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Differentiating between appraisal process and product in cognitive theories of posttraumatic stress

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Abstract

Biased appraisal is central to cognitive theories of posttraumatic stress, but little research has examined the potentially distinct meanings of the term. The on-going process of appraising social information and the beliefs that emerge as products of that process can be distinguished conceptually. The present study sought to examine if these two meanings are empirically distinct as well, and if so, to begin exploring potential relations between these appraisal constructs and posttraumatic stress symptoms. Soldiers (N = 424) preparing for deployment to Iraq or Afghanistan were administered measures of each construct. Results of confirmatory factor analysis suggest that the appraisal process and the products of that process (i.e., beliefs) are indeed

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distinct. Structural equation models are consistent with cognitive bias and social information processing literatures which posit that a biased appraisal process may contribute to the development of dysfunctional beliefs and posttraumatic stress symptoms following trauma. The potential utility of distinctly conceptualizing and measuring the appraisal process in both clinical and research settings is discussed.

Keywords

trauma; cognitive bias; appraisal; PTSD

Cognitive theories of posttraumatic stress posit that negatively biased appraisals contribute to the causation and maintenance of psychopathology following trauma (e.g., Brewin & Holmes, 2003; Ehlers & Clark, 2000). Despite the centrality of negative appraisal in contemporary trauma theory, its precise meaning is unclear. This imprecision appears to be rooted in the dual sense of the word “appraisal.” Appraisal can refer both to “the act of judging value” and to “a judgment of value” (Merriam-Webster, 2013). That is, appraisal can refer both to a process and to the product of that process.

The majority of the current literature emphasizes appraisal as *product.* Here, appraisal is used synonymously with *beliefs,* with appraisal conceptualized – at least implicitly – as stable, trait-like interpretations about the self, the world, and others that may emerge following trauma (e.g., Foa & Rothbaum, 1998; Resick & Schnicke, 1992). Appraisal as product is operationalized and measured using questionnaires, such as the Posttraumatic Cognitions Inventory (PTCI; Foa, Ehlers, Clark, Tolin, & Orsillo, 1999), where the respondent rates their agreement with certain negative interpretations about the meaning of the traumatic event. Though these appraisals could occur as momentary thoughts, they are typically understood to represent relatively stable underlying interpretations in response to trauma. Altering appraisal products/beliefs is a primary focus of interventions for trauma (Foa & Rothbaumm, 1998; Resick & Schnicke, 1992), and changes in these products/beliefs are associated with symptom improvement (Foa & Rauch, 2004; Resick et al., 2008). Emphasis is particularly placed on the importance of negative appraisal beliefs about the self in predicting posttraumatic psychopathology (e.g., Dunmore, Clark, & Ehlers, 1999; Ehlers, Maercker, & Boos, 2000; Ehlers & Steil, 1995; Foa & Riggs, 1993; Kleim, Ehlers, & Glucksman, 2012). Multiple studies show that negative self-appraisal is strongly associated with posttraumatic stress symptoms cross-sectionally (Beck et al., 2004; Constans et al., 2012; Foa et al., 1999; Moser, Hajcak, Simons, & Foa, 2007), particularly re-experiencing and numbing symptoms (Blain, Galovski, Elwood, & Meriac, 2013), and may uniquely predict later development of PTSD longitudinally (Bryant & Guthrie, 2005; Kleim et al., 2012).

The less commonly found meaning of appraisal in the trauma literature uses the term to refer to a *process*. Here, appraisal refers to the active on-line interpretation of incoming social information. Some individuals, for example, may be prone to interpreting ambiguous situations in a more negative fashion than others and may thus be more prone to emotional distress. This sense of appraisal as process has been described as a feature and etiological

factor in a variety of emotional disorders (Mathews & McCloud, 2005; Gross & Thompson, 2007), but it has been less emphasized in cognitive models of PTSD. Often implicit in these models, however, is the suggestion that a negatively biased process of interpreting information (appraisal as process) contributes to the development and maintenance of this disorder (Ehlers & Clark, 2000). Although more research is needed, available empirical evidence also suggests that, as with other emotional disorders, PTSD is associated with biased processing of incoming information. Specifically, individuals with PTSD are more likely to interpret ambiguous stimuli as being trauma related or as more threatening compared with those without this disorder (Amir, Coles, & Foa, 2002; Elwood, Williams, Olatunji, & Lohr, 2007; Kimble, et al., 2002).

