Published in final edited form as:

Assessment. 2020 April ; 27(3): 533–546. doi:10.1177/1073191119837613.

Quantifying Dispositional Fear as Threat Sensitivity: Development and Initial Validation of a Model-Based Scale Measure

Mark D. Kramer[1], **Christopher J. Patrick**[2], **John H. Hettema**[3], **Ashlee A. Moore**[3], **Chelsea K. Sawyers**[3], **James R Yancey**[2]

[1]University of Minnesota-Twin Cities, Minneapolis, MN, USA

[2]Florida State Univeristy, Talahassee, FL, USA

[3]Virginia Commonwealth University, Richmond, VA, USA

Abstract

The Research Domain Criteria initiative aims to reorient the focus of psychopathology research toward biobehavioral constructs that cut across different modalities of measurement, including self-report and neurophysiology. Constructs within the Research Domain Criteria framework are intentionally transdiagnostic, with the construct of “acute threat,” for example, broadly relevant to clinical problems and associated traits involving fearfulness and stress reactivity. A potentially valuable referent for research on the construct of acute threat is a structural model of fear/fearlessness questionnaires known to predict variations in physiological threat reactivity as indexed by startle potentiation. The aim of the current work was to develop an efficient, item-based scale measure of the general factor of this structural model for use in studies of dispositional threat sensitivity and its relationship to psychopathology. A self-report scale consisting of 44 items from a conceptually relevant, nonproprietary questionnaire was first developed in a sample of 1,307 student participants, using the general factor of the fear/fearlessness model as a direct referent. This new Trait Fear scale was then evaluated for convergent and discriminant validity with measures of personality and psychopathology in a separate sample (n = 213) consisting of community adults and undergraduate students. The strong performance of the scale in this criterion- validation sample suggests that it can provide an effective means for indexing variations along a dispositional continuum of fearfulness reflecting variations in sensitivity to acute threat.

Introduction

Innovative research strategies are needed to enhance our ability to relate psychological disorders as defined in current diagnostic systems to neurobiological constructs and measures. The National Institute of Mental Health’s Research Domain Criteria (RDoC) initiative (Insel et al., 2010; Kozak & Cuthbert, 2016), for example, seeks to reframe investigation of psychopathology in terms of core biobehavioral processes measured across multiple units of analysis—ranging from genes to neurophysiology to experiential report and from simpler to more complex behaviors. However, it remains unclear how variables

in the realms of biology and biologically-based behavior can be related most effectively to clinical symptom variables (Lilienfeld, 2014; Weinberger, Glick, & Klein, 2015). Trait counterparts to process constructs such as “acute threat” and “response inhibition” from the RDoC framework can serve a useful role in this regard, by providing concrete referents for interfacing psychological symptom variables with neural response measures (Patrick et al., 2013; Patrick & Hajcak, 2016). In prior work, we have presented evidence that a trait dimension of “threat sensitivity,” corresponding to the general factor of a structural model of fear/fearlessness scales known to correlate with acute threat reactivity as indexed by startle reflex potentiation (see Kramer, Patrick, Krueger, & Gasperi, 2012), can serve as one such interface—showing robust associations with both fear-related disorders and multiple physiological indices of threat reactivity (Nelson, Strickland, Arbisi, & Patrick, 2016; Venables et al., 2017; Yancey, Venables, & Patrick, 2016). In the current article, we describe efforts to develop and validate an efficient and effective nonproprietary scale for quantifying variations in fear/fearlessness (trait fear), conceptualized as the psychological-trait counterpart to the RDoC process construct of acute threat, that is, as threat sensitivity.

Conceptualizing and Measuring Fear/Fearlessness as Threat Sensitivity

The new scale described in this article was developed to assess variations in fear/fearlessness as represented by the general factor of a model of questionnaire-based measures of this type reported by Kramer et al. (2012). A major impetus for this modeling work was evidence from the psychophysiological literature demonstrating associations between blink–startle potentiation during aversive picture viewing and fear-related disorders and traits (Vaidyanathan, Patrick, & Cuthbert, 2009). Drawing on this evidence base, Vaidyanathan, Patrick, and Bernat (2009) demonstrated in an undergraduate sample that scale measures of fear/fearlessness shown to be associated with aversive startle potentiation (ASP) covaried together around a common factor, and that scores on this common factor accounted for associations of individual scales with ASP. Using data from a larger sample of adult twins and applying more formal modeling methods, Kramer et al. (2012) confirmed that these various fear/fearlessness scales (10 of them) all loaded onto a shared general factor and additionally onto secondary factors reflecting narrower spheres in which fearful tendencies are expressed (i.e., affective experience, social interaction, venturesome activity). Biometric (twin model- ing) analyses within this sample revealed substantial heritability (~50%) for scores on the general fear/fearlessness factor of the model, with the remaining variance in scores attributable to nonshared environment. In addition, Kramer et al. utilized fear scale data from this sample together with fear scale and ASP data from the Vaidyanathan, Patrick, and Bernat (2009) undergraduate sample to show that scores on the general factor of the fear/fearlessness model covaried robustly with variations in ASP.

Based on these findings, Kramer et al. (2012) interpreted the general factor of this model as indexing a dimension of biobehavioral defensive reactivity that projects into different modalities of measurable response—including reported experience of fear in relation to diverse stimuli and situations (i.e., as assessed by fear/fearlessness scales) and priming of defensive action in relation to aversive visual images (i.e., as assessed by ASP). As such, the general factor of the Kramer et al. model can be viewed as indexing, in the modality of self-report, the trait counterpart to the construct of “acute threat”—defined in the

RDoC framework as "activation of the brain's defensive motivational system to promote behaviors that protect the organism from perceived danger" (https://www.nimh.nih.gov/research-priorities/rdoc/constructs/acute-threat-fear.shtml). Conceptually, the dispositional counterpart to acute threat reactivity would be *general readiness to respond* to aversive cues (across different processing contexts) with defense-system activation, that is, *threat sensitivity*. The finding that differences in this trait dimension as assessed by self-report relate to variations in ASP is consistent with the idea of threat sensitivity as a biobehavioral construct (Patrick, Durbin, & Moser, 2012)—an attribute of individuals that is expressed in their physiological reactions along with their self-descriptions, and presumably in terms of overt behavioral response as well (e.g., performance under conditions of threat).

Operating from this perspective, the general factor of the Kramer et al. (2012) model provides a useful touchstone for developing a multimethod measurement model for the trait construct of threat sensitivity, that is, a framework for quantifying this dispositional construct through use of indicators from different modalities including self- or other-report, physiological response, and overt behavior. We have argued elsewhere that neurobehavioral traits quantified in this way can serve as effective vehicles for connecting clinical-symptom variables to biological-systems variables (Patrick et al., 2012; Patrick et al., 2013; Patrick & Hajcak, 2016). Relevant to this, Nelson et al. (2016) reported that estimated scores on the Kramer et al. fear/fearlessness factor showed a strong association (~.5) with interview-assessed symptoms of fear disorders and negligible associations with disinhibitory traits and problems. In other work, Yancey et al. (2016) showed that scores on a *multimethod* index of threat sensitivity—incorporating scores on Kramer et al.'s fear/ fearlessness factor along with three physiological measures of defensive reactivity to aversive cues (ASP, cardiac accel- eration, facial frowning)—correlated robustly with both clinical (i.e., fear disorder symptom) and physiological (i.e., other defensive reactivity) criterion measures.

