

BRIEF REPORTS

Divergent Cognitive Costs for Online Forms of Reappraisal and Distraction

Gal Sheppes and Nachshon Meiran
Ben-Gurion University of the Negev

The present study was set out to evaluate the cognitive costs of two major emotion regulation strategies under conditions of increased challenge. Previous studies have established that cognitive reappraisal (construing an emotional event in nonemotional terms) has no cognitive costs. However, in all of these studies, reappraisal was initiated at the emotional situation onset, before emotional response tendencies sufficiently evolved. In the present study, the challenge of regulation strategies was increased by initiating strategies online at a late time point in an emotional situation. Applying this procedure revealed for the first time a cognitive cost for reappraisal and also provided double dissociation between reappraisal and another major cognitive emotion regulation strategy – distraction (diverting attention from an emotional situation via producing neutral thoughts). Specifically, late reappraisal, relative to distraction, resulted in an expenditure of self control resources. Late distraction but not reappraisal impaired memory encoding of the emotional situation.

Keywords: online emotion regulation, self control, cognitive reappraisal, distraction, cognitive cost

Imagine yourself trying to decide between two products designed for the same purpose. Critical questions that pop to mind might be whether these products achieve their purpose equally and whether their prices are comparable. Psychologists from various subdisciplines ask similar questions concerning emotion regulation strategies (see Gross, 1998, for a review). In this work, we focus on the cognitive profile and costs of two major emotion regulation strategies: *Distraction*, which refers to engaging in another neutral thought (e.g., Nolen-Hoeksema, 1991), and *Reappraisal*, which involves reinterpreting the emotion invoking stimulus as nonemotional (e.g., Gross, 1998). More specifically, in the present study, we set out to answer the questions in what ways are distraction and reappraisal different from one another and what are their cognitive costs?

Various studies, using different procedures and measures, have established that reappraisal has no cognitive costs (e.g., Gross, 2002; Richards, 2004, for reviews). Most of them have focused on memory performance and have shown that initiating reappraisal leaves memory of the emotional situation intact or, in some cases, even improves the recall of the emotion-related event (e.g., Dillon, Ritchey, Johnson, & LaBar, 2007; Richards, Butler, & Gross, 2003; Richards & Gross, 2000). In addition, a related study found that reappraisal participants were not distracted during an emotional conversation (Butler et al., 2003).

Of particular interest in the present context is a single study that has shown indirectly that reappraisal does not consume self control resources (Vohs & Schmeichel, 2003). This study was inspired by the ego depletion theory, which views self control as a limited resource that gets depleted when one tries to inhibit competing behaviors, urges, or desires (see Muraven & Baumeister, 2000, for review). According to this theory, the exertion of self-control appears to depend on a limited resource. Just as a muscle gets tired after performing an effortful action, an initial act of a self-control task causes impairments (ego depletion) in the performance of a subsequent self-control task. The main argument of Vohs and Schmeichel (2003) was demonstrated via a mediation model where initial self control affects subjective time estimation, which in turn predicts subsequent self regulation performance (see also Wen Wan & Sternthal, 2008). With respect to reappraisal, the authors showed that it did not result in subjective overestimation of the duration of the film clip used to induce the emotion (Vohs & Schmeichel, 2003, Experiment 2). This indirect evidence that reappraisal does not deplete self control resources, was explained by Gross's (1998) process model of emotion regulation. This model views reappraisal as an antecedent focused emotion regulation strategy that starts operating early in the emotion generative process before response tendencies are fully activated. Accordingly, it was proposed that reappraisal does not cause ego depletion because it diverts the emotional trajectory off track quite early, making continuous self monitoring demand negligible (Baumeister, Schmeichel, & Vohs, 2007; Vohs & Schmeichel, 2003).

Note that in all of the aforementioned studies, reappraisal was indeed initiated at a time point in which the emotional response has probably not sufficiently evolved (at the mood induction onset), minimizing the self control challenge. We argue that to seriously challenge self control resources and to cause ego depletion, one has to initiate regulation strategies after the emotion has sufficiently evolved. We defined this phenomenon "online regula-

Gal Sheppes and Nachshon Meiran, Department of Psychology and Zlotowski Center for Neuroscience, Ben-Gurion University of the Negev, Beer-Sheva, Israel.

