Personality and Individual Differences 95 (2016) 40–44

Contents lists available at ScienceDirect

Personality and Individual Differences

journal homepage: www.elsevier.com/locate/paid

The relationship between anxiety and risk taking is moderated by ambiguity

Andrew R. Smith *, Eva E. Ebert, Joshua J. Broman-Fulks

Department of Psychology, Appalachian State University, United States

ARTICLE INFO

Article history:
Received 12 August 2015
Received in revised form 5 January 2016
Accepted 7 February 2016
Available online xxxx

Keywords:
Risk taking
Anxiety
Uncertainty
Ambiguity
Decision making
BART

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

* Corresponding author: Department of Psychology, Appalachian State University, Boone, NC 28608, United States.
E-mail address: smithar3@appstate.edu (A.R. Smith).

[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).

http://dx.doi.org/10.1016/j.paid.2016.02.018
0191-8869/

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.

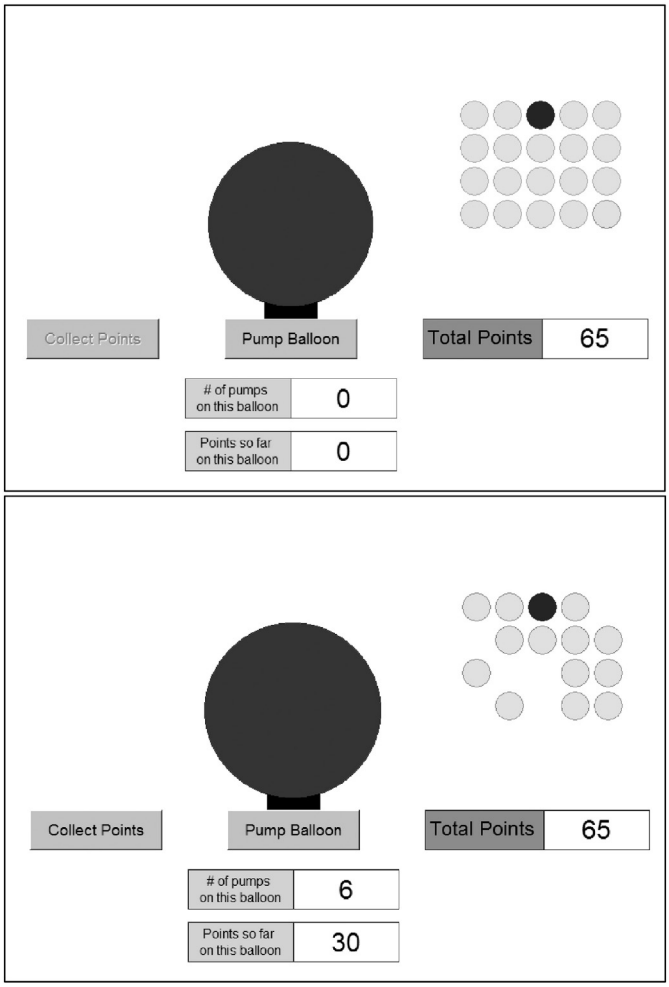

Fig. 1. Screenshots of the low ambiguity version of the Balloon Analogue Risk Task before the first pump (top) and after the 6th pump (bottom).

2.3. Procedure

After providing their consent, participants completed the DASS and LOT-R. Participants were then randomly assigned to complete either the high or low ambiguity version of the BART. To motivate the participants in their task, they were told that performance on the task is related to real-world decision-making skills. They were also told that they would see their score and the average person's score at the end of the study. Furthermore, the participants were told that their task was to score as many points as possible because the more points they earned, the more reward (candy) they would receive.

The participants received instructions about the BART and went through 5 practice rounds. During the practice rounds the balloon was yellow in order to limit learning the explosion rates. Aside from the second practice round, the explosion likelihoods of the practice balloons were 1/15 on the first pump. On the second practice round, the balloon exploded on the first pump. This ensured that every participant experienced an explosion during the practice rounds. After the practice rounds, the participants completed 60 rounds. The rounds were presented in two blocks of 30 rounds—10 per balloon color—with the order of the balloons randomized within each block. After completing the 60 rounds, the participants were asked their age and gender, were shown their score and the average participant's score (from a pilot study), and given their earned reward based on their performance.

