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Uninstructed emotion regulation choice in four studies of cognitive reappraisal^{★,★★}

Philipp C. Opitz^{1,2}, Sarah R. Cavanagh^{2,3}, and Heather L. Urry^{*}

Department of Psychology, Tufts University, 490 Boston Avenue, Medford, MA 02155, United States

Abstract

In emotion regulation (ER) research, participants are often trained to use specific strategies in response to emotionally evocative stimuli. Yet theoretical models suggest that people vary significantly in strategy use in everyday life. Which specific strategies people choose to use, and how many, may partially depend on contextual factors like the emotional intensity of the situation. It is thus possible – even likely – that participants spontaneously use uninstructed ER strategies in the laboratory, and that these uninstructed choices may depend on contextual factors like emotional intensity. We report data from four studies in which participants were instructed to use cognitive reappraisal to regulate their emotions in response to pictures, the emotional intensity of which varied across studies. After the picture trials, participants described which and how many strategies they used by way of open-ended responses. Results indicated that while a substantial proportion of participants in all studies described strategies consistent with cognitive reappraisal, a substantial proportion also endorsed uninstructed strategies. Importantly, they did so more often in the context of studies in which they viewed higher-intensity pictures. These findings underscore the importance of considering uninstructed ER choice in instructed paradigms and situational context in all studies of ER.

Keywords

Emotion regulation; Emotion regulation choice; SOC-ER; Cognitive reappraisal

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^{★★}The following abbreviations will be used in this article: ER for emotion regulation and CR for cognitive reappraisal (a subtype of emotion regulation).

^{*}Corresponding author at: Department of Psychology, Tufts University, Medford, MA 02155, United States.

¹Philipp C. Opitz is presently at the Davis School of Gerontology, University of Southern California, 3715 McClintock Avenue, Los Angeles, CA 90089, United States.

²Please note that the first two authors contributed equally to this manuscript.

³Sarah R. Cavanagh is presently at the Department of Psychology, Assumption College, 500 Salisbury Street, Worcester, MA 01609, United States.

8. Ethics statement

All methods and procedures were approved by the Tufts University Social and Behavioral Institutional Review Board. All participants provided written informed consent before the experiment.

1. Introduction

You are having a stressful morning. A winter storm created a chaotic commute to work. Upon arrival, you are reprimanded for being late. This is mildly upsetting to you but professional norms dictate that you must receive this information amiably. To regulate these unpleasant emotions, you choose to think about the situation differently: Being chastised this one time doesn't mean your supervisor has lost all respect for you.

Contrast the above situation with the following: You have to give an important presentation. Just before the presentation, you are informed that your closest work colleague was in a terrible storm-related accident and is in surgery. This is hugely upsetting to you but your presentation is critical so you must manage your negative emotions. Feeling overwhelmed by the gravity of the situation, you find yourself unable to think differently about it. Instead, you choose to focus your attention on neutral details, like the work at hand, and rehearse your presentation one more time.

Emotions are complex physiological, mental, and behavioral phenomena that arise by virtue of attending to and appraising internal and external events in our situational context. Emotions usually motivate the achievement of goals important to the organism, such as survival and well-being, and as such are typically adaptive (Gross, 2007; Levenson, 1994; Seligman, Railton, Baumeister, & Sripada, 2013). However, as the scenarios above illustrate, the circumstances of daily life often require us to diminish, amplify, or otherwise modulate our emotions when they might interfere with other goals, such as maintaining composure and effectiveness at work. The processes we use to manage our emotions are collectively termed emotion regulation (ER).

Considerable theoretical (Gross, 1998) and empirical (Webb, Miles, & Sheeran, 2012) work has identified numerous strategies that people use to regulate – that is, alter the type, intensity, and/or duration of – their emotions. According to the Gross (1998) process model of ER, there are five broad families of ER that can be implemented at various stages of the emotion generative cycle. People can choose which situations they enter (Situation Selection) and change aspects of the situations they choose (Situation Modification). Once in a situation, people can deploy their attention to (Attentional Deployment) and/or reinterpret aspects of the situation so as to change its emotional meaning (Cognitive Change). Finally, people can directly influence their emotional response, for example by controlling their facial expressions of emotion or breathing (Response Modulation).

Research has demonstrated that people differ with regard to which of these strategies they choose to implement (Parkinson & Totterdell, 1999) and that these choices vary systematically with individual-difference factors such as age (Isaacowitz, Allard, Murphy, & Schlangel, 2009; Opitz, Rauch, Terry, & Urry, 2012b; Phillips, Henry, Hosie, & Milne, 2006), culture (Matsumoto, Yoo, Nakagawa, & Multinational Study of Cultural Display Rules, 2008; Parkinson & Totterdell, 1999), and psychiatric diagnosis (Kimhy et al., 2012). Furthermore, ER choices have been shown to also vary systematically within individuals from one emotion episode to the next (Sheppes et al., 2012). We now turn to considering

theories that might explain between- and within-person variation in emotion regulation choice.

1.1. Emotion regulation choice

Recent theoretical efforts have attempted to explain variation in ER choice both as a stable individual-difference *between* people and as a reflection of the context from one emotion episode to the next *within* people. Applying P. B. Baltes and Baltes' Selection, Optimization, and Compensation meta-theory (1990) to ER (SOC-ER), Urry and Gross (2010) argued that people may regulate their emotions successfully by selecting the ER strategies they are best equipped to use. According to this framework, people are best equipped to use those ER strategies for which they have the relevant resources, defined as internal abilities (e.g., working memory) or environmental affordances (e.g., features of the environment, including other people) that help make a particular form of ER possible.

