ORIGINAL ARTICLE

Assessing Trauma-Related Appraisals by Means of a Scenario-Based Approach

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Abstract

Dysfunctional appraisals play a key role in Posttraumatic Stress Disorder (PTSD). The present study investigated a novel method to assess dysfunctional appraisals via an online study, in which participants ($N = 93$) were asked to specify a distressing, negative life event and were then presented with ambiguous, open-ended trauma-related scenarios. Participants were asked to generate an ending by writing down their first, spontaneous continuation for each scenario. Results showed that a greater number of dysfunctional appraisals generated on the scenario task was associated with higher scores on the Posttraumatic Cognition Inventory (PTCI) and Posttraumatic Stress Disorder Checklist for DSM-5 (PCL-5). In regression analyses, scores on the scenario task were predictive of current posttraumatic stress symptoms; however, this relationship was no longer statistically significant after controlling for PTCI scores. These results contribute to the literature on dysfunctional appraisals in PTSD, supporting the validity of the scenario task and indicating its potential utility in complementing the PTCI as a measure of dysfunctional appraisal.

According to cognitive models of Posttraumatic Stress Disorder (PTSD) (e.g., Brewin et al. 1996; Dalgleish 2004; Foa et al. 1989; Resick and Schnicke 1992), negative trauma-related appraisals play a key role in the development and maintenance of PTSD. To illustrate, the cognitive model of Ehlers and Clark (2000) postulates that individuals with persistent PTSD appraise the traumatic event and its consequences in a dysfunctional manner, including cognitions such as 'The event happened because of the way I acted' or 'Having these flashbacks must mean I'm going mad'. In this model, experiencing such dysfunctional appraisals is not only in itself highly distressing, but also drives further posttraumatic stress symptoms including intrusions, anxiety, and negative arousal.

There are various self-report measures assessing dysfunctional appraisals in PTSD, e.g., the posttraumatic maladaptive beliefs scale (PMBS; Vogt et al. 2012) or the Trauma Appraisal Questionnaire (TAQ; DePrince et al. 2010). A well-established instrument is the Post Traumatic Cognitions Inventory (PTCI; Foa et al. 1999). It includes three subscales: dysfunctional cognitions about the self, the world, and self-blame. Reliability is excellent for the full scale (Cronbach's α: 0.97; e.g., Foa et al. 1999), and excellent–good for the subscales (self: Cronbach's α.: 97; world: Cronbach's α: 0.88; self-blame: Cronbach's α: 0.86; Foa et al. 1999). Various studies using the PTCI have confirmed the role of dysfunctional appraisal in PTSD. In Foa et al.'s study (1999), results showed that all three scales were positively associated with PTSD severity, anxiety, and depression, and that they discriminated between traumatized individuals with and without a PTSD diagnosis. Further, Bryant and Guthrie (2005, 2007) demonstrated that a tendency to engage in dysfunctional appraisals before experiencing a traumatic event was predictive of subsequent PTSD symptomatology: Trainee fire-fighters completed the PTCI before being exposed to traumatic events and were

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then assessed for PTSD symptomatology after 6 months (Bryant and Guthrie 2005) and after 4 years (Bryant and Guthrie 2007). Results showed that pre-trauma scores on the PTCI self-subscale were particularly predictive of subsequent PTSD symptoms. More recently, Kleim et al. (2013) demonstrated that a reduction in dysfunctional appraisals predicted symptom reduction during trauma-focused CBT. However, symptom reduction did not predict a reduction in dysfunctional appraisals.

To summarize, there is theoretical and empirical evidence supporting the vital role of dysfunctional appraisals in PTSD, and there are well-established self-report measures to assess such appraisals. However, given the complex nature of dysfunctional appraisals in response to reminders of the trauma or its consequences, it should also be possible to measure these appraisals by methods other than self-report. Further, developing additional and complementary measures of dysfunctional appraisals may have several advantages. First, while completing self-report measures, participants are explicitly asked to express the thoughts that are measured, e.g., by asking whether or not they agree with a statement. Such 'direct measures' require deliberate and reflective processing of the presented items and bear several disadvantages, for example potential over- or underreporting. A second limitation of self-report measures is that participants are presented with pre-defined statements and/or a forced choice answering format, which may not be representative of participants' own thoughts. This is particularly relevant in the context of PTSD, in that different types of traumas may be associated with different types of dysfunctional appraisals, e.g., being a victim in a car accident or of a natural catastrophe is likely to be associated with different dysfunctional appraisals than being a victim of interpersonal violence. Thus, self-report measures do not necessarily allow expression of idiosyncratic appraisals that may be particularly personally relevant for an individual. Third, it is useful to have multiple measures of the same process, particularly if the measurement method is different, as this provides a means of cross-validation or triangulation of results, which can help to reduce potential biases in research arising from dependence on one specific measure (cf. Munafò and Davey Smith 2018).

