ACADEMIC PRESS

Organizational Behavior and Human Decision Processes 88 (2002) 667–682

ORGANIZATIONAL BEHAVIOR AND HUMAN DECISION PROCESSES

www.academicpress.com

Challenge versus threat effects on the goal–performance relationship

Anat Drach-Zahavy[a] and Miriam Erez[b,*]

[a] *Faculty of Health and Welfare, University of Haifa, Israel*
[b] *Faculty of Industrial Engineering and Management, Technion-Israel Institute of Technology, Haifa 32100, Israel*

Abstract

This study tested the situational effects of goals and stress on the performance of complex tasks and on adaptation to change in the task. Difficult goals often exceed the individual's resources and thus create stress. However, stress may be appraised as either challenge or threat. Challenge is experienced when there is an opportunity for self-growth with available coping strategies, whereas threat is experienced when the situation is perceived as leading to failure with no available strategies to cope with it. We hypothesized that participants who appraised the situation as a challenge would perform better and adapt better to changes under difficult goal conditions, as compared with general goals or strategy goals. By contrast, threat appraisals would be better addressed by strategy goals rather than difficult goals. One hundred and fifty five students performed a task, which required their making predictions concerning the value of 120 companies' stocks based on three manipulated cues. We used a three by three by two factorial design in which goals, stress, and change (as a repeated factor) were varied to test the hypotheses. Results supported the main hypotheses and demonstrated that the same level of goal difficulty may lead to high or low performance and adaptation to change depending on the appraisal of the situation as challenging or threatening. The theoretical and practical implications of these findings are further discussed.

Keywords: Difficult goal; Strategy goals; Stress; Challenge; Threat; Performance

1. Introduction

The present study focuses on the assignment of goals under the conditions of growing task complexity and stress. Previous research has demonstrated that as tasks become more complex, the effects of specific difficult goals on performance might be less pronounced or even harmful. One possible explanation is that the combination of complex tasks with difficult goals creates stress that leads to low performance, (e.g., Earley, Connolly, & Eakergen, 1989; Huber, 1985). However, people, who strive to accomplish difficult goals when task complexity is high, may perceive their goal as a challenge rather than a threat, thus, leading to high, rather than low levels of performance. It is the main purpose of the present study to investigate whether the

* Corresponding author.
E-mail address: merez@ie.technion.ac.il (M. Erez).

0749-5978/02/$ - see front matter
PII: S0749-5978(02)00004-3

appraisal of the situation of task performance as challenging or threatening could affect the performance of complex tasks. Two theoretical frameworks serve for generating the rational for this study: (a) Goal-Setting (Locke & Latham, 1990), which focused on the effectiveness of specific difficult goals versus do-your-best goals and no goals in motivating the performance of simple versus complex tasks, and (b) the Transactional Model of Stress and Coping (Folkman & Lazarus, 1985; Lazarus, 1999), which emphasized the subjective appraisal of stress as crucial to performance.

1.1. Goal-setting in complex tasks

Several studies have indicated that as tasks become more complex the typical motivational effects of specific difficult goals may not be sustained and may even become harmful (e.g., Campbell, 1984; Earley, 1985; Earley et al., 1989; Gist, Stevens, & Bavetta, 1991; Huber, 1985; Kanfer & Ackerman, 1989; Wood, Mento, & Locke, 1987). For example: Earley et al. found that specific difficult goals, as compared with do-best or easier goals, reduced the performance accuracy of a complex prediction task. In addition, results from a meta-analysis conducted by Wood et al. (1987) showed that the goal-setting effects were strongest for easy tasks (reaction time, brainstorming), and weakest for more complex tasks (business game simulations, scientific, and engineering work, faculty research productivity).

Complex tasks differ from simple tasks on three dimensions (Wood & Locke, 1990): component complexity, coordinating complexity, and dynamic complexity. Component complexity refers to the number of performance dimensions that must be attended to simultaneously. The task would be simpler if there were fewer acts to perform or less information cues to attend to. Coordinating complexity refers to the sequencing of acts and the coordination required among acts to accomplish the task. Thus, the task would be more complex if there were more acts to coordinate. Finally, dynamic complexity refers to the changes in the acts and information cues and their potential predictability. Dynamic complexity imposes an additional load on the performer due to the need to adjust to change. Change situations also lead to psychological states, such as anxiety, uncertainty, and resistance to change, which inhibit task performance (Wood & Bandura, 1989). Hardly any research has been conducted on adaptation to changes in a dynamic complex task. In the present study we examined the effects of goals on the performance of tasks with high component and coordinating complexity as well as on adaptation to changes in the rules of the task.

The research literature on goal-setting has identified several different conditions under which specific and difficult goals have either neutral or potentially harmful effects on the performance of complex tasks. Kanfer and Ackerman (1989) and Kanfer, Ackerman, Murtha, Dugdate, and Nelson (1994) showed that when tasks become more complex, specific difficult goals impose greater attentional demands on individuals compared with "do-best" goals. The authors asked US military force trainees to play the role of traffic controllers in a computerized simulation and to land planes safely and without errors, taking into consideration certain weather conditions. Results showed that specific difficult goals in this complex task had a detrimental effect on performance in the early stages of skill acquisition. Kanfer and Ackerman concluded that the combination of goal difficulty and high attentional demands induced by task complexity create work overload that may exceed the attentional resources of the performer, mainly in the early stages of learning when relevant task strategies have yet to be developed. Thus, effective performance of complex tasks depends not only on the amount of effort exerted in the task, but also on the development of relevant strategies. Still, the role of goal assignment in the process of strategy development is not fully clear, and research findings are somewhat conflicting. There is extensive empirical evidence to support the beneficial role of goal setting on strategy development (Campbell, 1984; Earley, 1985, 1986; Earley,

Hanson, & Lee, 1986; Earley & Perry, 1987; Earley, Wojnaroski, & Prest, 1987; Locke, 1981; Terborg, 1976; Wood & Bandura, 1989). On the other hand, research has shown that in complex tasks specific difficult goals may misdirect strategy search and thus induce frequent shifting from one strategy to another without use of the suitable weighting and evaluating processes to assess their appropriateness (e.g., Earley et al., 1989; Huber, 1985). Merely shifting from one strategy to another on a trial-and-error basis offers little prospects for improved performance (Earley et al., 1989). Another line of research by Dweck and her colleagues led to similar conclusions concerning the effect of performance goals. Their research found that performance goals, unlike learning goals, resulted in diminished learning and strategy development, and consequently in poor performance. They explained that individuals, who adopted a performance orientation, interpreted their difficulties in achieving desired outcomes as an indicator of low ability that posed serious threat to their self-esteem (Dweck & Legget, 1988; Heiyman & Dweck, 1992; Mueller & Dweck, 1998).

