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The Relationship Between Affect Intolerance, Maladaptive Emotion Regulation, and Psychological Symptoms

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Abstract

Affect intolerance (AI), one's perceived sensitivity to, and intolerance of, unpleasant emotional states, is a risk and maintenance factor of affective disorders. To cope with AI, individuals may rely on maladaptive emotion regulation techniques that provide quick, but short-lived, relief from distress. Two cognitively based maladaptive emotion regulation strategies—repetitive negative thinking (RNT) and thought suppression (TS)—reflect contrasting attempts to cope with unwanted emotions. The present study sought to simultaneously examine the relationships between AI, maladaptive cognitive emotion regulation strategies, and symptoms of mood and anxiety disorders using structural equation modeling. Data from a community sample ($N = 590$) was used to assess the relationship between an empirically derived latent AI factor and symptoms of depression, anxiety, and obsessive-compulsive disorder (OCD). This latent AI factor demonstrated *indirect* effects on depression symptoms via RNT ($\beta = 0.212$, $p = 0.039$) and on OCD symptoms via RNT ($\beta = 0.197$, $p = 0.021$) and TS ($\beta = 0.171$, $p = 0.001$). There were no indirect effects of the latent factor on anxiety symptoms. These results suggest that elevated AI is associated with greater psychological symptoms via the use of maladaptive cognitive emotion regulation strategies, and that this relationship differs by symptom type.

Keywords Affect intolerance · Repetitive negative thinking · Thought suppression · OCD · Depression · Anxiety · Structural equation modeling

Introduction

Individual differences in reactivity to emotion-eliciting stimuli have been observed in humans as early as infancy (Calkins 1994). These observations suggest that there are

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predispositions (e.g., temperaments), either learned or biologically driven, for the amount of distress an individual is comfortable enduring (Boyce and Ellis 2005; Zeman et al. 2006). This variability in reactivity to emotion-eliciting stimuli can be observed at two levels: first, the actual amount of distress or discomfort an individual can tolerate, and second, an individual's *perception* of the amount of distress or discomfort they can endure. A range of closely related constructs capture different facets of the perceived ability to tolerate negative or uncomfortable emotional states, including intolerance of uncertainty (IU) (Buhr and Dugas 2002), general distress intolerance (DI) (McHugh and Otto 2012), and anxiety sensitivity (AS; the intolerance of physiological symptoms of anxiety) (Reiss et al. 1986). These three elements can be conceptualized as part of an overarching, latent construct of affect intolerance (AI), which more broadly captures one's perceived sensitivity to, and intolerance of, various unpleasant emotional states (Bardeen et al. 2013; Bernstein et al. 2009). The construct of AI has been largely explored within the realm of anxiety disorders as a dispositional characteristic that gives rise to anxiety (Dugas and Robichaud 2012).

Maladaptive emotion regulation strategies may be one way through which AI gives rise to psychopathology. Individuals with greater AI have a tendency to experience distressing emotional states as more uncomfortable, intolerable, and unsustainable. They will therefore be more likely to engage in strategies designed to avoid or curtail the negative emotional states, and will be less likely to use more adaptive emotion regulation strategies (e.g., problem solving) that require one to sit with distressing emotional states (Jeffries et al. 2016). Over time, the reliance on maladaptive coping mechanisms can become negatively reinforcing, ultimately leading to a greater experience of mood and anxiety symptoms.

One maladaptive emotion regulation strategy that may be relevant for our understanding of the association between AI and psychopathology is repetitive negative thinking (RNT). RNT is defined as the tendency to recursively mull over current, past, or future concerns, and growing evidence suggests that it may serve as a transdiagnostic risk factor for the development of a number of disorders (Ehring and Watkins 2008). Three such disorders [major depressive disorder (MDD), generalized anxiety disorder (GAD), and obsessive-compulsive disorder (OCD)] are all characterized by the use of maladaptive cognitive emotion regulation strategies, including excessive ruminative thoughts, extreme worry, and/or compensatory mental rituals. Because RNT focuses on the shared process of perseverative thinking rather than the content of the thoughts, it is expected that individuals with MDD, GAD, and OCD would endorse using RNT (Ehring and Watkins 2008). Individuals who regularly engage in RNT tend to focus their thoughts on their negative feelings, detracting from their ability to actively problem solve, leaving the issue that elicited those negative feelings unresolved (Carver et al. 1989; Nolen-Hoeksema 2000).

With respect to the link between AI and RNT, very little research has explicitly looked at this association. Considering the theoretical model of AI, there are a number of reasons to believe that individuals with greater AI would be more likely to engage in RNT. One such explanation for the relationship between AI and RNT comes from AI research that reports that individuals with greater AI tend to focus their attention on negative experiences in the past in an attempt to ignore present problems (Leyro et al. 2010). Or, it could be that individuals who endorse AI use RNT as an ineffective cognitive coping mechanism as an attempt to regulate their negative emotion. It may be that these two concomitant experiences of perseverative thought—be it distraction or past-oriented problem solving—happen independently. In a way, individuals high in AI who use RNT to cope are still engaging in an avoidance tactic: they are avoiding the present negative emotional stimuli by perseverating on past situations.

