Anxiety and selective attention to threat in tactical decision-making

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ABSTRACT

This study investigated effects of anxiety on tactical decision-making. Trait and state anxiety were compared as predictors of bias in information search and decision-making, using a simulated search-and-rescue task. A mood induction was also used to manipulate anxiety. Results suggested that anxiety biased decision-making, but the effects were subtle, and depended on the anxiety variable involved. Participants were generally willing to accept the possibility of a low-probability large loss, but anxious mood induction reduced this bias. Trait anxiety was associated with a bias in information search, favoring sampling of information about possible losses, but only with a neutral mood induction. Anxiety may not be associated with a general, automatic bias towards threat on this task; instead, anxiety effects may vary with the affective context for information search.

1. Introduction

Personality may influence decision-making. Traits may influence whether the person engages in reckless, impulsive actions or, alternatively, shows an abundance of caution. Most experimental personality research has focused on simple decisions such as choosing between decks of cards in a gambling task (e.g., Hooper, Luciana, Wahlstrom, Conklin, & Yarger, 2008) or "go" and "no/go" responses in a reaction time task (e.g., Hewig, Hagemann, Seifert, Naumann, & Bartussek, 2005). However, real-life decisions often differ in two key respects from such paradigms. First, there are multiple items of information available that are potentially relevant to decision-making, so that an active *information search* must precede decision. Second, a more elaborate process of weighing up the evidence attached to each possible decisional choice is necessary. This article reports an initial attempt to investigate the effects of anxiety on a relatively complex tactical decision-making task.

There are two ways in which we might seek to predict effects of anxiety on decision-making. First, information-processing models of decision-making identify a variety of separate processing components that may independently influence the decision process. Hudlicka (2004, 2007) proposed a computational model of decision-making that explicitly represents modules for attention, situation assessment, generation of expectations and goal management, and models a range of affective biases on the

associated processes. Studies of anxiety and information-processing suggest that anxiety potentially has effects throughout such a cognitive architecture, including both encoding and response selection stages. Anxiety may 'narrow' attention so that critical cues are neglected during decision-making (Hartley, 1989). Anxiety is also associated with a selective attentional bias towards threat stimuli, and with bias in later interpretive and reasoning processes (Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & van Ijzendoorn, 2007; Mathews & MacLeod, 2005; Matthews, Deary, & Whiteman, 2009). Anxiety may also relate to faster visual search for threatening material, although findings are inconsistent (Rinck, Becker, Kellermann, & Roth, 2003). On the output side, anxiety promotes behavioral avoidance (Wells & Matthews, 1994). Anxiety diverts resources from task – to self-related processing (Wells & Matthews, 1994), and interferes with executive control processes (Eysenck, Derakshan, Santos, & Calvo, 2007), producing more general impairments in attention. Indeed, Hooper et al. (2008) found that a trait closely related to anxiety, neuroticism, was linked to poorer performance on a gambling task.

Anxiety might also influence the heuristics and biases that decision-makers use to simplify the cognitive demands of complex decision-making (Kahneman, Slovic, & Tversky, 1982). Emotional response may be used as a heuristic to guide response, for example, by avoiding choices that are associated with strong negative emotions (Loewenstein, Weber, Hsee, & Welch, 2001; Newell, Lagnado, & Shanks, 2007). Nabi (2003) found that different negative emotions influence how the person 'frames' the problem; angry individuals frame issues in terms of retribution, and anxious persons frame events in terms of self-protection. In laboratory performance

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studies, anxiety response is primarily driven by concerns over personal competence, and anxiety may be dynamically related to appraisals of task demands and choice of coping strategy (Matthews & Campbell, 2010; Wells & Matthews, 1994).

This study aimed to examine the effects of trait and state anxiety on a decision-making task based on a search-and-rescue scenario. The participant was required to choose the fastest out of four routes to reach a lost party of explorers. Each route had potential costs and benefits, expressed in a probabilistic form that permitted the participant to calculate an expected travel time for each route. Half the routes were designated as presenting a high probability of a small gain coupled with a low probability of a large loss ('likely small gain'); the remainder offered a high probability of a small loss coupled with a low probability of a large gain ('likely small loss'). In addition, some routes had a faster expected travel time than others, so that the quality of the person's choices could be determined. The participant was required to use the mouse to search for the relevant information prior to decision. The task was also configured to include a manipulation of threat, i.e., whether travel times for the routes generally exceeded the specified target time, or not.

