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The Expression of Determination:
Similarities between Anger and Approach-Related Positive Affect

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This set of studies examines the perceptual similarities between emotions that share either a valence or a motivational direction. Determination is a positive, approach-related emotion, whereas anger is a negative, approach-related emotion. Thus, determination and anger share a motivational direction, but are opposite in valence. An implemental mindset has previously been shown to produce high-approach motivated, positive affect. Thus, in Study 1, participants were asked to freely report the strongest emotion they experienced during an implemental mindset. The most common emotion reported was determination. Based on this result, we compared the facial expression of determination to anger. In Study 2, naïve judges were asked to identify photographs of facial expressions intended to express determination, along with photographs intended to express basic emotions (joy, anger, sadness, fear, disgust, neutral). Correct identifications of intended determination expressions were correlated with misidentifications of the expressions as anger, but not with misidentifications as any other emotion. This suggests that determination, a high-approach, positive affect, is perceived as similar to anger. In Study 3, naïve judges quantified the intensity of joy, anger, and determination expressed in photographs. The intensity of perceived determination was directly correlated with the intensity of perceived anger (a high-approach, negative affect), and was inversely correlated with the intensity of perceived joy (a low-approach, positive affect). These results demonstrate perceptual similarity between emotions that share a motivational direction, but differ in valence.

Most of the previous conceptual approaches to the study of positive emotions emphasize major differences between positive and negative emotions but rarely consider underlying similarities between certain positive and negative emotions (Fredrickson & Cohn, 2008; Tugade, Fredrickson, & Barrett, 2004). Recent conceptual models that emphasize the approach vs. withdrawal dimensions underlying emotions, however, suggest similarities between certain positive and negative emotions. For example, anger is a negative emotion that is associated with high approach motivation, and recent research has shown that approach-motivated positive emotions are increased during anger episodes (Harmon-Jones, Harmon-Jones, Abramson, & Peterson, 2009). Moreover, high-approach positive emotions (such as determination) are associated with anger responses during the angering episode (Harmon-Jones et al., 2009). The relationship between anger and high approach positive emotion suggests the counter-intuitive possibility that facial expressions of a positive emotion high in approach motivation—determination—may be perceived as similar to those of a negative emotion high in approach motivation—anger. This is the idea tested in the current research using the facial expression of determination.

Emotions are phenomena that involve multiple components. One prominent component is the facial and bodily expressions of emotions (Darwin, 1872; Ekman, 2003).

Research emphasizing the primacy of valence in emotion and research emphasizing motivational direction have relied on both self-reports and psychophysiological measures. The expressive and perceptual components of emotion have not been examined in this context. We reasoned that facial expressions could yield valuable evidence that emotions of opposite valence may share a motivational direction.

Prominent models of affect state that the basic structure of emotions is organized around two dimensions, arousal and valence (e.g., Lang, 1995; Russell, 1980; Watson & Tellegen, 1985). Arousal varies from low to high and valence varies from negative to positive. Some dimensional models also postulate a relationship between affective valence and motivational direction, such that positive affect is directly related to approach motivation, while negative affect is directly related to withdrawal motivation (Watson, 2000). However, research has shown that motivational direction is separable from valence, and that negative affect, particularly anger, can be associated with approach motivation (Carver, 2004; Harmon-Jones, 2003; Harmon-Jones & Allen, 1998; Harmon-Jones & Sigelman, 2001; Harmon-Jones, Sigelman, Bohlig, & Harmon-Jones, 2003; see review by Carver & Harmon-Jones, 2009).

Anger and high approach positive affect are positively related during anger episodes

One prominent dimensional model of emotion that assumes approach motivation and positive affect are equivalent is based on Watson and colleagues (1988) Positive and Negative Affect Schedule (PANAS). The PANAS is widely used as a measure of emotion. The article in which the PANAS was first described (Watson et al., 1988) had been cited over 5,000 times as of June, 2010 (Web of Science). In their review of self-report measures of affect, Gray and Watson (2007) suggested that “starting in the late 1980s, the Watson and Tellegen model – based on the dimensions of Positive and Negative Affect – gradually emerged as the most prominent structural/assessment scheme in research on self-rated affect” (p. 173).

The items on the PANAS positive affect (PA) scale are *active, alert, attentive, determined, enthusiastic, excited, inspired, interested, proud, and strong*, and the items on the PANAS negative affect (NA) scale are *afraid, scared, nervous, jittery, irritable, hostile, guilty, ashamed, upset, and distressed*. Researchers are sometimes surprised that certain “basic” emotion words are not found in the PANAS, including *joyful* (and synonyms such as *happy*), and *angry* (and synonyms such as *mad*). Nevertheless, researchers widely agree that the PANAS measures emotion and use it often just for this purpose, and so logically the PANAS items describe emotional states.

