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Rethinking the Role of Worry in Generalized Anxiety Disorder: Evidence Supporting a Model of Emotional Contrast Avoidance

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The Contrast Avoidance model (Newman & Llera, 2011) proposes that individuals with generalized anxiety disorder (GAD) are hypersensitive to sharp upward shifts in negative emotion that typically accompany negative events, and use worry to maintain sustained intrapersonal negativity in an attempt to avoid these shifts. Although research shows that worry increases negative emotionality and mutes further emotional reactivity to a stressor when compared to the worry period (e.g., Llera & Newman, 2010), no study has tracked changes in negative emotionality from baseline to worry inductions followed by a range of emotional exposures. Further, no study has yet assessed participants' subjective appraisals of prior worry on helping to cope with such exposures. The present study tested the main tenets of the Contrast Avoidance model by randomly assigning participants with GAD (n = 48) and nonanxious controls (n = 47) to experience worry, relaxation, and neutral inductions prior to sequential exposure to fearful, sad, and humorous film clips. Both physiological (nonspecific skin conductance responses [NS-SCRs]) and self-reported emotional changes were observed. Results indicated that worry boosted negative emotionality from baseline, which was sustained across negative exposures, whereas low negative emotionality during relaxation and neutral inductions allowed for sharp increases in response to exposures. Furthermore, GAD participants found worry to be more helpful than other conditions in coping with exposures, whereas control participants reported the opposite pattern. Results provide preliminary support for the Contrast Avoidance model. This suggests that treatment should focus on underlying avoidance patterns before attempting to reduce worry behavior.

Keywords: generalized anxiety disorder; worry; emotion; contrast avoidance; skin conductance

A NUMBER OF MODELS HAVE POSITED that for those with GAD, the central feature of worry may be recruited as an attempt to manage overwhelming emotional experiences (e.g., Borkovec, Alcaine, & Behar, 2004; Mennin, Heimberg, Turk, & Fresco, 2005; Newman, Castonguay, Borkovec, & Molnar, 2004; Roemer, Salters, Raffa, & Orsillo, 2005). Indeed, despite its anxious associations, those with GAD endorse positive beliefs about worry, including its utility in coping with negative emotions (Borkovec & Roemer, 1995; Penney, Mazmanian, & Rudanycz, 2013). Some regulation models (e.g., Newman et al., 2004) have even suggested that worry functions to avoid or suppress negative emotions, based on experimental data showing that worry reduces emotional responding to a subsequent negative stressor when compared to the prior worrisome state (e.g., Borkovec & Hu, 1990).

Confounding the argument that worry facilitates emotional avoidance, however, is abundant evidence that worry creates and sustains negative emotionality. For example, a number of studies show that worry is physiologically activating, leading to increased sympathetic and decreased parasympathetic

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nervous system activity (Andor, Gerlach, & Rist, 2008; Brosschot, Van Dijk, & Thayer, 2007; Llera & Newman, 2010; Stapinski, Abbott, & Rapee, 2010). Worry is also subjectively activating, such that individuals with and without GAD self-report higher negative emotion when induced into a worried state (Andor et al., 2008; Borkovec, Lyonfields, Wiser, & Deihl, 1993; Llera & Newman, 2010). Moreover, negative affectivity is included in the definition of worry (Borkovec, Robinson, Pruzinsky, & DePree, 1983).

To clarify the inconsistency with regard to models of worry as emotional avoidance, Llera and Newman (2010) directly tested the effects of worry inductions on both emotional impact as well as subsequent responding to various emotional exposures. Both GAD analogues and nonanxious control participants were randomly assigned to worry, relaxation, or neutral inductions, and were subsequently exposed to standardized film clips representing fearful, sad, calm, and happy emotions. Emotional responding was measured in terms of self-reported negative affect and heart rate variability (HRV). Results showed that worry led to lower HRV (or vagal withdrawal, indicating a stress response) for the GAD group compared to relaxation (with neutral in between), and higher negative affect for all participants compared to both relaxation and neutral activity. Additionally, extending the results of Borkovec and Hu (1990) to a GAD sample, this study found that for both GAD and nonanxious groups, worry led to less physiological and subjective reactivity in response to the fearful exposure compared to relaxation when using the worry and relaxation periods as baselines. Worry also led to less subjective reactivity than both relaxation and neutral inductions in response to the sad exposure (but did not interfere with physiological responding).

If worry had suppressed negative emotionality during these film clips, then findings would have supported the view that worry facilitates emotional avoidance. However, absolute levels of emotionality during the film clips were equivalent regardless of prior induction type. In fact, data from Llera and Newman (2010) suggested that the worry induction boosted negative emotionality levels, which only precluded further increases in response to subsequent negative exposures. This indicates that worry not only failed to suppress or avoid emotion, but actually created a heightened negative emotional state that was sustained across the negative film clips. These data are synchronous with similar studies on worry and subsequent fear exposures (Peasley-Miklus & Vrana, 2000; Stapinski et al., 2010). In sum, findings from exposure studies dovetail with the perspective that worry prolongs negative emotion (Newman & Llera, 2011), based on data showing that negative emotions remain even following worry termination (Brosschot et al., 2007; Zoccola, Dickerson, & Yim, 2011).

Such findings led Newman and Llera (2011) to propose the Contrast Avoidance model of GAD (see also Newman, Llera, Erickson, Przeworski, & Castonguay, 2013), which builds upon earlier models of worry as an emotion regulation strategy (e.g., Borkovec et al., 2004). This model states that the emotional implications of worry for those with GAD represent neither failed nor successful attempts at emotional avoidance. Instead, the model posits that those with GAD engage in worry as a coping strategy to *perpetuate* negative emotions as a means to avoid negative emotional contrasts. A negative emotional contrast is experienced as a surge of negative emotion that is distinct from the valence of the preceding state, such as a shift from a positive or euthymic state to one that is anxious. However, such emotional contrast could be avoided if the current emotion was similar in strength and valence to the one that immediately preceded it.

The Contrast Avoidance model is based partly on early cognitive research on affective contrasts. Such research indicated that the perception of a stimulus could be moderated by its preceding state, such that an unpleasant stimulus was perceived as even more unpleasant if it followed a positive stimulus, and less unpleasant if it was preceded by something more noxious (Bacon, Rood, & Washburn, 1914; Manstead, Wagner, & MacDonald, 1983). For example, a surge of fear caused by a scary stimulus will be experienced more acutely if preceded by a pleasant or neutral state, or attenuated if preceded by an equally fearful state. In the latter case, it is important to recognize that feelings of fear are still experienced in the moment, but it is the perception of a *contrast* that has been averted.

According to the Contrast Avoidance model of GAD (Newman & Llera, 2011), because worry itself generates a negative intrapersonal state, a person who is chronically worried would experience less emotional contrast when encountering negative events (e.g., "If I already feel bad now because I'm worried, then I cannot feel much worse if something bad actually happens"). Importantly, this sequence does not constitute emotional avoidance because the worrier is actually experiencing *sustained* negative emotionality. Given data showing emotional hyperreactivity and modulation difficulties in GAD

(see Newman et al., 2013, for a review), the model proposes that those with GAD are more acutely sensitive to negative emotional contrasts than nonanxious individuals, and therefore may prefer to maintain a chronically negative state as a protective emotional defense against any possible future negative events. Furthermore, this behavior could also facilitate positive emotional contrasts, such that a person may feel a great sense of relief if anticipated negative events do not occur or events instead lead to positive outcomes. Both cases would lead to negative reinforcement of worry for those with GAD.

The purpose of the current study was to test the main tenets of the Contrast Avoidance model of GAD: (a) that worry leads to heightened negative emotionality, thereby preventing a negative emotional contrast in the event of a stressor, or facilitating a positive contrast in the event of a pleasant experience, and (b) that individuals with GAD find contrast avoidance to be more helpful in managing emotional stressors than nonanxious controls. Importantly, no previous study of worry prior to emotional exposures has assessed participants' subjective appraisals of worry on emotional coping during this sequence.

To test this theory, we replicated and extended the original study (Llera & Newman, 2010), which set the stage for the Contrast Avoidance model; however, the original study did not provide all of the data necessary to test all aspects of the theory. Similar to Llera and Newman (2010), in the current study participants with GAD and nonanxious controls were randomly assigned to worry, relaxation, or neutral inductions just before exposure to fearful, sad, and humorous film clips. These emotions were chosen to test the Contrast Avoidance model using a range of emotional situations. As an extension, a pre-worry baseline was added to directly measure the within-subject emotional impact of worry as compared to other inductions, as well as to provide a baseline comparison for emotionality experienced during the film clips.

In order to improve the measurement of physiological responding, the current study utilized nonspecific skin conductance responses (NS-SCRs), a marker of sympathetic activity. NS-SCRs have been found to be the most sensitive out of a wide range of physiological indices for distinguishing differences in responding to neutral conditions versus fearful or sad film clip exposures (Kreibig, Wilhelm, Roth, & Gross, 2007) and therefore this methodology most closely matched our study goals. In order to measure subjective responding, we extended prior findings by including a list of specific emotion adjectives (as opposed to general negative affect) to determine more explicit emotional effects within the study. Additionally, by observing response to the emotional film clips relative to baseline, we were able to explore whether worry led to reduced emotion (i.e., emotional avoidance) or led to similar emotional responding to film clips as compared to other induction types. If worry indeed created heightened negative emotion relative to baseline, and this emotion was then sustained across negative film clips, we could conclude that worry did not lead to emotional avoidance but rather precluded emotional contrasts in response to the negative film clip exposures.

