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Anxiety Sensitivity, Distress Intolerance, and Negative Interpretation Bias Strengthen the Relationship Between Trait Anxiety and Depersonalization

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Abstract

Background and Objectives: Depersonalization is common in anxiety disorders, but little is known about factors that influence co-occurring anxiety and depersonalization.

Design: We investigated trait moderators of the relationships between state and trait anxiety and depersonalization to better understand their co-occurrence and to identify potential points of intervention.

Methods: Adults recruited on Amazon Mechanical Turk ($N = 303$) completed two computer tasks designed to increase variability in state anxiety and depersonalization as well as several self-report questionnaires.

Results: As hypothesized, anxiety positively predicted depersonalization at both a state level and trait level. Moreover, as hypothesized, the trait anxiety-trait depersonalization relationship was strengthened by greater anxiety sensitivity; distress intolerance; and negative interpretation bias for anxiety sensations, and for depersonalization sensations. None of these hypothesized trait moderators significantly strengthened the state anxiety-state depersonalization relationship.

Conclusions: These findings suggest that, on a trait level, anxiety and depersonalization more frequently co-occur when people catastrophically misinterpret their symptoms or have lower emotional distress tolerance.

Keywords

anxiety; depersonalization; derealization; anxiety sensitivity; distress tolerance; interpretation bias

Introduction

Depersonalization is a subjective experience of unreality with respect to one's sense of self and is often accompanied by derealization, that experience of unreality with respect to one's external world.[1] People experiencing depersonalization often have the unsettling sense that

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[1]We know of no evidence that distinguishes between individuals with predominant depersonalization versus derealization (American Psychiatric Association, 2013), and many authors do not regard the two as separate constructs (Radovic & Radovic, 2002). Therefore,

they are an outside observer to their own thoughts and actions and that their world is foggy and dreamlike (American Psychiatric Association, 2013). Depersonalization often co-occurs with anxiety but, historically, little attention has been paid to dissociative experiences among people with anxiety, including why dissociation occurs for some but not all people who experience anxiety. This study sought to replicate the established co-occurrence between trait anxiety and depersonalization symptoms (e.g., Michal et al., 2005; Sierra et al., 2012) and to test proposed trait moderators, which might explain why certain people are more prone to dissociation when anxious. Further, using mild symptom induction tasks, the study tested these moderators on the relationship between in-the-moment, state expressions of anxiety and depersonalization.

Depersonalization frequently occurs in a variety of anxiety and anxiety-related disorders, such as generalized anxiety disorder (Michal et al., 2016), social anxiety disorder (Michal et al., 2005), hypochondriasis (Torch, 1978), and obsessive-compulsive disorder (Boysan, 2014). It is also one of the defining features (but not necessary for diagnosis) of panic attacks and agoraphobia (American Psychiatric Association, 2013). The co-occurrence of anxiety and depersonalization also seems to hold in nonclinical populations (Trueman, 1984a). In fact, of all emotional states examined, Simeon et al. (2003) found anxiety to be the best predictor of depersonalization. Yet, not all people with anxiety experience depersonalization when highly anxious. Segui et al. (2000) found that only 24.1% of a panic disorder sample reported depersonalization during their panic attacks, and consequently proposed that “panic disorder with depersonalization” be considered a distinct subtype of panic disorder. Complicating things further, Sierra et al. (2012) found that the association between trait anxiety and depersonalization symptoms was apparent in depersonalization/derealization patients with milder depersonalization symptoms, but not in those with more severe depersonalization symptoms. Clearly, the relationship between anxiety severity and depersonalization severity is more complex than a simple linear function.

Why do high levels of anxiety predict depersonalization for some people? A few conceptual models have been proposed, though none has been rigorously tested. We focus on three potential moderators: distress tolerance, negative interpretation bias, and anxiety sensitivity. They were selected because of empirical research linking these constructs to anxiety and depersonalization,[2] and because each has a theoretical basis to suggest it may moderate the anxiety-depersonalization relationship.

First, a number of theorists hypothesize that depersonalization is an evolution-prepared psychological defense against extreme trauma, emotional distress, or anxiety (e.g., Boysan, 2014; Griffin et al., 1997; Sierra, 2009; Snyder, 1999; Zeidner & Endler, 1996). According to this view, when someone experiences distress above a given threshold, depersonalization “kicks in” to numb the anxiety and reduce the emotional intensity of the experience. This

for brevity, we use *depersonalization* to describe the range of low-intensity dissociative experiences that encompass feelings of unreality with respect to oneself and/or one’s external world.

