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Anger Is an Approach-Related Affect: Evidence and Implications

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The authors review a range of evidence concerning the motivational underpinnings of anger as an affect, with particular reference to the relationship between anger and anxiety or fear. The evidence supports the view that anger relates to an appetitive or approach motivational system, whereas anxiety relates to an aversive or avoidance motivational system. This evidence appears to have 2 implications. One implication concerns the nature of anterior cortical asymmetry effects. The evidence suggests that such asymmetry reflects direction of motivational engagement (approach vs. withdrawal) rather than affective valence. The other implication concerns the idea that affects form a purely positive dimension and a purely negative dimension, which reflect the operation of appetitive and aversive motivational systems, respectively. The evidence reviewed does not support that view. The evidence is, however, consistent with a discrete-emotions view (which does not rely on dimensionality) and with an alternative dimensional approach.

Keywords: anger, approach, appetitive system, avoidance, threat system

Recent years have seen a surge of interest in emotional experience (e.g., Barrett, Niedenthal, & Winkielman, 2005; Dalgleish & Power, 1999; Davidson, Scherer, & Goldsmith, 2003; Frijda, 2007; Lane & Nadel, 2000; Lewis & Haviland-Jones, 2000; Ortony, Clore, & Collins, 1988; Panksepp, 1998; Rottenberg & Johnson, 2007; Scherer, Schorr, & Johnstone, 2001). Views of emotion vary considerably, in several respects. As one example, some people view emotions as a set of distinct modular entities, often considered basic emotions (e.g., Ekman, 1992; Izard, 1991; Izard & Ackerman, 2000; Levenson, 1994, 1999; Panksepp, 1998; Roseman, 1991). Others hold that affects are best understood by reference to underlying dimensions (e.g., Barrett, 2006; Cacioppo, Gardner, & Berntson, 1999; Carver & Scheier, 1998; Davidson, 1998; Gray, 1994a; Lang, Bradley, & Cuthbert, 1992, 1998; Russell, 2003; Russell & Barrett, 1999; Russell & Carroll, 1999a, 1999b; Watson, Wiese, Vaidya, & Tellegen, 1999; Yik, Russell, & Barrett, 1999).

Anger

This article focuses on one specific affect—anger. Specifically, it addresses the relationship of this affect to broad motivational tendencies of approach and avoidance, and it considers implications of that relationship for two areas of thought and research. We begin with a few words about definitions.

Sometimes the terms affect, feeling, and emotion are treated as interchangeable (e.g., Isen, 2000); sometimes they are distinguished from each other (e.g., Fredrickson, 2001; Russell & Barrett, 1999). Affect is generally used to imply a hedonic experience, a sense of valence, a subjective sense of positivity or negativity arising from an event. When many use the word emotion, it is with that sense in mind. As Frijda (2000) put it, "For many theorists, the essence of emotion is feeling, and notably 'affect,' here used in the sense of a feeling of pleasure or pain . . . ." (p. 63). As Ortony et al. (1988) put it, emotions are ". . valenced reactions to events, agents, or objects . ." (p. 13). The focus in this article is on subjective valenced reactions.

Clearly more is at issue than valence per se, however. Affects are inextricably bound with the nature of the events that elicit them (cf. Ellsworth & Scherer, 2003, p. 575; Frijda, 1986, chapter 4). Many different kinds of events can produce negatively valenced feelings, for example, and the feelings that emerge differ by type of event. This binding of event type to feeling quality can be viewed in terms of appraisals (Ortony et al., 1988; Roseman, 1991; Scherer et al., 2001; C. A. Smith & Ellsworth, 1985) or scripts (Izard, 2007; Russell, 2003). It can also be viewed in terms of motivational processes underlying the affects (Arnold, 1960; Cacioppo et al., 1999; Carver & Scheier, 1998; Davidson, 1998; Frijda, 1986; Roseman, 1991). These are by no means mutually exclusive viewpoints. This article, however, focuses primarily on links to motivational processes.

The binding of affect to type of event also has implications for understanding the meaning of valence. Valence could be defined on the basis of the event that leads to the emotion, or on the basis of the feel of the emotion. In most appraisal theories, the most important basis for distinguishing positive from negative emotions is whether the emotion-evoking event is pleasant or aversive (e.g., Lazarus, 1991). On this view, anger is generally experienced as a negative emotion (Harmon-Jones, 2004) because it is elicited by events that are unpleasant or undesired. Because events can be undesirable for a variety of reasons, there are different kinds of

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negatively valenced emotions. One question underlying this article is whether what will be referred to as motivational direction (approach vs. avoidance) is an important basis for differentiating among negative affects.

As just noted, it is also possible to define valence on the basis of the feel of the emotion. From this perspective, anger could be defined as positive or negative as a function of whether an individual accepts or rejects, likes or dislikes, the subjective experience of anger. In general, most people regard anger as a negative subjective experience, though some people find it less aversive than others (Harmon-Jones, 2004). In these studies, means on a 5-point "attitude toward anger" scale hover around 1.5, where 1 = *strongly disagree* and 5 = *strongly agree* with statements that express liking the anger experience. Rarely do individuals score greater than 3.0, the midpoint of the scale, confirming that the experience of anger is typically negatively valenced in its subjective feel.

Anger and Approach

Anger has been defined by some as a negatively-valenced affect that arises from the blockage of movement toward a desired goal (Berkowitz, 1993; Depue & Zald, 1993; Dollard, Doob, Miller, Mowrer, & Sears, 1939; Lewis, Alessandri, & Sullivan, 1990). Although some evidence suggests that no additional appraisals are needed for anger to occur (Berkowitz & Harmon-Jones, 2004), many theorists do incorporate additional elements.

It has been said, for example, that anger arises when one person has the experience of being slighted or hurt by intentional acts of another person (Frijda, 1986, p. 198). Similarly, anger has been described as displeasure joined with a focus on the blameworthiness of someone else's actions (Ortony et al., 1988, p. 147). Anger has been characterized as the reaction to a displeasing violation of what the person counts upon, the occurrence of an event in which there is a violation of what "ought" to be (Frijda, 1986, pp. 198–199; Mascolo, Harkins, & Harakal, 2000, p. 137; Ortony et al., 1988, p. 152–153). In the same vein, the idea of precipitation by goal blockage has been extended to the violation of standards, or what Ortony et al. (1988) referred to as the thwarting of "Interest" goals.

Despite variations, depictions such as these all seem to connect anger to an approach motivational orientation. That is, goal blockage implies disruption of ongoing movement toward a desired end point. A violation of what "ought" to be implies failure to maintain an existing desired condition, as does the thwarting of an Interest goal. Such depictions imply that anger follows from disrupted approach (cf. Depue & Iacono, 1989; Fox, 1991; Fox & Davidson, 1988).

Approach tendencies also underlie many behavioral responses *to* anger, though we regard this as secondary. Anger often promotes an effort to remove the violation of what "ought" to be, an effort to change the behavior of others (Fischer & Roseman, 2007), an effort to reopen the path to the desired goal (Frijda, 1986). Anger sometimes promotes an effort to inflict pain or harm on the offending other. This is an act of approaching a particular desired condition, the creation of discomfort for someone else, or of rectifying an injustice (Shaver, Schwartz, Kirson, & O'Connor, 1987). That anger often leads to restoring a desired state leads many to view the appraisal of the situation as controllable as an important element in anger (Lerner & Keltner, 2001; Mackie, Devos, & Smith, 2000; Roseman, 1991; Roseman, Antoniou, & Jose, 1996).

Anger and Avoidance

On the other hand, some of the language used to convey the nature of anger bears substantive resemblance to language used to specify the nature of fear. Fear arises from threat of harm (Frijda, 1986, p. 197); it reflects displeasure at the prospect of an undesirable event (Ortony et al., 1988, pp. 109–111). The language used in such descriptions tends to suggest that fear occurs when there is an anticipation of something aversive, whereas anger is a reaction to the actual occurrence of something aversive. This in turn suggests a link between anger and fear.

A link between anger and fear would also be consistent with the sense of the well-known phrase "fight or flight" response (Cannon, 1929). That phrase implies that the two actions both involve mobilization of energy and thus have a common pathway at some level. The phrase also suggests that the two kinds of actions are closely related, in the sense that a given situation might lead to either of them depending on other factors (e.g., Berkowitz, 1993, p. 11; Lindsay & Anderson, 2000). In line with this idea, in describing their evolutionary view, Lang et al. (1998, p. 1249) held that both fear and anger arise from the aversive motivational system.

An association of anger and fear is also seen in factor analytic studies of the structure of self-reported mood and emotions. One prominent example of this approach is the development of the Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988). For the most part, reliability and validity studies (e.g., Watson & Clark, 1994; Watson et al., 1988) involved administering the measure to large numbers of persons and asking them to report their feelings with respect to some period of time (e.g., the present moment, today, during the past few days, the past week, the past month, and on the average). In factor analyses of these data, it is typical for items pertaining to anger or irritability to load together with items pertaining to anxiety or threat-avoidance. Such results have led some to conclude that negatively valenced affects have a common source (e.g., Watson et al., 1999).

Does anger relate to approach or to avoidance motivational tendencies? This is the central question underlying this article. The next section begins with a description of recent views of the central role of these two broad motivational tendencies in human behavior. Then evidence is considered that certain brain areas are differentially involved in the two motivational tendencies. After that, the place of affect in this picture is addressed.

Background: Approach and Avoidance as Organizing Principles

A good deal of theory in contemporary psychology rests on the idea that appetitive and aversive motivational systems represent core elements in the organization of behavior. This idea is not new (Miller, 1944; Miller & Dollard, 1941), but it has newly come to the fore during the past 2 decades. Different terms are used in different areas. The labels *appetitive*, *incentive*, and *approach* motivational system are used interchangeably here. The appetitive system organizes behavior involved in approaching desired incen-

tives (rewards, goals). The labels *aversive*, *threat*, and *avoidance* or *withdrawal* motivational system are also used interchangeably. The aversive system organizes behavior involved in avoiding threats (punishments).

The premise that approach and avoidance are building blocks also led long ago to the idea that the two tendencies are managed by different structures in the nervous system (e.g., Konorski, 1967; Miller, 1944; Schneirla, 1959). The idea that approach and avoidance systems have partially distinct neural substrates is also quite prominent today, in varying forms (e.g., Cloninger, 1987; Davidson, 1998; Depue & Collins, 1999; Fowles, 1980; Gray, 1994a, 1994b; Pizzagalli, Sherwood, Henriques, & Davidson, 2005).

