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Attentional Deployment Is Not Necessary for Successful Emotion Regulation via Cognitive Reappraisal or Expressive Suppression

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According to appraisal theories of emotion, cognitive reappraisal is a successful emotion regulation strategy because it involves cognitively changing our thoughts, which, in turn, change our emotions. However, recent evidence has challenged the importance of cognitive change and, instead, has suggested that attentional deployment may at least partly explain the emotion regulation success of cognitive reappraisal. The purpose of the current study was to examine the causal relationship between attentional deployment and emotion regulation success. We examined 2 commonly used emotion regulation strategies—cognitive reappraisal and expressive suppression—because both depend on attention but have divergent behavioral, experiential, and physiological outcomes. Participants were either instructed to regulate emotions during free-viewing (unrestricted image viewing) or gaze-controlled (restricted image viewing) conditions and to self-report negative emotional experience. For both emotion regulation strategies, emotion regulation success was not altered by changes in participant control over the (a) direction of attention (free-viewing vs. gaze-controlled) during image viewing and (b) valence (negative vs. neutral) of visual stimuli viewed when gaze was controlled. Taken together, these findings provide convergent evidence that attentional deployment does not alter subjective negative emotional experience during either cognitive reappraisal or expressive suppression, suggesting that strategy-specific processes, such as cognitive appraisal and response modulation, respectively, may have a greater impact on emotional regulation success than processes common to both strategies, such as attention.

Keywords: emotion regulation, cognitive reappraisal, expressive suppression, gaze

The experience of negative emotions is part of everyday life (Gross, Richards, & John, 2006) and is a major source of human suffering (Gross, 1999). Controlling or regulating negative emotions is integral to maintaining mental health (Gross & Munoz, 1995) and adaptive functioning within our complex social environments (Gross, Richards, & John, 2006). When emotions are not successfully regulated, psychological disorders, such as anxiety disorders, major depressive disorder, and borderline personality disorder, may manifest (Amstadter, 2008; Davidson, Putnam, & Larson, 2000; Gross & Munoz, 1995).

Appraisal theories of emotion have suggested that cognitive change processes are powerful emotion regulation strategies because changing our thoughts changes our appraisals and, therefore, our feelings (Lazarus, 1991). An exemplar cognitive change strategy is cognitive reappraisal (see Gross & Thompson, 2007, for a review). Cognitive reappraisal facilitates reframing the meaning and significance of emotional events to regulate emotions. Everyday use of cognitive reappraisal is linked with several indicators of healthy functioning, including fewer symptoms of depression, increased levels of optimism and life satisfaction, and the presence of social relationships and social support (Gross, Richards, & John, 2006).

Recently, findings from a neuroimaging study have challenged the importance of the cognitive change process in the emotion regulation success of cognitive reappraisal. van Reekum et al. (2007) observed that patterns of eye movements accounted for significant variance in the neural activity of older adults using cognitive reappraisal to regulate negative emotions. Based on their findings, the authors inferred that attentional deployment (Franconeri, 2013), instead of cognitive change, was a causal mechanism underlying the emotion regulation success of cognitive reappraisal. However, because this study did not experimentally manipulate attentional deployment, causal conclusions about the role of attentional deployment in emotion regulation success are limited.

To obtain causal evidence for the role of attentional deployment in emotion regulation success, Urry (2010) manipulated participants' gaze over emotional images while they used cognitive reappraisal. Specifically, participants were asked to maintain fix-

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ation within a small square area of interest within an emotional scene while the rest of the image was partially faded out. Here, participants' corrugator muscle activity, a sensitive measure of facial expressivity, was lower during cognitive reappraisal relative to the control condition (natural experience of emotion) when gaze was directed to arousing versus nonarousing areas of negative images. In contrast, self-reports of emotional intensity, a behavioral measure of emotion regulation success, did not vary with changes in arousal focus. Based on these findings, Urry concluded that attentional deployment influenced some (expressive behavior as indexed by corrugator activity), but not all (emotional experience as indexed by emotional intensity ratings), aspects of emotion regulation success, thereby providing initial evidence that cognitive change, independent of attentional deployment, contributes to the emotion regulation success of cognitive reappraisal. However, interpretation of this data is complicated given the lack of a free-viewing control group and the disruption of natural scan paths by holding participants' gaze in one place.

