Journal of Experimental Psychology: General

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Online First Publication, June 19, 2017. http://dx.doi.org/10.1037/xge0000335

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0096-3445/17/$12.00 http://dx.doi.org/10.1037/xge0000335

The Role of Empathy in Experiencing Vicarious Anxiety

Jocelyn Shu, Samuel Hassell, Jochen Weber, and Kevin N. Ochsner
Columbia University

Dean Mobbs
California Institute of Technology

With depictions of others facing threats common in the media, the experience of vicarious anxiety may be prevalent in the general population. However, the phenomenon of vicarious anxiety—the experience of anxiety in response to observing others expressing anxiety—and the interpersonal mechanisms underlying it have not been fully investigated in prior research. In 4 studies, we investigate the role of empathy in experiencing vicarious anxiety, using film clips depicting target victims facing threats. In Studies 1 and 2, trait emotional empathy was associated with greater self-reported anxiety when observing target victims, and with perceiving greater anxiety to be experienced by the targets. Study 3 extended these findings by demonstrating that trait empathic concern—the tendency to feel concern and compassion for others—was associated with experiencing vicarious anxiety, whereas trait personal distress—the tendency to experience distress in stressful situations—was not. Study 4 manipulated state empathy to establish a causal relationship between empathy and experience of vicarious anxiety. Participants who took an empathic perspective when observing target victims, as compared to those who took an objective perspective using reappraisal-based strategies, reported experiencing greater anxiety, risk-aversion, and sleep disruption the following night. These results highlight the impact of one's social environment on experiencing anxiety, particularly for those who are highly empathic. In addition, these findings have implications for extending basic models of anxiety to incorporate interpersonal processes, understanding the role of empathy in social learning, and potential applications for therapeutic contexts.

Supplemental materials: http://dx.doi.org/10.1037/xge0000335.supp

In our daily lives, we are often exposed to anxiety inducing scenes depicting others facing threats, whether of actual events in the media such as wars and conflicts around the world, or of fictional scenes such as ones found in horror movies. Although anxiety is an emotion often associated with negative consequences for mental health and well being, it is a response to potential threat that activates adaptive defensive responses to threats, including increased vigilance and behavioral avoidance of threats (Cisler & Koster, 2010; Davis, Walker, Miles, & Grillon, 2010; MacLeod & Mathews, 1988; McNaughton & Corr, 2004). Prior research on anxiety has mainly conceptualized anxiety as an intrapersonal response to potential threat (Graeff & Zangrossi, 2002; Lissek et al., 2005; MacLeod & Mathews, 1988; McNaughton & Corr, 2004; Mobbs et al., 2009; Mobbs et al., 2007). However, well-documented phenomena such as emotional contagion and affect sharing demonstrate that emotions are often vicariously experienced (Hatfield & Cacioppo, 1994; Hill, Rand, Nowak, & Christakis, 2010; Joiner & Katz, 1999; Waters, West, & Mendes, 2014). Yet, little research has considered the role of interpersonal processes in experiencing anxiety. Although the experience of vicarious anxiety may be prevalent in the general population, the phenomenon of vicarious anxiety and the mechanisms underlying it are not yet understood. As anxiety disorders in the United States constitute the most commonly diagnosed mental disorders and exact tremendous costs to individuals and society as a whole (Kessler, Ruscio, Shear, & Wittchen, 2010), it is important to consider different causal pathways that may exist for experiencing anxiety. In the present studies, we address who tends to experience vicarious anxiety, and why, by investigating the dispositional variables that predict experience of vicarious anxiety and the causal mechanisms by which vicarious anxiety is experienced. We also investigate the potential functions and sustained effects of experiencing vicarious anxiety, and the effects of regulating vicarious anxiety through the use of cognitive reappraisal.

Jocelyn Shu, Samuel Hassell, Jochen Weber, and Kevin N. Ochsner, Department of Psychology, Columbia University; Dean Mobbs, Division of the Humanities and Social Sciences, California Institute of Technology.

This research was supported by start-up funds awarded to Dean Mobbs by Columbia University and by Grant AG043463 awarded to Kevin N. Ochsner. Jocelyn Shu, Dean Mobbs, and Kevin N. Ochsner designed the studies. Jocelyn Shu and Samuel Hassell developed the stimulus set and collected data. Jocelyn Shu and Jochen Weber analyzed data. Jocelyn Shu wrote the manuscript. Dean Mobbs, Kevin N. Ochsner and Jochen Weber provided critical revisions to the manuscript. The Columbia University Institutional Review Board approved all procedures reported. We thank Charles Leps and Ying Fong Yan for assistance with data collection. We also thank the editor and two anonymous reviewers for their constructive feedback. Some of the data in this article have been presented at the New Insights into Affective and Behavioral Regulatory Processes Conference (Rutgers University-New Brunswick, 2017) and the Association for Psychological Science Annual Meeting (2014).

Correspondence concerning this article should be addressed to Jocelyn Shu, Department of Psychology, Columbia University, 406 Schermerhorn Hall, 1190 Amsterdam Avenue, MC 5501, New York, NY 10027. E-mail: js3526@columbia.edu

Functions and Effects of Experiencing Anxiety

Anxiety and fear are two emotions conceptualized as belonging to a spectrum of defensive responses to threats. With much conceptual and phenomenological overlap, anxiety and fear are often difficult to parse in experimental paradigms and have often been used as interchangeable concepts in research (Hartley & Phelps, 2012; Sylvers, Lilienfeld, & LaPrairie, 2011). However, research in humans and nonhuman animals has differentiated anxiety from fear by investigating the behavioral, physiological, and neural signatures associated with responses thought to correspond to anxiety and fear in humans. Such work has proposed that anxiety is a response to potential threat that is distal or unpredictable, whereas fear is a response to a concrete threat that is immediate or predictable (Davis et al., 2010; Mobbs, Hagan, Dalgleish, Silston, & Prévost, 2015). The functional roles of anxiety and fear have underlying mechanisms that enable sustained responses on the one hand with anxiety, and phasic responses on the other hand with fear (Davis et al., 2010; Walker, Toufexis, & Davis, 2003). The phasic responses associated with fear are active (e.g., startle), elicited by a discrete stimulus, and dissipate quickly when the eliciting stimulus is no longer present (Davis et al., 2010). In contrast, the sustained responses associated with anxiety are characterized by a longer duration and include increased autonomic responses, vigilance, risk-aversion, and avoidance of potential or future threats (Cisler & Koster, 2010; Hartley & Phelps, 2012; MacLeod & Mathews, 1988; McNaughton & Corr, 2004; Raghunathan & Pham, 1999).

In a social species such as ours, in which conspecifics depend on each other for survival, it may be evolutionarily adaptive to experience anxiety vicariously when a potential threat is in one's environment. Such interpersonal transmission of anxiety would occur when someone experiences anxiety upon seeing another person expressing anxiety or fear. Experiencing vicarious anxiety may activate defensive responses for distal threats and facilitate preparation for a threat that another has detected in the environment. However, the sustained nature of anxiety, which enables prolonged defensive responses in the absence of direct threat, has the potential to be maladaptive in situations where threat is unlikely to be personally encountered. Reflective of this, certain anxiety disorders have been demonstrated to be particularly associated with sensitivity to distal threats (Davis et al., 2010).

Dispositional Variables and Underlying Mechanisms of Vicarious Anxiety

Two dispositional factors seem likely to predict who tends to experience vicarious anxiety. On the one hand, it is intuitive to expect individuals with high *trait anxiety*—the tendency for one to experience anxiety or negative affect (Watson & Clark, 1984)—to experience greater vicarious anxiety when exposed to others expressing anxiety or fear. However, prior research has been inconclusive as to whether trait anxiety is associated with greater negative reactivity to stimuli that cause distress. Several studies have instead found no relationship between trait anxiety and degree of reactivity to a variety of stressful events (Watson & Clark, 1984). Other studies have found trait anxiety to be associated with variability in state anxiety when one's self-esteem is threatened, but not when faced with physical threats (Spielberger, 1972). Another dispositional variable that may be associated with experiencing vicarious anxiety is *trait empathy*. A core component of empathy is commonly thought to consist of the ability to feel the emotions experienced by another person (De Vignemont & Singer, 2006; Mehrabian & Epstein, 1972; Zaki & Ochsner, 2012). Therefore, trait empathy may be associated with experience of vicarious anxiety such that those who are high on dispositional empathy experience greater vicarious anxiety when observing others expressing anxiety or fear. In support of this, prior research suggests that empathy plays a role in adaptive responding to threats by demonstrating that state and trait empathy are associated with greater fear learning when observing a target person responding fearfully to a stimulus (Olsson et al., 2015). Prior studies also demonstrate that trait empathy is associated with experiencing negative affect when observing others in distress. Trait empathy was associated with experiencing increased state anxiety in classroom participants who observed a confederate speaker giving a lecture in a disorganized manner. However, state and trait measures of anxiety obtained from participants prior to the lecture were unassociated or negatively associated with experience of anxiety from observing the speaker (Kendall, Finch, & Montgomery, 1978).

Although one common conceptualization of empathy involves the capacity to vicariously experience emotions, empathy has also been conceptualized as a multifaceted construct consisting of interrelated capacities (Davis, 1983; Zaki & Ochsner, 2012). Accordingly, dispositional empathy can be measured with a multidimensional scale that assesses these separable capacities. The Interpersonal Reactivity Index (IRI) is a measure that assesses four dimensions of empathy with the following subscales: Empathic Concern, Personal Distress, Fantasy, and Perspective Taking. The Empathic Concern subscale assesses the tendency to feel an "other-oriented response" involving concern, sympathy, and compassion for others who are suffering. As a construct, empathic concern has been proposed to be a response experienced toward another person when one perceives the person to need help and values the person's welfare (Batson, Eklund, Chermok, Hoyt, & Ortiz, 2007). In contrast, the Personal Distress subscale assesses the tendency to feel a "self-oriented response" involving distress in tense situations. This construct is associated with the dispositional tendency to experience fear (Davis, 1983), and is thus similar to trait anxiety. The Fantasy subscale assesses the capacity to imagine oneself in the situation of fictional characters in movies and books. Finally, the Perspective Taking subscale assesses the ability to take the perspective of another person. Whereas the Empathic Concern, Personal Distress, and Fantasy subscales assess affective dimensions of empathy, the Perspective Taking subscale assesses a cognitive dimension of empathy (Davis, 1983).

Prior research has demonstrated that the Empathic Concern subscale is associated with experiencing greater negative affect after viewing film clips inducing sadness and anger (Davis, Hull, Young, & Warren, 1987). The Empathic Concern subscale is also associated with increases in cortisol when observing others experiencing stress, whereas the Personal Distress scale is not (Buchanan, Bagley, Stansfield, & Preston, 2012; Engert, Plessow, Miller, Kirschbaum, & Singer, 2014). These studies demonstrate that the Empathic Concern subscale is similar to other more general trait empathy measures in its association with experiencing negative affect when observing others experiencing distress. As

with prior findings regarding trait anxiety, the Personal Distress subscale was not found to be associated with negative reactivity when observing others in distress. These patterns suggest that the experience of vicarious distress is not only due to the tendency to experience the emotions of others, but involves interpersonal processes that predispose one to attend to and experience concern for others. However, these studies do not specifically investigate the vicarious experience of *anxiety* – an important emotion to focus on for its clinical implications.

Understanding the dispositional factors that predispose one to experience vicarious anxiety informs the nature of its underlying mechanisms. While trait anxiety is a measure of one's tendency to experience intrapersonal feelings of distress, trait empathy and even more so, trait empathic concern, are measures of one's tendency to experience interpersonal responses toward others (Davis, 1983). If trait empathy predisposes one to experience anxiety when observing others expressing anxiety or fear, the mechanisms underlying vicarious anxiety should be interpersonal in nature as well. Specifically, vicarious anxiety should be experienced as a function of perceiving a target expressing anxiety or fear. This relationship is supported by prior work in rhesus monkeys demonstrating a strong correlation between the degree to which a model exhibits fear related behavior and the degree of an observer's fear related behavior (Mineka & Cook, 1993). In this model of vicarious anxiety, trait empathy should be associated with the propensity to perceive anxiety or fear in targets who are facing threats. In support of this, trait empathy is associated with more accurate perception of emotions in targets when the targets are high in trait emotional expressivity (Zaki, Bolger, & Ochsner, 2008). Conversely, individuals with high levels of psychopathy, a disorder characterized by a lack of empathy, are impaired in the capacity to detect anxiety in target faces (Blair, 2005; Blair et al., 2004). Thus, it may be that empathy facilitates the ability to perceive anxiety in others who are facing threats, which in turn leads to greater experience of vicarious anxiety.

Regulation of Empathy and Vicarious Anxiety

We hypothesize that trait empathy will be associated with experiencing vicarious anxiety when observing others facing threats. As trait empathy characterizes the tendency to experience empathic responses to others across different situations (Batson, Fultz, & Schoenrade, 1987), we also predict that inducing state empathy should cause greater experience of vicarious anxiety when observing others facing threats. In support of this, it has been demonstrated that inducing greater state empathy while watching others receiving a shock leads to greater fear learning, as assessed by skin conductance responses in an observer. As discussed earlier, this pattern of results was also demonstrated in correlational findings with a trait empathy measure (Olsson et al., 2015). However, prior research has also found mixed results regarding whether an empathic perspective increases one's experience of distress when observing others who are suffering. In certain situations, people experience emotions that are sympathetic and warm in response to others in distress (Batson et al., 1987; Batson, O'Quin, Fultz, Vanderplas, & Isen, 1983). As with prior studies investigating the relationship between trait empathy and experience of distress, these studies do not always assess empathic responses to targets specifically expressing anxiety, as the targets are often expressing a range of distress emotions. Appraisal theories of emotion have proposed that different emotions have different underlying appraisal patterns and motivational functions (Smith & Lazarus, 1993). Thus, different empathic responses may be elicited in response to different emotions expressed by a target. In these prior studies, it is also the case that participants often have the opportunity to help the targets who are expressing distress (helping or pro-social behavior is often the dependent variable of interest in these studies). This context may elicit a different empathic response than when observing scenes of others facing threats in a context where one is unable to provide help.

When observing targets facing threats who are unable to receive help, we predict that taking an empathic perspective will lead to increased perception of anxiety in targets, as well as increased experience of vicarious anxiety and its associated defensive responses (e.g., behavioral avoidance of threats). Conversely, taking a perspective that decreases empathy should reduce one's experience of vicarious anxiety. This prediction is informed by research on emotion regulation that has established the effectiveness of using cognitive reappraisal to down-regulate negative affect. Reappraisal strategies involve thinking about an emotional stimulus from an objective or distanced perspective (Denny & Ochsner, 2014; Ochsner, Silvers, & Buhle, 2012; Silvers, Shu, Hubbard, Weber, & Ochsner, 2015). In the context of perceiving other people, such an objective perspective involves reducing empathy (Batson et al., 2007). As prior work has established the effectiveness of reappraisal in reducing negative affect to distressing stimuli, we predict that down-regulating state empathy by using reappraisal-based cognitive strategies will decrease the experience of vicarious anxiety, along with its associated defensive responses, when observing others facing threats.

The Present Studies

Across four studies, we aim to delineate the relationship between empathy and experience of vicarious anxiety. To investigate our hypotheses within the context of stimuli that may be commonly encountered by the general population, we constructed a set of short film clips obtained primarily from horror movies. These film clips depict target victims facing a potential or approaching threat and were thus expected to elicit vicarious anxiety. In Study 1, we address who tends to experience vicarious anxiety by investigating the role of trait empathy, as opposed to trait anxiety, in the experience of anxiety when observing a target victim facing a threat. Although prior studies have indicated that trait empathy is positively associated with experiencing negative affect when witnessing others in distress, few studies have obtained self-reports of emotion that specifically confirm experience of anxiety in response to another person's anxiety (as opposed to other negative emotions such as sadness and anger). As anxiety is defined as a sustained response, we measure anxiety both upon exposure to the film clips, and also as indicated by changes in a state anxiety measure after participants view the film clips and are no longer exposed to the stimuli. In Study 2, we begin to address the mechanisms underlying vicarious anxiety by investigating the relationship between trait empathy and perception of anxiety in target victims facing threats. We hypothesize that trait empathy will be associated with increased perception of anxiety in targets facing a threat. In Study 3, we further investigate the

mechanisms underlying vicarious anxiety and begin to address what the potential function of experiencing vicarious anxiety may be, by testing the following hypotheses: (a) the relationships seen for trait empathy in Studies 1 and 2 will extend to trait empathic concern. As was the case in prior studies that had demonstrated a positive relationship between trait empathic concern and distress, we predict that the disposition to experience concern and compassion for others will be associated with experience of vicarious anxiety, whereas trait personal distress will not be. (b) The degree of anxiety perceived as being experienced by targets facing threats will be positively associated with experience of vicarious anxiety. (c) The degree of anxiety perceived to be experienced by targets will mediate a positive relationship between trait empathic concern and experience of vicarious anxiety. (d) Empathy and experience of vicarious anxiety will be associated with greater avoidance of threat after observing others facing threats. In Study 4, we investigate a causal relationship between empathy and experience of vicarious anxiety by manipulating state empathy in a between-groups design. In addition, we address the effects of experiencing and regulating vicarious anxiety. In this study, one group is instructed to take an empathic perspective whereas the other group is instructed to down-regulate empathy by using a cognitive reappraisal strategy to view the film clips from an objective perspective. We hypothesize that participants who take an empathic perspective will perceive greater anxiety to be experienced by target victims, experience greater vicarious anxiety, and be more threat avoidant. Conversely, participants who reduce their state empathy will demonstrate decreased perception of anxiety in targets, as well as decreased experience of vicarious anxiety and threat avoidance. To investigate the protracted effects of taking an empathic perspective, we assess self-reported sleep disruption, a symptom of experiencing anxiety and trauma (Briere & Runtz, 1989; Lamarche & De Koninck, 2007), in a follow-up measure administered the following day.

