

## CHAPTER 44

# ANGER

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Anger likely serves a variety of adaptive functions. It organizes and regulates psychological processes, such as self-defense and mastery. It regulates social and interpersonal processes, and it organizes processes to assist with goal-directed action. However, anger may also be associated with negative intra- and interpersonal consequences, including child maltreatment and violence (Holtzworth-Munroe & Clements, 2007) and coronary heart disease (Niaura et al., 2002). For these reasons, individuals and societies often try to down-regulate anger to attempt to reduce these negative consequences.

Emotions are processes that involve involuntary action readiness (Frijda, 1986; Lewis & Michalson, 1983). Emotions provide organisms with complex and biologically prepared behavioral potentials that assist in coping with challenges to their welfare (Panksepp, 1998). However, these inherited behavioral potentials only imply ways of behaving as organisms evolved to have larger, more complex brains. While we as humans may possess the same emotional instincts as lower animals, we are not as constrained by their dictates and we have more choices (Panksepp, 1998). Consequently, our emotions can be controlled and may not directly influence behavior.

An emotion is a multicomponent process made up of basic processes such as feelings of pleasure or displeasure; facial/body expression components; particular appraisals; and motivational components such as particular action plans and activation states (Frijda, 1993; Lewis, 2014). Moreover,

these components are not perfectly correlated with one another (Lang, 1995). For example, anger is an unpleasant feeling, described using words like “annoyed,” “angry,” and “enraged,” which, in our view, express differences in intensity of experience (Berkowitz & Harmon-Jones, 2004a, 2004b; cf. Lewis, 1993, who suggested that rage and anger are qualitatively different). Anger is associated with appraisals of other blame, and it often motivates approach and attack behaviors.

When left uncontrolled or uninhibited, the facial expression of anger involves the muscles of the brow moving inward and downward, “creating a frown and a foreboding appearance around the eyes, which seem to be fixed in a hard stare toward the object of anger. The nostrils dilate and the wings of the nose flare out. The lips are opened and drawn back in a rectangle-like shape, revealing clinched teeth. Often the face flushes red” (Izard, 1977, p. 330). However, because most humans are taught to control anger and its expression, the facial expressions of anger vary considerably among people. However, “on the face of an angry person there is almost always one or more of the innate components of the natural expression which signals his or her internal state” (Izard, 1977, p. 330).

In this chapter, we review research and theoretical advances in the study of basic processes involved in (primarily human) anger. We focus our review on the causes of anger, and its subjective feeling and motivational components. We do not review the vast literature on angry facial expres-

sions, as it is beyond the scope of this chapter (see Russell & Fernández-Dols, 1997, for a review).

### Causes of Anger

Several theorists have proposed that anger results from physical or psychological restraint or from interference with goal-directed activity (Darwin, 1872/1965; Izard, 1977; Lewis, 1993). This perspective on understanding the causes of anger is consistent with proposals made by other major theoretical perspectives on the causes of various emotions.

### Reinforcement Approaches

Neo-behaviorists proposed that the actual or signaled arrival or termination of pleasant or unpleasant events, referred to as positive or negative reinforcers, respectively, is the primary cause of emotions (Mowrer, 1960). Gray (1987) extended these early ideas by including stimulus omissions and interactions with individuals' resources, such as ability to cope with events (see also Rolls, 1999). According to these theories, angry emotions—like frustration, anger, and rage—are caused by the omission of positive reinforcers or the termination of positive reinforcers.

Similarly, Lewis (1993) posited that the thwarting of goal-directed action is an unlearned cause of anger. In one experiment testing this idea, 2- to 8-month-old infants were first conditioned to move one of their arms in order to see a picture of another baby's smiling face as well as hear happy music. Then after they had learned this association, they were exposed to an extinction phase in which their arm movement did not result in the happy events. This termination of the positive reinforcer ("frustrating" event) caused the majority of the infants to have anger-like facial expressions (Lewis, Alessandri, & Sullivan, 1990; Lewis, Sullivan, Ramsay, & Alessandri, 1992).

In another model based on neo-behavioristic ideas, Berkowitz (1989) extended the original frustration-aggression model (Dollard, Doob, Miller, Mowrer, & Sears, 1939) in his cognitive neo-associative model of anger and aggression. Berkowitz proposed that any unpleasant event, such as frustration, pain, discomfort, or social stress, causes negative affect. According to Berkowitz (1989), this negative affect is associated with motivations to fight as well as flee; he has referred to this as a *fight-and-flight* motivation. His model goes further

to propose that an individual's prior experiences have created associations that provide cues that will influence what happens in any given situation. If these cues are associated primarily with a desire to escape, then the flight system will be activated and the person will experience mostly fear. If, however, these cues are associated primarily with a desire to attack, then the fight system will be activated and the person will experience mostly anger.

### Cognitive Appraisal Approach

Another prominent theoretical approach to understanding the causes of anger is the cognitive appraisal approach. Broadly speaking, these theorists posit that emotions are caused by an individual's appraisal or interpretation of a situation. Thus, it is not the situation itself that causes the emotion, but the way in which the person interprets the situation (e.g., Roseman, Spindel, & Jose, 1990). According to these theories, individuals constantly appraise situations in which they find themselves, and these appraisals, which can be conscious or nonconscious, always precede emotions.

According to appraisal theorists, anger is an unpleasant emotion that often occurs in response to an appraisal of a blocked goal. An appraisal of a blocked goal may consist of perception of the absence of a reward or presence of a punishment (Roseman, 1991), or of an obstruction to obtaining a goal (Lazarus, 1991; Scherer, 2001). To define the term "goal," some theorists refer to an outcome that is personally significant (Lazarus, 1991; Scherer, 2001). Other researchers define goals very broadly, such that every desired outcome would qualify, from the fulfillment of basic needs to achieving long-term, self-relevant plans. According to these broad definitions, pain may produce anger because the individual experiences it as blocking his or her goal of being physically comfortable.

Appraisal theories hypothesize that appraising situations as negative produces negative emotions, including, among others, anger, fear, sadness, and disgust. Thus, other appraisals, besides general negativity, are necessary to produce the discrete emotion of anger. The specific appraisal that is proposed to evoke anger, rather than one of the other negative emotions, is "other-blame," that is, a belief that the unpleasant situation was wrongly caused by someone or something (Lazarus, 1991; Ortony, Clore, & Collins, 1988). An appraisal of other-blame suggests a belief that the person

who caused the event acted in a manner that was improper or unfair (Shaver, Schwartz, Kirson, & O'Connor, 1987; Frijda, Kuipers, & ter Schure, 1989; Roseman, 1991). Lazarus (1991) additionally proposed that anger only occurs when individuals perceive a threat to their self-esteem.

