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RESEARCH ARTICLE

What Parts of Reappraisal Make Us Feel Better? Dissociating the Generation of Reappraisals from Their Implementation

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Abstract
Although reappraisal has been shown to be a highly successfully emotion regulation strategy, it requires several sequential steps, and it is still unclear when in the reappraisal process emotion changes. We experimentally dissociated the generation of reappraisals from their implementation and hypothesized that the biggest emotional effects would occur during implementation. In Study 1, participants ($N = 106$) saw a negative image and generated either just positive reappraisals (GEN ++) or positive and negative reappraisals (GEN +-). They then saw the image again and implemented either their positive reappraisals (for the GEN ++ and half of the GEN +- trials) or negative reappraisals (for the other half of GEN +- trials). Although there were small and significant changes in emotion when generating reappraisals, the robust changes in emotion that are typically observed during reappraisal occurred during implementation. In Study 2 ($N = 130$), we directly replicated the findings from Study 1 and demonstrated that this small emotional effect from just generating reappraisals was not due to discounting the forthcoming implementation goal. In summary, for the first time, we successfully dissociated reappraisal generation from implementation and show that the biggest emotional effects occur during implementation. We discuss the implications of these findings for understanding emotion regulation, the neural underpinnings of reappraisal, and the conditions for reappraisal success in clinical contexts.

Keywords Emotion regulation · Cognitive reappraisal · Positive emotion · Negative emotion

Cognitive reappraisal refers to changing the meaning of an emotional situation in order to feel differently about it (Gross, 1998) and is generally a highly effective emotion regulation strategy (Webb et al., 2012). Evidence from studies examining the psychological and neural substrates of reappraisal suggest that it is composed of sequential subprocesses (Kalisch, 2009; McRae, Jacobs, et al., 2012; McRae & Gross, 2020; Ochsner et al., 2012); however, it is not clear at which point the greatest affective benefits occur.

In the Extended Process Model (EPM; Gross, 2015) of emotion regulation, emotion regulation constitutes a hierarchy of W-VPA valuation cycles in which people negatively (V)alue their (P)erception of the current state of the (W)orld (in this case—the fact that their current emotional state is different from their desired emotional state) and then perform regulatory (A)ctions to change that world state (their emotion). The regulatory process can therefore be characterized as a series of hierarchically situated W-VPA valuation cycles that correspond to the stages of the ER process—namely, identification that an ER strategy is desired, selection of an appropriate ER strategy, and the implementation of that ER strategy (as well as monitoring the success of the ER process throughout; McRae & Gross, 2020). For example, let us say that I am interested in improving my negative emotions about the COVID-19 pandemic, so I recognize that I could either think about unrelated positive events (distraction), or attempt to change how I'm thinking about the events causing me to feel negatively (reappraisal), which constitutes identification of possible regulatory strategies. I may then select reappraisal as a viable strategy to mitigate my negative thoughts I have related to the pandemic (selection), and then use reappraisal to change my feelings (implementation). Although some studies

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have shown that the mere identification of a regulatory goal can yield affective benefits (Tamir et al., 2019) and that anticipating the use of reappraisal can later impact its success (Denny et al., 2014), the majority of the research on reappraisal involves the experimenters instructing the participant to use reappraisal to change their emotions and focuses on how implementing reappraisal yields affective benefits (Webb et al., 2012).

We suggest that the implementation of reappraisal as a regulatory strategy is itself constituted of a hierarchy of W-VPA valuation cycles that correspond to different subprocesses (Fig. 1) and that it is unclear which subprocess produces reappraisal's affective benefits. Once people have selected reappraisal as a strategy (Sheppes et al., 2014), the first step of implementation is to generate possible reappraisals, which involves generating alternative semantic meanings of the event (Weber et al., 2014). For example, I may generate alternative meanings to the pandemic such as "I got really good at video calls," or "I got to spend more time with my family." Although some evidence suggests that merely articulating the semantic meaning of an event can reduce its emotional impact (Lieberman et al., 2007), some evidence also suggests this does not always occur (McRae et al., 2010; Vlasenko et al., 2021), and the semantic meanings generated in these prior studies typically reflect the initial appraisals people make of the event/stimulus and not alternative reappraisals. Indeed, evidence suggests that the degree to which people can generate unique reappraisals does not actually correlate with how effective they are at using those reappraisals to feel better (Zeier et al., 2020).

