

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

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In this set of studies, we examine 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 mind-set 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 mind-set. The most common emotion reported was determination. On the basis of this result, we compared the facial expression of determination with that of anger. In Study 2, naive 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-motivated positive affect, is perceived as similar to anger. In Study 3, naive 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-motivated negative affect) and was inversely correlated with the intensity of perceived joy (a low-approach-motivated positive affect). These results demonstrate perceptual similarity between emotions that share a motivational direction but differ in valence.

*Keywords:* emotion, motivation, facial expressions, positive affect

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 versus withdrawal dimensions underlying emotions, however, suggest similarities between certain positive and negative emotions (Gable & Harmon-Jones, 2008, 2010a, 2010b; Harmon-Jones, 2004). 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-motivated positive emotions (e.g., determination) are associated with anger responses during the angering episode (Harmon-Jones et al., 2009). The relationship between anger and high-approach-motivated positive emotion suggests the counterintuitive 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 we tested in the current research using the facial expression of determination.

Emotions are phenomena that involve multiple components. One prominent component is people's facial and bodily expressions of emotions (Darwin, 1872/1965; 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, whereas 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; for a review, see Carver & Harmon-Jones, 2009).

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### Anger and High-Approach-Motivated 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, Clark, and Tellegen's (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 (as per a search on Web of Science). In their review of self-report measures of affect, E. K. 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 (PANAS PA) subscale are *active, alert, attentive, determined, enthusiastic, excited, inspired, interested, proud, and strong*, and the items on the PANAS Negative Affect subscale 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 largely 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 and Negative Activation to convey the activated nature of these dimensions (Watson, Wiese, Vaidya, & Tellegen, 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. (Watson et al., 1988, p. 1063)

More recently, in describing the PANAS, E. K. Gray and Watson (2007) 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. (p. 173)

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 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 . . . 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, pp. 22–23)

Other theories of emotion propose similar ideas (e.g., Cacioppo, Gardner, & Berntson, 1999; J. A. 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, 1872/1965; 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, Alessandri, & Sullivan, 1990; Lewis, Sullivan, Ramsay, & Alessandri, 1992).

Individuals' trait tendencies toward approach and withdrawal, as measured by Carver and White's (1994) behavioral inhibition sensitivity/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 participants' degree of agreement with statements such as "I tell my friends openly when I disagree with them.") related positively to BAS scores. Participants' tendency to express their 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 a 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 after 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 et al. (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 after an anger-evoking event. Harmon-Jones et al. (2009) 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 subscale 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*. Positive activation and negative activation were measured using the PANAS (Watson et al., 1988). PANAS PA correlated directly with both anger and happiness, whereas 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, 1872/1965; 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. On the basis of 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 et al. (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 (Schlosberg, 1941; Woodworth & Schlosberg, 1938/1954). Schlosberg (1941) had participants use a sorting method to classify facial expressions of emotion. On the basis of 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 six 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 that share the motivational characteristic of high approach, form a complex anchoring the unpleasant pole of a circular scale of perceived emotional facial expressions (Levy & Schlosberg, 1960; Schlosberg, 1941; Woodworth & Schlosberg, 1938/1954).

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, 2003; Ekman & Friesen, 1971). 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. In the current research, we examined whether the facial expression of determination is identifiable by participants, in addition to examining its similarities to joy and anger. We hypothesized that determination possesses a similar state of action readiness as anger, and thus its facial expression will appear similar to anger.

### The Action-Oriented Mind-Set: A Manipulation of High-Approach-Motivated Positive Affect

In deciding which positive approach-related facial expression to compare with expressions of joy and anger, we determined that 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 mind-set evokes a state of high-approach-motivated positive affect (Harmon-Jones, Harmon-Jones, Fearn, Sigelman, & Johnson, 2008; Taylor & Gollwitzer, 1995). Thus, in the current research, we first examined the specific emotion label that participants give to a positive action-oriented state.

According to Gollwitzer and Bayer (1999), an implemental mind-set 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 mind-set, their ambivalence is reduced and their behavior conforms more closely to their attitudes (Henderson, de Liver, & Gollwitzer, 2008).

