Available online at www.sciencedirect.com

ScienceDirect

Behavior Therapy 56(2019) 1173–1184

Behavior Therapy

www.elsevier.com/locate/bt

Repeated Exposure to Perceptual Illusion Challenges Reduces Anxiety Sensitivity Cognitive Concerns: Evidence From a Randomized Clinical Trial

Brian J. Albanese
Florida State University

Brian W. Bauer
University of Southern Mississippi

Alexa M. Raudales
Florida State University

Daniel W. Capron
University of Southern Mississippi

Norman B. Schmidt
Florida State University

Background: **Anxiety sensitivity cognitive concerns (ASCC), or fear of cognitive dyscontrol sensations, confers risk for anxiety and mood psychopathology. Recent work demonstrated that novel perceptual challenges generated by a head mounted display can elicit fear among those with elevated ASCC. This suggests that interoceptive exposure to perceptual challenges may offer a means to mitigate ASCC. This study was designed to evaluate whether repeated exposure to novel perceptual challenges can reduce ASCC, and if these effects are stronger among those experiencing greater negative emotionality as a proxy for individuals likely to present for treatment.**

Methods: **Participants with elevated ASCC (N = 57) were randomized to one of three experimental conditions utilizing a head-mounted display. In the rotations condition (n = 20), participants viewed themselves spinning in a circle. In the opposite directions condition (n = 20), participants turned their head while the camera moved in the opposite direction creating dissonance in their visual field. In the control condition (n = 17), participants completed a series of simple arithmetic problems.**

Results: **Participants in the rotation condition, relative to control, reported significant reductions in ASCC from pre- to post-exposure and these effects were strongest for those with elevated negative affect. The main effect of the opposite directions exposure on post-treatment ASCC was non-significant, but follow-up analyses revealed that reductions in ASCC were observed among those with elevated negative affectivity.**

Discussion: **Perceptual illusion challenges appear to have utility for reducing ASCC through repeated exposure. There was evidence for the perceptual illusion exercises, particularly the rotations condition, specifically reducing ASCC, making this challenge the first we are aware of that specifically targets ASCC-related concerns.**

Limitations: **As a proof-of-concept study, the present**

All data were collected and analyzed at the Florida State University, Department of Psychology, Tallahassee, FL.

This work was supported in part by the National Institute of Health Integrated Clinical Neuroscience Training for Translational Research (4T32MH093311-05).

Address correspondence to Brian J. Albanese, Florida State University, Department of Psychology, 1107 W. Call Street, Tallahassee, FL 32306; e-mail: albanese@psy.fsu.edu.

sample was not recruited for clinically-significant psychopathology, and only a brief follow-up was utilized. Future research should utilize a longer follow-up and test if these exposures mitigate ASCC-relevant psychopathology among clinical samples.

Keywords: Anxiety Sensitivity Cognitive Concerns; Exposure Therapy; Perceptual Illusions

Anxiety sensitivity (AS) is one of the most well-researched risk factors for anxiety- and mood-related psychopathology (Schmidt, Lerew, & Jackson, 1997; Schmidt, Zvolensky, & Maner, 2006). AS is a traitlike construct characterized by the belief that anxiety- and mood-related bodily sensations have deleterious cognitive (e.g., "going crazy"), physical (e.g., having a heart attack), or social (e.g., embarrassment) consequences (e.g., cognitive dyscontrol; Reiss, Peterson, Gursky, & McNally, 1986) and is believed to contribute to anxiety and mood psychopathology via a positive feedback loop in which existing symptomology is amplified by fears of such symptoms. Although early research on this construct focused on panic and other anxiety disorders (e.g., Reiss et al., 1986; Schmidt et al., 1997; Schmidt, Lerew, & Jackson, 1999), growing research has also linked AS with posttraumatic stress disorder (Taylor, Koch, & McNally, 1992) and major depressive disorder (Olatunji & Wolitzky-Taylor, 2009). Due to the prominent role AS plays in numerous disorders, the DSM-5 officially recognized AS as a significant transdiagnostic risk factor in the development of anxiety and mood disorders (American Psychiatric Association, 2013).

AS cognitive concerns (ASCC), a subfactor of the broader AS construct, is characterized by the fear of mental catastrophe associated with sensations like derealization, depersonalization, racing thoughts, and one's mind going blank. An emerging literature has shown associations between ASCC and suicide-related thoughts and behaviors (Capron, Allan, Ialongo, Leen-Feldner, & Schmidt, 2015; Capron, Cougle, Ribeiro, Joiner, & Schmidt, 2012; Capron, Fitch, et al., 2012; Capron, Kotov, & Schmidt, 2013; Capron, Norr, Macatee, & Schmidt, 2013; Capron, Norr, Zvolensky, & Schmidt, 2014; Oglesby, Capron, Raines, & Schmidt, 2015) as well as mood and trauma-related disorders (Mitchell, Capron, Raines, & Schmidt, 2014; Olthuis, Watt, & Stewart, 2014). More recent factor analytic work has demonstrated that ASCC is specifically linked with distress and mood-related disorders (e.g., major depressive disorder, PTSD) while AS physical concerns (i.e., fears of physical bodily sensations like a racing heart) relate to fear-based disorders (Allan, Albanese, Short, Raines, & Schmidt, 2015; Allan, Capron, Raines, & Schmidt, 2014; Allan, Norr, et al., 2015). Moreover, reductions in ASCC via psychoeducation-based interventions has been linked with reductions in anxiety, depression, and suicidal ideation (Schmidt, Capron, Raines, & Allan, 2014). The unique relations among ASCC and distress and mood-related pathology, relative to other AS subfactors (Allan, Albanese, et al., 2015; Allan et al., 2014; Allan, Norr, et al., 2015), and the demonstrated benefits of reducing ASCC (Schmidt et al., 2014) further underscore the utility of developing interventions specifically targeting ASCC.

Multiple laboratory challenges have been used to better understand and treat AS, though these challenges have focused primarily on producing sensations related to AS physical concerns (e.g., racing heart rate; Lickel, Nelson, Lickel, & Deacon, 2008) while most ASCC-relevant symptoms (e.g., dissociation, depersonalization, racing thoughts) are likely secondary (McNally & Eke, 1996). For example, hyperventilation (in which participants are asked to breathe more rapidly and deeply than normal), breathing through a narrow straw, and inhaling carbon-dioxide-enriched air are often used to evoke sensations that mimic symptoms of panic (e.g., elevated heart rate, shortness of breath; Schmidt & Trakowski, 2004; Zvolensky, Feldner, Eifert, & Stewart, 2001). As a result of research demonstrating reactivity to these laboratory challenges among those with high AS (e.g., Holloway & McNally, 1987; Schmidt, 1999), many of these have been used to reduce global AS via repeated interoceptive exposure exercises (Craske & Barlow, 2006; Schmidt & Trakowski, 2004). However, to our knowledge, there is not currently evidence that these exposures are effective for reducing ASCC. Rather, these challenges appear to be most useful for reducing global AS-related concerns and may be limited in their utility for reducing ASCC given the predominance of symptoms related to AS physical concerns that traditional interoceptive exposures elicit, as was reported by Schmidt and Trakowski.