This work was supported by a research grant from the Israel Science Foundation to Nachshon Meiran.

We thank Edward Skripnik for data collection, Assaf Gurner for film editing, and Rotem Eren-Rabinovich for English proofreading.

Correspondence concerning this article should be addressed to Gal Sheppes, Department of Psychology, Ben-Gurion University of the Negev, Beer-Sheva 84105, Israel. E-mail: sheppes@bgu.ac.il

tion”—the attempt to change an emotion that starts and continuously operates *during* an emotional situation (Sheppes & Meiran, 2007). In that study, we tested distraction and reappraisal in two ways. First, we replicated previous results in showing that when initiated early in the emotion generative process, both strategies were equally effective in reducing sad mood. However, when both strategies were initiated at a late time point in sadness inducing films, reappraisal resulted in less effective down-regulation of negative mood relative to distraction. To explain this result, we relied on the notion that reappraisal involves attending to the emotional situation but changing its emotional meaning into a neutral one (Gross, 1998). Therefore, the reappraised neutral contents are, by definition, associatively linked to and depend on the contents that have caused the emotion to rise. Accordingly, in the present study, we attempted to show that late reappraisal may deplete self control resources because it requires overcoming a previously well established tendency of identifying with the emotional content (formed during the long unregulated duration prior to the strategy initiation).

But what about the price tag of distraction? Distraction (as we operationally define it) is an attentional deployment strategy that narrows the emotional situation by producing neutral thoughts. Cognitively speaking, distraction involves diluting the proportion of emotional contents in working memory (WM) by loading it with neutral contents retrieved from long term memory (see especially Van Dillen & Koole, 2007). The cognitive cost associated with loading WM with neutral contents is an impairment of the emotional-situation encoding process, demonstrated in later impoverished recall of the emotional situation (e.g., Richards & Gross, 2006; Sheppes & Meiran, 2007). Back to online regulation, whereas late reappraisal involves attending to the emotional situation while struggling to transform a well established emotional interpretation of the contents into a neutral interpretation, late distraction involves diverting attention away from the emotional situation and its contents by producing independent neutral contents.

The present work was designed to test the predictions concerning divergent cognitive costs of online forms of Distraction and Reappraisal, by manipulating both strategies at a late time point in a sadness inducing film. Based on our previous findings (Sheppes & Meiran, 2007), we predicted that distraction but not reappraisal would impair memory encoding once initiated. To that end, we administered a surprise memory task following the film that checked the recognition for film facts prior and subsequent to the strategy initiation. In contrast, the increased self control challenge associated with online late reappraisal (relative to distraction) was predicted to lead to ego depletion. As in several previous studies, we used the Stroop task to assess ego depletion (e.g., Inzlicht & Gutsell, 2007; Richeson & Shelton, 2003; Richeson & Trawalter, 2005). We therefore predicted that initiating reappraisal late would result in an increased Stroop effect relative to distraction.

Method

Participants and Procedure

Forty-six undergraduate students (34 women, mean age 23.7 years) participated in the experiment for course credit or monetary compensation¹ (30 NIS; approximately US\$7). Since a (Hebrew) Stroop task was used, all participants were native Hebrew speak-

ers. The experiment was administered individually. After signing consent forms, participants were given short instructions regarding the verbal Stroop task followed by performing a practice phase. Immediately afterward, participants were randomly assigned to reappraisal ($n = 23$) or distraction ($n = 22$) conditions and received verbal instructions. To prevent them from using a strategy immediately after the film began (and prior to the late manipulation), all participants were given two types of verbal instructions: instructions of one of the strategies (distraction or reappraisal), and instructions for a control unregulated condition (which includes allowing their feelings). The participants were also asked how they planned to implement the strategy if asked, in order to ensure their comprehension of the instructions and the immediate initiation. Participants were told that their strategy condition would appear via subtitles during the film, that only one type of subtitle would appear and would remain valid thereafter, and to allow their feelings to arise before receiving the subtitle instructions. The distraction condition involved asking participants to think about something unrelated to the film content and emotionally neutral. The reappraisal condition (which adhered closely to instructions given by Richards & Gross, 2000) involved asking participants to adopt a neutral, analytical, and objective attitude toward the film contents. Participants watched a 403 second film clip taken from the TV documentary “The Real Story,” about Holocaust survivors hospitalized in a mental institution after being abandoned by their families and society. It was previously shown that this film mainly induces sadness (Sheppes & Meiran, 2007). One hundred ninety seconds following the film’s onset, the subtitles (containing the regulation condition) appeared at the bottom of the screen and remained throughout the film. After watching the film, participants were given a mood check, followed by a test phase of the Stroop task, and a surprise memory test.

