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Decision Making Under Stress: Scanning of Alternatives Under Controllable and Uncontrollable Threats

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This study tested the proposition that deficient decision making under stress is due, to a significant extent, to the individual's failure to fulfill adequately an elementary requirement of the decision-making process, that is, the systematic consideration of all relevant alternatives. One hundred one undergraduate students (59 women and 42 men), aged 20–40, served as subjects in this experiment. They were requested to solve decision problems, using an interactive computer paradigm, while being exposed to controllable stress, uncontrollable stress, or no stress at all. There was no time constraint for the performance of the task. The controllability of the stressor was found to have no effect on the participants' performance. However, those who were exposed to either controllable or uncontrollable stress showed a significantly stronger tendency to offer solutions before all available alternatives had been considered and to scan their alternatives in a nonsystematic fashion than did participants who were not exposed to stress. In addition, patterns of alternative scanning were found to be correlated with the correctness of solutions to decision problems.

The analysis of historical evidence (Holsti, 1972; Levi & Tetlock, 1980), behavior observations (Janis, 1982; Kasl & Cobb, 1966), and experimental data (Broadbent, 1971; Sieber, 1974) suggests that psychological stress exceeding a certain intensity affects the quality of decision making. Holsti's (1972) analysis of documents from European heads of state during the pre-World-War-I crisis revealed, for example, that some of their crucial decisions had been based on a narrow time perspective and on the weighing of immediate dangers rather than the long-range consequences of alternative courses of action. Similarly, heart attack victims frequently tend to delay the call for help unnecessarily, thereby enhancing the risk of fatal consequences (Hackett & Cassem, 1975). These and many other examples suggest that individuals under stress often fail to adhere to rational-choice models that assume that decisions are based on the weighing of the utilities and probabilities associated with all available courses of action (e.g., Miller & Star, 1967; Raiffa, 1968).

Janis and Mann (1977) developed a model of decision making under stress that posits that only a coping pattern of vigilance allows for sound and rational decision making. Vigilance is apparent when "the decisionmaker searches painstakingly for relevant information, assimilates information in an unbiased manner and appraises alternatives carefully before making a choice" (Janis, 1982, p. 73). However, under severe stress, vigilance might be replaced by hypervigilance, which engenders a hasty, disorganized, and incomplete evaluation of information leading to faulty decisions and postdecisional regret (Janis, 1982; Janis, Defares, & Grossman, 1982).

In this study I evaluated the effects of stress on a critical phase of the decision-making process: the scanning and consideration of relevant decision alternatives. Although systematic and well-grounded empirical evidence is lacking, the literature points to three apparently independent ways in which a decision maker's consideration of alternatives might be faulty.

1. *Premature closure.* A decision is reached before all available alternatives have been considered. Theoretical work on cue use, the foundations of which were laid by Easterbrook (1959), and research on the narrowing of attention (Bacon, 1974; Baddeley, 1972; Hockey, 1970; Kahneman, 1973; Weltman, Smith, & Egstrom 1971) suggest that stress narrows the span of perceptual attention. This finding was generalized by several authors (e.g., Janis, 1982) to the cognitive process of alternative scanning involved in decision making. Several experimental studies indicate that the harassed decison maker has trouble assimilating all of the information available to him or her and thus focuses on a limited number of data dimensions (Sieber, 1974; Wright, 1974; Wright & Weitz, 1977).

2. *Nonsystematic scanning.* Alternatives are considered and scanned in a nonsystematic, disorganized fashion. Janis (1982) has suggested that the stressed decision maker, "in a paniclike state, searches frantically for a way out of the dilemma, and rapidly shifts back and forth between alternatives" (p. 72). Wachtel (1967) states that the scanning of stimuli by anxious individuals appears scattered and poorly organized.

