Manipulating Anger Does Not Affect Risky Decision Making

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Abstract

To date, multiple studies have examined the influence of negative mood on performance on behavioral decision-making tasks. Self-reported negative mood was inconsistently associated with subsequent decision making, and a similar inconsistent pattern was seen when negative mood was manipulated in the study session. The present study sought to examine how deliberately inducing a particular negative mood, anger, would affect risky decision making. College student participants reported their political beliefs, then were randomly assigned to one of several mood manipulation conditions (political anger, anger, sadness, fear, control) prior to completion of standard behavioral risky decision-making tasks including the Iowa Gambling Task, Game of Dice Task, Balloon Analogue Risk Task, and Columbia Card Task. Results indicated an increase in negative mood in the anger condition following the study manipulation, but only minimal effects of negative mood on risky decision making across tasks. Future assessments of mood and decision making should address multiple negative mood affects in addition to manipulation techniques in order to determine if a specific mood and/or manipulation is contributing to an individuals' risky decision making.

Keywords: *anger, decision making, negative mood, Iowa gambling task, balloon analogue risk task, Columbia card task, game of dice task.*

Decision making involves, at minimum, a choice between two options. In neuropsychology, decision making is often assessed via either self-report or behavioral measures. The present study focuses on one aspect of decision making, risky decision making, which can be defined as continuing to make suboptimal decisions in the face of known risks (Bechara, 2007). Performance on behavioral decision making tasks will be used to examine the level of individual risk. Understanding why individuals engage in risk-taking behaviors is important in predicting who will take risks and when. Positive and negative mood are frequently examined in relation to decision making task performance, with conflicting findings based in part on when mood is assessed and if mood is first manipulated. The present study examined the influence of negative mood, most notably anger, on risky decision making.

To date, several studies have examined the influence of different negative moods on behavioral decision-making task performance as, in general, mood can influence decision making (Forgas, 1995; Schwarz & Clore, 1983). Most have focused on the Iowa Gambling Task (IGT; Bechara, Damasio, Damasio, & Anderson, 1994), Balloon Analogue Risk Task (BART; Lejuez et al., 2002), Columbia Card Task (CCT; Figner, Mackinlay, Wilkening, & Weber, 2009), and Game of Dice Task (GDT; Brand, Fujiwara, Borsutzky, Kalbe, Kessler, & Markowitsch, 2005), which are detailed in Table 2. Utilizing self-report of current mood, several researchers found negative mood impairs performance on the IGT (Buelow & Suhr, 2013; Suhr & Tsanadis, 2007) and Cambridge Gamble Task (specifically depressed mood; Kaplan et al., 2006; Roiser et al., 2009), whereas others found higher levels of current self-reported depressive symptoms improves performance on

the IGT (Smoski et al., 2008). Still others found no relationship between self-reported negative mood and performance on the CCT (Buelow, 2015; Panno, Lauriola, & Figner, 2013). Several researchers instead examined the effects of direct manipulation of negative mood on subsequent behavioral decision-making task performance. Deliberately inducing a negative mood can lead to: improved decision making on tasks including the IGT (general negative mood induction, Buelow, Okdie, & Blaine, 2013; sadness induction, Chou, Lee, & Ho, 2007; Harle & Sanfey, 2007; Yuen & Lee, 2003); impaired performance on the IGT (sadness induction; de Vries, Holland, & Witteman, 2008); and no change in performance on the IGT or BART (fear/disgust induced; Heilman, Crisan, Houser, Miclea, & Miu, 2010). Collectively, no consistent picture emerged of how negative moods affect decision making task performance and leads to the question of whether the particular type of negative mood—or cause of said negative mood—matters.

One negative mood that has not been studied extensively in the behavioral decision-making task literature to date is anger. Individuals with high self-reported trait anger engage in greater numbers of risky behaviors (Gambetti & Giusberti, 2009; Lerner & Keltner, 2001). It is possible this is due to a change in perceptions of risk, as angry individuals report more optimistic perceptions of risk (Hemenover & Zhang, 2004; Lerner & Keltner, 2001; Lerner & Tiedens, 2006; Lerner, Gonzalez, Small, & Fischhoff, 2003). If this is the case, then we should see worse performance on behavioral decision-making tasks, as participants would not accurately detect the level of risk in their risky decisions. Studies typically induced anger with either a movie clip or an autobiographical recall task, finding that inducing anger led to both impaired/riskier (Kugler, Connolly, & Ordonez, 2012; Scheibehenne & von Helversen, 2015; Szasz, Hofmann, Heilman, & Curtiss, 2016; but only in males, Ferrer, Maclay, Litvak, & Lerner, 2017) or improved/more advantageous (Bagneux, Bollon, & Dantzer, 2012; Bagneux, Font, & Bollon, 2013) decision making on various behavioral tasks. Of note, participants in an anger induction group outperformed participants in a fear induction group on the IGT (Bagneux et al., 2013) and GDT (Bagneux, Bollon, & Dantzer, 2012). However, others found no relationship between anger and decision making (Pietruska & Armony, 2013). Thus, the relationship between anger and decision making remains unclear.