Taken together, it is possible that under the demanding circumstances of complex tasks, specific difficult goals, by virtue of their focus on immediate performance outcomes, divert necessary attention from strategy development, and hence hamper performance. The present study addressed this issue in two ways. First, we introduced a strategy goal, which directs attention to strategy development, and compared its effectiveness with that of a specific difficult goal and a do-your-best goal. We expected that strategy goals would facilitate the performance of complex tasks when focusing attention on strategy development was critical. Moreover, strategy goals would stimulate strategy development without loading excessive stress on the performer. Second, we argued that the potential effectiveness of strategy and difficult goals would depend on the appraisal of the situation as a challenge or threat. The interplay between goals and appraisals of challenge versus threat is further discussed in the next section.

2. Stress and goal-setting

Very few studies have tested the effect of stress on the performance of complex tasks under difficult goal assignments. Huber (1985) found that individuals performing a heuristic maze task were less effective if they were given a specific difficult goal rather than a general ''do-best'' goal. Moreover, the results showed that specific difficult goals created excessive stress and arousal, thereby hampering performance. Huber concluded that the assignment of a specific difficult goal might not be an effective motivational tool for complex tasks in which arousal and stress are already high. However, Huber's focus on stress and arousal per se stopped short of further analyzing the underlying mechanisms responsible for creating the stress.

Researchers now agree that stress should be viewed as relational in nature (e.g., Dewe, 1992; Folkman & Lazarus, 1985; Lazarus, 1999; Lazarus & Launier, 1978) involving some sort of transaction between the individual and the environment. Stress (as opposed to no stress) therefore arises from a *judgment* that particular demands exceed the resources of the system for dealing with them and thus affect one's sense of well being (Folkman & Lazarus, 1985; Holroyd & Lazarus, 1982; Lazarus, 1991; Lazarus, 1999). Yet, stress can be cognitively appraised as either challenging or threatening to a person's well being (Holroyd & Lazarus, 1982). Two important interacting processes are involved in such cognitive appraisal: primary and secondary appraisals. Through primary appraisal, a person judges what is at stake (Folkman & Lazarus, 1985; Lazarus, 1999). The significance of the situation is evaluated in terms of the individual's well being as either an opportunity for self-growth or as a risk. Secondary appraisal is concerned with the controllability of the

situation. It refers to the evaluation of coping strategies available to manage the demands or shape the experience (Folkman & Lazarus, 1985). More specifically, when a person evaluates the situation as an opportunity for self-growth and identifies the coping strategies available to manage the demands, the stress is perceived in terms of challenge. By contrast, when a person evaluates the situation as a source of failure only, and does not find the appropriate coping strategies to manage the demands, the stress is perceived in terms of threat. These appraisals affect performance in different ways: perceptions of challenge enhance performance, whereas perceptions of threat inhibit performance.

To sum up, integrating the transactional model of stress and coping with the goal-setting model could broaden our understanding of how goals affect the performance of complex tasks. While the combination of difficult goals and complex tasks has been shown to lead to high levels of stress and to be detrimental to performance, past research has not made a distinction between perceptions of challenge versus threat. Hence, the second purpose of this study was to examine how the appraisal of stress as a challenge or a threat would interact with goals to affect performance. Specifically, we expected that challenge appraisals, would foster the performance under the specific difficult goal condition, in contrast to a strategy or do-your-best goal. However, under threat appraisals, assigning strategy goals would be a better motivational means than specific difficult goals or do-your-best goals. Finally, our third purpose was to examine participants' adaptation to change. We expected that change in the situation would increase the attentional demands that are needed to manage the task as well as the stress induced by the task. For example, attentional demands of the tasks are accelerated due to the need to develop new strategies to manage the change. On the other hand, failure to develop such strategies may cause additional stress. Hence, the joint effects of goals and stress would be more substantial during changes in the situation. More specifically, we argued that the combination of threat appraisal and specific difficult goals (as compared with strategy goals and do-your-best goals) would be detrimental to adaptation to change. By contrast, the combination of challenge appraisals and specific difficult goals would lead to adaptation to change, as observed by the maintenance of at least the same performance level.

2.1. Hypotheses

In line with the above discussion, the following hypotheses were formulated:

1. *Main effect of stress on performance*. Lazarus and his colleagues (Folkman & Lazarus, 1985; Lazarus, 1991, 1999) maintained that stress is appraised in terms of either challenge or threat, and that these appraisals can affect performance. Accordingly, hypothesis 1 proposes that the performance of participants in the challenge condition will be higher than the performance of participants in the threat condition,
2. *Interaction effect of stress and goals*. We proposed an interactive model where the effects of goals on the performance of complex tasks depend on the appraisal of the situation as a challenge or threat. We hypothesized that (2a) setting difficult goals will lead to better performance than setting strategy or "do-best" goals for participants in the challenge condition; (2b) setting strategy goals will lead to higher performance levels than setting difficult or "do-best" goals for participants in the threat condition.
3. *Interaction effect of stress, goals, and change*. Introducing change in the rules of the task will have a negative effect on the participants' performance in the threat condition, when they are assigned difficult goals rather than strategy or "do-best" goals. By contrast, difficult or strategy goals versus "do-best" goals the challenge condition will help maintain the performance level obtained prior to the change in the rules of the task.

3. Method

3.1. Participants

Participants were 155 undergraduate students (76 men and 79 women) from a major university in northern Israel. They were randomly assigned to the experimental conditions and were placed in small groups (of about eight participants). They worked individually on a simulated complex task for approximately 2 h and were paid for their participation.

