Predicting Choice: Distraction and Reappraisal as Strategies for Emotion Regulation

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Throughout the literature, emotion regulation has been linked to mental health and well-being, thereby highlighting its importance in everyday life (Gross & Munoz, 1995; Zapf, 2002; John & Gross, 2004). Children begin learning how to cope with their emotions and stress through self-regulation, and this skill is generally mastered through time and experience (Zeman, Cassano, Perry-Parrish, & Stegall, 2006). At a young age, significant individual differences in emotion regulatory abilities become apparent and have profound effects on lifespan development and functioning (Cole, Zahn-Waxler, Fox, Usher, & Welsh, 1996; John & Gross, 2004). In adulthood, emotion regulation continues to have profound implications for how individuals cope with life stressors and interact with others (Gross, 2001). The success with which one is able to regulate his or her emotion is linked to the approach that is taken to regulate. There are a variety of ways to regulate one's emotions, but the emotion regulation literature thus far has primarily focused on cognitive reappraisal.

Reappraisal generally describes the process of interpreting a potentially emotional situation in such a way that alters its emotional trajectory. For example, in response to a crying baby, reappraisal could be used to re-frame the situation in order to reduce negative experience and expression of emotion, perhaps by telling oneself the baby's parents will comfort the baby and that the baby is merely hungry for a snack. Such thoughts may help reduce initial negative affect and physiological arousal elicited by the crying baby. According to the process model of emotion regulation (Gross, 1998), reappraisal is an antecedent-focused strategy. This means that reappraisal is a type of emotion regulation that intervenes in the processes that generate an emotional response, specifically the appraisal event within the emotion-generative cycle (Gross, 1998). The use of reappraisal has implications for well-being; Gross and John (2003) demonstrated that higher levels of reappraisal are associated with an elevated level of life satisfaction, optimism, and increased self-esteem. Clearly, reappraisal seems to be a desirable strategy for emotion regulation.

Another emotion regulation process is distraction. Distraction can refer to redirecting one's attentional focus towards non-emotional information in such a way that alters its emotional trajectory. For instance, another plausible response to the crying baby example described earlier is to ignore the crying baby by thinking about plans for the day. By removing oneself from the situation at hand, the expression and experience of emotion will be changed because attention is not being directed towards the crying baby. In the context of the present study, distraction involves immersing oneself in a neutral thought as an alternative to dealing with the evoked emotion (Gross, 1998; Sheppes & Meiran, 2008). Similar to reappraisal, distraction is also considered an antecedent-focused strategy involving attention deployment (Gross, 1998). Distraction has been shown to provide short-term relief with no long-term benefits like reappraisal (Sheppes & Gross, 2010). Distraction alters emotional expression and experience, as well as physiological responses, by disengaging from negative stimuli; this strategy provides immediate relief and the achievement of hedonic goals to alleviate oneself from the initial negative response (Sheppes & Gross, 2010).

While studies that directly compare reappraisal with distraction are particularly rare in the current body of research, there is some evidence pointing to significant differences in terms of effectiveness. For example, in their functional neuroimaging study, McRae and colleagues (2009) found that both strategies were demonstrated to decrease negative affect and decrease amygdala activation. However, distraction had a stronger inhibitory effect on amygdala activity compared to reappraisal, presumably because not all emotional components of a stimulus or situation were being attended to and encoded. These findings hint that there is a crucial difference between how distraction and reappraisal respectively activate neural systems, and therefore, the strategies likely involve distinct processes and emotional outcomes. Sheppes, Catran, and Meiran (2009) demonstrate an observable difference in electrodermal activity (EDA), or skin conductance, when using distraction versus reappraisal. In particular, reappraisal generated a greater EDA response compared to distraction, and this was interpreted as a physiological cost of using reappraisal.

In the studies that compared the extent to which reappraisal and distraction impact emotional responding, participants were instructed when to use each strategy. Little is known about which strategies people would choose to use if left to their own devices. One factor of interest is the emotional intensity of the situation one is facing. For example, Freud (1962) introduced the possibility that people disengage from the task at hand when negative emotions are high, while engaging when negative emotions are relatively low. Drawing from this theory, Sheppes et al. (2011) demonstrate how participants engaged with stimuli when emotional intensity was low and disengaged under higher emotional intensities using pictures in an initial study and then electric shock in a subsequent study. Engagement referred to the use of reappraisal, while disengagement was associated with distraction. This study supports the idea that the level of emotional intensity impacts people's choice of emotion regulation strategies. However, it does not address what aspects of emotional intensity are responsible.

Some theories suggest that two dimensions, namely valence and arousal, best characterize emotions. Bradley and Lang (2007) explain how emotions are generally divided into positive and negative categories, and this reflects the valence dimension. These separate categories modulate subsequent actions taken in response to the emotional event, and thus the motivational systems that are activated in response to one's emotions. Valence, which refers to how pleasant or unpleasant a stimulus is, serves as an index of which emotions and motivational systems will be activated by a particular stimulus or task. On the other hand, arousal operates as an indicator of the degree to which the emotion and motivational system is activated (Bradley & Lang, 2007). Corrugator electromyography (EMG) activity, as measured by the corrugator supercilii muscles situated above and between the eyes, has been implicated as an index of valence, with greater activity occurring while viewing unpleasant pictures compared to neutral (Fridlund & Izard, 1983). Meanwhile, EDA is considered an index of arousal, with increased EDA while viewing emotional pictures compared to neutral; this effect was observed regardless of picture valence (Winton, Putnam, & Krause, 1984). Highly unpleasant (low valence) and highly arousing (high arousal) situations are experienced as highly emotional, while situations that are only mildly unpleasant and moderately arousing are experienced as less emotional.

The goal of the present study was to examine to what extent the valence and arousal dimensions of high and low emotion predict the strategies people choose to regulate their emotions. The present study addressed this issue by presenting participants with high and low emotional pictures and asking them to choose whether they wanted to use reappraisal or distraction when exposed to the pictures a second time. We examined whether a tendency to choose distraction versus reappraisal is predicted by valence, as measured by normative ratings and corrugator EMG activity, arousal, as measured by normative ratings and EDA, or both. Unlike previous studies, this task allowed us to compare the effectiveness of distraction versus reappraisal after participants have chosen to use each strategy rather than being assigned to do so. While there is no direct evidence to suggest that giving people a choice should make them more or less effective in actually reducing their emotional responses to negative stimuli, this task may provide a more externally valid conclusion since people are not typically forced to use a specific strategy to regulate their emotions outside of the laboratory environment.

