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Development and Validation of the Distress Tolerance Questionnaire (DTQ)

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Development and Validation of the Distress Tolerance Questionnaire (DTQ)

by

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A dissertation submitted in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
Department of Psychology
College of Arts and Sciences
University of South Florida

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ABSTRACT

Distress tolerance (DT) is the perceived ability to withstand psychological stress, and has been studied for its relationship to psychopathology, personality features, mood states, and behaviors. Previous work suggests that the two existing modalities of DT measurement (behavioral and self-report) are tapping conceptually and empirically different constructs. The current developed a novel, self-report measure of DT that conceptually mapped onto behavioral DT in two samples: community participants (N = 982) and undergraduates (N = 282). Two separate factors emerged, non-goal oriented distress intolerance (DI), and goal-oriented distress tolerance (DT). Fit indices were acceptable in the community sample, but poor in the college sample. Both factors showed associations with existing self-report (SR) DT measures, behavioral outcomes, and behavioral tasks (in the college sample) supporting construct validity. Associations with the DT personality network were similar to that of the existing DT-SR measures, and failed to support discriminant validity. Likewise, the documentation of the novel measures with the broad DT nomological network showed predicted associations with personality, mood, and psychopathology, supporting existing literature. Novel measures predicted some significant variance in DT outcomes (psychopathology, behavioral outcomes), above and beyond existing DT-SR, however magnitude was small in nature, and the college sample failed to replicate these results. Measurement invariance testing showed failure at the scalar level in college students. Overall, novel measures did not provide clear support for a separate behavioral definition of DT, and corroborated prior studies investigating extant DT measures and the broad DT nomological network.

INTRODUCTION

The definition of *behavioral distress tolerance* (DT) is an individual's ability to persist in goal-directed behaviors while experiencing negative emotional stress (Zvolensky, Bernstein, & Vujanovic, 2011). Traditionally, DT has been studied for its role in maintaining substance use disorders (SUDs) across alcohol, tobacco, and drug use (Anestis et al., 2012; Bornovalova et al., 2008; Daughters, Lejuez, Kahler, Strong, & Brown, 2005; Daughters, Sargeant, Bornovalova, Gratz, & Lejuez, 2008; Daughters et al., 2009; McHugh & Otto 2012; Nock & Mendes, 2008). Moreover, in both adult and adolescent populations, lower DT is related to frequency and severity of SUD disorders and symptoms (Brown, Lejuez, Kahler, Strong, & Zvolensky, 2005; Buckner et al., 2007; Marshall-Berenz et al., 2011). In particular, lower DT is predictive of shorter abstinence attempts and early relapses across all SUDS (Brandon et al., 2003; Daughters et al., 2005b; Quinn & Copeland, 1996; Brown et al., 2002), and higher rates of treatment drop-out (Daughters et al., 2005).

In addition to SUDs, DT is also related to a wide range of other psychopathology. Most prominently, it has figured into theoretical models and empirical studies of borderline personality disorder (BPD; Linehan, 1993; Bornovalova, Matusiewicz, & Rojas, 2011; Bornovalova et al., 2008; Daughters et al., 2008; Gratz et al., 2011; Gratz, Rosenthal, Tull, Lejuez, & Gunderson, 2006; Gratz & Tull 2011). Furthermore, DT plays a pertinent role in other psychopathology including depression (Ellis, Vanderlind, & Beevers, 2013; Perkins, Giedgowd, Karelitz, Conklin, & Lerman, 2012), anxiety (Leyro, Zvolensky, & Bernstein, 2010; Overstreet, 2015), obsessive-compulsive disorders (Hezel, Riemann, & McNally, 2012), trauma and stressor-related disorders (Marshall-Berenz, Vujanovic, Bonn-Miller, Bernstein, & Zvolensky, 2010), and eating disorders (Anestis et al., 2012).

DT – as is defined here - plays an important role in describing potential underlying mechanisms related to a range of psychopathology. Thus, several treatments are aimed at increasing DT in order to improve clinical outcomes. For instance, Dialectical Behavior Therapy (Linehan, 1993) is aimed at

increasing DT, and effectively reduces symptom severity of both BPD and SUDs (Harned et al., 2008; Linehan et al., 2002). Similarly, another treatment aimed at increasing DT (e.g., stress management training) has been effective in reducing obsessions in some forms of obsessive compulsive disorders (Macatee, Capron, Schmidt, & Cogle, 2013; Simpson et al., 2008). Brown and colleagues (2008) used a DT based treatment that targeted early-relapse smokers, and found that participants in the treatment group exhibited longer abstinence attempts, less treatment dropout, and more active engagement in treatment despite smoking lapses (Brown et al., 2009; Brown et al., 2008). Bornovalova et al., 2012 found individuals receiving a novel DT treatment evidenced clinically significant improvements in levels of DT and persisted longer on DT behavioral measures. These treatment studies suggest that improving DT may have a causal effect on reducing psychopathology and maladaptive behaviors.

Although there are plenty of studies involving the construct of DT, there are inconsistencies across the literature in its measurement. DT traditionally has been operationalized in two ways: self-report scales and behavioral tasks. Self-report DT examines an individual's perceived ability to withstand negative emotional states and situations. Self-report measures include the Distress Tolerance Scale (DTS; Simons & Gaher, 2005), the Frustration Discomfort Scale (FDS; Harrington 2005a) and the Tolerance of Negative Affective States (TNAS; Bernstein & Brantz, 2013). The second assessment modality is through behavioral measures of DT. These index an individual's ability to tolerate negative emotional states while performing a task that may result in a potential reward (e.g. small amount of money). An individual's DT is measured as seconds persisted on the most difficult level. Behavioral DT measures include the Paced Auditory Serial Task (PASAT; Lejuez, Kahler, & Brown, 2003) and the Mirror Tracing Persistence Task (MTPT; Strong et al., 2003).

There are clear definitional differences between DT measurement modalities. Behavioral measures of DT index persistence through difficult and frustrating situations or emotions with the possibility of a later reward (Brandon et al., 2003; McHugh et al., 2011; Zvolensky, Vujanovic, Bernstein, & Leyro, 2010). In contrast, self-report measures assess the perceived ability to withstand distress, without a goal-directed or reward component (Leyro et al., 2010; McHugh et al., 2011; Zvolensky et al.,

2010). Unsurprisingly, behavioral DT measures and self-report DT generally exhibit non-significant correlations with each other (Anestis et al., 2012; Kiselica et al., 2014; Marshall-Berenz et al., 2010; McHugh et al., 2011; Schloss and Haaga, 2011). Likewise, the two sets of measures exhibit very different nomological networks.

In a recent study, Kiselica et al. (2014) compared the nomological network of self-report and behavioral DT measures across personality traits, state affect, stress, psychopathology, and observable behaviors (e.g. suicide, self-harm) in substance users and college students. They found that across both samples, self-reported DT was inversely related to stress reaction, alienation, and impulsivity. Further, lower self-report DT was consistently related to psychopathology including increased symptoms of anxiety, depression, and BPD. A different pattern of results emerged for behavioral tasks. Behavioral DT was positively related to achievement and positive affect, but negatively related to negative affect (albeit somewhat inconsistently across substance users and college students). As in previous studies, behavioral and self-report DT measures did not significantly correlate.

There are two potential explanations for the disparities across DT measures. One possibility is method variance (failure to correlate due to cross-method measurement), which can conflate measured relationships between methods by increasing both Type I and Type II error (Podsakoff, Mackenzie, Lee, & Podsakoff, 2003; Reio, 2010). Thus, associations (or lack thereof) found between different methods may be distorted. A second possibility is that behavioral and self-report tasks may capture separable, unique/different aspects of the measured construct. Given that DT measures are confounded with the construct's definition, current assessment methods present challenges in understanding whether it is method variance or a separate construct (De Los Reyes et al., 2013; McHugh et al., 2011).

One approach to disentangling these possibilities is to create a self-report measure that conceptually maps onto behavioral DT. Thus a novel, behavioral self-report measure was developed that exists on a similar (self-report) metric to existing DT self-report measures while assessing the conceptual definition of behavioral DT. From that measure, relationships with the DT nomological network: existing DT measures, behavioral DT, personality, mood, psychopathology, and real-world DT behavioral

outcomes (quitting jobs, physical fights, arrests) were investigated. Likewise, the measure was examined for its incremental utility of DT-related outcomes (psychopathology, behavioral outcomes), above and beyond extant self-report DT measures. This documented the pattern of associations with the DT nomological network, and established the novel measure's relationship with the DT personality network. The resulting configuration of associations with the DT personality network were also considered relative to that of the existing DT self-report measures to provide information on the novel measure's similarities or differences with the extant measures. These analyses tested if in fact the measure captures unique aspects of the multidimensional DT construct, and if this novel measure carries predictive utility of DT correlates and outcomes above and beyond the existing self-report measures. Further research determined how the novel behavioral self-report measure may operate differently in its relationship to outcomes and correlates in different populations (e.g. community, college). These findings served to a) improve the measurement of DT; and b) understand its etiology.

Overview of the Current Investigation

Using two large samples (community participants and undergraduates), the current study aimed to do the following:

Aim 1) To develop a self-report measure that conceptually maps onto the DT behavioral tasks' definition, goal-oriented persistence through distress, and investigate its psychometric properties including factor structure and reliability. I hypothesized the novel behavioral self-report measure would reflect a unidimensional construct, and possibly capture unique aspects of the DT construct (De Los Reyes et al., 2013; McHugh et al., 2011).

Aim 2) To examine the novel measure's relationship to existing self-report DT measures, DT behavioral tasks, and self-reported real-world behavioral outcomes of DT (e.g. legal difficulties, divorces, number of jobs) for purposes of construct validity. I hypothesized that the novel behavioral self-report DT measure would show significant associations with all constructs listed here.

Aim 3) To examine the nomological network of the novel DT measures and document relationships with empirically-based external correlates of DT, across personality traits, state and trait

affect, other similarly termed constructs of DT (grit, resilience), and psychopathology (both clinical and self-report symptoms of mood, anxiety, and drug/alcohol use disorders). I predicted that the novel measure would show significant associations with the broad nomological network of DT state affect, specifically similarly-termed DT traits, normal personality (achievement) and psychopathology.

Aim 4) To examine discriminant validity, by investigating the novel DT measure's overlap with personality constructs in the DT nomological network as compared to existing self-report DT measures. I utilized profile correlations to evaluate the extent to which the novel DT measure is mapping the DT personality network compared to the existing self-report DT measures. I hypothesized that pattern of relationships with the DT personality network would differ to that of the existing self-report measures (Kiselica et al., 2014). Using standard conventions for agreement/reliability between generated profile correlations, low or poor reliability would suggest the presence of discriminant validity, however good to excellent reliability would suggest lack of discriminant validity.

Aim 5) To examine the incremental utility of the novel measure for empirical outcomes of DT (psychopathology, real-life behavioral outcomes) above and beyond existing self-report measures. I predicted that the novel measure would capture unique variance in indices of real world DT behavioral outcomes and some indices of psychopathology above and beyond existing DT measures (Brown et al., 2002; Daughters, Lejuez, Bornoalova et al., 2005; Krantz, Manuck, & Wing, 1986; Leyro et al., 2010; Nock & Mendes, 2008). Across aims, supported hypotheses would provide evidence that the measure is likely capturing the behavioral definition of DT.

METHOD

Study 1: Community Participants and Procedure

Participants were 982 individuals from Amazon's MTurk. Inclusion criteria were 1) Individuals 18 years of age or older 2) Native English speakers; 3) Hit approval rate on Amazon MTurk of 90% or above, where majority of responses were valid. This improved the reliability of participant's responses for accuracy and completion. Participants with invalid MPQ scores were excluded (N = 19). Participants' ages ranged from 18 – 87. Mean age was 37.03, standard deviation (SD) was 13.06. Gender was 36% males, 65% females. The ethnicity breakdown was: 78% White, 9% Black, 6% Hispanic/Latino, 5% Asian/Southeast Asian, 2% other. 34% reported a high school degree or the equivalent, 45% earned a college degree, 14% held a graduate degree, and 7% reported another type of continuing education. Median yearly reported income was between \$0 – 50,000.

Study questionnaires were administered online through Qualtrics surveys. Participants were required to read the consent form online, and consented by clicking “agree to participate” button. Participants were administered a battery of questionnaires, taking approximately 1 hour. Participants were paid \$6.00 for completion of the initial battery of questionnaires, and comparable to the median pay on MTurk. Once participants completed the surveys via Qualtrics, they received a code that they inputted back on the MTurk website to verify survey completion. There was a 12-hour period that allowed the research assistants to verify they completed the survey, before participants were automatically awarded compensation. Participants who withdrew before completing the questionnaires were not compensated. Unique identifiers were assigned to MTurk participants, which automatically ensured confidentiality. Please refer to Table 1 (see pages 8-9) for abbreviated measures and assessments.

Study 2: Undergraduates Participants and Procedure

Participants were 282 undergraduates recruited from the SONA subject pool of Psychology students. Inclusion criteria were 1) students between 18-65) and 2) registered in the SONA system.

Exclusion criteria were: 1) Participants who had invalid MPQ scores (N =3). Participants mean and standard deviation (SD) for age was 20.88 (4.53). 28% were males, 71% were females, and 1% were transgender. The ethnicity breakdown was: 46% White, 13% Black, 17% Hispanic/Latino, 13% Asian/Southeast Asian, and 11% Other. Average parental income reported annually was between \$50,000 – 150,000. Study questionnaires were administered and monitored by research assistants in the Substance Use, Personality and Emotions Lab, supervised by graduate students and the principal investigator (PI). Participants were asked to complete a battery of questionnaires, two behavioral computer tasks, one behavioral non-computer task, in addition to a clinical interview for psychopathology. Participants completed part one, the online survey, in the lab, and completed part two, the in-lab behavioral tasks and clinical interview within 3 days of completing part one. Only those with complete task and questionnaire data were included¹. The order in which tasks were administered was counterbalanced within subjects. The order of interview administration was counterbalanced between subjects relative to tasks to control for experimenter effects. Participants received SONA credit based on their participation in the study. In line with USF SONA policy, students were compensated with SONA credit after completion of both the online questionnaires and lab study. If the participant did not complete the lab portion of the study, they were compensated with SONA credit for the completion of the online surveys. Online surveys took approximately 1 hour to complete, and the lab study took approximately 2 hours to complete, for six SONA credits (1 credit per half hour of participation). Those who completed the lab study were entered into a raffle for a \$75 gift card.

¹ Differences between age, sex, ethnicity for completers versus non-completers of the study were not significant.