3.2. Experimental task

In keeping with the literature on complex tasks (e,g., Wood & Locke, 1990), we selected a task that required coordination between different performance dimensions and successful adaptation to changes in the rules of the task. The Stock Market Prediction Task employed in the present study was developed and tested in previous studies (for a detailed description see Earley et al., 1989). In essence, the task simulated the work of stockbrokers and required the prediction of the stock values of 120 different firms, based on business data. Stock value was determined by a linear function of three parameters: the performance of (a) the manufacturing department, (b) the marketing department, and (c) the R&D department, relative to each department's goal. The equation was not communicated to the participants, who had to infer the relative weights of the three parameters, based on their performance feedback. Moreover, the equation differed in each of the two experimental phases. In phase one, the equation that predicted the stock value was $Y_1 = .33X_1 + .67X_2 + 0X_3$. A change in the equation was introduced in phase two: $Y_2 = .50X_1 + 0X_2 + .50X_3$ (where Y_1 is stock's value at phase 1; Y_2 is stock's value at phase 2; X_1 is manufacturing department's performance; X_2 is marketing department's performance; and X_3 is R&D department's performance).

In each trial participants received the business data (in percentages) and recorded their predictions (in $) *without prior knowledge of the predicting equation*. For instance, the business data might be: Firm's name, Dalia; business area, textiles, production, 120%; marketing, 90%; R&D, 150%. After each trial, the actual stock market value was read aloud for immediate feedback.

Participants completed 90 trials at phase 1 and another 30 trials at phase 2. The two-phase design provided the opportunity to test participants' adaptation to changes in the prediction equation.

Memory test. This test was introduced to increase the experience of stress. Participants in the high stress conditions of threat and challenge were notified of the memory test prior to the two performance phases. The test was introduced upon completion of the second performance phase. It required the preparation of an investment portfolio for an important customer, based on effective recall of the business data formerly presented. The portfolio had to consist of at least six stocks (two stocks of textile companies, two stocks from the food industry, and two stocks of tourism organizations). A second requirement was to include only companies with departments' performance above 100%.

3.3. Design

The study consisted of 3 (goal) × 3 (stress) × 2 (phase) factorial design with phase as a within-subject factor.

Goals. Goal-setting conditions included difficult specific goals, strategy goals, and "do-best" goals. The difficult goal was the predicting of accurate stock prices for at least 80 trials. The level of goal difficulty was determined in a pilot study as the one

obtained by only 20% of the participants. The strategy goal instructed the participants to direct their efforts to finding the best task strategies during the first 20-min of task performance. The 20-min period was based on a pilot study where it took about 20 min to identify the best strategy. Setting a certain time period directed attention towards the strategy goal from the beginning of the task. Finally, participants assigned to the general goal condition were instructed to do their best to predict the stocks' values. The specific instructions in each one of the goal-setting conditions appear in the procedure section.

Stress. Stress conditions were low- and high-stress. The high stress was further divided into threat and challenge conditions. In our study, stress was defined as an individual's judgment that particular demands exceeded the resources of the system for dealing with them and thus affected individual's sense of well being (Folkman & Lazarus, 1985; Holroyd & Lazarus, 1982; Lazarus, 1991). Based on this definition, participants under the high-stress conditions (challenge and threat) were told that upon completion of the prediction task they would take a memory test based on the information they received during task performance. That manipulation increased the attentional demands of the task, as participants had to allocate attention to memorizing information on stocks, in parallel to their ongoing prediction task. To strengthen the significance of the task to the person's well being, we asked participants in the high-stress conditions to write their names and telephone numbers, so it would be possible to locate and interview the best (in the challenge condition) and the worst (in the threat condition) performers after the test. Participants under the low-stress condition received no such instructions. Thus, to manipulate stress as opposed to low-stress, we increased the demands for resource allocation, and the significance of the task for the participants in the high-stress conditions.

Challenge and threat. These two high-stress conditions were further manipulated in line with Lazarus's model (1985), using of both first and second appraisal processes. Table 1 summarizes these manipulations.

To manipulate the first appraisal process of challenge and threat, we used positive and negative framings. This method was used in previous research by Crowe and Higgins (1997) to assess promotion versus prevention focus. In the context of cognitive appraisal theory, Tomaka and his colleagues (e.g., Tomaka, Blascovich, Kibler, & Ernst, 1997; Tomaka, Palacois, & Lovegrove, 1995) manipulated two sets of instructions to elicit challenge versus threat appraisals. However, their framing did not explicitly address the first and second appraisal processes of challenge versus threat. In the present study, we differentiated between primary and secondary appraisals. Primary appraisal is concerned with the significance of the stress to a person's sense of well being. Hence, the challenge condition was framed in positive terms and highlighted positive outcomes and success, whereas the threat condition was framed in negative terms and emphasized negative outcomes and failure.

To manipulate the second appraisal process of challenge and threat, the challenge manipulation focused on controllability of the situation. Participants in the challenge

Table 1
Threat and challenge manipulations

	Primary appraisal	Secondary appraisal
Threat	Focus on failure: Instructions are framed in negative terms	85% failed
	Interview with the five worst performers	Reasons for success: Participation in a special course in the army
Challenge	Focus on success: Instructions are framed in negative terms	15% succeeded
	Interview with the five best performers	Reasons for success: High motivation and high efforts of earlier participants

condition were informed that the former participants' attributed their success to their own efforts, consistency, and focus on the task. By contrast, the threat manipulation emphasized lack of control of managing the task performance. Participants in the threat condition were informed that the former participants attributed their success to their enrollment in a special training program during their mandatory military service. Thus, subjects who did not have such training experience had less control over the situation.

In light with the conceptualizations of the primary and secondary appraisals, participants received the following instructions (note that in line with the cognitive appraisal theory, participants in both conditions were stressed, but they differed in their appraisal of the stress as challenging or threatening):

In the challenge condition: "Please write down your name and phone number so that you can be located if necessary...we would like to interview the five best performers...only 15% of the students who previously participated in the study succeeded on the task... These students reported that high effort, persistence, and attention helped them to accomplish the task...."

