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Trait anger predicts relative left frontal cortical activation to anger-inducing stimuli ☆

Eddie Harmon-Jones

Texas A&M University, Department of Psychology, 4235 TAMU, College Station, TX 77843-4235, United States

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Abstract

Building on past research that has suggested that relatively greater left frontal cortical activity is associated with approach-related anger and that individuals who are high in trait anger are more likely to evidence angry responses, the present research tested whether individuals high in trait anger would be more likely to evidence relatively greater left frontal cortical activity in response to anger-eliciting pictorial stimuli. In the experiment, participants were exposed to pictures intended to evoke anger, fear/disgust, positive, or neutral affective reactions. Electroencephalographic (EEG) activity was recorded continuously, and alpha power was derived from the EEG to measure cortical activity. Trait anger was measured using the Buss and Perry Aggression Questionnaire [Buss, A.H., Perry, M., 1992. The aggression questionnaire. Journal of Personality and Social Psychology, 63, 452–459]. Results revealed that trait anger was positively related to greater relative left frontal cortical activity to anger-evoking pictures but not to other types of pictures.

Keywords: Anger; Left frontal cortical activity; Aggression

1. Introduction

Over the past three decades, research using a variety of methodologies has revealed that the left and right frontal cortices are involved in different emotional or motivational processes (for recent reviews, see Coan and Allen, 2004; Pizzagalli et al., 2003). Early on, researchers suggested that relatively greater left frontal activity was associated with greater positive affect, whereas relatively greater right frontal activity was associated with greater negative affect (e.g., Ahern and Schwartz, 1985; Gotlib et al., 1998; Heller, 1990; Heller and Nitschke, 1998; Silberman and Weingartner, 1986). At the same time, researchers also suggested relatively greater left frontal activity was associated with greater approach motivation, whereas relatively greater right frontal activity was associated with greater withdrawal motivation (e.g., Fox, 1991; Harmon-Jones and Allen, 1997; Sutton and Davidson, 1997). Because affective valence and motivational direction was confounded in that research, the conceptual explanation was muddled.

To clarify this conceptual quagmire, researchers began to examine anger, because anger is typically thought to be a negative emotion that evokes approach motivation. Indeed, research has revealed that anger is experienced as negative (e.g., Harmon-Jones, 2004a) and that it is associated with approach motivation (e.g., Adams et al., 2006; Carver, 2004; Harmon-Jones, 2003; Putman et al., 2004). In examinations of anger and asymmetrical frontal cortical activity, studies have revealed that trait anger relates to relatively greater left frontal activity when measured at resting baseline (Harmon-Jones, 2004a; Harmon-Jones and Allen, 1998; Rybak et al., 2006). Other research has revealed that situational manipulations of anger evoke relatively greater left frontal activity (Harmon-Jones and Sigelman, 2001). Experiments have also revealed that manipulated increases of left frontal cortical activity via repetitive transcranial magnetic stimulation increase vigilant attention toward and memory for angry facial expressions (d'Alfonso et al., 2000; van Honk and Schutter, 2006). Moreover, research has independently manipulated anger and approach motivation and found that anger associated with approach motivation produces greater left

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E-mail address: eddiehj@gmail.com.

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frontal activity than equally intense anger that is not associated with approach motivation (Harmon-Jones et al., 2003). In addition, the importance of considering approach-related anger, as compared to other types of anger, has been demonstrated in trait anger research (Hewig et al., 2004).

The effect of approach motivation and anger on left frontal activity has recently been produced using pictorial stimuli that evoke anger (Harmon-Jones et al., 2006). In this experiment, participants low in racial prejudice were shown neutral, positive, and fear/disgust pictures from the International Affective Picture System (Lang et al., 1997). Mixed among those pictures were pictures depicting instances of racism and hatred (e.g., neo-Nazis, Ku Klux Klan). Prior to viewing the pictures, half of the participants were informed that they would write an essay on why racism is immoral, unjust and unfair at the end of the experiment. This manipulation served to increase their anger-related approach motivation. Results revealed that participants showed greater relative left frontal activity to anger pictures than other picture types only when they expected to engage in approach-related behavior.