Another approach would be to develop challenges that elicit symptoms that are specific to ASCC (i.e., cognitive dyscontrol) that may hold promise for reducing ASCC via repeated exposure. Laboratory challenges that elicit symptoms specific to ASCC may have several benefits. For instance, utilizing challenges that primarily target physical anxiety symptoms, such as hyperventilation, may obfuscate any secondary symptoms that are relevant to ASCC (e.g., cognitive dyscontrol), thereby potentially limiting the efficacy of hyperventilation for the reduction of ASCC. Furthermore, ASCC,

specifically, has been linked with a host of negative outcomes (Olatunji & Wolitzky-Taylor, 2009). Therefore, identifying novel ways to reduce ASCC, without sacrificing the potency via the elicitation of predominant physical symptoms, could have utility for ameliorating PTSD and mood-related pathology (Allan, Short, Albanese, Keough, & Schmidt, 2015; Schmidt et al., 2014; Schmidt, Norr, Allan, Raines, & Capron, 2017; Short et al., 2017).

The current study sought to build upon previous research of Capron, Norr, Albanese, and Schmidt (2017) by utilizing the most anxiogenic challenges from that study (i.e., Rotation and Opposite Directions) and testing whether repeated exposure to these challenges reduces ASCC relative to repeated exposure to a matched control. In line with evidence suggesting that repeated exposure to the feared stimulus is an effective means for reducing such fears (e.g., Craske et al., 2008) and initial data demonstrating that the perceptual illusions elicit fears relevant to ASCC (Capron et al., 2017), we hypothesized that (a) both the rotation and opposite directions conditions would predict greater dissociative symptoms relative to the control group and (b) both the rotation and opposite directions conditions would yield post-treatment ASCC reductions, relative to control. Lastly, existing literature asserts that ASCC is specifically linked with dysphoria and other distress-related phenomena (Allan, Albanese, et al., 2015; Allan et al., 2014; Allan, Norr, et al., 2015; Olatunji & Wolitzky-Taylor, 2009; Schmidt, Lerew, & Joiner, 1998). Therefore, dysphoric mood severity was included as a moderator to provide a preliminary test of whether the reductions in ASCC following repeated exposure to the perceptual illusion challenges are observed among those experiencing relevant psychopathology. Given that repeated exposures may be most helpful for individuals who more closely resemble a clinical population (i.e., elevated dysphoria), we hypothesized that individuals with greater dysphoric symptoms would exhibit the greatest reductions in ASCC following the exposures.

Method

PARTICIPANTS

Participants (N = 57) were recruited based on their endorsement of ASI-3 cognitive concerns scores greater than 1.5 *SD*s above the community mean (Taylor et al., 2007) on an initial screening through the psychology department participant pool. All participants were provided course credit for their participation. Two participants (Control = 1; Rotations = 1) were removed due to missing post-exposure data, yielding a final sample of 55 subjects (n = 16 control; n = 19 rotations; n = 20 opposite directions). Consistent with the demographics of Tallahassee, FL, the sample was primarily female (72.7%; n = 40) and Caucasian (92.7%; n = 51) followed by African American (3.6%; n = 2) and Asian/Pacific Islander (3.6%; n = 2). Age ranged from 18–25 (M = 18.87, SD = 1.52). The study was approved by Florida State University's Institutional Review Board.

SELF-REPORT MEASURES

Anxiety Sensitivity Index-3 (ASI-3)

The ASI-3 (Taylor et al., 2007) is based on the original ASI (Reiss et al., 1986) and is a widely used measure of the fear of anxiety-related symptoms. The ASI-3 was developed to provide a more stable assessment of the three AS subfactors: cognitive, physical, and social concerns. The ASI-3 has established strong psychometric properties (Taylor et al., 2007) and in the current study total score (α = .92–.91), cognitive concerns (α = .91-.94), physical concerns (α = .87–.90), and social concerns (α = .81-.83) scales demonstrated good to excellent internal consistencies at baseline and post-exposure.

Acute Dissociation Inventory–Cognitive (ADI-C)

The ADI-C (Capron et al., 2017) is a revision of a measure dissociative symptoms during lab-based biological challenges (ADI; Leonard, Telch, & Harrington, 1999; Leonard, Telch, & Owen, 2000). The ADI-C was created to be more amenable to repeated assessments and more focused on the cognitive symptoms of dissociation (e.g., *Was there any time during the challenge that you were not aware of what you were doing? Did you feel as if you were disconnected from all or part of your body? Did you feel as if you were watching/experiencing yourself from a distance?*). The ADI-C was administered at baseline, immediately following the first exposure, immediately following the sixth exposure, and immediately following the final exposure. One participant (assigned to the opposite directions condition) was not administered the ADI-C following the first exposure but completed all other surveys. This participant was not included in analyses utilizing the ADI-C (n = 54) but was retained for all other analyses. Internal consistency of this measure was good at baseline (α = .88) and following the first exposure (α = .90).

Inventory of Depression and Anxiety Symptoms (IDAS)

The IDAS (Watson et al., 2007) is a 64-item questionnaire designed to assess an individual's current experience of depressive and anxiety

symptoms on 10 specific symptom scales. Respondents are asked to rate the degree to which each statement describes their feelings and experiences during the past 2 weeks using a 5-point Likert scale ranging from 1 (*not at all*) to 5 (*extremely*). Research has demonstrated that the IDAS subscales demonstrate very good internal consistency (Watson et al., 2007). Among the symptom dimensions included are the IDAS General Depression and the IDAS dysphoria subscale. While the IDAS dysphoria subscale includes only items pertaining to negative affect, the IDAS General Depression subscale contains items from several other scales, including lassitude, insomnia, suicidality, and appetite loss. Because ASCC is an affective risk factor (Reiss et al., 1986), the focus of the dysphoria subscale on negative affect is a more appropriate variable to test treatment moderation effects. Therefore, the current study used the dysphoria (e.g., *I felt depressed, I had little interest in my usual hobbies or activities*) subscale as a covariate to account for individual differences in depressive symptoms. The IDAS dysphoria subscale demonstrated excellent internal consistency ($\alpha = .88$).

GENERAL PROCEDURE

Participants were invited for the experiment appointment via the psychology department's secure research participant registration website. Upon entering the lab, participants provided informed consent and then completed baseline questionnaires. Participants were then randomized to one of the three conditions described below. Full descriptions of each condition can be found in Capron et al. (2017).

In each active condition, participants completed twelve 2-minute exposures. To match this, participants in the control condition also completed twelve 2-minute exercises (see below). Following each exposure, participants removed the head-mounted display and rested for 2 minutes. At the conclusion of the 12th and final exposure, participants were given a 5-minute break to ensure a return to baseline functioning and then completed the ASI-3.

