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Development and Initial Validation of the Relaxation Sensitivity Index

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Abstract

Relaxation sensitivity indexes the fear of relaxation-related events. The purpose of this study was to develop and provide initial validation of a self-report measure of relaxation sensitivity, the Relaxation Sensitivity Index (RSI). Three independent samples of undergraduate students (n=300 unselected, n=349 non-clinical, and n=197 clinical analogs with elevated anxiety/depression symptoms) completed self-report measures to examine the factor structure, reliability, and validity of the RSI. Results of exploratory and confirmatory factor analyses supported a three-factor structure (correlated Physical, Cognitive, and Social Concerns). The RSI demonstrated good internal consistency and construct validity as evidenced by expected correlations with measures of anxiety and depression symptoms. The RSI showed good predictive validity in terms of a history of fearful responding to relaxation. RSI scores were significantly higher in the symptomatic compared to non-clinical sample. Results suggest the RSI is a valid and reliable measure that may be useful in clinical and research settings.

Keywords

anxiety sensitivity; construct validity; psychometrics; relaxation-induced anxiety; relaxation sensitivity

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Conflict of Interest Statement

On behalf of all authors, the corresponding author states that there is no conflict of interest.

Relaxation-induced anxiety is a relatively common occurrence that involves acute increases in anxiety as a result of relaxation (Cohen, Barlow, & Blanchard, 1985; Heide & Borkovec, 1983; Heide & Borkovec, 1984; Lazarus, 1965; Wells, 1990; Adler, Craske, & Barlow, 1987; Carrington, 1977). It has been shown to occur during a variety of relaxation procedures among both chronically anxious and non-anxious individuals, with prevalence rates for anxious individuals ranging from 31–54% (Heide & Borkovec, 1983; Lazarus, 1976; Lehrer, Woolfolk, Rooney, McCann, & Carrington, 1983; Luthe & Blumberger, 1977; Norton, Rhodes, & Hauch, 1985; Wells, 1990).

Theoretical accounts of relaxation-induced anxiety highlight the potential role of fears of physical and cognitive relaxation-related events. For example, relaxation-induced anxiety is theorized to result from hypervigilance to the physical or sensory effects of relaxation, and the perceptions of these events as aversive or unpleasant (e.g., feelings of floating, muscle tension release; Lazarus & Mayne, 1990; Heide & Borkovec, 1984; Denny, 1976). In terms of cognitive processes, relaxation-induced anxiety might occur as a result of unwanted cognitive activity during relaxation, such as a perceived loss of control, increased self-focus, or worrisome or disturbing thoughts (Heide & Borkovec; 1984). In line with these theories, individuals with a history of relaxation-induced anxiety have been shown to report physical discomfort during relaxation (e.g., tension, headache, restlessness) and a greater internal locus of control and fears of losing control as compared to individuals without relaxation-induced anxiety (Braith et al., 1988; Heide & Borkovec, 1983). Additionally, given the accelerated lifestyle of Western society and pressures for success, productivity, and progress (Rosa, 2003), relaxation-induced anxiety might result from a fear of negative social consequences of “slowing down,” such as appearing lazy or unattractive. This theory is also supported by research demonstrating that individuals with relaxation-induced anxiety report greater fears of social consequences of anxiety as compared to those without (Braith et al., 1988).

Taken together, there may be a subset of individuals who exhibit a fear of relaxation due to physical, cognitive, and social relaxation-related events. We have termed this fear *relaxation sensitivity*, and conceptualize it as a general fear of relaxation with three related but distinct specific fears (i.e., physical, cognitive, and social concerns). In addition to the research on relaxation-induced anxiety, the conceptualization of relaxation sensitivity was informed by theory and work on the related construct of anxiety sensitivity, defined as the fear of *arousal-related* sensations due to perceived negative physical, social, or psychological consequences (McNally, 2002; Reiss & McNally, 1985). Anxiety sensitivity is a well-established risk factor for anxiety disorders that reflects a relatively stable, albeit malleable, cognitive predisposition that is distinct from both trait anxiety and the general tendency to experience negative affect (McNally, 2002, Rapee & Medoro, 1994). Theoretically, individuals high in anxiety sensitivity become fearful due to the belief that anxiety-related interoceptive sensations have harmful physical, psychological, or social consequences, which amplifies levels of anxiety (Taylor et al., 2007). In line with this theory, anxiety sensitivity has been shown to be concurrently and prospectively associated with fearful responding to anxiety provocation tasks, as well as with an increased risk of anxiety psychopathology (Naragon-Gainey, 2010; Olatunji & Wolitzky-Taylor, 2009; Schmidt, Mitchell, & Richey, 2008).

Building on extant work on anxiety sensitivity, we have defined relaxation sensitivity as the trait-like fear of *relaxation-related* sensations because of their perceived negative physical, social, or psychological consequences. Relaxation sensitivity is theorized to be related to, but distinct from, anxiety sensitivity. Relaxation sensitivity and anxiety sensitivity are theorized to be complementary components of a higher-order fear of any deviation from normal functioning, whether it involves an increase or decrease in arousal or activity. Our theory is supported by empirical data which suggests that relaxation-induced anxiety involves a fear of the contrast that occurs from transitioning between positive and negative emotional states, and a desire to maintain emotional consistency (Kim & Newman, 2019). Thus, relaxation sensitivity and anxiety sensitivity should be related to one another given that they are both considered manifestations of the same underlying process, but also uniquely distinct in that they reflect specific cognitive, physiological, and social events that occur differentially within each state (e.g., decreased heart rate with relaxation vs. increased heart rate with anxiety).

Relaxation sensitivity is also theorized to be related to, yet distinct from, relaxation-induced anxiety. Relaxation sensitivity reflects the dispositional tendency to find relaxation-related events aversive, whereas relaxation-induced anxiety reflects the functional outcome of this fear, similar to the way in which anxiety sensitivity predicts fearful responding to anxiety provocation tasks (Zvolensky et al., 2010; Leen-Feldner, Feldner, Bernstien, McCormick, & Zvolensky, 2005). For example, relaxation sensitivity reflects the trait-like predisposition to have anticipatory fears or negative beliefs about the possible outcomes of relaxation, such as being judged by other people as being unmotivated or lazy (i.e., negative social consequences). Relaxation-induced anxiety refers to the actual increase in anxiety symptoms that occurs while relaxing (e.g., increased heart rate, muscle tension), regardless of whether or not the feared consequences occurred (e.g., other people may not make any negative judgments, but anxiety still occurs). Thus, relaxation sensitivity reflects fears and beliefs about the possible consequences of relaxation, while relaxation-induced anxiety refers to actual increases in anxiety symptoms while relaxing.

Relaxation sensitivity is thought to be related to anxiety problems more broadly because it encompasses several domains of fears. For example, relaxation sensitivity should be related to panic disorder symptoms given that both incorporate fears of physical sensations. Due to specific fears of relaxation-related cognitive events, relaxation sensitivity should be related to anxiety problems with a strong cognitive component, such as worry and trauma-related intrusive thoughts. Relaxation-related social concerns also suggest that relaxation sensitivity should be related to social anxiety symptoms in general. As anxiety is defined by the presence of negative affect, and mood disorders are also defined by the presence of negative affect, relaxation sensitivity should also be related to negative affect and mood disorder symptoms (e.g., depression, dysphoria). Thus, relaxation sensitivity is thought to be conceptually similar to other anxiety and mood problems; however, it is differentiated from each of these problems by the fact that anxiety occurs particularly in response to relaxation, and fears are related specifically to beliefs about the consequences of being relaxed.

In order to further examine the construct of relaxation sensitivity, and its relationship to anxiety sensitivity and relaxation-induced anxiety, a valid and reliable measure is needed.

Thus, we created the Relaxation Sensitivity Index (RSI) as a self-report assessment measure of this new construct. The factor structure and psychometric properties of the RSI were assessed in three independent samples across two different research studies. In Study 1, exploratory factor analyses were conducted among an "unselected" sample of undergraduate students. For cross-validation analyses in Study 2, confirmatory factor analyses were conducted in two additional independent samples: a "non-clinical" sample of students drawn from the same population as students in Study 1, and a "symptomatic" sample of students with clinically elevated symptoms of anxiety and depression.

