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# Implicit Emotion Regulation: A Novel Method for Capturing Individual Differences in Acute Emotion Regulation

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# Implicit Emotion Regulation: A Novel Method for Capturing Individual Differences in Acute Emotion Regulation

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## Abstract

Implicit emotion regulation is a mechanism that relies on habitual patterns to regulate efficiently without direct awareness. While an important aspect of successful regulation, few studies have assessed it experimentally. Those that have typically prime reappraisal and compare this strategy to explicit reappraisal or a control. The current study introduced a novel paradigm to assess implicit use of reappraisal or suppression. Specifically, we used a cognitive bias modification task to evaluate differences in implicit emotion regulation strategy selection. This resulted in roughly half of the participants tending toward choosing predominantly reappraisal words (*High Reappraisers*) and half choosing equal numbers of reappraisal and suppression words (*Flexible*

*Regulators*). The possibility that this reflected implicit regulation style was further supported by significant relationships between implicit regulation choice and self-reported use of strategies. Contrary to hypotheses, implicit regulation style did not affect self-reported emotions following the distress task. Still, those scoring high in implicit reappraisal reported fewer difficulties in overall emotion regulation. These findings highlight the utility of a behavioral measure to capture variations in implicit emotion regulation style to better understand the context and factors that are most effective for emotion regulation more generally.

## Keywords

Regulation profile, Priming, Reappraisal, Suppression, Automatic emotion regulation

## 1. Introduction

The ways in which emotions are regulated direct how they guide behavior (Gross & John, 2003). Emotion regulation (ER), similar to emotions themselves, is crucial to functioning and interacting with the environment. The majority of ER research has centered on understanding the deliberate, or explicit, regulation of emotion. Explicit ER occurs when regulation is a conscious effort, and individuals are actively aware of the need to modify their emotions. Yet, ER often occurs implicitly, relying on those habitual patterns to regulate efficiently without direct awareness (Koole & Rothermund, 2011). The purpose of the current study is to experimentally investigate the effectiveness of implicit regulation using a novel method for assessing implicit regulation use.

Most prior studies have relied on experimental methods to assess explicit ER, making regulation conscious to participants. While internally valid, this may yield a less ecologically valid understanding of how one typically regulates. In everyday life, implicit ER promotes flexible responding based on variations in context and environment (Bargh & Williams, 2013). This allows for enhanced coping in response to stressful events and requires less cognitive effort and fewer physiological resources (Dijksterhuis, Bos, Nordgren, & van Baaren, 2006). Yet, implicit regulation is less accessible to experimental methods.

Researchers have attempted to circumvent this issue by indirectly activating emotional regulation. This can be achieved through cognitive bias modification using incidental exposure to ER words, or, priming (MacLeod & Bucks, 2011). Priming itself has been effective at inducing emotion and training interpretation of ambiguity in stimuli, making it ideal for targeting and modifying the cognitive process of ER. Mauss, Cook, and Gross (2007) first successfully primed emotional “control” as a form of regulation and compared it to emotion expression. The emotional control condition encouraged regulation generally (e.g. restrain, stable), as opposed to priming any one specific strategy. Following a negative emotion induction task, those participants primed to use emotional control reported less negative emotion compared to the emotional expression group. This has been demonstrated in subsequent priming studies with emotional control yielding decreased self-reported negative emotion (Yang, Tang, Gu, Luo, & Luo, 2015) and lower skin conductance (Zhang, Lipp, & Hu, 2017) across multiple distress contexts. Moving beyond general regulation, Williams, Bargh, Nocera, and Gray (2009) primed implicit reappraisal and compared it to explicit reappraisal and a control group in two experiments. Effects of these strategies on emotional arousal were assessed by differences in heart rate reactivity. In the first study implicit and explicit reappraisal yielded less heart rate reactivity relative to the control group. In their second study, heart rate reactivity was dependent on the interaction between trait use of reappraisal (as assessed by the Emotion Regulation Questionnaire, ERQ; Gross & John, 2003) and emotion regulation strategy. Specifically, high reappraisers had similar heart rate reactivity when using implicit or explicit reappraisal, suggesting habitual responding that is unaffected by the nature of the task. However, low reappraisers seemed to benefit more from being implicitly primed. The low reappraisers had significantly less heart rate reactivity during implicit reappraisal compared to explicit reappraisal. It is possible that the effort required to use a strategy that is not automatic taxes the system more (Williams et al., 2009). Similarly, Yuan,