In a further study utilizing twin-analysis methods, Venables et al. (2017) demonstrated that the observed association of scores on this multimethod index of threat sensitivity with fear disorder symptoms ($r = .41$) was attributable largely to genetic influences in common between the two. The implication is that dispositional threat sensitivity, when quantified using neurophysiological and psychological indicators combined, reflects heritable proneness to focal fear problems (i.e., specific and social phobia, and to some extent panic disorder and agoraphobia).

Current Study Aims and Hypotheses

Further progress in identifying reliable physiological and behavioral indicators of threat sensitivity and organizing these together with report-based indicators into a formal measurement model would benefit greatly from a brief scale measure of the fear/fearlessness factor identified by Kramer et al. (2012). A brief scale measure would be especially useful for studies that can contribute to a multimethod measurement model for threat sensitivity, that is, studies in which data are collected using multiple methods of assessment. The above-noted investigations by Yancey et al. (2016) and Venables et al. (2017), conducted to expand on the work of Kramer et al. (2012), used a 55-item measure of the general fear/fearlessness factor consisting of items selected from the 10 scales used as indicators

in the Kramer et al. model. However, this 55-item scale is not amenable to general use in the field because it includes items with differing response formats and some items that are proprietary. With these considerations in mind, the current research sought to develop a relatively brief, psychometrically effective, nonproprietary scale measure for use in studies seeking to identify and integrate neurobiological and behavioral indicators of dispositional fear/fearlessness (trait fear), conceptualized as threat sensitivity (Yancey et al., 2016).

The approach we used in developing this new scale was a *model-based* approach. That is, we used the general factor of Kramer et al.'s (2012) structural model of existing fear/fearlessness measures as an explicit referent for selecting items from a larger pool of nonproprietary items to form the new scale. The nonproprietary item pool consisted of 130 items comprising the Boldness Inventory (Patrick et al., 2019), a multiscale questionnaire designed to index interpersonal, affective, and behavioral expressions of a fearless–dominant dispositional style (Benning, Patrick, Blonigen, Hicks, & Iacono, 2005; Lilienfeld & Widows, 2005) in a bipolar manner. The current work was undertaken in three phases. In the first, we developed an item-based anchor scale, consisting of items from already existing questionnaire measures, for assessing the general factor of the Kramer et al. fear/fearlessness model. In Phase 2, we used this anchor scale as a referent for selecting items from the Boldness Inventory that provided for (a) effective measurement of the trait continuum of fear/fearlessness with (b) varied coverage of different thematic expressions (facets) of dispositional fear. We used conventional psychometric statistics along with item response theory (IRT) and factor analytic methods to identify items with optimal measurement properties for quantifying variations in fear/ fearlessness.

Phase 3 of the current work was undertaken to evaluate the measurement properties of the new Trait Fear scale in a new sample of participants. Given the detailed and nuanced approach we took to scale construction, we expected that this new scale would demonstrate good psychometric properties. Additionally, given our use of the Kramer et al. (2012) general factor as a specific referent, we predicted that this new scale would correlate very highly with estimated scores on this general fear/fearlessness factor. We also expected that the Trait Fear scale would show robust associations with fearlessness-related psychopathic traits and normal-range personality traits predictive thereof, and minimal associations with traits reflecting disinhibited and antisocial tendencies (cf. Benning et al., 2005; Nelson et al., 2016). Interview-based diagnostic data were also available for adult participants in our criterion-validation sample, and thus we were able to evaluate scale validity in relation to clinical symptom variables. In line with findings reported by Nelson et al. (2016), we predicted that the new Trait Fear scale would correlate robustly with fear disorder symptoms, to a lesser degree with anxious–depressive ("distress") symptoms, and negligibly with substance dis- order symptoms.

Methods and Results

The development and validation of a new scale measure for indexing the general factor of the fear/fearlessness model delineated by Kramer et al. (2012) was undertaken in three successive phases, each consisting of a series of steps. The first part of the online Supplement for this article provides an overview of the participant samples, measures, and

procedures for each phase; detailed descriptions of the method and results for each phase are provided in the subsections that follow here. Briefly, Phase 1 focused on construction of a psychometrically coherent, item-based index of the general fear/fearlessness factor to serve as an anchor for scale development work undertaken in Phase 2. The pool of candidate items for Phase 1 consisted of items from the various scale measures of fear and fearlessness included in the structural model reported by Kramer et al. Phase 2 entailed selection of items from a separate, nonproprietary pool of items to form a new scale measure of the general fear/fearlessness factor using the anchor scale from Phase 1 as a referent. The pool of candidate items for Phase 2 consisted of items written to clarify the nature and boundaries of Fearless Dominance (aka "Boldness"; Patrick, Fowles, & Krueger, 2009), delineated through development of the nine-scale Boldness Inventory (Patrick et al., 2019). Factor analysis, measurement invariance modeling, IRT techniques, and other psychometric procedures were utilized in Phase 2 to develop an optimally effective scale for indexing the general fear/fearlessness dimension. Finally, Phase 3 involved preliminary construct validation of the new Trait Fear scale in two samples, one consisting of undergraduates only and the other of community-dwelling adults and undergraduates, through examination of the scale's relationships with other personality trait measures and interview-assessed clinical symptoms.

Phase 1

Participants.—The sample for this initial phase consisted of adult twins (N = 2,511) utilized in the structural analyses of fear/fearlessness measures undertaken by Kramer et al. (2012). Participants for the Phase 1 anchor scale construction work comprised a random half-sample of these twins (i.e., one twin from each pair and half of those whose co-twin did not participate). The other half-sample of twins served as a cross-validation sample for the anchor scale, and as part of the development sample for the new scale in Phase 2. The first half-sample was predominantly Caucasian American (90.0%, with no other group exceeding 1%) and female (68.8%), with an age range of 18 to 33 years (M = 26.0, SD = 4.65). The second half-sample was also pre- dominantly Caucasian American (89.0%) and female (68.4%), with an age range of 18 to 33 years (M = 26.2, SD = 4.68).

Measures.—Items selected for inclusion in the anchor scale used in Phase 1 of the current work were drawn from the 10 scales (encompassing 154 items) that served as indicators in the Kramer et al. (2012) structural model—namely, the Fear Survey Schedule–III (FSS-III; Arrindell, Emmelkamp, & van der Ende, 1984); the Fearfulness subscale of the Emotionality-Activity-Sociability Inventory (EAS; Buss & Plomin, 1984); four scales from the Tridimensional Personality Questionnaire (TPQ; Cloninger, 1987) assessing facets of Harm Avoidance; three scales from the Psychopathic Personality Inventory (PPI; Lilienfeld & Andrews, 1996) comprising its Fearless Dominance factor (Benning et al., 2005); and a measure of venturesomeness, the Thrill–Adventure Seeking subscale of the Sensation Seeking Scale (SSS-tas; Zuckerman, 1979). Descriptive statistics and reliability estimates for these measures in the full twin sample are presented in Kramer et al. (2012; see Table 1).

Twin participants in the Kramer et al. (2012) study also completed the brief form of the Multidimensional Personality Questionnaire (MPQ-BF; Patrick, Curtin, & Tellegen, 2002),

which assesses 11 basic traits through scales composed of 12 items each and yields scores on higher order personality dimensions of Positive Emotionality, Negative Emotionality, and Constraint. In addition, the MPQ-BF's trait scales can be used to estimate scores on the Fearless Dominance and Impulsive–Antisociality factors of the PPI (Benning et al., 2005), and scores for these psychopathy factors served as further criterion measures.