In other areas of psychopathology, methods have been developed to measure idiosyncratic responses to ambiguous disorder-relevant material more indirectly. One widely-applied method is a scenario task in which participants are presented with ambiguous, disorder-relevant open-ended scenarios and asked to provide the first completion that springs to mind. The cognitive bias of interest is then inferred from participants' performance on the task, i.e. the number of (disorder-relevant) dysfunctional continuations. Unlike direct measures, such an 'indirect measure' thus provides an index of the concept of interest via a behavioral

response, namely via participants' self-generated completion (De Houwer 2006). Across a number of areas of psychopathology, e.g., in the context of anxiety disorders (Hertel et al. 2008), eating pathology (Cooper 1997), or alcohol misuse and abuse (Woud et al. 2012, 2014), studies using an open-ended scenario task have consistently found that the number of dysfunctional continuations produced in response to disorder-related, ambiguous scenarios was positively related to actual levels of psychopathology. In the current study we aimed to investigate the application of this method to the assessment of dysfunctional trauma-relevant appraisals. Towards this aim, we developed a scenario task that included ambiguous, open-ended descriptions of potential trauma-related cognitions that could be appraised in a dysfunctional manner. Participants were neither instructed to rate nor to evaluate the scenarios. Instead, participants were simply instructed to generate an ending for each scenario. We could therefore assess whether presentation of such open-ended trauma-relevant stimuli could in fact elicit dysfunctional appraisals in the absence of explicit instructions to provide an appraisal, and whether the extent to which participants provided dysfunctional appraisals in response to the scenarios provided an apparently valid and useful measure.

One potential advantage of such a scenario-based task is that the open-ended scenarios provide the potential to examine unconstrained appraisals. That is, responses are participant-generated and thus reflect idiosyncratic thinking styles and appraisals (for similar reasoning, see e.g., Franklin et al. 2005; Hirsch et al. 2016; Stopa and Clark 2000). Consequently, the scenario task may explain additional variance and in turn add unique information to the prediction of PTSD-related symptomatology. The assumption that indirect measures may have unique predictive validity is supported by results of another indirect measure, namely the Implicit Association Test (IAT; Greenwald et al. 1998). The IAT is a well-established instrument assessing the associative strength between automatically activated memory associations. During the IAT, participants have to categorize stimuli, and the stimuli categorization times are then used to infer the concept of interest (e.g., faster response latencies for associatively matched concepts). Results of, for example, Lindgren et al. (2013) showed that their appraisal IAT was predictive of variance in PTSD symptomatology over and above direct measures (for contradictory findings using other IAT operationalizations, see e.g., Engelhard et al. 2007; Roth et al. 2012).

The scenario task could also potentially complement the PTCI due to the fact that the total score on each measure reflects a different operationalization of 'severity' of dysfunctional appraisals. A high score on the PTCI is likely to reflect endorsing a large number of different potential dysfunctional appraisals; conversely, a high score on a scenario-based task would rather indicate the reliability with which

dysfunctional appraisals are elicited by a range of different scenario descriptions. Conceivably for an individual there could be one very specific circumscribed dysfunctional appraisal that is reliably triggered in a broad range of possible contexts; such a person may receive a high score on a scenario-based task but not on the PTCI. Therefore, the extent to which people may score similarly or differently on these different tasks can provide useful information to further our understanding of dysfunctional appraisals in PTSD.

To further investigate the validity and utility of the scenario task, we included additional measures relevant in the context of posttraumatic stress and dysfunctional appraisals, i.e., measures assessing resilience, rumination, self-efficacy, optimism, and pessimism. According to cognitive models of PTSD (e.g., Ehlers and Clark 2000; Foa et al. 1989; Resick and Schnicke 1992) these concepts play an important role in predicting and maintaining PTSD, and are associated with and a mediator of posttraumatic stress symptoms, including dysfunctional appraisals, independent of the type of trauma. To illustrate, Sexton et al. (2018) reported a negative association between resilience and PTCI scores. Similarly, Zang et al. (2017) found negative associations between all three subscales of the PTCI and resilience, with the strongest association between the self-subscale and resilience. Regarding the concept rumination, positive associations with both intrusive and deliberate rumination were found with negative appraisals about the self and the world (Cann et al. 2011). Results of Cieslak et al. (2008) demonstrated negative correlations between coping self-efficacy and PTCI scores, including negative cognitions about the self and world. Furthermore, coping self-efficacy mediated the effects of these dysfunctional cognitions on posttraumatic distress assessed at 3 month follow-up. Finally, Levkovich et al. (2015) showed that optimism was negatively associated with threat-related appraisals.

To summarize, we sought to investigate the novel application of an indirect method for measuring dysfunctional appraisals and therefore tested its convergence and divergence with several measures relevant in the context of posttraumatic stress. The present study was conducted online. In order to provide a reference for participants to complete the scenario task and questionnaires, participants were asked to describe a negative, distressing life event prior to completing the online test-battery. The test battery included the novel scenario task and two trauma-specific measures, the PTCI (Foa et al. 1999) and the Posttraumatic Stress Disorder Checklist for DSM-5 (PCL-5; German version: Krüger-Gottschalk et al. 2017). The PTCI subscales were used to develop the scenarios to ensure that they targeted typical trauma-related cognitions. Our predictions were as follows: Since the PTCI and scenario task target the same concept (i.e., dysfunctional appraisals), we expected to find a positive correlation between the two measures, i.e., the higher the number of dysfunctional appraisals on the scenario task, the higher scores on the PTCI. However, the processes involved in completing the PTCI and scenario task are not identical (i.e., explicit evaluation of pre-defined statements vs. idiosyncratic continuation of open-ended, ambiguous scenarios), and thus we expected the correlation to be weak. Via exploratory analyses, we also investigated the correlation between the different scenario types (i.e., self, self-symptom, self-blame, world) and the sub-scales of the PTCI (i.e., self, self-blame, world). Regarding the correlation between the PCL-5 and the scenario task, we expected a positive correlation (e.g., Hertel et al. 2008; Woud et al. 2012, 2014), i.e., the higher the number of dysfunctional appraisals on the scenario task, the higher levels of posttraumatic stress symptoms. Regarding the correlation between the additional self-report measures assessing resilience, rumination, self-efficacy, optimism, and pessimism, we expected to find positive and negative correlations, depending on the included concepts. To illustrate, the scenario task should correlate positively with participants' past and present level of distress related to the negative life event but negatively with participants' level of self-efficacy and resilience. Finally, we also examined the predictive validity of the scenario task. Specifically, we aimed to test the predictive validity of the scenario task when additionally controlling for trauma-related measures, and specificity for the prediction of posttraumatic stress symptoms. Following previous research using an indirect measure in the context of appraisals (Lindgren et al. 2013), we expected that the scenario task would be a unique predictor of trauma-related symptomatology (PCL-5 scores), even after controlling for trauma-related and other relevant self-report measures (state anxiety and depressive symptoms), and dysfunctional appraisals assessed via explicit self-report with the PTCI.

