Research Article

aps ASSOCIATION FOR PSYCHOLOGICAL SCIENCE

Psychological Science
21(8) 1098–1105

DOI: 10.1177/0956797610375450
http://pss.sagepub.com
SAGE

Keeping Your Eyes on the Prize: Anger and Visual Attention to Threats and Rewards

Brett Q. Ford[1], Maya Tamir[1], Tad T. Brunyé[2,3], William R. Shirer[2,3], Caroline R. Mahoney[2,3], and Holly A. Taylor[2]

[1]Boston College, [2]Tufts University, and [3]United States Army Natick Soldier Research, Development & Engineering Center (NSRDEC), Natick, Massachusetts

Abstract

People's emotional states influence what they focus their attention on in their environment. For example, fear focuses people's attention on threats, whereas excitement may focus their attention on rewards. This study examined the effect of anger on overt visual attention to threats and rewards. Anger is an unpleasant emotion associated with approach motivation. If the effect of emotion on visual attention depends on valence, we would expect anger to focus people's attention on threats. If, however, the effect of emotion on visual attention depends on motivation, we would expect anger to focus people's attention on rewards. Using an eye tracker, we examined the effects of anger, fear, excitement, and a neutral emotional state on participants' overt visual attention to threatening, rewarding, and control images. We found that anger increased visual attention to rewarding information, but not to threatening information. These findings demonstrate that anger increases attention to potential rewards and suggest that the effects of emotions on visual attention are motivationally driven.

Keywords

emotions, visual attention, motivation, rewards, threat

Received 9/17/09; Revision accepted 11/19/09

People's emotions signal to them what is important in their environment. Emotions influence how people think and act, in part by influencing how people view the world around them. Given the multitude of stimuli in the environment, the ability to selectively pay attention to important and relevant information is crucial for survival (van der Heijden, 1992). Attention, therefore, essentially ties cognition to emotion and motivation (Simon, 1994). There is substantial evidence for the link between emotion and visual attention (for reviews, see Mathews & MacLeod, 1994; Williams, Watts, MacLeod, & Mathews, 1997). However, the general mechanism that links emotion to visual attention has yet to be identified. The research presented in this article uncovered important aspects of this mechanism by testing the effects of anger on visual attention to threats and rewards.

Effects of Emotions on Visual Attention

Research studies on emotion and visual attention tend to focus on negative high-arousal emotions, such as fear and anxiety, and visual attention to threatening information (see Williams et al., 1997). The most consistent finding is that anxious individuals selectively attend to threats, rather than nonthreats (e.g., MacLeod, 1999; Mathews & MacLeod, 1985). Other studies have examined the effect of positive high-arousal emotions, such as excitement and happiness, on people's visual attention to rewarding information. Specifically, there is evidence to suggest that happy or excited individuals selectively attend to rewards, rather than nonrewards (Tamir & Robinson, 2007).

At least two different theoretical accounts could explain such findings. The first account is based on two-dimensional frameworks of affect (e.g., Lang, Bradley, & Cuthbert, 2008; Tellegen, 1985), according to which emotions can be organized by the dimensions of valence (positive vs. negative) and engagement (high vs. low; e.g., Mogg & Bradley, 1998). In this valence-based account, emotional states that reflect increased engagement (i.e., those high in arousal) bias visual attention by prioritizing the processing of information that is consistent with the valence of the emotional state. For example, anxiety is associated with increased engagement and is

Corresponding Author:
Brett Q. Ford, Department of Psychology, Boston College, 140 Commonwealth Ave., Chestnut Hill, MA 02467
E-mail: fordbc@bc.edu

negatively valenced. Therefore, according to the valence-based account, anxiety should increase attention to threatening information, and excitement (although positively valenced) should increase attention to rewarding information, as it is also associated with increased engagement.

In the second theoretical account, emotions can be organized according to the two basic motivational systems of approach and avoidance. Emotions such as anxiety and fear reflect an active avoidance system, whereas emotions such as excitement and happiness reflect an active approach system (Cacioppo, Gardner, & Berntson, 1999; Carver & Scheier, 1998; Watson, Wiese, Vaidya, & Tellegen, 1999). According to the motivation-based account, emotional states that reflect an active motivational system should bias visual attention by prioritizing the processing of motivationally relevant information (van der Heijden, 1992). Anxiety, for example, should increase attention to threatening information because it is associated with an active avoidance system, and excitement should increase attention to rewarding information, as it is associated with an active approach system.

The predictions of the valence-based and motivation-based accounts are identical regarding fear and excitement, because for these emotions, the effects of valence and the effects of motivation cannot be distinguished. The available evidence is therefore consistent with the predictions of both accounts. To determine whether the influence of emotional state on visual attention is valence based or motivation based, it is necessary to examine visual attention in the context of emotional states in which valence-based and motivation-based predictions do not overlap.

Testing the Effect of Anger on Visual Attention

Like fear and anxiety, anger is a negatively valenced emotion that is high in arousal. Unlike fear and anxiety, however, anger reflects an active approach motivational system (Carver & Harmon-Jones, 2009). According to the valence-based account, anger should increase attention to threats, as it is a negatively valenced emotion that is also associated with increased engagement with the environment. According to the motivation-based account, however, anger should increase attention to rewards, as it reflects an active approach system. We designed this study to test these alternative predictions by examining the effects of anger on visual attention.

