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Recalibrating valence weighting biases to promote changes in rejection sensitivity and risk-taking

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Abstract

Past research has found that modifying individuals' valence weighting tendencies by recalibrating them to weight positive and negative valence in a more balanced manner influenced a variety of judgments. The current research examines the utility of the recalibration procedure as a targeted intervention. In Experiment 1, we recruited participants high in rejection sensitivity (who are known to exhibit a negative weighting bias) and in Experiment 2, we recruited participants with high risk tendencies (who are known to exhibit a positive weighting bias). In both experiments, participants first played BeanFest, in which they were presented with beans varying in shape and speckles and learned which increased or decreased points. They later classified the game beans, as well as novel ones varying in their resemblance to the known positives or known negatives, as good or bad. In the recalibration condition, participants were told if they classified each bean correctly, thus receiving feedback regarding the appropriate weighting of resemblance to a known positive versus a negative. The controls, who received no feedback, were less accurate at classifying the novel the beans than the recalibration participants. Furthermore, in Experiment 1, the recalibration condition subsequently exhibited lower sensitivity to rejection than the control condition, with this reduction being stronger for individuals initially higher in rejection sensitivity. This effect was still present a week later. In Experiment 2, the recalibration condition reported diminished risk-tendencies, again with this effect being stronger for individuals with initially higher riskiness, and persisting for a week. Even more importantly, recalibration participants also engaged in less risky behavior on a laboratory task.

Key words: Attitude generalization, valence weighting, cognitive modification, rejection sensitivity, risk

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Biases in favor of positive or negative information can be harmful for individuals' psychological wellbeing. For example, negative biases in attention (Hankin, Gibb, Abela, & Flory, 2010; MacLeod, Mathews, & Tata, 1986), interpretation of ambiguous situations (Mogg, Bradbury, & Bradley, 2006), and memory all relate to depression and anxiety symptoms (Mathews & Macleod, 2005; Matt, Vazquez, & Campbell, 1992). Sensitivity to punishment and a lack of appreciation of rewards in one's environment also are associated with high levels of anxiety and depression (Johnson, Turner & Iwata, 2003; Newman, Wallace, Schmitt, & Arnett, 1997; Pinto-Meza, Caseras, Soler, Puigdemont, Peréz, & Torrubia, 2006). However, having biases strongly in favor of positives can pose difficulties for wellbeing as well. Individuals who are overly sensitive to positives are more likely to engage in risky behaviors (e.g., having unprotected sex, taking illegal substances), which can be damaging for their health or put them in harm's way (Johnson et al., 2003; O'Conner, Stewart, & Watt, 2009).

In the current research, we hypothesize that an intervention can train individuals with potentially detrimental valence weighting tendencies to weight positive and negative information in a more balanced manner. Recently, research has both measured and manipulated proclivities in valence weighting. Specifically, this research relied on the notion that when people evaluate a new situation or object that is similar to past positive and negative experiences, they must weigh those resemblances in order to form a judgment of the situation or object (Fazio, Pietri, Rocklage, & Shook, 2015; Pietri, Shook, & Fazio, 2012; 2013a; Rocklage & Fazio, 2014). Thus, individuals essentially engage in attitude generalization processes whenever they evaluate a new occurrence or object. Some individuals may weight resemblance to known negatives very strongly and generalize negative attitudes to new situations or objects, whereas others may give more weight to positive resemblances. Such overweighting of negatives or positives during this generalization process has the potential to be harmful for wellbeing and result in individuals being overly fearful or particularly risky (Fazio et al., 2015; Pietri et al., 2013a). However, it is possible to modify these biases. Past research has also recalibrated individuals to give more balanced weight to positive and negative information, and in turn, shifted individuals away from their initial valence weighting tendencies (Fazio et al., 2015; Pietri, Shook, & Fazio, 2013b). Therefore, the goal of the current research was to examine the effectiveness of this recalibration procedure as a targeted intervention. The aim was to train participants recruited on the basis of specific criteria to weight positive and negative information in a more balanced manner so as to promote beneficial judgments (i.e., less anxiety at the prospect of rejection, and less detrimental risky behaviors).

Past research has successfully measured and manipulated valance weighting by utilizing a paradigm affectionately called “BeanFest”. Participants interact with new objects, or beans, which vary within a 10 by 10 matrix from circular to oblong and few to many speckles. During the game phase of BeanFest, participants are presented with a subset of beans from the matrix. Participants must then decide whether to select or not select these beans, some of which lead to a gain in points when selected and some of which lead to a loss. Following the game, participants complete a test phase in which they classify the game beans as good or bad, as well as new beans (i.e., beans that were not seen during the game) from the matrix that resemble both good and bad game beans. Thus, during the test phase, it is possible to examine how individuals formed positive and negative attitudes towards the game beans and how these attitudes generalize to the new beans (Fazio, Eiser, & Shook, 2004). People must weight the positive and negative characteristics of the new beans in order to classify these beans as good or bad.

Attitudes toward the game beans do generalize to the novel beans, i.e., people are more likely to classify beans that resemble positive (negative) game beans as positive (negative). As a result, past research has assessed individual differences in the weighting of positive and negative information during attitude generalization, or people's weighting biases, by calculating participants' positive (1) and negative (-1) responses to the novel beans while either statistically controlling for the learning of the good and bad game beans or ensuring that participants learned all the beans particularly well. The resulting index of valence weighting tendencies has been found to relate to a variety of judgments including (a) fear of rejection in interpersonal relationships, (b) threat assessment of ambiguous situations, (c) comfort in novel situations, (d) emotional reactivity to a novel stressful situation in the laboratory, and (e) risk assessments and risk behavior (Pietri et al., 2012, 2013a). Moreover, the predictive utility of this performance-based index of valence weighting has been evident over and above any relation with individuals' responses to direct queries about their sensitivity to positive and negative valence. In the real-world, valence is often confounded by differential distinctiveness and diagnosticity (Kanouse & Hanson, 1972; Skowronski & Carlston, 1989), and these natural confounds may make it difficult for individuals to accurately reflect and report their valence weighting tendencies (see Fazio et al., 2015).

Past research has also found that the performance-based measure of valence weighting was particularly predictive of situations individuals were unlikely to have encountered in the past. Specifically, the weighting bias only related to reactions to risky behaviors on the Domain Specific Risk-Taking Scale (DOSPERT; Weber, Blais, & Betz, 2002) that the participant population (college undergraduates) were unlikely to have experienced (e.g., “Chasing a tornado or hurricane by car to take dramatic photos”) and did not predict reactions to risks that the participants likely had experienced in the past (e.g., “Admitting that your tastes are different those of your friends”). Presumably, when judging a risk they have previously faced, people can rely on their memory of the good or bad outcomes associated risk to make an assessment. However, evaluating a new risk requires the integration of the potential positive and negative features associated with the behavior, and hence involves the attitude generalization process that the weighting bias captures.