In the threat condition: "Please write down your name and phone number so that you can be located if necessary...we would like to interview the five worst performers... 85% of the students who participated in the study previously failed on the task... These students reported that their previous enrollment in a special course during their mandatory military service helped them to accomplish the task...."

Change. Change was manipulated by introducing a change in the equation that predicted the stock value in phase two. Phase one in the experiment consisted of 90 trials of predicting stocks' values, using the first equation. Phase two consisted of 30 more trials, using the second equation. Our between–within experimental design allowed us to test for the differences in adaptation to change between the various experimental conditions.

3.4. Measures

Performance. We calculated the absolute difference score between the actual stock price and the participant's prediction. This measure estimated the extent to which participants used a close assessment of the equation. In that case high difference scores represented low performance. To ease the interpretation of the results, we reflected the scores such that high scores represented high performance by subtracting the difference score from the maximum difference score obtained in our sample.

Ability. Ability was measured by the baseline performance in the first 10 trials (prior to the experimental manipulations).

3.5. Manipulation checks measures

Stress. Stress was measured by a nine-item Likert-type scale specifically designed for use in this study. These items reflected the degree of task stress experienced during the performance of the task, such as ambiguity, work overload, and time pressure. For example: "to what extent did you experience work overload while performing the task?" and "To what extent did you experience ambiguity during the task?" Internal reliability for the stress questionnaire was .87. The stress questionnaire was presented to the participants twice: before and after the memory test.

Stress appraisals of challenge as opposed to threat. The challenge-threat scale consisted of 12 Likert-type items describing primary and secondary appraisals. Primary appraisal was measured by eight items describing participants' perceptions of the expected consequences of the situation for them. For example, in challenge appraisals: "The task seems like a challenge to me." "The task provides opportu-

nities to exercise reasoning skills.'' ''The task provides opportunities to overcome obstacles.'' ''The task provides opportunities to strengthen my self-esteem.'' For threat appraisals: ''The task seems like a threat to me.'' ''I'm worried that the task might reveal my weaknesses.'' ''The task seems long and tiresome.'' ''I'm worried that the task might threaten my self-esteem.'' Secondary appraisal was measured by four items describing participants' perceptions of their controllability, their available methods for carrying out the task, and their overall expectancies of success. For example, in challenge appraisals: ''Overall, I think I'll succeed in carrying out the task.'' ''I think that I have the abilities necessary for successful performance.'' For threat appraisals: ''Overall, it seems that I cannot succeed in a task like this.'' ''I'm worried that I lack the abilities to perform the task successfully.''

For assessing the challenge and threat manipulations, we averaged responses to the first and second appraisal items for challenge and threat separately. The Cronbach's Alpha reliability score for the challenge scale was .88 and for the threat appraisal .89.

Goals. We assessed the goal-setting manipulation by using a four-item Likert-type scale, describing participants' perceptions of the difficulty and specificity of the goals assigned (''How difficult was your performance goal?,'' ''How difficult would such performance goals be for a subject with similar abilities as yours?,'' ''How specific was your performance goal?,'' ''How clearly was the goal explained to you?''). The Cronbach's Alpha reliability scores were .84 for goal difficulty, and .81 for goal specificity.

3.6. Procedure

Participants were randomly assigned to one of nine combinations of goal $\times$ stress conditions, with two experimental phases. After the participants were seated, the experimenter introduced himself to them as one who is interested in decision-making processes, and he presented an overview of the prediction task. The experimenter informed all the participants that even though the task was a simulation of a stock market, they should not necessarily assume that the market would perform according to their past experiences; hence, they should approach the predictions with a ''clean slate.'' After the short briefing, participants were given a 10-trial practice session to familiarize themselves with the prediction task. In each trial, the experimenter read aloud the companies' business data and instructed participants to record their predictions on the answer sheet. He then paused for about 7 s before announcing the actual stock price, which the participants wrote down beside their predictions. Performance scores in the practice session served as a baseline measure of ability.

At this point, the manipulations of stress, (including the announcement of the forthcoming memory test), challenge, and threat were introduced both orally and in the form of writing by the instructions (see Section 3.3), followed by the completion of the challenge or threat manipulation checks. Next, the experimenter enacted the goal-setting manipulation by instructing participants to ''do-best'' or ''to meet the specific challenging goal of 80 correct predictions'' or to ''direct your efforts to finding the best task strategies mainly during the first 20 min of performing the task.'' Following the experimental manipulations, participants continued to work on the prediction task for approximately 1 h. After the first phase of 90 trials, participants were instructed to take a short break but were not informed about the change of the predicting equation. A few minutes later, participants completed the remaining 30 trials in the same manner as they did in phase 1, but with the new-predicting equation.

Upon completion of the two performance phases, the first stress manipulation check was administered, followed by the memory test. Finally, the participants were

given a post-experimental questionnaire, which included the manipulation checks (goal difficulty, goal specificity, and the second stress manipulation check). Participants were debriefed at the end of the experiment.

4. Results

Table 2 presents the intercorrelation matrix for all measured variables included in the study.

First, the results demonstrated a negative significant correlation between the challenge and the threat manipulation checks. In addition, as expected, the correlations between the stress manipulation checks and the threat manipulation check were significant and positive. However, no significant correlations were found between the stress manipulation checks and the challenge manipulation check. These results partially supported the notion that the same level of stress can be appraised as a challenge or threat depending on the situation. Second, no significant correlations were found between the perceptions of goal specificity and goal difficulty and the perceptions of stress/challenge/threat, indicating that those measures are relatively independent. Finally, no significant correlations were found between the performance scores and the perceptions of goals specificity and goal difficulty, thus providing initial support to our proposed model that the combination of goals and stress appraisals is the key factor that influences performance, and not goals per se.

4.1. Manipulation checks

Goal manipulation. To assess goal difficulty, we averaged responses to the difficulty items and analyzed them using a one-way analysis of variance. This model explained 22% of the variance ($F(2,148) = 19.01, p < .001$). As expected, the findings showed a significant effect of the goal manipulation ($F(2,148) = 6.89, p < .01$). Post hoc analysis (LSD) revealed that specific difficult goals were perceived to be more difficult than "do-best" goals, and strategy goals were perceived to be more difficult than "do-best" goals ($p < .05$).