Research has linked trait anger to paying selective attention to hostile information (e.g., van Honk, Tuiten, de Haan, van den Hout, & Stam, 2001; Wilkowski, Robinson, Gordon, & Troop-Gordon, 2007). Such work, however, does not address the potential effects of anger on selective attention to broadly construed threats and rewards. To date, no studies have examined the link between anger and selective attention to rewards. In addition, research has generally examined links between anger and hostile information, in particular, rather than links between anger and threatening information, broadly construed. Studies have also tended to examine trait anger, rather than state anger. Trait anger and state anger are conceptually distinct and may be differentially linked to cognitive processing (Wilkowski & Robinson, 2008). In this study, we therefore aimed to broaden the scope of research in this area, and tested the effect of state anger on participants' selective attention to threats and rewards.

We tested the effect of anger, fear, excitement, and a neutral emotional state on overt visual attention to threatening, rewarding, and control (i.e., neither threatening nor rewarding) information. Participants underwent an emotion induction, and we then measured their eye gaze to pairs of images. We expected participants in the fear condition to show increased attention to threats, and participants in the excitement condition to show increased attention to rewards. We expected participants in the anger condition to show increased attention to either threats or rewards, depending on whether the effect of emotion on visual attention depends on valence or motivation, respectively.

Method

Participants

Sixty-four male undergraduate students (mean age = 19.81 years, $SD = 1.41$) participated for monetary compensation.

Materials and procedure

Participants were randomly assigned to one of four emotion-induction conditions: anger, fear, excitement, or neutral. They were told that the study involved the effects of music and memory on visual attention and that they would be asked to recall a memory and listen to music before completing a visual attention task.

Participants then completed an eye-tracker calibration session. Eye tracking was performed with an iView X Hi-Speed system (SensoMotoric Instruments GmbH, Berlin, Germany), using monocular tracking at 1250 Hz (at < 0.01° tracking resolution and 0.25°–0.50° gaze-position accuracy). We performed a nine-point calibration using the integrated automatic calibration package included with the system, and repeated it until the average error between all points fell below 0.5°. All participants were at an approximate viewing distance of 80 cm.

After the eye-tracking calibration, we induced participants' emotions using a combination of autobiographical recall and emotion-eliciting music (e.g., Bradley, Mogg, & Lee, 1997). We first asked participants to write about an emotional event from their past in which they were angry (anger condition), were anxious and afraid (fear condition), were excited and happy (excitement condition), or felt little of any emotion (neutral condition). All participants were instructed to relive the event in their mind's eye as they wrote about it, for a total of 15 min.

Participants then listened to instrumental music corresponding to their emotion-induction condition for 5 min: Participants in the anger condition listened to angry music (e.g., "Refuse/Resist" by Apocalyptica, Tuppinen, 1998, track 5); participants in the fear condition listened to fearful music (e.g., "The Bone Dam" from the soundtrack *The Descent*, Julyan, 2006, track 12); participants in the excitement condition listened to exciting music (e.g., "Dreamoz," Hannan, 2002, side 1, track 8); and participants in the neutral condition listened to neutral music (e.g., "Indecision," Meyer et al., 2000, track 4).

Music pieces were selected based on the results of pilot testing, which confirmed that the angry music induced more anger in listeners ($M = 3.00$, $SD = 2.53$) than the exciting ($M = 0.12$, $SD = 0.64$), fearful ($M = 2.13$, $SD = 1.64$), or neutral music ($M = 0.17$, $SD = 0.42$), $t(106)$s > 2.10, p_{rep}s > .95, ds > 0.41. The exciting music induced more excitement in listeners ($M = 3.67$, $SD = 1.80$) than the angry ($M = 2.20$, $SD = 1.20$), fearful ($M = 2.40$, $SD = 1.45$), or neutral music ($M = 2.60$, $SD = 1.43$), $t(106)$s > 2.73, p_{rep}s > .96, ds > 0.66. Finally, the fearful music induced more fear in listeners ($M = 4.16$, $SD = 2.25$) than the angry ($M = 2.47$, $SD = 2.07$), exciting ($M = 0.60$, $SD = 1.10$), or neutral ($M = 0.71$, $SD = 1.11$) music, $t(106)$s > 3.48, p_{rep}s > .99, ds > 0.78.

Participants then began the study's eye-tracking phase, and were instructed to carefully study image pairs presented for 2 s each on a 19-in. computer monitor (1280 × 1024 resolution). Each participant viewed 27 image pairs. Fifty-four color images were selected from the International Affective Picture System (Lang et al., 2008)—18 from each of the following three categories: rewarding (e.g., erotic couples, rushing waterfalls), threatening (e.g., people yielding weapons, mutilated bodies), and control (e.g., jet planes). Images in the three categories produced identical arousal responses (Ms = 6.38, SDs = 0.33, 0.27, and 0.28, respectively). Valence ratings varied significantly such that rewarding images were rated as the most pleasant ($M = 7.40$, $SD = 0.37$), threatening images were rated as the least pleasant ($M = 2.64$, $SD = 0.63$), and the ratings of control images fell in the middle ($M = 4.86$, $SD = 0.52$), $F(2, 53) = 381.9$, $p_{rep} > .99$ $\eta^2 = .94$.

