Journal of Experimental Social Psychology, in press

Recalibrating Positive and Negative Weighting Tendencies in Attitude Generalization

Evava S. Pietri and Russell H. Fazio

Ohio State University

Natalie J. Shook

West Virginia University

Please address correspondence to:

Russell H. Fazio
Department of Psychology
Ohio State University
1835 Neil Avenue
Columbus, OH 43210-1287
Phone: 614-688-5408
Fax: 614-688-5414
E-mail: fazio.11@osu.edu

Abstract

Individual differences in the weighting of positive versus negative information when generalizing attitudes towards novel objects predict a variety of assessments that involve the integratation of valence information (Pietri, Fazio, & Shook, 2013). The goal of the current research was to manipulate valence weighting in attitude generalization to demonstrate its causal impact on various judgments and behaviors. In four experiments, participants first played BeanFest -- a game in which they approached/avoided novel stimuli (beans) varying in shape and speckles, in order to increase and not decrease their points (Fazio, Eiser, & Shook, 2004). Following the game, participants classified game beans, and novel ones that varied in resemblance to the game beans as either positive or negative. In the recalibration condition, participants were told whether each classification was or was not correct. Thus, they received feedback regarding the appropriate valence weighting of resemblance to a known positive versus a known negative. In Experiment 1, this recalibration influenced individuals' attitude generalizations regarding other (non-bean) novel objects. We then examined if recalibration would produce far-transferring effects by influencing interpretations of ambiguous situations (Experiment 2), risk assessments (Experiment 3), and finally risk-taking behavior (Experiment 4). Across the four experiments, the recalibration procedure led participants who were initially relatively cautious to be more positive when making these various judgments, whereas people who exhibited an initial risky bias became more negative as a function of recalibration.

Key Words: Attitude Generalization, Valence Weighting, Cognitive Modification

People are often faced with situations that involve understanding both positive and negative information in order to arrive at an appropriate reaction or judgment. When making such assessments, individuals must integrate the positives and negatives in order to respond. However, scientists in many areas of psychology have found that individuals often do not give equal weight to positive and negative information. In general, people tend to emphasize negative information more than positive (see Baumeister, Bratslavsky, Finkenauer, &Vohs, 2001; Rozin & Royzman, 2001, for reviews). Beyond average tendencies, personality researchers have posited that certain individuals are more sensitive to positive stimuli or rewards, whereas others are more affected by negatives or punishments (e.g., Elliot & Thrash, 2010; Gray, 1987; Idson, Liberman, & Higgins, 2000). Furthermore, individuals with such emotional disorders as anxiety and depression are often characterized by cognitive patterns and distortions that involve an overemphasis on the negative (Abramson, Metalsky, & Alloy, 1989; Riskind 1997).

These findings represent just a summary sampling of what is a vast and diverse literature demonstrating the variability in how individuals understand (and are affected by) positive versus negative information. Recently, researchers have aimed to measure how individuals weight purely positive and negative information when making decisions or judgments that involve some assessment of valence (Pietri, Fazio, & Shook, 2013). Importantly, one goal of this measurement approach was to avoid domain specificity so as to capture how individuals understand and integrate positive versus negative information across a variety of domains. The measure of valence bias focused specifically on differences in how individuals weight positive versus negative when generalizing their attitudes towards novel objects. Although the resulting assessment was predictive of judgments across many domains, the research was correlational in nature and, hence, did not demonstrate the causal impact of attitude generalization tendencies on judgments. With this limitation in mind, the current research aimed to modify individuals' valence weighting tendencies by training them to weight positive and negative information more equally during an attitude generalization task. Specifically, our goal was to train individuals who weight negative information strongly to give more weight to positive information, and to train individuals who overweigh positives to weigh negatives more strongly. An experimental manipulation of this sort would serve to show that this valence weighting tendency has a causal influence on subsequent judgments and reactions.

To elucidate the rationale underlying the series of experiments that we plan to report, we first will summarize our previous research findings concerning individual differences in valence weighting while engaged in attitude generalization. We then will discuss prior research that has successfully manipulated valence biases in attention and, hence, provides reason to believe that it may be possible to recalibrate individuals' valence weighting tendencies. Finally, we will describe the paradigm by which we propose to modify individuals' valence weighting biases.

Performance-Based Measure of Valence Weighting in Attitude Generalization

To articulate our motivation for manipulating valence weighting, we must first explain how and why individual differences in attitude generalization tendencies have been assessed in past research. The approach rested on the presumption that when individuals judge a novel or hypothetical situation they have to weigh how much it resembles a known positive versus a known negative. Thus, individuals are essentially engaging in attitude generalization whenever they are judging a novel situation. They are generalizing from their past positive and negative experiences with similar attitude objects. When doing so, some individuals may generalize their negative attitudes more strongly than their positive attitudes and, hence, give more weight to the negative. As a result, they are likely to form a negative evaluation of the situation. Others may give more weight to the positive and form a more positive evaluation. For this reason, an assessment of how individuals generalize their pre-established attitudes to similar but novel attitude objects can serve as an overall index of how people tend to weigh positive versus negative information when making any judgment that involves integrating valence information (Pietri, Fazio, & Shook, 2012, Pietri et al., 2013).

More specifically, past research has measured such tendencies in attitude generalization through a paradigm called BeanFest. BeanFest was originally created for the express purpose of examining how individuals form and generalize their attitudes towards novel objects (Fazio, Eiser, & Shook, 2004). In BeanFest, participants played a computer game in which their goal was to earn (and avoid losing) points by making appropriate decisions about which stimuli to select. Participants were presented with “beans” that varied within a ten by ten matrix from circular to oblong in shape and from having one to ten speckles. However, during the game, participants were presented with only a subset of the beans from different regions of the matrix (e.g., circular beans with few speckles, oval beans with few speckles, oblong beans with many speckles, etc.). Some types of beans would increase points, whereas others would decrease points, if they were selected. Participants were presented with one bean at a time, and they had to decide whether to select the bean or not. Following the BeanFest game, participants completed a test phase in which they were shown all 100 beans from the matrix, and indicated whether they believed a bean would have been good or bad during the game (i.e., would have increased or decreased their points, respectively). Because participants were presented with all 100 beans, one could assess both how participants formed attitudes towards the game beans and how these attitudes generalized towards the novel beans not seen during the game.

Fazio et al. (2004) observed valence asymmetries both in attitude learning and attitude generalization. The latter is pertinent to the current research. The attitudes that participants developed toward the game beans generalized to the novel beans. Beans that more closely resembled known positives (i.e., those with a Euclidean distance in the 10x10 matrix closer to positive game beans) were likely to be considered positive, and those that more closely resembled known negatives were likely to be considered negative. However, negative attitudes generalized more strongly than positive attitudes did. In particular, novel beans with a location in the matrix equidistant from positive and negative game beans were likely to be classified as negative. Thus, participants weighted resemblance to a known negative more heavily than resemblance to a positive (see also Shook, Fazio, & Eiser, 2007).

Although Fazio et al. (2004) observed this negativity bias in attitude generalization on average, naturally there was variability in the extent to which individuals displayed this asymmetry. Some individuals weighted resemblance to a negative much more strongly than resemblance to a positive when generalizing their attitudes, more so than was average. Others weighted resemblance to a positive equal to or more than resemblance to a negative. It is this variability that Pietri et al. (2013) proposed as an individual difference measure of valence weighting in generalizing positives versus negatives. As will be summarized shortly, Pietri et al. (2013) found this valence *weighting bias* in attitude generalization to be predictive of a variety of judgments that required integration of positive and negative information. They calculated the weighting bias as the average response to novel beans (+1 for positive, -1 for negative), while statistically controlling for the correct learning of positive and negative game beans. Specifically, Pietri el al. predicted average response to novel beans from a regression equation including the proportion of positive and negative game beans correctly classified. They then employed the deviation from the predicted value (i.e., the residual) as the estimate of an individual's weighting bias. More negative (positive) values indicate the tendency to classify more novel beans as negative (positive) than is to be expected from an individual's pattern of learning.

Because the attitudes towards the game beans were created experimentally and the stimuli were ones with which individuals had no prior contact, the measure captured a very pure estimation of individuals' valence weighting proclivities – one that is free of the various confounds that are typically associated with negative valence, such as distinctiveness and diagnosticity (e.g., Kanouse & Hanson, 1972; Skowronksi & Carlston, 1989).

Correlates of valence weighting in attitude generalization. The valence weighting that individuals exhibited with respect to their generalization of attitudes from game beans to novel beans related to their assessments of a variety of hypothetical or novel situations. In a series of studies, Pietri et al. (2013) found that the weighting bias in attitude generalization correlated with sensitivity to the possibility of rejection when considering hypothetical interpersonal events, assessment of ambiguously threatening situations, fear of entering new situations, and risk tendencies involving both hypothetical and actual behavior. Individuals who generalized negative attitudes more strongly than positive expressed more concern about the possibility of interpersonal rejection, judged ambiguous situations as potentially more threatening, and expressed hesitations about entering novel situations or meeting strangers. Those who generalized positive attitudes relatively more strongly exhibited greater risk tolerance and riskier behavior. Furthermore, in another pair of studies, Pietri et al. (2012) found the weighting bias predicted emotional reactivity to an actual experienced stressful event. Those individuals characterized by a more negative weighting bias in attitude generalization reported being more upset by a failure experience. Because this valence weighting bias correlated with judgments across so many diverse domains, Pietri et al. (2013) argued that it represents a fundamental individual difference that should relate to any judgment involving the integration of positive and negative information

Although the valence weighting measure correlated with a variety of judgments, it was most predictive for situations that were somewhat novel or hypothetical in nature. For example, Pietri et al. (2013) found that the weighting bias most strongly related to the assessment of risk situations that typical undergraduates were unlikely to have experienced in the past (e.g., chasing a tornado to take dramatic photos, piloting a small plane) as opposed to risk situations with which they were likely to be familiar (e.g., exposing oneself to the sun without sunscreen). Pietri et al. asserted that the process by which individuals generalize positive and negative attitudes towards novel objects, as in the BeanFest task, is similar to how individuals assess somewhat novel or hypothetical situations. Both rely on individuals' weighting of positive and negative information, i.e., weighting of resemblance to known positives versus known negatives, and generalizing from those to form an evaluation of the novel bean or situation. Such attitude generalization is less critical for events that one already has experienced as positive or negative and, hence, no longer has to engage in a construction process involving valence weighting.

Another important aspect of the BeanFest measure of valence weighting is that it is a performance-based measure, and as a result does not require participants to introspect and self-report. In fact, Pietri et al. (2013) found that individuals were not accurate in reporting their valence weighting tendencies. They observed a null relation between the weighting bias measure and self-report questionnaires that assess general sensitivity to positives versus negatives (i.e., Approach/Avoidant Temperament, Elliot & Thrash, 2010). Nor did the measure correlate with responses to questionnaire items that directly inquired about valence weighting tendencies (e.g., “To what extent do you tend to give more weight to negative information over positive information?”). Earlier we mentioned the natural confounds associated with positive versus negative valence. Pietri et al. focused on these confounds as factors that may contribute to the difficulty individuals face when attempting to discern and self-report their valence weighting tendencies.