The subscales of the PANAS have been renamed positive activation (PA) and negative activation (NA) to convey the activated nature of these dimensions (Watson et al., 1999). According to Watson et al. (1988), the positive items were chosen to tap a theoretical dimension defined as activation plus pleasantness. The negative items were chosen to tap a theoretical dimension defined as activation plus unpleasantness. More specifically, “High PA is a state of high energy, full concentration, and pleasurable engagement, whereas low PA is characterized by sadness and lethargy. In contrast, Negative Affect (NA) is a general dimension of subjective distress and unpleasurable engagement that subsumes a variety of aversive mood states, including anger, contempt, disgust, guilt, fear, and nervousness...” (p. 1063). More recently, in describing the PANAS, Gray and Watson (2007, p. 173) wrote, “Positive Affect is composed of positively valenced mood states, including enthusiasm, energy, interest, pleasure, confidence, and feelings of affiliation... state positive affect reflects an individual’s short-term, often context-specific, experience of positive emotions such as confidence or joy.”

Although the PANAS is well-accepted as a measure of emotion, it may not be comprehensive. It is possible that the methods used to identify the emotion words used on the PANAS may have obscured more complex relationships between the emotions by eliminating low-approach-related positive items (such as *joyful*) and non-withdrawal related negative items (such as *angry*). The items on the PANAS were selected from a large list of affect terms by means of principal components analysis (Watson et al., 1988). Items were selected if they had a substantial loading on one factor and a near-zero loading on the other.

Watson (2000) suggested that positive affect (PA) is equivalent to approach motivation. He wrote, “... a growing body of evidence has suggested that negative mood experience is part of a larger Behavioral Inhibition System (BIS), whereas positive mood experience is linked to what has variously been called the Behavioral Activation System, Behavioral Engagement System, or Behavioral Facilitation System” (Watson, 2000, p. 22-23). Other theories of emotion propose similar ideas (e.g., Cacioppo, Gardner, & Berntson, 1999; Gray, 1990; Lang, 1995; Lang, Bradley, & Cuthbert, 1990, 1992, 1998; Larsen, McGraw, & Cacioppo, 2001).

In contrast to these models, a growing body of research suggests that eliminating affects (such as anger) that violate the hypothetical direct relationship between valence and motivation may have produced a misleading picture of the structure of emotion. Anger violates the postulate of several models of emotion that approach motivation is always positively valenced. Anger is a negative emotion, yet theorists have long suggested that anger evokes behavioral approach tendencies (e.g., Darwin, 1872; Plutchik, 1980). Animal behavior theorists note that anger-induced offensive aggression is associated with attack and no attempts to escape, whereas fear-induced defensive aggression is associated with attempts to escape and attack only if escape is impossible (Blanchard & Blanchard, 1984; see Bell & Baron, 1990, for a similar human model). Developmental psychologists have also found that angry facial expressions are associated with approach motivation (Lewis et al., 1990; Lewis et al., 1992).

Individual’s trait tendencies toward approach and withdrawal, as measured by Carver and White’s (1994) behavioral inhibition/behavioral activation sensitivity (BIS/BAS) scales, are also related to anger. In two studies, Harmon-Jones (2003) showed that trait approach motivation, as measured by the BAS scale, related positively to trait anger, as assessed by the Buss and Perry (1992) anger subscale of the Aggression Questionnaire. In a second study, BAS was also related positively to physical aggression. Smits and Kuppens (2005) found that the tendency to express one’s anger outwardly (assessed by questions such as, “I tell my friends openly when I disagree with them.”) related positively to BAS scores. The tendency to express one’s anger inwardly rather than outwardly act on their anger related positively to BIS scores. Carver (2004) also found that self-reported frustration and anger in response to situational elicitors was related to greater trait BAS. Thus, longstanding theories of emotion, animal research, developmental research, and research assessing both state and trait approach motivation support the idea that anger is a negative affect associated with approach tendencies (for review, see Carver & Harmon-Jones, 2009).

Contrary to predictions derived from valence models of emotion, Harmon-Jones, Vaughn-Scott, Mohr, Sigelman, and Harmon-Jones (2004) found that both self-reported anger and PANAS PA increased following an insult. In this experiment, anger was induced by giving participants insulting feedback, followed by a measure of self-reported emotion. Anger and PANAS PA were greater in the insult condition than in the no-insult condition. Harmon-Jones, Harmon-Jones, Abramson, and Peterson (2009) also showed that an anger-inducing event increased self-reports of both anger and PANAS PA. Moreover, anger and PANAS PA were directly

associated with each other following an anger-evoking event. Harmon-Jones et al. suggested that the relationship between anger and PANAS PA might be due to their common association with approach motivation. Their results suggested that the PANAS PA scale assesses approach motivation, rather than purely positive activation.

