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Seeing Red: Distraction Influences Visual Attention for Anger but Not for Other Negative Emotions

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Emotion regulation is a vital skill that improves psychological well-being and overall functioning. Distraction (the purposeful internal disengagement from an emotional stimulus) and cognitive reappraisal (the process of changing one's thoughts about an emotional event/stimulus) are two well-established regulation strategies that can effectively decrease negative affect. Less understood, however, are the attention allocation strategies that occur when engaging in these emotion regulation strategies—specifically, do people visually scan emotional information differently when distracting vs. reappraising? In the current study, community participants were randomly assigned to either distract, reappraise, or view naturally while watching four emotional film clips that each elicited a different negative emotional state: anger, fear, sadness, and disgust. Eye tracking was used to record total time spent gazing ("dwell time") at faces within the emotion-eliciting film clips. An effect of condition was found for anger-eliciting material only: participants in the distraction condition exhibited shorter dwell times compared with reappraisal and natural viewing. Importantly, this effect was moderated by state anxiety, such that it was found at low but not high levels of state anxiety. These results show that emotion regulation strategies differentially affect attention to emotion-eliciting stimuli and points to the role of current affective states in impacting how distraction is used.

Keywords: emotion regulation, eye-tracking, distraction, reappraisal, anger

Emotion regulation, or an individual's ability to influence which emotions they experience—and to what extent—is an important skill with significant implications for psychological well-being and overall functioning (Gross, 1998). Two of the most widely used emotion regulation strategies are distraction (redirecting one's internal attention away from an emotion-eliciting stimulus) and cognitive reappraisal (altering one's assessment of the emotion-eliciting stimulus). Despite an abundance of research demonstrating that distraction and reappraisal both work to reduce the experience of negative emotions (see Koole, 2009; McRae et al., 2010 for reviews), questions remain regarding the mechanisms by which these two processes work. Given the importance of emotion regulation for well-being, it is imperative we better understand the processes that underlie these strategies. Here we investigate the importance of one potential mechanism in particular: visual attention.

One influential theory used to classify and understand the functions of different emotion regulation strategies, the process model (Gross, 1998), posits that emotion regulation strategies are separated into two broad categories, distinguished by whether they are antecedent- or response-focused. While antecedent-focused strategies (e.g., distraction and reappraisal) are generally employed in early stages of processing, before an emotional response has been fully generated, response-focused strategies (e.g., suppression) attempt to modulate affect after an emotional response occurs (Gross, 2002). Within the antecedent-focused domain, Gross (2002) further distinguishes four stages of emotion regulation, and distraction and reappraisal differ from one another with regard to the stage in which they occur. Distraction involves regulating at the level of attentional deployment (e.g., "I'll think about something else"), whereas reappraisal involves regulation at the level of cognitive change (e.g., "I'll interpret this differently"). Therefore, according to this model, we may expect differences in the allocation of sensory (e.g., visual) attention/resources when distraction

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is used, as compared with when cognitive reappraisal is used. In other words, this theory suggests that the mechanism underlying distraction is attention allocation, whereas attention is not proposed as a core mechanism by which reappraisal works.

By attention allocation, we mean selectively concentrating on a discrete aspect of information, while comparatively disregarding other perceivable information. Attention can be allotted across many modalities—for example, auditory (listening closely to a sound coming from one side of the room; Jäncke et al., 2001), internal (attending to thoughts or images in the mind; Amir & Bernstein, 2021), or visual (e.g., directing one's gaze to an area of the room; Armstrong & Olatunji, 2012).

In regulating emotions, attention allocation is central to distraction. During distraction, when redirecting attention away from the emotional stimulus, attention may theoretically be redirected to internal stimuli (e.g., diverting to thoughts/memories unrelated to the emotional content), external sensory stimuli (e.g., looking away from the emotional content), or both. Practically, however, when distraction is measured in studies of emotion regulation, participants are most typically instructed to divert their thoughts away from the content—in other words, to redirect attention to new internal stimuli without necessarily changing their attention to any external sensory stimulus (e.g., Gross, 1998; van Dillen & Koole, 2007).

Here, we focus on measuring visual attention. Though vision is just one domain of attention, it is readily studied due to the ease with which can measure it (Armstrong & Olatunji, 2012; Raila et al., 2015). In the visual domain, attention serves to select certain information in the visual field for in-depth processing. Though it is sometimes experienced as effortful, attention may be automatically captured by certain types of visual information (for a review, see Pashler, 1998). Patterns of attention deployment seem to be a fundamental component of a person's emotion experience (John & Gross, 2004; Gotlib et al., 2004).

Over the past decade, questions have been raised with regard to the role of visual attention in cognitive reappraisal. Some results suggest that internal attention may be an important mechanism in understanding reappraisal. Some electroencephalography (EEG) studies, for example, have shown that when participants are instructed to use cognitive reappraisal to decrease negative emotions, event-related-potential (ERP) components tied to motivated attention (i.e., late positive potential) show attenuated responses (Krompinger et al., 2008; Hajcak & Nieuwenhuis, 2006; Moser et al., 2006). These results suggest that—although cognitive reappraisal may not at first glance be expected to alter attention allocation—at least internal attention indeed may play a role when an individual is tasked with employing it.

Results from other recent studies, however, have challenged the idea that cognitive reappraisal impacts attention. One study (Urry, 2010) had participants use cognitive reappraisal while holding visual attentional deployment constant by instructing participants to direct their gaze to circumscribed areas of presented stimuli. Results showed that people successfully decreased emotional intensity and physiological arousal—even though their visual attention was held constant. This suggests that the emotional changes resulting from reappraisal were operating *independent* of attentional deployment. Similarly, Bebko and colleagues (2014) compared free-viewing and restricted-viewing conditions across cognitive reappraisal and emotional suppression and found that viewing condition did not alter the extent to which either strategy down-regulated negative affect. Taken together, both studies suggest that visual attention may not be an important mechanism by which reappraisal operates to downregulate negative affect. That said, it is possible that internally focused attention (e.g., thoughts and memories) is altered during reappraisal (e.g., Krompinger et al., 2008; Hajcak & Nieuwenhuis, 2006; Moser et al., 2006), but that visual attention to the external environment does not (e.g., Bebko et al., 2014).