Manipulating Valence Biases

Thus far, all of the research exploring the weighting bias via the BeanFest paradigm has been correlational in nature. Yet, it seems likely that how individuals weight positive and negative information in attitude generalization would exert a *causal* influence on how they assess novel judgmental situations. One means of demonstrating this theoretical causal direction is to experimentally manipulate attitude generalization tendencies and then test whether the manipulation affects subsequent judgments. However, it is unknown whether individuals’ valence weighting biases can be modified experimentally.

In other domains, training or cognitive modification paradigms have been successful in experimentally modifying biases that favor threatening stimuli. For example, Macleod, Rutherford, Campbell, Ebsworthy, and Holker (2002) conducted a seminal experiment in which they manipulated attentional biases using a dot probe paradigm. As in the traditional dot probe task, a neutral and a threatening word appeared simultaneously on a screen. The probe then appeared in place of one of the words, and participants had to quickly indicate when they saw it. For half of the participants, the probe always appeared in place of the neutral word, whereas for the other half the probe appeared in place of the threatening word. Thus, half of the participants were trained to exhibit an attentional bias favoring negative stimuli. When later subjected to a stressful anagram task, these participants displayed a more adverse emotional reaction than did the participants trained to attend to neutral words.

Since the Macleod et al. experiment, other researchers have successfully utilized similar dot probe paradigms. For individuals who are highly anxious, directing their attention away from threatening words has been found to lead to a decrease in feelings of anxiety (Amir, Weber, Beard, Bomyea & Taylor, 2008; Amir, Taylor, & Donohue, 2011). Dandeneau et al. (2007) trained participants to attend away from threatening information (frowning faces) and towards positive stimuli (happy faces), by having participants search for a single smiling face in a matrix of frowning faces. The researchers found that, in comparison to a control, this modification procedure successfully changed participants' attentional bias on a subsequent dot probe task that used rejecting, accepting, and neutral faces as targets, and also led to less negative reactions to subsequent stressful life events.

Research also has identified important moderators to such attentional modification effects. For example, Dandeneau et al. (2007) found that their cognitive modification procedure successfully changed attentional bias only for participants characterized by lower self-esteem (Studies 2a & b). Individuals with low self-esteem are particularly sensitive to rejection, and thus the procedure was effective for participants who already showed vigilance for such negative information. Furthermore, Amir et al. (2011) found that their attentional modification procedure was most effective for individuals who initially displayed strong attentional bias towards social threats. It was these individuals who showed the decrease in anxious symptoms after completing the training.

Near- and Far-transferring effects. Based on classic learning research by Ellis (1965), Hertel and Mathews (2011) suggested that many of the above cognitive bias modification paradigms could be viewed as demonstrations of near- and far-transferring effects. Specifically, “near-transferring” involves paradigms in which the cognitive modification affects a task very similar to training itself. Dandeneau et al.’s (2007) utilization of accepting and threatening faces to manipulate and measure attentional bias is an example of a near transferring effect. In contrast, “far-transferring” effects occur when the same cognitive processes are involved in both the modification procedure and the outcome measure, but the two tasks bear very little resemblance to each other. For example, training individuals using a dot-probe task to attend to negative words and then observing their reactions to a stressful event would be a far-transferring effect (e.g., Macleod et al., 2002). Although the cognitive modification procedure and the outcome measure are very distinct experiences, the training presumably has an effect because the two tasks rely on the same processes.

Manipulating Valence Weighting in Attitude Generalization

The success of the cognitive modification paradigms summarized above suggests that it may be possible to experimentally modify individuals’ biases in attitude generalization. The goal of the current research was to examine if individuals could be recalibrated away from their valence weighting tendencies. We aimed to extend the Pietri et al. (2013) research by, first, showing that we could manipulate valence weighting in attitude generalization and, second, demonstrating that this change in weighting bias affects subsequent judgments of various novel or hypothetical situations. It is the logic associated with far-transferring effects that would provide the strongest evidence of effective recalibrating of the weighting bias and, hence, demonstration of the causal relation between valence weighting in attitude generalization and judgments. Thus, we planned to recalibrate participants’ attitude generalization tendencies regarding novel beans, and examine how such a manipulation would influence attitude generalization proclivities beyond the BeanFest environment. We hypothesized that calibrating individuals toward more equal weighting of positive and negative information in their attitude generalizations regarding the novel beans would influence their judgments of novel or hypothetical situations, because such assessments are essentially exercises in attitude generalization.

Specifically, our BeanFest recalibration procedure gives participants feedback when they correctly or incorrectly classify a novel bean as positive or negative. As a result, they would learn whether the novel bean was objectively more similar to a positive or a negative game bean. Thus, during this recalibration phase, participants receive feedback that they normally would not obtain in the real world. Typically, if individuals falsely believe an object is positive or negative, they can hold this incorrect attitude for a long time before receiving corrective feedback, if ever. Indeed, this is especially true for invalid negative attitudes; because they foster avoidance of the attitude object, such attitudes rarely result in any information gain regarding the true value of the object (see Fazio et al., 2004, for evidence regarding the difficulty of overcoming invalid negative attitudes). Therefore, the present recalibration procedure, although relatively brief in duration, may be effective because it provides information that tends to be lacking in the real world – repeated feedback about the correctness of one’s valence weighting tendencies.

By receiving this feedback, participants should gradually correct their initial valence weighting biases and come to weight positive and negative information more equally when generalizing their attitudes towards novel beans. Eventually, they should be able to classify the novel beans more accurately. The goal was to recalibrate both negative and positive valence proclivities toward equivalence. Individuals with a strong negative weighting bias would be recalibrated to weight positive information more strongly. People with a neutral bias would show relatively little effect of recalibration. However, for individuals who show a positive weighting tendency, recalibration should lead to weighting negative information more strongly. Thus, similar to what has been observed with the cognitive modification paradigms we summarized earlier (e.g., Dandeneau et al., 2007; Amir et al., 2011), the recalibration effects should be moderated by initial valence biases.

Initial bias as a moderator. Given this prediction, we needed an estimate of participants' initial valence weighting tendencies prior to any recalibration. The present set of experiments precluded calculation of the standard index used in past research because the recalibration condition received feedback during the test phase, which naturally affected their responses to the novel beans. However, as will be detailed in the Method section of Experiment 1, participants completed an initial practice BeanFest game at the beginning of the experiment. Thus, for the current experiments, we were able to employ the total number of approaches during the practice game as a measure of initial tendencies toward cautious behavior. We reasoned that participants' decisions to approach a bean during the practice game reflected the risk they were willing to assume. Because the practice game was participants' first encounter with the various beans, participants were risking the possibility of losing ten points for the potential of gaining of ten points. Moreover, because the game was structured in such a way that participants would learn the value of a given bean regardless of whether they selected it or not, each decision to approach essentially represents a willingness to gamble. Past research has found that the weighting bias relates to both hypothetical risk-taking as well as actual risk behavior (Pietri et al., 2013, Studies 3, 5 and 6).

In accord with this reasoning, recent research (Rocklage, Pietri, & Fazio, 2013) has found that the standard measure of valence weighting bias assessed via BeanFest predicts the frequency of approaching novel objects in a similar task – “donuts” with values that vary as a function of their color and the size of the center hole (DonutFest). Specifically, in this study, participants completed the BeanFest paradigm along with various other measures in an initial session. Two months later, participants returned to the laboratory to complete a number of additional tasks, including DonutFest. The valence weighting bias estimated via the attitude generalization tendencies that participants exhibited during BeanFest predicted the total number of approach decisions participants made during the first block of the DonutFest learning trials (r=.50). Participants who displayed a negative weighting bias in the first session were also more cautious in the second session; they approached relatively infrequently during the first block of DonutFest. In contrast, individuals with a more positive weighting bias were more risky; they approached more often, despite not needing to do so in order to gain information about the valence of the stimuli.

Returning to the current recalibration experiments, we predicted that for individuals who are initially cautious, in the sense that they approach less often during the practice BeanFest game, recalibration should promote their development of a more positive weighting bias. In contrast, for participants who are riskier in that they approach more frequently during the practice game, recalibration should result in the development of a more negative bias.

Overview of Current Experiments

In sum, the goal of the current four experiments was to extend the Pietri et al. (2013) studies by manipulating the valence weighting bias in attitude generalization, and demonstrating its causal influence on a variety of judgments and assessments. We predicted that individuals who are initially more cautious would be recalibrated to give positives more weight, whereas individuals who are more risky would come to give negatives more weight. In the first experiment, we tested our hypothesis by examining whether recalibration in the context of the BeanFest paradigm would influence individuals' attitude generalization tendencies regarding other, non-bean, visual stimuli – a near-transferring effect. We then examined whether recalibration would produce far-transferring effects. Specifically, we tested whether recalibration influenced interpretations of ambiguous situations (Experiment 2), feelings about risk (Experiment 3), and risk-taking behavior (Experiment 4).

Experiment 1: Recalibration of the weighting bias

In the first experiment, we wanted to examine if recalibrating participants through the BeanFest paradigm would result in their weighting positive and negative information more equally when generalizing their attitudes towards other, non-bean, novel objects. We aimed to demonstrate that the recalibration procedure indeed affects the processes associated with attitude generalization. Thus, by recalibrating individuals to weight valence information more equally, we should lead those individuals who are initially cautious to be more positive whereas those who are more risky should come to weight negative information more strongly.

Method

Participants

Seventy-seven undergraduates completed this experiment for course credit. One participant was excluded for approaching only three beans during the practice game (over three standard deviations below the mean). Two participants were excluded from analyses for approaching all 40 beans during the practice game, demonstrating that they did not understand the instructions and were playing the game incorrectly. Thus, the final sample consisted of 74 participants (33 females, 40 males, 1 did not report). Thirty-six participants were assigned to the control condition and 38 to the recalibration condition.

Materials

The BeanFest game was the same as that used in Study 2 of Pietri et al. (2012). It was important to establish that participants learned the value of the game beans well, so differences in learning did not interfere with our efforts to recalibrate attitude generalization tendencies. In order to ensure this adequate learning, the “simplified” matrix employed by Pietri et al. (2012) was used in the current research; 10 beans from each of the four corners of the matrix were shown during the game, making a total of 40 game beans. Beans from each corner were assigned either a +10 or -10 value (see Figure 1). Thus, participants could learn simple associations to remember the value of the beans (e.g., circular beans with few speckles are good, whereas oblong beans with many speckles are bad).

Procedure

When participants first arrived in the lab they were shown to a testing room that consisted of four cubicles each containing a computer, monitor, keyboard and response box. When the participants were settled, the experimenter distributed written instructions to BeanFest. The experimenter read the instructions aloud while the participants read along. Participants were then told that to get acquainted with the BeanFest game, they would play a practice game. In the practice game, the participants first completed a practice block of 8 trials. Two beans from each of the four regions of the matrix were shown to the participants. For each of these trials, participants were instructed to accept the bean, i.e., respond “yes” on the response box. This would ensure that participants were familiar with the feedback and point displays, and learn the point value of the practice beans. Participants then played what they were told was a practice game in order to get acquainted with BeanFest, which consisted of one block of 40 trials that presented each of the game beans once. The first 12 trials were fixed to ensure that participants did not get an unlucky string of negative beans, and lose the game immediately. After these 12 beans, participants were presented with the remaining 28 beans randomly. This practice game not only acquainted participants with the valence of the various beans but, also provided the measure of initial cautious or risky tendencies. As noted earlier, more approach decisions reflect greater risk-taking.