The appraisal of "high coping potential" has been proposed as another evaluation necessary for anger to occur. High coping potential refers to the individual's perceived likelihood of being able to resolve the negative situation (Lazarus, 1991; Scherer, 2001; Stein & Levine, 1989). In contrast, if an individual believes he or she is unlikely to be able to resolve the negative situation satisfactorily (i.e., low coping potential), sadness, fear, or anxiety will be experienced rather than anger.

#### *Problems with the Appraisal Accounts*

Appraisal theories have generated much interest concerning the causes of emotions, and they are intuitively appealing. For instance, the idea that anger results from negative self-esteem threatening situations that are perceived to be caused by others and that one expects to be able to resolve favorably seems to explain many instances of anger. However, these intuitions may be incorrect. Several theorists have criticized the appraisal theories for not providing empirical evidence demonstrating that appraisals cause emotion. These theorists have suggested that the available evidence could be interpreted to indicate that emotions are the cause of appraisals rather than the converse. For instance, Frijda (1993; Frijda & Zeelenberg, 2001) and Parkinson and Manstead (1992) argued that because of the self-report methods used in tests of appraisal theories, it is difficult to determine whether the identified appraisal patterns preceded or followed the emotional experience. Parkinson and Manstead (1992) wrote, "Nothing in the data resists the interpretation that the relevant appraisals were consequences rather than precedents of the emotional reactions" (p. 129).

Are the appraisals mentioned above necessary for anger, specifically? Appraisals may be involved in the experience of anger, but occur later in the emotion process—that is, they may occur simultaneously with anger or may result from anger, rather than being the cause of anger (Berkowitz & Harmon-Jones, 2004a, 2004b). Berkowitz (1989) proposed a model in which anger is triggered through the fight-or-flight system when an aversive event, such as pain, occurs. His model proposes that once

the fight system and anger are activated, the individual then makes appraisals and engages in other cognitive processing to determine whether to attack, who or what to attack, and exactly how to attack. In this model, emotions are a more basic response to an unpleasant event, and cognitive processes, such as appraisals, serve to organize actions in service of emotions and their associated motivations. Berkowitz and Harmon-Jones (2004b) also noted that appraisal theorists' definitions of "goals," "cognitions," and "appraisals" are sometimes so broad that they are untestable (e.g., the "goal" of not experiencing discomfort is not normally active prior to the experience of discomfort).

The appraisal commonly proposed to cause anger, other-blame, also may not be necessary to cause anger. Instead, anger may motivate individuals to seek someone or something to blame for the negative situation. Frijda (1993) reviewed a number of cases where angry persons blamed, and aggressed against, inanimate objects. These cases support the idea that appraisals of other-blame may result from, rather than cause, anger.

The idea that self-esteem threats are necessary to evoke anger has also been questioned. Of course, self-esteem threats may evoke anger, but experiments have found that individuals report feeling anger in response to situations that would not threaten self-esteem (e.g., Berkowitz, 1989; Harmon-Jones, Lueck, Fearn, & Harmon-Jones, 2006). For example, simple physical pain increases anger and aggression, even though it is not associated with a failure or other threat to the self (e.g., Berkowitz, 1999, 2000; Berkowitz, Cochran, & Embree, 1981).

Last, the idea that high coping potential is necessary to create anger has been challenged by research that manipulated coping potential and found the manipulated coping potential influenced brain activations related to approach motivation (see below) but not self-reported anger (Harmon-Jones, Sigelman, Bohlig, & Harmon-Jones, 2003).

#### **Subjective Feelings and Anger**

We conceive of anger in a relatively broad way, proposing a commonality of anger rather than there being different kinds of anger (cf. Ellsworth & Scherer, 2003, p. 575). Spielberger and colleagues (Spielberger, Jacobs, Russell, & Crane, 1983; Spielberger, Reheiser, & Sydeman, 1995) also posited

this view when **15** proposed that anger encompassed low-intensity feelings such as irritation or annoyance as well as high-intensity feelings such as fury and rage. **15** factor analysis of the items in **15** State Anger Scale (containing items such as “I am furious” and “I feel irritated”) produced only a single factor, suggesting that the angry experiences measured by these items were a unitary affective state varying in intensity. Spielberger et al.’s (1983, 1995) distinction between “anger in” and “anger out” refers to differences in the trait of openly expressing the behavioral concomitants of anger rather than qualitative differences in the nature of the angry feelings (Spielberger et al., 1995). Our conception of anger experience is in agreement with the prototype view of emotion concepts of Shaver and colleagues (1987). Shaver et al. (1987) found that the anger prototype includes a variety of feelings such as *irritation*, *annoyance*, *exasperation*, *disgust*, and *hate*. Thus, various “nuances” of anger experience may not be distinctly different affective states.

Compared with moods, emotions are generally held to have a more specific, consciously recognized cause, a shorter duration, and a definite target. Although some emotion theorists consider moods and emotions to be unique entities, others consider the distinction to be “unsharp” (Frijda, 1986, pp. 59–60), a factor of the degree of clarity individuals believe they possess regarding their affective experience. Regarding varieties of anger, the terms “irritation” and “hostility” tend to be used for mood-like states, whereas “anger” and “rage” refer to more emotion-like states. However, these are merely attempts to capture the variety in the specificity, duration, and intensity of angry affects, as it is difficult to draw a firm dividing line in the continuum between mood and emotion.

### **The Valence of Anger**

Although the valence (positivity vs. negativity) of emotion is considered by many theorists to be one of the most important dimensions of affect, theorists do not always clearly define what is meant by valence. When they do, various emotion researchers have defined this concept in three different ways (Lazarus, 1991): (1) according to whether the conditions that brought about the emotion were pleasant or unpleasant, (2) according to whether the consequences of the emotion were adaptive or maladaptive, or (3) according to whether the emotion feels subjectively pleasant or unpleasant.

Anger can be viewed as a negative affect using the first definition of valence. That is, anger is evoked by negative events, as described in the section “Causes of Anger.” The second definition of valence is unwieldy, because it is difficult to definitively state whether the consequences of anger are good or bad. For example, a particular incidence of anger may be adaptive in the short run (a person gets his or her way following an angry outburst) but maladaptive in the long run (the target of the angry outburst avoids him or her in the future and he or she loses a friend), or may be beneficial to the individual, but harmful to others. Using the third definition of valence, anger would be categorized as a negative emotion if individuals dislike the experience of anger, and as a positive emotion if individuals enjoy the experience of anger.