Few studies have directly compared distraction and reappraisal in its effect on visual attention; however, two influential studies in this domain are worth noting. The first (van Reekum et al., 2007) used fMRI and eye tracking to study gaze fixation patterns while participants were instructed to employ emotion regulation strategies (like distraction and reappraisal) or to view negative pictures naturally. Results showed that participants instructed to use reappraisal techniques spent less time fixating on emotion-relevant parts in the image when instructed to decrease their emotion, and that variations in gaze fixation correspond to variance in brain activation during emotion regulation. Importantly, when instructed to "decrease emotions" using reappraisal, gaze fixations positively predicted the amount of BOLD signal response in the anterior cingulate cortex (ACC), dorsolateral prefrontal cortices (DLPFC), which are areas of the brain shown in past studies to be critical in the downregulation of negative emotions (e.g., Ochsner et al., 2002; Ochsner & Gross, 2005; Phan et al., 2005). These results highlight the importance of measuring gaze fixation patterns in better understanding how attention may be a key mechanism through which different emotion regulation strategies (e.g., distraction vs. reappraisal) operate.

The second (Strauss et al., 2016) used eye tracking to understand the mechanisms through which reappraisal and distraction work to downregulate negative emotions during the viewing of unpleasant still-frame photographs. This study found that both reappraisal and distraction successfully decreased self-reported ratings of negative affect as compared with passive viewing, and eye tracking results suggested that specific patterns of visual attention (e.g., pupil dilation and dwell time) predicted whether these strategies are effective in decreasing negative emotion. Specifically, pupil dilation and dwell time to arousing scene regions increased for reappraisal as compared with distraction and passive viewing, whereas total dwell time to arousing interest areas was reduced for distraction, compared with reappraisal and passive viewing. These results suggest that different emotion regulation strategies may require different patterns of visual attention to prove effective. Results of both studies are, however, mixed, and this area of research is limited—both of which point to a need for further investigation of how emotion regulation strategies differentially impact visual attention.

The Present Investigation

Our study compares the effects of distraction and reappraisal on attention and affect in response to video stimuli designed to elicit four distinct negative emotions. Importantly, we aimed to extend prior work in three particularly meaningful ways. First, we studied emotion regulation's effect on attention and affect across four different emotional states: anger, fear, sadness, and disgust. While the aforementioned studies (e.g., Strauss et al., 2016; van Reekum et al., 2007) examined negative emotions in collective, we implemented a

novel paradigm to study four negative emotions in particular (i.e., anger, fear, sadness, and disgust). As such, we aimed to gain a more specific understanding of the ways in which certain emotion regulation strategies may work differentially for different negative emotions and the vital role attention may play in this relation. Two theories explain the importance of examining varying emotional states. In a more recent expansion of the process model, Sheppes and Gross (2013) emphasized that emotion regulation strategy efficacy is dependent upon multiple factors, including the intensity of emotions, types of emotions, and goals of using a given strategy at any given time. Thus, broadly categorizing the mechanics and utility of different emotion regulation strategies for negative emotions at large is perhaps insufficient. A similar line of work on emotion regulation flexibility (e.g., Aldao et al., 2015) has posited that the adaptive use of emotion regulation strategies might be context-dependent, such that one strategy is not categorically "better" or more useful than another, but that the ability to flexibly implement a variety of strategies based upon the situation is what determines successful emotion regulation usage. Taken together, these theories suggest that by studying "negative emotions" as a collective, we may be missing nuanced differences in how emotion regulation strategies work and affect attention differently when a person is experiencing one emotional state versus another.

Second, in contrast to the prior studies cited, we used emotional film clips to elicit these affective states. The decision to use film clips was made in light of an increasing awareness of the advantages of using film clips over other methods of emotion elicitation. Film clips, unlike idiographic methods such as autobiographical recollection, can be easily standardized (e.g., Mills & D'Mello, 2014). In addition, film clips, unlike other standardized inductions such as IAPS still-frame images (e.g., those used in Strauss et al., 2016), engage participant attention for an extended period of time. This feature is particularly important for targeting attention as a mechanism by which emotions are regulated. Film clips also bolster the ecological validity of our research, as the dynamic progression of emotions generated by watching actions and events unfold closely mirrors the experience of real-world emotional responding (Gilman et al., 2017; Rottenberg et al., 2007). It is important to note that using dynamic film clips in eye tracking research presents a unique challenge, involving the selection of AOIs for analysis. In this study, we focused on faces of characters within the clips for a few reasons worth noting. Within attentional bias research, there is a long tradition of using emotional facial expressions to investigate the components of attentional bias. Facial expressions have been used in all most classic tasks—for example, the spatial cuing task (Koster et al., 2006; Leyman et al., 2007; Mogg et al., 2008; Yiend et al., 2015), the visual probe task (Schofield et al., 2013; Evans et al., 2016), and the visual search task (Derakshan & Koster 2010; Wisco et al., 2012). Over the years, several standardized stimuli packages of emotional facial expressions have been developed, such as the Pictures of Facial Affect (Ekman & Friesen, 1976), the Karolinska Directed Emotional Faces database (Lundqvist et al., 1998), and the NimStim Set of Facial Expressions (Tottenham et al., 2009). A primary reason for using facial expressions as stimuli is that they offer high reliability, as different researchers can be able to create the same AOIs between studies. Furthermore, even different AOIs are comparable because they all share similar features. Alternatively, if objects were to be used as AOIs, different researchers may not choose the same objects as AOIs, and different objects with different features would. Inherently be difficult to compare.