To ensure that the three image categories did not differ in visual complexity, we asked participants in a pilot study ($N = 12$) to rate each image on complexity (1 = *very low*, 5 = *very high*; Brunyé, Mahoney, Augustyn, & Taylor, 2009). We conducted a repeated measures analysis of variance (ANOVA), and confirmed that there was no significant difference in visual complexity between the rewarding ($M = 3.17$, $SD = 0.59$), threatening ($M = 3.18$, $SD = 0.42$), and control ($M = 3.12$, $SD = 0.34$) categories, $F(2, 22) = 0.06$, $p_{rep} = .13$, $\eta^2 = .005$.

All images were sized to 600 × 450 pixels. We created four image sets, each with 27 image pairs, consisting of combinations of rewarding, threatening and control images. We included all nine pair-wise combinations of rewarding, threatening, and control images and presented participants with 3 image pairs for each combination. Image pairs were created by horizontally aligning two images and separating them by a 25-pixel gap. We used random selection processes to produce two sets of image pairs and created the other two sets by rotating the selected images in the first two sets from the left to the right position and vice versa.

To ensure that participants were motivated to attend equally to both images in a pair, we told them that after viewing each pair, they would have to answer a question about the visual details in one of the two images, without knowing in advance which image would be selected. Questions were specific to each image pair and referred to inanimate and mundane objects that appeared in the images (e.g., "Did you see a key?" or "Did you see a tree?"). Approximately half of the questions featured an item that appeared in the image, and half did not. Half of the questions to be answered in the affirmative referred to an object in the left image, and half to an object in the right image, so as to prevent viewing preferences for images on one side of the screen.

Immediately after participants viewed an image pair, they were presented with a question positioned in the center of the monitor and two possible responses positioned above ("YES") and below ("NO") the question. Participants were instructed to respond to each question by directing their gaze to one of the responses. In each trial, participants observed the following on-screen sequence: a central fixation cross for 1 s, an image pair for 2 s, and a question for 4 s (see Fig. 1). Each trial took 7 s, and 27 trials were carried out, for a total of 3 min and 9 s of eye tracking.

Finally, after the eye-tracking phase, we assessed the effectiveness of the emotion-induction procedure by asking participants to rate their current feelings on a scale from 0 (*not at all*) to 8 (*extremely*). To assess feelings of anger, we averaged across participants' ratings of *angry*, *frustrated*, *irritated*, and *annoyed* ($\alpha = .87$). To assess feelings of fear, we averaged across ratings of *nervous*, *scared*, *afraid*, and *worried* ($\alpha = .88$). To assess feelings of excitement, we averaged across ratings of *excited*, *enthusiastic*, *cheerful*, and *joyful* ($\alpha = .75$).

Results

Manipulation check

As expected, the induction technique successfully induced the intended emotional states in participants (means for each emotional state appear in Table 1). Independent-sample t tests confirmed that ratings of anger were highest in the anger condition, $t(30)$s > 3.61, p_{rep}s > .98, ds > 1.28; ratings of fear were highest in the fear condition, $t(30)$s > 2.80, p_{rep}s > .95, ds > 0.99; and ratings of excitement were highest in the excitement condition, $t(30)$s > 2.79, p_{rep}s > .95, ds > 0.99. In addition, within the anger condition, participants experienced anger more intensely than other emotions, $t(15)$s > 4.13, p_{rep}s > .99, ds > 1.03; within the fear condition, fear was experienced more intensely than other emotions, $t(15)$s > 1.31, p_{rep}s > .72, ds > 0.33; and within

