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Emotion Regulatory Flexibility Sheds Light on the Elusive Relationship Between Repeated Traumatic Exposure and Posttraumatic Stress Disorder Symptoms

Einat Levy-Gigi[1,2], George A. Bonanno[3], Alla R. Shapiro[1], Gal Richter-Levin[1,4,5], Szabolcs Kéri[2,6,7], and Gal Sheppes[8]

[1]Institute for the Study of Affective Neuroscience, University of Haifa, Israel; [2]Nyíro˝ Gyula Hospital, National Psychiatry and Addiction Center, Budapest, Hungary; [3]Department of Counseling and Clinical Psychology, Teachers College, Columbia University; [4]Department of Psychology, University of Haifa, Israel; [5]Sagol Department of Neurobiology, University of Haifa, Israel; [6]Department of Cognitive-Science, Budapest University of Technology and Economics, Hungary; [7]Department of Physiology, Faculty of Medicine, University of Szeged, Hungary; and [8]School of Psychological Sciences, Tel-Aviv University, Israel

Abstract

Conventional wisdom suggests that repeated traumatic exposure should strongly relate to increased posttraumatic stress disorder (PTSD) symptoms. However, research with first responders, who are repeatedly exposed to traumatic events, finds inconsistent links to PTSD. Although recent studies explored associations between general self-reported emotion-regulation and PTSD, the present study was the first to test the moderating role of regulatory choice flexibility, the ability to choose regulatory options that suit contextual demands. A total of 69 firefighters with differing duty-related traumatic-exposure were tested on an innovative performance-based regulatory choice flexibility paradigm and evaluated for PTSD symptoms using clinical interviews. We predicted and found that firefighters with low but not high regulatory choice flexibility showed a significant positive correlation between traumatic exposure and PTSD symptoms. This moderation was specific to PTSD symptoms and contributed above and beyond other well-established correlates of PTSD. The results suggest that regulatory choice flexibility can intersect the deleterious link between traumatic exposure and PTSD symptoms.

Keywords

PTSD, trauma, exposure, emotion regulation, choice, flexibility

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We use idioms such as "a drop that makes a cup overflow" and "a last straw that breaks the camel's back" to convey our strong intuition that repeated encounters with adverse events gradually lead to negative outcomes. One central, and seemingly axiomatic, example in the field of clinical science is the relationship between repeated traumatic exposure and increased posttraumatic stress disorder (PTSD) symptoms. It is surprising, however, that empirical studies on first responders to trauma fail to find a consistent link between these two factors (e.g., Chang, Lee, Connor, Davidson, & Lai, 2008; Meyer et al., 2012). The aim of the present study was to test the moderating role of emotion regulatory choice flexibility to explain the puzzling inconsistent link between duty-related repeated traumatic exposure and PTSD symptoms.

The elusive relationship between repeated traumatic exposure and PTSD symptoms has attracted focal attention over the years (Galatzer-Levy et al., 2013; Marmar et al., 2006; Seal et al., 2009). The most intuitive

Corresponding authors:
Einat Levy-Gigi, University of Haifa, Mount Carmel, Haifa 3498838 Israel
E-mail: levygigie@gmail.com

Gal Sheppes, Tel- Aviv University, Israel.
Email: sheppes@post.tau.ac.il

hypothesis suggests a strong positive relationship between these two constructs. However, studies with first responders that are routinely exposed to traumatic events do not find consistent links between duty-related traumatic exposure and PTSD. Specifically, although several studies found a positive correlation between traumatic exposure and posttraumatic stress symptoms (e.g., Chang et al., 2008; Wagner, Heinrichs, & Ehlert, 1998), other studies did not find such direct effects (e.g., Beaton, Murphy, Johnson, Pike, & Corneil, 1999; Corneil, Beaton, Murphy, Johnson, & Pike, 1999; McFarlane & Alexander, 1989; Meyer et al., 2012). Moreover none of these studies have directly isolated duty-related traumatic exposure that is central to first responders' occupation, from non-duty-related traumatic exposure that is more general in nature.

This inconsistent link between repeated exposure and PTSD suggests that important moderators may be involved. In the present study we focused on one promising candidate that involves the way individuals regulate their negative emotional reactions (for meta-analysis and review, see Gross, 2014; Koole, 2009; Webb, Miles, & Sheeran, 2012). Specifically, an increasing set of studies shows that a self-reported maladaptive emotion regulation profile is associated with PTSD symptomatology (e.g., Ehring & Quack, 2010; Frewen & Lanius, 2006). Although important, these studies did not measure emotion regulation as a moderator of the relationship between repeated traumatic exposure and PTSD symptoms.

More important, these prior emotion regulation studies adopted a traditional view within the field of trauma and PTSD that tended to define certain strategies that involve *engagement* with emotional information processing or meaning making (e.g., reappraisal) as being "all good" and other strategies that involve *disengagement* from emotional information processing or meaning making (e.g., distraction) as being "all bad" (for a relevant discussion, see Coifman, Bonanno, Ray, & Gross, 2007; for reviews, see Aldao, Nolen-Hoeksema, & Schweizer, 2010; Bonanno, 2013; Park, 2010). The problem with this approach is that it does not take into account the notion that regulatory strategies may differ in their outcome in different contexts (for reviews, see Aldao, 2013; Bonanno & Burton, 2013; Bonanno, Papa, Lalande, Westphal, & Coifman, 2004; see Gross, 2014; Sheppes, 2014; Troy & Mauss, 2011). In plain words, a regulatory strategy that proves adaptive in one context can prove maladaptive in a different context.

Therefore, an adaptive regulatory profile is a flexible one. We define regulatory choice flexibility as the ability to flexibly choose between available regulatory options in a manner that suits differing contextual demands (Sheppes, 2014; Sheppes & Levin, 2013). In a series of recent studies in healthy individuals, we provided the first empirical evidence for the notion that regulatory choice flexibility represents an adaptive response to negative emotional challenges. Specifically, we developed a novel performance-based paradigm that tests how individuals choose between engagement or disengagement regulatory options when dealing with emotional contexts that vary in their intensity (Sheppes et al., 2014; Sheppes, Scheibe, Suri, & Gross, 2011). The disengagement regulatory option was *distraction* that involves directing attention away from emotional information by producing independent neutral thoughts. The engagement regulatory option was *reappraisal* that involves attending to emotional information but reinterpreting its negative meaning. The central assumption was that healthy individuals would be able to flexibly choose regulatory options that effectively modulate low and high emotional intensity events.

Previous studies (e.g., Schönfelder, Kanske, Heissler, & Wessa, 2014; Shafir, Schwartz, Blechert, & Sheppes, in press; Sheppes & Meiran, 2007, 2008) found that under low emotional intensity, distraction and reappraisal can reduce negativity, but only reappraisal allows for emotional processing, which is important for long-term adaptation. However, high emotional intensity distraction, which blocks emotional information processing, more successfully reduced negativity relative to reappraisal. Accordingly, these studies predicted and found that healthy individuals behave in ways that are consistent with the effectiveness of the strategies. Specifically, they flexibly switched their regulatory choice from preferring reappraisal under low intensity situations to preferring distraction under high intensity situations (Sheppes et al., 2011; Sheppes et al., 2014).

