An event-related potential investigation of distanced self-talk: Replication and comparison to detached reappraisal

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ARTICLE INFO

Keywords:
Emotion regulation
Distanced self-talk
Reappraisal
EEG
Event-related potentials
Stimulus preceding negativity

ABSTRACT

Emotion regulation is critical for managing stress, but many regulatory strategies consume high levels of cognitive resources to implement, which are depleted under stress. This raises a conundrum: the tools we have to feel better may be ineffective when they are most needed. Recent event-related potential (ERP) research indicates that distanced self-talk (i.e., reflecting on one’s experiences using non-first-person singular pronouns and one’s name) reduces negative emotional reactivity without overtaxing cognitive resources. Here, we report the first direct replication of this work and extend it by examining how distanced self-talk compares to detached reappraisal, one of the most frequently studied regulatory techniques. Sixty-seven participants were randomly assigned to an emotion regulation picture task and instructed to reflect on the feelings they experienced in response to viewing negative emotional images using distanced self-talk or detached reappraisal while ERPs were measured. Directly replicating past findings, distanced self-talk led to a reduction in an affective arousal ERP, the late positive potential (LPP), without increasing stimulus preceding negativity (SPN), an ERP that reflects anticipatory and preparatory processing. These results further bolster support for distanced self-talk as a relatively effortless emotion regulation strategy. On the other hand, detached reappraisal was neither associated with the modulation of the LPP nor the SPN. Due to the failed replication of the reappraisal effect, a direct comparison between emotion regulation strategies was not conducted. Methodological limitations that may have contributed to the reappraisal failure and future directions for comparisons between emotion regulation strategies are discussed.

1. Introduction

Emotion regulation is a critical skill for managing responses to stressors (Gross, 1998). However, the majority of emotion regulation strategies consume significant cognitive resources (Ochsner and Gross, 2008), which are depleted when people experience stress (Ortner et al., 2016; Sheppes et al., 2009; Sheppes and Meiran, 2008; Troy et al., 2018). Therefore, there is an urgent need to identify relatively effortless strategies that can be effective even when cognitive resources are exhausted (Orvell et al., 2019). One promising candidate is distanced self-talk, an emotion regulation strategy that involves using one’s own name and other non-first person pronouns during introspection (Kross et al., 2014; for reviews, see Kross and Ayduk, 2017; Orvell et al., 2021).

Individuals tend to view their experiences from a “self-immersed” perspective – using first person pronouns such as “I” and “me” to refer to themselves (Kross and Ayduk, 2017; Kross et al., 2014). Taking a self-immersed perspective makes it more difficult for an individual to reason objectively about an emotionally arousing experience due to their personal emotional connection to the situation.

It is well established that people have an easier time helping other people reframe their problems (Grossmann and Kross, 2014; Kross and Ayduk, 2017). Additionally, research has shown that when people help others regulate their emotions, it can help reduce their own negative emotions (Doré et al., 2017). Distanced self-talk leverages the structure of language to help people think about themselves more similarly to how they think about others (Gainsburg and Kross, 2020; Kross et al., 2014; Orvell et al., 2019). Specifically, when people think about others, they tend to use non-first-person pronouns and names. Thus, the theory motivating this work suggests that by using their own name to think about themselves, people can relatively effortlessly shift their
perspective and gain the psychological distance needed to manage their emotions effectively (Kross and Ayduk, 2017; Orvell et al., 2019).

Consistent with this hypothesis, behavioral evidence indicates that distanced self-talk operates effectively under conditions that typically impede more effortful strategies. For example, Orvell et al. (2019) found across two high-powered experiments that distanced self-talk promotes successful emotion regulation for high-intensity emotional experiences as well as for individuals who experience chronic levels of emotional distress (Kross et al., 2014, 2017; Orvell et al., 2021). Moreover, developmental work reveals that distanced self-talk is particularly effective among children with less developed executive functioning and effortful control (Grenell et al., 2019).

Perhaps the most direct evidence comes from a study performed by Moser et al. (2017), which found converging evidence across two neurophysiological methods (EEG and fMRI) demonstrating that distanced self-talk facilitates emotion regulation without recruiting fronto-parietal mechanisms involved in cognitive control (Moser et al., 2017). Specifically, when participants engaged in distanced self-talk, event-related potential (ERP) results revealed a dampened late positivity (LPP) amplitude, indicating decreased affective arousal (Hajcak et al., 2012; Hajcak and Foti, 2020), but no increase in the stimulus preceding negativity (SPN), an index of anticipatory and preparatory cognitive processes (Brunia et al., 2012; Moser et al., 2009, 2017). Similarly, fMRI revealed that distanced self-talk led to reduced activity in brain regions associated with self-referential emotional processing (e.g., medial frontal cortex), but no increase in those associated with cognitive control (e.g., lateral prefrontal cortex).

Despite the consistency of these findings, no research to date has attempted to replicate the neural evidence supporting the idea that distanced self-talk facilitates emotion regulation relatively effortlessly, without recruiting excessive cognitive resources. Therefore, our first goal was to directly replicate these findings. Specifically, we aimed to test whether distanced self-talk decreases emotional arousal without increasing preparatory cognitive processes using the identical ERP paradigm to Moser et al. (2017).