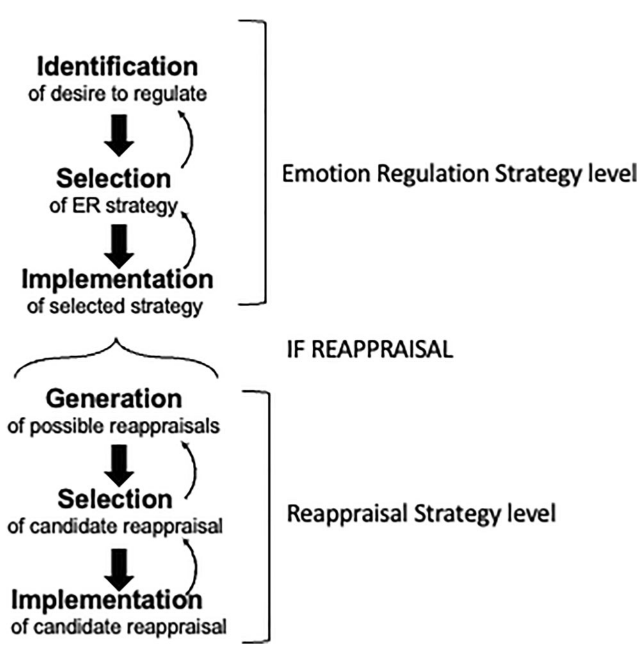


Fig. 1 An extension of the Extended Process Model of emotion regulation (Gross, 2015) in which the implementation stage at the emotion regulation strategy selection level is composed of subprocesses specific to the selected strategy—in this case reappraisal

After generating reappraisals, people then select a candidate reappraisal to implement. To avoid confusion, we refer to the top-level implementation stage as "strategy implementation," because it can refer to the implementation of any selected strategy (e.g., reappraisal, distraction, acceptance). We refer to the lower-level implementation stage as "reappraisal implementation" and define it as the set of mechanisms through which people use their selected candidate reappraisal to change/augment the original meaning of the emotional event (Fig. 1). In my example, if I select the reappraisal "I got to spend more time with my family" as one which could be successful at making me feel better, I implement that reappraisal by focusing on it, by elaborating on it by perhaps remembering fun times my family and I spent together, and perhaps even by sharing this reappraisal with others. We hypothesize that it is this reappraisal implementation subprocess that, if successful, yields the greatest affective benefits because it involves changing the meaning of the emotional event by replacing and/or adding to the original meaning of the event. Indeed, we believe that when people monitor the success of reappraisal (Paret et al., 2011) it is this stage that they are monitoring to see if it changes their emotions and if not, they may return to an earlier stage (e.g., select a different candidate reappraisal, or select a different strategy overall; McRae & Gross, 2020).

In the present study, we experimentally dissociate the reappraisal generation subprocess from the reappraisal implementation subprocess and hypothesize that the biggest emotional changes will occur during implementation. Reappraisal constitutes a wide variety of tactics that people can use to change their appraisals of an emotional event (McRae, Ciesielski, et al., 2012; Shiota & Levenson, 2012). Here, we focus on positive reappraisal, in which people reappraise by generating positive explanations of emotional stimuli/events (McRae & Mauss, 2016). We selected positive reappraisal as the initial tactic to test our primary hypotheses because when implemented in negative stimuli/contexts, positive reappraisal clearly involves generating alternative (positive) meanings of those stimuli/contexts in order to change emotions (McRae, Ciesielski, et al., 2012).

Study 1

Method

Participants

One hundred six participants (65 female, 39 male, 2 missing; M_{age} = 18.67, SD_{age} = .79) were recruited from the Wake Forest Introductory Psychology subject pool. Ethnical/racial representation was as follows: 70.75% White/Caucasian, 8.49% Asian, 7.55% Black/African-American, 1.89% American Indian or Alaskan Native, 5.66% identified with more than one race/ethnicity, 2.83% chose "Other" as a response, 2.83% unknown/not reported. In addition, 13.21% of participants identified as Hispanic/Latino. To take part in the study, participants had to be over 18 years old or 17 years old with the permission of a parent. Seven participants were excluded from the task due to either zero response variability in at least one of the negative trial types or for infrequent responding (less than 50% of responses for one of the trial types). Four participants were excluded due to wrong or vague answers to questions in post-task survey which checked comprehension of task instructions. Another four participants were excluded because they previously participated in a study that used the same images. In addition, data for one participant were lost due to technical difficulties. One participant chose to leave the study so their data were destroyed. The final analysis included eighty-nine participants. This sample size was selected a priori so as to achieve > 90% power at ∝ = .05 (two-tailed) to detect an effect size of .36 (reappraisal effects on self-reported emotional responses; Webb et al., 2012).