During each trial of the practice game, participants were shown a bean in the upper part of the monitor. They had to indicate whether they wished to “select” the bean or not, using a response box that consisted of two buttons labeled “yes” and “no.” In the lower left of the screen, the beans’ value (either -10 or 10) was shown. In the lower right of the screen, there was a box with the participant’s current points, and a point bar that reflected the score graphically. If participants selected the bean, they saw the value of the bean, and their point value changed according to the value of the bean. If participants did not select the bean, their point value did not change, but they were presented with the value the bean would have had, if they had selected it. This procedure ensured that participants received information about the value of each bean on each and every trial and, hence, facilitated learning of the beans.

Participants’ points could range from 0 to 100, and participants started the game with 50 points. If participants reached 0 points they would lose the game, and if they reached 100 points they would win the game. Any time participants won or lost, the game would restart with 50 points. Each time participants restarted they game, the beans retained their original value. How many times participants restarted the game depended on how many times participants won or lost the game. However, all participants were shown one block of 40 beans during the practice game no matter how many times they won or lost the game.

After participants played the practice game, they completed a classification training task, whose purpose also was to facilitate learning of the game beans. Instructions appeared on the screen explaining the task to participants. During this task participants simply saw a bean and had to quickly classify it as good or bad. Participants used the keyboard for this task, and pressed the “5” key on the number pad for bad, and the “A” key for good. The beans from the four sections of the matrix were randomly shown once during each block. There was no point value or point bar presented during these trials. The bean appeared in the middle of the screen, and the word positive appeared in the lower left corner of the screen and the word negative in the lower right corner. If participants correctly classified the bean, they moved to the next trial. However, if participants incorrectly identified the bean, a screen appeared that said “Error! This was *not* a Positive (or Negative).”

After the classification training task, participants played the actual BeanFest game. During the game phase, participants completed two blocks of 40 trials each, which consisted of the beans from the four selected sections of the matrix. The beans were presented randomly within each block. Otherwise, the game phase proceeded as the practice game had. The bean was displayed in the upper portion of the monitor, the participant’s decision and the bean’s value were displayed in the bottom left of the monitor, and the points and point bar were displayed in the lower right of the screen.

Following the game phase, participants completed the test phase in which they saw each of the 100 beans from the matrix (i.e., the 40 game beans and the 60 novel beans that had not been presented during the game) and had to decide whether each bean would have been good or bad during the game. During this test phase, there were no points or point bar displayed in the bottom of the screen. On each trial, a bean was presented in the middle of the screen, and the word “positive” appeared in the lower left corner, and the word “negative” appeared in the lower right corner. Participants again used the keyboard to classify the bean. Participants pressed the “5” key on the number pad for bad, and the “A” key for good.

Participants’ responses to the novel beans require their consideration of each bean’s resemblance to the previously learned positive and negative game beans and, hence, reflect their attitude generalization tendencies. It was these responses that we sought to modify. Hence, the recalibration manipulation occurred during the test phase. Approximately half of the participants were assigned to the recalibration condition, and the other participants were assigned to the control condition. In the recalibration condition, after participants indicated whether a bean was good or bad, the bean and the words “positive” and “negative” disappeared from the screen and participants received feedback about their decision. If participants classified the bean correctly, the monitor would read “Correct! This was Positive (or Negative)!!” If participants incorrectly classified the bean, the screen would read “Error! This was Positive (or Negative)!!” Such feedback was presented for every single bean. In contrast, the control condition received no feedback. The control participants simply classified each bean as it was presented.

Feedback for the recalibration condition was based on the value of the game beans (whether the game beans were good or bad). For the novel beans, feedback was established by a division of the matrix into fourths. Novel beans in a quadrant that contained positive game beans were classified as positive, whereas novel beans in a quadrant that contained negative beans were considered negative. In other words, feedback regarding the novel beans was based on their more closely resembling either positive or negative game beans.

Following the manipulation, participants played a game that we called DonutFest, which provided the outcome measure. Instead of beans, the novel stimuli that participants saw were donuts. The donuts varied so as to form a ten by ten matrix. Their middle hole ranged from small to large, and their color from red to orange. As in BeanFest, the four corners of the matrix were selected as game donuts, so participants could learn simple rules, such as “red with small hole -- good,” and “orange with a small hole -- bad.” The point assignment for the 100 donut matrix was that the same as that presented in Figure 1 for the 100 bean matrix.

We again wanted to ensure participants learned all the game donuts well so we could measure the weighting bias in attitude generalization without having to worry about variability in learning. Instead of playing a DonutFest game, participants were simply given handouts, which included eight pictures of Donuts, two from each of the four quadrants. Participants were told which of these eight donuts were good, or would increase their points by 10, and which were bad or would decrease their points by ten. Participants were instructed to study and memorize the characteristics of these donuts. To ensure that participants learned these game donuts well, they then completed a classification training task. They saw each of the 40 game donuts once, indicated whether they were good or bad and received feedback about their responses. Following the classification training task, participants completed a donut test phase. Participants were presented with all 100 donuts from the matrix, which included game donuts and novel donuts varying in resemblance to the game ones. Participants in both conditions were shown a donut and simply had to indicate if the donut would have been good or bad. No participants received feedback during the donut test phase. The valence weighting tendencies that participants exhibited with respect to the novel donuts constituted the dependent measure. Following DonutFest, participants were debriefed and thanked for their participation.

Results

Immediate Effects of Recalibration

We first wanted to confirm that participants had indeed learned the game beans very well and that they had learned the positive and negative beans equally well. Responses to the game beans during the test phase were very accurate; the average proportion of correct responses was well above chance (*M*=.93, *SD*=.07; *t*(73)=54.07, *p*<.001). We also ran a 2x2 mixed design ANOVA with valence as the within-subject variable, and condition as the between-subject variable. There was no significant difference between positive (*M*=.94) and negative (*M*=.93) correct , *F*<1, partial η^2=.002. Nor was there a difference between the control (*M*=.93) and recalibration conditions (*M*=.94) on proportion correct, *F*<1, partial η^2=.00. There also was not a significant interaction between condition and valence, *F*<1, partial η^2=.006.

Next we examined participants' responses to the novel beans. Indicating a bean was negative was coded as a -1 and positive as a 1. We averaged participants' responses across all 60 novel beans as an index of their weighting bias. Consistent with past research, participants in the control condition displayed a negativity bias on average (*M*=-.20, *SD*=.23, *t*(35)=5.30, *p*<.001). In contrast, the mean in the recalibration condition (*M*=-.01, *SD*=.10, *t*(37)=.39, *p*>.70) did not differ from zero. Indeed, participants in the recalibration condition exhibited a significantly less negative weighting bias than those in the control condition, *t*(72)=4.80, *p*<.001, Cohen's *d*=1.07.

Just as would be expected, the effects of recalibration occurred gradually through the course of the test phase. During the first twenty trials, participants' responses to the novel beans did not differ between the recalibration (*M*=-.06, *SD*=.31) and control conditions (*M*=-.18, *SD*=.33; *t*(72)=.68, *p*>.45, Cohen's *d*=.37). However, the recalibration condition (*M*=.03, *SD*=.25) had a more positive weighting bias than the control condition (*M*= -.29, *SD*=.35) in the last twenty trials, *t*(72)=4.43, *p*<.001, Cohen's *d*=1.05. This suggests that participants in the recalibration condition were responding to the feedback and correcting their initial biases.

In a final analysis, we examined if the recalibration condition was not just showing a lack of negativity bias, but was *accurately* classifying the novel beans as well. Because all the novel beans were closer to either a positive or negative game region, each novel bean had a correct valence classification. Thus, we could examine if participants in the recalibration condition were correctly discriminating positive and negative beans more so than the control. We calculated accuracy based on signal detection theory. Specifically, we calculated the proportion of times participants said a bean was positive when the bean was in fact positive (hit), and the proportion of times participants said a bean was positive when the bean was really negative (false alarm).We then calculated d' following the guidelines detailed by Stanislaw and Todorov (1999). The recalibration condition (average d'=1.30) was significantly more accurate at discriminating the positive and negative beans than the control condition (average d'=.89; $t(72)=3.94$, $p<.001$, Cohen's d=.92).

Effects of Recalibration on Outcome Variables

We next tested whether the BeanFest recalibration effects transferred to participant's performance with respect to the donuts. As with the beans, participants learned the value of the game donuts significantly better than chance (M=.88, SD=.16, $t(73)=20.16$, $p<.001$). We also ran a mixed model ANOVA with donut valence as the within-subject variable and condition as the between-subject variable. There was no significant difference between positive (M=.88) and negative (M=.87) correct, $F(1, 72)=1.91$, $p>.17$, partial η^2=.03. There was also no difference between the recalibration (M=.88) and control condition (M=.88) on proportion of donuts correctly classified (partial η^2=.00), nor an interaction between valence and condition (partial η^2=.005), $Fs<1$.

If recalibration on beans were to produce the predicted near-transferring effect on the classification of the novel donuts, we would expect to observe an interaction between condition and initial cautious tendencies. As noted earlier, we employed the total number of approaches during the practice BeanFest game as a measure of initial cautious tendencies (M=23.97, SD=5.10).[1] We ran a regression equation predicting participants' average response to the novel donuts from condition, approaches during the practice game and the interaction between the two (total R^2=.06, F(3,70)=1.38, p=.25). This equation did not yield a significant interaction (R^2 change= .03, B=-.18, t(69)=1.40, p<.17. However, this lack of an effect on the average response to all novel donuts was not surprising to us. Previous research employing the matrix of stimuli and values illustrated in Figure 1 has indicated that the novel stimuli are not equally relevant to the issue of weighting positive versus negative information (Pietri et al., 2012). The novel stimuli (beans in the Pietri et al. work and donuts in the current experiment) vary in the extent to which they resemble positive and/or negative game stimuli. In terms of their location in the matrix (see Figure 1), some novel stimuli are very close in proximity to either a positive or a negative game region. Such stimuli are "univalent" in that they are high in only either positive or negative characteristics. In addition, some beans/donuts are distant from any game areas. Due to their location in the center of the matrix, they bear little resemblance to either positive or negative game stimuli. Finally, some stimuli are relatively close to both positive and negative regions of the matrix. These novel stimuli share characteristics of both known positives and known negatives. Following Pietri et al. (2012), we termed these stimuli, ten from each of the four quadrants, "ambivalent."[2]

Because the ambivalent donuts strongly resemble both positive and negative game donuts, how individuals weight positive and negative information will be particularly important when classifying these donuts. As a result, how participants respond to these ambivalent novel objects should provide the best index of the weighting bias. In line with this reasoning, Pietri et al. (2012) found that responses to the ambivalent beans were the best predictor of emotional reactivity following a failure experience. Thus, we ran a regression analysis predicting responses to ambivalent donuts from condition, the number of approach decisions during the practice game, and the interaction (total R^2=.08, *F*(3,70)=2.12, *p*=.11). The analysis revealed a marginally significant interaction between condition and number of approaches during the practice game, R^2 change=.05, *B*=-.23, *t*(70)=1.90 *p*=.06 (see Figure 2). A similar interaction was not apparent when predicting average response to univalent donuts or center donuts, both *t*'s < 1. Thus, the recalibration manipulation was most effective on the ambivalent donuts, because these donuts are high in both positive and negative characteristics and, hence, require valence weighting.