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3. *Temporal narrowing.* Insufficient time is devoted to the consideration of each alternative. Janis (1982) argued that the decision maker under stress "impulsively seizes upon a hastily contrived solution that seems to promise immediate relief" (p. 72). Fritz and Marks (1954) reported that individuals threatened by a tornado failed to use all the time available to them efficiently and tended instead to react with great alacrity in poorly planned ways.

The attribution of poor decision making to a deficient scanning of alternatives seems quite convincing, yet much of the evidence supporting this contention is questionable. For one thing, it is largely inferential as it relates mostly to decisional outcomes. However, one cannot with certainty deduce from a poor decision outcome that the decision-making dynamics or process must have been faulty, that is, that not all relevant alternatives were properly considered. For example, a decision maker could conceivably weigh all alternatives carefully and still reach a disastrous decision simply because some relevant data were unavailable to him or her. Hence, propositions concerning the effects of stress on the consideration of decision alternatives should be evaluated via direct observation rather than through inference.

An additional difficulty with the interpretation of the evidence referred to derives from the fact that it usually involves situations where decisions had to be made under time pressure. This may indeed be a significant stressor (Janis & Mann, 1977; Kelley, Condry, Dahlke, & Hill, 1965; Wright & Weitz, 1977). Janis and Mann (1977), for instance, maintained that time pressure is one of the primary causes of the hypervigilance that engenders impulsive, disorganized decision making. Yet, although the effects of time pressure on premature closure, nonsystematic scanning, or temporal narrowing may be interpreted as manifestations of psychological stress, this interpretation is potentially confounded by the simple, almost trivial, possibility that a complete, systematic scanning of all available alternatives, and the investment of sufficient time in the evaluation of each, might be physically impossible when time is severely limited. I submit, then, that the evidence on the effects of stress on decision makers' consideration and scanning of alternatives is inconclusive.

The purpose of this study is to further the understanding of the relation between stress and decision making by examining, through direct observation rather than inference, the manner in which stressed and unstressed individuals consider and scan decision alternatives. The stressor in this study did not involve time pressure. The intent, in other words, was to avoid this potential confounding and to assess the net effects of stress.

The use of a stressor other than time pressure (e.g., a physical threat) gives rise to the interesting possibility that under certain conditions the presence of the stressor will not necessarily impair the quality of decision making. It stands to reason that if an individual faces a controllable stressor, that is, one that can be removed or attenuated by making the right decision, he or she will be strongly motivated to scan and weigh all alternatives carefully. This implies that the detrimental effect of stress on premature closure, nonsystematic scanning, and temporal narrowing is more likely to be found when stressors are uncontrollable than when they are controllable. Further support for this proposition may be derived from findings showing that in many cases controllable stressors are less stress inducing than uncontrollable ones (Folkman, 1984; Glass & Singer, 1972; Thompson, 1981).

With these considerations in mind, three hypotheses were formulated for the present study:

1. Stress will heighten the incidence of premature closure, nonsystematic scanning, and temporal narrowing.
2. These three indices of quality of alternative scanning will be related to the quality of decision outcomes.
3. When an individual can control the source of the threat, the detrimental effect of the stress on the process of alternative scanning will be less than if no such control is possible.

Method

Subjects

One hundred one undergraduates (42 men, 59 women) from the University of Haifa took part in the study. Subjects' ages ranged from 20 to 40, with the mean age being 25. Psychology students, who are generally familiar with experimental deceptions, were excluded from the sample.

Instruments

Computerized analogies test. A multiple-choice analogies test was used to examine the subjects' process of alternative consideration. The test consisted of 15 questions, for each of which one of six alternative answers was correct (e.g., "Butter is to margarine as sugar is to . . . beets, saccharine, honey, lemon, candy, chocolate"). Each item was presented individually on a computer monitor. By pressing one of the keys from *1* to *6* on the computer keyboard, the subject could choose which of the alternative answers would be displayed on the monitor. Only one answer could be displayed at a time. However, the subject was able to view the separate answers as many times as he or she wished in the sequence of his or her choice.