Two other additions were included in the current study. To explore whether worry increased the probability of experiencing a positive emotional contrast (which might involve both a decrease in negative emotion and an increase in positive emotion) in response to the humorous film clip, we extended prior findings by measuring change in both positive and negative emotion in response to this clip. Finally, we also included a measure of participants' subjective appraisals of their overall experience of each induction type in terms of its impact on their ability to cope with the subsequent emotional exposures as a direct test of the Contrast Avoidance theory.

Hypotheses

The current study had four hypotheses. *Hypothesis 1*: For both GAD and nonanxious controls, relative to the resting baseline, worry inductions would lead to significantly greater increases in negative emotionality as compared to relaxation or neutral inductions. *Hypothesis 2*: Based on findings from Llera and Newman (2010), heightened negative emotionality during the worry induction would prevent a sharp increase in both physiological and subjective emotionality during the fearful exposure, and in subjective emotionality during the sad exposure (i.e., precluding negative emotional contrasts). In comparison, we predicted that lower negative emotion during relaxation and neutral inductions would facilitate stronger emotional contrasts in response to negative exposures. Importantly, we did not expect worry, relaxation, or neutral inductions to impact degree of change in emotion from resting baseline to the emotional film clips, in that individuals in all conditions would experience similar increases from baseline levels. Additionally, we expected to replicate Llera and Newman (2010) such that the effects of worry on physiological responding and emotion ratings associated with the film clips would be the same for both GAD and nonanxious groups.

Hypothesis 3. Worry would not interfere with responding to the humorous exposure (Llera &

Newman, 2010), but would facilitate a positive emotional contrast (i.e., a greater decrease in negative emotion relative to other induction types) for all participants. Of note, both fear and humor have been shown to produce a shift towards higher sympathetic activity (Kreibig et al., 2007; Newman & Stone, 1996), whereas studies on sadness are equivocal, showing both increases and decreases in electrodermal markers of sympathetic activity across different studies (Kreibig et al.).

Hypothesis 4. GAD and nonanxious groups would demonstrate divergent appraisals of worry inductions with respect to coping with the emotional film clips. Those with GAD would experience prior worry as *more helpful* in coping with emotional exposures than would nonanxious control participants, and would report relaxation and neutral inductions to be *less helpful* than would nonanxious controls.

Research Design and Method

OVERALL DESIGN

A 2 (group: GAD vs. nonanxious) × 3 (induction type: worry, relax, or neutral) block design was used to explore the differential effects of worry, relaxation, and neutral inductions on reactivity to three different subsequent emotional stimuli (fear, sadness, and humor) in both individuals with GAD and nonanxious controls.

PARTICIPANTS

Based on an a priori power analysis, it was determined that a sample size of at least 95 participants was required to observe a medium between-groups effect size (Cohen's $f = .30$) with an α-level of .05 and power of .80 (Faul, Erdfelder, Lang, & Buchner, 2007). The 95 participants (68 females; *M* age = 19.03 years, *SD* = 1.71 years) were recruited from introductory psychology courses at a rural state university. Students were given class credit as compensation for their participation. The ethnic distribution of participants was 85.3% Caucasian, 6.3% African American, 6.3% Asian, 1.1% Latino(a), and 1.1% other ("mixed race").

Participants were selected based on their scores on the Generalized Anxiety Disorder Questionnaire-IV (GAD-Q-IV; Newman et al., 2002) and the Penn State Worry Questionnaire (PSWQ; Meyer, Miller, Metzger, & Borkovec, 1990). Scores from these measures were used to assign participants to either the GAD ($n = 48$) or nonanxious control group ($n = 47$). Individuals were included in the GAD group if they scored above the cutoff of 5.7 on the GAD-Q-IV ($M = 13.27$, $SD = 1.59$), endorsed symptoms for at least 6 months, and answered affirmatively to each of the first 4 questions on the GAD-Q-IV representing the major diagnostic criteria for GAD (i.e., Do you experience excessive worry? Is your worry excessive in intensity, frequency, or amount of distress it causes? Do you find it difficult to control your worry [or stop worrying] once it starts? Do you worry excessively and uncontrollably about minor things such as being late for an appointment, minor repairs, homework, etc.?). In the current study, the GAD group mean (13.27) was well above the recommended cutoff score of several studies (Moore, Anderson, Barnes, Haigh, & Fresco, 2014; Newman et al., 2002). These participants also scored at least one standard deviation above the overall mean (GAD group: $M = 68.29$, $SD = 6.22$) on the PSWQ. Mean PSWQ scores for the GAD group were comparable to mean levels of those with clinically diagnosed GAD (see Startup & Erickson, 2006).

Individuals were included in the control group if they answered negatively to the first 4 questions and scored below the 5.7 cutoff on the GAD-Q-IV ($M = 1.64$, $SD = 1.74$), and within a standard deviation below the overall mean on the PSWQ (control group: $M = 35.09$, $SD = 4.94$). Mean PSWQ scores for our nonanxious group were comparable to those groups selected for nonanxious status (see Startup & Erickson, 2006). Selection criteria were identical to those used in Llera and Newman (2010). There were no significant differences between GAD (worry = 16, relax = 16, neutral = 16) and nonanxious participants (worry = 15, relax = 16, neutral = 16) in age, gender, or ethnicity. Similarly, there were no demographic differences between those who were randomly assigned to the worry ($n = 31$), relaxation ($n = 32$), or neutral ($n = 32$) conditions.

Additional participant variables were considered that could impact findings. Data show that GAD commonly presents with comorbidity (Kessler et al., 2012; Newman, Przeworski, Fisher, & Borkovec, 2010). Nonetheless, because depression is associated with diminished reactivity to anxious stimuli (Rottenberg, Gross, & Gotlib, 2005) and may hinder emotional processing (Foa & Kozak, 1986), all participants were tested for comorbid depressed mood using the Beck Depression Inventory (BDI; Beck, Rush, Shaw, & Emery, 1979). Furthermore, although use of psychiatric medication may impact physiological responding to emotional stressors (Clemens & Selesnick, 1967; Licht, Penninx, & de Geus, 2012), a large prospective study found that 33% of individuals with GAD and 47% of those with GAD and comorbid depression took psychiatric medications (Moffitt et al., 2007). Thus, in

order to maximize the likelihood that results would generalize to others with GAD, both comorbid depression and medication use were allowed, but data were explored to determine the possible influence of these factors on emotional responding.

Selection Criteria

The GAD-Q-IV (Newman et al., 2002) is a 9-item self-report questionnaire based on criteria for GAD as delineated in the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-IV; American Psychiatric Association, 1994). Internal consistency (Cronbach's alpha = .94) and 2-week retest reliability (92% of the sample) are strong. In addition, the measure has demonstrated convergent and discriminant validity, and kappa agreement of .67 with a structured interview. A cutoff of 5.7 leads to sensitivity of 83% and specificity of 89%. Students diagnosed with GAD by the GAD-Q-IV were similar to a GAD community sample, and both groups scored higher than non-GAD students, demonstrating clinical validity of the GAD-Q-IV (Newman et al.).

The PSWQ (Meyer, Miller, Metzger, & Borkovec, 1990) is a 16-item self-report inventory designed to assess trait worry and to measure the generality, excessiveness, and uncontrollability characteristics of pathological worry. Factor analysis indicates that the PSWQ assesses a unidimensional construct with an internal consistency coefficient of .91 (Meyer et al., 1990). High retest reliability (ranging from .74–.93 across 2–10 weeks) was also demonstrated (Molina & Borkovec, 1994). The PSWQ has also been shown to distinguish individuals with GAD from each of the other anxiety disorder groups (Brown, Antony, & Barlow, 1992). Correlations between the PSWQ and measures of anxiety, depression, and emotional control supported the convergent and discriminant validity of the measure (Brown et al., 1992).

The BDI (Beck et al., 1979) assesses the presence and severity of affective, cognitive, motivational, vegetative, and psychomotor components of depression. Items are ranked on a scale of severity from 0 to 3. Retest reliabilities range from .48 for psychiatric patients after 3 weeks to .74 for undergraduate students after 3 months (Beck, Steer, & Garbin, 1988). The BDI has high concurrent validity with other measures of depression and there is evidence that it discriminates psychiatric from nonpsychiatric patients (Beck et al., 1988).

MANIPULATION CHECK MEASURES

In order to ensure that inductions were successful, participants were given a manipulation check immediately following each induction period. This measure consisted of three 5-point Likert scales (ranging from "not at all" to "definitely") assessing levels of anxiety, worry, and relaxation experienced as a result of the induction period. This measure was similar to that used in Llera and Newman (2010).

EMOTION-ELICITING STIMULI

To ensure consistency of emotional exposure across participants, the current study utilized standardized film clips as emotional stimuli. Participants viewed three brief film clips (ranging in length from 120 to 165 seconds) representing fearful, sad, and humorous emotions as a within-subjects variable. These film clips have been successful at eliciting the desired emotions in a number of previous studies (Gross & Levenson, 1997; Llera & Newman, 2010). Clips include scenes of a plane crash (fear), a son grieving over his dying father (sadness), and slapstick comedy (humor). The clips were presented in counterbalanced order.

SELF-REPORT EMOTION MEASURES

Emotion Adjectives

We adapted our subjective emotion measures from a self-report emotional response inventory first used by Gross and Levenson (1993). The inventory consisted of 8 emotion terms: *amusement, anger, contentment, disgust, fear, happiness, sadness,* and *tension*. Participants rated the greatest amount of each emotion they felt using an anchored 9-point Likert scale (0 = *none* and 8 = *the most in my life*).