Results such as these may suggest that relatively greater left frontal activity will occur in response to an angering situation only when there is an explicit approach motivational opportunity. However, it is possible that an explicit approach motivational opportunity is not necessary for increased left frontal activity to anger to occur, but that it only intensifies left frontal activity. In other words, there may be other features of the situation or person that make it likely that an angering situation will increase approach motivational tendencies and activity in the left frontal cortical region. One possibility along these lines is the personality characteristic of anger. That is, individuals who are chronically high in anger may evidence increased left frontal activity (and approach motivational tendencies) in response to angering situations that would not necessarily cause such responses in individuals who are not as chronically angry. This prediction is predicated on the idea that angry individuals have more extensive angry associative networks than less angry individuals, and that anger-evoking stimuli should therefore activate parts of the network more readily in these angry individuals (Berkowitz, 1990, 1993; Bower, 1981; Bushman, 1996). That is, among individuals high in trait anger, even mild anger cues might activate parts of the anger network, and through established associations, lead to angry expressive-motor responses, physiological reactions, feelings, thoughts, and memories.

Along the lines suggested by the cognitive neo-associative model of aggression (Berkowitz, 1990, 1993), research has revealed that participants high in trait anger show selective perceptual and cognitive biases toward angry words and facial expressions in Stroop-type and visual search tasks (Cohen et al., 1998; Eckhardt and Cohen, 1997; van Honk et al., 2001). However, no previous research has tested whether anger-evoking stimuli are more likely to activate neural structures involved in approach motivational tendencies in individuals who are high as compared to low in trait anger. Such results would extend our knowledge of the neural circuitry underlying angry individuals' enhanced likelihood of engaging in angry responses. Therefore, the primary goal of the current study was to assess whether individuals high in trait anger would show relatively greater left frontal cortical activation to mild anger cues even when explicit approach motivation opportunities were not made salient.

In the present study, participants were exposed to affective pictures used in previous research and found to evoke neutral, fearful/disgusting, positive, or angry affective reactions (Harmon-Jones et al., 2006). The current participants were given no explicit opportunities for approach-related behavior, but were instead simply informed that their brain wave responses would be recorded while they viewed pictures that might elicit various emotions. Following the completion of the viewing of the pictures and the simultaneous recording of EEG to the pictures, participants viewed the pictures a second time and rated how pleasant, aroused, and angry they felt while viewing each picture. Finally, they completed measures of trait anger and racism. It was predicted that individuals high in trait anger would be most likely to show increased relative left frontal activity to the anger-evoking pictures.

2. Method

Participants were 76 European American right-handed introductory psychology students (25 men and 51 women) at the University of Wisconsin — Madison. They participated in exchange for extra credit points. Gender did not interact with any of the results; therefore, it is not discussed further.

After greeting the participant, the experimenter explained that the session would involve a few tasks — viewing pictures of various types while brain waves were recorded and then completing personality questionnaires. Afterward, all participants viewed a series of pictures while EEG was recorded. The first three pictures presented were neutral practice trials and were not analyzed. Four types of pictures were presented in randomized order; there were 16 pictures of each type. Three of the types were obtained from the IAPS, and they were selected because they had been found to evoke negative (fear or disgust; e.g., bloody accident victims), positive (e.g., attractive couples), or neutral affect (e.g., neutral facial expressions) in past studies.[1] The fourth type was obtained from the internet (except two were from the IAPS); the pictures were selected because they evoke anger in individuals who were opposed to racism and prejudice (the same pictures were used in Harmon-Jones et al., 2006). Thus, these pictures depicted instances of racism and prejudice (e.g., Ku Klux Klan, Hitler, Neo-Nazis). Each picture trial consisted of a fixation cross presented for 1 s, a picture presented for 6 s, and an ITI of 14–19 s. After viewing