A living creature has many needs and thus has diverse appetites. No doubt there exist specialized neural structures pertaining to specific classes of needs and desires (Panksepp, 1998). However, many hold that it is also reasonable to speak of relatively generalized systems that organize approach and avoidance across diverse domains (Davidson, 1998; Depue & Collins, 1999; Fowles, 1980; Gray, 1994a, 1994b). That is the viewpoint behind research and theory on anterior cortical laterality (to be discussed shortly). That is also the viewpoint taken here; we disregard narrower specializations pertaining to specific motives throughout this discussion.

Approach, Avoidance, and Affect

From the start, studies of asymmetrical anterior cortical functions blended motivational considerations with affective considerations. This has been a continuing theme throughout the development of this literature. The asymmetric involvement of prefrontal cortical regions in approach (or positive affect) and withdrawal/avoidance (or negative affect) was suggested early on by observations of persons who had suffered damage to the right or left anterior cortex (Goldstein, 1939). Later research supported these observations using the Wada test, which involves injecting amytal, a barbiturate derivative, into one of the internal carotid arteries, thus infusing it into one cerebral hemisphere at a time. The effect of amytal is to suppress the activity of the relevant cerebral hemisphere. Amytal injections in the left side produced depressed affect, whereas injections in the right side produced euphoria (Alema, Rosadini, & Rossi, 1961; Perria, Rosadini, & Rossi, 1961; Rossi & Rosadini, 1967; Terzian, 1964). These effects are often interpreted as reflecting the release of one hemisphere from contralateral inhibitory influences. Thus, activation in the right hemisphere, when not inhibited by the left hemisphere, seems to yield depression; an uninhibited left hemisphere seems to yield euphoria.

Subsequent studies appeared to confirm these results, finding that persons who had suffered left hemisphere damage or lesions tended to show depression-like symptoms (Black, 1975; Gainotti, 1972; Gasparrini, Satz, Heilman, & Coolidge, 1978; R. G. Robinson & Price, 1982), whereas persons who had suffered right hemisphere lesions tended to show mania-like symptoms (Gainotti, 1972; R. G. Robinson & Price, 1982; Sackeim et al., 1982). Other research has revealed asymmetries underlying appetitive and avoidant behaviors in nonhuman animals, in species ranging from great apes and reptiles (Deckel, Lillaney, Ronan, & Summers, 1998; Hopkins, Bennett, Bales, Lee, & Ward, 1993) to chicks (Güntürkün et al., 2000), amphibians (Rogers, 2002), and spiders (Ades & Ramires, 2002). Observations such as these suggest that the hemispheric segregation of approach from withdrawal motivation is evolutionarily primitive.

More recent research suggests that in humans these asymmetrical activations are often specific to the anterior cortex. This research typically uses asymmetric activation in right versus left anterior cortical areas as a dependent variable, usually assessed by electroencephalogram (EEG) recordings. The use of this dependent variable is grounded in the assumption that elevations in activity reflect the differential engagement of those areas in responding to whatever is dominating the person's psychological experience at that time. Thus, if reward cues presently predominate over threat cues, and if one hemisphere were differentially involved in processing that pertains to reward cues, there should be more activity in the one area than in the other.

Anterior cortical asymmetry is assessed by comparing activation levels between comparable areas on the left and right sides. Difference scores are widely used in this research, despite controversies about their use (e.g., Schmidt, 1999). Specifically, it cannot be determined from a difference score alone whether activity in one area has increased or activity in the other area has decreased, or both. On the other hand, the amytal and lesion research described above suggests that asymmetry may be key, if one hemisphere is inhibiting the opposite one. Consistent with that view is evidence from studies of transcranial magnetic stimulation, discussed later in the article (Schutter, in press; Schutter, van Honk, d'Alfonso, Postma, & de Haan, 2001).

Situational Manipulations and Anterior Cortical Asymmetry

What evidence supports the idea that left versus right anterior cortical areas subserve different motivational tendencies (approach vs. avoidance)? The clearest evidence comes from studies in which the researchers created situations incorporating clear incentive or threat stimuli. The situations generally were designed so that they were likely to induce an avoidance motivational state (along with negative feelings) or an approach motivational state (along with positive feelings). Once those motivational (and affective) states were created, the participants' brain activity was recorded by EEG. Results from over 70 studies have supported this analysis (see review by Coan & Allen, 2004).

For example, to create avoidance motivation and negative affect, participants in one study were exposed to repellant film clips (Davidson, Ekman, Saron, Senulis, & Friesen, 1990), those in another study were confronted with threats of punishment (Sobotka, Davidson, & Senulis, 1992). In both cases, participants displayed elevations in right (compared with left) anterior cortical activation. On the basis of these and other conceptually compatible findings, it has been argued that portions of the specialized neural substrates for withdrawal or avoidance are lateralized in the right anterior region of the cortex (Davidson, 1992, 1995; Nitschke, Heller, & Miller, 2000).

Other studies exposed participants to positively valenced events, such as the promise of rewards (Sobotka et al., 1992), positive emotional adjectives (Cacioppo & Petty, 1980), and pictures of delicious desserts (P. A. Gable & Harmon-Jones, 2008). In all these cases, participants displayed relatively higher levels of left anterior cortical activity. In other studies, 10-month-olds had dif-

ferential left anterior activation to their approaching mothers (Fox & Davidson, 1988) and to a film clip of an actress with a happy facial expression versus a sad expression (Davidson & Fox, 1982). Newborn infants (2–3 days old) have shown greater relative left anterior cortical activation in response to sucrose than to water (Fox & Davidson, 1986). On the basis of these and other conceptually compatible findings, it has been argued that portions of the specialized neural substrates for approach are lateralized in the left anterior region of the cortex.

Traits and Anterior Cortical Asymmetry

Indirect evidence also comes from studies in which anterior cortical activity at rest (without any manipulation) has been related to trait variables that themselves relate to affective and motivational tendencies. The assumption underlying such work is that a person who by temperament is highly motivated by rewards is more likely to be experiencing approach-motivational activity even at rest than is a person who by temperament is not much motivated toward rewards. The evidence is indirect because such findings are subject to interpretational ambiguities. Unless there is a measure of affect or motivation at the time of cortical assessment, the existence of such differential states of affect or motivation remains speculation.

Given that caveat, several studies have found that trait levels of incentive sensitivity relate to left anterior resting asymmetry (Amodio, Master, Yee, & Taylor, 2008; Coan & Allen, 2003; Harmon-Jones & Allen, 1997; Sutton & Davidson, 1997). One study found a link between resting left anterior dominance and responsivity to reward in a task administered in a separate session (Pizzagalli et al., 2005). In another study, reports of personal growth (an approach experience) after severe motor vehicle accidents were linked to greater left frontal activity at baseline (Rabe, Zöllner, Maercker, & Karl, 2006). This latter effect held even after controlling for dispositional positive affect.

Results are less consistent regarding threat sensitivity. One study found a significant relationship between a measure of trait threat sensitivity and greater right than left frontal activity (Sutton & Davidson, 1997); two others found nonsignificant relations (Coan & Allen, 2003; Harmon-Jones & Allen, 1997). A possible interpretation of this inconsistency is that right frontal cortical regions may be more involved in withdrawal oriented attentional processes than in withdrawal oriented action processes (Peterson, Gable, & Harmon-Jones, 2008).

Motivation, Affective Valence, or Both?

The evidence just reviewed was introduced here as suggesting support for the idea that anterior cortical lateralization subserves two broad classes of motivation. This same set of findings has also been widely interpreted as indicating the involvement of the left anterior cortical region in the experience of positive affects, and the involvement of the right anterior cortical region in the experience of negative affects (e.g., Ahern & Schwartz, 1985; Davidson, 1992, 1995, 1998; Gotlib, Ranganath, & Rosenfeld, 1998; Heller, 1990; Heller & Nitschke, 1998; Herrington et al., 2005; Quaranta, Siniscalchi, & Vallortigara, 2007; Silberman & Weingartner, 1986). Indeed, most of the evidence just reviewed pertains just as readily to affective experience as to motivational involvement. At present, however, the affective valence interpretation of asymmetrical anterior activations appears to be somewhat more widely accepted than the motivational interpretation.

Indeed, several other studies were aimed more specifically at affect, examining how anterior cortical activity at baseline relates to measures of trait affective tendencies. This work was based on the idea that baseline asymmetry reflects a trait-like tendency toward experiencing a class of affective experience (Tomarken, Davidson, Wheeler, & Kinney, 1992). Consistent with that idea, trait positive affect, as measured by the PANAS (Watson et al., 1988), was linked to left frontal asymmetry, whereas trait negative affect was linked to right frontal asymmetry (Tomarken, Davidson, Wheeler, & Doss, 1992).

Resting frontal asymmetry has also predicted emotional responses to emotion-eliciting stimuli. Persons with relatively greater right frontal resting activity had larger negative affective responses to negative emotion-inducing films (fear and disgust) and smaller positive affective responses to positive emotion-inducing films (happiness; Tomarken, Davidson, & Henriques, 1990; Wheeler, Davidson, & Tomarken, 1993). Such findings fit the position that the resting asymmetry reflects a greater propensity to experience one or the other valence of affective states.

Given these various results, the prevailing view of hemispheric dominance links such effects both to affective valence and to motivational direction. That is, left anterior activity is widely seen as indicating both approach motivation and positive affect; right anterior activity is widely seen as indicating both avoidance motivation and negative affect (Cacioppo et al., 2007). For example, "The approach system facilitates appetitive behavior and generates certain forms of positive affect. The withdrawal system facilitates the withdrawal of an organism from sources of aversive stimulation and generates certain forms of negative affect" (Davidson, 1998, p. 608). This view has also promoted the widespread inference that positive affects derive from the appetitive system and that negative affects derive from the aversive system (Davidson, 1998, 2000; Tomarken & Keener, 1998; see also Lang et al., 1992, p. 44).

Hemispheric Activation, Affect, and Motivational Direction

The evidence promoting those conclusions, however, incorporates an enormous ambiguity. Specifically, most of those studies completely confounded motivational direction with affective valence. In studies that produced evidence of situational left cortical dominance, rewarding stimuli were being delivered or promised; this should yield both engagement of approach motivation and also positive-valenced affect. It is impossible to tell from these studies whether greater left anterior cortical activation relates to approach motivation, to positive affect, or to both. Similarly, in studies that found evidence of situational right cortical dominance, punishing stimuli were being delivered or promised; this should yield engagement of avoidance motivation and also negative-valenced affect. It is thus impossible to tell from these studies whether greater right anterior cortical activation relates to avoidance motivation, to negative affect, or to both. Similar problems exist for studies of traits and baseline cortical dominance.