Beyond measuring individual differences, past research also has manipulated the weighting bias in order to examine its causal influence. These experiments recalibrated individuals to give more equal weight to positive and negative information when generalizing their attitudes. To accomplish this aim, during the test phase of BeanFest, participants received feedback each time they classified a bean as to whether the classification was correct or incorrect. Although the novel beans technically had no associated value, their proximity to positive or negative game beans in the matrix meant that the novel beans objectively more closely resembled either a positive or negative game bean. By receiving feedback, participants gradually overcame the influence of their initial biases and weighted positive and negative information more equivalently when generalizing their attitudes towards new beans. Specifically, by the end of the test phase, participants were more accurately classifying novel beans compared to a control condition that received no feedback (Pietri et al. 2013b). Recalibrating participants to weight positive and negative information in a more balance manner when classifying the beans in turn affected their attitude generalization tendencies towards other non-bean objects (e.g., the extent to which they interpreted various ambiguous situations as positive or negative, their concerns about pursuing a risky option, and their actual risk-taking behavior) (Pietri et al., 2013b).

These first experiments employing the recalibration paradigm demonstrated the causal influence of valence weighting tendencies on a variety of judgments. They also suggest that the recalibration procedure has the potential to serve as an impactful intervention. However, there were limitations in the past research that hinder the ability to fully assess the efficaciousness of the recalibration paradigm. For example, because the recalibration paradigm trained individuals to give more equal weight to positive and negative information, it had different effects for individuals who began with positive or negative weighting biases. Specifically, this paradigm recalibrated individuals with a strong negative (positive) bias in the direction of their more heavily weighting positive (negative) valence than they did previously. To approximate participants' initial weighting tendencies, the past experiments considered the total number of times the participants selected a bean during the first block of the BeanFest game (Pietri et al., 2013b). This measure functioned well because selecting a bean during the first block of the game, when one has no information about the value of the bean, represents approaching an unknown and, hence, taking a risk, and the weighting bias is known to correlate with risk-taking behavior (Pietri, et al., 2013a). Thus, in the initial experiments, recalibration influenced participants who were more cautious during the first block of BeanFest, and presumably had a negative weighting bias, to develop more positive attitude generalization tendencies, express more favorable interpretations of ambiguous information, report less concern about risky alternatives, and engage in more risky behavior. In contrast, participants who took more risks by approaching more beans during the first block (evidence of a positive weighting bias) showed the opposite tendency; they became more cautious in their subsequent judgments and behavior

(Pietri, et al., 2013b). The critical finding from each of these experiments centered on the interaction between initial riskiness, as indexed by the total number of approach decisions during the first block of the game, and the experimental manipulation (recalibration versus control condition).

Rather than recruiting individuals in an unrestricted manner and estimating their valence weighting tendencies, the present research seeks to target specific subsets of people for whom the recalibration paradigm may function as a helpful intervention. As one example, consider individuals who score high on the Rejection Sensitivity Questionnaire (RSQ; Downey & Feldman, 1996), which measures individuals' anxiety towards various hypothetical situations involving the possibility of rejection (e.g., "You ask someone you don't know well out on a date"). Having high scores on the RSQ is detrimental because it predicts lower satisfaction in and the eventual dissolution of relationships (Downey & Feldman, 1996; Downey, Freitas, Michaelis, & Khouri, 1998). Pietri et al. (2013a) found that such individuals were characterized by a more negative valence weighting bias, as assessed by their performance in the BeanFest paradigm. Might individuals with high RSQ scores display a reduced sensitivity to rejection after undergoing the recalibration intervention? Experiment 1 examines this question.

As mentioned earlier, past research has also found that individuals with a positive weighting bias reported a higher likelihood of engaging in a variety of harmful risky behaviors (e.g., "Betting a day's income at a high stake poker game") on the DOSPERT (Pietri et al., 2013a). A positive weighting bias also related to actual risk taking behavior on the Balloon Analogue Risk Task (BART; Lejuez et al., 2002). During this task participants had to balance pumping a computerized balloon in order to gain money while also avoiding pumping the balloon too much and causing it to pop, which led to the loss of all their money for that trial.

Researchers have found that pumping the balloons many times, or being risky on the BART, predicts harmful real world actions such as drug abuse (Lejuez et al., 2002). Might the recalibration paradigm prove to be a useful intervention for individuals who tend to endorse the pursuit of risky behaviors? Experiment 2 focuses on this possibility.

A second limitation of the past research utilizing the recalibration paradigm was that the effect of recalibration was assessed only immediately following the training (Pietri et al., 2013b). As result, it was not possible to ascertain whether the effect of recalibration persisted beyond the laboratory session. If the changes in valence weighting disappear once participants leave the laboratory, then recalibration alone would not provide a particularly powerful intervention. However, if the effects of recalibration persisted, it would suggest that the recalibration paradigm has more potential to be an effective tool for modifying harmful biases involving the overweighting of either positive or negative valence.

Past cognitive modification paradigms have been successful when aiming their treatment towards individuals with strong negativity biases and have found that such effects are indeed enduring. For example, attention modification paradigms have effectively trained individuals to avert their attention away from threatening information during a dot-probe task (Hertel & Mathews, 2011). During this task, participants see two words or faces (typically a threatening word/face and a neutral word/face). Participants must quickly identify a probe that appears in place of one of the faces or words. People with anxiety symptoms tend to show a negative attentional bias or are quicker to identify the probe when it appears in place of the threatening word or face (MacLeod et al., 1986; Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & van IJzendoorn, 2007). To decrease negative attentional biases, researchers adjusted the paradigm to have the probe always appear in place of the non-threatening or neutral stimuli. Researchers have specifically recruited individuals with clinical anxiety disorder (i.e., individuals who have negative attentional biases) and found that this cognitive modification procedure results in a lasting reduction (up to four months) of anxiety symptoms (Amir, Beard, Burns, & Bomyea, 2009; Schmidt, Richey, Buckner, Timpano, 2009). Thus, targeted training has the potential to produce impactful effects.

Current Research

The current research expanded upon past research utilizing the BeanFest recalibration paradigm by targeting this training towards individuals with characteristics known to be associated with valence proclivities in favor of either positive or negative information and by then examining if the effects of recalibration persisted for at least a week after the intervention. In the first experiment, we recruited individuals with high rejection sensitivity scores, which earlier research has found to be associated with a negative weighting bias. We had participants undergo recalibration with the aim of helping them to give more equal weight to positive and negative information, and ultimately be less concerned about the possibility of rejection. In the second experiment we recruited individuals who reported a high likelihood of engaging in unfamiliar risky behaviors. Again we recalibrated participants toward a more balanced weighting of positive and negative valence, with the goal of reducing their reported risk tendencies and actual risk-taking behavior.

Experiment 1

In this first experiment, we targeted individuals who reported being sensitive to the possibility of rejection. We examined whether the recalibration intervention would produce a decrease in their sensitivity to potential rejection. We also contacted participants a week after the laboratory session to assess the persistence of any improvements they exhibited.

Method

Participants

Based on the sample sizes of past recalibration research, we recruited 80 (49 women, 31 men) introduction to psychology students who scored in the top third of the distribution of a large sample of students who had completed the RSQ, along with other surveys, early in the semester. These 80 participants completed the first laboratory session for course credit (38 in the control condition, 42 in the retraining condition), and 67 (43 female, 24 male) responded to an email invitation by completing an online survey a week later also for course credit (31 in the control condition, 36 in the retraining condition). Completion of the follow-up survey was not related to condition [$\chi^2(1, N=80)=.25, p=.617$], initial RSQ score [$r(78)=.03, p=.782$] or RSQ immediately following recalibration [$r(78)=.07, p=.536$] .