Contrast Avoidance Questionnaire

In order to determine the extent to which worry, relaxation, and neutral inductions helped participants cope with exposure to the subsequent film clips, a questionnaire was created using questions adapted from the Why Worry Scale–II (Gosselin et al., 2003). This questionnaire asked participants to use a 5-point Likert scale ranging from "not at all true" to "absolutely true" to rate the extent to which their assigned induction type helped them cope with their emotions when negative events occurred in the film clips. Three items targeted the extent to which prior inductions facilitated emotional coping during the films (e.g., led to feeling *less* upset by negative events in the film clips). Three reverse-scored items targeted the opposite effect. Depending upon induction condition, participants were asked questions based on the effect of their assigned induction type (e.g., "*Because I was in a relaxed state…*" versus "*Because I was already worrying…*"). The responses to the contrast avoidance questions were summed to create a total score.

Higher scores suggested that individuals found inductions to be *more* helpful in coping with negative emotional exposures, whereas low scores suggested inductions were found to be unhelpful in coping with exposures. In order to maximize reliability of the measure, one of the reverse-scored items with low item-total correlations was removed from final analyses, leaving 5 total items. Internal consistency reliability for the emotional coping scale total was high (.73). Each remaining item also demonstrated high and significant item-total correlations, ranging from .57 to .74 ($p < .001$ for all items). Also, using prescreening data, the Contrast Avoidance Questionnaire correlated significantly with the Penn State Worry Questionnaire ($r = .508$, $p < .001$) and the GADQ-IV ($r = .488$, $p < .001$), demonstrating convergent validity.

PHYSIOLOGICAL MEASURES

Electrodermal activity was monitored throughout the experiment using a Biopac Isolated Amplifier (MP30; Biopac Systems Inc., Santa Barbara, CA) at a sampling rate of 500Hz. Two Ag–AgCl electrodes filled with isotonic NaCl electrode gel were placed on the distal phalanges of the index and middle finger of the nondominant hand. The presence of NS-SCRs was determined using a minimal amplitude value of 0.05 microSiemens (μS). Once responses were identified, amplitude was quantified by measuring the difference between the zero-slope onset and the peak of the wave in μS. Amplitude was averaged for all responses within a given time period. Considering that skin conductance data are frequently found to be positively skewed and leptokurtic (Venables & Christie, 1980), a log transformation was performed on all physiological data. For the purposes of this study, we used short-term recordings (60 seconds) to observe amplitude average of NS-SCRs. Recordings were taken during the baseline periods, induction periods, and emotional exposures.

PROCEDURE

Participants were informed that they would be tested individually in a study of how people respond to movie scenes, and were randomly assigned to receive worry, relaxation, or neutral inductions as a between-subjects variable. After obtaining informed consent, participants washed their hands with nonabrasive soap, then were fitted with psychophysiology-monitoring equipment and seated facing a computer. The monitored arm rested on an adjacent table, and they were instructed to keep their arm still during periods of recording.

Participants completed a demographic information sheet and the BDI, followed by a 5-minute acclimation period. The last minute was used as baseline, and participants then completed ratings of anxiety, worry, relaxation, and emotion levels. Next, participants were trained in their assigned induction task (either worry, relaxation, or neutral activity), and practiced this task for 1 minute. Instructions were given for worrying ("think about your most worrisome topic and worry about it as intensely as you can"), relaxing (instructions on slowed diaphragmatic breathing), or neutral activity (reading a series of neutral informational passages). Prior to this experiment, neutral passages were pilot tested to verify their emotional neutrality. Participants were informed that if at any point their mind wandered off task, they were to refocus their thoughts on the task. Our worry, relaxation, and neutral inductions were congruent with those used in previous studies (e.g., Llera & Newman, 2010).

Following training, participants began with a 1-minute self-administered induction, followed by a manipulation check and emotion ratings. They then viewed the first emotional film clip and completed ratings targeting how they felt during the film clip. This was followed by a 1-minute distracter task (a neutral segment excerpted from the same film as the exposure).

To begin the next segment, participants were asked to reengage in their assigned worry, relaxation, or neutral induction task for 1 minute and repeat the same procedure until all three emotion exposures (fearful, sad, and humorous) were played. Film clips were presented in counterbalanced order. Participants were then asked to complete the Contrast Avoidance Questionnaire. At the end of the session, physiological monitors were removed and participants were fully debriefed. Care was taken that participants were not experiencing lingering and distressing negative emotions, and counselors were available if necessary.

DATA SCORING AND ANALYSIS

First, to measure the effectiveness of worry, relaxation, and neutral inductions, a MANOVA was run using log-transformed manipulation check data as the dependent variables, and group and induction type as the independent variables. In order to test Hypothesis 1 (that worry would lead to heightened negative emotionality), Hypothesis 2 (that heightened negative emotion caused by worry would preclude negative emotional contrasts to negative exposures), and Hypothesis 3 (that worry would facilitate a positive emotional contrast to a

positive stimulus), we used change scores for all emotion variables to control for individual differences. To measure the emotional impact of each induction type, change scores were created by subtracting baseline levels from induction period levels (collapsed across induction periods administered across the study protocol). Next, to measure the effect of induction condition on emotional response to the film clips, change scores were created for each emotional exposure by subtracting the preceding induction levels. Lastly, in order to observe overall emotional responding to film clips regardless of prior induction type, change scores were created by subtracting baseline emotion levels from each film clip exposure period.

Several participants evidenced missing segments of NS-SCR data due to recording error, and were therefore excluded from physiological analyses via listwise deletion. When measuring the effects of inductions, we excluded 2 participants from the control group (one of whom was a statistical outlier), and 2 participants from the GAD group. For the exposures, we excluded 2 control and 2 GAD participants from the fear clip, 2 control and 3 GAD participants from the sad clip, and 2 control and 4 GAD participants from the humorous clip. Although this may have reduced power, overall we used a sample of 45 control participants and approximately 45 participants with GAD.

Once data were scored, we first ran a series of MANCOVAs using change scores as the dependent variables, and group and induction type as the independent variables, while controlling for baseline BDI scores. Also, psychiatric medication use (0 = *does not take medications*, 1 = *takes at least one medication*) was entered as a covariate for all physiological data analyses. Next, we ran all analyses without controlling for these variables. Because none of our results changed, we report all findings without controlling for baseline BDI and medication use. We first measured the emotional impact of the worry, relaxation, and neutral induction periods overall, followed by separate analyses examining subsequent responses to the fearful, sad, and humorous film clips. Significant findings were further explored with follow-up univariate ANOVAs. If no clear significant differences were found between induction conditions, we used repeated measures ANOVAs with group and induction type as between-subject and time (from induction to film exposure) as within-subject variables to determine whether subjects experienced significant emotional responding irrespective of induction condition.

In order to test Hypothesis 4 (that individuals with GAD would report contrast avoidance to be more helpful in coping with negative exposures than would controls), an ANOVA was run using group and induction type as the independent variables and scores on the Contrast Avoidance Questionnaire as the dependent variable. In all analyses, significant effects were investigated further using post hoc analyses. In order to avoid chance effects, Bonferroni adjustments were used when comparing more than two groups in the same analysis.

Results

BASELINE

As expected, individuals with GAD had significantly higher BDI scores at baseline (M = 10.23, SD =7.94) than did nonanxious participants (M = 3.27, SD = 3.88), $F(1, 93) = 30.97$, $p < .001$, $\eta_p^2 = .26$. Although the overall means for each group were within the normal to low range of depressed mood, it should be noted that 18.75% of individuals in the GAD group had scores reflecting moderate to severe levels of depression (M = 22.78, SD = 4.94). However, there were no differences across worry, relaxation, or neutral induction conditions, $F(2, 92) = 1.40$, $p = .252$, $\eta_p^2 = .03$. Also as expected, participants in the GAD group reported taking medications more frequently than those in the control group, $F(1, 93) = 5.32$, $p = .023$, $\eta_p^2 = .06$, but there were no differences across worry, relax, or neutral induction conditions, $F(2, 92) = .84$, $p = .435$, $\eta_p^2 = .02$.

Further, as expected, individuals with GAD reported significant differences from the control group in additional baseline variables, including higher baseline levels of *worry*, $F(1, 93) = 4.14$, $p = .045$, $\eta_p^2 = .05$ (GAD: M = 1.47, SD = .65; Control: M = 1.24, SD = .57), and lower levels of *relaxation*, $F(1, 93) = 4.83$, $p = .031$, $\eta_p^2 = .05$ (GAD: M = 3.23, SD = 1.09; Control: M = 3.63, SD = .80). Similarly, the GAD group reported lower baseline levels of *contentment*, $F(1, 92) = 8.40$, $p = .005$, $\eta_p^2 = .09$ (GAD: M = 3.28, SD = 2.29; Control: M = 4.30, SD = 1.84), and *happiness*, $F(1, 92) = 5.53$, $p = .021$, $\eta_p^2 = .06$ (GAD: M = 2.89, SD = 1.95; Control: M = 3.83, SD = 1.81), and higher levels of *sadness*, $F(1, 92) = 11.26$, $p = .001$, $\eta_p^2 = .12$ (GAD: M = 1.45, SD = .83; Control: M = 1.04, SD = .29), than controls. However, there were no differences between worry, relaxation, and neutral induction conditions. Also, there were no differences between groups or induction conditions on resting physiological arousal levels.

Table 1
Manipulation Check Scores by Group and Induction Type

Manipulation Scale	Induction Type (M[SE])			Group (M[SE])	
	Worry	Neutral	Relax	GAD	Control
Anxiety	2.74 (.76)	1.56 (.95)	1.43 (.53)	2.16 (1.01)	1.72 (.88)
Worry	3.0 (.90)	1.20 (.60)	1.22 (.39)	1.98 (1.14)	1.73 (1.04)
Relaxation	1.98 (.66)	3.14 (1.16)	3.58 (.95)	2.55 (1.14)	3.18 (1.09)

Note. Although manipulation check scores were log-transformed to correct for violations of normality, all scores are reported here in non-transformed values.

