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RESEARCH REPORT

Vigilant and Hypervigilant Decision Making

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Recent studies have argued that deficient decision making under stress is due to adoption of a hypervigilant style of decision making, which has been characterized as disorganized and inefficient. However, under the conditions that characterize many real-world or naturalistic tasks, a hypervigilant pattern of decision making may be adaptive, because the decision maker does not have the luxury of implementing a more elaborate analytic procedure. This study examined the effectiveness of vigilant and hypervigilant decision-making strategies on a naturalistic task. Results indicated that participants who used a hypervigilant decision-making strategy performed better than those who used a vigilant strategy. Implications for decision making in naturalistic environments are discussed.

Janis and Mann (1977) presented a model of decision making in which they distinguished between vigilant and hypervigilant decision-making patterns. The vigilant decision-making process is characterized by (a) a systematic, organized information search, (b) thorough consideration of all available alternatives, (c) devotion of sufficient time to evaluate each alternative, and (d) the reexamination and review of data before making a decision. Vigilant decision making is described as an ideal pattern of decision making in which the decision maker "searches painstakingly for relevant information, assimilates information in an unbiased manner, and appraises alternatives carefully before making a choice" (Janis, 1982, p.73). This vigilant, analytic pattern of decision making, they concluded, generally results in high-quality decisions.

However, certain conditions such as sudden, unexpected threat or time pressure may give rise to a hypervigilant pattern of behavior. In contrast to vigilant decision making, a hypervigilant pattern of decision making is characterized by (a) a nonsystematic or selective information search, (b) consideration of limited alternatives, (c) rapid evaluation of data, and (d) selection of a solution without extensive review or reappraisal. According to Janis and Mann (1977), hypervigilant decision making represents an impulsive, disorganized pattern of decision making: The hypervigilant decision maker's "thought processes are disrupted . . . his thinking becomes more simplistic. He is likely to search frantically for a solution, persevere in his thinking about a limited number of alternatives, and then latch onto a hastily contrived solution" (p. 51). Thus, hypervigilance is viewed as a "defective coping pattern" in which "the decision maker will fail to carry out adequately the cognitive tasks that are essential for arriving at stable decisions" (Janis, 1982; p. 73).

In the original Janis and Mann formulation, a hypervigilant pattern of decision behavior was acknowledged to be occasionally adaptive in saving time and effort. Nevertheless, hypervigilance was clearly presented as a deviation from the ideal pattern of decision making that generally resulted in defective decisions. The intellectual legacy of this position is the assumption that effective decision making requires a laborious and comprehensive computational process of option generation and evaluation to reach a decision, and that "only a coping pattern of vigilance allows for sound and rational decision making (Keinan, 1987, p. 639). Recent research by Baradell and Klein (1993) and Keinan (1987) supports this perspective, demonstrating that a hypervigilant pattern of decision making resulted in poor performance on a laboratory analogies task. However, other researchers such as Klein (1996)

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and Payne, Bettman, and Johnson (1988) have argued that, under certain conditions, decision makers can make effective decisions without carrying out an elaborate and exhaustive analytic procedure. Moreover, a hypervigilant type of decision-making strategy may be adaptive in more realistic, or *naturalistic,* decision-making environments in which decisions are made under time pressure, data are ambiguous or conflicting, and decision makers are familiar with the task. In brief, whereas some have viewed hypervigilant decision making as evidence of a general breakdown in performance, others view hypervigilant decision making as an adaptive response to naturalistic task demands. The purpose of this study is to examine the effectiveness of hypervigilant and vigilant decision-making strategies on a naturalistic task.

Vigilant and Hypervigilant Decision Making

Several recent studies have attempted to test the Janis and Mann (1977) model by examining the impact of hypervigilance on decision-making performance. Baradell and Klein (1993) and Keinan (1987) found that stress tended to increase the use of hypervigilant decision making, which resulted in increased task errors. However, these empirical results were based on what, from an applied perspective, was a quite unique task. Participants in both studies were required to solve a series of logical analogies presented on a computer terminal. The task required the participant to select the best answer from six alternatives to an analogy such as "butter is to margarine as sugar is to (a) beets, (b) saccharin, (c) honey, (d) lemon, (e) candy, (f) chocolate." Those who scanned alternatives in a nonsystematic manner and reached a decision before viewing all alternatives made poorer quality decisions. Thus, Keinan (1987) concluded that a hypervigilant pattern of decision making resulted in deficient decisions. On the basis of these results, Keinan proposed the examination of interventions to enhance decision making that would "compel the decision maker to scan and weigh his or her alternatives fully and systematically" (p. 643).