Methods

Participants and Sample

Participants were recruited via social media and posters and flyers distributed at Ruhr-Universität Bochum (RUB, Germany). In addition, the study information and survey link was sent to self-help groups for trauma and PTSD. In order to be eligible for the survey, participants had to be ≥ 18 years. In order to take part in the study, participants were required to have experienced a distressing, negative life event, as this served as the reference point for the measures included in the survey. In total, $N = 198$ started the survey. However, not all participants completed the study, and for some the survey was terminated after they indicated the presence of no negative life event (when excluding these participants: $N = 122$). Further, some participants did not

provide valid and/or required data. For example, to stay close to the original PTCI pen-and-paper administration format, participants had to type in a number from 1 to 7 for each response, but some did not use the 1–7 answering format. Other participants did not complete any scenario on the scenario task. After exclusion of these participants, the final sample for the present analysis was $N = 93$. For the sample's characteristics see Table 1.

Scenario Task

Scenarios

The scenario task was developed to be similar to open-ended scenario tasks developed for other disorder areas such as anxiety disorders (Hertel et al. 2008) or alcohol misuse and abuse (Woud et al. 2012, 2014), the difference being that scenarios were designed to elicit trauma-relevant dysfunctional appraisals. Each scenario was composed of one or two sentences and ended abruptly, thereby providing the opportunity for a participant created continuation, based on the participant's first interpretation of the open-ended cognition. Themes of the PTCI subscales were used to develop the scenarios to ensure that they targeted typical trauma-related cognitions. However, the self-subscale was used to develop two types of scenarios, that is, three scenarios described cognitions related to the self, e.g., emotional change since the trauma or general negative view of the self (e.g., "Since the event happened, I know how I will react in difficult situations. I will react …)", and three scenarios described cognitions related to the interpretation of posttraumatic stress symptoms, called 'self-symptom', e.g., appraisal of trauma-related thoughts ("I think about the trauma repeatedly. This tells me that…"). This distinction was motivated by the fact that we aimed to disentangle the differential contribution of general, negative appraisals about oneself as a person (in line with the 'self schema' as described in Foa and Rothbaum 1998) versus pure symptom appraisals. For both the world and self-blame subscale, 2 scenarios were developed ("Sometimes I think about the way I reacted during the distressing event. At these moments I think that …"; "I learned something about the people around me. Other people are …"). The complete list of scenarios is presented in "Appendix" section. All scenarios were piloted in a sample of PTSD patients. The main aim of this pilot was to check that the scenarios were comprehensible and indeed provided the opportunity for differential and idiosyncratic interpretations, without grammatical restrictions.

The scenario task included 14 open-ended scenarios, with 10 trauma-relevant and 4 filler scenarios. The task's instructions asked participants to think back to the negative life event they had described earlier when completing the scenarios. Furthermore, participants were asked to imagine themselves engaging in the described cognition, to type in their first, spontaneous continuation of the scenario, and to produce a continuation that represented a clear and unambiguous ending of the scenario.

Scenario Ratings

Two trained students blind to the scenario type and not otherwise involved in the study rated the continuations. The two coders first rated whether a continuation represented an appraisal or not (1 = yes, 0 = no), and then rated whether the continuation was dysfunctional or not (1 = yes, 0 = no)[1]. The coding procedure was as follows: The two raters first rated a small number of scenarios individually and then discussed their ratings in order to clarify and check their understanding of the coding criteria. After that, the raters continued coding all remaining scenarios individually. Next, a consensus score was created, i.e., the raters met to discuss their individual scoring and then agreed on a consensus in case of a mismatch.

The first set of independent ratings resulted in only moderate agreement (Cohen's Kappa) between raters: appraisal: 0.436; dysfunctionality: 0.471. Discussion with the raters indicated that the coding rules developed had been over-complex and thus difficult to apply. We therefore developed a simpler set of coding rules. Two new student raters were trained using these new rules, and then independently coded the scenarios using the procedure outlined above. This resulted in an improved inter-rater reliability (Cohen's Kappa), indicating substantial agreement: appraisal: 0.790; dysfunctionality: 0.727. As Cohen's Kappa is sensitive to the base rate of the to-be-coded events and tends to be over-conservative with skewed distributions, we also calculated an inter-rater agreement coefficient, G, that has been shown to be less sensitive to base rates (Xu and Lorber 2014).[2] This provided a higher estimate of inter-rater reliability for appraisal ($G = 0.991$), but a similar estimate for dysfunctionality ($G = 0.730$). Following the recommendation of Xu and Lorber (2014), we also report percentage agreement, which was 99% for appraisal and 86% for dysfunctionality.