MANIPULATION CHECK

In testing the effectiveness of worry, relaxation, and neutral inductions, there was a main effect of group, $F(1, 84) = 4.04$, $p = .01$, $\eta_p^2 = .13$, and induction type, $F(2, 83) = 15.71$, $p < .001$, $\eta_p^2 = .37$, but no interaction. During inductions, participants with GAD reported greater levels of worry, $F(1, 84) = 3.98$, $p = .049$, $\eta_p^2 = .05$, and anxiety, $F(1, 84) = 8.53$, $p = .005$, $\eta_p^2 = .10$, and less relaxation, $F(1, 84) = 10.35$, $p = .002$, $\eta_p^2 = .12$, than controls, regardless of induction type. However, for both groups, inductions had the expected effects with those in the worry condition reporting more worry, $F(2, 83) = 87.45$, $p < .001$, $\eta_p^2 = .69$, and anxiety, $F(2, 83) = 33.37$, $p < .001$, $\eta_p^2 = .46$, than those in the relaxation and neutral conditions (post hoc: $p < .001$ for all comparisons), and those in the relaxation and neutral conditions reported more relaxation, $F(2, 83) = 23.8$, $p < .001$, $\eta_p^2 = .37$, than those in the worry condition (post hoc: $p < .001$ for both). Scores did not differ between the relaxation and neutral inductions on any variables (see Table 1). There were no significant changes in manipulation check scores from the first to the last induction, suggesting that induction effects did not diminish over time.

EFFECT OF INDUCTIONS

Subjective Measures

For both GAD and nonanxious groups, there was a significant main effect of induction type, $F(2, 85) = 4.72$, $p < .001$, $\eta_p^2 = .33$. Supporting Hypothesis 1, worry led to greater increases from baseline in reported levels of *anger*, $F(2, 85) = 10.22$, $p < .001$, $\eta_p^2 = .20$, *disgust*, $F(2, 85) = 8.60$, $p < .001$, $\eta_p^2 = .17$, *fear*, $F(2, 85) = 24.62$, $p < .001$, $\eta_p^2 = .38$, *sadness*, $F(2, 85) = 25.59$, $p < .001$, $\eta_p^2 = .38$, and *tension*, $F(2, 85) = 17.86$, $p < .001$, $\eta_p^2 = .30$, and a greater decrease in levels of *contentment*, $F(2, 85) = 13.05$, $p < .001$, $\eta_p^2 = .24$, than did relaxation and neutral conditions. Subjective effects of relaxation and neutral conditions were statistically similar (see Table 2).

Physiological Measures

Lending partial support to Hypothesis 1, there was a marginally significant effect of induction type on change in NS-SCR amplitude, $F(2, 88) = 2.97$, $p = .057$, $\eta_p^2 = .07$. When comparing worry and relaxation inductions directly, on average worry led to an increase in skin conductance responding whereas relaxation led to a decrease, $F(1, 58) = 3.34$, $p = .073$, $\eta_p^2 = .06$. Those in the neutral condition

Table 2
Change Scores in Emotion Adjectives from Baseline to Induction, with Post Hoc Analyses

Emotion	Induction Type (M[SE])			Bonferroni-corrected *p*-values		
	Worry	Relax	Neutral	W vs. R	W vs. N	R vs. N
Amused	-.41(.24)	-.32(.24)	.21(.24)	1.0	.13	.46
Anger	1.06(.24)	.10(.23)	-.02(.24)	.002	<.001	1.0
Contentment	-2.21(.29)	-.58(.28)	-.55(.29)	<.001	<.001	1.0
Disgust	.86(.20)	.01(.19)	.01(.20)	.001	.002	1.0
Fear	1.55(.23)	.02(.22)	-.14(.22)	<.001	<.001	1.0
Happy	-1.49(.29)	-.74(.29)	-.83(.29)	.23	.40	1.0
Sadness	1.45(.20)	-.16(.19)	.01(.19)	<.001	<.001	1.0
Tension	1.23(.26)	-.38(.26)	-.46(.26)	<.001	<.001	1.0

Note. Although emotion adjective scores were log-transformed to correct for violations of normality, all scores are reported here in non-transformed values. W = worry, R = relax, N = neutral.

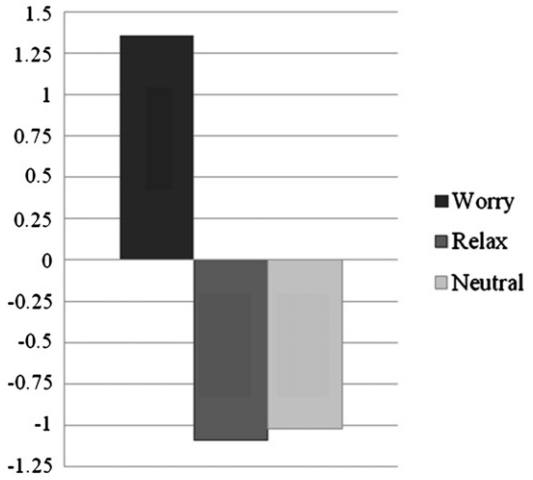


FIGURE 1 Change from baseline to the induction period in average amplitude of NS-SCRs, averaged across trials.

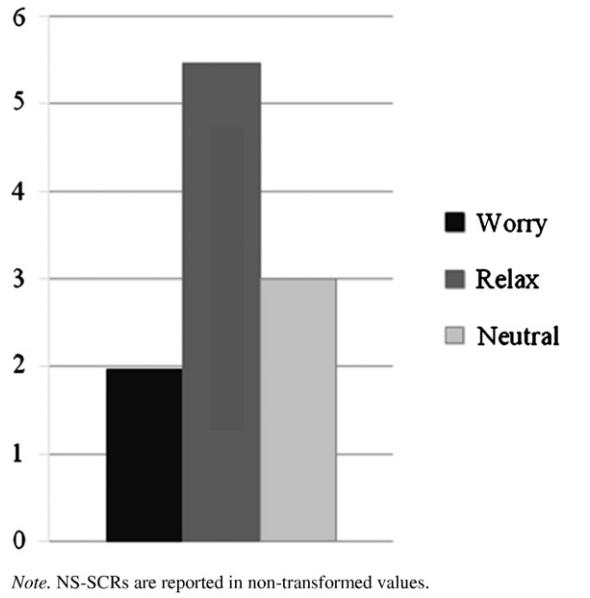


FIGURE 3 Change in average amplitude of NS-SCRs from the induction period to the fear exposure.

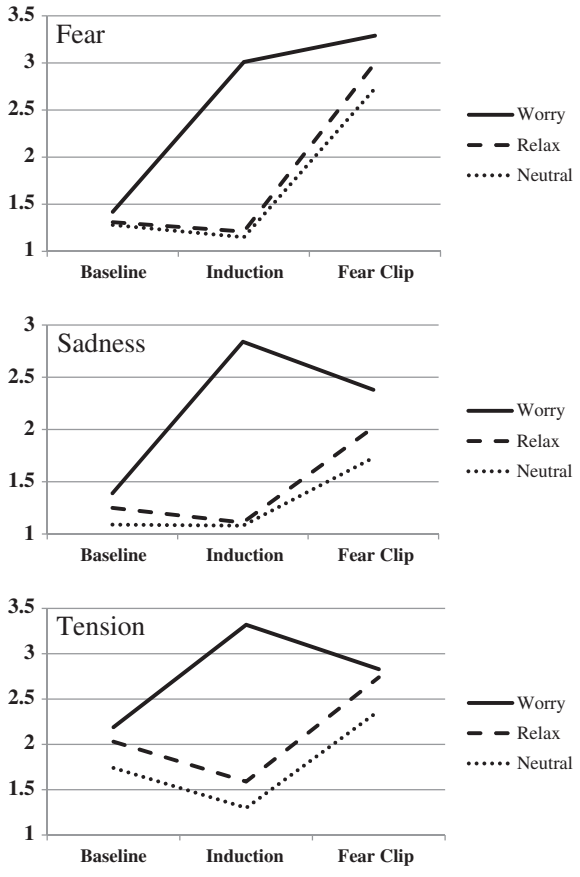


FIGURE 2 Change in reported levels of fear, sadness, and tension from baseline to the induction period to the fear exposure.

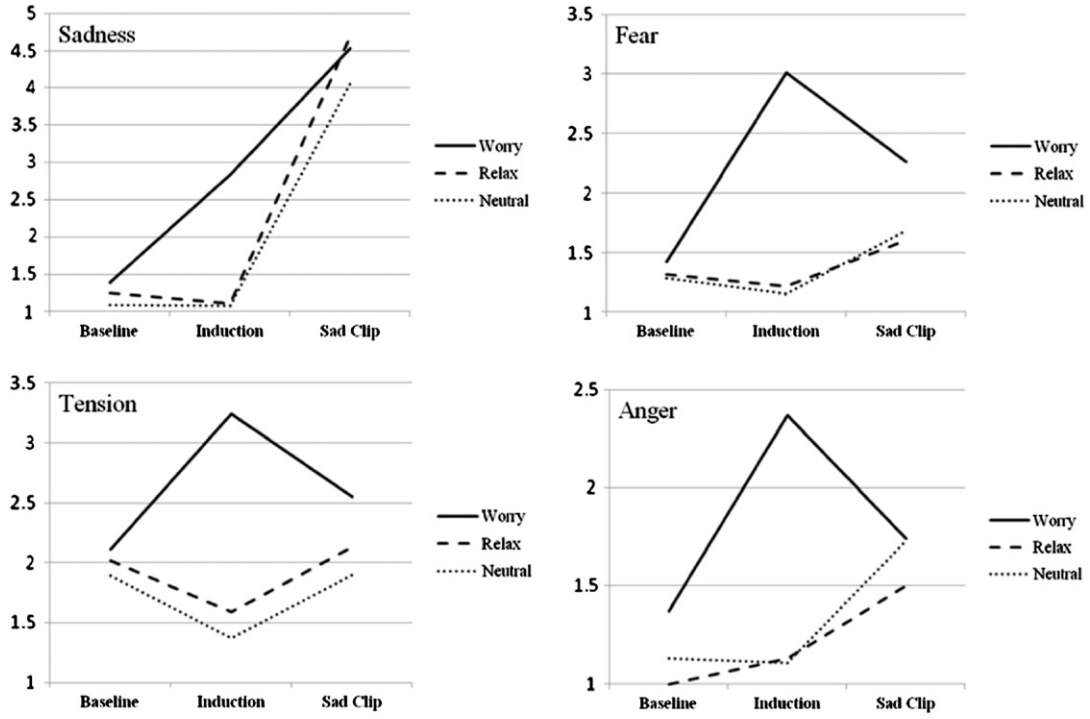
also experienced a mean decrease in skin conductance responding, although it was not significantly different from either the worry (p = 1.0) or relaxation conditions (p = .09) (Figure 1).