We further aimed to extend past findings by comparing distanced self-talk to detached reappraisal, another cognitive emotion regulation technique that has been the focus of much research to date. Detached reappraisal is a form of cognitive reappraisal that involves thinking about an emotional experience in such a way as to remove all personal connection from it and, therefore, significantly decrease its impact (Gross, 1998). Detached reappraisal is a self-focused reappraisal strategy – as opposed to a situation-focused reappraisal strategy (positive reappraisal). Self-focused reappraisal differ from situation-focused reappraisal in its regulatory goals and strategies (McRae et al., 2012a, 2012b). Specifically, self-focused reappraisal reduces the personal relevance of a negative stimulus, whereas situation-focused reappraisal reinterprets the context of the stimulus itself (McRae et al., 2012a, 2012b; Ochsner et al., 2004; Shiota and Levenson, 2012).

Detached reappraisal has been shown to effectively reduce emotional arousal via self-report (Qi et al., 2017; Shiota and Levenson, 2012) and ERP measures (Moser et al., 2009; Qi et al., 2017; Thiruchselvam et al., 2011). However, cognitive reappraisal techniques such as detached reappraisal require increased cognitive effort as they rely on frontally-mediated cognitive control networks to dampen subcortically-mediated emotional response regions (Buhle et al., 2014; Moser et al., 2005, 2006; Weger et al., 2008). Indeed, reappraisal techniques have been reliably associated with increased cognitive effort as revealed by self-report (Ortner et al., 2016), behavioral responses (Sheppes and Meiran, 2008), pupil dilation (Strauss et al., 2016), and ERPs (Moser et al., 2009; Qi et al., 2017; Thiruchselvam et al., 2011). Here, we aimed to investigate how detached reappraisal influences neural markers of affective arousal and preparatory cognitive processes compared to the effects of distanced self-talk.

To achieve these aims, we asked participants to view a series of negative (vs. neutral) images under distanced self-talk or detached reappraisal instructions while we recorded neural activity through EEG. As in Moser et al. (2017), we extracted the LPP to index affective arousal processes – the early LPP reflecting early attentional mechanisms and the late LPP reflecting later meaning making processes (Hajcak et al., 2010, 2012). The LPP is a robust neurophysiological index of affective arousal such that it is reliably modulated by the arousal properties of emotional images (Hajcak et al., 2010, 2012). That is, research has shown the LPP to be reliably larger in amplitude when viewing highly arousing images as opposed to low arousing images (e.g., Schupp et al., 2000). Importantly, its amplitude tracks very well with individual, trial-level self-reported affective arousal and skin conductance response (Cuthbert et al., 2000). Moreover, combined EEG and fMRI studies show a strong correlation between the scalp-recorded LPP and BOLD signal from brain regions implicated in affective processing, including the amygdala and distributed visual cortices (Liu et al., 2012; Sabatinelli et al., 2007). Thus, the LPP is often regarded as an index of affective arousal, albeit a cortical marker likely reflecting the coordination of multiple cortical and subcortical brain regions involved in emotional perception and experience. Importantly, the LPP has also been shown to be sensitive to emotion regulation instructions (Moser et al., 2009), making it ideal for comparing the effectiveness of emotion regulation strategies.

We also extracted the frontal SPN during the instruction period to index anticipatory and preparatory cognitive processes for emotion regulation implementation during subsequent picture viewing (Brunia et al., 2012; Moser et al., 2009; van Bockel and Böcker, 2004). Indeed, the frontal SPN is consistently increased when preparing to engage in emotion regulation strategies such as detached reappraisal and distraction (Moser et al., 2009; Qi et al., 2017; Shafir et al., 2015; Thiruchselvam et al., 2011). The increased frontal SPN appears specific to detached reappraisal and distraction relative to positive reappraisal (Moser et al., 2014) and personalization to increase negative emotions (Moser et al., 2009) suggesting that it is involved in cognitive processes that can be prepared before image content has been presented. Moreover, the frontal distribution of the detached reappraisal effect is consistent with the involvement of prefrontal control regions documented in fMRI research (Ochsner and Gross, 2008).

Based on our prior work, we predicted that distanced self-talk would be associated with a pattern of ERP activity indicative of an effective, but relatively effortless form of emotion regulation as evidenced by a dampened LPP but unaffected SPN. Further, we predicted that detached reappraisal would be associated with a pattern of ERP activity indicative of an effective, but relatively effortless form of emotion regulation as evidenced by a dampened LPP and enlarged SPN. We also predicted that both emotion regulation strategies would exhibit a dampened LPP amplitude in the late time window, and not in the early time window.

2. Methods

2.1. Sample size considerations

Results from the Moser et al. (2017) study indicated that distanced self-talk exhibited a large effect on the late LPP (Cohen’s d = 0.87) with a sample size of 29. Similarly, previous cognitive reappraisal research has shown a large effect on the late LPP (d = 0.90, N = 16; Moser et al., 2009). Therefore, we concluded that a sample size of at least N = 60 (in each strategy type group) would be sufficient to replicate the dampened LPP effect using a three-way Condition (regulation vs. no-regulation) × Valence (negative vs. neutral) × Strategy Type Group (detached self-talk vs. detached reappraisal) interaction. A post hoc sensitivity analysis confirmed that with a sample size of N = 60, alpha = 0.05, our design was powered to detect an effect size of at least d = 0.34 with 80% power. For the SPN effect, we predicted a differentiation between strategy types such that we expected a significant Condition (regulation vs. no-regulation) × Strategy Type Group (distanced self-talk vs. detached reappraisal) interaction.
detached reappraisal) interaction. Expecting a large effect size for reappraisal \((d = 1.02;\) Moser et al., 2009) and null effect size for distanced self-talk (Moser et al., 2017), we determined that a sample size of 60 would be sufficient to detect this interaction. A post-hoc sensitivity analysis confirmed that with a sample size of \(N = 60\), \(\alpha = 0.05\), our design was powered to detect an interaction effect of at least \(d = 0.42\) with 80% power.