The consensus coding derived from the second coding round was then used to calculate a dysfunctional appraisal

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[1] The scenarios' endings were also coded on two valence aspects, i.e., negativity (four-point Likert scale: -3 = very negative until 0 = neutral) and positivity (four-point Likert scale: $+3$ = very positive until 0 = neutral) and for complexity (1 = yes, 0 = no). However, for the purpose of the present paper we only included the first two ratings categories (i.e., whether the ending represented an appraisal and whether it was a dysfunctional appraisal).

[2] As the calculation of G requires a 2 × 2 contingency table, the small number of endings coded as 'missing' or 'not codable' were ignored in this calculation.

Table 1 Sample characteristics

	Percentage (N=93)
Gender	80.6 female
Education	
In school	1.1
Lower secondary education	2.2
High school	8.6
Completed apprenticeship	10.8
Vocational diploma	3.2
A-level	58.1
University degree	15.0
PhD	1.1
Employment status	
Pupil	1.1
Trainee	1.1
In apprenticeship	3.2
Student	61.3
Employee	20.4
Public official	2.2
Armed services	1.1
Unemployed	3.2
Disabled	4.3
Retired	2.2
Contents of negative life event[a]	
Death of close relative	29.0
Serious disease	19.4
Sexual assault/abuse	20.4
Violence	11.8
Parents' separation/divorce	12.9
Relationship issues	10.8
Bullying/emotional violence	11.8
Accident/natural disaster	5.4
Torture	1.1
Other	8.6

Measure	Mean (SD)	Range
Age	28.74 (10.59)	18–67
Scenario total	0.60 (0.21)	0–1
Scenario self	0.52 (0.29)	0–1
Scenario self symptom	0.78 (0.28)	0–1
Scenario self blame	0.56 (0.40)	0–1
Scenario world	0.46 (0.37)	0–1
PTCI total	91.87 (46.09)	33–211
PTCI self	51.73 (30.41)	21–135
PTCI self blame	14.01 (9.32)	5–35
PTCI world	26.13 (11.33)	7–49
PCL-5 total	25.73 (19.98)	0–74
Distress then	8.86 (1.86)	1–10
Distress now	5.84 (2.43)	1–10
Years event	8.14 (8.88)	0.10–45
RS-11	55.85 (14.34)	13–77
RSQ-D	61.06 (16.06)	34–104

Table 1 (continued)

Measure	Mean (*SD*)	Range
Self-efficacy	27.31 (6.65)	10–39
LOT-R O	4.29 (2.83)	0–9
LOT-R P	2.96 (2.66)	0–9
STAI-T	43.24 (14.05)	20–73
STAI-S	47.35 (14.07)	22–76

PTCI Posttraumatic Cognitions Inventory, *PCL-5* Posttraumatic Stress Disorder Checklist for DSM 5, *Years event* years passed since the negative life event happened, *RS-11* Resilience Scale, *RSQ-D* Response Styles Questionnaire, *Self efficacy* General Self-Efficacy Scale, *Life orientation test* revised optimism items, *LOT-R P* Life orientation test-revised pessimism items, *STAI T/S* Spielberger State-Trait Anxiety Inventory Trait/State version, *BDI-II* Beck Depression Inventory-II

[a]The total score exceeds 100% since some participants reported more than one negative life event

score for analysis.[3] This was the number of continuations judged to be both an appraisal *and* dysfunctional, divided by the total number of codable continuations (i.e. those judged either to be an appraisal or not an appraisal; percentage of missing values or not codable scenarios due to e.g., unclear language use was 0.03%). Hence, the higher the ratio, the greater the proportion of responses that were dysfunctional appraisals. Separate scores were also created for the four scenario types, i.e., self, self-symptom, self-blame, world.

The rules used for the final coding were as follows. A continuation was to be rated as an appraisal if it included an evaluation, estimation or judgement, or an assessment of worth or value. This rating should take into account both the scenario stem and the continuation. This was based on the fact that the ambiguous, open ended scenarios already represented an appraisal-related context, and thus the continuation only needed to 'finish off' the appraisal to be counted as such (example: 'My reactions following the distressing event are a clear sign that… it still distresses me/… I wish it never happened/… I was highly emotionally involved'). The rating of whether the continuation was dysfunctional or not was based on the cognitions typically reported in PTSD. That is, the continuation should involve a negative appraisal about the distressing event itself or the reactions during the event, the experienced symptoms following the event and the coping with these symptoms, or potential changes regarding the self or personality after the event. Further, a continuation could be coded as dysfunctional if it represented a negative appraisal about the world or others, or if the continuation expressed negative emotions, emotional numbness, distrust in one's own capacities, or being pessimistic about the future. As with the appraisal rating, the rating of dysfunctionality took the scenario stem into account. That is, as the scenario already established a trauma-related context, a negative continuation reflecting a first, spontaneous appraisal

of the ambiguous situation would in most cases complete the PTSD congruency (example: 'I learned something about the people around me. Other people are … unpredictable/… liars/… terrible').

Trauma-Related Questionnaires

Posttraumatic Cognitions Inventory

The Posttraumatic Cognitions Inventory (PTCI; Foa et al. 1999; German translation:; Ehlers 1999) comprises 33 statements reflecting appraisals surrounding a traumatic experience. It contains three subscales: negative cognitions about the self, the world, and self-blame. The PTCI's instructions were adapted and required participants to rate the statements based on their thoughts linked to the negative event they had described earlier, taking the last month as a temporal reference.