HEAD-MOUNTED DISPLAY

A head-mounted display (HMD; nVisor ST50, NVIS, Inc., Reston, VA) was placed on the participant's head in order to create each perceptual illusion. The HMD included a screen that was focused for each participant, on which a real-time feed from an accompanying universal serial bus (USB) camera was projected. A high-definition multimedia interface (HDMI) cord was used to connect the USB camera feed to the HMD projection screen.

DESCRIPTION OF PERCEPTUAL ILLUSION LABORATORY CHALLENGES

Opposite Directions

During this task, the experimenter stands next to the participant with a camera, which was connected to the HMD. The camera is placed on a tripod to provide smooth panning and is positioned to mimic the participant's natural field of vision. Participants were instructed to slowly turn their head to the left, right, up (towards the ceiling), and down (towards the ground). As the participant moved their head, the camera was moved in the opposite direction in attempt to give a sensation of discord between the movement of the participant's head and that of their visual field.

Rotation

The rotation task involves positioning the HMD camera on the tripod approximately four feet from the participant. The camera is positioned to capture the participant from the neck down, so that what the participant views the video feed of their own body from the perspective of someone facing them from a few feet away, thereby providing an "out-of-body" perspective. Participants were then instructed to slowly spin in a ¾ circle, and then rotate the other direction. The ¾ spins were implemented to prevent participants from tripping over HMD cord or becoming too dizzy.

Control

Individuals randomized to the control condition completed a series of simple arithmetic problems to account for any potential effects of fatigue on self-reported symptoms and AS scores. The math problems were presented on a series of printed pages, and participants were instructed to complete as many problems within the 2-minute time-frame as possible without rushing. To minimize performance fears, participants were also instructed that their math problems would not be scored or examined at by the experimenter. Further, to avoid potentially confounding the control condition through inadvertently inducing symptoms of depersonalization while wearing the HMD, and because the present study represents a preliminary investigation, we elected to utilize a simple arithmetic-based control condition.

DATA ANALYTIC PLAN

First, group differences in baseline ASI-3 total and subscale scores were examined using a series of independent samples *t*-tests. Next, a manipulation check was performed to ensure that the perceptual illusion challenges elicited the sensations of cognitive dyscontrol (e.g., dissociation, depersonalization, derealization) as intended. A mixed design analysis

Table 1
Descriptive Statistics and Correlations Among Study Variables

	M	*SD*	1	2	3	4	5	6	7	8	9	10	11
1. Rotation	—	—	—	—	—	—	—	—	—	—	—	—	—
2. Opposite Directions	—	—	—	—	—	—	—	—	—	—	—	—	—
3. BL IDAS Dysphoria	24.60	8.21	0.38*	0.31	—	—	—	—	—	—	—	—	—
4. BL ASI-3 Total	25.98	15.38	0.12	0.10	0.54**	—	—	—	—	—	—	—	—
5. BL ASI-3 Cognitive	8.54	6.86	0.15	0.18	0.56**	0.89**	—	—	—	—	—	—	—
6. BL ASI-3 Physical	6.96	5.78	-0.01	0.04	0.34*	0.82**	0.63**	—	—	—	—	—	—
7. BL ASI-3 Social	10.47	5.78	0.15	0.02	0.45**	0.79**	0.55**	0.43**	—	—	—	—	—
8. Post ASI-3 Total	21.53	13.83	-0.03	0.04	0.52**	0.89**	0.82**	0.76**	0.66**	—	—	—	—
9. Post ASI-3 Cognitive	6.95	6.54	-0.02	0.08	0.51**	0.77**	0.90**	0.58**	0.41**	0.88*	—	—	—
10. Post ASI-3 Physical	5.20	5.32	-0.09	-0.01	0.29*	0.74**	0.65**	0.88**	0.34**	0.84**	0.69**	—	—
11. Post ASI-3 Social	9.38	5.27	0.05	0.02	0.45**	0.64**	0.39**	0.38**	0.87**	0.68**	0.36**	0.35**	—

Note. $N = 55$. Rotation and Opposite Directions Intervention conditions are relative to Control. IDAS = Inventory of Depression and Anxiety Scale, Dysphoria Subscale. ASI-3 = Anxiety Sensitivity Index – 3, Total and Cognitive, Physical, and Social Subscales.
* = $p < .05$, ** = $p < .01$.

of covariance (ANCOVA) was used to evaluate differences between the control and each active condition in self-reported dissociative symptoms (i.e., ADI-C) at baseline, after the first exposure, after the sixth exposure, and after the final exposure.

Following this, a series of linear multiple regressions were used to test the effects of treatment condition (rotation vs. control) on changes in AS total and AS subscale scores following the exposures. AS total and subscale scores were measured prior to the start of the exposures as well as 2 minutes following the final exposure. The dependent variable in each of the linear multiple regressions was the respective AS score (total or subscale) following the 12 exposures to the assigned condition. Each model included a dummy-coded condition variable (0 = Control; 1 = Active Treatment). The respective baseline AS total or AS subscale score was entered as a covariate to account for pre-intervention AS, thus creating an autoregressive change score. IDAS dysphoria was also entered as a covariate to account for baseline differences in dysphoric affectivity.

Lastly, because a clinical sample was not utilized for the present study, moderation analyses were conducted to evaluate if repeated exposure to the active conditions resulted in greater reductions of ASCC among those with elevated baseline symptomology, as a proxy for how these exposures may perform in a clinical sample. The PROCESS macro for SPSS (Hayes, 2012) with 5,000 bootstrapped samples was used to conduct two separate moderation models (for the rotation and opposite directions conditions, respectively) in which baseline dysphoric mood was entered as a moderator of the relationship between condition (active vs. control) and posttreatment AS total and subscale scores when accounting for baseline AS scores. Effect sizes were presented at varying levels (i.e., based on percentile score relative to the mean scores of the two conditions being compared) of dysphoric mood, as defined by the PROCESS macro.

Results

PRELIMINARY RESULTS

Descriptive statistics and correlations can be found in Table 1. Independent samples *t*-tests revealed nonsignificant baseline differences in AS total and all subscales when comparing the control condition to the rotations (p's > .393) and opposite directions (p's > .274).

MANIPULATION CHECK: GROUP DIFFERENCES IN DISSOCIATION SYMPTOMS

A 3 × 4 mixed ANCOVA testing group (control, rotations, opposite directions) differences in dissociative symptoms across time (baseline, first exposure, sixth exposure, and final exposure) was conducted to evaluate the elicitation of dissociative symptoms in each condition. Due to sphericity [Mauchly's test of sphericity: $\chi^2(5) = 109.53$, $p < .001$] Greenhouse-Geisser-corrected values were utilized. A significant within-subjects effect emerged for Time × Condition [$F(2.85, 71.20) = 3.15$, $p = .032$] but not Time × Dysphoria [$F(1.42, 71.20) = 0.85$, $p = .40$]. Within-subject contrasts indicated a significant Time × Condition interaction predicting dissociative symptoms from baseline to the first exposure [$F(2, 50) = 4.03$, $p = .024$] but not from the first exposure to sixth exposure [$F(2, 50) = 0.49$, $p = .619$] or sixth exposure to final exposure [$F(2, 50) = 0.42$, $p = .657$]. Significant between-subjects effects emerged for Time × Condition [$F(2, 50) = 10.87$, $p < .001$] and Time × Dysphoria [$F(1, 50) = 6.49$, $p = .014$].