Though available evidence suggests posttraumatic psychopathology is associated with both negatively biased appraisal beliefs and negatively biased appraisal processes, a number of questions persist. One primary question is whether assessments of appraisal processes and appraisal products actually measure separate forms of cognition. Though there are clear conceptual distinctions between appraisal processes and appraisal products, evidence showing that the existing measures assess separate constructs is lacking. It remains possible that simple self-report assessments of beliefs may be a proxy measure for appraisal processes. Therefore, the first aim of this paper is to examine whether existing measures of biased interpretive processes are psychometrically distinct from measures of biased interpretive products. This project is not aimed to develop and evaluate an appraisal process measure. Our aim rather was to conduct an initial proof-of-concept exercise to determine if such measurement development would be warranted.

Addressing this question is not merely an exercise in semantic hairsplitting. Identifying any meaningful distinctions between process and product could have important implications for predicting and treating PTSD. If processing bias is distinct from negative beliefs, then measurement of processing bias could be important in determining risk for psychopathology. Indeed, social information processing models of posttraumatic stress imply that biased appraisal processes may contribute to the development of biased beliefs (Ehlers & Clark, 2000). If processing biases prove independent or perhaps even predictive of negative beliefs, this would suggest that modifying information-processing styles in addition to modifying underlying beliefs would be necessary in order to maintain treatment gains. To our knowledge, no previous studies have examined these propositions empirically. In the study that most closely addresses this question, (Gonzalo, Kleim, Donaldson, Morey, & Ehlers, 2012), self-report measures of attributional styles that are characteristic of depression (e.g., attributing negative events to global, stable, and internal causes) predicted DSM-IV PTSD independently of appraisal beliefs measured by the PTCI. The use of a self-report measure of attribution may limit the probative value of these findings, however, as appraisal or attribution processes *per se* were not measured. Rather, only the individual's general perception of this process were measured in this study. Moreover, no path models between attributional style, beliefs, or PTSD were tested. Therefore, our second aim was to examine the independent and combined roles of processing bias, measured more directly, and negative beliefs in their association with PTSD[1].

To pursue these aims, US soldiers preparing for deployment to Iraq or Afghanistan were asked to complete self-report measures of PTSD, posttraumatic beliefs, and a non-self-report measure of biases in the appraisal process. Using these data, we first tested the hypothesis that the appraisal process measures and the appraisal product measures reflect empirically distinct constructs rather than manifestations of a single underlying appraisal construct. We then explored the relations among the constructs, hypothesizing that the appraisal process would be associated with both appraisal products and PTSD. Consistent with general cognitive bias literature (e.g., Mathews & Macleod, 2005), we expected that the appraisal process would predict PTSD symptoms; and, in accord with social information processing theories of PTSD, we hypothesized that the relationships between the appraisal process and emotional distress would be mediated by appraisal products/beliefs. That is, we sought to test the viability of a model in which a general negative appraisal processing style would be associated with development of negative appraisal beliefs, and that these beliefs would lead to greater posttraumatic distress. Finally, as a secondary exploratory analysis, we examined the potential moderating effects of prior combat exposure on our hypothesized models.

Method

Participants

Participants were Virginia Army National Guard members scheduled for deployment to Iraq. Eligibility criteria included: Army National Guard member scheduled to deploy for Operation Enduring Freedom/Operation Iraqi Freedom (OEF/OIF) operations within the next 12 months, age 18 to 60, and willing to provide the name and phone number of at least one person to help locate the member for the follow-up assessments if necessary. Two battalions participated in this study, one from Aviation and one Cavalry. Six hundred soldiers completed a written consent process during a drill weekend soldier readiness check prior to pre-deployment training and a subset of 424 completed study measures during a subsequent 3-week pre-deployment training.

Four-hundred twenty four soldiers participated in the study. Demographics are presented in Table 1. Participants were predominantly male. The majority of participants identified as White/Caucasian. Black/African-American was the second most commonly endorsed racial identity. Regarding military rank and experience, the vast majority were enlisted soldiers.[2] Approximately half reported prior combat deployments. Of those with prior combat experience, average number of months in combat zones was about one year.

Measures

Appraisal process—The appraisal process measurement protocol was developed by Mathews and Mackintosh (2000) to assess changes in interpretive bias occurring in response to cognitive bias modification (CBM) procedures and has been validated through use in

[1]Our study examined PTSD as defined in DSM-IV so there was no item overlap between measures of PTSD and measures negative beliefs as there would be now given DSM-5 (American Psychiatric Association, 2014) changes to PTSD criteria. Within a DSM-5 framework, our study could be conceptualized as examining the contribution of appraisal process and appraisal beliefs to development of additional PTSD symptoms beyond the appraisal beliefs themselves.