### 2.2. Participants

To ensure a minimum of 60 participants in the final analyses, we recruited 75 undergraduate students from Psychology courses via the university research subject pool. Participants received partial course credit for their participation. Eight participants were excluded because of excessive artifacts that resulted in the rejection of >60% of trials, leaving only <8 trials per condition (Moran et al., 2013). Therefore, the final sample submitted to analysis consisted of 67 (51 female) participants. The sample's racial demographics were 51 White (76.1%), 7 Asian (10.4%), 6 Black/African American (9%), 2 Middle Eastern (3%), and 1 American Indian/Alaskan Native (1.5%). The mean age was 18.97 (SD = 1.29; for demographics, see Table 1). All procedures were performed in accordance with the relevant guidelines and regulations and approved by Michigan State University’s Institutional Review Board.

### 2.3. Stimuli

The stimuli consisted of 60 neutral and 60 negative images selected from the International Affective Picture System (IAPS; Lang et al., 1997). The negative image set consisted of mutilation and threat images. The neutral image set consisted of household items and neutral faces. Normative ratings indicated that negative images were rated as both more negative (Negative: \(M = 2.50, SD = 0.73\); Neutral: \(M = 4.96, SD = 0.41\); \(t(118) = 22.64, p < .001\)) and more arousing (Negative: \(M = 6.06, SD = 0.74\); Neutral: \(M = 3.04, SD = 0.68\); \(t(118) = 23.22, p < .001\)) than neutral images. The same images were used for both the emotion regulation and control conditions across both groups and thus did not differ on either valence or arousal. The task was administered on a Pentium D class computer, using E-Prime software (Psychology Software Tools; Pennsylvania, US) to control the presentation and timing of all stimuli. Each picture was displayed in color and occupied the entirety of a 19 in (48.26 cm) monitor. Participants were seated approximately 60 cm from the monitor in a brightly lit room.

### 2.4. Procedure

The primary aim of this study was to replicate the findings from Moser et al. (2017). Therefore, we aimed to match the original study’s procedure as closely as possible. Participants were randomly assigned to either the distanced self-talk strategy \((N = 35)\) or the detached reappraisal strategy \((N = 32)\) group (see Fig. 1 for a visual depiction of the conditions for each strategy type group). Each strategy type group consisted of two conditions (emotion regulation and control). In the self-talk strategy group, replicating Moser et al. (2017), distanced self-talk served as the emotion regulation condition and immersed self-talk served as the control condition. We chose immersed self-talk for the control condition as it reflects how an individual would typically react to negative experiences (Ayduk and Kross, 2010; Orvell et al., 2021). Orvell et al. (2021) found no significant difference in self-reported emotional reactivity when participants naturally reflected on a negative experience compared to when asked to use immersed self-talk to reflect on those same experiences. This suggests that immersed self-talk is similar to how individuals naturally react to negative emotional experiences.

In the reappraisal strategy group, detached reappraisal served as the emotion regulation condition and passive view served as the control. Each participant completed a cue-picture paradigm, similar in format to previous research on emotion regulation (Moser et al., 2006, 2017). Participants completed two blocks of trials: an emotion regulation condition block in which they were instructed to engage in either distanced self-talk or detached reappraisal, and a control condition block in which they were instructed to engage in either immersed self-talk (distanced self-talk control) or passive viewing (detached reappraisal control) while viewing negative or neutral images. The order in which participants received each block was counterbalanced. Each block consisted of 60 trials with 30 neutral and 30 negative images, and the order of the pictures in each block was randomized. At the midpoint of each block, participants received a break, during which the research assistant restated the condition instructions.

For each trial, participants first viewed an instruction phrase (Self-Talk Group: “First Person” or “Third Person”; Reappraisal Group: “Look” or “Reappraise”) for 2 s that directed them how to think about the following picture. After the instruction phase, a blank screen was presented for 500 ms, followed by a centrally presented white fixation cross lasting 500 ms. Following the fixation cross, an IAPS image was displayed for 6 s. Finally, a period of 2.5 s was inserted between the offset of images and the presentation of the next instruction phrase, during which the order of the pictures in each block was randomized. At the midpoint of each block, participants received a break, during which the research assistant restated the condition instructions.

Prior to each block, participants were given instructions by a research assistant and completed two practice blocks before each experimental block to familiarize themselves with the timing of events.

### Table 1

<table>
<thead>
<tr>
<th>Participant demographics</th>
<th>Distanced self-talk</th>
<th>Detached reappraisal</th>
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<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
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<tr>
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<td>36</td>
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<tr>
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<td>Race</td>
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<td>American Indian/Alaskan Native</td>
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<td>Asian</td>
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<td>Black/African American</td>
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<td>Middle Eastern</td>
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<tr>
<td>Ethnicity</td>
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<td>Hispanic/Latinx</td>
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1 The average number of trials included in each condition for the LPP were: Self-Talk Group: Emotion Regulation/Neutral = 24.37, Control/Neutral = 23.46, Emotion Regulation/Negative = 24.06, Control/Negative = 23.20; Reappraisal Group: Emotion Regulation/Neutral = 22.31, Control/Neutral = 22.53, Emotion Regulation/Negative = 23.16, Control/Negative = 22.31. The average number of trials for the LPP did not differ between condition (\(F(1, 65) = 1.672, p = .201, \eta^2_p = 0.025\), valence (\(F(1, 65) = 0.001, p = .979, \eta^2_p < 0.001\), or group (\(F(1, 65) = 1.175, p = .282, \eta^2_p = 0.018\). The average number of trials included in each condition for the SPN were: Self-Talk Group: Emotion Regulation = 50.06, Control = 49.46; Reappraisal Group: Emotion Regulation = 48.16, Control = 47.06. The average number of trials for the LPP did not differ between condition (\(F(1, 65) = 0.914, p = .343, \eta^2_p = 0.014\), or group (\(F(1, 65) = 0.078, p = .781, \eta^2_p < 0.001\).