[2]For example, greater anxiety sensitivity and lesser distress tolerance confer higher risk for anxiety (Allan et al., 2014; Keough et al., 2010; McNally, 2002; Michel et al., 2016). Negative interpretation bias is associated with more severe symptoms in social anxiety (Chen et al., 2020), panic disorder (Teachman et al., 2007), and generalized anxiety disorder (Hayes et al., 2010). Depersonalization has been linked to higher anxiety sensitivity and interpretation bias (Schweden et al., 2018; Weiner & McKay, 2013).

protective model of depersonalization has some empirical support. People who experienced depersonalization during a traumatic event reported lower intensity of other unpleasant symptoms during that event, indicating that depersonalization may have helped defend them from the full impact of the trauma (Shilony & Grossman, 1993), though causality cannot be inferred from this study's correlational design. This suggests that *distress tolerance*, the ability to withstand negative affect or other adverse psychological or physical states, might help explain variability in the anxiety-depersonalization relationship; if the protective model of depersonalization holds, greater distress *intolerance* might strengthen this relationship.

Second, in their cognitive-behavioral model of depersonalization/derealization disorder, which has early empirical support (Hunter et al., 2014), Hunter et al. (2003) posit that threat interpretations of otherwise transient depersonalization (e.g., believing that one is "going crazy") intensify subsequent anxiety and perpetuate an anxiety-depersonalization cycle. Indeed, individuals with chronic depersonalization sometimes report fears of having a brain disease or impending insanity (Hunter et al., 2003; Roth, 1960). Beyond the Hunter et al. model, there is evidence that threat interpretations about the psychosocial consequences of *anxiety* symptoms predict elevated levels of depersonalization (Marks et al., 1991), suggesting that threat interpretations of both anxiety and depersonalization symptoms will be similarly predictive. Thus, it appears that *negative interpretation bias*, the tendency to construe ambiguous situations in a negative or threatening way, may feed the vicious cycle of anxiety and depersonalization. In fact, early trials of cognitive therapy (Schweden et al., 2016) and cognitive behavioral therapy (Hunter et al., 2003), both of which target interpretation biases, have had success in treating patients with co-occurring anxiety and depersonalization.

Third, *anxiety sensitivity*, the fear of fear (i.e., fear of experiencing anxiety-related sensations), is a construct similar to, and yet distinct from, negative interpretation bias for anxiety symptoms. Olthuis and colleagues suggest anxiety sensitivity "…is the trait and negative interpretation biases are one of the cognitive processes by which this trait predisposes an individual to anxiety symptoms" (see Olthuis et al., 2012; p. 333). Anxiety sensitivity is often predictive of intense anxiety (i.e., panic symptoms) in response to tasks that provoke physical anxiety sensations (McNally, 2002). Anxiety sensitivity, too, may therefore strengthen the anxiety-depersonalization relationship, through its association with negative interpretation bias for anxiety sensations or by elevating anxiety level in response to anxiety sensations, thereby heightening the risk of triggering depersonalization.

Overview of Present Study and Hypotheses

The present study recruited participants online to test the relationship between anxiety and depersonalization (at both state and trait levels) and trait-level moderators of that relationship. Participants completed, in randomized order, two mild symptom induction tasks designed to increase variability in state anxiety (imagining an upcoming anxiety-provoking event) and depersonalization (staring intently at a dot), with intermixed self-reports of state anxiety and depersonalization, followed by reports of trait anxiety, depression, and the potential moderators: anxiety sensitivity, distress tolerance, and negative interpretation bias for anxiety sensations and for depersonalization sensations. We also

measured state negative valence and arousal, to better understand how the symptom induction tasks affected participants.

We hypothesized that each induction task would elevate both negative valence and arousal, along with state anxiety and depersonalization, relative to pre-induction ratings (Hypothesis A). Specifically, we expected the anxiety induction to increase anxiety and the depersonalization induction to increase depersonalization. Next, we hypothesized that there would be a significant, positive relation between anxiety and depersonalization (Hypothesis B). Finally, we hypothesized that greater distress intolerance (Hypothesis C1), negative interpretation bias for depersonalization symptoms (Hypothesis C2), negative interpretation bias for anxiety symptoms (Hypothesis C3), and anxiety sensitivity (Hypothesis C4) would strengthen the relation; this proposed moderation is Hypothesis C.

In addition to testing these predictions for trait levels of anxiety and depersonalization, it is worthwhile to test these predictions at a state level, using repeated measures data to examine within-person change. Indeed, the conceptual models that informed our design imply within-person effects. Moreover, for many psychological constructs, between-person effects and within-person effects are not equivalent (Molenaar, 2004), so it is important not to assume that anxiety-depersonalization relationships will operate identically at state and trait levels; thus, we examine this empirically. Further, evidence for state depersonalization-state anxiety co-occurrence is conflicting (Hoyer et al., 2013; Lickel et al., 2008; Sierra et al., 2002), warranting further study. We hypothesized that the direction and moderators of the relationship between anxiety and depersonalization would be the same on the state level as on the trait level.