In contrast to RNT, which involves the conscious decision to recursively mull over troubling thoughts, thought suppression (TS) is a separate maladaptive emotion regulation strategy that captures the opposite process: the tendency to avoid or push away unwanted cognitions. Despite this difference, TS and RNT are, in many ways, quite similar. Like RNT, TS is a transdiagnostic cognitive risk factor for the development or exacerbation of clinical features, particularly depressive thinking (Wenzlaff et al. 1988), anxiety (Clark and de Silva 1985; Salkovskis and Campbell 1994), and intrusive obsessional thoughts (Najmi and Wegner 2009; Purdon et al. 2011). And, like RNT, TS is a cognitive coping mechanism that may initially be helpful as it reduces the presence of unwanted cognitions in the short term. However, it can become problematic in the long term if used habitually in response to distressing thoughts or if it generalizes to inappropriate contexts (Abramowitz et al. 2001; Carver et al. 1989; Magee et al. 2012; Wegner et al. 1987) because TS provides only temporary relief from the unwanted thoughts and emotions they elicit (Muris et al. 1996). In fact, the intention to suppress an unwanted thought initiates a cognitively demanding thought-monitoring process that may actually increase the frequency of the unwanted thoughts as attention is drawn to those thoughts as a confirmation that they are (or are not) occurring (Wegner and Zanakos 1994). Because TS does not allow the individual to face and learn to tolerate unwanted thoughts and the emotions they elicit, TS is a cognitive emotion regulation strategy that is ultimately maladaptive. Therefore, unlike RNT, where thoughts are consciously intentionally maintained as a means to think about the causes and consequences, TS is an avoidance tactic that unintentionally maintains the unwelcome thought.

Given prior associations between AI and symptoms of psychopathology (Dugas et al. 2005; Jeffries et al. 2016), a growing literature about the relationship between AI and maladaptive emotion regulation strategies (Boyce and Ellis 2005; Jeffries et al. 2016; Zeman et al. 2006), and established associations between such two such strategies (RNT and TS) and symptoms of psychopathology (Clark and de Silva 1985; Najmi and Wegner 2009; Purdon et al. 2011; Salkovskis and Campbell 1994; Wenzlaff et al. 1988), the current study sought to clarify the connection between all three relationships within one framework. We sought to test whether the use of maladaptive cognitive emotion regulation strategies (defined as either RNT or TS) serves as an indirect link between AI and mood, anxiety, and obsessive-compulsive symptoms. We hypothesized that individuals who endorse heightened levels of AI will report both elevated symptoms of psychopathology and greater use of RNT or TS. As in prior literature, we also hypothesized that elevated RNT or TS will be associated with heightened symptoms of psychopathology. Finally, we predicted that there will be a significant indirect relationship between AI and symptoms of psychopathology via the use of one or both modes of maladaptive cognitive emotion regulation (RNT or TS). While we can extrapolate from past studies that such an indirect relationship may exist, to our knowledge, neither RNT nor TS has been studied as a possible mechanism of the impact of AI in this manner. We sought to quantitatively test this hypothesis using structural equation modeling, and as such, the present study provides a novel way to explore these potential associations.

Method

Participants

Five hundred ninety participants (female = 287, 49%) of ages 18–73 ($M = 36$ years, $SD = 11.82$) were included in the final sample. Participants were mostly non-Hispanic (92%) and identified with the following racial groups: 76.3% Caucasian/White, 13.1% Asian/Asian-American, 7.5% African-American/Black, 1.2% Native American, 0.2% Native Hawaiian/ Pacific Islander, and 2.5% Other. It was a highly educated sample (years of education: $M = 15.03$, $SD = 2.05$), with most individuals having completed at least some college.

Procedure

Participants ($N = 863$) included two subsamples ($n = 337$ and $n = 526$) recruited through Amazon's Mechanical Turk (MTurk). Previous research has demonstrated that on average, MTurk participants endorse elevated levels of clinically significant symptoms of anxiety or depression compared to a general population sample (Arditte et al. 2016). In fact, MTurk samples have been found to include a substantially higher percentage of individuals with clinically significant symptoms of unipolar depression and OCD, as compared to rates noted in epidemiological research (Arditte et al. 2016).

Procedures for each subsample were generally the same. Participants accessed a link through the MTurk portal to an online battery of self-report questionnaires and were compensated $4.00 for their participation. The measures were completed on Qualtrics, and consent was obtained electronically. The questionnaire battery differed somewhat for each subsample and included additional measures not relevant to the current investigation. One of the subsamples was not administered the White Bear Suppression Inventory (WBSI); the depression subscale of the Depression, Anxiety, and Stress Scale (DASS-21); and the obsessing subscale of the Obsessive-Compulsive Inventory-Revised (OCI-R), resulting in varying sample sizes across each measure examined.