Ding, Liu, and Yang (2014) developed a reappraisal priming task to compare implicit reappraisal to explicit reappraisal and a control group. The authors assessed for subjective emotion ratings in addition to heart rate reactivity. Consistent with Williams et al. (2009), individuals in the two reappraisal conditions had less heart rate reactivity relative to the control group (and did not differ from each other). However, the explicit reappraisal group reported lower subjective negative emotion, than both implicit reappraisal and the control group. These findings demonstrate that implicit regulation confers the same physiological benefits as explicit regulation, even while less negative affect is reported after explicit regulation. Existing experimental protocols may inadvertently promote explicit regulation as more effective given the decreased subjective ratings of negative affect. However, the very nature of the task may be contributing to those differences. Ideally, we would like to capture the effectiveness of the regulation style a person automatically chooses in a given context.

The field of ER is progressively acknowledging the context-driven, flexible nature of ER. It is becoming clear that examining a single ER strategy in isolation does not capture the span of individuals' regulation. People do not solely rely on a single strategy to guide their emotional experience but rather, rely on a repertoire of strategies that may help them achieve specific goals (Brans, Koval, Verduyn, Lim, & Kuppens, 2013; Chesney, Timmer-Murillo, & Gordon, 2019). Still, while we rely on a range of strategies, there is a habitual pattern to how strategies are typically used (Chesney & Gordon, 2016). To date, a small number of studies have evaluated ER patterns and general psychological well-being. Emerging patterns suggest positive associations between frequent use of strategies (particularly those that are adaptive) and greater well-being (Brans et al., 2013; Chesney et al., 2019; Chesney & Gordon, 2016). Conversely, low use of strategies and use of maladaptive strategies are associated with poorer outcomes (Eftekhari, Zoellner, & Vigil, 2009). For instance, Eftekhari et al. (2009) evaluated the patterns of reported use of reappraisal and suppression to find four patterns – high reappraisers/low suppressors, high regulators, moderate reappraisers/low suppressors, and low regulators. High reappraisers/low suppressors had the lowest levels of psychopathology compared to all other groups, whereas, low regulators (those who used reappraisal and suppression infrequently) had higher levels of psychopathology. These findings suggest the possibility of uncovering patterns of implicit regulation as well. However, this has remained unexplored.

Current implicit priming methods still determine which regulation strategy participants' use. Random assignment to a control or strategy condition is necessary to check the effectiveness of this method. What this method ignores, however, is the literature that highlights the importance of accounting for individuals' own regulation tendencies and use of multiple strategies (Brans et al., 2013; Eftekhari et al., 2009). Therefore, the current study sought to adapt a cognitive bias modification technique to explore a potential new method for assessing individual differences in implicit ER use. The aim here was to allow participants to implicitly *choose* reappraisal, suppression, or a combination of these words, to evaluate which strategy they may naturally use. This approach allowed us to answer two questions. The first is whether participants tend toward one regulation strategy over another, suggesting a possible implicit strategy preference. As such, it was hypothesized that there would be evidence of three distinct patterns of implicit preferences – high reappraisers, high suppressors, and flexible regulators. The second aim was to evaluate the relationship of their choice of implicit strategies to acute emotional responding, measures of emotional distress and trait regulation, and measures of psychopathology (Eftekhari et al., 2009). Given the existing implicit ER literature and studies that assess patterns of strategy use, it was hypothesized that participants who predominantly choose implicit reappraisal would report less negative emotion and greater positive emotion than those who chose implicit suppression and control participants following the distressing task (Eftekhari et al., 2009; Yuan et al., 2014). However, given the possibility that participants may have "flexible" ER, it was also hypothesized that those who flexibly regulated, as measured by equitable use of reappraisal and suppression, would demonstrate less negative emotion and greater positive emotion following the distressing task than suppression or control participants, but not reappraisers.