Method

Participants and Design

We collected data from 453 participants over three waves via Amazon Mechanical Turk (MTurk). In line with suggested practices for MTurk research (Kennedy et al., 2018), we manually sorted through responses at the end of each wave of data collection to flag those we suspected of being the work of automated bots. In the end, we were left with 303 responses for analyses. See Section S1.1 of the supplement for a detailed description of our method for excluding suspicious responses. Of these 303 participants, 65.4% identified as male, and 66.3% identified as White/European origin. Additionally, 12.5% identified as Hispanic or Latino. The mean age was 34.56 years ($SD = 9.80$). See Table 1 for full demographic information.

Recruitment—The study was advertised on MTurk as “[a] psychology study lasting 15–20 minutes that involves completing short tasks on the computer and answering questionnaires.” Participants were offered $3 for completing the study. Enrollment was restricted to adults (age 18+) who had at least 90% of their previously completed MTurk tasks approved for payment. There were no restrictions on country of residence, though the study was only provided in English.

Measures

State Anxiety, Depersonalization, Negative Valence, and Arousal—State anxiety, depersonalization, negative valence, and arousal were assessed with self-report sliders. The state anxiety slider spanned from *Calm* to *Anxious*, the state depersonalization slider from *Present/Grounded* to *Detached/Unreal*, the state negative valence slider from *Pleasant* to *Unpleasant*, and the state arousal slider from *Resting/Relaxed* to *Excited/Worked Up*. State valence and arousal were included to more broadly understand how the induction tasks (described below) affected participants and to distract participants from the main state phenomena of interest: anxiety and depersonalization. See Table 2 for descriptive statistics for the state-level measures and Figures S1 and S2 for visualizations of how mean state scores changed over time over the course of the induction tasks.

Trait Anxiety and Depersonalization—Trait anxiety was assessed with the Patient Health Questionnaire-4 (PHQ-4; Kroenke et al., 2009), a self-report of anxiety and depression symptoms over the past two weeks with four 4-point Likert items ranging from 0 (*not at all*) to 3 (*nearly every day*). Two anxiety items comprise the Anxiety subscale, for which a sum of 3 or greater reflects potential generalized anxiety, panic, social anxiety, or posttraumatic stress disorder. The sum of the anxiety items was used in analyses. Internal consistency[3] for the anxiety items was good, ω_t = .81, 95% CI = [.75, .85]. Trait depersonalization was assessed with the two-item version of the Cambridge Depersonalization Scale (CDS-2; Michal et al., 2011), a-self report of depersonalization symptoms over the past two weeks with two 4-point Likert items ranging from 0 (*not at all*) to 3 (*nearly every day*). A sum of at least 3 reflects potentially clinically significant depersonalization. Internal consistency was good, ω_t = .87, 95% CI = [.83, .90]. Prior studies support the construct and criterion validity of the GAD-2 and PHQ-2 (Kroenke et al., 2003, 2007, 2009; Löwe et al., 2005). Further, their internal consistency, discriminant validity, 1–4-week test-retest reliability, and sensitivity to treatment change have been found comparable to those of longer measures (Kroenke et al., 2010; Staples et al., 2019). Additionally, the 2-item version of the Cambridge Depersonalization Scale differentiates patients with clinically significant depersonalization well from other groups, and shows high reliability (Cronbach's α = 0.92; Michal et al., 2010).

Anxiety Sensitivity.—Anxiety sensitivity, the fear of arousal-related sensations, was assessed with the Anxiety Sensitivity Index-3 (Taylor et al., 2007), a multidimensional self-report of anxiety sensitivity with eighteen 5-point Likert items ranging from 0 (*very little*) to 4 (*very much*). Participants rate how much they agree with items such as "It is important for me to not appear nervous" and "It scares me when my heart beats rapidly." Six items comprise physical concerns, six items comprise cognitive concerns, and six items comprise social concerns. The sum of all 18 items was analyzed. Internal consistency was good, ω_t = .95, 95% CI = [.93, .95].

[3]Internal consistency was calculated based on McDonald's omega total, as recommended by methodologists (Dunn et al., 2014). Calculations were done using the MBESS package (ver. 4.7.0; Kelley, 2007) in R (ver. 3.5.2).

Distress Tolerance.—Distress tolerance, an individual's perceived ability to experience and endure negative psychological states, was assessed with the Distress Tolerance Scale-Short Form (DTS-SF; Garner et al., 2018), a self-report of overall distress tolerance with four 5-point Likert items ranging from 1 (*strongly agree*) to 5 (*strongly disagree*). For consistency with the other study measures, we reverse-coded the DTS-SF in our implementation, such that 1 represented *strongly disagree* and 5 represented *strongly agree*. The sum of the four items was used in analysis, and—because of the reverse coding—higher scores represent lower distress tolerance. Internal consistency was good, ω_t = .89, 95% CI = [.86, .91].