Despite the adaptive role regulatory choice flexibility plays in healthy individuals, and despite an impaired general emotion regulation ability in individuals with PTSD, the present study was the first to test the central role regulatory choice flexibility may have in explaining the elusive link between repeated traumatic exposure and PTSD symptoms.

To that end, in the present study we administered our performance-based regulatory choice flexibility paradigm to a unique population of active-duty firefighters who have been exposed to different levels of traumatic events during their years of service, and we assessed PTSD symptoms using clinical interviews. Evaluating regulatory choice flexibility using a well-established performance-based paradigm strengthens potential conclusions relative to prior findings that used self-report measures that are prone to multiple biases.

Furthermore, to examine the robustness and uniqueness of our regulatory choice flexibility moderator, we tested its influence above and beyond other established correlates of PTSD symptoms. Specifically, we focused on

IQ, depressive symptoms, and general traumatic life events, which have been previously associated with PTSD symptoms (e.g., Breslau, Chen, & Luo, 2013; Brewin, Andrews, & Valentine, 2000; Kolkow, Spira, Morse, & Grieger, 2007; Orr et al., 2012; Shalev, Peri, Canetti, & Schreiber, 1996), but that to the best of our knowledge were rarely examined as moderators between repeated traumatic exposure and PTSD symptoms.

Our main premise was that regulatory choice flexibility would moderate the relationship between repeated traumatic exposure and PTSD symptoms. Specifically, we predicted that among individuals with low but not high regulatory choice flexibility, repeated duty-related traumatic exposure would be related to increased PTSD symptoms. We further anticipated that this relationship would be evident even when controlling for depressive symptoms, general traumatic life events, and IQ levels that are established correlates of PTSD.

Methods and Materials

Participants

A total of 70 active-duty firefighters (age M = 36.66 years, SD = 9.06; education M = 12.39 years, SD = 1.09) who serve in five fire stations in southern Israel (time in service range = 1–37 years) volunteered to participate in the study with high rates of enrollment (~95%; Table S1 in the Supplemental Material available online presents a detailed description of the sample). One participant decided not to participate following initial task instructions. Therefore, the final sample included 69 firefighters. The participating fire stations are all located within a radius of less than 24 miles, in a region of similar topography and activity level. Assignment to the different stations across the country is made at the end of the training period. It is important to note that firefighters in different stations receive similar salaries and participate in similar tasks. Moreover, as part of the fire service policy, once in 1 to 2 years there is a rotation between firefighters from different stations. Therefore, there is no reason to believe that firefighters in our study have different characteristics than their peers. Finally, according to the fire and rescue archive the work load across all stations is relatively similar, due to the joint work in large-scaled events and the similar ratio between number of firefighters and number of emergency events per month. Exclusion criteria for all participants were current or past diagnosis of Axis I psychopathology other than PTSD; risk of suicidal/homicidal ideation; any substance dependence or abuse within the past 6 months; a history of concussion or other clinically significant head injury including loss of consciousness for over 10 min; or a history of neurological disorders such as epilepsy, multiple sclerosis, stroke, or encephalitis.

Measures

Emotional regulation choice task. In this task participants undergo an initial training in employing and choosing between distraction and reappraisal. Understanding how to employ both strategies was evident in all participants. In the actual choice phase of the experiment participants are presented with 60 negative emotional pictures from the International Affective Picture System (IAPS; Lang, Bradley, & Cuthbert, 2008). Half of the pictures are of low negative intensity (M arousal = 5.1; M valence = 2.8), and the other half are of high negative intensity (M arousal = 6.4; M valence = 1.81; Fig. S2 in the Supplemental Material available online presents examples of the stimuli). Categorization to low and high intensity is based on significant differences in IAPS normative data and previous findings showing that these two intensity categories yield differential regulatory choice patterns (Sheppes et al., 2011; Sheppes et al., 2014). Pictures' general content is roughly matched across the low and high intensity categories. An experimental trial involves a brief (500 ms) preview of each emotional stimulus followed by a choice screen where participants indicate whether they wish to select reappraisal or distraction (keyboard mapping is counterbalanced across subjects). Following their choice, the emotional picture reappears for an extended duration (5000 ms) and participants implement their chosen strategy. Although prior studies have already established that participants implement the strategies they indicate choosing (Sheppes et al., 2011), in the present study we further verified regulatory choice adherence by asking half of the participants to type one sentence, which describes how they implemented each strategy following every third trial. A judge who was blind to participants' choices (i.e., participants' button presses) coded the sentences for reappraisal and distraction. As expected, levels of agreement approached a perfect score (99.6%). As was mentioned earlier, the robust finding in this paradigm is that healthy individuals behave in ways that are consistent with the effectiveness of the strategies. Specifically, they prefer choosing reappraisal for low intensity pictures and prefer choosing distraction for high intensity pictures. Therefore, adaptive regulatory choice flexibility can be viewed as a maximal switch in regulatory preference from choosing distraction under high intensity pictures to selecting reappraisal (or not choosing distraction) under low intensity. Regulatory choice flexibility is calculated by subtracting the proportion of distraction choice in the low intensity pictures (which reflects maladaptive behavior) from the proportion of distraction choice in the high intensity pictures (which reflects adaptive behavior). Please note that the reported data are centered, and higher scores represent higher flexibility.

Table 1. Estimated Number of Exposures to Different Potential Traumatic Events per Participant per Year

Type of event	Estimated mean number of potential traumatic events per participant
Car fires	60
Building fires	82
Factory fires	3
Bush fires	516
Car accidents	39
Spilling of toxic/ combustion substances	2
Gas leak	36
Breaking and entering due to fear of a lost life	83
Missile attacks	97–365[a]
Attempted suicide	6
Animal rescue mission	6
Rescuing trapped people	11

Note: We sampled the last 10 years of the fire and rescue service archive records of the five stations participated in this study and calculated the mean number of events per year. Because all firefighters in this study work in 24- to 48-hr shifts (24 hr at work followed by 48 hr at home), we divided the number of events by 3, to provide an estimation of the number of events experienced by each participant per year. Please note that the actual traumatic exposure might be higher because all firefighters are called into action in large-scale events.

[a]Data on missile attacks refers to the last 7 years only. The range of events is due to significant differences between quiet years (3 years out of 7) and years of emergency circumstances (4 years out of 7). All participants in the study experienced at least one year of extensive missile attacks.

To ensure the reliability of the emotion regulation choice task, we calculated two types of reliability indices. First, we were interested in the internal response consistency for each emotional intensity level. To that end, we applied the Kuder-Richardson 20 index (KR-20) that is used for measures with dichotomous choices (i.e., the choice between distraction and reappraisal). The index was calculated separately for each of the emotional intensities. In addition 95% CI for KR-20 was estimated by a bootstrapping procedure with 1,000 iterations. The reliability for low emotional intensity was KR-20 = 0.81 (95% CI = 0.75, 0.87) and for high emotional intensity was KR-20 = 0.78 (95% CI = 0.73, 0.83). These results indicate good internal consistency of the ER choice task. In addition, we were interested in the reliability of the flexibility measure that was used in the present study (i.e., distraction under high intensity minus distraction under low intensity). Therefore, we created a program that takes the following steps: It randomly divides the items in each emotional intensity into two halves, computes average distraction choices scores for each half, and creates difference scores by subtracting the distraction average of each half of low emotional intensity from each half of the high emotional intensity. Finally, it estimates the intraclass correlation (ICC) between the two difference scores. In addition 95% CI for KR-20 was estimated by a bootstrapping procedure with 1,000 iterations. The analysis revealed ICC = 0.80 (95% CI = 0.74, 0.87), indicating good internal consistency of our flexibility index.