To assess goal specificity, we averaged responses to the specificity items and again obtained the expected significant main effect ($F(2,148) = 7.49, p < .001$). Post hoc analysis (LSD) revealed that "do-best" goals were perceived to be less specific than strategy goals and specific difficult goals ($p < .05$).

Stress manipulation. Table 3 presents the mean stress scores and standard deviations by experimental conditions.

To assess the stress manipulation, we analyzed the three main effects and interaction effects of stress, goals, and time (occasion) conditions on the perceptions of stress using a $3 \times 3 \times 2$ ANOVA with time as the repeated factor. This model explained 62% of the variance in time 1 ($F(8,135) = 26.03, p < .001$), and 43% of the variance in time 2 ($F(8,135) = 12.20, p < .001$). The results demonstrated two significant main effects and one interaction effect on perceptions of stress: Main effect of stress ($F(2,135) = 75.00, p < .001$), main effect of time ($F(2,135) = 60.39, p < .0001$); and an interaction effect of stress by time ($F(2,135)) = 15.41, p < .01$. There was no goal effect on the perceptions of stress. Post hoc analyses (LSD) of the differences between the stress conditions showed that the perceptions of stress were lower in the challenge condition than in the threat or the low-stress conditions, and lower in the low-stress condition than in the threat condition. Perceptions of stress were significantly lower in time 2 after the memory test than before.

Threat and challenge manipulation. To assess the threat and challenge manipulation, we analyzed the main effects of stress and goal conditions and their interaction effect on the perceptions of threat versus challenge using two separate 3×3 ANOVA

Table 2
Intercorrelations of study's variables

Variable	Mean	*SD*	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) Goal specificity	3.58	1.08	1.00							
(2) Goal difficulty	2.91	1.35	.17*	1.00						
(3) Threat appraisal	3.22	.95	−.02	.09	1.00					
(4) Challenge appraisal	4.94	.82	.11	−0.2	−.53**	1.00				
(5) Stress perception (I)	1.96	.78	.13	.06	.31**	.03	1.00			
(6) Stress perception (II)	1.60	.61	.06	.07	.27**	−.00	.81**	1.00		
(7) Performance I phase	23.84	2.89	.04	−.00	−.13	.14	.07	.05	1.00	
(8) Performance II phase	23.80	5.33	.03	−.04	−.28**	.37**	−.16*	.01	.42**	1.00

*$p < .01$.
**$p < .001$.

Table 3
Manipulation check: stress, challenge and threat means and *SD*s by experimental conditions

	Stress (phase I)						Stress (phase II)					
	Do-best		Specific goals		Strategy goals		Do-best		Specific goals		Strategy goals	
	Mean	*SD*	Mean	*SD*	Mean	*SD*	Mean	*SD*	Mean	*SD*	Mean	*SD*
Low stress	1.15	.17	1.14	.20	1.20	.25	1.16	.16	1.11	.14	1.16	.17
Threat	2.64	.62	2.67	.51	2.43	.57	2.15	.77	1.94	.58	2.01	.44
Challenge	2.30	.64	2.05	.66	2.07	.55	1.86	.50	1.79	.77	1.51	.36
Low stress	4.74	.27	4.70	.26	4.60	.16	3.15	.19	3.17	.59	3.09	.21
Threat	4.78	.91	4.73	.93	4.65	.72	3.95	1.04	3.69	.53	3.77	.89
Challenge	5.30	1.18	5.29	.64	5.67	.73	2.66	1.31	2.36	.80	2.55	.63

This model explained 35% of the variance in threat ($F(8,134) = 8.45, p < .001$), and 18% of the variance in challenge ($F(8,134) = 3.44, p < .001$). Table 2 presents the means and standard deviations of threat and challenge manipulation check scores by experimental conditions. The results demonstrated a significant main effect of stress on challenge scores ($F(2,134) = 12.37, p < .001$) and on threat scores ($F(2,134) = 32.71, p < .001$). There was no goal effect on the perceptions of challenge and threat. Post hoc analyses (LSD) of the differences between the stress conditions showed that as expected, challenge perceptions were higher in the challenge condition than in the threat or the low-stress conditions. In addition, as expected threat perceptions were higher in the threat condition than in the low-stress or challenge condition and higher in the low stress than in the challenge condition.

4.2. Hypotheses testing

We analyzed the main effects of stress, goals, and experimental phase (change), and their interactions on performance using three-way analyses of covariance (ANCOVA) with repeated measures, with experimental phase as the repeated factor, and ability as a covariate. The homogeneity of the covariate (ability) was tested and no significant differences were found between the groups.

Table 4 presents the mean performance scores and standard deviations, and Table 5 summarizes the results of the analysis of covariance. Fig. 1 presents a visual display of the results.

The results of the three-way ANCOVA demonstrated main effects of ability (covariate) and a main effect of stress, as well as interaction effects of stress by goals, stress by phase, and stress by goals by phase ($p < .05$), This model explained 29.3% of the variance in phase one ($F(9,145) = 6.66, p < .001$) and 25% of the variance in phase 2 ($F(9,145) = 5,38, p < .001$).

Hypothesis 1 tested the effect of stress on performance. In line with our first hypothesis, a main effect of stress was found ($F(2,144) = 132.28, p < .03$). Post hoc analyses (LSD) of the differences between the stress conditions showed that performance was lower in the threat condition than in the challenge or the low-stress conditions. No significant differences were found between the two latter conditions ($p > .05$). This finding supported hypothesis 1, and indicated that challenge appraisals facilitated performance whereas threat appraisals hampered performance.