2 Included images listed by their IAPS identification numbers: 1050, 1200, 1300, 1525, 1930, 2036, 2102, 2110, 2190, 2200, 2220, 2242, 2215, 2250, 2260, 2276, 2283, 2293, 2495, 2570, 2561, 2683, 2688, 2692, 2694, 2703, 2710, 2716, 2751, 2753, 2799, 2800, 2810, 2811, 2840, 3001, 3010, 3120, 3181, 3213, 3216, 3220, 3230, 3301, 3350, 3500, 3550, 5500, 5531, 5571, 6021, 6131, 6211, 6212, 6422, 6304, 6312, 6313, 6415, 6550, 6563, 6821, 6825, 6838, 7000, 7002, 7003, 7004, 7006, 7009, 7010, 7012, 7016, 7018, 7020, 7021, 7025, 7026, 7030, 7031, 7035, 7041, 7050, 7056, 7080, 7100, 7110, 7140, 7150, 7160, 7170, 7175, 7190, 7211, 7217, 7224, 7233, 7235, 7254, 7550, 7620, 7700, 7790, 9250, 9253, 9260, 9410, 9421, 9425, 9428, 9440, 9620, 9622, 9800, 9810, 9903, 9908, 9921.

2.4 Procedure
and instructions. In the first practice block, participants were guided through the picture viewing task and were instructed to think about each picture aloud. During the second practice block, participants were instructed to practice silently in order to simulate the experimental task. The first practice block consisted of 3 neutral and 3 negative images, and the second block consisted of 10 neutral and 10 negative images. None of the images in the practice block were included in the experimental task. Following each block, participants were asked to rate the extent to which they followed the instructions during the picture viewing task. Finally, after the experimental task, participants were asked to report on their emotional arousal and effort for each condition and picture valence.

2.5. Emotion regulation strategy instructions

Instructions for the self-talk strategy type group were taken directly from Moser et al. (2017). In the distanced self-talk condition, participants were instructed to reflect on their feelings elicited by the images using their own name as much as possible (e.g., “I feel sad”). During the immersed self-talk control condition, participants were instructed to reflect on their feelings elicited by the images using the pronoun “I” as much as possible (hereafter referred to as immersed self-talk; e.g., “I feel sad”). Instructions for the reappraisal strategy type group were adapted from Moser et al. (2009) to match the self-talk strategy type group instructions as closely as possible on length and content. When designing the task, we aimed to equate the reappraisal and self-talk instructions as closely as possible without sacrificing the active ingredients of either. To do this, we removed one instruction from the reappraisal instructions that is often included, which explicitly directs people to not feel negative emotions and thus is highly susceptible to demand effects. Specifically, we removed the following statement from the reappraisal instructions: “Think about the images in such a way that you feel your negative emotions less strongly.” The reappraisal instructions in the current study, therefore, instructed participants to reflect on their thoughts and feelings elicited by pictures using a detached perspective (i.e., “this image is from a movie” or “this image is not real”). For the passive view control condition, participants were instructed to simply view pictures and not to try and change their emotions (passive view). For all instructions, participants were further told not to generate unrelated thoughts or images to alter their responses and to view the images for the entire display period without looking away or closing their eyes. See Supplemental Materials for verbatim instructions.

2.6. EEG recording and data processing

Continuous EEG activity was recorded using the ActiveTwo Biosemi system (Biosemi, Amsterdam, The Netherlands). Recordings were taken from 64 Ag-AgCl electrodes embedded in a stretch-lycra cap. Additionally, two electrodes were placed on the left and right mastoids as references. Electro-oculogram (EOG) activity generated by eye movements and blinks was recorded at electrode site Fp1, and three additional electrodes were placed inferior to the left pupil and on the left and right outer canthi. During data acquisition, the Common Mode Sense active electrode and Driven Right Leg passive electrode formed the ground per Biosemi design specifications. Bioelectric signals were sampled at 512 Hz.

Electrical signal processing was performed offline using BrainVision Analyzer 2 (BrainProducts, Gilching, Germany). Scalp electrode recordings were re-referenced to the mean of the mastoids and band-pass filtered (cutoffs: 0.01–20 Hz; 12 dB/oct rolloff). Ocular artifacts were corrected using the method developed by Gratton et al. (1983). Cue- and picture-locked data were segmented into individual epochs beginning 500 ms before stimulus onset and continuing for 3000 ms and 6000 ms, respectively. Physiological artifacts were detected using a computer-based algorithm such that trials in which the following criteria were met were rejected: a voltage step exceeding 50 μV between contiguous sampling points, a voltage difference of 300 μV within a trial, and a maximum voltage difference of less than 0.5 μV within 100 ms intervals. The average activity in the 500 ms window prior to cue and picture onset served as the baseline and was subtracted from each data point subsequent to cue and picture onset.

Following previous research, the LPP was extracted at the CPz electrode site and averaged at early (400–1000 ms) and late (1–4 s) time windows (Moser et al., 2014; Schönfelder et al., 2014). Our decision to segment the late LPP at 1–4 s was motivated by research on the time course of emotion regulation, which found that the difference in LPP amplitude between reappraisal and passive view diminished after 4 s (Schönfelder et al., 2014). The SPN was extracted at the FCz electrode site and averaged at early (300–2300 ms) and late (2300–3000 ms) time windows (Brunia et al., 2012; Moser et al., 2009, 2017). The early time window reflects immediate processing of the cue, whereas the late time window reflects anticipatory and preparatory activity related to acting on the cue’s instruction.