Procedure

Early in the semester, all participants completed the Rejection Sensitivity Questionnaire online. The RSQ consist of the 18 hypothetical situations that involve the possibility of rejection (e.g., “You ask someone in class if you can borrow his/her notes” “You ask someone you don’t know well out on a date”). Participants first rated their level of anxiety/concern over the outcome (e.g., “How concerned or anxious would you be over whether or not your boyfriend/girlfriend would move in with you”) on a scale from 1 (very unconcerned) to 6 (very concerned) and then the likelihood of having their request accepted. (e.g., “I expect that he/she would be willing to move in with me”) on a scale from 1 (very likely) to 6 (very unlikely).

We calculated the rejection sensitivity score using the same expectancy-value system utilized by Downey and Feldman (1996). We weighted the likelihood of acceptance (i.e., the expectancy) by the concern or anxiety over the outcome (i.e., value) for each situation.

Specifically, we reverse-scored the likelihood estimates and multiplied those by the level of concern rating. We than calculated the mean across the 18 situations across the full sample, and recruited individuals who were in the top 33% of the sample (final recruited sample: *M*=14.38, *SD*=3.42; 95% CI: 13.73,15.23).

Upon arrival at the laboratory for the experimental session, participants were randomly assigned to either the recalibration condition or control condition. The session began with participants playing the game phase of BeanFest. During the game, participants interacted with "beans" that varied from circular to oblong and from few to many speckles on a ten by ten matrix (making a total of 100 beans). Participants were instructed to strategically select good beans and avoid bad beans in order to gain points and avoid losing. Participants began the game with 50 points and their assigned goal was to win the game, by reaching 100 points, and avoid losing the game, by hitting 0 points.

Participants saw and interacted with 40 beans during the game and were presented with these beans 3 times across three different blocks. These 40 beans were selected from the four corners of the matrix, and two corners were assigned a +10 value and two corners were assigned -10 value (see Figure 1 for the bean matrix). Thus, participants could learn fairly simple rules to remember the valence of game beans (e.g., circular with few speckles and oblong with many speckles=good, circular with many speckles and oblong with few speckles=bad). As in past research employing the recalibration paradigm (see Pietri et al., 2013b for a detailed description), this simplified matrix ensured that participants would learn both the positive and negative game beans well.

During a trial of the BeanFest game, participants were presented with a bean, and decided whether or not to select the bean by pressing the "k" button (to select the bean) or pressing the “d” button (to not select the bean). If participants selected the bean, in the lower right corner, participants saw the bean’s value as either +10 or – 10 depending on the bean. Below the bean’s value, participants saw their net gain or loss as +10 or -10. In the left corner participants saw their current point value, which had either increased or decreased by 10, and a bar that graphically displayed how close they were to 0 and 100 points. If participants did not select the bean, the value of the bean was still displayed, but their net gain or loss was shown as 0 and their point value did not change. If participants hit 0 or reached 100 points, a screen would appear telling them they had lost or won the game, respectively. In either case, a new game would then begin, so that all participants saw three blocks of 40 beans regardless of how many times they won or lost games.

To further facilitate learning, between the first and second block, participants completed a classification training task, in which they were presented with all 40 games and had to quickly identify the bean as good or bad. Participants were given corrective feedback when they incorrectly identified the bean (e.g., “Error! This was *not* a Positive (or Negative) bean.”

Following the game phase, participants completed the test phase in which they had to classify beans as helpful or harmful, i.e., as ones that would have increased or decreased their points. The control condition simply classified a bean and received no feedback. In contrast, the recalibration condition received feedback as to whether they had correctly or incorrectly classified the bean. Feedback for the novel beans in the recalibration condition was based on the novel beans’ proximity to the good and bad game beans. Objectively, these beans were closer to either positive or negative game beans in the matrix and, hence, could be correctly classified as positive or negative. By receiving this information, participants could slowly begin to weight resemblance to a known positive versus resemblance to a known negative in a more balanced and objectively appropriate manner.

In total, participants classified 20 game beans once each, and 48 novel beans twice each. The novel beans selected for inclusion were those that were maximally ambivalent, i.e., those that bore the closest resemblance to both positive and negative game beans (see Pietri et al., 2013b, for details). The first and last 20 trials were fixed, in that during the first 20 trials participants were presented with 4 game beans and 16 novel beans and during the last 20 trials participants classified 20 novel beans. As a result of this organization, we can examine changes in participants' responses to novel beans at the beginning and end of the test phase.

Immediately following BeanFest, participants completed the RSQ a second time.

A week after the laboratory session, participants were contacted via email and provided with instructions for completing the RSQ a final time online. After participants completed the second session, they were thanked for their participation and debriefed.

Results

Immediate effects of recalibration

Replicating past research (Pietri et al., 2013b), we found that this version of BeanFest successfully ensured participants learned the game beans well. During the test phase, participants' classifications of the game beans were, on average, significantly better than the chance level of .50, [M=.93, SD=.09, 95% CI: .91,.95; $t(79)$=43.79, p<.001]. Both the recalibration (M=.92, SD=.09, 95% CI: .88,.94) and control condition (M=.94, SD=.08, 95% CI: .91,.97) learned the game beans well and there was no difference between the two conditions with respect to the proportion of game beans correctly classified; $t(78)$=1.19, p=.238, Cohen's d=.27;.

Next we explored the effect of recalibration on participants' classifications of the novel beans. Specifically, we examined if recalibration resulted in participants more accurately classifying the novel beans. To achieve this goal, we employed a signal detection analysis approach, in which we first calculated "hits" or the proportion of times participants said a novel bean was positive when the novel bean was positive (i.e., closer in proximity to the positive game bean region). We then calculated "false alarms" or the proportion of times participants said a novel bean was positive when it was actually negative (i.e., closer in proximity to the negative game bean region). Finally, we computed *d'* following the procedure outlined by Stanislaw and Todorov (1999). As previously mentioned, participants responded to 16 novel beans (8 of which more closely resembled positive game beans and 8 of which more closely resembled negative game beans) during the first 20 trials of the test phase, and 20 novel beans (again evenly split in terms of their resemblance to positive or negative game beans) during the last 20 trials Thus, we calculated *d'* for the first 16 and the last 20 novel beans. This allowed us to examine if participants in the recalibration condition become more accurate during the course of the test phase. We conducted a mixed model ANOVA predicting *d'* with the first and last set of trials as a within-subjects variable, and condition as a between-subjects variable. As expected, there was a significant trial by condition interaction, *F*(1,78)=8.74, *p*=.004, η_p^2=.101. During the early trials, there was no significant difference between the recalibration (average *d'*= .51, *SD*=.53, 95% CI: .35,.67) and control condition (average *d'*= .56, *SD*=.58, 95% CI: .37,.74) [*t*(78)=.38, Cohen's *d*=.09 *p*=.706]. However, by the end of the test phase the recalibration condition (average *d'*= 1.23, *SD*=.96, 95% CI: .96, 1.52) was more accurately classifying the novel beans than the control condition (average *d'*= .65, *SD*=.64, 95% CI: .45,.86) [*t*(95)=3.10, Cohen's *d*=.71 *p*=.003].