These ambiguities could be diminished, if it were possible to isolate a case in which affective valence were disentangled from

motivational direction. Anger may provide such a case. As outlined earlier, some theorists regard anger as relating to appetitive motivation (approach), others regard it as relating to aversive motivation (avoidance). Evidence pertaining to anterior cortical asymmetry during anger would clarify that picture and simultaneously clarify the meaning of hemispheric dominance.

That is, if anger relates to right anterior cortical dominance, the pattern would support a convergence among the aversive motivational system, negative emotional valence, and right anterior dominance, precisely the view that is now widely held. If anger relates to left anterior dominance, however, the implications would be quite different. This would contradict a view in which left anterior cortical dominance reflects positive emotional valence, because anger has a negative valence. Indeed, when anger increases, happiness and good mood decrease (Harmon-Jones & Sigelman, 2001; Harmon-Jones, Sigelman, Bohlig, & Harmon-Jones, 2003). By process of elimination, linking anger to left cortical dominance would tend to support a view in which anterior cortical laterality effects indicate motivational direction (approach vs. avoidance). In supporting that view, the evidence would also argue that anger reflects approach motivation.

Valence, Motivation, and Frontal Cortical Asymmetry: The Case of Anger

To investigate these competing possibilities, Harmon-Jones and his colleagues have conducted a program of research on hemispheric laterality and anger. Initial studies provided only indirect evidence, because they used trait measures and relied on the implicit assumption that differences in traits render people more prepared, even at rest, to experience differences in motivational or affective states. Nonetheless, such studies provided a starting point.

In one early study, Harmon-Jones and Allen (1998) found that higher scores on a trait anger scale related to higher resting levels of left anterior activity and lower right anterior activity. This pattern was later conceptually replicated by Hewig, Hagemann, Seifert, Naumann, and Bartussek (2004) and by Rybak, Crayton, Young, Herba, and Konopka (2006). Harmon-Jones (2004) later confirmed that this pattern is not attributable to any positive feelings about anger among people high in trait anger.

In another recent study, participants were exposed to anger-inducing pictures (and other pictures). Persons high in trait anger had greater left frontal activity to anger-producing pictures, controlling for activity to neutral pictures (Harmon-Jones, 2007). Thus, elevation on the trait that reflects vulnerability to anger yielded a stronger left anterior cortical response to anger stimuli.

Experiments have also manipulated anger and assessed its effects on brain activity, ignoring trait differences. Harmon-Jones and Sigelman (2001) randomly assigned participants to be insulted or to be treated neutrally. Immediately afterward, EEG activity was assessed. As predicted, insulted persons displayed greater relative left frontal activity than the others. Within the insult condition, reported anger and subsequent aggression correlated positively with relative left frontal activity (neither correlation was significant in the no-insult condition).

Additional experiments have replicated these results (Jensen-Campbell, Knack, Waldrip, & Campbell, 2007) and also have revealed that state anger both increased left frontal activity and decreased right frontal activity (Harmon-Jones, Vaughn-Scott, Mohr, Sigelman, & Harmon-Jones, 2004). Consistent with the overall line of reasoning, creating sympathy for the person who would later insult the participant reduced the effects of insult on both left and right frontal activity (Harmon-Jones et al., 2004).

Other experiments in this research program addressed more subtle issues. The experiments just described were designed to evoke anger in a way that would enhance approach motivation. However, it is possible to interfere with a motivational state, even while the emotion exists. There is evidence that perceived ability to attain a goal influences motivational intensity, such that motivation falls off when attaining the goal seems impossible (Brehm & Self, 1989). Following this reasoning, Harmon-Jones et al. (2003) varied the intensity of approach motivation independent of anger, by manipulating perceptions. Expecting to be able to act to resolve the event should yield greater approach motivational intensity than expecting not to be able to act.

Both of these conditions evoked increases in anger (over baseline) and the degree of anger did not differ. Consistent with prediction, participants who expected to be able to act had more left frontal activity than those who expected to be unable to do so. Moreover, in the action-possible condition, those with greater left frontal activity after the angering event also reported more anger. This again is consistent with the idea that anger is an approach-related emotional response. Indeed, those with greater left frontal activity in this condition were subsequently more likely to act to change the situation. In the condition in which action was not possible, greater left frontal activity did not relate to greater anger. In our view, this is because when action is not possible, motivational engagement is low, even if angry feelings are high.

The research outlined above suggests that the left anterior region is most accurately described as a region that is involved in approach motivational engagement. Only when anger was tied to an opportunity to resolve the anger-producing event did participants show relative left anterior activation. The increase in left anterior activation from anger when approach-related action is possible has since been replicated (Harmon-Jones, Lueck, Fearn, & Harmon-Jones, 2006).

In the studies just discussed, the intent was to elicit anger, but not fear, and self-reports confirmed that fear was uniformly low. Sometimes, however, anger arises in situations that also elicit anxiety. For example, there are strong social norms against, and potential social sanctions for, expressing anger in interracial contexts (Plant & Devine, 1998). Indeed, Plant and Devine (2003) found that self-reported anger while awaiting an interracial interaction correlated with a desire to avoid the interaction. This suggests that anger sometimes prompts an avoidance motivation: a motivation to avoid the situation in which anger may lead to punishment.

Another recent study (Zinner, Brodish, Devine, & Harmon-Jones, 2008) explored this idea further. White participants received an experimental introduction stressing the importance of harmonious interracial interactions in today's increasingly diverse society, and then they were led to expect to interact with a Black participant. As they prepared mentally for the interaction, EEG recordings were made. Participants who reported feeling anger before the interaction had higher relative right frontal activity; those who reported feeling anger also reported feeling anxious. This differs from past research on anger, in which the manipula-

tions created only anger, not anxiety. The link from anger to right frontal asymmetry in this context is consistent with the interpretation that participants experiencing both anger and anxiety were also experiencing a desire to avoid the interaction that was evoking both feelings.

Not every attempt to separate motivational direction from emotional valence has been successful. Wacker, Heldmann, and Stemmler (2003) tried to manipulate anger versus fear, and independently approach versus withdrawal, by use of imagery. Participants were soccer players, and the imagery consisted of scenarios of game situations. Anger induction led to greater left anterior activity, but there was no support for an asymmetry as a function of approach versus withdrawal induction. As the authors noted, however, anger and fear were equally activated in the scenario intended to create fear; indeed, the motivational approach tendency was also rated higher in the fear condition than in the anger condition. Thus, it seems likely that the motive hypothesis was not well tested in this study.

A few additional studies have studied anger using imaging technologies other than EEG, such as positron emission tomography (PET) or functional magnetic resonance imaging (fMRI). In these studies, researchers tried to create anger by self-generated memories (e.g., Damasio et al., 2000; Dougherty et al., 1999) or via the presentation of angry faces (e.g., Blair, Morris, Frith, Perrett, & Dolan, 1999). These studies have generally produced evidence consistent with a link from anger to greater left anterior activation. For instance, Damasio et al. (2000) observed left lateralization during anger imagery in the anterior cingulate. Drexler et al. (2000) replicated this finding and also observed that anger caused greater activation of the left medial frontal gyrus and left cuneus. A meta-analysis by Murphy, Nimmo-Smith, and Lawrence (2003) found anger was associated with greater left anterior activations in the nine studies they reviewed.

Manipulation of Brain Activity

In the studies discussed above, the psychological variable of anger (and sometimes approach motivation) was manipulated, and the physiological variable of frontal activation was measured. There are also research techniques to manipulate brain activity and to measure resulting psychological/behavioral functions. Studies of this sort provide different information than do studies that manipulate psychological processes and observe their effects on brain activity (Sarter, Berntson, & Cacioppo, 1996). Several studies have now manipulated regional brain activity and observed its effects on reactions that appear to be anger-related, though not measuring anger per se.

For example, d'Alfonso, van Honk, Hermans, Postma, and de Haan (2000) used slow repetitive transcranial magnetic stimulation (rTMS) to inhibit the left or right prefrontal cortex. Slow rTMS reduces cortical excitability, so that rTMS applied to the right prefrontal cortex decreases its activation and causes the left prefrontal cortex to become more active, whereas rTMS applied to the left prefrontal cortex decreases its activation and causes the right prefrontal cortex to become more active (Nahas et al., 2001; Schutter et al., 2001). This effect is likely due to a reduction in transcallosal inhibition after the initial unilateral deactivation of the targeted area (Pascual-Leone et al., 1998; Schutter et al., 2001). d'Alfonso et al. (2000) found that rTMS to the right prefrontal cortex caused selective attention toward angry faces, whereas rTMS applied to the left prefrontal cortex caused selective attention away from angry faces. Thus, increased left prefrontal activity led participants to attentionally approach angry faces, as in an aggressive confrontation (further evidence that such attentional reactions reflect aggressive confrontation has been reported by Beaver, Lawrence, Passamonti, & Calder, 2008). In contrast, increased right prefrontal activity led participants to avoid angry faces, as in a fear response. These results have been conceptually replicated by van Honk and Schutter (2006).

Peterson, Shackman, and Harmon-Jones (2008) extended this work by examining whether a far simpler manipulation of asymmetrical frontal cortical activity would affect angry aggression. Because contracting the left hand increases right frontal cortical activity and contracting the right hand increases left frontal cortical activity (Harmon-Jones, 2006), Peterson, Shackman, and Harmon-Jones (2008) had participants squeeze a small ball in one hand or the other. Participants then received insulting feedback, after which they played a reaction time game against another person. Participants could give the other person a blast of white noise if they were faster to respond when an image appeared on the screen. Those who squeezed with their right hand gave significantly louder and longer noise blasts than those who squeezed with their left hand.

Summary

In summary, a variety of evidence links the experience of anger to elevations in left anterior cerebral activation. This is the brain area that has been related in a good deal of other work to both approach tendencies and positive feelings. At least one study has found the opposite asymmetry (Zinner et al., 2008); however, that pattern occurred in a context in which anger was mixed with anxiety, a context in which it is entirely reasonable to believe that anger led to a desire to escape from the situation so as not to risk disapproval (Plant & Devine, 2003). The body of research as a whole fairly consistently links anger to left anterior activation, suggesting further that left anterior activation reflects approach motivation. It also suggests thereby that anger is an approach-related affect.