Harmon-Jones et al. (2008) found that an implemental mind-set increases approach-related positive affect. In this research, participants were randomly assigned to an implemental mind-set condition, a neutral mind-set condition, or a positive nonaction condition. In the implemental condition, participants were asked to think of an intended project and to describe the five most important steps they needed to take to successfully complete this project. In the neutral condition, participants were asked to describe an ordinary day. In the positive nonaction 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 nonaction condition compared with 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, Harmon-Jones et al. (2008) recorded electroencephalography from the frontal, central, temporal, parietal, and occipital regions. Results showed that in the action-oriented condition, activation was greater in the left mid-frontal and left lateral frontal regions, compared with the other two conditions. These results suggest that an implemental mind-set 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

On the basis of the results of Harmon-Jones et al. (2008) and Taylor and Gollwitzer (1995), which showed that an implemental mind-set 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 mind-set 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 to partially fulfill a course requirement. Although data on race and ethnicity were not collected, in the pool from which the sample was drawn, approximately 5% are African American, 12% are Hispanic, 5% are Asian, and 78% are White.

**Procedure.** Data were collected online. Participants were randomly assigned to an implemental mind-set condition ( $n = 79$ ) or a low-approach-motivated positive condition ( $n = 89$ ). As in past research (Harmon-Jones et al., 2008; Taylor & Gollwitzer, 1995), participants in the implemental mind-set 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 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-motivated 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 mind-set 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 unaware of the conditions. The judges had 97% agreement on categorization of responses. They resolved through discussion the items on which there was disagreement.

The categories of responses that emerged were *determined* ( $n = 29$ ), *proud* ( $n = 12$ ), *nervous/anxious/overwhelmed* ( $n = 15$ ), *happy/joyful/related* ( $n = 35$ ), *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 mind-set 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 mind-set condition than in the low-approach-motivated positive condition (2.53%),  $\chi^2(1) = 38.55$ ,  $p < .001$ .

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

The results of Study 1 suggest that when participants are 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.

On the basis of 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-motivated 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-motivated positive affect. In Study 2, we compared the facial expression of determination with the expression of joy, which is a low-approach-motivated positive emotion, and with the expression of anger, which is a high-approach-motivated negative emotion.

### Study 2

Our hypothesis was that the facial expression of determination would be perceived as being 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. Our intention in the current study is not to examine whether determination is universally expressed or universally recognized. In fact, we expected that many naive 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 men, 22 women) who had answered “yes” to three prescreening questions: (a) “Are you good at communicating emotions with your face?” (b) “Would you like to participate in an experiment where you would be photographed while making emotional expressions with your face?” and (c) “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, four were Hispanic, and two were Asian. They participated in exchange for course credit.

The naive 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, in the pool from which the judges were drawn, approximately 5% are African American, 12% are Hispanic, 5% are Asian, and 78% are White.

**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 (see Figure 1). 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 telling them which muscles to contract, was to enable us 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 naive judges by computer using <http://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 and multiplying the dividend by 100. For example, for a photograph that was intended to express joy, the percentage of 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