Study 1

Method

Participants. Fifty-one participants were recruited over a semester from introductory psychology courses at Columbia University for course credits. This sample size was determined by the number of volunteers who signed up for participation in this study within the concurrent semester. Three participants chose to end the study without completing the task and data obtained from these participants were not analyzed. Data for one participant were not obtained due to a technical issue. The final sample used for analyses consisted of 47 participants (29 female and 18 male; M_{Age} = 20.02 years, SD = 2.36, range = 18–29).

Materials and procedures. Upon arriving at the lab, participants were greeted by an experimenter who informed the participant that the study would involve watching clips from horror movies and that participation in this study would be on a voluntary basis. After providing consent, participants completed questionnaires on a computer, including the General Empathy Scale, a measure of trait emotional empathy designed to assess one's tendency to react to and share the emotions of others in both positive and negative events. The measure consists of 30 items, which include statements such as "The suffering of others deeply disturbs me" and "I feel other people's joy", which were assessed with a 9-point Likert scale (M_{Sum} = 191.32, SD = 26.46, α = .89; Caruso & Mayer, 1998). Trait and state anxiety was measured with the State Trait Anxiety Inventory (Y Form; STAI). The STAI consists of two separate 20-item questionnaires on a 4-point Likert scale that assess trait anxiety (STAI-T; M_{Sum} = 40.94, SD = 9.81, α = .91) and state anxiety (STAI-S; M_{Sum} = 34.09, SD = 8.30, α = .88). The trait anxiety measure includes statements such as "I am a steady person" and "I feel secure", rated according to how participants are feeling in general. The state anxiety measure includes statements such as "I feel jittery" and "I feel frightened", rated according to how participants feel at the moment (Spielberger, Gorsuch, & Lushene, 1970). The STAI-S conceptualizes state anxiety as a complex of negative, high arousal affective responses associated with increased autonomic activity. Increasing scores on the STAI-S reflect greater feelings of apprehension and tension, with high scores indicating experience of fear (Spielberger, 1972). The STAI-S was assessed before and after watching the film clips to measure changes in responses related to state anxiety after the task.

After completing the questionnaires, participants entered a testing room, which was dimly lit and consisted of a Windows PC for running the task. After the participant was seated in front of the computer screen, the experimenter instructed the participant to put on headphones for the audio component of the film clips. The experimenter left the room once the participant began the study. The task was administered using E-Prime 2.0 software (Psychology Software Tools, Inc., 2012). During the task, participants watched 32 film clips that were 40 s each in duration, presented in random order. After watching each film clip, participants rated the greatest degree of each emotion they experienced while watching the clip for the following 11 emotion categories on a 9-point scale (1 = Not at all, 5 = Somewhat, 9 = Extremely): amusement, anger, anxiety, confusion, contempt, disgust, fear, interest, sadness, surprise, and unhappiness. These emotion categories were adapted from self-report methods used in norming procedures that distinguished film clips by the emotion most strongly experienced while watching them (Gross & Levenson, 1995). Multiple emotion categories were assessed to compare the degree of self-reported anxiety evoked by the film clips to that of other emotions. Participants rated each emotion in random order for each trial and all ratings were self-paced. After rating all the emotion categories, participants provided ratings on additional items that assessed their emotional and cognitive responses to the film clip. Instructions and all ratings administered as part of this task are described in Table S4 of the Supplementary Online Materials (SOM).

Upon completion of the task, participants completed another set of questionnaires on a computer outside of the testing room. Measures administered after watching the film clips included another administration of the STAI-S (STAI-$S_{Post\text{-}Task}$; M_{Sum} = 49.17, SD = 13.89, α = .95) to gauge the level of state anxiety sustained after the task. All questionnaires administered as a part of these studies are listed in Table S2 of the SOM. Participants were debriefed and thanked for their participation after completing these measures. Participants took approximately 90 min to complete the entire study.

Stimulus set. Thirty-two 40 s film clips were obtained from 25 movies that were selected by consulting several sources. These

sources included prior studies that have used film clips to elicit fear and anxiety (Gross & Levenson, 1995; Schaefer, Nils, Sanchez, & Philippot, 2010), recommendations from film critics, and online commentary on video sharing sites (e.g., YouTube). Film clips were selected based on the criteria that at least one target person was depicted in the scene facing a potential or approaching threat, with either the threat approaching the target person or the target person approaching the threat. This criterion was based on imminence theories of threat proposing fear and anxiety to be defensive responses to an approaching or potential threat (Graeff & Zangrossi, 2002; McNaughton & Corr, 2004; Mobbs et al., 2007). Film clips were selected to elicit low, medium, and high degrees of anxiety. To assess whether realism in the depicted scenes impacts the relationship between empathy and anxiety, half of the film clips depicted scenes that were imaginary and could not happen in real life (e.g., an approaching ghost), and half of the film clips depicted scenes that were nonimaginary and could potentially happen in real life (e.g., an approaching shark). A paired t test indicated that imaginary scenes were rated to elicit higher anxiety ($M = 5.38$, $SD = 1.77$) than nonimaginary scenes, $M = 4.96$, $SD = 1.89$; $M_{\text{Diff}} = .43$, $t(46) = 3.51$, $p = .001$. As trait empathy was not differentially correlated with mean ratings of anxiety for imaginary scenes ($r = .32$, 95% CI [.036, .56], $p = .028$) and nonimaginary scenes ($r = .29$, 95% CI [.008, .54], $p = .045$), subsequent analyses are collapsed across this category. See the SOM for additional information on the editing procedures for the clips, Table S3 for descriptions of the scenes depicted in the film clips, and Figure S1 for mean anxiety ratings on individual clips across participants in Study 1.

Results

Raw and summary data relevant to the results in Studies 1-4 are available at https://osf.io/34we9/. Experience of vicarious anxiety was assessed by calculating two measures: the mean of anxiety ratings made immediately after exposure to each of the film clips, and the change in the STAI-S measure after watching the film clips for each participant. This change score (ΔSTAI-S) was calculated by subtracting the STAI-S summed score obtained prior to watching the film clips ($\text{STAI-S}_{\text{Pre-Task}}$) from the $\text{STAI-S}_{\text{Post-Task}}$ summed score. These two measures of anxiety assess both the self-reported experience of anxiety immediately upon exposure to the stimuli, as well as the experience of sustained anxiety after exposure to the stimuli. On the one hand, the mean anxiety score assesses participants' lay understanding of emotion categories and provides insight into the specificity of how they are categorizing their affective responses to the film clips. On the other hand, the ΔSTAI-S score is more diffuse, as the STAI-S assesses several self-reported affective dimensions to infer increased autonomic arousal, along with the experience of apprehension and fear (e.g., items assessing degree of feeling jittery, nervous, and frightened; Spielberger, 1972). Assessing ΔSTAI-S captures a critical component of experiencing anxiety, that of a heightened and sustained threat response in the absence of direct exposure to threat. Together, these ratings are used as convergent measures to assess the experience of anxiety in response to the film clips, both as a categorical emotion and as a more diffuse, sustained affective response.

To assess the effects of trait empathy, as opposed to trait anxiety, on experience of anxiety from watching the film clips, separate correlations were conducted for trait empathy and trait anxiety with the measures assessing state anxiety experienced from watching the film clips. Partial correlations were also conducted for the relationships between trait empathy and anxiety experienced from the task, while controlling for trait anxiety. $\text{STAI-S}_{\text{Pre-Task}}$, gender, and age were assessed as additional confounds in the relationships between trait empathy and experience of anxiety. These measures were not found to affect the relationships between trait empathy and anxiety throughout all studies in this manuscript, unless otherwise indicated (analyses are reported in the SOM).

All results reported in this article are conducted with two-tailed tests unless otherwise noted. In all studies, Pearson's r (r) was used to test correlations between continuous variables with normal distributions, whereas the nonparametric Spearman's rho (r_s) was used to test associations between continuous variables where at least one variable exhibited a non-normal distribution as indicated by significance ($p \leq .050$) on the Kolmogorov–Smirnov or Shapiro-Wilk tests (see Table S1, SOM). Point-biserial correlations (r_{pb}) were performed to test associations between a categorical and continuous variable. To assess gender as a potential confound in our analyses, gender was coded as male = 0, female = 1. Parametric tests were used for all partial correlations.

For mediation analyses, INDIRECT and PROCESS macros for SPSS were used to implement bias-corrected bootstrapping procedures to test the significance of the indirect effect (ab) of the predictor variable (X) on the outcome variable (Y). For simple mediations, the product ab represents the degree to which a mediator (M) accounts for the total relationship (c) between X and Y. The degree of the total relationship between X and Y that is unaccounted for by M is quantified by the direct relationship (c'). The ab path is calculated by taking the product of the unstandardized path coefficients between the *a path* (the relationship between X and M) and the *b path* (the relationship between M and Y, with X held constant), and is tested with 10,000 bootstrapped samples at a 95% confidence interval (unless otherwise indicated; Hayes, 2012; Preacher & Hayes, 2008). Analyses for mediations are reported with unstandardized coefficients. All analyses were conducted with SPSS Version 23.0 and R (3.3.1)/RStudio (0.99.484; R Core Team, 2016; RStudio Team, 2015).

Emotion ratings. Averaged across all trials and participants, mean anxiety ($M = 5.17$, $SD = 1.78$) was the highest rated emotion compared with the means of the other emotion categories rated while watching the film clips. A repeated measures ANOVA (Greenhouse-Geisser corrected) indicated a significant difference among the 11 emotion categories, $F(3.15, 145.10) = 26.18$, $p < .001$ and post hoc tests with Bonferroni correction for multiple comparisons demonstrated that mean anxiety was significantly greater than the means for all other emotion categories except for interest (See Table 1). The mean difference between anxiety and interest ratings was significant when correction for multiple comparisons was not applied ($M_{\text{Diff}} = .98$, 95% CI [.26, 1.69], $p = .008$). See Table S11 (SOM) for correlations between the mean emotion ratings.

Sustained anxiety after the task. To determine whether participants experienced sustained anxiety after viewing the film clips, a paired t test was conducted to assess whether $\text{STAI-S}_{\text{Post-Task}}$ was greater than $\text{STAI-S}_{\text{Pre-Task}}$. This analysis indicated that compared with the level of anxiety reported prior to observing targets facing threats, participants experienced greater anxiety that was sustained after completing the task, $M_{\Delta\text{STAI-S}} =$

Table 1
Mean Emotion Ratings and Differences From Anxiety in Studies 1 and 2

	Study 1 (n = 47)		Study 2 (n = 60)	
	Own emotions		Target victims' emotions	
Emotion category	*M* (*SD*)	Difference from anxiety [95% CI]	*M* (*SD*)	Difference from anxiety [95% CI]
Anxiety	5.17 (1.78)		7.49 (1.06)	
Fear	4.92 (1.82)	−.25* [−0.45,−0.04]	7.98 (.74)	.48** [0.16, 0.80]
Surprise	4.30 (1.62)	−.87** [−1.40,−0.35]	7.02 (1.18)	−.48[a] [−0.99, 0.04]
Disgust	4.27 (1.62)	−.90** [−1.49,−0.30]	5.14 (1.64)	−2.35** [−3.06, −1.65]
Unhappiness	4.22 (1.90)	−.95** [−1.51,−0.39]	6.09 (1.73)	−1.40** [−2.06,−0.74]
Interest	4.19 (1.66)	−.98[a] [−2.24, 0.28]	4.67 (1.75)	−2.83** [−3.69, −1.97]
Confusion	3.82 (1.70)	−1.35** [−2.26,−0.44]	6.70 (1.33)	−.79** [−1.29,−0.29]
Amusement	2.91 (1.42)	−2.26** [−3.65,−0.86]	1.72 (.88)	−5.77** [−6.45, −5.09]
Sadness	2.83 (1.48)	−2.34** [−3.06, −1.62]	3.85 (1.78)	−3.64** [−4.41, −2.88]
Contempt	2.59 (1.35)	−2.58** [−3.43, −1.74]	3.35 (1.82)	−4.15** [−5.00, −3.29]
Anger	2.47 (1.40)	−2.70** [−3.48, −1.92]	3.55 (1.73)	−3.95** [−4.72, −3.17]

Note. Emotions were rated on a 9-point scale (1 = *Not at All*; 5 = *Somewhat*; 9 = *Extremely*). Mean ratings were averaged across 32 trials. 95% confidence intervals (CIs) are adjusted for multiple comparisons with Bonferroni correction.
[a] Mean differences from anxiety are significant without Bonferroni correction.
* $p \leq .01$. ** $p \leq .001$.

15.09, 95% CI [11.35, 18.82], $t(46) = 8.12$, $p < .001$, $d_z = 1.18$ (see Figure 1a).

Trait empathy and experience of anxiety during the task. To assess whether trait empathy is associated with experiencing anxiety when observing targets facing threats, we performed a correlation between the General Empathy Scale scores and mean anxiety ratings averaged across all trials of the task. Trait empathy was positively associated with mean anxiety ratings during the task ($r = .31$, 95% CI [.031, .55], $p = .031$, Figure 1b), as well as with mean ratings of surprise ($r = .29$, 95% CI [.00, .53], $p = .050$). Trait empathy was not significantly ($p > .050$) associated with any of the other emotion categories (see Table S9). Trait empathy and STAI-T were not significantly associated ($r = .21$, 95% CI [−.086, .47], $p = .16$), and the relationship between trait empathy and experience of anxiety during the task remained significant when controlling for STAI-T ($r = .30$, 95% CI [.015, .55], $p = .040$).

Trait empathy and sustained anxiety after the task. To assess whether trait empathy is associated with sustained anxiety after observing target victims facing threats, we performed correlations to test the relationships between the General Empathy Scale scores with STAI-$S_{Post\text{-}Task}$ and ΔSTAI-S. Trait empathy was associated with both STAI-$S_{Post\text{-}Task}$ ($r_s = .46$, 95% CI [.20, .66], $p = .001$) and ΔSTAI-S ($r = .40$, 95% CI [.12, .61], $p = .006$, Figure 1c). These relationships remained significant when controlling for STAI-T (STAI-$S_{Post\text{-}Task}$: $r = .38$, 95% CI [.097, .60], $p = .010$; ΔSTAI-S: $r = .38$, 95% CI [.10, .60], $p = .009$).

Anxiety during the task mediates the relationship between trait empathy and sustained anxiety after the task. As the anxiety ratings during the task indicate how participants are specifically categorizing their affective response to observing target victims, whereas the STAI-S assesses more diffuse responses related to anxiety, we used mediation analyses to assess whether anxiety ratings during the task specifically drive the relationship between trait empathy and ΔSTAI-S. Whereas a mediating effect of anxiety ratings during the task would indicate a specific role for the experience of anxiety in the relationship between trait empathy and ΔSTAI-S, the lack of such a relationship would suggest a more general affective response driving the relationship between trait empathy and ΔSTAI-S.

We first tested mean anxiety during the task as a mediator for the relationship between the General Empathy Scale scores and ΔSTAI-S. Mean anxiety during the task mediated the relationship between trait empathy and ΔSTAI-S ($ab = .074$, $SE = .035$, 95% CI [.013, .15]; $c = .19$, $SE = .066$, $t = 2.90$, $p = .006$; $c' = .12$, $SE = .061$, $t = 1.93$, $p = .060$). As trait empathy was significantly associated with both mean ratings of anxiety and surprise, we then conducted a multiple mediation analysis with mean anxiety and mean surprise ratings as parallel mediators for the relationship between trait empathy and ΔSTAI-S. Mean anxiety during the task mediated the relationship between trait empathy and ΔSTAI-S, whereas mean surprise ratings did not have a significant indirect effect (see Figure 1d).

To assess the possibility of other high arousal negative emotions mediating the relationship between trait empathy and ΔSTAI-S, separate multiple mediation analyses were conducted to test the specificity of mean anxiety with mean ratings of anger, disgust, and fear. When mean anxiety and anger were tested as parallel mediators for the relationship between trait empathy and ΔSTAI-S, mean anxiety during the task mediated the relationship between trait empathy and ΔSTAI-S ($ab = .073$, $SE = .040$, 95% CI [.011, .17]) whereas mean anger did not ($ab = .001$, $SE = .019$, 95% CI [−.028, .056]. Similarly, when mean anxiety and disgust were tested as mediators for the relationship between trait empathy and ΔSTAI-S, mean anxiety during the task mediated the relationship between trait empathy and ΔSTAI-S ($ab = .065$, $SE = .045$, 95% CI [.0007, .19]) whereas mean disgust did not ($ab = .011$, $SE = .036$, 95% CI [−.038, .11]. When assessed as parallel mediators in the same model, mean anxiety and fear did not significantly mediate the relationship between trait empathy and ΔSTAI-S.