However, we note that many real-world decision making settings of interest differ quite considerably from the laboratory task operationalized in the Baradell and Klein (1993) and Keinan (1987) studies. In a typical laboratory decision-making task (i.e., purchasing a refrigerator, buying a car, solving anagrams), decision makers perform at their own pace, data on choice options are unambiguous, the penalty for poor performance is modest, and decision makers are naive participants working on a task with which they have little familiarity. By contrast, naturalistic tasks share several key characteristics prevalent in many real-world decision environments: They typically involve time pressure, the information available is often conflicting or ambiguous, the consequences of error or poor performance are costly, and the task is one with which the decision makers have at least some familiarity (see Kaempf, Klein, Thordsen, & Wolf, 1996; Zsambok & Klein, 1996).

Moreover, some evidence suggests that in a more naturalistic task environment, decision makers may adopt a simpler analytic strategy more appropriate to these conditions (Beach & Mitchell, 1978; Payne, Bettman, & Johnson, 1988; Zakay & Wooler, 1984). Payne et al. (1988) have emphasized the contingent nature of decision making, arguing that under certain task conditions such as increased time pressure, adopting a less analytic decision-making strategy may be adaptive. Furthermore, the typical characteristics of hypervigilant decision making, including the narrowing of attention, filtering of information, the use of heuristics to speed information processing, and rapid closure, may represent an efficacious response to naturalistic task demands. In a study examining how decision makers adapt to time constraints, Payne et al. found that time pressure led to the use of simpler, less analytic decision-making strategies, and that this type of decision making resulted in a better outcome than the use of a truncated normative procedure. In brief, Payne et al. found that decision makers were able to adapt to time pressure by selectively filtering information, using simpler heuristics, and accelerating information processing to reach a timely decision.

Klein and his colleagues have examined decision making in real-world operational environments, such as in the command center of naval ships (Kaempf et al., 1996), in airline crews (Orasanu, 1993), and among firefighters (Klein, 1989). Klein (1996) argued that increased time pressure may prevent the use of analytic decision strategies but that this is little cause for concern because analytic strategies are rarely used in naturalistic settings. In a naturalistic environment, Klein noted that it makes little sense to adopt a time-consuming analytic strategy when time is severely limited, to painstakingly review all available information when experience can suggest what information is relevant, and to evaluate comparable data across all options when incomplete or ambiguous data make it difficult to compare options. Under these conditions, it may not be practical to generate a large option set and successively refine alternative courses of action to select an optimum outcome. In fact, Klein observed that decision makers in naturalistic settings often use their experience to identify meaningful data and generate reasonable options, use simplifying heuristics to select a course of action, and then implement the first workable solution. Within this context, what has been termed hypervigilant decision making—the consideration of limited alternatives, nonsystematic information search, accelerated evaluation of data, and rapid closure—may not represent "a defect in the decision making process" (Janis & Mann, 1977, p. 11) but an adaptive and effective response given the nature of the decision-making task. On the basis of this approach, we formulated the following hypothesis.

> *Hypothesis 1:* On a naturalistic task, the use of a hypervigilant decision-making strategy will lead to more effective decision making than the use of a vigilant strategy.

In the Janis and Mann (1977) model, hypervigilance is viewed as a defective coping pattern that interrupts the cognitive tasks required for successful performance. Janis and Mann defined hypervigilance in terms of disorganized mental activity, noting that "memory span is reduced and thinking becomes more simplistic" (p. 51) and "a marked lowering of cognitive efficiency in cognitive functioning" (p. 61). Thus, hypervigilance is seen as a response to external demands that results in cognitive inefficiency and disorganization. This view suggests that those using a hypervigilant strategy would report less cognitive demand or mental effort than those using the more organized vigilant pattern.

On the other hand, Payne et al. (1988) argued that the adaptive strategy selection that occurs in demanding situations is the result of the decision maker's attempt to maintain effective performance and to moderate effort. According to this perspective, the use of a less analytic hypervigilant strategy would allow the decision maker to perform better on a naturalistic task, as well as maintain a reasonable level of workload. It is unlikely that the use of a hypervigilant strategy will result in a decrease in workload, because on a complex and demanding task, any residual processing capacity freed up by the use of a simpler decision-making strategy will be devoted to the task (which should be reflected in enhanced performance). Again, these positions represent two contrasting perspectives: One argues that hypervigilant behavior represents cognitive inefficiency and disruption of mental effort, and the other views hypervigilant behavior as an attempt to maintain an effective level of effort in the face of increased task demands.[1] Consistent with this latter view, we expect workload for those using a hypervigilant strategy to be maintained at a level equivalent to that of a vigilant strategy. Thus, we formulated the following hypothesis.