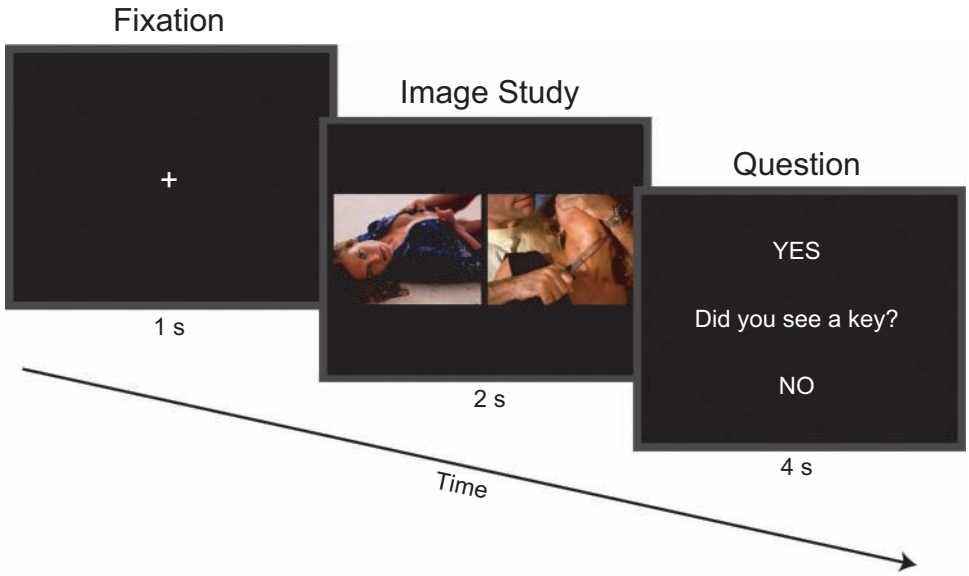

Fig. 1. Sample trial involving the pairing of a rewarding image (left) and a threatening image (right), followed by a question (with possible responses) that would be correctly answered "no."

the excitement condition, excitement was experienced more intensely than other emotions, $t(15)$s > 6.67, p_{rep}s > .99, ds > 1.67.

Effects on visual attention

Eye-gaze data were assessed by examining average fixation durations, which are composite measures of overt visual attention calculated by dividing total fixation duration by the number of fixations in a particular region of interest (ROI). This measure is one of the most common and widely accepted measures of gaze behavior during scene perception, as it takes into account both duration and frequency of fixations (Henderson & Hollingsworth, 1998). The minimum amount of eye-gaze time needed for a gaze to qualify as a fixation was 80 ms (see Inhoff & Radach, 1998).

For each image pair, we created two rectangular ROIs, one for each image. Eye-gaze data were collapsed across left and right counterbalanced image positions. This process created six image pairings of interest: rewarding-rewarding, rewarding-control, rewarding-threatening, threatening-threatening, threatening-control, and control-control. For each pair, we calculated difference scores to assess the relative average fixation duration on each image type within the pair. These difference scores allowed us to assess relative overt visual attention (as inferred via eye gaze) for each image type.

Table 1. Experience of Anger, Fear, and Excitement as a Function of Emotion Condition

Emotion condition	Anger	Fear	Excitement
Anger	2.94 (0.39)	0.98 (0.23)	1.63 (0.18)
Fear	1.13 (0.18)	2.41 (0.46)	1.78 (0.33)
Excitement	0.97 (0.38)	0.81 (0.38)	4.26 (0.19)
Neutral	0.77 (0.22)	0.84 (0.28)	3.06 (0.25)

Note: The table presents mean ratings, with standard errors in parentheses.

As expected, when all six difference scores were entered as levels of a dependent measure in a repeated measures ANOVA with emotion condition (anger, fear, excitement, or neutral) as a between-subjects factor, we found a significant Attention × Emotion Condition interaction, $F(6, 104) = 5.77$, $p_{rep} = .97$, $\eta^2 = .24$. We then examined the main difference scores of interest by conducting six one-way ANOVAs, each with emotion condition (anger, fear, excitement, or neutral) as the independent variable and one of the fixation difference scores as the dependent variable. We expected all three different-category scores (threatening-control, rewarding-control, and rewarding-threatening) to differ significantly as a function of emotion condition.

First, we tested whether the emotion-induction condition influenced visual attention to threatening (vs. control) images. As expected, there was a significant effect of the emotion condition on the threatening-control difference scores, $F(3, 62) = 3.19$, $p_{rep} = .95$, $\eta^2 = .14$. Our results were consistent with prior research, as participants in the fear condition on average fixated longer on threatening images (vs. control images) compared with participants in the neutral condition, $t(29) = 3.23$, $p_{rep} = .98$, $d = 1.15$ (see Fig. 2). As expected, fixation of participants in the excitement condition did not differ significantly from that of participants in the neutral condition, $t(30) = .35$, $p_{rep} = .33$, $d = 0.13$. It is important to note that participants in the anger condition also did not differ significantly from those in the neutral condition in their fixation on threatening (vs. control) images, $t(30) = .69$, $p_{rep} = .50$, $d = 0.24$.

Next, we examined whether emotions influenced visual attention to rewarding (vs. control) images. As expected, we found a significant effect of emotion condition on the