Measures of traumatic exposure. Our main goal was to evaluate the accumulative symptomatic effect of repeated traumatic exposure during active service. Such evaluation is challenging because it requires an effort to isolate traumatic events that occur during active service and hence are more likely to be experienced by first responders, from general traumatic events that may be experienced by any individual, independent of his or her specific occupation. To provide adequate estimation of repeated traumatic exposure during active service we concentrated on two types of measures. First, similar to several other studies we used years of service as a proxy of repeated duty-related traumatic exposure (e.g., Meyer et al., 2012; Regehr, Hill, Knott, & Sault, 2003; Shepherd & Wild, 2014; Wagner et al., 1998). It is important that, to further validate this measure in the present study, we gained access to the fire and rescue service archive and empirically estimated the type and average number of traumatic events experienced by our participants per service year (see Table 1). In addition to seemingly less life-threatening events (e.g., bush fires), Table 1 clearly shows that each of our participants was exposed to multiple major life-threatening events (e.g., missile attacks, car accidents, building fires, rescuing trapped people, breaking and entering into locked residence places due to concern for human life) each year. Therefore, although firefighters who served longer have been exposed to more personally life-threatening events than those who serve less, those who served less were also exposed to severe life-threatening events. Furthermore, as can be seen in Table 1, each firefighter in our sample was exposed to an annual average of hundreds of duty-related traumatic events. Level of duty-related traumatic exposure was further supported by the clinical interviews, where participants estimated a repeated exposure to multiple traumatic events per year. These data converge with the notion that an increased number of years in service, results in a substantial accumulation of potential duty-related traumatic event exposure. Second, to provide discriminant information regarding our years of service measure we also administered the Traumatic Events Questionnaire (range = 0–9, M = 1.81, SD = 1.95) to control for type and occurrences of traumatic events that are not part of active service (Vrana & Lauterbach, 1994). Specifically, the Traumatic Events Questionnaire

mainly includes types of traumatic exposure that are unrelated to active duty (e.g., death of a family member, history of domestic violence). In addition, this measure concentrates on traumatic event occurrences during childhood and adolescence, which precede the active-duty period of the participants of our sample, in addition to traumatic occurrences during adulthood. In the analyses we report we use an innovative approach that emphasizes a conceptual discrimination between duty-related traumatic exposure and general traumatic life events and provide for the first time empirical evidence for the independence of these two types of measures as well as for the contribution of years of service measure above and beyond general traumatic exposure.

SCID-CV. A well-trained PhD-level clinical psychologist interviewed all participants. Participants were assessed with the Structured Clinical Interview for the Diagnostic and Statistical Manual for Mental Disorders–Fourth Edition (*DSM-IV*) Axis I Disorders (SCID-CV; First, Spitzer, Gibbon, & Williams, 1996) to control for psychopathologies other than PTSD.

SCID–NP–PTSD. We interviewed the participants using the SCID–NP–PTSD module (Spitzer, Williams, Gibbon, & First, 1990), which measures the existence of symptoms during the past 4 weeks. Four participants reached a full diagnosis of PTSD; the rest of the participants showed various levels of PTSD symptoms (range = 17–51; score of the whole sample $M = 25.8$, $SD = 8.37$). In the present study, continuous levels of PTSD symptoms were used as our dependent measure. Previous studies reported strong correlations between the SCID-NP-PTSD and other commonly used continuous measures of PTSD, including the Clinician-Administered PTSD Interview (Blake et al., 1995; Foa & Tolin, 2000).

Additional control measures. To control for the influence of additional measures that have been previously associated with PTSD symptoms, participants also completed the revised version of the Beck Depression Inventory (BDI-II; Beck, Steer, & Brown, 1996; score of our sample $M = 5.77$, $SD = 7.65$) and the Wechsler Adult Intelligence Scale–III (WAIS-III) Vocabulary subtest (Wechsler, 1997; score of our sample $M = 8.58$, $SD = 1.92$). Many studies have found associations between level of IQ (Breslau et al., 2013; Orr et al., 2012) and depressive symptoms (Kolkow et al., 2007; Levy-Gigi et al., 2012; Levy-Gigi, Richter-Levin, & Kéri, 2014; Orr et al., 2012; Shalev et al., 1996) and PTSD symptoms. In the current study we wished to ensure that the moderating role of choice flexibility is meaningful above and beyond individual differences in these variables.

Results

Zero-order correlations between all measures are reported in Table 2. We found significant correlations between levels of PTSD symptoms and between depression symptoms, general traumatic life events, and years of service (which is our main measure of repeated duty-related traumatic exposure). Finding that each of the traumatic exposure measures was positively associated with posttraumatic symptoms supports their conceptual relationship to PTSD. In addition, the fact that there was no association between general traumatic life events and our repeated duty-related traumatic exposure confirms our expectations regarding their independence.

To examine our main prediction regarding the moderating role of regulatory choice flexibility on the relationship between repeated duty-related traumatic exposure and PTSD symptoms, we employed Hayes's (2013) PROCESS macro using 5,000 bootstrap resampling for calculation of confidence intervals (Model 1; for the advantages of using this macro, see Hayes, 2009). Levels of depressive symptoms, general traumatic life events, and IQ scores served as the control variables. Repeated traumatic duty exposure, regulatory choice flexibility, and PTSD symptoms were treated as independent variable, moderator and outcome, respectively.

The estimate coefficients of the main findings and their significance levels are described in Table 3. The general model was significant, $R^2 = .48$, $F(6, 62) = 9.49$, $p < .001$. Core analyses revealed a significant main effect of depressive symptoms and general traumatic life events. It is important that, consistent with our hypothesis, there was a significant interaction between repeated duty-related traumatic exposure and regulatory choice flexibility. This interaction accounted for an additional 4.4% of the variance above and beyond the variance explained by the main effects and by depressive symptoms, general traumatic life events, and IQ levels, which are established correlates of PTSD. The pattern of our results remained the same even after excluding the three women who participated in the study, $R^2 = .49$, $F(6, 59) = 9.34$, $p < .001$.