Analytic Approach.—Kramer et al.'s (2012) structural model of fear/fearlessness was developed using data from a self-report survey of adult twins. The survey included nonproprietary as well as proprietary items, but the pool of nonproprietary items was insufficient for developing an effective scale measure of fear/fearlessness. For this reason, we used the nonproprietary, 130-item Boldness Inventory (Patrick et al., 2019) as a source of items for our new Trait Fear scale. In developing this new scale, we linked data for new participants (i.e., undergraduates) to the Kramer et al. model through an "anchor" scale composed of items from scales used in the model, selected to index the general fear/ fearlessness factor in an optimal manner. This anchor scale served as a concrete referent for selecting items, from the nonproprietary Boldness Inventory, to form the new Trait Fear scale. In addition, this scale provided a means for incorporating data from the adult twin sample into analyses of undergraduate sample data, as described below, to enhance the generalizability and precision of item parameter estimates.

Data for the first twin half-sample (n = 1,256) were used to identify 50 "anchor" items that provided good coverage of the general factor of the model and its content subdomains. These anchor items were used to represent the general fear/ fearlessness dimension, and data for the second half-sample were used to verify that the items selected for the anchor scale performed similarly in a set of participants separate from that used to select items for the scale. Candidate items for the anchor scale were evaluated within the first twin half- sample in terms of their correlations with scores on the general factor and subfactors of the Kramer et al. structural model; scores on the factors of the model were estimated in the first twin half-sample by applying maximum likelihood (ML) estimation to scores for the 10 scales, using weights corresponding to loadings in the Kramer et al. model. Prior to performing IRT analyses of the anchor scale items, exploratory factor analysis was used to establish the essential unidimensionality of the underlying trait.

Results.—Most items selected as anchor scale items (37 of 50) correlated more strongly (±.40 or higher) with the general factor of the fear/fearlessness model than with the sub-factors of the model. A smaller number of selected items (i.e., 13) correlated more with one of the model subfactors than with the general factor; these items were included to broaden the content coverage of the anchor scale and optimize its ability to index the full range of fearful/fearless tendencies. The final anchor scale was well-balanced in terms of item polarity, with 26 items worded in the direction of fearfulness and 24 worded in the direction of fearlessness (see online Supplement for further details regarding anchor scale development).

The 50 anchor scale items were determined to be adequately unidimensional in structure as evidenced by comparable loadings on the general factor of an exploratory bifactor model relative to the sole factor of a one-factor confirmatory model (cf. Reise, 2012). IRT analyses

of the 50 anchor items within each twin half-sample (performed using *Mplus*; Muthén & Muthén, 1998-2012) revealed effective measurement of the fear/fearless trait continuum in both, as evidenced by symmetric test information functions (TIFs) extending across a broad range of scores (see Figure 1). Total scores on the anchor scale were comparable across the two twin half-samples (*Ms/SDs* for Half-Samples 1 and 2 = 64.7/22.66 and 64.2/23.06, respectively), with both halves demonstrating a scale internal consistency (α) of .94 and a mean interitem correlation (*r*) of .23. Within the two twin half-samples, total scores on the anchor scale correlated very highly with scores on the general factor of the fearless/ fearlessness model (computed via regression): *r*s = .94 and .95 for Half-Samples 1 and 2, respectively.

Phase 2

Participants.—Two samples of students participated in this phase of the work, one comprising a scale development sample (*n* = 1,307) and the other a cross-validation sample (*n* = 425); some individuals within the student development sample (*n* = 339) and all those in the cross-validation sample served as participants in work undertaken to develop the aforementioned Boldness Inventory (Patrick et al., 2019). Students in the development sample self-identified as 75.8% Caucasian, 15.4% Asian, 2.4% African, 1.7% Hispanic, and 0.4% Native American, and 4.3% Other/ mixed race; 68.9% were women; and their average age was 19.5 years (*SD* = 1.31). Students in the cross-validation sample identified as 76.4% Caucasian, 12.3% Asian, 3.1% African, 1.4% Hispanic, and 0.7% Native American, and 6.1% Other/mixed race; 63.5% were women; and their average age was 20.0 years (*SD* = 2.40). As described below under “Analytic Approach,” data for the Phase 1 twin sample were used in conjunction with data for the student development sample to evaluate the measurement properties of the anchor scale items in this student sample and to select items for the new Trait Fear scale measure.

Measures.—All members of the student development sample completed the full set of fear/fearlessness measures used by Kramer et al. (2012). Mean anchor scale scores in the student the student cross-validation sample (*n* = 175) completed the fear/fearlessness measures in full, with the remainder com- pleting the subset of items comprising the anchor scale. As noted under “Participants” above, a portion of the student development sample (*n* = 339) and all members of the student cross-validation sample completed the Boldness Inventory (Patrick et al., 2019). The pool of candidate items that was drawn on to create the new measure of fear/fearlessness in Phase 2 consisted of the 130 items of the Boldness Inventory. The Boldness Inventory contains nine scales, labeled Dominance, Social Assurance, Persuasiveness, Self-Confidence, Optimism, Resilience, Valor, Intrepidness, and Tolerance for Uncertainty. Each scale is bipolar (i.e., includes items worded in the direction of lower boldness/higher fear as well as items worded in the direction of higher boldness/ lower fear). Summaries of item content and internal consistency coefficients for these nine facet scales are reported in Patrick et al. (2019).

Though the Boldness Inventory was not developed specifically to index trait fear, given its conceptual and empirical ties to the Fearless Dominance factor of the PPI (whose sub-scales were included as indicators in the Kramer et al. [2012] fear/fearlessness model), a

sizable portion of its items—in particular, those represented in facet scales assessing Valor (bravery), Social Assurance, Tolerance for Uncertainty, and Intrepidness (venturesomeness)—were expected to operate as strong indicators of general fear/fearlessness.

Analytic Approach.—Prior to development of the new Trait Fear scale, the measurement properties of the anchor items were examined in the student development sample (n = 1,307) and compared with those in adult twin Half-Sample 1 (n = 1,256) to inform how best to utilize twin Half-Sample 2 (n = 1,255) in scale development analyses. This was done in three ways. First, a TIF for the 50 anchor items was generated in the student development sample and compared with the TIFs for twin Half-Samples 1 and 2. Second, factorial measurement invariance modeling was used to compare the parameters of the anchor item set in the first random half of the twin sample with those of the first cohort of students. Models specifying configural, metric, and strong invariance constraints (Meredith, 1993) on the anchor item set across the two samples were compared in order to determine (a) the degree to which anchor item performance was similar across the samples and (b) the appropriate constraints to place on subsequent modeling analyses used to select items from the Boldness Inventory to form the new scale. Third, we compared the TIFs resulting from simultaneous modeling of the 50 anchor items across the student development and second twin half-samples using these invariance constraints.

Formal factorial measurement invariance approaches assess the degree to which sets of items operate as comparable indicators of their respective factors across participant groups. Mixture modeling with known latent classes using ML estimation, as implemented in *Mplus*, was used to assess invariance of the anchor item set. Models with increasing constraints, as follows, were used to test for varying degrees of measurement invariance across the three groups: (a) a configural invariance model, evaluating whether the same single-factor structure could be imposed on the two groups; (b) a metric invariance model, assuming both configural invariance and equality of factor loadings for the anchor items across the two samples (twin, student); and (c) a strong invariance model, assuming equivalence of thresholds across samples as well as both configural and metric invariance.

Following these analyses, an initial set of 60 candidate items for the new Trait Fear scale was established by identifying items from the Boldness Inventory that correlated in desired ways with the general factor and subfactors of the Kramer et al. (2012) model. In the full twin sample (N = 2,511), regression equations linking scale indicators to the general factor and each of the subfactors were derived from the structural model to estimate factor scores in the subset of the student development sample (n = 339) who completed both the fear/fearlessness scales and the Boldness Inventory. Correlational analyses were then used to identify items from the Boldness Inventory that correlated strongly with estimated scores on the general factor and minimally with scores on the subfactors. Other criteria that were considered in identifying potential items for the new Trait Fear scale were mean endorsement (as an index of item difficulty), item keying, and item content.