Posttraumatic Stress Disorder Checklist for DSM-5

The Posttraumatic Stress Disorder Checklist for DSM-5 (PCL-5; German version: Krüger-Gottschalk et al. 2017) is a 20-item self-report measure assessing the DSM-5 symptoms of PTSD, i.e., intrusions, avoidance, changes in negative thoughts and mood, and trauma-related arousal. The PCL's instructions were adapted and required participants to indicate how often each listed problem generated distress for them during the past month in relation to the negative life event they had described earlier.

Additional self-report measures

Resilience

The Resilience Scale (RS-11; Schumacher et al. 2005) is a translated and shortened version of the resilience scale developed by Wagnild and Young (1993). It contains 11 statements related to psychosocial stress-resistance.

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[3] When repeating the analyses with the consensus score of the first coding round the results remain the same.

Participants are asked to rate each statement by means of seven-point Likert scale ranging from '1 = no, I do not agree' to '7 = yes, I fully agree'.

Rumination

The rumination subscale of the Response Styles Questionnaire (RSQ-D; Nolen-Hoeksema 1991; German version: Bürger and Kühner 2007) was used to assess participants' tendency to engage in ruminative response styles. It includes 26 statements describing situations related to the cognitive and behavioural coping strategies when feeling depressed or dysphoric. The statements are rated on a four-point Likert scale ranging from '1 = almost never' to '4 = almost always'.

Self-efficacy

The revised General Self-efficacy Scale (Jerusalem and Schwarzer 1986) was used to assess participants' perceived self-efficacy regarding daily hassles and difficult life situations. It includes ten statements which are rated by a four-point Likert scale ranging from '1 = not at all true' to '4 = exactly true'.

Optimism and Pessimism

The Life-Orientation-Test-Revised (LOT-R; Scheier et al. 1994; German version: Glaesmer et al. 2008) was used to assess dispositional optimism and pessimism. It includes ten statements, with three items to assess optimism and three items to assess pessimism. The remaining four items are filler items and are not scored. Participants rate each item by means of a five-point Likert scale ranging from '0 = strongly disagree' to '4 = strongly agree'.

State and Trait Anxiety

The State Trait Anxiety Inventory (STAI-T, STAI-S; Spielberger et al. 1970; German version: Laux et al. 1981) was used to measure state and trait anxiety. Both subscales comprise 20 anxiety-related statements describing anxiety symptoms that participants rate for occurrence and frequency, at this very moment (STAI-S) or in general (STAI-T). Ratings are made using a four-point Likert scale, ranging from '1 = not at all' to '4 = very much so' for the STAI-S, and from '1 = almost never' to '4 = almost always' for the STAI-T.

Depressive Symptoms

The Beck Depression Inventory II (BDI-II; Beck et al. 1996; German version: Hautzinger et al. 2006) was administered to assess depressive symptoms. It includes 21 depression-related questions with respect to the way participants felt during the past 2 weeks. The rating scales make use of a four-point Likert scale (i.e., 0–3), however, the scale's anchors vary per item.

Set-Up and Procedure for the Online Survey

The survey was programmed in SoSci Survey (Leiner 2014). It started with the study information and informed consent. The study information explicitly stated that participants would be asked to describe a negative life event. Accordingly, participants were advised not to take part in the study if this would be too distressing for them. Next, demographic data were obtained. This was followed by the question whether or not the participant ever experienced a negative, distressing life event. If a participant answered with 'no', the survey stopped. If a participant answered with 'yes', the participant was asked to describe the event briefly, to indicate how many years/months ago the event had happened, and how distressing the event was, now and then (both distress ratings used a ten-point Likert scale with the end labels 'not all distressing = 0' to 'very distressing = 9'). After that, participants completed the scenario task, the PCL-5 and PTCI, followed by the clinical measures, i.e., Resilience, Rumination, Self-efficacy, Optimism Pessimism, STAI State und Trait, and BDI-II. The survey ended with the debriefing and some information about whom to contact in case the survey's completion caused unexpected distress (i.e., a list of contacts of trauma advice centres and trauma therapy professionals). The analysed dataset can be obtained via the open science framework via the following link: https://osf.io/geqkj/?view_only=1e72d77ce258434bb46c9222780dc625.

Statistical Analyses

Correlational analyses were conducted in order to test the relationship between the scenario task and the PTCI, PCL-5, and other self-report measures. Prior to this analysis, scatterplots for each correlation were visually inspected, but no potentially overly influential data points were identified. Correlation coefficients and p-values are reported (see Tables 2, 3). A linear regression was conducted to examine the predictive validity of the scenario task. There were no overly influential data points (Cook's distance). We used the following step-wise approach: Scores on the PCL-5 served as outcome measures. Predictors of step 1 were age, sex, experienced distress now, and time since the negative event happened. In step 2, scores of the scenario task were entered, to test whether this measure of dysfunctional appraisals had predictive value above these demographic and event-related variables that were entered in step 1. In step 3, STAI-T and BDI-II scores were added, to test whether the potential prediction of scores on the PCL-5 was not due to shared