Trait anxiety and experience of anxiety during and after the task. STAI-T was not associated with mean anxiety during the task ($r = .093$, 95% CI [−.20, .37], $p = .53$). STAI-T was

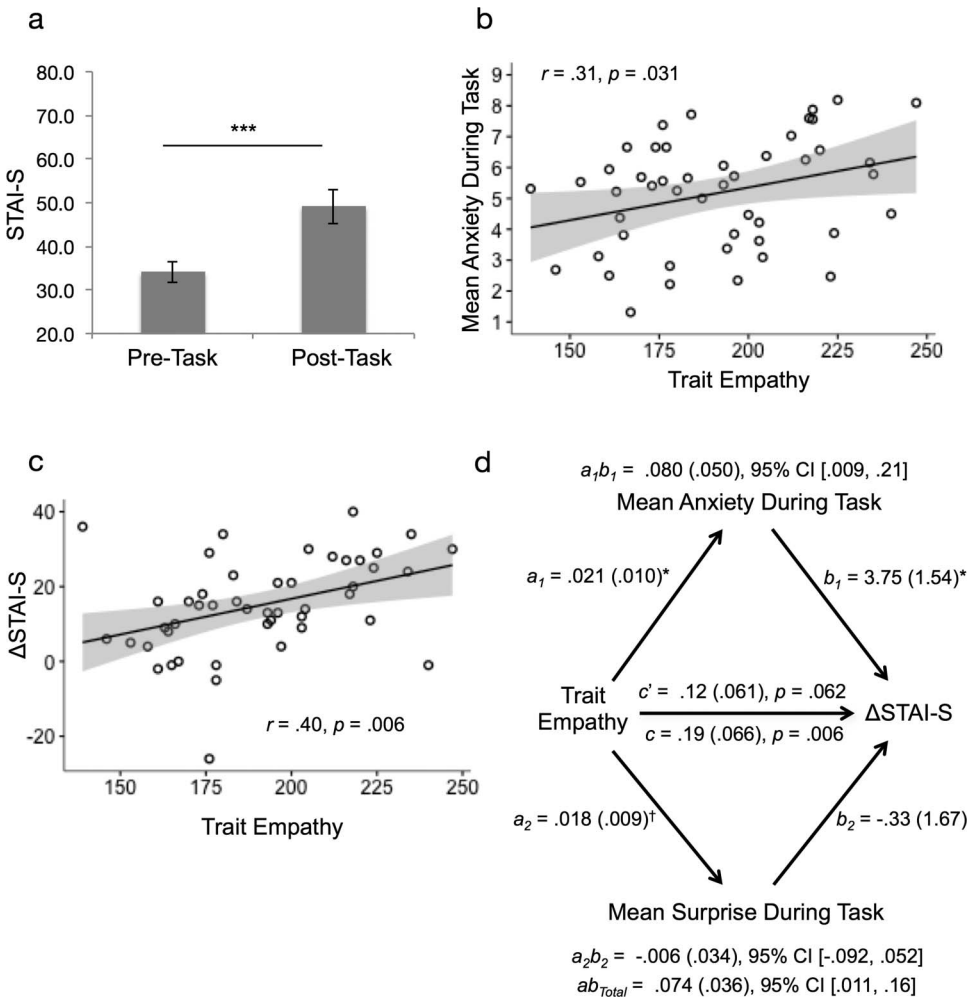

Figure 1. Results from Study 1 ($n = 47$). a) Mean STAI-S scores obtained before and after watching the film clips. Error bars represent 95% confidence intervals for the means. b) Scatterplot with line representing the linear best fit for the General Empathy Scale (sum) and mean anxiety ratings averaged across all trials of the task. c) Scatterplot with line representing the linear best fit for the General Empathy Scale scores (sum) and ΔSTAI-S. For panels b and c, bands represent 95% confidence intervals for the regression lines. Pearson's *r* correlation coefficients are displayed. d) Diagram illustrating the indirect effects of mean anxiety ratings and mean surprise ratings on the relationship between the General Empathy Scale and ΔSTAI-S in a multiple mediation model. Mean anxiety significantly mediates the relationship between the General Empathy Scale and ΔSTAI-S, whereas mean surprise does not. Unstandardized regression coefficients are displayed with the standard error in parentheses. STAI-S = State measure of the State Trait Anxiety Inventory, ΔSTAI-S = Difference score in STAI-S calculated by subtracting the score before the task from the score obtained after the task. † $p \leq .10$. * $p \leq .05$. *** $p \leq .001$.

associated with STAI-$S_{Pre\text{-}Task}$ ($r = .57$, 95% CI [.34, .74], $p < .001$) and STAI-$S_{Post\text{-}Task}$ ($r_s = .42$, 95% CI [.15, .63], $p = .003$), but was not significantly associated with ΔSTAI-S ($r = .14$, 95% CI [−.15, .41], $p = .35$).

Discussion

The results from Study 1 support our hypothesis that trait empathy is associated with experiencing greater vicarious anxiety when observing others facing threats. Trait empathy was positively associated with self-reported anxiety while watching target victims facing threats and with sustained anxiety after completing this task. Trait anxiety was not significantly associated with anxiety experienced during the task or with changes in sustained anxiety after the task. Although trait empathy was also significantly associated with mean ratings of surprise during the task, a multiple mediation model indicated a specific effect for mean ratings of anxiety when anxiety and surprise were tested as parallel mediators in the relationship between trait empathy and sustained anxiety after the task. Multiple mediation models also indicated a specific effect for mean anxiety during the task, when tested separately as parallel mediators with mean ratings of anger and disgust, in the relationship between trait empathy and sustained anxiety after the task. These analyses indicate some level of specificity

among high arousal negative emotions for the relationship between trait empathy and experience of anxiety from observing target victims facing threats.

However, a specific effect was not seen when mean ratings of anxiety and fear were assessed as multiple mediators in the relationship between trait empathy and sustained anxiety after the task. As anxiety and fear share many conceptual similarities, these two emotion categories may be particularly difficult to dissociate, as is evidenced by the extremely high correlation between the mean ratings for these emotions during the task ($r = .98$, 95% CI [.96, .99], $p < .001$). Mean anxiety was most highly correlated with mean ratings of fear, as compared with the other emotion categories. In addition, the STAI-S measure used to assess sustained anxiety after the task includes items that assess aspects of feeling fear (e.g., "I feel frightened"), and thus it may be particularly difficult to dissociate anxiety from fear in relation to this measure, which assesses experiences of both emotions. Although this limits the degree to which anxiety can be specified as the only emotion to drive the effect between trait empathy and sustained anxiety, the current analyses indicate specificity for experience of anxiety-related responses that pertain to defensive responding to threats.[1]

Study 2

To test the hypothesis that trait empathy increases the perception of anxiety in others facing threats, we recruited another set of participants to complete a protocol similar to Study 1. In Study 2, participants rated the emotions experienced by the target victim in each film clip instead of their own emotions.

Method

Participants. Sixty-two participants were recruited from introductory psychology courses at Columbia University for course credits. One participant chose to end the study without completing the task and one participant was dismissed prior to completing the study due to having taken longer on the task than the allotted 90 min for the study. Data obtained from these participants were not analyzed. The final sample used for analyses consisted of 60 participants (35 female and 25 male; $M_{Age} = 21.32$ years, $SD = 4.68$, range = 18–40). This target sample size was predetermined through a power analysis conducted with G*Power 3.1 for an a priori, one-tailed bivariate normal model correlation ($r = .315$, alpha level = .05, power = .80, and null = 0). We based the effect size for the power analysis on the correlation between trait empathy and mean ratings of experienced anxiety while watching the film clips in Study 1.

Materials and procedures. As in Study 1, participants first completed questionnaires including the General Empathy Scale ($M_{Sum} = 195.03$, $SD = 27.80$, $\alpha = .89$), STAI-T ($M_{Sum} = 41.80$, $SD = 10.65$, $\alpha = .91$), and STAI-$S_{Pre\text{-}Task}$ ($M_{Sum} = 34.80$, $SD = 10.74$, $\alpha = .93$) on a computer outside of the testing room. Participants then completed a task in which they watched the film clips used in Study 1 and made ratings after each clip. In this study, participants rated the greatest amount of each emotion they perceive*d the target victim* in each scene to have experienced on the 11 emotion categories used in Study 1 (1 = Not at all, 5 = Somewhat, 9 = Extremely). The film clips were presented in random order and the emotion categories were rated in random order after each film clip. To confirm that each scene clearly depicted a victim facing a threat, participants were asked to indicate whether they identified a victim in each scene (1 = "No, it was ambiguous or there was no victim", 2 = "Yes, there was clearly a victim"). Upon completion of the task, participants completed the STAI-$S_{Post\text{-}Task}$ ($M_{Sum} = 43.08$, $SD = 13.13$, $\alpha = .94$) along with other questionnaires on a computer outside of the testing room. See Table S5 (SOM) for all ratings and instructions administered during the task. This study took approximately 90 min to complete.

Results

Identification of a victim in each clip. Individual ratings were recoded for each film clip so that participants indicated whether a victim was identified in the scene by a response of 0 for "No, it was ambiguous or there was no victim" or 1 for "Yes, there was clearly a victim". A mean for each film clip was calculated based on ratings from all participants. The mean of ratings for all 32 clips was .85 ($SD = .16$, range = .38–1.00), and the distribution of these ratings indicated that a victim was clearly identified for the majority of the clips. Mean scores of .79, .90, and .97 represented the 25th, 50th, and 75th percentiles respectively for the 32 film clips.

Emotion ratings for target victims. Averaged across all trials, participants reported fear ($M = 7.98$, $SD = .74$) to be the greatest emotion experienced by victims on a 9-point scale, followed by anxiety ($M = 7.49$, $SD = 1.06$), and surprise ($M = 7.02$, $SD = 1.18$). A repeated measures ANOVA (Greenhouse-Geisser corrected) indicated a significant difference among the 11 emotions, $F(5.69, 335.57) = 174.76$, $p < .001$ and post hoc tests with Bonferroni correction for multiple comparisons demonstrated that the mean of fear ratings was greater than the means of all other emotion categories, including anxiety ($M_{Fear\text{-}Anxiety} = .48$, 95% CI [.16, .80], $p < .001$). Mean anxiety was not significantly different from mean ratings of surprise ($M_{Anxiety\text{-}Surprise} = .48$, 95% CI [−.04, .99], $p = .11$), but was significantly different from the means of the other emotion categories (see Table 1). The difference between mean anxiety and surprise ratings was significant when correction for multiple comparisons was not applied ($M_{Diff} = .48$, 95% CI [.18, .77], $p = .002$). For correlations between the means of all emotion ratings, see Table S12 (SOM).

Trait empathy and perception of anxiety in target victims. To assess whether trait empathy is associated with increased perception of anxiety in target victims, we performed a correlation between the General Empathy Scale scores and mean perceived anxiety ratings. Trait empathy was positively associated with mean ratings of perceived anxiety in victims ($r_s = .31$, 95% CI [.063, .52], $p = .015$, see Figure 2). This relationship remained significant when controlling for STAI-T ($r = .29$, 95% CI [.038, .51], $p = .025$). Trait empathy was also positively associated with mean ratings of perceived fear ($r_s = .30$, 95% CI [.051, .52], $p = .019$) and negatively associated with mean ratings of perceived amusement in target victims ($r_s = -.27$, 95% CI [−.49, −.017], $p = .037$). There were no other significant correlations between trait empathy and mean perceived emotions in the targets (see Table S9, SOM).

As trait empathy was associated with both perceived anxiety and negatively with amusement, a partial correlation was performed

[1] Mean ratings of anxiety and fear during the task were not dissociable throughout Studies 1-3. In these studies, analyses using a composite measure in which anxiety and fear ratings were averaged produced the same results as using only anxiety ratings (see Table S9).

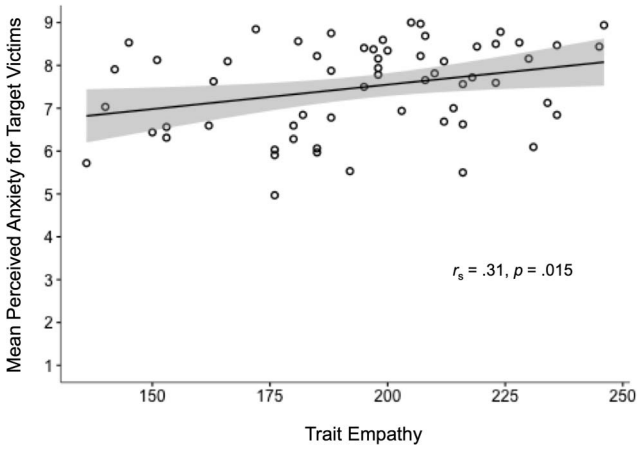

Figure 2. Results from Study 2 (n = 60). Scatterplot with line representing the linear best fit for the General Empathy Scale scores (sum) and mean perceived anxiety ratings for the target victim in each film clip, averaged across all trials of the task. Band represents the 95% confidence interval for the regression line. The Spearman's rho correlation coefficient is displayed.

between the General Empathy Scale scores and mean anxiety ratings, controlling for mean amusement, to test the specificity of the relationship between trait empathy and perceived anxiety. This relationship was significant (r = .27, 95% CI [.010, .49], p = .042). However, a partial correlation between trait empathy and perceived amusement when controlling for anxiety was not significant (r = −.20, 95% CI [−.44, .057], p = .12), indicating that the relationship between trait empathy and amusement may have been somewhat driven by the shared variability between amusement and anxiety ratings. A partial correlation between trait empathy and mean perceived anxiety, when controlling for fear, was not significant (r = .13, 95% CI [−.13, .37], p = .33).

As in Study 1, additional analyses were conducted to assess the specificity of the relationship between trait empathy and perceived anxiety in relation to high arousal negative emotions. Although trait empathy was not significantly associated with mean ratings of perceived anger (r_s = −.095, 95% CI [−.34, .16], p = .47) or disgust (r = .11, 95% CI [−.14, .36], p = .38), mean perceived anxiety was significantly associated with both ratings of anger (r_s = .30, 95% CI [.052, .52], p = .019) and disgust (r_s = .42, 95% CI [.19, .61], p = .001). Separate partial correlations performed between trait empathy and mean perceived anxiety indicated that the relationship between them remained significant when controlling for mean ratings of perceived anger (r = .34, 95% CI [.089, .55], p = .009) and disgust (r = .28, 95% CI [.025, .50], p = .032).

Trait anxiety and perception of anxiety in target victims. STAI-T was not significantly associated with mean perceived anxiety (r_s = .20, 95% CI [−.060, .43], p = .13).

Perception of anxiety in target victims and sustained anxiety after the task. Mean perceived anxiety was not associated with $STAI\text{-}S_{Post\text{-}Task}$ (r_s = .14, 95% CI [−.12, .38], p = .29) or with ΔSTAI-S (r_s = .058, 95% CI [−.20, .31], p = .66).

Replications of findings from Study 1. Replication analyses indicated a significant increase in anxiety sustained after the task, a significant positive relationship between trait empathy and ΔSTAI-S, and no significant relationship between STAI-T and ΔSTAI-S (see SOM for analyses).

Discussion

We aimed to establish a stimulus set depicting targets experiencing anxiety. However, fear was the most highly perceived emotion in target victims. As clear threats are often depicted to be approaching the targets in the film clips, this finding is congruent with conceptualizations of fear as a response to immediate threat. It may be that participants perceive targets to primarily experience anxiety, and then fear as the threat approaches and becomes more imminent to the target (Mobbs et al., 2009). However, the temporal dynamics of how participants perceived emotions to be experienced by targets was not assessed. The fact that most of the clips in this stimulus set end by depicting the threat at its most imminent position to the target victim may also influence overall judgments of the targets' emotions toward greater experience of fear rather than anxiety.

Supporting our hypothesis that trait empathy enhances perception of anxiety in targets facing threats, trait empathy was associated with perceiving greater anxiety to be experienced by target victims. However, trait empathy was also associated with perceiving targets to experience greater fear. As fear and anxiety were the two emotions most greatly perceived to be experienced by target victims, these patterns suggest that trait empathy facilitates perception of emotions most strongly experienced by a target, as agreed upon by a consensus of observers. Although these patterns do not support a relationship strictly between trait empathy and perception of anxiety, they indicate that in the context of targets facing threats, trait empathy facilitates perception of emotions that facilitate defensive responding to threats.

As we were unable to dissociate the relationship between trait empathy and perception of anxiety from fear in targets, we cannot assess whether expression of fear or anxiety drives the relationship between trait empathy and experience of anxiety. However, as trait empathy was not significantly associated with perceiving other high arousal negative emotions, such as anger and disgust, and trait empathy remained significantly associated with mean ratings of perceived anxiety when controlling for these emotions, there is some support for a specific relationship between trait empathy and perception of emotions closely associated with anxiety in response to observing others facing threats.