Study 1

The purpose of Study 1 was to develop and conduct an initial examination of the RSI among an unselected sample of undergraduate students. It was hypothesized that the RSI would: (1) show a three-factor latent structure consisting of correlated physical, cognitive, and social concerns; (2) show good construct validity via positive correlations with measures of anxiety, depression, and negative affect, and negative correlations with positive affect; (3) be moderately to strongly positively correlated with anxiety sensitivity, but still reflect a greater amount of unique than shared variance; (4) demonstrate criterion validity by uniquely predicting a history of relaxation-induced anxiety; and (5) demonstrate adequate test-retest reliability, temporal stability, and internal consistency reliability.

Method

Participants

In order to first provide normative data and establish how the relaxation sensitivity trait is distributed across a general population (c.f. Henry & Crawford, 2005; Abramowitz, Huppert, Cohen, Tolin, & Cahill, 2002), the current sample consisted of 300 undergraduate psychology students (73% female; M_{age} = 21.25, SD = 5.89). The racial composition of the sample was 83% White, 11.2% African American, 4.4% Asian, and 1.4% Other. Three percent identified as Hispanic.

Measures

Relaxation Sensitivity Index (RSI).—The RSI was developed based on measure development guidelines outlined by Clark and Watson (1995), and the structure and content of the Anxiety Sensitivity Index-3 (ASI-3; Taylor et al., 2007). We first conducted an extensive review of the literature to gain a more thorough understanding of relaxation-related fears and formalize our definition of the relaxation sensitivity construct. We then generated a broad range of approximately 60 items based on (1) relevant items from the ASI-3 that could be revised to focus on relaxation rather than arousal; (2) published accounts of adverse reactions to relaxation-related procedures; and (3) relaxation-related experiences theorized to be potentially frightening.

Items were intended to reflect a fear of relaxation-related consequences across the same three domains captured by the ASI-3: (1) physical (e.g., tension release), (2) cognitive (e.g., involuntary slowing of thoughts); and (3) social concerns (e.g., appearing unattractive). We aimed to generate multiple items for each domain, though not at all items were not written to

reflect a specific domain (i.e., items could reflect the higher-order general relaxation sensitivity factor and thus not be tailored to a specific lower-order fear). Members of our research team as well as experts in the field of anxiety sensitivity reviewed the items for wording, clarity, and relevance to the target construct. Items were revised or removed based on this feedback, resulting in an initial measure with 39 items. Respondents are asked to indicate on a 5-point scale (0 = *very little* to 4 = *very much*) how each statement applies to them; higher scores indicate greater relaxation sensitivity.

Inventory of Depression and Anxiety Symptoms (IDAS).—The IDAS (Watson et al., 2007) is a 64-item measure that assesses specific symptom dimensions of major depression and anxiety disorders. The IDAS contains 10 symptom scales (Suicidality, Lassitude, Insomnia, Appetite Loss, Appetite Gain, Ill Temper, Well-Being, Panic, Social Anxiety, and Traumatic intrusions) and two broader scales (General Depression and Dysphoria). The IDAS asks respondents to rate, on a 5-point scale (1 = *not at all* to 5 = *extremely*), the extent to which they experienced a given symptom in the last 2 weeks. The IDAS subscales demonstrate strong reliability and validity (Watson et al., 2007; Watson et al., 2008). In the present investigation, depression symptom scales (i.e., General Depression, Dysphoria) and anxiety symptom scales (i.e., Panic, Social Anxiety, Traumatic Intrusions) were used to assess convergent validity. Cronbach's alpha for these subscales in the current sample were good (range: .80 to .89).

Anxiety Sensitivity Index-3 (ASI-3).—The ASI-3 (Taylor et al., 2007) is an 18-item measure that assesses the degree to which participants fear negative consequences stemming from anxiety symptoms. Previous research indicates that the ASI-3 is made up of one higher-order factor and three lower-order factors: Physical, Psychological, and Social Concerns (Taylor et al., 2007). Respondents are asked to rate, on a 5-point scale (0 = *very little* to 4 = *very much*) the degree to which they fear arousal-related sensations. In the present investigation, the ASI-3 total score and physical, cognitive, and social concerns subscales were used as measures of convergent validity. Internal consistency for the total score and three subscales in the current sample was good to excellent (α = .83 to .91).

Positive Affect Negative Affect Schedule (PANAS).—The PANAS (Watson, Clark, & Tellegen, 1988) is a mood measure commonly used in psychopathology research (Watson, 2000). The PANAS assesses two global dimensions of affect: positive and negative. The negative affect scale (PANAS-NA) measures subjective distress during the past week and was used to assess convergent validity. The positive affect scale (PANAS-PA) measures subjective pleasure during the past week and was used to assess discriminant validity. A large body of literature supports the validity of the PANAS (Watson, 2000; Watson et al., 1988). Cronbach's alpha in the current sample was .83 for PANAS-NA and .85 for PANAS-PA.

Penn State Worry Questionnaire (PSWQ).—The PSWQ (Meyer, Miller, Metzger, Borkovec, 1990) is a 16-item self-report measure that assesses the tendency to worry. Respondents are asked to indicate, on a 5-point scale (1 = *not at all typical of me* to 5 = *very typical of me*), how likely they are to experience worrisome thoughts (example item: "Many

situations make me worry"). The PSWQ shows strong reliability and validity, and is able to discriminate between clinical and non-clinical samples (Meyer et al., 1990; Brown, Antony, & Barlow, 1992). The PSWQ was used in the present study to assess convergent validity with the RSI. Internal consistency in the current sample was excellent (α = .92).

Relaxation-induced anxiety.—To assess predictive criterion validity, participants were asked to report whether or not they had a history of relaxation-induced anxiety using the dichotomous (yes/no) item, *"Do you ever feel anxious when doing relaxing activities like yoga, meditation, or getting a massage?"*. The percentage of participants who responded "yes" to this item was also used to quantify the prevalence of relaxation-induced anxiety in the current sample.

Procedure

Undergraduate students at a large, urban university who were over the age of 18 were invited to participate in the study. Interested students registered online for in-person study sessions held in groups of 10–30 students. During the study session they provided informed, written consent and completed the battery of self-report measures. A subset of this sample (n = 69; M_{age} = 20.26, SD = 2.99; 74% female; 87% white) attended a second study session one week later to complete only the RSI for test-retest reliability analyses. This subset of participants did not differ from the total sample in terms of gender or race, though they were slightly younger than those who completed the first study visit only [M = 20.21, SD = 2.96 vs. M = 21.56, SD = 6.50; t (254.77) = 2.43 p < .05]. Participants received course credit as compensation for their time and effort. The Institutional Review Board approved all study materials and procedures prior to data collection.

Analytic Approach

To determine the latent structure of the RSI, exploratory factor analysis (EFA) with categorical indicators, oblique rotation, and weighted least squares estimation with mean and variance adjustment (WLSMV) was conducted using MPlus version 6.0 (Muthén & Muthén, 2010). Although we intended for the RSI to capture three specific domains, exploratory (rather than confirmatory) analyses were used at this first step because items were not written to reflect a specific domain; thus, exploratory analyses allowed items to load freely onto each factor to provide a statistical determination of item factor loadings. Model fit was examined using several criteria, including parsimony, theoretical interpretability, and scientific utility. Additionally, the MPlus program provides statistical model fit indices for exploratory factor analyses. Good model fit was defined as: (1) comparative fit index (CFI) values greater than .95; (2) Tucker-Lewis Index (TLI) values greater than .95; (3) standardized root mean square residual (SRMR) values less than .08; and (4) root mean square error of approximation (RMSEA) values less than .06 (Bentler, 1990; Bentler & Bonett, 1980; Browne & Cudeck, 1993; Hu & Bentler, 1999). We examined several models, re-specifying them in an iterative fashion until all item factor loadings were acceptable (i.e., > .32), no items cross-loaded (i.e., loaded within .20 across two factors), and no factors were poorly defined (i.e., contained only one or two items with high loadings; Tabachnick & Fidell, 2001; Gorusch, 1983).

Next, we examined descriptive statistics for the RSI. Independent samples *t*-tests were used to examine gender and racial differences (white compared to non-white) for the RSI total score and all identified subscales. We also examined intercorrelations between the RSI total and subscale scores. We then examined bivariate correlations between the RSI and all construct validity measures.