Our last aim was exploratory in nature: to gain a better understanding of individual state-level differences that might play an important role in affecting the relation between emotion regulation strategy and attention in response to different negative emotions. Indeed, individuals encounter emotional material in a variety of transient (as well as more stable) dispositions, and we know from the aforementioned work on the extended process model and emotion regulation flexibility theories that contexts and emotional states are important factors in determining the effectiveness of emotion regulation strategies. Given a body of literature on state anxiety and visual attention—some studies showing that those high on state anxiety visually attend toward negative stimuli (e.g., Quigley et al., 2012) and others demonstrating the opposite pattern (e.g., Fox et al., 2007), we were interested in examining further how this differed based on discrete negative emotions and emotion regulation strategy instruction. By taking into account the effects of individual differences, we gain a more generalizable picture of how distraction and reappraisal and their effects on visual attention may be affected by everyday individual-level factors (e.g., state anxiety).

Thus, using film clips to elicit negative emotions, we aimed to build on prior work with the goal of understanding what happens to attention allocation and consequent affect when people distract versus reappraise. Importantly, we paid particular attention to how individuals downregulate *specific* negative emotions and how individual—particularly, state-like—differences may affect the use of emotion regulation on attention.

Method

Participants

One hundred four unselected community members, ages 18 through 29 (M = 19.63, SD = 1.73), 60 (57%) of whom were female, were recruited from the greater New Haven area via community flyers and Craigslist advertisements to participate in this study in exchange for financial compensation. The self-reported racial/ethnic composition of the sample was as follows: 55 (49.1%) Caucasian/White, 9 (8.0%) African American/Black, 15 (13.4%) Asian American/Asian, 11 (9.8%) Latino/Hispanic, 3 (2.7%) Arab or Middle Eastern, 2 (1.8%) American Indian or Native American, and 9 (7.1%) multiracial. Four participants were excluded for missing data. Remaining participants were randomly assigned to the distraction (n = 34), reappraisal (n = 35), or control (n = 31) conditions. Posthoc power analyses were conducted using G*Power 3 (Faul et al., 2007). Power was calculated using $\alpha = .05$ (two-tailed) for detecting within-/between-subjects interaction with an effect size of $f = .25$. Based on these estimates, a sample size of 100 total participants is sufficient to achieve power $\geq$ 95%.

Video Clip Viewing Task

Eye gaze was tracked as participants viewed four video clips corresponding to the four emotional states: fear, anger, sadness, and disgust. Each clip was approximately two minutes long. See Appendix A for details about the clips and a link at which they can be publicly accessed. To ensure complete eye tracking data, participants were

told in all three conditions to keep their eyes on the screen (as opposed to elsewhere in the room) throughout the stimulus presentation.

Emotional Clips

To confirm that our video clips were eliciting the target emotions, 50 participants, aged 20 to 53 years (M = 32.02, SD = 7.50), 26 (52%) of whom were female, were recruited online via Amazon Mechanical Turk. They rated on a seven-point Likert-type scale (1 = *not at all*, 7 = *extremely*) how much they felt each of five emotions (scared, angry, sad, disgusted, happy) during each clip. Ratings indicated that each clip (e.g., fear) elicited its target emotion (e.g., scared) significantly more strongly than any of the other clips did (paired sample ts > 2.90, ps $< .007$). Each clip elicited its target emotion significantly more strongly than it elicited any of its nontarget emotions (e.g., angry, sad, disgusted, happy), paired sample ts > 3.27, ps $< .003$. Mean ratings of each clip are summarized in Table 1. Post-hoc analyses on emotional intensity and arousal of clips are reported in Appendix B.

Emotion Regulation Condition Instructions

Participants were assigned to one of three conditions: Reappraisal, Distraction, or Control. In the Control condition, participants were instructed to view the films naturally "as if at home watching TV." In the two emotion regulation conditions, participants were provided with detailed instructions for the emotion regulation strategy and given time to practice it with feedback from experimenters. In the Reappraisal condition, participants were told to think about the scene and "make new interpretations of the events in it, in order to turn down your emotions." In the Distraction condition, participants were told to view the scene but "think of other things that are completely unrelated to the scene, in order to turn down your emotions" (see Appendix C for full instructions).

To ensure compliance with the intended strategy, participants were then guided through two examples using still-frame photographs of emotional scenes (see Appendix C for stimuli and instructions used). In the first example, the experimenter walked the participant through how one might use the given emotion regulation strategy (e.g., "As I see this picture, I'm trying to turn down my emotions by thinking about what I had for breakfast today"). In the second example, the participant described their own process of reappraisal or distraction aloud and was given feedback before moving on to the experimental film clips.

Questionnaires

Positive and Negative Affect Scale

To measure state emotions, we administered a modified version of the Positive and Negative Affect Scale (PANAS; Watson et al., 1988) after each of the four emotional clips. The modified version asked participants to rate the extent to which they felt "angry," "disgusted," "happy," "sad," and "scared," and participants indicated their response on a five-point Likert-type scale ranging from 1 = *very slightly or not at all* to 5 = *extremely*.

State–Trait Anxiety Inventory

To measure participants' state and trait levels of anxiety, we administered the State–Trait Anxiety Inventory (STAI; Marteau & Bekker, 1992). The STAI is a 40-item self-report measure with two 20-item subscales to measure state (α = .62) and trait (α = .27) anxiety. Individuals rate their anxiety based on their agreement with different emotional states (e.g., "I feel at ease") according to "How they feel right now, at this moment" or "How they generally feel." Participants rate their agreement on a four-point Likert scale where 1 = *not at all* and 2 = *very much so*. Higher ratings indicate higher levels of anxiety.

Procedure

Participants arrived and were consented before completing a clinical battery including the STAI. Participants then were randomly assigned to their emotion regulation condition. Based on condition, they received the instructions and practice example for what to do while viewing the film clips. To ensure eye tracking accuracy, they then completed a standard eye tracker calibration, making sequential eye movements to several calibration points. They then viewed the four emotional film clips in a different randomized order for each participant. After each clip, participants completed the modified PANAS. Finally, all participants were debriefed and compensated for their time.