Incentive Sensitivity, Threat Sensitivity, and Anger

The research described in the preceding section made use of variations on one general theme to structure its methodology. The focus was on brain activity. The dependent variable in most cases was EEG activity in left versus right anterior cortical areas. In some studies, cortical activity was assessed after experimental manipulations. In others, cortical activity was assessed at rest and related to measures of traits that pertain to anger. In yet other studies, in contrast, cortical activity was experimentally manipulated, and the dependent measure was behavioral.

The case linking anger to approach would obviously be more compelling if this body of evidence were reinforced by findings using different methods. There are in fact several ways to study the involvement of approach versus avoidance motivational systems in the experience of anger. In this section, we review studies that used a strategy that employed individual differences as a methodological tool (cf. Underwood, 1975).

The reasoning behind this work goes as follows: First, the assumption is made that incentive and threat sensitivities are at least partly distinct from each other (Cloninger, 1987; Davidson, 1998; Depue & Collins, 1999; Fowles, 1980; Gray, 1990, 1994a, 1994b). There is in fact a great deal of evidence in support of this belief. In the developmental literature, Rothbart and her colleagues (e.g., Derryberry & Rothbart, 1997; Rothbart, Ahadi, & Evans, 2000; Rothbart, Ahadi, Hershey, & Fisher, 2001; Rothbart & Bates, 1998; Rothbart, Ellis, Rueda, & Posner, 2003; Rothbart & Posner, 1985; see also Kochanska & Knaack, 2003; Nigg, 2000) have long argued for the existence of separate temperament systems for approach and avoidance (and a third temperament termed effortful control) and have reported evidence consistent with that view.

Given the separability of these motivational sensitivities, individual differences in the sensitivities of each system (i.e., the extent to which each is readily engaged by stimuli in the environment) can be assessed separately (by self-report). These individual differences then can be related to a variety of phenomena pertinent to anger. In some cases, these associations are subject to the ambiguities of inference that resemble those addressed earlier with respect to trait measures: for example, when these individual difference measures are simply correlated with measures of anger proneness. Such correlations provide suggestive information on associations between anger and motivational sensitivity, but the information must be filtered through the fact that both measures refer to general tendencies rather than specific situational events.

In other cases, however, the individual difference measures have been used in combination with situational stimuli. In those cases, the individual differences can be tested as predictors of state anger in situations designed to be anger-relevant. If anger derives from an aversive motivational system (consistent with a view in which anger and fear have a great deal in common), anger should relate to individual differences in threat sensitivity. If anger derives from an appetitive motivational system (consistent with a view in which anger and fear are related to different motivations), it should relate to individual differences in incentive sensitivity.

In the studies described here, the measure of individual differences in threat and incentive sensitivities was Carver and White's (1994) Behavioural Inhibition System/Behavioural Activation System (BIS/BAS) scales. The BIS scale measures self-perceived proneness to anxiety in the presence of threat cues (e.g., "I feel pretty worried or upset when I think or know somebody is angry at me"). There are three BAS-related scales—not by design, but by virtue of the fact that several different potential manifestations of behavioral approach formed distinct (though correlated) factors (see Carver & White, 1994). Drive (e.g., "When I want something I usually go all-out to get it") reflects energetic pursuit of rewards; Reward responsiveness (e.g., "When I get something I want, I feel excited and energized") reflects positive emotional reactivity to rewarding events; Fun seeking (e.g., "If I see a chance to get something I want I move on it right away") reflects sensitivity to potential new rewards.

Internal consistency, factor structure, and test–retest reliability of the BIS/BAS scales are adequate (Carver & White, 1994; Heubeck, Wilkinson, & Cologon, 1998; Jorm et al., 1999). Across several diverse samples (Carver, 2004, in press; Carver & White, 1994; Jorm et al., 1999), the correlations of the BIS scale with Drive and Fun seeking was nominal (average rs = −.10 and −.05, respectively), but the BIS scale correlated moderately positively with Reward responsiveness (average r = .29). The three BAS scales correlate moderately positively with one another (average r = .38). There is evidence that the Fun seeking scale incorporates elements of impulsiveness that are absent from the other BAS scales (Carver, 2004; Smillie, Jackson, & Dalgleish, 2006; Zelenski & Larsen, 1999), though the content of this scale clearly concerns impulsiveness pertaining to the pursuit of rewards. Despite the divergence of content among BAS scales, some researchers have merged them into an overall index of incentive sensitivity.

The BIS and BAS scales have been validated in a number of studies. The scales have been shown to predict situational reports of anxiety and happiness, respectively, in the presence of cues of impending threat and impending reward (Carver & White, 1994; S. L. Gable, Reis, & Elliot, 2000). They have also predicted greater conditioning responses to punishment and reward, respectively (Zinbarg & Mohlman, 1998). Differences on these measures have also been related to differences in resting levels of asymmetrical frontal cortical activity, that is, in the absence of cues of incentive or threat (Harmon-Jones & Allen, 1997; Sutton & Davidson, 1997). The cumulative evidence suggests that the scales relate to diverse phenomena to which they should relate, if they are valid indices of individual differences in incentive and threat sensitivity.

In considering a research strategy based on correlating scores on the BIS and BAS scales with situational anger reactions (or anger-related traits), one more point should be noted. A key aspect of this strategy is that the BAS items all focus on positive affective and behavioral responses to incentive cues: All describe positive emotional and behavioral reactions to aspects of incentive pursuit (motivation to seek incentives, persistence in their pursuit, and positive feelings when obtaining them). No BAS item refers in any way to an adverse event, nor is there any hint of negative affect in the content of any BAS-related item. The opposite is true of BIS items. Each refers to a threatening event and assesses emotional responsiveness to the threat. The semantic content of the items, then, creates a bias against a link from BAS items to reports of negatively valenced affective experiences. To the extent that a response bias plays any role here, it favors associations from the BIS scale to reports of negatively valenced experiences.

Several studies have related the BIS and BAS scales to trait measures pertaining to anger. In two studies, Harmon-Jones (2003) showed that an index of the BAS scales related positively to trait anger. The second study also revealed that BAS scores related positively to reports of being physical aggressive. Simultaneously regressing the aggression scale onto BAS, BIS, and general negative affect determined that physical aggression scores were related positively to BAS, negatively to BIS, and positively to general negative affect. Thus, incentive and threat sensitivities related in opposite directions to self-reported physical aggressiveness.

Smits and Kuppens (2005) also found that both BIS and BAS were associated with trait anger, and that the relationship of BAS but not BIS remained when a control for neuroticism was included, as was true for Harmon-Jones (2003). Smits and Kuppens also found that reports of the tendency to express anger outwardly related positively to BAS scores and inversely to BIS scores. The tendency to turn anger inward related positively to BIS and inversely to BAS. This fits the idea that anxiety works against the expression of anger, whereas anger promotes its own expression.

Also fitting that view, Smits and Kuppens found that reports of both physical and verbal aggressiveness related positively to BAS and inversely to BIS. A similar pattern of associations was reported by Cooper, Gomez, and Buck (2007).

The studies described thus far all correlated trait-like measures with one another. However, studies have also been conducted in which the BIS- and BAS-related scales have been used to predict situational experiences of anger in response to anger-relevant cues. One study (Carver, 2004, Study 1) focused on a stimulus context that Gray (1990, 1994b) had contended should engage the aversive motivational system: the experience of frustrative nonreward. Participants were led to believe they would be able to obtain a reward if they performed well at a task. However, they then failed to perform well (because of experimental manipulation). There was no punishment, merely the absence of a desired reward. Increases in reports of frustration level from the start of the session until the failure to attain the incentive were correlated with an aspect of BAS sensitivity (Fun seeking), but not to the measure of BIS sensitivity.

In a second study (Carver, 2004, Study 2), participants read scenarios of events, each describing a situation in which an anger response would be plausible, as would an anxiety response. Participants were to try to imagine the events happening to them (cf. M. D. Robinson & Clore, 2001). They then reported how they would feel at that moment. Reports of anger related to Reward responsiveness, indeed related nearly as strongly to Reward responsiveness as they related to a separate measure of anger-hostility. The relation of anger to the measure of threat sensitivity (BIS) was significantly weaker, though the latter was also significant. When ratings of nervousness in response to the situation were also controlled for, anger no longer related to BIS scores. In contrast to these results, BIS scores quite reliably predicted ratings of nervousness.

A third study was conducted a week after the terrorist attacks of September 11, 2001 (Carver, 2004, Study 3). Participants were asked to report the feelings that they had when thinking back to the events of that day. Reports of anger correlated significantly with Drive and Reward responsiveness at the bivariate level, though the latter correlation faded away in multivariate analyses. Anger related more weakly to the BIS scale. When ratings of anxiety in response to the situation were also controlled for, that association also faded away. Again the BIS scale related uniquely to ratings of anxiety. Thus, once again, anxiety was predicted by a measure of threat sensitivity, and anger was predicted by a measure of incentive sensitivity.

Another study by Wingrove and Bond (1998) related the BIS/BAS scales to anger and aggressive behavior. Participants completed a computer game in which they believed themselves to be cooperating with a partner. The game was rigged so that most trials were failures, resulting in anger and dissatisfaction overall. Elevations in self-reports of situational quarrelsomeness, resentfulness, and discontent all correlated positively with Reward responsiveness, and increases in hostility correlated positively with Drive. Increased reports of discontent related inversely to BIS. The sending of critical feedback to the ostensible partner related inversely to BIS scores and positively related to Drive scores.

BAS sensitivity has been found to predict aggressive inclinations even more strongly when approach motivation was first primed (Harmon-Jones & Peterson, 2008). In this study, participants first wrote about an approach-motivating event, an important goal toward which they were working. Control condition participants wrote about a neutral day. Following this task, the participants were insulted and then given an opportunity to evaluate the person who had insulted them. An interaction of BAS and condition emerged. Within the approach-primed condition, higher BAS scores (averaged across subscales) were associated with more negative evaluations of the insulting person. BIS did not predict negative evaluations.

Additional research using the BIS/BAS scales used a paradigm in which participants are exposed to faces displaying emotional expressions. Attention toward angry faces has been linked to higher anger, and attention away from angry faces has been linked to social anxiety (van Honk, Tuiten, de Haan, van den Hout, & Stam, 2001; van Honk et al., 1998, 1999). The usual interpretation of such results is that quick attending to angry faces is the first step in an approach-based dominance confrontation (for support for that view, see Beaver et al., 2008). Putman, Hermans, and van Honk (2004) found that the Drive scale predicted vigilance to angry faces presented out of awareness, and did so significantly better than the BIS scale. In an fMRI study, Beaver et al. (2008) related the Drive scale to increased activation to angry faces in neural regions that previously had been related to aggression. In contrast, the BIS scale related to activation in regions associated with fear, threat, and response inhibition.