In a complementary model focused on emotion regulation choice, Sheppes et al. (2012) provide supporting evidence that one important influence on ER selection is the intensity of the emotion to be regulated. According to this model, both the emotional response and its regulation can deplete people's limited information processing capacity. When a person encounters a situation that generates a high-intensity emotional response, he or she will have fewer resources available to invest in complex, effortful ER strategies that require elaborative processing; in these instances, people should prefer relatively simple ER strategies. However, it is often advantageous to engage in elaborative processing of emotional situations in order to learn from them. Thus, when a person encounters a situation that generates a low-intensity emotional response, s/he will have more resources available; in these instances, people should prefer relatively complex ER strategies that require elaborative processing (Sheppes et al., 2012). We illustrated this relationship between high and low intensity and ER choice in our opening scenario, in which two different emotion-triggering situations elicited emotional responses of varying intensity (i.e., being reprimanded was mildly upsetting whereas hearing of a friend's grave injury was hugely upsetting), leading to different ER choices (reappraisal in the former case; attentional deployment in the latter).

1.2. Uninstructed emotion regulation choice

Considering the above frameworks, when the cognitive or emotional demands of the situation warrant it, people in laboratory settings are likely to use whichever ER strategies work best for them even when they have been trained and instructed to use one specific strategy. Aldao (2013) termed this practice "spontaneous regulation". Consistent with this idea, in a study in which participants were instructed to suppress or exaggerate facial expressions elicited by film clips, a significant number of participants reported employing uninstructed cognitive ER strategies (Demaree, Robinson, Pu, & Allen, 2006).

In addition, whether in the laboratory or in everyday life, people are not limited to choosing just one strategy. Indeed, people might at times employ multiple ER strategies to regulate emotions in response to the same events to ensure regulatory success. For example, a person may use more than one ER strategy because there is an advantage to employing multiple

versus single strategies in terms of increased overall regulatory success, or because the first strategy fails and so one switches to an alternate strategy to compensate. In support of this idea, Aldao and Nolen-Hoeksema (2012) examined the number of ER strategies endorsed by participants watching a film clip depicting amputations and reported that the majority of participants (65%) used multiple (more than one) ER strategies to regulate their disgust.

As reviewed above, Sheppes et al.'s (2012) theoretical model and corroborating evidence support the hypothesis that situational contexts, such as the intensity of the emotion-triggering situation, may influence the strategies that people choose to regulate their emotions. Just as situational contexts such as intensity may influence *which* strategies people choose to use, it logically follows that situational contexts could also influence whether people choose to implement uninstructed versus instructed strategies and/or one versus multiple ER strategies. When emotional intensity is high, people may be more likely to use uninstructed strategies if the instructed strategy is not effective in regulating high emotional arousal, or if combining instructed and uninstructed strategies bolsters regulatory effectiveness. While they did not have a low-intensity comparison, the high rate of multiple strategy use in Aldao and Nolen-Hoeksema's (2012) study of responses to a high-intensity film clip is at least consistent with the idea that we should expect high rates of uninstructed strategy endorsement under conditions of high emotional intensity. In another recent study, Dixon-Gordon et al. (accepted for publication) asked participants to recall emotional memories that varied in intensity, and found that participants retrospectively reported greater ER strategy use for high intensity versus low intensity episodes. While the works reviewed above all suggest greater uninstructed strategy use under conditions of high intensity, it is of course also possible that participants in high-intensity situations may choose to use uninstructed strategies *less* often due to diminished resources.

1.3. Present work

There are gaps in our understanding of ER choice. First, while past studies of instructed ER suggest that people may frequently engage in uninstructed ER choice, these studies have focused on highly specific instances of ER choice, like supplementing expressive manipulations with cognitive manipulations (Demaree et al., 2006). Thus the extent to which people may spontaneously choose a wider range of ER strategies remains unknown. Second, while the contextual factors that may govern ER choice between instructed alternatives are becoming increasingly characterized (Sheppes et al., 2012), few if any studies have evaluated the contextual factors that may govern *uninstructed* ER choice. These untested questions are critical to our understanding of how people implement ER in our studies of instructed ER. Clarifying these open issues will allow us to refine our theoretical models and identify practical implications for instructed ER studies.

To address these gaps, we evaluated instructed and uninstructed ER choices in four studies. In all studies, participants were instructed to use CR to regulate their emotional response to negative pictures; the pictures varied in emotional intensity from one study to the next. These studies were conducted to assess CR ability and its relationship to various aspects of psychological functioning, but in all four studies we followed the CR task with an open-ended prompt asking participants to describe the tactics they used to regulate their emotions.

This afforded us the opportunity to conduct a naturalistic assessment of the frequency of uninstructed ER choice in typical CR paradigms. Since we include four separate studies, this approach also permitted us to assess whether there were similar rates of uninstructed ER choice across the four studies, whose stimuli varied in emotional intensity. Two of the studies used primarily high-intensity pictures and two used primarily low-intensity pictures, which allowed us to investigate uninstructed strategy use in both intensity conditions (Studies 1 and 3) and then immediately conceptually replicate our findings (Studies 2 and 4).

Of note, we designed this methodology to specifically capture explicit, conscious forms of ER of which participants would be aware. These forms of ER should be distinguished from implicit, automatic forms of ER which may elude conscious control and/or awareness (Aldao, Sheppes, & Gross, 2015; Gyurak, Gross, & Etkin, 2011; Mauss, Cook, & Gross, 2007; Zhang & Lu, 2012). These automatic forms of ER are largely beyond the scope of the present research, although it is also possible that our measure of strategy use captured some automatic regulation—if people found themselves automatically engaging in uninstructed strategies (i.e., lacking conscious control but not awareness) that they then reported at the end of the experiment.

We coded participants' descriptions of employed ER tactics to catalog all of the ER strategies that participants reported using (i.e., not limited to forms of CR), consistent with the process model of ER. As participants were not limited to describing a single strategy and our coding scheme allowed for use of multiple strategies, this approach allowed us to detect when participants reported using a different strategy than CR (an uninstructed strategy) as well as when they were implementing multiple strategies (e.g., CR plus an uninstructed strategy).

Grounded in the prior literature, we hypothesized that people would frequently use the instructed strategy of CR, but that they would also spontaneously use uninstructed and/or multiple ER strategies. In addition, based on the prior work discussed above, we expected that use of uninstructed and/or multiple ER strategies might occur more frequently in the higher-intensity studies. Considering these hypotheses, we ask three questions in each study: (1) Given that CR was the prescribed instruction, did participants actually use CR strategies in this study? (2) Did participants use non-CR (uninstructed) strategies in this study? and (3) Did participants use multiple strategies in this study?