The materials and methodology for this study were approved by the Yale University Institutional Research Board as part of Yale's Human Research Protection Program (Approval No. 1411014938).

Eye-Tracking Recording and Data Reduction

Eye gaze was tracked as participants viewed stimuli on a 48-in. computer monitor from a distance of approximately 64 cm, so that the display subtended 79.3° × 49.5°. Binocular gaze was recorded with a Tobii X120 eye tracker, which collects pupil location at a

Table 1
Emotional Video Ratings

Emotion rating	Fear video M (SD)	Anger video M (SD)	Sad video M (SD)	Disgust video M (SD)
Fear	3.68[a, b] (1.87)	2.58 (1.77)	2.00 (1.31)	1.50 (0.91)
Anger	1.80 (1.44)	5.16[a, b] (1.66)	2.48 (1.82)	1.44 (0.99)
Sadness	1.90 (1.09)	4.04 (2.06)	5.16[a, b] (1.60)	1.46 (0.86)
Disgust	2.32 (1.46)	4.24 (2.07)	2.16 (1.62)	5.34[a, b] (1.89)
Happiness	1.52 (1.23)	1.44 (1.16)	2.16 (1.62)	1.62 (1.37)

[a] Indicates target emotion is higher than other emotions in that video. [b] Indicates target emotion of matched video is higher than the same emotion in other videos.

rate of 60 Hz, and gaze values were reduced for analysis using Tobii Studio Analysis Software (Tobii Technology, Danderyd, Sweden). Five calibration points were used in the eye-tracking procedure: one in the middle and one in each corner of the screen.

Previous research has revealed differences in attention to emotional information using facial expressions as stimuli (e.g., Ekman & Friesen, 1976; Lundqvist et al., 1998; Tottenham et al., 2009). Thus, the areas of interest (AOIs) of the present study were the facial expressions displayed in the four emotional videos. For eye-tracking analyses, the viewing area was defined as the entire display, and the AOIs were defined by the boundaries of the emotional faces. The AOIs were made by creating an ellipsis (similar to Sanchez et al., 2013) that covered the faces of the people in the videos (forehead, cheeks, and chin). This was done for every single frame of the videos (i.e., if the person was not moving the same AOI was used on succeeding frames, whereas if the person was moving a new AOI was made for each frame). Our eye-tracking variable of interest was dwell time—defined as the total time spent fixating and making saccades within a given AOI. A fixation was defined as any period for which gaze was still (varying less than 1°) for more than 100 ms. Dwell time was chosen because the stimuli were videoclips and not images; as such, the participants were forced to move their eyes to follow the moving stimuli. Had we focused our analyses on another variable of interest such as total fixation time, we likely would have lost the data collected during the movement. Other variables we could have targeted such as fixation count or first fixation were disregarded as we were interested in how much time the participants were looking at the stimuli, rather than how many times or when they were looking at the stimuli. Dwell time for each AOI was recorded and total dwell time for each emotion condition was used in the analysis (see Table 2). Two participants with less than 10% of eye tracking data being successfully recorded in the AOIs were removed from the analysis.

Results

To examine whether a specific emotion regulation strategy affects visual attention, we conducted a 3 × 4 mixed design analysis of variance (ANOVA), with strategy (distraction, reappraisal, control) as a between-subjects factor and emotion (anger, fear, sadness, disgust) as a within-subjects factor—with visual dwell time as the dependent variable. Analyses revealed a significant main effect of Strategy, $F(2, 102) = 5.81$, $p = .004$, $\eta^2 = .10$, such that distraction showed shorter dwell time as compared with reappraisal and control across emotions, as well as a significant main effect of emotion, $F(3, 306) = 3.93$, $p = .009$, $\eta^2 = .04$. These effects were qualified by a significant Strategy × Emotion interaction, $F(6, 306) = 3.33$, $p = .003$, $\eta^2 = .06$. To follow up on the two-way interaction, separate one-way ANOVAs were conducted for each emotion condition.

For the Anger clip, analyses revealed a significant simple effect of strategy, $F(2, 102) = 13.76$, $p < .001$, $\eta^2 = .21$. Between-groups comparisons showed that dwell time on the anger clip was significantly shorter for participants using distraction than participants using reappraisal ($p < .001$) and participants viewing naturally ($p < .001$); there was no difference between participants using Reappraisal and participants viewing naturally ($p > .990$). Post hoc tests also revealed that for participants using distraction, dwell time on the anger clip was significantly shorter than dwell time on the fear, sadness, and disgust clips ($p = .006$, $p = .002$, and $p = .001$, respectively). For the fear clip, analyses showed an effect of strategy, $F(2, 102) = 2.92$, $p = .058$, $\eta^2 = .05$ but it should be noted that it did not pass conventional levels of significance and should be interpreted with care. Between-groups comparisons showed that Dwell time on the Fear clip was shorter for participants using distraction than for participants using reappraisal, but this difference did not reach conventional thresholds of significance ($p = .087$). Analyses for the sadness and disgust clips did not reveal significant effects ($ps > .300$ and .778, respectively). These results are depicted in Figures 1, 2, and 3, and corresponding descriptive statistics are presented in Table 2.