A number of data screening steps were initiated to guarantee the integrity of our data and arrive at the final sample. First, we took several steps to remove individuals who may not have provided quality responses. Participants were excluded from their respective subsamples if they failed to complete the given questionnaire battery or did so in less than 60% of the expected completion time ($n = 177$). Furthermore, participants who did not respond correctly to at least 4 of 5 validity items embedded in each questionnaire set were also removed ($n = 44$). These methods are standard practices when collecting online survey data through MTurk (Behrend et al. 2011). The two subsamples were then combined, and the total sample was screened for any participants who appeared in both subsamples ($n = 52$). When a participant had completed both questionnaire sets, only the set of responses from the more complete questionnaire battery (the set which included the WBSI, DASS-21, and OCI-R) was retained. Data were accessed after the completion of the study, and initial data screening was completed in SPSS and R. The final sample sizes available for analysis across each measure are shown in Table 1. Structural equation model analyses were conducted using Mplus (Muthén & Muthén, 1998–2012). As noted above, the final dataset was drawn from two separate MTurk subsamples, one of which did not receive three of the measures utilized in the present analyses. Because the missing data is due to study design, the data is considered to be missing completely at random (MCAR).

Table 1 Descriptive statistics for all measures

Measure	*N*	*M* (*SD*)	Sample range	Skewness	Kurtosis	α
ASI-3	571	19.24 (14.24)	0–66	0.85	0.28	0.92
DII	575	12.38 (10.13)	0–40	0.61	− 0.51	0.95
IUS-12	578	36.57 (10.57)	12–60	− 0.27	− 0.36	0.93
PTQ	567	22.93 (14.09)	0–60	0.23	− 0.65	0.97
WBSI	241	46.31 (13.99)	15–75	− 0.34	− 0.41	0.94
DASS-anx	569	4.50 (5.91)	0–42	2.34	7.95	0.86
Log DASS-anx	569	0.53 (0.44)	0–1.63	0.21	− 1.12	N/A
DASS-dep	235	9.53 (10.89)	0–42	1.20	0.50	0.94
OCIR-obs	242	2.54 (2.94)	0–12	1.16	0.56	0.89

ASI-3 Anxiety Sensitivity Index-3; *DII* Distress Intolerance Index; *IUS-12* Intolerance of Uncertainty Index-12; *PTQ* Perseverative Thinking Questionnaire; *WBSI* White Bear Suppression Inventory; *DASS-anx* Depression, Anxiety, and Stress Scales anxiety subscale; *Log DASS-anx* log-transformed DASS-anx; *DASS-dep* Depression, Anxiety, and Stress Scales depression subscale; *OCIR-obs* Obsessive-Compulsive Inventory-Revised obsessing subscale

Measures

Measures of Affect Intolerance

Anxiety Sensitivity Index-3 The Anxiety Sensitivity Index-3 (ASI-3) (Taylor et al. 2007) is an 18-item questionnaire assessing intolerance of physiological symptoms of anxiety (e.g., "It scares me when my heart beats rapidly"). Participants rate the degree to which they agree with each statement on a 5-point Likert scale from 0 (*very little*) to 4 (*very much*). Across its subscales, the ASI-3 has shown acceptable to good internal consistency ($\alpha = 0.73$–0.91), as well as satisfactory convergent and discriminant validity in clinical and non-clinical samples (Taylor et al. 2007).

Distress Intolerance Index The Distress Intolerance Index (DII) (McHugh and Otto 2012) is a 10-item self-report measure of general distress intolerance (e.g., "I'll do anything to stop feeling distressed or upset"). Participants rate the degree to which each statement characterizes them from "very little" to "very much." The DII has shown excellent internal consistency in both non-clinical ($\alpha = 0.91$) and clinical ($\alpha = 0.92$) samples (McHugh and Otto 2012) as well as high concurrent validity with behavioral assessments of distress intolerance (McHugh and Otto 2011).

Intolerance of Uncertainty Scale-12 The Intolerance of Uncertainty Scale-12 (IUS-12) (Carleton et al. 2007) is a 12-item questionnaire of unwillingness to tolerate uncertainty about possible future negative outcomes (e.g., "I always want to know what the future has in store for me"). Participants rate the degree to which they agree with the statements from 1 (*most like me*) to 5 (*not like me*). The total score has demonstrated excellent internal consistency ($\alpha = 0.91$) and good convergent validity in a non-clinical sample (Carleton et al. 2007), with similar properties observed in a clinical sample (Bredemeier et al. 2018).