# 2. Methods

## 2.1. Participants

Participants (*N* = 146) were recruited from psychology courses at a Midwestern, Jesuit university and received partial course credit for their participation. Sample size was determined using the effect sizes of previous implicit priming studies, which ranged from small to medium effects ($\eta^2$ = 0.14–0.35; Williams et al., 2009; Yuan et al., 2014). A power analysis (G*power; Faul, Erfelder, Lang, & Buchner, 2007; with effect size = 0.15, power = 0.80, and α = 0.05) suggested a total sample size of 111 participants. The sample primarily consisted of White (70.3%) females (71.9%); ages ranged from 18 to 21 (*M* = 18.72, *SD* = 0.835).

## 2.2. Materials

### 2.2.1. Questionnaires

#### *2.2.1.1. Emotion regulation questionnaire (ERQ)*

The ERQ (Gross & John, 2003) is a measure used to assess a respondent's trait use of reappraisal and suppression. Respondents report how much they agree or disagree with 10 statements (6 related to reappraisal) regarding aspects of their emotional life. Suppression and reappraisal items are summed separately, with higher scores indicating greater reported use of that strategy. The initial psychometric evaluation demonstrated satisfactory reliability for reappraisal (Cronbach's α = 0.79) and suppression (Cronbach's α = 0.73) subscales, and test-retest reliability (Cronbach's α = 0.69; Gross & John, 2003).

#### *2.2.1.2. Difficulties in emotion regulation scale (DERS)*

The DERS (Gratz & Roemer, 2004) is a 36 item measure designed to assess six factors of ER along with a total score of general ER difficulty. Respondents report the extent to which they believe each item applies to them using a scale ranging from 1 = *almost never, 0–10%* to 5 = *almost always, 91–100%*. Items are summed for a total score and six subscale scores with higher scores indicating greater self-reported difficulties in regulating emotion. Previous studies indicate good reliability for the total scale (Cronbach's α = 0.93) and reliability ranging in 0.80–0.89 for the six subscales (Gratz & Roemer, 2004).

#### *2.2.1.3. Generalized anxiety disorder-7 (GAD-7) scale*

Given relationship between psychopathology and emotion regulation use, the GAD-7 was administered. The GAD-7 (Spitzer, Kroenke, Williams, & Löwe, 2006) is a 7-item self-report measure that assesses symptom severity of the diagnostic features of the Diagnostic Statistical Manual of Mental Disorders (DSM-5) for generalized anxiety disorder during the last 2 weeks. Response options include “not at all,” “several days,” “more than half the days,” and “nearly every day,” scored as 0, 1, 2, and 3, respectively. Therefore, GAD-7 scores range from 0 to 21, with scores of >5, >10, and >15 representing mild, moderate, and severe anxiety symptom levels.

#### *2.2.1.4. Patient health questionnaire (PHQ)*

The PHQ-9 (Kroenke, Spitzer, & Williams, 2001) is a 9-item depression measure that uses criteria from the DSM-IV. Response options are scored as “0” (not at all) to “3” (nearly every day). PHQ-9 scores of 5, 10, 15, and 20 represented mild, moderate, moderately severe, and severe depression. The PHQ-9 was included as a brief measure of depression symptoms to assess mood.

### 2.2.2. Cognitive bias measure of implicit regulation choice

Assessment of implicit ER tendencies was adapted from the methods of previous cognitive bias modification studies (Mauss et al., 2007; Williams et al., 2009; Yuan et al., 2014). The task involved a sentence unscrambling task that would result in a sentence related to a specfic regulation strategy - reappraisal or suppression. Specifically, fifteen sentences, developed and validated previously, were administered to participants in random

order. Sets of 5 words were presented to participants one set at a time to be unscrambled into a 4-word sentence. Each set of words included a reappraisal and a suppression word. To successfully unscramble the sentence, participants could only incorporate one of the ER words, highlighting their preference for either strategy. For example, the sentence stem "He ____ his judgment" could be unscrambled using the reappraisal word "reassessed" ("He *reassessed* his judgment") or the suppression word "concealed" ("He *concealed* his judgment"). Participants typed their four-word sentence into a text box on the computer and then advanced to the next set of words. One set of words was removed from analyses because participants were able to unscramble it by using both ER target words and leaving one of the neutral words out. A control condition included the same 5-word sets, but with words that had neutral meanings ("He *offered* his judgment").