Negative Interpretation Biases for Anxiety and Depersonalization Sensations.—Negative interpretation biases for anxiety and depersonalization sensations were assessed with the Anxiety and Depersonalization Sensations Interpretation Questionnaire (ADSIQ), a reading judgement task developed for the present study. The task presents eight ambiguous situations, four of which involve anxiety sensations (e.g., "You notice that your heart rate has risen and skips a beat") and four of which involve depersonalization sensations (e.g., "Out of the blue, you feel strange, as if you were not real or as if you were cut off from the world"). After each situation, participants read three possible explanations, two of which are benign interpretations (e.g., "You've been working too hard and need a rest") and one of which is a threat interpretation (e.g., "You are going out of your mind"). Participants rate the extent they think each explanation for a situation would be likely to be true if they found themselves in that situation on a 5-point Likert scale from 0 (*not at all likely*) to 4 (*extremely likely*). The structure of the questionnaire is based on the Body Sensations Interpretation Questionnaire (Clark et al., 1997), but all items were developed or modified specifically for the ADSIQ. See Section S1.2 for the questionnaire in full. The mean of the threat interpretation items for anxiety sensation situations and the mean of the threat interpretation items for depersonalization sensation situations were used in analyses. Internal consistency was good for the anxiety sensations items, ω_t = .84, 95% CI = [.81, .87], and for the depersonalization sensations items, ω_t = 0.87, 95% CI = [.85, .90]. See Table 2 for descriptive statistics of all trait scale scores.

Conditions

We are aware of no task that induces both state anxiety and state depersonalization that would be feasible and ethical to administer in an online format, so we chose to use two separate symptom inductions: one for state anxiety and one for state depersonalization. Participants were randomly assigned to one of two conditions to control for potential order effects of the inductions. Participants in Induction Order 1 completed the depersonalization induction first and the anxiety induction second. Those in Induction Order 2 completed the anxiety induction first and the depersonalization induction second.

Anxiety Induction—Participants were instructed to pick an upcoming situation they expected would make them feel anxious, worried, or scared and to describe the situation in a few words. Then, for 45 seconds, participants were instructed to imagine the situation as vividly as possible, playing out specific parts of the situation in their heads and imagining what they would see hear, smell, think, and feel in that situation. After the 45 seconds,

a button appeared allowing participants to proceed. The induction was adapted from prior online research on anxiety (Eberle et al., 2021; Ji et al., 2020). See Section S1.3 for the induction instructions in full.

Depersonalization Induction—Participants were instructed to position themselves a comfortable distance from their computer and stare intently at a dot on their screen for three minutes. The instructions informed participants that they may blink, but that they should try their best to not look away from the dot. A 3-minute countdown timer—intended to improve compliance by updating in participants' peripheral vision and assuring them the task was progressing—was visible. After 3 minutes, a button appeared allowing participants to proceed. The induction was adapted from Miller et al. (1994), who found that 3 minutes of dot-staring increased self-reported state depersonalization in participants with panic disorder and (to a lesser extent) in non-anxious control participants. See Section S1.4 for the induction instructions in full.

Procedure

Participants provided written informed consent and answered questions about demographic characteristics. Next, they completed the state-level measures, their first symptom induction, the state-level measures a second time, their second symptom induction, and the state-level measures a third and final time. Participants were then guided through a 30-second diaphragmatic breathing exercise intended to return them closer to a physiological baseline. Following the breathing exercise, participants completed a battery of trait questionnaires (PHQ-4, CDS-2, ASI-3, DTS-SF, and ADSIQ) in randomized order. Finally, participants were debriefed and paid. The University of Virginia Institutional Review Board approved all procedures.

Statistical Analysis

State anxiety, state depersonalization/derealization, state negative valence, and state arousal were each measured three times per participant: immediately before the first induction (Time 0), between the first and second induction (Time 1), and after the second induction (Time 2). All hypotheses involving the state scores were tested with linear mixed-effects models fitted using the lme4 package (ver. 1.1–23; Bates et al., 2015) in R. All simple and multiple linear regression models were tested with the stats package (ver. 3.6.2) in R. All significance tests are two-tailed with an alpha level of .05. See Section S1.5 for a description of how data were transformed to fit model assumptions. The analytic plan and hypotheses were preregistered prior to data collection (https://osf.io/xgazd), and data and analysis scripts are publicly available (https://osf.io/j486g). Missing data were handled by calculating the mean of available items or by listwise deletion if no items were available. See Section S1.6 for further detail.