To finalize the item set for the new scale, the IRT measurement properties of each of these 60 candidate items were examined within the context of the best-fitting measurement invariance model of the anchor scale items. These modeling analyses, each incorporating the

50 anchor items together with one of the remaining candidate items, were conducted using anchor-item data for the second twin half-sample (n = 1,255) and the student development sample (n = 1,307), with each candidate item represented by data for the portion of the student development sample completing the Boldness Inventory (n = 339). Model estimated IRT parameters were used to plot an item information function (IIF) for the individual candidate item in each analysis along with IIF's for the 50 anchor items, in order to evaluate relative performance of the candidate item in measuring the latent trait defined by the anchor items. Criteria for selecting final scale items from the reduced candidate set included the following:

(a) visual inspection of the IIF for a given candidate item to assess information provided by it across the range of the trait; (b) examination of the item's correlation with anchor scale total scores, and its loading on the factor defined by itself and the anchor item set; (c) inspection of the item's correlation with estimated scores on the general factor and subfactors of the fear/fearlessness model; and (d) preservation of balance in content representation and item keying. As an additional basis for selection, IRT parameters for individual candidate items from this series of modeling analyses were plotted together on a common coordinate system to evaluate their performance, relative to one another, in assessing the latent trait underlying the anchor items.

Results.—Anchor scale measurement invariance analyses, tested across twin Half-Sample 1 and student development samples, indicated that the metric invariance model fit best, demonstrating a lower Bayesian information criterion value (288,394) than either the configural (288,594) or strong (288,496) invariance models. After determining that the anchor scale was adequately unidimensional, IRT analyses showed that the TIFs for twin Half-Samples 1 and 2 were quite comparable (Figure 1). Then, IRT analyses conducted in twin Half-Sample 2 and the student development sample revealed comparability of the anchor items' performance in the two samples when modeled simultaneously with metric invariance constraints (see Figure A of the Supplement available online).

Correlations of the 60 initial candidate items with scores on the general fear/fearlessness factor ranged from −0.58 to 0.55. Ten items demonstrated slightly higher correlations with one of the model subfactors than with the general factor, but the magnitude of these differences was small and general factor correlations for these items were each ±.40 or greater. Only one item with a general factor correlation less than ±.30 was included in this 60-item subset, for reasons of content coverage.

Further evaluation of these 60 items using IRT analyses resulted in 16 being dropped. The final set of 44 items that were retained, consisting of 20 keyed in the fearful direction and 24 keyed in the fearless direction, are listed in the online Supplement to this article. IRT parameters for each item of the scale, computed using data for the subset of students who completed the Boldness Inventory (i.e., 339 development sample participants + 425 cross-validation participants = 764 total), are shown in Table 1 of this article. The Trait Fear scale showed a mean of 59.2 (SD = 22.59) and internal consistency of α = .95 (r_M=.31) in this group of participants, and it can be seen from the table that the loadings for the items were uniformly strong and that the difficulty parameters for individual item thresholds

covered a broad range of the underlying dimension. Given these findings, and considering the need for even shorter scales in research conducted using large batteries of assessment instruments, we also identified 20 items to constitute an even briefer form of the scale (see last part of online Supplement for items included in this version). This 20-item scale, though reduced in terms of its content coverage, showed a very strong correlation with the 44-item version in the subset of students who completed the Boldness Inventory (n = 764; r = .97); this scale showed a mean of 26.7 (SD 10.96) and internal consistency of α = .92(r_M=.37).

Phase 3

Participants.—In the third phase of the project, preliminary validation of the final Trait Fear scale was undertaken by examining its relations with criterion measures including the MPQ-BF personality inventory, PPI psychopathy scores estimated using scores from this inventory, mental health symptomatology, and disinhibitory proclivities. The complete twin sample (N = 2,511), the students not included in development of the scale (n = 425; cross-validation sample), and a separate sample consisting of adults from the community and undergraduates (n = 213; criterion-validation sample) were utilized in these analyses; data for this latter sample, consisting of personality disorder symptom scores not used in the current work, were reported in another article by Strickland et al. (2018). Individuals in the latter sample identified as 64.8% Caucasian, 12.2% Hispanic, 11.3% African, 5.6% Asian, and 0.5% Native American, and 5.6% Other/mixed race; 50.2% were women; and their average age was 20.6 years (SD = 3.78, range: 18-45).

Measures.—An important component of preliminary validation of a new personality scale is to examine its relations with an established, omnibus inventory of personality traits. The MPQ-BF (Patrick et al., 2002), administered both to twins and to the criterion-validation sample, was utilized for this purpose. The criterion-validation sample was also assessed for mental disorder symptoms using the Structured Clinical Interview for *DSM-IV-TR* Disorders (SCID-I non- patient edition; First, Spitzer, Gibbon, & Williams, 2002). Procedures for these diagnostic assessments mirrored those reported for a separate sample in Nelson et al. (2016), and the disorders assessed were the same as in that study, namely, fear-related disorders, distress-related disorders, and substance use disorders. Current analyses focused on (a) symptom counts for individual disorders within each of these categories and (b) symptom composites for each category (fear, distress, substance) computed as the mean of symptom counts for individual disorders within each category. Also available for the Phase 3 criterion-validation sample were scores on a Disinhibition scale consisting of 30 items from the Externalizing Spectrum Inventory (Krueger, Markon, Patrick, Benning, & Kramer, 2007) that assess dispositional tendencies toward impulsiveness, irresponsibility, and unrestrained behavior. As described in prior work by Yancey, Venables, and Patrick (2013), higher scores on this 30-item Disinhibition scale are associated with externalizing problems of various types. However, other work (Nelson et al., 2016) has shown that this scale is largely unrelated to dispositional fear/fearlessness as represented by the general factor of the Kramer et al. (2012) model. In the criterion-validation sample, the mean of the Disinhibition scale was 17.2 (SD = 12.49) and the mean of the Trait Fear scale was 57.9 (SD = 25.55). Internal consistencies for the two scales were α = .89 (r = .21) and α = .96 (r = .37), respectively.

Analytic Approach.—First, the correlation of the new Trait Fear scale with the anchor scale was examined in the student cross-validation sample (n = 425), and the correlation of the new scale with scores on the general factor of the Kramer et al. (2012) model was examined in participants from this sample who completed the fear/fearlessness scales (n = 175). Second, IRT parameters for the 44 items of the new Trait Fear scale were estimated in the student cross-validation sample and compared with parameters for the portion of the development sample that completed the Boldness Inventory (n = 339). The TIF for the student cross-validation sample was then plotted on the same coordinate system as the TIF for the development sample. Third, correlations of the general factor and the anchor scale with traits and broad dimensions of the MPQ-BF and MPQ-estimated PPI scores were examined in the full twin sample, and correlations of Trait Fear with these MPQ criterion measures were examined in the criterion-validation sample. Fourth, the correlation of the Trait Fear scale with the 30-item Disinhibition scale was examined in the criterion-validation sample. These analyses were undertaken to evaluate convergent validity as well as discriminant validity in relation to primary trait scales of the MPQ-BF, PPI factors, and the Disinhibition scale.

Criterion-related validity of the new 44-item Trait Fear scale was further evaluated by testing for associations of this scale with psychopathology symptom data collected in the criterion-validation sample. For purposes of comparison with relationships reported by Nelson et al. (2016) for trait fear and disinhibition as predictors of clinical symptoms in a different sample, the new (44-item) Trait Fear scale and 30-item Disinhibition scale were included as joint predictors in a regression model for each individual disorder and each disorder composite score.