Table 1. Summary of Measures

Variable	Instrument	Description	Sample	Reliability
Target Measure	Distress Intolerance	Non-goal oriented DT, lack of persistence through distress	Community College	$\alpha = .88 - .99$
	Distress Tolerance	Goal-oriented DT, persistence through distress to achieve goal		$\alpha = .92 - .99$
Construct				
DT Behavioral Tasks	Mirror Tracing Persistence Task- Behavioral (MTT-B)	Trace mirror image star shape	College	N/A
	Mirror Tracing Persistence Task- Computerized (MTPT- C; Strong et al., 2003).	Trace star shapes of increasingly difficulty 3 levels of increasing difficulty		
	Paced Auditory Serial Task-Computerized Version (PASAT-C; Lejuez, Kahler, & Brown, 2003).	Sum numbers using previous numbers, 3 levels of increasing difficulty Across tasks, errors induce distressing sound. Distress tolerance is measured in latency to quit (in seconds) on the final level of the task.		
Existing Distress Tolerance Questionnaires	Frustration Discomfort Scale (FDS Harrington, 2005) Distress Tolerance Scale (Simons & Gaher, 2005) Tolerance of Negative Affective States (TNASS - Bernstein and Brantz, 2013)	Self-report measures of individual's tolerance of psychological distress	Community College	$\alpha = .94 - .97$
External Correlates – Mood and Personality				
Behavioral Outcomes	Distress Intolerant Behavioral Outcomes (DTB)	Sum items of outcomes of distress tolerance	Community College	
Negative and Positive Affect	Profile of Mood States (POMS-SV; Usala, & Hertzog, 1989)	Negative and positive trait and state affect	Community College	$\alpha = .84 - .95$
Normal Personality	Multidimensional Personality Questionnaire (MPQ)	Scales include: well-being, social potency, achievement, social closeness, stress reaction, aggression, alienation, control, harm avoidance, traditionalism, absorption	Community College	$\alpha = .62 - .86$
Trait Impulsivity	UPPS-P Impulsive Behavior Scale (UPPS-P; Lynam, Smith, Whiteside, & Cyders, 2006)	Negative urgency, (lack of) premeditation, perseverance, sensation-seeking, positive urgency, scales of UPPS	Community College	$\alpha = .82 - .96$
Resilience/Grit	Grit Scale (Duckworth, Peterson, Matthews, & Kelly, 2007)	Hardiness/resilient beliefs	Community College	$\alpha = .79$
	Dispositional Resilience Scale (DRS; Bartone 1991, 1995)	Perseverance to achieve long term goals		$\alpha = .77 - .82$
	Resilience Scale (RS; Wagnild & Young, 1993)	Resilient behaviors		$\alpha = .95$
Psychopathology				
Borderline Traits	Personality Assessment Inventory (PAI-BOR; Morey, 1991)	Self-report continuous measure of BPD traits	Community	$\alpha = .91$
	Minnesota Borderline Personality Questionnaire (MBPD)		College	$\alpha = .80$

Table 1. (Continued)

Antisocial Behaviors	Subtypes of Antisocial Behaviors (STAB; Burt & Donnellan, 2009)	Total index aggressive and antisocial behaviors: Physical Aggression (AGG), Rule-Breaking (RB), and Social Aggression (SA).	Community College	$\alpha = .94 - .96$
Anxiety	State Trait Anxiety Inventory (STAI Spielberger, 1983)	Self-report trait and state anxiety symptoms	Community College	$\alpha = .91 - .96$
Disordered Eating	Eating Disorder Attitude Test (EAT; Garner, Olmstead, Bohr, & Garfinkel, 1982)	Self-report of Anorexia Nervosa and Bulimia	Community College	$\alpha = .92 - .93$
Psychiatric Distress	Brief Symptom Inventory (BSI-18; Derogatis, 1993)	9 dimensions of psychological symptoms: somatization, obsessive-compulsive, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation. Index of general severity.	Community	$\alpha = .98$
Drug Use	Texas Christian University Drug Use Questionnaire (TCUDS-II; Institute of Behavioral Research, 2007)	Self-report DSM-IV drug use disorder symptoms over past year	Community College	$\alpha = .82 - .87$
Alcohol Use	Alcohol Use Disorder Identification Test (AUDIT; Bohn, Babor, & Kranzler, 1995)	Self-report alcohol use, dependence symptoms, and impairment over past year	Community College	$\alpha = .77 - .87$
Depression	Mini International Neuropsychiatric Interview (M.I.N.I.; Sheehan, Janavs, Baker, et al., 1999) ¹	Max clinical symptom counts of lifetime and current major depressive disorder	College	
Anxiety Sx		Composite clinical symptom count for lifetime panic disorder, current post-traumatic stress disorder, current obsessive compulsive disorder, current generalized anxiety disorder	College	
Alcohol Dependence Sx		Max clinical symptom count for current alcohol dependence	College	
Substance Dependence Sx		Maximum clinical symptom count across amphetamines, cannabis, cocaine, hallucinogens, inhalants, opioids, PCP, and sedatives	College	

Note. 1. Final ratings and diagnoses reached through stringent consensus process with PhD level clinician (M.B.). Refer to measure section for further details. DSM- Diagnostic and Statistical Manual. N = 282 Undergraduates; N = 982 Community. Sx = Symptoms

MEASURES

Target Measure: Distress Tolerance Questionnaire (DTQ)

A pool of 40 items was written to capture the working definition of distress tolerance: an individual's ability to persist in goal-oriented behavior while experiencing negative emotions. Items were written and refined through several meetings with experts in the topic of measurement and distress tolerance. The self-report metric was constructed using a 5-point Likert scale similar to other self-report measures of DT and self-report DT correlates (e.g., symptom inventories, severity indices), minimizing the problem of method variance, and improving the reliability for the incremental utility of DT. Specifically, items were written to capture how tolerant or intolerant an individual is of psychological distress in a variety of task oriented contexts. Participants were given instructions that identified global characteristics. Instructions read: Please rate how probable these statements are of you on a 1 (not probable) to 5 (very probable). Example items "Pushing myself to follow through on a difficult task and complete it." Items were coded where higher scores indicate higher distress tolerance; items that were worded in terms of distress intolerance (e.g. "quitting my job if it is stressful) were reverse coded (5 = 1) so scores were all in the same direction. The final pool consisted of two 7-item factors (see analyses and results for item selection details). The first factor was interpreted to reflect negative, non-goal oriented distress intolerance (DI), whereas the second factor was interpreted to reflect positive goal-oriented distress tolerance (DT). Both reflected persistence (or lack of) through distress to achieve a goal. For the first factor of DI, this reverse-scoring approach is similar to the FDS (Harrington, 2005b) where scores are reverse coded to indicate lower levels of frustration intolerance (see previous studies Kiselica et al., 2014; Rojas et al., 2015). Higher scores on the second factor, DT indicated higher endorsement of goal-oriented DT, or higher scores for persistence through distress to achieve a goal. Please see Appendix A for the initial pool of items and refinement and Appendix B for the final measure (see pages 63 and 64,

respectively). In the undergraduates ($\alpha = .86, .91$) and community ($\alpha = .89, .91$) internal consistency was good for DI and DT, respectively.

Construct Validity Measures

Behavioral Outcomes

Undergraduates received the three behavioral tasks as described below. The *Mirror Tracing Persistence Task- Behavioral (MTT-B)* is a behavioral task aimed at indexing tolerance of distress. This task instructed the participant to outline geometric figures viewed through a mirror. Thus, when participants traced the figure, they had to move in the opposite direction of the mirror image presentation (e.g. tracing a line from left to right require the participant to move their hand from right to left). The MTPT has been used previously to increase participants' frustration and stress (Matthews & Stoney, 1988; Tutoo, 1971). The first level asked the participant to trace a star shape with their dominant hand. If participant moved off the line, a tone sounded indicating an error while tracing the shape, and a counter visible to participant recorded errors. This level was aimed at inducing distress and lasted approximately five minutes. The participant was instructed to move onto the next level despite tracing completion of the star shape after five minutes have elapsed. The second or last level was aimed at indexing tolerance to distress, and lasted approximately 15 minutes. The participant was instructed to use their non-dominant hand and trace the star shape. The same instructions are given as for the previous level however; the participant could decide to persist or quit the task at any time. The last level had a longer duration (15 minutes) than the original task in order to adapt to undergraduate samples abilities (Kiselica et al., 2014). Participants were unaware of the latency to quit, and were instructed that their performance would dictate the number of times their name was entered into a raffle for a monetary gift card. Distress tolerance was measured as the latency to quit (in seconds) on the final level of the task. Participants completed a measure of mood, including state negative and positive affect, before, during, and after the task to ensure negative affect induction.

The *Mirror Tracing Persistence Task- Computerized (MTPT- C; Strong et al., 2003)* is a computerized behavioral task administered to assess participants' ability to tolerate psychological distress.

The MTPT has been used previously to increase participants' frustration and stress (Schloss & Haaga, 2011; Matthews & Stoney, 1988; Tutoo, 1971). Participants were asked to trace a red dot along the lines of a star using the computer mouse. To make the computer version similar to the original mirror tracing task, the mouse was programmed to move the red dot in the opposite direction. For example, if the participant moved the mouse to the left then the red dot moved to the right and so on. To increase the difficulty level and frustration, if the participant moved the red dot outside of the lines of the shape or if the participant paused for more than 2 seconds then a loud buzzing sound occurred, and the red dot returned to the starting point. Participants were informed on the last level of the task that they can end the task at any time by pressing any key on the computer, but performance on the task affected how much money they make. The first level was a star shape with thicker lines, allowing the participant to get used to the task. The second level was a similar star shape but with thinner lines to increase the difficulty of the task. The third level increased in difficulty, with a star shape that had thinner lines than the previous level, and was aimed at inducing distress. The last level, or fourth was the most difficult level. Participants were told to trace the same star shape as the previous level; however, they were instructed that they can quit at any point if they feel too distressed. Participants were unaware of the latency to quit, and were instructed that their performance dictated the number of times their name was entered into a raffle for a monetary gift card. The last level was aimed at indexing tolerance to distress, and included a longer duration (15 minutes) than the original computerized task in order to adapt to undergraduates' abilities (Kiselica et al., 2014). Distress tolerance was measured by latency to quit (in seconds) on the final level of the task. Participants completed a measure of state negative and positive affect, before, during, and after the task to assess negative affect induction.

The *Paced Auditory Serial Task-Computerized Version (PASAT-C; Lejuez, Kahler, & Brown, 2003)* is a serial addition task. In the PASAT, numbers sequentially flashed on a computer screen and participants added the presented number to the previous, before the subsequent number appeared (the numbers range from 0-20 with no sum > 20 to control for math ability). There were three levels with varying latencies between number presentations: one practice level (two minutes) and two actual levels

(each with a ten-minute maximum, of which the participants are uninformed). This task was adapted from the original PASAT-C to index distress in college students, a higher functioning sample. The first level, or practice level allowed the participant to become familiarized with the task. For each incorrect or missed answer they heard a loud sound indicating an incorrect answer. The two actual levels increased in difficulty by titrating to the average response time from the practice level (e.g., at 75% titration value; if the participant's average response time was two seconds, latency was one and a half seconds). The first actual level, or second level, was titrated to 60% of the participant's practice level ability, but the third, or last level was titrated to 40% of the participant's practice level ability to increase the difficulty of the task. The second level was aimed at inducing distress, and the third level was aimed at measuring tolerance to stress. Total latency of the tasks was 1200, or 10 minutes per level. Other studies have suggested that college students do not quit in the original allotted time of 300 seconds, thus latency in each level was increased to capture variability in DT quit times (Kiselica et al., 2014). Participants were unaware of the latency to quit, and were told that on the last level that they are can quit at any time, but told their performance dictated the number of times their name was entered into a raffle. Distress tolerance was measured as the latency to quit (in seconds) on the final level of the task. Participants completed a measure of mood, including state negative and positive affect, before, during, and after the task to ensure negative affect induction on the task.

Self-Report DT Measures

Both undergraduates and community participants received the *Frustration Discomfort Scale (FDS; Harrington, 2005b)*, a self-report questionnaire of an individual's tolerance of distress. It consisted of 35 items, with four 7-item subscales: discomfort intolerance, entitlement, emotional intolerance, and achievement. Apart from two items, all statements were worded only in terms of frustration intolerance. Individuals were asked to rate the strength of belief on a 5-point Likert-type scale (1 – absent; 5 – very strong). The measure was recoded where higher scores indicated higher distress tolerance (e.g. 5 = 1). This measure has demonstrated good internal consistency ($\alpha \geq .84$; Harrington, 2005a; Harrington, 2005b) and discriminant validity. Internal consistency of this measure was high in previous studies ($\alpha \geq$

.84; Harrington, 2005b). In the current samples $\alpha = .96$ for both undergraduates and community participants. They also received the *Distress Tolerance Scale- DTS* (Simons & Gaher, 2005), a self-report questionnaire of an individual's tolerance to stress. It consisted of 16 items reflecting four subscales: ability to tolerate emotional distress, appraisal of distress, absorbed by negative emotion, and regulation efforts to alleviate distress. Items are rated on a 5-point scale (1 – Strongly agree; 5 – Strongly disagree). Example items included, “I can't handle feeling distressed or upset.” This measure has demonstrated both good reliability and validity (Simons & Gaher, 2005). In the current samples $\alpha = .91, .92$ for community and undergraduate participants, respectively. Lastly, both samples received the *Tolerance of Negative Affective States Scale – (TNASS - Bernstein and Brantz, 2013)*, a 25-item self-report questionnaire examining an individual's tolerance of negative emotions. Participants were asked to rate mood items (e.g. “sad” or “angry”) and how tolerant they are of these emotions (1 = intolerant, 5 = very tolerant). Tolerance and intolerance were defined in the measure's completed direction. This measure has shown good internal consistency $\alpha = .92$ and has been related to other measures of distress tolerance while discriminating from other measures of pure negative affect in previous study (Bernstein & Brantz, 2013). In the current samples $\alpha = .97$ in both community and undergraduate participants.

External Correlates

Both undergraduates and community participants received the *Distress Intolerant Behavioral Outcomes (DTB)*, a self-report measure indexing behavioral outcomes of distress tolerance. This 50-item questionnaire asked questions that are related to distress intolerance including “How many jobs have you quit?” and “Have you been detained in jail, and if so, how many times?” Other items measured distress tolerance “How long (in years) is your longest relationship?” “How many hours per week do you work?” Previous studies have shown that distress tolerance is related other similar outcomes, including treatment dropout, abstinence attempts, relapse, and self-harm (Brandon et al., 2003; Brown et al., 2002; Daughters et al., 2005ab; Kiselica et al, 2014; Quinn et al., 1996). Given the event-based nature of the measure, alpha was not calculated. Prior studies of other experienced life events questionnaires have been found to be valid and reliable measures, showing predicted associations with related constructs, and good

agreement over two week periods (Brand & Johnson, 1982; Brugha & Cragg, 1990; Paykel, 1983). Due to feasibility issues, test-retest reliability was not tested here, however, it did show relationships with expected variables in this sample (positive significant associations with resilience, grit $r = .22, p < .001$; negative associations with negative affect, $r = -.25, p < .001$). Median values were used and items were reverse coded, such that higher scores indicated better distress tolerance outcomes.

Personality Traits

Both undergraduates and community participants received the *Dispositional Resilience Scale-15* (*DRS-15*; Bartone, 2007), a 15-item measure that assesses psychological hardiness. It asked participants to rate hardiness behaviors on a 0 to 3 (0 = not at all true and 3 = completely true) scale. Sample items include: “Most of my life gets spent doing meaningful things” and “By working hard you can almost always achieve your goals.” Validity and reliability in previous study is good (Hystad, Eid, Johnsen, Laberg & Bartone, 2009). In the current study, $\alpha = .77, .82$ in undergraduate and community participants, respectively. They also received the *Grit Scale* (Duckworth, Peterson, Matthews, & Kelly, 2007).