Summary

In sum, a good deal of evidence links individual differences in incentive sensitivity to individual differences in anger-related traits. A good deal of evidence also links individual differences in incentive sensitivity to reports of differential levels of anger (and other indicators pertaining to anger) in anger-relevant situations. Threat sensitivity sometimes correlated with reports of anger in these situations as well, but generally that correlation faded from the picture when variance shared between anger and fear was removed. Such a control did not remove the association of the measure of incentive sensitivity with anger. There is also evidence that threat sensitivity relates to suppressing the expression of whatever anger is being experienced, whereas the opposite occurs for measures of incentive sensitivity. This also suggests that anger and fear reflect differing motivational pressures.

Further Sources of Evidence

Further evidence that bears on a link from anger to approach motivation comes from a number of other literatures. Most of the support provided by this evidence is indirect, but some is more explicit. For example, consider studies of responses to frustration in task performance. In one such study, Mikulincer (1988) had participants attempt an unsolvable problem, followed by a different cognitive task that was solvable. Those who reported angry feelings in response to the unsolvable problem had better performance on the subsequent task than did those who reported less anger, presumably because their approach motivation was stronger (Mikulincer, 1988). Unfortunately, this study did not include an assessment of anxiety, so a role for avoidance can not be definitively ruled out.

A conceptually similar study was conducted by Pittman and Pittman (1979), who did include a measure of anxiety. They found that a brief exposure to a frustrating loss of control produced greater anger, whereas more extensive exposure produced greater depression. Anxiety was elevated in both conditions but did not differ between conditions. Subsequent performance on another task was higher after the brief exposure (compared with a no-exposure condition) but lower after extensive exposure. This pattern is consistent with anger being associated with engagement of an approach motivational orientation.

Cardiovascular Patterns

Other lines of work involving physiological variables suggest a link between anger and approach. For example, inductions of anger cause increases in cardiovascular activity (Suls & Wan, 1993). Although commonly measured cardiovascular responses are not uniquely associated with approach versus withdrawal motivation, different *patterning* of cardiac activation and vascular resistance has been linked to approach and withdrawal motivation. Appraising stressful events as challenges (perceived personal resources exceed situational demands) causes high cardiac activation coupled with lower vascular resistance; appraising the same events as threats (perceived demands greater than resources) causes low to moderate cardiac activity coupled with higher vascular resistance (Blascovich, Mendes, Hunter, Lickel, & Kowai-Bell, 2001; Blascovich & Tomaka, 1996; Dienstbier, 1989). Challenge is an approach motivational state, threat is not (e.g., Tomaka & Palacios-Esquivel, 1997). The pattern of cardiovascular responses related to challenge has also been found to relate to anger (Herrald & Tomaka, 2002).

Testosterone

Evidence linking anger with approach motivation also comes from research on testosterone. Testosterone has long been associated with both anger and aggression in humans (e.g., Olweus, 1986). In animals and humans, high levels of testosterone have been found to be associated with approach inclinations such as dominance, social success, enhanced libido, and with anger-related inclinations such as assertive and violent behavior (e.g., Albert, Jonik, & Walsh, 1992; Carter, 1992; Mazur & Booth, 1998; Monaghan & Glickman, 1992).

In many primates, dominant males show transient testosterone increases in response to dominance challenges that involve aggression (Bernstein, Gordon, & Rose, 1983; Mazur, 1985; Sapolsky, 1987). Human males respond with testosterone increases to winning dominance contests, and with testosterone decreases to losing dominance contests (Mazur & Booth, 1998). Testosterone also plays a role in female dominance. Elevated testosterone in women enhances physiological and attentional responses to angry faces (van Honk et al., 1999, 2001). High-testosterone women occupy higher positions than low-testosterone women in social hierarchies (e.g., Dabbs, Alford, & Fielden, 1998; Purifoy & Koopmans, 1979). Furthermore, female prisoners who rank high in the prison hierarchy or have a history of unprovoked aggression have high levels of testosterone (Dabbs & Hargrove, 1997; Dabbs, Ruback, Frady, Hopper, & Sgoutas, 1988). High testosterone is associated with feelings of vigor and activation (Dabbs, Strong, & Milun, 1997; Sherwin, 1988), and testosterone is an effective antidepressant in clinical populations with very low or absent endogenous testosterone production (e.g., Rabkin, Wagner, & Rabkin, 1996).

Elevation in testosterone also reduces defensive (fear) responses in a number of species (e.g., Boissy & Bouissou, 1994; Frye, Edinger, & Sumida, 2008; Vandenheede & Bouissou, 1993). An attentional bias for fearful faces (which relates to elevations in fear and anxiety) diminishes after administration of testosterone; conversely, attentional bias for angry faces has been linked with both higher levels of approach motivation (e.g., BAS scores and anger) and higher testosterone (for review, see van Honk & Schutter, 2007). Other studies have shown that testosterone causes less sensitivity to punishment and more sensitivity to reward. In one such study, after testosterone administration (compared with placebo), participants showed a decision-making strategy that led to high rewards early but more punishments over time (van Honk et al., 2004). In another, administration of testosterone reduced fear responses, particularly in anxious individuals (Hermans et al., 2007).

Animal Behavioral Research

Our focus is on anger as an affective experience, rather than aggression as a behavior. However, there are animal research literatures bearing on aggression rather than the subjective experience of anger that seem relevant to the issue at hand. For example, in the animal literature a distinction is made between offensive or irritable aggression and defensive aggression (e.g., Moyer, 1976). Pure offensive aggression "involves attack without attempts to escape from the object being attacked" (Moyer, 1976, p. 187). "Offense involves approach locomotion and the bite-and-kick attack" (D. B. Adams, 2006, p. 306). In contrast, defensive aggression is associated with fear, attempts to escape, and attack only if escape is impossible (D. B. Adams, 2006; Blanchard & Blanchard, 1984; Lagerspetz, 1969; Lang et al., 1992; Moyer, 1976).

Consistent with the idea that offensive aggression represents an approach behavior, Lagerspetz (1969) found that under certain conditions mice would cross an electrified grid to attack another mouse. In rhesus monkeys, defensive aggression is associated with greater relative right frontal cortical activation and higher levels of cortisol, whereas offensive aggression is associated with higher testosterone levels and lower cortisol levels (see review by Kalin, 1999). Research with rodents has suggested that the posteroventral medial amygdala and dorsomedial ventromedial hypothalamus are more important for regulating aggression in defensive contexts, whereas the posterodorsal medial amygdala is more important in offensive contexts (Nelson & Trainor, 2007). The cases of offensive and defensive aggression seem quite different. The fact that they are distinguishable suggests that they reflect different motivational states.

Other animal behavior research yields results consistent with the idea that anger is linked to approach motivation. In one study, mice were selected according to high or low exploratory temperament. Then they were tested in other behavioral tasks. Compared with low exploratory mice, high exploratory mice displayed less evidence of anxiety in a light/dark task and the elevated plus maze, demonstrated greater locomotion in an open-field, and improved their performance across trials in an appetitive stimulus maze.

Most important, high exploratory mice were aggressive in the intruder test, whereas low exploratory mice were nonaggressive or submissive (Kazlauckas et al., 2005). Thus an approach-related temperament related to a tendency toward aggression.

Child Development Literature

Indirect support for the idea that anger relates to approach motivation also comes from several aspects of the human developmental literature (see also Caspi & Shiner, 2006; Nigg, 2006). One source is studies of learning in infants. Lewis et al. (1990; Lewis, Sullivan, Ramsey, & Alessandri, 1992) conditioned infants to pull a string to receive a reward. The reward was removed, then reinstated. Infants who displayed anger when the reward was withdrawn showed the highest levels of joy, interest, and renewed pulling when the learning aspect of the task was reinstated. This relation between anger and joy hints that both stem from the same system or closely related systems; if they came from independent systems, they would be less likely to be positively related.

Other research has found that infants who are high in approach motivation (assessed as a temperament) are more likely to exhibit angry reactions when blocked from achieving their goals and when they are physically confined or restrained (e.g., Rothbart, Derryberry, & Posner, 1994; Stifter & Fox, 1990). Putnam and Stifter (2005) found that mothers' rating of children's externalizing problems (aggressive and destructive problems) at 2 years of age was associated with the child's behavioral approach as measured over a wide range of lab behaviors. Rydell, Berlin, and Bohlin (2003) found that mothers' ratings of their child's exuberance (positive emotional reactions to approach situations) were positively related to ratings of anger at 5 years of age and at 6.5 years of age. Not surprisingly, anger at 5 and 6.5 years of age predicted externalizing behavior problems in elementary school at 8 years of age; more importantly, exuberance also predicted such problems.

Fear and anger as aspects of temperament can be identified in infancy (Caspi & Shiner, 2006; Nigg, 2006). They are not strongly interrelated (K. A. Buss & Goldsmith, 1998), and they have different effects on parental behavior (e.g., Kochanska, Friesenborg, Lange, & Martel, 2004). Higher infant frustration has been found to predict subsequent childhood extraversion (Rothbart, Derryberry, & Hershey, 2000), and measures of infants' approach tendencies have predicted later levels of anger and frustration (Rothbart, Derryberry, & Hershey, 2000). In one study of preschoolers 3–5 years of age, extraversion (teacher rated) was positively correlated with positive affect (coded by raters) when the children won a competitive game, but it was correlated with tense and angry affect when they lost (Donzella, Gunnar, Krueger, & Alwin, 2000). This again is consistent with the view that an approach motivational orientation can be related to anger as well as to positive affect.

Other longitudinal research also supports such a link. Children who failed to divert their attention away from rewards in delay of gratification tasks at 4 years of age were more impulsive, more frustrated, and more distractible at 17 years of age (Shoda, Mischel, & Peake, 1990). Similarly, children who displayed strong approach tendencies in lab assessments of responding at 21 months, 4 years, 5 years, and 7.5 years were more likely to be diagnosed with oppositional disorder at 8 years of age (Hirshfield et al., 1992). Taken together, various developmental results suggest that temperaments associated with approach motivation are directly correlated with angry feelings and aggressive behaviors in both cross-sectional and longitudinal designs.

Personality, Psychopathology, and Perceptions

Research has also linked anger to other psychological properties that suggest approach motivation. For example, Izard (1991) related state anger to self-assurance, physical strength, and bravery. A. H. Buss and Perry (1992) related trait anger to assertiveness and competitiveness. Cloninger's (1987) exploratory excitability, a subcomponent of novelty seeking that is itself heavily associated with approach motivation, is an anger-linked temperament trait. It is directly related to trait levels of outwardly directed anger (Giancola, Zeichner, Newbolt, & Stennett, 1994; Svrakic, Przybeck, Whitehead, & Cloninger, 1999).