A series of binary logistic regressions were used to examine the criterion validity of the RSI in terms of self-reported history of relaxation-induced anxiety. Separate models were examined for the total score and specific subscale scores identified in the EFA. Gender and negative affect were included as covariates in each analysis in order to control for the known effects of these variables on relaxation-induced anxiety (Heide & Borkovec, 1983; Heide & Borkovec, 1984; McKeachie, 1985). In order to examine the relative predictive validity and potential unique contributions of relaxation sensitivity and anxiety sensitivity, additional analyses were conducted including the appropriate anxiety sensitivity subfactor into the model (e.g., anxiety sensitivity- physical concerns added to the relaxation sensitivity-physical concerns model).

Cronbach's alpha was computed for the RSI total score and all subscales to assess internal consistency reliability. Participants' RSI scores from the first and second study visits were correlated to assess the RSI's test-retest reliability. Given that relaxation sensitivity is conceptualized as a trait-like construct, paired-samples *t*-tests were also used to examine the temporal stability of the RSI total score and subscale score means.

Results

Exploratory Factor Analyses

We examined models with one to six factors. Results indicated that model fit was similar across solutions and improved slightly as the number of factors increased (see Table 1). The three-factor model was identified as the best-fitting model, because it (1) was a good fit to the data (CFI = .97, TLI = .97, SRMR = .07, RMSEA = .04 [90% CI = .03– .04]); (2) was the most parsimonious model meeting all established cut-off values; (3) produced theoretically coherent and interpretable factors; (4) was consistent with *a priori* theory; and (5) allowed for direct comparisons between existing measures of key related constructs (i.e., the ASI-3).

Factor loadings were examined for the three-factor model. Sixteen items were removed due to cross-loadings. In the subsequent iteration, two items cross-loaded and were also removed. A third EFA was then conducted with the remaining 21 items. This final model fit the data slightly better than the initial three-factor model (CFI = .99; TLI = .99; SRMR = .05; RMSEA = .03 [90% CI = .00 – .04]) and produced a solution in which all items met the acceptable cut-off for item factor loadings, no items cross-loaded, and no factors were poorly defined (see Table 2).

The first factor consisted of four items (items 3, 7, 8, 17) reflecting concerns about other people's reactions to one's relaxation and, thus, was labeled Social Concerns. The second factor contained ten items (items 1, 6, 9, 11, 13, 14, 15, 16, 18, 19) related to physical or

bodily processes that may occur during relaxation and was named Physical Concerns. The third factor contained seven items (2, 4, 5, 10, 12, 20, 21), which reflected fears of internal cognitive and perceptual events; this factor was labeled Cognitive Concerns. Total and subscale scores were computed as unweighted sums of the items composing each scale.

Descriptive statistics and inter-correlations between RSI total and subscale scores are presented in Table 3. No significant gender or racial differences were found for the RSI total score or any of the subscale scores (p's > .05). All RSI subscales were significantly correlated with one another (range: .42 to .65), as well as with the RSI total score (range: .72 to .89).

Convergent Validity

Please see Table 4 for zero-order correlations between RSI scores and measures of validity. The RSI total score was significantly positively correlated with all anxiety and depression measures (range: .24 to .49) and significantly negatively correlated with positive affect (r = −.24, p < .01). The RSI total score was significantly correlated with the ASI-3 total score (r = .63, p < .01) and all of the RSI and ASI-3 subscales were significantly positively correlated (range: .40 to .53)

Predictive Criterion Validity

Fifteen percent (n = 46) of the sample endorsed relaxation-induced anxiety. Logistic regression results indicated that after controlling for the effects of gender and negative affect, the RSI total score (β = .11, OR = 1.11, p < .01) and physical (β = .17, OR = 1.19, p < .01), cognitive (β = .24, OR = 1.27, p < .01), and social concerns subscales (β = .22, OR = 1.24, p < .01) all significantly predicted relaxation-induced anxiety. When including anxiety sensitivity into the models, all relaxation sensitivity scores remained significant predictors (range ORs: 1.12 to 1.25), while anxiety sensitivity was not a significant predictor in any of the models (Table 5).

Internal Consistency Reliability

The RSI demonstrated good internal consistency in terms of the total score (α = .89), as well as for the Physical Concerns (α = .76), Cognitive Concerns (α = .82), and Social Concerns subscale scores (α = .89). Inter-item correlations were generally moderate, with the exception of a strong mean inter-item correlation for the Social Concerns subscale (M_r = .68).

Test-retest Reliability

In terms of test-retest reliability, the RSI total score (r = .83, p < .01) and Physical (r = .72, p < .01), Cognitive (r = .83, p < .01), and Social Concerns subscales (r = .81, p < .01) were significantly positively correlated across Time 1 and Time 2 (one week later). In terms of temporal stability, paired-samples t-tests revealed no significant changes in mean RSI scores for the total score [$t(69)$ = .75, p = .46], cognitive concerns [$t(69)$ = −.35, p = .73] or social concerns subscales [$t(69)$ = −.1.40, p = .17], though scores on the physical concerns subscale significantly decreased [$t(69)$ = 2.42, p = .02].

Discussion

The purpose of this study was to develop and provide initial validation of a self-report measure of relaxation sensitivity, the Relaxation Sensitivity Index (RSI), as well as examine its relations with anxiety sensitivity and relaxation-induced anxiety. Factor analytic results supported the hypothesized three-factor model consisting of physical, cognitive, and social concerns. All subfactors were significantly correlated with one another as well as with the RSI total score, suggesting that a general fear of relaxation involves related, but distinct, lower-order fears of relaxation-related physical (e.g., tension release, deep breathing), cognitive (e.g., intrusive thoughts, loss of control), and social consequences (e.g., appearing boring, physically unattractive).

Consistent with hypotheses, the RSI showed good validity and reliability. It generally showed moderate to large positive correlations with measures of anxiety and depression, and a negative correlation with positive affect. It also significantly predicted a self-reported history of relaxation-induced anxiety. The total score and subscale scores showed good internal consistency reliability and one-week test-retest reliability. Additionally, the total score and most of the subscale scores were also shown to be stable over the one-week period, providing support for the conceptualization of relaxation sensitivity as a trait-like individual difference variable. The physical concerns subscale, however, may be more state-dependent than the other two subscales. This finding might be due to the fact that reports of physical symptoms are influenced by multiple contextual factors, which can change frequently over time (e.g., attention, environmental stimuli; Pennebaker, 2000). The level of fear an individual has about a physical symptom can change depending on the presence and intensity of the symptom in that moment; as such, the relaxation sensitivity physical concerns factor may be less stable over time as individuals experience changes in physical symptoms that affect their emotional state (Abramowitz, Deacon & Valentiner, 2007). No significant demographic differences were shown, indicating similar levels of relaxation sensitivity across gender and ethnic groups. Taken together, the current findings suggest that the RSI shows promise as a valid and reliable measure of relaxation-related fears.

We also found expected relationships between relaxation sensitivity, anxiety sensitivity, and relaxation-induced anxiety. Specifically, we observed positive correlations between relaxation sensitivity and anxiety sensitivity that were strong but still reflected a greater amount of unique than shared variance (e.g., 60% to 82% unique variance across RSI scores). Moreover, relaxation sensitivity – but not anxiety sensitivity – significantly predicted a history of relaxation-induced anxiety. It is also worth noting that this is the first study to establish rates of relaxation-induced anxiety (15%) in a large unselected sample. These findings suggest that relaxation sensitivity and anxiety sensitivity are related, but uniquely distinct constructs, lending preliminary support to the theory that relaxation sensitivity and anxiety sensitivity are complementary components of a higher-order fear of any change in functioning, though further research is needed to directly test this theory.

Overall, the results of Study 1 provide an important first step in establishing the construct validity of relaxation sensitivity and psychometric properties of the RSI, though the results require replication in independent samples.

Study 2

The purpose of Study 2 was, therefore, to conduct cross-validation analyses of the RSI in two additional independent samples: a non-clinical sample and a symptomatic sample of undergraduate students with elevated depression and anxiety symptoms. It was hypothesized that, in both samples, the RSI would demonstrate (1) good model fit for the identified three-factor model (i.e., correlated physical, cognitive, social concerns); (2) good construct validity in terms of positive correlations with measures of anxiety symptoms, negative affect, worry, and depression, and negative correlations with positive affect; and (3) good internal consistency reliability for the total score and each subscale score. Additionally, RSI scores were expected to demonstrate known groups validity, as evidenced by significantly higher total and subscale scores in the clinical analog sample as compared to the non-clinical sample.