To interpret the interactive effect of repeated duty-related traumatic exposure and regulatory choice flexibility on PTSD symptoms we computed bootstrapping confidence intervals (95%) evaluating the magnitude of the relationship between repeated duty-related traumatic exposure and PTSD symptoms for individuals with low (–1 *SD*) and high regulatory choice flexibility (+1 *SD*). The results are depicted in Figure 1. As expected, the results revealed a significant positive relationship between repeated duty-related traumatic exposure and PTSD symptoms for individuals with low regulatory choice flexibility, $\beta = .26$, 95% CI = .06, .46, $t(68) = 2.69$, $p < .01$. However, no relationship between repeated

Table 2. Zero-Order Correlations Between Regulatory Choice Flexibility, PTSD Symptoms Depressive Symptoms, IQ Scores, General Traumatic Life Events, and Repeated Duty-Related Traumatic Exposure

Variable	1	2	3	4	5	6
1. Regulatory choice flexibility	1	−.106	−.026	.003	−.064	−.124
2. PTSD symptoms	−.106	1	.603**	.003	.351**	.319**
3. BDI-II	−.026	.603**	1	.062	.275*	.277*
4. IQ	.003	.003	.062	1	.143	−.255*
5. Non-duty-related general traumatic life events	−.064	.351**	.275*	.143	1	.004
6. Duty-related traumatic exposure	−.124	.319**	.277*	−.255*	.004	1

Note: BDI-II = Beck Depression Inventory–II; PTSD = posttraumatic stress disorder. IQ scores as estimated by the Wechsler Adult Intelligence Scale–III Vocabulary subtest.
*$p < .05$. **$p < .001$.

duty-related traumatic exposure and PTSD was found among individuals with high regulatory choice flexibility, β = −.08, 95% CI = −.32, .17, $t(68) = -.62$, *ns*. These results indicate that among low (but not high) regulatory choice flexibility individuals an increase in duty-related traumatic exposure is associated with enhanced PTSD symptomatology. Additional follow-up analyses further demonstrate that among low-exposure individuals (–1 *SD*) there were no significant differences in PTSD symptoms between those with low (–1 *SD*) versus high (+1 *SD*) regulatory choice flexibility, $t(65) = -1.27$, *ns*. However, among high exposure individuals (+1 *SD*) those with poor regulatory flexibility had significantly more PTSD symptoms compared with those with high regulatory flexibility, $t(65) = 2.78$, $p < .01$. Finally, we found a significant difference in mean PTSD symptoms between individuals with high flexibility in conditions of low exposure and those with low flexibility in conditions of high exposure, $t(65) = 2.31$, $p < .05$.

Two additional points are worth noting. First, the interaction between repeated duty-related traumatic exposure and regulatory choice flexibility was not restricted to a model that includes depressive symptoms, general traumatic life events, and IQ scores as control variables. Specifically, it was also evident when these control variables were not included (Table 3), accounting for 6.3% of the variance above and beyond the variance explained by the main effects. Second, given our conceptual focus on trauma, it was important to show that the interaction between regulatory choice flexibility and repeated traumatic duty exposure was specific to PTSD symptoms and not to depressive symptoms, especially given the high correlation between these two pathologies in our sample. To that end, we ran a similar analysis to the aforementioned main analysis, with the exceptions that depressive symptoms served as the dependent variable and PTSD symptoms were entered as a control variable. In this analysis there was no sign of an interaction

Table 3. Estimated Coefficients, Standard Errors, and 95% Confidence Intervals for Control, Independent, and Moderator Variables in the Model Predicting PTSD Symptoms

				95% confidence interval	
Variable	*B*	*SE*	*t* value	Low	High
Control variables					
Depressive symptoms	0.54	0.11	4.95**	0.32	0.76
General traumatic life events	0.84	0.42	2.03*	0.01	1.67
IQ scores	−0.26	0.43	−0.60	−1.11	0.60
Predictors					
Duty-related traumatic exposure	0.09	0.08	1.13	−0.07	0.26
Regulatory flexibility	−1.64	3.38	−0.48	−8.41	5.12
Duty-Related Traumatic Exposure × Regulatory Choice Flexibility	−0.74	0.32	−2.29*	−1.39	−0.09
Duty-Related Traumatic Exposure × Regulatory Choice Flexibility (without control variables)	−0.24	0.39	−2.21*	−1.64	−0.08

Note: *B* = unstandardized estimated coefficient; PTSD = posttraumatic stress disorder; *SE* = standard error. Depressive symptoms as measured by the Beck Depression Inventory–II (BDI-II). General traumatic life events as measured by the Traumatic Events Questionnaire. IQ scores as estimated by the Wechsler Adult Intelligence Scale–III Vocabulary subtest.
*$p < .05$. **$p < .001$.

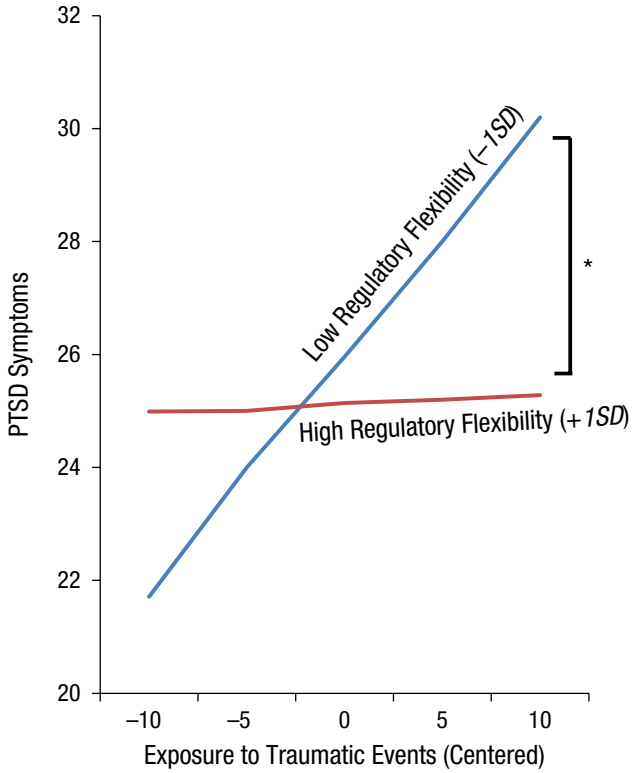

Fig. 1. PTSD symptoms, as measured by the SCID–NP–PTSD, across a 20-year (centered) range of repeated traumatic exposure as a function of regulatory choice flexibility (low vs. high).

between regulatory choice flexibility and duty-related traumatic exposure, $t(68) = 1.27$, *ns*.

Discussion

The aim of the present study was to explain the elusive relationship between repeated duty-related traumatic exposure and PTSD symptoms in a unique population of active-duty firefighters, by testing the moderating role of regulatory choice flexibility. Prior studies reported mixed findings regarding the relationship between traumatic exposure and PTSD symptoms (Beaton et al., 1999; Chang et al., 2008; Corneil et al., 1999; McFarlane & Alexander, 1989; Meyer et al., 2012; Wagner et al., 1998).

In the present study we predicted and found that the association between duty-related traumatic exposure and PTSD symptoms was moderated by regulatory choice flexibility. Specifically, although individuals with poor regulatory choice flexibility displayed elevated levels of PTSD symptoms over repeated duty-related traumatic exposure, individuals who could flexibly regulate their choice of strategy showed no changes in PTSD symptoms over repeated duty-related exposure to trauma. The interactive relationship between duty-related traumatic exposure and regulatory choice flexibility was significant even when we controlled for individual differences in levels of depressive symptoms, exposure to other general traumatic life events and IQ scores. Moreover, the interaction between regulatory choice flexibility and traumatic exposure showed considerable level of specificity as it was associated with PTSD symptoms and not with depressive symptoms.