Results.—The correlation between scores on the new Trait Fear scale and overall scores on the anchor scale in the student cross-validation sample (n = 425) was very high (r = .88, p < .001) and comparable to the r of .87 for Trait Fear scores with scores on the general factor of the structural model in the subset of participants (n = 175) who completed full versions of the fear/fearlessness scales employed in the model. The close resemblance between the TIFs indicates that the Trait Fear scale indexed the latent fear/fearlessness trait in a highly similar manner across the two samples (Figure 2).

In the twin participant sample, correlations with MPQ trait scales, higher order factor scores, and MPQ-estimated PPI-Fearless Dominance and PPI-Impulsive-Antisociality scores were examined for both ML estimated scores on the general factor and scores on the 50-item anchor scale developed to index the general factor. Within the community sample, correlations with MPQ trait, factor, and estimated PPI scores were examined for the new Trait Fear scale. As can be seen in Table 2, the overall pattern of correlations between the general factor, anchor scale, and Trait Fear scales is remarkably similar across measurement of this dimension by alternative methods, and across the two samples. Of note, trait fear appears to represent an interstitial vector between broad MPQ dimensions of Positive Emotionality (−), Constraint (+), and Negative Emotionality (+), as a function of relations with constituent traits of Social Potency, Harm Avoidance, and Stress Reaction in particular. Expectedly, the Trait Fear construct as indexed in these ways converged strongly with Fearless Dominance (−) and only modestly with Impulsive–Antisociality (−).

Table 3 shows correlations of the 44-item Trait Fear scale with symptom counts for fear-related disorders, distress disorders, substance use disorders, and symptom composites for each of these disorder categories. Consistent with prediction, scores on the new Trait Fear scale were uncorrelated with scores on the 30-item Disinhibition scale ($r = -.09$, $p = .199$), which showed weak correlations with fear disorder symptoms and strong correlations with substance disorder symptoms (see Table 3). Though participant samples for the two studies were entirely separate, patterns of associations for the Trait Fear scale with the various diagnostic variables in the current criterion-validation sample were highly similar to those reported by Nelson et al. (2016). Trait Fear was more strongly associated with fear- related disorders than was Disinhibition, whereas the reverse was true for substance use disorders.[1] Both trait variables evidenced associations with distress disorders, but each to a lesser extent than with fear or substance use disorders (see Table A of online Supplement for regression and bivariate correlational results for the abbreviated, 20-item version of the Trait Fear scale).

Discussion

The current work was undertaken with the purpose of developing a brief nonproprietary scale measure for quantifying variations in self-reported fear versus fearlessness as reflected in the general factor of a structural model of this dispositional construct (Kramer et al., 2012). The model that served to anchor the current work encompasses scales known to correlate with acute threat reactivity as indexed by potentiation of noise-elicited startle during aversive cuing (ASP), and subsequent research has shown that scores on the general factor of this model covary with ASP and other physiological indices of acute threat reactivity (Yancey et al., 2016), and predict fear disorder symptoms to a robust degree (Nelson et al., 2016). With these points in mind, a broader aim of the current work was to facilitate progress toward a multimethod model of dispositional threat sensitivity (see Patrick, Iacono, & Venables, in press) by providing an efficient and effective self-report measure of this construct for use in multimethod research protocols.

To create an optimal scale measure of the general factor of the Kramer et al. (2012) model, we selected items from a new nonproprietary questionnaire, the Boldness Inventory (Patrick et al., 2019), that includes strong representation of fear/fearlessness content. The items chosen for the new Trait Fear scale were ones exhibiting good convergence with scores on an anchor scale composed of fear/fearlessness items from the inventories modeled by Kramer et al., which correlated very strongly as a set (>.9) with the general factor of their structural model. Both classical test theory (CTT) and IRT methods were used to evaluate items for inclusion in the new Trait Fear scale; CTT methods were used to select and refine the initial candidate item set in Phase 2 of the work (with reference to the anchor scale developed in Phase 1), and IRT procedures were used to further refine the item set in Phase

[1]Of note, Trait Fear scores showed modest negative relations with alcohol abuse and alcohol dependence, both at the zero-order level and in the context of regression models including Disinhibition scores as a copredictor. Related to this, Hicks, Iacono, and McGue (2014) reported evidence of a *positive* association for dispositional boldness (akin to the concept of Fearless Dominance described in this article) with earlier initiation of alcohol use. Given evidence that boldness or Fearless Dominance represents the low pole of the trait fear dimension (Kramer et al., 2012; Patrick et al., 2019), these findings converge to indicate a role of dispositional threat sensitivity in alcohol use versus desistance.

2 and then evaluate the measurement properties of the resultant 44-item scale in Phases 2 and 3. A particularly novel approach employed at the final stage of scale refinement was to evaluate candidate items one-by-one against the full anchor item set in separate IRT analyses; this ensured that each item of the new scale contributed distinctively to measurement of the underlying trait continuum mapped by the anchor item set (i.e., general fear/fearlessness).

Success in indexing the general fear/fearlessness dimension of the Kramer et al. (2012) model was demonstrated by the very high correlation (.88) between Trait Fear scale scores and anchor scale scores in the student cross-validation sample as a whole (n = 425), and by the similarly high r (.87) between Trait Fear scores and scores on the general factor computed for members of this sample (n = 175) who had completed the Kramer et al. fear/fearlessness measures in full. Importantly, comparison of the TIFs for the new Trait Fear scale (see Figure 2) and the anchor scale index of the general fear/fearlessness factor (Figure 1) indicates similar effective measurement across the full range of the latent trait for the two scales.

Interpreting the Construct Assessed by the Trait Fear Scale

Perspective on the nature of the construct assessed by the new 44-item Trait Fear scale is provided both by the structural model on which it is based and the item content of the scale itself. Given its very high association with the general factor of the Kramer et al. (2012) fear/fearlessness model, this new scale can be viewed as indexing reported sensitivity to acutely threatening stimuli or situational stressors across different psychological realms covered by that model—namely, perceived emotional reactivity (i.e., general experience of fear), interpersonal interaction (i.e., comfort vs. discomfort in demanding social contexts), and venturesome behavior (i.e., tolerance/intolerance of novel or perilous situations). In line with this, the majority of items comprising the Trait Fear scale (40 of 44) are from the following four content scales of the Boldness Inventory (Patrick et al., 2019): Valor (fearfulness vs. calmness in contexts of threat), Tolerance for Uncertainty ([dis]comfort in unfamiliar situations), Social Assurance (nervousness versus ease in social contexts), and Intrepidness ([dis]inclination to engage in dangerous activities). Thus, high scorers on this scale are likely to experience states of fear on a regular basis and be socially anxious and sensitive to evaluation/ criticism, uncomfortable in novel or uncertain situations, and averse to activities that hold potential for harm.[2]

From the standpoint of well-known personality frame- works such as Tellegen's (1982; Tellegen & Waller, 2008) MPQ model or the five factor model (FFM; McCrae & John, 1992), the construct indexed by the Trait Fear scale appears to reflect a mix of traits from