> *Hypothesis 2:* There should be no difference in overall workload between vigilant and hypervigilant decision making.

Finally, we wanted to investigate the effects of vigilant and hypervigilant decision making under high-stress conditions. We have argued that hypervigilant decision making represents an adaptive and effective response to the task demands inherent in a naturalistic task environment. Therefore, as task demands further increase, we expected a hypervigilant pattern of decision making to be resistant to decay, and we expected a vigilant decision strategy to become less effective. Stress has been shown to lead to a number of undesirable consequences, including a restriction or narrowing of attention, increased distraction, increases in reaction time, and deficits in working memory (Driskell & Salas, 1996). A hypervigilant decision-making strategy may be less vulnerable to stress effects because it is less demanding, whereas a more analytic decision-making strategy coupled with the increased demands of a high-stress environment may exceed the processing capabilities of the decision maker. Thus, we proposed the following hypothesis.

> *Hypothesis 3:* Increased task stress is less likely to degrade decision-making performance for those using a hypervigilant strategy than for those using a vigilant strategy.

Method

Participants

Participants in this study were 90 U.S. Navy enlisted personnel assigned to a technical training school who volunteered to take part in a study on decision making. Assuming that some were undoubtedly "volunteered" by their commanding officer, each person was given the opportunity to give their consent to participate, privately, before the study.

Design

The study was a 2 (Decision Strategy: hypervigilant vs. vigilant) × 2 (Stress: high stress vs. normal stress) experimental design. Participants performed a computer-based simulation of a naval command and control task. They were trained to use either a hypervigilant or vigilant decision-making strategy and performed under either high- or normal-stress conditions.

Decision Task

The experimental task was a computer simulation of a real-world navy task. The participant's job was to monitor a radar screen that contained their own ship at the center and contained numerous unidentified contacts or threats that popped up at concentric rings away from the ship. The participants were instructed to identify and label each contact according to three classifications: the type of craft (aircraft, surface craft, or sub-

[1] An alternative perspective on hypervigilance is that those in a hypervigilant state may report *greater* cognitive activity and mental effort because they are totally and frantically consumed by the task. Note that, in both interpretations, hypervigilance is viewed as a dysfunctional pattern of behavior in which cognitive demand and effort are either weakened or cognitive demand and effort are heightened. Furthermore, both perspectives are distinct from the hypothesis proposed—that those using a hypervigilant strategy will maintain a level of workload equivalent to that of a vigilant strategy.

surface), its status (civilian or military), and the intentions of the craft (hostile or peaceful). To make each classification, the participant had to access three information fields or menus: A, B, and C, corresponding to these headings. The first information field, Menu A, contained five items that provided information regarding the type of craft. For example, the participant could access the "current speed" item to obtain the contact's speed, or "climb rate" to determine whether the craft was climbing or diving. Only one item could be opened at a time by selecting that item with the computer trackball. After viewing the separate items, the participant could select a "check data" option to review on a single screen all of the items of information that had previously been accessed. Then, the participant would make a determination of the type of craft by labeling it as an aircraft, surface craft, or subsurface craft before proceeding on to Menus B and C. Menu B contained five items relating to the civilian or military status of the craft, and Menu C contained five items relating to the hostile or peaceful intentions of the craft. Once the contact had been labeled as to the type of craft, its status, and its intentions, the contact would then be cleared from the screen if it was determined not to be a threat or engaged if it was determined to be hostile. Participants were told to work as quickly and as accurately as they could to identify and engage or clear each contact before it reached their ship.

There are two characteristics of this task that are noteworthy. First, the task was designed to incorporate the characteristics of a naturalistic task: Decision makers are under time pressure, the information available is conflicting or ambiguous, the consequences of error or poor performance are costly, and decision makers have some familiarity with the task. Accordingly, in this simulation, the decision maker was faced with multiple threats that had to be processed quickly to protect the ship. Furthermore, the data available in the information fields were ambiguous; that is, the information provided by one item (i.e., current speed indicating an aircraft) may conflict with another (climb rate indicating a subsurface craft), reflecting the uncertainty inherent in the real-world setting. Finally, the naval personnel who served as research participants had some familiarity with the nature of the task, and it was a task that was meaningful for them (it was related to their work environment). Therefore, although the task was a simulation, the participants were psychologically engaged in the performance of the task and understood the real-world consequences for failure.