Pairwise comparisons indicated that the control group did not differ from rotations ($M_{difference}$ =

Table 2
Results of Four Separate Regressions Evaluating the Effects of Exposure to the Rotation Challenge on Predicting Anxiety Sensitivity Post-Intervention

A. Post ASI-3 Total					
	B	*SE*	*β*	*t*	*p*
Condition	-4.31	2.13	-0.16	-2.02	0.052
BL ASI-3 Total	0.75	0.08	0.84	9.70	<0.001
BL IDAS Dysphoria	0.22	0.15	0.14	1.47	0.152
B. Post ASI-3 Cognitive Concerns					
	B	*SE*	*β*	*t*	*p*
Condition	-2.18	1.02	-0.17	-2.15	0.040
BL ASI-3 Cognitive Concerns	0.80	0.09	0.84	9.35	<0.001
BL IDAS Dysphoria	0.10	0.07	0.14	1.44	0.161
C. Post ASI-3 Physical Concerns					
	B	*SE*	*β*	*t*	*p*
Condition	-1.17	0.80	-0.11	-1.46	0.154
BL ASI-3 Physical Concerns	0.82	0.07	0.91	11.92	<0.001
BL IDAS Dysphoria	0.00	0.05	0.00	0.05	0.963
D. Post ASI-3 Social Concerns					
	B	*SE*	*β*	*t*	*p*
Condition	-0.81	0.99	-0.08	-0.82	0.420
BL ASI-3 Social Concerns	0.74	0.09	0.82	8.45	<0.001
BL IDAS Dysphoria	0.07	0.06	0.11	1.10	0.281

Note. Rotation challenge is relative to control. IDAS = Inventory of Depression and Anxiety Scale, Dysphoria Subscale. ASI-3 = Anxiety Sensitivity Index – 3, Total and Cognitive, Physical, and Social Subscales.

-53.98, $p = .207$) or opposite directions ($M_{difference}$ = -33.56, $p = .422$) at baseline. Likewise, the rotations and opposite directions conditions did not differ in baseline dissociative symptoms (reference group = rotations; $M_{difference} = 20.43$, $p = .600$).

The rotations condition elicited significantly greater dissociative symptoms than the control group following the first exposure ($M_{difference}$ = 198.49, $p < .001$), sixth exposure ($M_{difference}$ = 189.97, $p < .001$), and final exposure ($M_{difference}$ = 208.03, $p = .001$). The rotations condition also elicited significantly greater dissociative symptoms than the opposite directions condition following the first exposure ($M_{difference}$ = 163.88, $p = .001$), sixth exposure ($M_{difference}$ = 186.64, $p < .001$), and final exposure ($M_{difference}$ = 197.58, $p = .001$).

The opposite directions did not differ from the control group in dissociative symptoms following the first exposure ($M_{difference}$ = 34.61, $p = .504$), sixth exposure ($M_{difference}$ = 3.33, $p = .946$), or final exposure ($M_{difference}$ = 10.45, $p = .861$).

CHANGES IN ASCC FROM PRE- TO POST-EXPOSURE

Rotation

Relative to control, the rotation condition predicted marginally significant reductions in AS total score (β = -.16, t = -2.02, $p = .052$) and significant reductions in ASCC (β = -.17, t = -2.15, $p = .040$). Exposure condition did not predict changes in AS physical concerns (β = -.11, t = -1.46, $p = .154$) and AS social concerns (β = -.08, t = -0.82, $p = .420$; see Table 2 and Fig. 1).

Opposite Directions

Results indicated nonsignificant changes in AS total score (β = -.09, t = -1.12, $p = .272$), ASCC (β = -.10, t = -1.34, $p = .190$), AS physical concerns (β = -.06, t = -0.66, $p = .511$) and AS social concerns (β = -.04, t = -0.55, $p = .588$; see Table 3 and Fig. 1).

MODERATION OF EXPOSURES EFFECTS ON ASCC BY DYSPHORIC MOOD

Rotation

Results indicated a significant interaction of IDAS dysphoria and condition predicting reductions in ASCC (B = -0.26, SE = 0.11, t = -2.30, $p = .029$) such that the rotation condition, relative to control, predicted reductions in ASCC for individuals in the 75th (B = -4.17, SE = 1.29, t = -3.24, $p = .003$) and 90th (B = -5.46, SE = 1.71, t = -3.18, $p = .003$) percentiles of dysphoria but not for individuals in the 10th (B = 0.22, SE = 1.41, t = 0.15, $p = .880$), 25th (B = -0.30, SE = 1.26, t = -0.24, $p = .813$), or 50th (B = -1.33, SE = 1.02, t = -1.30, $p = .202$) percentiles of dysphoria. Unexpectedly, results also indicated a significant interaction of IDAS dysphoria and condition predicting reductions in AS social concerns (B = -0.29, SE = 0.11, t = -2.72, $p = .011$) such that the rotation condition, relative to control, predicted reductions in AS social concerns for

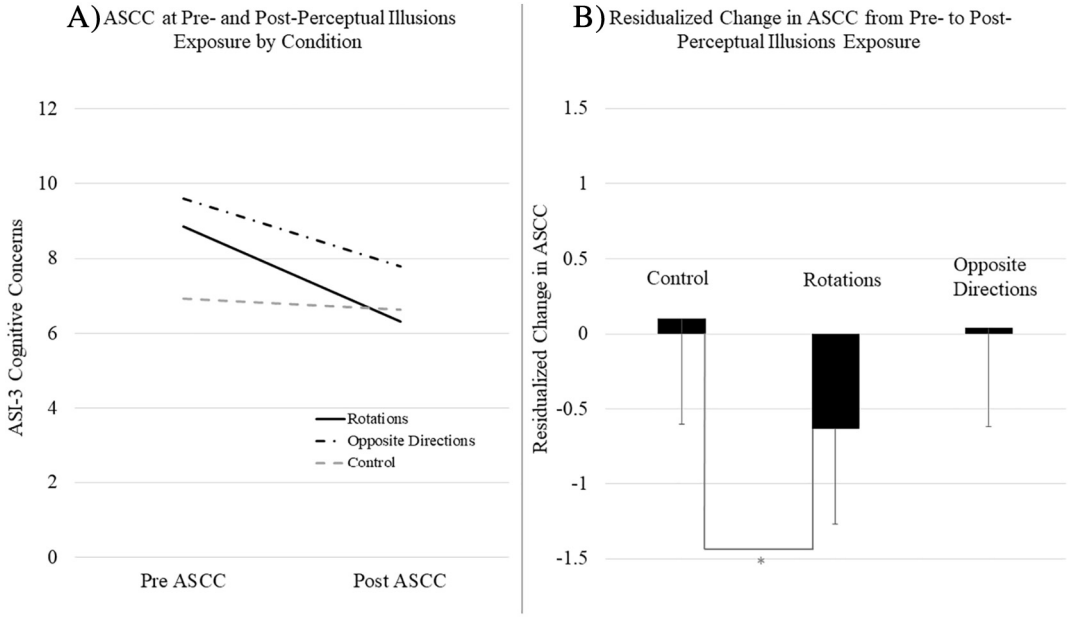

FIG. 1 ASCC = Anxiety Sensitivity Cognitive Concerns, as measured by the Anxiety Sensitivity Index-3. *Panel A*: Raw ASCC scores at pre- and post-exposure to the perceptual illusion challenges or control. Importantly, baseline group differences in ASCC were non-significant. *Panel B*: Residualized change scores (post-exposure ASCC regressed onto pre-exposure ASCC) representing changes in ASCC from pre- to post-exposure to each condition. Results indicate statistically significant reductions in ASCC among those in the rotation condition, relative to control. No significant differences in the directions condition, relative to control, were observed.