[2]Dispositional boldness, in reverse, can be viewed as strongly related to, but not isomorphic with, trait fear. As an illustration of this, Patrick et al. (2019) reported a correlation of −.67 in undergraduate participants for scores on the general factor of the 130-item Boldness inventory with the 50-item anchor scale measure used in the current work, developed to index the general factor of the Kramer et al. (2012) fear/fearlessness model. By comparison, the correlation between the anchor scale and the new Trait Fear (TF-44) scale in the undergraduate cross-validation of the current study was .88. Comparison of the structural models for trait fear (Kramer et al., 2012) and boldness (Patrick et al., 2019) indicates that affective–experiential and venturesome behavioral aspects of fear/fearlessness are represented more strongly in the general TF factor, whereas social–interpersonal aspects of fear/fearlessness are represented more strongly in the general bold-ness factor. A valuable avenue for future research will be to systematically evaluate overlap versus distinctiveness in the external correlates of these two constructs.

different psychological domains—specifically, of traits from MPQ domains of Positive Emotionality, Negative Emotionality, and Constraint (see Table 2; see also Patrick & Drislane, 2015) or FFM domains of Neuroticism, Extraversion, and Openness (Poy, Segarra, Esteller, López, & Moltó, 2014). Given this, adherents of these personality models might question whether the Trait Fear scale measures a coherent construct. Operating from a biobehavioral position, our view is that the scale indexes a latent trait of threat sensitivity that is manifested in different psychological realms (affective experience, interpersonal style, venturesome activity) and also in measurable physiological reactions to aversive stimuli. As evidence for this, Kramer et al. presented evidence that scores on the general fear/fearlessness dimension assessed by the Trait Fear scale correlate robustly with ASP, and Yancey et al. (2016) corroborated this finding in a separate sample and demonstrated correlations as well with cardiac and facial indices of threat reactivity. As such, the scale is intended to serve as a self-report referent for efforts to identify further neurophysiological as well as behavioral–performance indicators of threat sensitivity that can be integrated into a multimethod measurement model for this latent construct (Patrick et al., 2012, in press; Venables et al., 2017).

Evidence for the coherence of the construct indexed by the Trait Fear scale is also provided by the scale's robust associations with fear disorder symptoms and its distinctiveness from trait disinhibition—findings mirroring those reported by Nelson et al. (2016) for another measure of the Kramer et al. (2012) fear/fearlessness factor. In other work with adult twins, Venables et al. (2017) found that a composite measure of threat sensitivity incorporating physiological indicators along with the fear scale used by Nelson et al. showed a robust, genetically mediated association with fear disorder symptomatology. The implication is that threat sensitivity as indexed by variance in common between fear scale scores and physiological reactivity measures is indicative of heritable liability for fear-related pathology. This possibility is consistent with theory and research pointing to a distinct liability for focal fear problems (e.g., Rosen & Schulkin, 1998; Vaidyanathan, Patrick, & Iacono, 2011).

Limitations and Future Directions

Some limitations of the current work warrant mention. One is that data for both the new 44-item Trait Fear scale and the full set of fear/fearlessness inventories used by Kramer et al. (2012) were available for only part of the Phase 3 cross-validation sample (n = 175), which renders the reported correlation for the Trait Fear scale with the general factor of the Kramer et al. model (r = .87) somewhat tentative. Mitigating this concern, data for the Trait Fear scale and the 50-item anchor scale created to approximate the general factor were available for the overall cross-validation sample (n = 425), and the correlation between these two variables in this larger sample was essentially the same (.88). Nonetheless, it will be valuable to collect data for the new 44-item scale along with the full array of established scales used by Kramer et al. in a larger participant sample, in order to further evaluate equivalency between the new scale and the model factor. It will also be valuable to collect data for the new Trait Fear scale in samples of twin participants in order to evaluate the role of genetic versus environmental influences in scores on this scale—as was done by Kramer et al. (2012) for the general factor of their fear/fearlessness model.

Another notable limitation is that the construct validation measures in Phase 3 were limited to report-based measures consisting of diagnostic interview and questionnaire assessments of psychopathology symptoms and personality traits, respectively. However, the high internal consistencies (αs > .90) and strong interrelations of alternative trait fear measures (i.e., general factor, anchor item, 44-, and 20-item Trait Fear scale scores), and the comparability of their scale-level parameters (e.g., TIFs) across samples, provides confidence that our new Trait Fear scale will evince similar relations with fear-relevant measures from nonreport modalities—particularly ASP and other physiological indices of threat responding (Kramer et al., 2012; Yancey et al., 2016). Indeed, a major aim of the current scale development effort was to facilitate further work of this type.

Along with replicating previously reported associations, the new Trait Fear scale—as an easily administrable, self-report-based index of threat sensitivity—can serve as a referent for identifying additional physiological and behavioral indicators of this construct and for exploring interrelations among these other-modality indicators. In this way, the field can progress toward an innovative, multimethod model of threat sensitivity that can help fulfill the aim of an integrated biobehavioral science of psychopathology—as envisioned by the RDoC initiative (Kozak & Cuthbert, 2016).

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

References

Arrindell WA, Emmelkamp PMG, & van der Ende J (1984). Phobic dimensions: I. Reliability and generalizability across samples, gender, and nations. Advances in Behavior Research and Therapy, 6, 207–254.

Benning SD, Patrick CJ, Blonigen DM, Hicks BM, & Iacono WG (2005). Estimating facets of psychopathy from normal personality traits: A step toward community epidemiological investigations. Assessment, 12, 3–18. [PubMed: 15695739]

Buss A, & Plomin R (1984). Temperament: Early developing personality traits. Hillsdale, NJ: Lawrence Erlbaum.

Cloninger C (1987). A systematic method for clinical description and classification of personality variants: A proposal. Archives of General Psychiatry, 44, 573–588. [PubMed: 3579504]

First MB, Spitzer RL, Gibbon M, & Williams JBW (2002). Structured clinical interview for DSM-IV-TR Axis I disorders, Research version, non-patient edition (SCID-I/NP). New York, NY: Biometrics Research.

Hicks BM, Iacono WG, & McGue M (2014). Identifying childhood characteristics that underlie pre-morbid risk for substance use disorders: Socialization and boldness. Development and Psychopathology, 26, 141–157. [PubMed: 24280373]

Insel T, Cuthbert B, Garvey M, Heinssen R, Pine DS, Quinn K,… Wang P (2010). Research domain criteria (RDoC): Toward a new classification framework for research on mental disorders. American Journal of Psychiatry, 167, 748–751. [PubMed: 20595427]

Kozak MJ, & Cuthbert BN (2016). The NIMH Research Domain Criteria initiative: Background, issues, and pragmatics. Psychophysiology, 53, 286–297. [PubMed: 26877115]

Kramer MD, Patrick CJ, Krueger RF, & Gasperi M (2012). Delineating physiological defensive reactivity in the domain of self-report: Phenotypic and etiologic structure of dispositional fear. Psychological Medicine, 42, 1305–1320. [PubMed: 22008475]

Krueger RF, Markon KE, Patrick CJ, Benning SD, & Kramer MD (2007). Linking antisocial behavior, substance use, and personality: An integrative quantitative model of the adult externalizing spectrum. Journal of Abnormal Psychology, 116, 645–666. [PubMed: 18020714]

Lilienfeld SO (2014). The Research Domain Criteria (RDoC): An analysis of methodological and conceptual challenges. Behaviour Research and Therapy, 62, 129–139. [PubMed: 25156396]

Lilienfeld SO, & Andrews BP (1996). Development and preliminary validation of a self-report measure of psychopathic personality traits in noncriminal populations. Journal of Personality Assessment, 66, 488–524. [PubMed: 8667144]

Lilienfeld SO, & Widows MR (2005). Psychopathic Personality Inventory Revised (PPI-R): Professional manual. Memphis, TN: Psychological Assessment Resources.

McCrae RR, & John OP (1992). An introduction to the five- factor model and its applications. Journal of Personality, 60, 175–215.

Meredith W (1993). Measurement invariance, factor analysis, and factorial invariance. Psychometrika, 58, 525–543.