3. Results

3.1. Relationships between individual differences

For each participant, we calculated the average of their responses for the depression, stress, anxiety, and optimism scales. As shown in Table 1, higher levels of anxiety were associated with greater depression and stress, but lower optimism.

3.2. Risk taking

Participants' adjusted pumps for each balloon color (see Lejuez et al., 2002) were calculated by computing the average number of times the participant pumped up the balloon for all the rounds when the balloon did not explode. Therefore, the adjusted pumps is the average number of pumps for the rounds when the participant made the choice to stop pumping up the balloon (rather than the choice being made for him/her because the balloon exploded).[2] Higher adjusted pump scores indicate greater risk taking.

A 3 (balloon color: blue, purple, and gray) × 2 (ambiguity version: low or high) analysis of variance on participants' adjusted pump scores revealed a main effect of balloon color, $F(2, 121) = 188.62$, $p < .001$, $\eta_p^2 = .76$. Participants' adjusted pump scores were higher for the balloons that exploded less often. There was also a main effect of ambiguity version, $F(1, 122) = 41.85$, $p < .001$, $\eta_p^2 = .26$. Participants who went through the low ambiguity version of the BART exhibited higher levels of risk taking (i.e., had higher adjusted pump scores) than participants who went through the high ambiguity version. Finally, the analysis revealed a balloon color × ambiguity version interaction, $F(2, 121) = 64.06$, $p < .001$, $\eta_p^2 = .51$. As shown in Fig. 2, the adjusted pump scores for the participants who went through the low-ambiguity version varied across the three balloon colors to a greater extent than participants who went through the high-ambiguity version.

In short, participants were sensitive to the explosion rates of the three balloons, and participants who went through the low ambiguity version were more sensitive to these differences than participants who went through the high ambiguity version of the BART. These results suggest that the two versions of the BART varied with regards to the amount of ambiguity about the likelihoods of the balloons exploding.

3.3. Relationship between risk taking and anxiety

In order to test our hypothesis that the relationship between anxiety and risk taking is moderated by ambiguity, we combined participants' average adjusted pump scores for all three balloons.[3] We used the PROCESS SPSS macro (Hayes, 2013) to conduct a regression analysis with participants' anxiety score as the predictor, the ambiguity version as the moderator, and the participants' adjusted pump score as the outcome variable. In this analysis, the variables were mean centered and we added participants' gender, age, and levels of depression, stress,

[2] Participants' adjusted pump scores and average (unadjusted) pumps per round were highly correlated, $r(122) = .98$, $p < .001$. Therefore, analyses conducted on average pumps rather than adjusted pump scores were virtually identical.

[3] In addition to examining participants' overall adjusted pump scores, we also conducted separate analyses for each of the three balloons. A similar, but not identical pattern of results was observed for the three balloons. For all three balloons, anxiety did not predict risk taking ($ps > .50$). For all three balloons, ambiguity predicted risk taking (all $ps < .001$). With the purple and gray balloon, participants' adjusted pump scores were higher in the low ambiguity condition. However, with the blue balloon, scores were higher in the high ambiguity condition. Finally, there was the predicted interaction between anxiety level and ambiguity version for the purple ($p = .03$) and gray ($p = .005$) balloons, but not the blue balloon ($p = .20$).

Table 1
Descriptive statistics and relationships among participant characteristics.

	Mean (SD)	Depression	Anxiety	Stress	Optimism	Age	Gender
Depression	1.53 (0.49)	–	.43***	.31***	−.57***	−.01	0.07
Anxiety	1.47 (0.41)		–	.42***	−.47***	.00	−0.09
Stress	1.91 (0.41)			–	−.33***	−.03	−0.18
Optimism	3.39 (0.72)				–	−.03	−0.23
Age	19.64 (2.52)					–	0.55**
Gender	77% women 23% men						–