The present study sought to examine whether manipulating anger would affect subsequent risky decision making. Given the political climate during data collection (2016 U.S. presidential election), we chose to examine two methods of inducing anger: a political induction (in which participants read information contrary to their reported beliefs) and a writing prompt focused on terrorist attacks. Participants were randomly assigned to a mood induction condition (anger, political anger, fear, sadness, control), and both their current mood and performance on risky decision-making tasks were assessed. Based on the previous research, several study aims and hypotheses were addressed. First, we examined whether political issues could be used to induce anger in a lab-based setting hypothesizing that the political anger group would show higher state anger and negative mood than the control group. Next, an assessment was made on the potential relationship between anger and risky decision making. As previous research shows both positive and negative relationships between negative affect (and anger in particular) and decision making, however, no hypothesis was made as to a direction of this relationship. Also, it was hypothesized that reading contrary political viewpoints would induce a greater level of anger than writing about anger from terror attacks. Finally, we sought to examine how manipulating anger affected decision making in comparison to manipulating other negative emotions such as fear and sadness. We hypothesized that those in the anger groups would perform differently on decision making tasks than those in the fear and sadness conditions.

Method

Participants

Participants were 235 undergraduate students enrolled in psychology courses in which course credit was provided for involvement in research studies. Political party affiliation was as follows: 30.2% Democrat, 20.4% Republican, 18.3% Independent, 11.5% Other, and 19.6% None. Of those participants aged 18 or older during the 2016 presidential election cycle, 23.5% reported voting for a Democratic candidate and 14.0% voting for a Republican candidate. Of note, some participants completed the study prior to voting in the election, and did not indicate the candidate voted for. See *Table 1* for demographic information.

Measures and Procedure

At the study session, all participants first provided informed consent, then were randomly assigned to one of six computerized study manipulations. In the first (Political Anger), participants read two politically-based arguments and were asked to then summarize the information. Each argument reflected the opposite viewpoint of the participant on a "hot button" issue (e.g., abortion, gun legislation, same-sex marriage, health care) that they rated as very important, which was determined based on the participant's responses to a prescreening political beliefs questionnaire developed for the present study. In the second manipulation (Anger), participants read a brief prompt regarding recent terror attacks that might have prompted the participant to feel angry. Participants were then asked to write about the feelings of anger reading the prompt might have induced. The same prompt was utilized for the third (Sadness) and fourth (Fear) manipulations. The remaining two manipulations were control conditions. Participants were asked to write about what they did before arriving at the study session (Control 1) or responded to a non-specific version of the same prompts used in the anger, fear, and sadness conditions (Control 2). Following the study manipulation, participants completed the Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988) and State-Trait Anger Expression Inventory-2 (STAXI-2; Spielberger, 1999) to assess changes in positive and negative mood (including anger) following the manipulation.

Next, participants completed a series of risky decision-making tasks in a counterbalanced order: Balloon Analogue Risk Task (BART, Lejuez et al., 2002), Columbia Card Task (CCT, Figner et al., 2009), Game of Dice Task (GDT, Brand et al., 2005), and Iowa Gambling Task (IGT, Bechara, 2007) (see Table 2). The BART allows participants to pump a computer simulated balloon while earning $.05 for each pump which can be banked any time prior to the balloon exploding. The balloons have a random number of pumps before explosion, resulting in the retraction of all unbanked monies. During the CCT, points are allocated by turning over a series of cards. Points are either collected when the participant decides to stop turning cards over or subtracted if a loss card is turned. The number of points lost is determined by the designated amount on the loss card. Both the BART and CCT are similar, in that the greater number of balloon pumps or card turns are indicative of greater risk but also greater reward. While taking part in the GDT, individuals choose to risk money by predicting the outcome of the roll of a die. Participants can choose from a set of 1-, 2-, 3-, or 4-number sequences, in which the level of risk associated with the prediction decreases with additional numbers in the sequence (i.e., 1-number is riskier than 4-numbers). The IGT allows participants to maximize their earnings by choosing cards from one of four decks. Two decks are comprised of lower risk and immediate reward but higher long term reward while the other two are higher risk and immediate reward with lower long term reward. Contrary to the BART, CCT, and GDT, the advantageous and disadvantageous card decks are learned throughout the IGT process. At the end, all participants were debriefed and course credit was assigned.