RESPONSE TO EMOTIONAL EXPOSURES

Fear Exposure

Subjective Measures. For both GAD and nonanxious subjects, there was a main effect of induction condition on response to the fearful film clip, $F(2, 83) = 1.94$, $p = .021$, $\eta_p^2 = .17$. As predicted in Hypothesis 2, relaxation and neutral inductions facilitated similarly stronger responding to the fear exposure than the worry induction in terms of reported *fear,* $F(2, 83) = 9.18$, $p < .001$, $\eta_p^2 = .19$ (R vs. W: $p < .001$; N vs. W: $p = .003$), *sadness,* $F(2, 83) = 6.21$, $p = .003$, $\eta_p^2 = .13$ (R vs. W: $p = .004$; N vs. W: $p = .020$), and *tension,* $F(2, 83) = 7.70$, $p = .001$, $\eta_p^2 = .16$ (R vs. W: $p = .002$; N vs. W: $p = .004$). In comparison, the worry induction resulted in little change from previously high negative emotion levels in response to the fear clip. However, as predicted, there were no significant differences between groups ($p = .749$) or prior induction types ($p = .834$) in change from baseline levels of any emotions during the fear exposure (Figure 2).

Physiological Measures. Lending partial support to Hypothesis 2, there was a marginally significant effect of induction type for change in average amplitude of NS-SCRs in response to the fear clip, $F(2, 87) = 2.68$, $p = .074$, $\eta_p^2 = .06$. When comparing worry and relaxation inductions directly, on



Note. Emotion adjective scores are reported in non-transformed values.

FIGURE 4 Change in reported levels of sadness, fear, tension and anger from baseline to the induction period to the sad exposure.

average the marginally lower NS-SCR amplitude during prior relaxation facilitated significantly greater increases in response to the fear exposure than the worry condition, $F(1, 58) = 5.63$, $p = .021$, $\eta_p^2 = .09$. Those in the neutral induction also experienced an increase that fell nonsignificantly in between worry ($p = .383$) and relaxation ($p = 1.0$) conditions (Figure 3). Again, as predicted, there were no significant differences between GAD and control groups ($p = .857$) or prior induction types ($p = .344$) in terms of change from baseline NS-SCR amplitude during the fearful exposure.

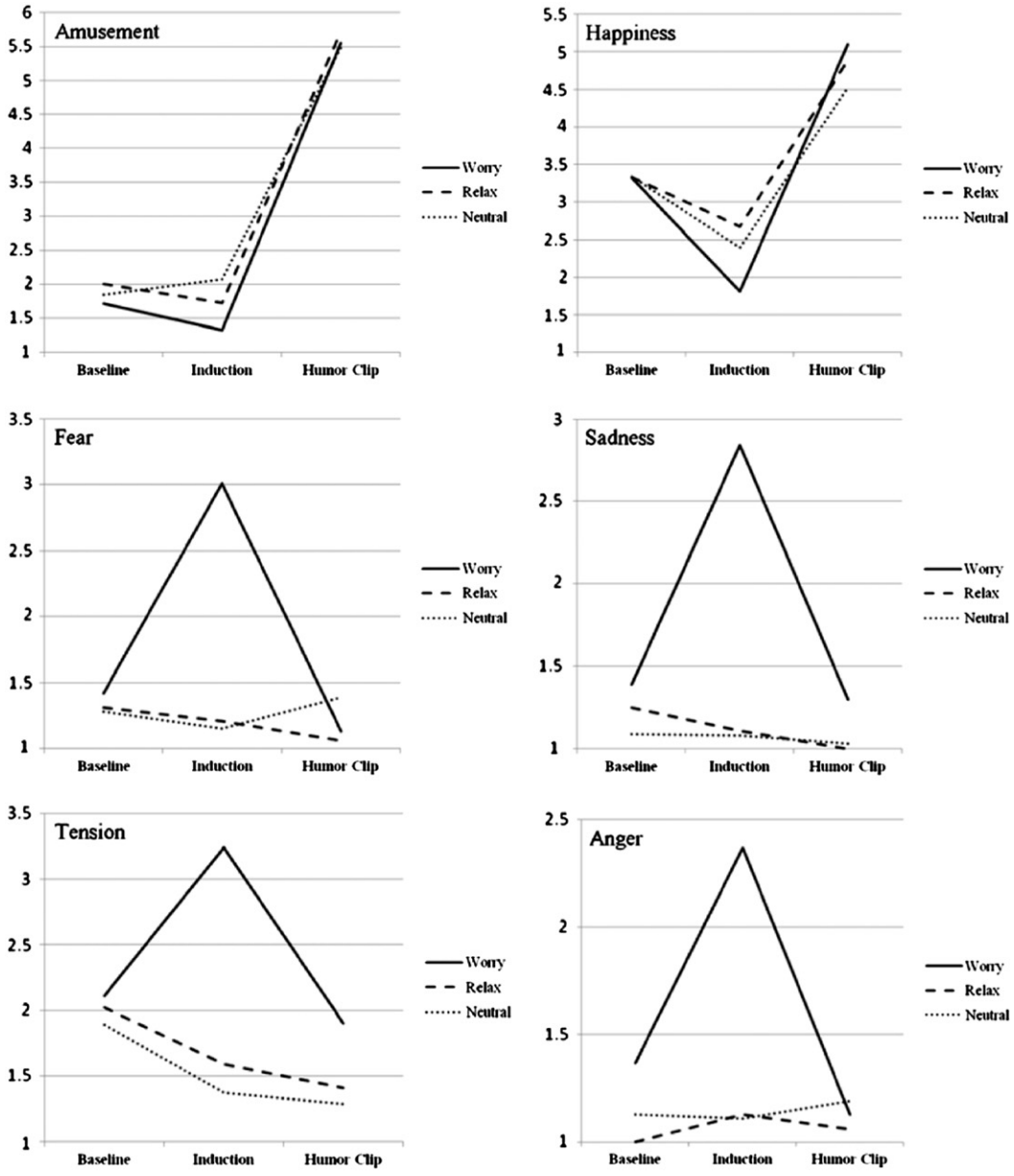
Sad Exposure

Subjective Measures. There was a main effect of induction condition for emotion ratings, $F(2, 85) = 3.30$, $p < .001$, $\eta_p^2 = .26$. As predicted in Hypothesis 2, relaxation and neutral inductions facilitated similarly greater responding to the sad exposure than the worry condition for reported *sadness*, $F(2, 85) = 16.69$, $p < .001$, $\eta_p^2 = .29$ (post hoc: $p < .001$ for both). Although those in the worry condition also experienced an increase in *sadness* in response to the exposure (even considering previously high levels during worry), this increase was significantly smaller than in other conditions. As for other subjective emotions, compared to worry, prior relaxation and neutral conditions both led to greater increases in levels of *fear*, $F(2, 85) = 10.68$, $p < .001$, $\eta_p^2 = .21$ (post hoc: $p < .001$ for both), *tension*, $F(2, 85) = 7.62$, $p = .001$, $\eta_p^2 = .16$ (R vs. W: $p = .001$; N vs. W: $p = .006$), and *anger*, $F(2, 85) = 6.77$, $p = .002$, $\eta_p^2 = .14$ (R vs. W: $p = .005$; N vs. W: $p = .01$). However, as predicted, there were no significant differences between groups ($p = .13$) or prior induction types ($p = .73$) in change from baseline levels of any emotion adjectives during the sad exposure (Figure 4).

Physiological Measures. As expected, there were no main effects of group or induction type when comparing change in physiological responding from the induction to the sad exposure. A repeated measures ANOVA revealed no significant effects of time, time-by-induction condition, or time-by-group-by-induction condition. Also, there were no significant differences between groups ($p = .22$) or prior induction types ($p = .52$) in terms of change from baseline NS-SCR amplitude during the sad exposure.

Humorous Exposure

Subjective Measures. Overall, there was a significant main effect for induction condition on



Note. Emotion adjective scores are reported in non-transformed values.

FIGURE 5 Change in reported levels of emotion adjectives from baseline to the induction period to the humorous exposure.

subjective emotion ratings during the humor exposure, $F(2, 85) = 4.29$, $p < .001$, $\eta_p^2 = .31$. For positive emotions, such as *happiness* and *amusement*, there were no significant effects of group or induction type, but all participants experienced significant increases in *happiness,* $F(1, 91) = 128.94$, $p < .001$, $\eta_p^2 = .60$, and *amusement,* $F(1, 91) = 300.91$, $p < .001$, $\eta_p^2 = .78$ (Figure 5).

