Development of the Posttraumatic Anger Scale

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Thesis submitted to the faculty of the Virginia Polytechnic Institute and State University in partial fulfillment of the requirements for the degree of

Master of Science
In
Psychology

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11/20/2015
Blacksburg, VA

Keywords: PTSD, anger, factor analysis, & psychometrics

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ABSTRACT

Anger is a pervasive problem after individuals experience traumatic stress that heightens the risk for violence, health problems, poor relationships, and poor treatment outcomes. Previous research has demonstrated a moderate relationship between anger and posttraumatic stress disorder (PTSD), yet this research also highlights that anger has not been rigorously measured in the context of PTSD. Thus, this study concerns the development of a complimentary measure to assess anger in the context of PTSD. Participants were 435 undergraduate students. The participants were given a battery including the proposed scale and measures of trauma exposure, PTSD, anger, depression, anxiety, and social desirability to assess. Exploratory factor analyses revealed that a hierarchical, four-factor model was the best model. The Posttraumatic Anger Scale appeared psychometrically sound, with excellent internal consistency, good evidence of validity, and good model fit. This scale may provide implications for clinical work, specifically for the assessment and tracking of anger symptoms connected to PTSD. Additionally, this scale may assist with research by predicting treatment outcomes, aggression, and PTSD.

ACKNOWLEDGMENTS

First, thank you to my advisor, Russell T. Jones, for his guidance and mentorship during this thesis process. I cannot tell you how grateful I am that you believed in me and supported my ambition to take on a challenging project.

And to my other committee members, Bradley White and Neil Hauenstein, thank you for challenging me and providing additional mentorship both professionally and personally.

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1.0 – Introduction

Anger is a pervasive and prevalent problem after individuals experience traumatic stress that heightens the risk for violence (Jakupcak et al., 2007; Sullivan & Elbogen, 2014; Wilk, Quartana, Clarke-Walper, Kok, & Riviere, 2015), health problems (Siegman & Smith, 2013), poor relationships (McFall, Fontana, Raskind, & Rosenheck, 1999), and poor treatment outcomes (Galovski, Elwood, Blain, & Resick, 2014). Despite these important potential impacts of anger, researchers do not measure anger comprehensively in the context of posttraumatic stress disorder (PTSD). For example, PTSD symptom checklists can only indicate the presence or absence of anger within the disorder. Additionally, most existing anger measures provide an assessment of general anger, but lack the specificity that trauma researchers and clinicians may find useful. Benefits of such specificity include predicting both PTSD and anger symptoms more precisely, and understanding the specific role of anger in trauma-related outcomes. Hence, the goal of this thesis is to develop a sufficient measure of posttraumatic anger to address this issue.

1.1 – Anger Definition

Before discussing anger in the posttraumatic context, it is important to define the construct of anger. Although anger is a widely studied emotion, defining anger has been problematic in the past, in part due to the complexity of defining emotions in general. Nevertheless, definitions of anger tend to converge on common themes. DiGiuseppe and Tafrate (2006) commented on the ambiguity of the definition of anger and then synthesized the literature to come up with their own definition. They defined anger as:

> A subjectively experienced emotional state with high sympathetic autonomic arousal. It is initially elicited by a perception of a threat (to one's physical well-being, property, present or future resources, self-image, social status or projected image to one's group, maintenance of social rules that regulate daily life, or comfort), although it may persist even after the threat has passed. Anger is associated with attributional, informational, and evaluative cognitions that emphasize the misdeeds of others and motivate a response of antagonism to thwart, drive off, retaliate against, or attack the source of the perceived threat. Anger is communicated through facial or postural gestures or vocal inflections, aversive verbalizations, and aggressive behavior. One's choice of strategies to communicate anger varies with social roles, learning history, and environmental contingencies. (pp. 21)

DiGiuseppe and Tafrate note that anger as an emotion is highly similar to fear, though in their definition they make it clear that anger is associated with an approach motivation, rather than an avoidance motivation. Overall, anger appears to be viewed as variable, associated with increased physical arousal, and negatively valenced.

1.2 – Evidence Linking Anger and PTSD

Empirically, there is a large literature supporting the association between anger and PTSD. For instance, a meta-analysis (Orth & Wieland, 2006) targeting anger and PTSD revealed a weighted mean effect size of r = .48. A limitation to this analysis pertains to the general measurement of anger, where one cannot know if the anger worsened after the traumatic event(s) or if the anger is specific to PTSD. Moreover, the authors identified that there is limited knowledge as to the causal pathway(s) between PTSD and anger and that future studies should rigorously test theories of anger in PTSD. Another, more recent meta-analysis also supported the

association between anger and PTSD (Olatunji, Ciesielski, & Tolin, 2010), and also indicated that anger was critical in differentiating PTSD from anxiety disorders. Olatunji and colleagues noted, however, that anger is not specific to PTSD, and suggested that more detailed analysis should be completed in future studies of anger.

More recent empirical studies continue to support this association between anger and PTSD (Galovski et al., 2014; Germain, Kangas, Taylor, & Forbes, 2015; Wilk et al., 2015). In a study of treatment outcomes, Galovski et al. (2014) found that anger was predictive of treatment response, where those with high levels of anger were more likely to drop out or not respond well to treatment. This analysis provides a good first investigation, and more rigorous analyses should try to determine why anger leads to these outcomes and how PTSD is related to this anger response. In another study involving combat veterans, Germain et al. (2015) found that negative beliefs mediated the path between PTSD and anger expression. Specifically, negative beliefs about the world lead to outward expression of anger and negative beliefs about the self lead to inward expression of anger (e.g., rumination). One limitation of this study is that it is unclear whether and how the eventual anger response is specific to PTSD. Finally, Wilk et al. (2015) found that trait anger moderated the pathway from PTSD to aggression in a sample of combat veterans. Further investigating how this trait anger is related to PTSD, or even specific to individuals with PTSD would prove invaluable for predicting aggression in future studies. In summary, to address several of the above limitations, a more detailed assessment of anger specifically in the context of PTSD is warranted.

1.3 – Anger Measurement in the Context of PTSD

Several self-report measures have previously been utilized to study anger in the context of PTSD, and thus will be briefly reviewed here, beginning with traditional measures of anger

(e.g., State Trait Anger Expression Inventory) and concluding with the PTSD Checklist (PCL), which also indexes anger. One of the most commonly used anger instruments in PTSD research is Spielberger's State Trait Anger Expression Inventory (STAXI-2; 1999), a 57 item questionnaire in which individuals rate their anger experiences on a 1 – 4 Likert scale. Anger is broken down into two major facets: state anger and trait anger. State anger is the amount of anger a person is feeling at the moment they are filling out the inventory. Trait anger is the frequency and amount of anger someone typically feels, his reactionary style, and behavioral responses in times of anger. Many empirical studies have utilized the STAXI-2 when studying PTSD (e.g., Jayasinghe, Giosan, Evans, Spielman, & Difede, 2008; Kulkarni, Porter, & Rauch, 2012; Lommen, Engelhard, Schoot, & Hout, 2014; Riggs, et al. 1992). Across these studies, those with PTSD had higher levels of anger, and anger was a significant predictor of PTSD severity.

Another anger measure that has been used in PTSD research is Novaco's Anger Scale and Provocation Inventory (NAS-PI; 2003), which reflects a somewhat different taxonomy from the STAXI-2. The Novaco Aanger Scale (NAS) is a 60 item scale that measures an individual's anger experiences and the Provocation Inventory (PI) is a 25 item inventory of situations that may provoke angry responses. The NAS is rated on a 1 – 3 Likert scale as to how true the question is and the PI is rated on a 1 – 4 likert scale as to how angry the person would be in response to the provocation. Fewer empirical studies have included the Novaco Anger Scale in the context of PTSD, but those that have included it found similar results to the STAXI-2 (Novaco & Chemtob, 2002). Novaco and Chemtob found that the NAS was able to additionally explain 39% of the variance when predicting PTSD.

A third instrument, the Dimensions of Anger Reactions (DAR, Forbes et al., 2014; Kunst, Winkel, & Bogaerts, 2011; Novaco, 1975), is a brief anger scale that has been used in trauma populations, recently re-developed to assist the military in providing a brief anger screener. The DAR was designed to succinctly measure anger pertaining to frequency, severity, duration, and functional impairment (Novaco, Swanson, Gonalez, Gahm, & Reger, 2012). Two research teams have measured anger after traumatic events using the DAR (Forbes et al., 2014; Kunst, et al., 2011). Kunst and colleagues (2011) assessed for posttraumatic anger in their study by altering the 7-item DAR to ask about anger after a criminal victimization and found that anger explained PTSD symptomatology, which was partially explained by peritraumatic emotions. Forbes et al. (2014) utilized the DAR-5 to assess for posttraumatic anger in a sample of 484 university students. They found that the DAR could be used to successfully differentiate high and low anger groups as well as those scoring high or low PTSD Checklist (PCL; Weathers, Litz, Herman, Huska, & Keane, 1993). Despite the benefits of the DAR, NAS-PI, and STAXI-2, they were not designed specifically to consider PTSD or posttraumatic anger and may thus have limitations in their utility in assessing specific elements and aspects of anger in relation to PTSD.