To further examine the relationship between attentional deployment and emotion regulation success, the current study experimentally controlled eye movements during emotion regulation and recorded participants' ratings of negative emotions as an indicator of emotion regulation success (experimental "regulate" ratings − baseline "attend" ratings). This work builds on previous studies in three novel ways. First, we examined how the act of controlling participants' attention, compared with conditions of free-viewing, influences emotion regulation success. Because previous work did not include a free-viewing condition, it is not clear whether the act of controlling visual attention itself could impact emotion regulation success. Here it is important to note that the visual content of the images being viewed was not critical; instead, we were simply interested in examining the effects of self-controlled visual attention (unrestricted viewing conditions) versus externally controlled visual attention (restricted viewing conditions) on emotion regulation success. Participants were assigned to either a free-viewing group (unrestricted viewing conditions) or an instructed gaze-control group (restricted viewing conditions). If attentional deployment is not involved in the emotion regulation success (indexed by changes in emotional experience) of cognitive reappraisal, as Urry (2010) demonstrated, then reappraisers in both groups should report similar levels of emotion regulation success (i.e., self-report less negative affect).

Second, to avoid disrupting natural scan paths, we controlled gaze by instructing participants to visually follow a small circle as it moved across a predetermined pathway of negative or neutral spatial locations within negative International Affective Picture System (IAPS) (Lang, Bradley, & Cuthbert, 2005) images. Here it is important to note that the valence (negative or neutral) of the spatial locations being viewed was critical because we were interested in examining how visual content[1] influenced emotion regulation success in the gaze-control participants (free-viewing participants were not directed to or restricted from viewing the images in this manner and, thus, not included in this aspect of the study). If attentional deployment is not involved in the emotion regulation success of cognitive reappraisal, then reappraisers should report similar levels of emotion regulation success whether they are viewing negative or neutral spatial locations within negative images.

Third, we included a second emotion regulation strategy—expressive suppression—in our study. Expressive suppression is a response-focused emotion regulation strategy that inhibits emotional expression without decreasing emotional experience (see Gross & Thompson, 2007, for a review). Studies often compare cognitive reappraisal and expressive suppression because these two emotion regulation strategies are used in everyday life, but are associated with different behavioral, experiential, and physiological outcomes. Because no studies have controlled gaze during expressive suppression, we did not have specific a priori hypotheses regarding the effects of attentional control on the emotion regulation success of expressive suppression.

Method

Participants

One-hundred sixty-eight healthy young adults (ages 18–24 years) with normal or corrected-to-normal vision participated in this study for either course credit or monetary compensation. Half of the participants were randomly assigned to a gaze-control group ($n = 84$; 41 women; $M_{\text{age}} = 18.75$ years, $SD = 0.96$). These 84 gaze-control participants were then randomly assigned to either a reappraise ($n = 43$; 22 women) or a suppress ($n = 41$; 19 women) group.

The other half of participants ($n = 84$; 40 women; $M_{\text{age}} = 19.67$ years, $SD = 2.08$) were randomly assigned to the free-viewing version of this study. These free-viewing participants were then randomly assigned to either a reappraise ($n = 40$; 23 women) or a suppress ($n = 44$; 21 women) group. Analyses examining the free-viewing groups' eye-movement patterns and pupil size during emotion regulation are reported elsewhere (Bebko, Franconeri, Ochsner, & Chiao, 2011).

Stimuli and Emotional Area-of-Interest Definition

Twenty digital IAPS color images (1024 × 768 pixels) (Lang, Bradley, & Cuthbert, 2005) were selected to be unpleasant ($M = 3.04$, $SD = 0.60$), dominating ($M = 4.60$, $SD = 0.52$), and arousing ($M = 5.15$, $SD = 0.59$), according to standardized IAPS ratings. Twenty neutral images (valence: $M = 6.02$, $SD = 0.56$; dominance: $M = 4.52$, $SD = 0.48$; arousal: $M = 5.41$, $SD = 0.48$) were also selected to prevent habituation to the negative images (see Bebko, Franconeri, Ochsner, & Chiao, 2011, for a full description of IAPS images included in the current research). Negative emotional areas-of-interest (eAOIs) were defined as the top 50% most emotionally negative spatial locations from the map of the most frequently fixated locations within the IAPS images (see Bebko, Franconeri, Ochsner, & Chiao, 2011, for a full description of the norming procedure and eAOIs within this set of IAPS images). Covering the eAOIs from visual perception led participants to report a different emotional experience than when partic-

[1] Affective processing of emotional visual information outside of foveal view can occur under specific circumstances, such as when emotional visual scenes have been viewed previously in the left visual field (Calvo & Nummenmaa, 2007). Because participants viewed each image in the current experiment only once, it is unlikely that visual information outside of foveal view during gaze control underwent affective processing.

ipants saw intact emotional IAPS images, suggesting that eAOIs contain emotional information important for emotional experience. As a baseline for comparison, we also defined neutral areas-of interest as the top 50% most emotionally neutral spatial locations from the map of the most frequently fixated locations within the IAPS images. Negative eAOIs were, on average, 14.3° away from neutral eAOIs (SD = 5.8°), and the closest negative eAOI to any given neutral eAOI was, on average, 10.0° (SD = 3.9°). These separations should place one location type clearly in the periphery (greater than 2° from fixation; see Strasburger, Rentschler, & Jüttner, 2011) when fixating the other location type. This should be true even when considering the average variability in eye gaze to the directed target position (mean error across participants of 3.31°).