Task

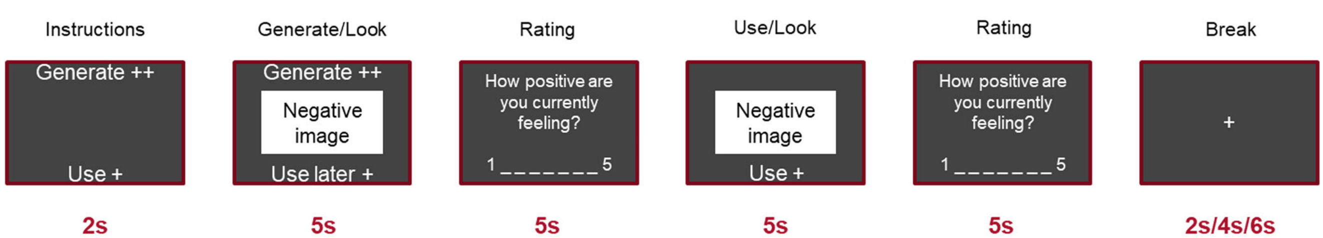
As our primary goal was to distinguish between generation and implementation of positive reappraisal, most trials consisted of two phases (Fig. 2): GENERATE and USE. In both phases of the trial, participants viewed negative emotional pictures (see details below). In the GENERATE phase, we asked participants to generate reappraisals ("generate reinterpretations, or re-framings, or re-considerations of the meaning of the picture") and instructed them to "really focus on changing the meaning of the emotional event," but to "not focus on any single explanation at this point in time." Thus, we aimed to have participants only generate reappraisals in this phase and to not implement them yet. In some trials, participants only generated positive reappraisals ("positive explanations of the events in the image," GENERATE ++), which were our reference trials and mimic the type of reappraisal instructions given in other studies. The potential problem with this trial, though, is that because they are only generating one type of reappraisal, participants might have time to begin implementing the positive reappraisals during the generation phase. To account for this, in the critical trials, participants generated positive and negative reappraisals ("positive and negative explanations of the events in the image," GENERATE +-) so that generating categorically different types of reappraisals might fill their time during this phase, and reduce the time available to begin implementing them.

In the USE phase, participants selected one of the candidate reappraisals they created during the GENERATE phase and then implemented it. If participants saw "USE +," they focused on one of the positive reappraisals they previously generated to try to make themselves feel better. If participants saw "USE -," they focused on one of the negative reappraisals they previously generated to try to make themselves feel worse.

To avoid confounding awareness of reappraisal goals with the reappraisal implementation phase, participants were given their reappraisal goals at the beginning of the trial. In this way, they knew that their goal was to use either positive or negative reappraisals throughout both the GENERATION and USE phases. This also allowed us to reduce uncertainty as a confounding factor between the GENERATE ++ trials on which participants knew they would be implementing positive reappraisals later and the GENERATE +- trials when they would not have known which reappraisal they would have been implementing had we not told them.

On some trials, participants were asked to simply LOOK at negative or neutral images and react naturally during the first part of the trial. Then, to parallel the two phases of the reappraisal trials, they saw the image again and were asked to continue to react naturally to what was happening in the picture.

The experimental task consisted of 20 trials of each type: (a) GENERATE +-/USE-, (b) GENERATE +-/USE+, (c) GENERATE ++/USE+, (d) LOOK NEGATIVE, (e) LOOK NEUTRAL. Eighty negative (depicting snakes, spiders, human concerns, and animal mistreatments) and twenty neutral (depicting objects, buildings, and furniture) images were selected from the Geneva affective picture database (GAPED; Dan-Glauser & Scherer, 2011). Images were originally normed on valence on a scale from 0 (negative) to 100 (positive) with 50 representing neutral. Negative images were divided into four sets of equivalent emotional valence (Set A: 13.71, Set B: 13.71, Set C: 13.70, Set D: 13.71). We created four different versions of the experimental task with the four sets of images assigned to the different trial types (a-d above)



so that each image set was used across all trial types. These versions were then counterbalanced across the participants. The neutral images had an average normed valence of 53.19.

Each trial consisted of 5 parts. Participants first viewed an instructions screen with both the GENERATE or LOOK instructions for the trial on the top of the screen as well as the USE or LOOK instructions for the trial on the bottom of the screen (2s). Then, participants viewed an image accompanied by the above instructions (GENERATE/LOOK phase; 5s), rated their positive emotions for the GENERATE/LOOK phase ("How positive are you currently feeling?" on a scale from 1 [not positive at all] to 5 [very positive]. Participants rated their emotion with a "double-tap" procedure in which they pressed the rating buttons twice to give them the option of choosing a response in between two numbers [e.g., pressing 3 and 4 = 3.5]; 5s), viewed the image for the second time accompanied by the USE or LOOK instructions (USE/LOOK phase; 5s), and rated their positive emotion for the USE/LOOK phase (5s). Finally, participants viewed a fixation cross for either 2s, 4s, or 6s (duration was randomly assigned to each trial) during which they could briefly rest before the next trial. In addition, participants rested during 3 break periods (20s each).