Measures of Maladaptive Cognitive Emotion Regulation

Perseverative Thinking Questionnaire The Perseverative Thinking Questionnaire (PTQ) (Ehring et al. 2011) is a 15-item questionnaire of content-independent RNT (e.g., "The same thoughts keep going through my mind again and again"). Participants rate the degree to which they typically think about negative experiences or problems on a 5-point Likert scale ranging from 0 (*never*) to 4 (*almost always*). The total score's internal consistency (non-clinical sample: $\alpha = 0.94$; clinical sample: $\alpha = 0.95$), temporal stability ($r = 0.69$), convergent validity, and predictive validity have been demonstrated in clinical and non-clinical samples (Ehring et al. 2011).

WBSI The WBSI (Wegner and Zanakos 1994) is a 15-item questionnaire that assesses self-reported use of suppression in response to intrusive and unwanted thoughts (e.g., "I often do things to distract myself from my thoughts"). Participants rate the degree to which they feel the items apply to themselves on a scale from 1 (*strongly disagree*) to 5 (*strongly agree*). The total score's internal consistency ($\alpha = 0.89$), temporal stability ($r = 0.8$, $p < 0.001$), and predictive validity have been demonstrated in clinical samples (Muris et al. 1996).

Measures of Psychological Symptoms

DASS-21 In the DASS-21 (Lovibond and Lovibond 1995), two of its three subscales were used in the current study to assess outcome variables of interest: one for anxiety (DASS-anx) and one for depression (DASS-dep). The third DASS-21 scale (DASS-stress) was omitted because the present study wanted to address specific symptoms of psychopathology. The DASS-anx subscale is a 7-item questionnaire that assesses anxiety symptom severity (e.g., "I felt scared without any good reason"). On this measure, participants rate the degree to which each statement characterizes them on a scale of 0 (*did not apply to me*) to 3 (*applied very much to me*). The DASS-dep subscale is a 7-item questionnaire that assesses depressive symptom severity (e.g., "I felt that I had nothing to look forward to"). Participants rate the degree to which each statement fits them on a scale of 0 (*did not apply to me*) to 3 (*applied very much to me*). The DASS-21 subscales have evidenced good internal consistency (Antony et al. 1998; Clara et al. 2001) and convergent and divergent validity (Henry and Crawford 2005) in both clinical and non-clinical samples.

OCI-R The OCI-R (Foa et al. 2002) is an 18-item questionnaire that assesses OCD symptom severity (e.g., "I am upset by unpleasant thoughts that come into my mind against my will"). Participants rate the degree to which they experience each statement in their everyday lives on a 5-point Likert scale from 0 (*not at all*) to 4 (*extremely*). While the OCI-R has several subscales, only the OCI-R obsessing (OCIR-obs) subscale was utilized for the present study, because this subscale is most predictive of OCD diagnostic status (Foa et al. 2002). The OCI-R obsessing subscale has shown satisfactory internal consistency ($\alpha = 0.77$–0.89) and test-retest reliability ($r = 0.66$–0.84), as well as convergent and divergent validity in both clinical and non-clinical samples (Foa et al. 2002; Hajcak et al. 2004).

Results

Initial data screening revealed one significant violation of normality: DASS-anx displayed a kurtosis value of 7.95 and a skewness of 2.34. As such, this variable was log-transformed (log DASS-anx). Following this transformation, it was determined that data for all remaining variables of interest were within acceptable limits (i.e., skewness $< |2|$ and kurtosis $< |7|$; Kline, 2011) and no further transformations were needed (Table 1). Zero-order correlations between all measures are included in Table 2.

Our proposed model, depicted in Fig. 1, examined the relationship between a latent AI factor and our three clinical outcomes (depression, anxiety, and OCD symptoms), both directly and indirectly through the use of maladaptive cognitive emotion regulation strategies (either RNT or TS). In line with previous research on AI, we used three different measures of AI (IU, DT, and AS) to create the latent AI factor (Bardeen et al. 2013; Bernstein et al. 2009; Shaw et al. 2015). Overall, the model demonstrated good fit [$\chi^2(10) = 14.539$, $p = 0.15$, RMSEA = 0.028, CFI = 0.996, SRMR = 0.018]. Estimates, standard errors, and standardized coefficients for all direct relationships are shown in Tables 3 and 4. Table 5 contains these values for all indirect relationships.

Direct Relationships

AI and Symptoms of Psychopathology

The latent AI factor had significant direct relationships with all three measures of psychopathology. AI was significantly and positively associated with our log-transformed anxiety symptom measure, log DASS-anx ($\beta = 0.52$, 95% CI [0.331, 0.709], $p < 0.001$). AI also demonstrated a significant and positive direct relationship with our depression symptom measure, DASS-dep ($\beta = 0.32$, 95% CI [0.077, 0.562],

Table 2 Zero-order correlations for all measures

Measure	1	2	3	4	5	6	7	8
1. ASI-3	1							
2. DII	0.70	1						
3. IUS-12	− 0.30	− 0.38	1					
4. PTQ	0.60	0.70	− 0.36	1				
5. WBSI	0.61	0.64	− 0.40	0.77	1			
6. DASS-anx	0.58	0.57	− 0.22	0.48	0.51	1		
7. Log DASS-anx	0.60	0.62	− 0.28	0.56	0.56	0.88	1	
8. DASS-dep	0.53	0.59	− 0.38	0.66	0.57	0.55	0.59	1
9. OCIR-obs	0.64	0.64	− 0.32	0.70	0.70	0.60	0.55	0.57