individuals in the 75th (B = -3.11, SE = 1.24, t = -2.52, p = .018) and 90th (B = -4.58, SE = 1.65, t = -2.77, p = .010) percentiles of dysphoria but not for individuals in the 10th (B = 0.1.89, SE = 1.34, t = 1.41, p = .169), 25th (B = 1.30, SE = 1.19, t = 1.09, p = .283), or 50th (B = .12, SE = 0.96, t = 0.13, p = .898. IDAS dysphoria did not moderate the effects of condition on changes in AS physical concerns (p = .498; see Table 4).

Opposite Directions

Results indicated a significant interaction of IDAS dysphoria and condition (B = -0.14, SE = 0.06, t = -2.37, p = .024) such that the directions condition, relative to control, predicted reductions in ASCC for individuals in the 75th (B = -1.54, SE = 0.59, t = -2.58, p = .015) and 90th (B = -2.11, SE = 0.77, t = -2.75, p = .010) percentiles of dysphoria but not for individuals in the 10th (B = 0.72, SE = 0.76, t = 0.94, p = .347), 25th (B = 0.02, SE = 0.56, t = 0.03, p = .978), or 50th (B = -0.69, SE = 0.47, t = -1.46, p = .154) percentiles of dysphoria. IDAS dysphoria did not moderate the effects of condition on changes in AS physical concerns (p = .590) or AS social concerns (p = .218; see Table 4).

Discussion

The present study provided support for the use of perceptual illusion exposures to reduce ASCC. Consistent with prior work (Capron et al., 2017), the rotation condition elicited greater dissociative symptoms compared to the control condition. The directions condition also appeared to elicit some symptomology, though a larger sample may be needed to detect these effects. These results served as a manipulation check, and support the assertion that the active conditions, particularly the rotations exercise, elicited the proposed sensations of dissociation, depersonalization, and cognitive dyscontrol. As hypothesized, repeated exposure to the rotation condition reduced ASCC post-exposure, with stronger intervention effects observed among those with elevated dysphoric mood. In partial support of hypotheses, the directions condition also reduced ASCC post-exposure but only among those with high dysphoria. Taken together, this pattern of results demonstrates the utility of repeated exposure to the proposed perceptual illusion challenges to reduce ASCC. The reduction of ASCC following repeated exposure to feared symptoms (e.g., depersonalization, dissociation, cognitive dyscontrol) is consistent with foundational models of cognitive behavior therapy (e.g., Craske et al., 2008; Foa & Kozak, 1986; McNally, 1990) and addresses an important gap in AS intervention literature by providing an effective and targeted approach for reducing ASCC.

Table 3
Results of Four Separate Regressions Evaluating the Effects of Exposure to the Opposite Directions Challenge on Predicting Anxiety Sensitivity Post-Intervention

A. Post ASI-3 Total					
	B	*SE*	*β*	*t*	*p*
Condition	-1.25	1.12	-0.08	-1.12	0.272
BL ASI-3 Total	0.79	0.08	0.86	10.56	<0.001
BL IDAS Dysphoria	0.25	0.17	0.13	1.48	0.149
B. Post ASI-3 Cognitive Concerns					
	B	*SE*	*β*	*t*	*p*
Condition	-0.68	0.51	-0.10	-1.34	0.190
BL ASI-3 Cognitive Concerns	0.86	0.08	0.89	11.14	<0.001
BL IDAS Dysphoria	0.07	0.07	0.08	0.98	0.333
C. Post ASI-3 Physical Concerns					
	B	*SE*	*β*	*t*	*p*
Condition	-0.33	0.50	-0.06	-0.66	0.511
BL ASI-3 Physical Concerns	0.87	0.08	0.91	10.51	<0.001
BL IDAS Dysphoria	-0.02	0.07	-0.02	-0.26	0.799
D. Post ASI-3 Social Concerns					
	B	*SE*	*β*	*t*	*p*
Condition	-0.25	0.45	-0.04	-0.55	0.588
BL ASI-3 Social Concerns	0.76	0.08	0.80	9.42	<0.001
BL IDAS Dysphoria	0.15	0.07	0.20	2.27	0.030

Note. Opposite directions challenge is relative to control. IDAS = Inventory of Depression and Anxiety Scale, Dysphoria Subscale. ASI-3 = Anxiety Sensitivity Index – 3, Total and Cognitive, Physical, and Social Subscales.

The effects of both challenges were moderated by current dysphoria such that greater reductions in ASCC were observed among those experiencing greater negative emotionality. There are several plausible explanations for this. First, repeated exposures to cognitive dyscontrol may have stronger effects for reducing ASCC among those experiencing some of these symptoms in their daily lives. The ASI-3 does not specify the frequency with which individuals experience the feared symptoms; rather, it assesses the tendency to respond to fearfully *if* the individual were to experience them. For an individual who is not currently experiencing some symptoms relevant to ASCC (e.g., cognitive control in the context of negative emotionality), repeated exposure to sensations approximating those symptoms may not be as effective. Unexpectedly, a similar interaction emerged indicating that AS social concerns reduced in the rotations condition but only among those with elevated dysphoric mood. The exposures were conducted with a research assistant in the room, thus individuals with greater dysphoric mood, who may have found the exposures to be more potent, may have also experienced some exposure to experiencing anxiety symptoms in a pseudo-social situation. Future research should investigate the efficacy of these challenges in both clinical and nonclinical samples to determine whether these exposures has utility as both an intervention and prevention strategy.

Though exposures for AS exist, most of these elicit symptoms most relevant to AS physical concerns. For example, hyperventilation and CO_2 both elicit symptoms such as a racing heart and difficulties breathing, and although an individual may experience some light-headedness, there are no specific cognitive symptoms, as were reported particularly by the participants in the rotations condition. Challenges that do claim to target ASCC have had limited scientific support (e.g., dot staring, mirror staring; Lickel et al., 2008). Thus, the perceptual illusion challenges presented here appear to be the first effective method for eliciting symptoms relevant to ASCC and specifically reducing ASCC following repeated exposure. Other methods for reducing ASCC have focused on the use of psychoeducation followed by exposure to existing challenges such as hyperventilation (e.g., Cognitive Anxiety Sensitivity Treatment [CAST]; Schmidt et al., 2014; Schmidt et al., 2017). Because these exposures are not specific to ASCC (e.g., difficulty breathing is captured by AS physical), the perceptual illusion challenges used in the present study may better augment the psychoeducation provided by CAST.