In a third study reported in Harmon-Jones et al. (2009), participants remembered a time when they were *really angry* and reported how they felt during that experience. Anger was measured using the items *hostile, angry, irritated, agitated, frustrated, furious, enraged, and mad*. Happiness was measured using the words *glad, content, pleasant, pleased, tranquil, well, calm, good mood, joyful, satisfied, and happy*. PA and NA were measured using the PANAS (Watson et al., 1988). PANAS PA correlated directly with both anger and happiness, while anger correlated inversely with happiness. In this study, attitudes toward anger were also assessed, and the correlation between anger and PANAS PA was not due to a positive attitude toward anger. Thus, self-reported anger and PANAS PA have been found to be directly correlated in a number of studies (see also Harmon-Jones & Harmon-Jones, 2010).

Facial expressions as a means to study emotion

The above research used self-reported emotions as a way to study affect. However, emotions involve multiple components, and self-reports alone may not provide a full understanding of their structure and functions. Another prominent component of affect is the facial and bodily expression of emotions (Darwin, 1872; Ekman, 2003). Examination of the connections between anger and some forms of positive affect at the expressive level of analysis is important theoretically and can provide a different means of examining affect. Based on the self-report research summarized above, as well as early facial expression research, we propose that facial expressions of certain approach-related positive affects may be perceptually similar to anger.

Watson and colleagues (1999) situated PANAS PA items such as determination at the activated, *positive* pole in their model of emotion. In contrast, early facial expression researchers referred to an anger/determination complex that was situated at the *unpleasant* pole of their emotion scale (Woodworth & Schlosberg, 1938/1954; Schlosberg, 1941). Schlosberg (1941) had participants use a sorting method to classify facial expressions of emotion. Based on these judgments, he created a circular scale with two axes. He labeled one of these axes pleasant vs. unpleasant. The other axis was labeled attention (or acceptance) vs. rejection. Schlosberg found that anger/determination expressions anchored the unpleasant axis of the scale. Levy and Schlosberg (1960) replicated these results using a different set of facial expression photographs.

In addition to the dimensions of pleasantness and attention, several other dimensions have been found to underlie facial expressions of emotion. Frijda and Tcherkassof (1997) reviewed evidence that suggested that somewhere between 6 and 18 distinct dimensions underlie facial expressions. They posited that emotional expressions communicate states of action readiness, and include dimensions such as approach, avoidance, and spontaneity-

reactivity. Along these lines, we suggest that consideration of motivational direction will improve understanding of facial expressions of emotional states such as anger and determination.

As reviewed above, research based on self-reports has emphasized the valence of emotion. It is possible that valence is particularly salient in individuals' experience of emotion, and thus highly accessible to self-report methods. In contrast, the motivational intentions of the expresser might be highly salient to perceivers of emotional expressions. This could account for the past finding that determination and anger, emotions which share the motivational characteristic of high approach, form a complex anchoring the unpleasant pole of a circular scale of perceived emotional facial expressions (Woodworth & Schlosberg, 1938/1954; Schlosberg, 1941; Levy & Schlosberg, 1960).

Facial expressions of both joy and anger, as well as the other basic emotion expressions (fear, disgust, and sadness), are reliably recognizable in Western and non-Western cultures (Ekman, Wallace & Friesen, 1971; Ekman, 2003). Research has shown that emotions beyond these emotions, including contempt (Matsumoto & Ekman, 2004) and pride (Tracy & Robins, 2004; Tracy, Robins, & Lagattuta, 2005), have identifiable facial expressions as well. The current research will examine whether the facial expression of determination is identifiable by participants, in addition to examining its similarities to joy and anger. We hypothesize that determination possesses a similar state of action-readiness as anger, and thus its facial expression will appear similar to anger.

The action-oriented mindset: A manipulation of high-approach positive affect

In deciding which positive, approach-related facial expression to compare to expressions of joy and anger, it was first important to establish which specific affect label individuals give to approach-related positive affect. Previous research demonstrated that an implemental, action-oriented mindset evokes a state of high-approach, positive affect (Harmon-Jones, Harmon-Jones, Fearn, Sigelman, & Johnson, 2008; Taylor & Gollwitzer, 1995). Thus, the current research first examined the specific emotion label that participants give to a positive action-oriented state.