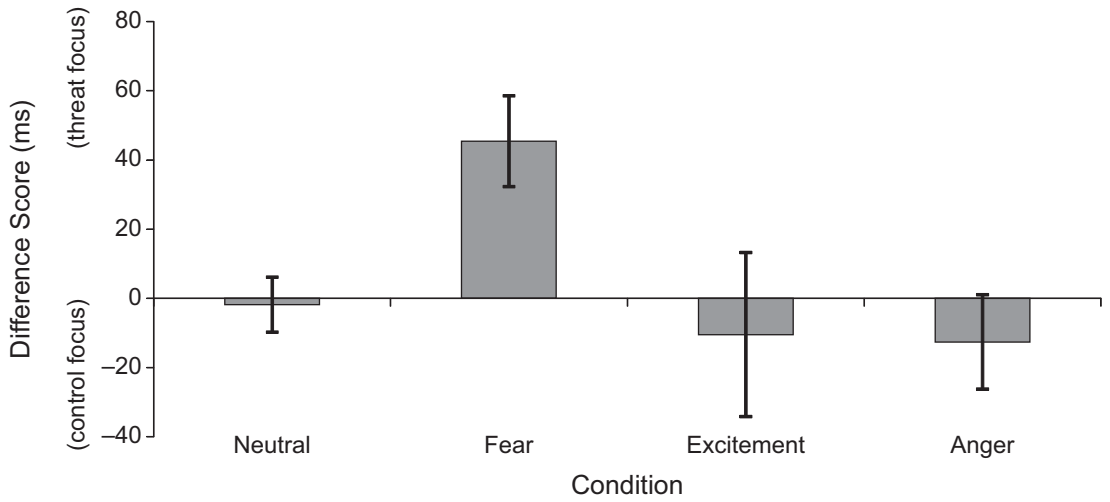

Fig. 2. Mean difference scores (and standard errors) comparing average fixation durations to threatening images versus control images, as a function of emotion condition.

rewarding-control difference scores, $F(3, 63) = 6.92$, $p_{rep} > .99$, $\eta^2 = .26$. Our results were consistent with prior research, as participants in the excitement condition fixated on average longer on rewarding images (vs. control images) compared with participants in the neutral condition, $t(30) = 2.71$, $p_{rep} = .95$, $d = 0.96$ (see Fig. 3). As expected, fixation of participants in the fear condition did not differ significantly from that of participants in the neutral condition, $t(30) = 0.89$, $p_{rep} = .19$, $d = 0.05$. It is important to note that participants in the anger condition showed significantly longer average fixation durations to rewarding (vs. control) images compared with participants in the neutral condition, $t(30) = 3.58$, $p_{rep} = .99$, $d = 1.27$.

We also examined whether emotions influenced visual attention to rewarding (vs. threatening) images. We found a significant effect of emotion condition on the rewarding-threatening difference scores, $F(3, 63) = 11.57$, $p_{rep} > .99$, $\eta^2 = .37$. Compared with participants in the neutral condition, participants in the fear condition showed longer average fixation durations to threatening (vs. rewarding) images, $t(30) = 2.91$, $p_{rep} = .96$, $d = 1.03$ (see Fig. 4). In contrast, compared with participants in the neutral condition, participants in the excitement condition showed longer average fixation durations to rewarding (vs. threatening) images, $t(30) = 3.72$, $p_{rep} = .99$, $d = 1.32$. In our most central finding, participants in the anger condition on average fixated longer on rewarding (vs. threatening) images compared with participants in the neutral condition, $t(30) = 2.94$, $p_{rep} = .96$, $d = 1.04$.

Finally, we examined difference scores for same-category image pairs (rewarding-rewarding, threatening-threatening, and control-control). We expected such scores to approach zero and not vary as a function of emotion condition. Three one-way ANOVAs confirmed that this was the case for

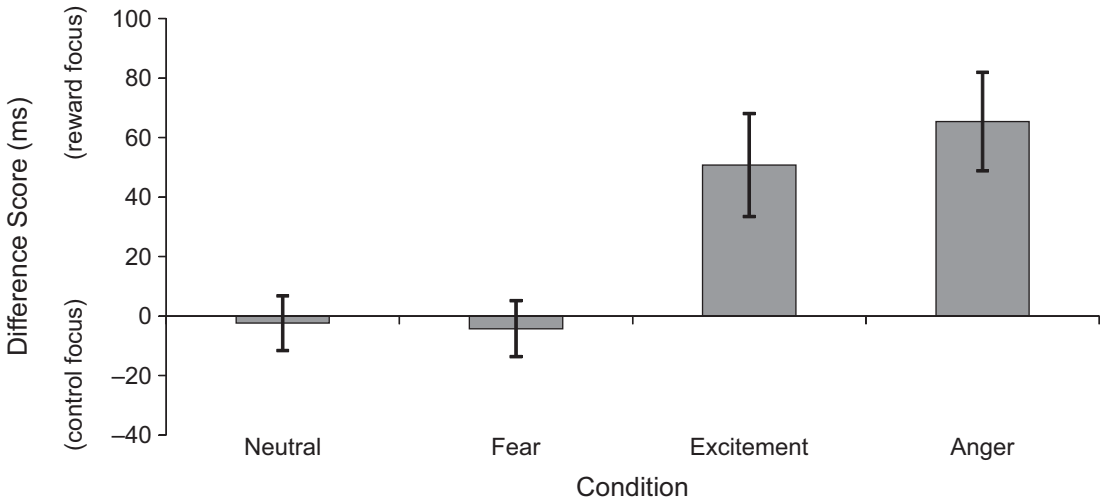

Fig. 3. Mean difference scores (and standard errors) comparing average fixation durations to rewarding images versus control images, as a function of emotion condition.