Measures

Mood Check

This was a 9-point visual analogue Likert scale (1 = *not at all*; 9 = *to a great deal*) on which participants rated their sadness and general mood and some filler questions regarding happiness, surprise, disgust, fear, frustration anger, and anxiety.

Stroop

Each trial began with a 500 ms fixation cross, followed by the Hebrew word “yellow,” “red,” “green,” or “blue” or a string of three Hebrew letter “ש” (i.e., “ששש”) that appeared in yellow, red, green, or blue. Words always appeared in a color other than its semantic meaning (e.g., “red” appearing in blue type; labeled incongruent trials). The string of “ששש”; appeared in all the above mentioned colors (e.g., “ששש”; appearing in blue type) labeled control trials. This resulted in a 25–75% control/incongruent ratio. Participants were asked to name quickly and accurately the color in which a stimulus word appeared and the word disappeared afterward. Response times were measured to the nearest ms and accuracy was scored and entered by an experi-

¹One participant from the distraction group was excluded from all analyses because he exhibited a reversed Stroop effect.

menter who sat in the room with his back to the participant. The difference between latencies associated with incompatible trials and control trials forms an index of Stroop interference. A practice phase, conducted prior to the manipulation, consisted of 100 trials. It was included to minimize learning effects, which may counteract depletion effects. The test phase (conducted following the manipulation) included 250 trials, lasting less than 10 minutes.

Memory Test

A surprise memory test, which included 34 five-alternative, forced choice verbal memory questions that covered the film's entire duration, was administered after the film following the test phase of the Stroop task. This measure was built in tally with the strategy initiation times. Specifically, 17 questions addressed film contents that appeared prior to the strategy initiation (preregulation period), and 17 questions addressed film contents relating to the regulation period.

Results

Mood Check

The dependent measure was the averaged (reversed) general mood score and the sadness score (Sheppes & Meiran, 2007). Distraction and Reappraisal resulted in similar levels of negative experience $t(43) < 1^2$. Therefore, the results described below could not be ascribed to negative experience differences between groups.

Stroop

Response times (RT) shorter than 150 ms and longer than 3000 were considered as outliers (0.002% of the data set) and were therefore discarded from the data. To increase the statistical power (Ratcliff, 1993), we used the harmonic mean RT as the dependent measure. As predicted, reappraisal resulted in a larger Stroop effect relative to distraction³ $t(43) = 2.18, p < .02$, one-tailed, $Prep = .91, d = 0.66$ (see Figure 1). Further analyses were carried out in order to check whether the group difference resulted from general fatigue rather than from ego depletion. To this end, we followed Inzlicht and Gutsell's (2007) suggestions. Like these authors, when we entered the neutral and incongruent mean RTs into an ANOVA including Congruency as a within participant independent variable, we found no main effect for Group $F(1, 43) < 1.47, ns$. This nonsignificant effect indicates that reappraisal participants were not generally slower than distraction participants. In addition when we analyzed the Stroop performance as a ratio score: $(RT_{incongruent} - RT_{neutral}) / (RT_{incongruent} + RT_{neutral})$ we found a significant difference between groups $F(1, 43) = 5.32, p < .03, Prep = .92$, partial $\eta^2 = .11$, indicating that the Stroop effect was larger for reappraisal relative to distraction, even after controlling for possible general slowing.

Memory Test

The two way mixed ANOVA on the proportion of correct answers was performed with Strategy (Reappraisal, Distraction) as a between subject independent variable and Memory part (preregulation, regulation) as a within subject independent variable. All effects were significant (all F 's $> 8.85, p$'s $< .005, Prep$'s $> .96$).