To confirm that participants were generating the appropriate reappraisals, they were asked to type in a free response box their interpretations after the trial ended for 6 trials throughout the course of the experimental task: 2 times for each trial type that included generation of interpretations (GENERATE +-/USE-, GENERATE +-/USE+, GENERATE ++/USE+). Four coders who were masked to condition on each trial coded whether the participant's interpretation was positive, neutral, negative, or irrelevant/blank (they were asked to just use their "gut feeling" to judge the valence of the interpretation). The coders first coded 100 interpretations, then met to reconcile any disagreements and to form a better understanding of how to code the rest of the interpretations. Then, the coders coded 100 more interpretations from which interrater agreement was calculated with weighted kappas. For the first interpretation, pairwise kappas between coders ranged from .76 to .85, and for those trials that had second interpretations, pairwise kappas ranged from .62 to .80. Both sets of kappas indicate sufficient agreement. Then the coders split up the remaining interpretations for both Study 1 and Study 2. We summarized each trial's interpretations as being either purely positive (one or two positive interpretations), purely negative (one or two negative interpretations), mixed (one positive and one negative interpretation), or other (neutral, or no interpretations). Supporting the manipulation, mixed pos/neg interpretations were the most common on the GENERATE+-/USE- (57.8%, purely pos = 1.9%, purely neg = 37.9%) and GENERATE+-/USE+ (57.1%, purely pos = 26.6%, purely neg = 9.9%) trials, and purely positive interpretations were most common on the GENERATE++/USE+ trials (56.2%, mixed = 25.6%, purely neg = 9.4%), $\chi^2(6) = 200.96$, $p < .001$. Notably, the second most common appraisal pattern for the mixed trials was consistent with the valence of appraisals participants were instructed to use during the implementation phase, possibly reflecting a slight recency bias toward reporting only the appraisal they implemented.

Procedure

The participants completed the task in person at Wake Forest University. Because this experiment took place during the COVID-19 pandemic, proper precautions were taken to decrease the risk of viral spread including having participants wear masks, greeting participants at a distance, giving instructions to participants through videoconferencing software, and thoroughly sanitizing the experimental room in between participants. An experimenter assigned participants to one of four counterbalanced versions of the task in accordance with prior random assignment. After providing informed consent, participants were instructed by the experimenter on how to perform the experimental task. Then, they completed five practice trials and answered one question that required them to type the interpretations they created into a free response box. Participants then completed the experimental task. After the end of the experimental task, participants filled out a post-task survey that assessed their understanding of the task. For each instruction (LOOK, GENERATE +-, GENERATE ++, USE +, USE -), they described what they were instructed to do, how difficult it was to follow that instruction, and what percentage of time they were able to follow the instruction. Finally, participants provided demographic information which included age, gender, ethnicity, education level, and income level. All participants were assigned 2.0 credit hours towards their psychology course. The procedure was approved by the Wake Forest University Institutional Review Board. We report all manipulations and primary dependent measures. The datasets generated during and/or analyzed during the current study are available in the OSF repository, [https://osf.io/vkcaz/?view_only=65ad3ecec46442d6abdd5b7a06b61cd2].

Results

We conducted a 2 (Phase: first viewing [generate/look], second viewing [use/look]) X 5 (Instruction: GENERATE +-/USE-, GENERATE +-/USE+, GENERATE ++/USE+, LOOK NEGATIVE, LOOK NEUTRAL) repeated-measures analysis of variance (ANOVA) on reported positive emotion (Fig. 3). The Greenhouse-Geisser correction was used in this and other analyses in the paper to account for violations of the assumption of sphericity. We report 95% confidence intervals for mean differences in pairwise comparisons.

The analysis yielded a significant main effect of Phase, $F(1, 88) = 50.29$, $p < .001$, $\eta_p^2 = .364$, and a significant main