This novel measure of implicit regulation style served as a quasi-experimental variable determined a priori with respect to the number of reappraisal words participants chose. Each sentence was scored as a 1 if the reappraisal word was selected and 0 if the suppression word was selected. Participants could obtain a total score from 0 to 14 where higher scores indicate choosing more reappraisal words. Reflected in previous studies exploring profiles of regulation we determined that three categories may occur within the task- those that chose few suppression words and mostly reappraisal words, those that chose few reappraisal words and mostly suppression words, and those that use relatively equal numbers. As such, participants with scores from 0 to 5 were coded as high suppressors ($n$ = 3), scores between 6 and 8 were coded as "flexible regulators" ($n$ = 27), and scores of 9–14 were coded as high reappraisers ($n$ = 41). The range for flexible regulators is narrower than suppressors or reappraisers to capture near equal selection of suppression and reappraisal words.

#### 2.2.3. Emotion-induction stimuli

Participants were shown a series of images depicting white male police officers using aggression against adult black men. These photos include images of protests with police standing guard, police in the process of detaining individuals, and police engaging in physical violence. The photos were obtained from the internet and induced negative affect in participants in pilot studies. Participants passively viewed 8 images displayed for 4 s each in a 32-second block.

### 2.3. Procedure

Participants underwent informed consent and were randomly assigned to either the ER sentence task (experimental) or neutral sentence task (control) condition. Participants were placed in front of a computer with E*Prime (Psychology Software Tools, Inc., 2013) for stimuli presentation. To start, participants rated baseline emotional state using a series of positive and negative emotion attributes as well as 'arousal' on a 10 cm Visual Analog Scale (VAS) of 0 = "not at all" to 10 = "extremely". Specifically, the participant moved a cursor situated in the middle of the line in the direction of "not at all" or "extremely" using computer keys. They rated 12 emotional descriptors (e.g. angry, aroused, cheerful, disgusted, fear, guilty, happy, neutral, patriotic, pity, sad, and sympathetic). Participants then completed the sentence unscrambling task based on condition. Next, participants passively viewed police aggression images to induce an emotional response. Following image presentation, participants rated emotional and arousal descriptors again. Finally, participants completed ER questionnaires, a demographics survey, and self-ratings on depression and anxiety scales.

## 3. Results

### 3.1. Exploration of implicit ER

Variable screening did not reveal any outliers or idiosyncratic response patterns. Analyses were conducted using SPSS Version 24.0 with an alpha level set to 0.05. Analyses established that age, gender, and race were not significantly different between conditions.

To assess whether the ER sentence task could serve as an indication of implicit ER, participants were categorized according to the a priori criteria described previously. A total of 71 participants were in the ER sentence task group and 75 were in the control sentence task group. For the ER sentence task, categorizing revealed that participants' implicit choice led to three distinct groups: high reappraisers ($n$ = 41), flexible regulators ($n$ = 27) – choosing roughly equal numbers of reappraisal and suppression, and, high suppressors ($n$ = 3). A chi-square test of goodness-of-fit determined that ER choice was not equally distributed in the sample, $X^2(2, N = 71) = 31.21$, $p < .001$, and thus distinct from what would be expected if participants were randomly completing the sentences with either ER word. Yet, since limited conclusions can be drawn on a group with three individuals, high suppressors were not included in the subsequent analyses comparing groups.

First, to check for concurrent validity of the task, we evaluated whether choices in the ER sentence task were reflective of self-reported ER strategy use. Pearson correlational analyses examined the relationship between scores on the ER unscrambling task (higher scores indicate more reappraisal) and the two subscales of the ERQ separately. Across all participants, there was a significant positive relationship between ER task score and the ERQ reappraisal subscale, $r(69) = 0.45$, $p < .001$, suggesting consistency between implicit reappraisal use and trait reappraisal use. There was no significant correlation with ER task score and the ERQ suppression subscale.

We conducted additional correlational analyses by group, to assess how trait reappraisal or suppression may be distinctively related to implicit preferences. For high reappraisers, there was a significant, positive correlation with ER choice and the ERQ reappraisal subscale, $r(37) = 0.34$, $p = .034$, but no relationship to the suppression subscale. For flexible regulators, there was a significant, positive relationship with ER choice and the ERQ reappraisal subscale, $r(24) = 0.501$, $p = .009$, and a trending significant, positive relationship with the ERQ suppression subscale, $r(24) = 0.38$, $p = .056$. As such, high reappraisers demonstrated a strong relationship with self-reported use of reappraisal but not suppression. Further, the flexible regulators demonstrated meaningful relationships to both subscales, confirming their tendency to use both strategies.