2. Overall method

2.1. Ethics statement

All methods and procedures were approved by the Tufts University Social, Behavioral, and Educational Research Institutional Review Board. All participants provided written informed consent before the experiment.

2.2. Cognitive reappraisal tasks

Participants were trained to use CR to change their response to emotional pictures (see Table 1 for study-specific details). During this training phase, the experimenter described the experimental conditions and provided example reappraisals for several pictures similar to the

ones that they would encounter during the CR task. For instance, participants in one study were shown a picture of a young child crying. These participants were then told that to decrease their negative emotions in response to this picture, they might imagine that the child was crying over a minor mishap like a misplaced toy as opposed to a more serious situation. Following these initial examples, participants completed several practice trials, generating their own reappraisals to new pictures. To conclude training, participants were shown several of the practice pictures again and asked to describe what they thought about when instructed to reappraise. In the rare cases where participants did not generate appropriate reappraisals, the experimenter provided feedback and additional examples. In each study, we also instructed participants to refrain from interpreting the pictures as being fake or unreal (e.g., “When you decrease your emotions to these unpleasant pictures, we don’t want you to look at them as fake or unreal”). We did so to increase ecological validity; people encountering emotional situations in their everyday lives are unlikely to benefit from challenging the reality of the situation. See Fig. 1 for a schematic of a typical trial. The regulation period differed slightly from study to study, ranging from six to eight seconds, due to differences in study design. We have no reason to believe that these slight differences exerted influence on participants’ ER use.

2.3. ER choice coding

In these experiments, trials began with a fixation cross, presented for 1 s in the center of a black screen. Following this, the picture was presented for several seconds without an ER instruction to engender an initial emotional response. Next, an auditory cue instructing the participant to either continue to view the picture without regulating (auditory instruction: “View”) or to decrease their emotion using CR only (auditory instruction: “Decrease”) was presented for approximately 1 s. Participants were asked to follow the instruction for the remainder of the time that the picture was on the screen.

At the end of the experiment in all studies, we administered a web-based questionnaire asking participants to describe in an open-ended short paragraph the strategies they used when instructed to decrease their response to unpleasant pictures. The questionnaire prompt asked participants: “What strategies did you use when instructed to decrease your response to unpleasant pictures?” This particular phrasing explicitly allowed participants to describe multiple strategies, whereas the more restrictive phrasing “what *strategy* did you use” might otherwise have artificially limited participants’ responses to a single strategy.

Six trained research assistants then coded each participant’s description using a coding scheme developed by the authors (see Table 2 for the coding scheme and sample responses for each strategy). This coding scheme was developed to capture the forms of ER described in the process model (Gross & Thompson, 2007). It allowed for the coding of: 1) multiple subtypes of CR (McRae, Ciesielski, & Gross, 2012; Ochsner et al., 2004) including acceptance (e.g., “this is just part of life”), self-focused reappraisal (e.g., “no one I know is involved in that crash”), and situation-focused reappraisal (anchored in three time points: past, e.g., “he was a bad man and is getting what he deserved”; present, e.g., “they are receiving help”; and future, e.g., “they will be reunited with their families”), 2) multiple subtypes of attentional deployment (visual, distancing, distraction, cleared mind), 3) response

modulation (e.g., “I slowed my breathing”); and 4) the “reality challenge” form of CR, which participants were explicitly discouraged from using, so as to maximize ecological validity of the reappraisals (e.g., “this is fake”). We coded “reality challenge” as distinct from the other forms of CR since we explicitly instructed participants to refrain from using this strategy (see the “Cognitive reappraisal tasks” section). To evaluate interrater agreement among our six coders, we computed Randolph’s free-marginal multirater kappas (Randolph, 2005) for each ER code, using Randolph’s Online Kappa Calculator (Randolph, 2005). Coders had excellent agreement, as suggested by the kappas (all $>.74$, most $>.90$, see Table 2).

A particular strategy was scored as “present” if at least 4 out of the 6 coders agreed that the strategy applied to the description. The coding scheme allowed multiple strategies to be coded as “present” for the same response (e.g., “I thought about it as a play, as a set-up for a picture” [coded as reality challenge], “or I just tried to think about the least horrible scenario for what was happening” [coded as situation-focused reappraisal]).

2.4. Data analysis plan

For each study, we first created three variables. For the first variable, “CR Present”, we classified participants who used any of the CR strategies in the coding scheme (excluding reality challenge, which was discouraged by instruction) by assigning them a value of one, and by assigning participants who did not use CR as defined above a value of zero. For the second variable, “Non-CR Present”, we numerically classified participants who used non-CR strategies (even if they also used CR) by assigning them a value of one, and by assigning participants who did not use any non-CR strategies as defined above a value of zero. For the third variable, “Multiple Strategies Present”, we numerically classified participants who used more than one ER strategy by assigning them a value of one (presence of multiple strategies), and by assigning participants who used only one ER strategy a value of zero (absence of multiple strategies). See Table 3 for the number of participants reporting CR and non-CR use in each study. For all of these variables, when one assigns presence a value of 1 and absence a value of 0 and categorizes each participant as one or the other, the means of these variables function as proportions (e.g., if the mean of the CR present variable is .74, this signifies that 74% of the sample endorsed strategies consistent with CR).

Following creation of these new variables, we used a series of one-sample t-tests⁴ to answer three questions in each study. First, we asked whether a significant proportion of participants reported strategies consistent with their CR training (variable: CR Present, tested against a value of 0). Second, we asked whether a significant proportion of participants reported strategies that were inconsistent with their CR training (variable: Non-CR Present, tested against a value of 0). Third, we asked whether a significant proportion of participants reported using multiple strategies of any kind, again inconsistent with their CR training (variable: Multiple Strategies Present, tested against a value of 0).

⁴We acknowledge that there are several reasonable methods for testing these hypotheses (e.g., binomial test, chi-square goodness of fit). Given that our focus was not on the probability that participants would fall into one grouping or another but rather on whether the proportion of participants – that is, the degree of divergence from 0 or 1 – was statistically significant, the one-sample t-tests presented were the best analytic fit.