Consistent with predictions, those in the worry condition evidenced significantly greater decreases from previously high levels of negative emotions compared to those in the relaxation and neutral conditions, including *fear,* $F(2, 85) = 34.74$, $p < .001$, $\eta_p^2 = .46$, *sadness,* $F(2, 85) = 16.85$, $p < .001$, $\eta_p^2 = .29$, *tension,* $F(2, 85) = 13.10$, $p < .001$, $\eta_p^2 = .24$, and *anger,* $F(2, 85) = 12.87$, $p < .001$, $\eta_p^2 = .24$ (post hocs: $p < .001$ for all items). Relaxation and neutral conditions did not lead to changes from previously low levels of these emotions. In sum, these data supported Hypothesis 3, such that prior worry led to a positive emotional contrast to the humorous exposure, facilitating decreases from previously high levels

of negative emotion. Again, there were no significant differences between groups ($p = .21$) or prior induction types ($p = .92$) in change from baseline levels of any emotion adjectives during the humorous exposure (Figure 5).

Physiological Measures. There were no main effects of group or induction type when comparing change from the induction to the humorous exposure. A repeated measures ANOVA revealed a significant effect of time, $F(1, 87) = 24.19$, $p < .001$, $\eta_p^2 = .23$, showing that all groups and induction types experienced significant increases in amplitude averages of NS-SCRs in response to the humorous exposure. Again, this was consistent with predictions. As with all other exposures, there were no significant differences between groups ($p = .74$) or prior induction types ($p = .98$) in terms of change from baseline NS-SCR amplitude during the humorous exposure.

CONTRAST AVOIDANCE QUESTIONNAIRE

There was a significant main effect of group, $F(1, 85) = 7.45$, $p = .008$, $\eta_p^2 = .084$, and a group-by-induction condition interaction, $F(2, 84) = 12.05$, $p < .001$, $\eta_p^2 = .23$. Consistent with Hypothesis 4, for individuals with GAD there was a significant main effect of induction type, $F(2, 42) = 5.32$, $p = .009$, $\eta_p^2 = .20$, showing that worry was rated as significantly *more* helpful in coping with the subsequent negative film clips than both relaxation ($p = .035$) and neutral ($p = .004$) inductions, which were statistically similar. The opposite effect was found for nonanxious control participants. There was a significant effect of induction type, $F(2, 39) = 7.61$, $p = .002$, $\eta_p^2 = .28$, but worry was rated by nonanxious participants as significantly *less* helpful in coping with the negative film clips than both relaxation ($p < .001$) and neutral ($p = .004$) inductions, which were statistically similar.

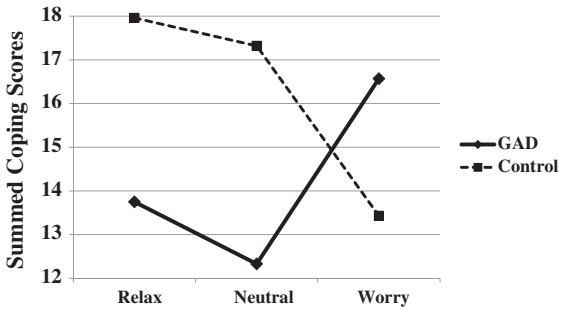


FIGURE 6 The degree to which preceding worry, relaxation, or neutral inductions facilitated ability to cope with the sad or fearful film clips in both GAD participants and nonanxious controls.

When further exploring the group-by-induction condition interaction, it was found that those in the GAD group reported prior worry as more helpful in coping during the emotional film clips, whereas control participants found it significantly less helpful, $F(1, 26) = 5.09$, $p = .03$, $\eta_p^2 = .16$. The opposite pattern was found for the relaxation and neutral inductions, showing that participants with GAD rated relaxation, $F(1, 28) = 12.31$, $p = .002$, $\eta_p^2 = .31$, and neutral inductions, $F(1, 27) = 15.87$, $p < .001$, $\eta_p^2 = .37$, as having made them feel less able to cope during the film clip than did nonanxious controls (see Figure 6).

Discussion

The Contrast Avoidance model of GAD (Newman & Llera, 2011) posits that worry boosts negative emotionality, thereby precluding further increases in the event of a negative stimulus, and in so doing facilitates avoidance of negative emotional contrasts (Hypotheses 1 and 2). According to this model, this cycle negatively reinforces the perspective of persons with GAD that chronic worrying is a way to feel emotionally braced for the worst outcome. Importantly, the Contrast Avoidance model departs from earlier models of worry as emotional avoidance by emphasizing that worry generates a negative emotional state that is sustained across negative experiences and only serves to avoid a sharp increase in negative emotion. In the event of a positive experience, negative emotion would give way to allow for a positive emotional contrast (Hypothesis 3), which may also reinforce worry. Finally, the model states that individuals with GAD are highly sensitive to negative emotional contrasts, and find it easier to cope with negative events by sustaining negative emotion as a means to avoid such contrasts (Hypothesis 4). The results from the current study partially supported our hypotheses.

Consistent with Hypothesis 1, for both GAD and nonanxious controls worry led to significant increases in subjective negative emotionality (i.e., *fear, sadness, tension, anger*, and *disgust*) and decreases in positive emotionality (*contentment*) from baseline, whereas relaxation and neutral inductions did not demonstrate substantial change from baseline. Although only marginally significant (albeit with medium effect sizes), NS-SCR amplitude reflected similar patterns. The fact that physiological findings did not reach significance could have been due to reduced power from missing data.

Consistent with Hypothesis 2, greater subjective negative emotionality and marginally higher sympathetic arousal during worry was sustained across the subsequent fearful film clip exposure for all participants. By comparison, low levels of negative

emotion and arousal during the relaxation and neutral inductions facilitated a substantial negative emotional contrast in response to the fear clip (though only relaxation led to stronger sympathetic increases than worry, with neutral falling non-significantly in between). This suggests that the worry group avoided a negative emotional contrast to the fear exposure, whereas the relaxation and neutral groups did not. Importantly, all participants demonstrated similar subjective and physiological responding during the fear exposure when compared to baseline levels, indicating that prior worry did not lead to emotional avoidance or suppression during the fear exposure.

The sad exposure showed patterns similar to the fear exposure for subjective negative emotional responding within each condition, with the exception that participants in the worry condition did experience an increase in subjective *sadness*, even from already higher levels during worry. In this case, it seems that the effect of prior worry was to reduce the degree of increase or intensity of emotional contrast; by comparison, relaxation and neutral groups experienced a much sharper contrast in *sadness* (see Figure 4). But again, when comparing change from baseline levels, all groups demonstrated similarly strong responding to the sad exposure, suggesting that worry did not suppress emotion to this exposure either.

As for physiological responding to the sad film, there were no significant differences between prior induction conditions, similar to Llera and Newman (2010). In fact, in the current study participants did not experience any significant change in sympathetic arousal in response to this film, which is notable considering that there was a subjective emotional impact and also because Llera and Newman observed parasympathetic increases to the same film clip. Given that the current study used sympathetic measures of responding instead, this could help to explain our desynchronous finding. Also, prior studies have shown mixed electrodermal responding to sadness, which may suggest that there is no "typical" electrodermal response pattern to this emotion (see Kreibig et al., 2007). Finally, it is possible that this lack of evidence for physiological change was due to diminished sample power from missing NS-SCR data.

In sum, these results support the proposed mechanisms of the Contrast Avoidance model. In particular, because participants in the worry condition were already in a more negative emotional state than those in the other conditions, they avoided or reduced the sharp shift in negative emotion experienced by those in the other conditions in response to the negative stimuli. This parallels findings of Fisher and colleagues (Fisher, Granger, & Newman, 2010; Fisher & Newman, 2013), showing that individuals with GAD who had higher baseline levels of NS-SCRs demonstrated less change in response to a stressor film as compared to those with lower NS-SCRs at baseline. Such findings could also help to explain the autonomic rigidity characteristic of individuals with chronic worry (e.g., Brosschot et al., 2007), as the negative emotional concomitants of chronic worry may leave an individual with less room for upward fluctuation in negative emotionality in the event of a stressor.

However, in the current study it appears that emotional inflexibility following worry only pertained to subsequent negative exposures. For the humorous exposure, all participants experienced significant increases in positive emotion, similar to Llera and Newman (2010). In the current study we were able to observe that individuals in the prior worry induction additionally experienced decreases in their negative emotion. Consistent with Hypothesis 3, this suggests that those who worried had an even stronger positive emotional contrast than those in other conditions. For individuals with chronic worry, this may mean additional negative reinforcement in the form of relief when events turn out better than anticipated. This could also help to explain the finding that participants with GAD endorse feeling threatened by their negative, but not positive, emotional experiences (Llera & Newman), when considering the James-Lange theory of emotion (i.e., if I'm not avoiding something, it must not be dangerous; James, 1890).

Finally, the Contrast Avoidance model states that individuals with GAD have developed a stronger aversive reaction and are even more sensitive to negative emotional contrasts than are nonanxious individuals, and that the avoidance of such contrasts motivates worry. In order to test Hypothesis 4, we measured a holistic appraisal of the overall effect of worry, relaxation, and neutral inductions on ability to cope with negative emotionality during the subsequent film clips, which has never been explored in previous studies.

We had anticipated that the GAD group would find prior worry more helpful than would controls on coping with the exposures. In fact, we found a cross-over interaction. Whereas the GAD group reported it was *easier* following worry (versus other inductions) to cope with negative exposures, controls reported the opposite pattern. For nonanxious participants, prior worry made them feel *less* able to cope with subsequent negative emotions than other induction types. This suggests that participants with GAD were significantly more bothered by the negative emotional contrasts

following relaxation and neutral periods than by the sustained negative emotionality caused by worry, whereas controls were significantly more bothered by sustained negative emotionality leading to the absence of a contrast (perhaps due to dissonance with more typical patterns of responding). Fundamentally, findings show that the GAD group preferred to avoid a negative emotional contrast even if it meant spending more time in a negative emotional state, whereas controls preferred the reverse.