Eye-Tracking Apparatus

Eye movements were recorded with an EyeLink 1000 (SR Research, Mississauga, Canada) eye tracker to obtain an error measurement (average distance in pixels) of each participant's fixation accuracy. The eye tracker was controlled by a personal computer, which simultaneously recorded event codes transmitted by a stimulus generation computer. A 9-point calibration was performed prior to the experiment. Images were displayed on a 19-in. LCD monitor (1024 × 768 resolution; 30.5 pixels per degree of visual angle) located approximately 60 cm from participants' eyes using Experiment Builder software (SR Research, Mississauga, Canada).

Emotion Regulation Training

To parallel training conducted in previous emotion regulation studies, an experimenter provided both a written and a verbal description of how to use the assigned emotion regulation strategy (see Gross, 1998; Ochsner et al., 2004). Participants in the suppress group were instructed to inhibit facial emotional expressions so that someone watching them would not be able to identify their feelings during "regulate" trials. Participants in the reappraise group were instructed to reinterpret the images to decrease their negative emotional response during "regulate" trials. For example, an image of a woman crying in a church may initially be interpreted as an expression of mourning at a funeral. When reappraising the image to feel more positive, one might reinterpret the picture as depicting a woman crying tears of joy at a wedding. The experimenter instructed participants to avoid using any type of strategy other than the assigned strategy during the experiment. As a baseline for comparison with the regulate trials, during "attend" trials, all participants in the study were instructed to respond naturally to the images.

Under the experimenter's supervision, participants practiced their assigned strategy while viewing 10 negative and 10 neutral IAPS images unique to the training session. In addition, participants also practiced rating how negative they felt on a scale from 1 (*weakly negative*) to 7 (*strongly negative*) after viewing each image. After the practice session, the experimenter verbally confirmed participants' ability to use the assigned strategy and to understand the emotion rating scale. Participants were also reminded to use the assigned emotion regulation strategy to the best of their ability and to accurately report their emotional experiences after performing the task regardless of how successful they felt they used the assigned emotion regulation strategy.

Procedure

We adapted a commonly used emotion regulation paradigm for use in the current study (i.e., see Ochsner et al., 2004) (see Figure 1a). At the beginning of each trial, participants first saw an instructional cue, presented for 2 s, to either attend or to regulate emotions elicited by the next image in the trial. After seeing the instructional cue, participants followed the instruction while viewing an IAPS image for 10 s. To control attentional deployment, the gaze-control group moved their eyes along a predetermined path comprised of a circle that moved across the screen (i.e., changed position on the computer screen by appearing in one location, disappearing, appearing in the next location, and so forth) six times (i.e., two visits to each of three target locations in the following order: A-B-C-B-A-C) during the 10-s image viewing period (see Figure 1b). The A-B-C-B-A-C pathway of targets was presented in the same order across participants for each image (i.e., each participant viewed the same pathway of targets for Image 1, Image 2, and so on). The circle (20 pixel diameter, 2 pixel stroke width) was bordered by both black and white in order to ensure visibility over various colors in the images (i.e., the black border would be visible if the circle overlapped white or a light color, and the white border would be visible if the circle overlapped black or a dark color), and the center was transparent to minimize obstruction of viewing the image. The circle spent approximately 1.67 s at each target in the path. For half of the negative images trials (10 negative images), gaze-control participants followed the moving circle within the eAOIs. For the other half of negative images trials, gaze-control participants followed the moving circle within the neutral areas. For all neutral images, the circles moved within neutral areas because neutral images do not have eAOIs. Because there were many potential "negative" or "neutral" areas within each image, the three circle positions were chosen to correspond to three negative and three neutral points that were centered on broad peaks of negativity in the image, but were also well spaced from each other. The free-viewing group freely viewed the images on the computer screen without restriction.