These one-sample t-tests allowed us to examine whether the overall proportion of participants using CR, non-CR, and multiple strategies was consistent or inconsistent with the CR instructions they received. For example, in the first analysis, if the CR Present mean is significantly different from zero, that means a significant proportion of participants were using CR, which is consistent with their CR training. And, in the second and third analyses, if the Non-CR Present and Multiple Strategies Present means are significantly different from zero, that means a significant proportion of participants were using non-CR or multiple strategies, respectively, which is inconsistent with their CR training. In the results below, we summarize the findings for these three tests, which we conducted in all studies.

In addition to the above analyses, the present design allowed us to test our hypothesis that uninstructed ER choice might occur more frequently in the higher-intensity studies. Because intensity and the strategy use variables are all dichotomous scores, we conducted three chi square tests of independence to investigate whether there were higher rates of non-CR and multiple strategy use in the higher-intensity studies. Emotional intensity was an independent variable that was manipulated across studies and the three strategy use variables were our dependent variables of interest. To retain our focus on the primary question of interest, we did not test potential interactions between intensity and use of strategies.

Each of the four studies represents a unique sample of participants. However, as described above, two studies involved stimuli of relatively high emotional intensity, and two studies involved relatively low emotional intensity.⁵ These shared characteristics regarding emotional intensity between independent samples of unique participants permitted us to test our hypotheses within each intensity level, and then conceptually replicate the results using a separate sample. We see this as a distinct strength of this paper, considering the heightened and increasing attention paid to the importance of replication within the field of psychological science (Ledgerwood, 2014).

As can be seen in Table 1, some studies included additional manipulations. In Study 1, there was a separate “breathe” condition; in the remaining studies, eye gaze manipulations were contemporaneous with the ER manipulations. The open-ended questionnaire item we used to assess people’s use of ER strategies was specific to their use of strategies during the “decrease” trials, and therefore ignores participants’ ER use during the “breathe” trials (assessed in a separate item in that study) and collapses across gaze conditions. Moreover, participants reported on strategy use once at the end of the experiment rather than trial-by-trial.

⁵Due to within-study variation in intensity, these designations represent relative differences in intensity across all pictures in the four sets. To test whether pictures classified as “higher-intensity” were more arousing overall than pictures classified as “lower-intensity”, we conducted an independent sample t-test using electrodermal activity (a measure of sympathetic arousal, collected in all four studies, view condition only) as the dependent variable. Electrodermal activity was significantly higher for participants viewing higher-intensity pictures ($M = .03$, $SE = .02$) than for participants viewing lower-intensity pictures ($M = -.04$, $SE = .01$), $t(173) = 3.38$, $p < .001$, suggesting that higher-intensity pictures were indeed more arousing than lower-intensity pictures. Because electrodermal activity is not otherwise relevant to the hypotheses of this paper, it will not be discussed further.

3. Study 1: higher-intensity negative emotions

In this first study, we aimed to examine participants' ER choices –specifically, whether they followed the instructions to use CR or used uninstructed strategies –when trying to regulate higher-intensity negative emotions.

3.1. Participants and materials

Fifty-one Tufts University undergraduates participated in Study 1. Data pertaining to the present analyses were not collected for fourteen participants. We removed two participants from the analyses, as they appeared to have misunderstood the questionnaire items. For example, in answer to the question pertaining to describing emotion regulation strategies, one participant answered, “it might have been more effective to show a video.” We removed one additional participant who reported using three strategies (the only participant throughout all studies to do so), which we considered atypical and therefore problematic in the analyses. Thus, the final sample included thirty-four undergraduates (13 women). The CR task in this study involved higher-intensity negative IAPS pictures (mean valence rating = 5.78, SD = .80), positive pictures, and neutral pictures. In addition to being trained to use CR to decrease and increase emotion, on some trials participants were instructed to instead simply take a deep breath while continuing to view the picture. On each trial, participants free-viewed the pictures for 4 s, followed by a 1 s audio instruction, followed by 8 s to regulate.⁶

3.2. Results

3.2.1. Did participants use CR strategies?—To examine whether participants reported using the instructed strategy, we submitted the CR Present (1 yes, 0 no) variable to a one-sample t-test with a test value of 0, as described above. This test revealed that the mean (.47) significantly differed from zero, $t(33) = 5.416$, $p < .0001$, Cohen's $d = 1.89$, suggesting that a significant proportion of participants reported using CR as instructed.

3.2.2. Did participants use non-CR strategies?—To examine whether participants reported strategies other than the instructed CR, we submitted the Non-CR Present variable to a one-sample t-test with a test value of 0. This test revealed that the mean (.65) significantly differed from zero, $t(33) = 7.778$, $p < .0001$, Cohen's $d = 2.71$, suggesting that, contrary to CR task instructions, a significant proportion of participants used non-CR strategies.

3.2.3. Did participants use multiple strategies?—Next to examine whether participants reported multiple strategy use, we submitted the Multiple Strategies Present variable to a one-sample t-test with a test value of 0. This test indicated that the mean (.25) significantly differed from zero, $t(33) = 3.447$, $p = .002$, Cohen's $d = 1.2$, suggesting that,

⁶In this and all studies reported herein, participants completed additional measures including questionnaires assessing various constructs. In addition, ratings of emotional experience and/or physiological responses were often collected during the picture task; see Table 1 for additional measures collected during the picture tasks. In all studies for which they were available, self-report data showed that emotional experience was reduced according to the regulatory goal to decrease negative emotion (all $p < .001$). In this report, we focus exclusively on the ER strategies participants reported, since those are the only data directly relevant to testing the hypotheses of interest.

contrary to CR task instructions, a significant proportion of participants used multiple strategies.

3.3. Discussion

In sum, although a significant proportion of participants in this study reported using the instructed CR strategies, a little over half of the sample reported using uninstructed, non-CR strategies. Indeed, nearly two-thirds of the sample reported using alternative ER strategies either instead of or in addition to CR, and about a quarter of people, a relatively small but significant proportion, endorsed using multiple strategies.