According to Gollwitzer and Bayer (1999), an implemental mindset evokes an action-oriented state in which plans are made to execute behaviors associated with a goal. In this state, the individual is approach motivated. The implementation of decisions is enhanced, decisions are enacted, and the individual engages in effective behavior in service of the goal. When individuals have been induced to experience an implemental mindset, their ambivalence is reduced and their behavior conforms more closely to their attitudes (Henderson, Liver, & Gollwitzer, 2008).

Harmon-Jones et al. (2008) found that an implemental mindset increases approach-related, positive affect. In this research, participants were randomly assigned to an implemental mindset condition, a neutral mindset condition, or a positive non-action condition. In the implemental condition, participants were asked to think of an intended project and to describe the five most important steps to

successfully complete this project. In the neutral condition, participants were asked to describe an ordinary day. In the positive non-action condition, participants were asked to describe a past event that made them feel very good about themselves, but that had not resulted from anything the participant had done. Positive affect was assessed using the items: *enthusiastic, interested, happy, proud, and feel good about myself*. Results showed that positive affect was greater in the action-oriented condition and the positive non-action condition compared to the neutral condition (for similar results, see Taylor & Gollwitzer, 1995).

In this same study, to examine whether an action-oriented state is associated with approach motivation, electroencephalography (EEG) was also recorded from the frontal, central, temporal, parietal and occipital regions. Results showed that, in the action-oriented condition, activation was greater in the left midfrontal and left lateral frontal regions, compared to the other two conditions. These results suggest that an implemental mindset evokes approach motivation, as activation in the left frontal region has been associated with approach motivation in past research (Coan & Allen, 2004; Harmon-Jones & Allen, 1997, 1998; Harmon-Jones, Gable, & Peterson, 2010; Robinson & Downhill, 1995).

Study 1

Based on the results of Harmon-Jones et al. (2008) and Taylor and Gollwitzer (1988), which showed that an implemental mindset produces approach-related, positive affect, Study 1 was conducted to identify the label that individuals are most likely to give to this state. In this study, we evoked approach-related, positive affect using an implemental mindset, and asked participants to name the emotion that they felt during this state.

Method

Participants

Participants were 168 introductory psychology students (80 women, 88 men) who participated in order to partially fulfill a course requirement. Although data on race and ethnicity were not collected, ethnic and racial minorities comprise approximately 23% of the pool from which these participants were drawn. Approximately 5% are African American, 12% are Hispanic, and 5% are Asian.

Procedure

Data collection was administered online. Participants were randomly assigned to an implemental mindset condition ($N = 79$) or a low approach positive condition ($N = 89$). As in past research (Harmon-Jones et al., 2008; Taylor & Gollwitzer, 1995), participants in the implemental mindset condition were instructed to think about an intended project, defined as a project that they planned to accomplish. They were informed that this should be a project about which they had decided to take action. They were informed that the project should be complex, but able to be achieved within the next 3 months. Participants were then asked to write five steps that they would undertake in order to accomplish this plan.

They were then asked to elaborate on each step, giving specific examples.

As in past research (Harmon-Jones et al., 2008), participants in the low-approach, positive affect condition were instructed to think about a day or time when something happened to make them feel very good about themselves, such as a special time with friends or loved ones. They were informed that this should be an event that had happened to them, and not one that resulted from something they did. Participants were asked to write about this exceptional time, describing it in enough detail to fill the allotted space.

After completing the mindset manipulation, participants were asked to name the emotion that they had experienced most strongly during the preceding exercise.

Results and Discussion

Responses were coded by two judges who were blind to condition. The judges had 97% agreement on categorization of responses. They resolved the items on which there was disagreement by discussion.

The categories of responses that emerged were *determined* ($n = 29$), *proud* ($n = 12$), *nervous/anxious/overwhelmed* ($n = 15$), *happy/joyful/elated* ($n = 35$), *desire/motivation/ambition* ($n = 6$), *excited* ($n = 10$), *love/affection* ($n = 13$), and *other* ($n = 48$). The “other” category was made up of words that occurred two or fewer times in the data set and were not synonymous with any other responses.

In the implemental mindset condition, the most common response was *determined* (36.71%), $\chi^2(7) = 75.60, p < .001$. Significantly more participants gave *determined* as their response in the implemental mindset condition than in the low-approach positive condition (2.53%), $\chi^2(1) = 38.55, p < .001$.

In the low-approach positive condition, the most common response was *happy/joyful/elated* (37.08%), $\chi^2(7) = 106.91, p < .001$. Significantly more participants gave *happy/joyful/elated* as their response in the low-approach positive condition than in the implemental mindset condition (0.00%), $\chi^2(1) = 35.51, p < .001$.