Table 2 Correlations scenario task and PTCI

	1.	2.	3.	4.	5.	6.	7.	8.
1. Scenario total	–							
2. Scenario self	0.600**	–						
3. Scenario self symptom	0.523**	0.273**	–					
4. Scenario self blame	0.535**	0.183*	0.202*	–				
5. Scenario self world	0.584**	0.323**	0.167	0.239*	–			
6. PTCI total	0.508**	0.521**	0.297**	0.269**	0.322**	–		
7. PTCI self	0.502**	0.534**	0.257**	0.291**	0.306**	0.792**	–	
8. PTCI self blame	0.303**	0.288**	0.212*	0.092	0.226**	0.515**	0.356**	–
9. PTCI world	0.505**	0.491**	0.276**	0.261**	0.367**	0.736**	0.580**	0.437**

PTCI Posttraumatic Cognitions Inventory

$*p < .05$; $**p < .01$; $N = 93$, coefficients represent Kendall tau indices

variance with measures of depression and anxiety. In step 4, PTCI scores were entered, to test potential specificity and to test whether the scenario task would remain a significant predictor. The model's statistics, R^2/adjusted R^2 and R^2 change will be reported, and t-values, Betas, and p-values per step and per predictor, respectively (see Table 4). Because of skewed distributions or lack of normally distributed data, correlational analyses used Kendall tau indices. In order to interpret the strength of the correlations, a conversion formula was used which converted Kendall's tau into Pearson correlations (Walker 2003).[4]

Results

Correlational Data

Scenario Task and PTCI

Analyses revealed that appraisals assessed via the scenario task correlated significantly and positively with PTCI scores. This pattern was consistent across all possible combinations, i.e., for the correlation between the two total scores, and for the correlations between all subscales (for the scenario task: self, self-symptom, self-blame, world, for the PTCI: self, self-blame, world). Further, both total scores also correlated significantly and positively with all subscales. Following this, it can be concluded that the more often participants generated a dysfunctional appraisal for a trauma scenario, the more dysfunctional appraisals they reported on the PTCI. Regarding the correlations' strength, coefficients indicated moderate to very strong relationships. The correlation of main interest, i.e., total score scenario task and total score

PTCI, was $\tau = 0.508$, was indicative of a strong relationship (see Table 2).

Scenario Task and PCL-5

Correlational analyses examining the relationship between the scenario task and PCL-5 scores revealed a significant and positive relationship, $\tau = 0.470$. That is, the more often participants generated a dysfunctional appraisal for a trauma scenario, the higher participants' level of posttraumatic stress symptoms. The correlation's coefficient was indicative of a strong relationship (see Table 3).

Scenario Task and Other Trauma-Relevant and Self-report Measures

Experienced distress then (i.e. at the time of the trauma) and now, and time passed since the negative life event were used as trauma-relevant indices. Here, correlational analyses revealed no significant correlation between the scenario task and experienced distress then ($\tau = 0.030$), but positive and significant correlations between the scenario task and experienced distress now ($\tau = 0.274$, moderate relationship) and time passed since the trauma ($\tau = 0.229$, weak relationship). Hence higher levels of distress now and an event further in the past were associated with a greater proportion of dysfunctional appraisals for the trauma scenarios. Regarding the self-report measures, results showed that the scenario task correlated significantly and negatively with levels of resilience, self-efficacy, and optimism. That is, lower levels of dysfunctional appraisals on the scenario task were associated with higher levels of resilience, self-efficacy, and optimism. However, the scenario task correlated significantly and positively with levels of rumination, pessimism, state and trait anxiety, and depressive symptoms. That is, higher levels of dysfunctional appraisals on the scenario task were associated with higher levels of rumination, pessimism, state and trait anxiety, and depressive symptoms. The correlation

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[4] Correlational analyses based on Pearson correlations revealed similar results.

Table 3 Correlations scenario task, PTCI and self-report measures

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
1. Scenario total	–												
2. PTCI total	0.508**	–											
3. PCL 5 total	0.470**	0.605**	–										
4. Distress then	0.030	0.129	0.220**	–									
5. Distress now	0.274**	0.289**	0.467**	0.140	–								
6. Years event	0.229**	0.093	0.085	–0.107	0.005	–							
7. RS-11	–0.355**	–0.390**	–0.399**	0.048	–0.280**	–0.138	–						
8. RSQ-D	0.361**	0.461**	0.449**	0.210*	0.203**	0.079	–0.289**	–					
9. Self-efficacy	–0.458**	–0.487**	–0.477**	–0.077	–0.256**	–0.054	0.561**	–0.402**	–				
10. LOT-R O	–0.430**	–0.440**	–0.463**	–0.005	–0.288**	–0.078	0.502**	–0.341**	0.572**	–			
11. LOT-R P	0.326**	0.440**	0.384**	–0.043	0.196*	0.243**	–0.398**	0.257**	–0.453**	–0.588**	–		
12. STAI-T	0.393**	0.447**	0.567**	0.030	0.348**	0.156*	–0.416**	0.446**	–0.464**	–0.520**	0.450**	–	
13. STAI-S	0.442**	0.574**	0.564**	0.027	0.315**	0.135	–0.505**	0.480**	–0.587**	–0.606**	0.572**	0.660**	–
14. BDI-II	0.399**	0.569**	0.654**	0.102	0.413**	0.141	–0.496**	0.444**	–0.533**	–0.517**	0.487**	0.618**	0.679**

PTCI Posttraumatic Cognitions Inventory, *PCL-5* Posttraumatic Stress Disorder Checklist for DSM 5, *Years event* years passed since the negative life event happened, *RS-11* Resilience Scale, *RSQ-D* Response Styles Questionnaire, *Self efficacy* General Self-Efficacy Scale, *LOT-R O* Life-Orientation-Test Optimism, *LOT-R P* Life-Orientation-Test Pessimism, *STAI T/S* Spielberger State-Trait Anxiety Inventory Trait/State version, *BDI-II* Beck Depression Inventory-II