Finally, the PCL is one of the most commonly used PTSD self-report measures. The current version, the PCL-5 (Weathers, Litz, Keane, Palmieri, Marx, & Schnurr, 2013) is based on the Diagnostic and Statistical Manual of Mental Disorders published by the American Psychiatric Association (*DSM-5*; APA, 2013) listing PTSD symptoms in order (1-20) following the *DSM-5*, and the individual indicates how severe each symptom has been for the past month. Regarding anger symptoms, the *DSM-5* PTSD workgroup believed that the *DSM-IV-TR* (APA, 2000) irritability symptom was conflating two symptoms: an emotional expression and a behavioral expression of anger (Friedman, 2013). As such, there are now two anger symptoms

in the PTSD criteria: persistent negative emotional states (4D) and irritable behavior and angry outbursts (1E; APA, 2013). Additionally, these symptoms must develop or worsen after the traumatic event to qualify as diagnostic criteria for PTSD. This change to the PTSD symptom criteria provides an exciting opportunity for researchers and clinicians to assess the complexity of anger in PTSD.

A potential shortcoming of the PCL is that it does not provide a comprehensive assessment of anger. Regarding the PCL-5, the measurement of the two anger symptoms (i.e., criteria 4D and 1E) only provides indication of the presence and severity of the two symptoms. While this information is useful, more detailed measurement of the two symptoms could provide beneficial information to better determine how anger is connected to PTSD, and subsequently why anger is a possible maintaining factor of PTSD and a contributor to poorer outcomes (Resick & Miller, 2009; Taft, Creech, & Kachadourian, 2012). A new measure could address this issue by specifically measuring the types of anger that are most common in PTSD according to empirical research and theory. Therefore, the goal of the present investigation is to devise a complementary measure which specifically assesses anger based on two theoretical frameworks that are detailed below.

1.3 – Development of the Posttraumatic Anger Scale

Survival Mode Theory. Chemtob and colleagues (Chemtob, Roitblat, Hamada, Carlson, & Twentyman, 1988; Chemtob et al., 1997) theorized that anger is a positive and essential component for surviving in a hostile environment such as combat. In these hostile environments irritability and anger energize the soldier so that they can act quickly against threats. This threat response is adaptive in situations of real threat. However, generalizing angry responses to non-threatening situations is maladaptive because they interfere with functioning. Such a

maladaptive response is what characterizes anger in the context of PTSD: the anger is linked to trauma exposure and has become problematic enough to be called a symptom. Regarding the PTSD anger symptoms in the DSM-5, the survival mode theory may best apply to the hyperarousal cluster (1E: irritability or outbursts of anger; Contractor, Armour, Wang, Forbes, & Elhai, 2015) in that it contextualizes anger as a type of alteration in arousal or hyperactivity.

The survival mode theory provides a more detailed view of anger in the context of PTSD which may improve existing measurement of posttraumatic anger. Currently, posttraumatic anger is measured by the PTSD Checklist (PCL). While indexing the severity of anger is useful, anger could be further examined in the context of the survival mode theory, by determining if the anger is in response to perceived generalized threat, and/or whether anger is energizing and thus perceived as potentially useful rather than interfering with functioning. Identifying these patterns and measuring them may be useful in a research context to predict future anger or aggression, as well as in a clinical context to help determine a possible treatment target (e.g., perceptions of threat and/or of anger as functional).

In order to create a more nuanced measure of anger that considers the survival mode theory, in the present study, the theory was broken down into two core components: generalized threat and energy, to reflect separate but related constructs of an anger response to generalized threat and an anger response that creates energy, respectively. As the survival mode theory states that anger creates energy so that an individual can respond to a threat, some of the energy-related items were written to also include a response to threat. Thus, two general pools of anger items were in accordance with these two core facets of the theory, for a total of 16 items. Sample items created for the response to threat were: "When I feel threatened, I get furious" and "I get mad at friends that I think are threatening me." Sample items that pertained to energy

were: "Anger gives me the energy to act quickly" and "Anger helps me feel strong when something/someone threatens me."

Fear Avoidance Theory. Originally introduced by Riggs and his colleagues (1992), the fear avoidance theory conceptualizes anger as a form of avoidance of unwanted thoughts or other emotions that are considered less acceptable to the individual (e.g., fear). Similar to the survival mode theory, anger is also seen as a mechanism motivating a person to act. Getting angry may allow someone with PTSD to approach unpleasant situations and also to diminish unwanted thoughts or emotions. In the context of PTSD, these thoughts or emotions are likely related to the traumatic event. Thus, as proposed by Contractor et al. (2015), the fear avoidance theory of anger may apply to the negative cognitions and mood cluster of PTSD (4D: persistent negative emotions such as fear, sadness, anger, and guilt) because anger is used to avoid other negative cognitions or mood states.

Existing instruments that index anger in PTSD (e.g., PCL-5) do not tap these central tenets of the fear avoidance theory of anger. For example, the PCL-5 negative cognitions and mood anger item matches the DSM-5 criterion "*Having strong negative feelings such as fear, horror, anger, guilt, or shame?"* The fear avoidance theory suggests certain undesired emotions (or thoughts) lead to persistent anger in PTSD as reactions to traumatic cues that persist after the traumatic event. Hence, the fear avoidance theory suggests assessment of pertinent functional details about this persistent anger based on two core facets of the theory, specifically: 1) whether the anger is used to avoid feared cognitions (which may relate to the traumatic event) and 2) whether the anger is in response to sadness, pity, or other emotions that are immediate reactions to traumatic cues. Identifying these patterns can be useful in a research context to predict other

avoidant behaviors, rumination, or depression, as well as useful in a clinical setting to identify maladaptive coping responses to negative cognitive or emotional experiences.

These two facets provided the framework to measure the fear avoidance theory. The fear avoidance theory appears to comprise thought avoidance and emotional avoidance functions of anger. Thus, two general pools of items were created to match these components of the theory. Thought avoidance items are exemplified by *"If I cannot avoid bad thoughts I get furious*" and *"When I have bad thoughts I get angry."* Anger reactions to other negative emotions are exemplified by *"I avoided dealing with my emotions by getting mad*" and *"Feeling guilty made me furious."* Further, the author noted that, in clinical settings clients often report anger in response to pity. Items focused on responses to perceived pity were thus added to the item pool. These anger reactions to pity are exemplified by *"People pitying me make me angry"* and *"I get enraged when people pity me."* Twenty items were created based on the fear avoidance theory, slightly more than the survival mode theory, in order to appropriately measure the range of possible thoughts or feelings that would provoke anger in individuals with PTSD.

Posttraumatic Anger Definition. Based on the two aforementioned theories and empirical evidence (Contractor et al., 2015; Olatunji et al., 2010; Orth & Wieland, 2006), an updated definition is being proposed. Whereas survival mode theory suggests that anger is necessary in times of threat and expressed outwardly because of anger's energizing quality (Chemtob, 1997), within the fear avoidance theory, anger is a more accepted emotion compared to negative thoughts and/or emotions (Riggs et al., 1992). Hence, posttraumatic anger will be reframed within the context of the *DSM-5* PTSD symptom criteria (4D and 1E) that develops or worsens pathologically. The primary goal of this investigation is to provide greater specificity in measuring PTSD and anger.

Improvements. Multiple steps were taken in the development of the Posttraumatic Anger Scale to improve upon existing measurement. First, the scale includes a section about the experience of anger *before* the traumatic event and a section about anger *after* the traumatic event, consistent with the *DSM-5* criteria and addressing the limitations about measuring anger before an event. A critical part of the development of the scale was framing the items in the context of PTSD. To do this, approximately half of the items were designed to reflect the survival mode theory and the other half to reflect the fear avoidance theory. Measuring the specific types of anger most related to PTSD will assist in understanding why anger and PTSD are related. Additionally, measuring anger this way helps make sure whether the anger is best explained by PTSD and not other disorders (e.g., depression, anxiety) or general anger problems.

1.5 – Hypotheses

Once finalizing the development of the Posttraumatic Anger Scale, it was expected that exploratory factor analysis (see method section) would reveal factors relating to the survival mode theory and fear avoidance theory. Other factors' existence was explored. Further, the Posttraumatic Anger Scale was compared to anger measures, the PCL, and non-related measures (i.e., anxiety, depression, social desirability) to explore convergent, discriminant, and incremental validity. It was expected that the Posttraumatic Anger Scale would be highly related to the anger measures and the PCL, but not closely related to the measures of anxiety, depression, and social desirability. Based on the previous findings, the posttraumatic anger scale included the rating of anger prior to an event and after the event. It was expected that those with probable PTSD would report higher anger than individuals without PTSD. Additionally, the anger was expected to increase more in individuals with probable PTSD, consistent with *DSM-5*. The Posttraumatic Anger Scale was also expected to predict PCL-5 scores over and above the

other anger measures (i.e, STAXI-2, NAS-PI, DAR), as well as the reverse (predict anger measures over and above the PCL).