Undergraduate and community samples received this 12-item scale that assesses how much effort one expends toward their goals. It asks on a scale from 0 to 4 (0 = Not like me at all to 4 = Very much like me) how much the statement applies to them. Sample items include: “I have overcome setback to conquer an important challenge” and “New ideas and projects sometimes distract me from previous ones.”

Reliability and validity in prior study is good (Singh & Jha, 2008). In the current study, $\alpha = .79$ for both undergraduates and community participants. An additional scale *The Resilience Scale* (*RS*; Wagnild & Young, 1993), a 25-item measure that assesses psychological resilience was administered in both samples. It asks on a scale from 1 to 7 (1 = strongly disagree to 7 = strongly agree) how much the statement applies to them. Sample items include: “I do not dwell on things that I can’t do anything about” and “It’s okay if there is people that don’t like me.” In previous study, reliability and validity has been good (Wagnild, 2009). In the current study $\alpha = .95$ in both undergraduates and community participants. A large normal personality inventory the *Multidimensional Personality Questionnaire-Brief Form* (*MPQ-BF*; Patrick, Curtin & Tellegen, 2002), was administered to both samples. The MPQ-BF, consists of 155-item true-

false scale comprised of 11 subscales including: well-being (optimistic, enjoying activities), social potency (decisive, enjoy leadership), achievement (hard working, ambitious), social closeness (sociable, warm and affectionate), stress reaction (tense, nervous, easily upset), aggression (physically aggressive, victimizes others), alienation (feeling pushed around, feeling betrayed and deceived), control (cautious, planful), harm avoidance (prefers safe activities and experiences), traditionalism (high moral standards, values a good reputation), and absorption (becomes immersed in own thoughts and feelings, responsive to evocative sensory experiences). The MPQ-BF has shown strong reliability when compared with the original MPQ (Patrick et al., 2002), with coefficients ranging from .75-.84 (Tellegen, 1982). The validity of MPQ responses was determined based on prior scoring procedures (see Patrick et al., 2002). The Variable Response Inconsistency (VRIN) and True Response Inconsistency (TRIN) scales of the MPQ were examined to determine validity of responses. Scores that were 1) greater than 3 SDs above the VRIN mean; or 2) ± 3 SDs within the mean of TRIN; or 3) 2 SDs above the VRIN mean and ± 2.28 SDs within the TRIN mean indicate inconsistent responding, and thus invalid MPQ scores. Participants with invalid scores were deleted from subsequent analyses. Internal consistencies across subscales of the MPQ-BF are good (as ranged from .66 to .83; Kiselica et al., 2014). In the current samples, as ranged from .62 - .85 for community and undergraduate participants.

A measure of trait impulsivity, the *UPPS-P Impulsive Behavior Scale (UPPS-P; Lynam, Smith, Whiteside, & Cyders, 2006)* was administered to both samples. The UPPS-P is a 59-item inventory that measures five subscales of impulsive behavior. The five subscales include Negative Urgency (i.e., “I have trouble controlling my impulses”), Positive Urgency (i.e., “When I am very happy, I can’t seem to stop myself from doing things that can have bad consequences.”), (lack of) Premeditation (i.e. “I have a reserved a cautious attitude towards life”), (lack of) Perseverance (i.e., “I tend to give up easily”), and Sensation-Seeking (i.e., “I’ll try anything once). The subscales have 11, 13, 12, 10, and 14 items respectively, each of which are calculated by taking the mean of the items. The items have a 4-point Likert scale (1-strongly agree to 4-strongly disagree). This measure has demonstrated external validity with antisocial personality traits, pathological gambling, and borderline personality features (Whiteside,

Lynam, Miller, & Reynolds, 2005). Good internal consistency across all subscales and the total scale has been previously reported (α s range from .74 - .92; Rojas et al., 2014). In the current study, α s ranged from .85 - .94, for undergraduates and community participants.

Psychopathology

A self-report measure of alcohol use problems, the *Alcohol Use Disorder Identification Test-Core* (AUDIT-C; Bohn, Babor, & Kranzler, 1995) was administered to both samples. The AUDIT-C is a 10-item questionnaire assesses alcohol consumption, dependence symptoms, and personal/social difficulties from drinking over the past year. Sample items included “how often do you have a drink containing alcohol” and “how often during the last year have you failed to do what was normally expected of you because of drinking.” Total score ranged from 0 – 40, where scores greater than 8 indicate the presence of alcohol use problems, and scores greater than 20 indicate severe alcohol use problems. This measure has been shown to be valid measure of alcohol use disorders (Bohn et al., 1995) with good internal consistency ($\alpha = .83$; Hays & Merz, 1995). In the current samples α s = .77, .87 for undergraduates and community participants, respectively. Both samples received the *Eating Attitudes Test – 26* (EAT-26; Garner, Olmstead, Bohr, & Garfinkel, 1982), a 26-item scale that assesses symptoms of anorexia nervosa and disordered eating behaviors. Responses on each item ranged from 0 (never) to 6 (always). Sample items include “am terrified of being overweight,” and “have gone on eating binge where I feel that I may not be able to stop.” The questionnaire asked individuals to self-report current height/weight, highest and lowest height/weight, and ideal height/weight. This measure has been shown to be reliable at assessing anorexia nervosa, bulimia, weight, and other body image variables with good internal consistency ($\alpha = .83$; Koslowsky et al., 1992; Williamson, Anderson, Jackman, & Jackson, 1995). In the current samples, α s = .92, .93 for undergraduates and community participants respectively. Both samples, received the *State-Trait Anxiety Inventory* (STAI; Spielberger, 1983), a 20-item questionnaire that assesses the tendency to experience anxiety-related symptoms on a 4-point scale, 1 (never) to 4 (being almost always). Sample items: “I am high-strung” and “I am jittery.” Items assessed state-dependent, and trait-like anxiety. This measure has been shown to be both a reliable and valid indicator of state and trait anxiety

symptoms (α s range from .82- .88; Spielberger & Sydeman, 1994; Storch, Roberti, & Roth, 2004). In the current sample, for undergraduates and community participants respectively, α s ranged from .91 - .94. Both samples received the *Subtypes of Antisocial Behavior Questionnaire* (STAB; Burt & Donnellan, 2009), a self-report measure containing 32 items, consisting of three factors that index aggressive and antisocial behaviors: Physical Aggression (AGG), Rule-Breaking (RB), and Social Aggression (SA). Items are rated on a five-point scale and assess lifetime frequencies of antisocial behaviors (1 – never to 5 – being nearly all the time). Items include: “felt like hitting people” (AGG), “blamed others” (SA), and “broke into a store, mall, or warehouse” (RB). Previous work has demonstrated the ability of the STAB to distinguish between populations with varying levels of antisocial behaviors across college students, community adults, and adjudicated adults (Burt & Donnellan, 2009). This measure has been shown to be a valid measure of antisocial behaviors with good internal consistency ($\alpha \geq .85$; Burt & Donnellan, 2009). In the community sample and undergraduate sample, α s for total scale were .96 and .94, respectively. Both samples received the *Texas Christian University Drug Screen-II* (TCUDS-II; Institute of Behavioral Research, 2007), a 15-item measure that screened for drug abuse and dependence based on DSM-IV. The first part of the measure assesses drug and alcohol use problems on a dichotomous (yes/no) scale over the past year. Sample items include “Did you use large amounts of drugs or use them for a longer time than you planned or intended?” The second part of the measure addresses frequency of use across drug classes and alcohol on a five-point scale (0 = never, 5 = about every day). This measure has been shown to be a reliable and valid measure of drug and alcohol use with good internal consistency ($\alpha \geq .79$; Pankow, Simpsons, Joe, Rowan-Szal, Knight, & Meason; 2012). In the community and undergraduate samples, α s for total scale were .87 and .82, respectively.

Only the community participants received the *Brief Symptom Inventory-53* (BSI-53; Derogatis & Melisaratos, 1983), a 53-item questionnaire that measures psychological symptoms and distress. The items measured a general severity index across symptoms of somatization, obsessive-compulsive, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, and

psychoticism. The items are rated on a 5-point scale (0= not at all to 4 =extremely). In the community sample, $\alpha = .98$.

Only the undergraduates received the *Mini-International Neuropsychiatric Interview (M.I.N.I.; Sheehan et al., 1998)*, a short structured diagnostic interview that assessed DSM-IV and ICD-10 disorders of: Major Depressive Disorder (MDD), Generalized Anxiety Disorder (GAD), Alcohol and Substance Abuse/Dependence, Social Anxiety, Obsessive Compulsive Disorder (OCD), and Panic Disorder. Symptom counts were measured. In order to measure reliability, 25% of the audio-taped interviews were rated independently for symptom count and diagnosis by two raters who are trained research assistants. For discrepancies in symptom ratings and/or diagnosis, consensus was reached through the aid of a PhD level clinician (M.B.). The consensus process entailed weekly meetings of trained interviewers, independent raters, and PhD level clinician (M.B.) to review audio-taped recordings and resolve discrepancies in symptom ratings and/diagnoses. Final symptom ratings and diagnoses were used in these analyses. Other peer-reviewed studies consistently utilize a similar approach to verify reliability of clinical interview administration and ratings (Blonigan, Hicks, Krueger, Patrick & Iacono, 2005; Nelson, Strickland, Krueger, Arbisi, & Patrick, 2016). This interview has shown concordance with the Structure Clinical Interview for Axis I DSM-IV Disorders (SCID-I; Sheehan et al., 1998). A composite variable for anxiety was calculated by taking the mean z-score of symptoms for DSM-IV anxiety disorders (general anxiety disorder, OCD, social anxiety, panic disorder, and posttraumatic stress disorder - PTSD). A composite variable for major depressive disorder (MDD) was calculated by taking max symptoms across past/current MDD. A composite variable for substance dependence was calculated by taking max symptoms across current drug dependence symptoms. A composite variable for symptoms of alcohol dependence were calculated by taking a mean z-score of current dependence symptoms. Previous study has shown that this clinical interview exhibits good interrater reliability (κ s range from .84 – 1.00; Rojas et al., 2014).

State Affect

Both samples received the *Profile of Mood States-Shortened Version* (POMS-SV; Usala, & Hertzog, 1989). A brief 24-item scale that assessed positive and negative affect administered to both undergraduates and community participants. Responses are on a 5-point scale 0 (not at all accurate in describing how I feel at the moment/during the past week) to 5 (being extremely accurate in describing how I feel at the moment/during the past week). The negative affect subscales included: Fatigue, Depression, Fear, Anxiety, and Hostility. The positive affect subscales included: Vigor, Calm, and Wellbeing. This measure has been shown to be both reliable and valid measure of positive and negative affect with good internal consistency (α s range from .73 to .97; DiLorenzo, Bovbjerg, Montgomery, Valdimarsdottir, & Jacobsen, 1999; McNair et al., 1992; Shacham, 1983) and acceptable short-term test retest reliability ($r = .66 - .76$; Fillion & Gagnon, 1999). In the current study α s for the community participants and college student ranged from (.84 - .92) and (.89 - .95) for each sample, respectively.

ANALYTIC PROCEDURE

Measure Development/Refinement

The goal of Aim 1, to develop and examine the psychometrics and fit of a novel behavioral self-report measure, was addressed using the following set of analyses. Items that were redundant in nature (same conceptual meaning but with different wording) and items that addressed only negative affect were removed. This resulted in 31 items. The purpose of such was one, for parsimony, and two to remain aligned with the nature of the measure (goal oriented persistence through distress). An exploratory factor analysis (EFA) was used to refine the initial pool of items. A split half approach was used to investigate factor structure in half the sample. The scree plot suggested 6 factors (elbow). However eigenvalues showed a 5 factor solution fit best (Eigenvalues >1.00 ; Costello & Osborne, 2005). Upon investigation of item content, there appeared to be a clear wording effect, where negatively coded items (lack of persistence through distress) and positively coded items (persistence through distress) loaded on separate factors. Negatively worded items (13 items) generated a strong one factor solution (e.g. factor loadings $>|.32|$, Comroy & Lee, 1992), and represented non-goal oriented distress intolerance (DI).

Therefore, I split up items into positive and negative oriented sets for further analyses. I built factors using both a bottom up (data-driven) and top bottom (theory-driven) approach. Specifically, items worded to capture the behavioral DT definition, goal-oriented persistence through distress, were retained on the positive, goal-oriented DT factor. An iterative EFA approach was used to refine the final two factors. For negative items selection procedures were as follows: 1) items that did not load preferentially on the factor (factor loadings $<|.32|$); 2) cross-loaded on another factor (factor loadings $>|.40|$); 3) showed a substantially lower loading than other items ($<|.60|$); 4) did not appear to be conceptually related (e.g. items related drinking/drug use when experiencing distress) were; or 5) or exhibited highly correlated residuals, (cut-off of $>|.20|$; Dowdy, Weardon, & Chilko, 2011) were dropped. In total 8 items were dropped from the negative factor, generating a 7 item factor.

Several of the positively worded items appeared to cross load onto factor(s) consisting of only positively oriented items (factor loadings $> |.40|$). The positively worded, cross loading items, were examined further for content, and represented a common theme of goal-oriented persistence through distress. Items that did not appear conceptually related were dropped (not engaging in externalizing behaviors when faced with distress; no referenced achievement/goal for tolerating distress) in addition to the data-driven procedures as described above for the negative refinement were used. See Appendix B for a summary of EFA results and factors loadings. This ultimately generated two 7-item factors of non-goal oriented distress intolerance (DI) and goal-oriented DT (DT). I investigated combining the two factors to create a unidimensional scale by generating interitem correlations for each factor separately, and factors combined. I then compared strength and magnitude of each to determine feasibility of a unidimensional scale (Prudon, 2014).

Subsequently, I cross-validated the resulting factors of negative non-goal oriented DI and positive goal-oriented DT in the second half of the sample. In doing so, I implemented a confirmatory factor analysis with a maximum likelihood (ML) estimator to investigate model fit. Cutoffs of fit indices were as follows: CFI ($>.90$), TLI ($>.90$), SRMR ($<.05$), and RMSEA ($<.08$ – acceptable, $>.10$ – poor) were examined (see Byrne, 1998; Diamantopoulos and Siguaw, 2000; Fabrigar et al., 1999; Hu & Bentler, 1999) for the resulting factor structure of the items. The fit of the two factors was also examined in the college students using fit indices indicated above. The possibility of combining the factors was also investigated in the college sample via interitem correlations.

Construct Validity

Aim 2 was addressed by performing correlational analyses between existing DT self-report scales, the novel two factors, and DT behavioral tasks (in the college students). Strong, significant correlations between self-report measures were found. Thus, for parsimony, a principal components analysis was used to extract a common, existing DT factor, and the resulting factor score was used in validity analyses. For behavioral tasks, a mean z-score of latency to quit was generated and retained for further validity analyses. Likewise, Aim 3 was operationalized by generating several sets of correlations

between the novel two factors with external correlates of personality, mood/affect variables, psychopathology, and DT behavioral outcomes, to document relationships with the broad DT nomological network.