The subjects' choice of an answer to a question was signaled by displaying that answer on the monitor and pressing the ENTER key. A new question was then displayed. The entire process, including the sequence used by the subject in displaying alternative answers, display time for each alternative, and the answers chosen, was recorded on a computer disk.

Manipulation-check questionnaires. In order to ascertain that the stress manipulation (a threat of electric shock) was effective, the State Anxiety Inventory developed by Spielberger, Gorsuch, and Lushene (1970) was administered. This questionnaire, which was translated and adapted for Hebrew speakers by Teichman and Melineck (1978), consists of 20 items that reflect the level of the subject's anxiety while answering the questions. The subject is asked to indicate on a scale of 1 to 4 the extent to which he or she is experiencing at the moment each of the sensations that appear on the questionnaire, from 1 = *not at all* to 4 = *very much.* According to Borus (1978), this is the psychological test most often used to measure anxiety.

In addition, each subject was asked to answer the question "How much stress have you felt thus far?" on a scale of 1 to 7, from 1 = *to a very minor extent* to 7 = *to a very great extent.*

In order to examine whether the manipulation of control was indeed effective, each of the subjects threatened with electric shock was asked to answer the following questions: (a) To what extent did you believe that you could control the electric shocks? (b) To what extent do you attribute the fact that you have not yet received any electric shocks to luck or fate? (c) To what extent do you attribute the fact that you have not yet received any electric shocks to your success in performing the task?

Here, too, the answers were to be marked on a scale of 1 to 7, with 1 = *to a very minor extent* and 7 = *to a very great extent.*

Procedure

The subjects were randomly assigned to one of the following three conditions.

Uncontrollable-stress condition. On arrival at the laboratory, the subject was asked to sit at a computer terminal and was presented with instructions for the experiment. These tape-recorded instructions informed the subject that the experiment dealt with problem solving under various conditions and that in the course of the experiment he or she would be asked to answer 50 questions. In addition, the subject was told that while carrying out the task, harmless but painful electric shocks might be administered.

At this point the experimenter asked the subject whether he or she was willing to continue with the experiment. After securing consent, the experimenter asked the subject to fill out a brief medical questionnaire. He then attached two electrodes, which were connected to a Grass SD 9 electric stimulator, to the subject's nondominant hand and informed the subject that the shocks would be administered randomly, independent of the subject's quality of performance. In other words, the threat was presented as uncontrollable. It was also made clear that the shocks could be delivered either at the beginning, the middle, or the end of the task.

The experimenter then directed the subject's attention to the computer monitor on which instructions for the multiple-choice analogies test were displayed. In addition to the explanation of the task, these instructions emphasized that alternative answers to each question could be scanned in any order as many times as the subject desired. No clue was given to the number of times the alternatives should be scanned. Time for the performance of the task was presented as unlimited, and speed was not to be considered a criterion of success. The latter information was repeated twice.

To ascertain that the instructions were properly understood, the experimenter asked the subject to answer two practice questions. After the subject had answered the second of these, the experimenter surreptitiously activated a pedal that had been placed under one of the tables in the laboratory. This pedal operated a light and a buzzer, and as a result the room was lit up brightly and a sharp, strident ringing was heard. The experimenter then explained that the light and noise represented an electric shock and that they had been produced to demonstrate the experimental procedure. He made it clear that this was a demonstration of the arbitrary manner in which the shock would be administered, independent of the subject's performance quality. It was explained that the computer had been programmed with the number and timing of the shocks in such a way that the subject had no control over them whatsoever. At this point the experimenter again stressed that there was no time limit to the performance of the task.

Following the instruction and sample questions, the experimenter turned off the lights in the room except for the one illuminating the computer terminal. He then picked up a remote-control switch connected to the electric stimulator and instructed the subject to commence the test.