[2]Aviation unit participants were not asked about prior military experience at baseline. Therefore military history data are reported only for the Cavalry unit who represent the majority of our overall sample (n = 378; 89.1%)

multiple other studies (Salemink, van den hout, & Kindt, 2007; Salemink & van den hout, 2010). Subjects were asked to read and imagine eight randomly presented three- to four-sentence scenarios. We adapted the content of the original protocol to focus on military-related scenarios with the assistance of a subject matter expert (OEF/OIF veteran). Scenarios were ambiguous with regard to the meaning of the event (e.g., "Your unit goes on night patrol. You spot possible insurgents in the distance and pursue them for 45 minutes. They eventually evade your capture, and you return to base camp. You do not go to sleep immediately.") Following each scenario, the participant rated its vividness to reinforce the implication that the procedures are simply to identify vivid and realistic combat scenarios. Following presentation of all scenarios, participants were asked to complete an unexpected recognition memory test to assess the appraisal process. For each scenario, participants were presented with a brief reminder of the scenario and asked to rate on a 10-point Likert type scale how well each of 4 statements represented the event described in the scenario. Two of the statements reflected legitimate interpretations of the ambiguous scenario, but one interpretation was positive and the other negative. Two interpretations did not represent events described in the scenario: one interpretation was positive and the other negative. For example, participants were asked "For the scenario involving a night patrol, please rate the accuracy of the following statements that describe what happened when you returned to base camp: (1) You lie awake filled with fear (legitimate/negative); (2) You lie awake talking to your buddies (legitimate/positive); (3) You do not eat because of nausea (foil/negative); (4) You do not eat because you want to relax (foil/positive). Participant endorsement of the inaccurate negative interpretation was used as the measure of the biased appraisal process. We believed this tendency to endorse an interpretation that had no factual basis in the actual text of the vignette and was likely rated as a viable interpretation only because of its negative valence was the best indicator of a generalized affinity for negatively valenced interpretations. Internal consistency of the items was .51.

Appraisal Products/Beliefs—Appraisal products (i.e. beliefs) were measured using the 27-item Negative Cognitions about the Self subscale of Posttraumatic Cognitions Inventory (PTCI-Self; Foa et al., 1999). The PTCI-Self scale consists of 75% of the items from 36 item PTCI. We used only the PTCI-Self for greater parsimony and due to the emphasis placed on negative self-appraisals in trauma theory and research. Participants are asked to think about a recent distressing event. Items inquire about participants' agreement with beliefs about the self in relation to this distressing event on a scale of 1 (Totally disagree) to 7 (Totally agree). The PTCI-Self has good internal consistency (alpha = .97) and good ability to discriminate between those with and without PTSD (Foa et al., 1999). The PTCI was designed for use in any trauma population including combat soldiers (Edna Foa, personal communication). Internal consistency in the current sample was .87.

Posttraumatic Stress Symptoms—Posttraumatic stress symptoms were measured using the PTSD Checklist – Military version (PCL-M; Weathers, 1993). The PCL-M is a widely used 17-item inventory with items consistent with the DSM-IV criteria for PTSD. Participants indicate for each symptom how much it bothered them in the past month on a scale from 1 (Not at all) to 5 (Extremely). Participants were prompted that items reflect possible reactions to stressful life events. They were not instructed to answer in regard to

any specific event. The PCL-M demonstrates robust psychometric properties (Weathers, Litz, Herman, Huska, & Keane 1993). Internal consistency in the current sample was .92.

Procedure

The study was approved and overseen by the Central Arkansas Veterans Health Care System Institutional Review Board. Data were collected as part of the baseline assessment for a broader longitudinal observational study with an embedded randomized controlled trial of resilience interventions for combat soldiers. Data collection occurred in person in individual data collection rooms approximately two months prior to deployment to Iraq. Appraisal process measures were collected first followed by self-report measures.

Data Analysis Plan

Confirmatory factor analysis using maximum likelihood estimation was used to examine the hypothesis that appraisal process and product measures tap distinct latent constructs. Item parceling was employed to reduce model estimation bias (Little, Cunningham, Shahar, & Widaman, 2002; Little, Rhemtulla, Gibson, & Schoemann, 2013). Parceling entails combining individual items to create indicator variables for use in latent-variable analyses (e.g., factor analysis and structural equation modeling; Little et al., 2002, 2013). Parceling items into indicators reduces model estimation bias in latent variable analyses because parcels typically have stronger psychometric properties than individual items and allow for the evaluation of more parsimonious models (Little et al., 2002, 2013) For each construct, items from the relevant measure were parceled into three separate indicator variables (See Appendix A for a breakdown of items in each parcel). That is, three indicators each were created for appraisal process, appraisal product and PTSD. The balancing approach to parceling was employed (Little et al., 2002, 2013). This approach uses item factor loadings to create relatively equivalent parcels for each hypothesized latent variable.