Method

Participants

Participants were 546 undergraduate students (M_{age} = 19.50, SD = 3.29; 71% female; 88% white). The sample was separated into a non-clinical sample and an analog clinical sample. The non-clinical sample consisted of 349 participants (M_{age} = 19.37, SD = 3.28; 67% female, 88% white) who scored less than or equal to one standard deviation above the mean on the State Trait Anxiety Inventory (STAI), and less than or equal to the clinical cut-off of 16 on the Centers for Epidemiological Studies- Depression Scale (CES-D). The analog clinical sample consisted of 197 participants (M_{age} = 19.09, SD = 2.15; 78% female, 86% white) who scored greater than one standard deviation above the mean on the STAI, or above 16 on the CES-D. In the analog sample, 6% had elevated anxiety symptoms only (n = 12; M_{STAI} = 57.95, SD = 5.94), 62% had elevated depression symptoms only (n = 121; $MCES\text{-}D$ = 25.86, SD = 6.84), and 32% (n = 64; M_{STAI} = 58.34, SD = 6.14; $MCES\text{-}D$ = 30.13, SD = 7.42) had both elevated anxiety and depression symptoms.

Measures

Participants completed the final 21-item RSI developed in Study 1 (see Appendix A) as well as the same measures of convergent validity (i.e., IDAS, ASI-3, PANAS, and PSWQ). In addition participants completed the STAI and CES-D as descriptive measures to create the non-clinical and analog clinical samples.

State-Trait Anxiety Inventory (STAI).—The STAI is a widely used and well-validated self-report measure of anxiety symptoms (Spielberger, 1983). The trait anxiety subscale was used in the current study to determine the analog clinical sample. Consistent with established recommendations and norms, a cut-off of one standard deviation above the mean (i.e., 51.14 in the current sample) was used to establish the presence of active anxiety symptomatology (Spielberger, 1983; Julian, 2011).

Center for Epidemiological Studies- Depression scale (CES-D).—The CES-D is a well-validated measure of depression symptoms (Radloff, 1977). Participants indicate the

extent to which they experienced a range of depression symptoms (e.g., depressed mood, appetite changes) over the past week. The established clinical cut-off of 16 was used to indicate probable current depression in the analog sample (Radloff, 1977).

Procedure

Participants who were over the age of 18 were recruited from Introductory Psychology courses at a large Midwest university to participate. Interested students were provided with a link to complete study measures online at their convenience using REDCap (Research Electronic Data Capture; Harris et al., 2009). After submitting the survey online, participants contacted study personnel via email to receive course credit for their participation. The Institutional Review Board approved all study materials and procedures prior to data collection.

Analytic Approach

The same set of analyses was conducted in both samples. Confirmatory factor analysis (CFA) with robust weighted least squares estimation and categorical indicators was used to test the factor structure of the 21-item RSI (i.e., three-correlated physical, cognitive, and social concerns factors). Similar fit indices as Study 1 were used to evaluate model fit: RMSEA < .06, CFI > .95, and TLI > .95 (Bentler, 1990; Bentler & Bonett, 1980; Browne & Cudeck, 1993; Hu & Bentler, 1999). Zero-order correlations were used to examine construct validity. Cronbach's alpha was used to assess internal consistency reliability. To examine known groups validity, independent samples *t*-tests were used to compare RSI total and subscale scores from the symptomatic sample with scores from the non-clinical sample.

Results

Factor Structure

In the non-clinical sample, the hypothesized 3-factor model was a good fit to the data: RMSEA = .05 (90% CI = .04 to .05), CFI = .98, TLI = .98. All items loaded strongly onto their hypothesized factor (M = .83, SD = .09, Range = .54 to .96) and factors accounted for a significant amount of variance in each item (R^2: M = .70, SD = .14, Range = .29 to .93). The 3-factor model also showed good model fit in the analog sample: RMSEA = .07 (90% CI = .06 to .08), CFI = .98, TLI = .97. Again, all items showed strong factor loadings (M = .81, SD = .09, Range = .53 to .96), and factors accounted for a significant amount of item variance (R^2: M = .66, SD = .14, Range = .28 to .93).[1]

Convergent Validity

See Table 6 for zero-order correlations between RSI scores and measures of construct validity. In both the non-clinical and symptomatic samples, as hypothesized, the RSI total score was significantly positively correlated with the ASI-3 total and subscale scores, social anxiety symptoms, panic symptoms, PTSD symptoms, negative affect, depression, and dysphoria. The RSI total score was significantly negatively correlated with positive affect in

[1]In the interest of space, full details on the CFA results from the non-clinical and analog samples are not presented here. They can be obtained from the corresponding author upon request.

the non-clinical sample ($r = -.15$, $p < .01$) but not in the symptomatic sample. The RSI subscales generally showed a similar pattern of results, with significant positive correlations with anxiety and depression measures in both samples. There were some exceptions to this pattern for the RSI subscales. In the symptomatic sample, IDAS-Depression was significantly correlated only with RSI-Cognitive Concerns ($r = .17$, $p < .05$), and IDAS-Dysphoria was significantly correlated with RSI-Cognitive Concerns ($r = .18$, $p < .05$) and RSI-Social Concerns ($r = .18$, $p < .05$), but not RSI-Physical Concerns. In addition, contrary to prediction, in both samples, worry was not correlated with any of the RSI total or subscale scores other than RSI- Cognitive Concerns in the analog clinical sample ($r = .13$, $p < .05$).

Internal Consistency Reliability

In the non-clinical sample, Cronbach's alpha for the RSI-Total Score was excellent ($\alpha = .94$) and good for the three RSI subscales (range; .83 to .89). For the symptomatic sample, Cronbach's alpha was excellent for the RSI-Total, RSI- Physical Concerns, and RSI-Social Concerns (range: .91 to .95) and good for RSI- Cognitive Concerns ($\alpha = .85$).

Known Groups Validity

Compared to the non-clinical sample, the symptomatic sample reported significantly higher RSI- Total [$M = 13.15$ vs. $M = 4.40$, $t(1) = -8.27$, $p = .00$], RSI- Physical Concerns [$M = 5.69$ vs. $M = 1.98$, $t(1) = -7.21$, $p = .00$], RSI- Cognitive Concerns [$M = 4.85$ vs. $M = 1.44$, $t(1) = -9.15$, $p = .00$], and RSI- Social Concerns [$M = 2.76$ vs. $M = .94$, $t(1) = -6.61$, $p = .00$] scores.

Discussion

The current results extend the findings of Study 1 by examining the psychometric properties of the RSI in two additional independent samples, a non-clinical sample and a symptomatic sample. As hypothesized, in both samples, the three-factor model was an excellent fit to the data; internal consistency reliability was good for all RSI subscales; and all RSI scores were significantly positively correlated with anxiety sensitivity, anxiety symptoms (i.e., panic, social anxiety, and PTSD symptoms), negative affect, and depression symptoms. It is worth noting, however, that RSI scores were generally uncorrelated with worry in both samples, and that the magnitude of the correlations was somewhat smaller in Study 2 than Study 1.

The current findings also highlight the relevance of relaxation sensitivity to psychological functioning in individuals with elevated psychopathological symptoms. Indeed, individuals with elevated anxiety and depression symptoms reported greater levels of relaxation sensitivity than those without. Among those with elevated symptoms, greater relaxation sensitivity in general was related to greater anxiety sensitivity, anxiety symptoms, and general negative affect, while greater relaxation-related cognitive or social concerns were relevant to depression symptoms. This latter finding is consistent with previous research indicating that the cognitive concerns subscale of anxiety sensitivity is also most relevant to depressive disorders (Rector, Szacun-Shimizu & Leybman, 2006; Tull & Gratz, 2008). Theoretically, greater relaxation-related fears may contribute to elevated anxiety symptoms by motivating individuals to avoid relaxing activities that would otherwise elicit

parasympathetic activation and thus reduce anxiety-related physiological arousal. Given the bidirectional relationships between stress and depression (Hammen, 2005; Shapero, Bankin, & Barrocas, 2013), relaxation sensitivity might similarly influence depression symptoms by preventing individuals from effectively utilizing relaxing stress management techniques, thereby maintaining vulnerability for depression. Future studies utilizing longitudinal designs are needed to provide insight into any causal relationships between relaxation sensitivity and anxiety and depression symptoms.