This finding could be interpreted as individuals with GAD taking a chronic negative intrapersonal stance in order to manage their emotional hyperreactivity to stressful events, and parallels the finding that worriers endorse using worry as a way to feel more prepared in case of negative events (Borkovec & Roemer, 1995). In addition, efforts by clinicians to reduce worry and increase positive affect could lead such individuals to feel stripped of their emotional defenses and less prepared to cope with potential negative events, which is consistent with evidence of relaxation induced anxiety experienced by those with GAD (Heide & Borkovec, 1983).

This unique sensitivity to emotional contrasts overlaps with data showing that GAD participants fail to adapt to conflicting emotional stimuli (e.g., happy cues coupled with fearful stimuli, similar to contrast), either behaviorally or in terms of neural regulation of the amygdala (Etkin, Prater, Hoeft, Menon, & Schatzberg, 2010). This difficulty in coping with contrast is also similar to Gray's discussion of the anxiety associated with a mismatch between what is anticipated and what actually happens in the environment (Gray, 1982). This could explain the motivation to adopt what from the outside appears to be a self-defeating strategy, because of the fact that generating a more chronic negative state irrespective of feedback from the environment feels more palatable than a series of ups and downs.

The adverse impact of this strategy on psychological and physical functioning is evident. Maintaining a defensively negative stance to avoid emotional responding to stressors hinders emotional learning (Newman & Llera, 2011) and does not allow an individual to metaphorically "roll with the punches," fostering an emotional brittleness, as discussed by Kashdan and Rottenberg (2010). These authors expound on the correlation between psychological inflexibility and psychopathology in general, showing that an inability to adapt to the demands of shifting situational contexts is linked to poorer psychological outcomes. Such emotional rigidity has also been demonstrated in diary studies of people with GAD (Newman & Fisher, 2013). Moreover, given the ramifications of chronic worry, individuals with GAD are at much greater risk for cardiovascular problems even above and beyond those with depression (Martens et al., 2010).

Finally, it is important to recognize the ways that the Contrast Avoidance model builds upon extant models of worry as an emotional coping strategy (e.g., Borkovec et al., 2004; Mennin et al., 2005; Roemer et al., 2005), but also to emphasize the novel perspective, which is at the core of this model. Whereas other models of GAD have described worry as an attempt to manage negative emotions through the reduction or avoidance of internal arousal, conversely, we propose that individuals with GAD *embrace* a chronic negative stance as a way to be emotionally prepared for any upcoming negative events, thereby avoiding a sharp shift in their negative emotions should these events occur. This is more consistent with data which is more consistent with data on the emotional effects of worry. Although we share the perspective that the underlying goal is an attempt to gain control over emotional experiences, the Contrast Avoidance model emphasizes that the mechanism employed is to recruit, rather than to avoid, negative emotional arousal via worry in order to avoid negative emotional contrasts. (For a more nuanced comparison to previous models, see Newman & Llera, 2011.)

AREAS OF FUTURE STUDY

To broaden our understanding of maladaptive efforts with respect to emotional coping more generally, it would be profitable to test the Contrast Avoidance model across diagnostic categories. For example, rumination is similar to worry as both are rigid cognitive styles that increase negative affect and prolong pathological symptoms (Segerstrom, Stanton, Alden, & Shortridge, 2003). Nolen-Hoeksema and colleagues have proposed that individuals with depression may engage in rumination to generate a negative internal state (i.e., feeling helpless) that reduces motivation to proactively strive for environmental change, thus protecting against an even more distressing experience of disappointment (Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008). What is similar to the Contrast Avoidance model is the idea that a perseverative cognitive style maintains a negative internal stance to avoid perceived future harm. Thus, it would be useful to test the Contrast Avoidance model for similarities and differences across different disorders.

LIMITATIONS

Limitations not already mentioned include the fact that the worry induction did not consistently discriminate physiological effects from the neutral induction. Although this may have been due to the methodology of the neutral condition, the manipulation check showed that all induction types had the intended effects, and subjective data throughout the experiment supported the Contrast Avoidance model. Further, as with Llera and Newman (2010), results from this study are based on a non-treatment-seeking GAD sample, and as such may not generalize to a treatment-seeking GAD population. Also, participants were assigned to the GAD and control groups based on self-report measures as opposed to a diagnostic interview. However, GAD group means were well above the cut-scores as recommended in the literature. Another limitation of our sample is that it was taken from a college population, and we did not test subjects for additional comorbidity beyond depression. On a related note, we used the original BDI to measure depression, where it may have been more useful to have used the more updated BDI-II (Beck, Steer, & Brown, 1996). It would therefore be useful to test this model with both a comorbid GAD group as well as those with other primary diagnoses to determine if these findings are unique to GAD alone or could be present transdiagnostically.

Conflict of Interest Statement

The authors declare that there are no conflicts of interest.

References

American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders* (4th ed).Washington, DC: American Psychiatric Association.

Andor, T., Gerlach, A. L., & Rist, F. (2008). Superior perception of phasic physiological arousal and the detrimental consequences of the conviction to be aroused on worrying and metacognitions in GAD. *Journal of Abnormal Psychology*, *117*, 193–205. http://dx.doi.org/10.1037/0021-843X.117.1.193

Bacon, M. M., Rood, E. A., & Washburn, M. F. (1914). A study of affective contrast. *American Journal of Psychology*, *25*, 290–293. http://dx.doi.org/10.2307/1413417

Beck, A. T., Rush, A. J., Shaw, B. E., & Emery, G. (1979). *Cognitive therapy of depression*. New York: Guilford Press.

Beck, A. T., Steer, R. A., & Brown, G. K. (1996). Manual for the Beck Depression Inventory-II. San Antonio, TX: Psychological Corporation.

Beck, A. T., Steer, R. A., & Garbin, M. G. (1988). Psychometric properties of the Beck Depression Inventory: Twenty-five years of evaluation. *Clinical Psychology Review*, *8*, 77–100. http://dx.doi.org/10.1016/0272-7358(88)90050-5

Borkovec, T. D., Alcaine, O., & Behar, E. S. (2004). Avoidance theory of worry and generalized anxiety disorder. In R. G. Heimberg, D. S. Mennin, & C. L. Turk (Eds.), *Generalized anxiety disorder: Advances in research and practice* (pp. 77–108). New York: Guilford.

Borkovec, T. D., & Hu, S. (1990). The effect of worry on cardiovascular response to phobic imagery. *Behaviour Research and Therapy*, *28*, 69–73. http://dx.doi.org/10.1016/0005-7967(90)90056-O

Borkovec, T. D., Lyonfields, J. D., Wiser, S. L., & Deihl, L. (1993). The role of worrisome thinking in the suppression of cardiovascular response to phobic imagery. *Behaviour Research and Therapy*, *31*, 321–324. http://dx.doi.org/10.1016/0005-7967(93)90031-O

Borkovec, T. D., Robinson, E., Pruzinsky, T., & DePree, J. A. (1983). Preliminary exploration of worry: Some characteristics and processes. *Behaviour Research and Therapy*, *21*, 9–16. http://dx.doi.org/10.1016/0005-7967(83)90121-3

Borkovec, T. D., & Roemer, L. (1995). Perceived functions of worry among generalized anxiety disorder subjects: Distraction from more emotionally distressing topics? *Journal of Behavior Therapy and Experimental Psychiatry*, *26*, 25–30. http://dx.doi.org/10.1016/0005-7916(94)00064-s

Brosschot, J. F., Van Dijk, E., & Thayer, J. F. (2007). Daily worry is related to low heart rate variability during waking and the subsequent nocturnal sleep period. *International Journal of Psychophysiology*, *63*, 39–47. http://dx.doi.org/10.1016/j.ijpsycho.2006.07.016

Brown, T. A., Antony, M. M., & Barlow, D. H. (1992). Psychometric properties of the Penn State Worry Questionnaire in a clinical anxiety disorders sample. *Behaviour Research and Therapy*, *30*, 33–37. http://dx.doi.org/10.1016/0005-7967(92)90093-V

Clemens, T. L., & Selesnick, S. T. (1967). Psychophysiological method for evaluating medication by repeated exposure to a stressor film. *Diseases of the Nervous System*, *28*, 98–104.

Etkin, A., Prater, K. E., Hoeft, F., Menon, V., & Schatzberg, A. F. (2010). Failure of anterior cingulate activation and connectivity with the amygdala during implicit regulation of emotional processing in generalized anxiety disorder. *American Journal of Psychiatry*, *167*, 545–554. http://dx.doi.org/10.1176/appi.ajp.2009.09070931

Faul, F., Erdfelder, E., Lang, A. -G., & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis for the social, behavioral, and biomedical sciences. *Behavior Research Methods*, *39*, 175–191.

Fisher, A. J., Granger, D. A., & Newman, M. G. (2010). Sympathetic arousal moderates self-reported physiological arousal symptoms at baseline and physiological flexibility in response to a stressor in generalized anxiety disorder. *Biological Psychology*, *83*, 191–200. http://dx.doi.org/10.1016/j.biopsycho.2009.12.007

Fisher, A. J., & Newman, M. G. (2013). Heart rate and autonomic response to stress after experimental induction of worry versus relaxation in healthy, high-worry, and generalized anxiety disorder individuals. *Biological Psychology*, *93*, 65–74. http://dx.doi.org/10.1016/j.biopsycho.2013.01.012

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

Gosselin, P., Ladouceur, R., Langlois, F., Freeston, M. H., Dugas, M. J., & Bertrand, J. (2003). Développement et validation d'un nouvel instrument évaluant les croyances erronéesà l'égard des inquiétudes. [Development and validation of a new instrument to evaluate erroneous beliefs about worries.]. *European Review of Applied Psychology/Revue Européenne de Psychologie Appliquée*, *53*, 199–211.