Muthén LK, & Muthén BO (1998-2012). Mplus user's guide (7th ed.). Los Angeles, CA: Muthén & Muthén.

Nelson LD, Strickland C, Krueger RF, Arbisi PA, & Patrick CJ (2016). Neurobehavioral traits as transdiagnostic predictors of clinical problems. Assessment, 23, 75–85. [PubMed: 25657306]

Patrick CJ, Curtin JJ, & Tellegen A (2002). Development and validation of a brief form of the Multidimensional Personality Questionnaire. Psychological Assessment, 14, 150–163. [PubMed: 12056077]

Patrick CJ, & Drislane LE (2015). Triarchic model of psychopathy: Origins, operationalizations, and observed linkages with personality and general psychopathology. Journal of Personality, 83, 627–643. [PubMed: 25109906]

Patrick CJ, Durbin CE, & Moser JS (2012). Reconceptualizing antisocial deviance in neurobehavioral terms. Developmental Psychopathology, 24, 1047–1071.

Patrick CJ, Fowles DC, & Krueger RF (2009). Triarchic conceptualization of psychopathy: Developmental origins of disinhibition, boldness, and meanness. Developmental Psychopathology, 21, 913–938.

Patrick CJ, & Hajcak G (2016). RDoC: Translating promise into progress. Psychophysiology, 53, 415–424. [PubMed: 26877135]

Patrick CJ, Iacono WG, & Venables NC (in press). Incorporating neurophysiological measures into clinical assessments: Fundamental challenges and a strategy for addressing them. Psychological Assessment.

Patrick CJ, Kramer MD, Vaidyanathan U, Benning SD, Hicks BM, & Lilienfeld SO (2019). Formulation of a measurement model for the boldness construct of psychopathy. Psychological Assessment. Advance online publication. doi:10.1037/pas0000690

Patrick CJ, Venables NC, Yancey JR, Hicks BM, Nelson LD, & Kramer MD (2013). A construct-network approach to bridging diagnostic and physiological domains: Application to assessment of externalizing psychopathology. Journal of Abnormal Psychology, 122, 902–916. [PubMed: 24016026]

Poy R, Segarra P, Esteller A, Lopez R, & Molto J (2014). FFM description of the triarchic conceptualization of psychopathy in men and women. Psychological Assessment, 26, 69–76. [PubMed: 24099318]

Reise SP (2012). Invited paper: The rediscovery of bifactor measurement models. Multivariate Behavioral Research, 47, 667–696. [PubMed: 24049214]

Rosen JB, & Schulkin J (1998). From normal fear to pathological anxiety. Psychological Review, 105, 325–350. [PubMed: 9577241]

Strickland CM, Hopwood CJ, Bornovalova MA, Rojas EC, Krueger RF, & Patrick CJ (2018). Categorical and dimensional conceptions of personality pathology in DSM-5: Toward a model-based synthesis. Journal of Personality Disorders. Advance online publication. doi:10.1521/pedi_2018_32_339

Tellegen A (1982). Manual for the Multidimensional Personality Questionnaire. Minneapolis: University of Minnesota Press.

Tellegen A, & Waller NG (2008). Exploring personality through test construction: Development of the Multidimensional Personality Questionnaire, In Boyle GJ, Matthews G & Saklofske DH (Eds.), Handbook of personality theory and testing: Vol. II. Personality measurement and assessment (pp. 254–285). London, England: Sage.

Vaidyanathan U, Patrick CJ, & Bernat E (2009). Startle reflex potentiation during aversive picture viewing as an index of trait fear. Psychophysiology, 46, 75–85. [PubMed: 19055499]

Vaidyanathan U, Patrick CJ, & Cuthbert BN (2009). Linking dimensional models of internalizing psychopathology to neurobiological systems: Affect-modulated startle as an indicator of fear and distress disorders and affiliated traits. Psychological Bulletin, 135, 909–942. [PubMed: 19883142]

Vaidyanathan U, Patrick CJ, & Iacono WG (2011). Patterns of comorbidity among mental disorders: A person-centered approach. Comprehensive Psychiatry, 52, 527–535. [PubMed: 21111407]

Venables NC, Hicks BM, Yancey JR, Kramer MD, Nelson LD, Strickland CM, … Patrick CJ (2017). Evidence of a prominent genetic basis for associations between psychoneurometric traits and common mental disorders. International Journal of Psychophysiology, 115, 4–12. [PubMed: 27671504]

Weinberger DR, Glick ID, & Klein DF (2015). Whither Research Domain Criteria (RDoC): The good, the bad, and the ugly. JAMA Psychiatry, 72, 1161–1162. [PubMed: 26558844]

Yancey JR, Venables NC, & Patrick CJ (2013). Evidence for a heritable brain basis to deviance-promoting deficits in self-control. Journal of Criminal Justice, 41(5), 1–22.

Yancey JR, Venables NC, & Patrick CJ (2016). Psychoneurometric operationalization of threat sensitivity: Relations with clinical symptom and physiological response criteria. Psychophysiology, 53, 393–405. [PubMed: 26877132]

Zuckerman M (1979). Sensation seeking: Beyond the optimal level of arousal. Hillsdale, NJ: Lawrence Erlbaum.

Figure 1.

Test information functions (TIFs) for the 50 anchor items modeled in the first (dark line, n = 1,256) and second (lighter line, n = 1,255) random halves of the adult twin sample.

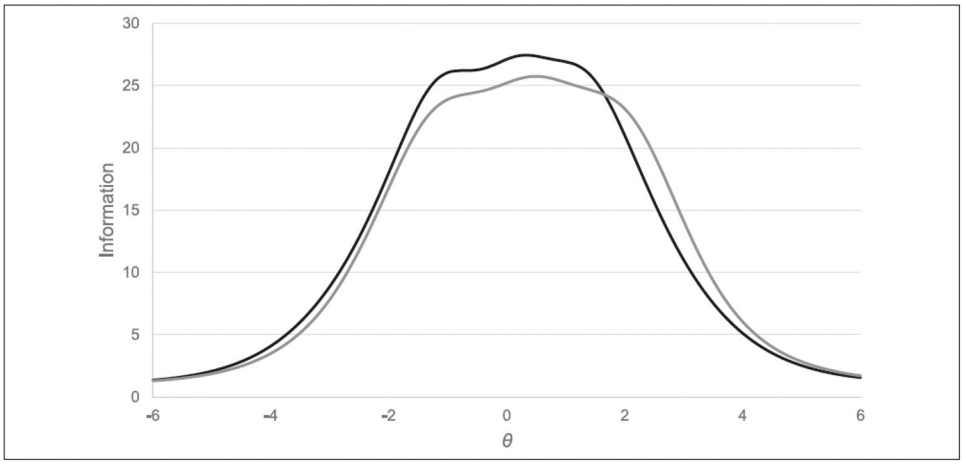

Figure 2.

Test information functions (TIFs) for the final 44 items of the Trait Fear scale modeled in the student development (dark line, $n = 339$) and cross-validation (lighter line, $n = 425$) samples.

Table 1.

IRT Parameters of the 44-Item Trait Fear Scale in Participants of the Student Development (n = 339) and Cross-Validation (n = 425) Samples.