Hypothesis A—State anxiety and depersonalization are related sensations, so we first tested whether it was necessary to separate state anxiety from depersonalization scores in our manipulation checks for the two symptom inductions. To do this, we used a mixed-effects model for each induction that tested the effect of time on state outcome (including state anxiety and state depersonalization in the same model). We entered time (0 = pre-

induction or 1 = post-induction), outcome (state anxiety or state depersonalization), Time × Outcome, and induction order (Induction Order 1 or Induction Order 2) as fixed effects, and we entered a random intercept for each participant. Time × Outcome was significant for both inductions, suggesting that the inductions had differential effects on state depersonalization versus state anxiety. Thus, we separated state anxiety from state depersonalization scores in our manipulation checks. To isolate the effects of time for *each level* of outcome in the combined models described above, we used the method and online tool (quantpsy.org/interact/hlm2.htm) developed by Preacher et al. (2006). Finally, we used four mixed-effects models to test the hypothesized increases in state negative valence and arousal—one model per outcome per induction. We entered time and induction order as fixed effects, and we entered a random intercept for each participant.

Hypothesis B—We used mixed-effects modeling to test the effect of state anxiety on state depersonalization. We computed level 1 (person-mean-centered) and level 2 (person mean) variables for each participant's state anxiety scores to fully disaggregate within-person from between-person effects.[4] State anxiety (person-mean-centered), state anxiety person mean, and time (coded as 0, 1, or 2) were entered as fixed effects, and we entered a random intercept for each participant.[5] The state anxiety (person-mean-centered) term was the effect of interest. We used simple linear regression to test the effect of trait anxiety on trait depersonalization.

Hypothesis C—We used mixed-effects modeling to test the moderating role of each of the proposed trait moderators (anxiety sensitivity, distress intolerance, negative interpretation bias for anxiety sensations, and negative interpretation bias for depersonalization sensations) on the effect of state anxiety on state depersonalization. A separate model was constructed for each moderator. We entered state anxiety (person-mean-centered), state anxiety person mean, moderator, State Anxiety (person-mean-centered) × Moderator, and time (coded as 0, 1, or 2) as fixed effects, and we entered a random intercept for each participant. The State Anxiety (person-mean-centered) × Moderator interaction was the effect of interest. We used multiple linear regression to test the moderating role of each of the four proposed trait moderators on the effect of trait anxiety on trait depersonalization. Trait anxiety, moderator, and Trait Anxiety × Moderator were entered as predictors. The Trait Anxiety × Moderator interaction was the effect of interest.

Results

Hypothesis A: Effects of Inductions on State Outcomes

The depersonalization induction and the anxiety induction each had differential effects on state depersonalization versus state anxiety, $\beta = 0.18$, $SE = 0.04$, $t(906.00) = 4.25$, $p < .001$, 95% CI [0.09, 0.26]; $\beta = -0.25$, $SE = 0.04$, $t(906.00) = -6.35$, $p < .001$, 95% CI [−0.33, −0.17]; respectively. Therefore, for our manipulation checks, we estimated the effect

[4]This decision, based on Wang and Maxwell (2015), deviates from the preregistration and reflects the authors' more advanced statistical training since publishing the preregistration.

[5]Adding only a random intercept (no random slope for time) for each participant also deviates from the preregistration and was done across all mixed-effects models to eliminate convergence and singularity warnings.

of each induction on state anxiety separately from state depersonalization. As expected, the depersonalization induction increased state depersonalization on average, β = 0.07, p = .024, 95% CI [0.01, 0.12], but—counter to hypotheses—decreased state anxiety on average, β = −0.11, p < .001, 95% CI [−0.17, −0.05]. The anxiety induction increased both state anxiety, β = 0.58, p < .001, 95% CI [0.52, 0.63], and depersonalization, β = 0.32, p < .001, 95% CI [0.27, 0.38], on average, as hypothesized. In the tests of the remaining hypothesized increases in state outcomes, the depersonalization induction had no significant effect on state negative valence and—counter to hypotheses—decreased state arousal on average, β = −0.13, p < .001, 95% CI [−0.19, −0.06]. Finally, the anxiety induction increased both negative valence, β = 0.44, p < .001, 95% CI [0.38, 0.50], and arousal, β = 0.51, p < .001, 95% CI [0.45, 0.57], on average, as expected (Table 3).

Hypothesis B: Effects of State/Trait Anxiety on State/Trait Depersonalization

As hypothesized, state anxiety scores (person-mean-centered) positively predicted state depersonalization scores, β = 0.43, SE = 0.02, t(604.00) = 19.46, p < .001, 95% CI [0.39, 0.47]. The relationship was mirrored on the trait level, β = 0.60, SE = 0.05, t(300) = 13.16, p < .001, 95% CI [0.51, 0.70].[6]

Hypothesis C: Moderation of Anxiety-Depersonalization Relationship at State and Trait Levels

None of the hypothesized trait moderators significantly impacted the relation between state anxiety scores and state depersonalization scores (see Table 4). Trait-level analyses, however, revealed that, as hypothesized, the trait anxiety-trait depersonalization relationship was strengthened by greater anxiety sensitivity, β = 0.25, p < .001, 95% CI [0.17, 0.34]; distress intolerance, β = 0.15, p = .004, 95% CI [0.05, 0.25]; negative interpretation bias for anxiety sensations,[7] β = −0.21, p < .001, 95% CI [−0.30, −0.13]; and negative interpretation bias for depersonalization sensations,[8] β = −0.27, p < .001, 95% CI [−0.35, −0.19] (see Table 4). Figure S3 shows how the strength of the trait anxiety-trait depersonalization relation varies for different levels of anxiety sensitivity, a pattern generally consistent across the other three moderators.