All are significant at the $p < 0.01$ level

ASI-3 Anxiety Sensitivity Index-3; *DII* Distress Intolerance Index; *IUS-12* Intolerance of Uncertainty Index-12; *PTQ* Perseverative Thinking Questionnaire; *WBSI* White Bear Suppression Inventory; *DASS-anx* Depression, Anxiety, and Stress Scales anxiety subscale; *Log DASS-anx* log-transformed DASS-anx; *DASS-dep* Depression, Anxiety, and Stress Scales depression subscale; *OCIR-obs* Obsessive-Compulsive Inventory-Revised obsessing subscale

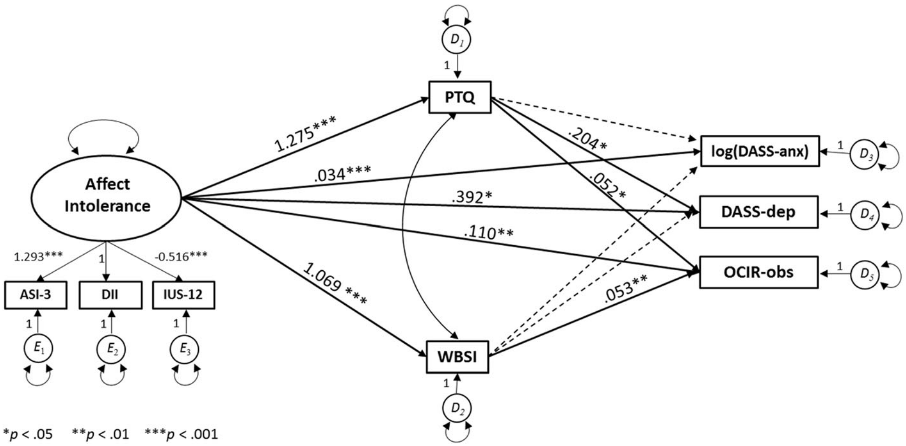

Fig. 1 Graphical depiction of the full model [$\chi^2(10) = 14.539$, $p = 0.15$, RMSEA = 0.028, CFI = 0.996, SRMR = 0.018] used to assess for the relationship between AI and symptoms of psychopathology via the use of maladaptive emotion regulation strategies. ASI-3, Anxiety Sensitivity Index-3; DII, Distress Intolerance Index; IUS-12, Intolerance of Uncertainty Index-12; PTQ, Perseverative Thinking Questionnaire; WBSI, White Bear Suppression Inventory; DASS-anx, Depression, Anxiety, and Stress Scales anxiety subscale; DASS-dep, Depression, Anxiety, and Stress Scales depression subscale; OCIR-obs, Obsessive-Compulsive Inventor-Revised obsessing subscale

$p = 0.010$). Finally, the direct relationship between AI and our OCD symptom measure, OCIR-obs, was also significant ($\beta = 0.33$, 95% CI [0.087, 0.573], $p = 0.008$).

AI and Cognitive Emotion Regulation Strategies

The latent AI factor was significantly and positively related to both cognitive emotion regulation strategies: RNT and TS. The direct relationship between AI and our measure of RNT, the PTQ, was significant ($\beta = 0.79$, 95% CI [0.745, 0.834], $p < 0.001$). Similarly, the direct relationship between AI and our measure of TS, the WBSI, was also significant ($\beta = 0.69$, 95% CI [0.608, 0.773], $p < 0.001$).

RNT and Symptoms of Psychopathology

RNT was significantly and positively associated with two measures of psychopathology: OCD and depression. This was evidenced by the significant direct relationships

Table 3 Latent variable loadings

Indicator	Loading	*SE*	*p*	Standardized loading
ASI-3	1.293	0.064	< 0.001	0.792
DII	1.000	N/A	N/A	0.869
IUS-12	− 0.516	0.066	< 0.001	− 0.429

ASI-3 Anxiety Sensitivity Index-3, *DII* Distress Intolerance Index, *IUS-12* Intolerance of Uncertainty Index-12, *N/A* not available

Table 4 Direct effects

Path	Estimate	*SE*	*p*	Standardized estimate (*β*)
PTQ on AI	1.275	0.060	< 0.001	0.79
WBSI on AI	1.069	0.087	< 0.001	0.69
Log DASS-anx on AI	0.034	0.006	< 0.001	0.52
DASS-dep on AI	0.392	0.153	0.010	0.32
OCIR-obs on AI	0.110	0.041	0.007	0.33
Log DASS-anx on PTQ	0.001	0.004	0.847	0.02
DASS-dep on PTQ	0.204	0.100	0.042	0.268
OCIR-obs on PTQ	0.052	0.023	0.025	0.249
Log DASS-anx on WBSI	0.001	0.003	0.740	0.026
DASS-dep on WBSI	0.083	0.071	0.283	0.105
OCIR-obs on WBSI	0.053	0.018	0.002	0.248