We decomposed the interaction that was observed between condition and total approaches when predicting responses to the ambivalent donuts. At one standard deviation below the mean number of approaches (in other words, among those who displayed relatively cautious initial behavior), participants in the recalibration condition were more likely to classify novel ambivalent donuts as positive than those in the control condition, *B*=.08 *t*(69)=2.51 *p*<.02. At one standard deviation above the mean, no effects were apparent *B*=-.01, *t*(69)=-.35 p>.74. This pattern indicates that recalibration had little effect on those participants who were initially more risky, but had a clear impact on those who were cautious. To further explore the nature of this interaction, we employed the Johnson-Neyman procedure, which examines at what level of the moderator (total approaches) the conditional effect of the independent variable (condition) on the dependent variable (response to ambivalent donuts) is statistically significant (Bauer & Curran, 2005).[3] The effect of condition was significant (α=.05), with the recalibration condition having more positive responses to the ambivalent donuts than the control condition, at approximately 23 approaches or less – a value just below the mean of 23.97 (see Figure 2). As total approaches increased to a value of approximately 28 (a little less than one standard deviation above the mean), participants in the recalibration condition began to respond to novel ambivalent donuts more negatively than those in the control condition (see the point of intersection in Figure 2). However, this reversal never reached statistical significance (lowest p=.19).

Discussion

We successfully recalibrated participants to weight positive and negative information equally during the BeanFest game. Among the participants who were initially cautious, this recalibration led to the development of a more positive weighting bias relative to the control. In contrast, among participants who were more risky, i.e., those who approached relatively often during the practice game, recalibration did not produce an effect. The interaction that we observed between initial tendencies and the recalibration manipulation suggests that, as predicted, recalibration has different effects for individuals who start out initially more cautious or risky. The procedure recalibrates participants away from their natural tendencies.

We found recalibration effects only for the ambivalent donuts, or ones that were high in positive and negative characteristics. Although we did not initially predict this finding, it actually provides evidence that we are in fact recalibrating a valence *weighting* bias. If we were simply training participants to increase the frequency of their positive or negative responses as a function of the feedback they received, recalibration should have changed responses to all the donuts. Because we observed effects for only the ambivalent donuts, it appears that the training procedure leads individuals to weight positive and negative information more equivalently. The univalent donuts require no valence weighting because they so clearly resemble donuts of known valence, and the center donuts bear little resemblance to either the positive or the negative donuts. These findings also suggest a way to strengthen the recalibration paradigm. Specifically, by presenting participants with many trials of the ambivalent beans during the test phase, we can focus recalibration more precisely on the weighting of positives and negatives. An increase in the number of recalibration trials involving ambivalent beans may strengthen the observed effects. This change is implemented in the subsequent experiments.

Although the critical interaction between initial tendencies and recalibration condition was only marginally significant (p=.06), the present findings provide some initial evidence regarding the effectiveness of the recalibration procedure. In so doing, they offer tentative support for the proposition that individual differences in valence weighting play a causal role when individuals are generalizing their current attitudes toward known objects to novel objects. However, the present experiment is somewhat limited by the obvious parallels between the recalibration procedure within the context of BeanFest and the outcome measure of DonutFest. Both involved evaluating visual stimuli that varied in their resemblance to objects of known positive versus negative value. In the subsequent research, we sought to both strengthen the recalibration procedure and examine whether the effects of recalibration would extend to evaluative assessments that did not involve the visual domain, i.e., assessments that could be characterized as more far-transferring. Thus, the next experiment focused on the effects of recalibration on individuals' interpretations of ambiguous events.

Experiment 2: Interpretation of ambiguous events

In Experiment 2, we wanted to explore the causal influence of the weighting bias on individuals' understanding of situations that involve some integration of positive and negative information. Specifically, we utilized descriptions of situations that were open to multiple interpretations and, hence, could be construed in either a positive or negative manner. In Experiment 1, we found that participants' initial cautiousness (more specifically, their total number of approaches during the practice game) was an important moderator of the recalibration effects. Thus, we expected to find the same interaction in the current experiment. We predicted that the initially cautious participants (those who approached relatively infrequently during the practice game) would be especially likely to display more positive interpretations of the ambiguous events as a result of recalibration.

Method

Participants

One-hundred and three undergraduates participated in this experiment for course credit. One participant exhibited very poor learning (four standard deviations below the mean on the proportion of game beans correctly classified) and, hence, was excluded from analyses. Of the remaining participants (39 females, 63 males), 53 were assigned to the recalibration condition and 49 to the control condition.

Procedure

The BeanFest game phase was exactly the same as that utilized in Experiment 1. Participants again played the practice game, followed by the classification-training task and then the two game blocks. Participants then completed the test phase. However, the beans presented during the test phase were somewhat different from those in Experiment 1. In Experiment 1 participants saw each of the 100 beans from the matrix once. With the hope of optimizing the effectiveness of the recalibration procedure, the test phase in Experiment 2 more heavily emphasized the ambivalent beans. As noted earlier, it is the ambivalent novel beans that involve resemblance to both positive and negative game beans and, hence, require the weighting of positive versus negative characteristics when making an evaluative assessment. We reasoned that by focusing our feedback on the ambivalent beans, participants would experience multiple trials of useful feedback pertinent to valence weighting. Thus, during the test phase, participants were presented each of the ambivalent beans multiple times, as well as a subset of representative game beans.

More specifically, the test phase was divided into five blocks. The first block consisted of 20 ambivalent beans. The subsequent 4 blocks each consisted of 20 ambivalent beans and five game beans. The 20 game beans presented across the four blocks were chosen to be a representative sample of the 40 game beans. We included these game beans, first, to ensure that participants did not grow suspicious as a result of not being presented familiar game beans, and second, as a way to substantiate that the two conditions had learned the game beans well. Between the third and fourth blocks, participants were given the opportunity to take a short break. As in Experiment 1, participants in the recalibration condition were told when they correctly and incorrectly classified a bean, whereas the control condition received no feedback.

Following the BeanFest phase of the experiment, participants completed the interpretation questionnaire, which presented 11 events that were pretested for being particularly ambiguous.[4] Below each description were three possible interpretations, one positive, one negative, and one neutral, randomly-ordered. For example, one such situation was “Your supervisor calls you into the office. Why?” The positive explanation was “Your supervisor is going to promote you,” the negative interpretation was “Your supervisor is going to fire you” and the neutral was “Your supervisor has a question for you.” Participants ranked the interpretations from most to least likely. After completing the interpretation questionnaire, participants were debriefed and thanked for their participation.

Results

Immediate Effects of Recalibration

As in Experiment 1, we found that participants on average learned the game beans well, and significantly above chance (*M*=.92, *SD*=.10, $t(102)=41.74$, $p<.001$). Also, as in Experiment 1, the recalibrating feedback resulted in the recalibration participants exhibiting a more neutral weighting bias, i.e., classifying an equivalent number of the novel ambivalent beans as positive versus negative (*M*=.00, *SD*=.15). In contrast, participants in the control condition showed the typical negative weighting bias (*M*=-.12, *SD*=.23), and this mean was significantly lower than that for the recalibration condition, $t(101)=3.20$ $p<.01$, Cohen's *d*=.62. In addition, a signal detection analysis again found that the recalibration condition (average d'=1.02) was better at discriminating between positive and negative beans than the control condition (average d'=.59, t(101)=4.74, Cohen's *d*=.95).

Effects of Recalibration on the Outcome Variables

The interpretation questionnaire was scored using a point system to create a "good" and a "bad" score. When participants ranked the good interpretation first, they received a score of three, when they ranked it second they received a score of two, and when they ranked it third, they received a score of 1. The same system was used to create a score reflecting the ranking of the bad interpretation. The means of these scores across the 11 situations were calculated, resulting in a good interpretations (*M*=1.85, *SD*=.24) and a bad interpretations score (*M*=1.70, *SD*=.29).

We created a difference score of the good index minus the bad because we were interested in how likely participants were to rank the good interpretation higher than the bad. We then predicted the difference score from condition, total approaches during the practice BeanFest game (*M*=23.02, *SD*=5.07), and the interaction between the two (total R^2=.07, *F*(3,98)=2.48, *p*<.07). We found a significant interaction between total approaches and condition, R^2 change=.04, *B*=-.20, *t*(97)=-2.10, *p*<.04 (see Figure 3). At one standard deviation below the mean, the recalibration condition had more positive interpretations relative to negative than the control condition, *B*=.37, *t*(97)=2.71 *p*<.01. No effects were apparent at one standard deviation above the mean, *B*=-.04, *t*(97)=-.28, *p*>.78. We again probed this interaction further using the Johnson-Neyman procedure to identify the points at which this effect of recalibration became significant and reversed. Similar to Experiment 1, the effect of condition was significant (α=.05) with the recalibration condition having relatively more positive interpretations than the control condition at approximately 22 approaches or less. As in Experiment 1, this was a value that was slightly below the mean, 23.02. Furthermore, as total approaches increased, this effect began to reverse, and the recalibration condition had relatively fewer positive interpretations in comparison to negative than the control condition (see the point of intersection in Figure 3 at approximately 27 approaches, slightly below one standard deviation above the mean). However, as in Experiment 1, this reversal never reached a level of statistical significance (lowest *p*= .14).

Discussion

We found that how individuals weight positive and negative information in attitude generalization causally influenced how likely individuals were to interpret ambiguous situations positively or negatively. For participants who approached relatively less during the practice game and, thus exhibited initially cautious tendencies, recalibration resulted in more positive interpretations than was true in the control condition. For participants who approached relatively more, or were initially risky, recalibration revealed no effect.

Thus, in this experiment, we replicated Experiment 1 using a domain completely unrelated to attitude generalization with visual stimuli. The findings provide evidence of a far-transferring effect. In the next experiment we wanted to explore yet another domain in which the weighting bias may causally influence judgments: individuals' reactions to risky situations.

Experiment 3: Reactions to Risk

Experiment 3 examined whether valence weighting causally influences individuals' reactions to hypothetical situations involving risk. Pietri et al. (2013) found a relation between the weighting bias and general risk tendencies in multiple studies. In the current experiment, we utilized a modified version of the Choice Dilemma's Questionnaire (CDQ; Wallach, Kogan, & Bem, 1962) as our outcome measure of general risk-tendencies. The measure asked participants to rate how apprehensive they would feel when deciding whether to pursue a course of action with many potential benefits, but also the possibility of major negative outcome (e.g. leaving your safe job for a more lucrative one with less job security). We again predicted that participants' initial cautiousness would interact with the recalibration manipulation in determining reported apprehension about taking the risk. Participants who are initially cautious are expected to report relatively less concern and anxiety about the risk after undergoing recalibration in comparison to the control. In other words, the initially cautious are expected to grow less cautious as a function of the recalibration procedure.