With the previous literature in mind, I hypothesized that distraction would be predominantly chosen under high emotion, while reappraisal would be mainly chosen under low emotion. I also hypothesized that lower levels of valence (i.e., more unpleasant) and higher levels of arousal as indexed by normative ratings, higher levels of corrugator EMG activity, and higher levels of EDA during an initial presentation of the unpleasant pictures would be associated with an increased likelihood of choosing distraction. Moreover, drawing from the hypothesized preferences for the respective strategies under high and low emotion, I hypothesized that higher levels of valence (i.e., less unpleasant) and lower levels of arousal as indexed by normative ratings, lower levels of corrugator EMG activity, and lower levels of EDA would predict quicker reaction times for choosing reappraisal for the low emotion pictures. Conversely, lower levels of valence and higher levels of arousal as indexed by normative ratings, higher levels of corrugator EMG activity, and higher levels of EDA would predict quicker reaction times for choosing distraction for the high emotion pictures. In terms of effectiveness, compared to distraction, I hypothesized that choosing reappraisal would be associated with lower negative emotion, as indicated by corrugator EMG activity, EDA, and participant ratings of valence and arousal during the regulation period.

Method

Participants

Forty students from Tufts University participated in this study (51.3% female). They ranged in age from 18 to 27 years old (M = 19.05, SD = 1.69). Participants were 74.4% White, 17.9% Asian, 12.8% Black, and 2.6% declined to answer, and 10.3% identified as being of

Hispanic or Latino ethnic origin. None of the participants had ever been married.[1] The Institutional Review Board at Tufts University approved all measures and procedures, and all participants provided written informed consent at the start of the experimental session. Participants received course credit in an undergraduate psychology course in exchange for the participation.

Measures

Stimuli. The choice task, which will be described below in Procedures, included 90 unpleasant digital images from the International Affective Picture System (IAPS) (Lang, Bradley, & Cuthbert, 2008). The researcher selected 45 low emotion pictures as well as 45 high emotion pictures. Based on normative ratings of valence, measured on a scale ranging from 1 (*completely unhappy*) to 9 (*completely happy*), the low emotion set (M = 3.42, SD = 0.32) was mildly unpleasant and significantly less unpleasant than the high emotion set (M = 1.99 and SD = 0.31). In terms of normative ratings of arousal, measured on a scale ranging from 1 (*completely aroused*) to 9 (*completely calm*), the low emotion set (M = 5.07, SD = 0.76) was moderately arousing and significantly less arousing than the high emotion set (M = 6.05 and SD = 0.76), $p < .001$. Note that all pictures were sufficiently arousing so that there would be negative emotion to regulate after the choice of regulation strategy had been made.

Ratings of emotional intensity. Participants provided subjective ratings of valence and arousal at the end of each trial in the choice task. The valence rating scale ranged from 1 (*not negative at all*) and 9 (*very negative*); see Figure 1. The arousal rating scale also ranged from 1 (*not aroused at all*) to 9 (*very aroused*); see Figure 2.

Physiological measures. For two objective measures of emotion, the researcher incorporated measures of facial EMG and EDA into the experimental design. These peripheral data were collected using an MP150 system (Biopac, Goleta, CA) and processed using ANSLAB (Wilhelm & Peyk, 2005). While measures of pupil dilation were collected during the experiment, the results will not be reported in the present paper.

Corrugator EMG. Corrugator EMG was selected as an index of facial expressive behavior. It is sensitive to stimulus valence, exhibiting higher activity in response to unpleasant stimuli and lower activity in response to pleasant stimuli (Bradley & Lang, 2007). Two 4-mm Ag/AgCl electrodes were placed in bipolar configuration over the left eye per Fridlund and Cacioppo (1986). One ground electrode for all physiological channels was placed on the forehead. Corrugator EMG was sampled at 1000 Hz and bandpass filtered online (5 Hz to 3 kHz; 60-Hz notch filter on). Offline, data were resampled to 400 Hz, rectified and smoothed with a 16 Hz low-pass filter, decimated to 4 Hz, and smoothed with a 1-s prior moving average filter.

EDA. EDA was selected as a measure of sympathetic activation of the peripheral nervous system (PNS). It is sensitive to stimulus arousal, exhibiting higher activity in response to unpleasant and pleasant emotional information relative to neutral information (Bradley & Lang, 2007). Two disposable Ag/AgCl electrodes pre-gelled with 0.5% chloride isotonic gel (1 cm circular contact area) were attached to the distal phalanges of the index and middle fingers on the left hand. EDA level was recorded with DC coupling and constant voltage electrode excitation at 31.25 Hz (sensitivity = .7 nS). Offline, EDA was smoothed with a 1 Hz low-pass filter and decimated to 10 Hz.

Questionnaires. After completing the choice task, participants completed several questionnaires. The results of these questionnaires will not be reported in the present paper.

Procedures

Choice task. The choice task involved three periods (initial presentation, choice, regulation). The initial presentation period allowed the researchers to record the participant's level of emotional response, while the regulation period allowed the researchers to compare distraction and reappraisal in terms of effectiveness. The choice task included 90 trials and lasted about 30 minutes. The choice task trials began with a white fixation cross centered on a black screen, followed by the initial presentation of the picture for 500 ms. The fixation cross screen would then reappear for a period of 2500 ms, after which the choice screen would come up for a minimum of 3000 ms to ensure the measurement of physiological data. Participants were prompted to choose between cognitive reappraisal and distraction. Following their selection, the prepare screen would appear, which served to confirm the participant's choice and give the participant time to prepare to implement the strategy selected. Then, for 5000 ms, the picture would reappear for a longer presentation, and during this time, participants were instructed to begin emotion regulation via the chosen strategy for each trial. Following this regulation period, the valence rating scale would appear followed by the arousal rating scale, and participants were asked to rate how they felt after trying to regulate their emotions. See Figure 3 for a comprehensive representation of the choice task used in the present study. The present paper will concentrate on the period of time during initial exposure to examine whether valence and arousal predict choice, and then on the regulation period to examine differences in effectiveness between distraction and reappraisal.