Our findings highlight the important role of regulatory choice flexibility for PTSD symptomatology. Prior studies have shown that general emotion regulation deficits were associated with PTSD symptomatology (e.g., Ehring & Quack, 2010; Frewen & Lanius, 2006). Although clearly important, these studies reflect an early dichotomous view according to which some regulatory options are inherently adaptive whereas other regulatory options are inherently maladaptive (see Bonanno & Burton, 2013, for a review). By contrast, more current approaches highlight the importance of regulatory choice flexibility, suggesting that adaptive coping is the result of flexibly choosing regulatory options that fit differing situational demands (e.g., Aldao, 2013; Bonanno & Burton, 2013; Bonanno et al., 2004; for reviews, see Aldao, Sheppes, & Gross, in press; Sheppes, 2014; Sheppes, Suri, & Gross, in press; Troy & Mauss, 2011). In that respect, our study is the first to show that regulatory choice flexibility may be particularly important for buffering the deleterious PTSD consequences of repeated exposure to traumatic events during active-duty service.

How might regulatory choice flexibility moderate the relationship between traumatic exposure and PTSD symptoms? Individuals' emotional life is composed of events that vary on several dimensions including their intensity. At the same time, possible regulatory options are also variable, with strategies that involve engaging or disengaging with emotional events. It seems that being able to match between core characteristics of regulatory options and of emotional events may function as a general trait that can promote adaptation. Specifically, there are some highly adverse emotional situations, including potentially traumatic events, where choosing to disengage may actually promote adaptation (for reviews, see, e.g., Park, 2010). However, applying disengagement regulatory options to emotional events that are less intense and thus tolerable may function as a risk factor for the development of anxiety disorders (see, e.g., Campbell-Sills & Barlow, 2007, for a review). Accordingly, it may be that in these tolerable events choosing to engage with emotional information for example, by meaning making, can be more adaptive.

Moving to firefighters one may still ask whether it is adaptive or even possible to disengage from intense emotional events that define emergency scenes. Congruent with our claim that engagement with emotional information should not be considered

unconditionally adaptive, we suggest that emergency scenes may similarly pose differing demands. These demands may also require flexibly choosing between engagement and disengagement. For example, consider an emergency scene that includes a building in flames with trapped burn victims. For the firefighter who is responsible for putting out the fire, it is probably adaptive to fully disengage his or her attention from the burn victims and to fully attend the flames. Note that we do not claim that disengagement is always adaptive in high intensity situations. Rather there are many intense situations where somewhat counterintuitively disengagement can be adaptive.

From a methodological point of view, relative to prior findings that mainly used self-report measures that are prone to multiple biases, in the current study we evaluated regulatory choice flexibility by using a well-established performance-based paradigm (Sheppes et al., 2011). Furthermore, our paradigm was highly sensitive as it allowed predicting continuous levels of PTSD symptoms. This enhanced sensitivity allowed us to refrain from relying on the crude dichotomic PTSD diagnostic criteria. Our approach represents a general shift in the field and adds to the growing body of research that looks at clinical disorders as continuous rather than dichotomous entities (e.g., Cuthbert & Kozak, 2013; Insel et al., 2010).

Our results add to the growing understanding that individuals with PTSD symptoms may show a broad deficit to flexibly modify their responses according to changing contextual demands (e.g., Acheson, Gresack, & Risbrough, 2012; Brewin, Gregory, Lipton, & Burgess, 2010; Levy-Gigi et al., 2012; Levy-Gigi et al., 2015; Levy-Gigi & Kéri, 2012; Maren, Phan, & Liberzon, 2013). For example, Levy-Gigi and Kéri (2012) found that individuals with PTSD were impaired when asked to flexibly adapt their visual attention to changing contextual demands. Levy-Gigi and colleagues (2015) have found that although individuals with and without PTSD were equally able to learn that a specific context has a negative outcome, individuals with PTSD failed to learn that the same context is associated with a positive outcome when presented later, as part of a different experimental phase. This inappropriate contextual processing significantly correlated with continuous levels of PTSD symptoms.

The current study has several limitations. First, although our regulatory choice flexibility measure moderated the relationship between duty-related traumatic exposure and PTSD symptoms, its underlying mechanisms should be further explored in future studies. Specifically, impaired regulatory choice flexibility can be the result of inflexible affective responding to stimuli of different intensities, or due to inflexible regulatory choices to emotional stimuli (see Gross, Sheppes, & Urry, 2011, for a review). Although the present study cannot completely determine between these two options, there are hints against the inflexible affective responding hypothesis. Specifically, one manifestation of inflexible affective responding that is typical in PTSD involves overly intense emotional reactions to aversive stimuli (Brohawn, Offringa, Pfaff, Hughes, & Shin, 2010; Stevens et al., 2013). Inflexible, overly intense affective responding is expected to be associated with very high overall levels of distraction (Sheppes et al., 2011; Sheppes et al., 2014), which is one form of regulatory inflexibility. To test this alternative explanation we repeated our core analyses where we replaced the regulatory choice flexibility score with overall distraction selection. Results showed that overall levels of distraction did not moderate the relationship between exposure time and PTSD symptoms, $t(68) = 0.26$, *ns*.

A second limitation relates to the interpretation of our traumatic exposure index, namely years of service. Although, this measure has been used in several other studies (e.g., Prati et al., 2012; Regehr et al., 2003; Shepherd & Wild, 2013; Wagner et al., 1998), several additional efforts were made in the present study to validate its relation to repeated duty-related traumatic exposure. First, we obtained estimates of actual annual rates of traumatic events that firefighters in the current sample were exposed to. Second, we showed that our measure of duty-related traumatic exposure interacted with regulatory choice flexibility to explain PTSD symptoms above and beyond general traumatic life events. Despite these efforts, it should be noted that years of service is still a rather crude measure that cannot be deconstructed to include only accumulative traumatic exposure. One example of an inherent correlation is between years of service and age. Given the multicollinearity between the two factors, there is no clear way to statistically tease the two factors apart as any analysis would not provide a correct estimate of the role of each predictor. At the same time, it is important to mention that there is no clear evidence that age is a risk factor for PTSD with a majority of studies that report no effect of age on PTSD in the general population (e.g., Bryant, Harvey, Guthrie, & Moulds, 2003; Chan, Air, & McFarlane, 2003; Galea et al., 2003; Irish et al., 2011; for a review, see Heron-Delaney, Kenardy, Charlton, & Matsuoka, 2013; but see Ditlevsen & Elklit, 2010) as well as in first responders (e.g., Fullerton, Ursano, & Wang, 2004; Marmar et al., 2006; Razik, Ehring, & Emmelkamp, 2013; Wang et al., 2011).

A third limitation relates to the size of the sample. One potential influence of our limited sample size is that in the present study we were not able to detect a relationship between IQ and PTSD that was observed in prior studies (Brandes et al., 2002; Vasterling et al., 2002). In addition, given that higher IQ is generally regarded as a

protective factor, it is surprising that there was no association between IQ and regulatory choice flexibility. It is important that although all firefighters need to fulfill certain criteria to be accepted for training, the mean and variability of IQ scores in our sample (as estimated by the WAIS-III Vocabulary subtest) were quite similar to the general population. Hence it seems that the observed results are not due to restricted IQ range. Although somewhat counterintuitive, these results are congruent with some recent findings showing that IQ is not related to other forms of flexibility, namely cognitive flexibility, in first responders that have been repeatedly exposed to trauma (e.g., Levy-Gigi et al., 2014; Levy-Gigi & Richter-Levin, 2014). Despite the difficulty to access and recruit participants from this unique population, future studies should aim to recruit a larger sample of participants to further understand the complex relationship between different predictors of PTSD symptoms.