Method

Participants

One-hundred and nine undergraduates completed this experiment for course credit. One participant was excluded from the analyses for having a very low score on the concern and upset variable of the CDQ (over five standard deviations below the mean). Another participant was excluded from the analyses for approaching very little during the practice BeanFest game (only three approaches, which was over three standard deviations below the mean). This left a total of 107 participants (65 females, 42 males) with 56 assigned to the control condition and 51 assigned to the recalibration condition.

Procedure

Participants first completed the same BeanFest procedures as in Experiment 2. Participants in the recalibration condition received feedback regarding the correctness of their responses during the test phase, whereas those in the control condition did not.

Following the BeanFest phase of the experiment, participants completed the dependent measure, in which they were presented with four scenarios modeled after those from the CDQ. As in the original CDQ, each hypothetical situation involved the dilemma of choosing between two courses of action. One option was attractive but carried the possibility of a negative outcome, whereas the other was less appealing but safer. In the traditional CDQ, the person in the scenario who must make the decision is another person (e.g., Mr. X). In order to make this questionnaire more personally relevant to participants, we changed the situations so the participant was the person who must make the decision. We also edited the situations so they would be more applicable to the typical undergrad. For example, one such situation was "Imagine that five years after you have graduated from college you have a spouse and a child and have been working for a large corporation. At your current job, you are assured a lifetime job with a modest, though adequate, salary and liberal pension benefits upon retirement. On the other hand it is very unlikely that your salary will increase much, if at all, before you retire. Now imagine that while attending a convention, you are offered a new job, at a small, newly founded company, which has a highly uncertain future (i.e., the company may go under, resulting in you losing your job). This new job would pay more to start and would offer the possibility of a share in the ownership if the company survived the competition of the larger firms. You must decide whether to take the new higher paying, but less secure job, or stay with the reliable job with a lower salary." Participants then had to rate (a) how concerned they would be about taking the risk on a scale ranging from 0 (not at all concerned) to 6 (very concerned), and (b) how upset they would be if they took the risk and the negative outcome occurred on a scale ranging from 0 (not at all upset) to 6 (very upset). Finally, participants rated how likely the positive outcome was to occur from 0 (Not at all likely) to 6 (Very likely). We calculated the mean score for the concern, upset, and likelihood ratings across the four scenarios. Following completion of this task, participants were thanked for their participation and debriefed.

Result

Immediate Effects of Recalibration

We again found that participants learned the game beans well above chance (M=.93, SD=.11, $t(106)$=42.03, p<.001). Also as in the previous experiments, a significant difference emerged between the recalibration condition (M=.01, SD=.13) and the control condition (M= -.09, SD=.21) on the average response to the ambivalent novel beans, $t(105)$=2.95, p<.01, Cohen's d=.57. Thus, the feedback provided during the recalibration influenced assessments of the novel stimuli. Furthermore, a signal detection analysis once again confirmed that the recalibration condition (average d'=1.00) was correctly discriminating between the negative and the positive beans more so than the control (average *d′*=.60, *t*(105)=4.00, *p*<.001, Cohen's *d*=.78).

Effects of recalibration on the outcome variables

We were next interested in the effects of recalibration on the modified CDQ. The upset (*M*=3.60, *SD*=.72, α=.68) and concern (*M*=4.53, *SD*=.94, α=.61) variables were significantly correlated (*r*(105)=.34, *p*<.001), and showed a very similar patterns of results,[5] so we combined the two scales to create a composite anxiety score. We ran a regression equation predicting this anxiety score from condition, total approaches in the practice block (*M*=20.25, *SD*=4.42), and the interaction (total R^2=.08, *F*(3,103)=2.85, *p*<.04), which revealed the predicted interaction between condition and total approaches, R^2 change=.05, *B*=.20, *t*(103)=2.34, *p*<.03 (see Figure 4). A significant difference between conditions was evident at one standard deviation below the mean of total approaches *B*=-.27, *t*(103)=-2.34, *p*<.05, and a non-significant reversal at one standard deviation above the mean *B*=.12, *t*(103)=.97, *p*=.33. We again probed the interaction further using the Johnson-Neyman method. The effect of condition was significant (α=.05) at 18 approaches or less, with participants in the recalibration condition reporting relatively less apprehension at the prospect of taking a risk. (This value was again slightly lower than the mean, 20.25.) As total approaches increased (reflecting riskier initial tendencies), this effect began to reverse (see the point of intersection in Figure 4 at approximately 23 approaches), resulting in a marginally significant difference between conditions at (α=.1) at 29 approaches and above. We did not find any effects on participants' ratings of how likely the positive outcome was to occur in the various CDQ scenarios (*M*=4.97, *SD*=.97, α=.41). In particular, no interaction between initial valence weighting tendencies and condition was apparent when predicting the likelihood scores, *t*<1. Nor did the likelihood ratings correlate with the composite anxiety scores ($r(106) = -.05$, $p>.6$)

Discussion

We found that how individuals weight positive and negative information in attitude generalization causally influences the anxiety they feel at the prospect of taking risk. As in the past two experiments, receiving feedback during the recalibration procedure as to the correctness of their classifications of novel beans led participants to weight positive and negative characteristics more equally. Among participants with relatively cautious tendencies (as indexed by their having engaged in relatively little approach behavior during the practice BeanFest game), this resulted in their feeling less apprehension at the prospect of taking risks. In contrast, for participants who approached relatively more during the practice game and presumably were initially riskier, recalibration led to reports of somewhat more anxiety concerning the risky situations, although this simple effect did not reach significance.

We did not find significant results for the participants' ratings of the likelihood of the positive outcome occurring. Interestingly, Pietri et al. (2013) observed a conceptually parallel discordance between an anxiety and a likelihood measure. In a study that employed the Rejection Sensitivity Questionnaire (RSQ; Downey & Feldman, 1996), participants provided assessments of both their concern about the possibility of rejection in various hypothetical situations involving their making an interpersonal request and the likelihood of such rejection. Although Pietri et al. (2013) observed a correlation with the overall RSQ score, they found that this relation was driven primarily by the concern component. Thus, the weighting bias may be most predictive of concern or cost assessments rather than likelihood estimates. As a result, the recalibration paradigm appears to be less successful at modifying predictions of likelihood.

Interestingly, this experiment showed the same general pattern as the first two experiments. The recalibration produced a strong effect for the participants who began with an initial negative bias, i.e., caution, but showed only a slight reversal for the participants who began with a more positive bias. This consistent finding raises a question. Is the BeanFest recalibration paradigm effective at influencing only those individuals who are initially cautious, or is there something about our outcome measures that made them particularly sensitive to changes away from initial negative tendencies? In the final experiment, we utilized a dependent measure that we thought might produce a stronger effect for participants with risky proclivities. The experiment had the additional advantage of involving actual risk-taking behavior.

Experiment 4: Risk-taking behavior

In this final experiment, we examined the weighting bias's causal relation to risk-taking behaviors. Specifically, we employed the Balloon Analogue Risk Task (BART) developed by Lejuez et al. (2002) as a behavioral measure of risk tendencies. On each trial of the BART, individuals can gain money by pumping and inflating an imaginary balloon to the point of their choosing. However, if participants pump the balloon too much, it bursts and they lose their earnings for that trial. Thus, participants must weigh pumping the balloon more to increase its value against the risk of popping the balloon and earning nothing on that trial. Pietri et al. (2013) found that risky behavior (i.e., more pumping) correlated with the weighting bias. The BART also may be particularly useful for our goal of examining an outcome measure that is likely to be sensitive to recalibrating valence weighting among participants who are initially risky. As noted by other researchers who have used the BART task (e.g., Benjamin & Robbins, 2007), the BART's basic framing is very gain oriented. Participants begin the BART with no money and their goal is to basically gain as much money as possible. Thus, pumping the balloon in the interest of gaining may be the default for most participants.

In contrast, the dependent measures in the previous three experiments may have had a default towards negative or neutral, i.e., may have encouraged participants to generally be cautious.[6] Any such general caution would mask the effects of recalibrating participants away from initial risky tendencies and toward more careful responses. In contrast, the BART may encourage participants to be generally risky, potentially masking the effects of recalibrating people toward riskier and more extensive pumping behavior. If so, the BART may prove somewhat less sensitive to changes in the direction of increased risk but more sensitive to changes in the direction of greater caution. In other words, the BART may reveal consequences to recalibrating individuals with initial risky tendencies to weight negativity more strongly and, hence, engage in less risk than control participants.

Irrespective of this admittedly somewhat speculative reasoning, our central prediction for the current experiment remains the same as for the earlier experiments. We expect to observe an interaction between initial valence weighting tendencies and recalibration. Participants who are initially more cautious (those who approach relatively infrequently) will grow more risky as a result of recalibration, whereas initially risky participants will become less risky.

Method

Participants

Eighty (36 females, 44 males) undergraduates completed this experiment for course credit. Forty-one participants were assigned to the control condition, and 39 to the recalibration condition.

Procedure

Participants first completed the BeanFest paradigm. The procedure was the same as that implemented in Experiments 2 and 3, with participants in the recalibration condition receiving feedback during the test phase, and the control condition receiving no feedback.

Following BeanFest, participants completed the BART. They were told that they would play a game involving balloons and that their goal was to earn imaginary money. During a trial of the BART, participants were presented with a small balloon on the computer screen and in the lower left side of the screen there was a button labeled “Pump up the balloon.” In the lower right area of the screen was a display indicating the balloon trial number (e.g., #5 of 20), the number of pumps delivered to the balloon, their total winnings thus far, and a button labeled “Collect.” Participants inflated the balloon by clicking the pump button. Each pump resulted in the balloon growing 5% and increasing in value by $.05. Once participants decided they had inflated the balloon to their desired level, they could end the trial by pressing the collect button. Their total earnings would then increase by the number of pumps delivered during that trial multiplied by $.05. The trial would also in end if the balloon popped, which was visually displayed on the computer screen. When the balloon popped, participants lost their earnings for that trial, and their total winnings did not increase. The point at which the balloon would pop, if the participant had not chosen to collect earlier, varied randomly from trial to trial from a minimum of 1 to a maximum of 25 pumps. Participants completed a total of 20 balloon trials, after which, they were thanked for their participation and debriefed.

Results

Immediate effects of recalibration

Participants again learned the game beans very well and significantly above chance (M=.92, SD=.14, $t(79)$=27.63, p<.001. As before, those in the recalibration condition (M=.01, *SD*=.17) classified the ambivalent beans as more positive than did those in the control condition (*M*=-.13, *SD*=.24; $t(78)= 3.00$, $p<.01$, Cohen's $d=.67$). Thus, the usual negativity bias was evident on average in the control condition, but had been eliminated by the recalibration procedure. In addition, the recalibration condition (average $d'=1.10$) also displayed significantly greater accuracy in discriminating between positive and negative novel beans than the control condition (average $d'=.73$, $t(78)=3.15$, $p<.01$, Cohen's $d=.70$).