$*p < .05$, $**p < .01$, $N = 93$, coefficients represent Kendall tau indices

Table 4 Regression analysis predicting PCL 5 scores

Predictors	Model	R^2/adjusted R^2	R^2 change	t	Beta	p
Step 1	$F(4) = 15.30, p < .001$	0.413/0.386	0.413			
Sex				−0.863	−0.072	.390
Age				0.867	0.076	.389
Distress now				7.260	0.605	<.001
Years event				1.286	0.115	.202
Step 2	$F(5) = 24.19, p < .001$	0.584/0.560	0.171			
Sex				0.055	0.004	.957
Age				1.567	0.116	.121
Distress now				5.848	0.442	<.001
Years event				−0.362	−0.029	.719
Scenario total				5.956	0.475	<.001
Step 3	$F(7) = 60.08, p < .001$	0.834/0.820	0.250			
Sex				−0.591	−0.027	.556
Age				1.529	0.073	.130
Distress now				3.378	0.183	.001
Years event				−1.026	−0.053	.308
Scenario total				3.172	0.186	.002
BDI-II				6.281	0.592	<.001
STAI-T				1.139	0.104	.258
Step 4	$F(8) = 66.28, p < .001$	0.865/0.852	0.031			
Sex				−1.144	−0.049	.256
Age				1.055	0.046	.295
Distress now				3.943	0.194	<.001
Years event				−0.246	−0.012	.806
Scenario total				1.180	0.070	.241
BDI-II				3.856	0.379	<.001
STAI-T				0.115	0.010	.909
PTCI total				4.369	0.404	<.001

$N = 93$

PCL-5 Posttraumatic Stress Disorder Checklist for DSM 5, *PTCI* Posttraumatic Cognitions Inventory, *Years event* years passed since the negative life event happened, *STAI-T* Spielberger State-Trait Anxiety Inventory Trait version, *BDI-II* Beck Depression Inventory-II

coefficients were indicative of moderate to very strong relationships.

Prediction Posttraumatic Stress Symptoms via Scenario Task

Of most interest here are results starting after step 2, i.e., after entering the scores of the scenario task. Results of step 2 showed that the scenario task was a statistically significant predictor of posttraumatic stress symptoms (Beta = 0.475, $p < .001$), and adding this predictor increased the explained variance by 18.4%. Further, the scenario task remained a statistically significant predictor after entering the STAI-T and BDI-II in step 3 (Beta = 0.186, $p = .002$), indicating that the relationship with scores on the PCL-5 were not simply due to shared variance with measures of depression and anxiety. However, when entering PTCI scores in step 4, the

scenario task was no longer a statistically significant predictor (Beta = 0.070, $p = .241$), whereas the PTCI was statistically significant (Beta = 0.404, $p < .001$).

Discussion

The present study aimed to investigate the application of a new, indirect method for assessing dysfunctional appraisals. A scenario task was developed including ambiguous, open-ended descriptions of potential trauma-related cognitions that could be appraised in a dysfunctional manner. It was the participants' task to generate an ending for each scenario, with the aim that this would elicit their first, spontaneous appraisal of the ambiguous cognition. We expected to find a positive but weak correlation between the two measures of appraisal, i.e., the scenario task and the PTCI. Further, we

expected positive correlations between the scenario task and trauma-related symptomatology, and correlations between the scenario task and clinically relevant self-report measures, whereby the direction of the correlation depended on the type of self-report measure used. Finally, we expected the scenario task to be a predictor of trauma-related symptomatology, even after controlling for other relevant measures and dysfunctional appraisals assessed via the PTCI. Two independent raters coded participants' responses on the scenario task as to whether they were an appraisal and dysfunctional, and disagreements were resolved via discussion to generate a consensus score.

As predicted, the more often participants generated a dysfunctional appraisal as their response on the scenario task, the higher levels of dysfunctional appraisals they self-reported on the PTCI. Contrary to our expectation, however, this correlation was very strong rather than weak. Results of the regression analysis were also only partly in line with our predictions. That is, the scenario task uniquely contributed to the prediction of posttraumatic stress symptoms, except that after the PTCI scores were entered, it was no longer a significant predictor. This could potentially reflect a high level of shared variance between the scenario task and PTCI, perhaps suggesting that there is a large overlap in terms of what they assess and how this is associated with posttraumatic stress symptoms.

Correlational analyses of the scenario task and symptoms of posttraumatic stress (PCL-5 scores) revealed the expected association, i.e., the more dysfunctional appraisals were generated on the scenario task, the higher levels of posttraumatic stress. Thus, the study shows that simply presenting open-ended trauma-relevant scenarios and asking for a completion can elicit dysfunctional appraisals, even when an appraisal is not explicitly requested. Further, the scenario task correlated in the expected direction with the included other (trauma-related) self-report measures (except for distress experienced at the time of the event). Higher levels of distress now were associated with more dysfunctional appraisals, which could indicate an influence of current distress on appraisals, or vice-versa, or that both reflect some other index of event severity. Negative events that were further in the past were also associated with more dysfunctional appraisals, which might be surprising if one would expect appraisals to become less dysfunctional over time with increasing distance from the event. However, it is difficult to disentangle this from age or age at the time of the event, and it could also be that an event would have to be more severe and more negatively appraised for a participant to still think it relevant for the purpose of the study. Regarding the self-report measures, reporting more dysfunctional appraisals on the scenario task was associated with lower levels of resilience, self-efficacy, and optimism, and higher levels of rumination, pessimism, state and trait anxiety, and