2.0 – Method

2.1 – Participants

Participants were undergraduate students at Virginia Tech. They were recruited electronically on the university's online Sona system, through which students can earn class credit by completing the survey. Six hundred twenty-five students were recruited for the study, of which 435 completed the survey and produced valid responses (69.6%). A recent study that surveyed 585 college students reported that 216 of them had experienced a trauma (36.92%), 49 met *DSM-5* criteria with mild impairment (8.4%), and 28 met *DSM-5* criteria with moderate impairment (4.8%; Elhai et al., 2012). Similar prevalence rates were found in the current sample. Two hundred eighty-eight participants had experienced a DSM-5 Criterion A event (66.21%) and 53 participants had PCL-5 scores above 38 (12.18%). Thirty-eight of the participants with PCL-5 scores above 38 also had a Criterion A event (8.73%). Demographics of the sample can be found in Table 1.

2.2 – Measures

Development of the Posttraumatic Anger Scale. The Posttraumatic Anger Scale was developed to assess anger related specifically to PTSD. The first step in developing the Posttraumatic Anger Scale was investigating the theory connecting anger and PTSD (i.e., the survival mode anger theory and fear avoidance theory). Items were crafted to match these theories and also intended to relate specifically to PTSD. Currently, the scale proposes to assess premorbid anger functioning, temporal posttraumatic anger increases, as well as anger in the

specific contexts of PTSD-related anger constructs (i.e., survival mode anger and fear avoidance anger).

The scale has two parts: a retrospective report of anger *prior* to the identified most distressing event (similar to the PCL) and a report of anger *after* the identified most distressing event. Response format is on a 0 to 3 Likert scale, from *Not at all true* to *Definitely true*. This follows a similar format to both anger questionnaires and PTSD questionnaires. The scale began with 72 items and there are currently 38 items in the scale following analysis. Alpha coefficients suggested the scale had excellent internal consistency (Before $\alpha = 0.93$; After $\alpha = 0.94$; Total Scale $\alpha = 0.96$). The unedited scale took an average of 8 minutes to complete. Psychometric analyses are described below.

Life Events Checklist for DSM-5 (LEC-5; Weathers, Blake, Schnurr, Kaloupek, Marx, & Keane, 2013). The LEC-5 is a questionnaire that screens for traumatic events, and thus the possible need to assess for posttraumatic stress disorder. The LEC-5 is a new measure for the *DSM-5*, and its reliability has not been tested nor empirically validated. However, the changes from the previous version are minimal. The internal consistency in this study was $\alpha = 0.92$.

PTSD Checklist for DSM-5 (PCL-5; Weathers et al., 2013). The PCL-5 is a 20 item self-report questionnaire designed to assess for posttraumatic stress disorder. The PCL-5 is a new measure, and its reliability and validity have not been tested empirically yet. The PTSD Checklist for *DSM-IV* has been empirically validated in numerous samples, even in non-clinical samples (Conybeare, Behar, Solomon, Newman, & Borkovec, 2012). The PCL-5 showed excellent internal consistency in this study, $\alpha = 0.95$.

Dimensions of Anger Reactions (DAR; Novaco, 1975). The DAR is a seven item measure. Four items pertaining to frequency, intensity, duration, and physical antagonism. The

other three items concern functional impairment: adverse effects on social relationships, work, and health. Participants rate items on a 0 to 8 scale (*not at all* to *exactly*). Convergent and discriminant validity for this measure were recently shown in a study of US military (Novaco et al., 2012). In this study the internal consistency was $\alpha = 0.88$.

State Trait Anger Expression Inventory-2 (STAXI-2; Spielberger, 1999). The STAXI-2 is a 57 item questionnaire that takes 5-10 minutes to complete. Overall, the STAXI-2 assesses dispositional anger (trait anger), situational anger (state anger), and the expression of anger (anger-in, anger-out, and anger control). Participants rate questions on a 1 to 4 likert scale. Adequate discriminant validity and convergent vailidity have been demonstrated by the STAXI-2 (Deffenbacher et al., 1996). Internal consistency for state anger was $\alpha = 0.93$ and for trait anger was $\alpha = 0.87$.

Novaco Anger Scale and Provocation Inventory (NAS-PI; Novaco, 2003). The NAS-PI is a two-part, self-report questionnaire that assesses the subjective experience of anger in cognitions, behaviors, and arousal. The questionnaire takes approximately 15 minutes. Internal consistency coefficients are $\alpha = 0.94$ for the NAS and $\alpha = 0.95$ for the PI total scores (Novaco, 2003). In this sample the internal consistency coefficients were similar: $\alpha = 0.93$ for the NAS and $\alpha = 0.92$ for the PI.

GAD-7 (Spitzer, Kroenke, Williams, & Lowe, 2006). The GAD-7 is a seven item questionnaire designed to measure symptoms of Generalized Anxiety Disorder where the individual marks how often each symptom has been occurring in the past two weeks. The validity and internal consistency of the GAD-7 has been demonstrated (Löwe, Decker, Müller, Brähler, Schellberg, Herzog, & Herzberg, 2008). The internal consistency in this study was similar to these results, $\alpha = 0.89$.

Patient Health Questionnaire (PHQ-9; Spitzer, Kroenke, Williams, Patient Health Questionnaire Primary Care Study Group, 1999). The PHQ-9 is a brief measure of depression symptoms where the individual marks the frequency of each symptom in the past two weeks. The PHQ-9's validity has been empirically demonstrated (Kroenke, Spitzer, & Williams, 2001). In this study, the internal consistency was $\alpha = 0.86$.

Marlowe-Crowne Social Desirability Scale, Short Form C (MC-SDS-C; Crowne & Marlowe, 1960; Reynolds & Gerbasi, 1982). The MC-SDS-C is a scale designed to measure social desirability by prompting individuals to answer thirteen true/false questions such as "I have never deliberately said something that hurt someone's feelings." Confirmatory factor analyses have shown that the short form is an improvement on the full scale (Loo & Lofwen, 2004). The MC-SDS-C showed adequate internal consistency in this study, $\alpha = .72$.

2.3 – Procedure

After recruiting participants, they were directed to the university research portal. The portal brought participants to an online survey. They were given confidentiality information and asked whether they understand their rights as a participant before continuing. At the end of the survey all participants were notified of Virginia Tech and community mental health services, particularly resources relevant to PTSD.

3.0 – Results

3.1 – Data Analysis

R (R Core Team, 2014) was used for all analyses. The Posttraumatic Anger Scale was evaluated primarily using exploratory factor analyses (EFA). Exploratory factor analysis is typically used when first developing a measure. This is because while there may be a proposed

structure, an EFA will suggest the best structure for the given data. To find the appropriate number of factors, a scree plot and parallel analysis were conducted. However, while the parallel analysis and scree plot suggest the number of factors that should be retained, larger or smaller numbers of factors should be tested. Hence, a range of factor analyses was conducted and fit statistics (e.g., BIC, χ^2, & RMSEA) were examined. Description of item-retention is described later in this section. Principal component analysis or maximum likelihood extraction of factors would be inappropriate to use with PTSD and anger variables, as both are often non-normally distributed (and were positively skewed in the current sample). Principal axis factors were utilized per suggestions by Costello and Osborne (2005). An oblique rotation was the most appropriate to allow for the factors to correlate (Costello & Osborne, 2005). Factor congruency was analyzed to determine how much the Before and After factor structures differed.

When there is a proposed general factor, or a higher-order factor that influences lower-order factors, a hierarchical EFA is useful because this allows the researcher to test a higher-order structure while exploring the hypothesized lower-order factors. This method was used to explore a model where a higher-order factor influences the lower-order factors, which then influence the items (see Figure 2). Similar to the non-hierarchical analyses, multiple iterations were completed after eliminating poor-fitting items, a range of factors was explored, and factor congruency was computed.

Regarding item-deletion, poor items were generally determined to be items with loadings less than .4 or high cross-loadings (e.g., .4 & .3). This was based off of Hair et al. (Hair, Black, Babin, Anderson, & Tatham, 2006), where given the current sample size (n = 435), factor loadings above .30 should be statistically significant and provide power $\beta = .80$. The minimum was increased to ensure more practical significance. Items were also considered for deletion

when the Before and After parts of the scale were inconsistent with one another, because the two parts were hypothesized to share the same factor structure. A hierarchy of decisions was made to ensure conserving as many items as possible.

Regarding model fit and model selection, Preacher and colleagues' research on model fit in factor analysis (Preacher, Zhang, Kim, & Mels, 2013) was used for guidelines when selecting the best model. The root mean square error of approximation (RMSEA) was identified as the best method for identifying models that best fit the quasi-true factor structure. The RMSEA is an index of misfit per degree of freedom; lower values are preferred (< .08, acceptable, < .06 desirable; Hu & Bentler, 1998), though more stringent criteria suggest RMSEA < .05 (Preacher et al., 2013). The Bayesian information criterion (BIC) is also a useful fit index, as instead of seeking the quasi-true factor structure, the BIC assists in selecting the most generalizable models (Preacher et al., 2013). There is no suggested cutoff or difference in BIC values, though the accepted rule of thumb is that lower values of the BIC are better. Other fit indices were included and reported (i.e., root mean square residual [RMSR], chi-square tests, and Tucker-Lewis Index), though did not have as much weight in the decision-making process as the RMSEA and BIC. The theoretical structure and hypotheses were also taken into consideration when picking the best model, wherein if models had similar fit statistics, the one with the best theoretical sense was chosen.