After viewing each image, participants rated how negative they felt on a scale from 1 (*weakly negative*) to 7 (*strongly negative*) as a measure of subjective negative emotional experience. Finally, a screen with the instruction to "relax" appeared for 4 s. There were five trials in each of the eight blocks (40 total trials), and the block order was counterbalanced between participants. The order of negative and neutral images was randomized within each block. We used a mixed-model design with type of instruction (attend, regulate) and image valence (negative, neutral) varied across blocks. Thus, there was one condition of interest for the free-viewing versus gaze-directed comparison, and there were four conditions of interest for the gaze-control condition: (a) attend to negative images with gaze directed toward negative emotional areas within negative images, (b) attend to negative images with gaze directed toward neutral areas within negative images, (c) regulate to negative images with gaze directed toward negative emotional areas within negative images, and (d) regulate to neg-

Figure 1. Emotion regulation task. For the first 2 s of each trial, a cue appeared with the instructions to attend (experience emotions naturally) or to regulate emotions during the trial (a). Next, participants followed the task instructions while viewing a negative or neutral International Affective Picture System image (Lang, Bradley, & Cuthbert, 2005) for 10 s. The gaze-control group, but not the free-viewing group, had restricted viewing conditions (see panel b for description). Participants then provided a self-report rating of "How negative do you feel?" on a scale from 1 (*weak*) to 7 (*strong*). At the end of the trial, a screen with the instruction "relax" appeared for 4 s (adapted from Bebko, Franconeri, Ochsner, & Chiao, 2011). A moving circle directed gaze-control participants' gaze to three target locations across a predetermined negative (A-B-C-B-A-C) or neutral (D-E-F-E-D-F) pathway of targets (b). The circle went to each target twice and spent approximately 1.67 s at each target.

ative images with gaze directed toward neutral areas within negative images.

Emotion Regulation Questionnaire

After completing the emotion regulation task, gaze-control participants[2] completed the Emotion Regulation Questionnaire (ERQ; Gross & John, 2003). The ERQ has two subscales that measure individual differences in the habitual use of cognitive reappraisal (ERQ-R) and expressive suppression (ERQ-S) in everyday life. We included the ERQ to examine whether the role of attention in emotion regulation success was influenced by the habitual use of cognitive reappraisal and/or expressive suppression.

Data Analysis

To obtain a behavioral measure of emotion regulation success, we subtracted the self-reported baseline "attend" ratings from the experimental "regulate" ratings (regulate − attend) of negative emotional experience. For our first hypothesis examining how the act of controlling participants' attention, compared with conditions of free-viewing, influences emotion regulation success, we used a 2 × 2 (Emotion Regulation Strategy [cognitive reappraisal, expressive suppression] × (Attentional Deployment [free-viewing, gaze-controlled]) analysis of variance (ANOVA) to examine emotion regulation success.[3]

To assess our second and third sets of hypotheses, we examined only the gaze-control group to further understand how manipulating the valence of attentional focus influenced emotion regulation success during cognitive reappraisal and expressive suppression. We conducted a 2 × 2 (Emotion Regulation Strategy [cognitive reappraisal, expressive suppression] × (Valence of Attentional Focus [negative, neutral]) repeated-measures ANOVA to examine emotion regulation success.[4]

In addition, we conducted two-tailed bivariate Pearson correlations between emotion regulation success, ERQ-R and ERQ-S to examine how emotion regulation success during gaze-controlled conditions was influenced by the habitual use of cognitive reappraisal and/or expressive suppression. We examined these correlations within the gaze-control group overall (regardless of assigned emotion regulation strategy) and split by emotion regulation strategy (cognitive reappraisal group and expressive suppression group).

For all three hypotheses, we (a) excluded trials with neutral images because they primarily served to prevent habituation to the

[2] The free-viewing participants participated in this study during academic quarters prior to the gaze-control participants. Unfortunately, we did not incorporate the Emotion Regulation Questionnaire into the experimental procedure until after the free-viewing participants had participated.

[3] Analyses examining attentional deployment differences between the reappraisers and suppressers in the free-viewing group are reported elsewhere (Bebko, Franconeri, Ochsner, & Chiao, 2011).

[4] When sex was included as a factor in these analyses, we did not observe significant differences between men and women ($ps > .05$).

negative images and (b) conducted post hoc two-tailed *t* tests to further examine the nature of significant findings.[5]

Results

Free Viewing Versus Gaze Control

We examined whether controlling attention, relative to free viewing, influenced emotion regulation success. Participants regulated emotions while viewing IAPS images either with (gaze-control group) or without (free-viewing group) viewing restrictions. There was no significant main effect of attentional deployment, $F(1, 164) = 2.26$, $p = .134$, $\eta^2 = .014$, or significant Attentional Deployment × Emotion Regulation Strategy interaction, $F(1, 164) = 0.05$, $p = .825$, $\eta^2 = .000$, on emotion regulation success, suggesting that controlling gaze did not influence emotion regulation success (see Figure 2a; Table 1).