It should be noted that, although the responses we evaluated pertained only to participants' use of CR, participants were instructed to “breathe” in other conditions of this same experiment. It is possible that these explicit instructions to use non-CR strategies in the same experiment may have increased the likelihood that participants would use those non-CR strategies instead of or in addition to CR on CR trials.

4. Study 2: higher-intensity negative emotions (replication)

In this second study, we aimed to conceptually replicate the findings of Study 1. Specifically, we examined whether a separate sample of participants would again frequently report using CR, non-CR, and multiple strategies when trying to regulate higher-intensity negative emotions.

4.1. Participants and materials

Forty-nine Tufts University undergraduates (25 women) participated in Study 2. The cognitive reappraisal task in this study involved higher-intensity negative IAPS pictures (mean valence rating = 5.93, $SD = .028$) and neutral pictures. Participants free-viewed the pictures for 4 s, followed by a 1 s audio instruction, followed by 6 s to regulate. As reported in Urry (2010), this study involved a gaze-direction manipulation in which, after 5 s of picture presentation, most of the picture was faded out except for one square to which gaze was directed (either the most emotionally arousing portion of the picture, or a non-emotionally arousing portion). This manipulation was employed to hold gaze direction constant and thus minimize use of visual attentional deployment as a supplementary regulatory strategy.

4.2. Results

4.2.1. Did we replicate the findings of Study 1?—As can be seen in Table 4, the results of the t-tests for CR use, non-CR use, and use of multiple strategies in Study 2 were equivalent to Study 1. We therefore successfully replicated all findings of Study 1.

4.3. Discussion

In this higher-intensity study employing a gaze-direction manipulation, over three-quarters of participants reported using the instructed CR strategy. However, close to half of the participants reported using alternative strategies either instead of or in addition to CR, and again about a quarter of the people, a relatively small but significant proportion, reported

using multiple strategies. Thus, Study 2 conceptually replicated the findings presented in Study 1.

Unlike in Study 1, there were no trials in Study 2 in which participants were instructed to use the non-CR “breathe” strategy. In addition, there was a gaze-direction manipulation which held visual attention relatively constant (randomly either on central or peripheral content). Both of these factors may have contributed to the numerically smaller proportion of participants using one or more non-CR strategies in Study 2 compared to Study 1.

5. Study 3: lower-intensity negative emotions

The first two studies primarily used negative picture stimuli that were of high emotional intensity. In this third study, we examined whether participants would use CR, non-CR, and multiple strategies when instead trying to regulate lower-intensity negative emotions.

5.1. Participants and materials

Forty-eight Tufts University undergraduates (24 women) participated in Study 3. The CR task in this study involved lower-intensity negative IAPS pictures (mean valence rating = 5.08, $SD = .64$), positive pictures, and neutral pictures. Participants free-viewed the pictures for 4 s, followed by a 1 s audio instruction, followed by 6 s to regulate. This study employed the same gaze-direction manipulation as that in Study 2.

5.2. Results

5.2.1. Did participants use CR strategies?—To examine whether participants reported using the instructed CR strategy, we submitted the CR Present (yes 1, no 0) variable to a one-sample t-test with a test value of 0. This test revealed that the mean (.81) significantly differed from zero, $t(47) = 14.271$, $p < .0001$, Cohen's $d = 4.16$, suggesting that a significant proportion of participants reported CR as instructed.

5.2.2. Did participants use non-CR strategies?—To examine whether participants reported using uninstructed strategies, we submitted the Non-CR Present variable to a one-sample t-test with a test value of 0. This test indicated that the mean (.35) significantly differed from zero, $t(47) = 4.622$, $p < .0001$, Cohen's $d = 1.35$, suggesting that a significant proportion of participants used non-CR strategies.

5.2.3. Did participants use multiple strategies?—To examine whether participants used multiple strategies, we submitted the Multiple Strategies Present variable to a one-sample t-test with a test value of 0. This test indicated that the mean (.17) significantly differed from zero, $t(47) = 3.066$, $p = .004$, Cohen's $d = 0.89$, suggesting that a significant proportion of participants used multiple strategies.

5.3. Discussion

In this study of young adults exposed to lower-intensity pictures and a gaze-direction manipulation, over 80% of participants reported using instructed CR strategies at least some of the time. A little over a third of participants reported using uninstructed non-CR

strategies, and a small-but-significant proportion of participants reported using multiple strategies.

6. Study 4: lower-intensity negative emotions (replication)

In this fourth study, we aimed to conceptually replicate the findings of Study 3. Specifically, we examined whether a separate sample of participants would again frequently report using CR, non-CR, and multiple strategies when trying to regulate lower-intensity negative emotion.

6.1. Participants and materials

Twenty-one Tufts University undergraduates (15 women; mean age 19.62; data unavailable for one participant) and 22 older adults recruited from the community participated (13 women; mean age 61.9) in Study 4. The cognitive reappraisal task in this study involved lower-intensity negative IAPS pictures, as well as pictures selected from other online repositories like Wellcome Trust pictures (mean arousal rating for the IAPS pictures = 4.97, $SD = .82$) and neutral pictures. Participants free-viewed the pictures for 4 s, followed by a 1 s audio instruction, followed by 8 s to regulate. Similar to Study 2 and Study 3, this study involved a gaze-direction manipulation to reduce use of visual attentional deployment as a supplementary regulatory strategy. Four seconds after picture onset, a white square was used to direct gaze to either the most emotionally relevant portion of the picture, or a non-emotionally relevant portion.

6.2. Results

6.2.1. Did we replicate the findings of Study 3?—As can be seen in Table 4, the results of the t-tests for CR use and non-CR use in Study 4 were equivalent to Study 3. We therefore replicated these findings of Study 3. Notably, we did not replicate the finding that participants used multiple strategies in this lower-arousal context.

6.3. Discussion

In this study of younger and older adults using lower-intensity pictures and a gaze-direction manipulation, we observed the highest rates of instructed CR use (with almost 85% of the sample reporting strategies consistent with CR). This was also the only one of our four studies in which the number of participants reporting using multiple strategies was not significant. We were thus able to partially replicate the findings presented in the previous three studies, with the exception of participants' use of multiple strategies under relatively low emotional intensity. It is possible that including older adults in the sample helps explain this difference. Of note, we did not examine age group as a factor here because this was not of primary interest to this study. Furthermore, the individual age groups were rather small in size, thus any examination of age group would likely have been underpowered and unreliable.