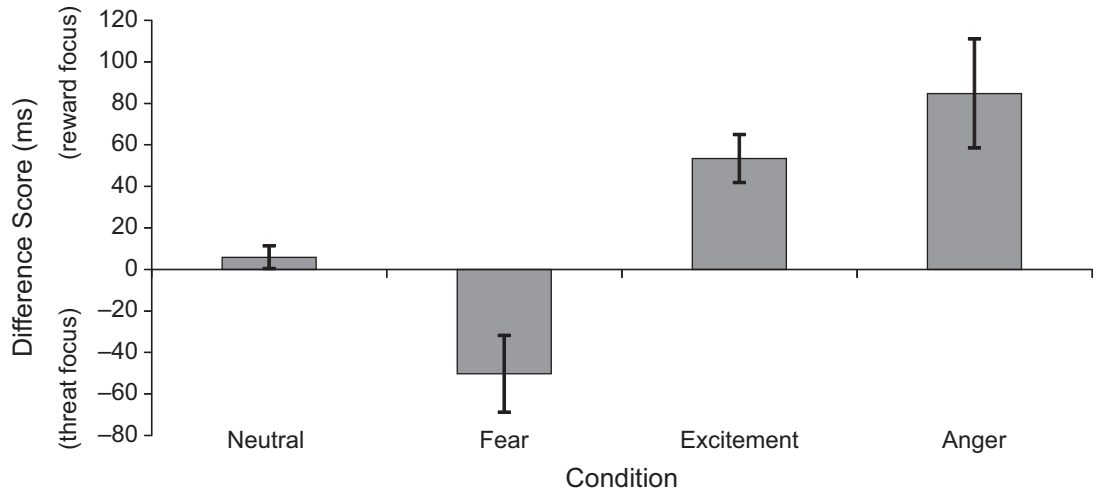

Fig. 4. Mean difference scores (and standard errors) comparing average fixation durations to threatening images versus rewarding images, as a function of emotion condition.

rewarding-rewarding, $F(3, 63) = 0.02$, $p_{rep} = .03$, $\eta^2 = .001$; threatening-threatening, $F(3, 63) = 0.03$, $p_{rep} = .08$, $\eta^2 = .001$; and control-control pairs, $F(3, 63) = 0.06$, $p_{rep} = .04$, $\eta^2 = .003$.

Accuracy

Participants' accuracy in responding to the questions following the image pairs was quite high ($M = .98$, $SD = .04$) and did not vary significantly according to emotion condition ($p_{rep} = .38$).

Discussion

Our findings demonstrate, for the first time, that anger can influence visual attention. We found that anger increases visual attention to rewarding, but not threatening, information. We also found that fear increases visual attention to threatening information and provided further evidence that excitement increases visual attention to rewarding information. These results were obtained even though participants were instructed to optimize their performance by paying equal attention to the simultaneously presented images. Because anger is a negative emotion that reflects an approach motivational system (Carver & Harmon-Jones, 2009), our findings suggest that the effects of emotional states on overt visual attention depend on the motivational implications of emotions, rather than their valence.

Theoretical implications

Multilevel models of emotion and cognition recognize that different emotional states—based on their motivational implications—serve distinct functions in the organization of perception, cognition and action (Izard, 1971, 1991). According to such models, different emotional states may influence distinct stages of cognitive processing in diverse ways. The findings presented here demonstrate that emotional states, such as fear, excitement, and anger, do indeed exert unique effects on visual attention, as a function of their motivational underpinnings. Our findings further emphasize the importance of examining the links between cognitive processing and distinct types of emotional experiences, rather than analyzing valence alone.

From an evolutionary perspective, goals that are particularly relevant for survival (e.g., avoiding a deadly snake bite) are likely to influence our attention. The behavioral effects of emotions may be driven, in part, by the enhanced processing of motivationally relevant information. For example, anxiety may help individuals avoid threats in their environment, in part by focusing attentional resources on threatening information and thus promoting its efficient processing (Mogg & Bradley, 2004). It is possible that excitement helps individuals attain rewards in their environment, in part by focusing attentional resources on rewarding information. Anger, in turn, is characterized as a reaction to an event that violates what "ought" to be (Frijda, 1986). It is possible, therefore, that by focusing an individual's attention on rewarding information (i.e., what ought to be), anger helps the individual remove the existing violation and restore the desired state (Carver & Harmon-Jones, 2009).

Our findings show that emotional states promote the cognitive processing of motivationally relevant stimuli, but do not impair the processing of motivationally irrelevant stimuli. Fear influenced participants' attention to threats, but not their attention to rewards. Excitement influenced their attention to rewards, but not their attention to threats. This distinction is particularly important in the context of anger, where researchers' conclusions about the link between anger and sensitivity to threats are inconsistent: Some studies link anger to a decreased sensitivity to threat (e.g., Lerner & Keltner, 2000), whereas others suggest that anger is largely unrelated to threat sensitivity (e.g., Lindquist & Barrett, 2008). Our results are consistent with the latter conclusion, as we found that anger

was largely unrelated to threat processing, at least in the context of visual attention. Anger does, however, appear to be linked to reward sensitivity, as we found that rewarding information was more likely to capture the attention of angry individuals, compared to those in a neutral or fearful state. Our findings suggest that anger could lead people to focus their attention on potential rewards (e.g., an ex-girlfriend one has feelings for), without influencing their attention to possible threats (e.g., the ex-girlfriend's current jealous partner).

