors' the team members made in this plan.

## Results

### *Manipulation Checks*

To check whether the threat manipulation succeeded, participants completed a threat questionnaire after the task (4 items, alpha = .85, e.g., "During the task, I felt threatened by the

circumstances). Participants in the threat condition reported feeling more threatened ($M$ = 3.48, $SD$ = 1.33) than those in the control condition ($M$ = 1.90, $SD$ = 1.15; $t(76) = 5.59$, $p < .001$).

*Tests of Hypotheses*

Table 1 presents means, standard deviations and intercorrelations at the team level for all key variables. To test our hypotheses, we conducted four separate multivariate analyses of variance (MANOVAs), with threat as the between groups variable and the different measures for each of the four concepts as dependent variables. We present the results of each overall MANOVA, and follow-up $t$ tests for each measure separately.[1]

Hypothesis 1 proposed that teams under threat show a restriction in information processing. Results of the MANOVA showed a significant multivariate effect for the threat manipulation (Hotelling's $T^2 = .80$, $F(4,21) = 4.21$, $p = .01$).[2] This result supports Hypothesis 1.

Follow-up $t$ tests revealed threat produced differences on two of the four univariate measures (see Table 2). Teams in the threat condition paid significantly less attention to peripheral information than teams in the control condition ($t(1,24) = 1.78$, $p = .04$). They also suffered more from a 'Lack of overview' than teams in the control condition ($t(1,24) = -2.52$, $p = .01$). No significant differences were found for Intelligence's 'Information search' ($t(1,24) = .96$, $p = .17$) and 'Tunnel vision' ($t(1,24) = -.53$, $p = .30$).

Hypothesis 2 stated that teams under threat exhibit a constriction in control. Results of the MANOVA showed a significant multivariate effect for the threat manipulation (Hotelling's $T^2 = .53$, $F(3,22) = 3.92$, $p = .02$). This result supports Hypothesis 2.

Follow-up $t$ tests revealed threat produced differences on all three univariate measures. Teams in the threat condition deliberated less with each other than teams in the control condition ($t(1,24) = 2.58$, $p = .01$). Furthermore, team leaders in the threat condition allowed less

participation of their teammates in decision making than team leaders in the control condition ($t(1,24) = 1.87$, $p = .04$), and team leaders under threat exerted more control than team leaders in the control condition ($t(1,24) = -2.87$, $p < .01$).

Hypothesis 3 posited that teams under threat exhibit a reduction in team perspective. Results of the MANOVA showed a significant multivariate effect for the threat manipulation (Hotelling's $T^2 = .54$, $F(3,22) = 3.96$, $p = .02$). This result supports Hypothesis 3.

Follow-up *t* tests revealed threat produced differences on two of the three univariate measures. Team members in the threat condition more often allocated role-specific information to both other teammates simultaneously than teams in the control condition ($t(1,24) = -2.20$, $p = .02$). A significant difference in backup behavior showed that team members in the threat condition forwarded only 40% of the 'wrongly delivered' e-mails to their teammates, while team members in the control condition did so in almost 60% of the cases ($t(1,24) = 1.75$, $p = .05$). No significant difference was found for the strength of the self-reported 'Team mental model' ($t(1,24) = 1.01$, $p = .16$).

Hypothesis 4 proposed that teams under threat demonstrate a deterioration of performance. Results of the MANOVA showed a significant multivariate effect of the threat manipulation on the performance measures (Hotelling's $T^2 = .98$, $F(3,23) = 11.26$, $p < .001$). This result supports Hypothesis 4.

Follow-up *t* tests revealed that teams in the threat condition delivered less complete evacuation plans than teams in the control condition ($t(1,24) = -3.61$, $p < .001$), and that teams in the threat condition made more errors than teams in the control condition ($t(1,24) = -2.01$, $p = .03$).

Hypothesis 5 proposed that information processing, degree of control, and team perspective would mediate the effects of threat on team performance. According to Baron and Kenny (1986), several conditions must be met to establish mediation. One of these conditions is that there is a significant relation between mediator and dependent variable. This condition was not met for any of the hypothesized mediating variables, as can be seen in Table 1. Hypothesis 5, therefore, was not supported.