General Discussion

Taken together, results from these two studies suggest that the RSI is a promising measure of relaxation sensitivity, and that the relaxation sensitivity construct may be relevant to both healthy individuals and those with mood and anxiety symptomatology. Greater RSI scores were significantly associated with greater levels of anxiety and depression symptoms across all samples. Based on cognitive-behavioral theory, it is possible that higher levels of relaxation sensitivity increase vulnerability for psychological problems by limiting the use of effective stress management behaviors, which are important for promoting psychological resiliency (Park et al., 2012). Further research is needed to explore any causal relationships between relaxation sensitivity and psychological problems.

Consistent with our conceptualization of relaxation sensitivity, RSI scores were also consistently positively correlated with anxiety sensitivity. These results lend preliminary support to the idea that relaxation sensitivity and anxiety sensitivity could reflect different aspects of a larger fear of psychophysiological changes, though further research is needed to explicate the relationships between relaxation sensitivity and psychopathological symptoms. For example, laboratory-based behavioral tasks would be useful for examining the relative predictive validity of the RSI and ASI-3 in terms of fearful responding to relaxation procedures and anxiety provocation tasks. Studies using structural equation modeling would be particularly helpful in elucidating the relationship between relaxation sensitivity and anxiety sensitivity at the latent level. Future research should also examine the relationship between relaxation sensitivity, avoidance of relaxation-related self-care behaviors, and objective biomarkers of health (e.g., cortisol) to elucidate the nature of the relationships between relaxation sensitivity and psychopathological symptoms.

There are several ways in which the RSI could be useful in clinical and research settings. The RSI could be used in studies of relaxation-based mind-body therapies and mindfulness-based interventions to control for the effects of relaxation sensitivity, as negative reactions to relaxation have been shown to adversely influence relaxation treatment outcomes (Heide & Borkovec, 1982; Wells, 1990). The RSI could also be used to identify patients for whom relaxation procedures might have adverse effects. Here, clinicians could utilize relaxation interventions as exposure exercises rather than coping mechanisms, or tailor relaxation techniques to patients' specific relaxation-related concerns. For example, a relaxation procedure that involves a strong physical component (e.g., progressive muscle relaxation, yoga), rather than one with a more cognitive focus (e.g., mindfulness, meditation), could be utilized for individuals with high levels of relaxation-related cognitive concerns. This recommendation is consistent with previous research suggesting that negative reactions to

relaxation are related to the type of relaxation procedure used (Norton et al., 1985). Lastly, the RSI could be used to study the relationship between relaxation sensitivity and other psychological outcomes (e.g., stress, burnout), health behaviors (e.g., substance use, poor sleep), and biological disease markers (e.g., cortisol, inflammation). Each of these outcomes are theoretically likely to be related to a fear relaxation, but without a tool for assessing this fear, past research has not been able to explore any potential effects. Thus, the RSI may allow researchers to ask and answer new clinical research questions.

Although the RSI generally showed good psychometric properties, the current findings also suggest potential ways to further improve its validity. For example, the mean inter-item correlation for the physical concerns subscale suggests that items are only moderately related to one another, while items on the social concerns subscale appear very strongly related, and therefore perhaps redundant, with one another. Items on the physical concerns subscale might be less strongly related to one another due to the fact that they tap a wide range of physical sensations (e.g., muscle tension, deep breathing, sensory alterations). Future research should explore whether omitting items from this subscale improves the utility of the measure. Strong inter-correlations on the social concerns subscale may be due to the fact that the items primarily reflect concerns related to social appearance or attractiveness, rather than other aspects of social performance (e.g., appearing lazy, unmotivated) that may be important to examine in the future.

Limitations to the current study are worth noting. First, although we provide preliminary cross-validation data from an analog clinical sample, we were unable to examine the relaxation sensitivity construct in individuals with clinician-diagnosed psychiatric disorders. Second, the current samples consisted primarily of white, female undergraduate students, limiting the generalizability of these results to other populations. The lack of racial/ethnic diversity and age restrictions are a limitation. Future studies should utilize more demographically diverse samples, and clinical samples with clinician-diagnosed psychological disorders. Third, the final three-factor model was reached through a series of three iterative EFAs with multiple items deletions. Although model fit did not appreciably change throughout these iterations, and the identified model was replicated in Study 2, this process could also limit the generalizability of the results by over-fitting the model to our initial data. Lastly, the current study relied on self-report measures, and a history of relaxation-induced anxiety was self-reported using a single-item question. This approach introduces the possibility of shared method variance and could potentially conflate the assessments of convergent validity. Future multi-method studies could strengthen the validity of the relaxation sensitivity construct by examining the predictive validity of the RSI in terms of fearful responding to real-time relaxation procedures.

Despite these limitations, results of the current study suggest that the RSI shows promise as a valid and reliable measure of relaxation sensitivity. Future studies utilizing diagnosed clinical samples, multi-method assessment techniques, and longitudinal designs are needed to further validate the measure and elucidate any effects of relaxation sensitivity on psychological outcomes in clinical and non-clinical groups.

Appendix A

RSI

Please rate each item by selecting one of the five answers for each question. Please answer each statement by circling the number that best applies to you.

		Very Little	A Little	Some	Much	Very Much
1.	It scares me when I feel tension release in my muscles.	0	1	2	3	4
2.	When I try to relax my body, I feel like I'm losing control.	0	1	2	3	4
3.	I fear that if my body is relaxed, I won't be socially appealing.	0	1	2	3	4
4.	I don't like to relax because it makes me feel out of contact with others.	0	1	2	3	4
5.	It scares me when I am relaxing and begin to feel like I am losing a sense of time.	0	1	2	3	4
6.	When my body feels as if it has been slowed down, I worry that there might be something terribly wrong with me.	0	1	2	3	4
7.	I worry that when I let my body relax, I will look unattractive.	0	1	2	3	4
8.	I worry that when I let my body relax, I will look silly.	0	1	2	3	4
9.	I don't like activities like meditation because of the way they make my body feel.	0	1	2	3	4
10.	Focusing on the present moment rather than the future or the past makes me feel anxious.	0	1	2	3	4
11.	It scares me when my breathing becomes deeper.	0	1	2	3	4
12.	I don't like to relax because it makes me feel out of control.	0	1	2	3	4
13.	I hate getting massages because of the feeling it creates when my muscles relax.	0	1	2	3	4
14.	It scares me when I am relaxing and I feel like I'm floating.	0	1	2	3	4
15.	It scares me when my limbs feel heavy.	0	1	2	3	4
16.	It frightens me when I'm relaxing and noises seem louder, muffled, or further away than they previously were.	0	1	2	3	4
17.	I worry that when I let my body relax, people will make fun of me.	0	1	2	3	4
18.	While I'm relaxing and images become fuzzy, I worry that something is wrong with me.	0	1	2	3	4
19.	It frightens me to focus on my breathing.	0	1	2	3	4
20.	I'm scared of doing relaxing activities because they make me feel vulnerable.	0	1	2	3	4
21.	I don't like to relax because I don't like when my thoughts slow down.	0	1	2	3	4

References

Abramowitz JS, D Huppert J, Cohen AB, Tolin DF, & Cahill SP (2002). Religious obsessions and compulsions in a non-clinical sample: The Penn Inventory of Scrupulosity (PIOS). Behaviour Research and Therapy,40(7), 825–838. [PubMed: 12074376]

Abramowitz JS, Deacon BJ, & Valentiner DP (2007). The short health anxiety inventory: Properties and construct validity in a non-clinical sample. Cognitive Therapy and Research, 31, 871–883. [PubMed: 32214558]

Adler CM, Craske MG, & Barlow DH (1987). Relaxation-induced panic: When resting isn't peaceful. Integrative Psychiatry, 5, 94–112.

Baer RA, Smith GT, & Allen KB (2004). Assessment of mindfulness by self-report: The Kentucky Inventory of Mindfulness Skills. Assessment, 11, 191–206. doi: 10.1177/1073191107313003 [PubMed: 15358875]

Baer RA, Smith GT, Hopkins J, Krietemeyer J, & Toney L (2006). Using self-report a ssessment methods to explore facets of mindfulness. Assessment, 13, 27–45. doi: 10.1177/107319110528504. [PubMed: 16443717]

Baer RA, Smith GT, Lykins E, Button D, Krietemeyer J, Sauer S, Walsh E, Duggan D, & Williams JMG (2008). Construct validity of the Five Facet Mindfulness Questionnaire in meditating and nonmeditating samples. Assessment, 15, 329–342. doi: 10.1177/1073191104268029 [PubMed: 18310597]

Barnes PM, & Bloom B (2008). Complementary and alternative medicine use among adults and children: United States, 2007. National Health Statistics Report, 12, 1–24.