Effects of recalibration on outcome variables

Rejection sensitivity immediately following recalibration. To examine the effects of recalibration on the RSQ immediately following recalibration (*M*=12.38, *SD*=4.57, 95% CI: 11.37,13.39), we conducted a regression analysis predicting the RSQ scores from initial RSQ scores (mean centered), condition (-.5-control, .5-recalibration), and the interaction between the two; total R^2=.56, *F*(3,76)=32.06, *p*<.001. Unsurprisingly, we observed a large effect of initial RSQ; *b*=1.10, *SE*=.12, *t*(76)=9.45, *p*<.001; 95% CI: .87,1.33. There was also an effect of condition; *b* =-1.40, *SE*=.70, *t*(76)=-1.99, *p*=.050; 95% CI: -2.78,-.02. Consistent with expectations, participants in the recalibration condition had lower rejection sensitivity scores than those in the control condition. In addition, these effects were qualified by a two-way interaction; R^2 change= .03, *b*=-.50, *SE*=.24, *t*(76)=-2.11, *p*=.038; 95% CI: -.97,-.03. At one standard deviation below the mean of the initial RSQ variable, there was no effect of recalibration, *b*=.32, *SE*=1.03, *t*(76)=.31, *p*=.755; 95% CI: -1.70, 2.34. In contrast, at one standard deviation above the mean, there was a strong effect of condition [*b*=-3.12, *SE*=1.12, *t*(76)=-2.78, *p*=.007; 95% CI: -5.32,-.92], such that the recalibration condition exhibited reduced rejection sensitivity relative to the control (See Figure 2). Thus, for participants who began with very high sensitivity to rejection, and were presumably strongly overweighting negative valence, recalibration produced a stronger decrease in rejection sensitivity.

Rejection sensitivity one week after recalibration. Next we examined the effects of recalibration on the sensitivity to rejection measured one week after recalibration. We predicted RSQ one week later (*M*=12.22, *SD*=4.86) from initial RSQ, condition, and the interaction between the two; total R^2=.54, *F*(3,63)=24.42, *p*<.001. There was a significant effect of initial RSQ; *b*=1.17, *SE*=.15, *t*(63)=8.03, *p*<.001; 95% CI: .89,1.46. There was no overall effect of condition, although the recalibration condition showed a non-significant trend toward less sensitivity to rejection than the control condition, *b*=-.53, *SE*=.43, *t*(63)=-1.25, *p*=.216; 95% CI: -1.37,.30. However, we again observed a significant two-way interaction, R^2 change= .03, *b*=-.64, *SE*=.31, *t*(63)=-2.11, *p*=.039; 95% CI: -1.24, -.04. At one standard deviation below the mean there was no effect of recalibration, *b*=1.19, *SE*=1.27, *t*(63)=.94, *p*=.349; 95% CI: -1.29,3.68. However, at one standard deviation above the mean initial RSQ score, there was a significant effect of recalibration [*b*=-3.32, *SE*=1.46, *t*(63)=-2.27, *p*=.027; 95% CI: -6.19,-.45], such that participants in the recalibration condition had lower RSQ scores than those in the control condition (See Figure 2).[1]

Discussion

In this first experiment we recruited participants who were sensitive to possibility of rejection and found that, relative to a control condition, the recalibration procedure reduced rejection sensitivity, especially for those participants initially characterized by higher rejection sensitivity scores. Furthermore, the effect of recalibration persisted for at least a week after participants left the laboratory.

Experiment 2

In the second experiment our objective was to recalibrate a sample of individuals who, according to previous research findings, were likely to overweight positive information. To achieve this goal, we recruited individuals who reported risky tendencies. Our aim was to recalibrate these individuals to a more balanced weighting of positive and negative information and ultimately make them more cautious.

Method

Participants

We recruited 97 (35 female, 62 male) introductory psychology students who scored in the top third on riskiness of a large sample of students who had completed multiple surveys early in the semester for extra credit. These 97 participants completed the first laboratory session for course credit (46 in the control condition, 51 in the recalibration condition), and 86 (30 female, 56 male) responded to an email invitation to complete an online survey a week later also for course credit (41 in the control condition, 45 in the recalibration condition). Completion of the follow-up survey was not related to condition [$\chi^2(1, N=97)=.02, p=.890$], initial risk score [$r(95)=-.04, p=.700$], or risk score immediately following recalibration [$r(85)=.12, p=.240$].

Procedure

Early in the semester participants completed a subset of items from the Doman Specific Risk-Taking Scale (DOSPERT; Weber, Blais, & Betz, 2002. The full DOSPERT asks participants to rate their likelihood of engaging in each of 40 risky behaviors (e.g., “Disagreeing with your father on a major issue” , “Trying out bungee jumping at least once”) on a 1 (*very unlikely*) to 5 (*very likely*) scale. Based on responses from undergraduates as to their likelihood of having previously encountered a risk behavior from the DOSPERT, Pietri et al. (2013a) divided the DOSPERT items into three categories: likely (9 items; “Admitting that your tastes are different those of your friends”), moderately likely (13 items; “Going camping in the wilderness, beyond the civilization of a campground”), and unlikely to have been encountered in the past (18 items; “Chasing a tornado or hurricane by car to take dramatic photos”). As mentioned in the introduction, the weighting bias related most strongly to participants’ likelihood of engaging in the behaviors unlikely to have been experienced and had no relationship with the likely-experienced behaviors on the DOSPERT (Pietri et al., 2013a). As a result, we utilized the 18 behaviors unlikely to have been experienced in the past to screen participants on riskiness. As in the previous experiment, a large sample of participants completed these 18 items, and we recruited participants who were in the top 33% of the sample (final recruited sample: *M*=2.97, *SD*=.38; 95% CI: 2.90, 3.05).

Upon coming into the laboratory, participants played the BeanFest game and completed the test phase, just as in Experiment 1. During the test phase, participants again classified game beans as well as novel beans as good or bad, and the recalibration condition received feedback on every trial whereas the control condition did not.

After finishing the BeanFest paradigm, participants completed the full 40-item DOSPERT. They then completed the Balloon Analogue Risk Task (BART) developed by Lejuez and colleagues (2002) as a measure of risk behavior. During a trial of the BART participants were presented with a small balloon in the middle of the computer the screen with button labeled “Pump up the balloon” under the balloon. On the right side of the screen were participants’ total earnings and a button labeled “collect.” During a given trial, participants click the pump button to inflate the balloon, and each time they pump the balloon they earned $.05 of imaginary money. Participants could end a trial by pressing the collect button, which then added the money they earned on that trial to their total earnings. However, a trial could also end if participants “popped” the balloon by over pumping it, which resulted in participants losing all their money for that trial. The “strength” of any given balloon was variable in that the balloon could pop at any point from 1 to 25 pumps. Thus, pumping the balloon was risky because participants could earn another $.05, but they also chanced popping the balloon and losing all their money for that trial. Participants completed 20 trials (i.e., were presented with 20 balloons).

We counted the total number of times participants clicked the pump button, i.e., took the risk of pumping the balloon to increase its value by an additional $.05 while risking loss of all their money for that trial.

One week after participants completed the laboratory session of the experiment, they were contacted via email and given instructions to complete an online survey. Participants were directed to a website that presented them with the full 40 item DOSPERT. After completing the online session, participants were fully debriefed and thanked for their participation.