Note: Depression, anxiety, and stress coded on a 1–4 point scale; optimism coded on a 1–5 point scale; values listed for relationships between depression, anxiety, stress, optimism, and age are r-values. Values listed for relationship with gender are d-values with positive numbers indicating higher values for men and negative numbers indicating higher values for women.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

and optimism as covariates.[4] This analysis revealed that, overall, anxiety did not predict participants' adjusted pump scores, $t = -0.74$, $b = -0.39$, $p = .46$, 95% CI [−1.44, 0.66]. The ambiguity version did predict risk taking, $t = 5.63$, $b = 2.01$, $p < .001$, 95% CI [1.30, 2.71]. Most importantly, there was a significant anxiety × ambiguity condition interaction, $t = 2.45$, $b = 2.17$, $p = .016$, 95% CI [0.42, 3.93]. This interaction explained a significant proportion of the variance, $R^2 = .04$, $F(1, 115) = 6.00$, $p = .016$. Fig. 3 plots the relationship at one SD above and one SD below the mean of participants' anxiety score. Simple effects analyses revealed that for the participants who went through the high ambiguity version of the BART, higher anxiety was associated with less risk taking, $t = -2.23$, $b = -1.50$, $p = .03$, 95% CI [−2.82, −0.17]. However, in the low ambiguity version, anxiety and risk taking were unrelated to one another, $t = 0.97$, $b = 0.68$, $p = .34$, 95% CI [−0.73, 2.08].

This analysis also revealed that gender predicted participants' adjusted pump scores, $t = -2.25$, $b = -0.99$, $p = .03$, 95% CI [−1.86, −0.12]—a result consistent with previous studies findings that men generally take more risks than women (Byrnes et al., 1999). None of the other covariates significantly predicted risk taking (all $ps > .27$).

4. Discussion

The current study investigated whether the amount of ambiguity in the likelihood of a negative outcome moderates the relationship between anxiety and risk taking. Consistent with our prediction, when the likelihood of the negative outcome was ambiguous, participants with higher anxiety exhibited less risk taking. This finding replicates numerous other studies demonstrating that anxiety and risk taking are often negatively related (e.g., Giorgetta et al., 2012; Maner & Schmidt, 2006). Most notably, Maner et al. (2007, Study 2) found that anxious individuals took fewer risks as measured by the BART—the same risk-taking measure used in the current study. While the results in the high ambiguity condition replicated previous studies, the pattern was different in the low ambiguity condition. When the likelihood of the negative outcome was relatively unambiguous, there was not a significant relationship between anxiety and risk taking. Anxious individuals were, on average, no more risk-seeking or risk-avoidant than their less anxious counterparts. This finding appears consistent with cognitive models of anxiety and suggests that, in the absence of information regarding the probability of positive and negative outcomes, the tendency of anxious persons to perceive increased threat and higher probability of negative outcomes may lead them to being less willing to engage in risk taking behaviors.

Although previous research has revealed high levels of uncertainty to be associated with reduced risk taking, the current study suggests that the relationship between anxiety and risk taking may not be driven solely by the uncertainty involved in risky-decisions. Both the high and low ambiguity versions of the BART involved uncertainty in that each time the balloon was pumped, there was a chance it would explode. Rather, what separated the two versions was that one version had outcomes that were relatively ambiguous and the other had outcomes that were relatively unambiguous. Thus, these results are consistent with the finding that intolerance of uncertainty and intolerance of ambiguity, while related, appear to be distinct constructs (Rosen, Ivanova, & Knäuper, 2014; but see Lauriola, Levin, & Hart, 2007), and it is important for research to consider both constructs with regard to the decision-making strategies of anxious individuals.

While our study adds to the literature regarding anxiety and risk taking, some limitations warrant acknowledgment. Perhaps the most notable limitation was the use of a non-clinical, undergraduate student sample. Although the pattern of results in the present study was largely consistent with previous research utilizing clinical samples, additional research is needed to determine whether these findings will extend to samples with clinical levels of anxiety. In addition, the present study only employed one measure of risk-taking behavior, and it is not clear whether these findings will extend to other behavioral risk-taking measures (e.g., the IGT, Bechara, Damasio, Damasio, & Anderson, 1994; the Cups Task, Levin & Hart, 2003). Previous research has suggested that performance on one task is not always correlated with performance on another task (Bishara et al., 2009), which may be at least partially related to the level of ambiguity surrounding the outcomes. For example, the BART and IGT require participants to learn the probabilities while going through the task, whereas the likelihoods in the Cups Task are clearly observable by the participants. Future research could investigate the relationship between anxiety and risk taking across different