PTQ Perseverative Thinking Questionnaire; *WBSI* White Bear Suppression Inventory; *AI* affect intolerance latent factor; *DASS-anx* Depression, Anxiety, and Stress Scales anxiety subscale; *DASS-dep* Depression, Anxiety, and Stress Scales depression subscale; *OCIR-obs* Obsessive-Compulsive Inventory-Revised obsessing subscale

between the PTQ and OCIR-obs ($\beta = 0.249$, 95% CI [0.036, 0.463], $p = 0.022$) and the PTQ and DASS-dep ($\beta = 0.268$, 95% CI [0.012, 0.524], $p = 0.04$). PTQ score was not significantly associated with log DASS-anx ($\beta = 0.02$, 95% CI [− 0.186, 0.226], $p = 0.85$).

TS and Symptoms of Psychopathology

TS was significantly related to only one of the symptom types measured: OCD. This was evidenced by the significant and positive direct relationship between the WBSI and OCIR-obs ($\beta = 0.248$, 95% CI [0.095, 0.401], $p = 0.001$). The WBSI was not significantly associated with DASS-dep ($\beta = 0.105$, 95% CI [− 0.070, 0.280], $p = 0.24$) or log DASS-anx ($\beta = 0.026$, 95% CI [− 0.127, 0.178], $p = 0.74$).

Table 5 Indirect effects

Path	Estimate	*SE*	*p*	Standardized estimate (*β*)
Log DASS-anx on AI via PTQ	0.001	0.005	ns	0.016
DASS-dep on AI via PTQ	0.260	0.128	0.042	0.212
OCIR-obs on AI via PTQ	0.066	0.029	0.025	0.197
Log DASS-anx on AI via WBSI	0.001	0.004	ns	0.018
DASS-dep on AI via WBSI	0.089	0.076	ns	0.073
OCIR-obs on AI via WBSI	0.057	0.018	0.001	0.171

AI affect intolerance latent factor; *PTQ* Perseverative Thinking Questionnaire; *WBSI* White-Bear Suppression Inventory; *DASS-dep* Depression, Anxiety, and Stress Scales depression subscale; *OCIR-obs* Obsessive-Compulsive Inventory-Revised obsessing subscale, *ns* not significant

Indirect Relationships

AI and Symptoms of Psychopathology Via RNT

The latent AI factor had an indirect association with both depression and OCD symptom severity through RNT: AI was significantly and positively related to DASS-dep ($\beta = 0.212$, 95% CI [0.011, 0.413], $p = 0.039$) and to OCIR-obs ($\beta = 0.197$, 95% CI [0.029, 0.364], $p = 0.021$) via the PTQ. Contrary to our original hypothesis, log DASS-anx was not significantly associated with AI through the PTQ ($\beta = 0.016$, 95% CI [− 0.147, 0.179], $p = 0.85$) (Fig. 2).

AI and Symptoms of Psychopathology Via TS

The latent AI factor also demonstrated a significant indirect relationship with OCD symptom severity through TS: AI was significantly and positively associated with OCIR-obs via the WBSI ($\beta = 0.171$, 95% CI [0.070, 0.272], $p = 0.001$). Contrary to our original hypothesis, log DASS-anx was not significantly associated with AI via the WBSI ($\beta = 0.018$, 95% CI [− 0.087, 0.123], $p = 0.74$), nor was DASS-dep significantly associated with AI via this path ($\beta = 0.073$, 95% CI [− 0.050, 0.175], $p = 0.24$) (Fig. 2).

Discussion

The present study investigated the relationship between a latent factor of AI and symptoms of psychopathology via two distinct cognitive emotion regulation strategies: RNT and TS. AI was represented by a single latent factor derived from measures of anxiety sensitivity, distress intolerance, and intolerance of uncertainty, in line with previous work that has used a similar measurement approach (Bernstein et al. 2009;

