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BRIEF REPORTS

The Effect of Embodied Emotive States on Cognitive Categorization

Tom F. Price and Eddie Harmon-Jones
Texas A&M University

Research has uncovered that positive affect broadens cognitive categorization. The motivational dimensional model, however, posits that positive affect is not a unitary construct with only one cognitive consequence. Instead, this model puts forth that there are different positive affects varying in approach motivational intensity. According to this model, only positive affects lower in motivational intensity should broaden cognitive processes, whereas positive affects higher in motivational intensity should narrow cognitive processes. Consistent with these predictions, high approach positive affect has been shown to narrow attention, whereas low approach positive affect has been shown to broaden it (Gable & Harmon-Jones, 2008). High approach positive affect, therefore, might narrow categorization. Two experiments investigated this possibility by having participants respond to cognitive categorization tasks in 3 body postures designed to elicit different levels of approach motivation: reclining backward, which should evoke low approach motivation; sitting upright, which should evoke moderate approach motivation; and leaning forward, which should evoke high approach motivation. Participants smiled while in each posture in order to experience positive affect. Experiment 1 provided initial support for the idea that high approach positive affect narrows categorization and low approach positive affect broadens categorization. Experiment 2 replicated these findings with improved smiling instructions. These results extend previous work by showing that the motivational model's predictions hold for basic attentional processes as well as higher level cognitive processes such as categorization.

Keywords: approach motivation, positive affect, embodiment, cognitive categorization

You lean toward something you desire, a delicious meal you are about to consume. You recline after accomplishing a goal, once the tantalizing food has been eaten and you are satisfied. Both of these actions are associated with positive affect, but they differ in approach motivational intensity, or the urge to move toward something. Past theories have often posited that positive affect broadens attention, cognitive categorization, and other processes (Fredrickson, 1998, 2001; Isen & Daubman, 1984). These theories, however, have focused their empirical efforts on positive affective states low in approach motivation and have ignored positive affects higher in approach motivation.

Recent research has found that whereas positive affects low in approach motivation broaden attention, positive affects higher in approach motivation narrow attention. In one experiment, participants induced to feel high approach positive affect with films of desirable desserts demonstrated narrower attention on local–global visual processing tasks as compared with participants induced to feel low approach positive affect with humorous films (Gable & Harmon-Jones, 2008, Study 1). Subsequent experiments found similar attention results with dessert pictures and cute baby animal pictures, which created high approach positive affective states (Gable & Harmon-Jones, 2008, Studies 2 and 3; Harmon-Jones & Gable, 2009). In another study, high trait behavioral approach system sensitivity, measured with Carver and White's (1994) scale, was correlated with more narrowed attentional focus following the presentation of appetitive primes (Gable & Harmon-Jones, 2008, Study 3). Finally, an experiment showed that participants had the greatest narrowing of attention on local–global tasks when they were informed that they would get to eat the desserts being presented to them (Gable & Harmon-Jones, 2008). Other experiments have shown that attentional narrowing is also linked with greater relative left frontal cortical activity (Harmon-Jones & Gable, 2009), a pattern of cortical activation often associated with approach motivation (Harmon-Jones, 2003; Harmon-Jones, Vaughn-Scott, Mohr, Sigelman, & Harmon-Jones, 2004). These experiments have offered initial support for the motivational dimensional model, which has two primary assumptions: Positive affects vary in approach motivational intensity, and positive affects with different motivational intensities have different cognitive consequences.

Theoretically, the motivational model posits that positive affects high in approach motivation narrow attentional and cognitive processes because organisms shut out irrelevant perceptions and cognitions as they approach and attempt to acquire desired objects (Harmon-Jones & Gable, 2008). In contrast and consistent with other perspectives (Carver, 2003; Fredrickson, 2001), the motiva-

Tom F. Price and Eddie Harmon-Jones, Department of Psychology, Texas A&M University.

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Correspondence concerning this article should be addressed to Tom F. Price or Eddie Harmon-Jones, Department of Psychology, Texas A&M University, 4235 TAMU, College Station, TX 77843. E-mail: pricth02@gmail.com or eddiehj@gmail.com

tional model posits that low approach positive affects broaden attentional and cognition processes because these positive affects suggest a stable and comfortable environment and thus open the mind to new and previously unforeseen opportunities.