Most appraisal theorists focus on the way the stimulus is evaluated in determining the valence of emotion, and thus, they subscribe to the first definition of valence. From this viewpoint, anger is a negative emotion because it occurs when a person appraises a situation as unpleasant. However, other emotion theorists focus on the responses evoked during the emotion, including physiological changes, facial expressions, subjective experiences, and molar behavior. These response-based theories of emotion tend to use the third definition of valence—that is, whether the individual’s experience of the subjective feeling is pleasant or unpleasant.

Most individuals evaluate the subjective experience of anger negatively. However, research has found variance among individuals in the degree of negativity with which anger is experienced (Harmon-Jones, 2004; Harmon-Jones, Harmon-Jones, Amodio, & Gable, 2011). Greater trait anger, measured by the Aggression Questionnaire (Buss & Perry, 1992) or by the hostility subscale of the Positive and Negative Affect Schedule—Expanded form (PANAS-X; Watson & Clark, 1994), is correlated with a more positive attitude toward anger (Harmon-Jones, 2004). Attitude toward anger does not relate to affect intensity or social desirability (Harmon-Jones, 2004). Furthermore, liking for anger relates negatively to trait fear (Harmon-Jones, 2004), and positively to interest in viewing anger-evoking stimuli (E. Harmon-Jones et al., 2011). Thus, when evaluated according to the pleasantness to unpleasantness of the subjective state, anger is a negatively valenced emotion. However, individuals vary in the degree to which they evaluate anger negatively.

### **Blends of Anger and Positive Affects**

Anger may be the primary emotion evoked in a given situation, but it also commonly occurs in combination with other negative emotions (Berkowitz, 1989). Less intuitively, anger may also be positively related to the experience of certain positive emotions. Interpersonal insult, a manipulation often used to evoke anger experimentally, produces greater self-reported anger compared with a no-insult condition, but also produces higher ratings of PANAS positive activation (PA; Harmon-Jones, Vaughn-Scott, Mohr, Sigelman, & Harmon-Jones, 2004). The increase in both anger and PANAS PA was replicated following different anger manipulations (Harmon-Jones, Harmon-Jones, Abramson, & Peterson, 2009). In these studies, anger and positive affect were correlated, and both state anger and state positive affect were also related to trait behavioral activation sensitivity (BAS; Carver & White, 1994), a measure of approach motivation.

One possible explanation for these surprising results is that the PANAS items intended to measure positive affect may not actually reflect pleasantness. These items that comprise the PA subscale are “active,” “alert,” “attentive,” “determined,” “enthusiastic,” “excited,” “inspired,” “interested,” “proud,” and “strong.” Notably, “happy” is not included, nor are its common synonyms such as “joyful,” “cheerful,” or “delighted.” The perplexing absence of these terms for positive affect from the PA subscale may be due to the methods used to develop the PANAS. The PANAS items were selected from a large set of emotion words using factor analysis. Items on the PA subscale were chosen because they had a large loading on the first factor and a near-zero loading on the second factor, whereas items chosen for the negative affect subscale had the converse loading (Watson, Clark, & Tellegen, 1988). This technique may have led to elimination of items that measure positivity per se (e.g., happy) and retention of items that measure something besides pure positivity. We suspect that that “something” is approach motivation, and the relationship between PANAS PA and anger supports this idea.

A study examined the hypothesis that the relationship of PANAS PA and anger is due to their common relationship with approach motivation (Harmon-Jones, Harmon-Jones, et al., 2009). Participants listened to either an insulting or a neutral radio broadcast, and then reported their anger, sadness, happiness, and PANAS PA. A fac-

tor analysis conducted within the insult condition revealed three factors, with PANAS PA and happiness loading on the first factor, all of the sadness-related items loading on the second factor, and all of the anger-related items loading on a third factor. In the neutral condition, only two factors, positive and negative, emerged. Participants in the insult condition reported greater anger, sadness, and greater endorsement of five PA items (active, alert, determined, interested, and strong), compared with the neutral condition. Participants in the insult condition also reported less happiness and less endorsement of one PA item (enthusiastic). Anger was positively correlated with PA, but negatively correlated with happiness. Furthermore, when happiness was controlled for using regression, the strength of the relationship between anger and PA increased. Similar results were found when anger was induced via autobiographical recall (Harmon-Jones, Harmon-Jones, et al., 2009).

Anger has also been found to relate positively to PANAS PA at the trait level (Harmon-Jones & Harmon-Jones, 2010). Participants completed the PANAS, several measures of trait anger, and a measure of trait happiness. At the zero-order level, PA was positively related to happiness, but not consistently correlated with the anger measures. However, when happiness and anger were used to predict PA in a simultaneous regression, PA was positively correlated with anger. These results, like experimental results assessing state emotions, suggest that happiness acts as a suppressor in the relationship of PA and anger.

Pettersson and Turkheimer (2013) have found conceptually similar results. They created a “balanced PANAS” by adding an antonym with the same valence as each of the original words on the PANAS. For example, the balanced PANAS added the similarly valenced antonym “meek” to account for the PANAS word “hostile,” and the similarly valenced antonym “opposite” to account for the PANAS word “excited.” Results revealed that participants’ endorsements of these items clustered around valence, and not content. In other words, meek and hostile were positively correlated. However, when variance associated with valence was statistically controlled, words assessing anger (“hostile,” “irritable”) clustered close to words assessing approach-related positive affect (“proud,” “excited,” “strong”). Moreover, these approach-related words were not clustered near positive and negative words suggesting vigilance, such as “guilty,” “ashamed,” “alert,” and “attentive.” These results support the idea that anger is related

to approach, but more importantly, suggest that the relationship between anger and some other measures of approach may be obscured because valence is represented more strongly than content in self-report measures.

Although anger was correlated with PA in these studies, the results do not suggest that anger is experienced as pleasant, because self-reported happiness was less in the anger conditions and anger negatively correlated with happiness. Rather, the results suggest that, in the context of an anger-evoking stimulus, certain items on the PA subscale may measure approach motivation rather than, or in addition to, pleasantness. With this in mind, PA more accurately refers to *pounce affect*, as pouncing can reflect anger or desire.