Hypothesis 2 focused on the interaction between stress and goals. The significant two-way interaction effect of stress by goals ($F(4,144) = 2.86, p < .02$) supported hypothesis 2b only (Table 5). Hypothesis 2b focused on the effect of goals in the threat condition. In line with our hypothesis, post hoc simple-effect tests across the two performance phases demonstrated that performance level was higher in the strategy goal condition than in the "do-best" and in the difficult goal conditions, and higher in the "do-best" than in the difficult goal condition ($p < .01$). Hypothesis 2a focused on the effects of goals in the challenge condition. Post hoc simple-effect tests

Table 4
Performance—means and *SD*s by experimental conditions (stress and goals)

Goals/stress	Low stress		Threat		Challenge	
	Mean	*SD*	Mean	*SD*	Mean	*SD*
Do-best (phase 1)	23.93	.59	23.04	.65	23.53	.74
Do-best (phase 2)	22.97	.99	22.70	1.09	24.54	1.24
Difficult goals (phase 1)	22.98	.70	23.36	.65	24.20	.73
Difficult goals (phase 2)	26.09	1.20	18.17	1.09	26.78	1.23
Strategy goals (phase 1)	23.78	.73	24.70	.65	25.34	.75
Strategy goals (phase 2)	25.31	1.24	24.63	1.09	24.94	1.27

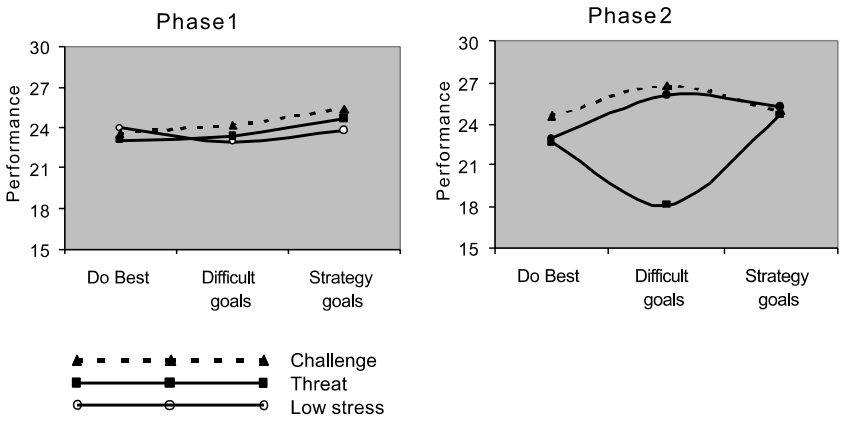

Fig. 1. Performance means by stress, goal, and experimental phase conditions.

Table 5
Performance—three-way analysis of covariance with repeated measures by experimental conditions

Source	Mean	*Df*	*F*	*Pr* < *F*
Between				
Goals	51.80	2	3.16	0.07
Stress	120.45	2	6.22	0.003
Stress * goals	55.56	4	2.87	0.02
Ability	452.46	1	23.38	0.001
Error	19.35	145		
Within				
Phase	3.98	1	0.53	0.46
Phase * goals	1.34	2	0.14	0.87
Phase * stress	81.02	2	8.41	0.001
Phase * stress * goals	66.11	4	6.86	0.001
Phase * ability	7.60	1	0.79	0.37
Error	7.61	145		

across the two performance phases demonstrated that for participants in the challenge condition no significant main effect of goals was found ($p > .01$).

Hypothesis 3 focused on the adaptation to change induced in the second phase. In support of this hypothesis, Table 5 demonstrated that there was no main effect of phase, but there were significant interactions of phase by stress, and phase by stress by goal. Concerning the two way interaction of phase by stress, results from the post hoc simple-effect tests revealed that, as expected, participants in the threat condition decreased their performance in phase two as compared with phase one, whereas participants in the challenge condition improved their performance in phase two as compared with phase one ($\bar{X}_1 = 5.84$ and $\bar{X}_2 = 3.66$ in the threat condition whereas $\bar{X}_1 = 6.60$ and $\bar{X}_2 = 7.25$ in the challenge condition). Concerning the three way interaction of stress by goal by phase, post hoc analyses (LSD revealed that changes in performance between phase 1 and phase 2 occurred mainly in the specific difficult goal condition and not in the do-best or strategy goal conditions ($p < .01$) (see Fig. 1). The combination of threat and difficult goals decreased phase 2 performance as compared with phase 1, indicating difficulties in adaptation to change (the lowest performance level occurred in the threat by difficult goal condition). By contrast, the combination of difficult goals and challenge improved phase 2 performance as compared with phase 1, indicating adaptation to change (see Fig. 1). No other significant differences between the two performance phases were found. These findings supported hypothesis 3.

The low stress condition had a similar performance pattern to that of the challenge condition (see Fig. 1).

5. Discussion

The question that stimulated the present study was whether the effect of goals on the performance of complex task could be moderated by the work context and its appraisal as challenging or threatening. The answer to this question is important, as high task complexity, stress, and work overload increasingly characterize the modern workplace. Previous research on goal setting has pointed to inconsistencies in the effects of goals on the performance of complex, as opposed to more simple tasks. These studies have demonstrated that as tasks become more complex, the effects of specific difficult goals on performance may be neutral or even potentially harmful (e.g., Campbell, 1984; Earley, 1985; Earley et al., 1989; Gist et al., 1991; Wood et al., 1987).

The present study has contributed to clarifying these issues by highlighting several points. First, we distinguished between stress in the form of challenge and stress in the form of threat, and demonstrated that the challenge condition facilitated performance, whereas the threat condition hampered the performance of complex tasks. Second, previous studies showed inconsistent results with respect to the effects of difficult goals on the performance of complex tasks. Our results helped to clarify this issue by looking at the interaction between goals and the situational demands. Our results demonstrated that the same level of goal difficulty impaired performance and adaptation to change when participants appraised the situation as a threat, and improved adaptation to change when participants appraised the situation as a challenge. Third, we introduced the assignment of strategy goals and compared their effectiveness with that of specific difficult goals and "do-best" goals. Past research has typically examined the effectiveness of specific difficult goals in comparison with that of "do-best" or of easier goals (for review see Locke & Latham, 1990). By introducing strategy goals in the context of complex tasks, we were able to show that strategy goals had an advantage over difficult goals in the threat condition.