Structural Equation Modeling (SEM) using maximum likelihood estimation was employed to evaluate relationships between constructs. Assuming distinct appraisal process and product constructs, we planned to test specifically the hypothesis that appraisal products (beliefs) mediate the relation between appraisal process and posttraumatic stress symptoms (Figure 1). The mediation model also included direct paths from appraisal process to PTSD to examine potential direct effects of processing style on emotional distress not mediated by appraisal products/beliefs. The fit of the hypothesized model to the data was compared with alternate causal models. All CFA and SEM analyses were performed in AMOS 20.0

Results

Clinical Characteristics

Emotional distress was low (Table 2). On the PCL-M, for which the minimum score is 17, the median was 20 (range 17 to 83) and the mean 23.44 (SD = 8.42). Approximately 16% reported PTS symptoms above the cut-off score of 30 that is recommended when screening at general military population (National Center for PTSD, 2014). Comparing those with prior combat deployment to those without prior combat experience[3] revealed significant differences in PTSD symptoms ($F = 24.85$, $p < .001$).

Confirmatory Factor Models

A confirmatory factor analysis of a two-factor solution with separate appraisal process and appraisal product factors revealed a very close fit with the obtained data. There was no significant difference between the hypothesized and obtained covariance matrix even using the very strict chi-square goodness of fit test ($\chi^2 = 14.91$ $p = .06$). Other fit indices also suggested good model fit (RMSEA = .045, 90% Confidence Interval = .000 to .080; CFI = .991; NFI = .980; IFI = .99). In this two-factor model, appraisal process parcels all loaded moderately on a single factor (Standardized Regression Weights: .46 – .53). Appraisal product parcels loaded strongly on a separate factor (Standardized Regression Weights: .81 – .85). The correlation between the factors was significant but only of moderate strength ($r = .44$, $p < .01$). In contrast, a confirmatory factor analysis using a single factor solution (i.e., a single appraisal factor underlying both process and product measures) indicated a poor fit ($\chi2 = 65.79$, $p < .001$; RMSEA = .122, 90% CI = .095 – .191; CFI = .924; NFI = .914; IFI = .925). Direct comparison of the models using a χ^2 difference test further confirmed the two-factor model was a significantly better fit than a one-factor model ($\Delta \chi^2 = 50.9$, $df = 1$, $p < .001$).

A confirmatory factor model including PTSD was next evaluated to ensure that appraisal process and appraisal product constructs are distinct from emotional distress. A CFA including appraisal process, appraisal product, and PTSD yielded a significant chi-square value ($\chi^2 = 62.97$ $p < .01$), but other fit indices suggested at least adequate model fit (RMSEA = .062; CFI = .979; NFI = .966; IFI = .979). Examination of modification indices revealed that overlap between indicators of the PTSD and appraisal product constructs most contributed to discrepancies between the hypothesized model and obtained data. This suggests our appraisal process measure taps a construct that is empirically distinct from appraisal products and PTSD.

Structural Equation Models—Structural Equation Modeling (SEM) was employed to evaluate whether, as hypothesized, a negatively biased appraisal process leads to biased appraisal products which, in turn, lead to PTSD. The hypothesized mediation model (Figure 1) fit the data well. Though the chi-squared value was statistically significant ($\chi^2 = 62.97$, $df = 24$, $p < .001$) other fit indices indicated close model fit (RMSEA = .062, 90% Confidence Interval: .044 to .081; CFI = .979; NFI = .966; IFI = .979). As expected there was a significant total effect of appraisal process on PTSD with more negative appraisal process predicting greater PTSD symptoms ($\beta = .21$, $p < .001$). Negative processing style also predicted appraisal products/beliefs ($\beta = .44$, $p < .001$), and as expected, appraisal products/beliefs in turn predicted PTSD ($\beta = .48$, $p < .001$). The indirect effect of appraisal process on PTSD mediated through appraisal product/beliefs, was significant (Standardized Indirect Effect = .22; Bias Corrected 95% Confidence Interval: .13 – .34). The residual direct effect of appraisal processing style on PTSD was not significant ($\beta = .00$; $p = .98$), indicating this relationship is fully mediated by appraisal products.