These empirical findings have provided support for the motivational dimensional model, which posits that positive affects varying in approach motivational intensity have different consequences on cognitive narrowing and broadening (Harmon-Jones & Gable, 2008). Empirical support for this model, however, has come solely from experiments on attentional precedence that manipulated affective states using pictorial and film stimuli. Support for the conceptual model would be broadened if other manipulations of positive affect were used and other cognitive measures were included. Studies supporting the older idea, that positive affect broadens cognition, have used diverse manipulations of affect (e.g., gifts, film clips, recall manipulations) and diverse measures of cognition (e.g., attentional precedence, cognitive categorization). Thus, proponents of the older conceptual models may claim that the predictions derived from the motivational model are limited to the affect manipulations and attention measures used in our past research. Consequently, the present experiments were designed to manipulate the approach motivational intensity of positive affect using a different manipulation than in our previous research. Moreover, cognitive narrowing versus broadening was assessed using a different measure.

Measuring Cognitive Narrowing Versus Broadening

One measure used in past research on positive affect and broadening is cognitive categorization (Isen & Daubman, 1984). Categorization tasks present participants with a given category (e.g., vehicle). Then, participants are shown a series of exemplars, or examples of that category. Some exemplars are common (e.g., car), and some are less common (e.g., camel). Previous research has indicated that when participants are given a free gift or asked to watch amusing films, manipulations that likely evoke low approach positive affect, they are more likely to think of categories in a broader sense (Isen & Daubman, 1984). That is, they are more likely than participants in neutral affective states to indicate that camels belong to the category vehicle. Similarly, positive moods have been shown to influence social categorization. In one experiment, people in positive moods were more likely to include typical (e.g., grandmothers) and atypical (e.g., bartenders) members of a social category within that category (e.g., nurturant), whereas neutral affect participants were more likely to include only typical members (Isen, Niedenthal, & Cantor, 1992). Related research has also indicated that people in positive moods tend to think of more unusual associates to neutral words than people in neutral moods (Isen, Johnson, Mertz, & Robinson, 1985). Together, these experiments suggest that positive affect broadens the way people think about related information. However, this may only occur with low approach manipulations. The present experiments were designed to test this possibility.

Manipulating Positive Affects Varying in Approach Motivation

Facial expressions combined with body postures might be able to elicit positive affects with different approach motivational intensities. This possibility has yet to be investigated, but it has long been known that facial expressions influence emotions (Laird, 1974). For example, participants who held a pen between their teeth, facilitating smiling, rated cartoons as funnier than participants who held a pen between their jutted lips, inhibiting smiling (Strack, Martin, & Stepper, 1988). In addition, people who nodded their heads up and down agreed more with a persuasive message than people who shook their heads side to side (Wells & Petty, 1980). Specific body postures also alter motivational behavior. Participants positioned in a slumped posture, for instance, demonstrated less persistence on an insolvable puzzle task than participants positioned in an upright posture (Riskind & Gotay, 1982). Finally, a few experiments have examined the effects of facial expressions and body postures on moods (Duclos et al., 1989). In the first of these experiments, participants were instructed to contract their facial muscles, thereby allowing them to have certain emotional expressions (e.g., fear, anger, sadness) without full knowledge of those expressions. In the second experiment, body postures indicative of the same emotions were manipulated with similar instructions. Adopting facial expressions and postures of certain emotions led participants to experience those emotions and, importantly, these effects were specific; participants with a fearful expression or posture reported being more fearful, but not angrier or sadder.

Expressions and postures have also been linked to specific physiological reactions. For example, different facial expressions have been shown to elicit associated emotional experiences as well as unique patterns of autonomic nervous system activity (Levenson, Ekman, & Friesen, 1990). Participants who contracted their facial muscles to make certain emotional expressions (e.g., happiness, anger, fear, disgust) reported feeling these emotions. They also demonstrated patterns of heart rate and skin conductance that were specific to each of these facial expressions. Expressions of anger, fear, and disgust had their own specific patterns of autonomic activity. Experiments employing similar facial expression manipulations have found comparable results for the specificity of certain emotions using electroencephalographic asymmetries over the frontal cortex (Coan, Allen, & Harmon-Jones, 2001). In particular, facial expressions of approach emotions such as anger and joy produced relatively greater left frontal cortical activity, whereas expressions of withdrawal-oriented emotions such as fear, sadness, and disgust produced relatively less left frontal activation. Body postures have also been found to influence asymmetrical cortical activity in response to emotion manipulations (Harmon-Jones & Peterson, 2009). Participants in a supine posture who were insulted demonstrated less left frontal cortical activity than participants who were insulted in an upright posture, suggesting that participants in a supine posture experienced less approach motivated anger when they were insulted. There has been no work, however, that integrates all of this research to test whether body postures paired with facial expressions can create high and low approach positive affective states.