Alpha coefficients and internal consistency were calculated using Cronbach's alpha. As there is a hypothetical general anger factor, an omega coefficient may be more appropriate. An omega coefficient is similar to an alpha coefficient, though is designed for scales where there is a higher order factor that accounts for all of the items (a general factor) and lower order factors that account for portions of the scale (e.g., subscales; McDonald, 1999).

Correlations were computed between the Posttraumatic Anger Scale, anger measures, PTSD measures, and depression and anxiety measures to assess for convergent and divergent validity. Additionally, an EFA was conducted with the subscales of the Posttraumatic Anger Scale and the other measures utilized in the study to assess for convergent validity. To assess for incremental validity, multiple regressions were computed to measure how much variance was further explained when the Posttraumatic Anger Scale scores were added to the regressions. A specific package in R, lmSupport, was used to assess for the ΔR^2 for each variable added to the regressions. Finally, t-tests were computed to compare individuals with traumatic event exposure (as measured by the LEC) or probable PTSD (determined by a criterion A event from the LEC and >36 on the PCL-5) compared to individuals without these experiences.

3.2 – Demographics

The sample collected consisted of 435 undergraduate students at Virginia Tech. The sample was predominantly female (n = 341, 78.39%). Racially, the sample included 351 Caucasian students (80.69%), 37 Asian (8.51%), 11 Hispanic (2.53%), 9 African American (2.06%), 2 Native American (0.46%), 2 Pacific Islander/Caribbean (0.46%), 20 Multiracial (4.60%), and 1 Other (0.22%). This distribution is comparable to Virginia Tech's racial diversity. The notable differences were more Caucasian students, fewer African American, and fewer Hispanic compared to the Virginia Tech population. The participant's average age was approximately 20 years old. The PTSD Anger Scale total score mean was 28.80 with a standard deviation of 31.48. The Before part of the scale had a mean of 12.84 and a standard deviation of 15.02. The After part of the scale had a mean of 15.97 and a standard deviation of 18.16.

3.3 – Factor Analysis

First, the data were examined for skew and kurtosis. The average skew was below 2 (1.65) and the average kurtosis was below 7 (3.09), which indicates that the assumptions of normality were not violated (Curran, West, & Finch, 1996). Then, parallel analysis and a scree plot were computed for the Before and After parts separately. The parallel analysis suggested a five factor solution for both parts of the scale as seen in Figure 1 with accompanying R output. When investigating the scree plot however, the first factor appeared to explain much of the variance and the other suggested factors did not appear to account for much at all as evidenced by the steep decline from the first factor to the other factors (see Figure 1). The suggested rule to read a scree plot is to find where the incline stops and the factors level off (Costello & Osborne, 2005). For these plots, both appear to level off immediately.

Non-hierarchical EFA Factor Structure. After investigating the parallel analysis and scree plots, the EFAs were computed for the Before and After parts of the scale. As was seen in the scree plot, there appeared to be a very substantial first factor, where the other factors included few items. The two parts of the scale were investigated concurrently, eliminating poor-fitting items and inconsistent items. Inconsistencies were determined by looking at the factor structure of the two parts of the scale. If items that were designed to be the same (e.g., "I got angry so I would not feel weak" & "I get angry so I will not feel weak") did not load onto the same factor, they were marked for elimination in the next iteration. If an item had a high cross-loading (.4 & .3), then the item was retained for the next iteration as the item then may load more strongly onto one factor or another after the other items were deleted.

Tables 2, 3, and 4 contain all non-hierarchical factor analysis results, with the exception of the five-factor model. A five-factor model was examined based on the results from the parallel

analyses and scree plots. A final model was not able to be constructed using a five-factor model because after many iterations there were still poor-fitting items and inconsistencies between the two parts of the scale.

Based on theory, a two-factor solution was examined. Twenty items were dropped for inconsistency and poor fit after 5 iterations. This analysis provided factor congruencies of .97 and .98 between the Before and After parts of the scale. Factor 1 reflected survival mode anger, while Factor 2 reflected fear avoidance anger. Each factor contained 8 items.

Three and four-factor solutions were also explored to thoroughly explore the factor structure of the Posttraumatic Anger Scale. The final three-factor model was completed after four iterations and deletion of 15 items. The three-factor model provided factor congruencies of .98, .98, and .92 between the Before and After parts of the scale. Similar to the two-factor model, Factor 1 reflected fear avoidance anger and Factor 2, survival mode anger, while Factor 3 appeared to be a subset of fear avoidance anger centered on pity. Factor 1 contained 9 items, Factor 2 contained 10 items, and Factor 3 contained 2 items.

The final four-factor model was completed after 5 iterations and deletion of 20 items. The four-factor model provided factor congruencies of .96, .98, .97, and .89 between the Before and After parts of the scale. Factor 1 related to anger giving a sense of control or energy, Factor 2 related to thought avoidance, Factor 3 reflected anger in response to pity, and Factor 4 reflected anger in response to threat. Factor 1 contained 6 items, Factor 2 contained 5 items, Factor 3 contained 2 items, and Factor 4 contained 3 items.

Hierarchical EFA Factor Structure. Once the non-hierarchical EFA solutions were fully explored, hierarchical EFAs were computed for the Before and After parts of the scale. Similar item-exclusion criteria were used for the hierarchical analysis. A five-factor scale was

examined first. Similar to the non-hierarchical five-factor model, there was not a compatible final solution after many iterations. See Tables 5, 6, and 7 for the factor loadings of each hierarchical model.

A two-factor scale was examined based on the survival mode theory and fear avoidance theory. The final model was completed after 3 iterations and the deletion of 10 items. The hierarchical two-factor model provided factor congruencies of .97 and .97 between the two parts of the scale. Factor 1 reflected fear avoidance anger and Factor 2 reflected survival mode anger. Factor 1 contained 15 items and Factor 2 contained 11 items.

Three and four-factor solutions were also explored in the hierarchical analyses. The three-factor hierarchical analysis was completed after 3 iterations and deletion of 14 items. The hierarchical three-factor model provided factor congruencies of .97, .97, and .92. The factor structure was similar to the non-hierarchical three-factor model; Factor 1 reflected survival mode anger, Factor 2 reflected fear avoidance anger, and Factor 3 reflected anger in response to pity. Factor 1 contained 10 items, Factor 2 contained 10 items, and Factor 3 contained 2 items.

The four-factor analysis was completed after 4 iterations and deletion of 17 items. The hierarchical four-factor model provided factor congruencies of .97, .96, .88, and .96. The factor structures resembled the non-hierarchical four-factor model; Factor 1 reflected anger giving a sense of control or energy, Factor 2 reflected thought and emotional avoidance relating to anger, Factor 3 reflected anger in response to threat, and Factor 4 reflected anger in response to pity. Factor 1 contained 7 items, Factor 2 also contained 7 items, Factor 3 contained 3 items, and Factor 4 contained 2 items.

Model Fit. Model fit indices are presented in Table 8. According to the BIC values, the model with the best fit was the hierarchical two-factor model; the Before BIC = -840.01 and the

After BIC = -617.5. However, the Before part RMSEA in this model had adequate fit (RMSEA = .069) and the After part RMSEA had less than acceptable fit (RMSEA = .082). According to the RMSEA values, the hierarchical four-factor model was the best model; the Before RMSEA = .04 and the After RMSEA = .035. The BICs for this model were Before BIC = -445.11 and After BIC = -462.9. These BIC values were better than the hierarchical two-factor model and the non-hierarchical four-factor model, but poorer compared to the three-factor models. Due to previous literature finding that the RMSEA is the best predictor of finding the quasi-true factor structure, the hierarchical four-factor model was chosen as the best model given the RMSEA values and the moderately high BIC values when compared to the other values. Additionally, because the model fit statistics were so similar, the four-factor model was chosen because its structure appeared to best match the original hypotheses.

3.4 – Internal Consistency

Alpha coefficients were computed before and after the factor analytic procedures. The scale had excellent internal consistency before (Before $\alpha = .96$; After $\alpha = .97$; Total Scale $\alpha = .98$) and after item deletion (Before $\alpha = .93$; After $\alpha = .94$; Total Scale $\alpha = .96$). Internal consistencies were evaluated for Factors 1 – 4 after the hierarchical four-factor model was chosen. Factor 1 (energy/control) $\alpha = .93$, Factor 2 (thought/emotional avoidance) $\alpha = .90$, Factor 3 (threat) $\alpha = .89$, and Factor 4 (pity) $\alpha = .89$.

3.5 – Validity

Convergent and Discriminant Validity. Correlations were computed to assess for simple convergent and divergent validity. Convergent validity in this case would be the Posttraumatic Anger Scale correlating well with both anger scales (i.e., DAR, NAS-PI, &

STAXI-2) and measures of PTSD (i.e., PCL-5). Discriminant validity would be the Posttraumatic Anger Scale not correlating well with measures of depression and anxiety (i.e., PHQ-9, GAD-7). Table 9 shows the correlation matrix of the Posttraumatic Anger Scale and other measures. The subscale scores based on the final factor structure were added into the matrix. The associations with the PCL-5 were moderate, with *r* ranging from 0.33 to 0.48. The associations with anger measures varied, with *r* ranging from .16 to .53. Excluding state anger, the correlations ranged from moderate to strong, with *r* ranging from .26 to .53. Factor analysis of the scales (see Table 10) showed that the Posttraumatic Anger Scale loaded onto Factor 1, the anger measures (except state anger) loaded onto Factor 2 along with a negative factor loading for social desirability, anxiety and depression loaded onto Factor 3, and state anger loaded onto Factor 4.