Discussion

The present study investigated trait moderators of the relationships between state and trait anxiety and depersonalization to better understand their co-occurrence and to identify potential points of intervention. As hypothesized, the depersonalization induction increased state depersonalization, but—unexpectedly—decreased state anxiety and arousal, and had no significant effect on state negative valence. The anxiety induction increased all of these

[6]Had we used the natural logarithm of trait anxiety scores (instead of untransformed trait anxiety scores) for this model, assumptions of linearity and dependent variable continuousness would have been violated, though the predicted effect of trait anxiety on trait depersonalization would have still held, β = 0.59, SE = 0.05, t(300) = 12.7, p < .001, 95% CI [0.50, 0.68].

[7]We inverse-transformed scores on the anxiety sensations subscale of the ADSIQ prior to standardizing to meet model assumptions. Therefore, the negative β suggests that greater negative interpretation bias for anxiety sensations strengthens the trait anxiety-trait depersonalization relationship.

[8]The above is also true for scores on the depersonalization sensations subscale of the ADSIQ, meaning the negative β suggests that greater negative interpretation bias for depersonalization sensations also strengthens the trait anxiety-trait depersonalization relationship.

state scores as hypothesized. As anticipated, anxiety positively predicted depersonalization at both a state and trait level, and the trait anxiety-trait depersonalization relationship was strengthened by greater anxiety sensitivity, distress intolerance, and negative interpretation bias for anxiety sensations and for depersonalization sensations. There were no significant effects of the moderators on the state anxiety-state depersonalization relationship.

For years, theorists have posited that depersonalization—or dissociation in general—is an evolution-prepared defense mechanism meant to make intense stressors more tolerable (e.g., Boysan, 2014; Griffin et al., 1997; Sierra, 2009; Snyder, 1999; Zeidner & Endler, 1996). This protective model of depersonalization would imply that individual differences in the severity of depersonalization symptoms at a given intensity of distress depend on each person's threshold for emotional distress, which we operationalized as distress tolerance (measured by the DTS-SF). In our data, lower distress tolerance strengthened the relationship between trait anxiety and trait depersonalization, which lends additional empirical support for the protective model of depersonalization. It is worth noting, though, that in cases of chronic depersonalization (as in depersonalization/derealization disorder), this model of depersonalization might be less applicable, as there is often no clear psychological stressor from which the constant depersonalization could be protecting (Dell, 2011). Further, distress tolerance was not manipulated, so causal inferences about its role are not possible with this design.

Hunter et al. (2003) proposed a cognitive-behavioral model of depersonalization, which contends that threat interpretations for depersonalization symptoms lead to elevated anxiety and, therefore, an increase in depersonalization symptoms, fueling the anxiety-depersonalization cycle. The present study tested aspects of this cognitive-behavioral model (with a larger sample size than Hunter et al., 2014) and also tested an extension of the model: that threat interpretations of *anxiety symptoms* (not just depersonalization symptoms) might also feed into the anxiety-depersonalization cycle, by—presumably—increasing levels of subsequent anxiety, which would in turn increase the severity of depersonalization symptoms. In our data, individuals who reported more catastrophic interpretations for anxiety symptoms and depersonalization symptoms had a stronger trait anxiety-trait depersonalization relationship. The relationship was also strengthened by higher levels of anxiety sensitivity. The present study therefore provides further empirical evidence for the cognitive-behavioral model of depersonalization and suggests that threat interpretations and fear of anxiety sensations also feed the anxiety-depersonalization cycle.

The protective and cognitive-behavioral models of depersonalization are not incompatible, and developing an integrated model might be warranted. Such a model would suggest that anxiety, trauma, and stress lead to symptoms of depersonalization, especially for individuals who stand to benefit most from the protective function of depersonalization (i.e., people with low distress tolerance). Additionally, individuals high in anxiety sensitivity and prone to negative interpretation bias for their original anxiety symptoms would experience an elevated anxiety response as they catastrophically misinterpret what their anxiety symptoms mean, thereby increasing their likelihood for experiencing symptoms of depersonalization. Once depersonalization symptoms occur, those prone to negative interpretation bias for their depersonalization symptoms would experience an increase in subsequent anxiety symptoms

as they catastrophically misinterpret what their depersonalization symptoms mean. The process would start again, with these elevated anxiety levels.