Other research has found diverse kinds of evidence differentiating anger from fear. Zuckerman, Kuhlman, Joireman, Teta, and Kraft (1993) characterized the aggression-hostility factor from their personality inventory as relating to agreeableness from the five-factor model, rather than neuroticism, which is heavily based in anxiety. The linking of anger and irritability to agreeableness has also emerged in a number of other studies of both adults and children (e.g., Ashton et al., 2004; Halverson et al., 2003). There is little evidence linking anger and irritability to self-reports of extraversion in adults; to the extent extraversion is identified with approach motivation, that contradicts the other literature reviewed here. However, at least one study found a moderate positive relation ($r = .27$) between Zuckerman et al.'s (1993) aggression-hostility scale and a more explicit measure of incentive pursuit (Drive, from the BIS/BAS scales; Carver, 2004, Study 2).

In other lexical studies of personality, "anxious distress proneness" and "irritable distress proneness" often appear on different factors (Peabody & DeRaad, 2002; Saucier & Goldberg, 2001). Mackie et al. (2000) found that intergroup anger was distinct from intergroup fear, and the tendency to take action against the out-group was distinct from the tendency to move away from the out-group. Lerner and Keltner (2001) found that anger (trait and state) related to favorable expectations, whereas fear related to unfavorable expectations. P. N. Smith and Mumma (2008) found that reports of anxiety in daily life experiences related differentially to cognitions pertaining to failure, whereas reports of anger related differentially to cognitions pertaining to transgression (consistent with the idea that anger is a reaction to an event in which there is a violation of what "ought" to be: Frijda, 1986; Mascolo et al., 2000; Ortony et al., 1988). Russell and Mehrabian (1974) found that anger in response to hypothetical situations related to elevations in dominance (by semantic differential) and that anxiety related to lower dominance.

Another source of indirect support for the idea that anger reflects an approach orientation is the literature of bipolar disorder. The currently dominant theoretical view is that mania reflects a hyperreactive approach system (Depue & Iacono, 1989; Fowles, 1993; Johnson, 2005). Consistent with this, one symptom of mania is euphoria, an affect unambiguously linked to approach. However, mania also is linked to anger (Cassidy, Forest, Murry, & Carroll, 1998; Depue & Iacono, 1989; Tyrer & Shopsin, 1982). Indeed, persons with hypomania show greater left anterior cortical activation than other persons when angered (Harmon-Jones et al., 2002)

and when working toward challenging rewards (Harmon-Jones et al., 2008). Furthermore, lithium carbonate, a treatment for mania, reduces aggression along with other manic symptoms (Malone, Delaney, Luebbert, Cater, & Campbell, 2000). This hints that anger and aggression derive from the same underlying motivational source as other symptoms of bipolar disorder: approach.

Another indirect source of evidence of a link between anger and approach motivation comes from recent research examining perceptions of the motivational intentions of anger expressions (R. B. Adams, Ambady, Macrae, & Kleck, 2006). This research was based on the idea that basic behavioral intentions are forecasted by emotional expressions. In two studies, perceivers were faster to correctly detect approaching anger faces (i.e., faces that moved in the direction of their own gaze) than approaching fear faces, withdrawing anger faces, or withdrawing fear faces. Other studies (R. B. Adams & Kleck, 2005) revealed that direct eye gaze from a face enhanced the perception of approach-oriented emotions (anger and joy), whereas averted eye gaze enhanced the perception of avoidance-oriented emotions (fear and sadness). These findings suggest that anger expressions signal the basic behavioral intent to approach, and are thus compatible with the idea that anger is associated with approach motivation rather than withdrawal motivation.

Summary

The literatures touched on in this section provide a variety of indications that anger relates to approach motivational tendencies. As was noted at the outset, much of this evidence is indirect and, therefore, should be interpreted with caution. Nonetheless, there does appear to be some degree of convergence on this point.

Theoretical Implications

The evidence reviewed in earlier sections provides considerable support for the position that the experience of anger relates to the functioning of an approach system. Far less evidence related anger to an avoidance system. Several broad areas of work were reviewed, bearing on cortical laterality, trait approach and avoidance tendencies and subjective experiences in anger-inducing contexts, cardiovascular and hormonal correlates of anger and approach, animal and developmental studies of temperament, personality and psychopathology, and person perception. Evidence from these very different areas converges on the same conclusion. The evidence suggests that anger relates to the functioning of an approach-oriented motivational system.

This accumulated evidence also appears to have theoretical implications in two areas of thought. One is the continuing effort to understand the meaning of asymmetric anterior cortical activation patterns. The other is the continuing effort to understand affects and their origins.

With respect to cortical activation, the point is simple. The evidence is consistent with the view that left anterior activation reflects approach motivational engagement. The evidence is not consistent with the view that left anterior activation reflects positive affective valence, because anger has negative valence. Precisely what is taking place in the left anterior area with respect to approach motivation that creates this activation is less clear. It may be planning, it may be something else. Whatever it is, however, does not appear to be directly tied to the subjective valence that is intrinsic to affect.

The other issue—the attempt to understand affects and their origins—is more complex. As noted earlier, previous findings concerning laterality have helped promote the inference that positive affects derive from the appetitive system, and negative affects derive from the aversive system (Davidson, 1998, 2000; Tomarken & Keener, 1998; see also Lang et al., 1992, p. 44). This view is quite consistent with the long-held position of Watson and Tellegen (1985, 1999; Watson et al., 1999), who have argued for a dimensional model of feelings, in which a positive affective dimension and a negative affective dimension are fundamental (see Figure 1A). Although this model had its origins primarily in psychometric work, Watson et al. (1999) have increasingly adopted a neurobiological view of motivation to account for the existence of those affective dimensions. Specifically, each dimension—positive activation and negative activation (formerly positive and negative affect)—relates to a category of motivational process—appetitive and aversive.

Their linking of approach with positive valence and avoidance with negative valence is quite explicit. Watson et al. (1999) wrote ". . . accumulating evidence suggests that the self-report NA [negative affect] dimension represents the subjective component of the withdrawal-oriented BIS . . . In contrast, variations in self-rated PA [positive affect] reflect the operation of the BFS [behavioral facilitation system]" (p. 830) and ". . . as our view of these dimensions has evolved, we increasingly have come to see them as truly *unipolar* [italics added] constructs that essentially are defined by their high poles . . . the low poles of these dimensions ultimately reflect the *absence* [italics added] of a particular kind of activation *rather than the presence of a certain affective state* [italics added]" (p. 827).

The notion that diverse negative affects, including anger, all relate to the same underlying system is also embodied in the PANAS (Watson et al., 1988). The negative affect (NA) scale includes the items "afraid" and "scared," but also "irritable" and "hostile." This assessment device was later expanded and elaborated as the PANAS-X (Watson & Clark, 1994), reflecting development of a hierarchical model of affects (Watson & Clark, 1992). In this expansion, separate scales were created for fear and hostility, but these qualities remain conceptualized as contributors to the same overriding factor of NA.

Cacioppo et al. (1999) have taken essentially the same position as was taken by Watson and colleagues (see Figure 1B): "In our formulation, positivity (and negativity) can range from inactive to fully activated" (p. 842). The writings of Lang and colleagues (e.g., Lang, 1995; Lang, Bradley, & Cuthbert, 1990, 1992, 1998) also tied valence explicitly to motivational direction. For instance, Lang (1995, p. 374) wrote, "It is proposed that two motive systems exist in the brain—appetitive and aversive—accounting for the primacy of the valence dimension." This unipolar view of each dimension, linking each valence to a separate motivational system, is the view that is most prominent among dimensional approaches to affective experience.

The findings that were reviewed in this article do not fit this picture. Specifically, the findings fail to support the theoretical position that all negatively valenced affects derive from an aversive motivational system. This is a problem for a dimensional view in which affects align in two unipolar dimensions defined by the

relative presence versus absence of positive and negative valenced affects, respectively (Cacioppo et al., 1999; Lang, 1995; Lang et al., 1990, 1992, 1998; Watson et al., 1999).

Is there another dimensional model that can accommodate the evidence reviewed here? There is at least one. A dimensional view was posed by Carver and Scheier (1990, 1998, 2008) that shares some of the same assumptions as made in the views just discussed but that also has important differences. This model began not with psychometric data, but with the view that approach and avoidance tendencies are fundamental to behavior. In this viewpoint, how-