[1] IAPs picture numbers that were used are listed here. For negative (fear/disgust), the following pictures were used: 1050, 1090, 1200, 1300, 3060, 3150, 3400, 3550, 6230, 7380, 9250, 9300, 9405, 9500, 9620, and 9630. For positive, the following were used: 4608, 4611, 4641, 4653, 4658, 4659, 4670, 4672 (the penis was cropped out, to avoid the possibility of making some participants uncomfortable), 5470, 5621, 5626, 7270, 8080, 8170, 8190, and 8370. For neutral, the following were used: 2190, 2200, 2440, 2480, 2500, 2620, 2850, 2880, 7000, 7004, 7006, 7010, 7020, 7031, 7080, and 7175. For anger, 9800 and 9810 were used; the other 14 were found on the web and can be obtained from the author.

the pictures, participants viewed each a second time and rated them on pleasantness, arousal, and anger (1 = not at all to 9 = extremely).

Participants then completed a packet of questionnaires that included the Attitudes toward Blacks scale (Brigham, 1993) and the Buss and Perry (1992) Aggression Questionnaire. These questionnaires were completed after the pictures to prevent potential effects of priming of these constructs on responses to the pictures. The Attitudes toward Blacks scale includes items such as, "Black and White people are inherently equal" and "It would not bother me if my new roommate was black." Responses to this scale were given on a 1 (strongly disagree) to 7 (strongly agree) scale. Participants' responses were averaged to produce the Attitude toward Blacks score, with higher scores indicating lower levels of prejudice. The Aggression Questionnaire is composed of four factors: (1) physical aggression, which assesses the frequency of acting aggressively; (2) verbal aggression, which assesses the frequency of behaving verbally aggressively; (3) anger, which assesses the emotional component of aggression; and (4) hostility, which assesses the cognitive component of aggression that can be described as "feelings of ill will and injustice." (Buss and Perry, 1992, p. 457). Our primary focus is on the anger subscale, as it has been found to relate to relative left frontal activity at resting baseline (Harmon-Jones, 2004a) and to trait behavioral approach sensitivity (Harmon-Jones, 2003). After participants completed these questionnaires, they were questioned about their reactions and told of the purpose of the study.

2.1. EEG recording and analyses

To record EEG, 27 (22 homologous and 5 midline) electrodes mounted in a stretch-lycra electrode cap (Electro-Cap, Eaton, OH) were placed on the participant's head using known anatomical landmarks. EEG was recorded from the frontal, central, temporal, parietal, and occipital regions of the brain (and regions in between), using the 10% electrode system (Chatrian et al., 1985). The ground electrode was mounted in the cap on the mid-line between the frontal pole (Fpz) and the frontal site (Fz). The reference electrode was placed on the left ear (A1), and data were also acquired from an electrode placed on the right ear (A2), so that an off-line digitally derived, averaged-ears' reference could be computed. Eye movements (EOG) were also recorded to facilitate artifact scoring of the EEG. EOG was recorded from the supra- and sub-orbit of the left eye, to assess vertical eye movements, and from the left and right outer canthus, to assess horizontal eye movements. All electrode impedances were under 5000 Ω, and homologous sites (e.g., F3 and F4) were within 1000 Ω of each other. Electro-Gel (Eaton, OH) was used as the conducting medium. EEG and EOG were amplified with Neuroscan Synamps (Herndon, VA), bandpass filtered (0.1 to 100 Hz; 60 Hz notch filter enabled), digitized at 500 Hz, and stored onto a computer. Prior to running each participant, 400 μV 20 Hz calibration signals were run and inspected.