The results of Study 1 suggest that, when allowed to make an open-ended response, *determined* is the most common label that individuals give to the experience of a state shown to be high in approach motivation and positive emotional valence (Harmon-Jones et al., 2008). Because the question posed to participants was, “What emotion did you feel most strongly during the previous exercise?”, the results suggest that participants considered determination to be an emotion.

Based on these results, a determined facial expression was selected as the emotional expression to test in subsequent studies. Past research has already shown that determination loads on a single factor with other words describing high-approach, positive affect (Watson et al, 1988). The results from Study 1 suggested that determination is a particularly good exemplar, because it was the word most often generated by participants who were allowed to make an open-ended response to describe the experience of high-approach, positive affect. Study 2 compared the facial expression of determination to the expression of joy, a positive, low-

approach emotion, and to the expression of anger, a negative, high-approach emotion.

Study 2

Our hypothesis was that the facial expression of determination would be perceived as more similar to anger than to joy. Determination and anger share a motivational direction, in that both are approach-motivated. Although determination and joy share a valence, in that both are positive affects, we did not predict that determination would be perceived as similar to joy. We based this hypothesis on the idea that the states of anger and determination are similar states of action-readiness.

Much research on facial expressions has focused on which emotions are universally identifiable. The intention of the current study is not to examine whether determination is universally expressed or universally recognized. In fact, we expected that many naïve expressers might not be capable of creating a recognizable determination expression. Instead, the hypothesis is that *when an intended determination expression is identifiable as determination, it will be similar in appearance to anger.*

Method

Participants

Participants in this study served as either expressers or judges. The expressers were 33 introductory psychology undergraduates (11 male, 22 female) who had answered “yes” to three pre-screening questions: (1) “Are you good at communicating emotions with your face?”; (2) “Would you like to participate in an experiment where you would be photographed while making emotional expressions with your face?”; (3) “Would you be willing for photographs of your face, making emotional expressions, to be shown to participants in other studies?” Of the expressers, 27 were White, 4 were Hispanic, and 2 were Asian. They participated in exchange for course credit.

The naïve judges were 462 introductory psychology undergraduates who participated in exchange for course credit. Although data on the race and ethnicity of the judges were not collected, approximately 5% of the students in the participant pool are African American, 12% are Hispanic, and 5% are Asian.

Procedure

Expressers were brought to the lab individually. They were photographed while making the basic emotion facial expressions (joy, anger, sadness, fear, and disgust), a determination expression, and a neutral expression. To create each expression, the participants were told, “Please express the emotion as clearly as you can. Try to make an expression so that absolutely anyone would be able to recognize what emotion you are communicating.” The rationale for asking participants to naturalistically make the facial expressions, instead of instructing them which muscles to contract, was to identify those participants who can make recognizable basic

emotion expressions and to examine the relationship of this ability to the ability to create recognizable determination expressions.

Judgment tasks

Photographs of the expressers were presented to a separate group of naïve judges by computer using www.surveymonkey.com. Photographs were presented individually. Judges were asked to identify the emotion expressed in each photograph, selecting from a list that included *neutral, joy, anger, sad, fear, disgust, determined* and *none of these*, as recommended by Matsumoto and Ekman (2004).

Data Processing

The percentage of correct identifications of each facial expression was calculated. The percentage of misidentifications of each expression was also calculated, by dividing the number of incorrect identifications as each specific emotion by the total number of incorrect identifications, times 100. For example, for a photograph that was intended to express joy, the percent misidentifications as anger is the number of identifications as anger divided by the total number of misidentifications for that photograph, multiplied by 100.

Results and Discussion

We predicted that intended determination expressions that were reliably identified as determination would appear similar to anger. Results showed that correct identifications of intended determination expressions were positively related to the percentage of misidentifications of the same expression as anger, $r(31) = .37, p = .04$, as shown in Table 1. Correct identifications of intended determination expressions were not significantly related to misidentifications as neutral, joy, sadness, disgust, fear or none of these (see Table 1). These results support the primary hypothesis that identifiable facial expressions of determination are similar in appearance to facial expressions of anger.

Determination was the only emotional expression for which correct identifications correlated significantly and positively with misidentification as another emotional expression. However, correct identifications of intended fear expressions were positively correlated with misidentifications as none of these. These results converge with past research showing that joy, anger, fear, sadness, and disgust are distinguishable from one another. The results suggest that determination is perceived as similar to anger, while other emotional expressions are not perceived as similar to one another.