Effects of recalibration on the outcome variable

Total number of pumps. Following Lejuez et al. (2002), we calculated the total number of times participants pumped the balloon across all 20 trials as our measure of risk behavior. Riskier participants would pump the balloon more times in order to increase its value and would be less concerned about popping the balloon. We predicted total number of pumps from approaches (*M*=20.54, *SD*=3.61) during the practice BeanFest game (i.e., initial tendencies regarding caution versus risk), condition, and the interaction between the two (total $R^2=.05$, $F(3,76)=1.44$, $p=.24$). We found a marginally significant two-way interaction between condition and total approaches, R^2 change=.05 $B=-.22$, $t(76)= -1.92$, $p<.06$. At one standard deviation below the mean number of approaches (the initially more cautious) there was no significant effect of condition, $B=.14$, $t(76)=-.86$ $p=.39$, but at one standard deviation above the mean (the initially riskier) a marginal effect of condition was apparent, with the recalibration condition pumping the balloons less than the control condition, $B=-.30$, $t(76)=-1.87$, $p<.07$ (see Figure 5).

Average pumps after a pop. We conducted a second regression analysis examining how much participants pumped on average after experiencing a pop. We reasoned that we might see stronger effects on such trials because a pop is a negative event in which participants lose all their money for the trial. Thus, participants can give this experience considerable weight and decide to be more cautious in pumping the next balloon, or not weight the pop heavily and continue to be risky on the subsequent trial. The regression equation predicting average pumps after a pop (total R^2=.12, *F*(3,76)=3.38, *p*<.03) revealed a significant two-way interaction between condition and total approaches, R^2 change=.10, *B*= -.32, *t*(76)= -2.91, *p*<.01 (see Figure 6). At one standard deviation below the mean number of approaches (among the initially more cautious), there was not a significant effect of condition, *B*=.18, *t*(76)=1.19 *p*=.24. However, at one standard deviation above the mean (the initially riskier), the effect of condition was significant, with participants in the recalibration condition pumping less than those in the control condition, *B*=-.45, *t*(76)=-2.96, *p*<.01.

We explored this interaction further using the Johnson-Neyman method. The recalibration condition was significantly more risky than the control condition (α<.05) at 13 approaches and lower. In contrast to the previous experiments, this value at which recalibrating away from an initial negativity bias produced an effect was considerably lower than the mean of 20.54. As total approaches increased (reflecting a more positive initial weighting bias), this effect began to reverse (see the point of intersection in Figure 6 at approximately 19 approaches). This reversal resulted in a significant difference between conditions (α=.05) at approximately 22 approaches and above. Thus, the point at which the effect reversed was lower than in the previous three experiments – an observation that receives further attention shortly.

Discussion

In the current experiment, we found that individuals' experimentally-modified valence weighting tendencies influenced risk behavior. As in the first three experiments, for participants who were relatively more cautious initially, recalibration resulted in tendencies toward riskier behavior, whereas for participants who were initially more risky, recalibration produced less risk-taking. We found this effect was particularly strong after trials on which participants had experienced a pop. After a pop, participants could weigh this negative experience strongly, and inflate the next balloon less, or not give much weight to the pop and continue to be risky.

The effects of recalibration were not significant for participants who approached relatively infrequently (1 SD below the mean) during the practice game, i.e., those who began relatively more cautious, but did reach significance for participants who approached relatively more often during the practice game (1 SD above the mean). This stands in contrast to the first three experiments, in which the simple effect of condition tended to be stronger for participants with a more cautious initial bias. Moreover, comparison of the relevant figures and the outcomes of the Johnson-Neyman analyses shows that the point of intersection between the regression line for the control condition and that for the recalibration condition was lower in Experiment 4 (approximately 19 approaches) than in Experiments 1-3 (approximately 28, 27, and 23 respectively). There appeared to be nothing unique about this particular sample of participants. That is, those in Experiment 4 did not approach more or less during the practice game than the participants in Experiments 1-3. Nevertheless, the recalibration procedure affected individuals who were initially risky, leading them to be less risky on the BART measure. Although the interaction was evident in all four experiments, its nature seemed to vary somewhat as a function of the dependent measure. As argued earlier, we suspect that this stems from the BART being so much more gain-oriented than the outcome measures employed in Experiments 1-3.

General Discussion

The above studies demonstrate that recalibrating individuals to weight positive and negative information equally as they are generalizing their attitudes toward novel objects causes a change in subsequent judgmental processes in a variety of domains. Furthermore, the direction of this recalibration effect depended upon individuals' initial cautiousness. In Experiment 1, we found that for participants who were initially cautious, as evidenced by their approaching relatively infrequently during the practice BeanFest game, recalibration resulted in weighting positive information more strongly when generalizing their attitudes, and thus, a higher likelihood of classifying novel donuts as positive. This first experiment demonstrated a near-transferring effect because the recalibration task was similar to the outcome measure in that both involved consideration of the extent to which novel visual stimuli resembled stimuli that the participants earlier had learned to associate with positive or negative valence.

In Experiments 2, 3, and 4, we examined the far-transferring effects of the recalibration paradigm. Specifically, we found that recalibration influenced participants' interpretations of ambiguous situations, risk-taking apprehension, and risk-taking behavior. Those participants with more cautious tendencies who underwent recalibration endorsed more positive interpretations, were less apprehensive about risk, and showed more risky behavior in comparison to those in the control condition. Thus, recalibrating individuals to weight positive and negative information equally while engaged in attitude generalization towards novel beans influenced judgments and actions that bore no similarity in terms of content but involved a parallel process of weighting and integrating positive and negative information.

Although the recalibration effect was moderated by initial cautious tendencies as measured by total approaches in all four experiments, the nature of this interaction varied somewhat across the experiments. For attitude generalization towards novel donuts, interpretations, and risk-apprehension, the observed interaction involved a significant difference among participants who were initially more cautious and a non-significant reversal for participants who were initially more risky. However, we believed that recalibration should also influence initially risky individuals to weight negative information more strongly. Thus, in the final experiment we aimed to use an outcome measure that would be particularly sensitive to recalibrating changes away from initial risky tendencies. We found that on this outcome measure, for participants who began with a risky bias, recalibration led to significantly more caution than was exhibited by the control participants.

The present research has demonstrated that individuals' natural valence weighting tendencies can be recalibrated. We believe that as recalibration participants are proceeding through the test phase and receiving the feedback about the correctness of their valence classifications, they are slowly being trained to weight the positive and negative features that are visually associated with a given novel bean more equally. This possibility is supported by the gradual nature of the recalibration effects observed during the course of the BeanFest test phase. Initially, both the control condition and the recalibration condition showed the typical negativity bias associated with attitude generalization. By the end of the test phase, however, the recalibration condition was classifying novel beans as positive and negative equally often, whereas the control condition still showed a strong negativity bias. Furthermore, signal detection analyses confirmed that recalibration led participants to more accurately discriminate between positive and negative novel beans. We argue that this greater accuracy emerged because participants were now giving resemblance to a known positive and resemblance to a known negative more equivalent weight when generalizing their attitudes.

Alternatively, one might assert that participants in the recalibration condition are not experiencing a change in their underlying valence weighting tendencies, but instead becoming consciously aware of the errors they are making and correcting for them. For example, participants who are initially cautious may notice that they are often incorrectly classifying beans as negative and then may purposefully try to be more positive on the later trials and on the subsequent outcome measures. If this were the case, our recalibration procedure would not be influencing individuals' valence weighting, but simply would be leading participants to believe they are too positive or too negative, which participants then would consciously correct. Although this may explain the near-transferring effects that we observed regarding the classification of the donut stimuli, it does not explain why the effect was limited to the novel donuts that were ambivalent. More importantly, this possibility does not seem very plausible for the far-transferring effects observed in Experiments 2-4. Participants would have had little or no reason to connect the BeanFest recalibration to what was presented as a subsequent separate experiment, especially given that the tasks bore no similarity in terms of content to the classification of beans.

Moreover, in a follow-up study involving 58 participants who completed the BeanFest recalibration procedure, we found no evidence that participants were at all aware of how many beans they classified as positive versus negative. For example, we asked participants if they were more likely to have classified beans as positive (scored as +1), as negative (-1), or equally so (0) during the test phase. Five participants indicated they did not know, and there was no correlation between the remaining participants' beliefs about their classification behavior and their actual average classification of beans (scored as +1 for positive and -1 for negative) during the test phase ($r(52)=-.10$, $p=.47$). We also asked participants how many positive and negative beans they correctly classified in the first 20 and the last 20 trials of the test phase. We then computed difference scores between positive correct and negative correct. In this way, we could discern the extent to which participants appeared aware of whether they were getting more positive or more negative correct during the first versus last part of the test phase. Seven participants did not answer; they reported that they had no sense of how many positive and negative beans they had identified correctly. For participants who did venture reports, there was no relation between their reported difference score and the actual difference between positive and negative correct during the first 20 trials ($r(50)=-.11$, $p=.43$) or the last 20 trials ($r(50)=.07$, $p=.60$). In sum, participants did not seem to notice whether they were committing more errors for positive or for negative beans, possibly because the feedback and the trials progressed rather rapidly. They simply may not have had the time to reflect upon which they were classifying more correctly. Thus, the recalibration process appears to operate at a less conscious level than implied by any alternative explanation based upon purposeful correction.

The current research is an important extension to the Pietri et al. (2013) studies. That research found that the weighting bias in attitude generalization correlated with participants' judgments across a variety of domains including concern about rejection, fear of novel situations and people, anxiety concerning ambiguously threatening situations, and risk-taking behavior. However, all of these previous studies were correlational in nature. In contrast, the present experiments manipulated weighting bias and, hence, demonstrated the causal role of valence weighting tendencies across a variety of judgmental domains.

This lack of domain specificity makes the BeanFest recalibration procedure somewhat unique as a cognitive modification paradigm. Many other cognitive modification paradigms rely on tasks that focus on and utilize specific content. For example, many of the attention modification paradigms use threatening facial expressions or words (e.g., Macleod et al., 2002; Dandeneau et al., 2007). There certainly are benefits to focusing cognitive modification programs on specific content. For example, Baert, Raedt, Schacht, and Koster (2010) aimed to modify attentional biases in depressed individuals, and thus created a procedure that was tailored to specific predispositions (i.e., attentional biases toward sad faces) known to be associated with depression. As a result, this training procedure successfully decreased depressive symptoms. Despite the potential benefits associated with tailoring a training task to specific symptoms or disorders, our goal was to create a more general modification procedure that would influence a variety of actions and would not, given the ubiquitous nature of valence, be limited to a single domain. At a theoretical level, our goal was to show it was possible to modify individuals' weighting of purely positive/negative information, free of specific content.