There was a significant main effect of emotion regulation strategy on emotion regulation success, $F(1, 164) = 51.18$, $p = .000$, $\eta^2 = .238$ (see Table 1), such that reappraisers reported greater emotion regulation success relative to suppressers.

Valence of Attentional Focus During Gaze Control

We also examined how varying the valence of attentional focus influenced emotion regulation success during cognitive reappraisal and expressive suppression by comparing gaze-control participants' ratings made when gaze was directed to negative versus neutral areas of negative images.[6]

A significant main effect of emotion regulation strategy, $F(1, 82) = 24.51$, $p = .000$, $\eta^2 = .228$, revealed that reappraisers experienced greater emotion regulation success than suppressers (see Table 2). There was no significant main effect of valence of attentional focus, $F(1, 82) = 0.66$, $p = .420$, $\eta^2 = .008$, or significant Valence of Attentional Focus × Emotion Regulation Strategy interaction, $F(1, 82) = 0.16$, $p = .693$, $\eta^2 = .006$, providing further evidence that controlling gaze does not influence emotion regulation success (see Figure 2b).

As a check, we conducted two statistical tests to examine whether gaze accuracy (i.e., maintaining fixation to the moving circles as measured by average distance in pixels) differed between the emotion regulation strategies and/or influenced emotion regulation success: (a) two-tailed independent-samples *t* test comparing gaze accuracy of reappraise and suppress groups and (b) two-tailed bivariate correlation of gaze accuracy and overall emotion regulation success (regardless of valence of attentional focus). Accuracy of gaze did not significantly differ between emotion regulation groups, $t(80) = 1.72$, $p = .090$, and did not correlate significantly with overall emotion regulation success (reappraise: $r = .074$, $p = .635$; suppress: $r = -.066$, $p = .691$).[7]

ERQ Correlation Analyses

Correlation analyses did not indicate significant associations between emotion regulation success and the habitual use of cognitive reappraisal and/or expressive suppression for the gaze-control group as a whole (ERQ-R: $r = .149$, $p = .175$; ERQ-S: $r = -.110$, $p = .321$) or individually for the gaze-control participants assigned to use cognitive reappraisal (ERQ-R: $r = .121$, $p = .439$; ERQ-S: $r = -.124$, $p = .430$) and expressive suppression (ERQ-R: $r = .194$, $p = .224$; ERQ-S: $r = -.092$, $p = .568$). Two-tailed *t* tests showed that there were no significant differences in ERQ scores between the cognitive reappraisal (ERQ-R: $M = 29.76$, $SD = 5.47$; ERQ-S: $M = 14.30$, $SD = 4.11$) and expressive suppressive groups (ERQ-R: $M = 29.56$, $SD = 4.79$; ERQ-S: $M = 14.09$, $SD = 4.52$), ERQ-R: $t(82) = .184$, $p = .855$; ERQ-S: $t(82) = .217$, $p = .828$.

Discussion

The purpose of the current study was to examine a causal relationship between attentional deployment and emotion regulation success. We hypothesized that emotion regulation success would not be influenced by (a) the general act of controlling visual attention or (b) controlling the valence of visual attention. To address our hypotheses, we experimentally controlled eye movements during emotion regulation and recorded participants' ratings of negative emotional experience as a measure of emotion regulation success.

Parallel with prior emotion regulation research (see Gross & Thompson, 2007, for a review), we found that participants using cognitive reappraisal experienced greater emotion regulation success compared with participants using expressive suppression. Novel to this study, we found that the general act of controlling attentional deployment during emotion regulation did not alter the emotion regulation success of cognitive reappraisal or expressive suppression relative to naturalistic free viewing. All participants, regardless of emotion regulation strategy or viewing condition (free-viewing vs. gaze-control), reported similar levels of emotion regulation success. In addition, within the gaze-control group, we found that varying the valence of attentional focus during gaze control did not alter the emotion regulation success of either emotion regulation strategy: Participants reported similar levels of emotion regulation success when they were viewing negative or neutral spatial locations within negative images. Correlational analyses with the ERQ indicate that this finding was independent of participants' habitual use of cognitive reappraisal or expressive suppression in daily life. Taken together, these findings both complement and extend Urry's (2010) findings by providing further evidence against a causal relationship between attentional deployment and the emotion regulation success of cognitive reappraisal and expressive suppression.

Several novel features of our study extend Urry's (2010) basic findings on gaze control during emotion regulation. First, we included a free-viewing condition to examine how the act of controlling attention, compared with conditions of free-viewing, influenced emotion regulation success because it was unclear

[5] To maintain consistency with our prior study (Bebko, Franconeri, Ochsner, & Chiao, 2011), three negative images were excluded from all analyses because less than 50% of the fixations made by the free-viewing group were within the emotional areas-of-interest.