A training phase preceded the experimental phase. The training phase was designed to teach participants the difference between cognitive reappraisal and distraction, how to use the respective strategies, and how to choose between strategies in response to a briefly presented picture. The instructions for distraction told participants to think of something emotionally neutral and completely unrelated to the picture at hand. For instance, instead of thinking of the negative image, participants could focus on taking a shower or going on a walk in their neighborhood. The instructions for reappraisal directed participants to think of something about the picture at hand to change how they were feeling. Common themes such as “help is on the way” were offered to the participants as examples. For both strategies, the importance of keeping one's eyes directed at the screen was emphasized to each participant. The order in which participants learned each strategy was counterbalanced across all participants, as were the buttons to press to choose the strategies. Experimenters followed a script, along with on-screen instructions, which kept the procedure consistent across all participants. The experimenter interacted with the participant extensively to ensure a thorough understanding of the choice task. The training phase concluded with eight practice trials that demonstrated trial structure in real time.

Data retention. The choice task consisted of five blocks, with optional breaks in between in order to prevent participant fatigue. For the physiological measures, change in activity was calculated relative to baseline (activity prior to picture or regulation instruction onset, depending on which phase of the experiment was being analyzed). Maximum values for each participant for each second in each trial were extracted, and these maxima were then averaged by trial and/or condition for each participant. Only trials falling less than 4 SD from the within-subjects mean were retained on a measure-by-measure basis for each participant. Across conditions, 98.9% of all trials were retained for corrugator EMG activity, 99.2% of all trials were retained for EDA, and 99.9% of all trials were retained for participant ratings of both valence and arousal.

Multivariate outliers were excluded using Mahalanobis Distance across all repeated measures ($p < .01$). One participant was dropped as an outlier for reaction time data, and another two participants were dropped as outliers for corrugator EMG activity. Moreover, additional participants (typically one to three participants) were removed on an analysis-specific basis, with the same Mahalanobis Distance criterion of $p < .01$.

Data analysis. Various analyses were conducted in order to verify the manipulation of emotion level and to test the different hypotheses. For the manipulation checks, paired samples t-tests were carried out across subjects to test whether the high and low emotion sets of pictures produced different levels of emotional responses during the initial presentation period. The dependent variables were corrugator EMG activity, EDA, and participant ratings of valence and arousal. Multiple regression analyses were also computed on a within-subjects basis to assess whether normative ratings of valence and arousal predicted trial-by-trial variation in these physiological and participant measures. The predictors included normative ratings of valence and arousal. A regression analysis was carried out for each subject to establish whether trial-by-trial changes in valence and arousal predicted emotional responding on a trial-by-trial basis. These within-subjects analyses produced a beta weight for each predictor for each participant. These betas were then submitted to one-sample t-tests across subjects to determine whether the magnitude of the within-subjects association was significantly different from 0.

In order to analyze how participants chose between strategies, we calculated the proportion of trials for which participants chose distraction over reappraisal. We then used an independent samples t-test to determine whether this proportion was higher for high versus low emotion pictures. Then, to determine whether the valence and/or arousal dimension of emotion is important in determining choice of regulation strategies as a function of high and low emotion, a within-subjects regression approach was utilized as described above. The predictors included normative ratings of valence and arousal in one set of analyses and corrugator EMG activity and

EDA during the pre-choice period in the second set of analyses; the criterion variable was choice (1 = distraction, 0 = reappraisal).

To see if participants exhibited differences in how quickly they chose strategies, a 2 x 2 multivariate GLM approach was used to test the effects of emotion level (*high* vs. *low*) and choice (*distraction* vs. *reappraisal*) on reaction time to make choice. Then, a within-subjects regression approach was utilized again. The predictors included normative ratings of valence and arousal in one set of analyses, and corrugator EMG activity and EDA during the pre-choice period in the second set of analyses; the criterion variable was reaction time to choose distraction or reappraisal.

Finally, to address the hypothesis about effectiveness of distraction versus reappraisal, a 2 x 2 multivariate GLM approach was used to examine whether emotion level (*high* vs. *low*) and choice (*distraction* vs. *reappraisal*) impacted emotional responding during the regulation period. The dependent variables were participant ratings of valence and arousal, corrugator EMG activity, and EDA. Then, a within-subjects regression approach was utilized. The predictors were normative ratings of valence and arousal and choice (1 = distraction, 0 = reappraisal); the criterion variables were participant ratings of valence and arousal, corrugator EMG activity, and EDA in separate analyses.

Results

Do the High and Low Emotion Categories Differentially Impact Emotional Responses?

As expected, high emotion pictures (M = 0.29, SD = 0.30) led to significantly greater corrugator EMG activity than the low emotion pictures (M = 0.19, SD = 0.22), $t(35) = -2.48$, $p = .018$. High emotion pictures (M = 0.18, SD = 0.17) also led to significantly greater EDA than the low emotion pictures (M = 0.13, SD = 0.14), $t(34) = -3.951$, $p < .001$. In addition, high emotion pictures (*M* = 5.13, *SD* = 1.45) led to significantly higher ratings of participant valence than the low emotion pictures (*M* = 2.69, *SD* = 0.92), *t*(36) = -16.24, *p* < .001. Finally, high emotion pictures (*M* = 5.08, *SD* = 1.37) led to significantly higher participant arousal ratings than low emotion pictures (*M* = 2.77, *SD* = 1.00), *t*(35) = -16.98, *p* < .001. Collectively, these data support the construct validity of the independent variable, emotion level (*high* vs. *low*).

Within-subjects regressions followed by one-sample t-tests across subjects indicated that lower normative ratings of valence (i.e., higher levels of unpleasantness) were associated with greater corrugator EMG activity, β = -.06, *t*(34) = -2.05, *p* = .048. However, normative ratings of arousal did not predict the average maxima of corrugator EMG activity, β = -0.01, *t*(34) = -0.54, *p* = .595. Similarly, lower normative ratings of valence were associated with increased EDA, β = -0.03, *t*(34) = -2.64, *p* = .012. Normative ratings of arousal did not predict the average maxima of EDA, β = .00, *t*(34) = -0.46, *p* = .651. Furthermore, lower normative ratings of valence predicted higher participant ratings of valence, β = -1.45, *t*(36) = -15.03, *p* < .001, as well as higher participant ratings of arousal, β = 0.24, *t*(36) = 4.43, *p* < .001. Higher normative ratings of arousal also predicted higher participant ratings of valence, β = -1.20, *t*(36) = -12.34, *p* < .001, as well as higher participant ratings of arousal, β = 0.51, *t*(36) = 8.43, *p* < .001. These results indicate that the high and low emotion categories might more strongly reflect differences in valence than arousal, at least based on the two physiological measures.