### Motivational Components of Anger

The evidence that anger is an approach-motivated emotion comes from diverse fields within psychology, including social, clinical, behavioral, and developmental (Carver & Harmon-Jones, 2009; Lewis, 2010). Although negative emotions are often presumed to be related to withdrawal motivation (e.g., Norris, Gollan, Berntson, & Cacioppo, 2010; Watson, 2000), many sources of evidence suggest that anger violates this expected relationship. Anger is negative, both in terms of the evoking stimulus and the subjective experience, but as hinted by its relationship with the PANAS PA, it is most often associated with the urge to approach rather than to withdraw. In humans, anger is associated with attack and aggression (Berkowitz, 1993). In animals, an analogous behavior is irritable aggression, which arises from the behavioral facilitation system (Depue & Iacono, 1989).

Developmental researchers have found a relationship between anger and approach motivation even in young infants. Infants were taught to pull a string in order to see a rewarding photograph and hear rewarding music. Their emotional expressions were recorded when the reward was withdrawn and when the contingency was subsequently reinstated. The infants who displayed the greatest anger when the reward was withheld demonstrated the strongest arm pull, and greatest interest and joy, when the reward was reinstated (Lewis et al., 1990, 1992). These results suggested that anger increased task engagement and persistence in response to goal blocking.

Psychological reactance, like anger, is a response to blocked goals, suggesting a link between

reactance theory (Wortman & Brehm, 1975) and anger. According to the model that integrated reactance theory and learned helplessness theory, how individuals respond to an undesired outcome depends on both the importance of the outcome and the degree to which they expect control. When expectations for control are high and a desired outcome fails to occur, psychological reactance is aroused, producing increased effort to achieve the desired outcome. However, after repeated, uncontrollable undesired outcomes, individuals show decreased motivation (learned helplessness). In support of the idea that psychological reactance is equivalent to anger, research has found that individuals who reported anger in response to an unsolvable puzzle performed better on a subsequent cognitive task compared with participants who exhibited less anger, presumably because the angry participants were more approach motivated (Mikulincer, 1988).

Other research in adult humans suggests that anger is related to approach motivation, at both the state and trait levels. For example, whereas fear is associated with pessimism, state and trait anger are associated with optimism (Lerner & Keltner, 2001). Similarly, traits reflecting approach motivation—including self-assurance, physical strength, and bravery—relate positively to state anger (Izard, 1991).

Research using facial expressions of emotion also suggests similarities between anger and high-approach positive emotions (Harmon-Jones, Schmeichel, Mennitt, & Harmon-Jones, 2011). To select a high-approach positive emotion to compare with anger, approach motivation was evoked by asking participants to write about an important, personal goal and how they intended to achieve it. This “implemental mind-set” has been shown to produce approach motivation in past studies (Harmon-Jones, Harmon-Jones, Fearn, Sigelman, & Johnson, 2008; Taylor & Gollwitzer, 1995). In a low-approach positive comparison condition, participants wrote about a very pleasant event that had happened to them because of someone else’s actions. Participants were then asked to name the emotion they experienced most strongly while engaging in this task. In the implemental mind-set condition, the most commonly freely generated word was “determined,” whereas in the low-approach positive condition the most common word was “happy” (or a synonym). These results suggested that determination may be the most prototypical high-approach emotion (C. Harmon-Jones et al., 2011).

In subsequent studies within this same article, participants then made voluntary emotional expressions intended to express determination, anger, joy, and other basic emotions (sadness, fear, disgust, and neutral)—that is, the participants were simply instructed to make the facial expression so that anyone would know what they were feeling (i.e., the participants were not given muscle-by-muscle instructions on making facial expressions). Naïve judges then attempted to identify the emotions in the photographs. The photographs of intended determination expressions that were most often correctly identified were more likely to be misidentified as anger, but not more likely to be misidentified as any other emotion, including joy. These results suggest that determination, a high-approach positive emotion, is perceived as similar to anger (C. Harmon-Jones et al., 2011).

In another follow-up study, naïve judges rated the intensity of joy, anger, and determination expressed in photographs (C. Harmon-Jones et al., 2011). For the determination expressions, the intensity of perceived determination was positively correlated with the intensity of perceived anger and was negatively correlated with the intensity of perceived joy. For the anger expressions, the intensity of perceived anger was positively correlated with the intensity of perceived determination and negatively correlated with the intensity of perceived joy. These results support the idea that anger is approach related, by showing the perceptual similarity between anger and determination, a positive, high-approach emotion.

### ***Anger and Individual Differences in Approach Motivation***

Research on bipolar disorder suggests that a hyperactive approach system may underlie mania (Depue & Iacono, 1989; Fowles, 1993; Urošević, Abramson, Harmon-Jones, & Alloy, 2008), and interestingly, the emotions anger and euphoria often co-occur during manic episodes (Cassidy, Forest, Murry, & Carroll, 1998; Depue & Iacono, 1989; Tyrer & Shopsin, 1982). Lithium carbonate, used to treat bipolar disorder, reduces aggression, also suggesting that anger and aggression are part of the syndrome of bipolar disorder (Malone, Delaney, Luebbert, Cater, & Campbell, 2000). In addition, approach motivation is associated with activity in the left frontal cortical region of the brain, as research on individuals who have suffered lesions has shown that damage to the right frontal cortex commonly produces mania (see Robinson

& Downhill, 1995, for a review), suggesting that mania and hypomania involve increased left frontal brain activity.

Research on BAS suggests that anger is also related to trait approach motivation within the nonclinical population. In two studies, BAS, measured with Carver and White's (1994) scale, correlated positively with trait anger, measured by the Buss and Perry (1992) aggression questionnaire. In one of the studies, anger also related positively to behavioral inhibition sensitivity (BIS), but when general negative affect was controlled statistically, the association between anger and BIS was eliminated, while the association between anger and BAS remained (Harmon-Jones, 2003). Trait BAS has also been found to predict anger in response to experimental provocations (Carver, 2004). In concert with the clinical studies on mania, the relationship between BAS and anger supports the idea that anger is approach motivated.

Anger has also been found to be associated with selective attention toward rewards but not threats. In one experiment, participants were induced to experience an angry, fearful, excited, or neutral state (Ford et al., 2010). Then, their selective attention toward images depicting threats, rewards, or high arousal controls was measured using eye tracking. Results revealed that participants induced to feel angry showed selective attention toward rewarding images when they were paired with threatening or control images. A follow-up study revealed a conceptually similar pattern of results: Trait anger (and aggression) correlated with more selective attention toward rewarding images (Ford, Tamir, Gagnon, Taylor, & Brunyé, 2012).

Animal behavior research also suggests that anger is associated with approach motivation. In one study, mice, which were selected according to being high or low in exploratory temperament, were tested in several behavioral tasks. Compared with mice that were low in exploratory temperament, mice high in exploratory temperament displayed less-anxious behavior in anxiety-evoking situations. Most important, they demonstrated more aggressive behavior in the intruder test (Kazlauskas et al., 2005).