6.3.1. Did ER choice vary by picture intensity?—In order to determine whether use of CR, non-CR, and multiple strategies varied by picture intensity across the four studies, we conducted three chi-square tests of independence. All reported results below are Yates'

corrected for continuity. None of the within-cell standardized residuals were significant at the $p = .05$ level, which suggests that none of the significant chi square results were carried by any one cell in these analyses. As such, we have omitted these results for the sake of brevity.

As hypothesized, participants in the lower-intensity studies endorsed using the instructed CR strategies (.83) more than participants in the higher-intensity studies (.67), $\chi^2(1, N = 175) = 5.355, p = .021$.

As hypothesized, participants in the higher-intensity studies (.47) endorsed using the uninstructed non-CR strategies more than participants in the lower-intensity studies (.25), $\chi^2(1, N = 175) = 8.285, p = .004$.

Finally, as hypothesized, participants in the higher-intensity studies endorsed using multiple strategies (.25) more than participants in the lower-intensity studies (.11), $\chi^2(1, N = 175) = 4.346, p = .037$.

7. General discussion

Emotion regulatory choices (McRae et al., 2012; Sheppes et al., 2012) and the contexts in which they are made (Aldao, 2013; Sheppes et al., 2012; Urry & Gross, 2010) are rapidly gaining attention in the field of emotion regulation research. In four studies of instructed cognitive reappraisal that varied in stimulus intensity, presence or absence of gaze-direction, and the age of participants, we demonstrated that participants spontaneously implemented a number of uninstructed ER strategies in significant proportions. In addition, a significant number of participants in all but one study reported using multiple ER strategies. These results extend the existing literature by providing evidence that participants in instructed ER paradigms use both instructed and uninstructed ER strategies to regulate their emotions. Moreover, our current results also suggest that the extent to which people use uninstructed ER strategies is more likely in the face of higher-intensity than lower-intensity stimuli. We will now turn to discussing the theoretical and practical implications of these findings.

7.1. Use of non-CR strategies as evidence of spontaneous selection of ER strategies

Consistent with previous work (Aldao & Nolen-Hoeksema, 2012; Demaree et al., 2006), we have presented evidence suggesting that, while most participants report using the instructed ER strategy (CR, specifically), many participants report using other, uninstructed ER strategies. This use of uninstructed ER strategies may be motivated by people's strong tendencies to select the ER strategies that work best for them in light of available resources. It may be easier and/or more effective to implement strategies with which one has a great deal of experience, and/or which have been successful in the past. Intriguingly, this practice suggests that participants' intrinsic motivation to feel less negative emotion may take priority over the experimenter's instructions.

In the present data, it is possible that participants may have been using uninstructed strategies only during those trials for which an uninstructed strategy might be particularly well-suited, whether due to stimulus characteristics (e.g., a picture of a mutilated hand

inducing a desire to look away) or regulatory failure (e.g., attempting to apply CR but failing to come up with a reasonable reappraisal and thus switching to an uninstructed strategy). We speculate that reported use of more than one ER strategy in these experiments may reflect a compensatory maneuver, allowing people to maintain ER success when faced with decreases in internal or environmental resources that render one particular ER strategy less effective. Such compensatory maneuvers are predicted by the SOC-ER framework.

It is important to note that we asked participants to report the strategies they used at the end of the experiment. As a result, we are unable to determine whether reported use of multiple strategies reflects participants switching strategies *within a given trial* (e.g., trying first to apply CR, then switching to distraction), switching strategies *from trial to trial* (e.g., using CR for one trial, distraction on another trial), or a combination of the two. Nevertheless, both types of strategy switching may represent ways in which participants attempt to compensate for changing resources. Moreover, there is growing evidence that strategy choices across emotional episodes may have interactive effects (e.g., Aldao & Nolen-Hoeksema, 2012). To better understand ER successes and failures, it will be important to determine the motives for and differences between these possible approaches to compensation, as well as the interactive effects of choosing one or more ER strategies, using refined methods in future studies.

7.2. Practical implications for the study of emotion regulation

Our finding that people will not necessarily follow experimenter instructions is consistent with previous research suggesting that participants do not necessarily follow the ER instructions they are given (Demaree et al., 2006), despite instructions and training focused on one strategy. While the majority of our participants (roughly 75% across studies) reported using CR to regulate their emotions, a significant number of participants (40%) used alternative strategies instead of or in addition to CR. These findings call for researchers in the field of ER to be cautious when collecting, analyzing, and interpreting data. Since we observed the use of uninstructed and/or multiple ER strategies more frequently in the higher-intensity studies, deviation from ER instructions may be particularly important to consider when using these stimuli. In future studies, researchers may wish to adopt paradigms that control or manipulate multiple ER strategies at the same time. For example, three of the four studies in this paper utilized gaze-directed cognitive reappraisal (Urry, 2010), in which overt attentional deployment was held constant while participants used CR.

Of course, it is worth noting that even with attempted experimental control of one alternative ER strategy (overt attentional deployment), participants in the gaze-directed cognitive reappraisal studies *still* used uninstructed, non-CR strategies. This suggests that perfect control of ER strategy use may be impossible and that it is always possible for participants to use uninstructed ER strategies that researchers are not attempting to control. However, the rates of uninstructed ER strategy endorsements were numerically lower for the gaze-directed CR studies than the non-gaze-directed study, suggesting that some control may be possible (although this could also indicate that subjects were too taxed to do much more than follow instructions).

From the standpoint of maximizing internal validity, controlling at least a subset of likely uninstructed ER strategies may be advisable for studies in which authors wish to make inferences about the instructed ER strategies of interest. At the same time, from the standpoint of maximizing external validity, controlling uninstructed ER strategies may produce effects that less well represent emotion regulation in daily life. When designing new studies, this trade-off between maximizing internal and external validity should be adjudicated in light of the goals of a given research effort. Either way, our results underscore the importance of including systematic measures of ER strategy use. The inclusion of such measures enables researchers to report compliance with experimental ER instructions and also to assess the impact of noncompliance in analyses where appropriate.