Do High and Low Emotion Categories Differentially Impact Choice of Strategy?

Collapsing across emotion levels, participants chose distraction less than 50% of the time (*M* = .44, *SD* = .09). This was significantly lower than the proportion expected by chance (.50), *t*(36) = -3.95, *p* < .001. In this forced choice task, this indicates that participants chose reappraisal more often than distraction overall. However, taking emotion level into account, the pattern is different. As hypothesized, participants chose distraction more often in response to high emotion pictures (*M* = .65, *SD* = .13) than low emotion pictures (*M* = .23, *SD* = .14), $t(36) = -11.61$, $p < .001$. Within each emotion level, the proportion of trials on which participants chose distraction was significantly different from chance (.50), both *p*s < .05, suggesting that participants chose distraction more than reappraisal in response to high emotion pictures and reappraisal more than distraction in response to low emotion pictures. See Figure 4 for a graphical illustration of choice behavior across participants.

Do the Valence and Arousal Dimensions Predict Choice?

Within-subjects regressions followed by one-sample t-tests across subjects indicated that lower normative ratings of valence (i.e., higher levels of unpleasantness) were associated with a greater likelihood of choosing distraction, $\beta = -0.23$, $t(39) = -11.15$, $p < .001$. Higher normative ratings of arousal were also associated with a greater likelihood of choosing distraction, $\beta = 0.07$, $t(39) = 5.03$, $p < .001$. This pattern is congruent with the original hypothesis.

Shifting to the physiological, the level of corrugator EMG activity during the initial presentation period did not predict choice, $\beta = 0.01$, $t(34) = 0.35$, $p = .732$. However, the level of EDA during the initial presentation phase was a significant predictor of choice, with greater EDA predicting distraction, $\beta = 0.33$, $t(34) = 2.294$, $p = .028$. The EDA result is congruent with the original hypothesis, while the corrugator EMG result is not.

Taking the same approach with normative ratings of valence and arousal as well as EDA examined at once, lower normative ratings of valence were still associated with a greater likelihood of choosing distraction, $\beta = -0.22$, $t(34) = -10.70$, $p < .001$. Higher normative ratings of arousal were also associated with a greater likelihood of choosing distraction, $\beta = 0.07$, $t(34) = 4.96$, $p < .001$. Conversely, the level of EDA during the initial presentation phase was no longer a significant predictor of choice, β = 0.19, $t(34) = 1.21$, $p = .235$. This suggests that EDA was not a strong unique predictor of choice when accounting for normative ratings of valence and arousal.

Were There Differences in How Quickly Participants Chose Between Strategies?

A multivariate GLM confirmed that, across participants, there was no difference in how quickly participants responded to pictures based on emotion level, $F(1, 34) = 0.13$, $p = .719$. However, participants were faster at choosing reappraisal (*M* = 1143.98, *SE* = 102.22) than distraction (*M* = 1378.66, *SE* = 130.93), as indicated by a main effect of choice, $F(1, 34) = 12.96$, $p = .001$. There was no interaction effect of choice and emotion level on reaction times, $F(1, 34) = 0.45$, $p = .507$. Thus, the results fail to support the original hypothesis with regards to reaction time data. See Figure 5 for a summary of the reaction time data.

Within-subjects regressions followed by one-sample t-tests across subjects indicated that none of the predictors (normative ratings of valence, normative ratings of arousal, and corrugator EMG activity and EDA during the pre-choice period) explained trial-by-trial variation in RT, all four *p*s > .05.

Which Strategy is More Effective?

Table 1 presents the descriptive statistics for emotional responding during the regulation period as a function of chosen strategy (*distraction* vs. *reappraisal*) and emotion level (*high* vs. *low*). Dependent variables include participant ratings of valence and arousal at the end of the regulation period and corrugator EMG activity and EDA during the regulation period.

The 2 x 2 GLM demonstrated that there was a main effect of choice on participant ratings of valence at the end of the regulation period. Ratings of valence were more negative following the use of distraction, (*M* = 4.53, *SE* = 0.24) compared to the use of reappraisal (*M* = 3.42, *SE* =

0.18), $F(1, 34) = 72.79$, $p < .001$. There was also a main effect of emotion level on valence ratings similar to the pattern described earlier for the manipulation check, $F(1, 34) = 182.06$, $p < .001$. However, there was no interaction of choice and emotion level on participant valence ratings, $F(1, 34) = 0.39$, $p = .536$.

Similarly, a second 2 x 2 GLM demonstrated that there was a main effect of choice on participant ratings of arousal at the end of the regulation period. Ratings of arousal were more negative following the use of distraction ($M = 4.60$, $SE = 0.22$) compared to the use of reappraisal ($M = 3.46$, $SD = 0.18$), $F(1, 35) = 59.09$, $p < .001$. There was also a main effect of emotion level on arousal ratings similar to the pattern described earlier for the manipulation check, $F(1, 35) = 159.74$, $p < .001$. There was no interaction effect of choice and emotion level on participant ratings of valence, $F(1, 35) = 1.35$, $p = .253$. Collectively, this pattern suggests that participants who selected distraction experience less success with emotion regulation than participants who selected reappraisal.

Two identical GLMs failed to find differences between distraction and reappraisal in terms of corrugator EMG activity and EDA during the regulation period. Specifically, there was no main effect of choice on corrugator EMG activity, $F(1, 33) = 0.06$, $p = .815$. Furthermore, there was no interaction of choice and emotion level on the maximum levels of corrugator EMG activity, $F(1, 33) = 1.10$, $p = .301$. There was a marginal main effect of emotion level on corrugator EMG activity with increased activity for the high relative to low emotion pictures, $F(1, 33) = 3.73$, $p = .062$. In terms of EDA, there was no main effect of choice, $F(1, 33) = 0.20$, $p = .655$, and no significant interaction effect of choice and emotion level, $F(1, 33) = 0.01$, $p = .928$. Furthermore, there was no main effect of emotion level, $F(1, 33) = 0.39$, $p = .534$. Collectively, and unlike the findings for self-reported emotional experience, this physiological pattern suggests no differences in the effectiveness of distraction versus reappraisal in this choice task.