Similarly, research has revealed that in children (4–9 years old) approach/positive anticipation is positively correlated with frustration/anger, and both of these variables are positively correlated with overt aggression (assessed using mothers' reports; Deater-Deckard et al., 2010).

Other evidence suggestive of anger being associated with approach motivation comes from

research examining the startle eye-blink reflex. A reduction in the magnitude of the startle eye-blink reflex during the viewing of arousing/pleasant stimuli has been suggested to be due to the increased approach motivation evoked by the arousing/pleasant stimuli. The researchers who discovered this phenomenon, Lang, Bradley, and Cuthbert (1990), wrote, “when a foreground stimulus engages an appetitive response, a negative probe of that foreground should prompt a reflex of lower amplitude” (p. 381). In a study examining the relationship between individual differences in self-reported trait emotions and the emotion-modulated startle-eye-blink reflex (Amodio & Harmon-Jones, 2011), it was found that trait anger, enjoyment, and surprise were each correlated with reduced startle eye-blink reflexes during the viewing of arousing/pleasant pictures but not aversive pictures.

### Asymmetrical Frontal Cortical Activity

Much research has focused on examining the relationship of anger with asymmetrical frontal cortical activity. The interest in examining the relationship between these two variables emerged from research that had suggested that relative left frontal cortical activity was associated with positive affect and approach motivation, whereas relative right frontal cortical activity was associated with negative affect and withdrawal motivation (Davidson, 1998; Harmon-Jones & Allen, 1997). For most emotions, the valence of the emotion (positivity/negativity) is related to its motivational direction (approach–withdrawal). Joy is often associated with approach motivation, and fear and disgust are often associated with withdrawal motivation. Thus, interpreting the research on asymmetrical frontal cortical activity and emotion/motivation in the above manner seemed valid. However, valence and motivational direction are not perfectly related as is illustrated with the emotion of anger—that is, anger is a negative emotion but it is often associated with approach motivation. Consequently, research on anger was conducted in part to test whether asymmetrical frontal cortical activity was associated with affective valence, motivational direction, or both.

In this research literature, the difference between activity in the left and right frontal cortical regions has been considered the variable of interest. In the electroencephalographic (EEG) research, the choice to use this difference score as the variable of interest was originally determined

by methodological reasons, such as the need to control for individual differences in skull thickness and volume conduction, which could influence the measured EEG signals recorded from the scalp’s surface. However, subsequent research using a variety of methods has suggested that the difference between activity in the left and right frontal cortical regions may in fact be the variable of interest at a psychological/conceptual level of analysis (Schutter & Harmon-Jones, 2013)—that is, it may be the dynamic relationship between the left and right frontal regions that is responsible (in part) for greater approach versus withdrawal motivation. Consequently, when referring to this difference score, we often use terms like “relative left frontal cortical activity” to indicate greater left than right frontal activity.

### Trait Anger

The first studies followed the lead of many past frontal asymmetry studies by simply examining the correlation of the affective/motivational trait with resting, baseline EEG activity measured over 4–8 minutes. The first study found that individual differences in anger, as measured by the anger subscale of the Buss and Perry (1992) Aggression Questionnaire, correlated with greater left frontal activity and lesser right frontal activity (Harmon-Jones & Allen, 1998). A follow-up study addressed an alternative explanation for the results of this study (Harmon-Jones, 2004). According to this alternative explanation, individuals who score high in trait anger may experience anger positively, and this positive feeling or attitude toward anger could explain why anger was correlated with greater relative left frontal activity. This study first developed a valid and reliable assessment of attitude toward anger, and then measured resting baseline EEG activity. Results revealed that trait anger correlated positively with attitude toward anger; individuals who scored as more chronically angry also evaluated their anger more positively. More important, however, **trait anger correlated with greater relative left frontal activity** not with attitude toward anger. In addition, **relationship** between trait anger and relative left frontal activity remained significant even when attitude toward anger was statistically controlled in regression analyses. Subsequent studies have revealed that trait aggression is also associated with greater relative left frontal activity (Rybak, Crayton, Young, Herba, & Konopka, 2006) even among imprisoned violent offenders (Keune et al., 2012).

### **State Anger**

Given these findings, experiments were conducted to address the limitations inherent in correlational studies. In these experiments, anger was manipulated to test the effects of state anger on asymmetrical frontal brain activity. In the first experiment, participants wrote an essay about an issue they regarded as important and then they received (via random assignment) feedback from another person that was insulting or neutral (Harmon-Jones & Sigelman, 2001). Immediately following the participants' reading of the feedback, EEG was collected. As expected, participants who received the insulting feedback had greater relative left frontal activity than individuals who received neutral feedback. Moreover, within the insult condition, self-reported anger and behavioral aggression were positively correlated with relative left frontal cortical activity. Within the neutral condition, neither of these correlations was significant. Thus, left frontal activation was correlated with more subjective anger and behavioral aggression in the insult condition. This experiment provided the first evidence supporting the hypothesis that anger caused greater relative left frontal cortical activation.

Several experiments have directly and conceptually replicated these results (e.g., Jensen-Campbell, Knack, Waldrip, & Campbell, 2007). For example, in one experiment (Harmon-Jones et al., 2004) participants were insulted (or not) in the same manner as used by Harmon-Jones and Sigelman (2001). They were also induced to sympathize (or not) with the person who would insult them prior to receiving the insult. Results revealed that the manipulated increase in sympathy caused a reduction in the effects of insult on relative left frontal activity. These results suggest that experiencing sympathy for another person may reduce aggressive behaviors (e.g., see Miller & Eisenberg, 1988, for a review) by decreasing the relative left frontal activity associated with anger.

Ostracism from others has been found to evoke anger in a number of experiments (Williams, 2007). EEG experiments have replicated these results and also found that the degree of relative left frontal cortical activity that occurs in response to ostracism correlates with self-reported anger in a standard ostracism paradigm (Cyberball; Peterson, Gravens, & Harmon-Jones, 2011). Moreover, the degree of relative left frontal cortical activity that occurs in response to ostracism correlates with self-reported jealousy in a "romantic/sexual partner" ostracism paradigm (Harmon-Jones, Peterson,

& Harris, 2009). In another experiment, Verona, Sadeh, and Curtin (2009) found that an impersonal stressor (high-pressure air blasts assigned by a computer) also evokes greater relative left frontal activity, and this increased left frontal activity correlated with more aggression in an "employee-supervisor" lab task.