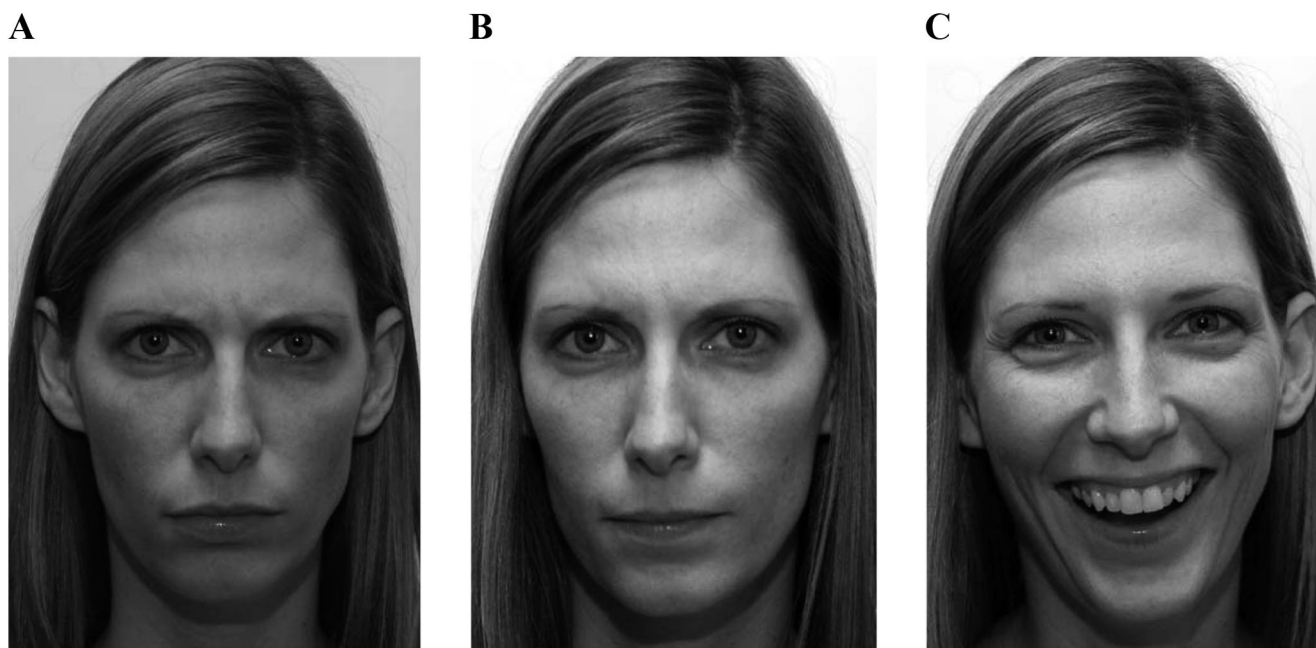


Figure 1. Sample facial expressions from Study 2. A: Anger. B: Determination. C: Joy.

Table 1  
*Intended Emotion Expressions: Correlations Between Correct Identifications and Misidentifications as Each Emotion*

Misidentified emotion	Intended emotional expression					
	Determination	Anger	Joy	Sadness	Fear	Disgust
Determination	—	.15	-.03	-.59***	-.26	-.39*
Anger	.37*	—	-.28	-.44**	.08	.29
Joy	-.20	-.01	—	.06	-.03	-.36*
Sadness	-.11	-.03	-.52**	—	-.35*	-.10
Fear	.02	.21	-.09	.33	—	-.44**
Disgust	-.12	.08	-.05	.18	-.00	—
Neutral	-.20	-.44**	-.45**	-.70***	-.47**	-.22
None of these	.11	-.39*	-.47**	.05	.58***	-.17

*Note.* These correlations represent the relationship between the percentage of judges correctly identifying each photograph as the intended emotional expression and the percentage of judges misidentifying the photograph as each alternative emotional expression.

\*  $p < .05$ . \*\*  $p < .01$ . \*\*\*  $p < .001$ .

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, whereas other emotional expressions are not perceived as similar to one another.

The percentages of judges selecting the correct label for each intended joy, anger, and determination expression were 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, seven (21%) were identified as determined, six (18%) were identified as anger, two (6%) were identified as joy, two (6%) were identified as disgust, and two (6%) were identified as none of these, one (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-square tests (for all chi-square tests,  $df = 7$ ,  $N = 462$ ,  $\chi^2 > 72.20$ ,  $p < .001$ ).

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 important, the more likely it was that 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.

### Method

**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, in the pool from which the sample was drawn, approximately 5% are African American, 12% are Hispanic, 5% are Asian, and 78% are White.

**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.

Table 2  
*Percentages of Identifications of Emotion Expressions for Individual Expressers*

Subject	% correct identifications			% misidentifications intended emotion/identified emotion					
	Joy	Anger	Determination	Joy/ anger	Joy/ determination	Anger/ joy	Anger/ determination	Determination/ joy	Determination/ 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

\*\*\*  $p < .001$  (modal response).

Participants then viewed photographs of the 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; 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 intense the facial expression of determi-

nation is perceived to be, the more intense the facial expression of anger also is perceived to be. For facial expressions intended to express anger, the more intense the facial expression of anger is perceived to be, the more intense the facial expression of determination is also perceived to be.

### 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 low-approach-motivated positive 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 being similar to anger according to early emotional expression theories (Schlosberg, 1941; Woodworth & Schlosberg, 1938/1954).

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

In Study 2, 33 naive expressers were photographed while creating expressions of the basic emotions plus determination. Of these 33 participants, seven created determination expressions that were reliably identified at greater than chance levels. Thus, many naive participants were not able to create recognizable determination expressions. This result was not unexpected. The intent of this research was not to demonstrate that naive, 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.