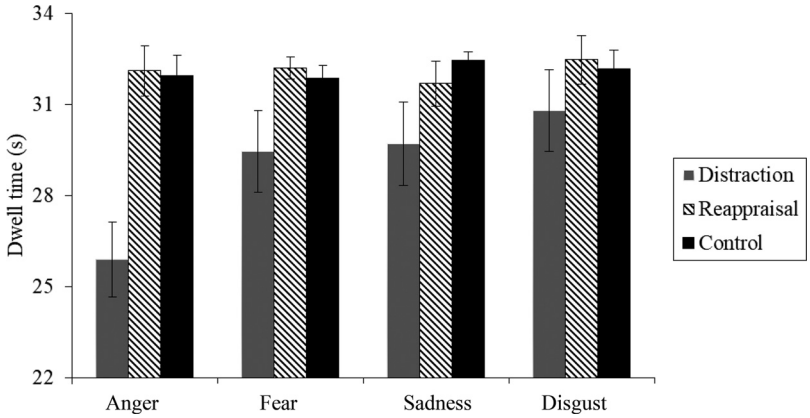
To assess effects of strategy-use on affective state for each of the film clips, separate one-way between subjects ANOVAs were conducted to compare the effect of strategy on affective state (anger, fear, sadness, disgust as measured by ratings on the modified PANAS, administered after each clip), for each individual emotion (anger, fear, sadness, disgust). All four one-way ANOVAs revealed a main effect of group, $F(2, 91) > 15.4$, $p < .001$. Separate Tukey post hoc tests revealed that for each emotion clip, ratings of corresponding affective state decreased for those in the distraction and reappraisal conditions as compared with those in the control condition ($ps < .02$). Differences in affective state between those in the distraction and reappraisal conditions were also assessed for each emotion using Tukey post hoc tests. When comparing distraction and reappraisal, no significant differences in affective state were found in response to fear, sadness, disgust clips ($ps > .23$). However, a marginally significant decrease was observed for those in the distraction ($M = 3.09$, $SD = 1.59$) as compared with the Reappraisal ($M = 3.94$, $SD = 1.67$) condition in affective state for the anger clip ($p = .057$). Thus, for each induced Emotion, respective affective state ratings decreased for those in the distraction and reappraisal conditions as compared with control; however, only for the emotion of anger did the difference

Table 2
Dwell Time Descriptive Statistics for Distraction, Reappraisal, and Control Groups

	Distraction ($N = 38$)			Reappraisal ($N = 35$)			Control ($N = 32$)		
Emotion	*M*	*SD*	95% CI	*M*	*SD*	95% CI	*M*	*SD*	95% CI
Anger	25.88	(7.57)	[23.39, 28.36]	32.10	(4.96)	[30.40, 33.81]	31.94	(3.78)	[30.58, 33.30]
Fear	29.45	(8.28)	[26.73, 32.17]	32.20	(2.19)	[31.45, 32.96]	31.86	(2.40)	[30.99, 32.72]
Sadness	29.71	(8.46)	[26.93, 32.49]	31.69	(4.40)	[30.18, 33.20]	32.46	(1.48)	[31.93, 33.00]
Disgust	30.80	(8.30)	[28.07, 33.53]	32.47	(4.74)	[30.84, 34.10]	32.16	(3.59)	[30.86, 33.45]

Note. CI = confidence interval.

Figure 1
Effect of Emotion on Attention by Group

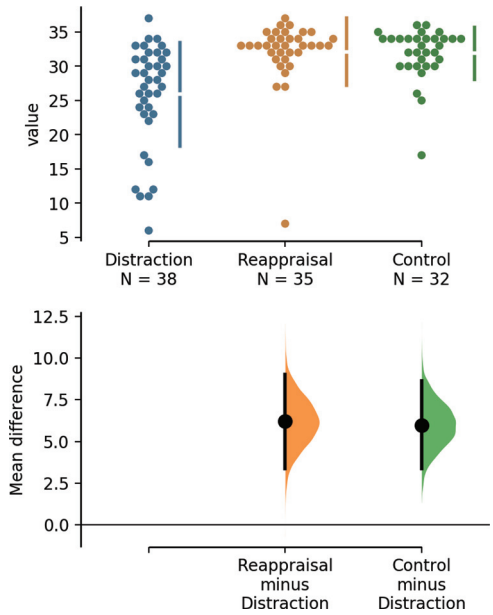


between affective state in distraction versus reappraisal approach significance.

Regression and simple slopes analyses were then used to test our hypotheses regarding the moderating effects of state and trait anxiety on the association between strategy and dwell time during the anger clip. We focused on the anger clip, specifically, as it was the only condition in which we saw differences in dwell time as a function of strategy. First, we mean-centered trait anxiety (STAI-T) and dummy coded emotion regulation strategy with the distraction condition as the reference group. Next, we created two interaction terms by multiplying state anxiety (mean-centered) by each of the dummy variables. We then ran a multiple linear regression analysis to determine whether self-reported state anxiety (as measured by the STAI-T subscale) moderated the effect of strategy on dwell time during the anger clip.

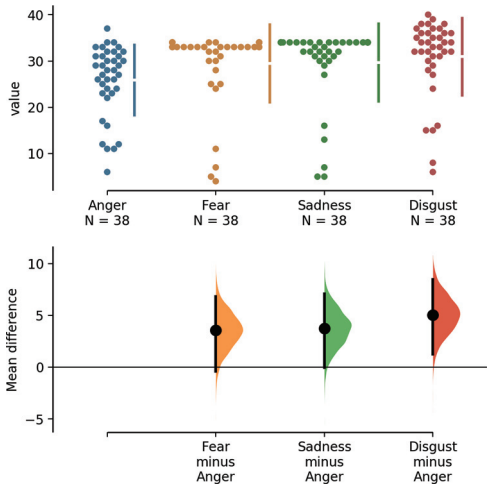
The analysis revealed no interaction between trait anxiety and reappraisal (compared with distraction; $b = -.164$, $SE = .19$, $p = .381$) or between trait anxiety and control (compared with distraction; $b = -.099$, $p = .624$). These results suggest that the effect of strategy on dwell time during the anger clip did not vary as a function of trait anxiety.

Figure 2
The Mean Difference for the Anger Condition Between the Distraction, Reappraisal, and Control Groups Shown in the Cumming Estimation Plot



Note. The raw data is plotted on the upper axes. On the lower axes, mean differences are plotted as bootstrap sampling distributions. Each mean difference is depicted as a dot. Each 95% confidence interval is indicated by the ends of the vertical error bars. See the online article for the color version of this figure.