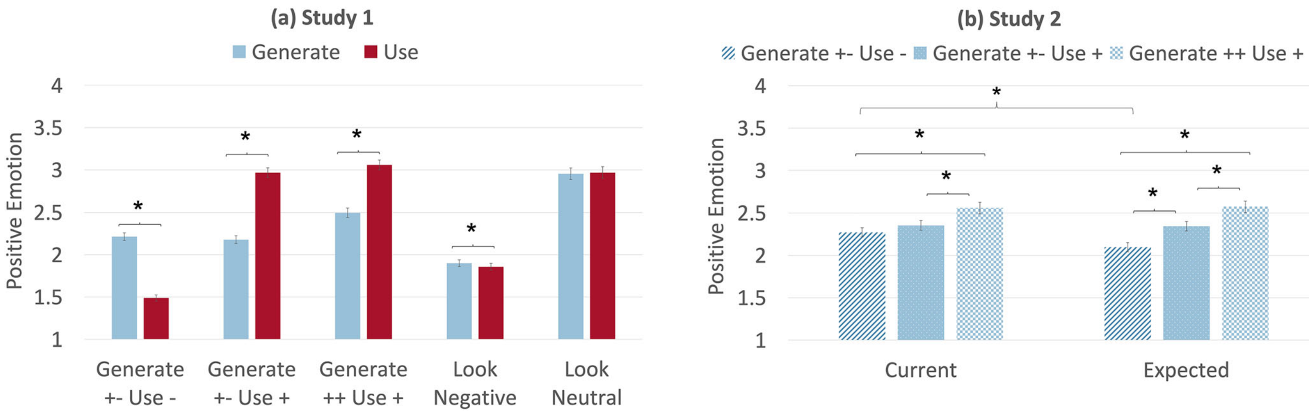


Fig. 3 **a** Mean positive emotion ratings in Study 1 on first viewing (generate/look) phase and on second viewing (use/look) phase for GENERATE +-/USE-, GENERATE +-/USE+, GENERATE ++/USE+, LOOK NEGATIVE, LOOK NEUTRAL trials. **b** Mean positive emotion ratings in Study 2 on first viewing (generate/look) phase for GENERATE +-/USE-, GENERATE +-/USE+, GENERATE ++/USE+ trials in CURRENT and EXPECTED groups. Error bars are standard error of the mean. * $p < .05$

effect of Instruction, $F(2.03[4], 178.50[356]) = 160.81$, $p < .001$, $\eta_p^2 = .646$, which were qualified by a significant interaction of Phase and Instruction, $F(1.84[4], 162.01[352]) = 291.66$, $p < .001$, $\eta_p^2 = .768$. Participants reported a strong and significant increase in positive emotion from the generate to use phase in both instructions for which they used positive reappraisals (GENERATE +-: $M = 2.18$, $SE = .05$, USE +: $M = 2.97$, $SE = .06$; t, 88 = -16.85, $p < .001$, $d = 1.79$, 95% CI [-.885, -.698]; and GENERATE ++: $M = 2.50$, $SE = .06$, USE +: $M = 3.06$, $SE = .06$, t, 88 = -12.82, $p < .001$, $d = 1.36$, 95% CI [-.651, -.477]). Participants also reported a significant decrease in positive emotion from generate to use phase in the trial in which they implemented negative reappraisals (GENERATE +-: $M = 2.22$, $SE = .05$, USE -: $M = 1.49$, $SE = .04$; t, 88 = 17.36, $p < .001$, $d = 1.84$, 95% CI [.645, .812]). Participants also reported a small, but significant decrease in positive emotion from the first to second viewing of the picture in LOOK NEGATIVE trials (first viewing: $M = 1.90$, $SE = .04$, second viewing: $M = 1.86$, $SE = .04$, t, 88 = 2.56, $p = .014$, $d = .27$, 95% CI [.008, .074]), but there was no significant difference between participants' ratings of positive emotion between the first and second viewing of the picture on LOOK NEUTRAL trials (first viewing: $M = 2.96$, $SE = .07$, second viewing: $M = 2.97$, $SE = .07$; t, 88 = -1.50, $p = .138$, $d = .16$, 95% CI [-.029, .004]).

During the first viewing (generate/look) phase, participants reported the highest level of positive emotion for LOOK NEUTRAL trials ($M = 2.96$, $SE = .07$) which were followed by GENERATE ++/USE+ trials ($M = 2.50$, $SE = .06$), $t(88) = 5.50$, $p < .001$, $d = .58$, 95% CI [.295, .630]. Participants reported higher positive emotion on GENERATE ++/USE+ trials than on GENERATE +-/USE- trials ($M = 2.22$, $SE = .05$), $t(88) = 8.21$, $p < .001$, $d = .87$, 95% CI [.211, .346], and GENERATE +-/USE+ trials ($M = 2.18$, $SE = .05$), $t(88) = 8.26$, $p < .001$, $d = .88$, 95% CI [.239, .389], which were not significantly different from each other, $t(88) = .84$, $p = .408$, $d = .09$, 95% CI [-.049, .120]. Finally, participants reported the lowest positive emotion on LOOK NEGATIVE trials ($M = 1.90$, $SE = .04$), all ts ≥ 7.23, all ps < .001.

During the second viewing (use/look) second viewing phase, participants reported the highest level of positive emotion for GENERATE ++/USE+ trials ($M = 3.06$, $SE = .06$), which was not significantly different than the LOOK NEUTRAL trials ($M = 2.97$, $SE = .07$), $t(88) = 1.00$, $p = .319$, $d = .11$, 95% CI [-.088, .268], but was significantly greater than the GENERATE +-/USE+ trials ($M = 2.97$, $SE = .06$), $t(88) = 3.22$, $p = .002$, $d = .34$, 95% CI [.033, .141]. Positive emotion on the GENERATE +-/USE+ trials was not significantly different than on the LOOK NEUTRAL trials, $t(88) = .03$, $p = .973$, $d = .004$, 95% CI [-.172, .178]. Participants reported higher positive emotion on GENERATE +-/USE+ trials than on LOOK NEGATIVE trials ($M = 1.86$, $SE = .04$), $t(88) = 18.90$, $p < .001$, $d = 2.00$, 95% CI [.997, 1.233], which in turn induced higher positive emotion than GENERATE +-/USE- trials ($M = 1.49$, $SE = .04$), $t(88) = 13.70$, $p < .001$, $d = 1.45$, 95% CI [.317, .423].

