Emotion Reactivity and Regulation Are Associated With Psychological Functioning Following the 2011 Earthquake, Tsunami, and Nuclear Crisis in Japan

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Frequent and successful use of cognitive reappraisal, an emotion regulation strategy that involves rethinking the meaning of an emotional event in order to change one’s emotional response, has been linked in everyday life to positive outcomes such as higher well-being. Whether we should expect this association to be maintained in a strong, temporally and spatially close emotional context is an unexplored question that might have important implications for our understanding of emotion regulation and its relations to psychological functioning. In this study of members of the U. S. Embassy Tokyo community in the months following the March 2011 earthquake, tsunami, and nuclear crisis in Japan, self-reported use of cognitive reappraisal was not related to psychological functioning, but demonstrated success using cognitive reappraisal to decrease feelings of unpleasantness in response to disaster-related pictures on a performance-based task was associated with fewer symptoms of depression and posttraumatic stress. Moreover, emotional reactivity to these pictures was associated with greater symptomatology. These results suggest that situational intensity may be an important moderator of reappraisal and psychological functioning relationships.

Keywords: cognitive reappraisal, emotion regulation, PTSD, trauma

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As we navigate our lives, we encounter emotional challenges small (your toddler throws a tantrum) and large (your spouse asks for a divorce). How we regulate the emotions these challenges evoke may impact our ill- and well-being (Gross & John, 2003). For example, regular use of and success at implementing cognitive reappraisal (CR), or the reinterpretation of the meaning of an emotional event, has been linked to good outcomes such as higher well-being (e.g., McRae, Jacobs, Ray, John, & Gross, 2012). However, these investigations evaluated everyday situations, leaving open an important question: What happens when we encounter a situation of extraordinary intensity?

Consider the plight of people living in Japan when the March 2011 earthquake, tsunami, and nuclear disasters struck. Two participants recollect their experience:

I thought it was my time to die. The SOUND and VIBRATIONS . . .

I was terrified as I huddled in a small room. [M]y consciousness seemed to cross over to a place that had accepted the shaking would never stop.

How might such high-intensity situations impact CR and psychological functioning relationships? On the one hand, Sheppes et al. (2012) demonstrated that high-intensity situations lead people to choose an emotion regulation strategy other than CR—distraction—which is quickly implemented and requires fewer cognitive resources. In the short term, at least, this suggests that high-intensity situations like the Japan crisis ought to reduce CR use and, thus, by reducing negative emotional responding, possibly predict better concurrent functioning. On the other hand, cross-sectional studies directly assessing the CR use and functioning relationship among trauma-exposed people have indicated that lower CR use is associated with higher posttraumatic symptomatology (Boden, Bonn-Miller, Kashdan, Alvarez, & Gross, 2012; Boden et al., 2013; Eftekhar, Zoellner, & Vigil, 2009; Ehrging & Quack, 2010). These studies are critical for documenting the potential importance of CR following trauma, but have limitations.

For one, all of these studies have demonstrated the CR use and functioning association quite some time after trauma exposure, either assessing combat-exposed veterans from a variety of wars.
(Boden et al., 2012; Boden et al., 2013; over a third of participants in each study were Vietnam veterans) or community samples surveyed about any past trauma, extending back to childhood (Eftekhari et al., 2009; Ehring & Quack, 2010). The association may differ if assessed closer to the trauma. When intensity is high, victims may be apt to engage in less resource-intensive strategies than CR. In addition, these studies assessed people exposed to a variety of traumas; trauma type thus remains a viable third-variable explanation for the CR use and functioning relationships. Third, these studies focused on CR use, that is, the frequency with which people reported using CR to regulate emotion. CR use may be differentiated from CR success, that is, demonstrable change in emotions in accordance with one’s emotion-regulatory goal. Troy, Wilhelm, Shallcross, and Mauss (2010) have presented evidence that better CR success relates to lower depressive symptoms, but only under high life stress. Because high life stress was operationalized as an accumulation of ordinary life stressors (from changes in sleep to job loss), it is unknown whether this may hold true when people experience events outside the realm of ordinary life experience (e.g., two natural disasters, ongoing threat of a nuclear disaster). Finally, greater CR use is associated with lower negative emotion and higher positive emotion (Gross & John, 2003), yet none of the existing studies assessed whether CR is uniquely associated with functioning above and beyond emotion reactivity.