[3]Among the Cavalry unit (n = 378) for whom this is known.

To rule out other causal explanations, alternative conceptually plausible structural models were evaluated using SEM. A model in which PTSD mediated the relationship between appraisal process and product was a poorer fit with the data as was the mathematically equivalent model in which PTSD predicted both appraisal process and product (χ^2 = 90.6, p <. 001; RMSEA = .079, 90% Confidence Interval: .062 – .097; Aikake Information Criterion (AIC) = 130.61 as compared to 104.97 in the hypothesized model). A model in which appraisal process served as a mediator between PTSD and appraisal beliefs was a poor fit (χ2 = 105.58, p <. 001; RMSEA = .087, 90% Confidence Interval: .070 – .105; AIC = 145.58 vs. 104.97). These results all suggest that the hypothesized mediation model (Figure 1) is the best fit for the obtained data.

As a final check of the validity of our model, we compared appraisal process and appraisal product between participants above the clinical cut-off for significant PTSD symptoms (PCL-M > = 30). Consistent with expectations, those with significant PTSD symptoms had significantly more negative appraisal processing (F = 6.06, p = .01) and appraisal products/ beliefs (F = 64.41, p < .001).

Secondary Analysis: Combat Deployment as Moderator—As a secondary exploratory analysis we examined potential impact of prior combat deployment on our CFA and SEM models[4]. Tests of measurement equivalence between those with and without combat deployment revealed similar factor structure between groups (Two Group Configural Model Fit Indices: χ^2 = 33.8, df = 16, RMSEA = .054, 90% CI = .028 – .080; CFI = .973; NFI = .951; IFI = .974). Thus it appears that the two-factor model with separate appraisal process and product factors identified in the overall sample applies equally well to those with and without prior combat employment.

Possible moderating effects of combat deployment on our structural mediation models were next evaluated using methods for testing interactions among latent variables in SEM as described by Little and colleagues (Little, Bovaird, & Widaman, 2006). Combat deployment was found to moderate the relationship of appraisal process on appraisal products (β = .18, p = .02) with a stronger relationship among those with combat deployment (β = .65, p < .001) compared to those without prior combat experience (β = .33, p = .01). Combat deployment was similarly found to moderate the relationship between appraisal products and PTSD (Interaction β = .22, p = .01) with a stronger relation in participants with prior combat exposure (β = .61, p <.001) than without (β = .43, p = .002). Due to these interactions, the indirect effect of appraisal process on PTSD through appraisal products was substantially greater among those with prior combat deployment (Standardized Indirect Effect = .39; Bias Corrected 95% CI: .21 – .98) than without (Standardized Indirect Effect = .14; Bias Corrected 95% CI: .04 – .35). In sum, the relations among appraisal process, appraisal product, and PTSD appear to be significantly strengthened among those with a history of combat exposure.

[4]Among the Cavalry unit (n = 378) for whom this is known.

Discussion

Results suggest that biases in the appraisal process and appraisal products/beliefs are empirically distinct. Future theory and research may benefit from differentiating between these meanings of appraisal, potentially providing a more precise cognitive model of trauma. Such higher definition theory may be particularly important as attempts are made to integrate multiple social, cognitive, and biological and levels of analysis into theories of mental disorders (Sanislow et al., 2010). It is feasible that appraisal processes and appraisal products may have distinct biological and social determinants, such that a biopsychosocial model of PTSD would need to distinguish between both senses of appraisal to be synchronous and complete.

Our results are consistent with information processing models of psychopathology that emphasize biases in the active online processing of experience as determinants of emotional distress. As found in previous studies (Amir et al., 2002; Elwood et al., 2007; Kimble, et al., 2002) biased information processing appears to be one aspect of dysfunction in the cognitive system associated with PTSD. The current findings also indicate biased appraisal process overlaps the biased products/beliefs that are consistently associated with posttraumatic stress symptoms (Beck et al., 2004; Blain et al., 2013; Bryant & Guthrie, 2005; Foa et al., 1999; Moser, Hajcak, Simons, & Foa, 2007). Interestingly, the results of the structural models, though exploratory, suggest that biased posttraumatic beliefs may be a function of general biases in the manner in which individuals with PTSD process information. This is consistent with social-information processing models of PTSD (Ehlers & Clarke, 2000), as individuals with a general predisposition to endorse negative interpretations may be more likely to develop the negative self-beliefs and negative appraisals about both the meaning of a traumatic event and post-event emotional responses that promote the development of this disorder. Although this study design was cross-sectional prohibiting definitive statements regarding causality, the findings are consistent with the hypothesis that pre-trauma biases in information processing partially determine beliefs formed about the trauma. Furthermore, it is possible that biased processing occurring post-trauma further reinforces negative beliefs once they emerge by continuously providing evidence of their apparent validity. Identification of appraisal processing as a distinct predictor of both cognitive products and emotional distress following trauma may be particularly useful in light of the inclusion of cognitive products/beliefs within the definition of PTSD in DSM-5 (American Psychiatric Association, 2014). As beliefs/products are established as elements of the disorder, theory and research may benefit from shifting focus toward the more proximal processes that determine their formation.