Gray, J. A. (1982). *The neuropsychology of anxiety: An enquiry into the functions of the septo-hippocampal system*. New York, NY: Clarendon Press/Oxford University Press.

Gross, J. J., & Levenson, R. W. (1993). Emotional suppression: Physiology, self-report, and expressive behavior. *Journal of Personality and Social Psychology*, *64*, 970–986. http://dx.doi.org/10.1037/0022-3514.64.6.970

Gross, J. J., & Levenson, R. W. (1997). Hiding feelings: The acute effects of inhibiting negative and positive emotion. *Journal of Abnormal Psychology*, *106*, 95–103. http://dx.doi.org/10.1037/0021-843X.106.1.95

Heide, F. J., & Borkovec, T. D. (1983). Relaxation-induced anxiety: Paradoxical anxiety enhancement due to relaxation training. *Journal of Consulting and Clinical Psychology*, *51*, 171–182. http://dx.doi.org/10.1037/0022-006X.51.2.171

James, W. W. (1890). *The principles of psychology, Vol I*. New York: Holt.

Kessler, R. C., Avenevoli, S., McLaughlin, K. A., Green, J. G., Lakoma, M. D., Petukhova, M., . . . Merikangas, K. R. (2012). Lifetime co-morbidity of DSM-IV disorders in the US National Comorbidity Survey Replication Adolescent Supplement (NCS-A). *Psychological Medicine*, *1–14*. http://dx.doi.org/10.1017/S0033291712000025

Kashdan, T. B., & Rottenberg, J. (2010). Psychological flexibility as a fundamental aspect of health. *Clinical Psychology Review*, *30*, 865–878. http://dx.doi.org/10.1016/j.cpr.2010.03.001

Kreibig, S. D., Wilhelm, F. H., Roth, W. T., & Gross, J. J. (2007). Cardiovascular, electrodermal, and respiratory response patterns to fear- and sadness-inducing films. *Psychophysiology*, *44*, 787–806. http://dx.doi.org/10.1111/j.1469-8986.2007.00550.x

Licht, C. M. M., Penninx, B. W. J. H., & de Geus, E. J. C. (2012). Effects of antidepressants, but not psychopathology, on cardiac sympathetic control: A longitudinal study. *Neuropsychopharmacology*, *37*, 2487–2495. http://dx.doi.org/10.1038/npp.2012.107

Llera, S. J., & Newman, M. G. (2010). Effects of worry on physiological and subjective reactivity to emotional stimuli in generalized anxiety disorder and nonanxious control participants. *Emotion*, *10*, 640–650. http://dx.doi.org/10.1037/a0019351

Manstead, A. S., Wagner, H. L., & MacDonald, C. J. (1983). A contrast effect in judgments of own emotional state. *Motivation and Emotion*, *7*, 279–290. http://dx.doi.org/10.1007/bf00991678

Martens, E. J., de Jonge, P., Na, B., Cohen, B. E., Lett, H., & Whooley, M. A. (2010). Scared to death? Generalized anxiety disorder and cardiovascular events in patients with stable coronary heart disease: The Heart and Soul Study. *Archives of General Psychiatry*, *67*, 750–758. http://dx.doi.org/10.1001/archgenpsychiatry.2010.74

Mennin, D. S., Heimberg, R. G., Turk, C. L., & Fresco, D. M. (2005). Preliminary evidence for an emotion regulation deficit model of generalized anxiety disorder. *Behaviour Research and Therapy*, *43*, 1281–1310.

Meyer, T. J., Miller, M. L., Metzger, R. L., & Borkovec, T. D. (1990). Development and validation of the Penn State Worry Questionnaire. *Behaviour Research and Therapy*, *28*, 487–495. http://dx.doi.org/10.1016/0005-7967(90)90135-6

Moffitt, T. E., Caspi, A., Harrington, H., Milne, B. J., Melchior, M., Goldberg, D., & Poulton, R. (2007). Generalized anxiety disorder and depression: Childhood risk factors in a birth cohort followed to age 32. *Psychological Medicine*, *37*, 441–452. http://dx.doi.org/10.1017/S0033291706009640

Molina, S., & Borkovec, T. D. (1994). The Penn State Worry Questionnaire: Psychometric properties and associated characteristics. In G. C. L. Davey, & F. Tallis (Eds.), *Worrying: Perspectives on theory, assessment and treatment* (pp. 265–283). Oxford, England: Wiley.

Moore, M. T., Anderson, N. L., Barnes, J. M., Haigh, E. A., & Fresco, D. M. (2014). Using the GAD-Q-IV to identify generalized anxiety disorder in psychiatric treatment seeking and primary care medical samples. *Journal of Anxiety Disorders*, *28*, 25–30. http://dx.doi.org/10.1016/j.janxdis.2013.10.009

Newman, M. G., Castonguay, L. G., Borkovec, T. D., & Molnar, C. (2004). Integrative psychotherapy. In R. G. Heimberg, C. L. Turk, & D. S. Mennin (Eds.), *Generalized anxiety disorder: Advances in research and practice* (pp. 320–350). New York, NY: Guilford Press.

Newman, M. G., & Fisher, A. J. (2013). Mediated moderation in combined cognitive behavioral therapy versus component treatments for generalized anxiety disorder. *Journal of Consulting and Clinical Psychology*, *81*, 405–414. http://dx.doi.org/10.1037/a0031690

Newman, M. G., & Llera, S. J. (2011). A novel theory of experiential avoidance in generalized anxiety disorder: A review and synthesis of research supporting a Contrast Avoidance Model of worry. *Clinical Psychology Review*, *31*, 371–382. http://dx.doi.org/10.1016/j.cpr.2011.01.008

Newman, M. G., Llera, S. J., Erickson, T. E., Przeworski, A., & Castonguay, L. G. (2013). Worry and Generalized Anxiety Disorder: A review and synthesis of research on its nature, etiology, and treatment. *Annual Review of Clinical Psychology*, *9*, 275–297. http://dx.doi.org/10.1146/annurev-clinpsy-050212-185544

Newman, M. G., Przeworski, A., Fisher, A. J., & Borkovec, T. D. (2010). Diagnostic comorbidity in adults with generalized anxiety disorder: Impact of comorbidity on psychotherapy outcome and impact of psychotherapy on comorbid diagnoses. *Behavior Therapy*, *41*, 59–72. http://dx.doi.org/10.1016/j.beth.2008.12.005.

Newman, M. G., & Stone, A. A. (1996). Does humor moderate the effects of experimentally-induced stress? *Annals of Behavioral Medicine*, *18*, 101–109. http://dx.doi.org/10.1007/BF02909582

Newman, M. G., Zuellig, A. R., Kachin, K. E., Constantino, M. J., Przeworski, A., Erickson, T., & Cashman-McGrath, L. (2002). Preliminary reliability and validity of the Generalized Anxiety Disorder Questionnaire-IV: A revised self-report diagnostic measure of generalized anxiety disorder. *Behavior Therapy*, *33*, 215–233. http://dx.doi.org/10.1016/S0005-7894(02)80026-0

Nolen-Hoeksema, S., Wisco, B. E., & Lyubomirsky, S. (2008). Rethinking rumination. *Perspectives on Psychological Science*, *3*, 400–424. http://dx.doi.org/10.1111/j.1745-6924.2008.00088.x

Peasley-Miklus, C., & Vrana, S. R. (2000). Effect of worrisome and relaxing thinking on fearful emotional processing. *Behaviour Research and Therapy*, *38*, 129–144. http://dx.doi.org/10.1016/S0005-7967(99)00025-X

Penney, A. M., Mazmanian, D., & Rudanycz, C. (2013). Comparing positive and negative beliefs about worry in predicting generalized anxiety disorder symptoms. *Canadian Journal of Behavioural Science/Revue canadienne des sciences du comportement*, *45*, 34–41. http://dx.doi.org/10.1037/a0027623

Roemer, L., Salters, K., Raffa, S. D., & Orsillo, S. M. (2005). Fear and avoidance of internal experiences in GAD: Preliminary tests of a conceptual model. *Cognitive Therapy and Research*, *29*, 71–88.

Rottenberg, J., Gross, J. J., & Gotlib, I. H. (2005). Emotion context insensitivity in major depressive disorder. *Journal of Abnormal Psychology*, *114*, 627–639. http://dx.doi.org/10.1037/0021-843x.114.4.627

Segerstrom, S. C., Stanton, A. L., Alden, L. E., & Shortridge, B. E. (2003). A multidimensional structure for repetitive

thought: what's on your mind, and how, and how much? *Journal of Personality and Social Psychology*, *85*, 909–921. http://dx.doi.org/10.1037/0022-3514.85.5.909

Stapinski, L. A., Abbott, M. J., & Rapee, R. M. (2010). Evaluating the cognitive avoidance model of generalised anxiety disorder: Impact of worry on threat appraisal, perceived control and anxious arousal. *Behaviour Research and Therapy*, *48*, 1032–1040. http://dx.doi.org/10.1016/j.brat.2010.07.005

Startup, H. M., & Erickson, T. M. (2006). The Penn State Worry Questionnaire (PSWQ). In G. C. L. Davey, & A. Wells (Eds.), *Worry and its psychological disorders: Theory, assessment and treatment* (pp. 101–119). Hoboken, NJ: Wiley. http://dx.doi.org/10.1002/9780470713143.ch7

Venables, P. H., & Christie, M. J. (1980). Electrodermal activity. In I. Martin, & P. H. Venables (Eds.), *Techniques in Psychophysiology* (pp. 3–67). Chichester, UK: Wiley.

Zoccola, P. M., Dickerson, S. S., & Yim, I. S. (2011). Trait and state perseverative cognition and the cortisol awakening response. *Psychoneuroendocrinology*, *36*, 592–595. http://dx.doi.org/10.1016/j.psyneuen.2010.10.004

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