### **Independent Manipulation of Approach Motivation within Anger**

The experiments presented so far were designed so that the anger evoked was approach oriented. Although most experiences of anger involve approach motivation, not every experience of anger involves approach motivation. For example, situational variables such as threats of punishment and personality variables such as punishment sensitivity may reduce the approach motivation that occurs with anger (and cause anger to be mixed with anxiety and fear). Variables that cause a lower approach motivational response may also cause sadness to be mixed with anger. However, if anger is associated with greater left frontal cortical activity because of anger's association with approach motivation, then variables that influence the level of approach motivation of anger should influence relative left frontal activity. Several experiments have tested this idea by manipulating approach motivation independently of anger.

Past research and theory has suggested that coping potential influences motivational intensity (Brehm & Self, 1989; Wright, Tunstall, Williams, Goodwin, & Harmon-Jones, 1995). In other words, when individuals expect to be able to act to resolve a particular problem, they should experience more motivation, particularly if it is moderately difficult to act. Consequently, we predicted that expecting to be able to act to resolve an anger-producing situation will increase approach motivational intensity as compared with expecting to be unable to take action. Thus, because relative left frontal activity is associated with approach motivational intensity, the expectation of high coping potential within an anger-inducing situation should cause greater relative left frontal activity. Three experiments have found evidence consistent with this prediction (Harmon-Jones et al., 2003, 2006).

In the Harmon-Jones et al. (2003) experiment, participants were led to believe that they could or could not act to attempt to change an upcoming event that angered them (i.e., a tuition increase at their university). Participants in both conditions reported significant increases in anger over base-

line, and the two conditions did not significantly differ from each other. More importantly, participants who believed they could engage in approach-related action to resolve the anger-producing event had greater left frontal activity than participants who expected to be unable to engage in such action. In addition, within this action-possible condition, participants who had greater left frontal activity to the angering situation also reported more anger; this correlational result suggests that their angry experience was approach motivated. In the condition where action was impossible, relative left frontal activity was not correlated with self-reported anger. Taken together with the high level of anger reported in this condition, this correlational result suggests that even though anger is usually associated with approach motivation, when approach-related action is not possible, approach motivation is low, even though angry feelings can be high. Last, within the action-possible condition, participants who had greater left frontal activity to the angering event were more likely to act in ways that would decrease the possibility of the angering event from occurring (i.e., they were more likely to sign a petition and take petitions with them for others to sign to try to eliminate a possible tuition increase at their university). This latter correlational result implies that greater approach motivation, as suggested by greater relative left frontal cortical activity, was associated with more overt behaviors aimed at resolving the angering negative situation.

This finding of greater left frontal cortical activation occurring when individuals are angered and expect to engage in approach-related action has been replicated (Harmon-Jones et al., 2006). In these two experiments, participants who scored low in racial prejudice were presented photographs depicting racist events as well as standard positive, negative (fear/disgust), and neutral photographs from the International Affective Picture System (Lang, Bradley, & Cuthbert, 1997). As expected, these racist photographs evoked self-reported anger. Prior to viewing all of the photographs, participants were assigned (or not) to expect an opportunity to act on their anger immediately after the viewing—that is, they were told that they would write essays discussing how racism was unjust, unfair, and immoral, and these essays would be used in prejudice-reduction studies in the future. In addition to that manipulation, the personal relevance of the photographs was manipulated by having participants either complete a self-report measure of racial prejudice or a comparable

questionnaire about a neutral topic. As predicted, the greatest left frontal cortical activity occurred in response to the anger-inducing photographs when the photographs were made more personally relevant and when participants expected to act on their anger. These results conceptually replicate the results of the previous experiment and suggest that increasing the approach motivational character of anger increases relative left frontal cortical activity. The second experiment revealed that this effect was indeed strongest among those participants who scored lowest in racial prejudice.

We believe that these results do not indicate that heavy-handed, explicit manipulations of action possibility are necessary to cause greater relative left frontal activity. These manipulations of action possibility probably only increase the effects of the emotion manipulations on relative left frontal cortical activity. In line with this interpretation, a follow-up study revealed that the anger-inducing pictures evoked a nonsignificant effect on relative left frontal activity when participants were given no manipulations to influence action expectations or personal relevance. However, individuals who scored high on trait anger did show greater relative left frontal activity to the anger-inducing pictures—that is, individual differences in trait anger correlated with greater left frontal activity to anger-producing pictures (controlling for activity to neutral pictures; Harmon-Jones, 2007).

Further support for the importance of approach motivational intensity in determining the relationship of anger and asymmetrical frontal cortical activity comes from an experiment in which whole body posture was manipulated (Harmon-Jones & Peterson, 2009). This experiment tested the hypothesis that a supine body posture or lying flat on one's back would reduce approach motivation and correspondingly the increase in relative left frontal activity that occurs in response to angering events. The idea that a supine posture would reduce approach motivation was based on the observation that individuals often recline backward after acquiring goals and that the posture itself may prevent one from easily moving toward goals (see Price, Peterson, & Harmon-Jones, 2012, for a review). In the experiment, participants were randomly assigned to sit in an upright or reclined position. Then, they received neutral or insulting interpersonal feedback, as described above (Harmon-Jones & Sigelman, 2001). For participants assigned to the upright body posture, results replicated past research: Those who received insulting feedback had greater relative left frontal activation

than those who received neutral feedback. More important, participants assigned to the supine body posture had a level of relative left frontal activation that was similar to those in the upright/neutral feedback condition and significantly less than those in the upright/insulting feedback condition. This whole body posture research illustrates the importance of approach motivation in the anger–relative left frontal activity relationship.

### ***Manipulation of Asymmetrical Frontal Cortical Activity and Anger Processing***

In the above research, anger was manipulated and regional brain activation was measured, as is commonly done in affective neuroscience research. Another less commonly used method involves the manipulation of regional brain activity and the measurement of a psychological variable. This method permits stronger causal inferences about the role of a particular brain region in a psychological process than the method of measuring regional brain activity to a psychological manipulation, because with the latter method, the measured variable may only be a correlate of the psychological process and not critically involved in the process.