Incremental Validity. The Posttraumatic Anger Scale was added into regressions predicting the PCL-5 in order to establish the amount of variance the newly developed measure explained over and above other measures. These results are shown in Table 11. The scores from the Posttraumatic Anger Scale were added last and the lmSupport package was utilized to calculate the unique variance explained by the Posttraumatic Anger Scale.

When predicting the PCL-5 scores, the Posttraumatic Anger Scale explained an additional 8% of the variance in the final model. Using the lmSupport package, the ΔR^2 for the Posttraumatic Anger Scale subscales were: Threat = 0.8%, Energy = 0.03%, Thought Avoidance = 3%, and Pity = 0.2%. The Threat and Thought Avoidance subscales were significant predictors, and the composite of the other anger measures was no longer significant. The PHQ-9 uniquely explained 5% of the variance in PCL-5 scores.

3.6 – *T*-tests

Finally, *t*-tests were computed to identify differences between hypothesized groups. Individuals with probable PTSD had higher Before part scores ($t = 4.09$, $p < .0001$, $d = 1.06$), After part scores ($t = 4.74$, $p < .0001$, $d = 1.26$), Total scores ($t = 4.85$, $p < .0001$, $d = 1.28$), and a larger difference from the Before to the After score ($t = 1.82$, $p = .04$, $d = 0.5$) compared to individuals without probable PTSD. Similarly, individuals that experienced a criterion A traumatic event had higher After scores ($t = 2.41$, $p = .008$, $d = 0.27$), Total anger scores ($t = 2.08$, $p = .02$, $d = 0.23$), and a larger Before-to-After increase ($t = 1.77$, $p = .04$, $d = 0.19$) compared to individuals without a criterion A event.

4.0 – Discussion

4.1 – Summary of Results

The Posttraumatic Anger Scale appeared psychometrically sound, with excellent internal consistency, good evidence of validity, and good model fit. Multiple models were explored based on theory and statistical analysis of the data available and the best model appeared to be a four-factor hierarchical model. This four-factor model was consistent with the hypothesis that factor structures would reflect anger (in a general sense), the survival mode theory, and the fear avoidance theory. To review, the survival mode theory demonstrates that anger is used for energy in response to threat (Chemtob et al., 1988; Chemtob et al., 1997) and the fear avoidance theory demonstrates that anger is used as an avoidance tactic of unwanted thoughts and emotions (e.g., fear, pity; Riggs et al., 1992). Based on the results, each theory was represented by the final model. Specifically, the survival mode theory was reflected by a factor pertaining to anger giving energy or strength and a factor pertaining to anger in response to threat. Further, the fear

avoidance theory was reflected by a factor of anger in response to unwanted thoughts and a factor about anger in response to feeling pity.

Beyond the factor structure, these results were consistent with the hypothesis that the Posttraumatic Anger Scale would have good convergent and discriminant validity with measures of PTSD and measures of anger, further supporting the survival mode theory and the fear avoidance theory. Moderate to strong correlations were found among the Posttraumatic Anger Scale, the PCL-5, the NAS-PI, the DAR, and the STAXI-2. If the correlations had only been strong with these anger measures and not the PCL-5, then one might suggest that the new scale was only a good measure of anger and, conversely, if the correlations had only been strong with the PCL-5 and not the anger measures, then one might suggest that the new scale was only a good measure of PTSD. Additionally, the scale showed via factor analysis that it loaded onto a separate factor, demonstrating that it is unique compared to other anger measures. Instead, the results demonstrate that the Posttraumatic Anger Scale may measures what it was intended to measure, namely anger in the context of PTSD based on the survival mode theory and fear avoidance theory.

Not only does the Posttraumatic Anger Scale measure anger in the context of PTSD, specifically anger relating to the survival mode theory and fear avoidance theory, but it also demonstrates adequate incremental validity over other measures when predicting PTSD. When predicting PTSD, the Posttraumatic Anger Scale explained more unique variance above and beyond the other anger measures (i.e., NAS-PI, STAXI-2, DAR), anxiety, and demographics. These results make sense because the scale was designed to be a measure of anger within the context of PTSD and not a measure of anger in a general sense. Thus, the newly developed scale

may be a useful predictor of PTSD. Depression, however, predicted more unique variance than other measures, and this may indicate possible comorbidities in the sample.

Finally, these results were also consistent with the hypothesis that individuals with probable PTSD would have higher scores on the Posttraumatic Anger Scale. Additionally, these results are consistent with recent research that demonstrates that individuals with PTSD report a greater increase in their anger from before the trauma to after the trauma (Lommen et al., 2014). This pattern of increasing anger was also found with individuals who reported experiencing a criterion A traumatic event. Overall, individuals with PTSD showed the greatest increase in anger, and individuals who experienced a criterion A event showed a smaller, but still significant increase in anger. From these results one may posit that posttraumatic anger is on a continuum: individuals that have experienced minimal stressors will be prone to experiencing minimal posttraumatic anger reactions; individuals that have experienced traumatic events will be prone to experiencing more posttraumatic anger reactions; and finally, those with psychopathological reactions to those traumatic events (e.g., PTSD) will be prone to experiencing high levels of posttraumatic anger reactions.

4.2 – Implications

First, the Posttraumatic Anger Scale appears to measure survival mode anger and fear avoidance anger in the context of a traumatic event and each of which had distinct factor structures in the analyses discussed above. As these factors are distinct and measured concurrently, the scale can be utilized to identify an overall increase in anger as a response to a traumatic event. Further, these factors provide detailed information above and beyond existing measures (e.g., PCL-5) regarding these aspects of anger: 1) anger as a form of energy, 2) anger as a response to threat, 3) anger as a form of thought avoidance, and 4) anger as a form of

emotional avoidance. This connection between theory and measurement is what provides the opportunity to explain and rigorously test the association between anger and PTSD as suggested in prior research (Olatunji et al., 2010; Orth & Wieland, 2006). Once that is done the Posttraumatic Anger Scale then may assist in targeting posttraumatic anger in clinical and research contexts as described below.

Clinically, based on the findings discussed above there are significant implications for the Posttraumatic Anger Scale including the identification of pathological levels of anger and assessing the types of posttraumatic anger responses, specifically survival mode anger and fear avoidance anger. The Posttraumatic Anger Scale can be used to determine what theory best explains an individual's anger responses by comparing the relative elevations in the respective subscales. First, the anger could be determined to be either problematic or not, and then if the anger is problematic, investigate the three combinations of posttraumatic anger (i.e., elevated survival mode anger, elevated fear avoidance anger, both elevated). Clinicians can then use their judgement to target the most problematic anger response. A suggestion would be to introduce psychoeducation about the two theories, which can help explain why the client may be getting so angry as a result of PTSD, and then work on breaking the existing pattern.

Second, the Posttraumatic Anger Scale can be used to evaluate treatment progress whether anger is a specific target of treatment or not. For example, a client could be given the Posttraumatic Anger Scale along with the PCL-5, and the client's treatment progress could be evaluated with both the PCL-5 and the Posttraumatic Anger Scale. Then, tracking this progress could help identify which portions of treatment impacted problematic anger responses by identifying the point in treatment where anger began to decrease. The Posttraumatic Anger Scale was designed with the intention to provide a useful measurement of anger in the context of PTSD

to give additional detail about the relationship between anger and PTSD by measuring survival mode anger and fear avoidance anger, and clinically it appears that the Posttraumatic Anger Scale can provide that detail with additional potential benefits of tailoring treatment and assessing progress.

Regarding research, the Posttraumatic Anger Scale was designed in order to benefit the research community by providing a clearer and more specific measure of anger in the context of PTSD to better predict PTSD, future anger, and other related constructs such as aggression. It appears that the scale may add research value as the scale showed excellent internal consistency, good convergent validity and discriminant validity, as well as good cross-sectional prediction of PTSD and anger. As clinical implications were just discussed, there is an implication for the Posttraumatic Anger Scale that bridges the gap between practice and research, which is the prediction of treatment outcomes. Previous outcome studies of PTSD have shown that anger negatively affects the course of treatment, where researchers posited that individuals avoid treatment because they are prone to avoiding negative emotional experiences with anger (Galovski et al., 2014). This phenomenon could be tracked as suggested in the clinical implications, and then this data could be used to identify risk factors for poor treatment outcomes such as anger as a form of avoidance of negative emotional experiences. Further, if clinicians do use the theories of anger in PTSD to target posttraumatic anger, the Posttraumatic Anger Scale can be utilized as the outcome measurement for the dependent variables. Other than clinical research, there are other research areas in which the Posttraumatic Anger Scale can be useful. For example, in that PTSD has been related to aggressive behavior (Jakupcak et al., 2007; Sullivan & Elbogen, 2014; Wilk et al., 2015) and anger has been specifically identified as a risk factor for aggression in individuals with PTSD (Elbogen et al., 2010; Sullivan & Elbogen, 2014;

Taft et al., 2007), the Posttraumatic Anger Scale could provide more of an explanation as to how PTSD leads to anger and aggression. Moreover, some researchers found that anger predicts the onset of PTSD (Lommen et al., 2014), and hence, a bi-directional approach could be taken with the Posttraumatic Anger Scale to research how posttraumatic anger reactions influence the onset of PTSD and how PTSD influences further anger. In summary, based on the initial performance of the Posttraumatic Anger Scale, the scale can offer clinical and research implications due to its good theoretical connection and ability to provide more detailed information about anger in PTSD.