There are several potential clinical implications of our results. If biased information processing does indeed promote and maintain biased products/beliefs, this suggests treatments for PTSD should target not only the distorted products but also the biased processing style from which they emerge. Cognitive therapies for PTSD emphasize modification of beliefs surrounding the meaning of the traumatic event (Foa & Rothbaumm, 1998; Resick & Schnicke, 1992; Resick et al., 2008) but give relatively less attention to modifying interpretive biases *per se*. The current study raises the possibility that treatment may benefit from greater emphasis on biases in appraisal processes. That is, if biased

appraisal processes partially determine the beliefs about traumatic events, negative appraisal products could re-emerge unless the biased processes are modified. There are now a number of studies showing the efficacy of modifying biased cognitive processes (i.e., Cognitive Bias Modification therapies) associated with generalized anxiety disorder and social phobia (Amir, Beard, Burns, & Bomyea, 2009; Amir, Beard, Taylor et al., 2009). The current study suggests that similar efforts to modify biases in interpretive processes may be helpful in the treatment of PTSD. Results also suggest that processing bias modification interventions may be useful in preventing the development of emotional distress or in preparing those for whom trauma exposure may be imminent (e.g., combat soldiers).

These results may also open up new measurement strategies for assessing biased appraisal both before and following trauma. The emphasis on appraisal beliefs in trauma theory weds research to the use of self-report measures commonly used to measure such constructs. Self-report measures of trauma-related beliefs, though informative, are limited in that they only assess semantically encoded attitudes of which the individual is introspectively aware. They are not able to directly examine information processing biases as such, biases which may operate outside of awareness. A behavioral performance based measure of cognitive bias could provide a useful supplement in tapping aspects of appraisal bias that are outside of introspective awareness. By focusing more closely on the immediate interpretation of day-to-day scenarios, such measures may also be more representative of current functioning than self-report measures of underlying beliefs or emotional distress, and thus may serve as particularly useful tools for tracking patient progress in treatment. Finally, by focusing on quotidian social information, appraisal process measures could be used to determine risk for post-trauma psychopathology before trauma occurs. Current self-report measures assess beliefs about the meaning of a prior trauma and post-trauma symptoms. An appraisal processing measure focused on daily events does not assume trauma has already occurred and could potentially be used prior to trauma exposure to identify those with an appraisal style that would predispose them to form negative beliefs or emotional disorders were they to experience a traumatic event.

The moderating effects of combat deployment on our models are particularly noteworthy. Appraisal process, appraisal product, and PTSD were more strongly related among those with prior combat exposure. This is consistent with cognitive theories of PTSD and general diathesis-stress models which posit that vulnerabilities, like appraisal processing biases or negative beliefs, may not necessarily be associated with emotional distress until “activated” by traumatic stress. The stronger relation between appraisal process and appraisal products/beliefs among those with combat exposure suggests that appraisal process may similarly serve as a pre-potent vulnerability that only results in the formation of such negative self-beliefs (and, in turn, PTSD) *following* trauma.

Limitations

Measurement method and theoretical constructs are confounded in our study. We employed only behavioral measures of appraisal process and self-report measures of appraisal products/beliefs. The apparent distinction between the appraisal process and appraisal product constructs may at least in part reflect the use of distinct methods to measure them.

Because beliefs and emotional distress were both measured solely through self-report, shared method variance may in part account for the stronger relation to emotional distress found for appraisal products/beliefs compared with appraisal process. Future research examining these constructs using a multi-trait, multi-method approach would be necessary to confirm our findings.