[6] The error measurement of fixation during gaze control ranged from 47−181 (average distance in pixels). Repeating the analysis without the top 15% of participants ($n = 6$) with the largest error measurement (greater than 131 pixels) and participants with missing error measurements due to technical difficulties with the eye tracker ($n = 2$) produced results without changes in significance.

[7] Two participants, who did not have error values due to technical difficulties with the eye tracker, were excluded from this analysis.

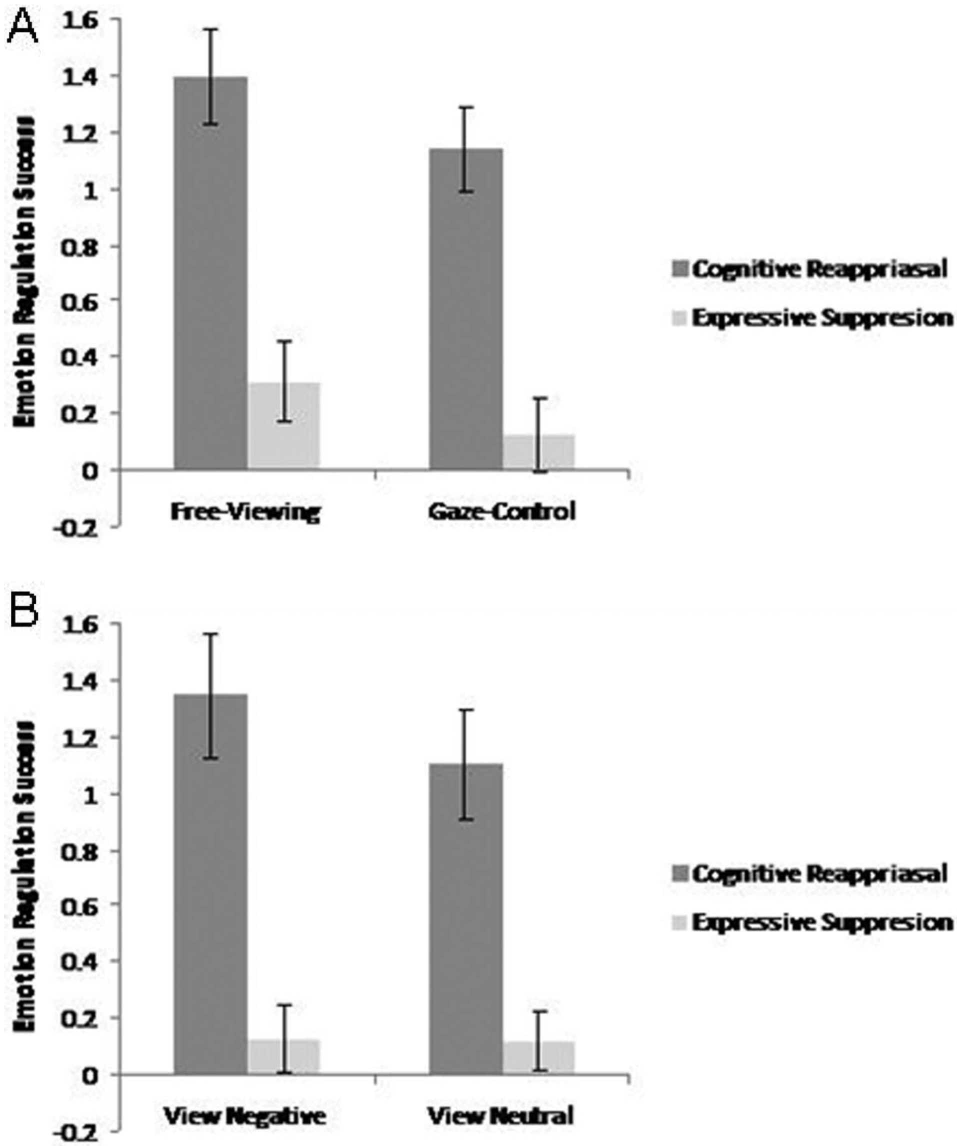

Figure 2. Reappraisers reported greater emotion regulation success relative to suppressers in both the free-viewing and gaze-control conditions (a) and regardless of the valence of gaze direction (b). Emotion regulation success scores were obtained by subtracting attend ratings from regulate ratings, however, they have been reverse coded in the graphs such that the higher the positive number, the greater the emotion regulation success.

whether the act of gaze control itself could impact emotion regulation. Second, our study directed participants' gaze in more naturalistic movements across emotional scenes relative to Urry's study (2010), which required participants to fixate within a small square area of interest within an emotional scene. Third, we included both cognitive reappraisal and expressive suppression groups in our study because these two emotion regulation strategies have an attentional component yet differ in behavioral, experiential, and physiological outcomes (see Gross & Thompson, 2007, for a review).