Second, the information fields for each contact were generated randomly; thus, each contact could potentially be any one of 3 (Types of Craft) × 2 (Status) × 2 (Intent) combinations. Some combinations (i.e., a civilian airplane showing hostile intent) would be unlikely to exist in the real world. However, it would not be unlikely for an operator to get such a reading in the real world (the operator in the real-world environment would gather further information to resolve this anomaly). Therefore, in the present task, the participants were told that the three information fields were independent (i.e., knowing that a contact is a submarine would not necessarily lead one to expect it to be military), that the results could conflict (i.e., one could get a correct reading from the menu items of a civilian submarine), and that their task was to identify each contact accurately according to the three information fields on the basis of the relevant information within each field.

Procedure

Study participants arrived at the experimental laboratory and were given detailed instructions on how to perform the decision-making task. During an approximately 30-min training period, task instructions were presented on videotape, after which participants received individualized instruction and practice. Participants completed a pretask questionnaire (containing the manipulation check items described below) and then performed the task. After a 30-min performance period, participants completed a postexperimental questionnaire and received a full explanation of the study.

Manipulations

Stress. Participants performed the task in either a normal- or high-stress environment. To induce high stress, we manipulated three factors: auditory distraction, task load, and time pressure. We implemented multiple stressors rather than a single stressor to provide a more robust manipulation of task stress. Auditory distraction was implemented by playing a multitrack audio recording of task-related chatter over the participants' headphones during the task. The recording contained different and overlapping speakers, similar to actual ship communications. Task load was implemented by increasing the rate at which contacts were presented on the screen. Thus, in the high-stress conditions, participants were presented with a greater number of potentially threatening contacts. Finally, time pressure was induced by the experimenters telling the participants to "hurry up" and "work harder" at 5-min intervals during the task.

Decision-making strategy. Participants were trained to implement either a vigilant or a hypervigilant pattern of decision making according to the criteria identified by Janis and Mann (1977; see also Table 1). All participants received a 30-min training and practice session to instruct them on playing the simulation. For the vigilant conditions, participants were instructed during training to (a) scan all available items in each information field before making a decision or labeling a contact, (b) scan each item in a sequential manner, (c) devote an equal amount of time to each item of information, and (d) review

Table 1
Experimental Operationalization of Vigilant Versus Hypervigilant Decision Making

Vigilant decision-making training	Hypervigilant decision-making training
A. Decision maker thoroughly scans all available information	A. Decision maker scans only that information needed to make an assessment
B. Decision maker scans information in a systematic and sequential manner	B. Decision maker scans information in any sequence
C. Decision maker devotes a consistent amount of attention to each data point	C. Decision maker rapidly attends to selected data points
D. Decision maker reviews all alternatives before making a decision	D. Decision maker reviews needed information only when required

scanned information before making each decision. For the hypervigilant conditions, participants were instructed to (a) scan only the items in each information field that he or she feels are sufficient to make a decision, (b) scan items in any sequence, (c) devote as much or as little time to each item as required, and (d) check or review items before making a decision only when that is felt to be necessary.

Measures

Manipulation checks. To assess the extent to which the vigilant and hypervigilant decision-making training resulted in the required decision-making behaviors, each participant received a score on the following four decision process measures. *Premature closure* represents the extent to which decisions were made without viewing all available alternatives. It was assessed by the number of items per information field not queried before a decision was attempted. *Nonsystematic scanning* represents the extent to which information was viewed in a nonsequential manner. Each information field or menu contained five information items. Scanning these items in the order of 1, 2, 3, 4, 5 received a score of 0. Any deviation from this serial sequence received a score of 1. *Temporal narrowing* was assessed by the total time spent querying information before making a decision. *Review* was assessed by the number of times the review data option was selected before making a decision.

Stress. To examine the effectiveness of the stress manipulation, we administered a seven-item scale adapted from Driskell and Salas (1991) to assess subjective stress. Participants rated the extent to which they felt excited, pressured, tense, nervous, stressed, distracted, and anxious on a 6-point scale on which 1 = *low perceived stress* and 6 = *high perceived stress.* Because these items were found to be highly intercorrelated (Cronbach's $\alpha = .77$), we combined them into a composite measure of subjective stress.