These findings are particularly interesting given the growing focus of AS research on the cognitive concerns subscale over the last decade, as research linking ASCC, specifically, with anxiety and mood conditions has flourished. For instance, a breadth of literature

Table 4
Results Evaluating the Interactive Effects of Condition and Baseline Dysphoria on Post-Intervention Anxiety Sensitivity Subfactors

Rotations (relative to Control)				
DV: Post ASI-3 Cognitive Concerns				
	B	*SE*	*t*	*p*
Rotations (relative to Control)	-2.34	0.95	-2.45	0.02
BL ASI-3 Cognitive Concerns	0.81	0.08	10.1	<0.001
BL IDAS Dysphoria	0.1	0.07	1.55	0.131
Rotation*IDAS Dysphoria	-0.26	0.11	-2.3	0.029
DV: Post ASI-3 Physical Concerns				
	B	*SE*	*t*	*p*
Rotations (relative to Control)	-1.22	0.81	-1.51	0.143
BL ASI-3 Physical Concerns	0.81	0.07	11.67	<0.001
BL IDAS Dysphoria	0.01	0.05	0.11	0.916
Rotation*IDAS Dysphoria	-0.07	0.1	-0.69	0.498
DV: Post ASI-3 Social Concerns				
	B	*SE*	*t*	*p*
Rotations (relative to Control)	-1.03	0.9	-1.14	0.265
BL ASI-3 Social Concerns	0.7	0.08	8.59	<0.001
BL IDAS Dysphoria	0.09	0.06	1.53	0.136
Rotation*IDAS Dysphoria	-0.29	0.11	-2.72	0.011
Opposite Directions (relative to Control)				
DV: Post ASI-3 Cognitive Concerns				
	B	*SE*	*t*	*p*
Opposite Directions (relative to Control)	-0.74	0.48	-1.56	0.129
BL ASI-3 Cognitive Concerns	0.87	0.07	12.03	<0.001
BL IDAS Dysphoria	0.06	0.07	0.88	0.384
Opposite Directions*IDAS Dysphoria	-0.14	0.06	-2.37	0.024
DV: Post ASI-3 Physical Concerns				
	B	*SE*	*t*	*p*
Opposite Directions (relative to Control)	-0.35	0.5	-0.69	0.498
BL ASI-3 Physical Concerns	0.87	0.08	10.37	<0.001
BL IDAS Dysphoria	-0.02	0.07	-0.27	0.788
Opposite Directions*IDAS Dysphoria	-0.03	0.06	-0.54	0.590
DV: Post ASI-3 Social Concerns				
	B	*SE*	*t*	*p*
Opposite Directions (relative to Control)	-0.28	0.44	-0.62	0.538
BL ASI-3 Social Concerns	0.76	0.08	9.47	<0.001
BL IDAS Dysphoria	0.14	0.06	2.25	0.031
Opposite Directions*IDAS Dysphoria	-0.07	0.06	-1.26	0.218

Note. Rotation and directions challenges are relative to control. IDAS = Inventory of Depression and Anxiety Scale, Dysphoria Subscale. ASI-3 = Anxiety Sensitivity Index – 3.

shows that elevated ASCC predicts greater PTSD symptoms cross-sectionally (Albanese, Macatee, Allan, et al., 2018; Norr, Albanese, Boffa, Short, & Schmidt, 2016; Olatunji & Wolitzky-Taylor, 2009) as well as prospectively (Boffa et al., 2016; Olatunji & Fan, 2015). Moreover, ASCC has been linked with traumatic brain injuries (TBI) dysfunction (Albanese, Boffa, Macatee, & Schmidt, 2017) and a moderator of the link between TBI history and PTSD (Albanese, Macatee, Boffa, et al., 2018; Albanese, Macatee, et al., 2017; Albanese, Macatee, Stentz, Schmidt, & Bryan, 2019). ASCC has also been linked with suicide risk (Capron, Kotov, & Schmidt, 2013; Capron, Norr, Albanese, & Schmidt, 2013; Capron et al., 2014; Stanley et al., in press), further underscoring the urgent need to develop effective interventions for ASCC. The present study provides an initial step in this line of work by demonstrating the ability to specifically reduce ASCC via perceptual illusion exposures in a nonclinical sample, particularly among individuals experiencing greater dysphoric affect. Future research should expand upon these findings by evaluating the efficacy of these exposures in a clinical sample, and if reductions of ASCC following these challenges yield subsequent reductions in PTSD symptoms or suicidality.

There are several limitations to the present study. First, the sample was relatively homogeneous and composed of undergraduate students completing the study for course credit, and not necessarily seeking treatment. Though this sample was adequate to explore a novel intervention, future research should test the efficacy of these interventions in demographically diverse clinical samples. Second, these results were tested only immediately post-exposures; longer follow-ups are needed to determine the durability of these effects. Third, head-mounted displays may not be readily available at all clinics, so the dissemination and implementation of these techniques could face challenges. However, perceptual illusion devices are becoming more readily available, and many smartphones can quickly be turned into an augmented or virtual reality headset. Future research should seek to test the proposed exposures using a smartphone or other more common device, as this may facilitate dissemination.

Despite these limitations, the present study demonstrated that repeated exposures to perceptual illusion challenges may be an effective means to reduce ASCC, thereby providing an effective means to specifically target ASCC via exposure. Given that repeated exposure is among the most effective interventions for anxiety-related conditions (e.g., Craske et al., 2008; Foa & Kozak, 1986; McNally, 1990), and the clinical import of ASCC (Olatunji & Wolitzky-Taylor, 2009; Stanley et al., in press), these findings open an exciting avenue for future research on the use of repeated exposure to perceptual illusion challenges to augment treatments for suicidality, anxiety, mood, and trauma-related psychopathology.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

References

Albanese, B. J., Boffa, J. W., Macatee, R. J., & Schmidt, N. B. (2017). Anxiety sensitivity mediates gender differences in post-concussive symptoms in a clinical sample. *Psychiatry Research*, *252*, 242–246. https://doi.org/10.1016/j.psychres.2017.01.099

Albanese, B. J., Macatee, R. J., Allan, N. P., Short, N. A., Norr, A. M., & Schmidt, N. B. (2018). Interactive effects of anxiety sensitivity and attentional control on posttraumatic stress in community and clinical populations. *Psychiatry*, *81*(1), 71–84. https://doi.org/10.1080/00332747.2017.1309867