Results

Immediate Effects of Recalibration

We again first confirmed that participants learned the game beans well. We found that across both conditions participants classified the beans significantly better than the chance proportion of .50 correct; *M*=.92, *SD*=.13; *t*(96)=67.13, *p*<.001; 95% CI: .89, .94. Furthermore, both the recalibration condition (*M*=.92, *SD*=.14, 95% CI: .88,.96) and the control condition (*M*=.91, *SD*=.12, 95% CI: .87,.93) learned the game beans well and there was no effect of condition on the proportion of game beans classified correctly; *t*(95)=.48, *p*=.63, Cohen's *d*=.10.

We again ran a mixed model ANOVA predicting *d'* for the first and last set of test trials as a within-subjects variable and condition as a between-subjects variable. As in Experiment 1, there was a significant trial by condition interaction *F*(1,95)=26.24, *p*<.001, η_p^2=.216. During the early trials there was no significant difference between the recalibration (average *d′*= .54, *SD*=.89, 95% CI: .32,.80) and control condition (average *d′*= .47, *SD*=.66, 95% CI: .30,.69) *t*(95)=.46, *p*=.649, Cohen's *d*=.09). However, by the end of the test phase the recalibration condition (average *d′*= .1.77, *SD*=1.26, 95% CI:1.44,2.12) was classifying the novel beans more accurately than the control condition (average *d′*= .61, *SD*=.57, 95% CI:.47,.82) (*t*(95)=5.75, *p*<.001, Cohen's *d*=1.19).

Effects of Recalibration on Outcome Variables

Predicted likelihood of engaging in risky behaviors immediately following recalibration. We next examined the effects of recalibration on the DOSPERT immediately following recalibration. Because past research found that the weighting bias was most predictive of the unlikely-experienced behaviors, we predicted that recalibration would make individuals less likely to engage in this specific subset of behaviors. Thus, we first looked at how recalibration influenced participants' likelihood of engaging in the 18 behavioral items they were unlikely to have experienced. We ran a regression predicting responses to these behaviors from participants' initial risk scores (mean-centered), condition (-.5-control, .5-recalibration) and the interaction between the two; total R^2=.11, *F*(3,93)=3.63, *p*=.016. There was a significant effect of initial risk [*b*=.34, *SE*=.14, *t*(93)=2.49, *p*=.015; 95% CI: 0.07,0.61]; those who endorsed more risk early in the semester tended to continue to do so. We also observed the anticipated effect of condition, *b* =-.23, *SE*=.10, *t*(93)=-2.30, *p*=.023; 95% CI: -0.43,-0.031. Participants who underwent recalibration displayed less risky tendencies relative to the control condition. Although the interaction was not significant [R^2 change= .01, *b*=-.34, *SE*=.28, *t*(93)=-1.23, *p*=.223; 95% CI: -0.88,0.20], the effect observed in Experiment 1 prompted us to engage in simple effect testing, which revealed a pattern similar to that obtained in Experiment 1 (see Figure 3). At one standard below the mean there was no effect of condition *b*=-.11, *SE*=.14, *t*(93)=-.74, *p*=.459; 95% CI:- 0.39,0.17. However, at one standard deviation above the mean there was a significant effect of condition, with the recalibration participants reporting less riskiness than the control participants, *b*=-.36, *SE*=.15, *t*(93)=-2.45, *p*=.016; 95% CI: -0.65,-.07.

Thus, recalibration was somewhat more effective for participants who started out with higher riskier tendencies, presumably because they were more strongly overweighting positive information. When we pursued the same regression analyses predicting behavioral items from the DOSPERT classified as likely to have been experienced and as moderately likely to have been experienced, we found no significant effects of condition or significant interactions between condition and initial risk (all *ps*>.298).

Predicted likelihood of engaging in risky behaviors one week following recalibration. We again examined if these effects persisted for one week after recalibration. We ran the same regression equation predicting responses to the 18 unlikely-experienced risk behaviors one week later from condition, initial risk, and the interaction between the two. Although the effects were weaker one week after recalibration, we observed a pattern very similar to that seen immediately follow recalibration (see Figure 3). Most importantly, there was an effect of condition, albeit marginally significant; *b*=-.20, *SE*=.11, *t*(82)=-1.81, *p*=.074; 95% CI: -0.42,0.02. The interaction was not significant [R^2-change= .01, *b*=-.19, *SE*=.29, *t*(82)=-67, *p*=.50; 95% CI:-0.76,0.37], but as Figure 3 suggests, the effects tended to be stronger for participants who had higher initial risk tendencies than for participants who began with lower initial riskiness. At one standard deviation below the mean there was no effect of condition [*b*=-.12, *SE*=.15, *t*(82)=-.79, *p*=.429; 95% CI: -0.42,0.18], whereas at one standard deviation above the mean on initial risk there was a marginal effect of condition *b*=-.27, *SE*=.16, *t*(82)=-1.72, *p*=.090; 95% CI: -0.58,0.04. We ran supplemental regression analyses predicting the average likelihood of engaging in the risk behaviors that were moderately likely to have been experienced and those that were likely to have been experienced and again found no effects of condition or interactions between condition and initial risk (all *ps*>.547).[2]

Risk behavior as measured on the BART task. Next we examined how the recalibration intervention affected actual risk behavior on the BART task. We ran the same regression equation as above predicting total pumps on the BART task (*M*=146.80, *SD*=49.74). There was a trending effect of initial risk [*b*=20.08, *SE*=13.50, *t*(93)=1.49, *p*=.140; 95% CI: -6.41,46.56]. Most importantly, there was an effect of condition [*b*=-23.79, *SE*=.9.98, *t*(93)=-2.38, *p*=.019; 95% CI:-43.37, -4.21] in that participants in the recalibration condition pumped fewer times than those in the control condition. There was no sign of an interaction between condition and initial risk [*b*=-1.17, *SE*=27.25, *t*(93)=-.04, *p*=.966; 95% CI:-54.63, 52.29]. Thus, we found that recalibration reduced risk-taking behavior within a sample of participants selected for their endorsement of novel risk behaviors, and the effect did not vary as a function of initial riskiness scores.

Discussion

In Experiment 2, we found that recalibration resulted in less riskiness, relative to the control condition, as indicated by both a self-report measure and a behavioral measure. We also observed some evidence that the decrease in risky tendencies persisted for a week after recalibration. Finally, as in Experiment 1, for the self-reported likelihood of engaging in risks, the effect was stronger for participants who began with a higher initial propensity for risk-taking.

General Discussion

Across two experiments we found evidence for the effectiveness of recalibrating valence weighting during attitude generalization as a targeted intervention. In the first experiment we recruited participants who were particularly sensitive to rejection. Recalibrating these participants toward a more accurate classification of the novel beans resulted in a decreased sensitivity to the prospect of rejection. Although all participants were recruited because they were highly rejection sensitive, there was still some variability among RSQ scores in the recruited sample. The recalibration effect was strongest for the participants who reported the highest levels of rejection sensitivity (i.e., participants who were likely giving the most weight to negative information). Furthermore, we found evidence that the effect of recalibration persisted for a week.