Finally, mean perceived anxiety ratings for target victims were not associated with sustained anxiety after the task. As prior research has demonstrated a positive association between the degree of observed fear related behaviors in others and the degree to which an observer exhibits fear related behaviors themselves (Mineka & Cook, 1993), it may be that the relationship between perceiving anxiety in others and experience of anxiety occurs in a more temporally proximal context. The next study tests this relationship.

Study 3

In Study 3, we used the IRI to investigate how specific dimensions of trait empathy are associated with experience of vicarious anxiety. As the trait empathy measure used in Studies 1 and 2 assessed general empathic responses to both positive and negative situations, the Empathic Concern subscale of the IRI was of particular interest as it specifically assesses the tendency to experience interpersonal responses to others who are in distress. We predicted that the relation-

ships seen between a general measure of trait empathy and anxiety in Studies 1 and 2 would extend to the Empathic Concern subscale. We also predicted that the Personal Distress subscale would not be associated with perception or experience of anxiety in response to the target victims, due to its conceptual similarities with trait anxiety.

We investigated the relationship between the degree of anxiety perceived in a target and the degree of vicarious anxiety experienced after observing the target. We hypothesize that the degree of anxiety perceived in a target will be positively associated with the degree of anxiety experienced from observing the target, and that the magnitude of perceived anxiety will mediate the relationship between trait empathy/empathic concern and experience of vicarious anxiety. To test these relationships, we adapted the protocols used in Studies 1 and 2 so that participants rated both their own emotions and the target victim's emotions after viewing each film clip.

A potential confound in the relationship between trait empathy and experience of vicarious anxiety may be that individuals who are more emotionally reactive report having higher trait empathy, and that it is emotional reactivity instead of empathy that drives reports of experiencing vicarious anxiety. To address this, we administered a measure of trait emotional reactivity, the Impulse Strength subscale of the Berkeley Expressivity Questionnaire. This subscale assesses emotional reactivity with statements such as "I experience my emotions very strongly" and "My body reacts very strongly to emotional situations" (Gross & John, 1997).

As prior literature has established a relationship between experiencing anxiety and avoidance of risk (Lerner & Keltner, 2001; Raghunathan & Pham, 1999), we predict that trait empathy/empathic concern and the experience of vicarious anxiety should also be associated with greater risk-aversion after observing target victims facing threats. To assess risk-aversion as an outcome of experiencing vicarious anxiety, we administered items from the Domain Specific Risk-Taking Scale (DOSPERT; Blais & Weber, 2006). The DOSPERT assesses risk-taking with items describing risky activities. On this scale, participants rate the likelihood they would engage in the activity described in each item (1 = Extremely unlikely, 2 = Moderately unlikely, 3 = Somewhat unlikely, 4 = Not sure, 5 = Somewhat likely, 6 = Moderately likely, 7 = Extremely likely). Due to time constraints, we used two subscales consisting of 12 items from the 30-item DOSPERT: the Health/Safety subscale (example item, "Walking home alone at night in an unsafe area of town"), and the Recreational subscale (example item, "Taking a skydiving class)". These subscales were selected as they present scenarios involving physical threats, and thus assess a specific domain of risk that pertains to the type of threats faced by the target victims in the film clips.

Method

Participants. Sixty-five participants were recruited from introductory psychology courses at Columbia University for course credits. Three participants chose to end the study without completing the task. Data from two participants were not fully obtained due to technical issues. The data obtained from these participants were not analyzed. The final sample used for analyses consisted of 60 participants (34 female and 26 male; M_{Age} = 20.33 years, SD = 2.18, range = 18–29). This target sample size was predetermined to be identical to that of Study 2.

Materials and procedures. After consenting to participate in the study, participants first completed questionnaires on a computer outside of the testing room that included the STAI-T (M_{Sum} = 42.13, SD = 9.80, α = .91), STAI-$S_{Pre\text{-}Task}$ (M_{Sum} = 35.98, SD = 10.13, α = .93), General Empathy Scale (M_{Sum} = 198.03, SD = 30.82, α = .92), IRI (28 items on a 5-point scale (0–4) with four subscales consisting of seven items. Total score: M_{Sum} = 69.98, SD = 10.87, α = .80; Empathic Concern: M_{Sum} = 20.62, SD = 4.02, α = .78; Personal Distress: M_{Sum} = 12.20, SD = 4.83, α = .78; Fantasy: M_{Sum} = 18.85, SD = 5.09, α = .82; Perspective Taking: M_{Sum} = 18.32, SD = 4.32, α = .74), the BEQ (16-item measure on a 7-point scale. The Impulse Strength subscale consists of six items. Total score: M_{Sum} = 71.75, SD = 17.39, α = .91; Impulse Strength subscale: M_{Sum} = 28.32, SD = 7.53, α = .81), and DOSPERT$_{Pre\text{-}Task}$ (12 items on a 7-point scale, M_{Sum} = 46.13, SD = 13.20, α = .76).

After completing the questionnaires, participants entered the testing room and completed a task in which they viewed 24 of the film clips used in Studies 1 and 2. Selection of these film clips was based off of ratings provided in Study 2 regarding whether a victim was easily identified in the scene. For each clip used in this study, at least 80% of the participants from Study 2 indicated that a victim was clearly identified in the scene (see Table S3). As in Studies 1 and 2, the film clips were presented in random order. After watching each clip, participants made eight ratings with four emotion categories on a 9-point Likert scale (1 = Not at all, 5 = Somewhat, 9 = Extremely) based on the greatest amount of each emotion (fear, anxiety, sadness, and amusement) they felt during each clip and the greatest amount of each emotion they perceived the target victim to have experienced in each clip (see Table S6 in SOM for instructions given). The emotion ratings were blocked so that ratings for one's own emotions were made sequentially in one block and ratings for the victim's emotions were made sequentially in a following block. The blocks were presented in random order after each clip such that participants rated their emotions first after some clips and rated the victim's emotions first after other clips. The emotion categories that were rated within a block were presented in random order. After completion of the task, participants came out of the testing room and completed the STAI-$S_{Post\text{-}Task}$ (M_{Sum} = 48.35, SD = 12.55, α = .94) and DOSPERT$_{Post\text{-}Task}$ (M_{Sum} = 44.65, SD = 12.65, α = .75). This study took approximately 1 hr to complete.[2]

Results

Relationships between trait empathy and the IRI subscales. The General Empathy Scale was associated with the following IRI subscales: Empathic Concern (r_s = .73, 95% CI [.58, .83], $p < .001$), Personal Distress (r = .29, 95% CI [.039, .51], p = .025), and Fantasy (r = .57, 95% CI [.37, .72], $p < .001$). The General Empathy Scale was not associated with the Perspective Taking subscale (r = −.079, 95% CI [−.33, .18], p = .55), which

[2] Heart rate and galvanic skin response measures were collected during the task. As neither of these measures was significantly associated with self-reported measures of empathy and anxiety collected in this study, these measures are not further discussed. Prior studies have similarly reported a lack of correspondence between such physiological measures and self-reports of emotional experience (Gump & Kulik, 1997; Mauss, Wilhelm, & Gross, 2004). It may be that other factors involved in the formation of an emotional experience, such as cognitive appraisals, preclude a direct relationship between physiological measures and self-reports of emotional experience (Barrett, Mesquita, Ochsner, & Gross, 2007; LeDoux, 2014; Mauss et al., 2004).

suggests that the Perspective Taking subscale is a measure that assesses a cognitive dimension of empathy dissociable from the affective dimensions assessed by the other subscales of the IRI.

Experienced emotions. The following analyses pertain to the participants' experience of their own emotions.

Emotion ratings for self. Averaged across all trials, participants rated anxiety to be the greatest experienced emotion ($M = 5.75$, $SD = 1.62$), followed by fear ($M = 5.44$, $SD = 1.75$), sadness ($M = 2.92$, $SD = 1.79$), and amusement ($M = 2.71$, $SD = 1.40$). A repeated measures ANOVA (Greenhouse-Geisser corrected) indicated a significant difference among the means for the four emotion categories, $F(1.84, 108.52) = 87.03$, $p < .001$ and post hoc tests with Bonferroni correction for multiple comparisons (applied to p values and confidence intervals) indicated that mean anxiety was greater than the means for all other emotion categories ($M_{\text{Anxiety-Fear}} = .31$, 95% CI [.13, .50], $p < .001$; $M_{\text{Anxiety-Sadness}} = 2.83$, 95% CI [2.28, 3.37], $p < .001$; $M_{\text{Anxiety-Amusement}} = 3.04$, 95% CI [2.24, 3.84], $p < .001$). These results reflect a similar pattern found in Study 1, in which the mean for experienced anxiety was greatest among all emotion categories.

Trait empathic concern and experience of anxiety during the task. The Empathic Concern subscale was associated with mean ratings of experienced anxiety during the task ($r_s = .48$, 95% CI [.25, .65], $p < .001$), as well as with mean ratings of fear, sadness, and negatively with amusement. In contrast, the Personal Distress subscale was not significantly associated with mean ratings of experienced anxiety during the task ($r = .15$, 95% CI [−.11, .39], $p = .26$). The difference of the dependent correlations between the Empathic Concern subscale on the one hand and Personal Distress subscale on the other hand, with mean ratings of experienced anxiety was significant ($t = 2.21$, $p = .03$, see Figure 3a).

Mean ratings of anxiety were associated with the Fantasy subscale ($r = .35$, 95% CI [.10, .55], $p = .006$), and were not significantly associated with the Perspective Taking subscale ($r = .14$, 95% CI [−.12, .38], $p = .29$). Mean ratings of anxiety were not significantly associated with the Fantasy subscale when controlling for the Empathic Concern subscale ($r = .14$, 95% CI [−.12, .38], $p = .28$). However, mean ratings of anxiety remained significantly associated with the Empathic Concern subscale when controlling for the Fantasy subscale ($r = .36$, 95% CI [.12, .57], $p = .005$). See Table 2 for correlations between all subscales of the IRI and mean emotion ratings.

To assess the specificity of the relationship between the Empathic Concern subscale and mean ratings of experienced anxiety, a partial correlation was conducted for this relationship, controlling for mean sadness. This relationship remained significant ($r = .41$, 95% CI [.17, .60], $p = .001$). However, a partial correlation between the Empathic Concern subscale and mean sadness when controlling for anxiety was not significant ($r = -.030$, 95% CI [−.28, .23], $p = .82$), indicating that the relationship between trait empathic concern and sadness was driven by the variability that sadness ratings shared with anxiety ratings. A partial correlation between trait empathic concern and mean experienced anxiety when controlling for fear was not significant ($r = .15$, 95% CI [−.11, .40], $p = .24$).

Trait empathic concern and sustained anxiety after the task. The Empathic Concern subscale was associated with STAI-$S_{\text{Post-Task}}$ ($r_s = .34$, CI 95% [.095, .55], $p = .008$) and with ΔSTAI-S ($r_s = .40$, CI 95% [.16, .59], $p = .002$). These relationships were significant when controlling for STAI-T (STAI-$S_{\text{Post-Task}}$: $r = .45$, 95% CI [.23, .64], $p < .001$; ΔSTAI-S: $r = .46$, 95% CI [.24, .64], $p < .001$). The Personal Distress subscale was associated with STAI-$S_{\text{Post-Task}}$ ($r = .36$, CI 95% [.11, .56], $p = .005$), but not significantly with ΔSTAI-S ($r_s = .19$, CI 95% [−.069, .42], $p = .15$). The Fantasy subscale was also associated with STAI-$S_{\text{Post-Task}}$ and ΔSTAI-S, whereas the Perspective Taking subscale was not significantly associated with sustained anxiety after the task (see Table 2).

Anxiety during the task mediates the relationship between trait empathic concern and sustained anxiety after the task. Mean experienced anxiety during the task mediated the relationship between the Empathic Concern subscale and ΔSTAI-S ($ab = .79$, $SE = .24$, 95% CI [.40, 1.38]; $c = 1.77$, $SE = .42$, $t = 4.26$, $p < .001$; $c' = .98$, $SE = .42$, $t = 2.34$, $p = .023$). This effect remained significant when controlling for the Fantasy subscale ($ab = .62$, $SE = .24$, 95% CI [.25, 1.22]; $c = 1.27$, $SE = .47$, $t = 2.71$, $p = .009$; $c' = .65$, $SE = .46$, $t = 1.43$, $p = .16$). Mean experienced anxiety also mediated the relationship between the Fantasy subscale of the IRI and ΔSTAI-S ($ab = .49$, $SE = .19$, 95% CI [.19, .95; $c = 1.29$, $SE = .34$, $t = 3.82$, $p < .001$; $c' = .79$, $SE = .31$, $t = 2.56$, $p = .013$]). However, this effect was not significant when controlling for the Empathic Concern subscale ($ab = .18$, $SE = .15$, 95% CI [−.075, .53]; $c = .77$, $SE = .37$, $t = 2.07$, $p = .043$; $c' = .59$, $SE = .34$, $t = 1.74$, $p = .088$).

We used a multiple mediation model to determine whether the mean anxiety score specifically drives the relationship between trait empathic concern and sustained anxiety after the task, with participants' mean anxiety and sadness ratings as parallel mediators. Mean anxiety significantly mediated the relationship between the Empathic Concern subscale and ΔSTAI-S ($ab = .82$, $SE = .27$, 95% CI [.36, 1.44]), whereas mean experienced sadness did not ($ab = -.025$, $SE = .14$, 95% CI [−.32, .26]).

Assessing trait emotional reactivity as a confound in the relationships between trait empathy/empathic concern and experience of anxiety. The Impulse Strength subscale of the BEQ was significantly correlated with the General Empathy Scale ($r = .60$, 95% CI [.41, .74], $p < .001$) and all of the IRI subscales at significant or trend levels: Empathic Concern ($r_s = .45$, 95% CI [.22, .63], $p < .001$), Personal Distress ($r = .47$, 95% CI [.25, .65], $p < .001$), Fantasy ($r = .39$, 95% CI [.16, .59], $p = .002$), and Perspective Taking ($r = -.23$, 95% CI [−.46, .024], $p = .075$). To assess trait emotional reactivity as a confound in the relationships between trait empathy/empathic concern with experience of anxiety (see SOM for replication analyses with the General Empathy Scale), multiple linear regressions were conducted in which the General Empathy Scale and Empathic Concern subscale were entered in separate models as predictors, with the Impulse Strength subscale, for anxiety during the task and sustained anxiety after the task. Tests for collinearity indicated that multicollinearity concerns between the predictors were not an issue in these models as tolerance was greater than .1 and the variance inflation factor (VIF) was less than 10 (O'Brien, 2007).

In predicting mean experienced anxiety during the task, multiple linear regression indicated that the General Empathy Scale and the Impulse Strength subscale accounted for 31.1% of the variance in mean experienced anxiety ratings (Adjusted $R^2 = .29$, $F(2, 57) =$

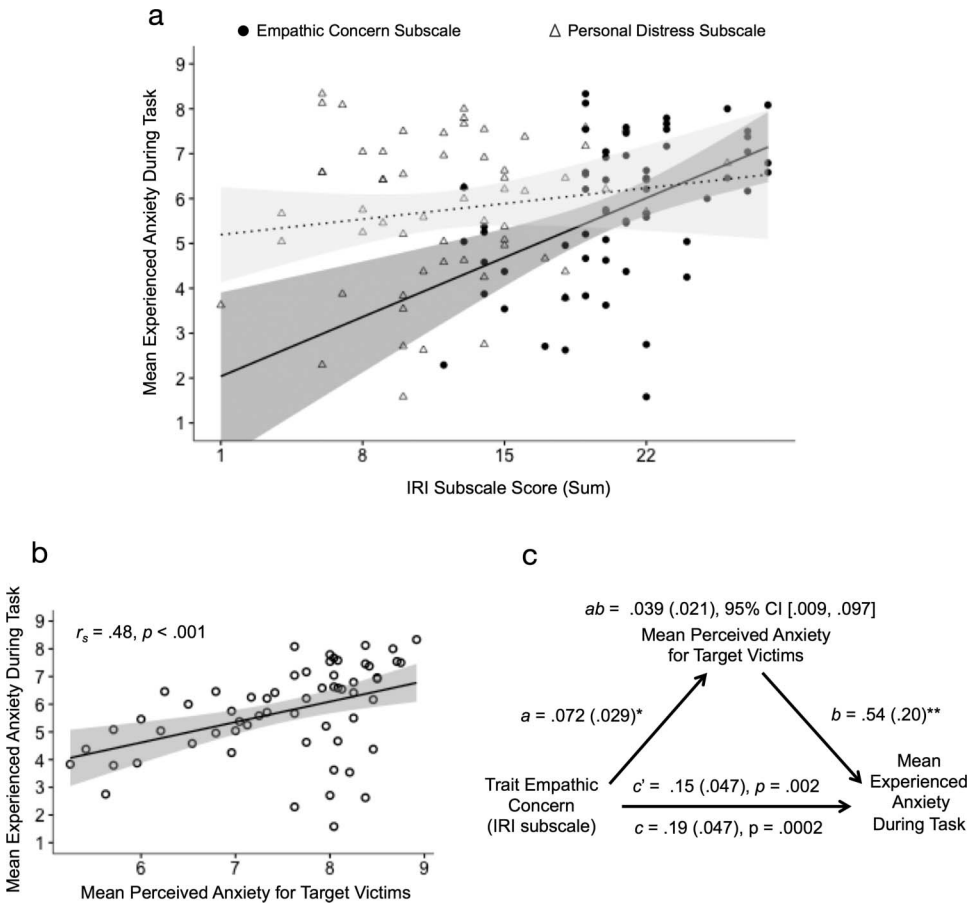

Figure 3. Results from Study 3 (n = 60). a) Scatterplots with lines representing the linear best fit for the relationships between mean ratings of experienced anxiety with the Empathic Concern (solid line: r_s = .48, p < .001) and Personal Distress (dotted line: r = .15, p = .26) subscales of the IRI. b) Scatterplot with line representing the linear best fit for the relationship between mean ratings of perceived anxiety for target victims and mean ratings of experienced anxiety. The Spearman's rho correlation coefficient is displayed. For panels a and b, bands represent 95% confidence intervals for the regression lines. c) Diagram illustrating the indirect effect of mean perceived anxiety for target victims on the relationship between the Empathic Concern subscale of the IRI and mean ratings of experienced anxiety during the task. Unstandardized regression coefficients are displayed with the standard error in parentheses. IRI = Interpersonal Reactivity Index. * $p \leq .05$. ** $p \leq .01$.