5.1. The effects of stress

The design of our study allowed testing the effect of challenge appraisals, which emphasized opportunity and success, against the effects of threat appraisals, which emphasized risk and failure. Although the theoretical concepts of challenge and threat are distinct, previous research has not clearly differentiated their effects on performance, mainly due to methodological constraints (Baum, 1990). Findings from laboratory studies (e.g., Croyle, 1992; Dewe, 1992; Folkman, Lazarus, Dunkel-Schetter, De Longis, & Gruen, 1986) showed that the way in which instructions were presented to the participants led most of them to appraise the situation as a threat. One exception is the research by Tomaka and his colleagues (e.g., Tomaka, Blascovich, Kelsey, & Leitten, 1993; Tomaka et al., 1995, 1997). They used manipulated instructions to elicit challenge versus threat responses in a similar way to the method employed in the present study. However, their framing process did not address explicitly the first and second appraisal processes of challenge versus threat as we did in the present study. Findings from field studies (e.g., George, Brief, & Webster, 1991) showed similar results, with nearly 80% of employees spontaneously appraising the stress situation as a threat. Consequently, it was not feasible to clearly differentiate between the effects of challenge and threat on coping processes or on performance.

The design of the present study enabled us to differentiate between challenge, threat, and low-stress conditions and to demonstrate that the primary and secondary

appraisals of threat and challenge were clearly differentiated by the experimental manipulations. Furthermore, results confirmed the hypothesis by indicating that (a) there was a significant effect of the experimental manipulations on the appraisals of Threat and Challenge, (b) challenge appraisals positively correlated with phase 2 performance whereas threat appraisals negatively correlated with it, (c) challenge appraisals yielded consistently better performance than threat appraisals. These findings underscore the critical role of appraisals in performance and provide further support for the idea of positive stress (e.g., Dewe, 1989, 1992; Folkman & Lazarus, 1985; Hobfoll, 1988; Lazarus, 1999; McGrath, 1970). The practical importance of this finding is that if appraisal processes can be influenced through simple oral instructions, then it may be possible to increase the level of performance of complex tasks by creating a more challenging work environment.

An additional contribution of the present study is the development of an empirical measure of cognitive appraisals. Several scholars (Brief & Atieh, 1987; Dewe, 1992; Glowkinkowski & Cooper, 1985; Payne, Jick, & Burke, 1982) argue that measurements of stress have seemingly ignored the process of appraisal, even though, it is conceptually at the core of stress research. The challenge/threat questionnaire, developed in this study is based on Folkman & Lazarus's (1985) conceptualization, and it assesses the cognitive aspect of the appraisal process.

Finally, although clearly supporting cognitive appraisal theory, the findings of the present study do not exclude the possibility that personal dispositions or self-efficacy beliefs can also lead to threat and challenge appraisals. Indeed, research has already shown that beliefs in a just world are positively associated with the experience of challenge (Tomaka & Blascovich, 1994). Future research is needed to examine more fully how situational and personality factors interact to determine stress-related responses.

5.2. The effects of goals

The present study differentiated the effects of goals from the situational demands of challenge versus threat. The results partially supported the hypotheses, and pointed to the detrimental effect of difficult goals in contrast to the positive effect of strategy goals on performance in the threat condition. Participants in the challenge condition reached higher levels of performance regardless of the goals. Hence, challenge appraisals outweighed the goal manipulation effect.

In addition, our design enabled us to examine how participants adapt to a dynamic environment. The change in the predicting equation in the second phase made it possible to test how employees regulated their performance under the variant conditions of goals and stress. The findings demonstrated that the combination of challenging work environment and difficult goals yielded the best performance level in the second phase, indicating high adaptation to change. Note that performance improvement occurred despite the change in the predicting equation, and despite the fact that the second performance phase was notably shorter. This finding means that participants in this condition developed appropriate strategies to handle the task and transferred necessary practices and knowledge from phase 1 performance. It is possible that the combination of challenge appraisals and difficult goals induced latent learning that was not expressed in phase 1 performance levels but helped the performance of phase 2. By contrast, the assignment of specific difficult goals to threatened participants yielded the worst performance level, and demonstrated the poorest level of adaptation to the changing task demands. To summarize, the present study demonstrated that a difficult goal could induce high adaptation to change when the work context is perceived as challenging, or poor adaptation and performance when the work context is perceived as threatening.

Considering the strategy goal we found that this goal yielded better performance and adaptation than difficult or "do-best" goals mainly under the threat condition. One possible explanation is that strategy goals directed attention and effort to the process of strategy development, which is necessary for the performance of complex tasks. Indeed, past research demonstrated that outcome goals undermined strategy development because these goals encouraged the use of simple means ends (backward strategies) that do not foster learning the rules of the task (Sweller & Levine, 1982). Moreover, strategy goals attenuated the excessive stress created by emphasizing goal accomplishment. The research on learning goals (Dweck & Legget, 1988; Heiyman & Dweck, 1992; Mueller & Dweck, 1998) also lends support to this explanation.

Only limited research has been conducted on strategy goals and their effects on strategy development, performance, and adaptation to change. Future research should further elaborate on the underlying cognitive and motivational processes that are activated by strategy versus performance goals.

Acknowledgments

We thank Richard Lazarus and Shelly Zedeach for their constructive comments on an earlier version of this article.

References

Baum, A. (1990). Stress, intrusive imaginary, and chronic distress. *Health Psychology, 9*, 653–675.

Brief, A. P., & Atieh, J. M. (1987). Studying job stress: are we making mountains out of molehills? *Journal of Occupational Behavior, 8*, 115–126.

Campbell, D. J. (1984). The effects of goal-contingent payment on the performance of a complex task. *Personnel Psychology, 37*, 23–40.

Crowe, E., & Higgins, T. (1997). Regulatory focus and strategic inclinations. *Journal of Applied Psychology, 69*(2), 117–132.

Croyle, R. T. (1992). Appraisal of health threats: cognition, motivation and social comparison. *Cognitive Therapy and Research, 16*, 165–182.

Dewe, P. J. (1989). Examining the nature of work stress: individuals under stressful experiences and copying. *Human Relations, 42*, 993–1013.

Dewe, P. J. (1992). Applying the concept of appraisal to work stresses: some exploratory analysis. *Human Relations, 45*(2), 143–163.