In the second experiment, we recruited participants who reported strong tendencies to engage in unfamiliar risky behaviors. After we recalibrated these participants toward a more accurate weighting of positive and negative valence, they reported a lower likelihood of taking risks and engaged in less risk-taking behavior (i.e., pumped the balloons less during the BART task). Although the interaction effects were less pronounced than in Experiment 1, the effect of recalibration on the self-reported likelihood of engaging in novel risk behaviors appeared especially strong for participants with the highest initial risk-taking propensities. Furthermore, there was evidence, albeit marginally significant, that the reduced likelihood of engaging in risks among the recalibrated participants continued for a week beyond the laboratory session. Thus, across the two experiments, we found evidence that the recalibration paradigm was beneficial for individuals with characteristics known to be associated with both positive and negative valence weighting biases.

Past research has successfully recalibrated valence weighting and in turn influenced judgments across a variety of measures, including attitude generalization towards new non-bean visual stimuli, interpretations of ambiguous situations, self-reported risk tendencies, and risk-taking behaviors (Pietri, et al., 2013b). However, these past experiments recruited participants with a range of initial valence weighting tendencies and did not target the intervention at individuals who could be presumed to overweight either positive or negative valence.

Recalibration led participants who were initially more cautious, in the sense that they approached unknown beans relatively infrequently, to give more weight to positive information when making judgments and evaluations, whereas it produced the opposite tendency for initially riskier individuals, those who approached unknown beans more frequently (Pietri et al., 2013b). The current research built upon these past experiments by demonstrating that it is possible and advantageous to target recalibration specifically towards individuals with specific characteristics. Moreover, the moderation by initial rejection sensitivity and riskiness further suggests that the recalibration paradigm may be particularly powerful when aimed at individuals with relatively extreme positive and negative biases. Importantly, although we saw that the effects of recalibration were strongest for participants who began with especially high sensitivity to rejection or risk tendencies, we did not observe a reversal of the effect in either experiment (i.e., we did not inadvertently cause participants to be more rejection sensitive or risky).

Further adding to past research on recalibrating valence weighting, we found that these effects persisted for at least a week. All of the dependent measures in past research were administered directly after the recalibration procedure (Pietri et al., 2013b). As a result, it was not possible to assess if the effect of recalibration was persistent in nature. Thus, the current experiments provided initial evidence that recalibrating valence weighting has effects that endure beyond the recalibration session.

Interestingly, past research has found that the recalibration procedure appears to be fairly subtle. After receiving feedback during the test phase, participants could not accurately report whether they had been committing more errors for positive or negative beans or whether they had been more likely to classify beans as positive or negative (Pietri et al., 2013b). These inaccuracies most likely occurred because the trials and the feedback progressed rather rapidly.

Nevertheless, these findings suggested that any changes as a result of recalibration were not due to participants' conscious self-refection and correction (e.g., noticing they classified many beans as negative and trying to be more positive). Instead, the recalibration procedure seems best viewed as an example of operant conditioning in which individuals gradually learn to assess positive and negative resemblances in a more balanced manner. Thus, recalibrating individuals to weight positive and negative information equally when evaluating novel beans, modifies a basic process that promotes weighting valence information equivalently across a range of occurrences. For example, people who are highly sensitive to the possibility of rejection likely overweight the potential harmful aspects of asking a favor of another person (i.e., the person will turn them down), and hence recalibration encourages these individuals to weight more strongly the positives associated with making the request (i.e., the favor will be granted). In contrast, risk-seeking individuals may overweight the beneficial characteristics of engaging in a potentially harmful behavior (i.e., the thrill of winning money from a bet), and as a result, recalibrating helps these individuals give more weight to negatives (i.e., losing money) associated with the risk.

Beyond previous recalibration work, the current experiments also speak to existing research utilizing cognitive modification paradigms, which have been efficacious in changing strong negativity biases in attention (see Hertel & Mathews, 2011 for review). Past research has successfully trained individuals with anxious tendencies to avert their gaze away from threatening stimuli, which resulted in reductions in anxiety symptoms and negative reactions to stress (Amir, Beard, Burns, & Bomyea, 2009; Daneneau, Baldwin, Baccus, Sakellaropoulo, & Pruessner, 2007; Hakamata et al., 2010; Schmidt, Richey, Buckner, Timpano, 2009). However, there are important differences between the recalibration and attentional modification paradigms.

The latter concern very early stages of information processing in that they train individuals to focus their gaze away from negative stimuli. In contrast, recalibrating the weighting of positive versus negative information influences a later stage, which occurs after individuals have attended to positive and negative features and while they are integrating this information into an overall evaluation. Despite their conceptual differences, these two processes may also be related. When individuals' attention is drawn to positive or negative stimuli they may be more likely to give that information greater weight as well. Likewise, individuals' greater weighting of positives or negatives may also come to foster the development of a corresponding attentional bias. Research has yet to empirically examine whether recalibrating valence weighting influences attention or whether modifying attentional biases affects valence weighting, and thus, this represents an important avenue for future research.

Importantly, attentional modification paradigms have typically focused on reducing negativity biases (Hertel & Mathews, 2011). The current two experiments add to past research by demonstrating the effectiveness of a new cognitive modification paradigm aimed at recalibrating positive as well as negative biases. Additionally, past cognitive modification research has tailored the training paradigms to achieve specific aims. For example, trainings intended to reduce anxiety symptoms refocused attention away from threatening or angry stimuli, whereas those with the goal of lessening depression symptoms directed attention away from sad faces (Amir et al., 2009; Baert, Raedt, Schacht, & Koster, 2010; Schmidt, et al., 2009). In contrast, the recalibration procedure is less domain-specific; it has the potential to influence judgments and behavior in any domain that involves the weighting of positive and negative valence.

However, it is worth noting that there is some specificity in the effects of the recalibration paradigm. In Experiment 2, participants completed the full DOSPERT, which includes behaviors that participants are likely to have encountered in the past as well as behaviors that participants were unlikely to have experienced in the past. We found that recalibration modified participants' reactions to the novel, unfamiliar risk behaviors, but had no effect on participants' response to those risky situations they were likely to have encountered in the past. When judging a past risk, people can rely on their memory of the event and whether or not they had a good or bad experience and need not engage in an integrative process that requires a weighting of positive versus negative valence (Pietri et al., 2013a). Thus, recalibration should be most effective at influencing people's evaluations of and behavior regarding novel situations.

Naturally, more research is required to continue to demonstrate the effectiveness of recalibration as an intervention. Although the current research provided initial evidence that the effects persist at least a week after recalibration, future research should determine if this change in valence weighting persists even longer. Moreover, future research needs to examine whether evidence of longer-term effectiveness can be obtained even when outcome measures are not administered immediately following the recalibration procedure. It is certainly possible that immediate completion of the measures facilitated the persistence of the effect, although our analyses cast some doubt on the possibility that the persistence effects were driven by accurate recall of the earlier responses (see footnotes 1 and 2). In any case, the effects of recalibration may slowly dissipate in the weeks and months that follow and participants may revert to their previous valence weighting tendencies. However, it is also conceivable that recalibration will initiate a series of cascading effects. Initial changes in the behaviors of recalibrated individuals may promote positive experiences, which then may sustain the changes in valence weighting. For example, people who are recalibrated to give less weight to negative valence and, hence, grow less sensitive to rejection, may ask more of others and find that their requests are granted.