2.7. Self-report measures

Self-reported compliance was measured after each block by asking participants the extent to which they followed the instructions during the picture viewing task using a 1 (Not at all) to 7 (The whole time) Likert scale. At the end of the experiment, self-reported reflections on emotional arousal and effort during the task were measured for each condition (regulation and no regulation), valence (neutral and negative), and across both strategy type groups (strategy type: distanced self-talk and detached reappraisal). Self-reported reflection on emotional arousal was measured using a 1 (Very Weak) to 7 (Very Strong) Likert scale. Similarly, self-reported reflection on effort was measured using a 1 (Very Little) to 7 (Very Much) Likert scale. See Supplemental Materials for verbatim self-report questions.

Fig. 1. Visual depiction of strategy type groups and conditions. Participants were randomized into one of two emotion regulation strategy type groups: Self-Talk and Reappraisal. Participants in each group completed two condition blocks (emotion regulation and control conditions). The Self-Talk strategy type group consisted of a distanced self-talk (emotion regulation) and immersed self-talk (control) condition. The Reappraisal strategy type group consisted of a detached reappraisal (emotion regulation) and passive view (control) condition. The order in which
3. Results

3.1. Task compliance

Across all conditions and strategies, self-reported compliance with the task was high (i.e., above the scale mid-point; see Table 2 for mean compliance ratings). Compliance was higher during the no regulation (control) blocks \((M = 6.29, SE = 0.123)\) relative to the regulation blocks \((M = 5.89, SE = 0.149)\); main effect of condition: \(F(1, 64) = 8.298, p = .005, \eta^2 = 0.114\) across both groups. However, across emotion regulation strategy type groups (distanced self-talk vs. detached reappraisal), this difference in compliance between emotion regulation and no regulation (control) blocks was equivalent, and average compliance did not significantly differ between strategy type groups \((Fs < 2.413, ps > 0.125)\).

3.2. Distanced self-talk

Our first aim was to replicate the Moser et al. (2017) findings regarding participants' affective arousal and preparatory cognitive effort while engaging in distanced self-talk. To do so, we conducted a series of repeated measures analyses of variance (rANOVA) in the self-talk strategy type group predicting neural and self-report outcomes from two within-subject factors — condition (regulation vs. no regulation) and valence (negative vs. neutral) — and their interaction. Significant condition \(\times\) valence interactions were followed up by comparing the negative minus neutral difference wave scores between the control and emotion regulation conditions. As the SPN was elicited before participants knew the valence of the stimulus, SPN analyses only included a condition factor. Overall, our results replicated previous findings, such that distanced self-talk decreased neural indices of emotional arousal without recruiting additional cognitive resources implicated in effortful anticipatory and preparatory processes.

Our primary measure of affective arousal was the late LPP (see Table 3 for mean LPP amplitudes). Results revealed a main effect of valence \((F(1, 34) = 30.846, p < .001, \eta^2 = 0.476)\), such that a greater late LPP amplitude was observed during unpleasant \((M = 6.89, SD = 7.09)\) images relative to neutral \((M = 1.00, SD = 5.80)\) images. There was no significant main effect of condition \((F(1, 34) = 0.067, p = .798; \eta^2 = 0.002)\) on the late LPP. Replicating Moser et al. (2017), the condition \(\times\) valence interaction was significant for the late window of the LPP \((F(1, 34) = 4.390, p = .044, \eta^2 = 0.114)\). Specifically, when participants engaged in distanced self-talk, they exhibited a smaller late LPP (negative minus neutral difference score) relative to immersed self-talk \((t(34) = 2.095, p = .044, d = 0.35; \text{see Fig. 3})\). Similar main and interaction effects emerged in the early window of the LPP. There was a main effect of valence \((F(1, 34) = 36.522, p < .001, \eta^2 = 0.518)\), such that a greater early LPP amplitude was observed during negative \((M = 6.12, SD = 5.69)\) images relative to neutral \((M = 1.53, SD = 3.86)\) images. There was no significant main effect of condition \((F(1, 34) = 2.291, p = .139; \eta^2 = 0.063)\) on the early LPP. There was a significant condition \(\times\) valence interaction \((F(1, 34) = 5.690, p = .023, \eta^2 = 0.143)\), such that engaging in distanced self-talk resulted in a smaller early LPP (negative minus neutral difference score) relative to immersed self-talk \((t(34) = 2.385, p = .023, d = 0.40; \text{see Fig. 3})\). These findings show that across both early and late time windows of the LPP, distanced self-talk

### Table 2

<table>
<thead>
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<th>Strategy type</th>
<th>Control</th>
<th>Emotion regulation</th>
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<tbody>
<tr>
<td></td>
<td>M (SD)</td>
<td>M (SD)</td>
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<tr>
<td>Distanced self-talk</td>
<td>6.11 (0.98)</td>
<td>5.89 (1.24)</td>
</tr>
<tr>
<td>Detached reappraisal</td>
<td>6.48 (1.00)</td>
<td>5.77 (1.15)</td>
</tr>
</tbody>
</table>

Total \(n = 67\); Distanced Self-Talk \(n = 35\), Detached Reappraisal \(n = 32\). Self-reported task compliance was reported using means and standard deviations.