## 3.2. Analyses of differences in emotion by group

Given that we were interested in comparing the effect of choice on implicit emotion regulation, two between-within repeated measures (rm) ANOVAs were conducted to compare negative or positive emotion ratings between the groups – high reappraisers, flexible regulators, and control participants – before and after image viewing. For negative affect, a 3 (group) × 2 (time) × 5 (negative emotion) rmANOVA revealed significant main effects for time [$F(1,126) = 197.34$, $p < .001$, $\eta_p^2 = 0.61$, power = 1.00], such that there was greater negative affect reported after viewing images (Time 2). There was also a main effect of emotion [$F(4,123) = 9.89$, $p < .001$, $\eta_p^2 = 0.24$, power = 1.00], such that across time, participants reported less guilt than all other emotions. However, both of these effects were qualified by a significant time by emotion interaction effect [$F(4,123) = 65.55$, $p < .001$, $\eta_p^2 = 0.68$, power = 1.00]. Fig. 1 illustrates that all emotions increased from time one to time two with the exception of fear. Additionally, anger and disgust increased at a higher rate than other emotions at Time 2. There was no significant effect of group.

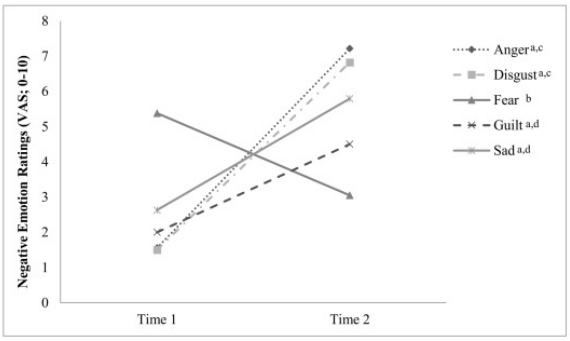

Fig. 1. Mean negative emotion ratings across time. Superscripts indicate significantly different ratings in emotion (*p*s < .05).

For positive affect, a 3 (group) × 2 (time) × 2 (positive emotion) rmANOVA was conducted. Fig. 2 illustrates the main effect of group [$F(1,126) = 4.01$, $p = .021$, $\eta_p^2 = 0.06$, power = 0.71], such that reappraisers reported greater positive affect than flexible regulators when ratings were collapsed across time. There were no mean differences between the control and ER groups. There was also a significant main effect for time [$F(1,126) = 349.06$, $p < .001$, $\eta_p^2 = 0.74$, power = 1.00], such that there was lower positive affect across all groups at time 2 (see Table 1). The emotion by time interaction was also significant [$F(1,126) = 22.78$, $p < .001$, $\eta_p^2 = 0.15$, power = 1.00] demonstrating that cheerfulness decreased more from Time 1 (*M* = 5.60, *SD* = 1.95) to Time 2 (*M* = 1.37, *SD* = 1.59) than happiness (Time 1: *M* = 4.95, *SD* = 2.61; Time 2: *M* = 1.95, *SD* = 1.85). There were no significant interactions by group. Finally, self-reported physiological arousal was assessed using a 3 (group) × 2 (time) rmANOVA. Results showed a main effect of time [$F(1,126) = 96.31$, $p < .001$, $\eta_p^2 = 0.43$, power = 1.00], such that increased arousal was reported after viewing images (Time 1: *M* = 2.56, *SD* = 2.48; Time 2: *M* = 5.86, *SD* = 2.71). No other significant main effects or interactions were observed.

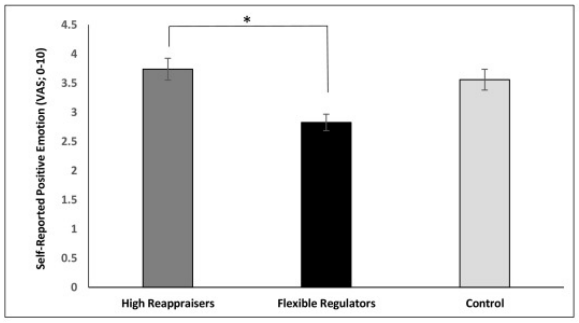


Fig. 2. Group mean (±SEM) positive emotion ratings collapsed across time (* *p* < .05).