The Present Experiments

The present experiments investigated this possibility by having participants smile in three body postures designed to elicit different levels of approach motivation. Afterward, participants completed categorization tasks. We expected that a condition associated with low approach positive affect, smiling and reclining, should cause more broadening of categorization than a control condition, smiling and sitting upright, and a condition associated with high approach positive affect, smiling and leaning forward, should cause the least broadening. Broadening of categorization should manifest as an increased likelihood to indicate that weak exemplars belong to a particular category.

Experiment 1

Method

Participants. Fifty-eight introductory psychology students (29 women) at Texas A&M University participated for course credit. Participants were randomly assigned to condition and experimenters were blind to condition. Twelve participants did not smile during the experiment and their data were excluded from analyses. An additional six participants did not follow instructions during the experiment; their data were also excluded.

Materials and procedure. Participants sat in a chair that could recline throughout the study. They were informed that the study concerned muscle contraction, brain activity, and four categorization tasks. One categorization task was used as a practice trial and one was used in each of the three subsequent experimental trials. After providing the cover story and obtaining informed consent, the experimenter placed electrodes on participants' temples to make the cover story about recording brain activity more believable. Individual electrodes were also placed half way between the corner of the lip and preauricular point on either side of the participants' face (on their cheeks). Participants were then fitted with a set of Vuzix VR920 computer goggles so that visual images could be presented equidistant from the eyes regardless of body position. Participants also wore a stereo headset with an attached microphone so that they could hear instructions and communicate with the experimenter. Once these items were in place, the experimenter turned off the lights to ensure that images were clearly visible on the computer goggles. The experimenter then closed the door and exited the room.

The experiment began with the practice trial; all participants were initially instructed to sit as they normally would for the complete duration of the practice. These instructions were conveyed through text screens presented on the goggles. Following these instructions, participants were told that brain activity would be recorded for 1 min. This time interval was actually included as an acclimation period for each body posture, and this was done during each of the four trials of the experiment. Afterward, participants were asked to contract their facial muscles so that the sensors on their cheeks moved toward their ears for 1 min. A 15-s break followed, and then another 1-min period occurred wherein participants contracted their facial muscles (smiled) again.

Next, participants completed a categorization task modeled after the work of Isen and Daubman (1984), Smith and Trope (2006), and Stapel and Semin (2007). Participants were told to rate 10 items on a 7-point scale (1 = *definitely does belong to the category* to 7 = *definitely does not belong to the category*). For each item, they saw the general category (e.g., vegetable), the specific item (e.g., carrot), and the rating scale. For each category there were two strong, three moderate, and five weak exemplars derived from Rosch's (1975) testing. Strong and moderate exemplars were included to ensure that participants understood the scale. Each category always began with a strong exemplar; the remaining nine were presented in random order. Participants saw each item for 4 s, with a 2-s delay between items. They spoke into the microphone, giving a verbal rating when they saw each item. The microphone was connected to a speaker in another room and an experimenter wrote down each rating. Participants were given no explicit instructions to continue (or not continue) to contract their facial muscles during the categorization tasks. We wanted to avoid telling them to stop contracting, and we were also concerned about the difficulty of contracting the facial muscles while uttering the category judgments.

On completion of the practice, participants started the three experimental trials in counterbalanced order. These differed from the practice in that participants were asked to assume one of three randomly designated body postures (e.g., leaning forward, upright, reclining) at the start of each experimental trial. Participants maintained this posture throughout the entire duration of the trial. The specific category (e.g., clothing, vehicle, furniture) and its corresponding exemplars were also randomly assigned to one of the three body posture trials.

After finishing all of the trials, participants were debriefed and asked several questions. In particular, participants were asked to show the experimenter how they physically contracted the muscles in their face during the experiment and why they thought they were asked to do so. These questions were included in the debriefing to ensure that participants smiled correctly and were unaware of the purpose of the study.