To fulfill Aim 4, the investigation of discriminant validity, profile correlations were generated. Patterns of correlations, for each of the novel factors, and existing self-report DT measures with the DT personality network (normal personality, impulsivity, and similar DT personality constructs of grit, hardiness, and resilience), were examined for their level of agreement. This tested the presence (or lack thereof) of discriminant validity for the novel DT factors with the DT personality network, as compared to that of the existing DT measures. Profile correlations were examined for each factor separately. Profile correlations generate two correlation columns: a) the correlations between existing DT and personality features, and b) each novel factor DI (or DT) with personality features. A double-entry q method was used, where pairs of correlations are entered twice; however, the second set of correlations is crossed. Specifically, the correlation for each existing DT measure and personality feature pair was entered again within the same row, but under the column for DI, and personality correlations with DI were entered under the existing DT measures column. This procedure was repeated replacing DI with DT. This allowed me to compare the agreement between the two columns using double-entry intraclass correlations (ICC_{DE}). The ICC_{DE} in turn examines the level of absolute agreement between existing DT measures-personality features and DI-personality features correlations (or DT-personality features) controlling for both the shape and elevations of each of these distributions. This means that even if the shape of both profiles is similar, it pairs high scores in one column, with low scores in the other column (and vice-versa), accounting for differences in magnitude of scores, and thus handling the potential problem of method variance (Crae, 2008; Cronbach, & Gleser, 1953; Humbad, Donnellan, Iacono, McGue, & Burt, 2013).

Aim 5, incremental utility, was tested using step-wise multiple linear regressions, entering covariates of demographics at step 1, existing DT measures at step 2, and each novel factor at step 3. The incremental validity analyses investigated each novel factor's ability, independently, to predict unique

variance in external correlates above and beyond existing DT measures, and relevant covariates (age, sex, ethnicity).

RESULTS

Aim 1: Item Selection and Refinement

As explained above in the analytical procedures for measure development and refinement, two distinct factors emerged. Fit indices in the community sample suggested borderline fit for non-goal-oriented DI (CFI = .95, TFI = .93; RMSEA = .09 [.07, .11], $p < .05$; SRMR = .04). Fit indices were acceptable for positive goal-oriented DT, (CFI = .98; TLI = .97; RMSEA = .08 [.07, .10], $p < .05$; SRMR = .02). The sample was split in half to confirm the factor structure. For DI, fit indices in the first and second half, respectively, were as follows: CFI = .96, .96; TLI = .95, .94; RMSEA = .09 [.07, .11], RMSEA = .09, [.08 to .12], $p < .01$; SRMR = .03, SRMR = .03. For DT, fit indices in the first half and second half, respectively, were: CFI = .97, .98; TLI = .95, .97; RMSEA = .09 [.08, .12], RMSEA = .09, [.07, .12], $p < .01$; SRMR = .03, SRMR = .02. Thus, similar fit was found across both halves for both factors, with negligible differences. Internal consistencies were good in each factor, non-goal oriented DI, and positive goal-oriented, DT ($\alpha = .89$, $p < .001$; $\alpha = .91$, $p < .001$, respectively).

Next, mean inter-item correlations were evaluated, and the purpose was two-fold: 1) to provide support of the reliability of the measure and 2) to determine if the two factors could be combined into a unidimensional construct. Mean inter-item correlations (r) in the community were: $r_{interitem} = .38$; DI = $r_{interitem} = .53$, DT $r_{interitem} = .61$. In regards to reliability, mean inter-item correlations for each factor were good. However, when investigating the possibility to combine factors into a unidimensional scale, the mean correlation of each individual factor was higher than the combined scale. This suggested that a combined measure should not be interpreted further (Prudon, 2014).

In the college sample, fit indices were poorer. For non-goal oriented DI, fit indices were below acceptable cut-offs: CFI = .93, TLI = .90, RMSEA = .11 [.09, .14], $p < .05$, SRMR = .04. Likewise, positive goal-oriented DT fit indices were poor CFI = .97, TLI = .95, RMSEA = .10 [.07, .13], $p < .01$, SRMR = .03. Mean inter-item correlations in the college samples were as follows: DI = $r_{interitem} = .47$, DT

= $r_{interitem} = .63$. Previous research evidence suggests that the model is not misspecified. Rather, small degrees of freedom and sample sizes can incorrectly indicate RMSEA misfit (Kenny, Kaniskan, & McCoach, 2015). Likewise, when the internal reliability of the measure is high and variance of within variables is small, RMSEA can incorrectly reject models (Prudon, 2014). This was the case as supported by high alpha ($\alpha = .86, .91$ for each factor respectively), and low variance (.005, .008, respectively). Additionally, measures should be conceptually constructed and theory driven, despite goodness of fit indices. Thus, these results did not necessarily indicate a poorly constructed measure, but rather a lack of unidimensionality in this sample.

Community Sample

Aim 2: Construct Validity

As shown in Table 2 (see page 32), DI and DT showed significant, positive, correlations with the existing DT measures (moderate), and with each individual existing DT measure as well as behavioral DT outcomes (small to moderate), providing similar construct validity results.

Aim 3: External Validity/Correlates

In regards to mood, DI and DT showed significant correlations with *positive and negative affect* (small to moderate), showing that lack of non-goal oriented distress intolerance and goal-oriented distress tolerance are related to lower negative and higher positive state affect.

In regards to *personality*, DI and DT showed significant positive relationships with resilience (large) and grit (small to moderate) supporting that novel factors are related to conceptually similar personality traits (Table 2; see page 32). In examining normal personality, DI and DT showed significant associations with higher scores on MPQ wellbeing, achievement (moderate), and to a lesser extent constraint and positive emotionality (small). DI and DT were significantly negatively related to social closeness, stress reaction, aggression, alienation and negative emotionality (small to moderate). Higher impulsivity (UPPS) was significantly related to lower scores on both factors except for sensation seeking. Thus, across both factors, relationships indicate that those with higher goal-oriented DT and lack of non-goal oriented DI reported more adaptive personality features and less maladaptive personality features. A

graphical representation of patterns of correlations of DI and DT with personality features are presented in Figure 1C and 2C (see pages 65 and 66, respectively).

Upon examining *psychopathology*, results for the clinical variables showed significant relationships of varying magnitudes with the majority of psychopathology variables (Table 2) including: borderline features (large), drug/alcohol use (small), psychological distress (moderate to large), state/trait anxiety (moderate to large), and disordered eating (small). Therefore, both higher goal-oriented DT and lack of non-goal oriented DI were related to lower clinical pathology. Figure 3C (see page 67) provides a graphical representation of patterns of correlations of DI and DT with personality features.

Aim 4: Profile Correlations and Agreement with Existing DT Measures

In regards to *mood/personality* variables, the existing DT measures (as represented by the existing DT measure factor) showed similar relationships with state affect, MPQ traits, and impulsivity. DI, DT, and existing DT showed 18, 16, and 15 significant correlations, respectively, across normal personality features, similarly termed DT constructs, and impulsivity. To better test for discriminant validity, profile correlations were generated. As described above in Aim 4, a double-entry q method was used to determine ICC_{DE} or absolute agreement between novel DT factors and existing DT measures with personality features. For DI, $ICC_{DE} = .92, p < .001$, and for DT, $ICC_{DE} = .87$, indicating excellent agreement. Overall both factors show similar relationships with personality to existing DT measures, and fail to support discriminant validity.

Aim 5: Incremental Utility

The incremental utility of each factor was examined and unique variance was identified above and beyond demographics (Step 1) and the existing DT measures (Step 2). As seen in Table 3 (see page 33), DI predicted a considerable amount (Hunsley & Meyer, 2003, $\Delta R^2 > .0225$) of unique variance for all correlates of psychopathology (drug/alcohol use, borderline traits, anxiety, psychiatric distress) as well as DT behavioral outcomes with the exception of eating disorders. A slightly differently pattern of results was found for DT, where the magnitude of incremental variance accounted for was considerably smaller

(and in fewer cases). Nevertheless, DI and DT appear to capture somewhat unique variance, relative to existing DT measures.

Undergraduate Sample

Aim 2: Construct Validity

As seen in Table 4 (see pages 34-35), both factors showed significant positive associations with the existing DT factor as well as each individual measure (small to moderate). DT showed a significant positive correlation with the mean latency to quit across behavioral tasks (small), however only DI was related to DT behavioral outcomes (moderate).

Aim 3: External Validity/Correlates

As seen in Table 4 (see pages 34-35), both factors showed significant associations with *state negative and positive affect* in the expected directions (small to moderate); those with higher DT and lack of DI report higher positive and lower negative affect.

Moreover, conceptually related *personality traits* were significantly related to both higher DI and DT showing moderate correlations with all indices, except grit, which exhibited a large correlation with DI. For normal personality, DI showed significant associations with higher well-being, achievement, harm avoidance, and positive emotions (small to moderate). However, DT exhibited significant associations with higher achievement and harm avoidance only (small). On the other hand, lower reported stress reaction, alienation, aggression, and negative emotionality were significantly related to higher DI (moderate) and DT (weak). Higher impulsivity was significantly inversely related to DI and DT across facets (moderate to strong) but to a lesser extent for premeditation (small). An additional significant positive association with sensation seeking was found for both factors (small). Thus, those with higher goal-oriented DT and lack of non-goal oriented DI, reported more positive personality features (more so for DI), and less maladaptive traits. A graphical representation of patterns of correlations of DI and DT with personality features are presented in Figures 4C and 5C (see pages 68 and 69, respectively).

For indices of psychopathology, higher DI and DT scores were significantly related to lower state/trait anxiety scores (moderate) and disordered eating (moderate and small, respectively). DI showed

additional significant relationships with lower reported antisocial behaviors (moderate), and clinical symptoms of anxiety and depression (small). Thus, across both factors, higher scores indicated less psychological dysfunction, but higher scores specifically on lack of DI was related to less clinical psychopathology. Please see graphical presentation in Figures 6C and 7C (see pages 70 and 71, respectively).

Aim 4: Comparisons to Existing DT Measures

In regards to mood/personality variables, the existing DT measures (as represented by the existing DT measure factor) showed similar relationships with state affect, MPQ traits, and impulsivity as DI and DT. DI, DT, and existing DT showed 16, 15, and 16 significant correlations, respectively, with the normal personality features, similarly-termed DT constructs, and impulsivity. Again, as performed in the community sample, profile correlations were generated to examine discriminant validity. For DI, $ICC_{DE} = .91$ and for DT, $ICC_{DE} = .85, p < .001$, indicating excellent agreement. Similar to the community sample, both factors show similar patterns of relationships with personality as existing DT, and failed to support discriminant validity.

Aim 5: Incremental Utility

As in the community sample, incremental utility analyses were conducted to examine utility of novel measures, above and beyond the existing DT measures, and relevant demographic covariates. DI predicted considerable significant variance ($\Delta R^2 > .0225; p < .001$) in anxiety, antisocial behaviors, borderline traits, DT behavioral outcomes, and disordered eating. DT predicted significant unique variance in borderline traits (small) and anxiety only. This suggested lack of non- goal oriented DI, captured some variance in psychosocial impairment, and more so than goal-oriented DT. Please refer to Table 5 for incremental utility analyses (see page 36).

Comparison across Samples: Measurement Invariance

Differences across samples in relationships with the DT nomological network, and more so, the incremental utility of the DT scales (college sample), suggested the possibility of measurement invariance (MI; differences in the relationships between items and the latent trait). As such, the next logical step was

to investigate to what extent the items and measure were invariant. In determining measurement invariance several step-wise analyses were conducted. First, I investigated item-level differential item functioning (DIF) and determined what item(s) may be non-invariant (and which items can be used as equality constraints). Second, I tested the overall scale for configural, metric, and scalar invariance. The configural level, or baseline model, establishes the pattern of factors and loadings across samples. For metric invariance, factor loadings are equivalent across samples. Finally, for scalar invariance, the most restrictive model, factor loadings and intercepts are equivalent across samples (Dimitrov, 2010).

A sequential free baseline analysis approach for DIF detection was chosen. In this approach, I first selected an anchor item to compare scores on items across samples, and then determined which items were non-invariant. This method is considered superior to traditional MI testing because it takes a quantitative approach to choosing an item as most discriminating or invariant (rather than choosing an item at random). This allows for more statistically driven detection of true DIF, increasing power and decreasing Type I error (see Lopez-Rivas, Stark, & Chernyshenko, 2009; Stark et al., 2006). Step 1 of the DIF screening procedure began with a fully constrained baseline model with factor loadings/intercepts set as equivalent across groups. This was followed by freeing loadings/intercepts for each item, independently, and comparing model fit using chi-square difference testing. An item was identified as non-invariant if the freed model fit significantly better than the baseline model (i.e., $\Delta\chi^2 > 5.99$, $\Delta df = 2$). Likewise, to determine the most discriminating or invariant item, unstandardized lambdas or factor loadings are compared, and the largest value indicated the most discriminatory item, and served as the anchor item. This is a stringent test with higher power, and minimization of Type I error, when examining variability in difficulty of items for factor indicators across samples. Results showed that the most invariant item for non-goal-oriented DI, was Item 6 (“Not completing a frustrating assignment or task on time because I gave up on it;” Unstandardized $\lambda = 1.009$) and served as the anchor item. For goal-oriented DT, the anchor item was 5 (“Not giving up on things just because I feel frustrated; Unstandardized $\lambda = .99$) and served as the anchor item.

In Step 2, a backwards approach is taken, beginning with a fully free model (all loadings, intercepts remain freely estimated) with the exception of the anchor item (constrained to be equal for loadings/intercepts across groups). Next, each item's parameters, loading and intercepts, are constrained to be equal, evaluating change in model fit at each step, for each item separately. If model fit was significantly worse, the item was flagged as noninvariant; if there was no significant change in model fit the item was determined to be invariant. Results showed that for DI two items were noninvariant item 3 ("Quitting my job if it is stressful") and item 4 ("Giving up on a difficult task without completing it") [Item 3 $\Delta\chi^2 = 17.21$, $\Delta df = 2$; Item 4 $\Delta\chi^2 = 26.05$, $\Delta df = 2$]. The same procedure was repeated for DT and one item, item 4 ["Not letting stress govern my driving behaviors," ($\Delta\chi^2 = 10.64$, $\Delta df = 2$)] was found to be noninvariant. Please refer to Table 6 (see page 37) for detailed results on MI testing.

The anchor item was used to investigate at which level the model failed (overall, scale-level), and was constrained across samples at each step. Model fit was compared for each scale (DI and DT) examining $\Delta\chi^2$, beginning with the least restrictive model or baseline model (configural) to a more restrictive model; metric (constrained factor loadings) followed by scalar (constrained factor loadings and intercepts); constricting relevant parameters at each step. Change in chi-square suggested that model failed across both factors at the scalar level, as seen in Table 7 (see page 38). AIC values were also examined as they provide additional information in determining which model, metric or configural, fit best, taking into account the tradeoff between model complexity and fit (van de Schoot, Lugtig, & Hox, 2012) [DI Factor 1: Metric vs Scalar: $\Delta\chi^2 = 31.82$, $p = .00$; Scalar vs Configural: $\Delta\chi^2 = 34.98$, $p = .00$]; [DT Metric vs Scalar: $\Delta\chi^2 = 16.94$, $p = .01$; Scalar vs Configural: $\Delta\chi^2 = 22.54$, $p = .03$]. Likewise, AIC values showed values were lowest for the metric model; AIC = 24498.18, 21419.60 for DI and DT respectively; suggesting support of metric invariance. This proposed that a secondary dimension was likely influencing the intercepts independent of factors means, and results should be interpreted with caution. Between-sample factor mean differences were marginally significant. Both the DI and DT factor means in college students were .13 units higher than the community sample ($ps = .05$, $.07$ for DI and DT).