The EEG and EOG signals were visually scored and portions of the data that contained eye movements, muscle movements, or other sources of artifact were removed (data from all channels were removed at that point in time). Derived averaged-ears reference data were used for further data reduction (Hagemann, 2004). All artifact-free epochs that were 1.024 s in duration were extracted through a Hamming window, which was used to prevent spurious estimates of spectral power. Contiguous epochs were overlapped by 75%, to minimize loss of data due to Hamming window extraction. A fast Fourier transform (FFT) was used to calculate the power spectra. These power values were averaged across the 1.024-sec epochs of a given trial. Because alpha power is inversely related to cortical activity (Cook et al., 1998; Goldman et al., 2002; Lindsley and Wicke, 1974), total power within the alpha (8–13 Hz) frequency range was obtained. The power values were log transformed for all sites, to normalize the distributions.

As in previous research (Harmon-Jones et al., 2002, 2006), a frontal asymmetry index [natural log right minus natural log left alpha power] was computed for 0–3 s of each picture, using mid-frontal, lateral frontal, and frontal temporal sites (F3/4, F7/8, Ft7/8).[2] For comparison purposes, asymmetry indexes for the other sites (Fp1/2, Fc3/4, T3/4, T5/6, C3/4, Cp3/4, P3/4, O1/2) were also computed. Because alpha power is inversely related to cortical activity, higher scores on the indexes indicate greater relative left hemisphere activity.

3. Results

3.1. Overall analyses without consideration of individual differences

3.1.1. Asymmetrical frontal activity

A repeated measures ANOVA on relative left frontal activity (average of F3/4, F7/8, Ft7/8) to neutral, fear/disgust, positive and angry pictures revealed a non-significant effect, $F(3, 225) = 1.26$, $p = 0.29$. Separate ANOVAs on individual asymmetry indexes over the whole head revealed non-significant effects, p's > 0.20. However, the asymmetry index at anterior temporal sites (T3/4) approached significance, $F(3, 222) = 2.42$, $p = 0.07$,[3] with the response to anger pictures differing from all other picture types (see Table 1). Moreover, frontal pole and frontal asymmetry indexes (Fp1/2, F3/4, F7/8, and Ft7/8) all produced non-significant overall effects (p's > 0.10). In each case, the means were in the direction of anger pictures evoking relatively greater left frontal activity than the neutral and negative pictures, as shown in Table 1. This failure to find asymmetrical frontal activations to differ as a function of type of affective stimuli is consistent with past research (Canli, 1999; Murphy et al., 2003; Pizzagalli et al., 2003), and replicates past anger results in conditions where participants were not given an explicit approach opportunity (Harmon-Jones et al., 2006).

[2] Only the first 3 s of picture viewing were analyzed because I was interested in examining the immediate response to the picture. Also, startle probes were presented at 3.5 s on some trials; those data are not presented here.

[3] Degrees of freedom differ in some analyses because of loss of EEG data due to high impedances at certain electrode sites or because participants failed to complete all of the items on particular questionnaires.

Table 1
Means and standard deviations (in parentheses) for asymmetry indexes at anterior temporal (T3/4) and lateral frontal (F7/8) sites

Site	Picture type			
	Anger	Negative	Neutral	Positive
T3/4	0.040635 $(0.32)_a$	−0.002797 $(0.32)_b$	−0.006276 $(0.31)_b$	−0.012672 $(0.34)_b$
F7/8	0.037300 $(0.30)_a$	0.000475 $(0.32)_b$	0.003664 $(0.32)_b$	0.020643 $(0.31)_a$

Note. Within rows, means with different subscripts differ by $p<0.05$ (one-tailed).

3.1.2. Independent estimates of left and right activity

Next, we explored whether significant effects emerged at separate left and right sites. That is, the above results concerned asymmetrical activations, whereas the below concern independent estimates of left and right activity. A 2 (hemisphere) × 4 (picture type) repeated measures ANOVA was performed on frontal and anterior temporal sites. The ANOVA involving anterior temporal sites revealed a significant main effect of picture type, $F(3, 222)=3.73$, $p<0.02$, and a significant picture type by hemisphere interaction, $F(3, 222)=4.19$, $p<0.01$. The interaction indicated that only within the anger pictures did the left and right hemispheres differ significantly ($p<0.05$). No frontal sites showed significant effects involving affective picture types.