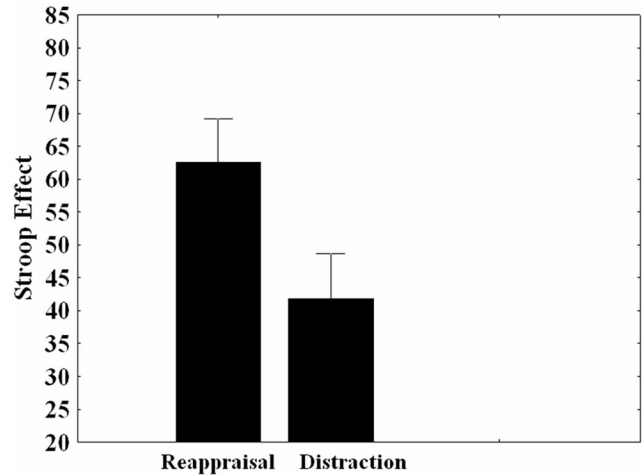


Figure 1. Harmonic mean of the Stroop Effect according to strategy. Bars represent Standard Error.

It is important to note that the Strategy by Memory-Part interaction was significant $F(1, 43) = 25.26, p < .0001, Prep > .99$, partial $\eta^2 = .37$. As predicted, only Distraction participants showed decrease memory for film events that took place during the regulation period relative to the preregulation period⁴ $F(1, 43) = 37.99, p < .000001, Prep > .99$, partial $\eta^2 = .47$; similar contrast for Reappraisal participants $F(1, 43) < 1$. Furthermore, Distraction participants also showed an impaired memory for film information appearing during the regulation period relative to their reappraisal counterparts $F(1, 43) = 22.37, p < .0001, Prep > .99$, partial $\eta^2 = .34$ (see Figure 2).

Discussion

The present study demonstrated a direct behavioral double dissociation of reappraisal and distraction by increasing the challenge of emotion regulation strategies. Former research has repeatedly shown that reappraisal is an effective, cost free emotion regulation strategy (Gross, 2002; Richards, 2004). By setting a higher challenge than used before to emotion regulation strategies, we demonstrated for the first time an important cognitive cost for late reappraisal and also provided a behavioral double dissociation of reappraisal and distraction within a single study. Specifically, we found that initiating reappraisal late in an emotional situation results in impaired subsequent Stroop performance relative to distraction, thus showing that employing reappraisal late temporarily exhausted self control resources. We were also able to show that this effect found for reappraisal resulted from specific self

²We formerly showed that the late reappraisal condition used in this study was effective in reducing negative experience (Sheppes & Meiran, 2007, Experiment 2).

³The groups differed neither in their Stroop effect in the practice phase, nor in error rates during the test phase. Both t 's $< 1.11 ns$.

⁴The reduced memory performance in the regulation period for distraction ($\hat{p} = 0.4$) was significantly higher than chance ($p = .2$) $Z\hat{p} = 2.39, p < .01, Prep = .96$, indicating that distraction participants do not ignore the film contents altogether.

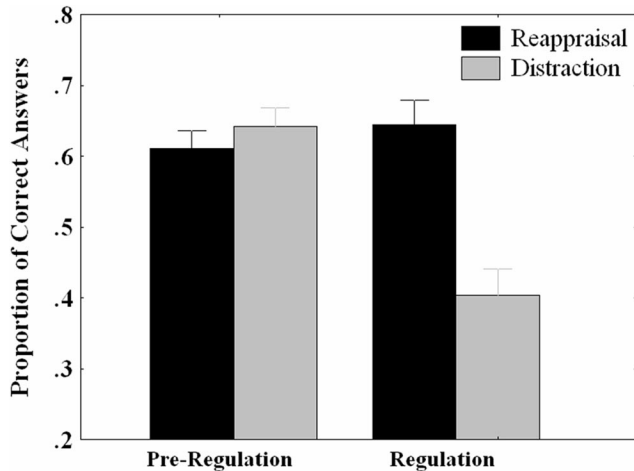


Figure 2. Proportion of correct memory answers according to strategy and memory part. Bars represent Standard Error.

control depletion rather than from general fatigue. By contrast, initiating distraction, but not reappraisal, resulted in impaired memory for film events that took place from the initiation point onward. This finding suggests that diverting attention from the emotional situation via loading the WM with independent neutral contents appears to reduce encoding of the emotional situation (Van Dillen & Koole, 2007).