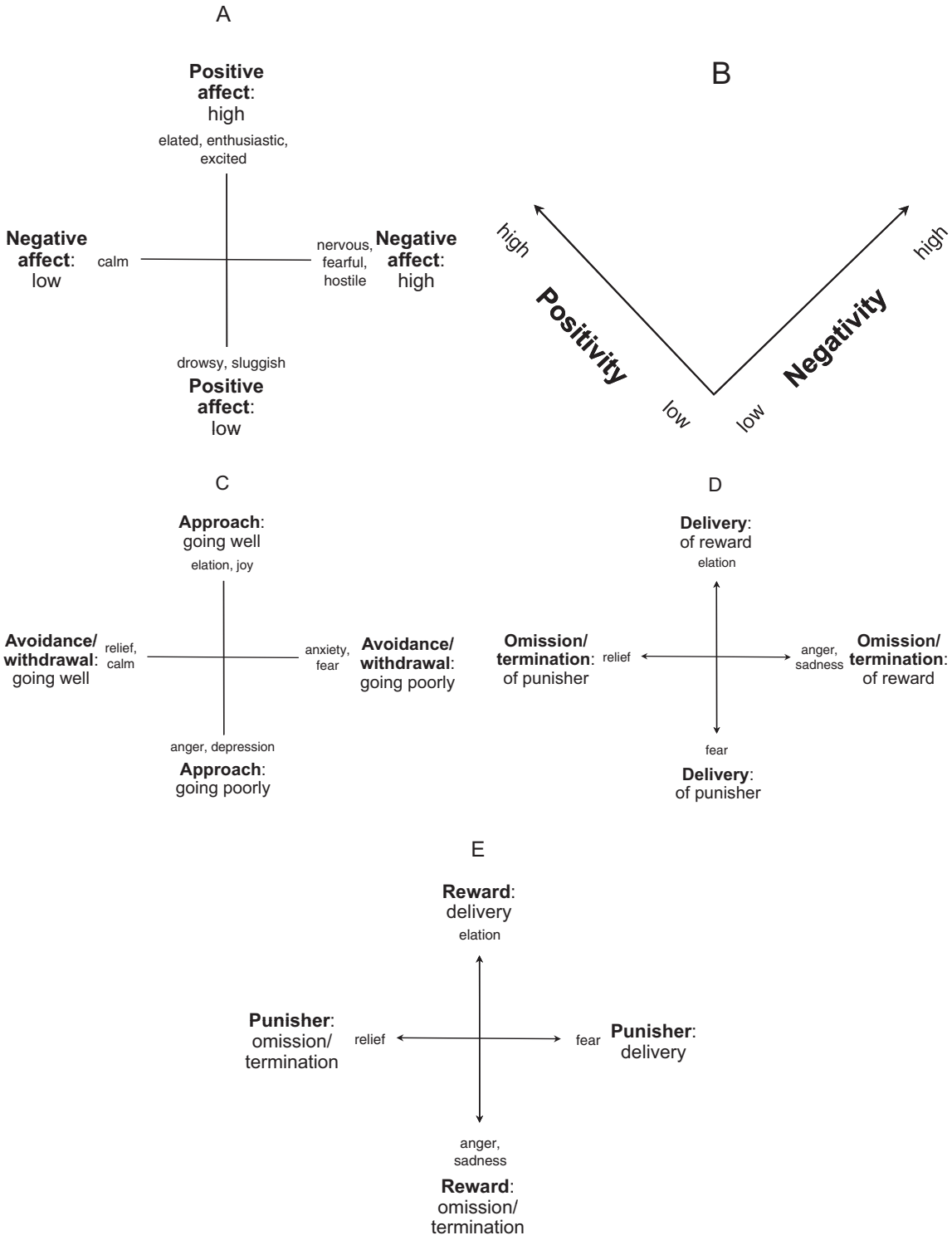

Figure 1.

ever, affective valence does not reflect the mere engagement of the motivational system. Instead, affect is considered an internal indicator of whether progress toward a goal (reward) or away from a threat (punishment) is sensed as going well or poorly at that moment in time (for detail, see Carver & Scheier, 1990, 1998). Positive valence emerges when progress is going well with regard to its intended endpoint; negative valence emerges when progress is going poorly with regard to its intended endpoint. In this view, any action tendency, be it approach or avoidance, can yield either positive affect or negative affect.

Based in part on work by Higgins (1997), Carver and Scheier (1998, 2008) also argued that the existence of two kinds of motivational systems with divergent aims—one organized to approach incentives, the other organized to avoid threats—suggests the possibility of differences in the precise nature of the positive and negative affective qualities that arise with respect to the two systems (see also Higgins, 1997). This argument is consistent with the view, discussed at the start of this article, that valence per se is bound together with other elements of the experience to yield particular affects, with one such element being motivational direction.

A portrayal of the resulting dimensions is displayed in Figure 1C. In this portrayal, each motivational system potentially relates to both positive and negative affect, depending on how well the system is doing at what it is organized to do (approach incentives or avoid threats). The negative affects proposed as pertaining to a given system differ from one to the other, in ways other than valence. The affects proposed as positive also differ from one system to the other, in ways other than valence. This view resembles the emergent view of Watson et al. (1999) in being grounded in approach and avoidance systems, but it differs in predicting that affects of both positive and negative valence exist with respect to both systems.[1]

A position on the bases of emotion that in some ways resembles that of Carver and Scheier was articulated for different reasons by Rolls (1999, 2005). Rolls's theory starts with reinforcement contingencies (though the theory is far more elaborate than that). Rolls identified emotions in terms of the occurrence of reinforcers and punishers and the omission or termination of reinforcers and punishers (see Figure 1D). Of particular importance for present concerns, Rolls has been explicit in differentiating the occurrence of a punisher (which yields fear) from the omission of a reinforcer (which yields frustration and anger).

Rolls (2005) stated that he did not intend the scheme he proposed to be a dimensional one, which appears to be reflected in the organizing principle he used in displaying the affects figurally (Figure 1D). That is, one dimension there is *occurrence*, with the two polarities of event at the two ends; the other dimension is *omission*, with the two polarities of event at the two ends. However, the vectors that Rolls proposed could readily be realigned, such that one line pertained to *reinforcers* (occurrence vs. omission) and the other pertained to *punishers* (occurrence vs. omission), as in Figure 1E. The result of this realignment would be quite similar to the dimensions argued for by Carver and Scheier (1998, 2008). This realignment arguably is more natural than the one displayed by Rolls (2005). Each dimension of variability would pertain to a particular class of event (reward, punishment); each dimension would range from highest probability (occurrence) to lowest probability (omission).

The findings reviewed in the earlier sections of this article are consistent with Carver and Scheier's (1998) dimensional model and with the model of Rolls (1999, 2005). Among models that are explicitly dimensional, apparently only Carver and Scheier's model fits these findings. Thus, if one's conceptual preference is

[1] Figure 1A has been simplified from the model of Watson and Tellegen (1985), to focus on the affects closest to the ends of its constituent dimensions rather than to focus on the fact that the full model forms a circumplex. Figure 1C is drawn to facilitate comparison with the other panels, and to indicate that the two motivational tendencies are presumed to be relatively independent, but no implication of a circumplex is intended. In one respect, Figure 1C is misleading as a representation of the theory (see Carver, 2004, or Carver & Scheier, 2008, for a more elaborated representation of approach-related affects). Specifically, anger and depression are both seen as potential consequences of doing poorly at approach; which one emerges is presumed to be a function of how poorly approach is going and, thus, whether the reward seems attainable (the theory of Rolls, 1999, 2005, addressed next, makes a related distinction). Carver and Scheier's (2008) viewpoint thus is dimensional in the sense of being predicated on a dimension of system functioning (from very well to very poorly), but the affects themselves are not necessarily dimensional (i.e., depression is not simply a more intense state of frustration or anger). The affects may be thought of as nonlinear consequences of linear variation in system functioning.

Figure 1 (opposite). Four dimensional views of affects. (A) Simplified version of the circumplex model of positive and negative affect, showing only the main axes and affects that fall at extremes of each dimension, adapted from Watson and Tellegen (1985). The crossing point in this diagram is the midpoint on each dimension, rather than neutral-affect points; absence of each class of affect occurs at the low end of each dimension. (B) Dimensions of positivity and negativity, adapted from Cacioppo et al. (1999), that are presumed to form evaluative space. The neutral point here is the point where the dimensions intersect, with both affects at low levels. (C) Dimensions of approach-related and withdrawal-related affects postulated by Carver and Scheier (1998, 2008). The crossing point in this diagram represents neutral points on both dimensions. (D) Affects postulated by Rolls (1999, 2005) to be associated with different reinforcement contingencies (adapted from Rolls, 2005). Rolls indicated explicitly that he was not intending to display a dimensional scheme, but his depiction aligns the affects in terms of delivery of an event (one line) versus omission or termination of an event (the other line). The crossing point in this diagram represents a neutral point where neither reward nor punishment is being either delivered or omitted. (E) The vectors of Rolls's figure here are realigned in terms of reward (occurring or not) versus punisher (occurring or not). This alignment creates a pattern quite similar to that shown in Panel C. *Note*. Panel A is adapted with permission from "Toward a Consensual Structure of Mood," by D. Watson and A. Tellegen, 1985, *Psychological Bulletin, 98,* p. 221, Copyright 1985 by the American Psychological Association. Panel B is adapted with permission from "The Affect System Has Parallel and Integrative Processing Components: Form Follows Function," by J. T. Cacioppo, W. L. Gardner, and G. G. Berntson, 1999, *Journal of Personality and Social Psychology, 76,* p. 842, Copyright 1999 by the American Psychological Association. Panels D and E are adapted with permission from *Emotion Explained* (p. 14), by E. T. Rolls, 2005, Oxford University Press (Oxford, England).

for a dimensional model, that particular one is superior in accounting for the evidence reviewed here concerning anger.

It is also the case, however, that the findings are also consistent with many models that are not dimensional. Consider appraisal models. The matrix of possibilities just described with respect to the Rolls theory (reward vs. punishment crossed by occurrence vs. omission) also appears in the writings of Roseman, an appraisal theorist (e.g., Roseman, 1991; Roseman et al., 1996). The structure of emotions hypothesized by Roseman et al. (1996) assumes appraisals of the motivational direction (whether the outcome at issue is appetitive or aversive), whether the outcome is consistent with the motivation (success) or inconsistent with it (failure), and relative certainty of the outcome's occurrence. In addition are variations in the degree to which the outcome is appraised as controllable and the extent to which it is caused by the self, another person, or circumstances. Combinations of attributes result in different affective experiences.

In that model, the combination of an appetitive motive, a motive-inconsistent outcome, high control potential, and appraisal of cause by circumstances, is said to result in frustration; change the cause appraisal to another person, and the result is anger. That pattern of appraisals incorporates the conditions identified by Rolls (1999, 2005) and elaborates on it. That pattern of appraisals is also consistent with the evidence reviewed earlier, though most of the evidence reviewed did not distinguish between anger and frustration.

Roseman is not alone among appraisal theorists in incorporating motivational direction in the binding of valence to other qualities to create affect. For example, Oatley and Johnson-Laird (1987) similarly linked anger to blockage of a goal or plan and linked anxiety to threats to self-preservation. On the other hand, motivational direction is not seen as a key issue by all appraisal theorists. For example, Scherer (1984; Ellsworth & Scherer, 2003) has focused on the role of goals in affective experiences and has made distinctions among goals, but has not seen appetitive versus aversive motivation as an important distinction. Ortony et al. (1988) did not distinguish among undesired outcomes either; they specifically addressed Crisis goals (which concern derailing threats to the preservation of desired states of affairs, p. 41), but in their portrayal these goals seem to be approach goals in the service of other approach goals. Thus, appraisal theories as well as dimensional theories diverge on what variables should be taken as focal.

One implication for appraisal theories of the evidence reviewed here seems to be that this distinction between motivational directions is indeed important. The evidence thus suggests merits of appraisal theories that do incorporate this distinction over those that do not.

Although not all appraisal theories include this distinction, the fact that some do suggests a potential for integrating across what sometimes seems to be a conceptual chasm between discrete-emotion and dimensional views. Roseman's theory is one of discrete emotions but, as noted, two of the appraisal qualities he treats as critical are conceptually very similar to parameters in Carver and Scheier's (1998) dimensional view. Both assume a key role for the distinction between appetitive and aversive motivations, and both refer to successful and unsuccessful outcomes (as does Higgins, 1997). The views differ with respect to what outcomes are under consideration—Roseman (1991) typically focuses on ultimate outcomes, whereas Carver and Scheier (1990, 1998) focus on progress toward those ultimate outcomes—but this difference is minor in this context.