In Study 3, we used a novel method for examining similarities between emotions. Instead of giving participants a forced choice between emotion labels, in Study 3, we asked participants to rate how intense they perceived several specific emotions in each photograph to be. 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 nonemotional 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, whereas the motivational components are not as consciously accessible.

The results for other emotional expressions (see 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 six and 18 dimensions, and, on the basis of 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 a similar motivational direction (withdrawal), 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, although emotional valence may be highly accessible to self-report, other methodologies may be more sensitive to the motivational component of emotion.

### References

- Bell, P. A., & Baron, R. A. (1990). Affect and aggression. In B. S. Moore & A. M. Isen (Eds.), *Affect and social behavior* (pp. 64–88). New York, NY: Cambridge University Press, and Paris, France: Editions de la Maison des Sciences de l'Homme.
- Blanchard, D. C., & Blanchard, R. J. (1984). Affect and aggression: An animal model applied to human behavior. In R. J. Blanchard & D. C. Blanchard (Eds.), *Advances in the study of aggression* (Vol. 1, pp. 1–62). New York, NY: Academic Press.
- Buss, A. H., & Perry, M. (1992). The aggression questionnaire. *Journal of Personality and Social Psychology*, *63*, 452–459. doi:10.1037/0022-3514.63.3.452
- Cacioppo, J. T., Gardner, W. L., & Berntson, G. G. (1999). The affect system has parallel and integrative processing components: Form fol-