4.3 – Future Directions

There are many available uses for the Posttraumatic Anger Scale as detailed above, however there are also more immediate steps that should be undertaken, namely further exploring and confirming the factor structure as well as measuring a variety of populations. First, a clear future direction is to complete a confirmatory factor analysis with a new and similar sample. Then, this step could be repeated with populations that are often sampled in PTSD, such as military veterans, survivors of natural disasters, etc. After evaluating the factor structure, analyses of construct validity could be completed to further demonstrate the scale's utility.

4.4 – Limitations

This study is not without limitations. The sample was collected using college undergraduate students, and while the sample was generally diverse compared to the population from which it was taken. Future studies could attempt to sample more generalizable populations or trauma-specific populations. Students also had a larger than expected number of invalid responses and some students did not complete the full set of assessments. This limitation could

be addressed by providing more of an incentive to fully participate and better methods of ensuring valid responses. Finally, the scale is retrospective in nature, which may affect how well individuals could report on their premorbid levels of anger as well as tell how much that anger increased after, though the patterns of results are consistent with other patterns of retrospective reports from individuals with PTSD (Naragon-Gainey, Simpson, Moore, Varra, & Kaysen, 2012).

4.5 – Conclusion

The Posttraumatic Anger Scale was developed to address the need for a more detailed assessment of anger in the context of PTSD. The scale itself demonstrated good psychometric properties and once researchers confirm the factor structure, the scale may have promise for clinical and research utility in the future. Overall, the Posttraumatic Anger Scale may be most useful in a treatment setting to track progress and assist in individualizing treatments or in research contexts most closely related to anger, such as aggression.

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Table 1. Sample Demographics

	Sample (n=435)	
	n / M	*% / SD*
Gender		
Female	341	78.39
Male	94	21.61
Race/Ethnicity		
Caucasian	351	80.69
African-American	9	2.07
Hispanic	11	2.53
Asian	37	8.51
Native American	2	0.46
Pacific Islander	2	0.46
Multiracial	20	4.60
Other	1	0.22
Did not provide race	2	0.46
Employed		
Yes	149	34.25
No	286	65.75
Criterion A Event		
Yes	288	66.21
No	147	33.79
Probable PTSD (PCL-5>38)		
Yes	53	12.18
No	382	87.82
Age	19.93	2.20
Income	4,410.30	17,078.73
Posttraumatic Anger Scale Total Score	16.71	17.64

Table 2. Factor Loadings of the 2-Factor Non-Hierarchical Model

	Before		After	
Item	PA1	PA2	PA1	PA2
Anger helped me feel in control when I felt threatened	**0.65**	0.15	**0.69**	0.13
Anger helped me feel strong when something/someone threatened me	**0.69**	0.11	**0.76**	0.05
Anger gave me the energy to act quickly	**0.58**	0.2	**0.77**	0.01
When I felt threatened, I got furious	**0.61**	0.14	**0.73**	0.03
I got mad at friends that I thought were threatening me	**0.78**	-0.11	**0.81**	-0.07
I got mad at people that I thought were threatening me	**0.84**	-0.12	**0.87**	-0.10
Anger helped me make it through tough events	**0.49**	0.27	**0.70**	0.12
When I got angry I became highly focused	**0.43**	0.22	**0.63**	0.09
When I cried I got angry	-0.08	**0.55**	-0.06	**0.55**
If I felt anxious I got livid	0.02	**0.67**	0.26	**0.46**
If I felt scared for too long I became irate	0.09	**0.60**	0.26	**0.51**
Times when I was alone with my thoughts I got angry	0.01	**0.67**	-0.01	**0.77**
Feeling guilty made me furious	-0.12	**0.71**	-0.04	**0.79**
Not being able to avoid my thoughts caused me to be angry	0.13	**0.65**	0.02	**0.79**
I got enraged if I couldn't avoid my thoughts	0.12	**0.65**	-0.01	**0.83**
Feeling weak infuriated me	0.12	**0.55**	0.21	**0.47**

Table 3. Factor Loadings of the 3-Factor Non-Hierarchical Model

	Before			After		
Item	PA1	PA2	PA3	PA1	PA2	PA3
Anger helped me feel in control when I felt threatened	0.06	**0.66**	0.09	0.07	**0.71**	0.07
Anger helped me feel strong when something/someone threatened me	0.04	**0.76**	-0.02	0.05	**0.78**	-0.03
Anger gave me the energy to act quickly	0.11	**0.6**	0.08	0.02	**0.83**	-0.09
When I felt threatened, I got furious	0.13	**0.59**	0.05	-0.01	**0.66**	0.15
I got mad at friends that I thought were threatening me	-0.02	**0.69**	0.00	-0.06	**0.74**	0.08
People told me I was angry and too sensitive	-0.02	**0.82**	-0.11	-0.09	**0.80**	0.06
Anger helped me make it through tough events	0.08	**0.59**	0.12	0.09	**0.69**	0.07
When I got angry I became highly focused	-0.07	**0.52**	0.28	0.06	**0.66**	0.01
I didn't get scared when something threatened me if I was angry	-0.03	**0.44**	0.10	0.18	**0.55**	-0.08
When I cried I got angry	**0.46**	-0.11	0.16	**0.45**	-0.09	0.16
If I felt anxious I got livid	**0.47**	0.14	0.06	**0.46**	0.28	-0.03
If I felt scared for too long I became irate	**0.55**	0.12	0.03	**0.52**	0.24	0.02
Times when I was alone with my thoughts I got angry	**0.75**	-0.09	0.05	**0.77**	-0.04	0.05
Not being able to avoid my thoughts caused me to be angry	**0.69**	0.06	0.06	**0.87**	-0.06	0.03
I got enraged if I couldn't avoid my thoughts	**0.72**	0.09	-0.06	**0.8**	-0.06	0.12
I was angry at myself when I got scared	**0.54**	0.10	0.07	**0.5**	0.19	0.11
When I had bad thoughts I got angry	**0.57**	0.15	-0.05	**0.81**	0.05	-0.08
I got angry if I couldn't get scary thoughts out of my head	**0.77**	-0.05	-0.05	**0.75**	0.07	-0.02
If I could not avoid bad thoughts I got furious	**0.72**	-0.03	0.01	**0.76**	0.09	-0.03
People pitying me made me angry	0.04	-0.04	**0.76**	0.03	0.03	**0.80**
I got enraged when people pitied me	0.02	0.07	**0.84**	0.04	0.05	**0.84**

Table 4. Factor Loadings of the 4-Factor Non-Hierarchical Model

	Before				After			
Item	PA1	PA3	PA2	PA4	PA1	PA2	PA3	PA4
Anger helped me feel in control when I felt threatened	**0.61**	0.01	0.06	0.17	**0.85**	-0.05	0.08	-0.02
Anger helped me feel strong when something/someone threatened me	**0.66**	0.08	-0.07	0.16	**0.70**	0.04	-0.05	0.16
Anger gave me the energy to act quickly	**0.52**	0.2	0.03	0.09	**0.67**	0.02	-0.08	0.2
Anger helped me make it through tough events	**0.62**	0.06	0.07	0.05	**0.71**	0.03	0.08	0.07
When I got angry I became highly focused	**0.67**	-0.04	0.18	-0.1	**0.55**	0.05	0.04	0.14
Anger stopped me from being scared	**0.54**	0.13	0.02	0.14	**0.71**	0.18	0.08	-0.12
Times when I was alone with my thoughts I got angry	0.13	**0.65**	0.06	-0.15	0.11	**0.72**	0.05	-0.08
Not being able to avoid my thoughts caused me to be angry	0.04	**0.61**	0.12	0.08	-0.07	**0.88**	0.03	0.05
I got enraged if I couldn't avoid my thoughts	0.21	**0.68**	-0.07	-0.05	0.04	**0.72**	0.13	-0.02
When I had bad thoughts I got angry	0.00	**0.58**	0.00	0.17	0.22	**0.71**	-0.06	-0.06
If I could not avoid bad thoughts I got furious	-0.15	**0.73**	0.08	0.11	-0.05	**0.76**	-0.03	0.19
People pitying me made me angry	-0.06	0.01	**0.81**	0.02	0.03	0.01	**0.82**	0.00
I got enraged when people pitied me	0.09	0.02	**0.82**	0.00	0.00	0.01	**0.86**	0.05
When I felt threatened, I got furious	0.16	0.16	0.12	**0.43**	0.06	0.09	0.13	**0.63**
I got mad at friends that I thought were threatening me	0.21	0.03	0.07	**0.49**	0.05	0.06	0.06	**0.72**
I got mad at people that I thought were threatening me	0.06	0.02	0.01	**0.82**	0.11	0.03	0.02	**0.75**