Within-subjects regressions followed by one-sample t-tests across subjects mirrored the pattern above (results not shown for the sake of brevity).

Discussion

The present study was conducted to answer four specific questions. First and foremost, do low and high levels of emotional intensity affect a choice of strategy to regulate emotions? Second, could initial emotional responses, as indexed by normative ratings of valence and arousal as well as the level of corrugator EMG activity and EDA, predict choice of strategy among participants on a trial-by-trial basis? Third, mirroring the hypotheses for choice behavior, would participants be quicker to choose one strategy over another, and would this effect vary based on emotional intensity? Finally, were there differences in effectiveness between the two strategies in the context of having chosen to use them, as indexed by participant ratings of valence and arousal as well as corrugator EMG activity and EDA?

As hypothesized, the results indicate that participants chose distraction in response to high emotion pictures and cognitive reappraisal in response to low emotion pictures. Furthermore, the results show that lower normative ratings of valence, higher normative ratings of arousal, and greater EDA predicted a greater likelihood of choosing distraction over reappraisal as a regulatory strategy. Thus, the present study provides evidence that both valence and arousal help to explain why people choose distraction and reappraisal as strategies for emotion regulation differentially as a function of high and low levels of emotional intensity.

An unexpected finding in the present study was that manipulation checks demonstrated that normative ratings of valence—not arousal—predicted EDA. In general, EDA is considered to be a physiological indicator of arousal (Bradley & Lang, 2007), so it is unclear what to make of arousal and EDA in the context of the choice task used in the present study. Although we included EDA as a physiological index of the arousal dimension, EDA may have predicted a higher likelihood of choosing distraction because higher EDA marked a more unpleasant (rather than a more aroused) initial emotional response. Regardless, putting the EDA results together with the finding that both normative ratings of both valence and arousal predict choice, the results support the notion that both valence and arousal play a significant role in determining how people choose to regulate their emotions.

Participants were quicker to select reappraisal than distraction, regardless of the level of emotional intensity. Participants also chose reappraisal more than distraction across all pictures. This implies that cognitive reappraisal is perceived to be the superior or perhaps default strategy. However, under highly negative situations, people switch to using distraction. These findings, which replicate the behavioral findings of Sheppes et al. (2011), provide a fundamental insight into how people choose to regulate negative emotions. Consistent with Freud's (1962) idea, when faced with a highly negative emotional situation, people prefer to disengage from the situation at hand and instead think of something else. However, when faced with a less charged emotional situation, people prefer to engage in the situation, re-structuring the meaning of the situation to be less negative and emotionally arousing. This may occur because reappraisal is an effortful process. People may not be cognitively equipped to properly re-frame the negativity in higher emotion situations that overwhelm one's cognitive resources.

In terms of effectiveness, compared to choosing reappraisal, choosing distraction predicted more negative participant ratings of both valence and arousal at the end of the regulation period. Thus, distraction was less effective than reappraisal in reducing felt negative emotion.

This is in line with the findings of McRae et al. (2010), who also showed that reappraisal reduced felt negative emotion more than distraction. Perhaps the more negative participant ratings following the use of distraction reflect beliefs about effectiveness. If participants really consider reappraisal the default strategy, then choosing distraction serves as a signal of just how difficult it would be to use reappraisal for a particular picture. Participants may be implicitly hinting to themselves that a picture is very negative and highly arousing because distraction had to be used instead of the preferred strategy of reappraisal. Participants in the present study do not exhibit differences in physiological responses following the use of distraction versus reappraisal, but they still seem to feel that reappraisal is more effective at regulating negative emotion than distraction. Therapists should take this into account while also considering the different types of situations a patient is facing in determining a plan for treatment. Yet, until questions about effectiveness can be adequately addressed, it would be imprudent to fully advocate reappraisal as the dominant strategy compared to distraction.

Unlike previous studies (e.g., Sheppes et al., 2009), there were no physiological differences in the effectiveness of distraction and reappraisal based on corrugator EMG activity and EDA. However, it is imperative to emphasize that the research conducted by Sheppes et al. (2009) did not allow participants to choose between distraction and reappraisal. This may explain why they observed higher EDA for reappraisal than distraction, but the present study did not. The observed difference in EDA in the previous study may have been a result of "forcing" participants to use reappraisal in a highly charged situation. This further underlines the possible significance of choice in determining the success of emotion regulation, and suggests a need for further research that examines the success of distraction and reappraisal with and without being able to choose which strategy to use.

There were a few limitations to the present study. First, although analyses were conducted to assess the relative effectiveness of distraction and reappraisal, the choice task was not actually designed optimally to address this question since it did not incorporate a control condition that instructed participants to passively view pictures without using any methods of emotion regulation. This control condition would have served as a natural comparison for distraction and reappraisal, and this would have aided in determining whether distraction and reappraisal reduced emotional responding relative to how they would naturally respond and whether there were any real differences in effectiveness between the two strategies.

Second, plots of change in corrugator EMG activity and EDA over time (not shown) during the pre-choice period indicate that the choice to use distraction or reappraisal was prompted when the signal for corrugator EMG activity had already returned to baseline. This is because corrugator EMG activity peaked at around one second into the three-second pre-choice period. In contrast, EDA was at its maximum at roughly three seconds, which is exactly when choice was prompted. This may explain why EDA was a better predictor of choice than corrugator EMG activity. Corrugator EMG activity may have been a better predictor of choice if choice had been prompted when corrugator EMG activity was at its peak. This should be examined in future studies.

A third limitation of the present study has to do with the graphic nature of the pictures used in the high emotion set. Many of these images depicted accident scenes, burn victims, and mutilation wounds. Although pictures were selected in such a way so that the researchers attempted to match images across picture sets in order to control for content, the high emotion pictures still tended to be more graphic than the low emotion pictures. This raises the possibility that participants may have chosen distraction under high emotional intensity because reappraisals were simply unbelievable for such disgust-invoking images in which the people depicted likely would not have survived. For example, it is not credible to reappraise a highly negative picture of a burn victim by thinking that help is on the way and that the individual will be restored to health soon if participants believe the burn victim probably died as a result of the injuries. However, Sheppes et al. (2011) demonstrated the same behavioral pattern in a study that used high and low intensity shocks instead of high and low intensity pictures. Since it is unlikely that the reappraisals used in response to high and low intensity shocks differed in terms of their believability, this probably does not fully explain the behavioral pattern in the present study. Future studies should try to avoid using excessively graphic images in the choice task, or perhaps even use another type of stimuli all together, such as video clips, shocks, or speaking tasks instead of pictures.