One of the first experiments to manipulate brain activity and measure anger-related processes was conducted by d'Alfonso, van Honk, Hermans, Postma, and de Haan (2000). They used slow repetitive transcranial magnetic stimulation (rTMS) to inhibit activity in the left or right prefrontal cortex. Slow rTMS has been found to cause inhibition of cortical excitability. When slow rTMS is applied to the right prefrontal cortex, the right prefrontal cortex becomes less active and the left prefrontal cortex becomes more active. When slow rTMS is applied to the left prefrontal cortex, the left prefrontal cortex becomes less active and the right prefrontal cortex becomes more active. d'Alfonso et al. found that rTMS to the right prefrontal cortex caused more attention toward angry faces, whereas rTMS to the left prefrontal cortex caused more attention away from angry faces. These researchers interpreted these results to indicate that the increase in left prefrontal activity caused participants to attentionally engage with angry faces, as in an aggressive or dominance confrontation. On the other hand, the increase in right prefrontal activity caused participants to attentionally avoid angry faces, as in a fearful avoidance or submissiveness. These results are conceptually similar to other research that has found that attention toward angry faces is associated with high levels of

self-reported anger and that attention away from angry faces is associated with high levels of fear responses (van Honk, Tuiten, de Haan, van den Hout, & Stam, 2001; van Honk et al., 1998, 1999). These results with rTMS have been replicated using other tasks (Donhauser, Belin, & Grosbras, 2014; van Honk & Schutter, 2006).

This research using rTMS has been extended using a different manipulation of asymmetrical frontal cortical activity and a different outcome variable related to anger. Past research has found that contraction of the left hand increases right frontal cortical activity and contraction of the right hand increases left frontal cortical activity (Harmon-Jones, 2006). These unilateral hand contractions also influence emotive responses (Harmon-Jones, 2006; Schiff & Lamon, 1989, 1994).

To test whether the unilateral contraction of hands would influence asymmetrical frontal cortical activity and angry aggression, participants were randomly assigned to contract their right or left hand. Then, they received insulting feedback from another participant, as in previous research (Harmon-Jones & Sigelman, 2001). Afterward, they performed a reaction time game against this other (ostensible) participant. The reaction time game was based on Buss's (1961) aggression paradigm and it was used so that behavioral aggression could be measured. In the game, participants could deliver blasts of white noise, ranging from 60 to 100 decibels and for any period of time up to 10 seconds if they won the reaction time trial (i.e., fastest to press the shift key when an image appeared). As predicted, participants who contracted their right hands gave louder and longer noise blasts to the other participant than those who contracted their left hands (Peterson, Shackman, & Harmon-Jones, 2008). Moreover, within the right-hand contraction condition, greater relative left frontal activation correlated with more behavioral aggression.

Another brain stimulation technique that has been used in the study of anger and asymmetrical frontal cortical activity is transcranial direct current stimulation (tDCS). This methodology uses two electrodes, an anode and a cathode, to simultaneously modulate activity in opposite directions in the left and right frontal cortices. Anodal tDCS increases excitability, whereas cathodal tDCS decreases cortical excitability in the targeted brain region (Ardolino, Bossi, Barbieri, & Priori, 2005; Nitsche & Paulus, 2000). Thus, this method is perfect for studies of asymmetrical frontal activ-

ity and emotive states where the psychophysiological variable of interest—the asymmetry—shows greater activity in one hemisphere and lesser activity in the contralateral hemisphere.

So far, two tDCS experiments on anger have been conducted. In both, participants were randomly assigned to one of three tDCS conditions: anodal to right frontal cortex and cathodal to left frontal cortex; cathodal to right frontal cortex and anodal to left frontal cortex; or sham, which is a condition that gives stimulation for a few seconds at the beginning of the 15-minute stimulation period. In both experiments, participants were unable to correctly guess which condition they had experienced, thus suggesting that the sham stimulation was successful. After 10 minutes of stimulation, participants in both experiments received insulting interpersonal feedback similar to that used in past experiments such as Harmon-Jones and Sigelman (2001). In the first experiment (Hortensius, Schutter, & Harmon-Jones, 2012), at the beginning of the session, participants were led to believe that they might interact with the other person participating in the session (which was ultimately the person who insulted them). After the 15 minutes ended, participants played a competitive reaction time game against the other person, so that behavioral aggression could be measured. Finally, self-reported emotions about the feedback were measured. Results revealed that only within the condition in which left frontal cortical activity was increased did self-reported anger relate to aggression. In other words, when individuals were angry and their left frontal cortex was made more active, they behaved more aggressively. In the other two conditions, this effect did not emerge.

In the second experiment (Kelley, Hortensius, & Harmon-Jones, 2013), at the beginning of the session, participants were *not* led to believe that they might interact with the other person participating in the session. After the 15 minutes ended, participants completed two self-report measures of rumination. Based on past work that had linked rumination with more depression (Nolen-Hoeksema, 2000) and depression with greater relative right frontal activity (Thibodeau, Jorgensen, & Kim, 2006), it was expected that the manipulated increase in right frontal activity might cause more rumination about the angering feedback as compared with the other two tDCS conditions. Indeed, it did. These results are conceptually consistent with earlier results obtained from a study examining how individual differences in depression versus mania relate to asymmetrical frontal cortical

activity to angering events (Harmon-Jones et al., 2002). In this study, greater mania related to greater relative left frontal cortical activity and greater depression related to greater relative right frontal cortical activity to the anger-evoking event.

### Conceptual Interpretation of the Anger–Approach Relationship

One issue that has arisen in the consideration of anger being an approach-oriented emotion is exactly how it is approach oriented. On one hand, anger is associated with approach motivation because anger occurs when approach-oriented goals are blocked—that is, when an individual is motivated to gain a desired reward and is blocked from progress toward the reward, then anger occurs (Carver & Harmon-Jones, 2009). This interpretation of the anger–approach relationship employs the stimulus (i.e., blocked approach motivation) as the determinant of the relationship.

Because anger occurs when desires are blocked, anger itself may orient individuals toward positive outcomes. Indeed, the reviewed research suggests this to be the case (e.g., Ford et al., 2010). However, does anger always orient individuals toward positive outcomes? We suspect that anger will not always do so, because one of anger's main motivational imperatives is to attack the source of anger (Berkowitz, 2012). In these cases, anger may cause individuals to temporarily abandon the original blocked goal so that the angering stimulus or person can be attacked. This latter case may illustrate the difference between anger and rage (Lewis, 1993).

Another, parallel interpretation, however, employs the response as the determinant of the anger–approach relationship—that is, anger is linked to approach motivation, because anger is tightly linked to approach-related responses. Moreover, anger appears to occur in a wide array of situations that do not appear to result from goal blocking (e.g., Berkowitz & Harmon-Jones, 2004a, 2004b). For example, simply adopting physical expressions of anger, even when individuals are not aware that they are creating angry expressions, causes physiological and cognitive responses that are approach oriented (Coan, Allen, & Harmon-Jones, 2001; Keltner, Ellsworth, & Edwards, 1993). Also, angry moods and trait anger appear to be linked to approach motivation, and it seems that these characteristics are at least occasionally linked with approach motivation that did not result from blocked

goals. Thus, we suggest that anger may evoke approach motivation even in situations that do not contain an obstacle to a desired outcome.