12.86, p < .001). The General Empathy Scale scores significantly predicted mean ratings of anxiety (β = .62, t = 4.53, p < .001, tolerance = .64, VIF = 1.57), whereas the Impulse Strength subscale scores did not (β = −.13, t = −.91, p = .34, tolerance = .64, VIF = 1.57). The Empathic Concern and Impulse Strength subscales accounted for 22.2% of the variance in mean experienced anxiety ratings (Adjusted R^2 = .20, F(2, 57) = 8.15, p < .001). The Empathic Concern subscale significantly predicted mean ratings of anxiety (β = .45, t = 3.42, p = .001, tolerance = .78, VIF = 1.28), whereas Impulse Strength subscale scores did not (β = .042, t = .32, p = .75, tolerance = .78, VIF = 1.28).

In predicting sustained anxiety after the task, multiple linear regression indicated that the General Empathy Scale and the Impulse Strength subscale accounted for 34.8% of the variance in ΔSTAI-S (Adjusted R^2 = .32, F(2, 57) = 15.19, p < .001). The General Empathy Scale scores significantly predicted ΔSTAI-S (β = .63, t = 4.70, p < .001, tolerance = .64, VIF = 1.57), whereas Impulse Strength subscale scores did not (β = −.074, t = −.55, p = .58, tolerance = .64, VIF = 1.57). The Empathic Concern subscale and Impulse Strength subscale accounted for 24.7% of the variance in ΔSTAI-S (Adjusted R^2 = .22, F(2, 57) = 9.34, p < .001). The Empathic Concern subscale scores significantly predicted ΔSTAI-S (β = .44, t = 3.40, p = .001, tolerance = .78, VIF = 1.28), whereas Impulse Strength subscale scores did not (β = .10, t = .79, p = .44, tolerance = .78, VIF = 1.28).

Perceived emotions. The following analyses pertain to the participants' perceptions of the target victims' emotions.

Emotion ratings for target victims. Averaged across all trials, target victims were perceived to experience fear the most (M = 7.90, SD = .77), followed by anxiety (M = 7.53, SD = .93), sadness (M = 3.68, SD = 1.86), and amusement (M = 1.56, SD = .75). A repeated measures ANOVA (Greenhouse-Geisser corrected) indicated a sig-

Table 2
Correlations Between IRI Subscales With Emotion Ratings and STAI Measures in Study 3 (n = 60)

Emotion ratings	IRI subscale			
	Empathic Concern	Personal Distress	Fantasy	Perspective Taking
Own emotion				
Anxiety	.48***	.15	.35**	.14
Fear	.47***	.17	.33*	.13
Sadness	.27*	−.02	.11	**.25**
Amusement	−.44***	**−.25**	**−.25**	.11
Target victims' emotion				
Anxiety	.27*	.02	**.24**	.05
Fear	.27*	−.02	.10	.04
Sadness	.19	−.07	.02	.07
Amusement	−.41***	−.35**	−.28*	.09
STAI measure				
STAI-T	−.18	.43***	−.04	−.06
$STAI\text{-}S_{Pretask}$	−.28*	.20	**−.25**	−.05
$STAI\text{-}S_{Posttask}$	.34**	.36**	.32*	.06
ΔSTAI-S	.40**	.19	.46***	.15

Note. Coefficients in bold represent correlations significant at trend level ($p \leq .10$). IRI = Interpersonal Reactivity Index; STAI-T = Trait measure of the State–Trait Anxiety Inventory; STAI-S = State measure of the State–Trait Anxiety Inventory; ΔSTAI-S = Difference score in STAI-S calculated by subtracting the score before the task from the score obtained after the task.
* $p \leq .05$. ** $p \leq .01$. *** $p \leq .001$.

nificant difference among the four emotions, $F(1.83, 108.21) = 543.84$, $p < .001$ and post hoc tests with Bonferroni correction for multiple comparisons indicated that the means for all four emotion categories were significantly different from each other ($M_{Fear\text{-}Anxiety} = .36$, 95% CI [.16, .57], $p < .001$; $M_{Anxiety\text{-}Sadness} = 3.86$, 95% CI [3.29, 4.43], $p < .001$; $M_{Sadness\text{-}Amusement} = 2.11$, 95% CI [1.41, 2.81], $p < .001$). These results demonstrate a similar pattern as seen with the emotion ratings in Study 2.

Trait empathic concern and perception of anxiety in target victims. The Empathic Concern subscale was significantly associated with mean ratings of perceived anxiety in target victims ($r_s = .27$, 95% CI [.012, .49], $p = .040$), as well as with perceived fear and negatively with perceived amusement (see Table 2). In contrast, the Personal Distress subscale was not associated with mean ratings of perceived anxiety during the task ($r_s = .019$, 95% CI [−.24, .27], $p = .89$). The difference of the dependent correlations between the Empathic Concern subscale on the one hand and Personal Distress subscale on the other hand, with mean perceived anxiety was marginally significant ($t = 1.95$, $p = .06$). Mean perceived anxiety was marginally associated with the Fantasy subscale ($r_s = .24$, 95% CI [−.017, .46], $p = .067$), and was not associated with the Perspective Taking subscale (see Table 2).

Relationships Between Perceived and Experienced Emotions. The following analyses pertain to the relationship between participants' perceptions of the target victims' emotions and their own emotions.

Perception of anxiety in target victims and experience of anxiety during the task. Mean perceived anxiety for target victims was associated with mean experienced anxiety ($r_s = .48$, 95% CI [.26, .65], $p < .001$, see Figure 3b), as well as with mean ratings of experienced fear ($r_s = .44$, 95% CI [.20, .62], $p < .001$), and sadness ($r_s = .44$, 95% CI [.20, .62], $p < .001$).

Mean ratings of experienced anxiety were also associated with perceived fear ($r_s = .48$, 95% CI [.25, .65], $p < .001$) and perceived sadness ($r_s = .42$, 95% CI [.18, .61], $p < .001$). When controlling for perceived sadness, mean perceived anxiety remained significantly associated with experienced anxiety ($r = .29$, 95% CI [.038, .51], $p = .025$). Perceived sadness was marginally associated with experienced anxiety when controlling for perceived anxiety ($r = .24$, 95% CI [−.017, .47], $p = .067$). See Table S13 (SOM) for all correlations between mean experienced and perceived emotions.

Perception of anxiety in target victims mediates the relationship between trait empathic concern and experience of anxiety during the task. Mediation analyses were conducted to test a causal model in which trait empathic concern enhances the capacity to perceive anxiety in target victims, which in turn drives experience of vicarious anxiety when observing targets facing threats. Mean perceived anxiety partially mediated the relationship between the Empathic Concern subscale and mean experienced anxiety during the task (see Figure 3c). This relationship did not change when controlling for the Impulse Strength subscale ($ab = .040$, $SE = .027$, 95% CI [.003, .11]; $c = .18$, $SE = .053$, $t = 3.42$, $p = .001$; $c' = .14$, $SE = .053$, $t = 2.68$, $p = .010$). A similar pattern of results was seen in the relationship between the General Empathy Scale and mean experienced anxiety. Mean perceived anxiety partially mediated the relationship between the General Empathy Scale and mean experienced anxiety ($ab = .005$, $SE = .003$, 95% CI [.0006, .013]; $c = .029$, $SE = .006$, $t = 5.00$, $p < .006$; $c' = .024$, $SE = .006$, $t = 4.16$, $p < .001$). This relationship did not change when controlling for the Impulse Strength subscale ($ab = .005$, $SE = .004$, 95% CI [.0002, .015]; $c = .033$, $SE = .007$, $t = 4.53$, $p < .001$; $c' = .027$, $SE = .007$, $t = 3.76$, $p < .001$).

To test for emotional specificity of mean perceived anxiety as a mediator in the relationship between trait empathic concern and experience of anxiety, a multiple mediation model was conducted with mean perceived anxiety and mean perceived sadness as parallel mediators in the relationship between trait empathic con-

cern and mean experienced anxiety. Perceived anxiety did not specifically mediate the relationship between trait empathic concern and mean experienced anxiety in this model. Mean perceived anxiety partially mediated the relationship between the Empathic Concern subscale and mean experienced anxiety when perceived sadness was controlled for as a covariate in the model, with a lowered 90% CI level ($ab = .018$, $SE = .015$, 90% CI [.001, .052]; $c = .16$, $SE = .045$, $t = 3.62$, $p < .001$; $c' = .14$, $SE = .046$, $t = 3.16$, $p = .003$). These mediation models were not significant for the relationship between the General Empathy Scale and mean experienced anxiety.

Support for a reverse mediation model was also found when mean experienced anxiety was tested as a mediator for the relationships between the General Empathy Scale and perceived anxiety ($ab = .006$, $SE = .003$, 95% CI [.0006, .011]; $c = .010$, $SE = .004$, $t = 2.54$, $p = .014$; $c' = .004$, $SE = .004$, $t = .82$, $p = .41$), as well as between the Empathic Concern subscale and perceived anxiety ($ab = .039$, $SE = .018$, 95% CI [.009, .082]; $c = .072$, $SE = .029$, $t = 2.50$, $p = .015$; $c' = .033$, $SE = .031$, $t = 1.07$, $p = .29$). In this model, trait empathy would induce greater experience of anxiety when observing targets facing threats, which in turn causes greater perception of anxiety in targets. This alternative model seems less plausible, as it proposes the experience of anxiety prior to perceiving anxiety in a target. However, a potential explanation for this relationship may be that perceiving anxiety in others and experiencing anxiety are mutually enhancing in a feedback loop.

Perception of anxiety in target victims and sustained anxiety after the task. In this study, mean anxiety perceived in victims was associated with $\text{STAI-S}_{\text{Post-Task}}$ at trend level ($r_s = .22$, 95% CI [−.034, .45], $p = .088$), and was significantly associated with ΔSTAI-S ($r_s = .27$, 95% CI [.013, .49], $p = .040$). The relationship between mean perceived anxiety and ΔSTAI-S was significantly mediated by mean ratings of experienced anxiety ($ab = 3.59$, $SE = .81$, 95% CI [2.07, 5.33]; $c = 5.48$, $SE = 1.93$, $t = 2.85$, $p = .006$; $c' = 1.89$, $SE = 1.83$, $t = 1.03$, $p = .31$).

Serial mediation. To assess all of the main variables of interest in one causal model, we conducted a serial mediation analysis, which tests the effect of multiple sequential mediators in an indirect relationship. We tested our hypothesized model in which trait empathic concern (X) causes greater perception of anxiety in targets facing threats (M_1, a path), which causes greater experience of anxiety during the task (M_2, d path), which in turn causes greater change in sustained anxiety after the task (Y, b path). The indirect effect is estimated by calculating the product of the a, d, and b path coefficients. The d path holds the effect of X constant, whereas the b path holds the effects of both X and M_1 constant. Bias corrected confidence intervals for the indirect effect (adb) are calculated with 10,000 bootstrapped samples. This analysis also tests each mediator separately to assess the contribution of the simple mediations on the indirect effect in the relationship between X and Y (Hayes, 2012).

The indirect effect for this model (X = Empathic Concern subscale, M_1 = mean perceived anxiety in target victims, M_2 = mean experienced anxiety during the task, Y = ΔSTAI-S) through the adb pathway was significant ($adb = .15$, $SE = .084$, 95% CI [.038, .41]; $c = 1.77$, $SE = .42$, $t = 4.26$, $p < .001$; $c' = .94$, $SE = .43$, $t = 2.21$, $p = .032$). In contrast, reversing the sequence of the mediators (in which M_1 = mean experienced anxiety and M_2 = mean perceived anxiety in target victims) did not result in a significant indirect effect for the adb pathway in the relationship between the Empathic Concern subscale and ΔSTAI-S ($adb = .052$, $SE = .083$, 95% CI [−.051, .31]). This was due to the b path being insignificant between perceived anxiety and ΔSTAI-S.

A similar pattern of results was seen for the indirect effect of the General Empathy Scale on sustained anxiety after the task through the adb pathway (X = General Empathy Scale, M_1 = mean perceived anxiety in target victims, M_2 = mean experienced anxiety during the task, Y = ΔSTAI-S; $adb = .015$, $SE = .010$, 95% CI [.003, .053]; $c = .28$, $SE = .050$, $t = 5.52$, $p < .001$; $c' = .17$, $SE = .056$, $t = 3.08$, $p = .003$). Similarly, reversing the sequential order of the mediators (M_1 = mean experienced anxiety, M_2 = mean perceived anxiety in target victims) did not result in a significant indirect effect through the adb pathway ($adb = .008$, $SE = .010$, 95% CI [−.005, .041]).

Effect of trait empathic concern and experiencing vicarious anxiety on risk-aversion. To assess whether empathy is associated with greater risk-aversion after observing target victims facing threats, partial correlations were performed to test associations with $\text{DOSPERT}_{\text{Post-Task}}$, while controlling for scores on the $\text{DOSPERT}_{\text{Pre-Task}}$. The relationship between the General Empathy Scale and $\text{DOSPERT}_{\text{Post-Task}}$ was not significant ($r = -.18$, 95% CI [−.42, .079], $p = .17$). However, the Empathic Concern subscale was negatively associated with $\text{DOSPERT}_{\text{Post-Task}}$ scores ($r = -.32$, 95% CI [−.53, −.067], $p = .014$), indicating that those with high trait empathic concern became more risk-averse after observing target victims facing threats. This relationship was not significant between the other subscales of the IRI and $\text{DOSPERT}_{\text{Post-Task}}$ (Personal Distress: $r = .14$, 95% CI [−.12, .39], $p = .27$, Fantasy: $r = -.17$, 95% CI [−.41, .086], $p = .19$, Perspective Taking: $r = -.11$, 95% CI [−.35, .15], $p = .42$).

Partial correlations also indicated that sustained anxiety after the task was associated with greater risk-aversion after the task. Controlling for $\text{DOSPERT}_{\text{Pre-Task}}$, $\text{DOSPERT}_{\text{Post-Task}}$ was associated with $\text{STAI-S}_{\text{Post-Task}}$ ($r = -.29$, 95% CI [−.50, −.031], $p = .028$) and ΔSTAI-S ($r = -.34$, 95% CI [−.55, −.095], $p = .008$). $\text{DOSPERT}_{\text{Post-Task}}$ was not significantly associated with STAI-T ($r = .12$, 95% CI [−.14, .36], $p = .36$) or $\text{STAI-S}_{\text{Pre-Task}}$ ($r = .14$, 95% CI [−.12, .38], $p = .28$). These patterns indicate that although trait empathic concern and sustained anxiety were associated with greater risk-aversion after observing target victims facing threats, state and trait anxiety assessed before observing targets facing threats were not associated with risk-aversion after the task.

Replications of findings from study 1 and study 2. Replication analyses indicated that there was significantly increased anxiety sustained after the task, and significant positive relationships between the General Empathy Scale with experience of anxiety during the task and ΔSTAI-S. Anxiety during the task significantly mediated the relationship between trait empathy and ΔSTAI-S, whereas sadness did not. As in Study 2, Trait empathy was significantly associated with increased perception of anxiety in target victims (see SOM for analyses).