Table 2. Community Correlations (DT Factors, Existing DT Measures, External Correlates)

Construct	DI	DT	Existing DT
DI	----	.35**	.38**
DT	.35**	----	.37**
Existing DT	.38**	.37**	----
DTS	.47**	.34**	.79**
FDS	.17**	.14**	.60**
TDASS	.14**	.27**	.73**
DTB	.43**	.19*	.18*
Mood/Personality			
STATE NA	-.49**	-.28**	-.33**
STATE PA	.34**	.39**	.36**
MPQ Wellbeing	.37**	.33**	.25**
MPQ Social Potency	-.07	.03	-.14*
MPQ Achievement	.35**	.30**	.05
MPQ Social Closeness	-.29**	-.14*	-.27**
MPQ Stress Reaction	-.46**	-.36**	-.60**
MPQ Alienation	-.37**	-.29**	-.39**
MPQ Aggression	-.33**	-.22**	-.28**
MPQ Control	.03	.13*	-.05
MPQ Harm Avoidance	-.03	-.01	.09
MPQ Traditionalism	.18*	.08	-.07
MPQ Absorption	-.19**	-.06	-.27**
MPQ Unlikely Virtues	.00	.08	-.1
MPQ Positive Emotionality	.19**	.24**	-.01
MPQ Negative Emotionality	-.48**	-.36**	-.54**
MPQ Constraint	.14*	.14*	-.01
Resilience	.50**	.65**	.40**
Grit	.34**	.30**	.30**
DRS	.23**	.21**	.21**
UPPS Negative Urgency	-.56**	-.42**	-.47**
UPPS Premeditation	-.28**	-.35**	-.07
UPPS Sensation Seeking	-.05	-.02	-.03
UPPS Lack of Perseverance	-.28**	-.28**	-.14**
UPPS Positive Urgency	-.26**	-.29**	-.27**
Psychopathology			
PAI-BOR	-.70**	-.41**	-.52**
TCUDS	-.19**	-.13*	-.17*
AUDIT	-.27**	-.19**	-.11*
BSI	-.57**	-.31**	-.40**
STAB	-.48**	-.12*	-.27**
STAI – State	-.51**	-.48**	-.43**
STAI – Trait	-.59**	-.46**	-.51**
STAI – Total	-.59**	-.49**	-.50**
EAT	-.12**	-.13**	-.26**

Note. * $p < .01$, ** $p < .001$. DT – Goal-oriented Distress Tolerance. DI - Non-goal oriented Distress Intolerance. Bolded correlations indicate variables in the DT personality network for profile correlations. DTS – Distress Tolerance Scale. Sx – Symptoms. FDS- Frustration Discomfort Scale. MINI – Mini International Neuropsychiatric Interview. MPQ – Multidimensional Personality Questionnaire. STAI – State and Trait Anxiety Inventory. AUDIT – Alcohol Use Disorders Identification Test. TCUDS – Texas Christian University Drug Use Scale. STAB – Subtypes of Antisocial Behaviors. UPPS-P – UPPS Impulsive Behavior Scale. DRS – Dispositional Resilience Scale. EAT – Eating Attitudes Test. BSI – Brief Symptom Inventory. STAB – Subtypes of Antisocial Behaviors. RS - Resilience. DRS – Dispositional Resilience Scale. TNASS – Tolerance of Negative Affective States Scale. PAI-BOR- Personality Assessment Inventory-Borderline Scale. DTB – Distress Tolerance Behaviors

Table 3. Community Incremental Utility Analyses

Construct	Step 1			Step 2			Step 3					
	Age	Sex	Ethnicity	Multiple R	R ² Δ	Existing DT	Multiple R	R ² Δ	Existing DT	DT	Multiple R	R ² Δ
DTB	.27*	.07	-.04	.30	.09**	.16**	.33	0.11	.03	.45**	.41	.17**
DTB	.27*	.07	-.04	.30	.09**	.16**	.33	0.11	.14**	—	.38	.14**
TCUDS	-.13	-.08	-.05	.15	.02	-.17*	.22	.03*	-.12	-.14*	.26	.08**
TCUDS	-.13	-.08	-.05	.15	.02	-.17*	.22	.03*	-.06	—	.23	.00
AUDIT	-.19**	-.10*	-.03	.22	.05**	-.09*	.24	.01	.00	-.26**	.33	.06**
AUDIT	-.19**	-.10*	-.03	.22	.05**	-.09*	.24	.02	-.04	—	.27	.02**
PAI	-.33**	.08	.06	.35	.12**	-.47**	.58	.21**	-.27**	-.55**	.76	.24**
PAI	-.33**	.08	.06	.35	.12**	-.47**	.58	.21**	-.40**	—	.60	.03**
BSI	-.30**	.04	.04	.30	.09**	-.36**	.46	.12**	-.19**	-.46**	.62	.17**
BSI	-.30**	.04	.04	.30	.09**	-.36**	.46	.12**	-.31**	—	.48	.01*
STAB	-.08	-.16*	-.02	.18	.03*	-.28**	.33	.08**	-.13*	-.44**	.53	.17**
STAB	-.08	-.16*	-.02	.18	.03*	-.28**	.33	.08**	-.27**	—	.33	.00
STAI-Total	-.26**	.05	.03	.26	.07**	-.46**	.53	.21**	-.31**	-.44**	.66	.16**
STAI-Total	-.26**	.05	.03	.26	.07**	-.46**	.53	.21**	-.35**	—	.61	.09**
EAT	-.05	.03	-.02	.06	.00	-.26**	.26	.06**	-.25**	-.03	.26	.00
EAT	-.05	.03	-.02	.06	.00	-.26**	.26	.06**	-.24**	—	.26	.00

Note. * $p < .01$, ** $p < .001$. DT—Distress Tolerance. DTB—Distress Tolerance Behavioral Outcomes PAI—Personality Assessment Inventory—Borderline Scale. EAT—Eating Attitudes Test. STAI—State Trait Anxiety Inventory—Total. STAB—Subtypes of Antisocial Behaviors. AUDIT—Alcohol Use Disorders Identification Test. TCUDS—Texas Christian University Drug Use Scale. BSI—Brief Symptom Inventory. . . DI = Non Goal Oriented Distress Intolerance. DT = Goal Oriented Distress Tolerance. Covariates entered at Step 1, Existing DT entered at Step 3, each novel factor, DI or DT, entered independently at Step 3.

Table 4. Undergraduate Correlations (DT Factors, Existing DT Measures, External Correlates)

Construct	Existing DT Factor	DI	DT
Existing DT Factor	—	.47**	.27**
DT F1	.47**	—	.38**
DT F2	.27**	.38**	—
DT Bx Tasks ¹	.03	.13	.22**
DTB	.09	.30**	.12
DTS	.88**	.46**	.30**
TDASS	.71**	.25**	.20*
FDS	.79**	.40**	.14
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Mood/Personality			
State NA	-.34**	-.33**	-.17*
State PA	.16*	.17*	.19*
MPQ Wellbeing	.22**	.26**	.10
MPQ Social Potency	-.08	.03	.05
MPQ Achievement	.07	.33**	.25**
MPQ Social Closeness	-.19*	-.15	-.11
MPQ Stress Reaction	-.58**	-.40**	-.24**
MPQ Alienation	-.36**	-.33**	-.24**
MPQ Aggression	-.24**	-.41**	-.18*
MPQ Control	-.08	.01	-.10
MPQ Harm Avoidance	.21**	.22**	.26**
MPQ Traditionalism	-.11	.01	.02
MPQ Absorption	-.21**	-.07	-.03
MPQ Unlikely Virtues	-.04	.09	-.01
MPQ Positive Emotion	.02	.20*	.10
MPQ Negative Emotion	-.49**	-.46**	-.28**
MPQ Constraint	.03	.15	.13
RS	.36**	.44**	.49**
GR	.52**	.70**	.49**
DRS	.29**	.42**	.38**
UPPS Negative Urgency	-.55**	-.48**	-.23**
UPPS Premeditation	.04	-.10	-.16*
UPPS Sensation Seeking	.13	.17*	.16*
UPPS Lack of perseverance	-.28**	-.55**	-.34**
UPPS Positive Urgency	-.38**	-.38**	-.23**
<hr/>			
Psychopathology			
MBPD	-.49**	-.44**	-.26**
TCUDS	-.14	-.07	-.06
AUDIT	-.11	-.07	-.06
STAI State	-.37**	-.34**	-.30**

Table 4 (Continued)

STAI Trait	-.60**	-.48**	-.33**
	-.52**	-.45**	-.34**
STAI Total			
EAT	-.40**	-.34**	-.22**
MDD Sx	-.29**	-.25**	-.11
AUD Sx	-.10	-.09	-.07
DUD Sx	-.13	-.05	-.04
Anxiety Sx	-.29**	-.20*	-.03
STAB	-.23**	-.38**	-.02

Note. * $p < .01$, ** $p < .001$. Bolded correlations indicate variables included in the DT personality network for profile correlations. 1 = Mean Z score for behavioral tasks on latency to quit. DI = Non Goal Oriented Distress Intolerance. DT = Goal Oriented Distress Tolerance DTS – Distress Tolerance Scale. TNASS – Tolerance of Negative Affective States Scale. Sx – Symptoms. FDS- Frustration Discomfort Scale. MINI – Mini International Neuropsychiatric Interview. MPQ – Multidimensional Personality Questionnaire. STAI – State and Trait Anxiety Inventory. AUDIT – Alcohol Use Disorders Identification Test. TCUDS – Texas Christian University Drug Use Scale. STAB – Subtypes of Antisocial Behaviors. UPPS-P – UPPS Impulsive Behavior Scale. DRS – Dispositional Resilience Scale. EAT – Eating Attitudes Test. BSI – Brief Symptom Inventory. AUD – Alcohol Use Disorder. DUD – Drug Use Disorder. MDD – Major Depression Disorder. Sx – Symptoms. STAB – Subtypes of Antisocial Behaviors. RS = Resilience. DRS – Dispositional Resilience Scale. MBPD – Minnesota Borderline Personality Disorder Scale.

Table 5. Undergraduate Incremental Utility Analyses

Construct	Step 1			Step 2			Step 3					
	Age	Sex	Ethnicity	Multiple R	R ² Δ	DT Factor	Multiple R	R ² Δ	DT Factor	Multiple R	R ² Δ	DT
DTB	-.31**	.08	.01	.32	.10**	-.34**	.36	.03*	.02	.31**	.08**	–
DTB	-.31**	.08	.01	.32	.10**	-.34**	.36	.03*	.02	–	.01	.11
MBPD	-.14	.07	-.10	.19	.04	-.49**	.51	.22**	-.35**	-.29**	.07**	–
MBPD	-.14	.07	-.10	.19	.05	-.49**	.51	.22**	-.45**	–	.53	-.14*
TCUDS	.12	-.21**	-.10	.26	.07**	-.21**	.33	.04**	-.21**	-.00	.01	–
TCUDS	.12	-.21**	-.10	.26	.07**	-.21**	.33	.04**	-.20*	–	.00	-.02
AUDIT	.02	-.15	-.18*	.23	.05*	-.14	.27	.02	-.13	-.03	.00	–
AUDIT	.02	-.15	-.18*	.23	.05*	-.14	.27	.02	-.13	–	.00	-.03
STAB	.05	-.11	-.08	.14	.02	-.27**	.30	.07**	-.10	-.35**	.10**	–
STAB	.05	-.11	-.08	.14	.02	-.27**	.30	.07**	-.28**	–	.00	.05
STAI– Total	-.14	.03	-.01	.15	.02	-.52**	.52	.25**	-.39**	–	.06**	–
STAI – Total	-.14	.03	-.01	.15	.02	-.52**	.52	.25**	-.46**	–	.04**	-.22**
EAT	.11	.18*	.03	.21	.04**	-.38**	.43	.14**	-.29**	-.20*	.03*	–
EAT	.11	.18*	.03	.21	.04**	-.38**	.43	.14**	-.35**	–	.01	-.12
MDD Sx	.11	.02	-.17*	.20	.04	-.32**	.37	.10**	-.26**	-.14	.01	–
MDD Sx	.11	.02	-.17*	.20	.04	-.32**	.37	.10**	-.31**	–	.00	-.04
AUD Sx	.03	-.15	-.12	.19	.04	-.13	.23	.02	-.10	-.06	.00	–
AUD Sx	.03	-.15	-.12	.19	.04	-.13	.23	.02	-.12	–	.00	-.03
DUD Sx	-.02	-.17*	-.07	.18	.03	-.16*	.24	.03*	-.16	.00	.00	–
DUD Sx	-.02	-.17*	-.07	.18	.03	-.16*	.24	.03*	-.16	–	.00	.01
Anxiety Sx	.07	.06	-.12	.15	.02	-.31**	.34	.10**	-.28**	-.08	.01	–
Anxiety Sx	.07	.06	-.12	.15	.02	-.31**	.34	.10**	-.33**	–	.00	.04

AUD – Alcohol Use Disorder. DUD – Drug Use Disorder. MDD – Major Depression Disorder. EAT – Eating Attitudes Test. STAB – Subtypes of Antisocial Behaviors. Sx – Symptoms. STAI – State Trait Anxiety Inventory. Texas Christian University Drug Use Questionnaire. AUDIT – Alcohol Use Disorders Identification Test. DI = Non Goal Oriented Distress Intolerance. DT = Goal Oriented Distress Tolerance . Covariates entered at Step 1, Existing DT entered at Step 3, each novel factor, DI or DT, entered independently at Step 3.