Data Analysis

See *Table 2* for a full description of study tasks and scoring procedures. One-way ANOVAs were conducted to compare responses across mood manipulation groups on the PANAS, STAXI-2, BART, CCT, and GDT. For the IGT, a mixed ANOVA was conducted, with group assignment as the between subjects factor and block (Trials 1-40, Trials 41-100) as the within subjects factor. Of note, gender ratio varied significantly between the mood induction groups. However, performance on the decision-making tasks was not associated with gender (ps > .330), and thus we did not include gender as a covariate in the remaining analyses.

Results

First, the two control groups were compared on the mood and decision-making variables. No differences emerged in responses to the mood items (*ps* > .312) or on the decision-making tasks (*ps* > .206), so the control groups were combined for the remaining analyses. No differences were found in positive mood following the mood manipulation, $F(4,230) = 1.289$, $p = .275$, but significant differences at the .05 level emerged in negative mood on the PANAS, $F(4,230) = 2.566$, $p = .039$. Participants in the anger group reported greater levels of negative mood than the political anger, $p = .045$, and combined control, $p = .042$, groups. In addition, a significant effect emerged for state anger, $F(4,227) = 2.496$, $p = .044$, but the post-hoc tests were not significant (political anger >

control, p = .071). No group differences emerged in trait anger, F(4,227) = 0.681, p = .606. Contrary to prediction, there were no mood group differences in performance on the BART, F(4,212) = 0.584, p = .674, CCT, F(4,216) = 0.354, p = .841, or GDT, F(4,211) = 1.828, p = .125. On the IGT, there was not a significant main effect of mood condition, F(4,198) = 0.904, p = .462, n_p2 = .018, nor a significant condition by block interaction, F(4,198) = 1.248, p = .292, n_p2 = .025. The main effect of block was significant, F(1,198) = 4.129, p = .043, n_p2 = .020, with performance improving from Block 1 to Block 2.

Discussion

Taken together, minimal support was found for our hypotheses. We hypothesized that the political anger group would score higher on state anger and negative mood than the control group. In addition, we hypothesized that the political anger group would report greater anger than the anger group. No support was found for either hypothesis, as the political anger group did not differ from the control group and the anger group actually reported greater negative mood (but not anger) than the political anger group. We also found no effect of manipulated negative mood—political anger, anger, sadness, and fear—on subsequent risky decision-making task performance. While these non-significant findings are consistent with some previous research (self-reported negative mood: Buelow, 2015; Panno et al., 2013; manipulated negative mood: Heilman et al., 2010; Pietruska & Armony, 2013), they run counter to other research suggesting increasing a negative mood either improves (Bagneux et al., 2012, 2013; Buelow et al., 2013; Chou et al., 2007; Harle & Sanfey, 2007; Yuen & Lee, 2003) or impairs (de Vries et al., 2008; Ferrer et al., 2017; Kugler et al., 2012; Scheibehenne & von Helversen, 2015; Szasz et al., 2016) subsequent decision making.

It is unclear why we failed to find support for our hypotheses. It is possible that our sample of college student participants might have affected the results, as a number of participants—though eligible—did not vote in the 2016 election and may not have been as affected by the political anger manipulation. It is also possible that the context of the 2016 election might have resulted in participants who were at least partially "jaded" to politics and the manipulations used in the present study. That said, the non-political mood manipulations (anger, fear, sadness) also failed to significantly affect subsequent decision-making task performance, which points instead in the direction that these manipulated negative moods were not sufficient to exert change in decision making processes on the tasks. It is also possible that the cause of anger might exert a greater influence on tasks than the extent of the anger. For example, previous research has utilized movie clips and autobiographical recall tasks to induce anger (e.g., Bagneux et al., 2012, 2013; Kugler et al., 2012; Szasz et al., 2016). It is possible that the more personal the manipulation of mood, the stronger the effect on decision making tasks. Future research investigating the effects of mood on decision making should manipulate multiple negative moods and utilize multiple manipulation methods, in order to investigate whether the type and cause of a negative mood matters

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Table 1
Study variables presented as mean (standard deviation).