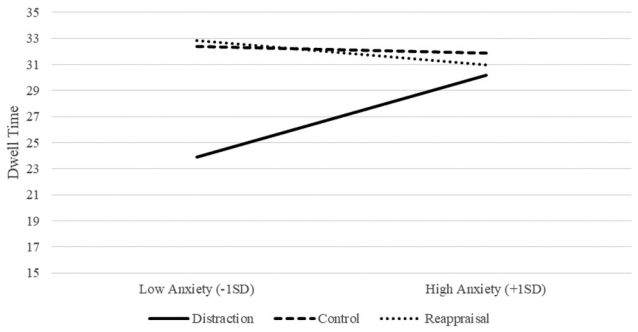
Figure 3
The Mean Difference for the Distraction Group Between the Anger, Fear, Sadness, and Disgust Conditions Shown in the Cumming Estimation Plot



Note. The raw data is plotted on the upper axes. On the lower axes, mean differences are plotted as bootstrap sampling distributions. Each mean difference is depicted as a dot. Each 95% confidence interval is indicated by the ends of the vertical error bars. See the online article for the color version of this figure.

Figure 4

State Anxiety Moderates Relation Between Dwell Time and Emotion Regulation Strategy During Angry Emotional Material



We then repeated the moderation analysis using state anxiety (STAI-S). This analysis revealed a significant interaction between state anxiety and reappraisal (compared with distraction; $b = -.37$, $SE = .15$, $p = .015$) and a significant interaction between state anxiety and control (compared with distraction; $b = -.31$, $SE = .16$, $p = .051$), indicating that strategy on dwell time during the Anger clip varied as a function of level of state anxiety.

We probed these interactions by examining the simple slopes for the association between emotion regulation strategy and dwell time at low (-1 *SD*) and high ($+1$ *SD*) levels of state anxiety. Results showed a significant effect of engaging in reappraisal (as compared with distraction) at low levels of state anxiety ($b = 8.94$, $SE = 2.11$, $p < .001$), but not at high levels of state anxiety ($b = .81$, $SE = 2.36$, $p = .733$), as well as a significant effect of not engaging in a particular emotion regulation strategy (i.e., control as compared with distraction) at low levels of state anxiety ($b = 8.49$, $SE = 2.26$, $p < .001$), but not at high levels of state anxiety ($b = 1.69$, $SE = 2.39$, $p = .482$), such that distraction elicited less dwell time toward anger-eliciting content, but only when individuals are low (not high) on state anxiety. These results are depicted in Figure 4.

Discussion

The current study aimed to compare the effect of two different emotion regulation strategies (distraction and reappraisal) on attention and affect during viewing of film clips that elicited four different negative emotions (anger, fear, sadness, and disgust). The results show that distraction, but not reappraisal, reduces the amount of dwell time spent visually attending to anger-inducing content. Further, when people are distracting, they look less at anger-inducing content than fear-, sadness-, and/or disgust-inducing content. The finding that only during distraction (and not reappraisal) do individuals display briefer Dwell time parallels results by Strauss and colleagues (2016), which also showed greater reductions in dwell time on unpleasant pictures while using distraction than while using reappraisal. However, our results also extend this work, showing that this association holds even when the emotional content is longer in duration and more visually complex (i.e., using video stimuli), and suggesting that the allocation of visual resources during distraction may also depend on the *type* of negative emotion an individual is experiencing (i.e., anger, specifically).

We also found that affective state (as indexed by PANAS ratings for each emotion after their respective clip) significantly decreased for those instructed to distract or reappraise in comparison to those who were instructed to view the film clips naturally. Interestingly, when comparing affective state responding between those in the distraction versus reappraisal conditions, we found only one marginally significant difference, reflecting decreases in self-reported anger for those who distracted, in comparison to those who reappraised the anger film clip material. These results provide some evidence to suggest that the use of any emotion regulation strategy (as compared with natural viewing) had a greater effect on the downregulation of this emotion itself, and that the use of distraction may have been particularly potent when used while viewing the anger clip.

Last, we found that state anxiety moderated the relation between emotion regulation strategy and attention while viewing anger-eliciting film clip. Importantly, distraction only elicited less dwell time than reappraisal and natural viewing among those with lower state anxiety. These results suggest that individual differences—particularly state differences in anxiety—may affect the extent to which the use of distraction impacts visual attention allocation.

Theoretical Implications

In their extension of the original process model, Sheppes and Gross (2013) stated that "the success of any particular emotion regulation attempt is thought to be a joint function of the underlying operation of different regulation strategies, levels of emotional intensity, and regulation goals." As such, answering the questions of how and why certain emotion regulation strategies affect attention (and affect) more than others requires careful attention to the type and intensity of the specific negative emotion an individual is attempting to downregulate.

Some studies have shown that individuals differ in their choice of emotion regulation strategy on the basis of the intensity of the emotional material with which they are presented (e.g., Martins et al., 2018; Sheppes et al., 2014). For example, one study (Sheppes et al., 2011) presented participants with negatively valenced emotional pictures (ranked from low- to high-emotional intensity) and instructed participants to either think of something emotionally neutral (i.e., employ distraction) or think about each picture in a way that reduced its negative emotional meaning (i.e., employ reappraisal). Results showed that healthy individuals switch flexibly between different emotion regulation strategies but that they choose to employ distraction when the intensity of negative emotional material is high and alternatively employ cognitive reappraisal when the intensity of negative emotional material is relatively low. It is this very flexibility—the propensity to choose when a given emotion regulation strategy will be effective and to adapt to ever-changing emotional states and environments that researchers such as Aldao and colleagues (2015) suggested is predictive of most successful emotion regulation usage. Though in our study we did not provide participants with a choice between different emotion regulation strategies, this work nevertheless suggests that distinct differences in emotions are an important factor when it comes to the utility and efficacy of different emotion regulation strategies in any given situation.