A final limitation is the unselected nature of the sample of participants used in the present study. It is unknown whether participants in the sample had clinical disorders, which could have an effect on the results. Future studies should assess whether the presence of psychopathology is an important determinant of the pattern of results found in the present study.

In spite of its limitations, the present study is original and relevant because it looks at a topic that few studies in the past have investigated—specifically, how people choose between different strategies, in this case cognitive reappraisal and distraction, to regulate their emotions. It seems that highly negative and arousing situations, as indexed by ratings of valence and arousal as well as EDA, are likely to promote choosing distraction over reappraisal as the preferred emotion regulatory strategy. Additionally, the present study provides support for the notion of reappraisal as the preferred "default" strategy over distraction, at least when not taking the intensity of the situation into account. Due to the importance of emotion regulation for mental health and well-being, these novel findings should be further explored in future research with a focus on identifying other predictors of choice. Identification of the factors that determine choice between strategies, as well as effectiveness of using certain strategies under varying levels of emotional intensity, will serve to benefit the emotional health of society and its individuals.

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Table 1.

Means (SD) for emotional responding when engaging in emotion regulation

	Low Emotion		High Emotion	
	Distraction	Reappraisal	Distraction	Reappraisal
Participant rating of valence	3.55 (1.37)	2.51 (0.88)	5.51 (1.67)	4.34 (1.34)
Participant rating of arousal	3.60 (1.34)	2.59 (0.93)	5.59 (1.54)	4.32 (1.39)
Corrugator EMG activity	0.31 (0.44)	0.26 (0.35)	0.36 (0.34)	0.39 (0.47)
EDA	0.005 (0.091)	0.009 (0.045)	-0.004 (0.081)	0.002 (0.077)

Notes. EMG = electromyography; EDA = electrodermal activity

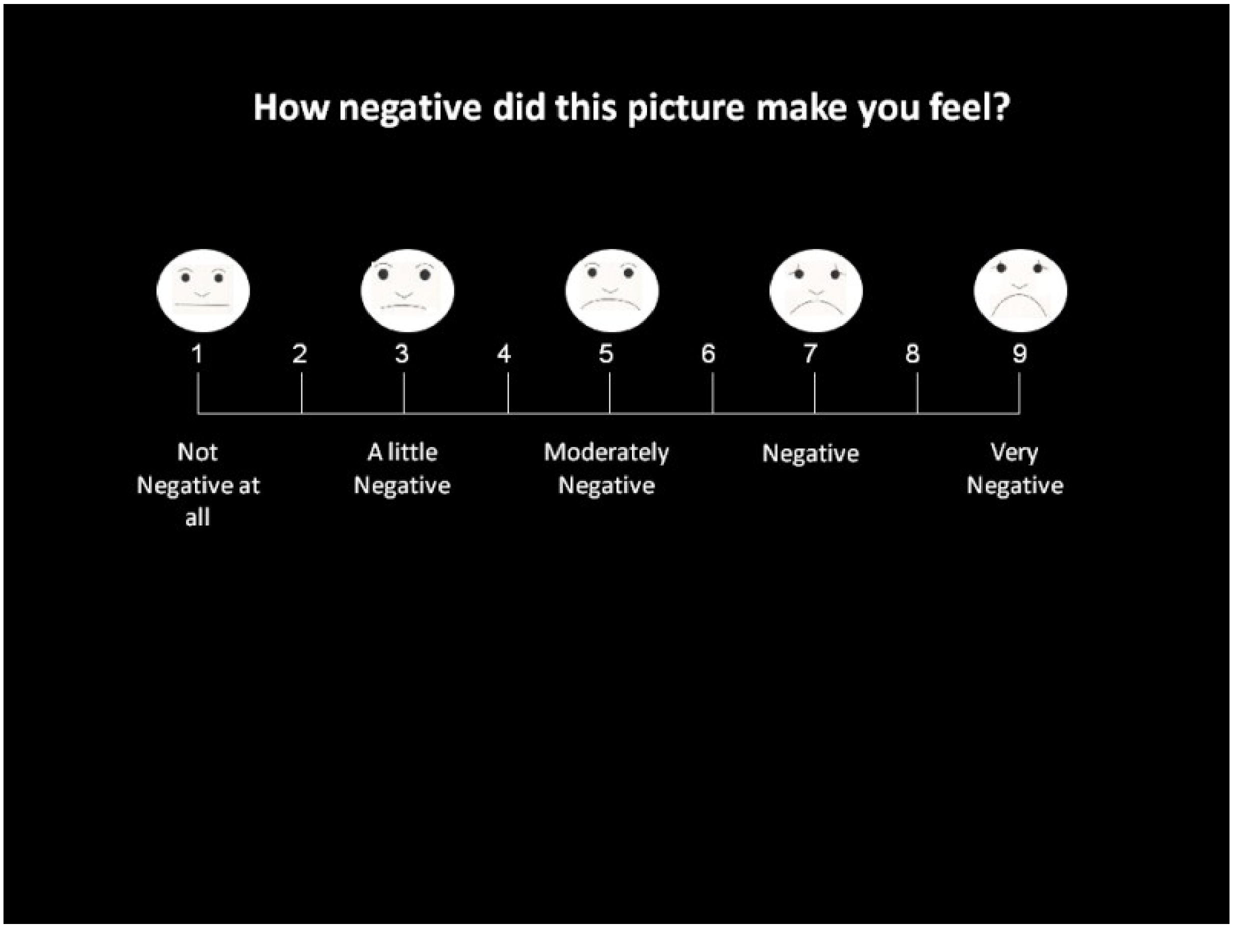

Figure 1. The valence rating scale is pictured above. Participants used the keyboard to complete their ratings following each trial.

