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The relationship between anxiety and risk taking is moderated by ambiguity

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ABSTRACT

By definition, risk taking involves uncertainty surrounding potential outcomes. However, risky decisions can vary in the amount of ambiguity about the likelihood of each outcome occurring. The current study tested the hypothesis that the amount of ambiguity in risky-decisions would moderate the relationship between risk taking and anxiety. In this study, participants completed individual difference measures and then a version of the Balloon Analogue Risk Task (BART) with either high or low ambiguity about the likelihood of a negative outcome. As hypothesized, higher levels of anxiety predicted less risk taking in the high ambiguity version of the BART, but anxiety and risk taking were unrelated to one another in the low ambiguity version. This study demonstrates that in order to understand the relationship between anxiety and risk taking, ambiguity level must be taken into account. Furthermore, this finding provides support for cognitive models of anxiety suggesting that anxious individuals interpret negative outcomes as more likely to occur than less anxious individuals.

1. Introduction

People often make decisions in situations with uncertain outcomes. For example, Vanessa, who is running late for work, might choose to drive faster than the speed limit in an attempt to get to work on time. Or, while playing poker, Neil might place a large bet knowing that he will only win the hand if he gets a spade and completes his flush. What unites these risky situations is the potential for a negative outcome (Vanessa gets a speeding ticket, Neil loses the hand). One important distinction between these situations, however, is that the likelihood of a negative outcome is much less clear for Vanessa than Neil. Neil can precisely compute the likelihood that he will get the needed spade,[1] but it is much more difficult for Vanessa. (How likely is it that she will pass a police officer on her way to work?) The current study was designed to investigate risky decisions in situations that differed in terms of the ambiguity surrounding the likelihood of the negative outcome.

People's tendency to seek or avoid taking risks is related to a number of individual differences, including age (Figner, Mackinlay, Wilkening, & Weber, 2009), gender (Byrnes, Miller, & Schafer, 1999), emotional state (Fessler, Pillsworth, & Flamson, 2004), and personality characteristics (Nicholson, Soane, Fenton-O'Creevy, & Willman, 2005; Lauriola & Levin, 2001). One factor that has received a considerable amount of attention is trait anxiety. Because anxiety is associated with pessimistic expectations regarding future events (e.g., Shepperd, Grace, Cole, & Klein, 2005), high anxiety might act as a signal to avoid taking risks. In support of this assumption, numerous studies have found that people with higher levels of anxiety tend to be risk-averse (e.g., Giorgetta et al., 2012; Maner et al., 2007; Maner & Schmidt, 2006). For example, Maner et al. (2007) found that trait anxiety was negatively correlated with participants' risk-taking behavior. However, this finding has not been universal, and studies investigating the relation this relationship have sometimes generated contradictory results. For example, Mitte (2007) conducted two similar studies and found the expected relationship between anxiety and risk taking in the first study, but not the second. A number of variables have been investigated in an effort to explain these conflicting results, including both situation- and person-specific constructs. The domain of the risk, for instance, appears to influence anxious individuals' risk-taking behaviors, with studies suggesting that individuals with high anxiety are more likely to take health-related risks but less likely to take risks in most other domains (e.g., recreation, career, and finance; Nicholson et al., 2005). Similarly, Lauriola, Russo, Lucidi, Violani, and Levin (2005) found that the way risky health decisions were framed moderated the relationship between anxiety and risk taking. When making a choice between safe and risky options that were framed positively, anxiety did not predict participants' choices. However, when the options were framed negatively, higher anxiety was related to risk-seeking choices.

One variable that has received relatively little attention in the literature on the relation between anxiety and risk taking is the level of

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[1] In Texas Hold'em, if Neil has a flush draw (i.e., he only needs one card to complete his flush) on the flop, there is a 34.97% chance he will complete his flush on either the turn (i.e., fourth card) or the river (i.e., fifth card).

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ambiguity involved in the likelihood of outcomes. Cognitive models of anxiety propose that anxious individuals exhibit biases for threat-related information and a propensity to interpret ambiguous stimuli as more threatening and negative outcomes as more likely to occur than less anxious individuals, which may in turn affect their ability to process non-threat information and impair decision-making (Butler & Mathews, 1987; Clark & Wells, 1995). A relatively large and accumulating body of research appears to support these models (e.g., Butler & Mathews, 1987; Maner & Schmidt, 2006). For example, patients with Social Anxiety Disorder exhibit threat interpretation biases toward ambiguous social stimuli on both reaction time and self-report measures (Beard & Amir, 2009), and individuals with high levels of trait anxiety demonstrate impaired discriminatory fear learning under conditions of ambiguity (Arnaudova et al., 2013; Lommen, Engelhard, & van den Hout, 2010). Further, preliminary research suggests that highly anxious individuals may exhibit impaired decision-making on tasks that involve risk with high levels of ambiguity (e.g., the Iowa Gambling Task; IGT), but not low levels of ambiguity (e.g., the Game of Dice Task; Kim et al., 2015; Zhang et al., 2015). However, these studies have been limited in several respects. For example, these tasks differ in a number of ways other than their levels of ambiguity. Therefore, it is difficult to know whether the observed differences were due to the level of ambiguity or some other feature of the tasks. In addition, these studies have often relied on comparisons of relatively small samples of individuals with a diagnosed anxiety disorder (e.g., OCD; Kim et al., 2015; Zhang et al., 2015) versus matched controls, despite noting that most of the clinical patients were taking anxiolytic or antidepressant medications at the time of the assessment, which may have impacted their performance. Furthermore, these studies have not examined additional constructs (e.g., dispositional optimism) that might partially account for the relationship between anxiety and risk taking. Thus, additional research using tasks that differ only in the ambiguity about the likelihood of the outcomes and assessing a range of constructs is needed to clarify the relation between anxiety, risk taking, and ambiguity.