Building upon these frameworks that suggest many emotion regulation strategies are not best used nor yield the same results in

all situations, we find that only with some types of emotional information (e.g., anger-eliciting material)—and under some kinds of affective states (e.g., high state anxiety)—does strategically distracting oneself also elicit reduced visual attention to the information. We also find that not to be the case for other types of emotional information—and under other kinds of affective states. These results imply that distraction does not always affect visual attention in the same way. We suggest that perhaps part of why findings in this arena (e.g., Strauss et al., 2016; van Reekum et al., 2007) have been shown mixed results (in terms of whether or how emotion regulation strategies influence visual attention) is because previous studies' designs have been influenced by an assumption that the effect of emotion regulation strategy on visual attention will be consistent across types of emotion and individual states.

Aligned with Sheppes and Gross (2013) extended model, our results suggest we cannot say that distraction does one thing as though distraction always or consistently will do that one thing. Instead, we show that it depends on at least two factors (i.e., type of emotion and state anxiety)—and likely many more. We propose that the major implication of our findings is the suggestion that we remain cautious about drawing conclusions that one type of strategy will always have the same effect on cognitive or affective processes. Here, we see that whether distraction affects a core cognitive process (even in the context of an identical experimental procedure) entirely depends on the nature of the emotional content and an individual's affective state.

Limitations and Future Directions

This study has several limitations worth addressing. First, the clinical information collected on participants was limited. Our participants were an unselected sample of community members, so we were unable to determine whether a history of psychopathology may have also moderated the effect of using a particular emotion regulation strategy on dwell time. Indeed, a meta-analytic review by Aldao et al. (2010) examining the magnitude of relationships between emotion regulation strategies and psychological outcomes demonstrated important differences when type of psychopathology was included in their model. For example, reappraisal was shown to be a more effective strategy for downregulating emotion for those with depression and anxiety disorders than for those with eating and substance use disorders (Aldao et al., 2010). Thus, it is possible that certain strategies may have been more or less effective at downregulating particular negative emotions based not only upon state levels of anxiety, but also upon current and/or diagnostic history of psychiatric disorder(s). To our knowledge, no previous work has examined this question—particularly across different types of negative emotions—and this question should be interrogated in future research.

A second potential limitation of this study is the difficulty in isolating the most emotional material in a rich and complex film clip. As previously mentioned, one strength of this study was our use of dynamic film clips, rather than the still-frame stimuli utilized widely in literature (e.g., Ferri et al., 2013; Strauss et al., 2016; van Reekum et al., 2007). Nevertheless, employing this more complex stimulus posed challenges in determining exactly which AOIs to circumscribe. We relied on previous work (e.g., Duque et al., 2014; Sanchez et al., 2013; Sanchez et al., 2014) showing the robust effects of emotional faces on eliciting both positive and negative mood states, and we defined the emotional content within each clip as the faces. That said, it is possible that these AOIs did not capture the full extent of emotional material within each frame of each video (e.g., the rope holding a man who had just committed suicide was not included as emotional content in the sad clip). It is also worth noting that not all faces in the videos were emotion-matched. For example, in the fear clip (a famous clip from *The Shining* Kubrick, 1980), though the small boy was expressing fear/terror, the other twin girls in the frame had expressionless frames. Though we used all faces to remain consistent across films, it is possible that the inclusion of some nonemotion-matched (e.g., nonfearful) faces generated noise in our results. Future work may be able to compare the effects of facial and nonfacial emotional AOIs in a paradigm such as ours. It may be the case that by capturing more emotional material within our AOIs we can more accurately predict the relation between visual attention and emotion regulation.

Third, though we elucidated an important effect of emotion regulation strategy on visual attention allocation—particularly when viewing anger-inducing stimuli—we were only able to find marginally significant evidence that the emotional strategy downregulated the emotion itself (as measured by the modified PANAS). Given that we did not provide participants' the opportunity to reflect on their experiences using these strategies, we can only speculate on why we did not see a more robust effect of Strategy on Affective State, despite observing an effect of visual attention allocation. We believe one reason for this lack of effect may be that although anger is often experienced as affectively negative and is linked to psychological disorders such as depression, anxiety, and PTSD (e.g., Busch, 2009; McHugh, 2012; Novaco, 2010), some scholars emphasize the positive aspects of the emotion, such as its function of mobilizing individuals toward action (e.g., in the face of witnessing injustices; Hess, 2014; Williams, 2017). For this reason, despite being instructed to use the assigned emotion regulation strategy to "turn down" their emotions, some individuals may have cognitively resisted the act of "turning down" aspects of their angry emotional response. As such, overall ratings of anger on a one-item scale such as the modified-PANAS may not have been able to reflect any decreases in anger as a negative emotion. Given the complexity of an emotion such as anger, use of a more extensive battery assessing emotional states and/or eliciting reflections from participants at the end of the task may have provided us with more reliable information about changes in negative emotional experience.

Two final minor drawbacks are worth noting. The first was that clips used in this study were not chosen from an existing stimulus set and differ from those traditionally utilized in the literature (e.g., Carvalho et al., 2012; Gross & Levenson, 1995; McHugo et al., 1982; Philippot, 1993; Schaefer et al., 2010). Though the four clips used in this study were validated for their targeted emotion via our Mechanical Turk (MTurk) pilot and appeared to generate their target emotion in the study itself, we are limited in the ability to directly compare our study to those that have used more well-validated clips. Last, for the sake of accomplishing our goal of comparing attention allocation across several emotions and investigating associations with state anxiety, we relied on dwell time as a singular eye-tracking variable of interest. That said, it is possible that more a fine-grained time-course attention analysis (e.g., see Strauss et al., 2016) may have yielded more detailed information regarding patterns of attention processing across the clips and potentially more closely replicated other work's

results. Future studies should aim to expand upon our work using such metrics of eye-tracking analysis.