Discussion

Supporting our hypotheses, we found that the robust changes in emotion that are typically associated with reappraisal occurred during the implementation phase, rather than the generation phase. Notably, this was a fairly conservative test of the separability of generation and implementation given that during the generation phase, participants knew which reappraisals they were to later implement. That said, the generation of positive reappraisals did result in slightly, but significantly higher positive emotion, which seemed to correspond to the number or proportion of positive reappraisals being generated (moderate increases compared to LOOK NEGATIVE for the GENERATE +- trials and larger increases for the GENERATE ++ trials). It is possible that participants were beginning to implement the reappraisals during the generation phase, however, participants reported the same level of positive emotion when generating both positive and negative reappraisals, regardless of their instructed goal to implement the positive or negative ones, indicating that they were likely not implementing during the generation phase. This finding suggests instead that generating positive reappraisals alone may lead to a small emotional benefit even before people implement them. In Study 2, we addressed a challenge to this formulation and attempted to replicate these findings.

Study 2

Study 2 had two aims. First, we attempted to directly replicate the findings from Study 1. Second, we tested competing hypotheses regarding the potential impact of implementation goals on the changes to positive emotion observed during the generation phase. In Study 1, we saw that the implementation condition to come had no effect on the emotion reported during the generation phase. There are two possible explanations for this. One is that the task instructions resulted in complete compartmentalization of the generation and implementation phases, causing participants to focus only on the current task phase. In this possibility, although participants were shown the implementation goal before the generation phase, they may have actively ignored, or been unintentionally inattentive to, the implementation goals during the generation phase, and only began following implementation instructions once the implementation phase began. By contrast, it is possible that participants were able to attend to the implementation goal during the generation phase, but that nonetheless, the forthcoming goal did not have an effect on emotion during the generation phase. To replicate Study 1 and test this interpretation, half of participants were told to report their current positive emotional responses, as in Study 1 (direct replication) and half of participants were told to report their *expected* positive emotional responses (in the next several seconds). This "expected emotion" condition tests whether participants have access to implementation goals during the generation phase. If so, then they should report less positive emotion when reporting their expected emotion than those reporting their current emotion in the GENERATE +-/USE – condition. By contrast, ratings of the 'current' and 'expected' emotional responses should not be different for the GENERATE ++ and GENERATE +-/USE + trials because the generated and to-be implemented reappraisals are both positive. Should we observe this pattern, it means that the separation of generation and implementation is not due to active or passive inattention, but rather, an ability to separate out emotions due to generating possible interpretations from emotions that follow from goal-oriented elaboration and attempts to believe one or more of those interpretations.

Method

Participants

One hundred and thirty participants (81 female, 48 male, 1 missing; M_{age} = 18.91, SD_{age} = .94) were recruited from the Wake Forest Introductory Psychology subject pool. Ethnical/racial representation was as follows: 74.62% White/Caucasian, 10.00% Asian, 6.92% Black/African-American, 3.85% identified with more than one race/ethnicity, 1.54% chose "Other" as a response, 3.08% unknown/not reported. In addition, 10.8% of participants identified as Hispanic/Latino. To take part in the study, participants had to be over 18 years old or 17 years old with the permission of a parent. Nine participants were excluded from the task due to either zero response variability in at least one of the negative trial types or for infrequent responding (less than 50% of responses for one of the trial types). One participant was excluded due to wrong or vague answers to questions in the post-task survey. In addition, data for one participant were lost due to technical difficulties. The final analysis included one hundred and nineteen participants. To justify sample size, we first balanced the initial effect size from the meta-analysis (d = .36 – requiring 85 participants for 90% power) and the effect sizes from Study 1 (d = 1.38 for difference between generate and use phases – requiring 8 participants for 90% power) and then doubled that balanced sample size to test for the interaction between the conditions.

Task

The experimental task was similar to the one in Study 1 but this time participants were randomly assigned to one of two experimental groups: CURRENT and EXPECTED. Participants in the CURRENT group completed the task identical to that in Study 1. Instead of reporting their current positive emotion, participants in the EXPECTED group reported how positive they "expect to feel in the next several seconds." We also added a few pre-task questions to instructions to confirm that participants understood how to do the task. Again supporting the manipulation, mixed pos/neg interpretations were the most common on the GENERATE+-/USE- (57.4%, purely pos = 4.4%, purely neg = 37.5%) and GENERATE+-/USE+ (57.1%, purely pos = 21.0%, purely neg = 14.3%) trials, and purely positive interpretations were most common on the GENERATE++/USE+ trials (50.4%, mixed = 29.4%, purely neg = 10.3%), $\chi^2(6) = 200.96$, $p < .001$.