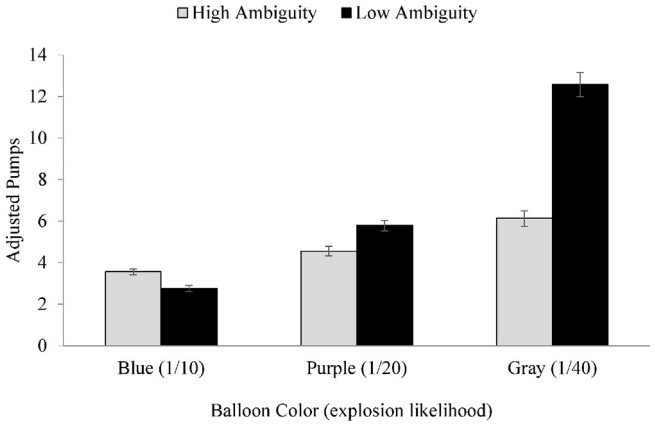

Fig. 2. Participants' average adjusted pump scores as a function of balloon color and BART version. Error bars represent ±1 *SE*.

[4] A similar analysis predicting participants' adjusted pump scores while *not* controlling for gender, age, depression, stress, and optimism yielded similar results. Specifically, anxiety did not predict participants' adjusted pump scores, $t = 0.09$, $b = 0.04$, $p = .93$, 95% CI [−0.83, 0.91]. The ambiguity version did predict risk taking, $t = 5.73$, $b = 2.05$, $p < .001$, 95% CI [1.34, 2.76]. Most importantly, there was a significant anxiety × ambiguity condition interaction, $t = 2.68$, $b = 2.36$, $p = .008$, 95% CI [0.62, 4.11].

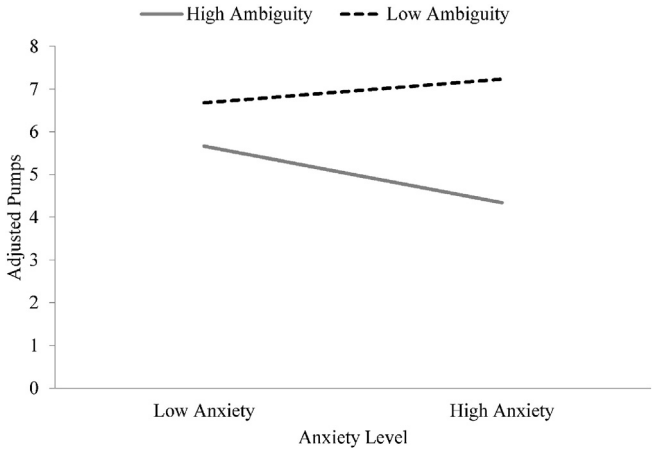

Fig. 3. Participants average adjusted pump scores as a function of their level of anxiety and BART version.

behavioral tasks that vary in respect to the amount of ambiguity regarding the likelihood of the outcomes.

Finally, a possible limitation in the current study is that the participants were not given monetary incentives for their performance on the BART; instead, they received points so they could get a non-monetary reward (i.e., candy). Ferrey and Mishra (2014) recently demonstrated that the compensation method used in the BART may affect participants' risk taking, with participants who were paid for their participation in addition to being paid based on their performance tending to take more risks than participants who were only paid for their performance or not paid at all. While our compensation method might have influenced participants' risk taking, it seems unlikely that this can account for the interactive effect of ambiguity and anxiety on risk-taking behavior. Future research is needed to assess whether alternative compensation methods may impact the relation between ambiguity, risk-taking, and anxiety.

Despite the need for further research, the current study demonstrates that in order to understand the relationship between anxiety and risk taking, the ambiguity level must be taken into account. This is especially important because many real-world decisions vary in terms of the ambiguity surrounding the likelihood of the outcomes. Furthermore, this finding provides additional support for cognitive models of anxiety suggesting that anxious individuals interpret ambiguous stimuli as more threatening and negative outcomes as more likely to occur than less anxious individuals.

References

Arnaudova, I., Krypotos, A. -M., Effting, M., Boddez, Y., Kindt, M., & Beckers, T. (2013). Individual differences in discriminatory fear learning under conditions of ambiguity: A vulnerability factor for anxiety disorders? *Frontiers in Psychology*, *4*, 1–9. http://dx.doi.org/10.3389/fpsyg.2013.00298.