### Anger and Withdrawal Motivation

The research reviewed so far suggests that anger is associated with greater relative left frontal activation because anger is often associated with approach motivation. This conclusion is supported by the experiments that manipulated approach motivation independently of anger and found that it was the approach motivational intensity of anger that determined relative left frontal activation.

Could anger ever be associated with withdrawal motivation and increased relative right frontal activation? Based on past research, we suspect that anger may be evolutionarily prepared to be associated with approach motivation. In support, research with infants (Lewis et al., 1992) and non-human animals (Blanchard & Blanchard, 1984) suggests that anger is predominantly associated with approach motivational tendencies.

However, anger may become associated with other response tendencies in addition to approach ones over the lifetime. Moreover, although the blocking of approach motivation may be the primary elicitor of anger, the situations that block approach may also contain threats of punishment that elicit other emotional states. Thus, some situations may cause and/or persons may experience some withdrawal tendencies and increased relative right frontal cortical activity during the experience of anger. As we review below, a few studies have tested these ideas.

One of the first experiments designed to test this idea had soccer players *imagine* that their coach unfairly prevented them from playing a soccer game (Wacker, Heldmann, & Stemmler, 2003). In the anger–approach condition, the players imagined approaching the coach and protesting, whereas in the anger–withdrawal condition, they imagined backing out of the locker room and silently swearing at the coach. In both conditions, the players reported feeling angry; however, the two conditions did not differ from each other in relative left frontal activation, even though both anger conditions evoked greater relative left frontal activation than the neutral comparison condition.

Another study (Hewig, Hagemann, Seifert, Naumann, & Bartussek, 2004) examined the relationship between resting baseline frontal asym-

metry and trait anger out, trait anger in, and trait anger control, measured with the State–Trait Anger Expression Questionnaire (Spielberger, 1988). These three measures of anger traits are designed to measure how individuals express anger. Anger out is defined as “expressing angry feelings in aggressive verbal or motor behavior directed toward other people or objects in the environment” (e.g., “When angry or furious, I lose my temper”; Spielberger et al., 1995, p. 57). Therefore, anger out appears to be assessing an approach-related response of anger. Anger in is defined as the degree to which individuals suppress anger and/or direct it at themselves (e.g., “When angry or furious, I keep things in”). Anger control is defined as the degree to which individuals monitor and prevent the expression of anger (e.g., “When angry or furious, I control my angry feelings”). Hewig and colleagues (2004) found that trait anger out correlated with greater relative left frontal activity at resting baseline, but that trait anger control correlated with greater relative right frontal activity. Trait anger in was not correlated with resting frontal asymmetry. Hewig and colleagues (2004) interpreted the results with anger control as suggesting that individuals who score high in anger control may be particularly high in withdrawal motivation. This latter correlation may be due to individuals who score higher in anger control being higher in anxiety or sadness, as these emotions may reduce approach motivation (Lewis & Ramsay, 2005).

As revealed above, the evidence in support of the idea that anger can be associated with withdrawal motivational tendencies is mixed. Anger may be associated with withdrawal motivation but this may occur only when the angering situation also arouses punishment concerns. Thus, these types of situations may evoke feelings of anger as well as anxiety.

A study designed to test these ideas created a situation in which anger was considered particularly socially inappropriate (Zinner, Brodish, Devine, & Harmon-Jones, 2008). This study built on past research suggesting that norms exist that encourage political correctness and discourage expressions of racial prejudice, but that some individuals are angered by the pressures to behave in accord with these norms (Plant & Devine, 1998). These individuals, rather than outwardly expressing their anger in response to situations that emphasize these norms. Indeed, other research has found that some individuals report ~~ing~~ being angry when socially pressured to respond without racial preju-

dice (Plant & Devine, 2001). In the EEG study, white participants (university students in the United States) were led to believe they were about to interact with a black person. To increase the possibility of anger among some participants, the experimenter mentioned that the study concerned the importance of harmonious interracial interactions. The participants were then instructed to “mentally prepare” for the interaction, and EEG was recorded. Then, prior to the (ostensible) interaction, participants completed a self-report affect measure that asked them to indicate how they felt about the upcoming interaction. In this particular situation, self-reported anger correlated with greater relative right frontal cortical activity as well as increased skin conductance levels and more spontaneous eye blinking. Taken together, these results suggest that the individuals who felt the most anger may have been motivated to withdraw (as suggested by relative right frontal activity), were aroused (skin conductance), and were attempting to suppress their anger (eye blinking; Gross & Levenson, 1993). These individuals may have been motivated to withdraw and suppress their anger because they did not want to appear socially inappropriate. Importantly, the self-reported anger was correlated with anxiety; these results suggest that this social context may have evoked punishment concerns among those who were angry.

Much evidence supports the idea that anger is associated with approach motivational tendencies. Less evidence supports the idea that anger is associated with withdrawal motivational tendencies. In the studies that have examined this latter idea, the results have revealed that state anger may be associated with relative right frontal cortical activity (and possibly withdrawal motivation) when individuals also experience anxiety and are perhaps concerned about punishment (Zinner et al., 2008). In addition, individuals who score high in the trait of anger control tend to have greater relative right frontal activity at rest, suggesting that they may be motivated to withdraw when angry (Hewig et al., 2004).

## Conclusion

In this chapter, we have reviewed theories and research related to understanding the causes of anger, the subjective feeling of anger, and the motivational components of anger. In doing so, we also reviewed research relating anger to asymmetrical frontal cortical activity, which led to a better

understanding of the role of asymmetrical frontal cortical activity in emotive processes but also suggested new insights into understanding anger.

In addition to increasing our understanding of anger, the reviewed research has pointed to the importance of delineating emotional experience from emotional expression and emotional valence from motivational direction. The reviewed research contributes to a better understanding of the conceptualization of emotional space. Previously, much research and theory emphasized emotional valence and arousal as primary dimensions underlying emotions (Lang, 1995; Watson, 2000). These perspectives have also suggested that valence relates directly to motivational direction, such that positivity is approach oriented and negativity is withdrawal oriented (e.g., Norris et al., 2010). However, research on anger suggests that the valence of an emotion is independent of the motivational direction of an emotion. Negative emotions such as anger may be associated with approach motivation.



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