Table 5. Factor Loadings of the 2-Factor Hierarchical Model

	Before		After	
Item	F1	F2	F1	F2
Anger helped me feel in control when I felt threatened	0.11	**0.67**	0.09	**0.73**
Anger helped me feel strong when something/someone threatened me	-0.01	**0.78**	0.02	**0.78**
Anger gave me the energy to act quickly	0.16	**0.61**	-0.06	**0.82**
When I felt threatened, I got furious	0.17	**0.58**	0.08	**0.68**
I got mad at friends that I thought were threatening me	-0.03	**0.70**	-0.05	**0.78**
I got mad at people that I thought were threatening me	-0.14	**0.85**	-0.09	**0.84**
Anger helped me make it through tough events	0.18	**0.58**	0.09	**0.73**
I was angry while I felt on guard	0.26	**0.50**	0.25	**0.53**
When I got angry I became highly focused	0.18	**0.47**	0.03	**0.70**
I didn't get scared when something threatened me if I was angry	0.05	**0.43**	0.12	**0.55**
I would not have gotten things done without being angry	0.16	**0.42**	0.21	**0.43**
When I cried I got angry	**0.60**	-0.12	**0.63**	-0.14
If I felt anxious I got livid	**0.49**	0.18	**0.46**	0.24
If I felt scared for too long I became irate	**0.52**	0.17	**0.55**	0.22
Times when I was alone with my thoughts I got angry	**0.69**	0.00	**0.78**	-0.03
Feeling guilty made me furious	**0.73**	-0.13	**0.84**	-0.11
Not being able to avoid my thoughts caused me to be angry	**0.61**	0.16	**0.83**	-0.03
I got enraged if I couldn't avoid my thoughts	**0.58**	0.18	**0.84**	-0.04
Feeling weak infuriated me	**0.65**	0.02	**0.58**	0.11
I was angry at myself when I got scared	**0.58**	0.12	**0.62**	0.14
People pitying me made me angry	**0.66**	-0.12	**0.50**	0.14
I got enraged when people pitied me	**0.64**	0.03	**0.54**	0.16
When I had bad thoughts I got angry	**0.43**	0.26	**0.72**	0.06
Nothing infuriated me more than feeling scared	**0.58**	-0.01	**0.70**	0.02
I got angry if I couldn't get scary thoughts out of my head	**0.61**	0.06	**0.73**	0.06
If I could not avoid bad thoughts I got furious	**0.59**	0.10	**0.71**	0.09
General Anger Factor	0.90	0.90	0.90	0.90

Table 6. Factor Loadings of the 3-Factor Hierarchical Model

	Before			After		
Item	F1	F2	F3	F1	F2	F3
Anger helped me feel in control when I felt threatened	**0.68**	0.04	0.07	**0.74**	0.04	0.06
Anger helped me feel strong when something/someone threatened me	**0.78**	0.03	-0.04	**0.81**	0.03	-0.03
Anger gave me the energy to act quickly	**0.61**	0.11	0.07	**0.85**	0.00	-0.09
When I felt threatened, I got furious	**0.57**	0.14	0.04	**0.64**	-0.01	0.16
I got mad at friends that I thought were threatening me	**0.67**	-0.01	-0.01	**0.71**	-0.05	0.10
I got mad at people that I thought were threatening me	**0.81**	-0.02	-0.12	**0.77**	-0.08	0.08
Anger helped me make it through tough events	**0.61**	0.06	0.11	**0.72**	0.06	0.06
When I got angry I became highly focused	**0.54**	-0.08	0.27	**0.67**	0.05	0.02
I didn't get scared when something threatened me if I was angry	**0.48**	-0.06	0.09	**0.58**	0.17	-0.08
Anger stopped me from being scared	**0.68**	0.04	0.05	**0.52**	0.28	0.05
When I cried I got angry	-0.10	**0.46**	0.16	-0.09	**0.45**	0.16
If I felt anxious I got livid	0.13	**0.48**	0.06	0.29	**0.45**	-0.03
If I felt scared for too long I became irate	0.11	**0.55**	0.03	0.25	**0.51**	0.02
Times when I was alone with my thoughts I got angry	-0.10	**0.76**	0.06	-0.03	**0.77**	0.05
Not being able to avoid my thoughts caused me to be angry	0.06	**0.69**	0.06	-0.07	**0.87**	0.04
I got enraged if I couldn't avoid my thoughts	0.12	**0.70**	-0.06	-0.06	**0.79**	0.12
I was angry at myself when I got scared	0.10	**0.54**	0.07	0.20	**0.49**	0.11
When I had bad thoughts I got angry	0.17	**0.56**	-0.05	0.06	**0.81**	-0.08
I got angry if I couldn't get scary thoughts out of my head	-0.04	**0.76**	-0.05	0.07	**0.75**	-0.01
If I could not avoid bad thoughts I got furious	-0.03	**0.71**	0.01	0.08	**0.76**	-0.03
People pitying me made me angry	-0.03	0.04	**0.75**	0.03	0.03	**0.80**
I got enraged when people pitied me	0.07	0.03	**0.83**	0.05	0.04	**0.84**
General Factor	0.80	0.90	0.60	0.90	0.90	0.70

Table 7: Factor Loadings of the 4-Factor Hierarchical Model

	Before				After			
Item	F1	F2	F3	F4	F2	F1	F3	F4
Anger helped me feel in control when I felt threatened	**0.54**	0.11	0.16	0.05	**0.81**	-0.05	0.00	0.10
Anger helped me feel strong when something/someone threatened me	**0.67**	0.07	0.15	-0.08	**0.72**	0.02	0.15	-0.03
Anger gave me the energy to act quickly	**0.54**	0.17	0.10	0.03	**0.71**	-0.01	0.18	-0.07
Anger helped me make it through tough events	**0.62**	0.06	0.05	0.06	**0.72**	0.01	0.06	0.08
When I got angry I became highly focused	**0.71**	-0.07	-0.10	0.17	**0.60**	0.02	0.11	0.03
I didn't get scared when something threatened me if I was / angry	**0.41**	-0.06	0.12	0.08	**0.61**	0.11	0.03	-0.07
Anger stopped me from being scared	**0.57**	0.11	0.13	0.01	**0.74**	0.16	-0.14	0.09
When I cried I got angry	-0.01	**0.42**	-0.07	0.17	-0.08	**0.42**	0.04	0.16
Times when I was alone with my thoughts I got angry	0.11	**0.69**	-0.15	0.04	0.12	**0.69**	-0.09	0.06
Not being able to avoid my thoughts caused me to be angry	0.06	**0.61**	0.08	0.11	-0.07	**0.89**	0.04	0.02
I got enraged if I couldn't avoid my thoughts	0.22	**0.67**	-0.05	-0.07	0.03	**0.74**	-0.03	0.12
When I had bad thoughts I got angry	0.03	**0.56**	0.16	0.01	0.20	**0.73**	-0.08	-0.06
I got angry if I couldn't get scary thoughts out of my head	-0.07	**0.73**	0.06	0.00	0.03	**0.73**	0.09	-0.01
If I could not avoid bad thoughts I got furious	-0.11	**0.68**	0.11	0.08	-0.04	**0.76**	0.17	-0.03
When I felt threatened, I got furious	0.17	0.17	**0.42**	0.13	0.07	0.10	**0.61**	0.13
I got mad at friends that I thought were threatening me	0.20	0.06	**0.47**	0.07	0.08	0.06	**0.69**	0.06
I got mad at people that I thought were threatening me	0.05	0.01	**0.84**	0.02	0.11	0.05	**0.74**	0.03
People pitying me made me angry	-0.06	0.02	0.02	**0.79**	0.04	0.01	0.00	**0.81**
I got enraged when people pitied me	0.08	0.02	0.00	**0.83**	0.00	0.02	0.06	**0.85**
General Factor	0.90	0.80	0.70	0.60	0.80	0.90	0.70	0.70

Table 8. Model Fit Indices

Model	**Factors**	**Items**	**BIC**	**RMSR**	**RMSEA**	χ^2	**Pval**
2 Factor Non-Hierarchical	2	16	-356.07 / -178.66	.03 / .04	.051 / .085	184.64 / 362.05	< .0001 / < .0001
2 Factor Hierarchical	2	26	-840.01 / -617.5	.04 / .04	.069 / .082	824.63 / 1047.14	< .0001 / < .0001
3 Factor Non-Hierarchical	3	21	-587.75 / -472.89	.03 / .03	.053 / .068	323.55 / 438.41	< .0001 / < .0001
3 Factor Hierarchical	3	22	-650.53 / -515.71	.03 / .03	.054 / .069	370.13 / 504.94	< .0001 / < .0001
4 Factor Non-Hierarchical	4	16	-268.01 / -270.66	.02 / .01	.043 / .041	108.66 / 106.02	.0002 / < .0001
4 Factor Hierarchical	4	19	-445.11 / -462.90	.02 / .02	.040 / .035	168.5 / 150.71	< .0001 / < .0001