Albanese, B. J., Macatee, R. J., Boffa, J. W., Bryan, C. J., Zvolensky, M. J., & Schmidt, N. B. (2018). Interactive effects of traumatic brain injury and anxiety sensitivity on PTSD symptoms: A replication and extension in two clinical samples. *Cognitive Therapy and Research*, 1–14. https://doi.org/10.1007/s10608-017-9883-4

Albanese, B. J., Macatee, R. J., Schmidt, N. B., Leeson, B., Clemans, T. A., Mintz, J., & Bryan, C. J. (2017). Interactive effects of traumatic brain injury and anxiety sensitivity cognitive concerns on post-traumatic stress among active duty soldiers. *Cognitive Therapy and Research*, *41*(6), 902–910. https://doi.org/10.1007/s10608-017-9863-8

Albanese, B. J., Macatee, R. J., Stentz, L. A., Schmidt, N. B., & Bryan, C. J. (2019). Interactive effects of cumulative lifetime traumatic brain injuries and combat exposure on posttraumatic stress among deployed military personnel. *Cognitive Behaviour Therapy*, *48*(1), 77–88. https://doi.org/10.1080/16506073.2018.1478446

Allan, N. P., Albanese, B. J., Short, N. A., Raines, A. M., & Schmidt, N. B. (2015). Support for the general and specific bifactor model factors of anxiety sensitivity. *Personality and Individual Differences*, *74*, 78–83. https://doi.org/10.1016/j.paid.2014.10.003

Allan, N. P., Capron, D. W., Raines, A. M., & Schmidt, N. B. (2014). Unique relations among anxiety sensitivity factors and anxiety, depression, and suicidal ideation. *Journal of Anxiety Disorders*, *28*(2), 266–275.

Allan, N. P., Norr, A. M., Capron, D. W., Raines, A. M., Zvolensky, M. J., & Schmidt, N. B. (2015). Specific associations between anxiety sensitivity dimensions and fear and distress dimensions of emotional distress disorders. *Journal of Psychopathology and Behavioral Assessment*, *37*(1), 67–78. https://doi.org/10.1016/j.janxdis.2013.12.004

Allan, N. P., Short, N. A., Albanese, B. J., Keough, M. E., & Schmidt, N. B. (2015). Direct and mediating effects of an anxiety sensitivity intervention on posttraumatic stress disorder symptoms in trauma-exposed individuals. *Cognitive Behaviour Therapy*, *44*(6), 512–524. https://doi.org/10.1080/16506073.2015.1075227

American Psychiatric Association (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Washington, DC: Author.

Boffa, J. W., Norr, A. M., Raines, A. M., Albanese, B. J., Short, N. A., & Schmidt, N. B. (2016). Anxiety sensitivity prospectively predicts posttraumatic stress symptoms following a campus shooting. *Behavior Therapy*, *47*(3), 367–376. https://doi.org/10.1016/j.beth.2016.02.006

Capron, D. W., Allan, N. P., Ialongo, N. S., Leen-Feldner, E., & Schmidt, N. B. (2015). The depression distress amplification model in adolescents: A longitudinal examination of anxiety sensitivity cognitive concerns, depression and suicidal ideation. *Journal of Adolescence*, *41*, 17–24. https://doi.org/10.1016/j.adolescence.2015.02.001

Capron, D. W., Cougle, J. R., Ribeiro, J. D., Joiner, T. E., & Schmidt, N. B. (2012). An interactive model of anxiety sensitivity relevant to suicide attempt history and future suicidal ideation. *Journal of Psychiatric Research*, *46*(2), 174–180. https://doi.org/10.1016/j.jpsychires.2011.10.009

Capron, D. W., Fitch, K., Medley, A., Blagg, C., Mallott, M., & Joiner, T. E. (2012). Role of anxiety sensitivity subfactors in suicidal ideation and suicide attempt history. *Depression and Anxiety*, *29*(3), 195–201. https://doi.org/10.1002/da.20871

Capron, D. W., Kotov, R., & Schmidt, N. B. (2013). A cross-cultural replication of an interactive model of anxiety sensitivity relevant to suicide. *Psychiatry Research*, *205*(1-2), 74–78. https://doi.org/10.1016/j.psychres.2012.08.006

Capron, D. W., Norr, A. M., Albanese, B. J., & Schmidt, N. B. (2017). Fear reactivity to cognitive dyscontrol via novel head-mounted display perceptual illusion exercises. *Journal of Affective Disorders*, *217*, 138–143. https://doi.org/10.1016/j.jad.2017.03.068

Capron, D. W., Norr, A. M., Macatee, R. J., & Schmidt, N. B. (2013). Distress tolerance and anxiety sensitivity cognitive concerns: Testing the incremental contributions of affect

dysregulation constructs on suicidal ideation and suicide attempt. *Behavior Therapy*, *44*(3), 349–358. https://doi.org/10.1016/j.beth.2012.12.002

Capron, D. W., Norr, A. M., Zvolensky, M. J., & Schmidt, N. B. (2014). Prospective evaluation of the effect of an anxiety sensitivity intervention on suicidality among smokers. *Cognitive Behaviour Therapy*, *43*(1), 72–82. https://doi.org/10.1080/16506073.2013.777466

Craske, M. G., & Barlow, D. H. (2006). *Treatments that work: Master of your anxiety and worry* (2 ed.). London: Oxford University Press.

Craske, M. G., Kircanski, K., Zelikowsky, M., Mystkowski, J., Chowdhury, N., & Baker, A. (2008). Optimizing inhibitory learning during exposure therapy. *Behaviour Research and Therapy*, *46*(1), 5–27. https://doi.org/10.1016/j.brat.2007.10.003

Foa, E. B., & Kozak, M. J. (1986). Emotional processing of fear: exposure to corrective information. *Psychological Bulletin*, *99*, 20–35. https://doi.org/10.1037/0033-2909.99.1.20

Hayes, A. F. (2012). *PROCESS: A versatile computational tool for observed variable mediation, moderation, and conditional process modeling*. University of Kansas, KS.

Holloway, W., & McNally, R. J. (1987). Effects of anxiety sensitivity on the response to hyperventilation. *Journal of Abnormal Psychology*, *96*(4), 330. https://doi.org/10.1037/0021-843X.96.4.330

Leonard, K. N., Telch, M. J., & Harrington, P. J. (1999). Dissociation in the laboratory: A comparison of strategies. *Behaviour Research and Therapy*, *37*(1), 49–61. https://doi.org/10.1016/S0005-7967(98)00072-2

Leonard, K. N., Telch, M. J., & Owen, K. K. (2000). Fear response to dissociation challenge. *Anxiety, Stress and Coping*, *13*(4), 355–369. https://doi.org/10.1080/10615800008248341

Lickel, J., Nelson, E., Lickel, A. H., & Deacon, B. (2008). Interoceptive exposure exercises for evoking depersonalization and derealization: A pilot study. *Journal of Cognitive Psychotherapy*, *22*(4), 321.