Beard, C., & Amir, N. (2009). Interpretation in social anxiety: When meaning precedes ambiguity. *Cognitive Therapy and Research*, *33*(4), 406–415. http://dx.doi.org/10.1007/s10608-009-9235-0.

Bechara, A., Damasio, A. R., Damasio, H., & Anderson, S. W. (1994). Insensitivity to future consequences following damage to human prefrontal cortex. *Cognition*, *50*(1–3), 7–15. http://dx.doi.org/10.1016/0010-0277(94)90018-3.

Bishara, A. J., Pleskac, T. J., Fridberg, D. J., Yechiam, E., Lucas, J., Busemeyer, J. R., ... Stout, J. C. (2009). Similar processes despite divergent behavior in two commonly used measures of risky decision making. *Journal of Behavioral Decision Making*, *22*(4), 435–454. http://dx.doi.org/10.1002/bdm.641.

Butler, G., & Mathews, A. (1987). Anticipatory anxiety and risk perception. *Cognitive Therapy and Research*, *11*(5), 551–565. http://dx.doi.org/10.1007/BF01183858.

Byrnes, J. P., Miller, D. C., & Schafer, W. D. (1999). Gender differences in risk taking: A meta-analysis. *Psychological Bulletin*, *125*, 367–383. http://dx.doi.org/10.1037/0033-2909.125.3.367.

Clark, D. M., & Wells, A. (1995). A cognitive model of social phobia. In R. G. Heimberg, M. R. Liebowitz, D. A. Hope, & F. R. Schneier (Eds.), *Social phobia: Diagnosis, assessment, and treatment* (pp. 69–93). New York, NY: Guilford Press.

Fernie, G., Cole, J. C., Goudie, A. J., & Field, M. (2010). Risk-taking but not response inhibition or delay discounting predict alcohol consumption in social drinkers. *Drug and Alcohol Dependence*, *112*(1–2), 54–61. http://dx.doi.org/10.1016/j.drugalcdep.2010.05.011.

Ferrey, A. E., & Mishra, S. (2014). Compensation method affects risk-taking in the Balloon Analogue Risk Task. *Personality and Individual Differences*, *64*, 111–114. http://dx.doi.org/10.1016/j.paid.2014.02.008.

Fessler, D. T., Pillsworth, E. G., & Flamson, T. J. (2004). Angry men and disgusted women: An evolutionary approach to the influence of emotions on risk taking. *Organizational Behavior and Human Decision Processes*, *95*(1), 107–123. http://dx.doi.org/10.1016/j.obhdp.2004.06.006.

Figner, B., Mackinlay, R. J., Wilkening, F., & Weber, E. U. (2009). Affective and deliberative processes in risky choice: Age differences in risk taking in the Columbia Card Task. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *35*(3), 709–730. http://dx.doi.org/10.1037/a0014983.

Giorgetta, C., Grecucci, A., Zuanon, S., Perini, L., Balestrieri, M., Bonini, N., ... Brambilla, P. (2012). Reduced risk-taking behavior as a trait feature of anxiety. *Emotion*, *12*(6), 1373–1383. http://dx.doi.org/10.1037/a0029119.

Hayes, A. F. (2013). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. New York, NY, US: Guilford Press.

Kim, H. W., Kang, J. I., Namkoong, K., Jhung, K., Ha, R. Y., & Kim, S. J. (2015). Further evidence of a dissociation between decision-making under ambiguity and decision-making under risk in obsessive–compulsive disorder. *Journal of Affective Disorders*, *176*, 118–124.

Lauriola, M., & Levin, I. P. (2001). Personality traits and risky decision-making in a controlled experimental task: An exploratory study. *Personality and Individual Differences*, *31*(2), 215–226. http://dx.doi.org/10.1016/S0191-8869(00)00130-6.

Lauriola, M., Levin, I. P., & Hart, S. S. (2007). Common and distinct factors in decision making under ambiguity and risk: A psychometric study of individual differences. *Organizational Behavior and Human Decision Processes*, *104*(2), 130–149. http://dx.doi.org/10.1016/j.obhdp.2007.04.001.