7.3. Strengths, limitations, and future directions

The current findings offer support for several theoretical frameworks of emotion regulation choice and success, and how these may vary by context. Drawing on data from four studies of CR, we provide evidence suggesting that people may compensate for changes in resources, thus supporting Aldao's notion of spontaneous regulation even in a controlled laboratory context. The present data also supplement the finding that people in instructed CR studies use multiple types of CR (McRae et al., 2012) by providing evidence that participants in studies of CR spontaneously use many strategies from multiple families of the process model. Furthermore, these data mesh well with the predictions of Sheppes and colleagues' model of emotion regulation choice (Sheppes, Scheibe, Suri, & Gross, 2011). Specifically, these data demonstrate that the intensity of the emotional situation impacts not only the choice of ER strategies between forced alternatives (e.g., reappraisal versus distraction in their studies), but also is systematically related to open-ended descriptions of instructed and uninstructed ER strategies.

We used a novel method of soliciting free-form reports of ER choice and coding them in terms of ER families defined by the process model of emotion regulation (Gross & Thompson, 2007). A strength of such a coding approach is that it was designed to flexibly handle multiple forms of ER, which allowed us to capture the full range of strategies and tactics that our participants employed when asked to use CR to regulate emotion. Examining this important question in the context of four separate studies employing typical CR paradigms allowed for a naturalistic assessment of the frequency of ER choices in the context of instructed CR paradigms.

Despite the novelty and importance of these findings, there are several issues that limit our conclusions and thus motivate the need for further study. First, as all four of these studies involved instructed CR, it is not clear whether the proportions of CR and non-CR strategy use that we documented are applicable to studies in which participants can freely choose ER strategies or those that prescribe a single non-CR strategy. As CR may be a particularly resource-intensive strategy (Sheppes & Meiran, 2008), use of uninstructed ER strategies could be higher in CR studies than those in studies of other specific strategies. Also, the four studies employed slightly different methods (e.g., some included gaze direction, two included positive pictures) and these variations could have impacted reported use of ER strategies. However, the fact that we observed very similar patterns of use of uninstructed

ER strategies across paradigms with such variation in methods suggest that the use of uninstructed ER strategies is likely occurring in most studies of instructed CR.

Second, the higher- and lower-intensity pictures differed in more than just intensity; they also differed in terms of the nature of the situations they depicted. While lower-intensity pictures frequently depicted sad social situations, higher-intensity pictures frequently depicted injured individuals. Our results could, therefore, be partly driven by differences in content beyond mere intensity, as well as other, unidentified differences varying systematically along with intensity. It should be noted, however, that we do not consider this to be a confound, but rather an inherent difference in the characteristics of high-and low-intensity pictures. It is unlikely that any two pictures of starkly differing intensity could be equated for content because content is a main determinant of emotional intensity in pictures. Future research may thus wish to examine the role of emotional intensity in ER choices using other kinds of stimuli, such as white noise blasts or electric shocks that differ in intensity. Related to this, it is important to note that we did not directly manipulate emotional intensity in the confines of a single study; rather, we examined different studies which systematically varied in emotional intensity. Thus, future research may wish to directly examine the impact of emotional intensity on the number and type of strategies people choose to regulate their emotions in a single study.

Third, ER strategy use was assessed just once after the CR task in post-experiment questionnaires. As such, we are unable to determine whether the use of multiple ER strategies reflected switching strategies from one trial to another or within single trials or both. A design in which strategy use is assessed continuously would be well-suited to disentangle the various explanations for use of multiple ER strategies.

Fourth, for the purposes of this paper, we focused on the strategies that participants reported using when they were instructed to decrease their negative emotion, not when they were instructed to view. Future research may wish to classify responses to both regulatory and non-regulatory instructions, which may provide further insight into the spontaneous actions that people engage in when faced with emotional challenges.

Fifth, given that these studies differed in a number of important respects and that we are unable to differentiate between within-trial versus between-trial spontaneous ER choice, we are unable in the current paper to examine how the use of instructed, uninstructed, and multiple ER strategies relates to ER success (i.e., successfully changing one's emotions in accordance with the regulatory goal). Future designs should test for these factors within a single controlled study.

Sixth, we did not adjust our alpha threshold for multiple comparisons, which raises concerns about Type I errors. However, overall, the results were highly statistically significant and exhibited very large effect sizes. Indeed, the statistical significance attained in the majority of comparisons is below a Bonferroni-adjusted alpha of .0033, correcting for 15 comparisons. Due to the genuine independence of all samples, the a priori nature of this inquiry, and the built-in replications of most effects, we did not deem it necessary to adjust the alpha for multiple comparisons.

Finally, it should be noted that variations in emotional intensity likely impact many variables in addition to emotion regulation choice. Effects of emotional intensity have been demonstrated on neural correlates of memory retrieval (Schaefer, Fletcher, Pottage, Alexander, & Brown, 2009; Schaefer, Pottage, & Rickart, 2011), spontaneous memory recall (Staugaard & Berntsen, 2014), time perception (Tamm, Uusberg, Allik, & Kreegipuu, 2014), word processing (Kuperman, Estes, Brysbaert, & Warriner, 2014), and cognitive processing of behavioral inhibitory control (Yuan et al., 2012). It is possible that some of the effects in the present study can be at least partially accounted for by way of these effects. For example, selection of multiple ER strategies under high intensity conditions may be partially influenced by diminished behavioral inhibitory control under high arousal. In the present study, we are unable to determine whether and/or to what extent this is the case. Similarly, it is plausible that in addition to explicit ER strategies which participants could recall, variation in emotional intensity also affected participants' use of implicit, automatic forms of ER. These forms of ER may elude description, and are thus unlikely to be captured in our present questionnaire and coding scheme. Future research using new methodologies designed to capture these automatic forms of ER may be well-suited to address the impact of emotional intensity on these processes.