Table 1. Mean (standard deviation) scores for self-report measures.

| Questionnaires | High reappraisers | Flexible regulators | Control |
|---|---|---|---|
| ERQ reappraisal | 32.05 (4.61) | 29.54 (6.69) | 30.45 (6.08) |
| ERQ suppression | 13.90 (4.67) | 15.27 (6.02) | 14.47 (4.54) |
| DERS total | 74.03 (18.61)* | 90.35 (27.53) | 86.22 (26.31) |
| DERS nonacceptance | 11.68 (4.91)* | 15.04 (7.10) | 14.89 (7.55) |
| DERS impulse | 9.60 (4.47)* | 13.23 (5.38) | 11.42 (5.04) |
| DERS access to strategies | 13.66 (4.98)* | 19.38 (8.26) | 17.89 (8.35) |
| PHQ-9 total | 13.42 (5.73) | 16.10 (8.16) | 15.26 (6.63) |
| GAD-7 total | 5.95 (4.36) | 8.45 (6.31) | 7.15 (5.18) |
| Pos Emo Time 1 | 5.40 (2.05) | 4.64 (2.68) | 5.45 (2.21) |
| Pos Emo Time 2 | 2.07 (1.84) | 1.02 (1.71) | 1.67 (1.63) |

Note: High reappraisers reported significantly less difficulty in regulation compared to both flexible regulators and control.

∗p < .05.

## 3.3. Group comparisons of additional measures

We were further interested in whether this novel assessment of ER had the same associations with regulation difficulties as other established measures. A multivariate analysis of variance comparing high reappraisers,

flexible regulators, and control participants on total DERS score and DERS subscales revealed several significant findings. The MANOVA was significant, [$F(2, 140) = 4.43$, $p = .014$], and Tukey's post-hoc comparison revealed several significant group differences. Specifically, high reappraisers reported significantly less difficulty in regulation compared to flexible regulators and control participants (Table 1). There was no significant difference between flexible regulators and control participants. Significant differences were observed in the nonacceptance, impulse, and access to strategies subscales, such that high (Faul et al., 2007) reappraisers reported less difficulties in these subscales compared to the other groups. With respect to psychological health, multivariate analyses of variance comparing high reappraisers, flexible regulators, and control participants revealed no significant differences found between groups on self-reported depression (PHQ-9) or anxiety (GAD-7) (see Table 1).

# 4. Discussion

The current study aimed to extend previous implicit ER priming methods to assess for individual differences in implicit ER strategy use. The novelty of this paradigm was its ability to capture individual differences in automatic ER by allowing participants to implicitly select reappraisal or suppression priming words. This task uncovered statistically significant differences in implicit regulation use such that a majority of the participants primarily chose reappraisal words (High Reappraisers); a sizeable though slightly smaller group chose approximately equal numbers of reappraisal and suppression words (Flexible Regulators); and only three individuals predominantly chose suppression. These results are a promising sign this technique effectively taps into nonconscious preferences for ER words– a potential indication of automatic regulation. Further, these automatic regulation patterns were significantly correlated with the ERQ reappraisal subscale in the expected direction, suggesting consistency between implicit reappraisal and trait reappraisal. Group differences were observed in emotion and emotion regulation. Specifically, high reappraisers were generally more positive than flexible regulators as reflected by self-reported positive emotion. However, contrary to our hypothesis, there were no group differences in emotion following distressing images. The high reappraisers also reported fewer general difficulties in ER than flexible regulators on the DERS.

Priming ER via sentence unscrambling tasks has been effective in previous studies (Mauss et al., 2007; Williams et al., 2009; Yang et al., 2015; Yuan et al., 2014; Zhang et al., 2017). Importantly, this was the first study to use cognitive bias methods to explore individual differences in implicit regulation based on participants' choices – perhaps reflecting their automatic or habitual ER use. The findings of this implicit assessment are consistent with studies using self-report measures demonstrating different ER patterns (Chesney et al., 2019; Eftekhari et al., 2009). While participants were ultimately categorized based on their *pattern* of selections, individuals did not categorically select only reappraisal or suppression. Indeed, this is consistent with progressive approaches in the field arguing for person-centered methodology that accounts for individual differences in the use of multiple strategies (Brans et al., 2013; Chesney et al., 2019; Chesney & Gordon, 2016; Eftekhari et al., 2009). For instance, Eftekhari et al. (2009) found four patterns – high reappraisers/low suppressors, high regulators, moderate reappraisers/low suppressors, and low regulators using self-report methods. Although this is the first time the current methods have been employed, they show promise in circumventing explicit procedures (sometimes prone to demand characteristics) and measuring implicit regulation outside of the participant's awareness. The tendency for many participants to flexibly choose both strategies demonstrates a need to consider individuals' patterns of regulation within experimental research. Development of new methods that account for individual differences in strategy use and multiple strategy use is critical.