Baum C, Kuyken W Bohus M, Heidenreich T, Michalak J, & Steil R (2009). The psychometric properties of the Kentucky Inventory of Mindfulness Skills in clinical populations. Assessment, 17, 220–229. doi: 10.1177/1073191109356525 [PubMed: 20040728]

Bentler PM (1990). Comparative fit indexes in structural models. Psychological Bulletin, 107, 238–246. doi: 10.1037/0033-2909.107.2.238. [PubMed: 2320703]

Bentler PM, & Bonett DG (1980). Significance tests and goodness of fit in the analysis of covariance structures. Psychological Bulletin, 88, 588–606. doi: 10.1037/0033-2909.88.3.588.

Braith JA, McCullough JP, & Bush JP (1988). Relaxation-induced anxiety in a subclinical sample of chronically anxious individuals. Journal of Behavior Therapy and Experimental Psychiatry, 19, 193–198. doi: 10.1016/0005-7916(88)90040-7 [PubMed: 3069875]

Brown TA, Antony MM, & Barlow DH (1992). Psychometric properties of the Penn Sate Worry Questionnaire in a clinical anxiety disorders sample. Behaviour Research and Therapy, 30, 33–37. doi: 10.1016/0005-7967(92)90093-V [PubMed: 1540110]

Brown TA, Campbell LA, Lehman CL, Grisham JR, & Mancill RB (2001). Current and lifetime comorbidity of the DSM-IV anxiety and mood disorders in a large clinical sample. Journal of abnormal psychology, 110(4), 585. [PubMed: 11727948]

Browne MW (1968). A note on lower bounds for the number of common factors. Psychometrika, 33, 233–236. [PubMed: 5242173]

Browne M, & Cudeck R (1993). Alternative ways of assessing model fit. In Bollen KA & Long JS (Eds.), Testing structural equation models (pp. 136–159). Newbury Park, CA: Sage.

Carrington P (1977). Freedom in Meditation. New York: Doubleday-Anchor.

Cattell RB, & Jaspers J (1967). A general plasmode for factor analytic exercises and research. Multivariate Behavioral Research Monographs, 3, 1–212.

Clark LA, & Watson D (1991). Tripartite model of anxiety and depression: Psychometric evidence and taxonomic implications. Journal of Abnormal Psychology, 100, 316–336. [PubMed: 1918611]

Clark LA, & Watson D (1995). Constructing validity: Basic issues in objective scale development. Psychological Assessment, 7, 309–319. doi: 10.1037/1040-3590.7.3.309

Cliff N (1988). The eigenvalues-greater-than-one rule and the reliability of components. Psychological Bulletin, 103, 276–279.

Cohen AS, Barlow DH, & Blanchard EB (1985). Psychophysiology of relaxation-associated panic attacks. Journal of Abnormal Psychology, 94, 96–101. doi: 10.1037/0021-843X.94.1.96 [PubMed: 3980861]

Crawford CB, & Koopman P (1979). Note: Inter-rater reliability of scree test and mean square ratio test of number of factors. Perceptual and Motor Skills, 49, 223–226.

Denny MR (1976). Post-aversive relief and relaxation and their implications for behavior therapy. Journal of Behavioral Therapy and Experimental Psychiatry, 7, 315–322. doi: 10.1016/0005-7916(76)90098-7

Flora D, & Curran P (2004). An Empirical Evaluation of Alternative Methods of Estimation for Confirmatory Factor Analysis With Ordinal Data. Psychological Methods, 9, 466–491. [PubMed: 15598100]

Guadagnoli E, & Velicer WF (1988). Relation of sample size to the stability of component patterns. Psychological Bulletin, 103, 265–275. [PubMed: 3363047]

Hammen C (2005). Stress and depression. Annual Reviews in Clinical Psychology, 1, 293–319.

Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, & Conde JG (2009). Research electronic data capture (REDCap)—a metadata-driven methodology and workflow process for providing translational research informatics support. Journal of biomedical informatics, 42(2), 377–381. [PubMed: 18929686]

Haynes SN, Richard DCS, & Kubany ES, (1995). Content validity in psychological assessment: A functional approach to concepts and methods. Psychological Assessment, 7, 238–247. doi: 10.1037/1040-3590.7.3.238

Hayton JC, Allen DG, & Scarpello V (2004). Factor retention decisions in exploratory factor analysis: A tutorial on parallel analysis. Organizational Research Methods, 7, 191–205. doi: 10.1177/1094428104263675.

Heide FJ, & Borkovec TD (1983). Relaxation-induced anxiety: Paradoxical anxiety enhancement due to relaxation training. Journal of Consulting and Clinical Psychology, 51, 171–182. DOI: 10.1037/0022-006X.51.2.171 [PubMed: 6341426]

Heide FJ, & Borkovec TD (1984). Relaxation-Induced Anxiety: Mechanisms and Theoretical Implications. Behavior Research Therapy, 22, 1984. doi: 10.1016/0005-7967(84)90027-5

Henry JD, & Crawford JR (2005). The short-form version of the Depression Anxiety Stress Scales (DASS-21): Construct validity and normative data in a large non-clinical sample. British Journal of Clinical Psychology, 44(2), 227–239.

Horn JL (1965). A rationale and test for the number of factors in factor analysis. Psychometrika, 32, 179–185.

Hu L, & Bentler P (1999). Cutoff criteria for fit indices in covariance structure analysis: conventional criteria versus new alternatives. Structural Equation Modeling, 6, 1–55. doi: 10.1080/10705519909540118.

Julian LJ (2011). Measures of anxiety. Arthritis Care Research, S11, S467–S472. doi: 10.1002/acr.20561.

Kaiser HF (1960). The application of electronic computers to factor analysis. Educational and Psychological Measurement, 20, 141–151.

Kessler RC, Chiu WT, Demler O, & Walters EE (2005). Prevalence, severity, and comorbidity of 12-month DSM-IV disorders in the National Comorbidity Survey Replication. Archives of general psychiatry, 62(6), 617–627. [PubMed: 15939839]

Kim H & Newman MG (2019). The paradox of relaxation training: Relaxation induced anxiety and mediation effects of negative contrast sensitivity in generalized anxiety disorder and major depressive disorder. Journal of Affective Disorders, 259, 271–278. [PubMed: 31450137]

Lazarus AA (1965). Behavior therapy, incomplete treatment, and symptom substitution. Journal of Nervous and Mental Disease, 140, 71–79.

Lazarus AA (1976). Psychiatric problems precipitated by transcendental meditation. Psychological Reports, 39, 601–602. [PubMed: 790439]

Lazarus AA, & Mayne TJ (1990). Relaxation: some limitations, side effects, and proposed solutions. Psychotherapy, 27, 261–266. doi: 10.1037/0033-3204.27.2.261

Lee HB, & Comrey AL (1979). Distortions in a commonly used factor analytic procedure. Multivariate Behavioral Research, 14, 301–321. [PubMed: 26821852]

Leen-Feldner EW, Feldner MT, Bernstein A, McCormick JT, & Zvolensky MJ (2005). Anxiety sensitivity and anxious responding to bodily sensations: A test among adolescents using a voluntary hyperventilation challenge. Cognitive Therapy and Research, 29(5), 593–609.

Lehrer PM, Woolfolk RL, Rooney AJ, McCann BC, & Carrington P (1983). Progressive relaxation and meditation: A study of the psychological and therapeutic differences between two techniques. Behaviour Research and Therapy, 21, 651–666. [PubMed: 6362649]

Linn RL (1968). A Monte Carlo approach to the number of factors problem. Psychometrika, 33, 37–71. [PubMed: 5239570]

Luthe W & Blumberger SR (1977). Autogenic therapy. In Whittkower DW & Warnes H (Eds.), Psychosomatic medicine: its clinical applications (pp. 146–165). New York: Harper & Row.