Our structural equation models (SEM) only examined cross-sectional data so no conclusions regarding causation can be made. Though SEM compares the relative fit of various causal models to the observed data, our correlational design precludes inferences about causation. Moreover, SEM does not allow for the comparison of certain mathematically equivalent models. In the present study, a structural model in which products/beliefs cause both the processing biases as well as emotional distress is mathematically indistinguishable from the hypothesized mediation model (process -> product-> distress). Though information processing theories suggest process leads to products/beliefs as hypothesized, cognitive theory would support this alternative model in which beliefs are the source of both processing biases and emotional distress. We cannot compare these models using cross-sectional SEM data. Future longitudinal or experimental research will be needed in order to test fully the causal hypotheses suggested by the current results.

Appraisal process measures have not been through an extensive, formal test development process. The internal consistency of the items is relatively poor. This is of less concern for analyses like SEM in which measurement error is accounted for. At this time, however, use of these items in other analyses that do not account for measurement error (e.g., linear regression) cannot be recommended due to poor internal consistency. Formal test development and demonstration of stronger psychometric properties would be needed before this specific measure could be used in such analyses or in clinical assessment.

Certain characteristics of the sample are also limiting. It is unknown how our findings from this National Guard sample would generalize to the general military or to civilian populations. It is also noteworthy that the data collection was performed at relatively short duration before deployment such that some soldiers may have denied difficulties as a way of coping. Alternatively, impending deployment could exacerbate emotional distress in some participants. Longitudinal studies with multiple time points prior to deployment may be needed to identify the impact of impending deployment on emotional distress. Finally, emotional distress in the sample was relatively low. It is not clear how our models would apply in a more severely distressed sample. Restriction of range in emotional distress within this sample may lead to an underestimation of relationship strength such that more robust findings would be present in samples with higher levels of distress. Comparisons between those with and without prior combat suggest this may be the case, as at least the relationship between appraisal product and PTSD was stronger among a combat deployed subsample that had higher and more variable PTSD scores. Indeed, it is possible that greater variability in PTSD scores contributed to significant interactions between combat deployment and predictors of PTSD. That combat deployment moderated the relation between appraisal product and appraisal process-variables with similar variance between combat deployed and not deployed groups, suggests that combat deployment interactions are not solely the result of greater variability/less restriction of range in the combat experienced subsample.

Summary

The notion of biased appraisal is central to cognitive theories of posttraumatic stress, but little research has examined the potentially distinct meanings of the term. Our results suggest that the appraisal process and the products of that process (i.e., beliefs) are empirically distinguishable. Results are also consistent with cognitive bias and social information processing literatures which suggest that a biased appraisal process may contribute to the development of dysfunctional beliefs and PTSD following trauma. Though additional longitudinal research is needed to confirm these implications, our findings highlight the potential utility of distinctly conceptualizing and measuring the appraisal process in both clinical and research settings. Differentiating between appraisal process and product may provide for higher definition theories of posttraumatic emotional distress while expanding approaches to its assessment and treatment.

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Appendix. Item Parcels

Parcel	Item Content*	Factor Loading
Process Parcel 1		.46
	1. You are standing on post and think you see someone in the distance. 6. You are on patrol and see something on the side of the road.	
Process Parcel 2		.53
	2. You see soldiers removed from a helicopter. 4. Your commanding officer approaches you and says your orders have changed. 8. You hear that senior officials were gunned down.	
Process Parcel 3		.51
	3. You experience negative thoughts and feelings about the Iraqi people. 5. You are ordered to assist in rescue and recovery efforts. 7. You see one of your friends fall and realize he has been hit.	
Product/Belief Parcel 1		.83
	3. I am a weak person. 5. I can't deal with even the slightest upset. 9. I feel dead inside 20. I have permanently changed for the worse. 26. I can't stop bad things from happening to me. 30. My reactions since the event show that I am a lousy coper 33. I feel like I don't know myself anymore.	
Product/Belief Parcel 2		.85
	4. I will not be able to control my anger and will do something terrible. 6. I used to be a happy person but now I am always miserable. 12. I am inadequate. 17. I will never be able to feel normal emotions again. 21. I feel like an object, not like a person. 24. I feel isolated and set apart from others. 28. My life has been destroyed by the trauma.	
Product/Belief Parcel 3		.81
	2. I can't trust that I will do the right thing. 14. If I think about the event I will not be able to handle it. 16. My reactions since the event mean that I am going crazy. 25. I have no future. 29. There is something wrong with me as a person. 36. Nothing good can happen to me anymore.	
PTSD Parcel 1		.92
	1. Repeated, disturbing memories, thoughts, or images of a stressful military experience 2. Repeated, disturbing dreams of a stressful military experience	