Internal meta-analyses of data across studies 1, 2, and 3. As the designs for Studies 1–3 were similar, we conducted internal meta-analyses to estimate the average effect sizes of the main correlations reported in these studies (Braver, Thoemmes, & Rosenthal, 2014; Cumming, 2014). Effects were averaged across Studies 1 and 3

for correlations involving mean ratings of experienced emotions during the task. Effects were averaged across Studies 2 and 3 for correlations involving mean ratings of perceived emotions for target victims. Anxiety, fear, sadness, and amusement were the only emotion categories analyzed in these meta-analyses as Study 3 had only assessed these emotions during the task. Effect sizes were obtained from either the Pearson's or Spearman's correlation coefficient, depending on the method used for each correlation as reported in the study. Meta-analyses were conducted with the *metacor* function in the 'meta' package in R, which uses Fisher's z transformations of correlations, inverse variance weighting for the fixed effects model, and the DerSimonian-Laird estimate in the random effects model (Schwarzer, 2007).

For ratings of participants' own emotions across Studies 1 and 3 ($n = 107$), all mean effects were significant for correlations between the General Empathy Scale and mean ratings of anxiety, fear, sadness, and amusement. Effects for anxiety (fixed effects: $M_r = .45$, 95% CI [.29, .59], $z = 4.91$, $p < .001$; random effects: $M_r = .44$, 95% CI [.18, .65], $z = 3.33$, $p = .001$) and fear were the largest. For ratings of target victims' emotions across Studies 2 and 3 ($n = 120$), mean effects were significant for correlations between the General Empathy Scale and mean ratings of perceived anxiety (fixed effects: $M_r = .34$, 95% CI [.16, .49], $z = 3.72$, $p < .001$; random effects: $M_r = .34$, 95% CI [.16, .49], $z = 3.72$, $p < .001$), fear, and amusement. The mean effect for the correlation between trait empathy and perceived sadness was not significant (see Table S16).

Mean effects across studies indicated that there were no significant positive relationships between STAI-T and mean ratings of experienced emotions during the task in Studies 1 and 3, or with mean ratings of perceived emotions in target victims in Studies 2 and 3. This was also the case for correlations between $\text{STAI-S}_{\text{Pre-Task}}$ and mean ratings of experienced and perceived emotions during the task (see Table S17).

Across Studies 1, 2, and 3 ($n = 167$), the mean effect for the correlation between trait empathy and ΔSTAI-S was significant (fixed effects: $M_r = .43$, 95% CI [.30, .55], $z = 5.79$, $p < .001$; random effects: $M_r = .43$, 95% CI [.28, .56], $z = 5.24$, $p < .001$). However, the mean effect for the correlation between STAI-T and ΔSTAI-S was not significant (fixed effects: $M_r = -.029$, 95% CI [−.18, .13], $z = -.36$, $p = .72$; random effects: $M_r = -.027$, 95% CI −19, .14], $z = -.32$, $p = .75$). Across Studies 1 and 3, mean effects were significant for all relationships between experienced emotions and ΔSTAI-S. Mean ratings of anxiety, fear, and sadness were positively associated with ΔSTAI-S, whereas mean amusement was negatively associated with ΔSTAI-S. Across Studies 2 and 3, there was a trend in the fixed effects model indicating a positive correlation between mean perceived anxiety in target victims and ΔSTAI-S (fixed effects: $M_r = .17$, 95% CI [−.016, .34], $z = 1.79$, $p = .074$; random effects: $M_r = .17$, 95% CI [−.047, .36], $z = 1.53$, $p = .13$). The mean effect was also significant for the relationship between perceived sadness and ΔSTAI-S (see Table S18).

Discussion

In this study, we investigated the relationships between specific dimensions of trait empathy, as assessed by the IRI, and experience of vicarious anxiety. As predicted, the Empathic Concern subscale of the IRI demonstrated a similar pattern to perceiving and experiencing vicarious anxiety as the General Empathy Scale. However, the Empathic Concern subscale assesses a more specific aspect of empathy than the General Empathy Scale, indicating that a tendency to attend to others and feel compassion to those who are suffering is associated with experiencing vicarious anxiety when observing others facing threats. Also as predicted, the Personal Distress subscale of the IRI, which was positively associated with trait anxiety, was not significantly associated with experience of vicarious anxiety. Although the Fantasy subscale was associated with experiencing anxiety from watching the film clips, this relationship did not remain significant when controlling for the Empathic Concern subscale, suggesting that the relationship between the Fantasy subscale and experience of anxiety in this task may be due to variability that the Fantasy subscale shares with the Empathic Concern subscale. The Perspective Taking subscale was not associated with perceiving or experiencing anxiety, indicating that experience of vicarious anxiety is not associated with a cognitive dimension of empathy. We did not find support indicating trait emotional reactivity to be a confound in the relationships between trait empathy and experience of anxiety.

As hypothesized, the degree of anxiety perceived in target victims facing threats was positively associated with the degree of anxiety experienced when observing target victims facing threats. Furthermore, the degree of anxiety perceived in target victims partially mediates the relationship between trait empathy/empathic concern and experience of anxiety during the task. A serial mediation analysis provided support for a causal model of vicarious anxiety in which trait empathy/empathic concern increases the perception of anxiety in others who are facing threats, which in turn induces greater experience of anxiety when observing the targets, which leads to sustained anxiety after observing the targets.

We hypothesized that empathy and vicarious anxiety would be associated with greater risk-aversion. Although the General Empathy Scale was not significantly associated with risk-aversion, trait empathic concern and sustained anxiety after the task were both associated with greater risk-aversion after viewing target victims facing threats. As the Empathic Concern subscale specifically assesses the tendency to attend to others in distress, whereas the General Empathy Scale assesses the tendency to experience empathic responses to others in both positive and negative situations, the additional emphasis of the Empathic Concern subscale on an interpersonal response to others in distress may be what drives the relationship with risk-aversion. These findings provide initial support for a role of empathy in facilitating defensive responses for threats in the environment through the experience of vicarious anxiety.

Study 4

In Study 4, we manipulate state empathy in a between-groups design to demonstrate a causal role for empathy in the experience of vicarious anxiety. We hypothesize that participants in an Empathy condition will experience greater vicarious anxiety compared with those in an Objective condition. Participants in the Empathy condition were instructed to take an empathic perspective when observing target victims facing threats, whereas participants in the Objective condition were instructed to down-regulate state

empathy by employing reappraisal-based strategies to take an objective, fact-based perspective. We also hypothesize that participants in the Empathy condition will become more risk-averse after watching target victims facing threats as compared with participants in the Objective condition. In addition, we investigate how decreasing state empathy impacts the relationship between trait empathy and experience of vicarious anxiety. To assess protracted effects of empathy on the experience of vicarious anxiety, follow-up measures were administered the next day, including a measure that assessed self-reported sleep disruption during the previous night. In a clinical context, sleep disturbances are commonly reported by individuals who have experienced or are experiencing trauma, posttraumatic stress disorder, and generalized anxiety disorder (Benca, Obermeyer, Thisted, & Gillin, 1992; Briere & Runtz, 1989; Charuvastra & Cloitre, 2009). We hypothesized that those in the Empathy condition would experience greater sleep disruption than those in the Objective condition.

Method

Participants. One hundred and two participants were recruited from the Columbia University community, for a target recruitment number of 100 participants (for 50 participants each in the Empathy and Objective conditions). Two participants did not complete the study. One of these participants had been uncomfortable viewing the film clips and decided to end the study early, the other participant had exceeded the time limit allowed to complete the study and had not completed the main experimental tasks. The target recruitment number of 50 participants for each condition was determined prior to running the study and was based off of a recommended sample size guideline of at least 50 participants in each condition for a between groups design, when the expected effect size of the results is unknown (Simmons, Nelson, & Simonsohn, 2013). An a priori power analysis was not conducted to determine the sample size for this study, as the differences in design for the current study from the prior studies would make estimating the effect size of our results based off of findings from the prior studies unjustified.

In the Empathy condition, there were 17 males and 33 females (M_{Age} = 21.3 years, SD = 7.66, range = 18–64). In the Objective condition, there were 20 males and 30 females (M_{Age} = 21.6 years, SD = 4.94, range = 18–37). Participants received either course credits or $17 for completing the entire study, including the follow-up questionnaire administered the next day. All participants received an additional $3 reward for one of the tasks in the study. One participant did not complete the follow-up questionnaire.

Materials and procedures. Participants were assigned to either the Empathy or Objective condition in counterbalanced order. Upon arriving at the lab, participants were informed that the study involved a task in which they would watch clips from horror movies and other similar types of sources. After consenting to participate in this study, participants completed questionnaires on a computer outside of the testing room that assessed individual differences and demographics including the STAI-T, STAI-$S_{Pre\text{-}Task}$, IRI, BEQ, and DOSPERT$_{Pre\text{-}Task}$ (see Table S2 in SOM for descriptive statistics on the measures collected). Participants also completed the Emotion Regulation Questionnaire (ERQ). The ERQ was administered to assess participants' scores on the Reappraisal subscale, which measures the dispositional tendency to use cognitive reappraisal to regulate one's emotions in daily life (example item, "When I want to feel less *negative* emotion, I *change the way I'm thinking* about the situation"; Gross & John, 2003). To further assess trait emotional reactivity as a confound in our results, participants completed the Emotion Reactivity Scale (ERS), a 21-item measure that assesses the degree to which participants report sensitivity to, and intensity and persistence of emotional experiences (example item, "I tend to get very emotional very easily"; Nock, Wedig, Holmberg, & Hooley, 2008).

After completing the questionnaires, participants entered a testing room in which the experimenter trained them on the experimental task. Depending on the condition that the participant was in, the participant underwent training procedures that instructed them to view the clips from either an empathic or objective perspective. Instructions for the Empathy condition were partly based on wording from items on the General Empathy Scale questionnaire (which was not administered in this study). Instructions for the Objective condition were based off of prior studies implementing cognitive reappraisal strategies (Denny & Ochsner, 2014; Silvers et al., 2015). In the Empathy condition, participants were given the following instructions:

> In the following clips, please try to imagine yourself as the main character or victim in each scene. Try to immerse yourself in the situation that the person depicted is in and be thoughtful of that person's feelings. Imagine what it feels like to experience what is happening to the person depicted. Tune in to the emotions of this person, and try to let yourself feel deeply what the person is feeling.

In the Objective condition, participants were given the following instructions:

> In the following clips, please try to remember that these scenes are from movies, so the characters depicted are not actually experiencing the emotions that they are expressing. Try to focus on the facts of the scenes instead of the emotions expressed by the characters in them. Do not give too much thought to the feelings of the person depicted. Be as objective as possible about what is happening to the person. Remember that this person is acting, so do not get carried away by the emotions they are expressing.

After receiving these instructions, participants practiced taking the respective perspective by watching two film clips and verbally describing the perspective they took after watching each clip to the experimenter.

After completing the training session, participants completed the experimental task in which they watched 15 of the film clips used in Study 3. Only 15 clips were used due to time constraints, and the clips were selected to be the ones inducing the greatest degree of anxiety in the prior studies (see Table S3 and Figure S1). The clips were presented in random order across participants. After each clip, participants rated the following emotions based on the degree to which they experienced them while watching the clips, and the degree to which they perceived the emotions to be expressed by the victim depicted in each scene: anxiety, sadness, calm, and amusement (1 = *Not at all*, 5 = *Somewhat*, 9 = *Extremely*). The order in which the emotion categories were presented and rated was random on every trial. Ratings for experienced and perceived emotions were blocked together, and the order by which experienced or perceived emotions were rated first was ran-

domly ordered on every trial. After completing the emotion ratings, participants also rated how much they were able to empathize or take an objective view, depending on the respective condition (1 = *Not at all*, 5 = *Somewhat*, 9 = *Extremely*; see Table S7 in SOM for instructions given to participants). After completing this task, participants were taken out of the testing room to complete a few questionnaires including the $\text{STAI-S}_{\text{Post-Task}}$ and $\text{DOSPERT}_{\text{Post-Task}}$ to assess changes on these measures after viewing the clips.

After completing these questionnaires, participants returned to the testing room and completed the Balloon Analogue Risk Task (BART). In this task, participants were instructed to blow up a balloon presented on the computer screen by pressing a key on the keyboard. In each trial of this task, participants earned three points for every successful pump they made without the balloon exploding. However, with every press, participants risked the balloon exploding, upon which zero points would be received for that trial. The average break point across trials for which the balloon exploded was 64 pumps. Participants were informed that they would receive a monetary reward depending on the average number of points they earned across trials. Fifteen trials were administered on this task, which has been determined to be sufficient for reliable results (Lejuez et al., 2002). All participants received a $3 reward for this task at the end of the study. The lab-based portion of this study took about an hour to complete.

On the following morning after participants watched the film clips, a follow-up questionnaire was sent by email to assess emotional and behavioral differences between groups in the time period after watching the video clips. For a list of all measures in the follow-up questionnaire, see Table S8 (SOM).

Results

Perspective ability. To establish construct validity for the tasks in the Empathy and Objective conditions, correlations were performed between mean ratings of perspective ability averaged across trials, the IRI subscales, and the Reappraisal subscale of the ERQ. We expected perspective ability to be positively associated with the Empathic Concern subscale of the IRI in the Empathy condition, and to be positively associated with the Reappraisal subscale of the ERQ in the Objective condition. In the Empathy condition, mean perspective ability ($M = 6.12$, $SD = 1.33$) was associated with the Empathic Concern subscale of the IRI at trend level ($r_s = .25$, 95% CI [−.032, .49], $p = .081$). This relationship was significant in a partial correlation controlling for age and gender ($r = .41$, 95% CI [.14, .62], $p = .004$). Mean perspective ability was not significantly associated with any of the other subscales of the IRI (Personal Distress: $r_s = -.031$, 95% CI [−.31, .25], $p = .83$; Fantasy: $r_s = .078$, 95% CI [−.20, .35], $p = .59$; Perspective Taking: $r_s = .16$, 95% CI [−.13, .42], $p = .28$), and was not associated with the Reappraisal subscale of the ERQ ($r_s = .092$, 95% CI [−.19, .36], $p = .53$).

In the Objective condition, mean perspective ability ($M = 7.20$, $SD = 1.05$) was correlated with the Reappraisal subscale of the ERQ ($r = .30$, 95% CI [.021, .53], $p = .036$), but was not significantly correlated with any of the subscales of the IRI (Empathic Concern: $r = -.23$, 95% −I [−.47, .056], $p = .11$; Personal Distress: $r = -.12$, 95% CI [−.38, .16], $p = .41$; Fantasy: $r = -.040$, 95% CI [−.32, .24], $p = .78$; Perspective Taking: $r = .21$, 95% CI [−.073, .46], $p = .14$).

Effect of condition on experienced emotions. The following analyses pertain to the participants' experience of their own emotions.

Emotion ratings for self. All means for ratings across emotion categories were significantly different between the Empathy and Objective conditions (all independent samples *t* tests in this manuscript are performed with Welch's *t* test for unequal variances. See Table S19 in SOM for descriptive and test statistics). Mean anxiety was greater in the Empathy condition ($M = 6.69$, $SD = 1.38$) than in the Objective condition, $M = 4.25$, $SD = 1.70$; $M_{\text{Diff}} = 2.43$, 95% CI [1.82, 3.05], $t(94.05) = 7.85$, $p < .001$, $d = 1.58$, as was the case with sadness. Mean calm and amusement ratings were greater in the Objective condition than in the Empathy condition (see Figure 4a).

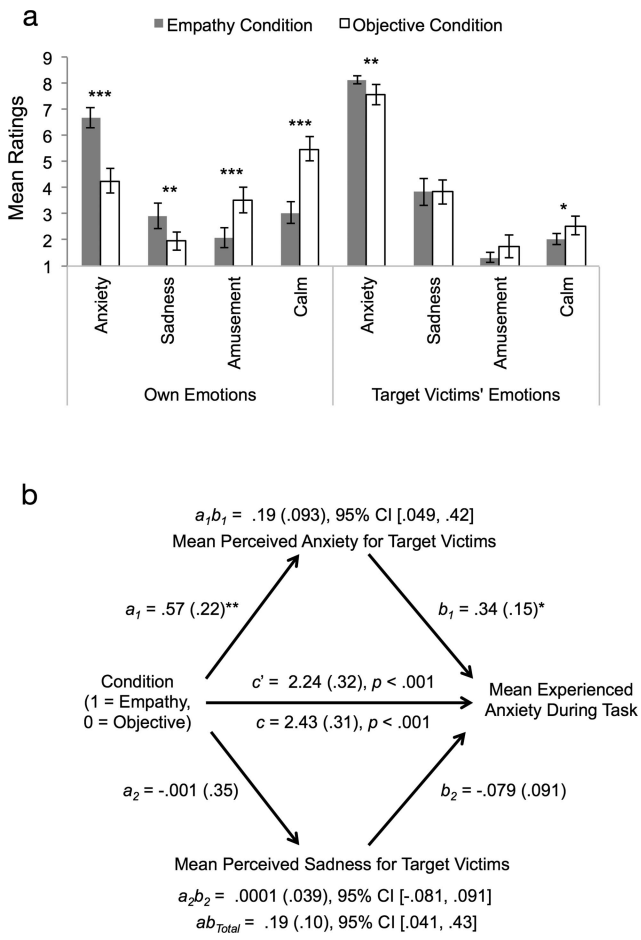

Figure 4. Results from Study 4 ($n = 100$). a) Mean ratings for emotions experienced by participants during the task and perceived in target victims. Error bars represent 95% confidence intervals for the means. b) Diagram illustrating the indirect effects of perceived anxiety and perceived sadness on the relationship between condition type and experienced anxiety during the task in a multiple mediation model. Mean perceived anxiety partially mediates the relationship between condition type and experienced anxiety during the task, whereas mean perceived sadness does not. Unstandardized regression coefficients are displayed with the standard error in parentheses. $^{*}\ p \leq .05$. $^{**}\ p \leq .01$. $^{***}\ p \leq .001$.