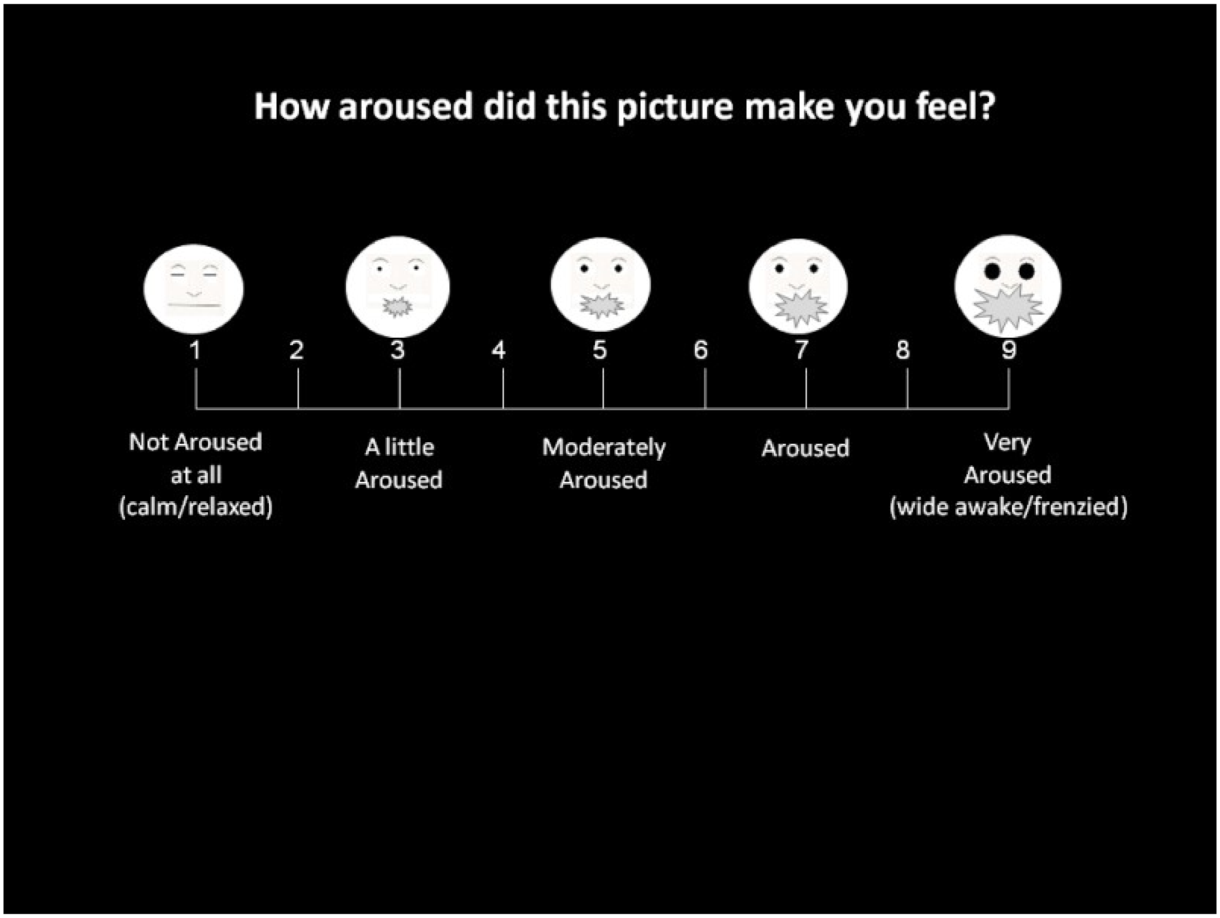

Figure 2. The arousal rating scale is pictured above. As with the valence rating scale, participants used the keyboard to complete their ratings following each trial.

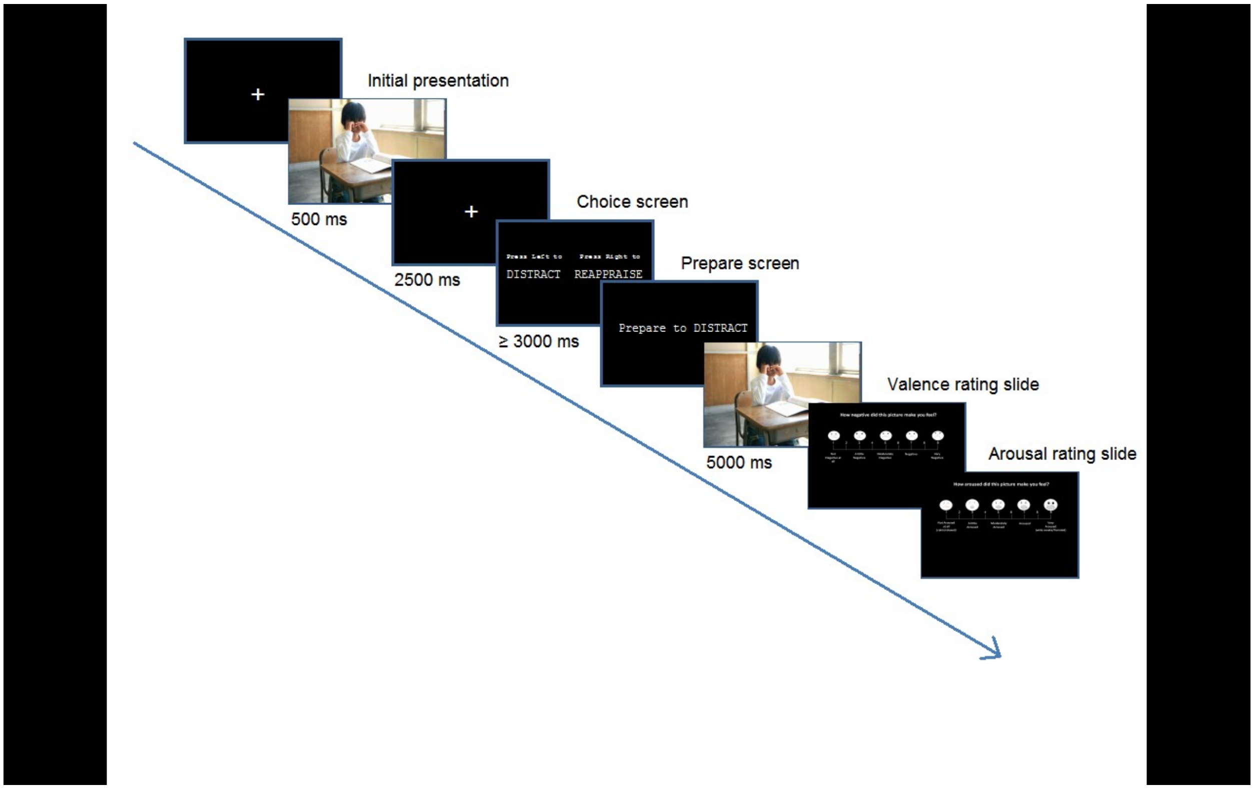

Figure 3. The time structure and organization of the choice task is outlined above.