Item No.	Content category	λ	a	b^1	b^2	b^3
1	Tolerance for Uncertainty	.71	1.82	−2.66	0.00	3.26
2	Valor	.64	1.52	−1.95	1.23	3.46
3	Self-Confidence	.58	1.29	−2.23	0.10	2.91
4	Intrepidness	.67	1.64	−2.83	−0.41	1.57
5	Tolerance for Uncertainty	.68	1.69	−3.17	−0.13	2.67
6	Valor	.68	1.67	−0.98	1.40	3.53
7	Social Assurance	.52	1.12	−1.10	1.24	3.62
8	Tolerance for Uncertainty	.61	1.40	−2.17	−0.13	2.52
9	Valor	.67	1.62	−2.42	0.28	2.74
10	Tolerance for Uncertainty	.78	2.25	−2.78	0.37	3.14
11	Valor	.51	1.08	−0.07	1.34	3.45
12	Intrepidness	.57	1.26	−2.03	−0.24	0.82
13	Tolerance for Uncertainty	.62	1.44	−0.88	1.32	3.67
14	Social Assurance	,50	1.05	−2.29	−0.15	1.77
15	Valor	.62	1.42	−0.98	1.12	3.35
16	Tolerance for Uncertainty	.59	1.31	−2.03	1.08	3.62
17	Intrepidness	.51	1.09	−1.28	0.14	1.08
18	Social Assurance	.45	0.92	−1.12	0.22	1.82
19	Tolerance for Uncertainty	,55	1.21	−3.63	−1.50	1.57
20	Valor	.70	1.79	−1.94	1.35	3.79
21	Self-Confidence	.41	0.80	0.79	2.15	3.71
22	Tolerance for Uncertainty	.73	1.94	−2.53	0.64	3.36
23	Social Assurance	.52	1.09	−1.62	−0.06	2.17
24	Valor	.66	1.57	−3.87	−0.71	1.00
25	Resilience	.54	1.17	−2.19	−0.15	2.60
26	Intrepidness	.58	1.29	−0.22	1.15	2.02
27	Tolerance for Uncertainty	.69	1.71	−1.10	1.62	3.77
28	Valor	.55	1.20	−1.19	0.90	2.66
29	Intrepidness	.61	1.40	−1.40	0.21	1.27
30	Tolerance for uncertainty	.57	1.25	−1.96	0.10	2.59
31.	Valor	.65	1.53	−1.56	1.73	4.48
32.	Social Assurance	.52	l.11	−1.43	0.36	2.12
33	Tolerance for Uncertainty	.72	1.88	−2.47	0.56	3.93
34	Intrepidness	.58	1.29	−2.16	−0.17	2.02
35	Valor	.65	1.54	−2.53	0.32	2.68
36	Social Assurance	.46	0.94	−1.57	0.08	2.26
37	Tolerance for Uncertainty	.55	1.18	−3.73	−1.81	1.22
38	Valor	.52	1.12	−2.94	−0.29	1.72

Item No.	Content category	λ	a	b^1	b^2	b^3
39	Social Assurance	.45	0.92	−1.39	−0.17	1.60
40	Tolerance for Uncertainty	.60	1.35	−2.68	−0.21	2.15
41	Intrepidness	.60	1.38	−0.50	1.11	2.20
42	Valor	.60	1.38	−1.60	0.69	2.86
43	Dominance	.61	1.40	−1.16	1.21	3.76
44	Tolerance for Uncertainty	.77	2.19	−2.56	0.93	3.52

Note. Factor loadings (λ), discrimination (α), and difficulty (b^1, b^2, b^3) parameters were estimated using all available student data. Content labels correspond to names of Boldness Inventory subscales from which items were drawn. For item wordings, see online Supplement.

Table 2.

Correlations of Fear-Model General Factor, Anchor Scale, and Trait Fear Scale With Multidimensional Personality Questionnaire (MPQ) Primary Trait, Broad Factor, and MPQ-Estimated PPI Scores.

	Twin sample (*N* = 2,511)		Community sample (*n* = 213)	
MPQ score	**General factor**	**Anchor scale**	**Trait Fear scale (44-item)**	**Trait Fear scale (20-item)**
Primary traits				
Well-being	**−.45**	**−.42**	**−.42**	**−.38**
Social Potency	**−.48**	**−.47**	**−.44**	**−.43**
Achievement	**−.30**	**−.29**	−.23	−.24
Social Closeness	**−.25**	−.23	−.22	−.19
Stress Reaction	**.63**	**.56**	**.41**	**.42**
Alienation	.23	.22	.22	.20
Aggression	−.02	−.07	−.15	−.17
Control	**.33**	**.33**	**.42**	**.37**
Harm Avoidance	**.41**	**.47**	**.47**	**.40**
Traditionalism	,09	.10	−.02	−.04
Absorption	−.05	−.10	−.04	−.02
Broad factors				
PEM: Overall	**−.52**	**−.50**	**−.48**	**−.46**
Agentic	**−.52**	**−.50**	**−.44**	**−.44**
Communal	**−.41**	**.38**	**−.39**	**−.35**
NEM	**.35**	**.30**	.20	.19
CON	**.41**	**.44**	**.41**	**.35**
MPQ-estimated PPI score				
PPI total	**−.59**	**−.58**	**−.59**	**−.57**
PPI-FD	**−.78**	**−.76**	**−.69**	**−.68**
PPI-IA	−.14	−.17	−.18	−.16

Note. PEM = Positive Emotionality; NEM = Negative Emotionality; CON = Constraint; PPI = Psychopathic Personality Inventory; PPI-FD = PPI-Fearless Dominance; PPI-IA = PPI-Impulsive-Antisociality. MPQ scores are for the brief form of the inventory (Patrick et al., 2002). General factor is from Kramer et al. (2012) structural model of fear/fearlessness scale measures. Anchor scale is the measure of the general factor consisting of items from scales used as indicators in the Kramer et al. structural model, *r* Values ≥ |.25| are bolded to highlight salient patterns of associations.

Table 3.

Prediction of *DSM-IV* Clinical Symptoms From Trait Fear and Disinhibition Scale Scores (n = 213).

	Correlations		Regression model		
	TF-44	DIS-30	TF-44	DIS-30	Model
Clinical symptom variable	***r***	***r***	**β**	**β**	***R*/*R*²**
Fear disorders					
Specific phobia	**.34***	−.04	**.34***	−.01	.34/.12
Social phobia	**.37***	.07	**.37***	.10	.38/.14
Panic disorder	**.21***	.12	**.22***	.14	.25/.06
Agoraphobia	**.21***	.04	**.21***	.05	.21/.05
Fear composite	**.45***	.07	**.46***	.11	.47/.22
Distress disorders					
Major depression	.15	**.28***	.17*	**.30***	.33/.11
Dysthymia	.19*	**.22***	**.22***	**.24***	.31/.10
Generalized anxiety disorder	**.34***	**.20***	**.37***	**.23***	.42/.17
Posttraumatic stress disorder	.12	**.26***	.15	**.28***	.30/.09
Distress composite	**.30***	**.32***	**.33***	**.35***	.46/.21
Substance use disorders					
Alcohol abuse	**−.21***	**.53***	−.16*	**.51***	.55/.30
Alcohol dependence	**−.20***	**.49***	−.16*	**.48***	.52/.27
Cannabis abuse	−.11	**.38***	−.08	**.38***	.39/.15
Cannabis dependence	−.09	**.37***	−.05	**.37***	.38/.14
Other drug abuse	−.03	**.24***	−.01	**.24***	.24/.06
Other drug dependence	−.06	**.35***	−.02	**.35***	.35/.12
Substance use composite	−.17	**.56***	−.12	**.55***	.58/.33

Note. D5M-IV = Diagnostic and Statistical Manual of Mental Disorders–fourth edition; TF-44 = 44-Item Trait Fear scale; DIS-30 = 30-Item Disinhibition scale, r and β values greater than or equal to |.20| are bolded to highlight salient patterns of associations.

*$p < .01$.