## Discussion

This study experimentally investigated the effects of threat on complex planning and decision making behavior in teams. As expected, the results showed that threatened teams restricted their information processing, resulting in a narrowed field of attention: they paid less attention to peripheral information, and suffered from a lack of overview. Furthermore, results also showed that teams under threat exhibited clear signs of a constriction in control: team leaders became more controlling and directive in the eyes of their members and deliberation within the team decreased. These results provide experimental support for the threat rigidity thesis at the team level (Staw et al., 1981).

In addition to these effects, team members under threat also showed signs of a reduced focus on the team, as hypothesized. This resulted in a lack of awareness of their team members' tasks and responsibilities, and failure to provide backup to their team members. These results support the idea that a narrowing of attentional capacity (e.g., Easterbrook, 1959; Cohen, 1980) extents to social cues as well (Driskell et al., 1999; Ellis, 2006). The present study implies that this effect exists next to the effects proposed by the threat-rigidity thesis, instead of replacing it, as suggested by Ellis (2006).

Finally, results pointed out that threat negatively affected team performance on the planning and decision making task, as expected. Contrary to our predictions, however, information processing, control and team perspective did not mediate the relation between threat and team performance. A possible explanation for this is that the level of measurement of the team performance measures did not match the level of the process measures. Perhaps the use of more proximal outcome measures would better reveal the relations between processes and outcomes (see also Hackman & Morris, 1975).

*Implications, Strengths, Limitations, and Future Research*

The results of this study provide support for the threat-rigidity thesis as a powerful framework for understanding reactions of teams to a threat. The results extend and integrate previous research by demonstrating the effects of threat on information processing and control, as well as on team perspective. Moreover, in this experiment we were, to our knowledge for the first time, able to demonstrate these effects experimentally in teams executing a complex planning and decision making task.

Organizations can benefit from the results of this study, because it demonstrates in a clear manner how team processes are affected by external threat. Each of these processes could be used as a starting point to prevent the detrimental effects of threat from occurring. Restrictions in information processing could, for example, be countered with interfaces that support operators to divide their attention in a better way (Bosse, Van Doesburg, Van Maanen, & Treur, 2007). Constrictions in control could be countered with specific participative leadership training or by flattening team structures. Reductions of team perspective could be prevented through team training, for example cross-training, wherein team members are not only trained for their own tasks, but also for the tasks of their teammates (e.g., Marks, Sabella, Burke, & Zaccaro, 2002).

Methodologically, the strength of this experiment lies in the fact that we used a complex planning and decision making task. As a result of this, we were able to investigate team behavior at a strategic level, which is not possible with the existing more executive, tactical team tasks often used in this kind of research (e.g. TANDEM, Weaver, Bowers, Salas, & Cannon-Bowers, 1993). Also, as a result of the different roles, real interdependence existed between team members. Furthermore, we introduced a paradigm for successfully manipulating a physical threat that was not performance-contingent (Driskell & Salas, 1991). Finally, we used converging data sources (both subjective and objective) to measure the relevant concepts.

We should also note some limitations. Although the task environment ensured a high degree of realism, the findings were obtained in an experimental setting, with short-lived teams and an artificial task. Future research should be directed toward investigating whether these results also hold in more natural settings. Furthermore, we were not able to demonstrate a relationship between processes and performance. Therefore, practical implications should be considered with caution. Future research should address this issue in such a way that it will be possible to discern the relative impact of each of the processes on team performance.

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## Footnotes

[1] Follow-up *t* tests reported were planned and therefore one-tailed.

[2] Because in seven cases the website visits from Logistics were not logged by the server, the measure of 'Information search' included in the MANOVA was made up solely by the website visits from Intelligence. We conducted an additional *t* test to investigate the results for the 19 Logistics-cases separately. These results contribute to the pattern of the main analysis: team members in the threat condition visited their web pages less ($M = 6.70$, $SD = 5.23$) than team members in the control condition ($M = 19.11$, $SD = 10.91$; $t(1,17) = 3.22$, $p < .01$).