### Table 3

<table>
<thead>
<tr>
<th>Time window</th>
<th>Control</th>
<th>Emotion regulation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Neural images (M (SD))</td>
<td>Negative images (M (SD))</td>
</tr>
<tr>
<td>Distanced self-talk</td>
<td>1.47 (4.17)</td>
<td>4.66 (6.40)</td>
</tr>
<tr>
<td>400-1000 ms</td>
<td>0.13 (6.61)</td>
<td>7.36 (7.42)</td>
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<tr>
<td>1000-3000 ms</td>
<td>0.75 (6.48)</td>
<td>4.66 (6.40)</td>
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Detached reappraisal

<table>
<thead>
<tr>
<th>Time window</th>
<th>Control</th>
<th>Emotion regulation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Neural images (M (SD))</td>
<td>Negative images (M (SD))</td>
</tr>
<tr>
<td>Distanced self-talk</td>
<td>400-1000 ms</td>
<td>0.35 (6.84)</td>
</tr>
</tbody>
</table>

Total \(n = 67\); Distanced Self-Talk \(n = 35\), Detached Reappraisal \(n = 32\).
effectively dampened emotional processing of negative stimuli relative to immersed self-talk.

Our primary measure of preparatory cognitive effort was the SPN (see Table 4 for mean SPN amplitudes). Replicating Moser et al. (2017), the main effect of condition was non-significant for the early (300–2300 ms; \( F(1, 34) = 0.021, p = .884, \eta^2_p = 0.001 \)) and late (2300–3000 ms; late: \( F(1, 34) = 1.438, p = .239, \eta^2_p = 0.041 \)) time windows (see Fig. 5 A–B). These results suggest that using distanced self-talk did not require additional preparatory effort relative to immersed self-talk.

Self-report data were partially consistent with these neural findings (see Table 5 for mean self-report ratings). Results revealed a significant condition × valence interaction on self-reported emotional arousal \( (F(1, 34) = 8.081, p = .008, \eta^2_p = 0.192) \), such that participants reported that their emotional arousal was significantly lower while engaging in distanced (vs. immersed) self-talk \( (t(34) = 2.843, p = .008, d = 0.48) \). However, results also revealed a significant condition × valence interaction on self-reported effort \( (F(1, 34) = 6.792, p = .013, \eta^2_p = 0.167) \), such that participants reported that distanced self-talk required more effort than immersed self-talk \( (t(34) = 2.606, p = .013, d = 0.44) \).

### 3.3. Detached reappraisal

Our second aim was to examine the same measures of emotional arousal and preparatory effort while people engaged in detached reappraisal. To do so, we conducted the same analyses in the reappraisal strategy type group that we did in the self-talk group, predicting neural

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3 In addition to the effect of interest, we also detected an interaction with Order – the results and discussion of which can be found in the Supplemental Materials.
and self-report outcomes from two within-subject factors — condition (emotion regulation vs. control) and valence (negative vs. neutral) — and their interaction. Significant condition × valence interactions were followed up by comparing the negative minus neutral difference wave scores between the control and emotion regulation conditions. Again, SPN analyses only included the condition factor.

In the Reappraisal group, results revealed a main effect of valence in the early (F(1, 31) = 26.63, p < .001; η²p = 0.462) and late (F(1, 31) = 12.31, p = .001; η²p = 0.284) LPP time windows, such that a greater LPP amplitude was observed during negative (Early LPP: M = 4.59, SD = 5.69; Late LPP: M = 4.35, SD = 6.50) images relative to neutral (Early LPP: M = 0.61, SD = 5.20; Late LPP: M = 0.45, SD = 6.03) images. There was no significant main effect of condition (F(1, 31) = 0.276, p = .603; η²p = 0.009). Unexpectedly, detached reappraisal did not lead to a decreased LPP in the early (condition × valence interaction: F(1, 31) = 0.011, p = .916, η²p < 0.001) or late (condition × valence interaction: F(1, 31) = 0.103, p = .751, η²p = 0.003) time windows (see Fig. 4). Reappraisal also unexpectedly did not modulate the SPN amplitude in both early (300–2300 ms; F(1, 30) = 0.592, p = .448, η²p = 0.019) and late (2300–3000 ms; F(1, 30) = 0.242, p = .626, η²p = 0.008) time windows (see Fig. 5C–D).

Self-report data were inconsistent with these neural findings, but consistent with prior work (see Table 5). Results revealed a significant condition × valence interaction on self-reported emotional arousal (F(1, 30) = 9.922, p = .004, η²p = 0.249), such that participants reported that their emotional arousal (negative minus neutral difference) was significantly lower while engaging in detached reappraisal relative to passive view (t(30) = 3.150, p = .048, d = 0.57). Additionally, results revealed a significant condition × valence interaction on self-reported effort (F(1, 30) = 4.243, p = .048, η²p = 0.124), such that participants reported that detached reappraisal required more effort than passive view (t(30) = 2.060, p = .048, d = 0.37).

Given this set of unexpected findings, which are inconsistent with previous reappraisal literature (e.g., Moser et al., 2009; Shafir et al., 2015), we did not conduct the final step of our planned analyses to...
compare the two strategies directly.

4. Discussion

Recent research has provided promising behavioral (Kross et al., 2014, 2017; Orvell et al., 2021) and neural (Moser et al., 2017) evidence of the benefits of distanced self-talk as an effective and easily implemented emotion regulation strategy. Here, we report the first neural replication of this work. Consistent with Moser et al. (2017) and the first aim of the current study, we found that distanced self-talk diminished affective arousal (as evidenced by LPP amplitude) without recruiting additional cognitive resources related to preparatory effort (as evidenced by SPN amplitude). These findings extend the growing literature on the efficacy of self-distancing as an emotion regulation technique (Grenell et al., 2019; Kross et al., 2014, 2017; Orvell et al., 2021).

Specifically, these findings bolster support for the use of simple linguistic shifts in regulating emotions (Orvell et al., 2019).