We conducted an online assessment of CR use (using the Emotion Regulation Questionnaire [ERQ]), CR success, emotion reactivity (using a performance-based picture task), and psychological functioning (i.e., depression symptoms, posttraumatic symptoms, and satisfaction with life) in participants living in Tokyo, Japan, in the months following the March 2011 disasters. Our participants were recently exposed to potentially traumatic events of extremely high intensity (the initial earthquake and tsunami) and were living with daily ongoing stress (the nuclear crisis and aftershocks were still occurring).

We tested the hypothesis that greater CR use (based on previous studies) and CR success (on logical grounds) would be associated with better psychological functioning. However, if (a) high-intensity traumatic situations fundamentally alter the use and success of CR or their relation with functioning, and/or (b) emotion reactivity explains the relation in previous studies, CR use and/or success may be unrelated or even inversely related to functioning. “Better psychological functioning” was operationalized as lower levels of depressive and posttraumatic symptoms and higher levels of satisfaction with life.

Method

We report how we determined our sample size, all data exclusions, all manipulations, and all measures in the study (Simmons, Nelson, & Simonsohn, 2012).

Participants

One hundred twenty people started the survey, and 53 (61.1% female; 31 American and 22 Japanese/Okinawan) provided data on all key measures. All participants were permanently residing in Japan during the crisis. All materials were presented in English. Participants were members of the U.S. Embassy Tokyo community, and were recruited on a volunteer basis through email, flyer, and digital bulletin board. To maximize statistical power, our sample size was determined by recruiting as many participants as possible between July 1 and 31, 2011 (thus, 3–4 months after the initial earthquake). All procedures were approved by the Assumption College Institutional Review Board; participants provided electronic informed consent.

Materials and Procedures

Participants were directed to the study website (hosted by SurveyMonkey.com) where they completed demographics, the picture task, a disaster-related questionnaire, and questionnaires about psychological functioning (in this order; see Table 1 for descriptive statistics, including internal consistency estimates for all measures using Cronbach’s alpha).

Table 1

<table>
<thead>
<tr>
<th>Measures</th>
<th>M (SD)</th>
<th>Cronbach’s α</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control variables</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (years)</td>
<td>43.21 (10.52)</td>
<td>NA</td>
</tr>
<tr>
<td>Sex (female)</td>
<td>62.3%</td>
<td>NA</td>
</tr>
<tr>
<td>SDS score</td>
<td>17.51 (4.35)</td>
<td>.64</td>
</tr>
<tr>
<td>Emotion regulation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ERQ CR subscale score</td>
<td>29.68 (6.30)</td>
<td>.83</td>
</tr>
<tr>
<td>Picture task arousal ratings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Decrease negative</td>
<td>6.38 (1.60)</td>
<td>.82</td>
</tr>
<tr>
<td>View negative</td>
<td>6.85 (1.48)</td>
<td>.84</td>
</tr>
<tr>
<td>View neutral</td>
<td>3.44 (1.46)</td>
<td>.80</td>
</tr>
<tr>
<td>Increase positive</td>
<td>3.23 (1.55)</td>
<td>.73</td>
</tr>
<tr>
<td>View positive</td>
<td>3.15 (1.68)</td>
<td>.84</td>
</tr>
<tr>
<td>Picture task valence ratings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Decrease negative</td>
<td>7.30 (1.06)</td>
<td>.77</td>
</tr>
<tr>
<td>View negative</td>
<td>7.74 (0.83)</td>
<td>.75</td>
</tr>
<tr>
<td>View neutral</td>
<td>4.51 (0.73)</td>
<td>.58</td>
</tr>
<tr>
<td>Increase positive</td>
<td>2.60 (1.24)</td>
<td>.85</td>
</tr>
<tr>
<td>View positive</td>
<td>2.41 (1.15)</td>
<td>.89</td>
</tr>
<tr>
<td>Psychological functioning</td>
<td></td>
<td></td>
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<tr>
<td>PCL-C score</td>
<td>31.32 (10.05)</td>
<td>.89</td>
</tr>
<tr>
<td>BDI-II score</td>
<td>7.28 (6.09)</td>
<td>.86</td>
</tr>
<tr>
<td>SWLS score</td>
<td>24.99 (5.87)</td>
<td>.83</td>
</tr>
</tbody>
</table>