In addition, from a more practical standpoint, the recalibration procedure may have some potential as an intervention tool. The recalibration paradigm may especially benefit individuals with valence weighting tendencies that are extreme, in either the positive or the negative direction. For example, negative interpretation biases correlate with, and produce, anxious symptoms (Amir, Foa, & Coles, 1998; French & Richards, 1992; Wilson, MacLeod, Mathews, & Rutherford, 2006). Our findings indicate that recalibrating individuals with an initial negative bias promotes their development of more positive interpretations of ambiguous situations. Potentially, then, recalibrating people with a strong negative weighting bias could be beneficial for their mental well-being. Having a strong positive weighting bias also can be detrimental, because it is associated with risky and potentially negative behavior, such as gambling or using illegal substances. The current recalibration procedure led people with a positive weighting bias to become less risky. Hence, it has the potential to promote a greater concern for safety among individuals who too frequently engage in risky actions.

Clearly more research is necessary before we can address any such practical applications of the BeanFest recalibration paradigm. The current work used the number of approaches during the practice BeanFest game as a proxy for individuals' riskiness and initial valence weighting proclivities. However, in future research it may be useful to employ other measures of initial valence weighting. For example, based on the Pietri et al. (2013) findings regarding various judgments that correlate with the weighting bias (e.g., rejection sensitivity, threat assessment, neophobia, or risk tolerance), it may prove useful to recruit individuals strongly predisposed to weight positives or negatives, as indicated by extreme scores on one of these measures, and then modify their valence weighting tendencies through the recalibration paradigm. The current research is further limited in that all the studies were conducted in a laboratory setting and the outcome measures of interest were administered directly after completion of the BeanFest recalibration paradigm. As result, we do not how long these recalibration effects persist, nor what sort of real life situations they may affect. Future research should examine how recalibration influences individuals' everyday experiences outside the laboratory (e.g., risky drinking behavior). In addition, research should have participants complete outcome measures following the passage of a more substantial length of time after the recalibration procedure.

Despite the obvious limitations, the present four experiments provide an important extension of previous research concerning valence weighting in attitude generalization. Pietri et al. (2013) established that the valence weighting in attitude generalization correlates with judgments across a variety of domains. However, the current research built on these previous findings by demonstrating we can successfully recalibrate individuals to weight positive and negative information more equally when generalizing their attitudes and that such recalibration influences subsequent assessments in a variety of domains.

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Footnotes

[1]As is to be expected given that the recalibration manipulation occurred well after this initial practice game, there were no differences between the recalibration (*M*=23.24, *SD*=4.05) and control conditions (*M*=24.8, *SD*=6) on total number of approaches during the practice game $t(72)=1.28$, $p>.20$.

[2]We employed a similar method as Pietri, Fazio and Shook (2012, Study 2), to classify which novel donuts were univalent, center or ambivalent. Specifically, we calculated resemblance to a positive (versus a negative) as the Euclidean distance in the matrix separating a novel stimulus from the nearest positive (negative) game stimuli. We then used the Jamieson method for calculating ambivalence scores (Thompson, Zanna, & Griffin, 1995). Based on this calculation, the novel stimuli were characterized by scores of 4.17, 3.20, 2.25, 1.33, 0.80, 0.50, and 0.17. The forty donuts that had ambivalence scores higher than 1, were termed ambivalent; they were relatively high in resemblance to both positive and negative game stimuli. Sixteen novel stimuli had ambivalence scores lower than one; they were close to either a positive or negative game region, and thus were termed univalent. Finally, four additional stimuli had ambivalence scores less than one, but were far from, and thus low in resemblance to, both positive and negative game stimuli, and were called center stimuli. The mean ambivalence scores for the ambivalent, the univalent, and the center stimuli were 2.49, 0.51, and 0.50, respectively. Thus, the 40 ambivalent stimuli were much higher in positive and negative characteristics than either the univalent or center stimuli.

[3]As will soon become apparent, the Johnson-Neyman procedure will provide a way of comparing the interactions across the four experiments.

[4] We generated situations that intuitively seemed to have the potential to be viewed positively or negatively, as well as possible positive, neutral, and negative responses to each situation. We then chose the situations that yielded the most variable responses across 100 pilot participants, so as to include only those that were open to either positive or negative interpretation.

[5]We ran the regression equation examining condition, total approaches and the interaction between the two predicting only the upset variable (total R^2=.04, *F*(3,103)=1.33, *p*=.27), and found a tendency toward a two-way interaction, R^2 change=.02, *B*=.16, *t*(103)=1.59, *p*<.12. At one standard deviation below the mean on approaches there was a marginal effect of condition (*B*=-.26, *t*(103)=1.90, *p*=.06), whereas at one standard deviation above the mean there was no effect to recalibration (*B*=.05, *t*(103)=.36, *p*=.72). We found similar effects when we ran the same regression predicting only the concern score (total R^2=.07, *F*(3,103)=2.91, *p*<.04). There was a significant two-way interaction, R^2 change=.05, *B*=.22, *t*(103)=2.24, *p*<.03. At one standard deviation below the mean, there was a marginally significant effect of condition (*B*=-.26, *t*(103)=1.93, *p*<.06), in that participants in the recalibration condition were less concerned with the possibility of risk than the control condition. At one standard deviation above the mean, there was a non-significant reversal, *B*=.17, *t*(103)=1.25, *p*=.22.

[6] Some evidence in support of this characterization is provided by the control conditions of the previous experiments. In the first experiment, the control condition classified the novel donuts as more negative than positive (*M*=-.08, *SD*=.20, *t*(35)=2.31, *p*<.05). In Experiment 2, participants in the control condition were significantly more likely to give a neutral interpretation (*M*=2.49, *SD*=.20) than a positive interpretation (M=1.79, SD=.21), *t*(47)=17.06, *p*<.001. Finally, in the control condition of Experiment 3, the mean score on the composite anxiety measure was

significantly above the midpoint of 3 on the 0-6 scale, with higher scores indicating being more apprehensive about the risk (M=4.67, SD=.78, $t(55)$=16.05, p<.001).

Figure Captions

Figure 1. Bean Matrix. X= shape from oval (1) to oblong (10). Y= number of speckles from 1 to 10. The cells with a point value present the beans presented during the game.

Figure 2. Experiment 1 regression lines showing condition effects on average response to the novel ambivalent donuts as a function of total approaches during the practice game.

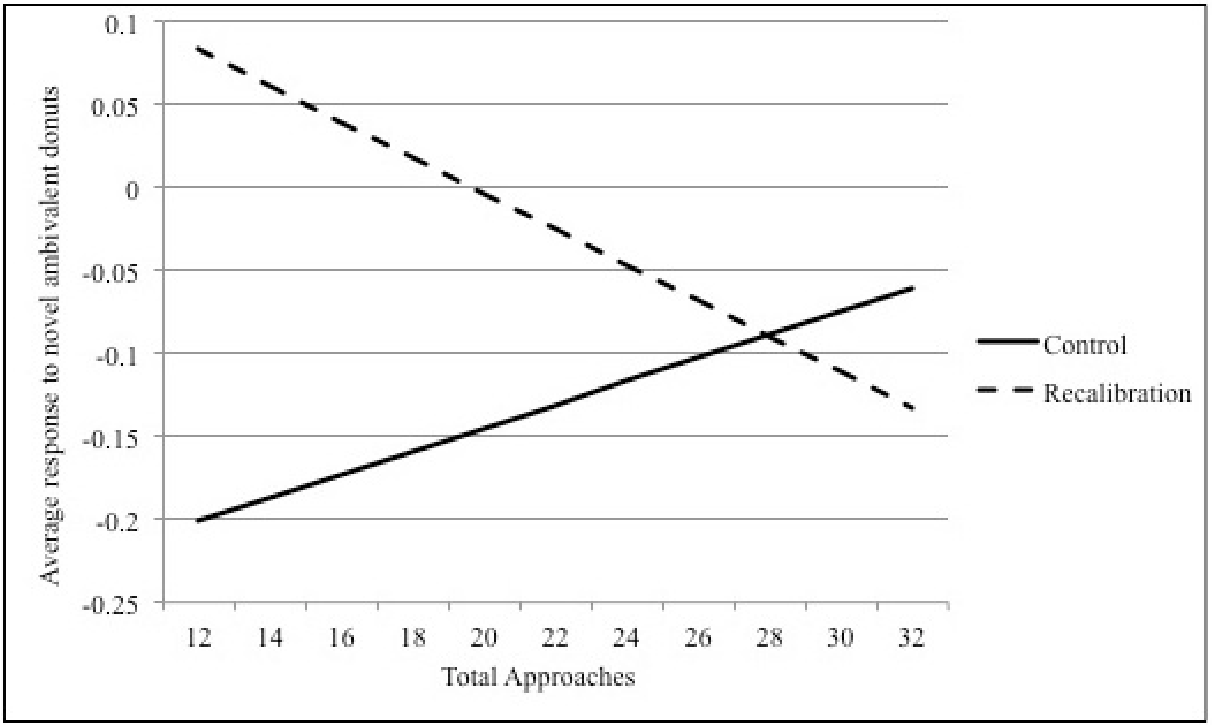
Figure 3. Experiment 2 regression lines showing condition effects on good minus bad interpretations as a function of total approaches during the practice game.

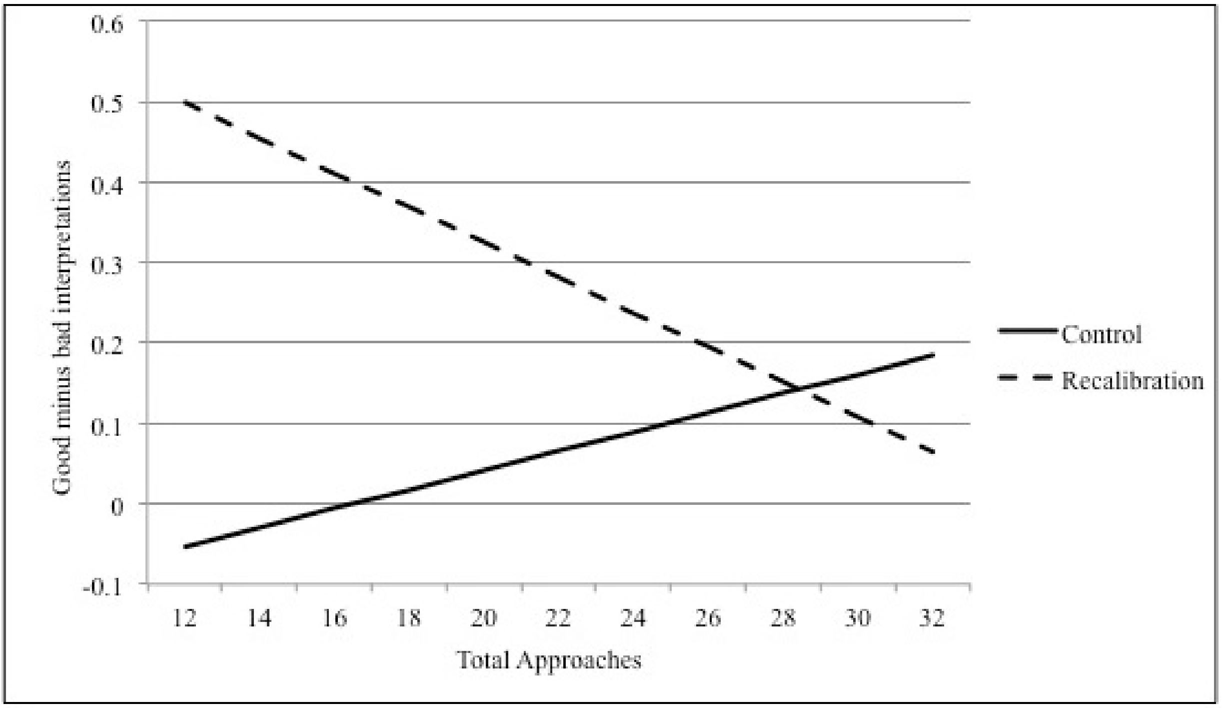
Figure 4. Experiment 3 regression lines showing condition effects on apprehension of taking a risk as a function of total approaches during the practice game.