The content of visual attention may therefore speak to the goals people pursue, but not necessarily to the ways in which people pursue them. Despite the distinct psychological and behavioral implications of each emotion, we found that both excitement and anger increased attention to rewards. It is possible, then, that both excitement and anger can promote the attainment of rewards by increasing an individual's attention to them, but that the two emotions promote the attainment of rewards in very different ways. For instance, excitement or happiness may promote reward attainment by facilitating collaboration with others, whereas anger may do so by facilitating competition or confrontation with others (e.g., Tamir & Ford, 2010; van Kleef, De Dreu, & Manstead, 2004). Such possibilities remain to be tested, and attest to the complex relationships among emotions, cognition, and behavior.

Future directions

Research on anxiety and visual attention has found that threat-oriented attention in anxiety occurs in response to both supraliminal and subliminal exposures to threats, suggesting that the attentional effects of emotions may involve early preattentive stages of processing as well as later postattentive stages (MacLeod & Rutherford, 1992; Mogg, Bradley & Hallowell, 1994). In this investigation, we sought to test whether anger can affect visual attention at all, rather than to examine the time course of such effects. An important task for future research, therefore, is to examine how early in cognitive processing anger influences visual attention.

Visual attention is a complex process that involves distinct component processes, including engagement, attention shifting, and disengagement (Posner, Inhoff, Friedrich, & Cohen, 1987). Some researchers argue that anxiety influences the engagement or initial orientation of attention (e.g., Mogg, Garner, & Bradley, 2007), whereas others propose that anxiety has little impact on the initial detection of threat but has a stronger effect on the inability to disengage attention from threat (e.g., Fox, 2004; Fox, Russo, Bowles, & Dutton, 2001). Our experimental design did not allow us to reliably examine processes underlying attention engagement and disengagement. Therefore, future research could examine whether anger affects the specific component processes of visual attention.

Finally, research on anxiety and visual attention shows that increased attention to threatening information may play a causal role in the genesis of anxiety-related states (MacLeod, 1999; MacLeod, Rutherford, Campbell, Ebsworthy, & Holker, 2002). Our findings suggest that the effect of visual attention on emotional experience may depend on the relevant motivational context. It is possible that an individual's increased attention to rewards helps maintain a state of either excitement or anger, depending on the preliminary state of the individual or the characteristics of the present context. We hope that our findings set the stage for testing such exciting ideas.

Declaration of Conflicting Interests

The authors declared that they had no conflicts of interest with respect to their authorship or the publication of this article.

References

Bradley, B., Mogg, K., & Lee, S. (1997). Attentional biases for negative information in induced and naturally occurring dysphoria. *Behaviour Research and Therapy*, *35*, 911–927.

Brunyé, T.T., Mahoney, C.R., Augustyn, J.S., & Taylor, H.A. (2009). Emotional state and local versus global spatial memory. *Acta Psychologica*, *130*, 138–146.

Cacioppo, J., Gardner, W., & Berntson, G. (1999). The affect system has parallel and integrative processing components: Form follows function. *Journal of Personality and Social Psychology*, *76*, 839–855.

Carver, C., & Harmon-Jones, E. (2009). Anger is an approach-related affect: Evidence and implications. *Psychological Bulletin*, *135*, 183–204.

Carver, C., & Scheier, M. (1998). *On the self-regulation of behavior*. New York: Cambridge University Press.

Fox, E. (2004). Maintenance or capture of attention in anxiety-related biases? In J. Yiend (Ed.), *Cognition, emotion and psychopathology: Theoretical, empirical and clinical directions* (pp. 86–105). New York: Cambridge University Press.

Fox, E., Russo, R., Bowles, R., & Dutton, K. (2001). Do threatening stimuli draw or hold visual attention in subclinical anxiety? *Journal of Experimental Psychology: General*, *130*, 681–700.

Frijda, N. (1986). *The emotions*. London: Cambridge University Press.

Hannan, J. (2002). Dreamoz [Recorded by Lith De Lanka]. On *Lazy dog*, Vol. 2 [CD]. New York: Astralwerks.

Henderson, J.M., & Hollingworth, A. (1998). Eye movements during scene viewing: An overview. In G. Underwood (Ed.), *Eye guidance in reading and scene perception* (pp. 269–291). New York: Elsevier.

Inhoff, A.W., & Radach, R. (1998). Definition and computation of oculomotor measures in the study of cognitive processes. In G. Underwood (Ed.), *Eye guidance in reading and scene perception* (pp. 29–53). New York: Elsevier.

Izard, C. (1971). *The face of emotion*. East Norwalk, CT: Appleton-Century-Crofts.

Izard, C.E. (1991). *The psychology of emotions*. New York: Plenum Press.

Julyan, D. (2006). The bone dam. On *The descent* [CD]. London: Cooking Vinyl.

Lang, P.J., Bradley, M.M., & Cuthbert, B.N. (2008). *International Affective Picture System (IAPS): Affective ratings of pictures and instruction manual* (Technical Report A–8). Gainesville: University of Florida.