Dweck, C. S., & Legget, E. L. (1988). A social cognitive approach to motivation and personality. *Psychological Review, 95*, 256–273.

Earley, P. C. (1985). Influence of information, choice and task complexity upon goal acceptance, performance and personal goals. *Journal of Applied Psychology, 70*, 481–491.

Earley, P. C. (1986). An examination of the mechanisms underlying the relation of feedback to performance. *Academy of management best papers proceedings*, 214–218.

Earley, P. C., Connolly, T., & Eakergen, G. (1989). Goal, strategy development and task performance. *Journal of Applied Psychology, 74*, 24–33.

Earley, P. C., Hanson, L. A., & Lee, C. (1986). Relations of task complexity, task strategies, individual differences and goals to performance. *Academy of Management Best Papers Proceedings*, 184–188.

Earley, P. C., & Perry, B. C. (1987). Work plan availability and performance: an assessment of task strategy priming on subsequent task completion. *Organizational Behavior and Human Decision Processes, 39*, 279–302.

Earley, P. C., Wojnaroski, P., & Prest, W. (1987). Task planning and energy expended: exploration of how goals influence performance. *Journal of Applied Psychology, 72*, 107–114.

Folkman, S., & Lazarus, R. S. (1985). If it changes it must be a process: a study of emotion and copying during three stages of a college examination. *Journal of Personality and Social Psychology, 48*, 150–170.

Folkman, S., Lazarus, R. S., Dunkel-Schetter, C., De Longis, A., & Gruen, R. J. (1986). The dynamics of a stressful encounter: cognitive appraisal, coping and encounter outcomes. *Journal of Personality and Social Psychology, 50*, 992–1003.

George, J. M., Brief, A. P., & Webster, J. (1991). Organizational intended and unintended copying. *Journal of Occupational Psychology, 64*, 193–205.

Gist, M. E., Stevens, C. K., & Bavetta, A. G. (1991). Effects of self efficacy and post training interventions on the acquisition and maintenance of complex interpersonal skills. *Personnel Psychology, 44*, 837–861.

Glowkinkowski, S. P., & Cooper, C. L. (1985). Current issues in organizational stress research. *Bulletin of the British Psychological Society, 38*, 212–216.

Heiyman, G. D., & Dweck, C. S. (1992). Achievement goals and intrinsic motivation: their relation and their role in adaptive motivation. *Motivation and Emotion, 16*(31), 231–247.

Hobfoll, S. E. (1988). *The ecology of stress*. New York: Hemisphere.

Holroyd, K. A., & Lazarus, R. S. (1982). Stress, coping and sometic adaptation. In L. Goldberger, & S. Breznitz (Eds.), *Handbook of stress: theoretical and clinical aspects*. New York: Free press.

Huber, V. L. (1985). Effects of task difficulty, goal setting and strategy on performance of heuristic task. *Journal of Applied Psychology, 70*, 492–504.

Kanfer, R., & Ackerman, P. L. (1989). Motivation and cognitive abilities: an integrative approach to skill acquisition. *Journal of Applied Psychology—Monograph, 74*, 657–690.

Kanfer, R., Ackerman, P. L., Murtha, T. C., Dugdate, B., & Nelson, L. (1994). Goal setting, conditions of practice, and task performance: a resource allocation perspective. *Journal of Applied Psychology, 79*(6), 826–835.

Lazarus, R. (1991). Cognition and motivation in emotion. *American Psychologist, 46*, 352–367.

Lazarus, R. (1999). *Stress and emotion: a new synthesis*. New York: Springer.

Lazarus, R., & Launier, R. (1978). Stress related transactions between person and environment. In L. A. Pervin, & M. Lewis (Eds.), *Perspectives in interactional psychology*. New York: Plenum Press.

Locke, E. A. (1981). Comment on Neider: the issue of interpretation of experiments. *Organizational Behavior and Human Performance, 21*, 425–430.

Locke, E. A., & Latham, P. G. (1990). *A theory of goal setting and task performance*. Englewood Cliffs: Prentice-Hall.

Mueller, C. M., & Dweck, C. S. (1998). Praise for intelligence can undermine children's motivation and performance. *Journal of Personality and Social Psychology, 75*(1), 33–52.

McGrath, J. E. (1970). *Social and psychological factors in stress*. New York: Holt Reinhart and Winston.

Payne, R. L., Jick, T. D., & Burke, R. J. (1982). Wither stress research. An agenda for the 1980's. *Journal of Occupational Behavior, 3*, 131–145.

Sweller, J., & Levine, M. (1982). Effects of goal specifity on means-ends analysis and learning. *Journal of Experimental Psychology, 8*(5), 463–474.

Terborg, J. R. (1976). The motivational components of goal setting. *Journal of Applied Psychology, 63*, 29–39.

Tomaka, J., & Blascovich, J. (1994). Effects of justice beliefs on cognitive appraisals of, and subjective, physiological, and behavioral effects to, potential stress. *Journal of Personality and Social Psychology, 67*, 732–740.

Tomaka, J., Blascovich, J., Kelsey, R. M., & Leitten, C. L. (1993). Subjective, physiological, and behavioral effects of threat and challenge appraisals. *Journal of Personality and Social Psychology, 65*, 248–260.

Tomaka, J., Blascovich, J., Kibler, J., & Ernst, J. M. (1997). Cognitive and physiological antecedents of threat and challenge appraisal. *Journal of Personality and Social Psychology, 73*(1), 63–72.

Tomaka, J., Palacois, R. L., & Lovegrove, A. (1995). Manipulation of threat and challenge responses. *Psychophysiology, 32*, S76.

Wood, R. E., & Bandura, A. (1989). Social cognitive theory of organizational management. *Academy of Management Review, 14*(3), 361–384.

Wood, R. E., & Locke, E. A. (1990). Goal setting and strategy effects on complex tasks. In B. Staw, & L. Cummings (Eds.), *Research in Organizational Behavior* (12). Greenwich, CT: JAI Press.

Wood, R. E., Mento, A. J., & Locke, E. A. (1987). Task complexity as a moderator of goal effects: a meta analysis. *Journal of Applied Psychology, 72*, 416–425.

Received 28 September 2000