Table 6. Model Comparisons for MI Constraint Levels for DI and DT

	Step 1				Step 2					
	χ^2	$\Delta\chi^2$	MI result	Unst. λ	df	χ^2	$\Delta\chi^2$	MI result	Unst. λ	df
DI										
Base	226.821				40	191.844				28
DI 1	217.36	9.461	non invariant	0.824	38	194.805	-2.961	invariant	.768	30
DI 2	225.13	1.691	invariant	0.895	38	192.46	-0.616	invariant	.961	30
DI 3	209.607	17.214	non invariant	0.861	38	208.877	-17.033	non invariant	.793	30
DI 4	220.77	6.049	non invariant	0.905	38	198.257	-6.413	non invariant	.955	30
DI 5	226.21	0.616	invariant	0.936	38	193.648	-1.804	invariant	.982	30
DI 6	223.77	3.055	invariant	1.009	38			anchor		28
DI 7	224.92	1.9	invariant	0.954	38	191.871	-0.027	invariant	.958	30
DT										
Base	201.45				40	178.907				28
DT 1	200.52	0.932	invariant	0.809	38	180.478	-1.571	invariant	.786	30
DT 2	197.63	3.823	invariant	0.878	38	180.335	1.428	invariant	.576	30
DT 3	197.37	4.081	invariant	0.842	38	181.891	-2.984	invariant	.901	30
DT 4	188.69	12.764	non invariant	0.89	38	189.548	-10.641	non invariant	.889	30
DT 5	200.45	0.999	invariant	0.976	38			anchor		30
DT 6	199.06	2.392	invariant	0.9	38	179.375	-0.468	invariant	.968	30
DT 7	200.90	.55	invariant	0.768	38	180.06	-1.153	invariant	.743	30

Note: DI = Distress Intolerance, Non-Goal Oriented Factor. DT = Distress Tolerance Goal Oriented Factor. $\Delta\chi^2$ in step 1 represents the difference between a fully constrained model and a model with the particular item allowed to vary across samples. In contrast, $\Delta\chi^2$ in Step 2 represents a model with all parameters (with the exception of the anchor item) freely estimated across samples, compared with a model with the item in question constrained to be equal between groups. For DI, Item 6: "Not completing a frustrating assignment or task on time because I gave up on it;" served as the anchor item (bolded). For DT the anchor item (bolded) was Item 5 "Not giving up on things just because I feel frustrated." These were used as anchors for each factor respective in Step 2. Unst. λ is estimated in Step 1 and represents the unstandardized factor loading when the item is constrained to be equal across gender groups. The critical $\Delta\chi^2$ for noninvariance is >5.99 ($df = 2$).

Table 7. Sequential Free Baseline Analysis

Factor	Model	$\Delta\chi^2$	df	$\Delta\chi^2$ Each Group	$\Delta\chi^2$ Model Fit	Δ df	RMSEA (90% CI)	CFI	AIC
DI									
	Configural	191.84	28	125.63 (Community) 66.21 (College)	Metric vs Configural: 3.16 p= .79	6	.09 (0.084 , 0.110)	.96	24507.02
	Metric	195.00	34	126.23 (Community) 68.77 (College)	Metric vs Scalar: 31.82 p =.00	6	.08 (0.075, 0.099)	.96	24498.18
	Scalar	226.82	40	133.69 (Community) 93.13 (College)	Scalar vs Configural: 34.98, p = .00	12	.08 (0.076, 0.097)	.95	24518.00
DT									
	Configural	178.91	28	126.38 (Community) 52.528 (College)	Metric vs Configural: 5.61 p= .47	6	.09 (0.080, 0.106)	.97	21425.99
	Metric	184.52	34	127.563 (Community) 56.951 (College)	Metric vs Scalar: 16.94 p =.01	6	.08 (0.072, 0.096)	.97	21419.60
	Scalar	201.45	40	131.546 (Community)	Scalar vs Configural: 22.54, p = .03	12	.08 (0.069, 0.091)	.97	21424.54

Note. DI = Non Goal Oriented Distress Intolerance Factor. DT = Goal Oriented Distress Tolerance Factor. Df = degrees of freedom. $\Delta\chi^2$ = change in model fit for measurement invariance. Lower AIC indicates better model fit.

DISCUSSION

The current study aimed to develop and validate a novel self-report measure of distress tolerance that captures the behavioral definition of DT, or an individual's ability to persist in goal-oriented behaviors while experiencing negative emotional states. The measure's purpose was to minimize method variance, and provide an intermediary to the behavioral DT tasks by developing a scale that is on the same measurement metric as existing DT self-report measures. The novel measures' relationship with existing self-report DT measures, behavioral outcomes of DT, and the nomological network of DT were examined. In turn this showed how the measure mapped onto extant DT measures and the general DT nomological network (personality, mood, psychopathology (Anestis et al., 2012; Kiselica et al., 2014; Marshall-Berenz et al., 2010; McHugh et al., 2011; Schloss & Haaga, 2011)).

First and foremost, findings did not align with the predicted structure. Rather, I found two separate factors highly suggestive of wording effects; positive, goal-oriented DT (persistence through distress to achieve a goal) and negative, non-goal oriented DI (lack of goal-oriented persistence through distress). Fit indices suggested acceptable to borderline fit for each factor in the community sample but poor fit in the college sample.

The finding of two distinct factors were interesting, however not a unique finding to tests and measurements literature. Prior studies on item wording and effects on scale conceptualization and factor structure indicate using positive/negative item content to assess continuous personality constructs (e.g. low to high levels of a trait) generate similar results. For instance, the long-standing and well-studied self-esteem scale (Rosenberg Self-Esteem scale) was theorized as a unidimensional measure of self-esteem. However, studies in diverse samples, varying in age and culture, supported a two-factor scale of positive self-esteem and negative self-esteem items, with improved model fit over the original one factor scale (Bachman & O'Malley, 1986; Goldsmith, 1986; Greenberger, Chen, Dmitrieva, & Farrugia, 2003; Kaplan & Pokorny, 1969; Owens, 1993; Sheasby, Barlow, Cullen, & Wright, 2000). Although there is substantial

evidence for systematic wording effects, arguments suggest different explanations: 1) systematic bias due to item wording artifacts or error variance in method unrelated to the measured construct (cognitive processing effects, careless responding – “yea” or “nay”-saying); or 2) individual differences in “true” response bias or item content interpretation with the self as context. The former argument suggests inattention. Individuals may not attend to polarity of item wording or inconsistently respond to equivalent negative and positively worded items pairs (Schmitt & Stults, 1985). In this study, although not a stringent test, I performed attention checks throughout the surveys, in addition to calculating MPQ validity indices to identify inconsistent responders. Thereby, it appears unlikely that the two-factor solution is fully explained by careless responding.

The latter argument appears to be more appealing in general, as studies in support of the former (Greenberger et al., 2003; Schmitt & Stults, 1985) generally fail to control or test for these methods effects (testing if answers to other content areas show similar or dissimilar response style). Research on the second argument suggests that this specific response style can be modeled as a latent trait – a consistent manner of responding across different content areas. Studies corroborate this effect even when controlling for method/item wording artifacts. Likewise, this effect remains stable over time, lending credit to its trait-like nature (Distefano, & Motl, 2006). In other words, individuals may have the tendency to endorse positive (or negative) worded characterizations of themselves in the same way, across personality features (Bentler, Jackson, & Messick, 1971; Couch & Keniston, 1960; Motl, Conroy, & Horan, 2000; Tomas & Oliver, 1999; Wang et al., 2001). Other studies have found consistency in response styles by sample (college students, adolescents, drug users; Marsh, 1996; Tomás & Oliver, 1999; Wang et al., 2001), across varying personality content areas (Conroy, 2001; Motl & Conroy, 2000; Motl et al., 2000), and longitudinally; cross-lagged relationship between depression and negatively worded self-esteem items (Owens, 1994).

This study did not formally test these premises; however such response style can be modeled at the individual level using multilevel modeling techniques. Specifically, one approach could be applying a random intercepts model to determine how much variation in intercepts or item means is attributed to an

individual's responses on negative and positively coded item factors. (Maydeau-Olivares & Coffman, 2006). Significant variability would suggest presence of an underlying response style due to wording direction. future study, such a methodology can be used to test if, in fact, wording effects are better explained as a style of responding than as an artifact of wording.

Second, construct validity of measure showed predicted relationships with real-world behavioral outcomes, existing self-report measures, and related personality constructs. In the college sample, behavioral tasks were indeed associated with goal-oriented DT, indicating that I may have achieved my goal of constructing a scale that conceptually and empirically maps onto the behavioral measures of DT. However, across both samples, evidence of a separate construct that is unique only to the behavioral goal-oriented definition of DT was only partially supported. Incremental utility analyses illustrated that both factors captured considerable unique variance in DT outcomes (psychopathology and real-world behavioral outcomes) in the community sample, but to a lesser extent for the college sample. In both samples, it appeared that DI consistently predicted more variance in outcomes compared to DT. It is likely that the existing measure and my two new measures are competing for the same variance in outcomes. For instance, measures' overlap with negative affect may contribute to confounded results, as it was not controlled for in this study. However, given that it is part in parcel with the DT construct, an attempt to disentangle negative affect from DT measures may constitute statistical over control (Hill, 2014; Kiselica et al., 2014; Lynam, 2006)

However, rather than supporting discriminant validity, profile correlations for both factors, showed high levels of agreement across samples; corroborating that the novel measures show similar patterns of correlations with the DT personality network as existing DT measures. Considered together with findings related to behavioral outcomes, inconsistencies in literature are likely more an artifact of method variance (Daughters et al., 2011; Kiselica et al., 2014; McHugh, 2011). Despite these mundane findings, results at the very least, addressed the argument of method variance, and provided data that the novel measures and the existing self-report DT measures are providing relatively good coverage of purported behavioral DT construct, and the DT construct as a whole.

Documentation of the nomological network of the novel factors further supported coverage of the DT construct. Specifically, the novel factors, across samples, showed both were related to higher report of adaptive normal personality traits (wellbeing, achievement, positive emotions, and behavioral control), less maladaptive personality traits (stress, aggression, negative emotions, impulsivity), lower rates of psychological problems, and overall better psychosocial functioning. These findings are generally supportive of what was found in previous literature that investigated the nomological network of DT (Kiselica et al., 2014), and support relationships between DT (self-report and behavioral) across personality, psychopathology, and DT outcomes (Anestis et al., 2012; Anestis, et al., 2007; Bernstein et al., 2009; Bernstein & Brantz, 2013; Bornovalova, Matusiewicz, & Rojas, 2008; Cogle, Timpano & Goetz, 2012; Ellis, Vanderlind, & Beevers, 2013; Linehan, 1993; Keough et al., 2010; Leyro et al., 2010; Mashall-Berenz et al., 2010; Vujanovic et al., 2011). Although my measure is redundant in nature, it supports the use of these novel scales as a possible substitute to DT behavioral tasks, and provides good coverage of the broader DT nomological network.

Finally, differences in model fit and the presence of DIF was found in the college sample. As the pattern of associations of DI and DT was somewhat different, measurement invariance was examined. Several items were found to be noninvariant: items 3 (“Quitting my job if it is stressful”) and 4 (“Giving up on a difficult task without completing it”) for non- goal oriented DI, and item 4 (“Not letting stress govern my driving behaviors”) for goal oriented DT. Additionally, scalar invariance was not achieved, indicating that a sample-related second dimension was likely influencing item intercepts. The individual item DIF results indicate that college students likely do not interpret these items in the same manner as the other scale items that appear to map onto the definition of DT. For instance, they may not consider maintaining steady employment in college despite distress (which are conventionally short-term in nature) as meaningful or important, compared to other goal-oriented (or lack of non-goal oriented) items, particularly relative to community individuals (e.g. jobs are long-term, stable, career-focused). Thus, this and the latter non-invariant items may not be related to traditional DT characteristics (persistence through negative emotions to achieve a meaningful reward/goal) as items found to be invariant across samples.

In sum, across both samples, results generated evidence that the two novel DT and DI factors appeared to minimize method variance, operated similarly in coverage of the DT personality network as existing DT measures, and documented associations with the broader DT nomological network. However, it failed to provide evidence of a unique or separate construct of DT, as suggested by the behavioral DT definition, and provided moderate incremental utility above and beyond the extant DT measures. Findings that the factor structure showed poor fit in the college students and failed at the scalar level suggested possible factors may be multidimensional in nature for the college students.

Several strengths of this study include two relatively large samples, community participants and college students, and the ability to cross validate the measure in separate samples. The community sample was large and included a comprehensive assessment of constructs related to DT. Additionally, both self-report and behavioral measures of DT were administered to the college students, where most literature reports use of one or the other. Additionally, college students received a clinical interview building upon self-report measures of pathology alone.

Limitations of the study could explain some of the inconsistency in findings. For instance, the smaller sample size of college students may account for failure to detect significant associations across the DT nomological network. The community sample did show a number of more significant and predicted associations compared to college students, but it is difficult to tell if fewer significant effects in the college students simply reflect Type II error. Further, due to feasibility and nature of administration, the community sample did not receive the behavioral tasks, thus lacking an additional construct validity index to compare the developed measures. Likewise, only the college sample received the clinical interview. Given that college students are a subset of the population, results may not generalize because they largely report lower rates of psychopathology, and different demographics not reflective of the community (younger, parentally based income). Future studies should aim to build on these limitations to better investigate broad applications of this measure. Specifically, other studies should include clinical interviews and the behavioral tasks in large, community-based samples; examine replicability of results; and support or discount results in the college sample. Likewise, comprehensive replication of this study in

large, diverse, samples, particularly ones that include the behavioral tasks, will help to increase the utility of this measure as a substitute to behavioral tasks/ extant self-report DT measures, reducing participant burden.

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APPENDICES

Appendix A: Exploratory Factor Analysis

Table A1. Patterns of Factor Loadings

	Item	Initial					Final				
		Factor Loadings					Factor Loadings				
		1	2	3	4	5	1	2	3	4	5
Negative Non Goal Oriented Items											
Not showing up for work (or class) if it is boring	1	.00	.67	.03	.06	-.07	–	.64	–	–	–
Quitting tasks when they get too tedious	2	.02	.79	.04	-.20	-.10	–	–	–	–	–
Making excuses to get out of things that irritate me	3	-.01	.66	.07	-.28	.09	–	.74	–	–	–
Quitting my job if it is stressful	4	.04	.61	-.03	-.10	.03	–	.64	–	–	–
Giving up on a difficult task without completing it	5	.05	.77	.01	-.28	-.06	–	.84	–	–	–
Sleeping when I'm stressed out instead of showing up to [class, work, or a job]	6	.01	.77	-.07	.17	-.03	–	–	–	–	–
Purposely coming to work late so I do not have to deal with the hassles of a full work day	7	-.02	.74	.01	.30	-.07	–	–	–	–	–
Leaving events early when they are stressful	8	-.04	.66	.02	-.08	.10	–	.66	–	–	–
Having difficulties studying for a stressful exam	9	-.01	.70	-.02	.01	.11	–	.82	–	–	–
Not completing a frustrating assignment or task on time because I gave up on it	10	.06	.82	-.02	.01	.00	–	–	–	–	–
Drinking more than I should have because of a stressful day	11	-.01	.06	.90	.04	-.01	–	–	–	–	–
Drinking more when I have had a long, frustrating day at work (or school)	12	-.02	-.01	.93	-.10	.02	–	–	–	–	–
Drinking too much whenever I am stressed	13	.00	.03	.90	.01	-.02	–	–	–	–	–
Missing a stressful event or meeting because I drank too much the night before	14	.09	.31	.37	.34	.05	–	–	–	–	–
Ending intimate relationships when I find my partner irritating	15	-.03	.53	.03	.21	.20	–	–	–	–	–
Speeding in my vehicle when I am frustrated	16	-.01	.44	.10	.24	.42	–	–	–	–	–
Difficulty putting enough effort into stressful tasks	17	.03	.74	-.03	-.10	.01	–	.76	–	–	–
Tolerating a demanding job	18	.69	.01	.00	.02	-.11	–	–	–	–	–
Positive Goal Oriented Items											
Accepting frustration as a necessary obstacle to persist through when trying to achieve a goal	19	.74	-.05	.00	-.05	.02	.71	–	–	–	–
Sticking to a regular schedule at work (or school)	20	.60	.07	.03	.08	-.20	–	–	–	–	–
Pushing myself to follow through on a difficult task and complete it	21	.74	.04	.03	-.02	-.23	.74	–	–	–	–
Not believing in using drugs or alcohol to escape from my worries	22	.50	-.13	.44	.01	.00	–	–	–	–	–
Believing that putting effort into difficult tasks are worth it	23	.81	.01	-.02	.00	.10	.82	–	–	–	–
Not letting stress govern my driving behaviors	24	.73	-.02	.01	-.03	.50	.68	–	–	–	–
Not giving up on things just because I feel frustrated	25	.79	.08	.00	-.17	.13	.83	–	–	–	–
Finishing frustrating things	26	.82	.10	-.04	-.09	.02	.85	–	–	–	–
Trying to work through stressful intimate relationships	27	.68	-.01	-.05	.15	.11	.65	–	–	–	–
Coping well with negative emotions	28	.70	.17	.01	.04	-.11	–	–	–	–	–
Not engaging in physical fights when I am irritated with a family member or friend	29	.66	-.07	.06	.38	-.05	–	–	–	–	–
Attending marital counseling instead of getting separated or filing for divorce	30	.53	-.02	-.08	.14	.00	–	–	–	–	–
Pushing myself through physical discomfort	31	.57	.01	.03	.01	-.14	–	–	–	–	–
Eigen Values		10.92	4.3	2.4	1.1	1.0	4.1	4.4			
			4	5	4	7	9	3			

Note. Factors loadings in **bold** | > .40|.