Note. We submitted the valence and arousal ratings to general linear model analyses with cognitive reappraisal (CR) condition (negative decrease, negative view, positive increase, positive view, neutral view) as a within-subjects factor, and age, sex, nationality, and SDS scores as covariates of no interest. These analyses revealed a significant main effects of CR condition for valence, F(2, 31, 111.06) = 15.48, p < .001, ηp2 = .24, and arousal, F(2, 28, 109.45) = 3.17, p = .040, ηp2 = .06. Pairwise comparisons (Fisher’s least significant difference) revealed that negative pictures were more arousing and unpleasant than positive or neutral pictures, and positive pictures were more pleasant than neutral pictures. Moreover, participants demonstrated successful reduction of negative emotions, rating negative pictures as less arousing and unpleasant when instructed to decrease their emotions compared with the view condition. However, participants did not demonstrate successful upregulation of positive emotions; positive pictures were not rated more arousing or pleasant when instructed to increase their emotions. NA = not applicable; SDS = Marlowe–Crowne Social Desirability Scale; ERQ CR = Emotion Regulation Questionnaire Cognitive Reappraisal subscale; PCL-C = Posttraumatic Stress Disorder Checklist, Civilian Version; BDI-II = Beck Depression Inventory–II; SWLS = Satisfaction With Life Scale.
CR use. To evaluate the extent to which participants used CR in everyday life, participants completed the well-validated 10-item ERQ (Gross & John, 2003), which yields a score reflecting the degree to which people habitually use CR (e.g., “When I want to feel less negative emotion, I change the way I’m thinking about the situation”).

Picture task. Participants were asked to regulate their emotional response to negative (disaster-related; e.g., toddler being scanned for radiation), positive (e.g., bride on her wedding day), and neutral (e.g., man washing windows) pictures. The negative pictures were selected from major media outlets. Neutral and positive pictures were selected from the online image source DepositPhotos.

Participants were trained to use CR (instruction: “To change your emotional response, you should change how you THINK about the meaning of the picture”). During training, participants viewed four example pictures each, followed by three different examples of possible cognitive reappraisals, as well as an example view trial. Following CR training, the instructions were shortened to “Please DECREASE/INCREASE your emotional reaction (feel more/less emotional)” and “Please VIEW the picture naturally (do not change your emotional reaction)”.

The CR task was presented in five blocks (three pseudorandom orders) of five trials (decrease/negative, view/negative, view/neutral, increase/positive, and view/positive). Participants rated their experienced arousal (calm-to-exciting) and valence (pleasant-to-unpleasant) using 9-point scales after each trial. Means were computed across trials for each participant within each cell of the design for general linear model (GLM) analysis. Reliability analyses indicated that the condition means were estimated with acceptable internal consistency despite the low number of trials (see Table 1). Scores capturing emotion reactivity (view/negative – view/neutral; view/positive – view/neutral) and CR success (view/neutral – decrease/negative; increase/positive – view/positive) were computed for correlation and regression analyses.

Psychological functioning. To assess psychological functioning, participants completed the Posttraumatic Stress Disorder Checklist, Civilian Version (PCL-C; Weathers, Huska, & Keane, 1991); the Beck Depression Inventory—II (BDI-II; Beck, Steer, & Brown, 1996), modified to exclude the suicidal ideation item; and the Satisfaction With Life Scale (SWLS; Diener, Emmons, Larsen, & Griffin, 1985).