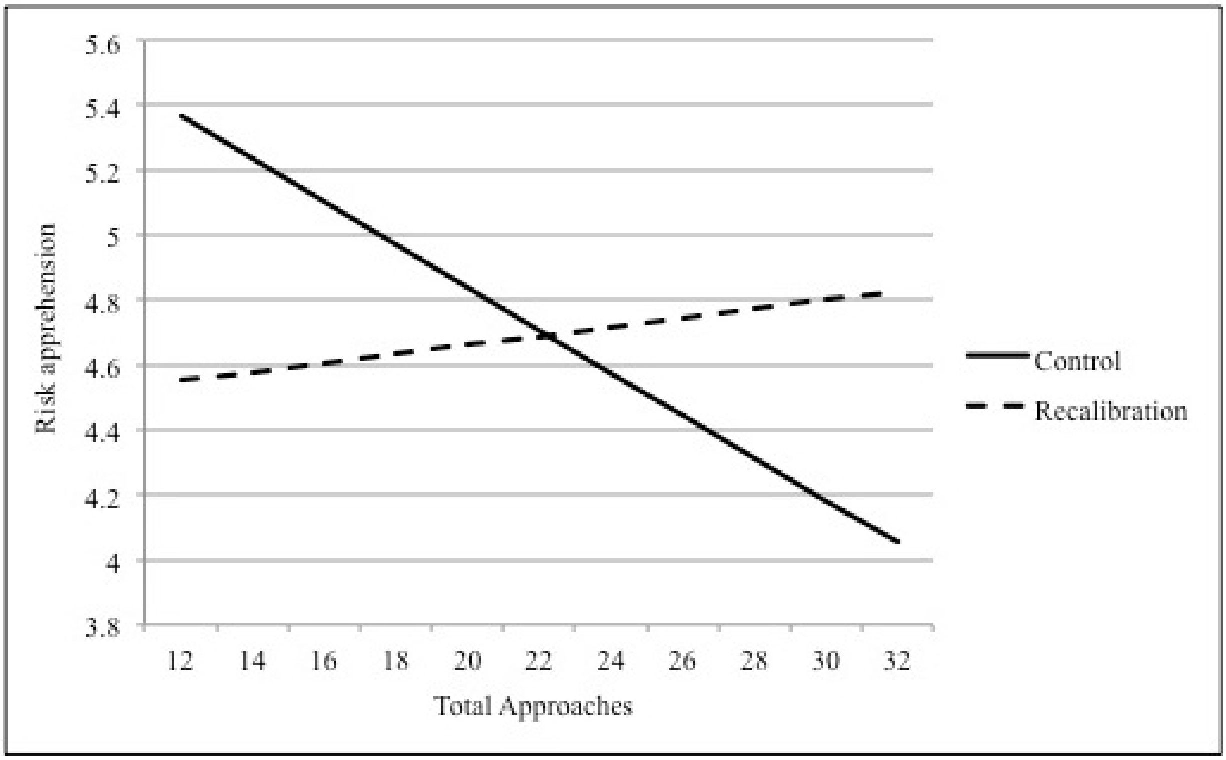
Figure 5. Experiment 4 regression lines showing condition effects on total pumps as a function of total approaches during the practice game.

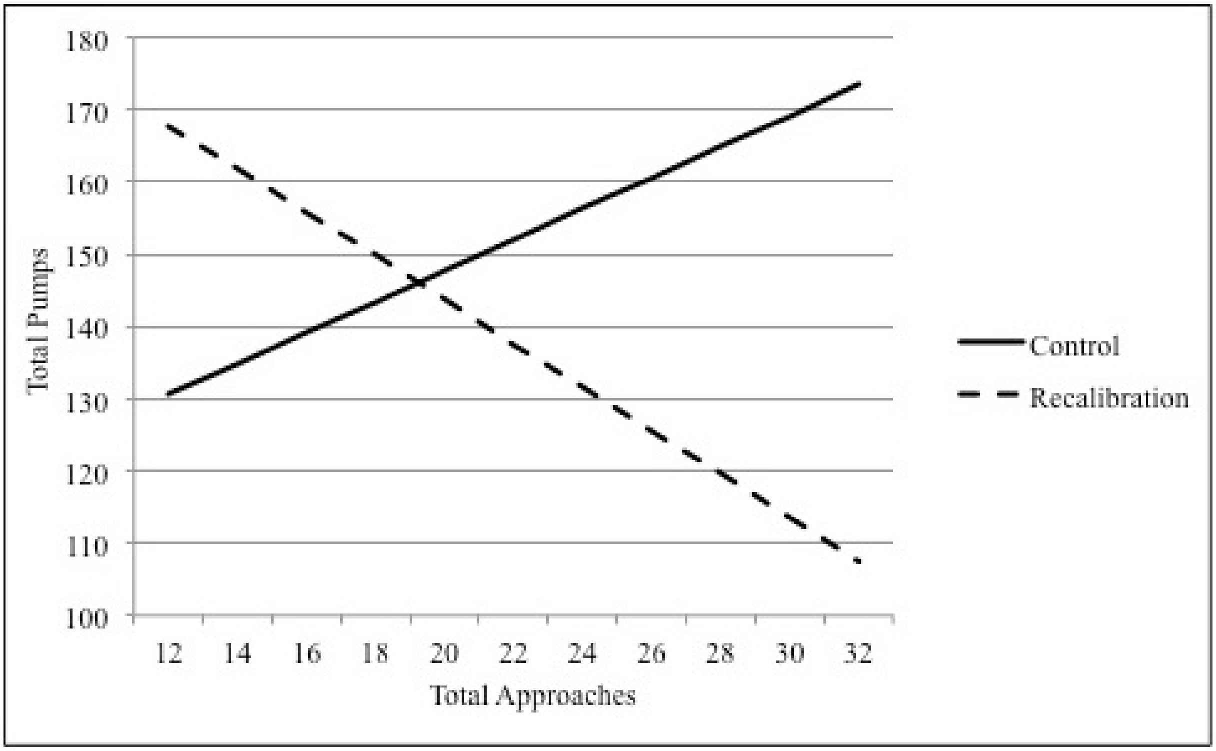
Figure 6. Experiment 4 regression lines showing condition effects on average number of pumps following a pop as a function of total approaches during the practice game.

	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10
X1	10	10	10	10			-10	-10	-10	-10
X2	10	10	10					-10	-10	-10
X3	10	10							-10	-10
X4	10									-10
X5										
X6										
X7	-10									10
X8	-10	-10							10	10
X9	-10	-10	-10					10	10	10
X10	-10	-10	-10	-10			10	10	10	10


0.1
0.05
0
-0.05
-0.1
-0.15
-0.2
-0.25
Average response to novel ambivalent donuts
12
14
16
18
20
22
24
26
28
30
32
Total Approaches
Control
Recalibration


0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
Good minus bad interpretations
12
14
16
18
20
22
24
26
28
30
32
Total Approaches
Control
Recalibration


5.6
5.4
5.2
5
4.8
4.6
4.4
4.2
4
3.8
Risk apprehension
12
14
16
18
20
22
24
26
28
30
32
Total Approaches
Control
Recalibration


180
170
160
150
140
130
120
110
100
Total Pumps
12
14
16
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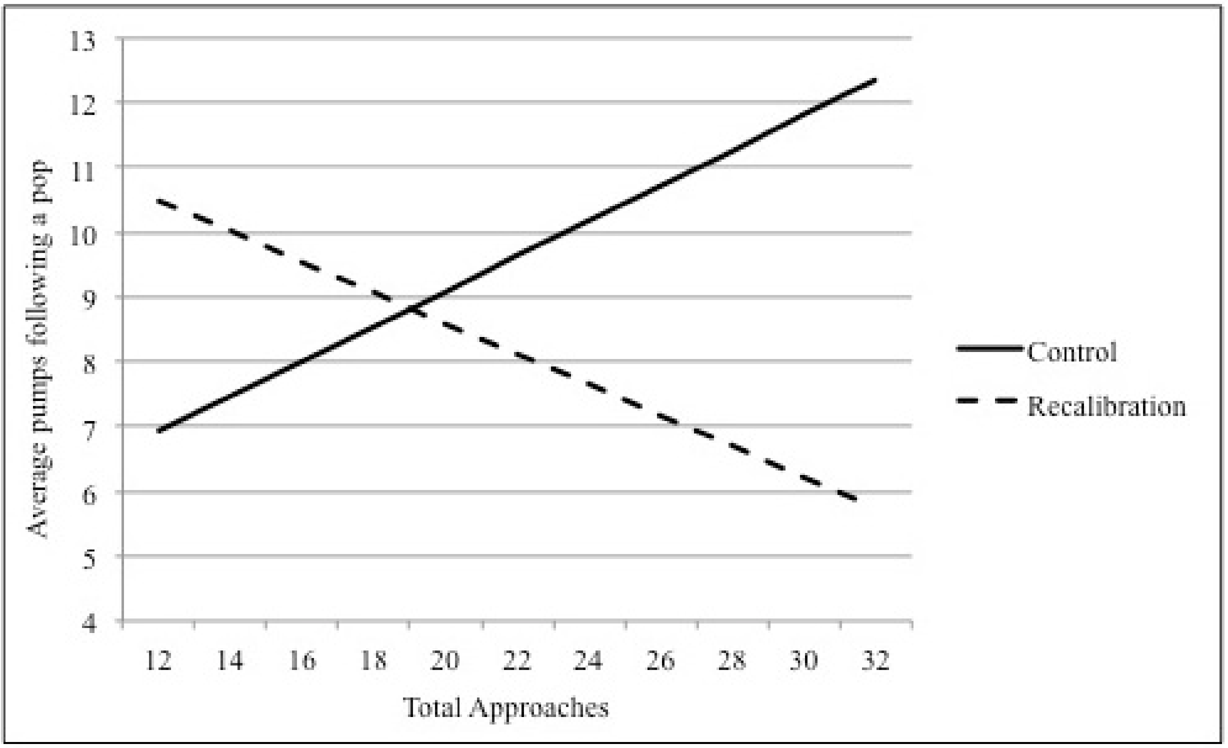
30
32
Total Approaches
Control
Recalibration


13
12
11
10
9
8
7
6
5
4
Average pumps following a pop
12
14
16
18
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24
26
28
30
32
Total Approaches
Control
Recalibration