Performance. Performance on the decision-making task was the primary behavioral dependent measure. The task required that each contact be labeled according to the three information fields described earlier: the type of craft, its status, and its intentions. A performance score was calculated as the accuracy of identification (i.e., percentage of information fields correctly identified) multiplied by the number of targets attempted.

Workload. Subjective workload was measured by two items from the National Aeronautics and Space Administration Task Load Index Scale (NASA-TLX; Hart & Staveland, 1988) assessing mental demand and effort. Participants circled a point on 20-point scales reflecting both the mental demand and effort required by the task, and scores were assigned a value ranging from 0 to 100 on the basis of these ratings. The two ratings were averaged to obtain a mean workload score.

Results

Descriptive statistics for all of the measures used in the study are reported in Table 2. Means and standard deviations for each condition are summarized in Table 3. Data were analyzed in a 2 (Task Environment) × 2 (Decision Strategy) analysis of variance (ANOVA; see Table 4).

Manipulation Checks

There was a significant main effect for decision-making strategy on premature closure, nonsystematic scanning, and review, $ps < .01$. Those using a hypervigilant strategy queried fewer information fields before making a decision, deviated more frequently from a fixed sequence in scanning information, and checked or reviewed data less frequently before making a decision than those using a vigilant strategy. There was a marginally significant main effect for decision-making strategy on temporal narrowing, $p = .06$, reflecting the tendency for those using a hypervigilant strategy to spent less time viewing alternatives before making a decision than those using a vigilant strategy. There were no significant main effects of stress on the decision-making process measures nor any significant interactions, $ps > .1$. On the basis of these results, we concluded that the decision-making training manipulation was successful.

Stress

There was a significant main effect for stress on participants' reports of subjective stress, $F(1, 85) = 18.53$, $p < .01$. Those in the high-stress task conditions reported experiencing greater subjective stress ($M = 3.72$, $SD = 0.95$) than those in the normal-stress task environment ($M = 2.86$, $SD = 0.92$). There was no main effect for decision-making strategy, $F(1, 85) = 0.12$, $p > .1$, nor was there any significant interaction, $p > .1$. Participants reported no greater subjective stress when using a hypervigilant strategy ($M = 3.24$, $SD = 1.04$) than when using a vigilant strategy ($M = 3.32$, $SD = 1.02$).

Task Performance

The analysis revealed a significant main effect for stress on performance, $F(1, 86) = 6.06$, $p < .05$. Those in the high-stress conditions made fewer accurate identifications ($M = 10.11$, $SD = 4.90$) than those who performed under normal-stress conditions ($M = 12.14$, $SD = 4.95$). The analysis also indicated a significant main effect for decision-making strategy, $F(1, 86) = 77.80$, $p < .01$. Those who used a hypervigilant strategy made a greater number of accurate target identifications ($M = 14.60$, $SD = 4.58$) than those who used a vigilant strategy ($M = 7.85$, $SD = 2.57$). Thus, consistent with Hypothesis 1, the results indicated that hypervigilant decision making resulted in more effective performance than vigilant decision making.[2]

[2]An anonymous reviewer made the helpful suggestion that the results would be less compelling if indeed the participants using hypervigilant strategies were performing more quickly but at a serious cost of accuracy—for example, if they were performing twice as fast but only half as accurately as the vigilant group. Indeed, this pattern of results would support Janis

Table 2
Means, Standard Deviations, and Intercorrelations of Measures

Measure	M	SD	1	2	3	4	5	6	7
1. Premature closure	0.53	0.76	—	.40*	−.53*	−.81*	−.02	.56*	−.10
2. Nonsystematic scanning	0.49	0.35		—	.17	−.40*	.04	.43*	−.07
3. Temporal narrowing	106.04	92.08			—	.60*	.20	−.34*	.22*
4. Review	2.91	2.07				—	.13	−.74*	.18
5. Stress	3.28	1.03					—	−.19	.55*
6. Performance	11.15	5.00						—	−.19
7. Workload	59.08	23.85							—

* $p < .05$.

The data further indicated no significant interaction between stress and decision-making strategy, $F(1, 86) = 0.00$, $p > .1$. Contrary to Hypothesis 3, performance tended to degrade under high stress for either type of strategy. An a priori comparison indicated that those using a vigilant strategy performed significantly worse under high-stress task conditions ($M = 6.90$, $SD = 2.30$) than under normal-stress task conditions ($M = 8.79$, $SD = 2.52$), $t(86) = 1.77$, $p < .05$. Similarly, for those using a hypervigilant strategy, performance was significantly worse under high-stress task conditions ($M = 13.63$, $SD = 4.58$) than under normal-stress task conditions ($M = 15.50$, $SD = 4.49$), $t(86) = 1.72$, $p < .05$.