Note: BIC, RMSR, RMSEA, χ^2, Pval – Before / After

Table 9. Correlation Coefficients between Measures

Measure	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
1. PCL-5	-												
2. DAR	.33	-											
3. NAS	.30	.65	-										
4. PI	.16	.52	.57	-									
5. STAXI-2 State	.29	.41	.31	.30	-								
6. STAXI-2 Trait	.22	.64	.71	.63	.44	-							
7. PHQ-9	.49	.38	.37	.28	.43	.32	-						
8. GAD-7	.43	.38	.39	.32	.36	.33	.78	-					
9. MC-SDS-C	-.13	-.43	-.50	-.46	-.24	-.51	-.29	-.30	-				
10. Posttraumatic Anger Scale: Threat	.34	.47	.53	.37	.21	.45	.18	.20	-.26	-			
11. Posttraumatic Anger Scale: Energy	.37	.53	.53	.36	.32	.49	.22	.24	-.25	.77	-		
12. Posttraumatic Anger Scale: Thought Avoidance	.48	.51	.47	.35	.33	.44	.34	.36	-.24	.64	.73	-	
13. Posttraumatic Anger Scale: Pity	.33	.36	.37	.26	.16	.34	.20	.15	-.17	.52	.58	.58	-

Note: All correlation coefficients are significant at $p < .05$. PCL-5 = PTSD Checklist; DAR = Dimensions of Anger Reactions; NAS = Novaco Anger Scale; PI = Provocation Inventory; STAXI-2 = State Trait Anger Expression Inventory – 2nd Edition; PHQ = Personal Health Questionnaire; GAD = Generalized Anxiety Disorder; MC-SDS-C = Marlowe Crowne Social Desirability Scale, Form C.

Table 10. Convergent/Discriminant Validity Factor Analysis

	Before			
Scale/Subscale	F1	F2	F3	F4
Posttraumatic Anger Scale: Threat	**.78**	.13	-.05	-.09
Posttraumatic Anger Scale: Energy	**.90**	.01	-.06	.07
Posttraumatic Anger Scale: Thought Avoidance	**.80**	-.07	.15	.06
Posttraumatic Anger Scale: Pity	**.67**	-.01	.02	-.05
NAS	.15	**.74**	.09	-.09
PI	-.03	**.73**	.03	-.01
STAXI-2: Trait	.01	**.83**	-.08	.15
DAR	.20	**.54**	.07	.12
MC-SDS-C	.13	**-.67**	-.10	.05
PHQ-9	.00	-.02	**.86**	.08
GAD-7	.00	.06	**.86**	-.04
STAXI: State	.03	.07	.07	**.74**

DAR = Dimensions of Anger Reactions; NAS = Novaco Anger Scale; PI = Provocation Inventory; STAXI-2 = State Trait Anger Expression Inventory – 2nd Edition; PHQ = Personal Health Questionnaire; GAD = Generalized Anxiety Disorder; MC-SDS-C = Marlowe Crowne Social Desirability Scale, Form C.

Table 11. Incremental Validity Predicting PTSD

	Model 1: Posttraumatic Anger			Model 2: Anger Scales			Model 3: Depression & Anxiety			Model 4: All Factors		
	b	*p*	*Unique* R^2	*b*	*p*	*Unique* R^2	*b*	*p*	*Unique* R^2	*b*	*p*	*Unique* R^2
Intercept	17.04			6.07			-17.85			-5.60		
Demographics												
Age	0.05	.89	< .0001	0.02	.96	< .0001	0.13	.65	.0004	0.23	.41	.001
Male Gender	-2.18	.24	.003	-2.12	.19	.003	-2.85	.08	.006	**-3.38**	**.03**	**.008**
Caucasian	**-3.86**	**.04**	**.01**	-2.81	.10	.005	-2.87	.08	.005	-2.28	.14	.004
Income	-0.00002	.74	.0003	-0.00001	.82	.0001	-0.000004	.93	< .0001	0.00001	.79	.0001
Employed	1.79	.28	.0029	1.11	.44	.001	1.12	.43	.001	1.18	.37	.001
Psychopathology & Social Desirability												
Depression (PHQ-9)				**1.34**	**< . 0001**	**.06**	**1.20**	**< .0001**	**.05**	**1.20**	**< .0001**	**.05**
Anxiety (GAD-7)				0.41	.11	.005	0.25	.32	.002	0.08	.72	.0002
Social Desirability (MC-SDS-C)				0.19	.45	.001	**0.69**	**.01**	**.01**	**0.54**	**.03**	**.007**
Anger Scales (DAR, NAS-PI, STAXI-2)							**0.13**	**< .0001**	**.04**	0.009	.79	.0001
Posttraumatic Anger Scale												
Threat										**0.61**	**.03**	**.008**
Energy										-0.07	.68	.0003
Thought avoidance										**0.61**	**< .0001**	**.03**
Pity										0.27	.32	.002
	F (5,398) = 1.28, p = .27, R^2 = .02, Adjusted R^2 = .003			F (8,388) = 17.81, p < .0001, R^2 = .27, Adjusted R^2 = .25			F (9,387) = 18.76, p < .0001, R^2 = .30, Adjusted R^2 = .29			F (13,372) = 18.48, p < .0001, R^2 = .39, Adjusted R^2 = .37		

Figure 1: Parallel Analysis of the Before and After parts of the scale.

fa.parallel(before, fm="pa")
Parallel analysis suggests that the number of factors = 5 and the number of components = 3
fa.parallel(after, fm="pa")
Parallel analysis suggests that the number of factors = 5 and the number of components = 2

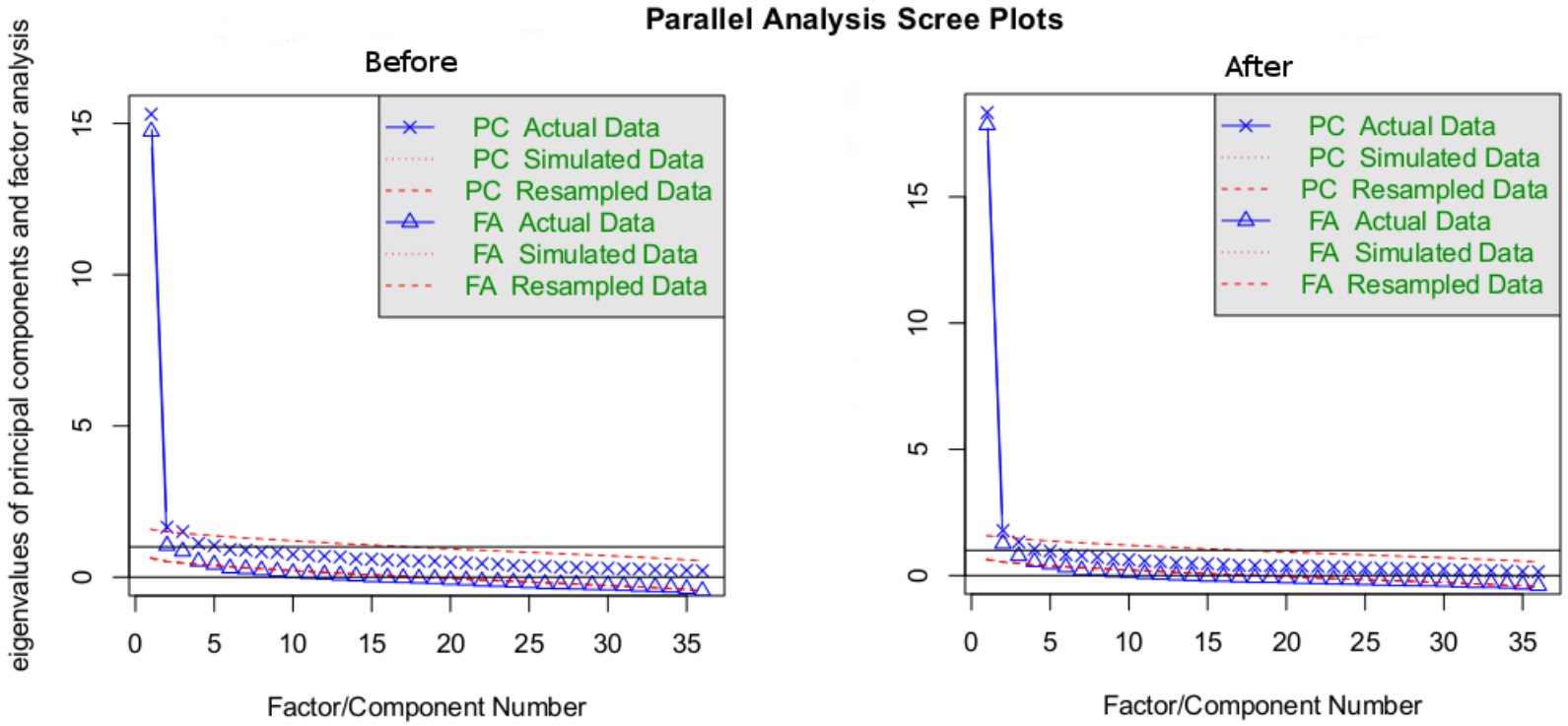

Figure 2: Example of Hierarchical Factor Structure, also the 4-Factor Model of the Before Part of the Scale. Note: the cross-loading is an artifact of the R software.