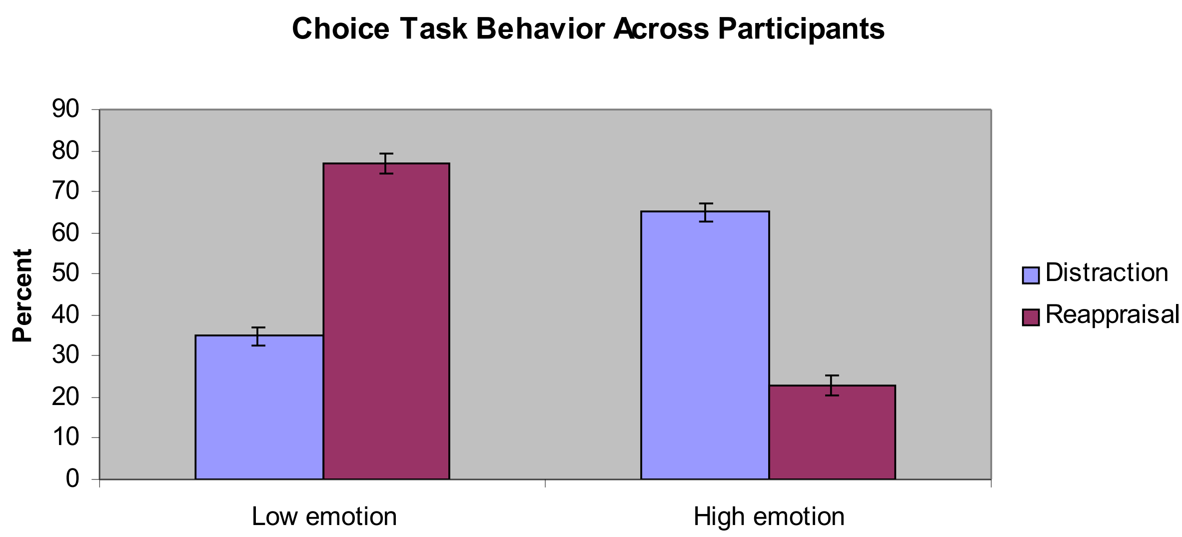

Figure 4. The graph above depicts behavior for how strategies were selected for the pictures based on emotion level across all participants. Participants chose to use distraction for the high emotion pictures 65.13% of the time, while using reappraisal for the high emotion pictures 34.87% of the time. Conversely, distraction was selected for the low emotion pictures 22.91% of the time, while reappraisal was picked for the low emotion pictures 77.09% of the time.

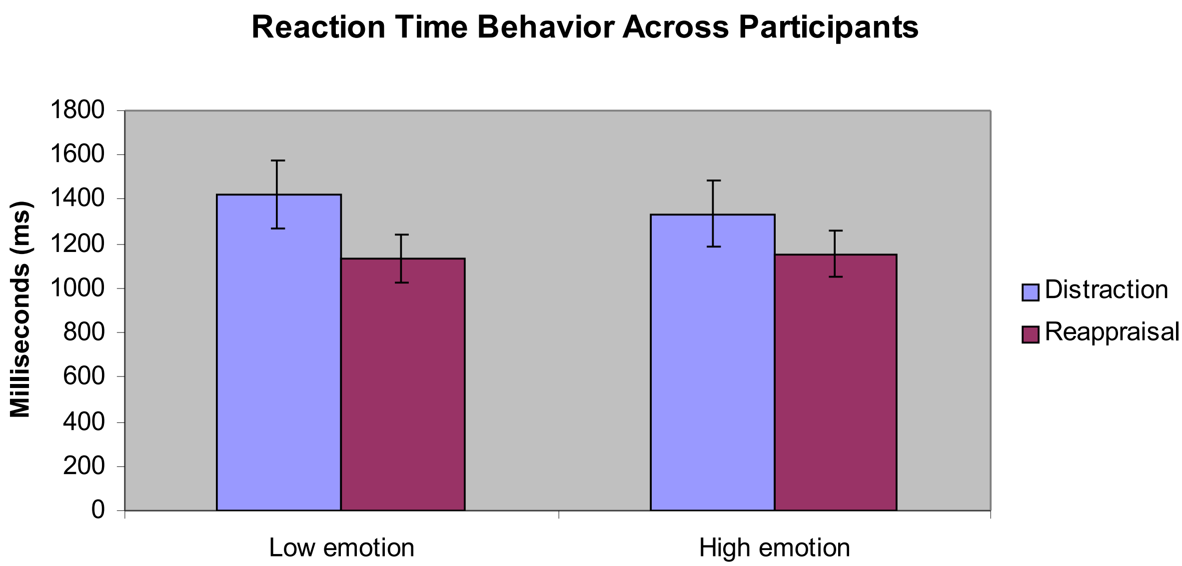

Figure 5. The graph above illustrates reaction times based on choice, across emotion level. Participants were faster at choosing reappraisal than distraction, suggesting reappraisal as the preferred strategy collapsing across the emotional intensity of the pictures. However, there was no interaction between choice and emotion level, which was originally hypothesized. There was no difference in how quickly participants chose distraction under low emotion ($M = 1420.88$, $SE = 149.60$) versus high emotion ($M = 1336.43$, $SE = 152.92$). Similarly, there was no difference in how quickly participants chose reappraisal under low emotion ($M = 1132.27$, $SE = 109.77$) versus high emotion ($M = 1155.70$, $SE = 104.41$).

[1]Footnotes

[1] One participant did not complete the questionnaires, so demographic information on this single participant is unavailable and therefore omitted from the summary statistics.