The results of this replication slightly differed from Moser et al. (2017) as we found that distanced self-talk decreased emotional arousal in both the early and late LPP time window. The Moser et al. (2017) study only detected an effect of distanced self-talk in the late LPP time window. It is unclear why the earlier effect was detected here, but it suggests that distanced self-talk may have rapid effects on emotional reactivity. Future studies should further examine the time course of distanced self-talk.

Unfortunately, we were unable to adequately evaluate our second aim because detached reappraisal failed to produce the expected decrease on the LPP and increase on the SPN. The null results for the LPP and SPN were surprising, as the modulation of the LPP and SPN by reappraisal instructions has been shown in previous studies (Moser et al., 2009; Thiruchselvam et al., 2011). Below we review potential methodological limitations that may have contributed to the null effects below (see Methodological Considerations and Limitations).

It is also notable that our neural findings did not completely converge with participants’ self-reported ratings of emotional arousal and effort. These differences may be due to the temporal delay of self-report relative to ERPs. Participants retrospectively reported on each condition and valence after completing the entire picture-viewing task, which may have reduced the accuracy of their judgments. Furthermore, the temporal delay may have led participants to use heuristic judgments, rather than judgments from their own experiences during the task. For example, participants likely hold preconceived notions that emotion regulation strategies are effective at reducing emotion and require effort. Thus, these beliefs may have been brought to bear on the self-reports when participants had time to reflect on their experiences and incorporate their beliefs based on prior experiences, whereas this would be less likely in real-time while viewing the pictures and reflected in ERPs.

Indeed, ERPs and self-report capture overlapping but separable aspects of regulatory effort as their temporal properties differ. Differences in temporal properties between the self-reported effort and preparatory effort measured via the SPN may explain the lack of coherence between the self-report and ERP results (Mauss et al., 2005). The SPN specifically measures “online” preparatory cognitive processes prior to the implementation of an emotion regulation strategy on a trial-by-trial basis, whereas self-reported effort taps retrospective perceptions of effort on the whole. Therefore, it is unlikely that self-reported perceived effort captures the same preparatory processes elicited from SPN that we were primarily interested in investigating. In the self-talk strategy group, as predicted, distanced self-talk did not modulate “online” moment-to-moment preparatory cognitive processes (i.e., SPN), but led to increased “offline” self-reported perceptions of regulatory effort. In the reappraisal strategy group, detached reappraisal led to expected increased “offline” perceptions of regulatory effort but failed to modulate “online” moment-to-moment preparatory cognitive processing mechanisms as predicted. In sum, the lack of coherence between measures of regulatory effort highlights the importance of considering differences in temporal properties between measures when evaluating the effectiveness of emotion regulation strategies (Mauss et al., 2005; Sheppes and Gross, 2011). It should be noted that coherence between
measures should not always be the goal, as there are benefits to capturing unique mechanisms rather than multiple measures of the same construct (Taschereau-Dumouchel et al., 2022). Together, both “online” measures of preparatory effort captured moment-to-moment and “offline” measures of perceived effort can uniquely provide important information regarding the mechanisms that underlie effortful emotion regulation. In this current study, although participants did not exhibit increased moment-to-moment preparatory effort, their retroactive reflection of perceived effort suggests that distanced self-talk may in fact recruit separate effortful processes not captured during preparation to implement an emotion regulation strategy.

4.1. Methodological considerations and limitations

This study has several limitations that should be considered when interpreting the findings. Unfortunately, we were unable to evaluate our second aim because detached reappraisal failed to produce the expected decrease on the LPP and increase on the SPN. Although several studies have found evidence for dampened LPP by cognitive reappraisal (e.g., Hajcak et al., 2010; Krompinger et al., 2008; Moser et al., 2009, 2014), other studies have not (Bernat et al., 2011; Woodward et al., 2015; Shafir et al., 2015). The mixed findings in this literature may be related to methodological differences among these studies. Below, we consider methodological choices that may have influenced our results.

In the present work, we employed a reappraisal design that was as similar as possible to the self-talk paradigm. Specifically, (1) we removed demand language from the reappraisal instructions (e.g., “Think about the images in such a way that you feel your negative emotions less strongly”) and (2) we did not include valence in the picture cue. Our findings suggest that reappraisal’s effect may be sensitive to these methodological changes.

Given that our primary goal was to replicate the Moser et al. (2017) findings and our secondary goal was to compare distanced self-talk with detached reappraisal, we prioritized adapting the study design to match Moser et al. (2017) as closely as possible. One methodological choice involved altering the language in the detached reappraisal instructions to reduce demand characteristics. Our results suggested that despite the removal of demand characteristics, the reappraisal instructions in our study were effective at reducing emotional arousal, albeit only in self-report. Given that self-report is highly influenced by demand characteristics (Orne, 1962; Weber and Cook, 1972), the reappraisal effect on self-reported affective arousal provides support for the validity of our adapted reappraisal instruction. We did not, however, replicate the reappraisal effect on the LPP as expected. ERPs and self-report capture overlapping but separable aspects of emotional processing, as their temporal properties are very different. Self-report measures tap retrospective, “offline” reflections whereas ERPs capture moment to moment, “online” processing (Maus et al., 2005). Together, the current findings suggest that reappraisal led to expected decreases in “offline” emotional experience but failed to modulate “online” emotional processing mechanisms. In contrast, distanced self-talk led to decreases in emotional arousal across both “offline” and “online” measures. Distanced self-talk may therefore be a more robust emotion regulation strategy.