7.4. Concluding remarks

Increasingly, researchers in the field of emotion regulation are recognizing the importance of individual choice (McRae et al., 2012; Sheppes et al., 2011; Urry & Gross, 2010) and context (Aldao, 2013; Opitz, Gross, & Urry, 2012a). Drawing on four ER studies involving varying degrees of stimulus intensity, the data presented in this paper suggest that, in addition to using the single, specific strategy (CR) that was instructed, people spontaneously use uninstructed and/or multiple ER strategies. These findings underscore the importance of considering both context and choice when investigating specific ER strategies.

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Fig. 1.

Typical trial structure broken into four distinct periods. Participants first saw a fixation cross. This was followed by initial exposure to the picture. Participants then heard a regulation instruction over headphones. Finally, participants attempted to regulate their emotional responses accordingly. Note that the picture was displayed just once; it is depicted three times in this figure to distinguish the three periods during picture presentation.

Table 1

Study characteristics.

Study	Participants (age in years)	N (female)	Emotional intensity	Dependent measures	ER conditions	Other study characteristics
1	Undergraduates (M = 19.45, SD = 0.83)	34 (13)	High (min = 3.91, max = 7.35, M = 5.78, SD = .80)	COR, ZYG, ECG, EDA, RESP, PULSE	Decrease negative, increase negative, view negative, decrease positive, increase positive, view positive	Also included a "Breathe" ER condition.
2	Undergraduates (M = 18, SD = 1.01)	49 (25)	High (min = 5.50, max = 6.49, M = 5.93, SD = .028)	COR, ECG, EDA	Decrease negative, increase negative, view negative, view neutral	Gaze-directed reappraisal (CR variant described in Urry, 2010).
3	Undergraduates (M = 19.17, SD = 1.21, SD = 1.21)	48 (24)	Low (min = 3.95, max = 6.01, M = 5.08, SD = .64)	ECG, EDA	Decrease negative, view negative, view neutral, increase positive, view positive	Gaze-directed reappraisal.
4	Undergraduates and older adults (M = 41.65, SD = 22.09)	44 (29)	Low (min = 3.08, max = 7.07, M = 4.97, SD = .82)	ECG, EDA, COR	Decrease negative, view negative	Gaze-directed reappraisal.

Note. Characteristics of the four studies comprising the research described in this paper. Minimum, maximum, mean, and standard deviation reflect normative arousal ratings for IAPS pictures. The IAPS pictures used in the higher-intensity studies exhibited significantly higher normative arousal ratings than the pictures used in the lower-intensity studies (all $p < .001$). EDA = electrodermal activity. COR = *corrugator supercilii* electromyography. ZYG = *zygomaticus major* electromyography. RESP = respiratory rate. PULSE = pulse plethysmography.

Table 2

Strategy coding scheme and participant-provided examples.

Strategy (subtype)	Descriptor	Free marginal kappas	Example
Reappraisal: (acceptance)	Assuming a technical role (such as doctor) or reflecting on the inevitability of pain and suffering in life.	0.94	"I try to tell myself that the event I am witnessing happens all the time, to everyone, no big deal."
Reappraisal (self-focused)	Interpreting the content of the photo as less relevant to oneself — no one in the picture was known to the participant, the situation had nothing to do with the participant.	0.92	"I removed myself from the situation and thought about how I wasn't involved."
Reappraisal (situation-focused)	Reconstruing the picture's historical, current, or future circumstances so as to make it less emotional.	.88 (past), .74 (present), .91 (future)	"I made the picture seem better by adjusting the situation. For example, I decided that a gun was unloaded instead of loaded or a person was getting medical attention instead of dying."
Reappraisal (reality challenge)	Telling oneself that the picture was staged for television or somehow is not real.	0.95	"I imagined that it was a skit on a comedy show."
Attentional deployment (distraction)	Focusing on thoughts unrelated to the picture.	0.94	"I thought about things that weren't on the screen."
Attentional deployment (visual)	Looking away, focusing on non-emotional parts of the picture, focusing on lights or colors.	0.96	"I looked at the most bland, neutral part of the picture and concentrated on that."
Attentional deployment (distance)	Imagining being physically removed from the picture.	0.92	"I would try to imagine it was separated from me by a glass."
Attentional deployment (cleared)	Clearing one's mind of relevant thoughts.	0.98	"Just kept an empty mind."
Response modulation	Attempting to modulate one's emotional response.	0.98	"I slowed 'breathing.'"

Note. For the analyses in which we examine whether people followed the cognitive reappraisal training, the following codes were included as types of cognitive reappraisal: acceptance, self-focused reappraisal, and situation-focused reappraisal (past, present, and future). Reality challenge was not included as a form of instructed CR because the instructions explicitly prohibited using this strategy. Of note, participants' responses describing any form of response modulation, including descriptions of physiology regulation (e.g., controlled breathing) or suppression of facial expression (e.g., hide fear), were intended to be coded in the "response modulation" category. However, all responses reflect other bodily regulation because no participants endorsed the suppression of facial expressions.

Table 3

Number of participants reporting CR and non-CR strategies in each study.

	Study 1	Study 2	Study 3	Study 4
One strategy: CR (all types)	12	28	31	34
One strategy: Non-CR (all types)	13	9	9	7
Two strategies: CR and Non-CR	4	11	8	3
Two strategies: Multiple Non-CR	5	1	0	0

Descriptive statistics, *t* and *p* statistics, as well as Cohen's *d* effect size for the analyses conducted described in Studies 2 and 4, conceptually replicating studies 1 and 3, respectively. See the data analysis plan section for detailed descriptions.

Table 4

		M (SD)	<i>t</i> (df)	<i>p</i>	Cohen's <i>d</i>
1: CR use	Study 2	.80 (.41)	13.682 (48)	<.0001	3.95
	Study 4	.84 (.37)	15.076 (43)	<.0001	4.6
2: Non-CR use	Study 2	.35 (.48)	5.05 (48)	<.0001	1.46
	Study 4	.18 (.39)	3.091 (43)	0.003	0.94
3: Use of multiple strategies	Study 2	.25 (.43)	3.946 (33)	<.0001	1.14
	Study 4	.07 (.26)	1.774 (43)	0.083	0.54