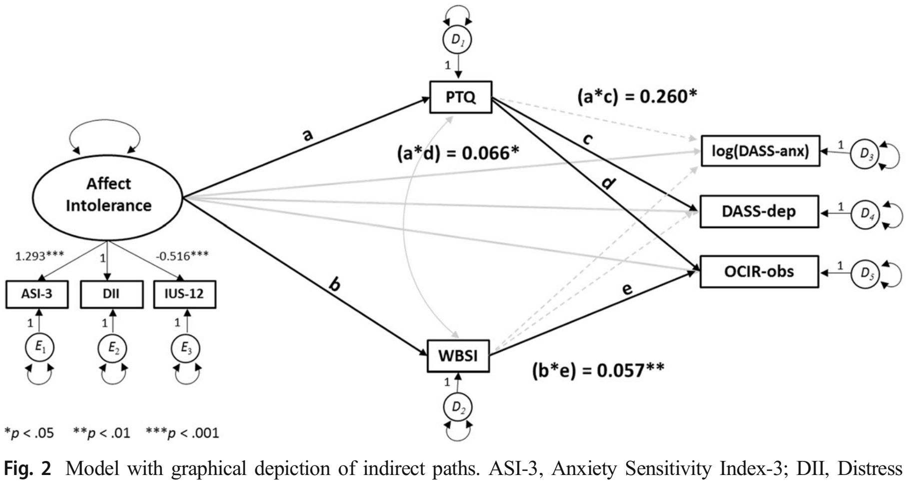

Fig. 2 Model with graphical depiction of indirect paths. ASI-3, Anxiety Sensitivity Index-3; DII, Distress Intolerance Index; IUS-12, Intolerance of Uncertainty Index-12; PTQ, Perseverative Thinking Questionnaire; WBSI, White Bear Suppression Inventory; DASS-anx, Depression, Anxiety, and Stress Scales anxiety subscale; DASS-dep, Depression, Anxiety, and Stress Scales depression subscale; OCIR-obs, Obsessive-Compulsive Inventor-Revised obsessing subscale

Laposa et al. 2015). Results demonstrated that AI was directly and significantly related to symptoms of all three forms of psychopathology assessed. Three indirect effects were also significant: the relationship between AI and depression symptoms via RNT and the relationship between AI and OCD symptoms via RNT and TS. Interestingly, the latent variable AI was not indirectly related to anxiety symptoms through the use of either RNT or TS. Our results suggest that elevated AI is associated with greater symptoms of psychopathology via the use of maladaptive cognitive emotion regulation strategies, and that this relationship differs by symptom type.

Previous research shows that RNT predicts the development of depression (Ehring and Watkins 2008). Our study sought to expand on this research by testing a theory about why individuals may develop the need to use RNT as a coping mechanism for their depression: AI. Individuals with a predisposition for AI who recursively mull over past negative events will exacerbate the internal experience of negative emotion. If they are unable to disengage from the negative emotion, it could lead to the manifestation of more severe psychopathology, such as depression symptoms. From a cognitive-behavioral framework, this relationship demonstrates the maladaptive cycle between negative cognitive biases, poor emotion regulation, and the manifestation of psychopathology symptoms. Therefore, it appears that RNT may be an avoidance tactic utilized by depressed individuals as a means to ignore present negative emotional stimuli.

Interestingly, symptoms of OCD were related to AI through RNT. There has been comparatively less research on the relationship between RNT and OCD symptoms than that between RNT and depression. Here, it is important to distinguish between intrusive thoughts and the transdiagnostic perseverative thinking style assessed in this model, as there is evidence to suggest that they are related, but distinct, phenomena in OCD (Raines et al. 2017). Whereas obsessional thoughts are typically conceptualized as intruding upon the patient's mind against their will, RNT can be viewed as a more volitional process and is explored here as a proposed reaction to broader AI. The relationship between AI and OCD by way of RNT may indicate that while obsessional thoughts are typically reported as intrusive and uncontrollable, the cognitive response to those thoughts (i.e., perseverative processing) introduces an aspect of control. This may help explain why individuals with OCD have been shown to exhibit both heightened RNT-like processes (Abramowitz et al. 2003; Amir et al. 1997) and increased AI (Laposa et al. 2015), but there has been limited work looking at the association between the two, and no studies, to our knowledge, have looked at the impact of AI on OCD symptom severity via the increased use of RNT. In our study, this emotion regulation strategy was also associated with both elevated AI and elevated OCD symptoms, such that those who were more intolerant of strong negative emotions were more likely to engage in RNT and, in turn, exhibit more severe symptoms of OCD. However, as noted above, this relationship was not specific to OCD—depression symptoms were also associated with heightened AI by way of RNT. This point may offer one explanation for the frequent co-occurrence of depressive and obsessive-compulsive symptoms. Research has shown that up to one third of participants who struggle with OCD also meet criteria for MDD (Overbeek et al. 2002). It may be that, for participants with OCD, the use of RNT in response to AI is not only linked to elevated OCD symptoms, but it may also be associated with the development of depressive symptoms.

Interestingly, AI demonstrated a direct relationship with anxiety symptoms but did not relate to anxiety symptoms via RNT. One explanation for this unexpected finding is that anxiety symptoms measured by the DASS closely resemble the items used in our AI latent factor (distress intolerance, anxiety sensitivity, and intolerance of uncertainty) such that the direct relationship superseded the endorsement of RNT. Had we included an anxiety measure that focused on the cognitive distress of anxiety symptoms, these results might have more closely resembled our initial hypothesis that anxiety would be related to AI via the use of RNT.