In our study, we also did not include the valence of each image in the instructional cue (e.g., Repraise Negative). Instead, solely the emotion regulation instruction was provided (e.g., Repraise). We made this methodological design to replicate the Moser et al. (2017) distanced self-talk design. However, it is possible that this design choice could explain the null results found for the SPN for reappraisal. Given that the SPN occurs before stimulus onset, it is possible that without knowing whether the following image would be neutral or negative, participants were forced to wait until the image was presented before engaging in reappraisal processes. In Moser et al. (2014), engaging in positive reappraisal did not result in an increased SPN amplitude relative to view, but resulted in an increased Frontal LPP amplitude – suggesting that effortful emotion regulation cognitive processes did not begin until after stimulus onset. Positive reappraisal relies on viewing an emotional image to effectively reinterpret its emotional salience, thus making it difficult to prepare prior to image onset (Moser et al., 2014; Qi et al., 2017). An investigation of the temporal dynamics of positive and detached reappraisal found that engaging in detached reappraisal exhibited an opposite neural profile as positive reappraisal – an enhanced SPN activity and no modulation of the frontal LPP (Qi et al., 2017). These results suggest that individuals engaged in preparatory processes during detached reappraisal prior to image onset. If prior knowledge of the valence of the upcoming image was necessary to prepare to use detached reappraisal, we should have seen evidence of an increased frontal LPP amplitude after stimulus onset, which we did not (data available upon request).

Furthermore, research on the effects of anticipatory information on emotion regulation provide additional support that it is possible to engage in preparatory processes without anticipatory information (Shafir et al., 2015; Shafir and Sheppes, 2018, 2020). To our knowledge, two studies have directly examined the effect of anticipatory information on the SPN during reappraisal (Shafir et al., 2015; Shafir and Sheppes, 2018). In these studies, reappraisal’s effect on the SPN amplitude was not related to whether or not participants received information on specific features of the stimuli (i.e., description of the upcoming image; Shafir and Sheppes, 2018), nor was it related to receiving information on the emotional intensity of the upcoming stimulus (Shafir et al., 2015). In both cases, the researchers replicated the larger SPN on reappraisal trials compared to control trials. If anticipatory information were required to elicit an enhanced SPN prior to engaging in emotion regulation, it would be expected that participants would have shown greater SPN activity during trials in which they received additional information on the upcoming stimulus compared to trials in which they received no information. Therefore, preparatory activity needed to implement reappraisal occurs irrespective of whether an individual receives information on the specific features of the upcoming stimulus.

Lastly, an additional limitation of this study was the lack of a fully representative sample. Specifically, the study sample consisted of predominately White, college-aged, female students. It is common in emotion regulation research to focus on females given that they show greater reactivity to negative affective stimuli (Gardener et al., 2013; Gasbarri et al., 2007; Lithari et al., 2016; Stevens and Hamann, 2012). Although females exhibit greater reactivity to negative stimuli, research is mixed on whether emotion regulation ability differs by sex (Domes et al., 2010; Gardener et al., 2013; McRae et al., 2008). Our predominately female sample is therefore similar to past studies and likely did not contribute to the failed replication of the detached reappraisal effect.

Regarding the predominantly college-age population, research has suggested that adolescents and young adults may lack the cognitive resources to effectively use emotion regulation strategies such as cognitive reappraisal as they have yet to fully develop prefrontal cortex brain regions implicated in executive functioning and cognitive control (Desatnik et al., 2017; McRae et al., 2012a, 2012b). Despite this, many emotion regulation studies utilize college samples and have replicated the reappraisal effects therein (Moser et al., 2006; Moser et al., 2009; Thiruchselvam et al., 2011). Nonetheless, we recognize that our sample is not fully representative of all ages and likely speak more directly to regulation mechanisms in emerging adults.

4.2. Conclusion and future directions

In conclusion, this study further bolsters support for distanced self-talk as an effective emotion regulation technique. However, given that self-reported and neural measures of effort did not converge, the effortfulness of distanced self-talk may be dependent on the specific temporal mechanisms that underlie effortful emotion regulation. For example, when retroactively reflecting on using distanced self-talk, individuals may perceive using this seemingly new and different way of
thinking about their emotions as effortful despite not recruiting increased preparatory resources in the moment. Additional research on the temporal dynamics of effortful emotion regulation is needed. Furthermore, the failed replication of the detached reappraisal effect highlights the importance of methodological decisions when adapting emotion regulation instructions. Here, we provide suggestions for future studies in this area.

When attempting to replicate or directly compare emotion regulation strategies, special consideration must be made when adapting emotion regulation designs and instructions. The adaptation of previous study designs and instructions is sometimes necessary to aid in the comparison between emotion regulation strategies. Consequently, creating adaptations to study designs may potentially result in failed replications. Researchers should consider their study aims and weigh the pros and cons of making adaptations. Additionally, researchers should use transparency and report the methodological decision-making processes involved in any adaptations.

Although emotion regulation paradigms have typically utilized passive view as a control, alternative control conditions (e.g., Immersed self-talk) should be investigated further. Control conditions in emotion regulation paradigms should reflect an individual’s natural emotional self-talk) should be investigated further. Control conditions in emotion research should apply distanced self-talk to real-world scenarios such as (Kross et al., 2014; Moser et al., 2017; Orvell et al., 2019). Future support for distanced self-talk as an effective emotion regulation strategy could be an instrumental component of future treatment populations. Research indicates that individuals with mental health disorders do not recruit preparatory cognitive resources such as distanced self-talk could be an instrumental component of future treatment strategies (Orvell et al., 2021).

### Appendix A. Supplementary data

Supplementary data to this article can be found at https://doi.org/10.1016/j.ijpsycho.2022.05.003.

### References