Lerner, J., & Keltner, D. (2000). Beyond valence: Toward a model of emotion-specific influences on judgment and choice. *Cognition & Emotion*, *14*, 473–493.

Lindquist, K.A., & Barrett, L.F. (2008). Constructing emotion: The experience of fear as a conceptual act. *Psychological Science*, *19*, 898–903.

MacLeod, C. (1999). Anxiety and anxiety disorders. In T. Dalgleish & M. Power (Eds.), *Handbook of cognition and emotion* (pp. 447–477). New York: John Wiley & Sons.

MacLeod, C., Rutherford, E., Campbell, L., Ebsworthy, G., & Holker, L. (2002). Selective attention and emotional vulnerability: Assessing the causal basis of their association through the experimental manipulation of attentional bias. *Journal of Abnormal Psychology*, *111*, 107–123.

MacLeod, C., & Rutherford, E.M. (1992). Anxiety and the selective processing of emotional information: Mediating roles of awareness, state and trait variables, and personal relevance of stimulus materials. *Behaviour Research and Therapy*, *30*, 479–491.

Mathews, A., & MacLeod, C. (1985). Selective processing of threat cues in anxiety states. *Behaviour Research and Therapy*, *23*, 563–569.

Mathews, A., & MacLeod, C. (1994). Cognitive approaches to emotion and emotional disorders. *Annual Review of Psychology*, *45*, 25–50.

Meyer, E., O'Connor, M., Foster, S., Krauss, A., Taylor, J., & Ma, Y.-Y. (2000). Indecision. On *Appalachian journey* [CD]. New York: Sony.

Mogg, K., & Bradley, B.P. (1998). A cognitive-motivational analysis of anxiety. *Behaviour Research and Therapy*, *36*, 809–848.

Mogg, K., & Bradley, B.P. (2004). A cognitive-motivational perspective on the processing of threat information and anxiety. In J. Yiend (Ed.), *Cognition, emotion and psychopathology: Theoretical, empirical and clinical directions* (pp. 68–85). New York: Cambridge University Press.

Mogg, K., Bradley, B.P., & Hallowell, N. (1994). Attentional bias to threat: Roles of trait anxiety, stressful events, and awareness. *The Quarterly Journal of Experimental Psychology A: Human Experimental Psychology*, *47*, 841–864.

Mogg, K., Garner, M., & Bradley, B.P. (2007). Anxiety and orienting of gaze to angry and fearful faces. *Biological Psychology*, *76*, 163–169.

Posner, M., Inhoff, A., Friedrich, F., & Cohen, A. (1987). Isolating attentional systems: A cognitive-anatomical analysis. *Psychobiology*, *15*, 107–121.

Simon, H. (1994). The bottleneck of attention: Connecting thought with motivation. In W. Spaulding (Ed.), *Nebraska Symposium on Motivation: Vol. 41. Integrative views of motivation, cognition, and emotion* (pp. 1–21). Lincoln: University of Nebraska Press.

Tamir, M., & Ford, B.Q. (2010). *Instrumental emotion regulation in negotiations: Goals and the expected usefulness of emotions*. Manuscript submitted for publication.

Tamir, M., & Robinson, M. (2007). The happy spotlight: Positive mood and selective attention to rewarding information. *Personality and Social Psychology Bulletin*, *33*, 1124–1136.

Tellegen, A. (1985). Structures of mood and personality and their relevance to assessing anxiety, with an emphasis on self-report. In A. Tuma & J. Maser (Eds.), *Anxiety and the anxiety disorders* (pp. 681–706). Hillsdale, NJ: Erlbaum.

Tuppinen, E. (1998). Refuse/resist [Recorded by Apocalyptica]. On *Inquisition symphony* [CD]. Los Angeles: Mercury Records.

van der Heijden, A. (1992). *Selective attention in vision* (International Library of Psychology). Florence, KY: Taylor & Francis/Routledge.

van Honk, J., Tuiten, A., de Haan, E., van den Hout, M., & Stam, H. (2001). Attentional biases for angry faces: Relationships to trait anger and anxiety. *Cognition & Emotion*, *15*, 279–297.

van Kleef, G., De Dreu, C., & Manstead, A. (2004). The interpersonal effects of emotions in negotiations: A motivated information processing approach. *Journal of Personality and Social Psychology*, *87*, 510–528.

Watson, D., Wiese, D., Vaidya, J., & Tellegen, A. (1999). The two general activation systems of affect: Structural findings, evolutionary considerations, and psychobiological evidence. *Journal of Personality and Social Psychology*, *76*, 820–838.

Wilkowski, B., & Robinson, M. (2008). The cognitive basis of trait anger and reactive aggression: An integrative analysis. *Personality and Social Psychology Review*, *12*, 3–21.

Wilkowski, B., Robinson, M., Gordon, R., & Troop-Gordon, W. (2007). Tracking the evil eye: Trait anger and selective attention within ambiguously hostile scenes. *Journal of Research in Personality*, *41*, 650–666.

Williams, R., Watts, F., MacLeod, C., & Mathews, A. (1997). *Cognitive psychology and emotional disorders*. Chichester, England: Wiley.