Parcel	Item Content*	Factor Loading
	3. Suddenly acting or feeling as if a stressful military experience were happening again (as if you were reliving it) 12. Feeling as if your future will somehow be cut short 14. Feeling irritable or having angry outbursts 16. Being “super alert” or watchful on guard	
PTSD Parcel 2		.88
	6. Avoid thinking about or talking about a stressful military experience or avoid having feelings related to it? 7. Avoid activities or talking about a stressful military experience or avoid having feelings related to it 10. Feeling distant or cut off from other people 11. Feeling emotionally numb or being unable to have loving feelings for those close to you? 13. Trouble falling or staying asleep 15. Having difficulty concentrating	
PTSD Parcel 3		.89
	4. Feeling very upset when something reminded you of a stressful military experience 5. Having physical reactions (e.g., heart pounding, trouble breathing, or sweating) when something reminded you of a stressful military experience 8. Trouble remembering important parts of a stressful military experience 9. Loss of interest in things that you used to enjoy 17. Feeling jumpy or easily startled	

*Appraisal process item content consists of general summaries of vignettes.

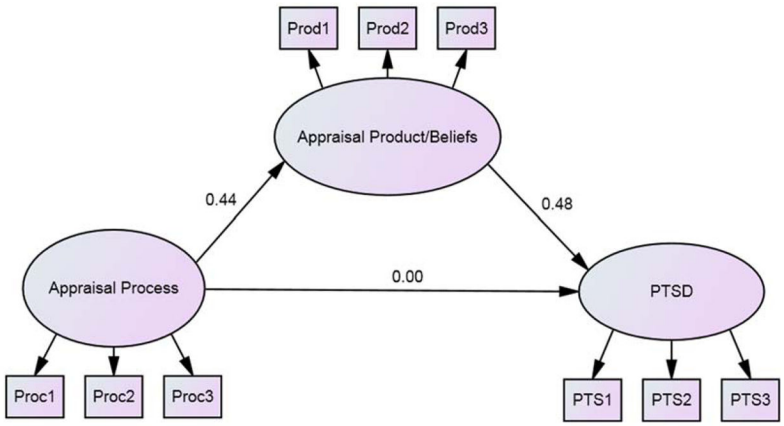

Figure 1.

Hypothesized Mediation Model. Circles represent hypothesized latent variables. Rectangles represent measured indicator variables. Regression weights are standardized. Error and disturbance terms are omitted

Table 1

Demographics and Military Service Data

	No (%)	Mean (SD)	Median
Gender			
Male	387 (91.3)		
Female	37 (8.7)		
Race/Ethnicity			
White/Caucasian	287 (67.5)		
Black/African-American	82 (19.3)		
Hispanic	22 (5.2)		
Asian/Pacific Islander	11 (2.6)		
American Indian/Alaskan Native	4 (0.9)		
Other	18 (4.2)		
Marital Status			
Married/Cohabitating	193 (45.5)		
Never Married	189 (44.6)		
Separated/Divorced	32 (9.9)		
Education			
No High School Diploma	1 (0.2)		
High School Graduate/GED	100 (23.6)		
Some College/Technical School	246 (58.0)		
College Graduate	54 (12.7)		
Some Post-graduate Work	10 (2.4)		
Graduate Degree	13 (3.1)		
Income			
Less than $20,000	84 (19.8)		
$20,000 – $39,999	129 (30.4)		
$40,000 – $59,999	88 (20.8)		
$60,000 – $79,999	62 (14.6)		
$80,000 or more	61 (14.4)		
Military Rank[a]			
Enlisted	345 (91.3)		
Warrant Officer	9 (2.4)		
Officer	29 (5.0)		
No Response	5 (1.3)		
Military Service (Years)[a]		7.52 (7.66)	5.00
Previous Combat Deployment			
Yes	184 (48.7)		
No	240 (51.3)		
Months in Combat[b]		12.41 (8.50)	10.00

[a]Members of the Aviation unit (n = 46) were not asked this question at baseline assessment and are not included in these analyses.

Table 2

Clinical Characteristics

	Mean (SD)				
	Total Sample (N = 424)	**Prior Combat[a] (n = 184)**	**No Prior[a] Combat (n = 194)**	***F***	***P***
Appraisal Process	16.35 (6.67)	16.40	16.13	0.15	.70
Appraisal Product	30.30 (11.35)	30.47 (10.74)	29.28 (11.29)	0.93	.34
PTSD	23.44 (8.42)	25.60 (10.19)	21.39 (5.73)	24.85	<.001

[a]Members of the Aviation unit (n = 46) were not asked this question at baseline assessment and are not included in these analyses.