Controllable-stress condition. The procedure used in this condition was identical to that in the uncontrollable-stress condition, with only one difference: Receiving shocks was presented to the subject as contingent on his or her performance. In other words, high-quality task performances could prevent the shocks. To underline this point, the experimenter informed the subject when he operated the light and buzzer that these represented the electric shock and that they had been set off because the subject had answered one of the sample questions incorrectly.

No-stress condition. Subjects in this condition performed the multiple-choice analogies test without being exposed to the stress manipulation: Shocks were not mentioned, the subjects were not requested to fill out a medical questionnaire, and the electric stimulator was not in sight. In every other respect, the procedure was identical to that used in the two stress conditions.

After the subjects had answered the 15 items on the analogies test, the experimenter stopped him or her and announced a short break in the test. He asked the subject to complete the manipulation-check questionnaires. When the subject had completed the questionnaires, he or she was informed that the experiment was over and was fully debriefed.

Because in effect no shocks were administered, it was possible that the credibility of the shock would diminish as the subject progressed with the task without receiving any. The aim of two of the steps mentioned previously was to overcome this problem. First, the subjects were told that the task would consist of 50 questions, whereas in fact they answered only 15, and second, they were told that the shock might be administered at the beginning, the middle, or the end of the task, so that a subject who did not receive a shock at the beginning of the test could assume that the threat might still be carried out at some later time.

Dependent Measures

Each subject received four scores. The first measured premature closure, or the number of questions the subject answered before he or she had scanned all six alternative answers. The second measured nonsystematic scanning, the number of departures from a systematic scanning pattern. The alternative answers were numbered from 1 to 6, and any deviation from a forward or backward scanning pattern received a score of 1. For example, the pattern 1, 2, 3, 4, 5, 6, 5, 4, 3, 2, 1 or 6, 5, 4, 3, 2, 1, 2, 3, 4, 5, 6 received the score of 0. On the other hand, the pattern 1, 4, 3, 2, 5, 6, 3, 4, 5, 6 received the score of 3, as it contains three deviations from a serial sequence: after the first, fourth, and sixth alternatives. The only exception to this scoring rule was made when a deviation from seriality resulted from the repetition of a serial sequence. For example, the jump from 6 to 1 was not scored in the pattern 1, 2, 3, 4, 5, 6, 1, 2, 3, 4, 5, 6. The third score, for temporal narrowing, measured the average display time in seconds for each alternative answer for each subject, taking into consideration all the alternatives he or she displayed for all 15 questions. Quality of performance, the fourth score, measured the number of correct answers to the 15 questions.

Results

First, the effectiveness of the stress manipulation was examined. To this end, we compared the means of the answers given by the subjects in the different groups to the question "How much stress have you felt thus far?" The results indicated a significant difference between the groups in the level of reported stress, $F(2, 97) = 36.31$, $p < .0001$. Tukey's test revealed that the mean stress score for the control group ($M = 1.85$) was significantly lower than the average score for the controllable-stress group ($M = 5.40$) and the uncontrollable-stress group ($M = 5.05$). There was no significant difference between the scores of the two latter groups.

Similar findings were produced by a comparison of the scores of the different groups on the State Anxiety Inventory. The results indicated a significant difference between the three groups in the study, $F(2, 97) = 28.10$, $p < .0001$. A more specific examination of the source of the difference revealed that the mean anxiety score of the control group ($M = 29.45$) was significantly lower than that of the controllable-stress group ($M = 45.37$) and of the uncontrollable-stress group ($M = 46.50$). However, there was no significant difference between the latter two groups.