A fourth limitation is that in the current study we measured level of PTSD symptoms without referring to time of onset. Collecting data on onset time of symptoms is quite challenging in our unique population that by definition is repeatedly exposed to traumatic events. Specifically, in the firefighter population it is unlikely that there is a single isolated point in time in which individuals developed PTSD symptoms; rather, it is very likely that different symptoms evolved following different traumatic events.

Finally another possible limitation relates to the cross-sectional design of our study. Such a design does not allow to test whether emotion regulation functions as an antecedent or consequence of PTSD symptoms (see Kring, 2008, for a review). Specifically, regulatory choice flexibility can be antecedent to PTSD symptoms and hence may predict levels of PTSD symptoms across repeated traumatic exposure. Alternatively, it can be a consequence of traumatic exposure hence individuals with higher PTSD symptoms may become less emotionally flexible. Finally, there might be other possible antecedent sources of emotion flexibility and rigidity other than PTSD symptoms. However, two points are worth noting. First, whether regulatory choice flexibility is antecedent or consequence of PTSD our study provides a proof of concept that regulatory choice flexibility is an important variable in the relationship between duty-related traumatic exposure and PTSD symptoms. In addition, one of our control variables (Traumatic Events Questionnaire) functions as partial antecedent source of our main duty-related traumatic exposure variable, because it includes items that relate to general traumatic exposure during childhood and adolescence, which precede active duty. Nevertheless, a longitudinal study that separates the measurement time of regulatory choice flexibility from traumatic exposure and PTSD symptomatology is needed to establish its causal role as a vulnerability or consequential factor.

In closing, the present study utilizes a novel concept of regulatory choice flexibility to shed light on the puzzling link between exposure to trauma and PTSD symptoms. Specifically, it demonstrates that the ability to flexibly regulate emotions in accordance with changes in contextual demands is associated with the tendency to develop fewer PTSD symptoms over repeated duty-related exposure to trauma. The study contributes to the understanding of the central role emotion regulation plays in traumatic exposure and PTSD symptomatology and may have important clinical implications.

Author Contributions

E. Levy-Gigi and G. Sheppes developed the study concept. All authors contributed to the study design. Testing and data collection were performed by E. Levy-Gigi and A. R. Shapiro. S. Kéri, E. Levy-Gigi, and G. Sheppes performed the data analysis and interpretation. E. Levy-Gigi and G. Sheppes drafted the manuscript, and G. A. Bonanno, A. R. Shapiro, G. Richter-Levin, and S. Kéri provided critical revisions. S. Kéri supervised all clinical aspects of the study. All authors approved the final version of the manuscript for submission.

Declaration of Conflicting Interests

The authors declared that they had no conflicts of interest with respect to their authorship or the publication of this article.

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Supplemental Material

Additional supporting information may be found at http://cpx.sagepub.com/content/by/supplemental-data.

References

Acheson, D. T., Gresack, J. E., & Risbrough, V. B. (2012). Hippocampal dysfunction effects on context memory: Possible etiology for post-traumatic stress disorder. *Neuropharmacology*, *62*, 674–685. doi:10.1016/j.neuropharm.2011.04.029

Aldao, A. (2013). The future of emotion regulation research capturing context. *Perspectives on Psychological Science*, *8*, 155–172. doi:10.1177/1745691612459518

Aldao, A., Nolen-Hoeksema, S., & Schweizer, S. (2010). Emotion-regulation strategies across psychopathology: A meta-analytic review. *Clinical Psychology Review*, *30*, 217–237. doi:10.1016/j.cpr.2009.11.004

Aldao, A., Sheppes, G., & Gross, J. J. (in press). Emotion regulation flexibility. *Cognitive Therapy and Research*.

Beaton, R., Murphy, S., Johnson, C., Pike, K., & Corneil, W. (1999). Coping responses and posttraumatic stress

symptomatology in urban fire service personnel. *Journal of Traumatic Stress*, *12*, 293–308.

Beck, A. T., Steer, R. A., & Brown, G. K. (1996). *Manual for the Beck Depression Inventory–II*. San Antonio, TX: Psychological Corporation.

Blake, D. D., Weathers, F. W., Nagy, L. M., Kaloupek, D. G., Gusman, F. D., Charney, D. S., & Keane, T. M. (1995). The development of a clinician-administered PTSD scale. *Journal of Traumatic Stress*, *8*, 75–90.

Bonanno, G. A. (2013). Meaning making, adversity, and regulatory flexibility. *Memory*, *21*, 150–156. doi:10.1080/09658211.2012.745572

Bonanno, G. A., & Burton, C. L. (2013). Regulatory flexibility: An individual differences perspective on coping and emotion regulation. *Perspectives on Psychological Science*, *8*, 591–612. doi:10.1177/1745691613504116

Bonanno, G. A., Papa, A., Lalande, K., Westphal, M., & Coifman, K. (2004). The importance of being flexible: The ability to both enhance and suppress emotional expression predicts long-term adjustment. *Psychological Science*, *15*, 482–487.

Brandes, D., Ben-Schachar, G., Gilboa, A., Bonne, O., Freedman, S., & Shalev, A. Y. (2002). PTSD symptoms and cognitive performance in recent trauma survivors. *Psychiatry Research*, *110*, 231–238.

Breslau, N., Chen, Q., & Luo, Z. (2013). The role of intelligence in posttraumatic stress disorder: Does it vary by trauma severity? *PLoS ONE*, *8*, e65391. doi:10.1371/journal.pone.0065391

Brewin, C. R., Andrews, B., & Valentine, J. D. (2000). Meta-analysis of risk factors for posttraumatic stress disorder in trauma-exposed adults. *Journal of Consulting and Clinical Psychology*, *68*, 748–766. doi:10.1037//0022-006X.68.5.748

Brewin, C. R., Gregory, J. D., Lipton, M., & Burgess, N. (2010). Intrusive images in psychological disorders: Characteristics, neural mechanisms, and treatment implications. *Psychological Review*, *117*, 210–232. doi:10.1037/a0018113

Brohawn, K. H., Offringa, R., Pfaff, D. L., Hughes, K. C., & Shin, L. M. (2010). The neural correlates of emotional memory in posttraumatic stress disorder. *Biological Psychiatry*, *68*, 1023–1030. doi:10.1016/j.biopsych.2010.07.018

Bryant, R. A., Harvey, A. G., Guthrie, R. M., & Moulds, M. L. (2003). Acute psychophysiological arousal and posttraumatic stress disorder: A two-year prospective study. *Journal of Traumatic Stress*, *16*, 439–443. doi:10.1023/A:1025750209553

Campbell-Sills, L., & Barlow, D. H. (2007). Incorporating emotion regulation into conceptualizations and treatments of anxiety and mood disorders. In J. J. Gross (Ed.), *Handbook of emotion regulation* (pp. 542–559). New York, NY: Guilford.