Control variables. To assess the degree to which self-report responses in this study might be impacted by self-presentation concerns, participants also completed the Crowne—Marlowe Social Desirability Scale (SDS; Crowne & Marlowe, 1960). Along with sex, age, and nationality (i.e., American and Japanese), SDS scores were entered as covariates of no interest in all analyses, though repeating the analyses with no covariates did not substantially change the results.

Results

Did Participants React Emotionally and Successfully Implement CR?

To assess emotion reactivity and CR success during the picture task, we submitted the valence and arousal ratings to GLM analyses with CR condition (negative/decrease, negative/view, positive/increase, positive/view, neutral/view) as a within-subjects factor, and age, sex, nationality, and SDS scores as covariates of no interest. As reported in Table 1, these analyses suggested that participants responded emotionally to the pictures; they rated negative pictures as more arousing and unpleasant and positive pictures as more pleasant than neutral pictures.

Moreover, participants demonstrated successful reduction of negative emotions, rating negative pictures as less arousing and unpleasant when instructed to decrease their emotions compared with the view condition. However, participants did not demonstrate successful upregulation of positive emotions. We thus focused on CR success in decreasing negative emotion when testing our hypotheses.

Was Self-Reported CR Use Associated With Better CR Success?

To examine whether CR use based on the ERQ was significantly related to CR success assessed in the picture task, we conducted bivariate correlations between CR use and our measures of CR success. None of the use and success measures correlated (lowest \( p = .28 \)).

Were CR Use and Success Associated With Psychological Functioning?

To investigate whether CR use and success predicted levels of psychological functioning, we computed three linear regressions with BDI-II, PCL-C, and SWLS scores as criterion variables. Age, sex, SDS scores, and nationality were entered as control variables on a first step, negative emotion reactivity (view/negative – view/neutral) was entered on the second step, and CR use and negative CR success (view/neutral – decrease/negative) were entered on the third step.

These analyses revealed that CR use did not significantly predict BDI-II (\( p = .18 \)) or PCL-C (\( p = .76 \)) scores. However, greater negative CR success (valence) was associated with lower self-reported depressive, \( \beta = -3.70, t(43) = -3.10, p = .003 \), and posttraumatic, \( \beta = -5.43, t(43) = -2.82, p = .007 \), symptoms. In addition, greater negative emotion reactivity (valence) was associated with higher depressive, \( \beta = 2.60, t(43) = 2.81, p = .007 \), and posttraumatic, \( \beta = 6.51, t(43) = 4.36, p < .001 \), symptoms (see Figure 1 for partial regression plots). Neither arousal-rated CR success nor emotion reactivity predicted psychological functioning, and none of the CR or emotion reactivity measures predicted satisfaction with life.

1 Participants also completed items assessing Asian and European American values (Butler et al., 2007). These data are not presented, because of high overlap with our nationality groupings. Because our focus in this study was CR, we do not report data on the Emotion Regulation Questionnaire Expressive Suppression subscale.

2 Table 2, available in supplemental material, provides the correlations between these condition means and our measures of psychological functioning.

3 To investigate whether nationality moderated the relationship between CR success and Beck Depression Inventory—II (BDI-II) and Posttraumatic Stress Disorder Checklist, Civilian Version (PCL-C), scores, we repeated these regressions, removing nationality as a control variable on the first step and, instead, including the interaction of nationality and CR success on the fourth step. Nationality did not interact with CR success to predict either BDI (\( p = .94 \)) or PCL-C (\( p = .31 \)) scores.
Discussion

In the aftermath of the March 2011 earthquake, tsunami, and nuclear crisis in Japan, greater emotional reactivity to disaster-related images and success using CR to regulate these emotions predicted concurrent symptoms of psychopathology in participants still living with the effects of the disasters. Higher emotional reactivity was associated with poorer functioning and better CR success associated with better functioning.