1.1. Current study

Given the inconsistencies observed in previous studies (e.g., Mitte, 2007), indications that the relationship between anxiety and risk taking is moderated by various factors (e.g., Nicholson et al., 2005; Lauriola et al., 2005), and preliminary evidence suggesting that ambiguity may be particularly relevant to risky decision-making among anxious individuals (Kim et al., 2015; Zhang et al., 2015), the goal of the present study was to investigate whether the level of ambiguity involved in a risky decision would moderate the relationship between anxiety and risk taking. Based on previous research, we hypothesized that anxiety would predict risk taking under conditions of high ambiguity, but not under conditions of low ambiguity.

2. Method

2.1. Participants

One hundred and twenty-four (77.4% women, 22.6% men; $M_{age} = 19.64$, $SD_{age} = 2.52$) undergraduate students from a university in the Southeastern region of the United States participated as partial fulfillment of a course requirement.

2.2. Measures

Participants completed measures of depression, anxiety, stress, optimism, and risk taking. We included measures of depression, stress, and optimism to ensure that the observed relationship between anxiety and risk taking was not driven by another, related construct.

2.2.1. Depression, anxiety, and stress

Participants completed a computerized version of the 21-item Depression, Anxiety, and Stress Scale (DASS-21; Lovibond & Lovibond, 1995). For each item on this scale, participants indicate how often they experienced a situation over the past week using a 1 ("Did not apply to me at all. NEVER") to 4 ("Applied to me very much, or most of the time. ALMOST ALWAYS") point response scale. Example items are "I felt down-hearted and blue" (depression), "I felt I was close to panic" (anxiety), and "I found it difficult to relax" (stress). In the current sample, internal consistency was relatively good for depression ($\alpha = .88$) and anxiety ($\alpha = .72$), and acceptable for stress ($\alpha = .67$).

2.2.2. Dispositional optimism

Participants completed a computerized version of the Life Orientation Task—Revised (LOT-R; Scheier, Carver, & Bridges, 1994). This 10-item scale (6 critical items and 4 fillers) assesses participants' level of dispositional optimism. Participants indicate their level of agreement with each item on a 1 ("I disagree a lot") to 5 ("I agree a lot") point response scale. An example item is "In uncertain times, I usually expect the best". In the current sample, the scale had relatively good internal consistency ($\alpha = .78$).

2.2.3. Risk taking

Participants completed a slightly modified version of the Balloon Analogue Risk Task (BART; Lejuez et al., 2002). Risk taking, as measured by the BART, correlates with a variety of risk taking behaviors, including risky sexual behavior (Lejuez, Simmons, Aklin, Daughters, & Dvir, 2004) and alcohol consumption (Fernie, Cole, Goudie, & Field, 2010). The BART is a computerized task in which participants pump up numerous balloons, one at a time. Each pump of a balloon earns five points and participants can collect points at any time. If they collect the points for a given balloon, that round is over, and they move to the next balloon. If the balloon explodes before they collect the points, they lose all the points for that round. With each pump of the balloon, the likelihood of the balloon exploding increases. This task requires that participants weigh the likelihood of the negative outcome (i.e., the balloon explodes and all points for that round are lost) with the potential gains (i.e., getting 5 points for each pump).

We included three different balloon colors (blue, purple, and gray), each with a different initial likelihood of exploding. The blue balloon had a 1/10 chance of exploding on the first pump, the purple balloon had a 1/20 chance, and the gray balloon had a 1/40 chance. With each pump, the chance of explosion increased by decreasing the denominator by 1. For example, the blue balloon had a 1/9 chance of exploding on the second pump, a 1/8 chance of exploding on the third pump, and so on.

Most importantly, we created two versions of the BART—one with relatively high ambiguity about the likelihood that the balloons would explode and one with relatively low ambiguity. The high ambiguity version closely replicated the classic version of the BART. Participants were told that the explosion likelihood of the three balloons varied, but they were not told what the likelihoods were.

The low ambiguity version included a visual indicator to let the participants know each balloon's explosion likelihood (see Fig. 1). The visual indicator consisted of an array of balls on the right side of the screen. The participants were told that the computer picked a ball at random each time the balloon was pumped. If the computer picked a green ball, the balloon did not explode. If the computer picked the red ball, the balloon exploded. Each time the participant pumped up the balloon, a green ball was removed from the array to show the current explosion likelihood. Aside from the visual indicator of the explosion likelihood, the high and low ambiguity versions of the BART were identical.