3.1.3. Reported affective reactions

A repeated measures one-way ANOVA on anger ratings revealed a significant effect of picture type, $F(3, 198)=213.98$, $p<0.001$. Reported anger was greatest to racism pictures, and next greatest to fear/disgust pictures. Reported anger was lowest to positive and neutral pictures and they did not differ from one another (see Table 2). Significant effects also emerged for pleasantness ratings, $F(3, 195)=366.95$, $p<0.001$, and arousal ratings, $F(3, 195)=95.347$, $p<0.001$. Means and comparisons are in Table 2.

3.2. Individual difference predictors of EEG and reported affective reactions

Our primary prediction was that trait anger would predict relative left frontal activation to the anger-evoking pictures. Because the degree to which the racism-related pictures should evoke approach motivation and relative left frontal activity will depend on individual differences in attitudes toward Blacks, individual differences in attitudes toward Blacks were statistically controlled. Also, individual differences in relative left frontal activity were controlled by entering frontal asymmetry to neutral pictures as a predictor. Thus, the regression analysis contained attitudes toward Blacks, relative left frontal activity to neutral pictures, and trait anger as predictors of relative left frontal activity to anger pictures.

The overall analysis was significant, $R^2=0.72$, $F(3, 66)=55.96$, $p<0.001$. Relative left frontal activity to neutral pictures was a significant predictor, $\beta=0.82$, $t\,(66)=12.44$, $p<0.001$, and attitudes toward Blacks was a marginally significant predictor, $\beta=0.12$, $t\,(66)=1.72$, $p=0.09$. More importantly, trait anger was a significant predictor, $\beta=0.14$, $t\,(66)=2.12$, $p<0.04$. See Fig. 1 for a scatterplot of the zero-order correlation of trait anger and relative left frontal activity to anger pictures. Inclusion of state anger in this regression did not alter the results, and state anger was not a significant predictor of left frontal activity to anger pictures, p's>0.25.

Two additional regression analyses were performed with frontal asymmetry to disgust/fear pictures and positive pictures as criteria and the same predictors as above. They revealed that trait anger was not a significant predictor of asymmetrical frontal cortical activity to fear/disgust pictures or positive pictures, p's>0.25.

Additional regressions were performed with physical aggression, verbal aggression, and hostility substituted for anger as a predictor of asymmetrical frontal activity to anger pictures (in the same regression models as conducted for anger). Physical and verbal aggression were non-significant predictors, p's>0.20. These results are consistent with our past trait research that has revealed anger to be more strongly related to resting frontal asymmetry than trait aggression (e.g., Harmon-Jones and Allen, 1998). Trait physical aggression and verbal aggression may not solely tap approach motivation. For example, aggression may result from defensive motivation and may not be motivated by angry, approach-related motivation. Hostility, however, emerged as a significant predictor, $\beta=0.18$, $t\,(67)=2.68$, $p<0.01$.

Because of the significant effects that were observed with asymmetrical activity at anterior temporal sites as a function of picture type, trait anger, attitudes toward Blacks, and relative left

Table 2
Means and standard deviations (in parentheses) for reported affective reactions to pictures

Rating	Picture type			
	Negative	Positive	Neutral	Anger
Anger	$3.96\ (1.82)_a$	$1.24\ (0.42)_b$	$1.20\ (0.33)_b$	$5.71\ (1.96)_c$
Pleasant	$1.92\ (0.76)_a$	$6.52\ (1.20)_b$	$4.76\ (1.39)_c$	$2.07\ (1.02)_a$
Arousal	$3.84\ (2.29)_a$	$5.01\ (1.59)_b$	$1.88\ (1.01)_c$	$3.50\ (2.36)_a$

Note. Within rows, means with different subscripts differ by $p<0.05$ (two-tailed).