In the Empathy condition, participants rated anxiety to be the emotion most greatly experienced, a pattern consistent with the prior studies. A repeated measures ANOVA (Greenhouse-Geisser corrected) indicated a significant difference among the means for the four emotion categories, $F(2.08, 101.93) = 79.53$, $p < .001$ and post hoc tests with Bonferroni correction for multiple comparisons (applied to p values and confidence intervals) indicated that mean anxiety was greater than the means for all other emotion categories ($M_{\text{Anxiety-Sadness}} = 3.75$, 95% CI [2.93, 4.57], $p < .001$; $M_{\text{Anxiety-Calm}} = 3.65$, 95% CI [2.57, 4.72], $p < .001$; $M_{\text{Anxiety-Amusement}} = 4.59$, 95% CI [3.57, 5.60], $p < .001$).

In the Objective condition, a different pattern from prior studies was seen in which anxiety was not the emotion most greatly experienced (see Figure 4a). A repeated measures ANOVA (Greenhouse-Geisser corrected) indicated a significant difference among the means for the four emotion categories, $F(1.98, 96.90) = 37.72$, $p < .001$. However, post hoc tests with Bonferroni correction for multiple comparisons (applied to p values and confidence intervals) indicated that mean anxiety was only greater than the mean of ratings for sadness ($M_{\text{Anxiety-Sadness}} = 2.29$, 95% CI [1.73, 2.85], $p < .001$). Mean anxiety ratings were marginally less than mean ratings for calm ($M_{\text{Anxiety-Calm}} = -1.24$, 95% CI [−2.49, .011], $p = .053$,) and were not significantly different from mean ratings of amusement ($M_{\text{Anxiety-Amusement}} = .71$, 95% CI [−.27, 1.68], $p = .31$).

Trait empathic concern and experience of anxiety during the task. To understand the impact of down-regulating state empathy on the relationship between trait empathy and experience of vicarious anxiety, we tested the condition that participants were in as a moderator in the relationship between trait empathic concern and mean ratings of experienced anxiety. The condition participants were in significantly moderated the relationship between the Empathic Concern subscale of the IRI and mean ratings of experienced anxiety during the task ($\Delta R^2 = .026$, $F(1, 96) = 4.42$, $p = .038$). In the Empathy condition, a similar pattern as in prior studies was seen in the relationship between trait empathy and experienced anxiety. The Empathic Concern subscale of the IRI was positively associated with mean ratings of experienced anxiety ($r_s = .31$, 95% CI [.038, .54], $p = .027$, see Figure 5). This relationship remained significant when controlling for ERS and IS ($r = .48$, 95% CI [.22, .67], $p = .001$). No other subscales of the IRI were significantly associated with mean experienced anxiety. In the Empathy condition, the Empathic Concern subscale was also negatively associated with mean ratings of experienced calm ($r_s = -.30$, 95% CI [−.54, −.028], $p = .032$), and was not significantly associated with mean ratings of experienced sadness ($r_s = -.032$, 95% CI [−.31, .25], $p = .83$) or amusement ($r_s = -.20$, 95% CI [−.45, .083], $p = .16$).

In the Objective condition, the Empathic Concern subscale was not associated with mean ratings of experienced anxiety ($r = .001$, 95% CI [−.28, .28], $p = .99$, see Figure 5). This suggests that down-regulating state empathy diminishes the impact that dispositional empathy has on experiencing vicarious anxiety. In this condition, the Empathic Concern subscale was associated with mean sadness ($r_s = .29$, 95% CI [.016, .53], $p = .039$), and was not significantly associated with mean ratings of calm ($r_s = -.19$, 95% CI [−.44, .093], $p = .19$) or amusement ($r_s = .16$, 95% CI [−.13, .42], $p = .28$).

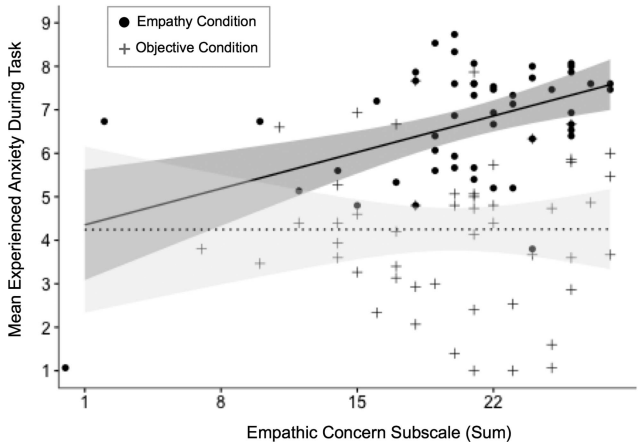

Figure 5. Results from Study 4 ($n = 100$). Scatterplots with lines representing the linear best fit for the relationships between the Empathic Concern subscale and mean ratings of experienced anxiety in the Empathy condition (solid line: $r_s = .31$, $p = .027$) and Objective condition (dotted line: $r = .001$, $p = .99$). Bands represent 95% confidence intervals for the regression lines.

Sustained anxiety after the task. In the Empathy condition, STAI-S_{Posttask} ($M_{\text{Sum}} = 46.18$, $SD = 10.09$) was greater than STAI-S_{Pretask}, $M_{\text{Sum}} = 39.42$, $SD = 11.71$; $M_{\text{Diff}} = 6.76$, 95% CI [3.52, 10.00], $t(49) = 4.19$, $p < .001$, $d_z = .59$. In the Objective condition, STAI-S_{Posttask} ($M = 41.46$, $SD = 10.88$) was also greater than STAI-S_{Pretask}, $M = 37.62$, $SD = 11.05$; $M_{\text{Diff}} = 3.84$, 95% CI [.77, 6.91], $t(49) = 2.52$, $p = .015$, $d_z = .36$.

The mean for STAI-S_{Posttask} was greater in the Empathy condition than in the Objective condition, as indicated in a between-subjects t test, $M_{\text{Diff}} = 4.72$, 95% CI [.56, 8.88], $t(97.46) = 2.25$, $p = .027$, $d = .45$. However, ΔSTAI-S was not significantly different between conditions, $M_{\text{Diff}} = 2.92$, 95% CI [−1.49, 7.33], $t(97.70) = 1.32$, $p = .19$, $d = .26$. In a multiple mediation analysis, significant indirect effects were found in the relationship between condition and ΔSTAI-S both through mean ratings of anxiety (which had a positive effect) and sadness (which had a negative effect). The opposing directions of these effects may account for the lack of a total effect between condition and ΔSTAI-S (see SOM for analyses; Hayes, 2009; Shrout & Bolger, 2002).

Effect of condition on perceived emotions in target victims. As predicted, anxiety was perceived to be more greatly experienced by target victims in the Empathy condition ($M = 8.15$, $SD = .59$) than in the Objective condition, $M = 7.57$, $SD = 1.41$; $M_{\text{Diff}} = .57$, 95% CI [.14, 1.01], $t(65.39) = 2.66$, $p = .010$, $d = .54$. Mean perceived calm was greater in the Objective condition than in the Empathy condition. There were no significant differences in ratings for perceived emotions between the two conditions for sadness and amusement (see Figure 4a and Table S19 for descriptive and test statistics).

In both the Empathy and Objective conditions, participants rated perceived emotions for victims in a pattern consistent with the prior studies. Anxiety was the most greatly perceived emotion in both conditions. For the Empathy condition, a repeated measures ANOVA (Greenhouse-Geisser corrected) indicated a significant difference among the means for the four emotion categories, $F(1.81, 88.74) =$

403.48, $p < .001$ and post hoc tests with Bonferroni correction for multiple comparisons (applied to p values and confidence intervals) indicated that mean anxiety was greater than the means for all other emotion categories ($M_{\text{Anxiety-Sadness}} = 4.31$, 95% CI [3.56, 5.06], $p < .001$; $M_{\text{Anxiety-Calm}} = 6.11$, 95% CI [5.62, 6.60], $p < .001$; $M_{\text{Anxiety-Amusement}} = 6.82$, 95% CI [6.41, 7.24], $p < .001$). For the Objective condition, a repeated measures ANOVA (Greenhouse-Geisser corrected) indicated a significant difference among the means for the four emotion categories, $F(2.34, 114.80) = 136.67$, $p < .001$ and post hoc tests with Bonferroni correction for multiple comparisons (applied to p values and confidence intervals) indicated that mean anxiety ($M = 7.57$, $SD = 1.41$) was greater than the means for all other emotion categories ($M_{\text{Anxiety-Sadness}} = 3.74$, 95% CI [3.08, 4.40], $p < .001$; $M_{\text{Anxiety-Calm}} = 5.02$, 95% CI [4.07, 5.98], $p < .001$; $M_{\text{Anxiety-Amusement}} = 5.81$, 95% CI [4.82, 6.80], $p < .001$).

Effect of condition on relationships between perceived and experienced emotions. The following analyses pertain to the relationship between participants' perceptions of the target victims' emotions and their own emotions.

Perception of anxiety in target victims and experience of anxiety during the task. In the Empathy condition, mean perceived anxiety in target victims was positively associated with mean experienced anxiety ($r_s = .51$, 95% CI [.27, .69], $p < .001$), negatively associated with mean ratings of experienced calm ($r_s = -.53$, 95% CI [−.70, −.29], $p < .001$) and amusement ($r_s = -.32$, 95% CI [−.55, −.041], $p = .025$), and was not associated with mean experienced sadness ($r_s = .10$, 95% CI [−.18, .37], $p = .49$). However, in the Objective condition, mean perceived anxiety was not significantly associated with any of the means for experienced emotions. See Table 3 for correlations between all perceived and experienced emotions in the Empathy and Objective conditions.

Perception of anxiety in target victims mediates the relationship between condition and experience of anxiety during the task. To test a causal model in which increasing state empathy leads to greater perception of anxiety in target victims, which in turn causes experience of vicarious anxiety during the task, a mediation analysis was conducted to assess mean perceived anxiety as a mediator in the relationship between condition and mean ratings of experienced anxiety. Consistent with the mediation results in Study 3 for the relationship between trait empathy and experience of vicarious anxiety, mean perceived anxiety partially mediated the relationship between condition (1 = Empathy condition, 0 = Objective condition) and mean experienced anxiety ($ab = .18$, $SE = .090$, 95% CI [.039, .39]; $c = 2.43$, $SE = .31$, $t = 7.85$, $p < .001$; $c' = 2.26$, $SE = .32$, $t = 7.16$, $p < .001$). This relationship was unchanged when controlling for the Impulse Strength subscale and ERS ($ab = .16$, $SE = .090$, 95% CI [.028, .39]; $c = 2.43$, $SE = .31$, $t = 7.86$, $p < .001$; $c' = 2.27$, $SE = .32$, $t = 7.15$, $p < .001$).

To test for specificity of perceived anxiety as a mediator between condition and mean experienced anxiety, a multiple mediation model was tested with mean perceived anxiety and mean perceived sadness as parallel mediators. While mean perceived anxiety significantly mediated the relationship between condition and mean experienced anxiety, mean perceived sadness did not (see Figure 4b). These patterns indicate a certain level of specificity among the negative emotions assessed for a mediating role of perceived anxiety in the relationship between empathy and experiencing anxiety. However, the results are tentative in supporting this model, as the indirect effect of perceived anxiety is a relatively small percentage (7.8%) of the total effect between condition and experience of anxiety. As in Study 3, an indirect effect was also seen in a reverse mediation analysis in which mean experienced anxiety was tested as a mediator in the relationship between condition and mean perceived anxiety ($ab = .36$, $SE = .15$, 95% CI [.11, .72]; $c = .57$, $SE = .22$, $t = 2.66$, $p = .009$; $c' = .21$, $SE = .27$, $t = .79$, $p = .43$).

Serial mediation. As in Study 3, we conducted a serial mediation analysis to test the effect of perceived and experienced anxiety as multiple sequential mediators in the indirect relationship between condition and sustained anxiety after the task (X = condition, M_1 = mean perceived anxiety in target victims, M_2 = mean experienced anxiety during the task, Y = ΔSTAI-S). The indirect effect for this model was significant through the *adb* pathway ($adb = .43$, $SE = .24$, 95% CI [.10, 1.10]; $c = 2.92$, $SE = 2.22$, $t = 1.32$, $p = .19$; $c' = -2.14$, $SE = 2.69$, $t = -.79$, $p = .43$). In contrast, reversing the sequence of the mediators (M_1 = mean experienced anxiety, M_2 = mean perceived anxiety in target victims) did not result in a significant indirect effect through the *adb* pathway for the relationship between condition and ΔSTAI-S ($adb = -.58$, $SE = .52$, 95% CI [−2.00, .16]). As in Study 3, this was due to the b path being insignificant between perceived anxiety and ΔSTAI-S.

Effect of condition on threat responses. The following analyses pertain to threat-related responses associated with experiencing anxiety.

Changes in risk-aversion. To assess changes in risk-aversion within the two conditions, separate paired t tests were conducted on the mean DOSPERT scores before and after watching the video clips for the two groups. In the Empathy condition, $\text{DOSPERT}_{\text{Post-Task}}$ ($M_{\text{Sum}} = 41.64$, $SD = 13.82$) was significantly lower than $\text{DOSPERT}_{\text{Pre-Task}}$, $M_{\text{Sum}} = 43.90$, $SD = 13.03$; $M_{\text{Diff}} = -2.26$, 95% CI [−3.59, −.93], $t(49) = -3.42$, $p = .001$, $d_z = -.48$. However, in the Objective condition, $\text{DOSPERT}_{\text{Post-Task}}$ ($M_{\text{Sum}} = 44.12$, $SD = 13.34$) was not significantly lower than $\text{DOSPERT}_{\text{Pre-Task}}$, $M_{\text{Sum}} = 44.92$, $SD = 12.72$; $M_{\text{Diff}} = -.80$, 95% CI [−1.99, .39],

Table 3
Correlations Between Mean Perceived and Experienced Emotions in Study 4 (n = 100)

	Target victims' emotions			
Own emotions	Anxiety	Sadness	Calm	Amusement
Empathy condition				
Anxiety	.51***	−.17	−.54***	−.34*
Sadness	.10	.80***	−.15	.31*
Calm	−.53***	.20	.62***	.33*
Amusement	−.32*	.44***	**.25**	.60***
Objective condition				
Anxiety	.10	.07	−.04	.10
Sadness	.05	.41**	−.03	.51***
Calm	−.09	−.14	.15	−.18
Amusement	−.04	.29*	−.02	.50***

Note. Coefficients in bold represent correlations significant at trend level ($p \leq .10$).
* $p \leq .05$. ** $p \leq .01$. *** $p \leq .001$.

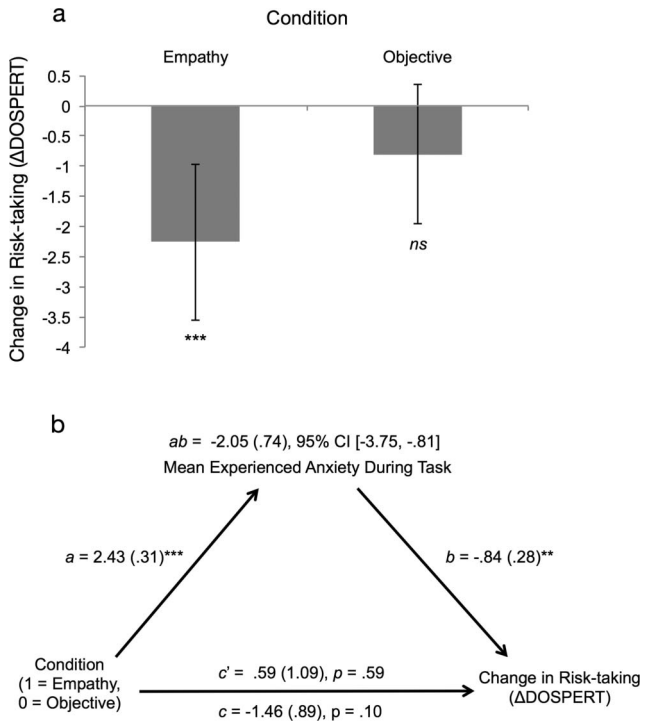

Figure 6. Results from Study 4 (n = 100). a) Bar graph of mean change (Post-task − Pre-task) in DOSPERT scores (with lower scores indicating greater risk-aversion) after viewing film clips depicting target victims facing threats in the Empathy and Objective conditions. Paired t tests performed for each condition indicated that DOSPERT scores decreased in the Empathy condition after viewing the film clips, $M_{Diff} = -2.26$, $t(49) = -3.42$, $p = .001$, 95% CI [−3.59, −.93], whereas DOSPERT scores in the Objective condition did not, $M_{Diff} = -.80$, $t(49) = -1.35$, $p = .18$, 95% CI [−1.99, .39]. Error bars represent 95% confidence intervals for the means. b) Diagram illustrating the indirect effect of mean ratings of experienced anxiety during the task on the relationship between condition type and change in DOSPERT scores after the task. Unstandardized regression coefficients are displayed with the standard error in parentheses. ** $p \leq .01$. *** $p \leq .001$

$t(49) = -1.35$, $p = .18$, $d_z = -.19$, see Figure 6a. An independent samples t test demonstrated that ΔDOSPERT was not significantly different between the Empathy and Objective conditions, $M_{Diff} = -1.46$, 95% CI [−3.22, .30], $t(96.79) = -1.65$, $p = .10$, $d = .33$. As we had a directional hypothesis predicting that participants would experience greater risk-aversion after the task in the Empathy condition, we also conducted a one-tailed test, which indicated that participants in the Empathy condition had a marginally significant greater decrease in DOSPERT scores than participants in the Objective condition (95% CI [-∞, .013], $p = .052$).