- lows function. *Journal of Personality and Social Psychology*, 76, 839–855. doi:10.1037/0022-3514.76.5.839
- Carver, C. S. (2004). Negative affects deriving from the behavioral approach system. *Emotion*, 4, 3–22. doi:10.1037/1528-3542.4.1.3
- Carver, C. S., & Harmon-Jones, E. (2009). Anger is an approach-related affect: Evidence and implications. *Psychological Bulletin*, 135, 183–204. doi:10.1037/a0013965
- Carver, C. S., & White, T. L. (1994). Behavioral inhibition, behavioral activation, and affective responses to impending reward and punishment: The BIS/BAS scales. *Journal of Personality and Social Psychology*, 67, 319–333. doi:10.1037/0022-3514.67.2.319
- Coan, J. A., & Allen, J. J. B. (2004). Frontal EEG asymmetry as a moderator and mediator of emotion. *Biological Psychology*, 67, 7–50. doi:10.1016/j.biopsycho.2004.03.002
- Darwin, C. (1965). *The expressions of the emotions in man and animals*. New York, NY: Oxford University Press. (Original work published 1872)
- Ekman, P. (2003). *Emotions revealed: Recognizing faces and feelings to improve communication and emotional life*. New York, NY: Times Books.
- Ekman, P., & Friesen, W. V. (1971). Constants across cultures in the face and emotion. *Journal of Personality and Social Psychology*, 17, 124–129.
- Fredrickson, B. L., & Cohn, M. A. (2008). Positive emotions. In M. Lewis, J. M. Haviland-Jones, & L. F. Barrett (Eds.), *Handbook of emotions* (3rd ed., pp. 777–796). New York, NY: Guilford Press.
- Frijda, N. H., & Tcherkassof, A. (1997). Facial expressions as modes of action readiness. In J. A. Russell & J. M. Fernandez-Dols (Eds.), *The psychology of facial expression* (pp. 78–102). Cambridge, United Kingdom: Cambridge University Press. doi:10.1017/CBO9780511659911.006
- Gable, P. A., & Harmon-Jones, E. (2008). Approach-motivated positive affect reduces breadth of attention. *Psychological Science*, 19, 476–482. doi:10.1111/j.1467-9280.2008.02112.x
- Gable, P. A., & Harmon-Jones, E. (2010a). The blues broaden, but the nasty narrows: Attentional consequences of negative affects low and high in motivational intensity. *Psychological Science*, 21, 211–215.
- Gable, P. A., & Harmon-Jones, E. (2010b). The motivational dimensional model of affect: Implications for breadth of attention, memory, and cognitive categorization. *Cognition and Emotion*, 24, 322–337.
- Gollwitzer, P. M., & Bayer, U. (1999). Deliberative versus implemental mindsets in the control of action. In S. Chaiken & Y. Trope (Eds.), *Dual-process theories in social psychology* (pp. 403–422). New York, NY: Guilford Press.
- Gray, E. K., & Watson, D. (2007). Assessing positive and negative affect via self-report. In J. A. Coan & J. J. B. Allen (Eds.), *Handbook of emotional elicitation and assessment* (pp. 171–183). New York, NY: Oxford University Press.
- Gray, J. A. (1990). Brain systems that mediate both emotion and cognition. *Cognition & Emotion*, 4, 269–288. doi:10.1080/02699939008410799
- Harmon-Jones, E. (2003). Anger and the behavioral approach system. *Personality and Individual Differences*, 35, 995–1005. doi:10.1016/S0191-8869(02)00313-6
- Harmon-Jones, E. (2004). On the relationship of anterior brain activity and anger: Examining the role of attitude toward anger. *Cognition & Emotion*, 18, 337–361. doi:10.1080/02699930341000059
- Harmon-Jones, E., & Allen, J. J. B. (1997). Behavioral activation sensitivity and resting frontal EEG asymmetry: Covariation of putative indicators related to risk for mood disorders. *Journal of Abnormal Psychology*, 106, 159–163. doi:10.1037/0021-843X.106.1.159
- Harmon-Jones, E., & Allen, J. J. B. (1998). Anger and frontal brain activity: EEG asymmetry consistent with approach motivation despite negative affective valence. *Journal of Personality and Social Psychology*, 74, 1310–1316. doi:10.1037/0022-3514.74.5.1310
- Harmon-Jones, E., Gable, P. A., & Peterson, C. K. (2010). The role of asymmetric frontal cortical activity in emotion-related phenomena: A review and update. *Biological Psychology*, 84, 451–462. doi:10.1016/j.biopsycho.2009.08.010
- Harmon-Jones, E., & Harmon-Jones, C. (2010). On the relationship of trait PANAS positive activation and trait anger: Evidence of a suppressor relationship. *Journal of Research in Personality*, 44, 120–123. doi:10.1016/j.jrp.2009.09.001
- Harmon-Jones, E., Harmon-Jones, C., Abramson, L. Y., & Peterson, C. K. (2009). PANAS positive activation is associated with anger. *Emotion*, 9, 183–196. doi:10.1037/a0014959
- Harmon-Jones, E., Harmon-Jones, C., Fearn, M., Sigelman, J. D., & Johnson, P. (2008). Left frontal cortical activation and spreading of alternatives: Tests of the action-based model of dissonance. *Journal of Personality and Social Psychology*, 94, 1–15. doi:10.1037/0022-3514.94.1.1
- Harmon-Jones, E., & Sigelman, J. (2001). State anger and prefrontal brain activity: Evidence that insult-related relative left prefrontal activation is associated with experienced anger and aggression. *Journal of Personality and Social Psychology*, 80, 797–803. doi:10.1037/0022-3514.80.5.797
- Harmon-Jones, E., Sigelman, J. D., Bohlig, A., & Harmon-Jones, C. (2003). Anger, coping, and frontal cortical activity: The effect of coping potential on anger-induced left frontal activity. *Cognition & Emotion*, 17, 1–24. doi:10.1080/02699930302278
- Harmon-Jones, E., Vaughn-Scott, K., Mohr, S., Sigelman, J., & Harmon-Jones, C. (2004). The effect of manipulated sympathy and anger on left and right frontal cortical activity. *Emotion*, 4, 95–101. doi:10.1037/1528-3542.4.1.95
- Henderson, M. D., de Liver, Y., & Gollwitzer, P. M. (2008). The effects of an implemental mind-set on attitude strength. *Journal of Personality and Social Psychology*, 94, 396–411. doi:10.1037/0022-3514.94.3.396
- Lang, P. J. (1995). The emotion probe: Studies of motivation and attention. *American Psychologist*, 50, 372–385. doi:10.1037/0003-066X.50.5.372
- Lang, P. J., Bradley, M. M., & Cuthbert, B. N. (1990). Emotion, attention, and the startle reflex. *Psychological Review*, 97, 377–395. doi:10.1037/0033-295X.97.3.377
- Lang, P. J., Bradley, M. M., & Cuthbert, B. N. (1992). A motivational analysis of emotion: Reflex–cortex connections. *Psychological Science*, 3, 44–49. doi:10.1111/j.1467-9280.1992.tb00255.x
- Lang, P. J., Bradley, M. M., & Cuthbert, B. N. (1998). Emotion, motivation, and anxiety: Brain mechanisms and psychophysiology. *Biological Psychiatry*, 44, 1248–1263. doi:10.1016/S0006-3223(98)00275-3
- Larsen, J. T., McGraw, A. P., & Cacioppo, J. T. (2001). Can people feel happy and sad at the same time? *Journal of Personality and Social Psychology*, 81, 684–696. doi:10.1037/0022-3514.81.4.684
- Levy, N., & Schlosberg, H. (1960). Woodworth scale values of the Light-foot pictures of facial expression. *Journal of Experimental Psychology*, 60, 121–125. doi:10.1037/h0043130
- Lewis, M., Alessandri, S. M., & Sullivan, M. W. (1990). Violation of expectancy, loss of control, and anger expressions in young infants. *Developmental Psychology*, 26, 745–751. doi:10.1037/0012-1649.26.5.745
- Lewis, M., Sullivan, M. W., Ramsay, D. S., & Alessandri, S. M. (1992). Individual differences in anger and sad expressions during extinction: Antecedents and consequences. *Infant Behavior and Development*, 15, 443–452. doi:10.1016/0163-6383(92)80012-J
- Matsumoto, D., & Ekman, P. (2004). The relationship among expressions, labels, and descriptions of contempt. *Journal of Personality and Social Psychology*, 87, 529–540. doi:10.1037/0022-3514.87.4.529
- Plutchik, R. (1980). *Emotion: A psychoevolutionary synthesis*. New York, NY: Harper & Row.
- Robinson, R. G., & Downhill, J. E. (1995). Lateralization of psychopathology in response to focal brain injury. In R. J. Davidson & K.