Chan, A. O. M., Air, T. M., & McFarlane, A. C. (2003). Posttraumatic stress disorder and its impact on the economic and health costs of motor vehicle accidents in South Australia. *Journal of Clinical Psychiatry*, *64*, 175–181. doi:10.4088/JCP.v64n0210

Chang, C. M., Lee, L. C., Connor, K. M., Davidson, J. R., & Lai, T. J. (2008). Modification effects of coping on post-traumatic morbidity among earthquake rescuers. *Psychiatry Research*, *158*, 164–171. doi:10.1016/j.psychres.2006.07.015

Coifman, K. G., Bonanno, G. A., Ray, R. D., & Gross, J. J. (2007). Does repressive coping promote resilience? Affective-autonomic response discrepancy during bereavement. *Journal of Personality and Social Psychology*, *92*, 745–758. doi:10.1037/0022-3514.92.4.745

Corneil, W., Beaton, R., Murphy, S., Johnson, C., & Pike, K. (1999). Exposure to traumatic incidents and prevalence of posttraumatic stress symptomatology in urban firefighters in two countries. *Journal of Occupational Health Psychology*, *4*, 131–141. doi:10.1037/1076-8998.4.2.131

Cuthbert, B. N., & Kozak, M. J. (2013). Constructing constructs for psychopathology: The NIMH research domain criteria. *Journal of Abnormal Psychology*, *122*, 928–937. doi:10.1037/a0034028

Ditlevsen, D. N., & Elklit, A. (2010). The combined effect of gender and age on post traumatic stress disorder: Do men and women show differences in the lifespan distribution of the disorder. *Annals of General Psychiatry*, *9*, 32–44. doi:10.1186/1744-859X-9-32

Ehring, T., & Quack, D. (2010). Emotion regulation difficulties in trauma survivors: The role of trauma type and PTSD symptom severity. *Behavior Therapy*, *41*, 587–598. doi:10.1016/j.beth.2010.04.004

First, M. B., Spitzer, R. L., Gibbon, M., & Williams, J. B. W. (1996). *User's guide for the Structured Clinical Interview for DSM-IV Axis I Disorders–Research Version*. New York, New York State Psychiatric Institute, Biometrics Research Department.

Foa, E. B., & Tolin, D. F. (2000). Comparison of the PTSD Symptom Scale–Interview Version and the Clinician-Administered PTSD scale. *Journal of Trauma Stress*, *13*, 181–191.

Frewen, P. A., & Lanius, R. A. (2006). Toward a psychobiology of posttraumatic self dysregulation: Reexperiencing, hyperarousal, dissociation, and emotional numbing. *Annals of the New York Academy of Sciences*, *1071*, 110–124. doi:10.1196/annals.1364.010

Fullerton, C. S., Ursano, R. J., & Wang, L. (2004). Acute stress disorder, posttraumatic stress disorder, and depression in disaster or rescue workers. *American Journal of Psychiatry*, *161*, 1370–1376. doi:10.1176/appi.ajp.161.8.1370

Galatzer-Levy, I. R., Brown, A. D., Henn-Haase, C., Metzler, T. J., Neylan, T. C., & Marmar, C. R. (2013). Positive and negative emotion prospectively predict trajectories of resilience and distress among high-exposure police officers. *Emotion*, *13*, 545–553. doi:10.1037/a0031314

Galea, S., Vlahov, D., Resnick, H., Ahern, J., Susser, E., Gold, J., Bucuvalas, M., & Kilpatrick, D. (2003). Trends of probable post-traumatic stress disorder in New York City after the September 11 terrorist attacks. *American Journal of Epidemiology*, *158*, 514–524. doi:10.1093/aje/kwg187

Gross, J. J. (2014). *Handbook of emotion regulation*. New York, NY: Guilford.

Gross, J. J., Sheppes, G., & Urry, H. L. (2011). Emotion generation and emotion regulation: A distinction we should make (carefully). *Cognition & Emotion*, *25*, 765–778. doi:10.1080/02699931.2011.555753

Hayes, A. F. (2009). Beyond Baron and Kenny: Statistical mediation analysis in the new millennium. *Communication Monographs*, *76*, 408–420. doi:10.1080/03637750903310360

Hayes, A. F. (2013). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. New York, NY: Guilford.

Heron-Delaney, M., Kenardy, J., Charlton, E., & Matsuoka, Y. (2013). A systematic review of predictors of posttraumatic stress disorder (PTSD) for adult road traffic crash survivors. *Injury*, *44*, 1413–1422. doi:10.1016/j.injury.2013.07.011

Insel, T. R., Cuthbert, B. N., Garvey, M. A., Heinssen, R. K., Pine, D. S., Quinn, K. J., . . . Wang, P. S. (2010). Research domain criteria (RDoC): Toward a new classification framework for research on mental disorders. *American Journal of Psychiatry*, *167*, 748–751. doi:10.1176/appi.ajp.2010.09091379

Irish, L. A., Fischer, B., Fallon, W., Spoonster, E., Sledjeski, E. M., & Delahanty, D. L. (2011). Gender differences in PTSD symptoms: An exploration of peritraumatic mechanisms. *Journal of Anxiety Disorders*, *25*, 209–216. doi:10.1016/j.janxdis.2010.09.004

Kolkow, T. T., Spira, J. L., Morse, J. S., & Grieger, T. A. (2007). Post-traumatic stress disorder and depression in health care providers returning from deployment to Iraq and Afghanistan. *Military Medicine*, *172*, 451–455.

Koole, S. L. (2009). The psychology of emotion regulation: An integrative review. *Cognition and Emotion*, *23*, 4–41. doi:10.1080/02699930802619031

Kring, A. M. (2008). Emotion disturbances as transdiagnostic processes in psychopathology. In L. F. Barrett, M. Lewis, & J. M. Haviland-Jones (Eds.), *Handbook of emotion* (3rd ed., pp. 691–705). New York, NY: Guilford.

Lang, P. J., Bradley, B. N., & Cuthbert, B. N. (2008). *International Affective Picture System (IAPS): Affective ratings of pictures and instruction manual* (Tech. Rep. A-8). Gainesville: University of Florida.

Levy-Gigi, E., & Kéri, S. (2012). Falling out of time: Enhanced memory for scenes presented at behaviorally irrelevant points in time in posttraumatic stress disorder (PTSD). *PLoS ONE*, *7*, 1–8. doi:10.1371/journal.pone.0042502

Levy-Gigi, E., Kéri, S., Myers, C. E., Lencovsky, Z., Sharvit-Benbaji, H., Orr, S. P., & Gluck, M. A. (2012). Individuals with posttraumatic stress disorder show a selective deficit in generalization of associative learning. *Neuropsychology*, *26*, 758–767. doi:10.1037/a0029361

Levy-Gigi, E., & Richter-Levin, G. (2014). The hidden price of repeated traumatic exposure. *Stress*, *17*, 343–351.

Levy-Gigi, E., Richter-Levin, G., & Kéri, S. (2014). The hidden price of repeated traumatic exposure: Different cognitive deficits in different first-responders. *Frontiers in Behavioral Neuroscience*, *8*, 281.

Levy-Gigi, E., Szabo, C., Richter-Levin, G., & Kéri, S. (2015). Reduced hippocampal volume is associated with overgeneralization of negative context in individuals with PTSD. *Neuropsychology*, *29*, 151–161. doi: 10.1037/neu0000131.