We did not replicate past research linking CR use and psychological functioning following trauma exposure (e.g., Boden et al., 2013). Consistent with Sheppes et al.’s (2012) theoretical model, the emotional intensity associated with close temporal and spatial proximity of the crisis may have altered the typical CR—functioning relations. Frequently choosing CR may be adaptive for everyday situations, but not when emotions become extremely intense. Future investigations should evaluate whether resource-sparing strategies (e.g., distraction) may be better associated with psychological functioning under these circumstances.

Although CR use was not associated with psychological functioning, our results provide one of the first empirical demonstrations that
higher CR success on a performance-based task is linked to better psychological functioning following a trauma. Prospective research investigating multiple channels of the emotional response (i.e., physiological response and expressive behavior) is needed to elaborate on this intriguing but preliminary finding. If replicated in such designs, this would provide support for the idea that skill at decreasing negative emotions by changing one’s thoughts about the event is associated with better immediate outcomes in potentially traumatic circumstances. This is consistent with multiple theoretical models of emotions and their management (e.g., Beck, 1975; Gross & John, 2003), but has not been demonstrated before in a performance-based task in a recently trauma-exposed sample.

In addition to CR success, greater ratings of unpleasantness to disaster-related images uniquely predicted higher levels of post-traumatic and depressive symptoms. Practically speaking, this suggests that our picture task validly indexed emotional reactivity. This finding is also consistent with studies demonstrating that psychophysiological reactivity to trauma cues is associated with posttraumatic symptoms (Pitman et al., 2012). The current work conceptually replicates and extends this association in a sample with relatively low symptomatology, supporting arguments that we should conceptualize symptoms of mental distress in a continuous rather than a categorical framework (Insel et al., 2010).

Our measures of CR use and CR success did not correlate significantly, whereas the few studies that have evaluated both in the same participants have demonstrated a modest but significant relationship (e.g., McRae, Gross, et al., 2012). However, there are good reasons to separate emotion regulation frequency from success (McRae, 2013), and the absence of strong associations in the present study and the modest nature of associations in other studies would suggest that doing something frequently does not necessarily mean doing it well. Echoing McRae (2013), we suggest that researchers measure both frequency and success whenever possible, because they may have different functional consequences.

This research has several notable strengths. We studied an ecologically valid sample of culturally diverse men and women still living with the effects of the crisis. In addition, we demonstrated that it is both feasible and conceptually lucrative to administer a performance-based task assessing individual differences in emotion reactivity and CR success online. The task was relatively brief and yielded signs of both valid and reliable assessment. Of import, the task revealed that emotional reactivity and successful emotion regulation each contribute unique variance to concurrent symptomatology in the wake of a potentially traumatic event.

This study also has several limitations, thus, our conclusions are tentative. For one, all of our measures were self-report and correlational. Although the inclusion of a measure of social desirability bias partially mitigates the self-report weakness, it is nonetheless true that this is not a precise measure of experimental demand, and these self-reports could be subject to a number of other biases. Moreover, the correlational nature of these data prevents us from making conclusions about causal relationships. In addition, to minimize participant burden and maximize recruitment, we used a limited number of trials and, given the web-based assessment, had no experimental control over the circumstances in which participants completed the picture task and questionnaires. That participants rated their emotional response to the conditions largely as expected and that we observed acceptable to high levels of internal consistency mitigates these concerns to some degree. Finally, for several reasons, we do not report how these CR and functioning relationships varied by culture, which extensive research has suggested they should (e.g., Matsumoto, Yoo, Nakagawa, & Sanae Multinational Study of Cultural Display Rules, 2008). However, we did control for cultural background in all of our analyses.

Conclusion

Our results provide evidence that, in the months after exposure to a potential trauma, emotional reactivity to reminders of the event is linked with poorer functioning, and demonstrated success implementing CR is linked with better functioning. CR use, by contrast, was not linked with functioning in this context. Overall, these results underscore the potential importance of situational intensity as a moderator of CR and psychological functioning relationships.

References


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