Few studies to date have investigated state depersonalization. One reason for this may be the lack of a validated state depersonalization questionnaire, leading researchers to adapt pre-existing trait measures of depersonalization for an in-the-moment timescale (e.g., Hoyer et al., 2013). To increase variability in symptoms (which we expected to be too low and invariant at baseline for the statistical models), participants in the present study completed mild symptom induction tasks. The anxiety induction increased state anxiety, depersonalization, negative valence, and arousal, as hypothesized. The depersonalization induction yielded more unexpected effects. It increased state depersonalization slightly, as predicted, but significantly decreased state anxiety and arousal, counter to hypotheses. The induction results may suggest that change in state anxiety more strongly predicts change in state depersonalization than the reverse. This inference must be made with considerable caution, however, given the nature of the symptom inductions, which were intentionally low intensity, because the study was conducted online and remotely. Additionally, demand characteristics might have had differential confounding effects on state outcomes. That is, it is likely that participants would recognize the anxious imagery activity was meant to raise anxiety, and less likely that participants would recognize the dot-staring activity was meant to make them feel more “detached/unreal.”

Further research is needed to determine the nature of the anxiety-depersonalization relationship at the state level and why the factors that moderated the trait-level relationship had nonsignificant effects on the state-level relationship. It could be that the trait moderators tested are only risk-factors for more long-term, pathological co-occurring anxiety and depersonalization, and have little effect on their co-occurrence in a given moment. Alternatively, the mismatch between the hypothesized trait-level moderators and state-level symptom measures may have reduced the power of analyses. Future studies could examine whether state-level appraisals (i.e., how people are actually interpreting their symptoms in a given moment) rather than trait-level tendencies to interpret hypothetical sensations in a threatening or benign way (what was captured by the ADSIQ) impact the state anxiety-state depersonalization relationship.

Limitations and Future Research Directions

Limitations of the symptom induction tasks and study design may have also contributed to the nonsignificant state-level results. Given its relatively weak effects on state outcomes, the inclusion of the dot-staring task may have limited the power of analyses. More generally, the low-intensity symptom induction tasks may not have produced enough variability in state symptoms for the moderation analyses to reveal significant effects, especially in an unselected sample. Future research might benefit from trying different methods of inducing state symptoms or using a single and more potent induction task, such as hyperventilation, which—according to results from a pilot study—may increase both state anxiety and depersonalization (Lickel et al., 2008). Additionally, future researchers may want to use longer versions of questionnaires for trait anxiety and depersonalization to examine the robustness of the present study’s results with more comprehensive measures. Finally, the

ADSIQ requires further validation as a tool for measuring threat interpretations of anxiety and depersonalization sensations.

Conclusion

Although clinical implications from this study are necessarily limited by the use of an unselected sample, the present study raises interesting possibilities for future tests of possible intervention targets with clinical samples. First, distress tolerance training (Linehan, 1993, 2015) might help to disrupt the anxiety-depersonalization cycle. Second, training more benign interpretations of depersonalization symptoms, as suggested by Hunter et al. (2003), along with Anxiety Sensitivity Amelioration Training (Schmidt et al., 2007) or cognitive bias modification to train benign interpretations of anxiety sensitivity symptoms (e.g., Steinman & Teachman, 2010) might improve outcomes when anxiety and depersonalization co-occur. As research grows on depersonalization, a historically treatment-resistant symptom, it will be important to consider its close relationship with anxiety and ways their co-occurrence may affect the course of treatment. The current results suggest a series of moderating factors that make co-occurrence more likely.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Demographic Characteristics by Condition

Characteristic	Induction Order 1 (*n* = 164)	Induction Order 2 (*n* = 139)
Age (years): *M* (*SD*)	34.75 (9.50)	34.33 (10.17)
Gender: *n* (%)		
Female	50 (30.5)	51 (36.7)
Male	112 (68.3)	86 (61.9)
Transgender Female	0 (0.0)	1 (0.7)
Transgender Male	0 (0.0)	1 (0.7)
Other	2 (1.2)	0 (0.0)
Prefer not to answer	0 (0.0)	0 (0.0)
Race: *n* (%)[a]		
American Indian/Alaska Native	4 (2.4)	5 (3.6)
East Asian	15 (9.1)	8 (5.8)
South Asian	22 (13.4)	18 (12.9)
Native Hawaiian/Pacific Islander	2 (1.2)	1 (0.7)
Black/African origin	19 (11.6)	12 (8.6)
White/European origin	105 (64.0)	96 (69.1)
Other or Unknown	1 (0.6)	3 (2.2)
Prefer not to answer	4 (2.4)	0 (0.0)
Ethnicity: *n* (%)		
Hispanic or Latino	25 (15.2)	13 (9.4)
Not Hispanic or Latino	138 (84.1)	121 (87.1)
Unknown	1 (0.6)	2 (1.4)
Prefer not to answer	0 (0.0)	3 (2.2)

Note. Induction Order 1 = depersonalization induction first, Induction Order 2 = anxiety induction first.