Workload

The results indicated a significant main effect for stress on workload, $F(1, 86) = 12.95$, $p < .01$. The high-stress task conditions resulted in greater perceived workload ($M = 67.61$, $SD = 19.63$) than the normal-stress conditions ($M = 50.92$, $SD = 24.85$). There was no main effect of decision-making strategy on workload, $F(1, 86) = 0.40$, $p > .1$, nor was there any significant interaction ($p > .05$). Consistent with Hypothesis 2, we found no significant difference in perceived workload between those using a vigilant strategy and those using a hypervigilant strategy.

and Mann's (1977) assertion that hypervigilant behavior reflects frantic but inefficient activity. To address this question, we examined separately the number of targets processed and percent of information fields correctly identified for the vigilant and hypervigilant groups. The data indicate a significant increase in speed of performance for the hypervigilant group ($M = 16.04$, $SD = 4.58$), compared with the vigilant group ($M = 8.61$, $SD = 2.50$), $t(88) = 9.63$, $p < .001$. The data further indicate no significant difference in accuracy between the hypervigilant group ($M = 90.80$, $SD = 9.37$) and the vigilant group ($M = 90.41$, $SD = 8.15$), $t(88) = 0.21$, $p > .1$. Therefore, contrary to Janis and Mann, the increase in speed of performance of the hypervigilant group was not gained at the expense of accuracy.

Discussion

Hypervigilant decision making has traditionally been viewed as a deviation from the more ideal pattern of analytic decision making, and this perspective has informed subsequent research and opinion. As Beach and Mitchell (1978) have noted, "In general, people in our culture regard the more formally analytic strategies as the ones most likely to yield correct decisions" (p. 445). However, our results clearly qualify this conclusion and further illustrate the importance of the nature of the task. The results of this study indicate that those who were trained to use a hypervigilant decision-making strategy did indeed ex-

Table 3
Mean Scores for the Manipulation Check Items, Subjective Stress, Performance, and Workload as a Function of Stress and Decision Strategy

	Normal stress		High stress	
Measure	M	SD	M	SD
Premature closure				
Vigilant	0.04	0.09	0.04	0.05
Hypervigilant	0.94	0.65	1.15	0.97
Nonsystematic scanning				
Vigilant	0.26	0.22	0.26	0.25
Hypervigilant	0.69	0.27	0.76	0.30
Temporal narrowing				
Vigilant	113.56	64.01	133.81	78.57
Hypervigilant	91.90	109.21	82.88	107.56
Review				
Vigilant	4.36	0.54	4.67	0.77
Hypervigilant	1.25	1.66	1.22	1.71
Subjective stress				
Vigilant	2.95	0.91	3.70	1.00
Hypervigilant	2.76	0.94	3.74	0.93
Performance				
Vigilant	8.79	2.52	6.90	2.30
Hypervigilant	15.50	4.49	13.63	4.58
Workload				
Vigilant	56.96	26.82	64.67	20.92
Hypervigilant	44.89	21.62	70.83	18.05

Note. In the normal-stress conditions, $n = 23$ for both the vigilant group and the hypervigilant group. In the high-stress conditions, $n = 23$ for the vigilant group and $n = 21$ for the hypervigilant group.

Table 4
Analysis of Variance Results for the Manipulation Check Items, Subjective Stress, Performance, and Workload

Dependent variable and source	*df*	*MS*	*F*
Premature closure			
Decision strategy (A)	1	22.54	68.72**
Stress (B)	1	0.25	0.75
A × B	1	0.28	0.85
Residual	86	0.33	
Nonsystematic scanning			
Decision strategy (A)	1	4.75	69.57**
Stress (B)	1	0.03	0.41
A × B	1	0.03	0.40
Residual	86	0.07	
Temporal narrowing			
Decision strategy (A)	1	29,592.60	3.54
Stress (B)	1	708.05	0.08
A × B	1	4,808.84	0.58
Residual	86	8,368.64	
Review			
Decision strategy (A)	1	241.08	149.35**
Stress (B)	1	0.47	0.29
A × B	1	0.67	0.42
Residual	86	1.61	
Subjective stress			
Decision strategy (A)	1	0.11	0.12
Stress (B)	1	16.51	18.53**
A × B	1	0.30	0.34
Residual	85	0.89	
Performance			
Decision strategy (A)	1	1,013.74	77.80**
Stress (B)	1	78.95	6.06*
A × B	1	0.00	0.00
Residual	86	13.03	
Workload			
Decision strategy (A)	1	195.89	0.40
Stress (B)	1	6,363.00	12.95**
A × B	1	1,865.38	3.79
Residual	86	491.29	