Furthermore, individuals who are recalibrated to give less weight to positive information may be less likely to engage in harmful actions (e.g.., overconsumption of alcohol) and want to maintain the positive health benefits that accrue (i.e., not feeling hung-over or sick). Additionally, if individuals continue to partake in these new behaviors, they may ultimately replace their old habits with more adaptive new ones (Bandura, 1998). In line with this reasoning, similar arguments have been made about the cascading and lasting effects of brief interventions that target basic psychological processes (see Walton, 2014; Sherman & Cohen, 2014; Walton, Logel, Peach, Spencer, & Zanna, 2015). Certainly, valence weighting is a similarly fundamental process (Fazio et al., 2015).

The current two experiments suggest that recalibration may be a useful tool to promote physical and psychological being. The first experiment demonstrated that recalibrating individuals with a strong negative weighting bias resulted in less anxiety and concern when considering the possibility of interpersonal rejection. As a result, recalibration may have the potential to also reduce anxiety and depressive symptoms more generally. In line with this reasoning, past research has found that having a strong negative weighting bias prospectively predicts increased depressive symptoms (Pietri, Vasey, Grover, & Fazio, 2015). Thus, it may be possible and beneficial to recruit individuals at risk of developing depressive symptoms in order to recalibrate them to give less weight to negatives and reduce their likelihood of developing depressive symptoms. The recalibration paradigm may also help decrease detrimental risky behaviors associated with overweighting positives, and in turn promote healthier lifestyles. For example, recalibration reduced the extent to which initially risky participants exhibited risky behavior during the BART, a task which researchers have found to predict such negative health behaviors as taking illegal substances (Lejuez et al., 2002). Because the recalibration paradigm is relatively subtle and easy to administer but still effective at modifying both positive and negative biases across domains, it has the potential to be a powerful intervention. The current research represents an important first step in exploring these possibilities.

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Footnotes

[1] The correlation between participants' RSQ scores immediately following recalibration and one week after recalibration was high, *r*(64)=.91, p<.001. This strong correlation between the two time points suggests the persisting effect of recalibration may have resulted from participants recalling their answers to the RSQ immediately following recalibration to generate their answers on the RSQ one week later. To explore this possibility, we calculated the absolute difference score between participants' responses on each RSQ individual item at time 1 and time 2, and then calculated the mean of these scores to index absolute RSQ item variability. Lower scores indicated less variation in responses to individual items from time 1 to time 2 (i.e., a score of 0 would indicate that participants provided the exact same response on each item). Despite the high correlation between the total RSQ scores at the two time points, participants' scores on this index of absolute item variability ranged from .29 to 2.39 (*M*=.75, *SD*=.35). If the persisting effect of recalibration were a result of participants simply remembering their responses to the RSQ items, then we would expect the effect of recalibration at time 2 to be larger for participants with lower RSQ item variability scores. Thus, we ran a regression equation predicting RSQ scores one week after recalibration from condition, initial RSQ, and the absolute RSQ item variability score, all the two-way interactions, and the three-way interaction. Importantly, there was no significant effect of the RSQ item variability score [*b*=-.65, *SE*=1.24, *t*(59)=-.52, *p*=.603; 95% CI: -3.09,1.79], two-way interaction between the RSQ item variability score and condition [*b*=.99, *SE*=1.27, *t*(59)=.78, *p*=.439; 95% CI:-1.51,3.49], or three-way interaction between the RSQ item variability score, condition, and initial rejection sensitivity [*b*=.40, *SE*=1.03, *t*(59)=.39, *p*=.698; 95% CI: -1.62,2.41]. This finding implies that the effects of recalibration were evident

regardless of whether participants' item variability scores suggest that they may have been recalling their answers at time 1 when generating their time 2 responses.

[2] The correlation between participants' likelihood ratings on the unlikely-experienced behaviors immediately following recalibration and one week after recalibration was much lower than was the case for RSQ scores in Experiment 1, but still significant, $r(84)=.48$, $p<.001$. To examine the possibility that the persistence effect was moderated by accurate recall of the responses provided immediately following recalibration, we again calculated the mean of the absolute difference scores between participants' responses to each unlikely-experienced behavior at time 1 and time 2. The scores ranged from .22 to 2.00 ($M=.92$, $SD=.40$). We ran a regression equation predicting likelihood ratings on the unlikely-experienced behavioral items one week after recalibration from condition, initial risk scores, and the absolute DOSPERT item variability score, all the two-way interactions, and the three-way interaction. Importantly, there was no significant effect of the DOSPERT item variability score [$b=.20$, $SE=.16$, $t(78)=1.25$, $p=.216$; 95% CI: -0.12,0.53], the two-way interaction between the item variability score and condition [$b=.20$, $SE=.32$, $t(78)=.92$, $p=.363$; 95% CI:-.34,0.93], or the three-way interaction between the item variability index, condition, and initial risk scores [$b=-.04$, $SE=.82$, $t(78)=-.05$, $p=.958$; 95% CI: -1.65,1.57]. This result again suggests that the persistence effect was not dependent upon participants' accurate recall of the responses they had provided at time 1 when responding at time 2.

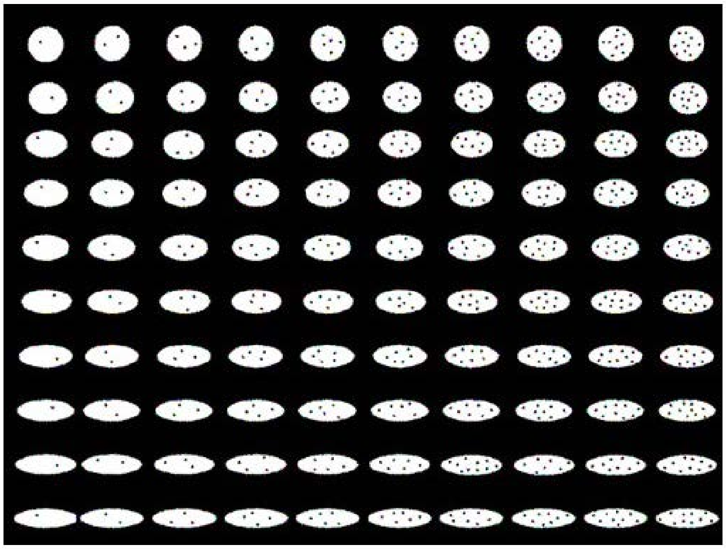

Figure 1. The full matrix of the beans shown during the BeanFest game and test phase.