Ratings for exemplars within each category were averaged. As in past research, we expected our manipulation to influence ratings of weak exemplars. Because predictions were directional, derived from theory, and specified in advance, they were evaluated using planned comparisons and a one-tailed criterion of significance (Rosenthal, Rosnow, & Rubin, 2000).

Results and Discussion

As predicted, breadth of categorization was affected by the body posture (leaning forward, upright, reclining) manipulation. Whereas reclining and smiling broadened categorization, leaning forward and smiling narrowed categorization (see Figure 1). This

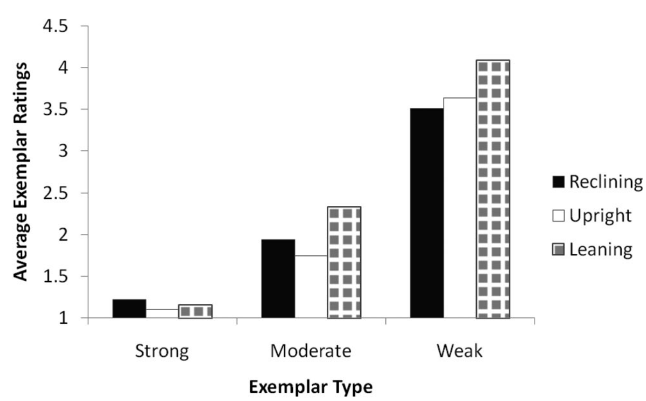

Figure 1. Average exemplar ratings as a function of exemplar type and posture (Experiment 1). Ratings were made on a 1 (*the exemplar definitely does belong to the category*) to 7 (*the exemplar definitely does not belong to the category*) scale.

effect was supported by a significant planned linear contrast, $t(39) = 2.74$, $p = .004$, which demonstrated that weak exemplars were rated as more fitting of the category in the reclining condition ($M = 3.51$, $SD = 0.17$), then the upright condition ($M = 3.64$, $SD = 0.17$), and finally the leaning forward condition ($M = 4.09$, $SD = 0.20$).

In line with prior research investigating positive affect and categorization (Isen & Daubman, 1984), we generated no hypotheses for strong and moderate exemplars. However, we felt readers might be interested in this information. Average strong and moderate exemplar ratings were entered into two separate repeated measures analyses of variance, with body posture serving as the within-subjects variable in each. There was no effect of body posture on strong exemplar ratings, $F(2, 78) = 0.62$, $p = .53$, indicating that ratings given in a reclining ($M = 1.22$, $SD = 0.11$), upright ($M = 1.10$, $SD = 0.07$), and leaning forward ($M = 1.16$, $SD = 0.09$) posture were not significantly different from one another. There was a significant effect, however, of body posture on moderate exemplar ratings, $F(2, 76) = 3.58$, $p = .03$. Moderate exemplars were considered as more belonging to the category in the reclining condition ($M = 1.94$, $SD = 0.17$) and upright condition ($M = 1.74$, $SD = 0.13$) as compared with the leaning forward condition ($M = 2.33$, $SD = 0.20$).

Experiment 2

The results in Experiment 1 are consistent with the prediction that high approach positive affect causes a relative narrowing of cognitive categorization, whereas low approach positive affect causes a relative broadening of cognitive categorization. These results add further support to the motivational dimensional model, and suggest that high approach positive affect might lead to a narrowing of many cognitive states, not just attention. And, to the best of our knowledge, this is the first instance where leaning forward has been shown to influence cognition, supporting the notion that bodily states can influence how individuals think.

The large amount of unsmiling participants, however, was unfortunate. To rectify this problem and replicate the findings of the first experiment, we conducted a second with clearer smiling instructions.

Method

Participants. Forty-three psychology students (22 women) at Texas A&M University participated for course credit. As with Experiment 1, participants were randomly assigned to condition and experimenters were blind to condition. One participant did not smile during the experiment and his data were excluded from analyses.

Materials and procedure. Experiment 2 was identical to Experiment 1 with the exception of smiling instructions. Participants were again asked to contract their facial muscles so that the sensors on their cheeks moved toward their ears. New instructions were also included, informing participants that the corners of their mouth should be brought closer to their ears and that their mouth should remain closed.