depressive symptoms. Generally, these findings are in line with previous studies using the scenario task, in that the more disorder-specific dysfunctional endings are generated on the scenario task, the higher levels of psychopathology. We found the highest correlation between the scenario task and posttraumatic stress symptoms, which we consider as an important indication that our task taps into processes specific for posttraumatic stress. However, correlations with the PTCI were always higher than those of the scenario task. This could be explained by the fact that the PTCI has a higher internal validity than the scenario task, i.e., is a better representation of dysfunctional trauma symptoms. Alternatively, the PTCI has more items and thus could be more reliable than the scenario task. It is also possible that because participants completed the PTCI after the scenario task, responses on the PTCI could have been influenced by the scenario completion. For example, participants may have become more aware of their appraisals during the scenario task and thus provided a more accurate set of responses on the PTCI. In any case, follow-up research is needed to further improve the scenario task's validity.

The present study is not without limitations. First, although the Kappa indices indicated substantial agreement (following refinement of coding procedures) there is still room for improvement. Thus, although the scenario based approach offers the unique opportunity to assess participants' idiosyncratic appraisals, this also creates diverse data. Hence, follow-up research should be concerned about how both the task and the coding method could be improved. At this stage, concrete suggestions to enhance the inter-rater reliability would be to design the scenarios in such a way that the prompt to continue the scenarios with an appraisal is much stronger. Further, it may be useful to have a longer and more intensive training period of the raters, including more exchange prior to the actual rating and more training examples. Finally, it would be interesting to also ask participants to rate their own ending as this provides additional insights into the participants' idiosyncratic interference (for a similar approach, see Woud et al. 2012). Second, we tested a very heterogeneous, non-clinical sample, and the reported distressing events may not be representative of events that would be reported in a sample of PTSD patients. This limits the generalizability of our findings to such a sample, so follow-up work is needed testing the scenarios task in clinical context. Further, we do not know whether participants' continuations are truly reflective of specific trauma-related symptomatology, since they could also be indicative of e.g., depression or rumination-related symptoms. Third, participants were advised not to take part in the study if they thought it would be too distressing for them. As a consequence, there might be a response bias, i.e., our sample might only include participants who felt

that they could cope with re-activating the negative life event. Fourth, to further examine the validity of the scenario task, the addition of a second, direct measure of dysfunctional appraisals would have been useful, for instance the Trauma Appraisal Questionnaire (TAQ; DePrince et al. 2010), especially given the fact that the scenarios were matched rather closely to the items of the PTCI. It would also be useful to test alternative indirect measures of dysfunctional appraisals, for example using reaction time (RT) tasks to increase the task's sensitivity regarding the temporal stage at which the dysfunctional appraisal occurs (or at least restrict the stage). For example, a lexical decision task could be used in which participants would be presented with an ambiguous, trauma-related scenario, followed by a word cue that they would have to categorize as a word or non-word. In case the word cue is an existing word, it would also disambiguate the scenario. Hence, by varying the word's valence, word categorization times would thus represent an index of participants' automatic appraisal of the scenario (example: 'Intrusions following a traumatic event are …' 'normal' vs. 'abnormal', with faster RTs for the latter than former word in case of a dysfunctional appraisal). Finally, our data are only supportive of a correlational role for dysfunctional appraisals. In order to also test their potential causal role, as postulated by cognitive models PTSD (e.g., Brewin et al. 1996; Dalgleish 2004; Ehlers and Clark 2000; Foa et al. 1989; Resick and Schnicke 1992), studies are needed manipulating dysfunctional appraisals (for a review, see Woud et al. 2017). There are some first promising findings in analogue settings using the trauma film paradigm (e.g., Woud et al. 2012, 2013) or negative autobiographical events (Woud et al. 2018), however, this research area clearly needs follow-up work.

To summarize, results support the validity of our newly-developed scenario task, although there are some limitations in relation to its precise operationalisation in the current study. Hence, this study should be considered as 'proof of principle' for the application of this method to assessment of idiosyncratic appraisals in posttraumatic stress. Therefore, future research is clearly warranted, e.g., by testing the scenario task in a clinical setting with PTSD patients and different types of traumatic experiences. Further, it would be worthwhile to apply the task using a longitudinal design, e.g., before, during, and after treatment, to also test its sensitivity and specificity over time. Using such a scenario-based assessment of appraisals alongside well-established methods such as the PTCI can help provide cross-validation and triangulation of results and provide further insights into the nature and role of dysfunctional appraisals in PTSD.

Compliance with Ethical Standards

Appendix

Examples trauma scenarios per factor.

Factor	Example
Self	Since the event happened I know how I will react in difficult situations. I will react …
	I experience feelings differently now. My feelings are…
	If I had to make a prediction about my future I would say that…
Self-symptom	My reactions following the distressing event are a clear sign that …
	Images of the distressing event pop into my mind regularly. This means that…
	I think about the trauma repeatedly. This tells me that…
Self-blame	Sometimes I think about the way I reacted during the distressing event. At these moments I think that …
	During the distressing event I reacted in a certain way. What this reveals about me is that…
World	I learned something about the people around me. Other people are …
	When I think about my family, my thoughts are…

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