Conclusions

In sum, our findings provide evidence that different emotion regulation strategies differentially affect attention allocation—and that the relation between emotion regulation strategy and attention allocation is moderated by state-level individual differences. Specifically, we found that distraction, but not reappraisal, reduces the amount of dwell time one spends visually attending to anger-inducing content. However, we found that this relation is significantly stronger in those who are low (as compared with high) on state anxiety. These findings provide valuable insights into the mechanism through which distraction may downregulate negative affect, the negative emotional state(s) for which certain emotion regulation strategies may (or may not) be useful, and the person-level characteristics that may interfere with the ability to alter affective state (e.g., high anxiety/arousal). Because the use of emotion regulation strategies is vital to the maintenance of individuals' emotional well-being, it is integral that we better understand the mechanisms by which they work and how, in fact, they differ. This work is a first step in understanding the crucial role visual attention plays in the use of distraction on the experience of anger. Future studies are needed to more deeply interrogate the dynamic properties of emotions and how attention allocation may alter them.

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(*Appendices follow*)

Appendix A

Emotional Film Clip Information

Emotional film clips consisted of two-minute scenes from the following sources, selected to elicit each respective emotion (Anger, Fear, Sadness or Disgust). Clips were validated via an MTurk pilot to ensure each clip reliably elicited its target emotion.

Public access to view each video clip: perceptionexperiments.net/HR/Rutherford.et.al.

Anger:
The Color Purple (Walker et al., 1985)
Fear:
The Shining (Kubrick, 1980)
Sadness:
An Officer and a Gentleman (Stewart et al., 1982)
Disgust:
Fear Factor (van Ende & Rogan, 2001–2006)

Appendix B

Post Hoc Analyses

To assess whether there were any differences in intensity or arousal associated with each target emotion, another 50 participants (age range 18–50 years) were recruited online via Amazon Mechanical Turk. Participants rated each clip using the Self-Assessment Manikin (SAM; Bradley & Lang, 1994), a nine-point Likert-type scale rating where they indicate how aroused the video made them feel (from *very calm* to *very aroused*) and how pleasant the video made them feel (from *unpleasant* to *very pleasant*). A one-way ANOVA comparing the effect of Emotion on Arousal revealed there was no significant difference in Arousal between the groups, $F(3, 107) = 1.16$, $p = .330$. A one-way ANOVA comparing the effect of emotion on valence also revealed there was no significant difference in valence between the groups, $F(3, 107) = .703$, $p = .552$. Post hoc Tukey's HSD analyses for both ANOVAs indicated no significant differences in arousal or valence ratings among any clip pairs ($ps > .304$).

Appendix C

Emotion Regulation Condition Instructions

Distraction Versus Reappraisal Instructions

Reappraisal

During the film, your task is to use REAPPRAISAL (or, in other words, reinterpretation). That is, think about the scene and make new interpretations of the events in it, in order to turn down your emotions. It is very important that you think about the scene in such a way that it helps you feel less negative about it. In order to do so, we ask that you view the film and try to think about it in a less upsetting light. If it depicts something that makes you feel upset, try and change the meaning of it, such as by reminding yourself that though it may be painful in the moment, it could improve over time. For example, you can focus on imagining that whatever is going on will soon be resolved, that help is on the way, or that the characters will soon learn something that will make it okay. You could also focus on an aspect of the situation that may not be so bad. That is to say, at the same time of viewing the film, try to focus on reinterpreting the events depicted in it so you can see them in an emotionally neutral light. Change something about the scenario that helps you feel less negative about it. While you are using reinterpretation, it is very important that you continue to keep your eyes on the screen at all time.

Distraction

During the film, your task is to use DISTRACTION—that is, think of other things that are completely unrelated to the scene, in order to turn down your emotions. Therefore, it is very important that you try your best to think about something that is emotionally neutral and that is not related to the film content. For example, you can imagine your neighborhood or think about the layout of a nearby grocery store. You could also imagine yourself doing everyday things like making coffee in the morning. It is important not to focus on something that is highly emotional, since we do not want you to think about

(*Appendices continue*)

Figure C1
Emotion Regulation Strategy Practice Image

Note. This image was shown to participants. See the online article for the color version of this figure.

anything that brings extreme sadness or happiness. Regardless of how you choose to distract yourself, make sure that at the same time of viewing the film, you try to focus your thoughts on something that is unrelated and neutral. While you are using reinterpretation, it is very important that you continue to keep your eyes on the screen at all time.

Distraction Versus Reappraisal Instruction Examples

Image 1: [Image of one male adult and one female adult arguing with each other was shown to participants].

Distraction

So, I see this picture of a couple fighting, and it initially looks like a bad situation. But I want to think of something totally unrelated to this scene in order to turn down my emotions and decrease my emotional reaction. So now I'm thinking of drinking tea this morning and picturing the mug it was in: This really bright blue mug that I have and use a lot. And this makes me think of the other mugs that I have, so to distract myself I'm kind of going through my cupboard thinking of the different shapes and patterns of mugs that are in there. So that's an example of what I might think about during an emotional scene if I were trying to distract myself.

Reappraisal

So, I see this picture of a couple fighting, and it initially looks like a bad situation. But I want to think of something totally neutral in order to turn down my emotions and decrease my emotional reaction. Maybe they are mad right now, but they are going to get through this. People argue all the time, but it is going to get better. They will look back on this one day and be okay.

Examples of Constructive Feedback to Participants' Practice

(i) REAPPRAISAL: "OK, so one thing I noticed is you were explaining the scene in a way that is different from the immediate interpretation but is still sad, rather than in a way that turns down your emotions. What's another interpretation of it you could make where your interpretation makes the events emotionally neutral?"

(ii) DISTRACTION: "OK, so one thing I noticed is that what you were thinking about was a very positive memory, rather than an emotionally neutral memory. What's a more neutral memory that you could think of instead?

Whatever researcher says, make sure that the participant is reinterpreting the scene by making alternate explanations/stories for what is going on and in a way that is emotionally neutral.

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