The percentage of judges selecting the correct label for each intended joy, anger and determination expression was computed, as shown in Table 2. The percentages of misidentifications were also computed. Of 33 intended determination expressions, 12 (36%) were identified as neutral as the modal response, 7 (21%) were identified as determined, 6 (18%) were identified as anger, 2 (6%) were identified as joy, 2 (6%) were identified as disgust, and 2

(6%) were identified as none of these, 1 (3%) was identified as sadness, and none (0%) were identified as fear. Chi-square tests compared the percentage of judges correctly identifying the expressions, with expected frequencies set at one-eighth (i.e., chance). The seven expressions that were correctly identified as determination as the modal response all had recognition levels much higher than chance, according to chi-squared tests ($df = 7$, $N = 462$, for all chi-square tests), $\chi^2 = 238.03$, $p < .001$, $\chi^2 = 77.83$, $p < .001$, $\chi^2 = 72.22$, $p < .001$, $\chi^2 = 180.41$, $p < .001$, $\chi^2 = 119.11$, $p < .001$, $\chi^2 = 72.38$, $p < .001$, $\chi^2 = 137.52$, $p < .001$, respectively, by order of data in Table 2.

These results support the primary hypothesis, that determination expressions appear similar to anger expressions, and do not appear similar to joy expressions. The results also suggest that many of the expressers were not able to make recognizable expressions of determination. However, some participants were able to do so. Most importantly, the more likely an intended determination expression was recognized as determination, the more likely it was incorrectly identified as anger.

Study 3

Study 2 was modeled after the methods used in previous research on the identification of facial expressions (Matsumoto & Ekman, 2004; Tracy & Robins, 2004; Tracy, Robins, & Lagattuta, 2005). However, this methodology was designed to assess whether emotions are distinguishable from one another. It may be less appropriate for assessing similarities between different emotions. A forced choice between emotions, as was used in Study 2, may not be a sensitive way to examine similarities between emotion expressions.

In Study 3, we used a new method. Instead of giving participants a forced choice of which emotion they perceived in each photograph, we asked participants to quantify the intensity of emotion expressed in the photographs.

Participants

Participants were 38 (15 women, 23 men) introductory psychology undergraduate students who participated in exchange for course credit. Although data on race and ethnicity were not collected, approximately 5% of the participant pool are African American, 12% are Hispanic, and 5% are Asian.

Procedure

Participants were run individually. They were brought to the lab and seated at a computer. The experimenter then stated, "You've been asked to participate in a study about facial expressions. You'll view photographs that show people expressing emotions. You'll be asked how much emotion is being expressed in each photo. People sometimes express more than one emotion at a time. You'll view each photo several times. Each time, you'll be asked how much of a different emotion is being expressed in the same photographs. Try to rate the photographs independently each time you see

them, based on just the emotion you've been asked about at that time." The experimenter then started the stimulus presentation program on the computer, and the participants saw these instructions again in written form.

Participants then viewed photographs of six male and six female expressers, who had produced the most highly recognizable determination expressions (from Study 2 and an unpublished study). Eleven of the expressers were White, and one was Hispanic. These expressers' determination, anger, and joy expression photographs were used in Study 3 (36 photographs in all). The photographs were presented along with a 5-point scale for the participant to use in rating the intensity of emotion, where 1 = *none at all*, and 5 = *an extreme amount*.

The 36 photographs were presented in three blocks. In one block, participants were asked to rate each photograph on how much determination was being expressed. In another block, participants rated how much anger was being expressed, and in another block, they rated how much joy was being expressed. The order of blocks was randomized across participants. The order of presentation of the photographs was also randomized within each block. An average rating of the amount of each emotion for each photograph was computed.

Results and Discussion

Across all 36 photographs, ratings of how much determination was being expressed correlated positively with ratings of how much anger was being expressed, $r(34) = .92$, $p < .001$. Ratings of determination correlated negatively with ratings of joy, $r(34) = -.89$, $p < .001$. Ratings of anger also correlated negatively with ratings of joy, $r(34) = -.85$, $p < .001$.

Within the intended determination photographs, determination ratings correlated positively with anger ratings, $r(10) = .80$, $p = .002$. Determination ratings were not significantly related to joy ratings, $r(10) = -.35$, $p = .28$. Anger ratings were negatively related to joy ratings, $r(10) = -.74$, $p = .006$.

Within the intended anger photographs, determination ratings were significantly related to anger ratings, $r(10) = .61$, $p = .03$. Anger ratings were not significantly related to joy ratings, $r(10) = -.41$, $p = .19$. Determination ratings were not significantly related to joy ratings, $r(10) = -.46$, $p = .13$.

Within the intended joy photographs, joy ratings were not significantly correlated with determination ratings, $r(10) = .12$, $p = .71$. Anger ratings were not significantly related to determination ratings, $r(10) = .32$, $p = .31$. Anger ratings were negatively related to joy ratings, $r(10) = -.57$, $p = .05$.