Although attentional deployment may not play a causal role in the emotion regulation success of cognitive reappraisal and expressive suppression, prior research has shown that attention is an important component of emotion regulation success. Previously, we found that emotion regulation success correlated with naturalistic gaze patterns (Bebko, Franconeri, Ochsner, & Chiao, 2011): Participants exhibited greater emotion regulation success when viewing negative relative to neutral spatial locations of negative images, irrespective of emotion regulation strategy. Based on these findings, we suggested that attentional deployment influenced emotion regulation success independent of the cognitive change or response modulation processes underlying cognitive reappraisal and expressive suppression, respectively. Thus, we propose that attentional deployment may be associated with emotion regulation

Table 1
Mean (Standard Deviation) Comparisons of Negative Emotion Ratings for the Free-Viewing and Gaze-Control Group

	Main effect across image viewing conditions[a]		Gaze-control group		Free-viewing group	
Emotion regulation group	Attend	Regulate	Attend	Regulate	Attend	Regulate
Cognitive reappraisal	4.65 (1.04)	3.44 (1.06)	4.60 (1.00)	3.46 (1.00)	4.71 (1.10)	3.41 (1.34)
Expressive suppression	4.49 (1.11)	4.31 (1.24)	4.35 (1.12)	4.22 (1.20)	4.63 (1.11)	4.40 (1.29)

Note. For negative valence, ratings are a function of emotion regulation strategy, task, and gaze-control condition.
[a] Displays statistics across both levels of the gaze-control variable (gaze-control condition and free-viewing condition).

success (Bebko, Franconeri, Ochsner, & Chiao, 2011) but is not a causal mechanism for the emotional regulation success of cognitive reappraisal (Urry, 2010; current study) or expressive suppression (current study). In other words, attentional deployment may be a common cognitive process associated with, but is not necessary for, the emotion regulation success of cognitive reappraisal or expressive suppression. Strategy-specific processes, such as cognitive change (cognitive reappraisal) and response modulation (expressive suppression), may have a greater impact on emotional regulation success than processes common to both strategies, such as attention.

Basic and Clinical Research Applications

At a basic research level, this work contributes to and advances the study of emotion regulation by providing a more detailed observation into the functional architecture of emotion regulation, which, like other young areas of research, is generally understood but lacks specificity (Ochsner & Gross, 2005). In particular, this study examined how a specific cognitive process (attention) impacted specific emotion regulation strategies (cognitive reappraisal and expressive suppression) and their subsequent emotional responses (self-reported negative emotional experience) (Ochsner & Gross, 2005). This type of research is a critical step toward cultivating a richer understanding of emotion generation and regulation. Additional studies replicating and extending our findings are necessary to further our knowledge of emotion regulation at this basic level of research.

At a clinical research level, this work provides a normative foundation of the role of attention in emotion regulation success in healthy young adults. Future research should examine this relationship in clinical populations because maladaptive attention, a form of emotion dysregulation, characterizes many psychiatric disorders (Campbell-Sills & Barlow, 2007). For example, rumination, a form of maladaptive attention, underlies both anxiety and mood disorders and has been shown to predict both the onset (Nolen-Hoeksema, 2000) and duration (Kuehner & Weber, 1999) of depressive episodes. Understanding the relationship between attention and emotion dysregulation in clinical populations will be key toward developing a greater knowledge of the underlying processes supporting psychopathology.

Limitations and Future Directions

Our study has limitations. First, we did not have a behavioral (i.e., videotape) or physiological (i.e., corrugator activity) index of expressive suppression, so it is unknown whether the expressive suppression participants successfully suppressed facial expressions of emotion. Future studies may want to use a remote eye tracker because it does not require a head rest or mount that physically obstructs the face from indexing facial expressions of emotion through video or electrophysiological recording. Second, we may not be able to generalize our findings to populations other than healthy young adults because gaze patterns to emotional stimuli differ throughout the life span (see Isaacowitz, 2012, for a review) and in psychiatric disorders (Aue et al., 2013). Future studies are needed to assess the causal role of attentional deployment in emotion regulation success in populations other than healthy young adults. Third, the emotion regulation instructions may have biased participants' self-reported emotions. Irrespective of the specifics of how the instructions were worded, the results were both theoretically expected and dovetailed with prior studies that have shown self-reports of emotion, while sometimes decreasing during expressive suppression, do not decrease as much as they do during reappraisal (Goldin, McRae, Ramel, & Gross, 2008; Gross, 1998). Although issues of demand are always a concern in behav-