Table 1
Scanning and Quality-of-Performance Scores in the Three Experimental Conditions

Variable	Uncontrollable stress	Controllable stress	No stress	$F(2, 98)$	p
Premature closure					
M	5.21	4.36	1.29	10.13	.0001
SD	4.67	4.13	2.24		
Nonsystematic scanning					
M	8.30	8.64	3.20	7.85	.0007
SD	6.69	7.92	3.97		
Temporal narrowing					
M	3.03	3.32	3.12	0.52	.59
SD	1.13	1.32	1.18		
Quality of performance					
M	4.85	6.06	8.91	12.56	.0001
SD	2.60	3.80	3.78		

Second, the extent to which the control manipulation induced a subjective feeling of control was examined. To this end the mean scores of the subjects in the two groups threatened with electric shock were compared in regard to the question "To what extent did you believe that you could control the electric shocks?" The subjects in the controllable-stress group did in fact have a greater belief that they could control the shocks than did the subjects in the uncontrollable-stress group, $F(1, 64) = 26.24$, $p < .0001$. More specifically, the mean score of the controllable-stress group was found to be 5.13, whereas the mean score of the uncontrollable-stress group was 2.45.

Similar findings were produced by the two groups in regard to the questions "To what extent do you attribute the fact that you have not yet received any electric shocks to luck or fate?" and "To what extent do you attribute the fact that you have not yet received any electric shocks to your success in performing the task?" Compared with the uncontrollable-stress group, the subjects in the controllable-stress group attributed the absence of electric shocks significantly more to their own ability to perform the task, $F(1, 64) = 40.30$, $p < .0001$, and less to luck or fate, $F(1, 64) = 28.53$, $p < .0001$. These results show, then, that the manipulations used in this study were indeed effective.

Table 1 presents the mean scores on premature closure, nonsystematic scanning, temporal narrowing, and quality of performance of each of the three groups.

A multivariate analysis of variance (MANOVA) on the four variables yielded (using Wilks's criterion) a significant effect, $F(8, 190) = 5.14$, $p < .0001$.

In order to examine the hypotheses of the study more specifically, four univariate ANOVAs were conducted for the three groups, one on each of the dependent variables. Significant differences in the mean scores of the different groups were found for three of the four dependent variables: premature closure, $F(2, 98) = 10.13$, $p < .0001$; nonsystematic scanning, $F(2, 98) = 7.85$, $p < .0001$; and quality of performance, $F(2, 98) = 12.56$, $p < .0001$.

No significant differences between the mean scores of the three groups were found for the temporal-narrowing variable, $F(2, 98) < 1$. Tukey tests conducted on the data revealed that the mean scores of the two groups under stress were higher for the premature closure and nonsystematic scanning variables, and lower for the quality of performance variable, than were the scores of the no-stress control group. However, no significant difference was found on these variables between the controllable- and uncontrollable-stress groups. In other words, the controllability of the stressor had no effect on any of the dependent variables.

Additional analyses carried out on the data revealed that the correlations between quality of performance on the one hand and nonsystematic scanning, premature closure, and temporal narrowing on the other were −0.49, −0.34, and 0.16, respectively. The first two correlations are significant and the third is not.

Further insight into the relation between patterns of scanning and the quality of performance may be gained from a detailed examination of the premature closure variable. Overall, there were 261 instances of premature closure, 80% of which occurred under the two stress conditions. Of the answers that followed premature closure, 67% were erroneous. By comparison, only 51% of those given after a complete scanning of alternatives were incorrect ($\chi^2 = 19.36$, $p < .001$). Interestingly, in 72% of the 175 instances in which incorrect answers followed premature closure, the answers were given without the correct alternative having been displayed.

Discussion

Examination of the first hypothesis revealed that there was a greater incidence of premature closure and nonsystematic scanning among the subjects in the two groups threatened with electric shock than in the control group. In earlier studies investigating the effect of stress on decision making, because time pressure was involved (e.g., Kelley et al., 1965), it could not be determined conclusively whether deficient scanning was a direct result of the psychological stress or whether the time constraints simply rendered thorough and systematic scanning impossible. In this study, subjects were asked to perform a task under a stressor that did not involve time pressure. The findings thus clearly indicate that psychological stress, in and of itself, has a significant effect on the manner in which the decision makers scan the alternatives available to them.