[a]Percentages total over 100.0, because participants were able to select multiple races.

Table 2

Mean (SD) State/Trait Scores by Condition

Construct / Time Point	Induction Order 1 (*n* = 164)	Induction Order 2 (*n* = 139)
State Anxiety		
Time 0	24.27 (25.91)	23.73 (23.93)
Time 1	34.09 (29.44)	65.32 (28.52)
Time 2	69.07 (25.37)	35.89 (28.51)
State Depersonalization		
Time 0	22.21 (24.07)	21.63 (22.90)
Time 1	38.60 (30.02)	47.17 (25.52)
Time 2	51.47 (27.86)	38.60 (30.17)
State Negative Valence		
Time 0	29.68 (23.95)	28.09 (23.88)
Time 1	43.15 (27.88)	57.29 (25.65)
Time 2	64.85 (23.11)	43.26 (27.37)
State Arousal		
Time 0	27.46 (25.63)	28.18 (26.57)
Time 1	33.02 (26.81)	59.58 (26.09)
Time 2	62.70 (23.79)	34.76 (27.25)
Trait Anxiety	1.97 (1.84)	2.47 (1.77)
Trait Depression	1.72 (1.87)	2.11 (1.84)
Trait Depersonalization	1.10 (1.67)	1.52 (1.79)
Anxiety Sensitivity	27.44 (17.45)	27.83 (16.93)
Distress Tolerance	11.02 (4.99)	11.52 (4.58)
Neg. Interpretation Bias for Anxiety Sensations	1.07 (1.00)	1.19 (1.02)
Neg. Interpretation Bias for Depersonalization Sensations	1.10 (1.11)	1.19 (1.04)

Note. Induction Order 1 = depersonalization induction first, Induction Order 2 = anxiety induction first. Time 0 = baseline, Time 1 = after first induction, Time 2 = after second induction.

Table 3

Hypothesis A: Effects of Time on State Outcomes

Induction	State Outcome	β (*SE*)	*df*	*t*	*p*	95% CI
Depersonalization Induction	Anxiety	−0.11 (0.03)	906.00	−3.76	<.001 ***	[−0.17, −0.05]
	Depersonalization	0.07 (0.03)	906.00	2.26	.024 *	[0.01, 0.12]
	Negative Valence	0.01 (0.03)	302.00	0.45	.654	[−0.05, 0.08]
	Arousal	−0.13 (0.03)	302.00	−3.91	<.001 ***	[−0.19, −0.06]
Anxiety Induction	Anxiety	0.58 (0.03)	906.00	20.63	<.001 ***	[0.52, 0.63]
	Depersonalization	0.33 (0.03)	906.00	11.65	<.001 ***	[0.27, 0.38]
	Negative Valence	0.44 (0.03)	302.00	14.89	<.001 ***	[0.38, 0.50]
	Arousal	0.51 (0.03)	302.00	15.93	<.001 ***	[0.45, 0.57]

Note. Time was coded as either 0 = immediately before induction or 1 = immediately after induction.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

Table 4

Hypothesis C: Moderation of Anxiety-Depersonalization Relationship at State and Trait Levels

Trait Moderator	β (*SE*)	*df*	*t*	*p*	95% CI
State Level					
Anxiety Sensitivity	0.03 (0.02)	601.00	1.48	.139	[−0.01, 0.06]
Distress Intolerance	0.02 (0.02)	601.00	0.92	.357	[−0.02, 0.05]
Negative Interpretation Bias for Anxiety Sensations[a]	0.00 (0.02)	603.00	−0.23	.819	[−0.04, 0.03]
Negative Interpretation Bias for Depersonalization Sensations[a]	0.00 (0.02)	603.00	0.16	.876	[−0.03, 0.04]
Trait Level					
Anxiety Sensitivity	0.25 (0.04)	298	5.70	<.001***	[0.17, 0.34]
Distress Intolerance	0.15 (0.05)	298	2.92	.004**	[0.05, 0.25]
Negative Interpretation Bias for Anxiety Sensations[a]	−0.21 (0.04)	298	−4.79	<.001***	[−0.30, −0.13]
Negative Interpretation Bias for Depersonalization Sensations[a]	−0.27 (0.04)	298	−6.54	<.001***	[−0.35, −0.19]

Note. Effects on state depersonalization were estimated with mixed-effects models. Effects on trait depersonalization were estimated with multiple linear regression models.

[a]Negative Interpretation Bias for Anxiety Sensations and Negative Interpretation Bias for Depersonalization Sensations were inverse-transformed to meet model assumptions. Therefore, negative values for β suggest positive effects of Trait Anxiety × Negative Interpretation Bias for Anxiety Sensations and Trait Anxiety × Negative Interpretation Bias for Depersonalization Sensations on Trait Depersonalization.

*$p < .05$.

**$p < .01$.

***$p < .001$.