Appendix B: Distress Tolerance Questionnaire (DTQ)

Please use the following scale to indicate how probable these statements are of you.

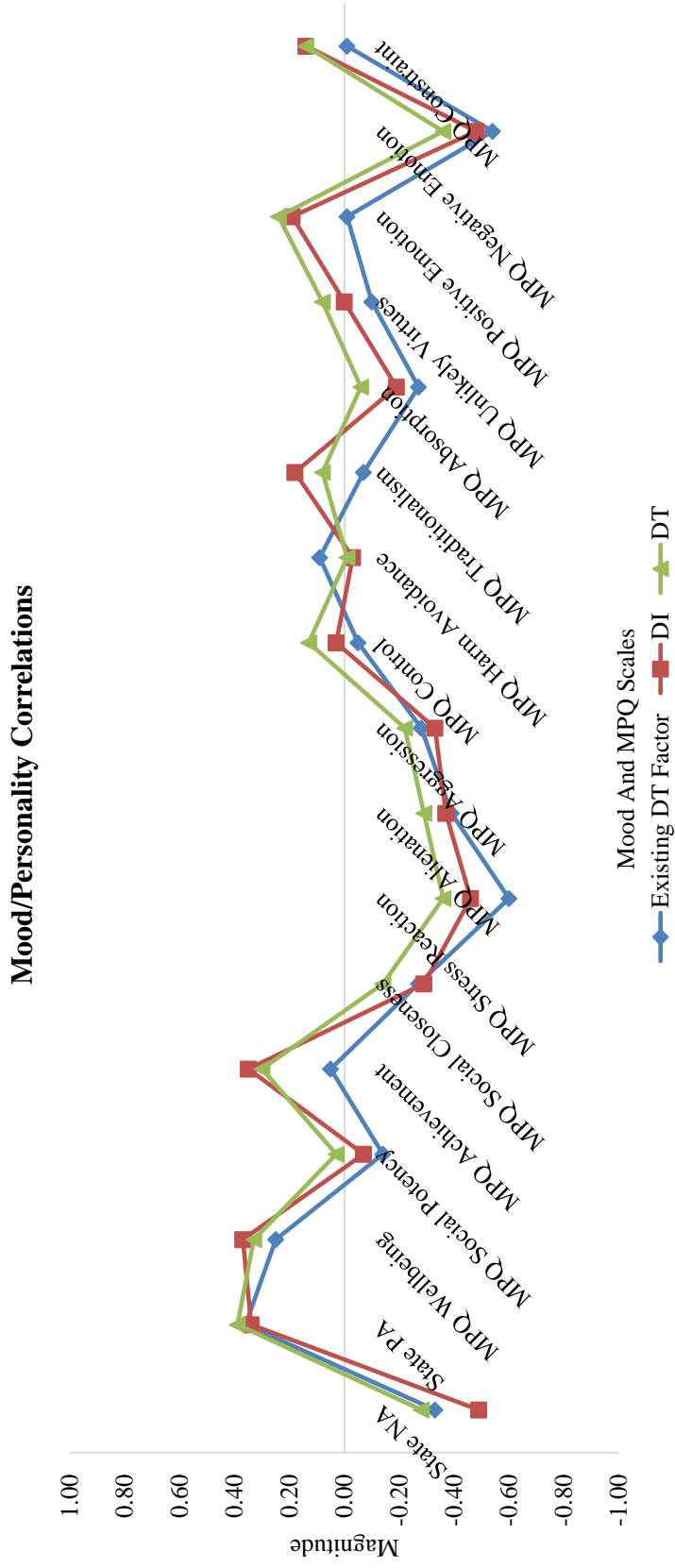
- 1 – Not probable
- 2 – Somewhat improbable
- 3 – Neutral
- 4 – Somewhat probable
- 5 – Very probable

Distress Intolerance (DI): Non Goal Oriented DT

1. Not showing up for work (or class) if it is boring
2. Making excuses to get out of things that irritate me.
3. Quitting my job if it is stressful.
4. Giving up on a difficult task without completing it.
5. Leaving events early when they are stressful.
6. Not completing a frustrating assignment or task on time because I gave up on it.
7. Difficulty putting enough effort into stressful tasks.

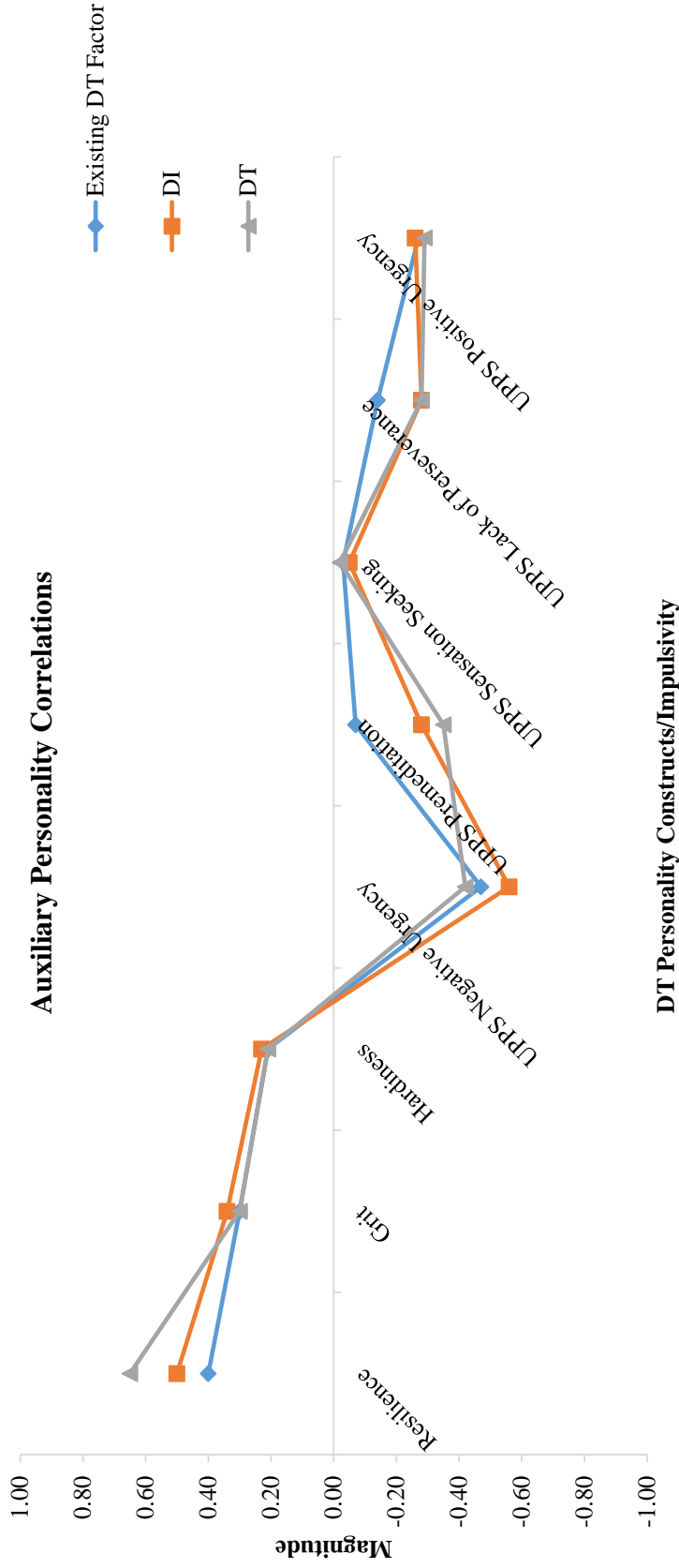
Distress Tolerance (DT): Goal-Oriented DT

1. Accepting frustration as a necessary obstacle to persist through when trying to achieve a goal.
2. Pushing myself to follow through on a difficult task and complete it.
3. Believing that putting effort into difficult tasks are worth it.
4. Not letting stress govern my driving behaviors.
5. Not giving up on things just because I feel frustrated.
6. Finishing frustrating things.
7. Trying to work through stressful intimate relationships.



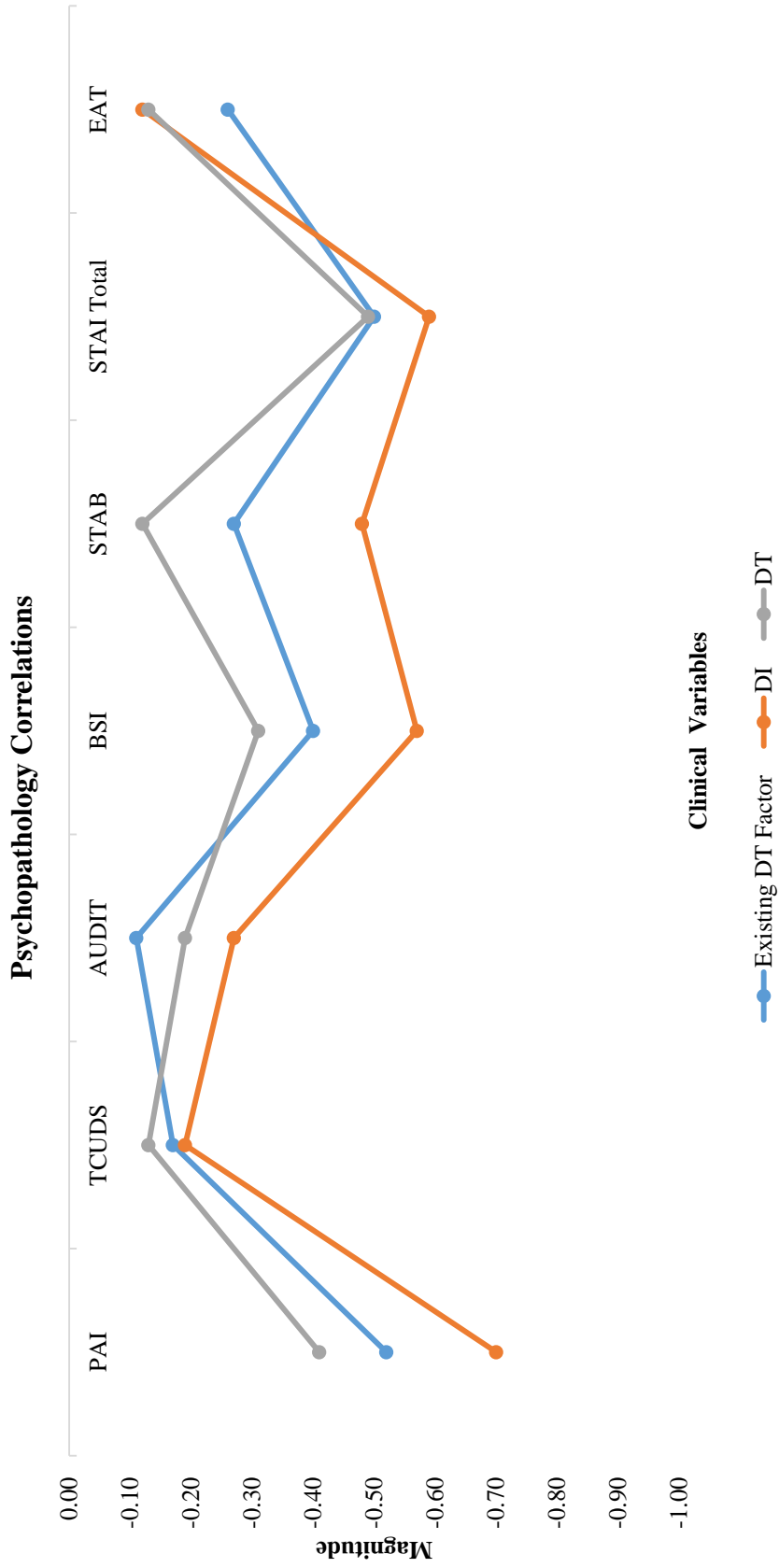
Note. Correlations trends for variables depicted here (excluding state affect) are included within profile correlations generated across novel factors and existing DT with the DT personality network.

Figure 1. Community Mood/Personality Correlations



Note. Correlations trends for variables depicted here are included within profile correlations generated across novel factors and existing DT with the DT personality network.