Performance on the BART task was calculated by assessing the average number of pumps made on trials in which the balloon did not explode (Lejuez et al., 2002). There was no difference between conditions on BART performance as indicated by an independent samples t test between the Empathy condition ($M = 32.69$, $SD = 14.00$) and Objective condition, $M = 34.43$, $SD = 13.04$; $M_{Diff} = -1.75$, 95% CI [−7.12, 3.63], $t(97.51) = -.64$, $p = .52$, $d = .13$. As the BART measured risk-taking in the context of earning a monetary reward, the lack of difference in performance between groups may be due to empathy facilitating risk-aversion for domain specific threats in the environment akin to threats that targets are observed to face. The effect of vicarious anxiety on risk-aversion in the context of observing others facing physical threats may be specific to scenarios that present physical threat or harm to oneself, as is assessed by the items on the DOSPERT.

Indirect effect of condition on risk-aversion through experience of anxiety. To assess a causal model in which taking an empathic perspective increases experience of anxiety when observing others facing threat, which in turn increases risk-aversion, mean experienced anxiety during the task was tested as a mediator in the relationship between condition and ΔDOSPERT. There was a significant indirect effect of condition on ΔDOSPERT, through mean experienced anxiety (see Figure 6b). This relationship remained significant when controlling for the Impulse Strength subscale and ERS ($ab = -1.92$, $SE = .74$, 95% CI [−3.53, −.59]; $c = -1.37$, $SE = .87$, $t = -1.58$, $p = .12$; $c' = .54$, $SE = 1.08$, $t = .50$, $p = .62$). In a multiple mediation model with mean experienced anxiety and mean sadness as parallel mediators in the relationship between condition and ΔDOSPERT, mean anxiety was a significant mediator in this relationship ($ab = -2.33$, $SE = .84$, 95% CI [−4.26, −.88]), whereas mean sadness was not ($ab = .35$, $SE = .36$, 95% CI [−.23, 1.25]).

Sleep disruption. We tested three predictions about the ways that experiencing vicarious anxiety could have a protracted impact on experiencing sleep disruption, a symptom of anxiety and trauma, after watching the film clips. First, because taking an empathic perspective led to greater experience of vicarious anxiety as compared with taking an objective perspective with reappraisal-based strategies, we expected that participants in the Empathic condition would experience greater sleep disruption than those in the Objective condition. We address this prediction with four items adapted from the Trauma Symptom Checklist, which asked participants to rate on a 4 pt. Likert scale (1 = Not at all, 2 = Somewhat, 3 = A lot, 4 = Extremely,) how much they experienced the following during the past night: insomnia, restless sleep, nightmares, and early morning awakening. As expected, participants in the Empathy condition reported greater sleep disruption ($M_{Sum} = 6.02$, $SD = 2.38$) than participants in the Objective condition, $M_{Sum} = 4.94$, $SD = 1.41$; $M_{Diff} = 1.08$, 95% CI [.30, 1.86], $t(77.63) = 2.75$, $p = .007$, $d = .55$.

Second, if decreasing empathy by employing reappraisal-based strategies reduces experience of vicarious anxiety, we expect those in the Empathy condition to be able to reduce the effects of vicarious anxiety on sleep disruption if they habitually use cognitive reappraisal strategies to cope with distressing emotions. In support of this prediction, we found that the condition participants were in significantly moderated the relationship between trait reappraisal, as assessed by the Reappraisal subscale of the ERQ prior to watching the film clips, and sleep disruption across all subjects ($\Delta R^2 = .042$, $F(1, 95) = 4.54$, $p = .036$). For participants in the Empathy condition, trait reappraisal was negatively associated with experiencing sleep disruption ($r_s = -.31$, 95% CI [−.54, −.034], $p = .031$). However, there was no relationship between trait reappraisal and sleep disruption for participants in the Objective condition ($r_s = .026$, 95% CI [−.25, .30], $p = .86$). This may be because participants in the Objective condition had

been instructed to use reappraisal-based strategies while watching the film clips, and doing so at the time of exposure to the stimuli eliminates the impact of trait reappraisal on protracted effects of experiencing vicarious anxiety.

Third, if experience of vicarious anxiety is what leads to experiencing sleep disruption, then we would expect that measures of anxiety assessed in the 24 hr after watching the film clips should be associated with the magnitude of sleep disruption reported. Across all participants, we found that this was the case. The degree of sleep disruption reported was positively associated with single-item measures on the follow-up questionnaire that assessed how much anxiety the participant experienced in the 24 hr after watching the film clips ($r_s = .34$, 95% CI [.070, .57], $p < .001$), and how much the participant thought of the images in the film clips during this time ($r_s = .42$, 95% CI [.16, .62], $p < .001$; 1 = Not at all, 4 = Somewhat, 7 = Extremely). The degree of self-reported sleep disruption was also associated with the STAI-S measure administered in the follow-up questionnaire, when controlling for STAI-$S_{Pre\text{-}Task}$ ($r = .27$, 95% CI [.099, .44], $p = .007$).

Replications of findings from study 3. Replication analyses indicated that when collapsing data across both conditions, $DOSPERT_{Post\text{-}Task}$ scores, when controlling for $DOSPERT_{Pre\text{-}Task}$ scores, were negatively associated with the Empathic Concern subscale, STAI-$S_{Post\text{-}Task}$, and ΔSTAI-S. $DOSPERT_{Post\text{-}Task}$ scores were not associated with the other subscales of the IRI or with STAI-$S_{Pre\text{-}Task}$ (see SOM for analyses).

Discussion

In this study, state empathy was manipulated in a between groups design to establish a causal role for empathy in the experience of vicarious anxiety and its sustained effects. An additional aim was to investigate the impact of down-regulating state empathy on the relationship between trait empathic concern and vicarious anxiety. As expected, participants in the Empathy condition rated anxiety to be the emotion most strongly experienced. This was not the case in the Objective condition, as experience of anxiety significantly decreased whereas experience of positive emotions increased. In the Empathy condition, participants perceived anxiety to be the greatest emotion experienced by target victims, and as predicted, anxiety was perceived to be experienced less by targets in the Objective condition. Mean perceived anxiety partially mediated the relationship between condition and experience of anxiety during the task, whereas support was not found for a mediating effect of mean perceived sadness in this relationship. As in Study 3, a serial mediation analysis provided support for a causal model in which greater empathy leads to increased perception of anxiety in target victims, which in turn leads to greater experience of anxiety during the task and consequently, sustained anxiety after the task.

As with findings from Study 3, trait empathic concern was associated with experiencing anxiety during the task in the Empathy condition. However, this relationship was diminished by down-regulating state empathy in the Objective condition. A moderation analysis indicated a differential effect of trait empathic concern on experiencing vicarious anxiety during the task, depending on condition. In addition, there was no significant association between perceiving anxiety in others and experiencing anxiety when down-regulating state empathy, a relationship that was seen in Study 3 and in the Empathy condition of this study. These findings indicate that regulating state empathy by using reappraisal-based strategies can disrupt the relationships seen in the previous studies between dispositional empathy and experiencing vicarious anxiety.

As predicted, participants in the Empathy condition experienced greater anxiety-related defensive responses. Consistent with the patterns of correlational findings from Study 3, participants in the Empathy condition became more risk-averse after observing target victims, as demonstrated by decreased ratings on the DOSPERT subscales after observing targets facing threats. Participants in the Objective condition did not show a change in risk-aversion after observing target victims. A mediation analysis indicated an indirect effect of condition on risk-aversion, through anxiety experienced during the task. This effect supports a causal model in which increased state empathy leads to greater experience of vicarious anxiety, which in turn leads to greater risk-aversion. Changes in risk-aversion were not seen with the BART task, which measures risk-taking in the context of seeking rewards, suggesting that risk-aversion experienced from empathy and vicarious anxiety in the context of this study is domain specific for activities that pose risk to one's health and physical safety. Protracted effects from taking an empathic perspective and experiencing vicarious anxiety were seen in a follow-up measure assessed the next day. Participants in the Empathy condition reported greater sleep disruption during the night following the lab task as compared with participants in the Objective condition. However, a moderation analysis indicated that for those in the Empathy condition, the dispositional tendency to use reappraisal strategies to regulate emotions mitigated the effects of empathy and experiencing vicarious anxiety on sleep disruption.

The impact of down-regulating empathy had a stronger effect in reducing experienced anxiety during the task than for perceiving anxiety in the target victims. As our proposed mechanistic model for vicarious anxiety involves perceiving anxiety as a cause of experiencing anxiety, this pattern is unexpected. A potential reason for a stronger effect of empathy on experienced anxiety than perceived anxiety may be due to the measurement of perceived anxiety in our studies. Throughout our studies, participants consistently perceived target victims in the film clips to experience a high degree of anxiety, with mean ratings of perceived anxiety near the ceiling of the scale. As the actors playing the target victims in the film clips are highly expressive, this finding is unsurprising. It may be that a ceiling effect artificially limits the degree to which perceived anxiety is rated in the Empathy condition, and as a consequence, seemingly limits the impact of down-regulating empathy on perceived anxiety in the Objective condition. As such, it may be that empathy would demonstrate a stronger relationship with perceived anxiety in targets facing threats if the targets' expressed anxiety were more ambiguous, as this would allow more variability in judgments of perceived anxiety.

General Discussion

In four studies, we investigated the role of empathy in experiencing vicarious anxiety. In Study 1, we demonstrated that a general measure of trait emotional empathy is associated with experiencing anxiety when observing target victims facing threats. Support was not found for a significant relationship between trait anxiety and experience of anxiety from the task. Trait empathy was associated with both ratings of experienced anxiety while watching

target victims, and with sustained anxiety measured by changes in the STAI-S, a general measure of state anxiety, after observing target victims. Anxiety ratings during the task mediated the relationship between trait empathy and experience of sustained anxiety after the task, indicating that anxiety is specific to some degree in driving the relationship between trait empathy and sustained changes on the STAI-S measure. Study 2 demonstrated that trait emotional empathy is associated with perceiving greater anxiety to be experienced by target victims facing threats. This provides some support for interpersonal processes underlying the experience of vicarious anxiety. Study 3 demonstrated that the relationships found in Studies 1 and 2 extended beyond a general measure of trait empathy to trait empathic concern, the tendency to feel concern and compassion toward others in distress. This further supports a model of vicarious anxiety involving interpersonal responses where one is attuned to others in distress. Support was found for a mechanistic model in which trait empathy and empathic concern lead to greater perception of anxiety in target victims, which in turn leads to greater experience of vicarious anxiety. In beginning to investigate the function and effects of experiencing vicarious anxiety, we demonstrated that trait empathic concern and vicarious anxiety are correlated with decreased risk-taking after observing target victims facing threats. Study 4 established a causal role for empathy in the experience of vicarious anxiety by manipulating state empathy. We demonstrated that taking an empathic perspective increased perception of anxiety in target victims, experience of vicarious anxiety, and sustained effects of anxiety such as risk-aversion and sleep disruption. Conversely, reducing state empathy by employing a cognitive reappraisal strategy diminishes the experience and effects of vicarious anxiety, as well as the impact of trait empathy on experience of vicarious anxiety.

Together, these studies map the phenomenon of vicarious anxiety by delineating a role for empathy in the experience of vicarious anxiety, and investigating the functions and protracted effects of experiencing vicarious anxiety. Although much prior research has conceptualized anxiety as a response to a potential or approaching threat, the association between empathy and vicarious anxiety indicates that the role of interpersonal processes and one's social environment should be considered as important factors in experiencing anxiety. Our research also has implications for understanding the role of empathy in social learning. Although the functional role of empathy has been commonly thought of as one that facilitates prosocial behaviors (Coke, Batson, & McDavis, 1978; Eisenberg & Miller, 1987), empathy may also have a critical role in facilitating the social transmission of emotions that engender defensive responses. Through facilitating the vicarious experience of defensive emotions such as anxiety, empathy may play an important role in how we learn about threats in our environment through the emotions of others.

Although we found some support for trait empathy being specifically associated with the experience of anxiety and fear, we were not able to differentiate ratings of experienced and perceived anxiety from fear. As fear was perceived to be the greatest emotion experienced by target victims in Studies 2 and 3, the inability to dissociate anxiety from fear may be likely due to the fact that targets expressed both anxiety and fear to a high degree. Importantly, in the context of our study, these findings do not contradict a role for empathy in the vicarious experience of emotions similar in their functional role of facilitating defensive responses to threats. Empathy and experience of vicarious anxiety were associated with greater risk-aversion, a defensive response associated with experiencing anxiety. As demonstrated in Studies 1 and 2, trait empathy was not associated with other high arousal negative emotions, such as anger, which is an emotion associated with an opposing functional pattern to fear and anxiety in facilitating risk-seeking behavior (Lerner & Keltner, 2001). As we did not find consistent support for a confounding role of high arousal negative emotions in the relationships between trait empathy and anxiety, the effect of empathy on experiencing vicarious emotions in the context of our studies seems to be primarily specific to anxiety and fear, and the possibility of other emotions similar to anxiety with respect to having a functional role of avoiding threats.

It may be the case that if targets were primarily expressing another kind of emotion (e.g., sadness), empathy would demonstrate specificity in inducing the same emotion in a perceiver. However, as different emotions have different underlying appraisal patterns and functions (Smith & Lazarus, 1993), we would expect the vicarious experience of different emotions to result in sustained effects that are congruent with the functions of the emotion elicited. For example, as sadness is associated with appraisals of experiencing loss (Smith & Lazarus, 1993), it may serve a specific social function of eliciting emotional support from others. Thus, a speculative hypothesis may be that vicarious experience of sadness is more effective in promoting prosocial behaviors in an observer than the vicarious experience of anxiety. It may also be the case that emotions serving defensive functions, such as anxiety, are more prone to being transmitted vicariously. This may be the case, as a selective capacity for vicariously experiencing emotions with defensive functions may promote one's chances for survival in an evolutionary context. Future research may investigate the susceptibility and functions of vicariously experiencing a wider range of emotions.

Although it is possible that a third variable drives the relationship between trait empathy and anxiety, we did not find support for this with perhaps the most probable trait measures to have been associated with vicarious anxiety. We did not find trait emotional reactivity to be a confound in our results, indicating that the vicarious experience of anxiety is not due to a tendency to generally experience emotions more strongly. The predisposition to experience anxiety and personal distress was not positively associated with the experience of anxiety while watching target victims facing threats. Similarly, state anxiety prior to the task, as measured by the STAI-$S_{\text{Pre-Task}}$ measure, also was not positively associated with experience of vicarious anxiety (reported in the SOM). These measures were not positively associated with perceiving anxiety in the target victims or with sustained anxiety after observing the targets. A potential explanation for this pattern may be that empathy involves controlled processes capable of being disrupted by stress or cognitive load (Gu & Han, 2007; Hodges & Wegner, 1997; Rameson, Morelli, & Lieberman, 2012; Zaki, 2014). As prior work has demonstrated a relationship between trait anxiety and dysfunction in regulatory control (Bishop, 2008), trait and state levels of distress may interfere with empathic processes and render one less susceptible to experiencing vicarious anxiety in response to witnessing anxiety in others. Future research will be needed to further investigate the systems underlying vicarious anxiety and the role of trait anxiety in relationship to it.

Our findings have implications for many who are commonly exposed to depictions of threats in their everyday lives. Notably, much of the general population faces such exposure from popular media sources. Our stimulus set was constructed to reflect such depictions of threats in the media, both fictional and nonfictional in nature. If highly empathic individuals are more susceptible to experiencing vicarious anxiety, such chronic exposure to footage of others facing threats may be particularly detrimental to the well-being of these individuals. Awareness of how empathy may predispose one to experience vicarious anxiety may encourage those who are most affected to adopt effective coping strategies and regulate exposure to such depictions of threat. Adapting basic models of anxiety to account for social and empathic processes may inform our understanding of different pathways that lead to experiencing anxiety and promote targeted treatments for those who suffer from anxiety in its various forms.

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Received April 19, 2016
Revision received May 3, 2017
Accepted May 5, 2017 ■