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

hibit the characteristics of hypervigilant decision making: (a) consideration of limited alternatives, (b) nonsystematic information search, (c) rapid evaluation of data, and (d) limited review of alternatives before decision making. However, the results further indicate that, on a naturalistic task, using this type of decision-making pattern led to better performance than using a more analytic vigilant strategy. The results of this study further suggest that the view of hypervigilant decision making as indicative of a near-panic state is not accurate. The fact that those using a hypervigilant decision strategy reported no less effort and reported no greater subjective stress than those using a vigilant strategy is consistent with the position that hypervigilant decision making is an adaptive response to demanding conditions, not simply unorganized or haphazard behavior.

Finally, the results of this study indicate that a hypervigilant decision-making strategy was more effective than a vigilant strategy on a naturalistic task under both normal- and high-stress conditions. However, the failure to find support for Hypothesis 3 indicates that a hypervigilant decision-making strategy is not immune to the effects of high stress; that is, we found that stress had a similar effect on degrading performance for both vigilant and hypervigilant strategies.

As Payne et al. (1988) and Klein (1996) have noted, the effectiveness of a particular decision-making strategy is dependent on many task and context variables. In the present study, we used a naturalistic task that involved a complex, time-pressured performance setting, information that was ambiguous and conflicting, and decision makers that had some familiarity with the task environment. Under time pressure, decision makers do not have the luxury to adopt a more time-consuming analytic strategy; the ambiguity of the data precludes a patterned, systematic review of data across all options; and familiarity with the task environment can inform the selective evaluation of information. The results of this study indicate that the selective focus, filtering of information, and accelerated information processing characteristic of hypervigilant decision making may be adaptive under these conditions.

On one hand, one may argue that, for real-world tasks, there are few decisions of importance that are not made under conditions of time pressure and ambiguity, suggesting the limited usefulness of the more comprehensive analytic decision-making strategies. However, there are many real-world settings for which analytic strategies are applicable. For example, analytic strategies are more likely to be effective when tasks are less complex and ill structured, data are unambiguous, and time constraints do not preclude their use. The point is that the ideal pattern of decision making is not invariant across task environments but is dependent on the nature of task demands.

It is prudent at this point to discuss several limitations of the present study. First, we use the term "naturalistic task" in this study in a somewhat broad manner. "Naturalistic task" is a psychological construct. Constructs are intended to refer to a broad class of phenomena and are, thus, abstract and open-ended rather than concrete. The naturalistic task construct has been used to represent a number of applied environments of interest, including military combat decision making (Klein, 1996), aviation crew performance (Orasanu, 1993), and the performance of chess masters (Klein, Wolf, Militello, & Zsambok, 1995). We have defined a naturalistic task as one in which decisions are made under time pressure, data are ambiguous or conflicting, the consequences of error or poor performance are costly, and decision makers are familiar with the task. However, not all naturalistic tasks share all of these characteristics. For example, although high time pressure is typical of many naturalistic tasks, it is not necessarily a characteristic of all naturalistic tasks. Therefore, although we intend our results to apply to naturalistic tasks in general, further research is needed to examine whether different types of decision-making strategies are more effective for different types of naturalistic task environments. This further raises the question of what specific aspects of a naturalistic task account for the effectiveness of a hypervigilant strategy. For example, is time pressure the critical component that determines the effectiveness of a hypervigilant strategy, or would we also expect a hypervigilant strategy to be effective for a task in which time pressure is less evident but in which decision makers have a high level of domain knowledge? Further research is needed to examine these issues.