Procedure

The procedure for Study 2 was the same as for Study 1. The only exception is that participants were randomly assigned into the two conditions and, therefore, received instructions appropriate for their assignment. All participants were assigned 1.5 credit hours towards their psychology course. The procedure was approved by the Wake Forest University Institutional Review Board.

Results

Replication of Study 1 We first aimed to replicate the findings from Study 1. For those in the CURRENT condition, we conducted a 2 (Phase: first viewing [generate/look], second viewing [use/look]) X 5 (Instruction: GENERATE +-/USE-, GENERATE +-/USE+, GENERATE ++/USE+, LOOK NEGATIVE, LOOK NEUTRAL) repeated-measures analysis of variance (ANOVA) on reported positive emotion. Like Study 1, the analysis yielded a significant main effect of Phase, $F(1, 58) = 41.04$, $p < .001$, $\eta_p^2 = .414$, and a significant main effect of Instruction, $F(2.36[4], 137.12[232]) = 139.14$, $p < .001$, $\eta_p^2 = .706$, which were qualified by a significant interaction of Phase and Instruction, $F(1.75[4], 101.48[232]) = 222.79$, $p < .001$, $\eta_p^2 = .793$. Like Study 1 and again supporting our hypothesis, participants reported a significant increase in positive emotion from generate to use phase in GENERATE +-/USE+ trials (GENERATE: $M = 2.35$, $SE = .05$, USE: $M = 2.99$, $SE = .06$; t, 58 = -15.17, $p < .001$, $d = 1.97$, 95% CI [-.720, -.554]), and in GENERATE ++/USE+ trials (GENERATE: $M = 2.56$, $SE = .06$, USE: $M = 3.02$, $SE = .06$, t, 58 = -11.74, $p < .001$, $d = 1.53$, 95% CI [-.536, -.379]), and a significant decrease in positive emotion from generate to use phase in GENERATE +-/USE- trials (GENERATE: $M = 2.27$, $SE = .05$, USE: $M = 1.61$, $SE = .05$; t, 58 = 16.24, $p < .001$, $d = 2.11$, 95% CI [.584, .748]) and from the first to second viewing in LOOK NEGATIVE trials (GENERATE: $M = 2.00$, $SE = .06$, USE: $M = 1.92$, $SE = .06$, t, 58 = 4.28, $p < .001$, $d = .56$, 95% CI [.041, .113]). Unlike Study 1, they reported an increase in positive emotion between the first and second viewing in LOOK NEUTRAL trials (first viewing: $M = 3.00$, $SE = .06$, second viewing: $M = 3.03$, $SE = .06$; t, 58 = -2.90, $p = .004$, $d = .38$, 95% CI [-.049, -.009]). Additional statistics on this interaction can be found in Supplementary Information.

Current vs. expected emotion Second, we tested the hypothesis that CURRENT and EXPECTED emotion after the generation phase might differ when the generated and to-be implemented reappraisals differ. We conducted a 2 (Group: CURRENT, EXPECTED) X 3 (Instruction: GENERATE +-/USE-, GENERATE +-/USE+, GENERATE ++/USE+) repeated-measures analysis of variance (ANOVA) on reported positive emotion (Fig. 3). The analysis yielded a significant main effect of Instruction, $F(1.69[2], 198.00[234]) = 56.63$, $p < .001$, $\eta_p^2 = .326$, which was qualified by a significant interaction of Group and Instruction, $F(1.69[2], 198.00[234]) = 4.14$, $p = .023$, $\eta_p^2 = .034$. As hypothesized, when the to-be implemented reappraisals were negative (i.e., on the GENERATE +-/USE- trials), participants reported significantly less expected positive emotion than participants reporting their current emotion, $t(117) = -2.27$, $p = .024$, $d = .42$, 95% CI [-.327, -.023]. By contrast, there was not a significant difference between participants who reported their current and those reporting their expected emotion when the to-be implemented reappraisals were positive (GENERATE +-/USE+ trials: t, 117 = .11, $p = .912$, $d = .02$, 95% CI [-.149, .167]; and GENERATE ++/USE+ trials: t,117 = -.15, $p = .881$, $d = .03$, 95% CI [-.199, .171]). Additional statistics for the EXPECTED emotion group's responses across the phases can be found in Supplementary Information.

Discussion

First, we replicated the findings from Study 1 to show again that people can distinguish the generation from the implementation of reappraisals and that the large emotional effects of reappraisal occur during the implementation phase. The pattern of emotion in the expected condition indicated that participants had access to the forthcoming implementation goals during the generation phase, and did not achieve separation of generation from implementation by entirely ignoring implementation while engaged in generation. This strengthens our conclusion that people are able to separately generate and implement reappraisals.