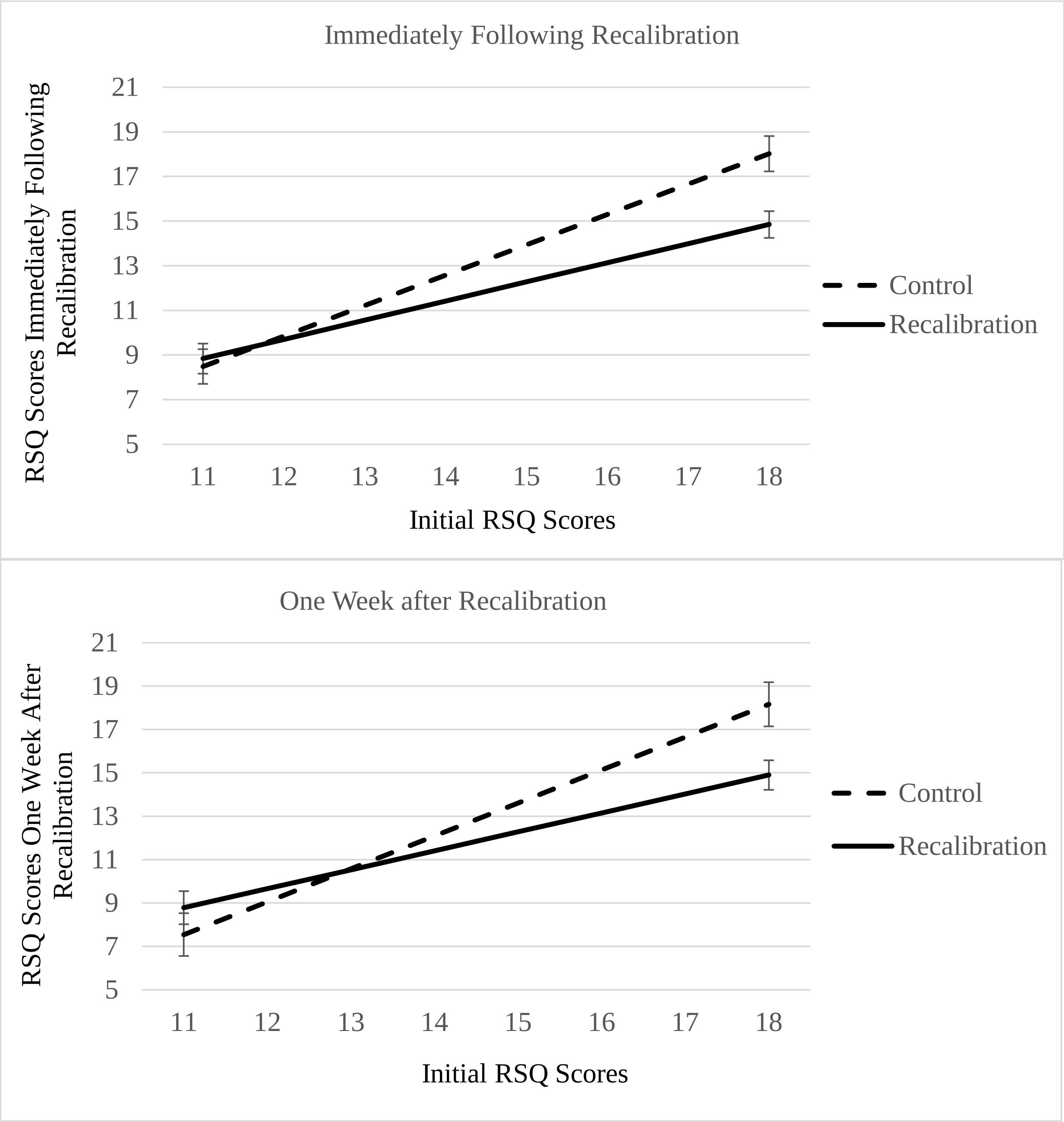

Figure 2. The effect of condition on RSQ scores immediately following recalibration and one week after recalibration as a function of initial RSQ scores. Initial RSQ scores range from one standard deviation above to one standard deviation below the mean. The error bars represent the standard error at one standard deviation above and below the mean.

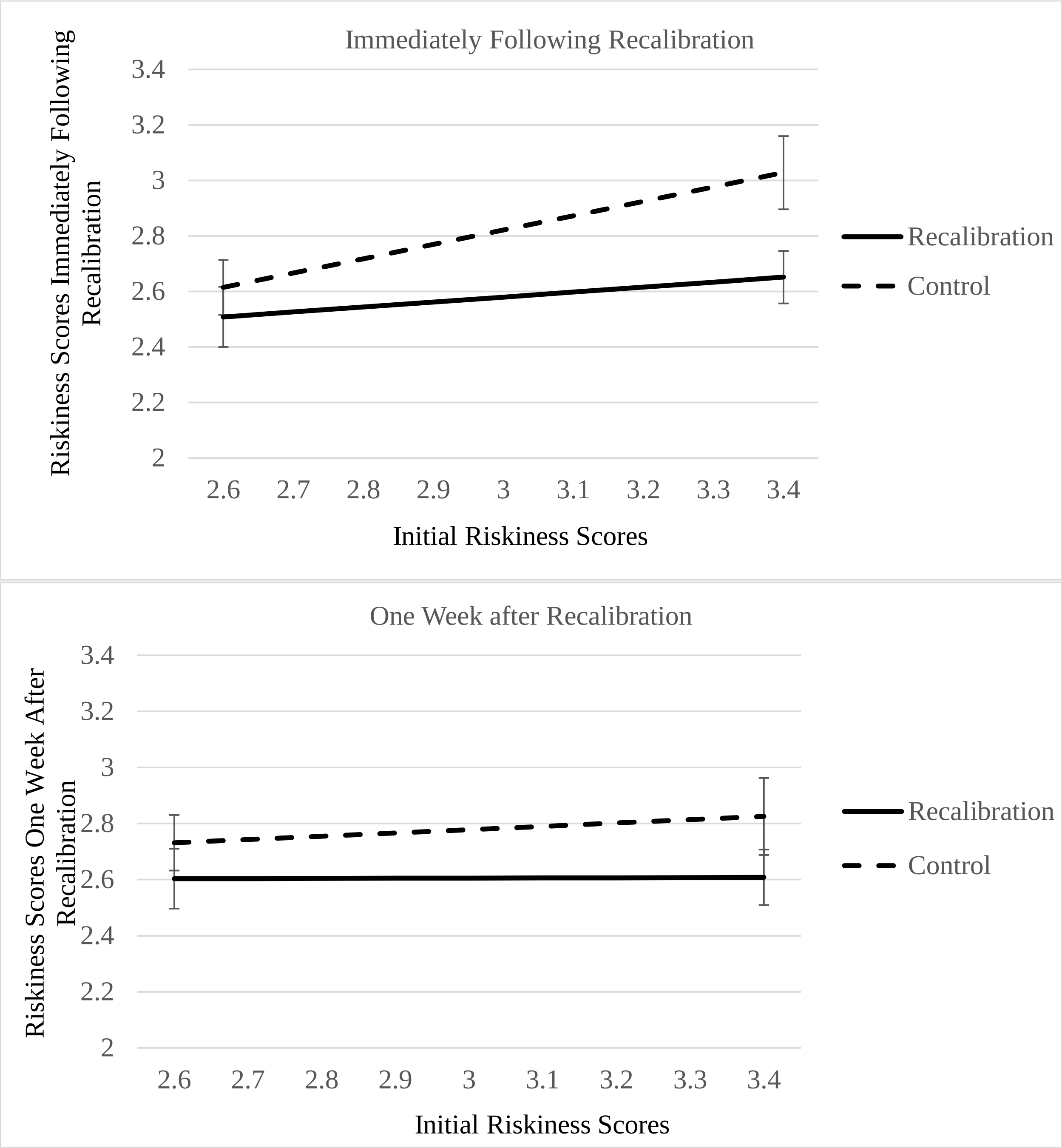

Figure 3. The effect of condition on the mean likelihood of engaging in novel risk behaviors immediately following recalibration and one week after recalibration as a function of initial riskiness (i.e., the mean likelihood ratings for the same novel risk behaviors as measured prior to the experiment). Initial riskiness scores range from one standard deviation above to one standard deviation below the mean. The error bars represent the standard error at one standard deviation above and below the mean.