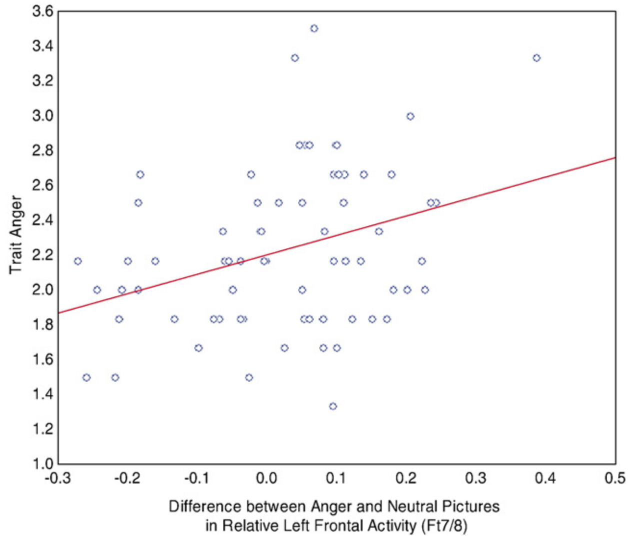

Fig. 1. Scatterplot of zero-order correlation of trait anger and asymmetrical frontal cortical activity to anger pictures.

anterior temporal activity to neutral pictures were analyzed as predictors of relative left anterior temporal activity to anger pictures. The overall analysis was significant, $R^2=0.75$, $F(3, 65)=66.55$, $p<0.001$. Relative left anterior temporal activity to neutral pictures, $\beta=0.89$, $t\,(65)=14.13$, $p<0.001$, and trait anger predicted relative left anterior temporal activity to anger pictures, $\beta=0.18$, $t\,(65)=2.76$, $p<0.01$. Trait hostility and aggression were non-significant predictors of relative left anterior temporal activity to anger pictures.

Additional regressions analyses were performed with individual sites as criteria. None of these regressions revealed significant effects of anger on individual frontal sites, suggesting that the relative difference between left and right frontal cortical activity (the asymmetry) was more affected by picture type and trait anger.

3.2.1. Reported affective reactions

For reported anger reactions to the anger pictures, trait anger did not emerge as a significant predictor in regression analyses with reported anger to neutral pictures and attitudes toward Blacks also in the equation as predictors. However, the overall effect was significant, $R^2=0.22$, $F(3, 63)=5.96$, $p<0.01$, with only attitudes toward Blacks emerging as a significant predictor, $\beta=0.40$, $t\,(63)=3.49$, $p<0.01$.[4]

4. Discussion

In general, in the present study, the affective pictures did not evoke reliable shifts in asymmetrical frontal cortical activations. Several past studies using similar affective stimuli have also failed to produce such activations, leading some scientists to question the validity and replicability of past research that has found asymmetrical frontal activation to emotional stimuli. In the present experiment, at the level of all participants, we did not observe significant effects of affective stimuli on asymmetrical frontal cortical activations. However, we did observe a marginally significant effect of picture type on cortical asymmetry at the anterior temporal sites, with anger pictures producing greater relative left anterior temporal activity than other picture types. Effects of affective manipulations on anterior temporal asymmetry have been observed in some past research (Davidson et al., 1990; Ekman and Davidson, 1993), though they are not as common as effects at more frontal sites.

However, recent research has strongly suggested that asymmetrical frontal cortical activations are due to motivational direction and not affective valence. Therefore, manipulations of affect will not inevitably produce asymmetrical frontal activations because not all affective manipulations induce approach or withdrawal motivation (of at least sufficient intensity to be assessed at frontal sites). Recent experiments have found that manipulations of approach-related action expectations cause greater relative left frontal activations (Harmon-Jones et al., 2003, 2006). In the present study, we extend these results by showing that trait angry individuals, who are particularly likely to evidence approach motivation in response to anger-producing situations, are more likely to show increased left frontal activation to anger-producing stimuli. Together with recent experimental research, this study suggests that asymmetrical frontal cortical activations to affective stimuli are reliable and valid as long as the intensity of motivational direction is seriously considered.