General Discussion

In these studies, we showed for the first time that the generation and implementation of reappraisals are separable subprocesses of reappraisal with distinct effects on emotional experience. In the reappraisal generation phase, people create alternative semantic meanings of the target event/stimulus, which can produce mild emotional effects compared to the robust changes gained from implementing the reappraisals. A possible explanation for this finding is that generating the positive semantic content in the positive reappraisals recruits automatic associations between the content of these reappraisals and positive emotion, which in turn produces boosts in positive emotion (e.g., Vlasenko et al., 2021). A second possibility is that even generating alternative possible meanings of the stimulus challenges and weakens the meaning of the initial negative appraisals of the stimulus (Norris & Wu, 2021). These and other explanations for these findings should be tested in future investigations. Intriguingly, findings from the generation phase also provided evidence for polyregulation models (Ford et al., 2019), by showing that people are able to hold in mind and then implement different regulatory goals (use positive reappraisal, use negative reappraisal) at the same time (on GENERATE +- trials).

The biggest emotional effects, however, occurred when people implemented their reappraisals, which suggests that it is primarily during this phase that people actually change the meaning of the negative stimulus. In the extended process model of ER (Gross, 2015), "implementation" of the strategy of reappraisal denotes the entire processes of generating, selecting, and implementing specific alternative interpretations to achieve reappraisal, but we show here that these subprocesses are distinct. Individuals can be instructed to generate alternate appraisals, and appear to be able to do so while refraining from selection and implementation of those options. Importantly, these findings are specific to positive reappraisal, so future research is needed to determine whether these subprocesses exist and are similarly distinct for other reappraisal tactics such as self-distancing and minimization (McRae, Ciesielski, et al., 2012; Shiota & Levenson, 2012). Further, it would be informative to investigate whether these subprocesses loosely translate to the subprocesses involved in other regulation strategies. For example, in our model, we specified the initial subprocess as "generation" of alternative meanings, however, generation might also be generalized to match the 'identification' stage of the top-level emotion regulation stages if it is reinterpreted as "identification" of possible candidate reappraisals. Then, this "identification" subprocess might be generalized to other emotion regulation strategies. For example, in distraction, the subprocesses might be 'identification' of possible alternative activities, 'selection' of a candidate alternative activity, and 'implementation' might reflect engaging in that alternative activity (Waugh et al., 2020).

This experimental separation of reappraisal subprocesses introduces the exciting possibility of measuring differential recruitment of neural systems that may support them. Generating reappraisals may be associated with brain regions responsible for generating semantic representations such as the ventrolateral prefrontal and temporal cortices (Ochsner et al., 2012) or regions associated with achieving psychological distance such as inferior parietal cortex (Powers, Davis et al., 2020, Powers, Graner et al., 2020). These alternate semantic representations or distanced perspectives may then be processed by other brain regions that elaborate on them to generate and change the meaning of the stimulus such as the medial prefrontal cortex (Otto et al., 2014; Roy et al., 2012; Waugh et al., 2014). These formulations should be investigated in future neuroimaging studies of reappraisal. Both the current behavioral paradigms and future neural paradigms would benefit from adding other assessments of emotional responding including physiological responding, behavioral tendencies, and automatic associations.

One limitation of this study is that our implementation phase still included both the selection of an appropriate reappraisal and elaboration on that reappraisal to change the stimulus meaning. Future investigations should further dissociate these subprocesses and relate them to emotional effects as well as determine their neural underpinnings. Another limitation was that we only examined reappraisal of negative stimuli and only measured positive emotions. It will be important for future investigations to examine whether these subprocesses can be similarly dissociated and have similar emotional effects when people reappraise positive stimuli (e.g., Quoidbach et al., 2015) and/or report their negative emotions. Also, these studies should be conducted with other samples (more diverse in age, race/ethnicity, culture, etc.) to examine whether these findings generalize to other populations besides predominantly white undergraduate students.

These findings significantly propel the literature on reappraisal forward by pinpointing its greatest emotional effects to implementation. This finding contributes also to the clinical literature by suggesting that in therapeutic settings, a client may be able to generate reappraisals of circumstances in their lives, but that it may also be necessary for them to gain practice and build skills selecting a candidate reappraisal and elaborating on it fully to change how they really feel. In sum, these studies demonstrate the importance of dissociating the subprocesses of reappraisal for fully understanding its emotional effects, which has implications for emotion regulation, the neural basis of reappraisal, and knowing when reappraisal might or might not work for clinical samples.

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Additional Information

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Data Availability The datasets generated during and/or analyzed during the current study are available in the OSF repository, [https://osf.io/vkcaz/?view_only=65ad3ecec46442d6abdd5b7a06b61cd2].

Ethics Approval This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Institutional Review Board at Wake Forest University.

Conflicts of Interest The authors declare no competing interests.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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