Table 1

*Descriptive Statistics and Intercorrelations at the Team Level of Analysis (N = 26)*

| Variable | *M* | *SD* | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Threat manipulation | 1 = No threat<br>2 = Threat | | – | | | | | | | | | | | |
| 2. Information search[a] | 48.15 | 43.70 | -.19 | – | | | | | | | | | | |
| 3. Attention to peripheral info | 2.52 | 1.45 | -.34$^{\dagger}$ | .60$^{**}$ | – | | | | | | | | | |
| 4. Lack of overview | 3.88 | 0.61 | .46$^{*}$ | -.19 | .07 | (.59) | | | | | | | | |
| 5. Tunnel vision | 5.54 | 0.49 | .11 | .15 | .20 | -.15 | (.56) | | | | | | | |
| 6. Amount of deliberation | 26.42 | 11.54 | -.47$^{*}$ | .01 | -.14 | -.38$^{\dagger}$ | -.04 | – | | | | | | |
| 7. Participative leadership | 5.62 | 0.73 | -.36$^{\dagger}$ | .26 | .11 | -.53$^{**}$ | .11 | .45$^{*}$ | (.76) | | | | | |
| 8. Leadership control | 2.47 | 0.79 | .51$^{**}$ | -.22 | -.10 | .38$^{\dagger}$ | .00 | -.42$^{*}$ | -.53$^{**}$ | (.67) | | | | |
| 9. Undifferentiated info allocation | 34.90 | 21.91 | .41$^{*}$ | .09 | -.20 | -.06 | .23 | -.39$^{\dagger}$ | .14 | -.09 | – | | | |
| 10. Backup behavior | 50.00 | 29.15 | -.34$^{\dagger}$ | .34$^{\dagger}$ | .04 | -.19 | -.16 | -.05 | .37 | -.24 | .14 | – | | |
| 11. Team mental model | 4.67 | 0.58 | -.20 | .17 | -.13 | -.60$^{**}$ | -.12 | .31 | .48$^{*}$ | -.35 | .17 | .35$^{\dagger}$ | (.79) | |
| 12. Completeness | 2.12 | 1.52 | -.59$^{**}$ | .06 | .24 | -.17 | .12 | .27 | .03 | -.20 | -.29 | .14 | .11 | – |
| 13. Errors | 3.08 | 1.26 | .38$^{\dagger}$ | .07 | .07 | .15 | .31 | -.16 | -.12 | -.10 | .34$^{\dagger}$ | -.17 | -.05 | -.00 |

*Note*. Reliabilities (Cronbach's alphas) for the self-report measures are on the diagonal in parentheses. Info = information.

[a] Information search consists only of the website visits made by Intelligence. Web site visits from Logistics were excluded from the main analyses because in seven cases data were missing as they were not logged by the server because of software problems.

[b] $^{\dagger}$ $p < .10$. $^{*}$ $p < .05$. $^{**}$ $p < .01$

Table 2

*Follow-up Analyses of Variance for the Separate Measures*

| Variable | Threat | | Control | | |
|---|---|---|---|---|---|
| | *M* | *SD* | *M* | *SD* | *t*(1,24) |
| 1. Information search | 39.92 | 28.68 | 56.38 | 54.86 | 0.96 |
| 2. Attention to peripheral info | 2.03 | 0.74 | 3.00 | 1.82 | 1.78* |
| 3. Lack of overview | 4.15 | 0.54 | 3.61 | 0.57 | -2.52** |
| 4. Tunnel vision | 5.59 | 0.52 | 5.49 | 0.47 | -0.53 |
| 5. Amount of deliberation | 21.15 | 9.78 | 31.69 | 11.03 | 2.58** |
| 6. Participative leadership | 5.48 | 0.71 | 5.93 | 0.51 | 1.87* |
| 7. Leadership control | 2.87 | 0.84 | 2.08 | 0.52 | -2.87** |
| 8. Undifferentiated info allocation | 43.71 | 17.98 | 26.10 | 22.56 | -2.20* |
| 9. Backup behavior | 40.38 | 24.02 | 59.62 | 31.52 | 1.75* |
| 10. Team mental model | 4.55 | 0.62 | 4.78 | 0.54 | 1.01 |
| 11. Completeness | 1.23 | 1.32 | 3.00 | 1.18 | 3.61** |
| 12. Errors | 3.54 | 1.09 | 2.61 | 1.28 | -2.01* |

*$p < .05$. **$p < .01$