Lauriola, M., Russo, P. M., Lucidi, F., Violani, C., & Levin, I. P. (2005). The role of personality in positively and negatively framed risky health decisions. *Personality and Individual Differences*, *38*(1), 45–59. http://dx.doi.org/10.1016/j.paid.2004.03.020.

Lejuez, C. W., Read, J. P., Kahler, C. W., Richards, J. B., Ramsey, S. E., Stuart, G. L., ... Brown, R. A. (2002). Evaluation of a behavioral measure of risk taking: The Balloon Analogue Risk Task (BART). *Journal of Experimental Psychology: Applied*, *8*(2), 75–84. http://dx.doi.org/10.1037/1076-898X.8.2.75.

Lejuez, C. W., Simmons, B. L., Aklin, W. M., Daughters, S. B., & Dvir, S. (2004). Risk-taking propensity and risky sexual behavior of individuals in residential substance use treatment. *Addictive Behaviors*, *29*(8), 1643–1647. http://dx.doi.org/10.1016/j.addbeh.2004.02.035.

Levin, I. P., & Hart, S. S. (2003). Risk preferences in young children: Early evidence of individual differences in reaction to potential gains and losses. *Journal of Behavioral Decision Making*, *16*(5), 397–413. http://dx.doi.org/10.1002/bdm.453.

Lommen, M. J. J., Engelhard, I. M., & van den Hout, M. A. (2010). Neuroticism and avoidance of ambiguous stimuli: Better safe than sorry? *Personality and Individual Differences*, *49*, 1001–1006. http://dx.doi.org/10.1016/j.paid.2010.08.012.

Lovibond, P. F., & Lovibond, S. H. (1995). The structure of negative emotional states: Comparison of the Depression Anxiety Stress Scales (DASS) with the Beck Depression and Anxiety Inventories. *Behaviour Research and Therapy*, *33*(3), 335–343. http://dx.doi.org/10.1016/0005-7967(94)00075-U.

Maner, J. K., & Schmidt, N. B. (2006). The role of risk avoidance in anxiety. *Behavior Therapy*, *37*, 181–189. http://dx.doi.org/10.1016/j.beth.2005.11.003.

Maner, J. K., Richey, J. A., Cromer, K., Mallott, M., Lejuez, C. W., Joiner, T. E., & Schmidt, N. B. (2007). Dispositional anxiety and risk-avoidant decision-making. *Personality and Individual Differences*, *42*(4), 665–675. http://dx.doi.org/10.1016/j.paid.2006.08.016.

Mitte, K. (2007). Anxiety and risky decision-making: The role of subjective probability and subjective costs of negative events. *Personality and Individual Differences*, *43*(2), 243–253. http://dx.doi.org/10.1016/j.paid.2006.11.028.

Nicholson, N., Soane, E., Fenton-O'Creevy, M., & Willman, P. (2005). Personality and domain-specific risk taking. *Journal of Risk Research*, *8*(2), 157–176. http://dx.doi.org/10.1080/1366987032000123856.

Rosen, N. O., Ivanova, E., & Knäuper, B. (2014). Differentiating intolerance of uncertainty from three related but distinct constructs. *Anxiety, Stress & Coping: An International Journal*, *27*(1), 55–73. http://dx.doi.org/10.1080/10615806.2013.815743.

Scheier, M. F., Carver, C. S., & Bridges, M. W. (1994). Distinguishing optimism from neuroticism (and trait anxiety, self-mastery, and self-esteem): A reevaluation of the Life Orientation Test. *Journal of Personality and Social Psychology*, *67*(6), 1063–1078. http://dx.doi.org/10.1037/0022-3514.67.6.1063.

Shepperd, J. A., Grace, J., Cole, L. J., & Klein, C. (2005). Anxiety and outcome predictions. *Personality and Social Psychology Bulletin*, *31*, 267–275. http://dx.doi.org/10.1177/0146167204271322.

Zhang, L., Dong, Y., Yifu, J., Zhu, C., Yu, H., Chen, X., & Wang, K. (2015). Dissociation of decision making under ambiguity and decision making under risk: A neurocognitive endophenotype candidate for obsessive–compulsive disorder. *Progress in Neuro-Psychopharmacology and Biological Psychiatry*, *57*, 60–68. http://dx.doi.org/10.1016/j.pnpbp.2014.09.005.