As predicted, these results suggest that determination and anger are perceptually related. For facial expressions intended to express determination, the more intensely determination is perceived in the face, the more intensely anger is also perceived. For facial expressions intended to express anger, the more intense anger a face is perceived to be expressing, the more intense determination is also perceived.

General Discussion

The current research advances the understanding of approach-oriented emotions by showing that the facial

expression of determination, a positive, approach-related emotion, appears similar to anger, a negative, approach-related emotion. In contrast, the facial expression of determination did not appear similar to joy, a positive, low-approach emotion. Determination is used as an exemplar of activated positive affect on the PANAS (Watson et al., 1988), a commonly used instrument for measuring emotion. However, determination has previously been identified as similar to anger according to early emotional expression theories (Woodworth & Schlosberg, 1938/1954; Schlosberg, 1941).

We chose determination as the emotion to compare with anger and joy based on the results of Study 1. In Study 1, participants were randomly assigned to either a high-approach positive mindset or a low-approach positive mindset condition. Participants were then asked to name the emotion they had experienced. The most common emotion label for the high-approach positive mindset condition was *determined*, and the most common label for the low-approach positive mindset was *happy/joyful/elated*.

In Study 2, 33 naïve expressers were photographed while creating the basic emotions plus determination. Of these 33 participants, seven created determination expressions that were reliably identified at greater than chance levels. Thus, many naïve participants were not able to create recognizable determination expressions. This result was not unexpected. The intent of this research was not to demonstrate that naïve, untrained participants are reliably able to voluntarily create recognizable expressions that communicate determination. Rather, our prediction was that, to the extent that an expression is recognizable as determination, it will appear similar to anger. This prediction was supported. Correct identifications of intended determination expressions were positively related to misidentifications as anger. In contrast, correct identifications of intended determination expressions were not significantly related to misidentifications as neutral, joy, sadness, disgust, fear, or none of these.

Finally, in Study 3, we examined similarities between the emotional expressions by asking participants to rate 36 photographs on the amount of determination, joy and anger that they perceived in each photograph. Across all photographs, ratings of the amount of determination correlated positively with the amount of anger, and ratings of both anger and determination correlated negatively with ratings of the amount of joy. Within the 12 photographs intended to express determination, and within the 12 photographs intended to express anger, the amount of perceived determination also correlated positively with the amount of perceived anger. These results suggest that not only is determination perceptually confused with anger, but also the more intensely determined a face appears, the more angry it appears.

Study 3 used a novel method for examining similarities between emotions. Instead of giving participants a forced choice between emotion labels, in Study 3 participants were asked to rate the intensity with which they perceived several specific emotions in each photograph. This method may be useful in future studies of facial expressions of mixed emotions and similar emotions.

The results of this set of studies emphasize the importance of the motivational component of emotion, as

distinguished from the valence of emotion. The valence of emotion has been prominent in most past research on self-reported moods (which have often been evaluated under non-emotional circumstances), and consequently, the valence of emotion often serves as a guiding principle in research on emotion. However, the motivational component of emotion may be more prominent during the perception of facial expressions, as suggested by early facial expression research (Schlosberg, 1941; Woodworth & Schlosberg, 1938/1954) and as suggested by the results of the current studies. These results converge with past research suggesting that facial expressions express motivational states, or states of action readiness (Frijda & Tcherkassof, 1997). In contrast, the valence of emotion may be highly salient to the individual who is self-reporting an emotion, while the motivational components are not as consciously accessible.

The results for other emotional expressions (Table 1) suggest that for the basic emotions (joy, anger, fear, disgust and sadness), correct identifications are not positively correlated with misidentifications as any other emotion. According to Frijda and Tcherkassof (1997), emotional expressions are differentiated on somewhere between 6 and 18 dimensions, and based on our results, we would not expect similarity of motivational direction to always cause confusion of emotional expressions. For anger and determination, incorporation of the similarity of approach motivation does assist in understanding why these two expressions are confused. However, other emotions, such as fear and disgust, share similar motivational direction but their expressions are not confused. Even though fear and disgust share a motivational direction, they differ on other action tendencies.

These results demonstrate perceptual similarity between anger and determination, emotions that share a motivational direction but differ in valence. This adds to a growing body of research demonstrating that valence and motivational direction are separable. It also suggests that, while emotional valence may be highly accessible to self-report, other methodologies may be more sensitive to the motivational component of emotion.