Second, the possibility exists that the relatively poor performance of those using a vigilant decision-making strategy is evidence of the inability to implement the vigilant strategy under time pressure rather than the relative ineffectiveness of this strategy. However, this is inconsistent with previous research: Zakay and Wooler (1984) found that those who were taught to use a vigilant strategy persisted in using that strategy under conditions of high time pressure, albeit with less success. In addition, ancillary analysis of the present results reveals little evidence to support this conclusion. As expected, those using the vigilant strategy under high-stress conditions did exhibit the overall poorest performance, as shown in Table 3. However, this score reflects a mean number of 8.13 contacts attempted and a mean accuracy score of 84%, suggesting that those using a vigilant strategy under high stress were able to perform with at least some modicum of success. Furthermore, if the vigilant group were simply not able to implement this strategy under high stress, then we would expect a drastic reduction in scanning time compared with the vigilant, normal-stress group. However, our temporal narrowing measure as presented in Table 3 indicates that there was no significant difference in overall scanning time between the vigilant, normal-stress group and the vigilant, high-stress group, $t(44) = 0.96$, $p > .1$. Thus, there is no evidence that those in the vigilant, high-stress group devoted less processing effort to the task or that they had abandoned the strategy. Finally, anecdotal observations during the debriefing procedure indicated that participants in the vigilant conditions felt that the task was challenging but reported no untoward consternation about the unfeasibility of the strategy. In brief, there is little evidence to indicate that those using a vigilant strategy were unable to implement it under stress. The available evidence clearly indicates that the vigilant strategy was less effective than the hypervigilant strategy under these conditions.[3]

Finally, although this study was not designed to examine this issue, it is informative to address the broader question of adaptability in decision making. The results of Zakay and Wooler (1984) and Payne et al. (1988) suggest that decision makers tend to adapt strategies to task constraints. However, Payne, Bettman, and Johnson (1992) also noted that people are not always as adaptive to task demands as they should be, and they discussed conditions under which there may be a failure to adapt. Although we would assume that in a naturalistic environment, increased task demands would lead a decision maker to abandon a vigilant strategy in favor of a less analytic approach, it would also seem reasonable to assume that there are certain conditions (i.e., when the decision maker does not have a repertoire of decision-making strategies available for use) when the decision maker does not abandon a "losing" strategy. Payne et al. (1992) noted that people can decide how to decide at the beginning of a task or as the task unfolds. Further research is needed to examine the conditions that determine adaptability in decision making.

The results of this study have strong implications for training and decision aiding. Keinan (1987) concluded that decision making may be enhanced by compelling the decision maker to scan all alternatives fully and systematically. By contrast, our results suggest that such a strategy may be detrimental under conditions that characterize many real-world tasks. Orasanu (1993) has warned that the tendency to impose a normative model as a standard basis for decision-making training is seductive. Encouraging the decision maker to approximate a normative model could undermine behavior that may more adequately fit the requirements of the task situation. This position is consistent with that of Zakay and Wooler (1984), who examined the question of whether it was effective to train decision makers to use a multiattribute utility (MAU) analysis when time is limited. They found that those who were trained to use a MAU strategy performed more effectively than an untrained group under no time pressure but that, under high time pressure, those who were trained to use a MAU strategy performed more poorly than an untrained group. Zakay and Wooler concluded that the constraints of a real-world decision-making environment may create conditions under which it is difficult to meet the demands of a normative strategy. The results of the present study concur and suggest that training should not encourage the adoption of a complex analytic strategy under the conditions that characterize many naturalistic task environments. We propose that a more useful goal for training is to enhance flexibility in adapting decision-making strategies to task demands. This may include training to help the decision maker identify conditions under which the use of simpler strategies may be effective, training in the use of simplifying heuristics to manage effort and accuracy, and training to improve the capability

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[3] We thank an anonymous reviewer for suggesting this line of thought.

of the decision maker to perform under high demand or stressful conditions (see Inzana, Driskell, Salas, & Johnston, 1996; Saunders, Driskell, Johnston, & Salas, 1996).

In summary, the picture that emerges from this research is quite different from that envisioned by Janis and Mann (1977), who perceived a "reluctant decision maker—beset by conflict, doubts, and worry, struggling with incongruous longings, antipathies, and loyalties, and seeking relief by procrastinating, rationalizing, or denying responsibility for his own choices" (p. 15). Buffeted by these forces, the decision maker is apt to fall prey to a hypervigilant pattern of decision making in a state of near-panic or psychological trauma. We contrast this view with that of Payne et al. (1988), who draw a more optimistic picture of an adaptive decision maker who may adopt a less analytic decision-making strategy in response to situational demands, and that of Klein (1996), who has observed pilots and others in real-world settings using abbreviated but, in many cases, effective decision-making strategies. The present study demonstrates that a hypervigilant strategy, generally viewed as indicative of disorganized and deficient decision making, may be an effective course of action in a naturalistic task setting.

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