A convergence between dimensional and discrete-emotion viewpoints, which often seem so different from one another, would seem to be highly desirable. We note, in this regard, that this particular convergence follows specifically from Carver and Scheier's (1998) dimensional model. There is no obvious way to derive it from dimensional models in which affects of positive valence relate solely to approach and affects of negative valence relate solely to avoidance. Thus, this particular dimensional approach has one more benefit: fostering convergence among conceptual viewpoints with very different origins.

Further Questions

Several questions can be raised about the conclusions drawn from this review.

Approach Motive as Precondition to, or Consequent to, Anger

One question is this: Does the experience of anger require the engagement of an approach motivational tendency as a precondition? Or is the approach tendency instead only a response *to* anger? That is, perhaps anger has its origin in some process that has no relation to approach, but once anger is elicited, approach motivation is engaged.

Some of the evidence pertaining to approach tendencies reviewed here clearly does represent responses to anger, but not all. For example, Harmon-Jones and Peterson (2008) found that BAS scores predicted an aggressive response to an insult, but did so best when the participants had received an approach prime. Thus, the approach tendency was engaged first.

Nonetheless, if an approach motive is actually a precondition to anger, a state of anger would have to reflect disruption of attaining or maintaining an incentive of some sort. For any specific case, then, one must identify the goal or incentive whose disrupted attainment produces the anger. Some cases of goal disruption are easily specified. Sometimes anger arises when the person who is on the way to a specific goal encounters an obstacle. Anger promotes the attempt to remove or overcome the obstacle, in service to attaining the goal. If the person were not in pursuit of that goal, the obstacle would not matter and anger would not occur.

Other cases are more difficult. Sometimes anger seems to occur in the absence of any obvious goal pursuit. For example, an insult may come unexpectedly, when a person is doing nothing in particular. However, it can be difficult to know a priori what goals and values are in place in the person's psychological space. People have goals that represent values to be adhered to continuously, rather than representing end points of specific actions (Interest goals; Ortony et al., 1988). Sometimes a verbal attack is upsetting precisely because it disrupts (frustrates) the person's continuing desire to be regarded favorably (cf. Berkowitz, 1989). People and situations vary in the extent to which the desire for favorable evaluation is salient as a motive, but certainly this motive is generally at work under the surface for most people. When problems arise with regard to it, it can quickly become more salient or focal.

The desire to be regarded favorably is not the only incentive that can be invoked in this kind of situation. There is also evidence that hostile aggression sometimes represents an attempt to restore a preexisting desired condition of equity between individuals that one person disrupted (Green & Murray, 1975). More recently, an argument has been made that a great deal of angry aggression is motivated by the desire to maintain a sense of honor (Cohen, Nisbett, Bowdle, & Schwarz, 1996; Nisbett & Cohen, 1996; Vandello & Cohen, 2003). When that sense of honor is sullied or disrupted, anger and aggression are the result. Consistent with this line of thought, Tiedens (2001) found that a person who expresses anger is accorded greater status by observers. Schectman and Horowitz (2006) found that assertive people who believed themselves to be interacting with a dominating partner expressed anger in response. In short, we do not see a great deal of difficulty in pointing to desired conditions that are sometimes disrupted or interfered with, resulting in anger (see also Frijda, 2007, Table 8.1).

Aversive Yielding to Appetitive?

Nonetheless, is it possible that the precipitating event in all these cases begins with a response of the aversive system, and that the incentive system is engaged only later? Perhaps the aversive system is intrinsically engaged by pain, frustration, insult, or the like (Gray, 1990, 1994b), and the initial aversive reaction subsequently promotes an appetitive reaction. This is a more subtle version of the argument that the approach tendency is only a response to anger rather than a partial determinant of it. In this view, even frustration of pursuit of a desired goal is not fundamentally about the approach tendency, but about avoidance of the undesired condition. This view appears ultimately to rest on the assumption that any negatively valenced experience must *necessarily* involve the aversive motivational system, which ultimately is tautological.

People sometimes hold that the aversive motivational system is responsible for responses to all negatively valenced experiences because positive and negative reinforcement function in similar ways in conditioning. Does that mean that the omission of a reward is identical to the delivery of a punishment? No (see Rolls, 2005). There is evidence that failure in the attempt to *promote* an outcome leads to different emotional experience than does failure in the attempt to *prevent* the opposite outcome (Higgins, 1997), despite the fact that the emotions in both cases are negative in valence. Trying to be liked is not the same as trying to avoid being disliked; trying to succeed is not the same thing as trying to avoid failing (cf. Atkinson, 1957; Elliot, 2005). These two classes of motives in many cases yield differences in important outcomes when failure does occur (see Elliot, 2008, for broader treatment).

The literature reviewed here does not hold much support for the argument that all states of anger begin with the engagement of the aversive motivational system. Indeed, it was relatively rare for the aversive system to emerge at all as a correlate of anger in these studies, except when both anger and anxiety were evoked at the same time. It is possible that this failure is attributable to an issue of timing: that the involvement of the aversive system is immediate and relatively fleeting, and that the data were recorded after its involvement had been superceded. We have no way to rule this possibility out from the studies reviewed. If this happens, however, it must occur quickly, because greater relative left frontal activation during anger has been recorded during the first 3 s of anger evocation (Harmon-Jones, 2007; Harmon-Jones et al., 2006). Indeed, Putman et al. (2004) found that BAS sensitivity related to attentional engagement toward angry faces even when the angry faces were presented below conscious levels of detection.

Only Approach?

Does anger derive only from thwarted approach tendencies? Do not events that are purely punishing, purely painful also produce anger? Imagine someone holding your hand down on a plate that delivers painful electric shocks. Does this experience create anger? If so, is the anger a response to the pain, or is it a response to something about the context in which the pain occurs?

Sorting out the elements of such a situation is a complex task (see Berkowitz & Harmon-Jones, 2004, for broader treatment of issues involved). In some respects, this situation seems analogous to those, described earlier from the animal literature, that yield defensive aggression. That is, pain may promote aggression toward the person inflicting the pain, but it can still be unclear whether the aggression implies anger or is rather an instrumental effort to remove the pain through the most effective means possible. It may also be that anger in this kind of situation does occur but reflects factors other than the pain per se. If the pain is being inflicted arbitrarily or unjustly, anger may concern the arbitrary injustice, an infringement on a desired state. In the end, the question of whether pain (without any appraisal of the meaning of the pain-causing event) produces anger is very difficult to answer.

Why Are Anger and Fear So Closely Related?

If anger is fundamentally different from fear, as the evidence reviewed here suggests, why are anger and fear so often closely related empirically? In Watson and Tellegen's (1985, 1999) dimensional model, and in Russell's (1980, 2003; Russell & Barrett, 1999) circumplex as well, anger and fear appear at virtually the same place: high in activation and negative in valence. Why do these affects align so closely, if they are not produced by the same system?

There are several likely reasons. One is their descriptive similarities in valence and activation. If people construct their affective experience from these qualities as core constituents (Russell, 2003), it is entirely natural that they would align closely despite their very important functional differences.

Another possibility is that the affects also co-occur with relatively high frequency because of the nature of the contexts in which they occur. Threats of punishments to be avoided often are correlated in real life with impediments to desired conditions (Carver, 2004, Studies 2 and 3). A person who has just disrupted your good social standing (eliciting anger) may also want to cause you pain (eliciting fear). It is likely that approach and avoidance motivational qualities are often aroused simultaneously; as a consequence, anger and fear would exist simultaneously, or nearly so. There remain arguments about whether mixed feelings are simultaneous or oscillating (cf. Larsen, McGraw, Mellers, & Cacioppo, 2004), but for present purposes that issue is unimportant. In a given behavioral epoch, anger and fear can both be present; if so,

they thus are likely to correlate strongly in a self-report of the experience.

Another consideration is that most of the evidence showing co-occurrence of these feelings comes from contexts in which the feeling qualities were not very intense. The majority of that evidence may reveal information about relationships among affects when people are not feeling strong affects. This issue may be particularly relevant to negative affective situations, because negative affects are presumed to last only a short period of time. For instance, Watson (2000) wrote,

> negative moods should remain at relatively low, baseline levels during the bulk of everyday life . . . However, when confronted with a threat or crisis, the individual should experience a sudden, sharp increase in negative mood that is designed to help resolve the crisis . . . After the crisis has passed, negative mood should return quickly to its basal level. (pp. 81–82)

Many past factor-analytic studies have found anger or hostility to be located within NA and unrelated to positive affect (PA; Watson & Clark, 1994). Those studies examined hostility in the absence of specific anger-inducing situations (Watson & Clark, 1994); the mean rating of hostility was just below 2 on a rating scale ranging from 1 (*very slightly or not at all*) to 5 (*extremely*). Hostility thus was close to the psychological floor. Perhaps the relationships between these affects differ during the experience of a strong affective state (such as anger) than during a more neutral state.

To our knowledge, no previous research has examined the relationship of PANAS with other affects *during the experience of anger*. Several recent studies, however, assessed PANAS items along with anger words following the experimental manipulation of anger (Harmon-Jones, Harmon-Jones, Abramson, & Peterson, in press). Five studies using three different types of anger evoking events revealed that experimental manipulations of anger caused increases in both self-reported anger and overall PA, which were correlated with each other. Importantly, these studies also revealed that the manipulations of anger reduced happiness, and that anger was inversely related to happiness, whereas PA was positively related to happiness.

Summary

This article reviewed a range of evidence that anger as a negative affect derives from, or relates to, an approach-oriented motivational system. This approach system appears to involve activations in the left anterior areas of the cerebral cortex. The evidence appears to support the view that those cortical areas are involved in approach motivational functions, rather than in a positive valence of affective experience.

This accumulation of evidence also reveals a problem with a dimensional model of affect that treats the dimensions as unipolar. The problem is that such a model does not have a basis for the existence of negative affect arising within the approach process. There appear to be at least two ways to interpret this pattern. One of them is to take a discrete-emotions view, in which the nature of anger as an affect is defined partly by disrupted approach. From that way of thinking, there is no reason to be concerned about the combination of negative valence and approach motivation.

A second way to interpret the evidence uses a dimensional model in which the affects associated with approach are arrayed along a dimension of doing well at goal attainment to doing poorly at goal attainment. This kind of model assimilates the findings reviewed here because it explicitly assumes that approach efforts can relate to affects of both valences.

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