Maren, S., Phan, K. L., & Liberzon, I. (2013). The contextual brain: Implications for fear conditioning, extinction and psychopathology. *Nature Reviews Neuroscience*, *14*, 417–428. doi:10.1038/nrn3492

Marmar, C. R., McCaslin, S. E., Metzler, T. J., Best, S., Weiss, D. S., Fagan, J., & Neylan, T. (2006). Predictors of posttraumatic stress in police and other first responders. *Annals of the New York Academy of Sciences*, *1071*, 1–18. doi:10.1196/annals.1364.001

McFarlane, A. C., & Alexander, C. (1989). The etiology of posttraumatic stress morbidity: Predisposing, precipitating, and perpetuating factors. *British Journal of Psychiatry*, *154*, 221–228. doi:10.1192/bjp.154.2.221

Meyer, E. C., Zimering, R., Daly, E., Knight, J., Kamholz, B. W., & Gulliver, S. B. (2012). Predictors of posttraumatic stress disorder and other psychological symptoms in trauma-exposed firefighters. *Psychological Services*, *9*, 1–15. doi:10.1037/a0026414

Orr, S. P., Lasko, N. B., Macklin, M. L., Pineles, S. L., Chang, Y., & Pitman, R. K. (2012). Predicting post-trauma stress symptoms from pre-trauma psychophysiologic reactivity, personality traits and measures of psychopathology. *Biology of Mood and Anxiety Disorders*, *2*, 8. doi:10.1186/2045-5380-2-8

Park, C. L. (2010). Making sense of the meaning literature: An integrative review of meaning making and its effects on adjustment to stressful life events. *Psychological Bulletin*, *136*, 257–301. doi:10.1037/a0018301

Prati, G., Pietrantoni, L., Saccinto, E., Kehl, D., Knuth, D., & Schmidt, S. (2013). Risk perception of different emergencies in a sample of European firefighters. *Work: A Journal of Prevention, Assessment and Rehabilitation*, *45*, 87–96. doi:10.3233/WOR-121543

Razik, S., Ehring, T., & Emmelkamp, P. M. (2013). Psychological consequences of terrorist attacks: Prevalence and predictors of mental health problems in Pakistani emergency responders. *Psychiatry Research*, *207*, 80–85. doi:10.1016/j.psychres.2012.09.031

Regehr, C., Hill, J., Knott, T., & Sault, B. (2003). Social support, self-efficacy and trauma in new recruits and experienced firefighters. *Stress and Health*, *19*, 189–193.doi:10.1002/smi.974

Schönfelder, S., Kanske, P., Heissler, J., & Wessa, M. (2014). Time course of emotion-related responding during distraction and reappraisal. *Social Cognitive and Affective Neuroscience*, *9*, 1310–1319. doi:10.1093/scan/nst116

Seal, K. H., Metzler, T. J., Gima, K. S., Bertenthal, D., Maguen, S., & Marmar, C. R. (2009). Trends and risk factors for mental health diagnoses among Iraq and Afghanistan veterans using Department of Veterans Affairs health care, 2002–2008. *American Journal of Public Health*, *99*, 1651–1658. doi:10.2105/AJPH.2008.150284

Shafir, R., Schwartz, N., Blechert, J., & Sheppes, G. (in press). Emotional intensity influences pre-implementation and implementation of distraction and reappraisal. *Social Cognitive and Affective Neuroscience*.

Shalev, A. Y., Peri, T., Canetti, L., & Schreiber, S. (1996). Predictors of PTSD in injured trauma survivors: A prospective study. *American Journal of Psychiatry*, *153*, 219–225.

Shepherd, L., & Wild, J. (2014). Cognitive appraisals, objectivity and coping in ambulance workers: A pilot study. *Emergency Medicine Journal*, *31*, 41–44. doi:10.1136/emermed-2011-200511

Sheppes, G. (2014). Emotion regulation choice: Theory and findings. In J. J. Gross (Ed.), *Handbook of emotion regulation* (pp. 126–139). New York, NY: Guilford.

Sheppes, G., & Levin, Z. (2013). Emotion regulation choice: Selecting between cognitive regulation strategies to control emotion. *Frontiers in Human Neuroscience*, *7*, 179. doi:10.3389/fnhum.2013.00179

Sheppes, G., & Meiran, N. (2007). Better late than never? On the dynamics of online regulation of sadness using distraction and cognitive reappraisal. *Personality and Social Psychology Bulletin*, *33*, 1518–1532. doi:10.1177/0146167207305537

Sheppes, G., & Meiran, N. (2008). Divergent cognitive costs for online forms of reappraisal and distraction. *Emotion*, *8*, 870–876. doi:10.1037/a0013711

Sheppes, G., Scheibe, S., Suri, G., & Gross, J. J. (2011). Emotion-regulation choice. *Psychological Science*, *22*, 1391–1396. doi:10.1177/0956797611418350

Sheppes, G., Scheibe, S., Suri, G., Radu, P., Blechert, J., & Gross, J. J. (2014). Emotion regulation choice: A conceptual framework and supporting evidence. *Journal of Experimental Psychology: General*, *143*, 163–181. doi:10.1037/a0030831

Sheppes, G., Suri, G., & Gross, J. J. (in press). Emotion regulation and psychopathology. *Annual Review of Clinical Psychology*.

Spitzer, R. L., Williams, J. B. W., Gibbon, M., & First, M. B. (1990). *Structured Clinical Interview for DSM-III-R*. Washington, DC: American Psychiatric Press.

Stevens, J. S., Jovanovic, T., Fani, N., Ely, T. D., Glover, E. M., Bradley, B., & Ressler, K. J. (2013). Disrupted amygdala-prefrontal functional connectivity in civilian women with posttraumatic stress disorder. *Journal of Psychiatric Research*, *47*, 1469–1478. doi:10.1016/j.jpsychires.2013.05.031

Troy, A. S., & Mauss, I. B. (2011). Resilience in the face of stress: Emotion regulation ability as a protective factor. In S. Southwick, D. Charney, M. Friedman, & B. Litz (Eds.), *Resilience to stress* (pp. 30–44). Cambridge, England: Cambridge University Press.

Vasterling, J. J., Duke, L. M., Brailey, K., Constans, J. I., Allain, A. N., Jr., & Sutker, P. B. (2002). Attention, learning, and memory performances and intellectual resources in Vietnam veterans: PTSD and no disorder comparisons. *Neuropsychology*, *16*, 5–14.

Vrana, S. R., & Lauterbach, D. (1994). Prevalence of traumatic events and post-traumatic psychological symptoms in a nonclinical sample of college students. *Journal of Traumatic Stress*, *7*, 289–302.

Wagner, D., Heinrichs, M., & Ehlert, U. (1998). Prevalence of symptoms of posttraumatic stress disorder in German professional firefighters. *American Journal of Psychiatry*, *155*, 1727–1732.

Wang, H., Jin, H., Nunnink, S. E., Guo, W., Sun, J., Shi, J., . . . Baker, D. G. (2011). Identification of post-traumatic stress disorder and risk factors in military first responders 6 months after Wen Chuan earthquake in China. *Journal of Affective Disorders*, *130*, 213–219. doi:10.1016/j.jad.2010.09.026

Webb, T. L., Miles, E., & Sheeran, P. (2012). Dealing with feeling: A meta-analysis of the effectiveness of strategies derived from the process model of emotion regulation. *Psychological Bulletin*, *138*, 775–808. doi:10.1037/a0027600

Wechsler, D. (1997). *Wechsler Adult Intelligence Scale–Third Edition (WAIS–III)*. San Antonio, TX: NCS Pearson.