McNally RJ (2002). Anxiety sensitivity and panic disorder. Biological Psychiatry, 52, 938–946. doi: 10.1016/S0006-3223(02)01475-0 [PubMed: 12437935]

McKeachie WJ (1985). Relaxation-induced anxiety: additional findings. Psychological reports, 57, 1277–1278. [PubMed: 3912788]

Meyer TJ, Miller ML, Metzger RL, Borkovec TD (1990). Development and validation of the Penn State Worry Questionnaire. Behaviour Research and Therapy, 28, 487–495. doi: 10.1016/0005-7967(90)90135-6 [PubMed: 2076086]

Muthén B, du Toit SHC, & Spisic D (1997). Robust inference using weighted least squares and quadratic estimating equations in latent variable modeling with categorical and continuous outcomes. Psychometrika.

Muthén LK, & Muthén BO (2010). Mplus User's Guide (6th Ed.). Los Angeles, CA: Muthén & Muthén.

Naragon-Gainey K (2010). Meta-analysis of the relations of anxiety sensitivity to the depressive and anxiety disorders. Psychological Bulletin, 136, 128–150. doi: 10.1037/a0018055 [PubMed: 20063929]

Norton GR, Rhodes L, & Hauch J (1985). Characteristics of subjects experiencing relaxation and relaxation-induced anxiety. Journal of Behavior Therapy and Experimental Psychiatry, 16, 211–216. doi: 10.1016/0005-7916(85)90065-5 [PubMed: 3905864]

Nunnally JC (1978). Psychometric theory (2nd ed.). New York: McGraw-Hill

Pennebaker JW (2000). Psychological factors influencing the reporting of physical symptoms. The science of self-report: Implications for research and practice, 299–315.

Rapee RM, & Medoro L (1994). Fear of the physical sensations and trait anxiety as mediators of the response to hyeprventiliation in nonclinical subjects. Journal of Abnormal Psychology, 103, 693–699. doi: 10.1037/0021-843X.103.4.693 [PubMed: 7822570]

Rector NA, Szacun-Shimizu K, & Leybman M (2007). Anxiety sensitivity within the anxiety disorders: disorder-specific sensitivities and depression comorbidity. Behaviour Research and Therapy, 45(8), 1967–1975. [PubMed: 17084380]

Reiss S, & McNally RJ (1985). Expectancy model of fear. In Reiss S, & Bootzin RR, (Eds.), Theoretical Issues in Behavior Therapy (pp.107–122). New York: Academic Press.

Revelle W, & Rocklin T (1979). Very simple structure: An alternative procedure for estimating the optimal number of interpretable factors. Multivariate Behavioral Research, 14, 403–414. [PubMed: 26804437]

Rosa H (2003). Social acceleration: Ethical and political consequences of a desynchronized high-speed society. Constellations, 10, 3–33. doi: 10.1111/1467-8675.00309

Schmidt NB, Lerew DR, & Jackson RJ (1997). The role of anxiety sensitivity in the pathogenesis of panic: Prospective evaluation of spontaneous panic attacks during acute stress. Journal of Abnormal Psychology, 106, 355–364. doi: 10.1037/h0090325 [PubMed: 9241937]

Schmidt NB, Lerew DR, & Jackson RJ (1999). Prospective evaluation of anxiety sensitivity in the pathogenesis of panic: Replication and extension. Journal of Abnormal Psychology, 108, 532–537. doi: 10.1037/0021-843X.108.3.532 [PubMed: 10466277]

Schmidt NB, Zvolensky MJ, & Maner JK (2006). Anxiety sensitivity: Prospective prediction of panic attacks and Axis I psychopathology. Journal of Psychiatric Research, 40, 691–699. doi: 10.1016/j.jpsychires.2006.07.009 [PubMed: 16956622]

Schulenberg JE, Sameroff AJ, & Cicchetti D (2004). The transition to adulthood as a critical juncture in the course of psychopathology and mental health. Development and psychopathology, 16(04), 799–806. [PubMed: 15704815]

Shapero BG, Hankin BL, & Barrocas AL (2013). Stress generation and exposure in a multi-wave study of adolescents: Transactional processes and sex differences. Journal of Social and Clinical Psychology, 32, 989–1012. [PubMed: 24683291]

Spielberger C (1983). Manual for the State-Trait Anxiety Inventory (rev. ed.). California: Consulting Psychologists Press.

Tabachnick BG, & Fidell LS (2001). Using multivariate statistics (4th ed.). Boston: Allyn & Bacon.

Tabachnick BG, & Fidell LS (2007). Using multivariate statistics (5th ed.). Boston: Allyn & Bacon.

Taylor S, Zvolensky MJ, Cox BJ, Deacon B, Heimberg RG, Ledley DR, Abramowitz JS, Holaway RM, Sandin B, Stewart SH, Coles M, Eng W, Daly ES, Arrindell WA, & Bouvard M (2007). Robust dimensions of anxiety sensitivity: Development and initial validation of the Anxiety Sensitivity Index – 3. Psychological Assessment, 19, 176–188. doi: 10.1037/1040-3590.19.2.176 [PubMed: 17563199]

Tull MT, & Gratz KL (2008). Further examination of the relationship between anxiety sensitivity and depression: The mediating role of experiential avoidance and difficulties engaging in goal-directed behavior when distressed. Journal of Anxiety Disorders, 22(2), 199–210. [PubMed: 17419002]

Twenge JM, Catanese KR, & Baumeister RF (2003). Social exclusion and the deconstructed state: Time perception, meaninglessness, lethargy, lack of emotion, and self-awareness. Journal of Personality and Social Psychology, 85, 409–423. [PubMed: 14498779]

Watson D (2000). Basic problems in positive mood regulation. Psychological Inquiry, 11, 205–209.

Watson D, Clark LA, & Carey G (1988). Positive and negative affectivity and their relation to anxiety and depressive disorders. Journal of Abnormal Psychology, 9, 346–353.

Watson D, Clark LA, & Tellegen A (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. Journal of Personality and Social Psychology, 54, 1063–1070. [PubMed: 3397865]

Watson D, & Clark LA (1992). Affects separable and inseparable: On the hierarchical arrangement of the negative affects. Journal of Personality and Social Psychology, 62, 489–505.

Watson D, O'Hara MW, Chmielewski M, McDade-Montez EA, Koffel E, Naragon K, & Stuart S (2008). Further validation of the IDAS: Evidence of convergent, discriminant, criterion, and incremental validity. Psychological Assessment, 20, 248–259. doi: 10.1037/a0012570 [PubMed: 18778161]

Watson D, O'Hara MW, Simms LJ, Kotov R, Chmielewski M, McDade-Montez EA, Gamez W, & Stuart S (2007). Development and validation of the Inventory of Depression and Anxiety Symptoms (IDAS). Psychological Assessment, 19, 253–268. doi: 10.1037/1040-3590.19.3.2 [PubMed: 17845118]

Wells A (1990). Panic disorder in association with relaxation induced anxiety: An attentional approach to treatment. Behavior Therapy, 21, 273–280.

Yeomans KA & Golder PA (1982). The Guttman-Kaiser criterion as a predictor of the number of common factors. Statistician, 31, 221–229.

Zinbarg RE, Barlow DH, & Brown TA (1997). Hierarchical structure and general factor saturation of the Anxiety Sensitivity Index: Evidence and implications. Psychological Assessment, 9, 277–284.

Zinbarg RE, Brown TA, Barlow DH, & Rapee RM (2001). Anxiety sensitivity, panic, and depressed mood: A reanalysis teasing apart the contributions of the two levels in the hierarchical structure of the Anxiety Sensitivity Index, 110, 372–377.

Zvolensky MJ, Feldner MT, Eifert GH, & Stewart SH (2001). Evaluating differential predictions of emotional reactivity during repeated 20% carbon dioxide-enriched air challenge. Cognition and Emotion, 15, 767–786.

Zvolensky MJ, Goodie JL, Ruggiero KJ, Black AL, Larkin KT, & Taylor BK (2002). Perceived stress and anxiety sensitivity in the prediction of anxiety-related responding: A multichallenge evaluation. Anxiety, Stress & Coping, 15(3), 211–229.

Zwick WR, & Velicer WF (1982). Factors influencing four rules for determining the number of components to retain. Multivariate Behavioral Research, 17, 253–269. [PubMed: 26810950]

Zwick WR, & Velicer WF (1986). Comparison of five rules for determining the number of components to retain. Psychological Bulletin, 99, 432–442.