- Hugdahl (Eds.), *Brain asymmetry* (pp. 693–711). Cambridge, MA: MIT Press.
- Russell, J. A. (1980). A circumplex model of affect. *Journal of Personality and Social Psychology*, *39*, 1161–1178. doi:10.1037/h0077714
- Schlosberg, H. (1941). A scale for the judgment of facial expressions. *Journal of Experimental Psychology*, *29*, 497–510. doi:10.1037/h0061489
- Smits, D. J. M., & Kuppens, P. (2005). The relations between anger, coping with anger, and aggression, and the BIS/BAS system. *Personality and Individual Differences*, *39*, 783–793. doi:10.1016/j.paid.2005.02.023
- Taylor, S. E., & Gollwitzer, P. M. (1995). Effects of mindset on positive illusions. *Journal of Personality and Social Psychology*, *69*, 213–226. doi:10.1037/0022-3514.69.2.213
- Tracy, J. L., & Robins, R. W. (2004). Show your pride: Evidence for a discrete emotion expression. *Psychological Science*, *15*, 194–197. doi:10.1111/j.0956-7976.2004.01503008.x
- Tracy, J. L., Robins, R. W., & Lagattuta, K. H. (2005). Can children recognize pride? *Emotion*, *5*, 251–257. doi:10.1037/1528-3542.5.3.251
- Tugade, M. M., Fredrickson, B. L., & Barrett, L. F. (2004). Psychological resilience and positive emotional granularity: Examining the benefits of positive emotions on coping and health. *Journal of Personality*, *72*, 1161–1190.
- Watson, D. (2000). *Mood and temperament*. New York, NY: Guilford Press.
- Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology*, *54*, 1063–1070. doi:10.1037/0022-3514.54.6.1063
- Watson, D., & Tellegen, A. (1985). Toward a consensual structure of mood. *Psychological Bulletin*, *98*, 219–235. doi:10.1037/0033-2909.98.2.219
- Watson, D., Wiese, D., Vaidya, J., & Tellegen, A. (1999). The two general activation systems of affect: Structural findings, evolutionary considerations, and psychobiological evidence. *Journal of Personality and Social Psychology*, *76*, 820–838. doi:10.1037/0022-3514.76.5.820
- Woodworth, R. S., & Schlosberg, H. (1954). *Experimental psychology*. New York, NY: Holt, Rinehart & Winston. (Original work published 1938)

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