These results help elucidating the divergent cognitive mechanisms that constitute online reappraisal and distraction. Late reappraisal involves attending to the emotional situation (and as such leaves memory intact), but it consumes self control resources, as one has to stop and override the well established previous interpretation when transforming it to a neutral one. Late distraction involves diverting attention from an emotional situation by loading WM with independent neutral contents. This results in impoverished memory of the emotional situation but does not seem to substantially challenge self control resources since the neutral contents do not directly compete or depend on the emotional situation contents.

Online regulation and its related findings have important implications. We argue that online regulation definitely takes place outside the laboratory. Many real life situations cause individuals to get somewhat emotional before they start trying to control these emotions. Therefore, in such instances, the depletion of self control resources should be considered following the use of late reappraisal. According to the ego depletion theory, all self control operations (even seemingly different operations) rely on the same limited resource (Muraven & Baumeister, 2000). As such, the use of self control resources for one purpose would reduce the resources available for a subsequent different purpose if the latter demands self control. For example, starting late to reappraise an upsetting situation may temporarily deplete the resources needed for subsequent self control operations such as impulse control. Although late distraction does not seem to drain self control resources, its costs also have important implications. There are many situations that start off negatively but evolve differently (e.g., new social encounters that might first seem awkward and slowly pick up). In such cases, the early negative interpretation of

the emotional situation that is formed prior to late initiated distraction may perpetuate since distraction does not allow continued monitoring for changes in that situation.

There are several limitations in the present study that should be noted. First, the present study pitted online versions of distraction and reappraisal but did not include a control group. Therefore, we can conclude with relatively high confidence the relative but not absolute cognitive price for each strategy. Particularly, regarding the memory results, the present study enables us to infer that distraction impairs memory relative to reappraisal. However, our previous results (Sheppes & Meiran, 2007, Experiment 1) showed that late reappraisal results in intact memory relative to a control condition. Therefore, although we base our conclusion on separate studies, it appears that late reappraisal (as we have checked it) leaves memory intact. Regarding the ego depletion results, late reappraisal is probably more depleting than late distraction, but we cannot determine whether distraction is more depleting than not regulating at all. Accordingly, one would think that the simplest suggestion for future studies would be to include a control group, in order to better evaluate the absolute price of depletion. However, the snag in this solution is that it creates a different confound. In our previous studies, we showed that both strategies improve negative mood relative to a control condition (Sheppes & Meiran, 2007). This possible disparity may be especially important for ego depletion since a recent study showed that mood affects self control (Tice, Baumeister, Shmueli, & Muraven, 2007). In that sense, the results of the current study go beyond mood attenuation divergence since we did not find any such differences between groups.

Second, in the present study, we did not have anticipatory forms of reappraisal and distraction. Consequently, although we show for the first time that some forms of reappraisal are costly, we cannot determine how our results relate to the lack of cognitive costs repeatedly demonstrated in previous studies. It is crucial that future studies would directly compare these two forms of reappraisal in order to better determine under which conditions reappraisal is costly.

Third, we did not include self report measures of task difficulty and task compliance. However, in a sense, our dependent measures provide partial performance-based solution to the task compliance issue. Specifically, the memory scores provide compelling evidence that not only did distraction participants divert attention from the emotional situation and reappraisal participants did not, but also that participants started using distraction only when subtitles appeared, as there were no memory differences between groups during the preregulation period. Regarding task difficulty, it may be that reappraisal is more difficult than distraction, but we did show that the increased self control demand found for reappraisal cannot be explained by general fatigue.

Last, Ochsner et al. (2004) proposed that there are at least two types of reappraisal: (a) self-focused reappraisal, which involves internal focusing in decreasing the sense of personal meaning of the situation through detachment; and (b) situation-focused reappraisal, which includes external focusing in reinterpreting the emotional contents as neutral. In the present study, our instructions included both types of reappraisal, thus we have no way to determine whether the increased self control demand found for reappraisal is caused by the internally or externally focused components of reappraisal. However, the fact that the memory for the

film content was intact during reappraisal suggests that at least to some extent external focused processing was involved.