Table 1

Model Fit Indices for all Tested Solutions for the Initial Version of the RSI

	CFI	TLI	SRMR	RMSEA (90% CI)
1-factor	.91	.90	.11	.06 (.06 – .07)
2-factor	.95	.94	.09	.05 (.04 – .05)
3-factor	.97	.97	.07	.04 (.03 – .04)
4-factor	.98	.98	.06	.03 (.02 – .04)
5-factor	.99	.98	.05	.03 (.02 – .03)
6-factor	.99	.98	.05	.02 (.02 – .03)

Note. Standard cut-offs for fit indices: CFI > .95, TLI > .05, SRMR < .08, RMSEA < .06

Table 2

Item Factor Loadings for Final Three-Factor Model

Item		Factor		
		1	2	3
7.	I worry that when I let my body relax, I will look unattractive.	**1.06** *	−0.16	0.02
3.	I fear that if my body is relaxed, I won't be socially appealing.	**0.98**	−0.02	−0.11
8.	I worry that when I let my body relax, I will look silly.	**0.75**	0.07	0.18
17.	I worry that when I let my body relax, people will make fun of me.	**0.75**	0.20	−0.01
1.	It scares me when I feel tension release in my muscles.	−0.06	**0.77**	−0.11
11.	It scares me when my breathing becomes deeper.	−0.12	**0.72**	.00
15.	It scares me when my limbs feel heavy.	−0.01	**0.70**	0.01
9.	I don't like activities like meditation because of the way they make my body feel.	−0.03	**0.63**	0.08
19.	It frightens me to focus on my breathing.	0.04	**0.58**	0.09
6.	When my body feels as if it has been slowed down, I worry that there might be something terribly wrong with me.	0.07	**0.57**	0.14
14.	It scares me when I am relaxing and I feel like I'm floating.	0.02	**0.57**	0.24
16.	It frightens me when I'm relaxing and noises seem louder, muffled, or further away than they previously were.	.00	**0.56**	0.19
13.	I hate getting massages because of the feeling it creates when my muscles relax.	0.01	**0.52**	0.30
18.	While I'm relaxing and images become fuzzy, I worry that something is wrong with me.	0.27	**0.52**	.00
12.	I don't like to relax because it makes me feel out of control.	−0.06	0.04	**0.99**
21.	I don't like to relax because I don't like when my thoughts slow down.	−0.24	−0.03	**0.96**
20.	I'm scared of doing relaxing activities because they make me feel vulnerable.	0.18	0.04	**0.70**
4.	I don't like to relax because it makes me feel out of contact with others.	0.19	−0.01	**0.67**
5.	It scares me when I am relaxing and begin to feel like I am losing a sense of time.	0.03	0.15	**0.56**
2.	When I try to relax my body, I feel like I'm losing control.	0.13	0.21	**0.54**
10.	Focusing on the present moment rather than the future or the past makes me feel anxious.	−0.02	0.23	**0.52**

Note. Final items were organized by factor and renumbered to account for deleted items. 1 = Social Concerns; 2 = Physical Concerns; 3 = Cognitive Concerns.

*The factor loading above 1.0 for item 7 was not associated with a negative residual variance.

Table 3

Descriptive Statistics and Zero-order Correlations for RSI Factors and Total Score

	1	2	3	4	*M*	*SD*	Possible Range	Observed Range
1. RSI- SC	-	.42**	.52**	.72**	1.18	2.50	0 – 14	0 – 14
2. RSI- PC	-	-	.65**	.86**	2.48	3.56	0 – 40	0 – 20
3. RSI- CC	-	-	-	.89**	2.49	3.75	0 – 28	0 – 22
4. RSI- Total	-	-	-	-	6.16	8.21	0 – 84	0 – 45

** $p < .01$.

SC = Social Concerns; PC = Physical Concerns; CC = Cognitive Concerns.

Table 4

Zero-order Correlations Between the RSI and Measures of Validity in the Unselected Sample

	RSI-Total	RSI- PC	RSI-CC	RSI-SC
ASI- Total	.63**	.54**	.56**	.47**
ASI- PC	.49**	.49**	.40**	.30**
ASI- CC	.57**	.45**	.53**	.42**
ASI- SC	.53**	.42**	.48**	.43**
Social Anxiety	.44**	.34**	.38**	.39**
Panic	.24**	.25**	.21**	.13*
PTSD	.35**	.28**	.32**	.26**
Negative Affect	.46**	.35**	.46**	.31**
Worry	.47**	.39**	.45**	.30**
Depression	.47**	.38**	.47**	.31**
Dysphoria	.49**	.37**	.48**	.36**
Positive Affect	−.24**	−.14*	−.23**	−.25**

* $p < .05$;

** $p < .001$.

PC = physical concerns, CC = cognitive concerns, SC = social concerns. RSI = Relaxation Sensitivity Index; ASI = Anxiety Sensitivity Index-3 (Taylor et al., 2007); Social Anxiety = Inventory of Depression and Anxiety Symptoms- Social Anxiety subscale (Watson et al., 2007); Panic = Inventory of Depression and Anxiety Symptoms- Panic subscale (Watson et al., 2007); PTSD = Inventory of Depression and Anxiety Symptoms- Traumatic Intrusions subscale (Watson et al., 2007); Negative Affect = Positive Affect Negative Affect Schedule- Negative Affect subscale (Watson et al., 1988); Worry = Penn State Worry Questionnaire (Meyer et al.,1990); Depression = Inventory of Depression and Anxiety Symptoms- Depression subscale (Watson et al., 2007); Dysphoria = Inventory of Depression and Anxiety Symptoms- Dysphoria subscale (Watson et al., 2007); Positive Affect = Positive Affect Negative Affect Schedule- Positive Affect subscale (Watson et al., 1988)

Table 5

RSI and ASI-3 Scores Predicting Self-Reported Relaxation-Induced Anxiety

		β	Wald	OR (95% CI)	*p*-value
Model 1.	RSI- Total	.12	20.37	1.12 (1.07 – 1.18)	.00
	ASI- Total	−.01	.49	.99 (.95 – 1.03)	.48
Model 2.	RSI- PC	.17	12.66	1.18 (1.08 – 1.29)	.00
	ASI- PC	−.00	.01	1.00 (.92 – 1.09)	.93
Model 3.	RSI- CC	.22	18.67	1.25 (1.13 – 1.38)	.00
	ASI- CC	.03	.59	1.03 (.95 – 1.12)	.44
Model 4.	RSI- SC	.21	10.37	1.23 (1.08 – 1.40)	.00
	ASI- SC	.01	.04	1.01 (.94 – 1.08)	.84

Note. All models controlled for gender and negative affect. RSI = Relaxation Sensitivity Index; ASI = Anxiety Sensitivity Index-3 (Taylor et al., 2007). PC = physical concerns, CC = cognitive concerns, SC = social concerns.

Table 6

Zero-order Correlations Between the RSI and Measures of Validity in the Non-Clinical and Symptomatic Samples

	Non-Clinical Sample				Symptomatic Sample			
	RSI-Total	**RSI-PC**	**RSI-CC**	**RSI-SC**	**RSI-Total**	**RSI-PC**	**RSI-CC**	**RSI-SC**
ASI- Total	.37**	.39**	.26**	.30**	.35**	.31**	.31**	.27**
ASI- PC	.30**	.35**	.21**	.23**	.26**	.33**	.20**	.19*
ASI- CC	.31**	.32**	.26**	.20**	.34**	.29**	.32**	.32**
ASI- SC	.17**	.17**	.10	.19**	.26**	.24**	.25**	.17*
Social Anxiety	.19**	.19**	.14**	.19**	.27**	.22**	.23**	.26**
Panic	.22**	.22**	.23**	.18**	.36**	.43**	.34**	.21**
PTSD	.22**	.22**	.24**	.16**	.21**	.24**	.24**	.15*
Negative Affect	.33**	.32**	.31**	.22**	.23**	.19**	.28**	.16*
Worry	.08	.05	.13*	.05	−.03	−.11	.10	−.03
Depression	.33**	.28**	.33**	.28**	.11	.06	.17*	.11
Dysphoria	.28**	24**	.29**	.22**	.13	.07	.18*	.17*
Positive Affect	−.15**	−.14*	−.10	−.13*	.08	.09	.11	.03

* $p < .05$;

** $p < .001$.

PC = physical concerns, CC = cognitive concerns, SC = social concerns. RSI = Relaxation Sensitivity Index; ASI = Anxiety Sensitivity Index-3 (Taylor et al., 2007). Citations for all measures are the same as indicated in Table 4.