One possible explanation for this derives from the proposition that the threatened organism devotes part of its conscious attentional capacity to the threat and to the autonomous reactions elicited by it and is therefore left with insufficient capacity to cope efficiently with the task at hand (e.g., Mandler, 1982). The incomplete consideration of alternatives could thus be interpreted as the result of a temporarily narrowed attentional capacity or as a defense mechanism designed to prevent an information overload. Alternately, disorganized and incomplete scanning of alternatives might result from the basic motivation to terminate or escape from a generally aversive situation as quickly as possible.

Contrary to expectations, the stress/no-stress manipulation had no effect whatsoever on temporal narrowing. I attribute this finding to a floor effect. That is, the alternatives that the

subjects had to consider consisted of single words. Accordingly, display times were extremely brief: on the average, 3.12 s in the no-stress condition and 3.17 s in the two stress conditions. Hence, there was little room for any temporal narrowing to take place. This suggests, therefore, that temporal narrowing should be tested with problems whose alternative solutions require lengthier consideration.

The second hypothesis was confirmed in part. Two of the three scanning measures were found to be significantly correlated with the quality of the individual's decision making. Furthermore, in many instances subjects in the stress conditions chose an answer before they had even seen the correct alternative. Here too it would seem that relatively low correlation between temporal narrowing and quality of performance can be attributed to the floor effect. The standard deviations of this scanning measure proved to be relatively low for all three groups and thus did not allow for high correlations.

The third hypothesis was not empirically confirmed. Contrary to expectations, no significant differences were found between the mean scores on the scanning measures for the group in the controllable-stress condition and that in the uncontrollable-stress condition. Moreover, no significant differences were found between the two groups in regard to the level of stress experienced by the subjects while exposed to threatening stimuli.

Much of the literature suggests, as previously mentioned, that controllable stressors engender less stress than do uncontrollable ones. However, recent evidence (Folkman, 1984; Thompson, 1981) raises the possibility that, under certain circumstances, not only does control not alleviate stress but it might actually enhance it. Particularly pertinent in this context is the proposition that for control to reduce stress, the individual's belief that the stressor is controllable is insufficient. The individual additionally must be motivated to exercise control (cf. Houston, 1972; Mills & Krantz, 1979) and believe that he or she possesses the ability or skills needed to apply it (cf. Friedland & Keinan, 1982).

In my study, subjects were asked to solve logical analogies on a computer terminal. For most of them this might have been a novel task. Thus, the finding that subjects in the controllable-stress condition did not perform any better than their counterparts in uncontrollable-stress condition may be due to a lack of confidence in their ability to master the task.

In summary, these findings shed light on the relation between stress on the one hand and decision and choice behavior on the other. These findings strongly suggest that the detrimental effects of stress on decision making are mediated, at least in part, by the impairment of alternative scanning patterns. Most important, such impairment may be expected to occur even when time constraints, which often characterize decision-making situations, are relaxed or removed altogether.

Further research is needed to clarify the role of control. I have speculated that the novelty of the task may have weakened the impact of the control afforded subjects in the controllable-stress condition. If this is so, then familiarity with the decision problem that an individual is expected to solve might improve his or her scanning of alternatives and thereby lead to better solutions. This seemingly trivial proposition cannot be accepted at face value, however. Decision makers typically operate in dynamic environments in which the value and relevance of information are constantly changing. Thus, confidence bred of familiarity, which often entails an unreserved belief in tried and true solutions, might enhance rather than decrease the likelihood of such phenomena as premature closure.

The preceding proposition implies that the seemingly obvious suggestion that decision making may be improved by advance training ought to be carefully evaluated. Training is undeniably important, yet it could prove to be a mixed blessing. I therefore propose that the investigation of decison-making improvement via training should be supplemented by the design of decision procedures and aids that would compel the decision maker to scan and weigh his or her alternatives fully and systematically. Thus, research on issues such as formats and mechanisms of data presentation could prove to be a rich source of practical remedies for decision-making deficiencies.

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