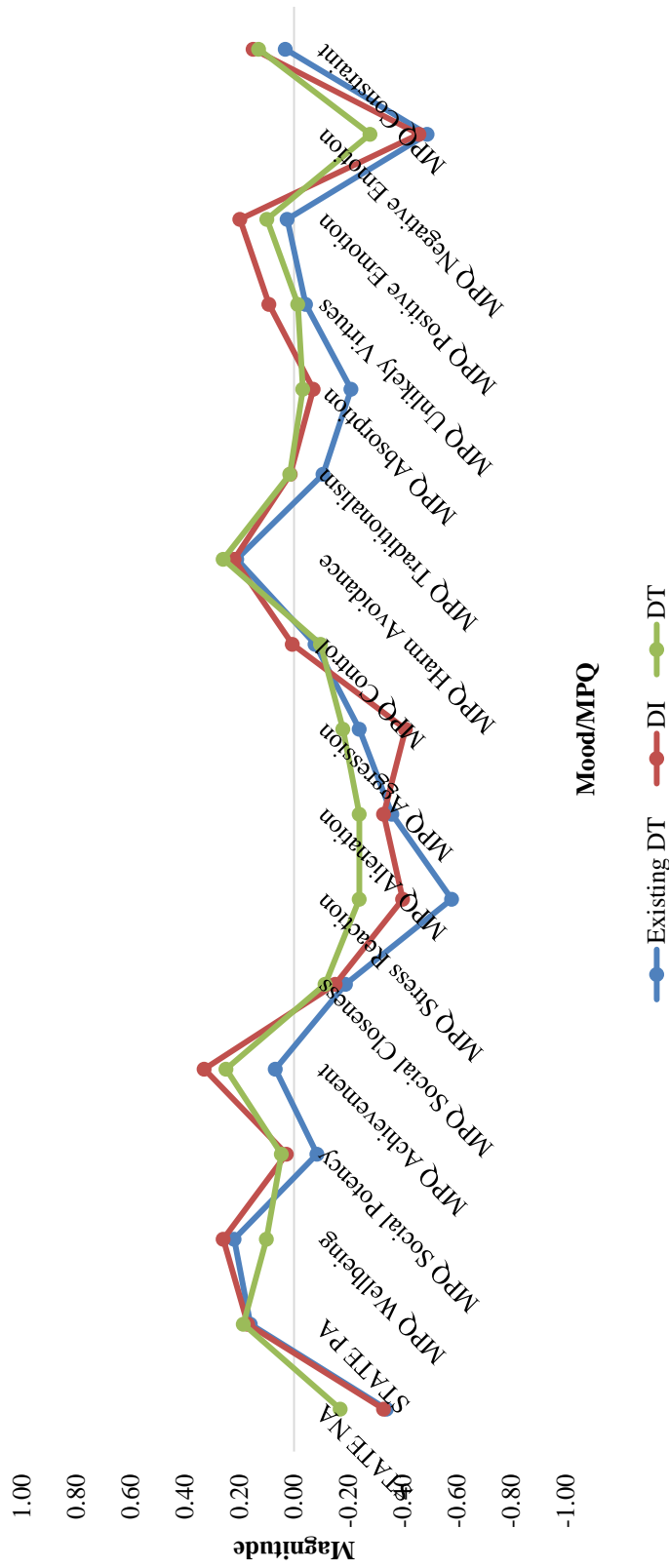
Figure 2. Community Auxiliary Personality Correlations



Note. PAI- Personality Assessment Inventory-Borderline Scale. AUDIT-Alcohol Use Disorders Identification Test. EAT- Eating Attitudes Test. TCUDS- Texas Christian University Drug Use Scale. BSI – Brief Symptom Inventory. STAI-State Trait Anxiety Inventory

Figure 3. Community Psychopathology Correlations

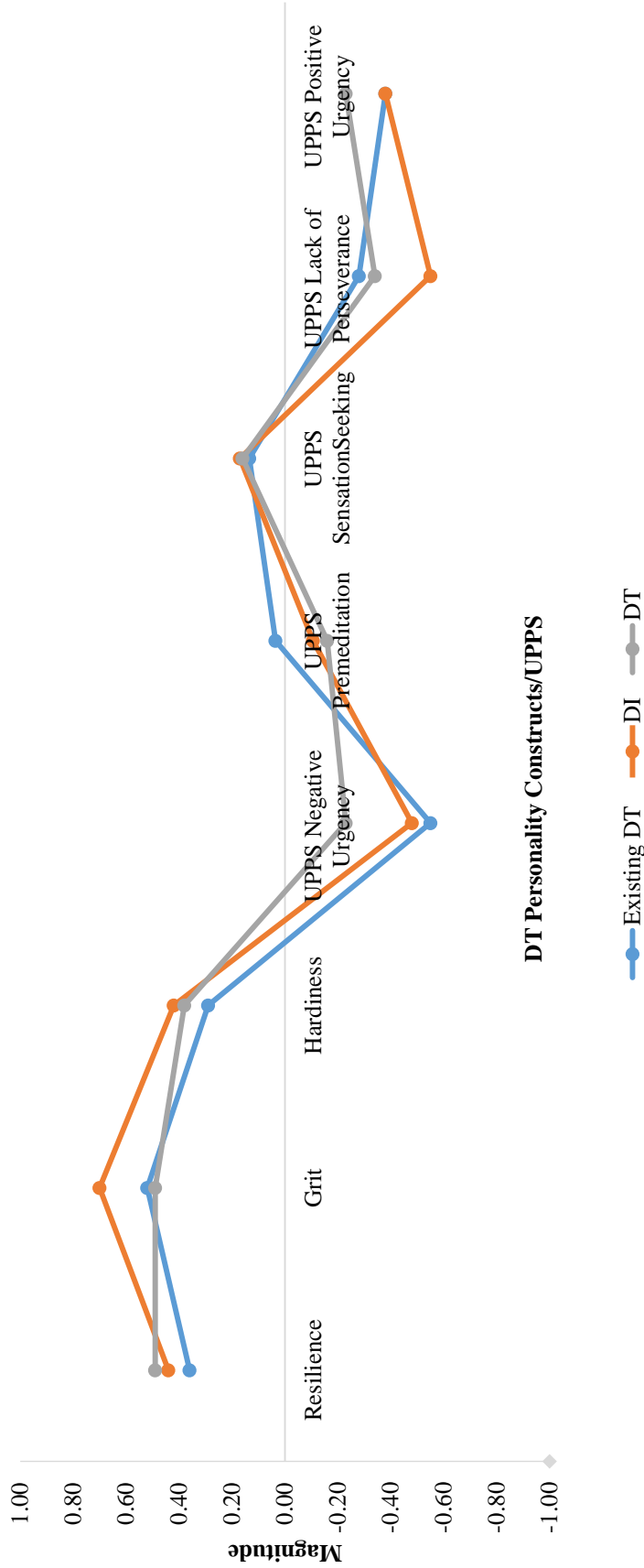
Mood/Personality Correlations



Note. Correlations trends for variables depicted here (excluding state affect) are included within profile correlations generated across novel factors and existing DT with the DT personality network.

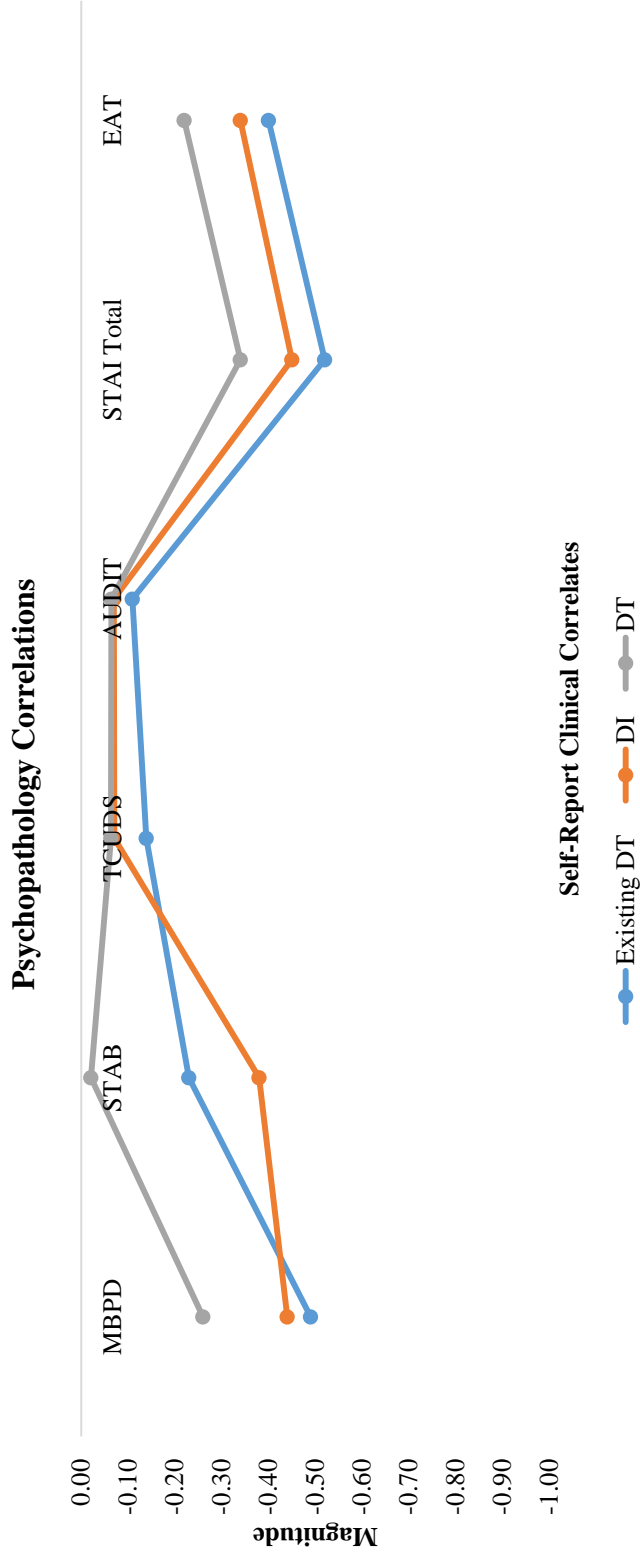
Figure 4. Undergraduate Mood/Personality Correlations

Auxiliary Personality Correlations



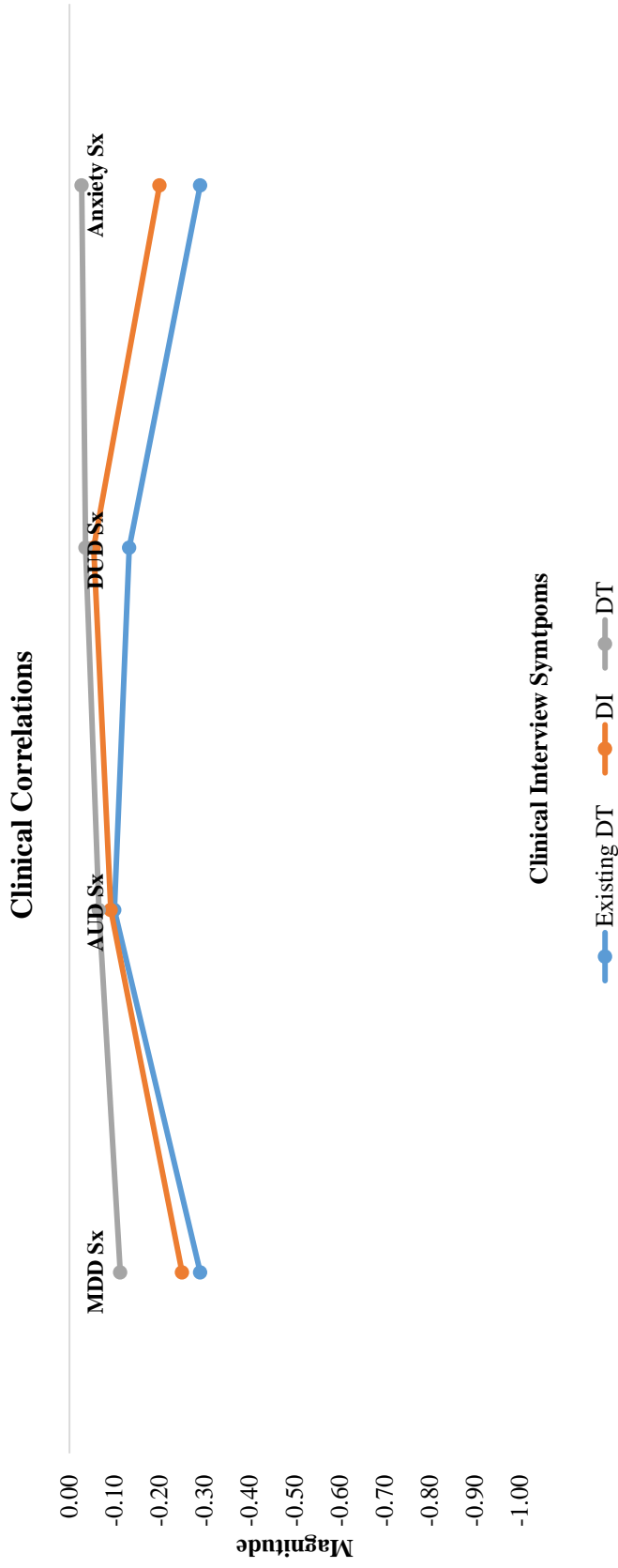
Note. Correlations trends for variables depicted here are included within profile correlations generated across novel factors and existing DT with the DT personality network.

Figure 5. Undergraduate Auxiliary Personality Correlations



Note. MBPD – Minnesota Borderline Personality Disorder Scale. AUDIT-Alcohol Use Disorders Identification Test. EAT- Eating Attitudes Test. TCUDS- Texas Christian University Drug Use Scale. STAI-State Trait Anxiety Inventory

Figure 6. Undergraduate Psychopathology Correlations



Note. MDD – Major Depressive Disorder. AUD- Alcohol Use Disorder. DUD-Drug Use Disorder. Sx – Symptoms.

Figure 7. Undergraduate Clinical Variables Correlations

Appendix D: IRB Approval Letter



RESEARCH INTEGRITY AND COMPLIANCE
Institutional Review Boards, FWA No. 00001669
12901 Bruce B. Downs Blvd., MDC035 • Tampa, FL 33612-4799
(813) 974-5638 • FAX (813) 974-7091

10/7/2014

Marina Bornovalova, Ph.D.
Psychology
4202 East Fowler Ave, PCD4118G,
Tampa, FL 33620

RE: **Exempt Certification**

IRB#: Pro00019088

Title: Validation of a Distress Overtolerance Questionnaire and Novel Distress Tolerance Questionnaires

Study Approval Period: 10/7/2014 to 10/7/2019

Dear Dr. Bornovalova:

On 10/7/2014, the Institutional Review Board (IRB) determined that your research meets USF requirements and Federal Exemption criteria as outlined in the federal regulations at 45CFR46.101(b):

(2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless:
(i) information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (ii) any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, or reputation.

Approved Documents

[Institutional Review Board Protocol.docx](#)

[Informed Consent Form.docx](#)

Your study qualifies for a waiver of the requirements for the documentation of informed consent as outlined in the federal regulations at 45CFR46.117(c) which states that an IRB may waive the requirement for the investigator to obtain a signed consent form for some or all subjects if it finds either: (1) That the only record linking the subject and the research would be the consent document and the principal risk would be potential harm resulting from a breach of confidentiality. Each subject will be asked whether the subject wants documentation linking the subject with the research, and the subject's wishes will govern; or (2) That the research presents

no more than minimal risk of harm to subjects and involves no procedures for which written consent is normally required outside of the research context.

As the principal investigator for this study, it is your responsibility to ensure that this research is conducted as outlined in your application and consistent with the ethical principles outlined in the Belmont Report and with USF IRB policies and procedures. Please note that changes to this protocol may disqualify it from exempt status. Please note that you are responsible for notifying the IRB prior to implementing any changes to the currently approved protocol.

The Institutional Review Board will maintain your exemption application for a period of five years from the date of approval or for three years after a Final Progress Report is received, whichever is longer. If you wish to continue this protocol beyond five years, you will need to submit a new application at least 60 days prior to the end of your exemption approval period. Should you complete this study prior to the end of the five-year period, you must submit a request to close the study.

We appreciate your dedication to the ethical conduct of human subject research at the University of South Florida and your continued commitment to human research protections. If you have any questions regarding this matter, please call 813-974-5638.

Sincerely,



John Schinka, Ph.D., Chairperson
USF Institutional Review Board