Elevated TS has often been associated with increased symptom severity in OCD (Purdon 2004); likewise, AI has been linked to increased use of suppression strategies (Jeffries et al. 2016). However, here, we not only replicate those relationships separately but also further demonstrate that increased AI is associated with heightened OC symptomatology via the use of TS. From a cognitive-behavioral framework, this relationship makes sense: TS is believed to be an unhelpful strategy that individuals with OCD employ when they feel they are unable to tolerate the distress elicited by an intrusive thought. However, attempts at TS have been demonstrated to actually increase negative appraisal of the recurrence of suppressed thoughts (Purdon et al. 2005), potentially exacerbating symptoms further. Our results, in which heightened OCD symptoms are associated with greater AI via greater TS, are in line with this model. From these results we can conclude that TS may be a more specific mechanism by which AI gives rise to OC phenomena, whereas RNT seems to be a more broadly employed maladaptive emotion regulation strategy in relation to AI and psychological symptom presentation.

Contrary to our original hypothesis, AI was not indirectly related to symptoms of anxiety via RNT. While RNT is proposed to be a transdiagnostic version of worry (Ehring and Watkins 2008), a symptom more commonly experienced in anxiety disorders, as well as rumination, it is possible that the direct relationship between AI and anxiety symptoms superseded the use of maladaptive cognitive emotion regulation strategies. These results may also be driven by the subscale of the DASS-anx. The DASS-anx focuses primarily on the physiological symptoms of anxiety, and there are many symptoms on the DASS-anx that were simultaneously measured in the latent AI factor. In order to make a stronger conclusion about the indirect relationship between AI and anxiety through the use of RNT, additional research is needed.

Limitations and Future Directions

It is important to note that the data used for these analyses were cross-sectional in nature and therefore cannot be used to draw causal conclusions. Ideally, similar data would be collected utilizing a longitudinal design, allowing the investigator to establish temporal precedence of distress intolerance. This, in turn, would also allow us to more convincingly interpret any observed indirect effects as true mediation. Within the current design, we are unable to test the directionality of the relationship between the latent variable AI and the maladaptive thinking styles. Thus, while the literature suggests that distress intolerance may well lead to the use of maladaptive emotion regulation strategies, it is also possible that the direction of this relationship could be reversed (or that perhaps distress intolerance and maladaptive emotion regulation simply covary).

A second limitation resides in the properties of the measures selected for this study. These measures were designed for use with clinical populations; however, the majority of our sample endorsed low rates of symptomatology, suggesting that they were relatively healthy. This is somewhat surprising given that past literature has often highlighted *elevated* rates of psychopathology in MTurk samples (see Arditte et al. 2016; Chandler and Shapiro 2016); however, this potential lack of alignment between our sample characteristics and the intended recipients of our measures further limits our ability to generalize results to clinical populations.

A third, and perhaps more nuanced, limitation lies in our ability to theoretically and empirically differentiate the use of maladaptive strategies like RNT and TS from the frequency of unwanted thoughts that might spur their use. Someone may consistently use strategies like RNT and TS when they experience unwanted thoughts, but if such thoughts are infrequent, they may experience little or no impairment associated with these strategies. On the other hand, someone may often experience unpleasant thoughts, use RNT or TS in only a fraction of these instances, and yet still manifest the consequences of habitual use in inappropriate contexts. As a result, we cannot rule out the possibility that individuals who endorse elevated levels of RNT and TS do so simply because they experience distressing and intrusive thoughts more often. Current validated measures rarely disentangle the use of cognitive strategies like RNT and TS from the frequency of unwanted thoughts, and future research should work to elucidate this distinction, as well as how it relates to AI and symptom expression.

A final limitation concerns the observed as well as conceptual overlap between some of the variables investigated in our model. Although the WBSI, PTQ, and OCI-R obsessing subscales are all hypothesized to capture distinct constructs, there are notable similarities among some items from each scale. This highlights the challenge of disentangling disorder-specific symptoms, which are thought to be more state-like, from trait-like cognitive styles (Dohrenwend et al. 1990). Here, there are similarities between the frequency and severity of obsessions and individual differences in how one tends to respond to unwanted thoughts. A perhaps important distinction is that the obsessing subscale of the OCI-R captures a specific type of cognitive symptom (i.e., intrusive repugnant thoughts), while the PTQ and WBSI each assesses patterns of responding to thoughts, regardless of content. Future research should consider the overlap between these measures, particularly in the context of distinguishing between states and traits.

Despite the limitations of this study, there is evidence to suggest that maladaptive emotion regulation may be one route by which AI is linked to heightened symptoms of depression and OCD. In contrast, anxiety symptomatology does not seem to be associated with AI via the use of the cognitive emotion regulation strategies assessed here. Our results suggest that, in addition to exploring the immediate relationship between AI on the symptoms of anxiety, depression, and OCD, it may be also be important to consider the intermediate role of emotion regulation that augment the relationship between AI and depression and OCD symptoms.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

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