	Negative Mood Conditions				Control Conditions		
Variable	**Political Anger**	**Anger**	**Sadness**	**Fear**	**Control 1**	**Control 2**	**Total Control**
n	62	33	34	38	38	30	68
Gender[a] (% male)	46.7%	21.9%	29.0%	25.0%	37.8%	51.7%	43.9%
Age[b]	18.35 (0.78)	18.69 (1.80)	18.25 (0.92)	18.32 (0.66)	18.35 (0.89)	18.48 (1.37)	18.41 (1.11)
Ethnicity[c] (%Caucasian)	69.0%	65.6%	45.2%	71.4%	51.4%	71.4%	60.3%
PANAS-P	2.47 (0.83)	2.57 (0.80)	2.34 (0.83)	2.56 (0.85)	2.69 (0.76)	2.71 (0.86)	2.70 (0.80)
PANAS-N	1.61 (0.58)	2.03 (0.81)	1.81 (0.73)	1.67 (0.67)	1.56 (0.67)	1.69 (0.77)	1.62 (0.71)
STAXI-2-S	19.84 (6.27)	20.12 (6.74)	19.41 (6.47)	18.13 (4.59)	16.92 (5.10)	17.59 (3.49)	17.21 (4.44)
STAXI-2-T	17.26 (4.08)	18.58 (3.61)	17.79 (3.70)	18.08 (4.13)	18.08 (4.46)	17.10 (2.97)	17.65 (3.88)
BART	22.50 (12.41)	24.91 (12.42)	24.43 (12.67)	22.24 (9.88)	20.04 (10.11)	23.48 (11.47)	21.65 (10.83)
CCT	14.35 (5.25)	13.84 (5.93)	13.54 (4.96)	14.92 (4.31)	13.93 (4.53)	14.82 (5.94)	14.35 (5.22)
GDT	2.23 (8.50)	2.32 (8.33)	4.00 (9.21)	1.44 (9.08)	4.59 (8.44)	6.67 (8.67)	5.56 (8.54)
IGT 1-40	-2.76 (11.33)	-3.45 (11.65)	-4.93 (6.45)	-4.24 (9.22)	-2.63 (6.92)	-2.78 (8.57)	-2.69 (7.57)
IGT 41-100	4.00 (22.45)	-2.00 (15.80)	-4.36 (17.22)	-0.18 (22.36)	-4.44 (18.11)	0.26 (21.89)	-2.47 (19.72)

[a] $p = .045$
[b] $p = .628$
[c] $p = .391$

Note: PANAS = Positive and Negative Affect Schedule (average Positive and Negative subscale scores); STAE = State Trait Anger Expression Inventory (total State and Trait subscale scores); BART = Balloon Analogue Risk Task, number of average pumps per balloon adjusted for only unexploded balloons; CCT = Columbia Card Task, average selections per trial; GDT = Game of Dice Task, risky minus safe selections; IGT = Iowa Gambling Task, advantageous minus disadvantageous selections by early (trials 1-40) and later (trials 41-100) selections.

Table 2

Description of study tasks

Task	Description	Study Variable
Balloon Analogue Risk Task (BART; Lejuez et al., 2002)	Participants blow up a series of 30 balloons, earning $0.05 per pump. The money earned on a balloon is lost if it pops before the money is banked.	Average number of pumps per balloon, adjusted for only unexploded balloons (higher values indicate riskier decision making)
Columbia Card Task (CCT; Figner et al., 2009)	Participants earn points by turning over a series of 32 cards (24 trials). Each trial varies the number of loss cards (1 or 3), amount to be won on each card (10 or 30 points), and amount to be lost if a loss card is chosen (250 or 750 points).	Average number of selections per trial (higher values indicate riskier decision making)
Game of Dice Task (GDT; Brand et al., 2005)	Participants earn money by predicting the roll of a die. They can choose a 1-, 2-, 3-, or 4-number sequence, risking $100, $200, $500, $1000 on each prediction respectively.	Advantageous (3, 4 dice) minus disadvantageous (1, 2 dice) selections (higher values indicate more advantageous decision making)
Iowa Gambling Task (IGT; Bechara, 2007)	Participants maximize profit by selecting 100 cards from one of four decks. Two decks are advantageous (low immediate reward, low losses, long-term gains) and two decks are disadvantageous (high immediate reward, high losses, long-term losses). Risks and benefits of the decks are learned as the task progresses.	Advantageous (C, D) minus disadvantageous (A, B) selections during the earlier (Trials 1-40) and later (Trials 41-100; Brand et al., 2008) blocks (higher values indicate more advantageous decision making
Positive and Negative Affect Schedule (PANAS; Watson et al., 1988)	Participants respond to a series of 10 positive and 10 negative mood items assessing in-the-moment state mood.	Average scores were calculated separately for the positive and negative items (higher values indicate greater positive or negative mood)
State-Trait Anger Expression Inventory-2 (STAXI-2; Spielberger, 1999)	Participants respond to a series of 57 items regarding their intensity and frequency of anger. Only state and trait items were used in the present study.	Summed total scores were calculated for the state and trait anger subscales separately (higher values indicate greater anger)