Results and Discussion

As before, smiling and reclining broadened categorization, whereas smiling and leaning forward narrowed categorization. Again, the planned linear contrast was significant, $t(39) = 1.78$, $p = .04$. Consistent with Experiment 1, weak exemplars were rated as more fitting of the category in the reclining condition ($M = 4.29$, $SD = 0.17$) as compared with the leaning forward condition ($M = 4.66$, $SD = 0.15$). In this experiment, the upright condition's weak exemplar ratings ($M = 4.18$, $SD = 0.18$) did not lie between the other two conditions but were more similar to the reclined condition. The key conceptual result, the difference between reclining and leaning forward, was replicated.

Like with Experiment 1, there was no effect of body posture on strong exemplar ratings, $F(2, 78) = 0.05$, $p = .94$. Strong ratings given in a reclining ($M = 1.62$, $SD = 0.10$), upright ($M = 1.15$, $SD = 0.08$), and leaning forward ($M = 1.25$, $SD = 0.04$) posture were not significantly different from one another. Moderate ratings given in the reclining condition ($M = 2.14$, $SD = 0.15$), upright condition ($M = 2.18$, $SD = 0.16$), and leaning forward condition ($M = 2.42$, $SD = 0.19$) did not differ from one another either, $F(2, 78) = 0.98$, $p = .37$.

General Discussion

We examined the effects of high and low approach motivated positive affect on categorization in two experiments. In both experiments, body postures associated with high approach positive affect narrowed categorization relative to body postures associated with low approach positive affect. These results extend previous research (Gable & Harmon-Jones, 2008; Harmon-Jones & Gable, 2009) by demonstrating that manipulated positive affects with different motivational intensities have different consequences for more complex cognitive processes, such as categorization. As a whole, these experiments suggest that high approach positive affect may narrow cognition in general.

Past models of the relationship between positive affect and cognition have suggested that positive affect causes broadening of cognition (Fredrickson, 2001) and that positive affect causes increased cognitive flexibility (Isen & Daubman, 1984). These perspectives are often considered identical (Fredrickson, 1998). However, they do diverge occasionally in their predictions, with the broadening perspective predicting an increase in attentional broadening (global bias), but the cognitive flexibility perspective not making this prediction. Given that most past experiments testing the motivational dimension model assessed attentional broadening, the present research is particularly important because it demonstrates that positive affects differing in approach motivational intensity also influence cognitive categorization processes that have been associated with cognitive flexibility (Isen & Daubman, 1984). Thus, positive affects low in approach motivation increase cognitive broadening and flexibility, whereas positive affects high in approach motivation decrease cognitive broadening and flexibility.

These results also add further support for the motivational dimensional model's predictions for the effect of emotions of different motivational intensities on cognitive broadening by demonstrating that the effects also extend to other manipulations of emotive states. Specifically, whereas past experiments used pictorial and film stimuli, the present research used facial expressions and body postures to manipulate positive affects varying in approach motivational intensity. The emotional effects of body postures are probably quite subtle, especially compared to pictures and films of dessert stimuli, which elicit discrete emotions such as desire. The present findings, however, suggest that both of these manipulations lead to similar cognitive effects. These effects, therefore, are not limited to manipulations of discrete emotions. This finding is particularly important because it indicates that there are multiple ways to induce high approach positive states, and regardless of how these states are evoked, they consistently narrow cognition.

The present findings also extend those of Harmon-Jones and Peterson (2009), who used a reclining body position to lower approach motivated anger responses. In addition to using that position, the present experiments manipulated leaning forward, a position associated with higher approach motivation. As predicted, this body position caused a narrowing of cognitive categorization processes. These results also fit with the notion that cognition can be grounded, or rather, that actions can be closely associated with a particular way of thinking, further supporting the idea that the motor and cognitive systems are tightly coupled (Barsalou, Simmons, Barbey, & Wilson, 2003; Winkielman, Niedenthal, & Oberman, 2008). As our results suggest, such a connection might exist between reclining, leaning forward, and different levels of approach motivation.

In summary, the current research extends previous work with attention, cognition, and embodiment. Taken together, this line of research suggests that positive affect should not be thought of as a unitary construct that aids only in broadening. Positive affect can broaden or narrow cognitive processes, depending on the approach motivational intensity of the positive affective state.

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