Furthermore, there were important differences based on participants' pattern of ER selection. Consistent with previous literature, high reappraisers reported more adaptive ER ability than flexible regulators. Further, the high reappraisers reported greater overall positive emotion compared to flexible regulators. This was similar

to Eftekhari et al.'s (2009) findings that participants who were high reappraisers reported more positive outcomes than those having other regulation patterns. Specifically, high reappraisers/low suppressors had the lowest levels of psychopathology (depression, anxiety and PTSD) compared to all other groups, including high regulators who used both reappraisal and suppression. While we found evidence that people gravitate toward implicit patterns of responding, which are associated with self-reported emotion and regulation abilities, the current methods did not capture an acute emotion difference following a distressing task. While some studies exploring implicit regulation found significant differences, it is possible that self-reported emotion may not be sensitive to capturing differences in responding based on implicit patterns of regulation. It may be beneficial to explore differences in physiological measures with this new technique since those measures may be more sensitive to implicit regulation.

Also inconsistent with the previous literature, the current study evidenced no differences between implicit priming of ER with a control group. In previous studies, priming emotion control or reappraisal led to less negative emotion than a control group or an emotion expression group across multiple contexts. One possibility for this finding is that the control group participants were engaging in their own strategies of automatic regulation. As such, one limitation to the current study is the lack of a manipulation check. This would have allowed us to establish participants' perceived regulation style during the distressing task. Another factor that could have influenced these findings is the type of negative stimuli presented. Previous studies tend to induce negative emotion through frustrating counting or math tasks (Mauss et al., 2007; Yang et al., 2015; Yuan et al., 2014). Given the increasing attention to context, the deviation of the current emotion induction procedure from past studies may be noteworthy (Aldao, Sheppes, & Gross, 2015). Specifically, previous experimental work revealed that as the intensity of emotion induction stimuli increases, a participant's tendency to rely on strategies beyond reappraisal also increases (Opitz, Cavanagh, & Urry, 2015). Thus, the graphic depiction of injured individuals within the current study is likely comparable to high-intensity stimuli, leading to use of strategies such as avoidance (i.e. looking away from the images) or distraction. Previous studies utilizing math tasks may have been better suited to reappraisal given the possibility that increases in arousal could have been interpreted as facing a challenge. Therefore, while participants in the current study may have selected ER priming words that reflected their natural tendencies, the subsequent induction task may not have been the best task for use of reappraisal given the high-intensity stimuli in a low-control context.

Additionally, while there was a benefit in allowing participants to implicitly choose the regulation word, this led to an unequal distribution across the three regulation groups. While unequal groups were anticipated, very few participants fell within the suppression category, limiting our ability to conduct statistical group comparisons. However, this is consistent with previous literature that also found that few individuals use predominantly suppression within undergraduate samples (Eftekhari et al., 2009).

The current study aimed to capture individual differences in implicit ER using a novel task. The task highlighted the variability in participants' selection tendencies, and how these were consistent with self-report measures of ER. The current study demonstrates initial promise for research to begin capturing implicit regulation use but more work is needed to assess whether the paradigm is successful at assessing acute implicit ER. As such, future work must continue to evaluate how best to study implicit regulation while acknowledging the variability in ER strategies, as well as variability in individual implicit patterns of responding.

## CRediT authorship contribution statement

**Sydney C. Timmer-Murillo:** Conceptualization, Methodology, Formal analysis, Investigation, Data curation, Writing - original draft, Writing - review & editing. **Keara J. Kangas:** Writing - original draft, Writing - review & editing. **Nakia S. Gordon:**Conceptualization, Methodology, Resources, Writing - original draft, Writing - review & editing.

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