Future research with other negative and positive emotional stimuli may benefit by considering the present results. That is, based on the current results and the results of Harmon-Jones et al. (2006), it could be predicted that positive emotional pictures would most likely activate the left frontal cortex for individuals with enhanced motivational sensitivity for such emotional cues or when approach motivation is evoked in the situation (see e.g., Gable and Harmon-Jones, submitted for publication).

In addition to contributing to a better understanding of affect and asymmetrical frontal cortical activity, the present research contributes to a more thorough understanding of trait anger. As anticipated by the cognitive neo-associative model of anger and aggression, individuals high in trait anger were more likely to show evidence of activation of part of the anger-aggression network upon encountering a mild cue for anger. The present results are the first to demonstrate that part of the neural circuitry of approach motivation – relative left frontal cortical activity – is more easily activated in angry individuals than in less angry individuals in response to anger-evoking stimuli.

4.1. Questions about state anger

That trait anger did not predict self-reported anger responses to the racism-related pictures may indicate that the self-reported anger reactions did not accurately reflect experienced anger. The mean anger reported was almost 6 on a 9-point scale, where 9 indicated extremely angry. In past research in which participants have been insulted directly for work they had done in a 10-min period (Harmon-Jones and Sigelman, 2001) and in research in which participants who paid a substantial portion of their own tuition were exposed to a communication that argued for a sizable tuition increase (Harmon-Jones et al., 2003), reported anger was not as high (approximately 2 on a 1-to-5-point scale and 3.5 on a 0-to-8 scale). It seems possible that participants in the current study who are relatively low in prejudice may over-report anger to the racism-related pictures because doing so is consistent with their non-prejudiced belief systems. The fact that trait non-prejudice related to state anger but that trait anger did not relate to state anger is consistent with this speculation. Because the state anger measure may have been contaminated by such self-presentational concerns, it may not provide a measure that would be useful in comparing state to trait anger in predicting relative left frontal activity to anger stimuli.

4.2. Conclusion

The current study, together with other research, suggests that the left frontal cortex is involved in approach motivated anger and

[4] These results are inconsistent with an interpretation that suggests that the completion of the trait anger measure after the picture viewing contaminated the results because of possible carryover or demand effects. That is, if participants who reported feeling very angry to the pictures overestimated their trait anger, it seems that the state anger ratings would have correlated with the trait anger ratings.

other approach motivational states and traits. This conclusion, however, is at odds with a view that the frontal cortex is only involved in the suppression of negative affect. The frontal cortex is a large and complex set of structures and it is likely involved in a number of psychological processes, some involving the suppression of negative affect (e.g., orbital frontal cortex), and some involving the expression of approach motivation (e.g., dorsolateral frontal cortex). The present results are difficult to interpret in terms of suppression as individuals high in trait anger were more likely to evidence increased left frontal activity to "socially appropriate" anger cues. As discussed previously (Harmon-Jones, 2004b), other anger results are also difficult to interpret in suppression terms. For instance, research by d'Alfonso et al. (2000) and van Honk and Schutter (2006) demonstrating that manipulation of left frontal activity affects anger responses in the same direction as the present results cannot be interpreted as being due to suppression.

The present study provides the first demonstration of a relationship between trait anger and relative left frontal cortical activation during an angering situation. Thus, the results have theoretical and practical importance. Theoretically, the research is consistent with the cognitive neo-associationistic model of anger and aggression in demonstrating that individuals high in trait anger show neural activation of part of the angry-aggressive network even in response to mild anger cues. Practically, the results suggest that treatments aimed at increasing relative left frontal activity, as is currently being done in the treatment of depression, may have the unfortunate consequence of increasing approach-related anger.

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