Trait and state anxiety were assessed using the State-Trait Personality Inventory (STPI: Spielberger & Reheiser, 2004). Five hypotheses were tested. First, anxiety should generally interfere with attention and so correlate with poorer performance (H1). Second, if anxiety increases the salience of possible large losses, as suggested by the notion of affect as a heuristic (Newell et al., 2007) and the framing hypothesis (Nabi, 2003), then anxious individuals should tend to avoid the 'likely small gain' option, because it also carries the risk of catastrophic loss (H2). Third, anxiety should also affect information search behavior; the attentional bias hypothesis (Bar-Haim et al., 2007) suggests that anxiety should be associated with relatively more frequent sampling of information about possible costs, compared with information about possible benefits (H3).

There has been little research on the relative impacts of trait and state anxiety on decision-making. However, bias in information-processing may depend on the interaction of trait and state anxiety (e.g., Egloff & Hock, 2001). The effects of trait anxiety may be enhanced by state anxiety. To investigate this possibility, we included an experimental manipulation that induced anxiety (Mayer, Allen, & Beauregard, 1995). It was expected that the influence of anxiety on information search and decision-making would be amplified both by induced anxiety (H4), and by the level of threat posed by the particular decision-making problem (H5).

2. Method

2.1. Participants

We recruited 120 participants (62% female) from a pool of University of Cincinnati undergraduate psychology students. Ages ranged from 18 to 44 years ($M = 21$).

2.2. Decision-making task

The decision-making task was made up of a series of 24 discrete trials. On each trial, the participant was required to evaluate four possible routes that a 'snowcat' vehicle could take in order to rescue a 'lost party' of explorers in the Antarctic. Following evaluation, participants chose the single route they thought would provide the fastest travel time. On each trial, a map displaying the terrain was presented, together with icons indicating the positions of the participant and the lost party, and a target travel time necessary to save the lost party. Four alternative, color-coded routes were shown (color was unrelated to the properties of the routes). For each route, 'risk' and 'benefit' icons were displayed (an exclamation point and a 'smiley' face). Using the computer mouse to place a cursor over the icon, the participant opened a window that described the potential costs or gains of the route in question (see Fig. 1). Only a single window could be viewed at one time, requiring multiple, successive views of the different icons. Costs related to obstruction of progress due to terrain, weather and
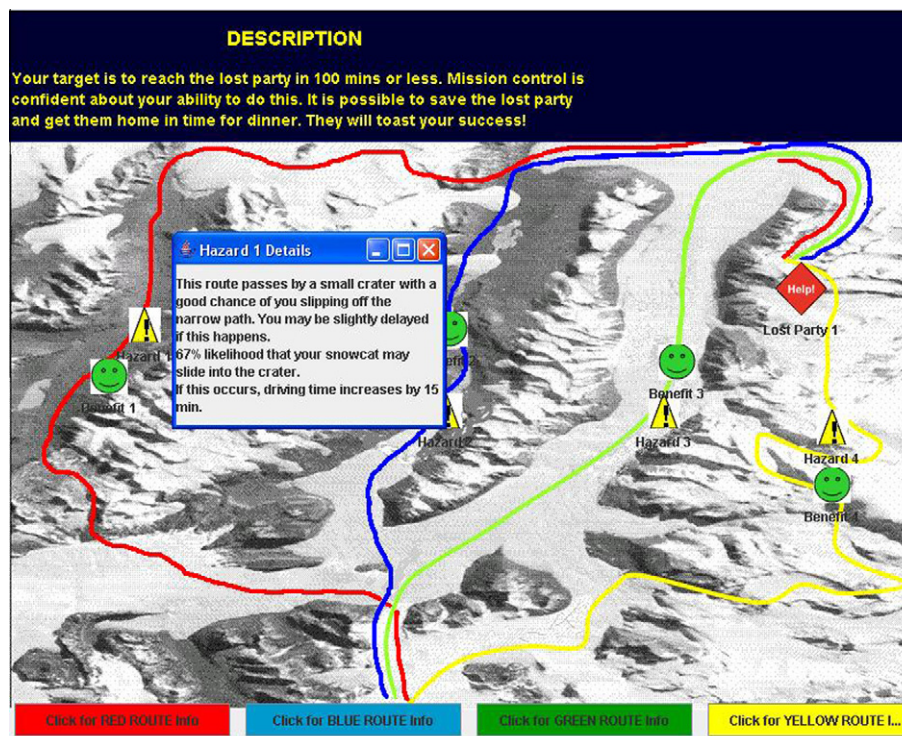

Fig. 1. Sample screenshot of the display: the participant has "moused over" the "Hazard 1" icon (exclamation point) to open a window showing cost information for the route.