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Table 1

*Intended Emotion Expressions:**Correlations between Correct Identifications and Misidentifications as Each Emotion*

	determination	Intended emotional expression				
		anger	joy	sadness	fear	disgust
misidentified as determination	--	0.15	-0.03	-0.59***	-0.26	-0.39*
misidentified as anger	0.37*	--	-0.28	-0.44**	0.08	0.29
misidentified as joy	-0.20	-0.01	--	0.06	-0.03	-0.36*
misidentified as sadness	-0.11	-0.03	-0.52**	--	-0.35*	-0.10
misidentified as fear	0.02	0.21	-0.09	0.33	--	-0.44**
misidentified as disgust	-0.12	0.08	-0.05	0.18	-0.00	--
misidentified as neutral	-0.20	-0.44**	-0.45**	-0.70***	-0.47**	-0.22
misidentified as none of these	0.11	-0.39*	-0.47**	0.05	0.58***	-0.17

Note. *** $p < .001$, ** $p < .01$, * $p < .05$, + $p < .10$. These correlations represent the relationship between the percent of judges correctly identifying each photograph as the intended emotional expression, and the percent of judges misidentifying the photograph as each alternative emotional expression.

Table 2
Percentages of Identifications of Emotion Expressions for Individual Expressers

Subject Number	% Correct Identifications			% Misidentifications Intended Emotion/Identified Emotion					
	Joy	Anger	Determ	Joy/Anger	Joy/Determ	Anger/Joy	Anger/Determ	Determ/Joy	Determ/Anger
1	91.58***	33.91	58.32***	0.00	7.69	0.65	54.58***	8.29	0.00
2	93.74***	28.94	9.72	0.00	0.00	0.00	11.25	2.15	5.74
3	98.42***	21.17	4.97	4.08	8.16	0.27	14.25	68.86***	0.23
4	91.58***	5.18	3.02	2.56	2.56	2.05	20.73	0.45	1.34
5	88.77***	48.81***	33.05***	3.85	1.92	0.42	20.68	0.32	36.13
6	92.22***	9.50	27.21***	2.78	2.78	1.43	18.62	21.66	1.48
7	89.63***	66.74***	51.40***	0.00	4.17	16.88	14.94	2.67	38.22
8	89.85***	41.47***	18.79	2.13	0.00	0.00	14.76	0.27	52.66***
9	87.04***	23.54	12.74	0.00	5.00	2.26	50.28***	0.50	6.44
10	92.01***	21.17	8.21	2.70	2.70	0.55	28.77	0.24	5.41
11	90.28***	7.99	43.84***	0.00	2.22	0.00	25.12	0.38	32.69
12	93.09***	65.01***	26.13	0.00	3.13	0.00	38.27	0.58	14.04
13	89.85***	15.55	16.20	2.13	2.13	0.77	32.74***	9.54	1.03
14	91.79***	35.21***	26.13	0.00	2.63	0.33	32.33	0.58	47.66***
15	90.06***	23.76***	6.48	2.17	0.00	0.00	9.63	1.39	3.46
16	93.09***	36.07***	4.54	0.00	3.13	0.00	29.39	0.45	25.34
17	90.28***	57.24***	30.02***	2.22	2.22	0.51	27.78	23.15	34.57
18	92.44***	6.91	12.10	0.00	2.86	9.74	31.79	55.28***	0.49
19	90.06***	12.53	2.59	2.17	2.17	0.49	0.25	0.44	1.77
20	89.63***	84.23***	15.98	0.00	4.17	0.00	30.14	19.54	0.51
21	90.06***	40.82***	4.75	2.17	2.17	0.00	18.98	0.45	1.81
22	91.36***	61.12***	7.78	0.00	2.50	0.00	28.89	33.96	0.23
23	91.36***	11.88	7.13	5.00	2.50	6.37	10.29	20.47	0.93
24	89.42***	36.50***	36.50***	2.04	2.04	0.34	37.07	2.38	1.36
25	87.69***	73.65***	20.30***	1.75	1.75	0.82	14.75	0.27	62.06***
26	90.71***	49.46***	27.86	0.00	6.98	0.43	12.82	0.00	46.11***
27	93.52***	69.33***	9.07	0.00	3.33	0.00	30.28	0.71	74.82***
28	91.58***	11.23	13.82	2.56	2.56	0.00	7.30	10.78	10.53

29	88.55***	51.62***	15.55	1.89	1.89	1.34	32.59	12.53	8.95
30	89.63***	48.16***	4.10	2.08	2.08	0.00	13.33	0.90	4.50
31	90.50***	33.91	19.87	2.27	0.00	1.31	63.73***	26.95	4.85
32	88.77***	29.37	28.29	1.92	1.92	0.31	13.46	0.00	60.84***
33	90.93***	40.17***	15.12	0.00	4.76	0.36	26.71	19.59	1.02

Note. *** modal response; $p < .001$.

Figure 1



Left, anger; middle, determination; right, joy.