To conclude, reappraisal and distraction are indeed quite different from one another. Though both are effective means of reducing subjective sadness, each carries a different cost. Reappraisal currency is in self control coins, whereas distraction toll is in encoding decrements of the emotional situation.

References

- Baumeister, R. F., Schmeichel, B. J., & Vohs, K. D. (2007). Self regulation and the executive function: The self as controlling agent. In A. W. Kruglanski & E. T. Higgins (Eds.), *Social psychology: Handbook of basic principles* (2nd ed., pp. 516–539). New York: Guilford Press.
- Butler, E. A., Egloff, B., Wilhelm, F. H., Smith, N. C., Erickson, E. A., & Gross, J. J. (2003). The social consequences of expressive suppression. *Emotion, 3*, 48–67.
- Dillon, D. G., Ritchey, M., Johnson, B. D., & LaBar, K. S. (2007). Dissociable effects of conscious emotion regulation strategies on explicit and implicit memory. *Emotion, 7*, 354–365.
- Gross, J. J. (1998). The emerging field of emotion regulation: An integrative review. *Review of General Psychology, 2*, 271–299.
- Gross, J. J. (2002). Emotion regulation: Affective, cognitive, and social consequences. *Psychophysiology, 39*, 281–291.
- Inzlicht, M., & Gutsell, J. N. (2007). Running on empty neural signals for self-control failure. *Psychological Science, 18*, 933–937.
- Muraven, M., & Baumeister, R. F. (2000). Self-regulation and depletion of limited resources: Does self-control resemble a muscle? *Psychological Bulletin, 126*, 247–259.
- Nolen-Hoeksema, S. (1991). Responses to depression and their effects on the duration of depressive episodes. *Journal of Abnormal Psychology, 100*, 569–582.
- Ochsner, K. N., Ray, R. D., Cooper, J. C., Robertson, E. R., Chopra, S., Gabrieli, J. D., et al. (2004). For better or for worse: Neural systems supporting the cognitive down- and up-regulation of negative emotion. *Neuroimage, 23*, 483–499.
- Ratcliff, R. (1993). Methods for dealing with reaction time outliers. *Psychological Bulletin, 114*, 510–532.
- Richards, J. M. (2004). The cognitive consequences of concealing feelings. *Current Directions in Psychological Science, 13*, 131–134.
- Richards, J. M., Butler, E. A., & Gross, J. J. (2003). Emotion regulation in romantic relationships: The cognitive consequences of concealing feelings. *Journal of Social and Personal Relationships, 20*, 599–620.
- Richards, J. M., & Gross, J. J. (2000). Emotion regulation and memory: The cognitive costs of keeping one's cool. *Journal of Personality and Social Psychology, 79*, 410–424.
- Richards, J. M., & Gross, J. J. (2006). Personality and emotional memory: How regulating emotion impairs memory for emotional events. *Journal of Research in Personality, 40*, 631–651.
- Richeson, J. A., & Shelton, J. N. (2003). When prejudice does not pay: Effects of interracial contact on executive function. *Psychological Science, 14*, 287–290.
- Richeson, J. A., & Trawalter, S. (2005). Why do interracial interactions impair executive function? A resource depletion account. *Journal of Personality and Social Psychology, 88*, 934–947.
- Sheppes, G., & Meiran, N. (2007). Better late than never? On the dynamics of on-line regulation of sadness using distraction and cognitive reappraisal. *Personality and Social Psychology Bulletin, 33*, 1518–1532.
- Tice, D. M., Baumeister, R. F., Shmueli, D., & Muraven, M. (2007). Restoring the self: Positive affect helps improve self-regulation following ego depletion. *Journal of Experimental Social Psychology, 43*, 379–384.
- Van Dillen, L. F., & Koole, S. L. (2007). Clearing the mind: A working memory model of distraction from negative mood. *Emotion, 7*, 715–723.
- Vohs, K. D., & Schmeichel, B. J. (2003). Self-regulation and the extended now: Controlling the self alters the subjective experience of time. *Journal of Personality and Social Psychology, 85*, 217–230.
- Wen Wan, E., & Sternthal, B. (2008). Regulating the effects of depletion through monitoring. *Personality and Social Psychology Bulletin, 34*, 32–46.

Received January 8, 2008

Revision received June 12, 2008

Accepted July 29, 2008 ■