McNally, R. J. (1990). Psychological approaches to panic disorder: A review. *Psychological Bulletin*, *108*(3), 403. https://doi.org/10.1037/0033-2909.108.3.403

McNally, R. J., & Eke, M. (1996). Anxiety sensitivity, suffocation fear, and breath-holding duration as predictors of response to carbon dioxide challenge. *Journal of Abnormal Psychology*, *105*(1), 146. https://doi.org/10.1037/0021-843X.105.1.146

Mitchell, M. A., Capron, D. W., Raines, A. M., & Schmidt, N. B. (2014). Reduction of cognitive concerns of anxiety sensitivity is uniquely associated with reduction of PTSD and depressive symptoms: A comparison of civilians and veterans. *Journal of Psychiatric Research*, *48*(1), 25–31. https://doi.org/10.1016/j.jpsychires.2013.10.013

Norr, A. M., Albanese, B. J., Boffa, J. W., Short, N. A., & Schmidt, N. B. (2016). The relationship between gender and PTSD symptoms: Anxiety sensitivity as a mechanism. *Personality and Individual Differences*, *90*, 210–213. https://doi.org/10.1016/j.paid.2015.11.014

Oglesby, M. E., Capron, D. W., Raines, A. M., & Schmidt, N. B. (2015). Anxiety sensitivity cognitive concerns predict suicide risk. *Psychiatry Research*, *226*(1), 252–256. https://doi.org/10.1016/j.psychres.2014.12.057

Olatunji, B. O., & Fan, Q. (2015). Anxiety sensitivity and posttraumatic stress reactions: Evidence for intrusions and physiological arousal as mediating and moderating mechanisms. *Journal of Anxiety Disorders*, *34*, 76–85. https://doi.org/10.1016/j.janxdis.2015.06.002

Olatunji, B. O., & Wolitzky-Taylor, K. B. (2009). Anxiety sensitivity and the anxiety disorders: a meta-analytic review and synthesis. *Psychological Bulletin*, *135*(6), 974. https://doi.org/10.1037/a0017428

Olthuis, J. V., Watt, M. C., & Stewart, S. H. (2014). Anxiety Sensitivity Index (ASI-3) subscales predict unique variance in anxiety and depressive symptoms. *Journal of Anxiety Disorders*, *28*(2), 115–124. https://doi.org/10.1016/j.janxdis.2013.04.009

Reiss, S., Peterson, R. A., Gursky, D. M., & McNally, R. J. (1986). Anxiety sensitivity, anxiety frequency and the prediction of fearfulness. *Behavior Research and Therapy*, *24*(1), 1–8. https://doi.org/10.1016/0005-7967(86)90143-9

Schmidt, N. B. (1999). Examination of differential anxiety sensitivities in panic disorder: A test of anxiety sensitivity subdomains predicting fearful responding to a 35% CO_2 challenge. *Cognitive Therapy and Research*, *23*(1), 3–20. https://doi.org/10.1023/A:1018754522981

Schmidt, N. B., Capron, D. W., Raines, A. M., & Allan, N. P. (2014). Randomized clinical trial evaluating the efficacy of a brief intervention targeting anxiety sensitivity cognitive concerns. *Journal of Consulting and Clinical Psychology*, *82*(6), 1023–1033. https://doi.org/10.1037/a0036651

Schmidt, N. B., Lerew, D. R., & Jackson, R. J. (1997). The role of anxiety sensitivity in the pathogenesis of panic: prospective evaluation of spontaneous panic attacks during acute stress. *Journal of Abnormal Psychology*, *106*(3), 355. https://doi.org/10.1037/0021-843X.106.3.355

Schmidt, N. B., Lerew, D. R., & Jackson, R. J. (1999). Prospective evaluation of anxiety sensitivity in the pathogenesis of panic: replication and extension. *Journal of Abnormal Psychology*, *108*(3), 532. https://doi.org/10.1037/0021-843X.108.3.532

Schmidt, N. B., Lerew, D. R., & JoinerJr., T. E. (1998). Anxiety sensitivity and the pathogenesis of anxiety and depression: Evidence for symptom specificity. *Behaviour Research and Therapy*, *36*(2), 165–177. https://doi.org/10.1016/S0005-7967(98)00011-4

Schmidt, N. B., Norr, A. M., Allan, N. P., Raines, A. M., & Capron, D. W. (2017). Randomized clinical trial evaluating the efficacy of an automated intervention targeting anxiety sensitivity cognitive concerns for patients with suicidal ideation. *Journal of Consulting and Clinical Psychology*, *85*(6), 596–610. https://doi.org/10.1037/ccp0000195

Schmidt, N. B., & Trakowski, J. (2004). Interoceptive assessment and exposure in panic disorder: A descriptive study. *Cognitive and Behavioral Practice*, *11*(1), 81–92. https://doi.org/10.1016/S1077-7229(04)80010-5

Schmidt, N. B., Zvolensky, M. J., & Maner, J. K. (2006). Anxiety sensitivity: Prospective prediction of panic attacks and Axis I pathology. *Journal of Psychiatric Research*, *40*(8), 691–699. https://doi.org/10.1016/j.jpsychires.2006.07.009

Short, N. A., Boffa, J. W., Norr, A. M., Albanese, B. J., Allan, N. P., & Schmidt, N. B. (2017). Randomized clinical trial investigating the effects of an anxiety sensitivity intervention on posttraumatic stress symptoms: A replication and extension. *Journal of Traumatic Stress*, *30*(3), 296–303. https://doi.org/10.1002/jts.22194

Stanley, I. H., Boffa, J. W., Rogers, M. L., Hom, M. A., Albanese, B. J., Chu, C., Capron, D. W., Schmidt, N. B., & Joiner, T. E. (2019). Anxiety sensitivity and suicidal ideation/risk: A meta-analysis.*Journal of Consulting and Clinical Psychology* (in press)

Taylor, S., Koch, W. J., & McNally, R. J. (1992). How does anxiety sensitivity vary across the anxiety disorders? *Journal of Anxiety Disorders*, *6*(3), 249–259. https://doi.org/10.1016/0887-6185(92)90037-8

Taylor, S., Zvolensky, M. J., Cox, B. J., Deacon, B., Heimberg, R. G., Ledley, D. R., & Cardenas, S. J. (2007). Robust dimensions of anxiety sensitivity: development and initial validation of the Anxiety Sensitivity Index-3. *Psychological Assessment*, *19*(2), 176–188. https://doi.org/10.1037/1040-3590.19.2.176

Watson, D., O'Hara, M. W., Simms, L. J., Kotov, R., Chmielewski, M., McDade-Montez, E. A., & Stuart, S. (2007). Development and validation of the Inventory of Depression and Anxiety Symptoms (IDAS). *Psychological Assessment*, *19*(3), 253–268. https://doi.org/10.1037/1040-3590.19.3.253

Zvolensky, M. J., Feldner, M. T., Eifert, G. H., & Stewart, S. H. (2001). Evaluating differential predictions of emotional reactivity during repeated 20% carbon dioxide-enriched air challenge. *Cognition & Emotion*, *15*(6), 767–786. https://doi.org/10.1080/02699930143000284

Received: November 12, 2018
Accepted: April 16, 2019
Available online: 26 April, 2019