Table 2
Mean (Standard Deviation) Comparisons of Negative Emotion Ratings in the Gaze-Directed Group When Viewing Negative Regions Versus Neutral Regions of Negative Images

	Main effect across image valence[a]		Negative attentional deployment[b]		Neutral attentional deployment[c]	
Emotion regulation group	Attend	Regulate	Attend	Regulate	Attend	Regulate
Cognitive reappraisal	4.53 (1.03)	3.40 (1.06)	4.69 (1.15)	3.46 (1.21)	4.36 (1.12)	4.33 (1.15)
Expressive suppression	4.27 (1.02)	4.13 (1.12)	4.44 (1.20)	4.25 (1.24)	4.08 (1.09)	4.02 (1.26)

Note. For negative valence, ratings are a function of emotion regulation strategy, task, and valence of attentional deployment.
[a] Displays statistics across both levels of the image valence variable (negative attentional deployment and neutral attentional deployment). [b] Refers to gaze direction to negative areas within negative image. [c] Refers to gaze direction to neutral areas within negative images.

ioral research, it can be useful to differentiate between conditions where self-reports are more likely to be erroneous or biased. Historically, research has shown that self-reports are least likely to be accurate when an individual is asked to report on the activity or the process for the cause of the behavior. However, simple self-reports of one's current mood, affect, or emotion in experimental circumstances, like those used in the present study, are more likely to be as veridical as self-reports can be. Evidence in favor of this comes from a number of studies showing correlations between self-reports of emotion and a variety of physiological and neural indices of emotional response, including corrugator activity, zygomatic activity, startle eyeblink response, and activity in brain structures like the amygdala (Jackson, Malmstadt, Larson, & Davidson, 2000; Lang, Greenwald, Bradley, & Hamm, 1993; Ochsner et al., 2009; Ray, McRae, Ochsner, & Gross, 2010). Of note, these correlations can be observed both in studies of emotional response and in studies of emotion regulation, with the magnitude of regulation-related change in a behavioral measure of emotion correlating with the magnitude of change in a biological measure of emotion. Fourth, visually attending to the target locations may have distracted gaze-control participants from performing the emotion regulation task. Although we were unable to completely eliminate visual distraction from the task due to the nature of controlling gaze, we were able to minimize distraction by using a small visual target (transparent circle with a black and white border). Fifth, we did not counterbalance or randomize target presentation in the gaze-control condition, so order and/or priming effects (i.e., viewing one target location primed the emotional appraisal of the next target) may have influenced the emotional experience and emotion regulation success of the gaze-control participants, leading to no significant main effects. However, all eAOIs were preselected as negative or neutral and equally salient and, thus, the order of presentation should not have influenced processing of the scene. Sixth, it is possible that peripheral visual information outside of foveal view captured participants' attention during the gaze-control condition, however, it is uncertain to what extent this information was processed. Findings from the emotion attention literature are conflicting: Some studies have shown automatic processing of peripheral emotional facial expressions (Bayle, Schoendorff, Henaff, & Krolak-Salmon, 2011) and peripheral emotional scenes (Calvo, Nummenmaa, & Hyönä, 2008; Lichtenstein-Vidne, Henik, & Safadi, 2012), while other studies have shown affective processing of peripheral emotional scenes occurring under specific circumstances (Calvo, Avero, & Nummenmaa, 2011; Calvo & Nummenmaa, 2007) and being impaired relative to the affective processing of foveal visual information. Further research is needed to determine whether peripheral visual information under conditions of gaze-control undergoes affective processing that influences emotion regulation success. Finally, although the current study and Urry's (2010) study have demonstrated that attentional deployment is not a causal mechanism for the emotion regulation success of cognitive reappraisal, our studies could not confirm that cognitive changes in appraisal are the only causal mechanism underlying cognitive reappraisal success. Instead, other factors, such as motivation or social support, may independently, or in combination with cognitive changes in appraisal, contribute to reappraisal success (Opitz, Gross, & Urry, 2012; Parkinson, 1997). Further work is needed to advance our understanding of the causal factors underlying emotion regulation success.

Conclusion

Building on prior emotion regulation research, the current study further emphasizes the absence of a causal relationship between attentional deployment and emotion regulation success. To summarize, we found that the emotion regulation success of cognitive reappraisal and expressive suppression was not altered by controlling attention during emotion regulation compared with free viewing or by varying the emotional valence of the stimulus content within the focus of attention. Taken together, these findings provide convergent evidence that attentional deployment does not alter subjective negative emotional experience during cognitive reappraisal or expressive suppression. Instead, strategy-specific processes, such as cognitive appraisal and response modulation, may have a greater impact on emotional regulation success than processes common to both strategies, such as attention.

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